ETC-BE Report 2026/3

# Marine Messages III

## *State, pressures, and choices for the future of Europe's seas*

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**PUBLICATION DATE** *17 July 2026*

**EEA ACTIVITY** *Biodiversity and Ecosystems*

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*Preparation of this report has been co-funded by the European Environment Agency as part of a grant with the European Topic Centre on Biodiversity and ecosystems and expresses the views of the authors. The contents of this publication do not necessarily reflect the position or opinion of the European Commission or other institutions of the European Union. Neither the European Environment Agency nor the European Topic Centre on Biodiversity and ecosystems is liable for any consequence stemming from the reuse of the information contained in this publication.*

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## HOW TO CITE THIS REPORT

*Andersen, J.H, Korpinen, S., Reker, J. Aho, M., Aydin, E.B., Aydin, M., Barkardóttir, E.D., Bigagli, E., Carstensen, J., Carvalho, N., Dige, G., Gelabert, E.R., Harvey, E.T., Knudsen, S.W., Murray, C.J., Nygård, H., Özkan, S.A., Peterlin, M., Ramon, P., Snoj, L., Sommer, H.M., Stock, A., Vaughan, D. (2026). Marine Messages III. State, pressures, and choices for the future of Europe's seas. ETC-BE Report 2026/3. European Topic Centre on Biodiversity and Ecosystems. 80 pp + Supplementary Material.*

*doi: 10.5281/zenodo.21358681*

*European Topic Centre on Biodiversity and Ecosystems*
**https://www.eionet.europa.eu/etcs/etc-be**

# Contents


Foreword . . . . . 4

Acknowledgements . . . . . 5

Executive summary . . . . . 6

1. Resilient seas for a sustainable future . . . . . 8

1.1 Europe's seas — a shared, diverse part of the global ocean . . . . . 8
1.2 What is happening? Europe's seas in the nexus of a triple crisis . . . . . 10
1.3 Why does the degradation of Europe's seas matter to you and me? . . . . . 12
1.4 Towards EU policy coherence at a time of crisis . . . . . 13
1.5 Main content and objectives . . . . . 16

2. Status of Europe's marine ecosystems . . . . . 17

2.1 Biodiversity remains challenged across vast marine areas . . . . . 19
2.2 Status of habitats, fish, seabirds, sea turtles and marine mammals . . . . . 22
2.3 Ecosystem health of Europe's seas . . . . . 25
2.4 Cascading human impacts through marine ecosystems . . . . . 28

3. Pressures from sea- andland-based human activities . . . . . 30

3.1. Cumulative effects: Human activities shape the marine environment . . . . . 31
3.2 Hazardous substances . . . . . 33
3.3 Marine litter . . . . . 35
3.4 Nutrient enrichment and eutrophication . . . . . 37
3.5 Species extraction by commercial fishing . . . . . 39
3.6 Non-indigenous species . . . . . 40
3.7 Other pressures from human activities . . . . . 41

4. Climate change's toll on marine ecosystems . . . . . 43

4.1 Rising temperatures . . . . . 43
4.2 Deoxygenation . . . . . 46
4.3 Ocean acidification . . . . . 46
4.4 From single pressures to system stress: Climate change reshaping Europe's seas . . . . . 47

5. How to achieve healthy, clean, productive and resilient seas? . . . . . 50

5.1 Managing activities: Overcoming the implementation gap . . . . . 51
5.2 Integrating ecosystems and management – scaling solutions across sectors, pressures and ecosystems . . . 55
5.3 Embracing resilience thinking within EU marine governance . . . . . 58

6. Steps towards restoration of the resilience of Europe's seas . . . . . 64

6.1 Securing resilience: Towards integrated marine governance . . . . . 64
6.2 Declining resilience: Barriers to systemic change . . . . . 66
6.3 Resilience or decline: Europe's choice for our seas . . . . . 68

References . . . . . 69

List of abbreviations . . . . . 79

Overview of Supporting Material . . . . . 80

# Foreword

This report, 'Marine Messages III. State, pressures, and choices for the future of Europe's seas', provides an assessment and synthesis of the status of Europe's seas and the impact of human activities on marine ecosystems and recommends actions and solutions to restore ecosystems and their services, particularly food provision and resilience.

The 'Marine Messages III' report uses comprehensive data sets and assessment tools to distinguish 'problem areas' from 'non-problem areas' in terms of biodiversity, ecosystem health, contamination, marine litter as well as nutrient enrichment and eutrophication. These analyses reveal that substantial portions of our seas are 'problem areas' where intense human activities and pressures hinder the achievement of environmental goals. Detailed information about the data and tools used can be found in the Supplementary Material.

Human pressures on Europe's marine ecosystems are identified and ranked by mapping and analysis. The analyses highlight fishing activities, pollutant inputs (contaminants and nutrients), physical modifications, noise inputs, and climate change as the primary factors that impair the environmental status.

For decades, Europe has striven for clean, healthy, and productive seas. Existing policies, strategies, and legal frameworks set clear goals for environmental protection and restoration of Europe's seas. This synthesis assessment highlights disparities between the envisioned goals and the actual measures taken to achieve them. Using the best available data and tools, the report highlights two key points: first, while progress has been made, the goals have not yet been achieved; second, currently agreed actions will not ensure that existing goals are met. European countries face an implementation gap that should be prioritised prior to proposing new policies. Additionally, increasing pressures on marine ecosystems, particularly due to climate change, requires attention. Current actions and measures are insufficient to address the additional stress imposed by climate change.

This report emphasizes the urgent need to restore clean, healthy, productive seas to prevent irreversible losses in resilience and ecosystem services. Otherwise, social consequences could be substantial, particularly for sustainable food provision and in the face of biodiversity loss, pollution, and climate change. Thus, this synthesis assessment serves as a warning and call to action to restore the resilience of Europe's seas.

# Acknowledgements

The ‘Marine Messages III’ synthesis assessment report was developed and written by the European Topic Centre on Biodiversity and Ecosystems (ETC-BE) in collaboration with the European Environment Agency (EEA). It was authored by Jesper H. Andersen, Samuli Korpinen, Johnny Reker (leading authors), Meri Aho, Eda Aydin, Mustafa Aydin, Emanuele Bigagli, Emma D. Barkardóttir, Jacob Carstensen, Natacha Carvalho, Gorm Dige, Eva Gelabert, Therese Harvey, Steen W. Knudsen, Ciarán Murray, Henrik Nygård, Simon A. Özkan, Monika Peterlin, Paula Ramon, Luka Snoj, Helle M. Sommer, Andy Stock, and David Vaughan.

The report was edited by ETC-BE and additional guidance was received from Claudia Neitzel and Thorjørn Larssen (ETC-BE) as well as Lotte Worsøe Clausen, Erini Glyki, and Jock Martin (EEA).

Many colleagues helped with conversations and workshops, the provision of datasets, or wider comments. These include Emilie Kallenbach, Jørgen Nørrevang Jensen, Niko Kallio, Hans Mose Jensen, Hjalte Parner, Torsten Berg, Benjamin Halpern, Melanie Frazier, Ángel Borja, Michael (Mike) Elliott, Nadia Papadopoulou, Gerjan Piet, Melissa Dallet, Gašper Šubelj, Joana Mira Veiga, and Miguel Leal.

Special thanks, linked to the work on non-indigenous species and the CIMPAL index, are directed to Heliana Teixeira, Fábio L. Matos, Stelios Katsanevakis, Yolanda Stranga, Chrysanthi Kalloniati, George Tsirtsis, Marco Nurmi, Danilo Scannella, Emanuela Spada, Serena Zampardi, Tomaso Fortibuoni, Luca Castriota, Patrizia Perzia, Silvia Livi, Patrizia Borrello, Ana Cristina Cardoso, Chiara Magliozzi, Ivan Deriu, George Harcota, Oana Vlas, Elena Pantea, Laura Boicenco, Elena Bisinicu, Yolanda Sagarminaga, Ángel Borja, Marika Galanidi, and Argyro Zenetos.

Special thanks, linked to the work on eutrophication, are due to Michelle Devlin, Helene Frigstad, Luminita Lazar, Erika Magaletti, Jesús M. Mercado Carmona, Alain Lefebvre, Tanya Milkova, Michele Giani and Aleka Pavlidou. The Regional Seas Conventions in Europe (BSC, HELCOM, OSPAR, and BARCOM-UNEP/MAP), the European Environment Information and Observation Network (EIONET) and the EU Commission are thanked for comments and/or discussions.

Special thanks are also due to Anna-Stiina Heiskanen, division director at Finnish Environment Institute (SYKE), Ángel Borja, principal researcher at AZTI in the Basque Research and Technology Alliance (BRTA) and former member of the EEA’s Scientific Committee (2013-2022), Jan O. Ekebom, senior ministerial advisor at the Ministry of the Environment of Finland and Thorjørn Larssen, deputy managing director at Norwegian Institute for Water Research (NIVA) and manager of ETC-BE; we value their reviews of and comments to a draft of ‘Marine Messages III’.

We extend our sincere gratitude to the Horizon Europe project, ‘Achieving Good Environmental Status for maintaining ecosystem services by assessing integrated impacts of cumulative pressures’ (see www.GES4SEAS.eu). There has been a close collaboration with this project from 2023 to 2026, particularly with work packages 4 (development of the ‘Tikta’ tool) and 5 (testing). All thematic tool-based assessments, as detailed in chapters 2 and 3, have been demonstrated using ‘Tikta’ and are thus indirectly validated.

The report was an outcome of the long-term effort of the EEA and the European Topic Centre on Biodiversity and Ecosystems 2023-2026 and its predecessor, the European Topic Centre on Inland, Coastal and Marine Waters (ETC ICM 2018-2022).

# Executive summary

The 'Marine Messages III' synthesis assessment report provides an up-to-date analysis of the condition of Europe's seas, the pressures on them and provides actionable solutions. Using multiple data sources, harmonised datasets, and assessment tools it distinguishes 'problem' and 'non-problem' areas across biodiversity, ecosystem health, pressures like contamination, eutrophication, and climate change. The findings show that substantial parts of Europe's seas remain under pressure, slowing progress towards environmental objectives and, with this, the sustainable provision of ecosystem services.

## EUROPE'S SEAS REMAIN CHALLENGED

According to the analysis carried out in this report, Europe's seas are, overall, not in good condition (Table 0.1). Pollution, resource overexploitation, habitat degradation, and the spread of non-indigenous species combined with the accelerating impacts of climate change to intensify ecosystem stress and reduce resilience. Many species and habitats remain in poor status, and 'problem areas' extend across most parts of Europe's seas. At the same time, projected global warming of around 2.3–2.5 °C by the end of the century risks undermining ecological improvements achieved so far.

## CLIMATE CHANGE IS RESHAPING MARINE ECOSYSTEMS

Climate change is no longer a background pressure. It is already among the most significant stressors on Europe's seas and is projected to become the dominant driver by mid-century. In a viscious circle, warming, acidification and deoxygenation amplify other human pressures, weakening ecosystem resilience (Table 0.1).

Without rapid reductions in greenhouse gas emissions, alongside decisive actions to address other pressures, marine ecosystems may lose further capacity to sustain biodiversity, regulate climate, and provide essential services. Encouragingly, EU legislative frameworks may have slowed degradation compared with global trends. However, recovery at scale is not yet evident, and pressures are projected to rise further if current trajectories persist. Cumulative impacts in Europe's seas are expected to rise by 75-89 % by mid-century compared to an envisioned 220-260 % increase of impacts in the global ocean.

## SOLUTIONS EXIST – IMPLEMENTATION NEEDS TO ACCELERATE

The EU has established a comprehensive marine and maritime governance framework, including the Marine Strategy Framework Directive, Water Framework Directive, Maritime Spatial Planning Directive, Nature Restoration Regulation, Birds Directive and Habitats Directive, as well as strategies like the 2030 Biodiversity Strategy and the European Ocean Pact. Together, these instruments provide a strong legal and strategic foundation for aligning conservation and sustainable use.

Management measures derived from this EU policy framework, such as nutrient and contaminant reductions, marine protected areas, habitat restoration and ecosystem-based management, deliver measurable improvements in marine ecosystem condition when applied consistently and at sufficient scale. There is evidence suggesting that this framework has slowed ecosystem degradation across Europe's seas compared with global trends and promoted some ecosystem recovery. However, substantial recovery is not yet evident, and progress remains uneven and often insufficient to offset the accelerating pressures. Current measures have not yet delivered good condition across all of Europe's seas. Overall, the gap persists between EU policy ambition and what is observed at sea. Cumulative pressure from land- and sea-based activities continues to exceed ecological limits, while fragmented governance, delayed implementation and misaligned financial flows hinder coordinated action to reverse such a trend.

## A SYSTEMIC SHIFT TOWARDS MARINE ECOSYSTEM RESILIENCE

Maintaining and restoring ecosystem resilience requires a shift from sectoral management to managing the sum of cumulative pressures within ecological boundaries alongside restoration efforts. This means reducing pressures, expanding, and effectively managing protected areas, restoring degraded ecosystems, removing harmful subsidies, strengthening enforcement, and aligning public and private finance with ecological objectives. Good environmental status provides the boundary for sustainable use and could guide future policy coherence. The ongoing revision of the Marine Strategy Framework Directive, together with the development of the Ocean Act, offers a unique opportunity to simplify, integrate and strengthen EU marine and maritime governance – embedding ecosystem resilience at the centre of EU marine and maritime policy. Keeping this ambition is critical due to the time lags inherent in marine ecosystems and policy cycles. Decisions taken today may need 10–15 years, or more depending on response time, to become detectable within the marine environment. During this timeframe, and in line with the requirement of the EU legal framework, it is indispensable that EU countries keep taking mea-

sures to reduce pressures and manage activities in a sustainable way to avoid delays in the recovery of marine ecosystems already under significant stress from climate change.

## A DECISIVE DECADE FOR THE RECOVERY OF OUR SEAS

The coming years will determine whether marine ecosystems can recover and continue to underpin biodiversity, climate regulation, economic activity, and societal gains.

The EU possesses the legal/-policy instruments, scientific knowledge and institutional capacity required. Delivering results depends primarily on pressure reductions but also on coherent implementation aligning climate and environmental ambition, economic priorities, and marine governance. The conditions for success are known, and Europe's seas can recover, but the scale and consistency of action in the years ahead will determine the outcome.

**TABLE 0.1**
Europe's seas: selected indicators for state, pressures, and governance responses as documented by 'Marine Messages III' and its Supplementary Material

| | Indicator | Observation | | What this reflects |
|---|---|---|---|---|
| Biodiversity and overall condition | Biodiversity | 85 % of sea area assessed;<br>~7 % of this is a 'non-problem area'. | | Biodiversity remains under pressure. |
| | Ecosystem health | 39 % of sea area assessed;<br>~19 % of this is a 'non-problem area'. | | Marine ecosystems are not in good condition. |
| | Ecosystem health score; 0.6-1.0 is good condition | Europe's seas: 0.51 | North-east Atlantic Ocean: 0.54<br>Baltic Sea: 0.40<br>Black Sea: 0.47<br>Mediterranean Sea: 0.47 | None of the regional seas are overall in 'good condition' and, thus, neither is Europe's seas overall. |
| Single pressure | Hazardous Substances | 8 % of sea area assessed;<br>~96 % is a 'problem area' and<br>~4 % is a 'non-problem area'. | | Limited data coverage, areas exceed contaminant thresholds. |
| | Nutrients and eutrophication | 25 % sea area assessed;<br>~24 % is a 'problem area' and<br>76 % is a 'non-problem area'. | | Nutrient pressures localised but significant in certain areas. |
| | Marine litter | 28 % of sea area assessed;<br>~66 % is a 'problem area' and<br>34 % is a 'non-problem area'. | | Marine litter remains a persistent pressure. |
| | Invasive alien species | Invasive alien species impact ≥27 % of Europe's coastal waters (100 % sea area assessed). | | Invasive alien species are an enduring threat. |
| | Fish ($B_{MSY}$) | Only 32 % of assessed commercial fish/shellfish stocks across EU marine waters were sustainably fished and in good condition by 2023. | | Fishing pressure remains too high for full stock recovery. |
| Cumulative stress | Ranking of pressures | The dominating pressures are<br>1) contaminants, 2) fishing, 3) climate change,<br>4) seabed disturbance and loss, and<br>5) eutrophication. | | Pressure overlaps spatially.<br>It slows progress toward healthy, clean and productive seas. |
| Climate change | Sea surface temperature (SST) | 1991–2024 SST decadal trends: +0.3 °C (North Sea), up to +0.5 °C (Black Sea), +0.54 °C (Baltic Sea) and +0.75 °C (Mediterranean Sea). | | Rapid ocean warming causing movement northward or toward deeper waters. |
| | Marine heat waves (MHW) | Marine heatwaves in the Mediterranean Sea are three times more frequent and last 50 % longer than in the 1980s. | | Escalating extremes which can be harmful or lethal. |
| | Ocean acidification trend | Surface pH decline: −0.03 (Europe, since 1960s);<br>−0.11 globally since pre-industrial<br>(~30 % higher acidity). | | Long-term chemical change jeopardising some marine organisms. |
| Governance | 100 % in GES | GES under WFD and MSFD is not yet achieved in all parts of Europe's seas. | | WFD and MSFD Programmes of Measures are not effective. |
| | 30 % protected | ~14 % of EU seas have been designated as protected areas. | | Area-based protection are progressing but not at 2030 goal. |
| | 10 % strictly protected | ~1 % of EU seas have been designated as strictly protected areas. | | Protection gap and lack of speed to reach 2030 vision. |

*Notes: Drawing on consolidated EU-level data from environmental reporting, regional sea cooperation mechanisms and sectoral databases, the table highlights key quantitative indicators that characterise ecosystem health, climate-related and other anthropogenic pressures, and the extent of protection and restoration efforts. Areas not assessed are due to limited or no data availability.*

# 1. Resilient seas for a sustainable future

- Europe's seas are rich in biodiversity, ecosystem services, and economic potential; yet their long-term contribution to climate goals, human well-being, and the Blue Economy depend on managing human activities within environmental limits to preserve ecological integrity.
- Europe's seas are at the frontline of a growing triple crisis where biodiversity loss, climate change and pollution converge, degrading ecosystem resilience and undermining their capacity to provide critical services necessary for resilient European communities.
- Comprehensive, systemic actions are also needed. The upcoming Ocean Act will be an important opportunity to strengthen coherence of the EU marine/maritime governance framework, in addition to embedding ecosystem resilience as a guiding principle in policies and financial incentives.

## 1.1 EUROPE'S SEAS — A SHARED, DIVERSE PART OF THE GLOBAL OCEAN

Europe's seas are dynamic, ecologically complex systems shaped by oceanographic, climatic, and biological processes that underpin the planet's life support functions (Estes et al., 2021). They stretch from the Arctic waters of the Barents Sea to the windy coasts of Macaronesia and the Canary Islands in the south, from the semi-enclosed Mediterranean Sea to the shallow Baltic Sea and enclosed Black Sea. Together, they form a heterogeneous mosaic of inter-connected marine regions, covering more than 11 million km², an area equivalent to over half of Europe's land area (EEA, 2015a).

From the canyons at the edge of the continental shelf and cold-water corals in the North-east Atlantic Ocean, to seagrass meadows in the Mediterranean Sea and the delicate ecological balance of the brackish Baltic Sea, each region hosts distinct habitats and species. They provide nursery grounds for fish and turtle populations, migratory corridors for birds and mammals, and a unique endemism shaped by isolation. For example, the Mediterranean Sea covers <1 % of the global ocean but hosts 4–18 % of all known marine species (Mouillot et al., 2011). Overall, Europe's seas have intrinsic value and make a plethora of contributions to society including the EU's expanding Blue Economy (EC, 2023b; EC, 2025d).

### The living components of Europe's seas are important:

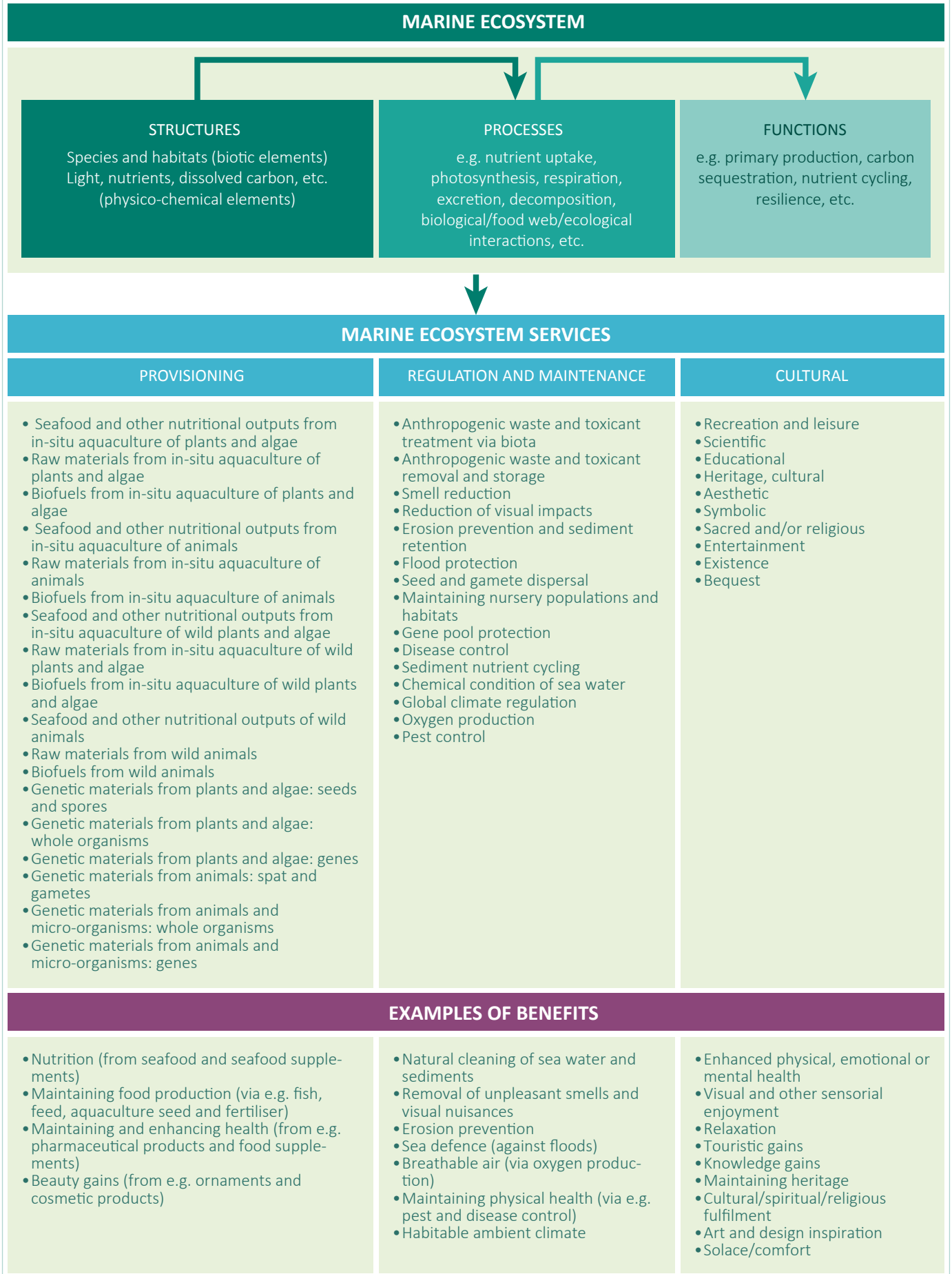
- They deliver essential ecosystem services such as seafood, pharmaceuticals, climate regulation, and opportunities for recreation and leisure. These translate into benefits for humans such as nutrition, health, a habitable living environment, and well-being (Culhane et al., 2019; IPCC, 2019; EEA, 2019).
- They are part of Europe's rich maritime history and cultural heritage, where marine and coastal ecosystems also sustain the blue bioeconomy, including fisheries and aquaculture, coastal and sea-based tourism, and marine biotechnology (Culhane et al., 2019; Figure 1.1).

### The non-living components of Europe's seas also matter, by:

- Providing abiotic resources, such as hydrocarbons, sand, gravel, and minerals, and space for renewable energy deployment. Marine renewable energy is central to EU's climate neutrality ambitions, such as installation of 317 GW of offshore wind energy by 2050 (EC, 2025d).
- Supporting shipping lanes, ports, and other maritime infrastructure (EEA-EMSA, 2024; EC, 2025d).

The human use of these resources and other land- and sea-based resources puts pressure on, and can damage, marine ecosystems. Directly through overexploitation (e.g. fishing beyond sustainable limits) or indirectly through nutrient discharges or losses causing eutrophication in coastal waters, or fisheries by-catch of non-target species. Thus, the combined effects of use have not been sustainable, as many areas of Europe's seas remain in impaired conditions (Figure 2.3; ETC/ICM, 2019; EEA, 2019;

**FIGURE 1.1**
Marine ecosystem services and examples of their benefits for people




*Source: EEA (2019).*

EC, 2020a; EC, 2025e; EC, 2025f; Nikolaou et al., 2025). This occurs in the shadow of a growing demand for marine resources, raising fundamental questions about sustainability, environmental limits, and trade-offs between competing uses (EC, 2023a; Lloret et al., 2025).

As the EU advances implementation and further development of its marine and maritime policy framework, different instruments play complementary roles. The Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) establish the overarching objective of achieving and maintaining good ecological/environmental status in Europe's coastal water and seas, respectively. Similarly, the Nature Restoration Regulation introduces legally binding obligations to protect and restore marine ecosystems taking the provisions of the Habitats Directive further. The EU Biodiversity Strategy for 2030, the Zero Pollution Action Plan and the European Ocean Pact together with the Water Resilience Strategy and it 'source-to-sea' approach reflect and reinforce these commitments within a broader strategic agenda for sustainable use and resilience. In this context, managing human activities damaging marine ecosystems, in ways that safeguard ecological integrity while supporting long-term prosperity, has become increasingly urgent.

## 1.2 WHAT IS HAPPENING? EUROPE'S SEAS IN THE NEXUS OF A TRIPLE CRISIS

### Beneath the blue surface of Europe's seas lies a troubling reality (von Schukmann et al., 2025) - the seas are neither healthy nor clean and productive:

- They are polluted by nutrients, contaminants, noise, and marine litter (EEA, 2019; HELCOM, 2023c; OSPAR, 2023a; EEA, 2024b; EEA, 2024d).
- In some areas, they are disturbed by bottom-touching towed fishing gears and coastal development (EEA, 2019).
- They are warming, acidifying, and losing oxygen (IPCC, 2019; EEA, 2023a; EEA, 2024d).
- The resulting biodiversity loss and habitat degradation have weakened the resilience (ability to absorb disruptions) that once allowed marine ecosystems to recover from disturbances (EEA, 2023a; HELCOM, 2023c; OSPAR, 2023a; UNEP-MAP, 2024). This undermines their capacity to deliver ecosystem services to people, from seafood supply to climate regulation (EEA, 2019; IPCC, 2019; Santana-Falcón et al., 2023).
- Simultaneously, societies and economies demand more of marine ecosystems and their services (EC, 2025c).

Europe's seas sit at the nexus of a 'triple crisis' of biodiversity and habitat loss, climate change, and pollution, each reinforcing the other (EEA, 2019; UNEP, 2024; EC, 2025a). Since the 2014 and 2019 EEA Marine Messages reports, pressures have continued, including unsustainable extraction, nutrient and chemical pollution, seabed disturbance, non-indigenous species, and increasing land- and sea-based activities. Climate change acts both independently and as a multiplier, driving and amplifying the severity and complexity of its impact (EEA, 2023a; EEA, 2024d).

This is not only a 'marine environmental crisis'. It is part of a broader global polycrisis, in which environmental degradation occurs along with societal, economic, and geopolitical instability. This larger picture comprises multiple compounding crises including impacts on biodiversity, climate, resource availability, and energy, as well as social inequality, and weakening trust in institutions, threatening sustainable development and governance (EEA, 2024c).

Europe's seas, once a buffer and provider, are now on the front line, risking the EU's ability to meet the goals for pressures reduction, protection and restoration as outlined by e.g. the MSFD, the 2019 European Green Deal and, for example, the 2025 European Ocean Pact's priority 1 on 'protection and restoration ocean health' as attention shifts towards defence, energy security, growth ,and regulatory simplification (Table 1.1; EC, 2025h).

### Globally, safe operating boundaries for humanity are eroding:

- By 2025, seven of the nine planetary boundaries have been breached, including biosphere integrity, climate change, and novel pollutants (Richardsson et al., 2023; Armstrong McKay et al., 2022; PBScience, 2025).
- Breaching these boundaries risks inducing feedback, which drives rapid and irreversible changes because of their profound interdependence. The collapse of one ecosystem or species de-stabilises others, undermining health, livelihoods, and safety (Richardsson et al., 2023; EEA, 2024d).
- The observed mounting degradation across the board was primarily due to inadequate pressure reduction. This is also the case in Europe, despite demands for action from the EU policy framework (for example EC, 2025b).

The state of Europe's marine ecosystems also reflects a general degradation, from long-term warming, heatwaves, deoxygenation, and acidification to shifting, or dwindling, benthic, and fish communities (Coni et al., 2021; EEA, 2024d; Nagelkerken et al., 2023; Table 2.1; Table 2.2). Europe's marine ecosystems mirror the global trajectory, with many species and habitats still not in 'good environmental status' or at 'favourable conservation status' despite

obligations under the EU Marine Strategy Framework Directive and Habitats Directive, respectively (Table 2.1; Table 2.2).

This means that our way of life is reducing the liveability of planet Earth and placing our health and lives at risk, contrary to the EU's 2050 ambition of 'living well within the limits of our planet' (EC, 2019a). Failure to act urgently and proportionally will further erode the living conditions that have enabled human prosperity, with billions already affected by rising temperatures (Armstrong McKay et al., 2022; Richardsson et al., 2023; EEA, 2024d).

**TABLE 1.1**
Objectives of selected EU marine and maritime policy and legislative initiatives

| EU policy | Aim |
|---|---|
| EU Biodiversity Strategy to 2030 | The Biodiversity Strategy aim to ensure that Europe's biodiversity will be on the path to recovery by 2030 for the benefit of people, the planet, the climate, and our economy. |
| European Ocean Pact | The Ocean Pact supports six priorities:<br>1) protecting and restoring ocean health, 2) boosting sustainable competitiveness of the Blue Economy, 3) supporting coastal, island communities, and outermost regions, 4) advancing ocean research, knowledge, skills, and innovation, 5) enhancing maritime security and defence as a prerequisite, 6) strengthening EU ocean diplomacy and international rules-based governance. |
| Common Fisheries Policy (CFP) | The CFP shall ensure that fishing and aquaculture activities are environmentally sustainable in the long-term and are managed in a way that is consistent with the objectives of achieving economic, social, and employment benefits, and of contributing to the availability of food supplies. It also includes more detailed objectives. |
| The EU Water Resilience Strategy | The Water Resilience Strategy aims to ensure long-term access to clean and affordable water while addressing climate change and protecting ecosystems. The strategy has three main objectives:<br>a) Restoring and protecting the water cycle to ensure sustainable water supply, b) Building a water-smart economy to enhance EU competitiveness and support the water industry, and c) Securing clean and affordable water and sanitation for all, empowering citizens for water resilience. |
| **EU legislation** | **Objective** |
| Habitats Directive (92/43/EEC) | Requires Member States to protect, maintain or restore natural habitats and species to 'favourable conservation status' (FCS). |
| Water Framework Directive (2000/60/EC) | Establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater and achieve 'good ecological/chemical status' (GEcS). |
| Marine Strategy Framework Directive (2008/56/EC) | Requires Member States to ensure that their marine waters achieve 'good environmental status' (GES) by 2020 through applying an ecosystem-based approach to management of human activities. |
| Maritime Spatial Planning Directive (2014/89/EU) | Establishes a framework for maritime spatial planning aimed at promoting the sustainable growth of maritime economies, the sustainable development of marine areas and the sustainable use of marine resources through applying an ecosystem-based approach to management of human activities. |
| Nature Restoration Regulation ((EU) 2024/1991) | Contribute to a) the long-term and sustained recovery of biodiverse and resilient ecosystems across the Member States' land and sea areas through the restoration of degraded ecosystems; b) achieving the Union's overarching objectives concerning climate change mitigation, climate change adaptation and land degradation neutrality; c) enhancing food security, and d) meeting the Union's international commitments. |
| EU Climate Law ((EU) 2021/1119) | Reduce green-house gas emissions to net zero by 2050, and the Union shall aim to achieve negative emissions thereafter. |

*Notes: EU marine governance is anchored in binding legislation, including directives, laws, and regulations, which establish enforceable objectives and obligations for Member States. Regulations are directly applicable in all Member States, while directives are binding as to the results to be achieved but require national transposition. EU strategies and policy initiatives (e.g. the EU Biodiversity Strategy for 2030 or the European Ocean Pact) are non-binding; they provide strategic direction and support the coherent implementation and further development of Union legislation. Objectives are (mostly) compatible with each other though they do not always overlap in space. Please also see chapter 5 for additional details.*

## 1.3 WHY DOES THE DEGRADATION OF EUROPE'S SEAS MATTER TO YOU AND ME?

Europe's seas are not just expanses of water:

- They are dynamic ecosystems tied to the ability to remain alive, healthy, and economically secure. Much of this 'coupling' is realised through the supply of marine ecosystem services, including seafood and pharmaceutical provisioning, coastal protection, climate regulation, and offering opportunities for recreation and leisure (Figure 1.1).
- Their condition is inseparable from ours because the flow of marine ecosystem services to people can only be sustained over time if ecosystems are in good condition. This translates into using them within certain limits, so that they can be healthy, clean, productive, and resilient. The degradation of marine ecosystems would directly affect food, livelihoods, employment and social, coastal, and climate resilience.
- They are also the place many people call 'home': 40 % of Europeans live within 50 km of the sea (EC, 2025c).

However, overextraction, infrastructure development, and intensified human activity undermine marine ecosystems on which we depend. As pressures including overfishing, pollution, and seabed disturbance multiply, these ecosystems are pushed towards the limits of their capacity to self-renew, biodiversity continues to be lost, ecological feedback is broken, their resilience erodes, and their ability to supply essential services declines (EEA, 2019; IPBES, 2019; EEA, 2024a; EC, 2025a). Without resilience, ecosystems lose their shock-absorbing properties, leaving them vulnerable to cumulative and novel pressures, including climate-driven pressure.

The seas and ocean in Europe and globally are becoming a key defence against more catastrophic climate change. This is because of the capacity of marine ecosystems to provide both natural climate change mitigation and adaptation:

- Seawater has absorbed ~30 % of atmospheric $CO_2$ emissions and >90 % of the excess heat in the climate system since 1970 (IPCC, 2019; Gruber et al., 2019; IPCC, 2021). This absorption makes the ocean more acidic and warms it up, thereby affecting marine organisms.
- Certain marine organisms and habitats, such as whales, seagrasses, and soft sediment bottoms, can 'sequester' the atmospheric CO2 captured by seawater as carbon – thereby removing it from circulation (Culhane et al., 2019; NOAA Fisheries, 2024; Porz et al., 2024; Zhang et al., 2024).
- Degradation risks flipping these 'blue carbon' stores, or sinks, into net carbon sources, amplifying climate risks (Armstrong McKay et al., 2022; Richardsson et al., 2023). However, they are currently making a greater contribution to planetary resilience to climate change than land-based sinks, including soils and forests, because the latter are weakening (Gatti et al., 2021; Ke et al., 2024). Some European croplands, grasslands (EEA, 2025a), and parts of the Amazon rainforest (Gatti et al., 2021) and boreal forests (Virkkala et al., 2025) are becoming net carbon sources.
- Adaptation to climate change events or impacts, such as storm surges, sea flooding, and erosion, can be provided by 'marine forests', including macroalgae and animal-formed reefs, as well as coastal habitats such as salt marshes. These can stop or slow water and mass (e.g. sediment) flows, which can then keep coasts and people safe (EEA, 2021a; Culhane et al., 2019).

Yet, climate change impacts are very much visible across Europe's seas, adding to the existing pressures. For example, rising seas, storm surges, increasing seawater temperatures, and marine heatwaves compound stress on degraded coastal ecosystems, accelerating species and habitat loss, and exposing settlements (EEA, 2024c, EEA, 2024d).

Regional examples include the following:

- In the Baltic Sea, deoxygenation and overfishing, combined with warming and nutrients, disrupt fish recruitment and trophic stability (HELCOM, 2023c).
- In the Mediterranean Sea, heatwaves and non-indigenous species displace native biodiversity and alter food webs, with cascading effects on fisheries and tourism (Garrabou et al., 2022; EEA, 2024a).

These marine ecosystem shifts have direct economic implications:

- The EU's Blue Economy is valued at >€250 billion gross added value and employs nearly 5 million people; part of this, the blue bioeconomy, depends on stable ecosystems. Fisheries, aquaculture, tourism, and biotechnology all rely on nature's contribution. However, disruption of the flow of marine ecosystem services, such as declining fish stocks, shellfish bed collapse, and reduced bioprospecting, undermines long-term competitiveness and innovation (EEA, 2024d). The Blue Economy is comprehensively assessed in the annual EU Blue Economy Report (JRC/DG MARE) and is therefore not further elaborated on here (EC, 2025d).

- The sea is also a frontier for innovation, from pharmaceuticals to adaptation technologies and nature-based solutions (Santana-Falcón et al., 2023). However, innovation cannot thrive in a degraded system. An ecologically impaired sea limits the options for technological progress, prosperity, health, and well-being.

In short, having healthy, clean, productive, and resilient seas matters to us all because they provide safe food, secure coasts, a liveable ambient environment, and thriving economies – among other contributions to people. It is not a luxury or a side issue; it is a precondition for the thriving of humans and our society in a changing world.

## 1.4 TOWARDS EU POLICY COHERENCE AT A TIME OF CRISIS

Recognising the triple crisis of biodiversity loss, climate change, and pollution, the EU has built a wide-ranging and increasingly integrated framework of marine and maritime legislation and policies over the past three decades. These policy efforts aim to balance marine environmental protection and restoration with sustainable use, both within EU waters and beyond the EU. Since the introduction of the Marine Strategy Framework Directive in 2008, the aim has been to achieve this through an ecosystem-based approach to the management of human activities affecting the EU's marine waters (EBA/EBM; Box 1.1).

Thus, an ecosystem-based approach to management as required by the MSFD is the key governance tool bridging the objectives of earlier EU legislation, such as the EU Habitats and Birds directives, with more recent objectives, such as those of the Maritime Spatial Planning Directive, the Nature Restoration Regulation and the European Ocean Pact (Table 1.1). The focus has shifted from single-species conservation to securing ecosystem functioning and integrity. The challenge is to develop EBA/EBM into a pragmatic, operational governance tool capable of integrating basic responses to individual pressures while advancing ecosystem-scale solutions through cross-sectoral approaches and nature-based solutions. Here, the Maritime Spatial Planning Directive play a core role by ensuring the combined effects from activities stays within the boundary for sustainable use as defined by 'good environmental status'. Simultaneously, this needs to be supported by the Member States' governance level, as we recognise the continued societal need for marine ecosystem services and resources.

**BOX 1.1**
An ecosystem-based approach to management of Europe's seas

An 'ecosystem-based approach' (EBA), or 'ecosystem-based management' (EBM), is an integrated approach to the management of human activities that considers the entire ecosystem, including humans. The goal is to maintain ecosystems in a healthy, clean, productive, and resilient condition, so that they can provide humans with the services and goods upon which we depend. It is a spatial approach that builds around a) acknowledging connections, b) cumulative impacts, and c) multiple objectives. In this way, it differs from basic approaches that address single concerns e.g. species, sectors or activities.

A comprehensive integrated management of human activities, based on best available scientific knowledge about the ecosystem and its dynamics, can lead to the identification and action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity.

Source: CSWD (2020). Please note that the EU legal requirement for an ecosystem-based approach is defined by the MSFD article 1(3) and further defined in EC (2020c).

### Proper implementation of the Marine Strategy Framework Directive can help overcome this challenge. Thus, the MSFD is the EU's central environmental legislation for the marine environment and:

- Sets a clear, legally binding goal: To establish programmes of measures to achieve or maintain 'Good Environmental Status' in all EU marine waters. This ambition is operationalised through 11 Descriptors which define what it means for EU seas to be in a state where human activities are sustainable and their impacts remain compatible with maintaining marine biodiversity, balanced food webs and, more broadly, marine ecosystems that are healthy, clean, productive, and resilient.
- It is guided by the ecosystem-based approach to management by: a) integrating environmental objectives across major pressures and across the land–sea interface by addressing cumulative impacts, b) using a comprehensive monitoring framework able to make connections, and ensuring that the biotic and abiotic outputs from the sea are balanced with its environmental conditions, and so that related EU policy objectives can be achieved, and c) working in concert with other EU policies to secure both sustainable use and long-term resilience.
- Reinforces cooperation with neighbouring countries including third countries via the Regional Seas Conventions.

Despite progress, however, 'Good Environmental Status' was not achieved in all EU marine waters by 2020 (Figure 2.2), and many marine ecosystems remain under pressure (EEA, 2023a; OSPAR, 2023a; HELCOM, 2023c; EC, 2025a; EC, 2025b), which is mounting due to climate change (Halpern et al., 2025).

### The key reasons for the lack of adequate progress include:

- The Commission's evaluation concluded that, while the Marine Strategy Framework Directive provides a coherent legal framework, progress towards achieving good environmental status remains limited due to uneven ambition, insufficient measures, gaps in monitoring and data comparability, and inadequate integration with other relevant Union policies (EC, 2020c; EC, 2025c).
- Sub-optimal coherence with the wider EU maritime policy, such as maritime spatial planning and common fisheries policy, can detract from the achievements of GES. The MSFD, Common Fisheries Policy (CFP), and Maritime Spatial Planning Directive (MSPD; EC, 2014) operate with limited integration (EC, 2025a; EC, 2025b). For example, the first MSPD implementation report identified the need to strengthen the ecosystem-based approach, embed biodiversity objectives, and improve synergies between fisheries and marine protection within national plans (EC, 2022a). Similarly, subsidies and land-use incentives can increase nutrient run-off, and habitat loss can undermine recovery of marine habitats (ECA, 2020b: EEA, 2022a, 2024b).
- Insufficient time for recovery between the entry into force of the MSFD and the timeline for achieving GES. Recovery can take years or even decades (Borja et al., 2010; EEA, 2019), and this is further slowed by the cumulative pressures from human activities and climate change. Policy incoherence and misaligned actions across sectors can delay recovery and increase both ecological and economic costs (Millage et al., 2026). Signs of improvement are emerging though, from grey seal populations achieving GES to white-tailed eagles' recovery, improved status of commercially exploited fish stocks, and expanding European seagrass meadows, showing that sustained policy interventions can deliver environmental gains (Figure 1.2; HELCOM, 2023a; HELCOM, 2023b; de los Santos et al., 2019).

### Over time, the MSFD's aim of achieving GES has been complemented with new ambitions:

- The EU Biodiversity Strategy for 2030 (EC, 2020b) is a flagship of the European Green Deal. It has a policy objective for Member States to protect at least 30 % of the EU's seas, with 10 % under strict protection.
- The EU's Marine Action Plan on 'Protecting and restoring marine ecosystems for sustainable and resilient fisheries' (EC, 2023a), which reviews the implementation of existing obligations and sets up the 'next steps'.
- The Nature Restoration Regulation (NRR), adopted in 2024 (EC, 2024a), was the first EU law mandating active restoration across land and sea. It sets binding targets for recovering de-graded marine ecosystems, from seagrass meadows to sponge reefs and kelp forests, shifting focus from halting the decline to reversing the degradation of Europe's biodiversity. However, pressure reductions and protection, notably through the achievement of GES, must be implemented before active restoration can occur (Hemraj et al., 2024).

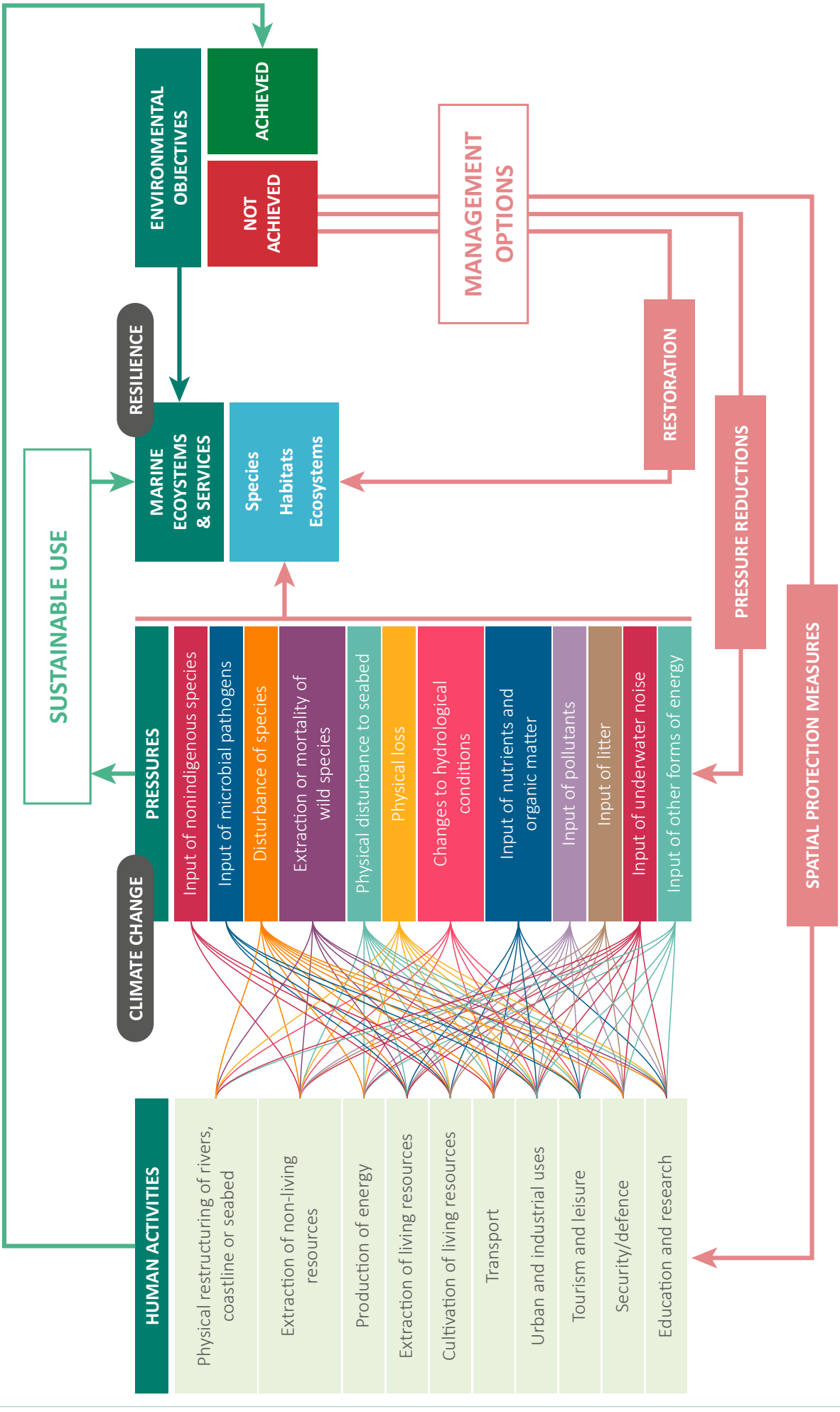
The above legislative and strategic instruments are further reinforced by non-binding initiatives that support implementation through enhanced policy coherence and strategic direction, including the European Water Resilience Strategy (EC, 2025a) and the European Ocean Pact (EC, 2025c). These are complemented by enabling actions on research and innovation under the EU Mission 'Restore our Ocean and Waters by 2030', which aims to accelerate practical solutions and regional cooperation.

The first two announced a revision of the MSFD to accelerate progress towards achieving GES, simplify implementation, and reduce the administrative burden associated with reporting and data management. The Ocean Pact also announced the adoption of an Ocean Act building on the revision of the Maritime Spatial Planning Directive.

The European Ocean Pact communication aims to strengthen linkages between EU marine environmental protection and maritime activities, including commitments under the Common Fisheries Policy (CFP), Fit-for-55 package, and global targets, including the Kunming-Montreal Global Biodiversity Framework and UN Sustainable Development Goals. The MSFD already contains provisions for governance across Member States, industries, science, and society to realise efforts towards healthy, clean, productive, and resilient seas. Therefore, achieving integration between these two legislative tools is key to resolve the current lack of coherence between EU marine and maritime policies, instead of perpetuating it.

Bridging between the Ocean Act's ambitions and GES of the MSFD would allow marine biodiversity protection and restoration, as well as pollution reduction targets, climate commitments, and EU safety and sustainable growth objectives, to be pursued within the sustainability limit provided in the definition of 'good environmental status'.

**FIGURE 1.2**
Connecting across EU's marine and maritime policy frameworks



## 1.5 MAIN CONTENT AND OBJECTIVES

'Marine Messages III' (MMIII) provides a science-based synthesis of the condition of Europe's seas at a time of accelerating anthropogenic climate change, and a multi-level set of actionable solutions to the observed changes in marine ecosystems. It is set in the context of the EEA/Eionet Strategy to 2030 and the evolving EU marine and maritime policy framework.

Drawing on multiple datasets, information sources and established analytical methods, MMIII delivers an integrated assessment of Europe's seas, the scale and distribution of the human activities impacting them, the cumulative pressures these generate and the resulting ecosystem state. The report integrates data and information from Regional Seas Conventions' most recent assessments, EMODnet, EU-funded research, maritime sector databases, and peer-reviewed literature. It also uses available EU-level reporting on the implementation of the MSFD and other EU environmental directives with a marine component (i.e. the Water Framework Directive and Habitats Directive). The focus has been to ensure the best possible spatial coverage of data to better demonstrate the integrated, tool-based approach. For an assessment by the EU Member States for the period 2018-2024, please refer to the EEA's report of the MSFD third reporting round presented in the 'State of Europe's seas' due end of 2026.

Building on 'Marine Messages' (EEA, 2014) and 'Marine Messages II' (EEA, 2019) and an array of EEA reports, and indicators as well as recent reports from the ETC-BE, MMIII advances both spatially explicit overviews of the state and pressures on Europe's seas and a range of solutions to overcome their degradation. It strengthens comparability across marine regions to provide a consolidated European perspective. MMIII has a stronger focus on demonstrating an ecosystem-based approach to management of human activities and what can be done to reverse the observed degradation of Europe's marine ecosystems. It shows why and how resilient marine ecosystems could be placed at the centre of our marine and maritime governance, and therefore, contributes to illuminating sustainability transitions.

MMIII delivers a robust baseline against which progress towards fulfilling marine objectives of the EU 2030 Biodiversity Strategy, the Nature Restoration Regulation and the ocean health aspects of the European Ocean Pact and the forthcoming Ocean Act could be measured. It also puts forward potential governance responses and other actionable solutions to reverse the current trajectory of ecosystem degradation observed across Europe's seas.

MMIII is distinct from, and does not replicate, the upcoming EU-level assessment under the MSFD. While the MSFD assessment formally appraises EU Member States' progress towards achieving and maintaining GES in EU waters, this report adopts a broader geographic and analytical scope. It covers Europe's regional seas by including both the waters of EU and EIONET countries. By integrating environmental reporting, regional sea data, sectoral information, and scientific literature, it places available evidence within a wider environmental and maritime policy context. It provides a systems-level perspective on ecosystem resilience and the adequacy of current responses, offering strategic evidence to inform future policy development, including revision of the MSFD and the development of the Ocean Act.

# 2. Status of Europe's marine ecosystems

- Despite four decades of EU policy implementation, Europe has not halted biodiversity decline, leaving the resilience and ecosystem services of its seas at risk.
- For biodiversity and ecosystem health in Europe's seas, 'problem areas' are found in many areas (97 % and 81 %, respectively). For ecosystem health, 'non-problem areas' are only found in the Norwegian Sea and Barents Sea, some offshore parts of the Bothnian Bay, parts of the Celtic Seas, in offshore waters south-west of the Iberian Peninsula and parts of the eastern Mediterranean Sea.
- Long-term trends in the status of commercially exploited fish stocks indicate a recent recovery over the past 25 years, but most of Europe's marine areas are still 'problem areas' (>95 %) because of current fishing practices.

Europe's seas, covering more than 11 million km², host an extraordinary variety of ecosystems, from coastal lagoons and seagrass meadows in shallow waters to the cold deep basins of the North-east Atlantic Ocean. The Mediterranean Sea is recognised as a global biodiversity hotspot containing up to 18 % of the world's marine species, despite representing only 0.92 % of the global ocean (Bianchi & Morri, 2000; Coll et al., 2010). In contrast, the low salinity Bothnian Bay in the Baltic Sea supports only approximately 300 species, illustrating how environmental conditions constrain species richness (HELCOM, 2018c). However, vulnerability is shared across both the Mediterranean Sea and Baltic Sea, as marine biodiversity is not just a question of numbers, but of the intricate structure and function of habitats, the myriad interactions between species and environmental conditions, and the resilience that emerges from this complexity (Box 2.1).

Species interact through predation, competition, and mutual dependencies, forming food webs that stabilise ecological processes and enable ecosystems to deliver services, such as fisheries, carbon storage, coastal protection, recreation, and cultural values. When these structures lose coherence, their resilience is weakened and ecosystems become more prone to abrupt shifts, crossing ecological tipping points into degraded states that are far less desirable for society (Gomes et al., 2024; Cael et al., 2021; Sardanyés et al., 2024).

To understand the status of biodiversity and enable potential measures, an integrated indicator-based assessment of the status of species and habitats could be complemented by spatial descriptions of ecosystem conditions, an approach pioneered by the Helsinki Commission (HELCOM, 2010). Such maps are essential to reveal where pressures and activities intersect with biodiversity and where resilience is maintained or degraded.

Therefore, this chapter assesses and maps the conditions of species, habitats, and ecosystems. It links biodiversity status to the ability of ecosystems to maintain their structure and function under pressure and highlights the risks of further degradation. Building on Marine Messages II (EEA, 2019), it integrates new data and improved methodologies to distinguish 'problem' and 'non-problem' areas and explores ecosystem vulnerability by maintaining declining resilience and a reduced capacity to deliver services at the core of the narrative. Examining the state of biodiversity from several perspectives allows for a strong basis for conclusions (Figure 2.1). In some cases, the different assessment results require an understanding of the differences in the underlying assessment methodologies and data.

Results from the first two MSFD reporting cycles, Habitats Directive reporting, EEA indicators, Regional Seas Conventions' most recent assessments and EU-funded projects converge to confirm that Europe's marine biodiversity continues to face extensive challenges (EEA, 2019a; HELCOM, 2023c; OSPAR, 2023a; Nikolaou et al., 2025).

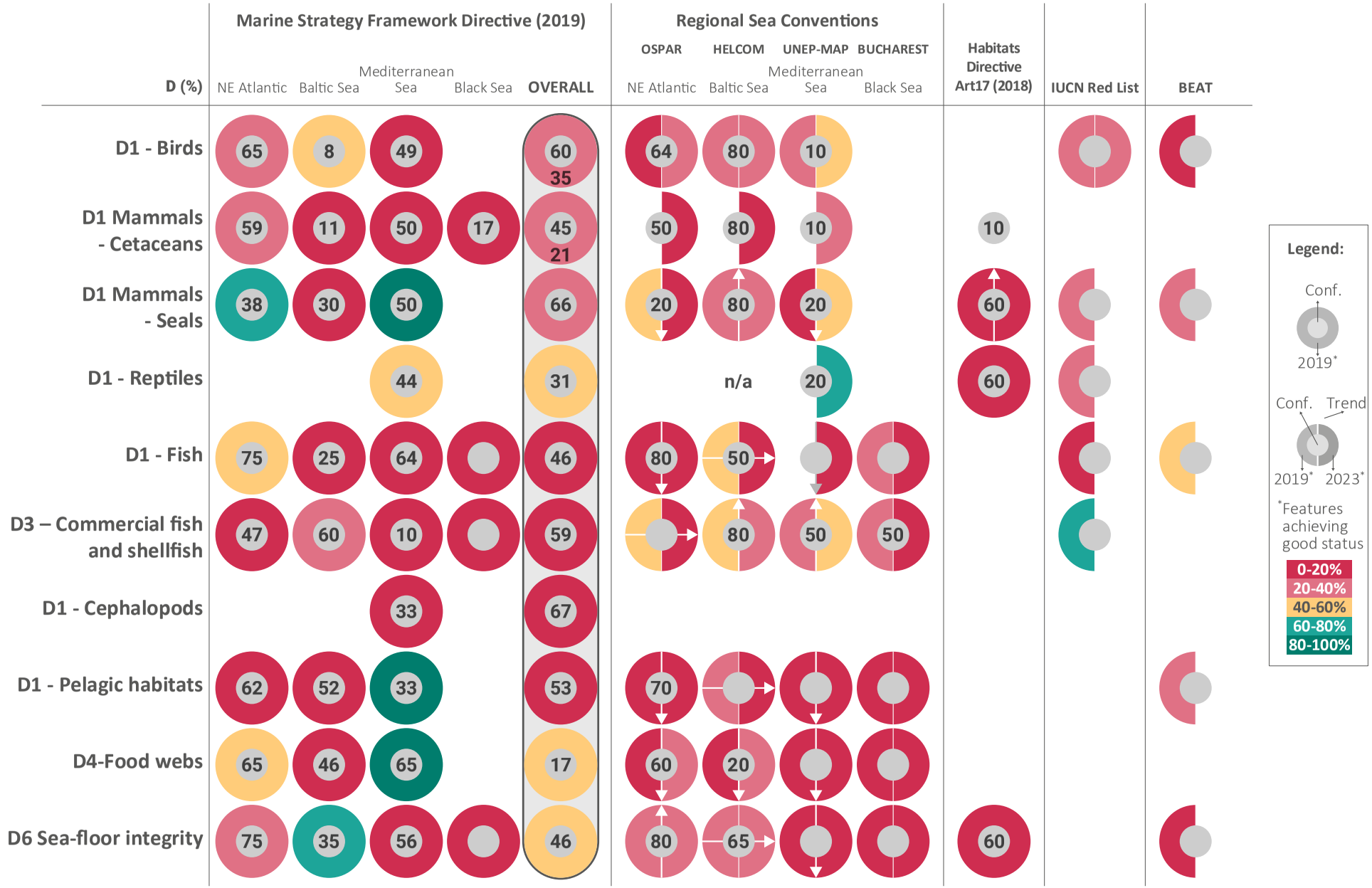
**BOX 2.1**
Ecosystem resilience

Ecosystem resilience can be defined as the capacity of an ecosystem to absorb disturbances without collapsing into a qualitatively different state that is controlled by a different set of ecological processes. In practice, ecosystem resilience builds on three characteristics:

1. An ecosystem's capacity to resist change;
2. The amount of change an ecosystem can undergo while still retaining the same controls on structure and function; and
3. An ecosystem's ability to reorganise following disturbance. Thus, resilience relates to the characteristics that underpin the capacity of ecosystems to provide ecosystem services and benefits.

For more information, please confer with EEA (2012).

**Figure 2.1**
Overall summary of the status of biodiversity in Europe's seas



## 2.1 BIODIVERSITY REMAINS CHALLENGED ACROSS VAST MARINE AREAS

Europe has long sought to halt biodiversity loss, beginning with the Birds Directive in 1979 and Habitats Directive in 1992 (Table 1.1; EC, 2009; EC, 1992). Together, these directives established the Natura 2000 network. Building on this foundation, the EU adopted a Biodiversity Action Plan in 2006 and, two years later, the Marine Strategy Framework Directive, which set the explicit objective of achieving 'good environmental status' (GES) in Europe's seas by 2020 (EC, 2006; EC, 2008). These efforts were reinforced by the EU Biodiversity Strategy for 2020, the EU Biodiversity Strategy for 2030 and most recently, the Nature Restoration Regulation in 2024 (EC, 2011; EC, 2020a; EC, 2024a). This has resulted in the monitoring of Europe's seas using more than 600 indicators, drawing on Regional Seas Conventions, EU initiatives, Member State monitoring and reporting, and independent studies (Teixeira et al., 2016). As such, many indicators cannot help in EU-wide evaluations unless they are included into integrated multi-metric indicator-based assessments which provide a coherent basis for judging the status of Europe's sea areas.

Member States' reports under the MSFD offer a first line of evidence showing which biodiversity elements have or have not achieved GES (Nikolaou et al., 2025). Although these MSFD assessments are more optimistic than regional assessments, few areas have achieved GES. Positive examples include seafloor integrity in parts of the Baltic Sea, seal assessments in the North-east Atlantic Ocean, and pelagic habitats in the Mediterranean Sea (Figure 2.2).

At the regional sea level, where biodiversity status is assessed by the Regional Seas Conventions, including inputs from non-EU Member States, the state is almost never good. Evidence from the Baltic Sea on the shortfalls in biodiversity status, declining trends across the North-east Atlantic Ocean, and repeated mass mortality events in Mediterranean Sea benthic habitats reinforce this picture (Figure 2.1; HELCOM, 2023c; OSPAR, 2023a; UNEP-MAP, 2024; Carlot et al., 2025). This is echoed by IUCN Red List trends, which highlight increasing threats for many biodiversity elements, where assessments show declines, with more species or habitats at risk of falling into vulnerable or threatened IUCN Red List categories, and even regional extinctions (IUCN, 2023; IUCN, 2026). However, a few notable exceptions exist, such as the increase in turtle breeding populations and monk seal in the Mediterranean Sea and the recovery of Baltic Grey seals and White-tailed eagle (Casale & Tucker, 2017; HELCOM, 2023c).

The combined evidence from the MSFD and Habitats Directive reporting, Regional Seas Convention assessments, and the IUCN Red List confirms that biodiversity decline in Europe's seas is systemic and widespread; however, the picture remains fragmented across regions, taxa, and assessment methods. This fragmentation makes it difficult to determine where resilience is maintained or lost, in a way that supports coherent management. To address this, MMIII presents an integrated, Europe-wide spatial assessment approach to marine biodiversity, bringing together multiple data sources across Europe's seas, including MSFD reporting (Figure 2.2; Box 2.2). By connecting activities, pressures, and ecosystem elements in a spatial context, this assessment approach supports place-based solutions, from restoration measures that can be taken under the Nature Restoration Regulation to the spatial allocation of uses as managed by the MSPD, while ensuring alignment with the MSFD objective of achieving GES.

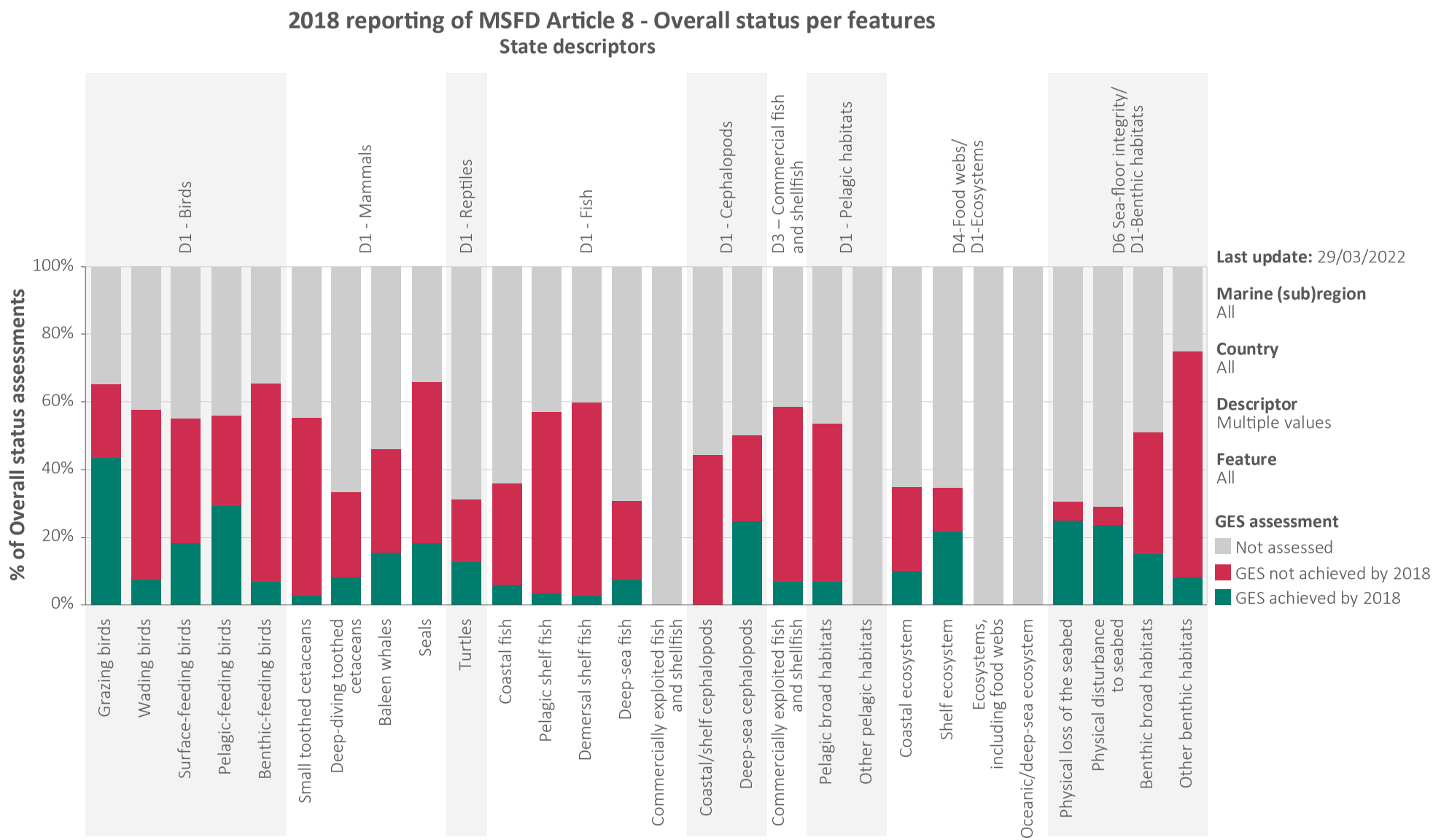
The European-wide biodiversity assessment shows that 97 % of the evaluated areas are classified as 'problem areas' (Figure 2.3). Approximately 1.33 million km², representing 15 % of Europe's seas, were not assessed by BEAT due to insufficient data.

In the North-east Atlantic Ocean, the biodiversity status is generally 'poor' to 'moderate', although some coastal areas have a 'good' status (Figure 2.3, Figure 2.4). The Baltic Sea remains largely in poor condition, whereas the Mediterranean Sea shows high variability, with areas ranging from 'bad' to 'good'. In the Black Sea, the coastal areas are mostly below the agreed thresholds for 'good' status (and offshore areas were not assessed).

Comparing coastal and offshore areas revealed similar overall patterns, but the finer spatial resolution in coastal zones highlighted substantial heterogeneity, where status ranged from best ('high') to worst possible ('bad'). These insights help identify areas where management measures are necessary. However, data on trends of offshore biodiversity remain scarce, and confidence in the assessment is low. Reliable baselines and continued and harmonised monitoring are therefore critical to improve certainty.

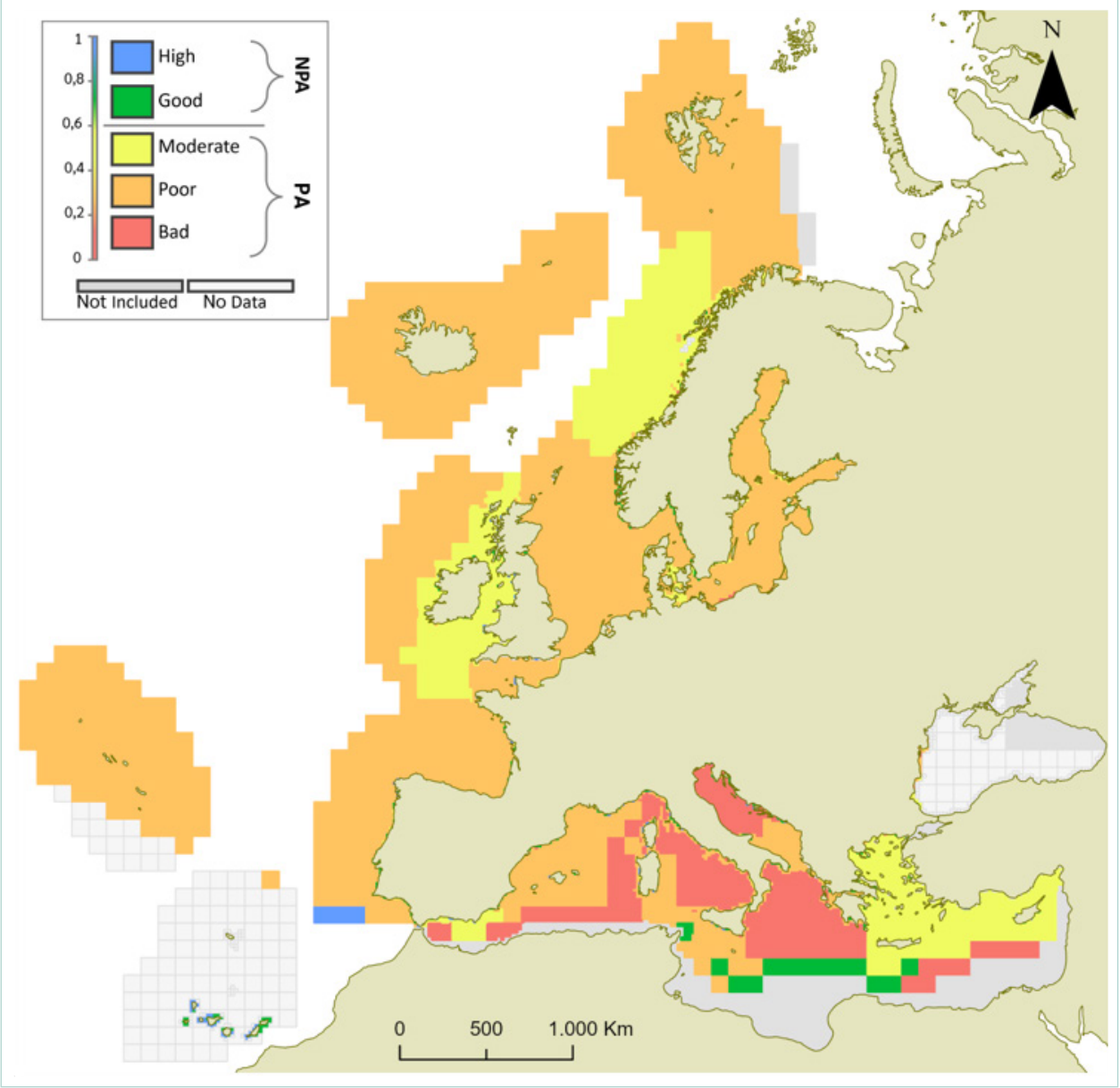
This integrated assessment of biodiversity in Europe's seas provides three main conclusions: 1) Biodiversity loss appear to be a widespread problem across Europe's seas, undermining ecosystem function, resilience to climate change, and delivery of essential goods and services, 2) habitat assessments reveal pelagic habitats in generally good condition offshore (apart from the Baltic Sea), whereas large areas of benthic habitats in shelf seas remain degraded, and 3) the overall picture arising from the MSFD, the Regional Seas Conventions, IUCN, and EEA assessments of marine biodiversity is clear: biodiversity remains impaired across Europe's seas, undermining ecosystem functions, eroding resilience to climate change, and jeopardising the delivery of essential goods and services. However, a few encouraging signs of recovery exist, such as recovering seal populations in the North-east Atlantic Ocean, and healthier pelagic habitats in parts of the Mediterranean Sea, however these remain exceptions.

**Figure 2.2**
Overall status per biodiversity feature reported by EU Member States in EEA's WISE-Marine portal (see WISE-Marine, 2026)




Notes and data sources
*This graph shows the overall status of the features reported for each descriptor, expressed as the percentage of reports in each of the 'GES achieved' categories (i.e. whether GES had already been achieved by 2018 or by when it is expected to be achieved). Member States reported on varying numbers of features within each descriptor. By using the filters, the data can be displayed by marine region/subregion, country, Descriptor and feature.*

**FIGURE 2.3**
'Biodiversity' and mapping of 'problem areas' (PA) and 'non-problem areas' (NPA)




*The mapping of 'problem areas' and 'non-problem areas' regarding marine biodiversity is based on 1) existing monitoring data from national reporting to the EU, Regional Seas Conventions, national assessment reports, and scientific literature, 2) existing and agreed assessment criteria (threshold values), 3) the EEA assessment grid, and 4) an application of the BEAT tool (Nygård et al. 2018). The mapping results (classifications) are not directly related to the status reported in relevant EU water (WFD, ND), marine (MSFD) and nature directives (HD, BD). Data collection is strong in the north because of the consistent work of the HELCOM and OSPAR Commissions. Improvements in data and indicator availability has taken place in the Mediterranean Sea Quality Status Report 2024, but the Black Sea data availability remains poor. See SM C2 for additional details regarding the data and methodology. See Table 2.1 for area-weighted BEAT scores for Europe's seas.*

**Table 2.1**
Area-weighted BEAT scores for Europe's seas

| Regional sea | Score |
|---|---|
| Baltic Sea | 0.35 |
| Black Sea | 0.37 |
| Mediterranean Sea | 0.29 |
| North-east Atlantic Ocean | 0.34 |
| Europe's seas (average) | 0.33 |

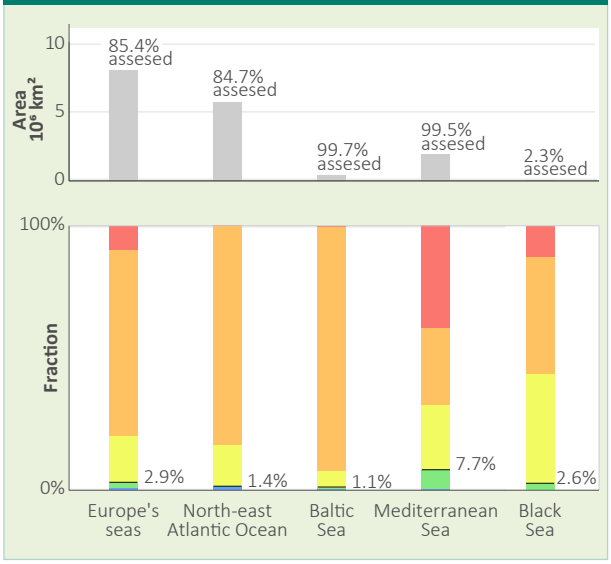
**BOX 2.2**
From data to mapping and analyses

BEAT is a multi-metric indicator-based tool for the integrated assessment of marine biodiversity. BEAT combines normalised distributions of indicators (ranging from 0 to 1, with 0.6 representing the boundary between good and 'moderate' status) in a hierarchical/nested weighting scheme and identifies 'problem areas' and 'non-problem areas' (Vaughan et al. 2019).

BEAT is based on the versions developed by HELCOM (2010, 2018) and the EU-funded DEVOTES project (Uusitalo et al., 2016; Nygård et al., 2018). Each indicator has two numerical values: one for biodiversity and another for agreed-upon target values (e.g. from MSFD, WFD, HELCOM, OSPAR, 'Maximum Sustainable Yield' (MSY), etc.).

For this assessment, the identification of 'problem areas' and 'non-problem areas' was performed on gridded indicators to produce INSPIRE-compliant maps. The details of the two tools are provided in SM C1 and C2.

**FIGURE 2.4**
European and regional BEAT results




*Notes: The total area assessed using the BEAT tool (upper panel) and the fraction of the area in each status class (lower panel). See Figure 2.3 for explanation of legend. See SM C2 for additional information.*

## 2.2 STATUS OF HABITATS, FISH, SEABIRDS, SEA TURTLES AND MARINE MAMMALS

Beyond the overall assessment of biodiversity and ecosystem health, it is necessary to examine the status of specific habitats and species groups. These details are critical for guiding targeted protection and management measures. The following section summarises the conditions of pelagic and benthic broad-scale marine habitats and major species groups, including commercially exploited fish, seabirds, sea turtles, and marine mammals.

### Pelagic habitats

Pelagic habitats form the living environment of the water column and harbour the essential building blocks of marine productivity. Phytoplankton maintains pelagic food webs, supporting higher trophic levels from zooplankton to fish, seabirds, and marine mammals, and indirectly fuelling benthic communities. Therefore, alterations in pelagic conditions cascade throughout the ecosystem.

The assessment results showed that pelagic habitats generally achieved GES in offshore waters. However, in the Baltic Sea, and many coastal areas of the Greater North Sea and Black Sea, conditions have degraded, largely due to eutrophication. In the Baltic Sea, the phytoplankton status was poor, although an increase in the zooplankton size in some areas suggests local improvement (HELCOM, 2023c). In the Mediterranean Sea, pelagic habitats were mostly in good condition, while some coastal areas showed sign of local degradation.

### Benthic habitats

At the seafloor, a variety of benthic habitats underpin biodiversity by providing structure, nurseries, and carbon storage. In EU-level assessments, they are defined based on substrate type (mud, sand, gravel, or rock) and depth zone, ranging from the littoral to the deep ocean, thus lacking data on biological features which often provide structure and characteristics for habitats. Benthic habitats provide essential ecosystem services such as natural coastal protection, carbon sequestration, and seafood production.

Benthic habitats are degraded across most assessed areas of the Baltic Sea, Black Sea, Greater North Sea, and Mediterranean Sea. Nevertheless, the BEAT assessment identified areas where GES was achieved, including the Bay of Biscay, Iberian coast, Celtic Seas, Macaronesia, offshore parts of the Norwegian Sea and Barents Sea, and the northern Baltic Sea. In the Baltic Sea, wide-spread hypoxia, driven by eutrophication, continues to degrade benthic communities, with only northern areas unaffected by oxygen depletion reaching GES (Carstensen et al., 2014; HELCOM, 2023d; Stoicescu et al., 2024).

Seagrass meadows illustrate both the vulnerability and recovery potential of benthic systems. Although loss has slowed since the 1980s and net trends have reversed since the 2000s (de los Santos et al., 2019), declines continue in the Mediterranean Sea, where many *Posidonia* meadows remain impaired (Marbà et al., 2014; Blanco-Murillo et al., 2022; Litsi-Mizan et al., 2023). According to the recent WFD assessments by Member States, about two thirds of the coastal waterbodies have macrophytes in unknown or less than good status. Similarly, about two thirds of the waterbodies have benthic fauna in unknown or less than good status (WISE-Marine, 2026).

## Fish

Europe's seas host more than 1,220 native fish species, including bony, cartilaginous (sharks, rays, and chimaeras), and jawless (hagfish and lampreys) fish. Around 15 % are endemic, with biodiversity hotspots in the Mediterranean, Macaronesia, and the Iberian Peninsula - regions that also concentrate the highest numbers of threatened species (European Commission, 2015). According to the IUCN Red List, 7.5 % of fish are threatened (15 Critically Endangered, 22 Endangered, and 22 Vulnerable, with an additional 26 Near Threatened), although risks are likely underestimated since 20 % of species remain data deficient. *Chondrichthyans* (sharks and rays) are the most at risk: all 15 Critically Endangered and 17 of the 22 Endang ered species fall within this group, including five endemic species (European Commission, 2015).

Globally, more than one third of *Chondrichthyan* species are now listed as threatened on the IUCN Red List. Recent studies show that many species, particularly those inhabiting shallow-water, coastal, and continental-shelf areas, such as angel sharks, face increasing extinction risk. This deterioration is driven largely by overfishing, by-catch, pollution, and the degradation or loss of critical habitats (e.g. Dulvy et al., 2021; Dulvy et al., 2024; Jabado et al., 2024; Koehler et al., 2025).

MSFD assessments confirm that GES for fish biodiversity (Descriptor 1) and commercial stocks (Descriptor 3) has not been achieved in any of the marine regions. In the North-east Atlantic Ocean, none of the subregions or fish assemblage groups (demersal, pelagic, coastal, and deep-sea) attained GES, and most species classified as threatened or declining continue to show a poor status (OSPAR, 2023b). In the Baltic Sea, coastal fish communities achieved GES in only two of 22 areas, and 14 species are threatened, including the regionally extinct sturgeon (*Acipenser oxyrinchus*) and the critically endangered European eel (HELCOM, 2023c). In the Mediterranean Sea and Black Sea, most fish communities remain in a degraded state, largely because of chronic overfishing (UNEP/MAP, 2024; Akoglu, 2024; Serpetti et al., 2025).

Commercially harvested fish species, especially larger individuals, play a crucial role in marine ecosystems, and most are subject to annual catch limits based on scientific assessments. Box 2.3 presents a first attempt to align the status of commercially exploited stocks with biodiversity (section 2.1), ecosystem health (section 2.3), and other thematic assessments (chapter 3), re-evaluating all-inclusive datasets on fish stock status using the same principles applied to other assessments.

## Seabirds

Seabirds are generally defined as birds adapted to life at sea, for example having salt glands used to excrete salt from ingested water and food or wing morphology easing gliding or diving. Examples of true seabirds include gannets, auks, cormorants, and some gulls. Here, the definition is broadened to include waterbirds that use the marine environment as their main foraging or wintering area, including groups such as sea ducks, loons, grebes, and waders. All seabirds nest on land contributing to the energy flow from the sea to land. In the integrated assessment seabirds were grouped based on their feeding guilds into surface-feeding, pelagic-feeding, benthic-feeding, grazing birds, and waders.

At the pan-European level, over a third of seabird species show declining trends and 26 % of species are regarded as threatened (Vulcano et al., 2024). However, the integrated assessment indicated a good overall status in large areas of Europe's seas. Grazing birds generally achieved good status and pelagic feeders showed good status in large areas of the Baltic Sea. Wading bird and benthic-feeding bird populations were in good status in many regions. Three of four grebe species and 50 % of sea-duck species are declining in Europe (Vulcano et al., 2024). In the Baltic Sea, reasons for the declining abundance of eider ducks are the increasing abundance of white-tailed eagles but also predation by invasive species on nesting sites. These cause higher predation pressure and induces breeding habitat shifts (Hermansson et al., 2023, Ekblad et al., 2025). A positive sign can be seen in the Mediterranean Sea, where the populations of two endemic shearwater species, Balearic and Scopoli's shearwaters, have increased (Martín et al., 2019).

Seabirds face many threats and as most seabirds are predators, the availability of prey restricts many populations. Fisheries compete for the same resources and degrade foraging grounds, climate change induces changes in prey availability and offshore wind farm developments potentially displace seabird foraging areas (OSPAR, 2023c). The impacts of by-catch mortality on seabird populations are still significant in areas with high fishing intensity (Ramirez et al. 2024). Most of the mortality takes place in gillnets and trawls. Breeding habitat loss and degradation, along with human disturbance of breeding colonies and hunting, exert further pressure on seabird populations (Gallo-Orsi, 2003). In addition, Highly Pathogenic Avian Influenza (HPAI) has raised concerns as species which had been resilient to the virus in previous outbreaks were impacted in 2021-2022 (Bregn-balle et al., 2024; Tremlett et al., 2024).

## BOX 2.3

'Fish stock health' and mapping of 'problem areas' and 'non-problem areas'

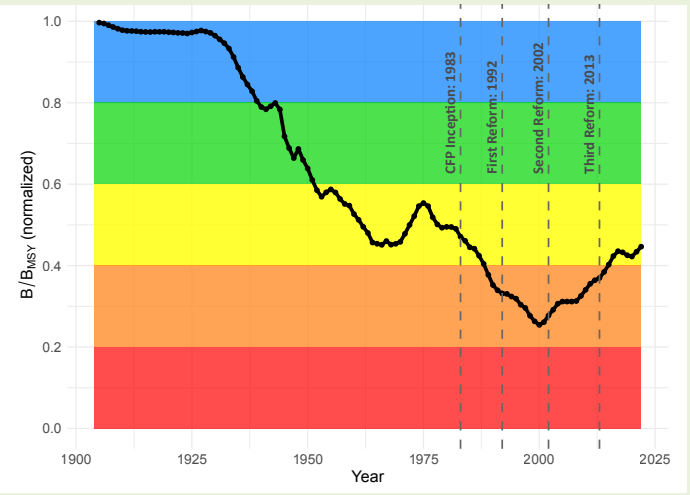
What is the status of commercial fish stocks across Europe and are there regions where stocks are being sustainably exploited? The spawning stock biomass (B) relative to the biomass that would produce MSY (B/BMSY) provides an indicator of stock health (and reproductive capacity), allowing trends in ecological status to be tracked and areas where stocks are overfished to be identified. This indicator is used in MSFD assessments (Descriptor 3, Criteria 2 on commercial fish and shellfish) to evaluate progress towards GES.

**Panel A** shows long-term trends in B/BMSY for commercially exploited fish stocks in Europe's seas, based on stock assessments from 1900-2023, normalised to a 0-1 scale to provide a standardised index of relative stock health. **Panel B** delineates assessment outcomes for 2019-2023 into 'problem areas' - where stocks, on average, are not in a good biological state (i.e., B/BMSY<1), and 'non-problem areas'- where stocks, on aver-age, are in a healthy state (i.e., B/BMSY ≥1) across the area. This analysis enables a spatial assessment of stock status comparable to other peer-reviewed multi-metric assessment tools applied in 'Marine Messages III'.

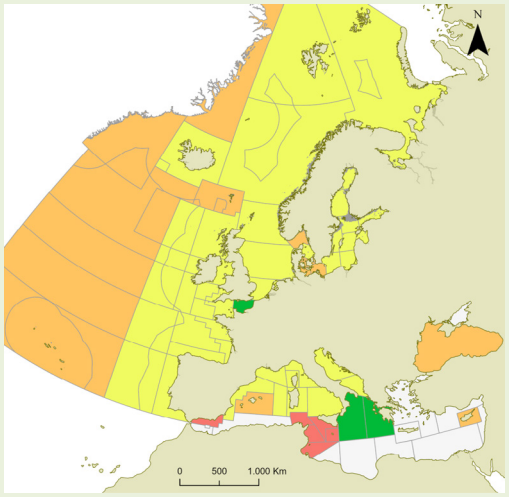
Long-term trends in biological state of stocks show three phases: 1) initial phase (up to 1950): stock status is generally 'high' to 'good', 2) deterioration phase (1950s–late 1990s): status steadily declines from good to 'moderate' to poor, remaining low for over 25 years, 3) recovery phase (early 2000s–present): status improves from to 'moderate' around 2015, reaching good status around 2023. The improvement in phase 3 stems from targeted management measures, including science-based Total Allowable Catches and quotas under the Common Fisheries Policy (CFP).

The mapping of 'problem' and 'non-problem' areas shows that for: 1) Northeast Atlantic region: most areas are 'problem areas', except one non-problem area (Eastern English Channel - Division VIId). Stock assessments here relate mainly to 'widely distributed' stocks, such as pelagic species (horse mackerel, herring, blue whiting) and sharks (porbeagle, spurdog) (no full assessments available for Azorean stocks). 2) Baltic Sea: All fishing areas are 'problem areas'. 3) Mediterranean Sea: Mixed results from NPA to PA. 4) Black Sea: the region is classed as a 'problem area'. No fishing areas achieved NPA. > 95 % of the assessed waters are problem areas, while small areas in the English Channel and the Ionian Sea are shown as non-problem areas.

**Panel A**




**Panel B**




*Notes: The mapping of 'problem areas' and 'non-problem areas' regarding the biological status of commercial fish stocks is based on: 1) existing stock assessments (available from ICES, STECF and GFCM), used to produce the EEA indicator on the Status of fish and shellfish stocks in Europe's seas (EEA, 2024a); 2) existing and agreed-upon assessment criteria (i.e., stock-specific SSBMSY or proxy values); 3) ICES statistical areas and FAO fishing areas in the Northeast Atlantic and GFCM Geographical Subareas (GSA) for the Mediterranean and Black Sea, and 4) an application of a tool for mapping fish stock status. Areas classified as 'High' and 'Good' are identified as 'non-problem areas' whilst 'Moderate', 'Poor' and 'Bad' are identified as 'problem areas'. The mapping results (classifications) are not directly related to the status reported in relevant EU fisheries (CFP) and marine (MSFD) directives. See SM C8 for additional details regarding the data and methodology.*

## Sea turtles

Marine turtles are the only reptiles found in Europe's seas. Marine turtles maintain seagrass beds by grazing and transferring energy from the sea to land through their nesting behaviour (Smulders et al., 2022).

Loggerhead and leatherback turtles occur regularly In the North-east Atlantic Ocean, whereas logger-head turtle and green turtle are found in the Mediterranean Sea. Threats to turtles include incidental capture in fisheries, contamination, nesting habitat loss and degradation, and marine litter (entangling and ingestion).

Despite gaps in systematic monitoring data, modelling has provided new insights into the population abundance and distribution of loggerhead turtles in the Mediterranean Sea (DiMatteo et al., 2022). Although the global populations of loggerhead turtles and green turtles are assessed as Vulnerable

(Casale & Tucker, 2017) and Endangered (Seminoff, 2023), respectively, both species have regional subpopulations in the Mediterranean Sea (Wallace et al., 2023) and the increasing populations and expanding distributions of both loggerhead turtles and green turtles indicate that GES can be considered achieved in the Mediterranean Sea (UNEP-MAP, 2024). Data limitations restrict trend assessments of turtle populations in the North-east Atlantic Ocean, but both species are in poor condition and were impacted by by-catch and marine litter. However, loggerhead turtles show slightly increasing occurrence around the Azore Islands (OSPAR, 2023a).

### Marine mammals

Globally, approximately 130 mammal species depend on the ocean to complete their life cycles. Marine mammals occurring in Europe's seas include pinnipeds (seals) and cetaceans (whales, dolphins, and porpoises). Among these, some are only found regionally, such as the Baltic ringed seal, which is restricted to the northern Baltic Sea, whereas many others are widespread or migratory, such as the blue whale which mainly migrate through the area and are rarely sighted.

Monitoring marine mammals is complex because of their wide distribution and high motility, which induces uncertainty in status assessments. All species are protected by EU legislation and global policy, but they face many threats and are still recovering from historical exploitation.

Grey seal abundance has been increasing in all areas where it was assessed: the Baltic Sea, Greater North Sea, and Celtic Seas. Harbour seal abundance was increasing in some parts of the Baltic Sea and the Greater North Sea, but overall, the species did not achieve GES. In the Mediterranean Sea, conservation efforts have put the monk seal population on a positive trajectory. As a result of population growth and expanded distribution the IUCN classification of the species has changed from 'Endangered' to 'Vulnerable' (Karamanlidis et al., 2023).

Small-toothed cetaceans are not in good status in any of the regions where they were assessed, largely because of mortality from fishery by-catch. Approximately 77 % of the Mediterranean cetaceans are threatened (IUCN 2023). The harbour porpoise population in the Baltic Sea are listed as Critically Endangered (Carlström et al., 2023). The Common dolphin is listed as Vulnerable in the Black Sea and Endangered in the Mediterranean Sea according to IUCN (Birkun, 2008; Bearzi, 2012). In the Mediterranean Sea, the status of common bottlenose dolphins and striped dolphins has improved since the mid-2000s (UNEP-MAP, 2024).

The status of baleen whales and deep-diving toothed cetaceans remains unknown owing to limited data, but many species, including the bowhead whale, North Atlantic right whale, and blue whale, have not yet recovered from historical whaling, and are considered threatened (OSPAR, 2023e). Consequently, the bowhead whale, North Atlantic right whale and blue whale are all red-listed in the European IUCN assessment (Weir 2023a, 2023b, 2023c).

## 2.3 ECOSYSTEM HEALTH OF EUROPE'S SEAS

The goal for Europe's seas is to achieve a state of cleanliness, health, and productivity, as outlined in the MSFD and other EU legislation (Table 1.1; EC, 2008). The European Marine Ecosystem Health Index (MESH) provides a tool for assessing overall ecosystem health, measuring the condition of marine ecosystems in relation to cumulative impacts including climate change, offering a spatially explicit perspective on where resilience is maintained or under pressure (Box 2.4; Figure 2.5).

By linking directly to the overall objective of the MSFD (achieving GES), the index connects, in a straight-forward manner, environmental assessments with policy. This helps to visualise 'ocean health' supporting resilience as the guiding principle for spatial management and solutions across Europe's seas. As such, it enables linking ecosystem resilience to both the Nature Restoration Regulation and the Maritime Spatial Planning Directive. MESH is

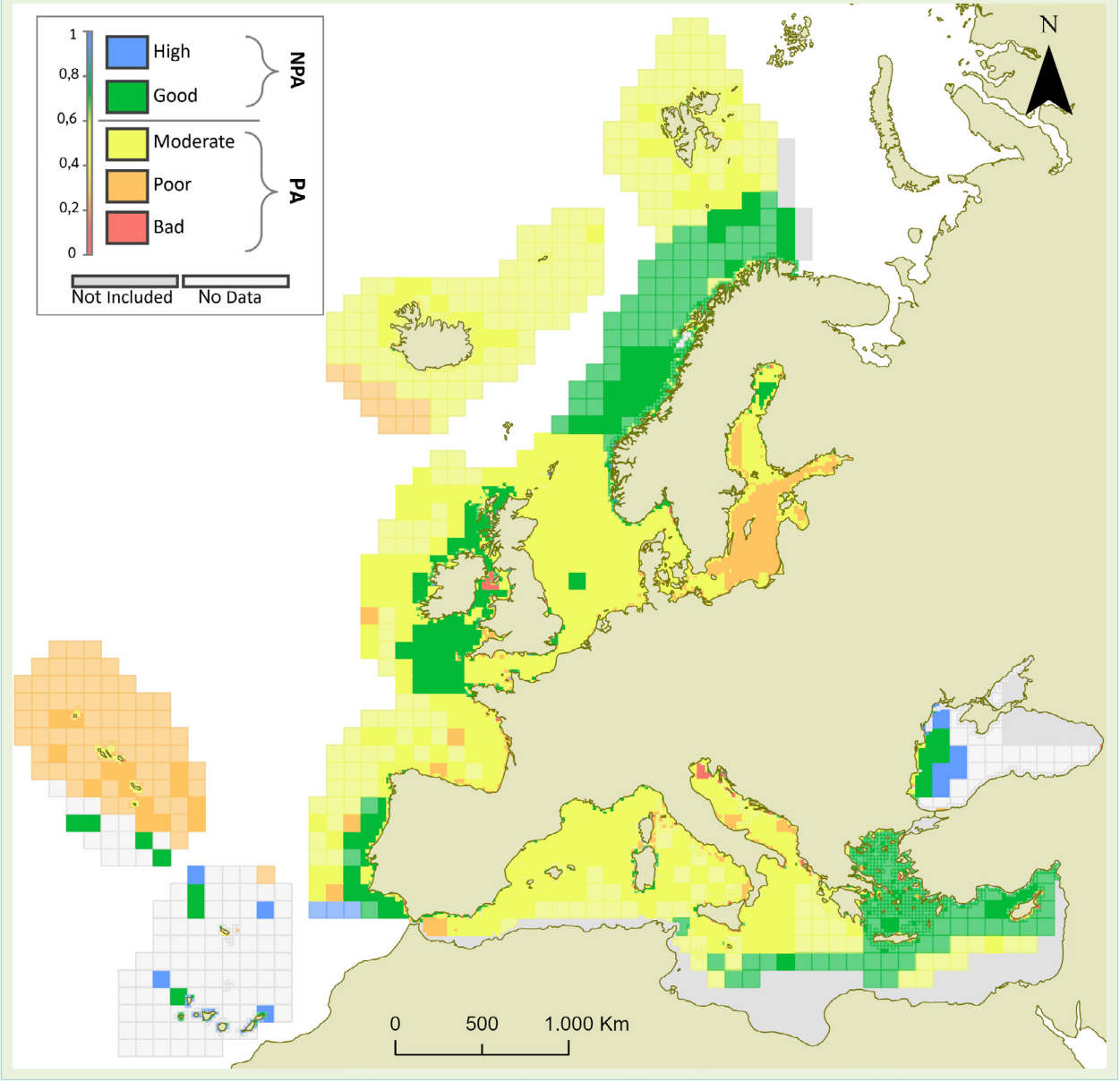
**BOX 2.4**
MESH – from data to mapping and analyses of ocean health

The 'European Marine Ecosystem Health Index' (MESH) is a multi-metric indicator-based index for the integrated assessment of marine ecosystem health. The index was originally demonstrated by Marine Messages II (EEA, 2019). In principle, it is an Ocean Health Index for Europe's seas.

MESH combines normalised distributions of indicators (ranging from 0 to 1, with 0.6 representing the boundary between good and 'moderate' status) in a hierarchical/nested weighting scheme and identifies, using the 'one out – all out' principle as a proxy for the Precautionary Principle, 'problem areas' and 'non-problem areas'.

The identification of 'problem areas' and 'non-problem areas' is based on the indicators and threshold values used in the BEAT (section 2.1), CHASE (section 3.2), HEAT (section 3.4) and MALT (section 3.3), respectively. The identification of 'problem areas' and 'non-problem areas' is carried out on gridded indicators to produce maps. See SM C2 for more information.

**FIGURE 2.5**
'Ecosystem health' and mapping of 'problem areas' (PA) and 'non-problem areas' (NPA)




*The mapping of 'problem areas' and 'non-problem areas' regarding 'ecosystem health' is based on 1) existing monitoring data from national reporting to the EU, Regional Seas Conventions, national assessment reports and scientific literature, 2) existing and agreed assessment criteria (threshold values), and 3) an application of the MESH tool. Data availability can influence results: 1) in the eastern parts of the Mediterranean Sea data are weak and cause a 'false positive' classification with low confidence, and 2) for Macaronesia, weak data cause a 'false negative' classification. Classification results are not directly related to those of the status reported in relevant EU waters (WFD, ND), marine (MSFD) and nature directives (HD, BD). The integrated assessment is calculated by the MESH index. See SM C2 for additional information about data and method. Dark grey: not assessed. Light grey: EEA area with insufficient data and thus not assessed. Full colouring: Acceptable data availability; Transparent colouring: weak data.*

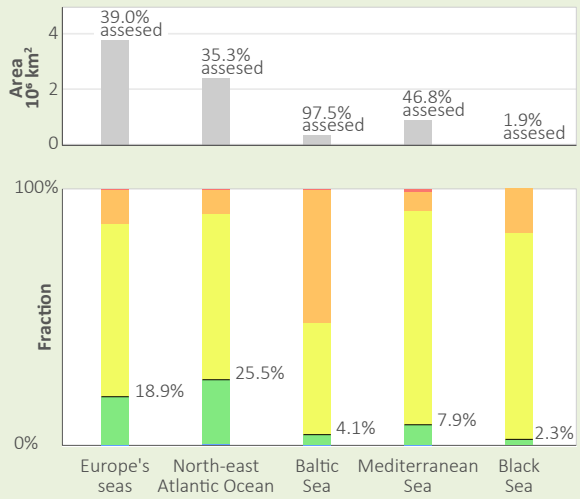
based on indicators with agreed-upon target values from EU directives, Regional Seas Conventions, and national legislation (Box 2.4). The results revealed that 'problem areas' dominate across Europe's seas, while 'non-problem areas' are rare and mostly limited to regions with low human impact (Figure 2.6). A ranking of countries with regard to ecosystem health of their marine waters is presented in Figure 2.7.

Efforts to broadly categorize ocean or marine ecosystem health are limited by data availability and consensus on thresholds, the quantitative criteria defining GES. In 2022, outcomes from the MESH tool and indicator-based tools for biodiversity (BEAT), eutrophication (HEAT), and contaminants (CHASE) were compared to EU Member Status reporting under MSFD (ETC ICM, 2022). The comparison showed high concordance between EEA's multi-metric indicator-based tools and Member States' assessments for eutrophication, biodiversity, and contaminants.

Furthermore, studies across Europe show that comprehensive evaluations can be conducted using existing data. Borja et al. (2019) determined that the use of approximately 40 indicators is sufficient to achieve robust assessment outcomes. The implementation of MESH employed 419 different indicators with associated targets, averaging 96 indicators per assessment category (Biology: 312, Chemistry: 83 and Supporting indicators: 24). Nikolaou et al. (2025) synthesised MSFD data across descriptors to generate a European regional impact assessment. The findings reveal that 8 out of 10 sub-regions (Baltic Sea, Icelandic, Celtic Seas, Bay of Biscay and the Iberian Coast, Western Mediterranean Sea, Ionian Sea and the Central Mediterranean Sea, Macaronesia, North Sea) marine sub-regions of Europe's seas are not close to be NPA and thus not in a state comparable to GES.

Founded on MESH-based identifications of 'problem areas' and 'non-problem areas', the following can be concluded: 1) Impaired ecosystem health persists from the 2019 MESH evaluations, except in the northern Celtic Seas and North of Norway, 2) 81 % of assessed areas are classified as 'problem areas,' with 'non-problem areas' limited to regions along northern Norway, Ireland, and Portugal coasts, 3) 'problem areas' distribution is similar in coastal and offshore waters, showing broad spatial impact of human activities, and 4) high human pressure is evident in the Baltic and Adriatic Seas, where biological and supporting indicators show degradation.

**FIGURE 2.6**
European and regional MESH results

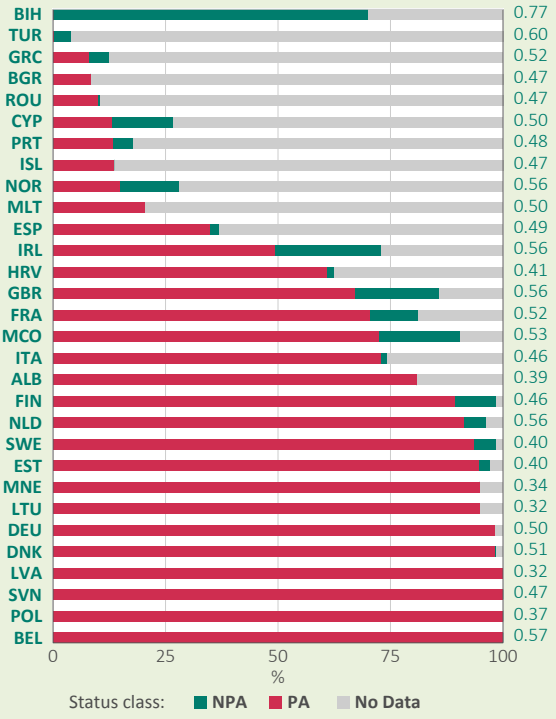



*Notes: Sum of areas by assessed integrated status class. Areas classified as 'High' and 'Good' are identified as 'non-problem areas' whilst ''moderate'' (labelled 'Mod'), 'Poor' and 'Bad' are identified as 'problem areas' with respect to marine ecosystem health by the MESH index. See SM C2 for more information.*

**Table 2.2**
Area-weighted MESH scores for Europe's seas

| Regional sea | Score |
|---|---|
| Baltic Sea | 0.40 |
| Black Sea | 0.47 |
| Mediterranean Sea | 0.47 |
| North-east Atlantic Ocean | 0.54 |
| Europe's seas (average) | 0.51 |

**FIGURE 2.7**
Ranking of European countries, based on their MESH scores



## 2.4 CASCADING HUMAN IMPACTS THROUGH MARINE ECOSYSTEMS

Marine ecosystems are dynamic, linking species, resources and human impacts via predation, competition, and resilience to anthropogenic changes. In this human-dominated world, healthy ecosystems are recognized by their ability to sustain their functionality and diversity. Such areas are rare, and human activities disturb ecosystem dynamics. While fully understanding these dynamics may be beyond reach, sufficient knowledge exists to sustainably manage human impacts. However, our understanding of indirect impacts remains simplified, although many of them are documented in the literature (Wåhlström et al., 2025).

### There are three main ways to disturb marine ecosystems:

1. altering the physical or chemical living conditions for species,
2. removing top predator species from the food web, and
3. increasing nutrient supply to the food web, altering its balance (e.g. Cloern, 2001; Korpinen & Bonsdorff, 2014).

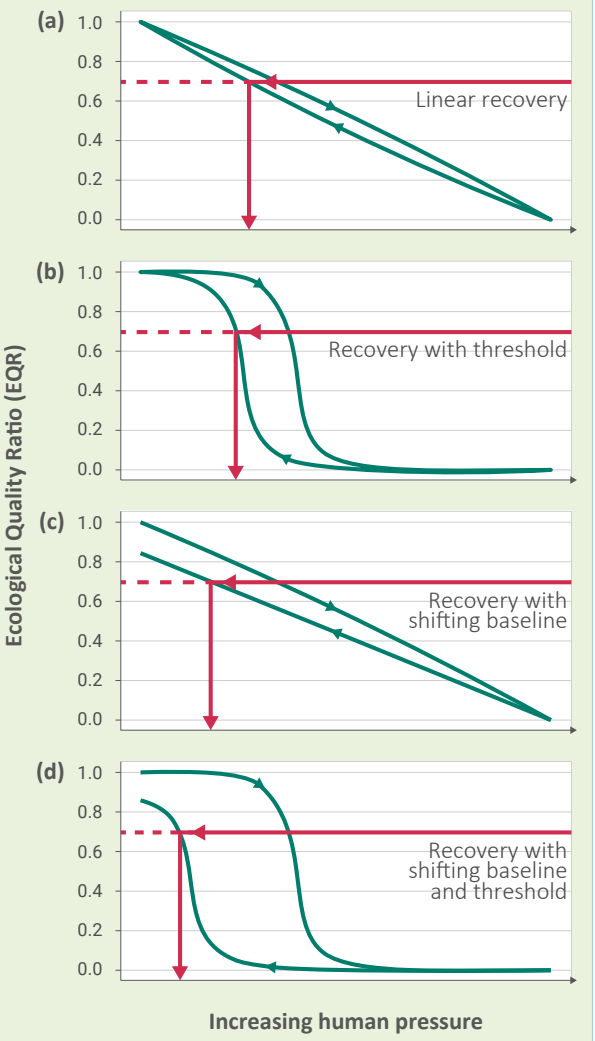
Each cause has a direct impact but the effects ripple through the entire ecosystem. These indirect consequences can be viewed from angles: How does a species' community change if physicochemical conditions are altered? How does a food web react if the predation pressure on top decreases? How do herbivores react when plants grow faster? It is acknowledged that all three ways are severe, acting all together and managing them is vital to maintain healthy ecosystems.

Throughout history, Europe's fisheries have depleted the marine food web from large fish species, whaling caused extinction of one species and nearly many others, seal hunting with pollutants greatly reduced seal populations, and persecution drove white-tailed eagle near extinction. The loss of top predators caused cascading effects through the food web with smaller fish species becoming abundant which feed more effectively on herbivores (both benthic and planktonic). Supporting this logic, evidence shows that such a loss of top-down control may amplify eutrophication of marine environments (Heck & Valentine, 2007).

After World War II, the availability of artificial fertilizers enabled rapid expansion of food production, but built-up excess nutrients in European soils, which leaked into aquatic systems.

The resulting eutrophication was not new, as poor waste management earlier had polluted coastal waters earlier, but nutrient loads to aquatic environments polluted entire sea basins (HELCOM, 2023c) or parts of sub-basins (Devlin et al., 2023; Gianni et al., 2024). This led to high primary production and alterations in chemical conditions, such as lack of oxygen (Korpinen & Bonsdorff, 2014). Food web changes were evident, including increases in plant biomass and changes in species composition. With the lack of top predators, the food web became dominated by small- to medium-sized fish and reduced herbivory. Indirect effects are even more complicated with the spread of invasive species, further disturbing the trophic balance (Katsanevakis et al. 2014). This dual challenge of increased nutrient supply and loss of top predators raises

**FIGURE 2.8**
Examples of response trajectories, thresholds and a shifting baseline




*Notes: Conceptual models of (a) linear recovery, (b) recovery with a threshold, (c) recovery with a shifting baseline and (d) recovery with the combination of a shifting baseline and regime shifts. The dotted red line indicates the target, and the red arrow indicates the needed reduction of pressures. Source: Laamanen et al. (2017).*

questions about potential recovery trajectories; and if the recovery will become more difficult to achieve (Figure 2.8).

Ensuring the success of management actions depends on incorporating strategies to improve environmental status through action-mediated recovery processes that cannot assume linear recovery trajectories. Ecosystem degradation trajectories are not necessarily bidirectional. Ecosystem-based approaches and management strategies must address both moving thresholds and shifting baselines, adding a requirement for flexible and adaptive management responses (Figure 2.8). Ensuring that measures are grounded in science and evidence creates the best chance of achieving 'good environmental status', 'good ecological status', and 'favourable conservation status'. In doing so, the EU can not only reduce the risk of future implementation gaps but also demonstrate how effective monitoring and assessment can drive planning of policies and actions to real progress toward healthier, cleaner, and resilient seas.

The MSFD takes a holistic view of the marine environment and aims to restore ecosystem balance by ensuring that all levels of the marine food web are balanced. This report shows that trends toward a balanced ecosystem are visible for large marine species, but the goal remains distant. The integrated fish assessment (Box 2.3) showed that recovery of commercially exploited fish stocks is halfway to healthy levels. Positive trends in recovering from eutrophication exist in some European areas, while other regions experience intense bottom-up control. Reducing fisheries and fertilization while maintaining food production in Europe has been challenging. Chapters 3 and 4 present the causes, and Chapter 5 presents and discusses the solutions.

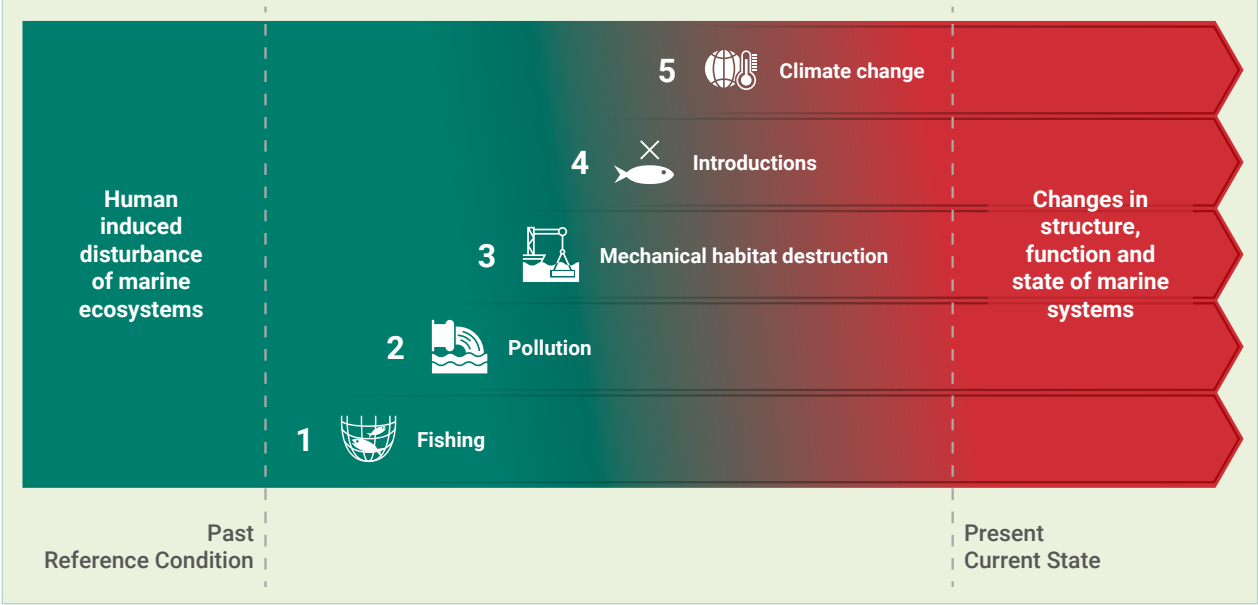
# 3. Pressures from sea- and land-based human activities

- The dominant pressures on marine ecosystems are: 1) inputs of contaminants, 2) extraction of fish species including by-catch, 3) climate change, 4) seabed loss and disturbance, and 5) inputs of nutrients.
- The most impacted habitats and species, based on spatial analyses of pressures, are soft-bottom habitats and seabirds and fish.
- 'Problem areas' were identified in all assessed areas in Europe's seas for contaminants (CHASE; 96 %), eutrophication (HEAT; 16 %) and marine litter (MALT; 70 %), when using multi-metric indicator-based assessment tools.
- The cumulative effects of historic and current land- and sea-based human activities are at unsustainable levels and thus putting the achievement of good environmental status at risk.

Throughout history the ocean has been considered as a source of rich, bountiful resources capable of absorbing all human waste and exploitation. This assumption is no longer true. The first signs of overexploitation were seen in extinctions of oyster beds and some island birds and sharp declines in whale and seal populations. This was followed by pollution effects in coastal marine waters and fish stock collapses due to overfishing resulting in severe economic losses (Jackson et al., 2001).

These patterns of overexploitation and pollution continue today, with the added threat of anthropogenic climate change causing tipping points to be passed leading to abrupt changes to alternative, less desirable states (Möllmann et al., 2009; IPCC, 2018; IRP, 2019). These changes may be irreversible within policy-relevant timescales. Therefore, management solutions to achieve clean, healthy, and productive seas have to look not only at the individual parts of marine ecosystems but also at the cumulative effects of multiple stressors causing the disturbance (Figure 3.1).

**FIGURE 3.1**
Progression of human induced disturbance in coastal marine ecosystems




*Notes: Historical progression of human disturbances affecting coastal ecosystems. Commercial exploitation of fish stocks (step 1) always preceded other human disturbances. This is the basis for their hypothesis of the primacy of overfishing in the deterioration of coastal ecosystems world-wide. Subsequent step 2 (pollution: contaminants and/or nutrients), step 3 (loss or degradation of benthic habitats), step 4 (introduction of non-indigenous species) and step 5 (climate change: temperature, pH and alkalinity) may vary in order. Source: Modified from Jackson et al. (2001).*

This chapter presents the distribution and intensity of pressures from human activities in Europe's seas and assesses their potential effect on the marine ecosystems. Adopting a dual approach, it examines both cumulative effects and selected individual pressures of sea- and land-based origin and their impacts on habitats and ecosystems. Spatial understanding of these human-ecosystem connections can enhance ecosystem-based management approaches and inform EU policy dialogue balancing marine environment objectives with Blue Economy goals, thereby integrating social and ecological resilience rather than pursuing them separately.

## 3.1. CUMULATIVE EFFECTS: HUMAN ACTIVITIES SHAPE THE MARINE ENVIRONMENT

Many pressures occurring together can overwhelm local ecosystems' resilience and have adverse synergistic effects that exceed the sum of the individual pressures' effects (Arrigo et al., 2020; Nagelkerken et al., 2020). While pressure interactions are typically too complex for reliable prediction of the effects of multiple pressures (Côté et al., 2016), the risk of adverse effects is high where many intense pressures coincide with sensitive species and habitats.

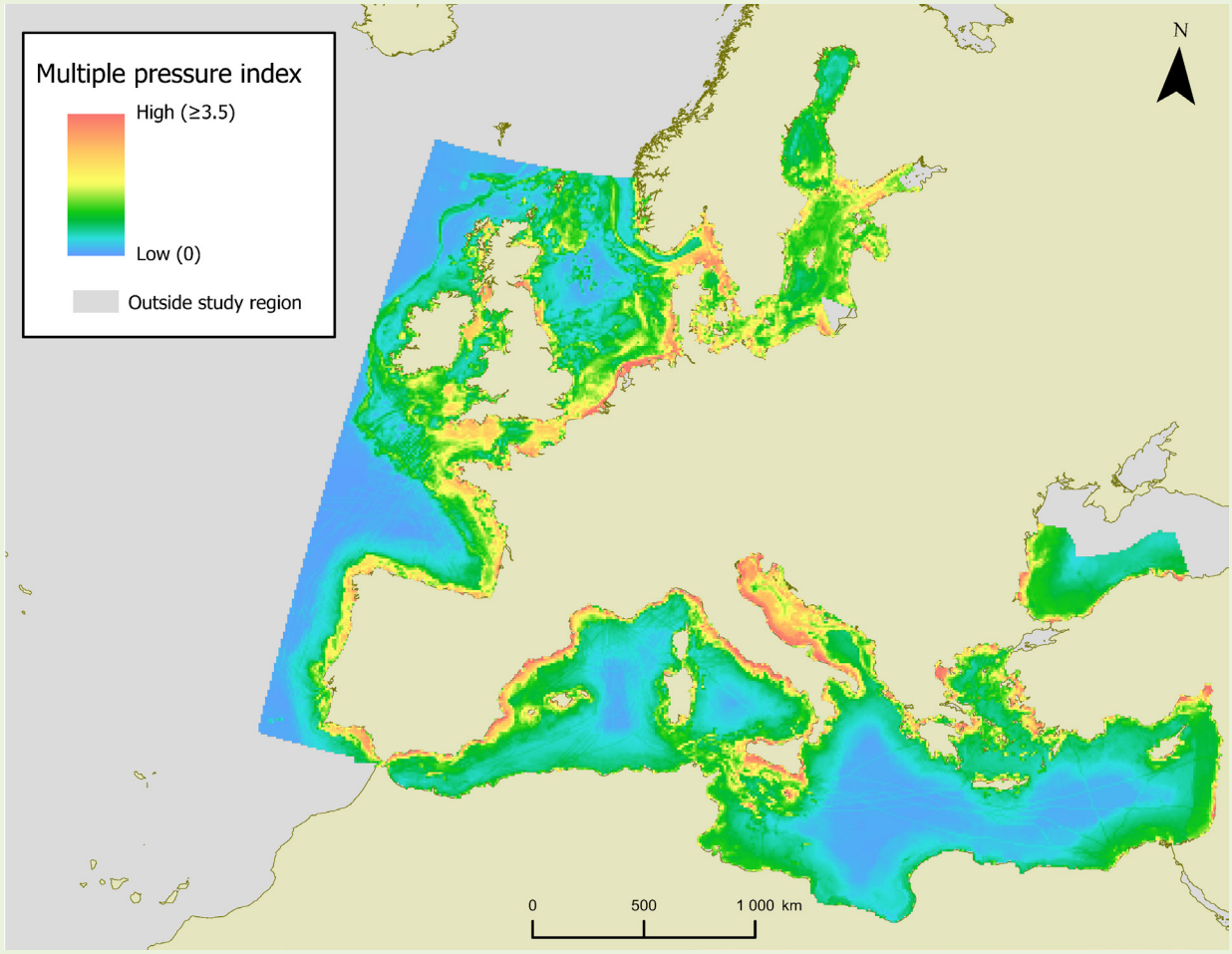
This risk was mapped with a simple spatial model that overlays data describing pressures with data describing broad habitats or species groups (henceforth, ecosystem components), as well as the sensitivity of these ecosystem components to each pressure (Halpern et al., 2008, 2025). The pressures included species extraction by commercial fishing (target species and by-catch), climate change (sea surface temperature and pH changes), hazardous substances, loss and disturbance of the seabed, eutrophication, non-indigenous species, underwater sound from shipping, and densely populated and urbanized coasts. The ecosystem components included pelagic and seabed habitats, mainly pelagic species groups like fish, seabirds, and baleen whales, and biogenic habitats like coldwater corals and seagrass meadows (see SM C3).

The output from the analysis is a map with a quantitative index. This index has no direct physical interpretation but can be understood as an indication of the relative risk of harmful effects from all pressures on sensitive ecosystem components and how this risk varies across Europe's seas. The results showed that the risks of adverse cumulative effects are high along many of Europe's coasts, especially on the southern North Sea coast and the northern Mediterranean coast. It is 'moderate' on most of the continental shelf and lower in deeper waters (Figure 3.2). Coastal ecosystems are exposed to numerous pressures from local human uses of the sea and catchment. In contrast, many continental shelf areas are primarily at risk from a combination of commercial fishing, seabed loss and disturbance, and hazardous substances. Eutrophication is a key pressure in the Baltic Sea and in several coastal areas elsewhere in Europe's seas.

Hazardous substances had the largest footprint on Europe's seas, followed by species extraction from commercial fishing, and current climate change pressures (Figure 3.3). The other pressures affected smaller areas but can pose considerable local to regional risks. With a rapidly expanding footprint, climate change has myriad effects across ecological scales (Woodburn et al., 2025) and can exacerbate or mitigate local pressures, depending on the ecological context (Gissi et al., 2021). The effects of climate change are widespread (see Chapter 4). Already now, regular marine heat waves disturb wide areas in the Mediterranean Sea and other southern sea areas (Dabulevičienė & Servaitė, 2024; Darmaraki et al., 2024).

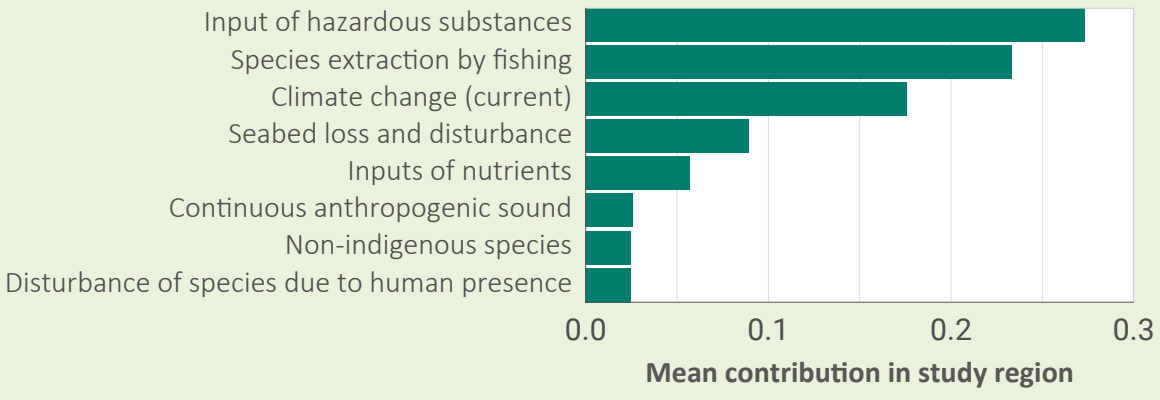
In Europe's seas, all species groups and habitats are exposed to several pressures to which they are sensitive. Among species groups, certain fish species are under the most pressure from commercial fishing and seabed habitats suffer from coastal development and recreational activities (Figure 3.4). Among habitats, soft-bottom habitats, coastal pelagic habitat, and biogenic habitats like seagrass meadows, rocky reefs, and salt marshes are under most pressure, whereas deep-sea habitats are less exposed (Figure 3.4).

**FIGURE 3.2**
Mapping of multiple human pressures in Europe's seas



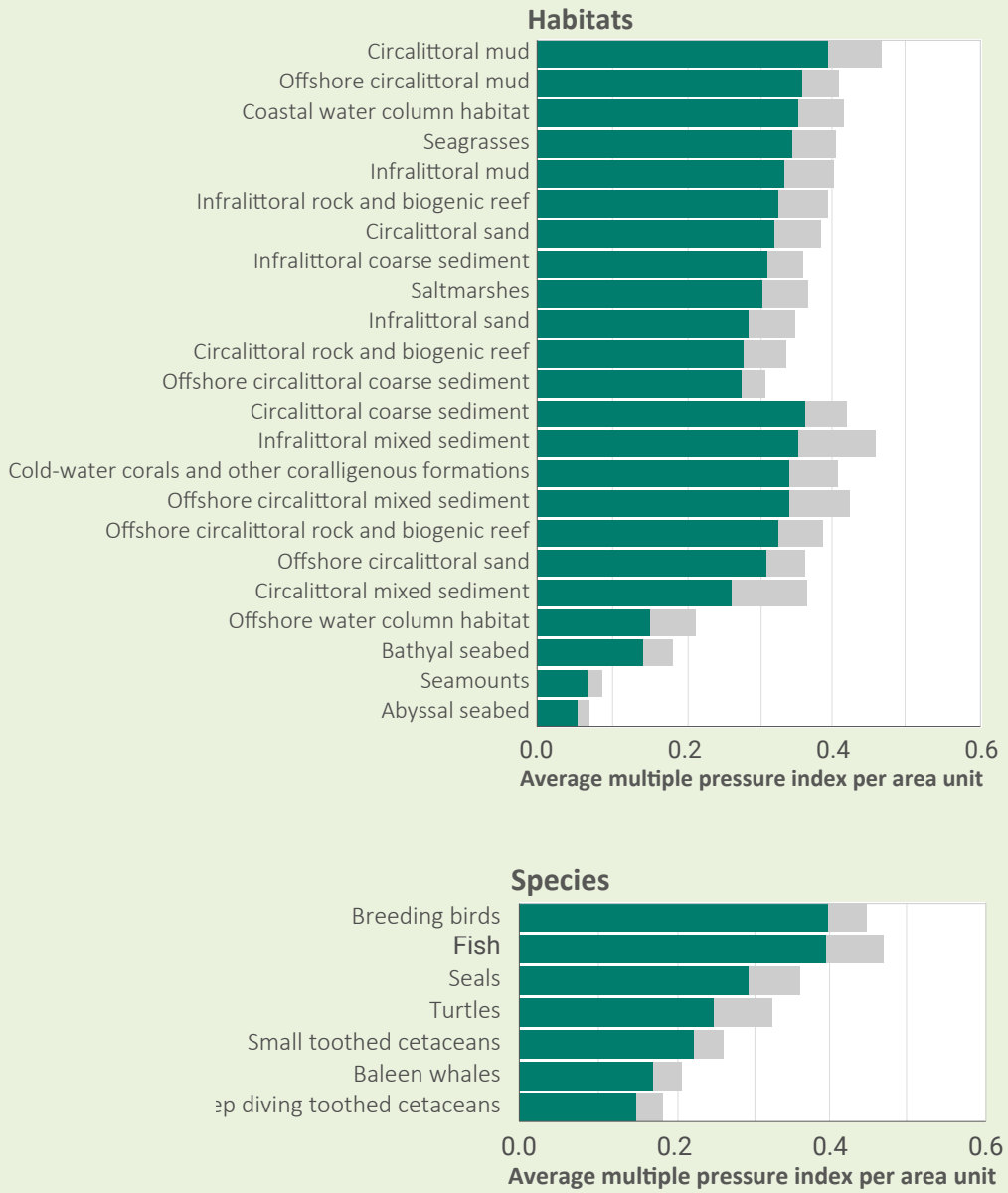

*Notes: Index showing where multiple pressures co-occur with sensitive species and habitats, including current (2025) climate pressures. The underlying data used are in some cases proxies for the pressures. For example, data on the commercial fishing are from the Global Fishing Watch and not official EU fishing statistics due to restricted access to fine-resolution spatial data. As other examples, shipping intensity serves as a proxy for underwater sound, and substance inputs are extrapolated from their at-sea concentrations. Access to gap-free, fine-resolution, continental-scale data is needed to improve the analyses, especially for fishing effort and catch. See SM C3 for additional information.*

**FIGURE 3.3**
Pressures posing greatest impacts on Europe' seas




*Notes: Ranking of pressures reflecting their spatial extent and how sensitive species and habitats are where they occur. See SM C3 for additional details regarding the data and methodology.*

**FIGURE 3.4**
Habitats and species groups most impacted by anthropogenic pressures



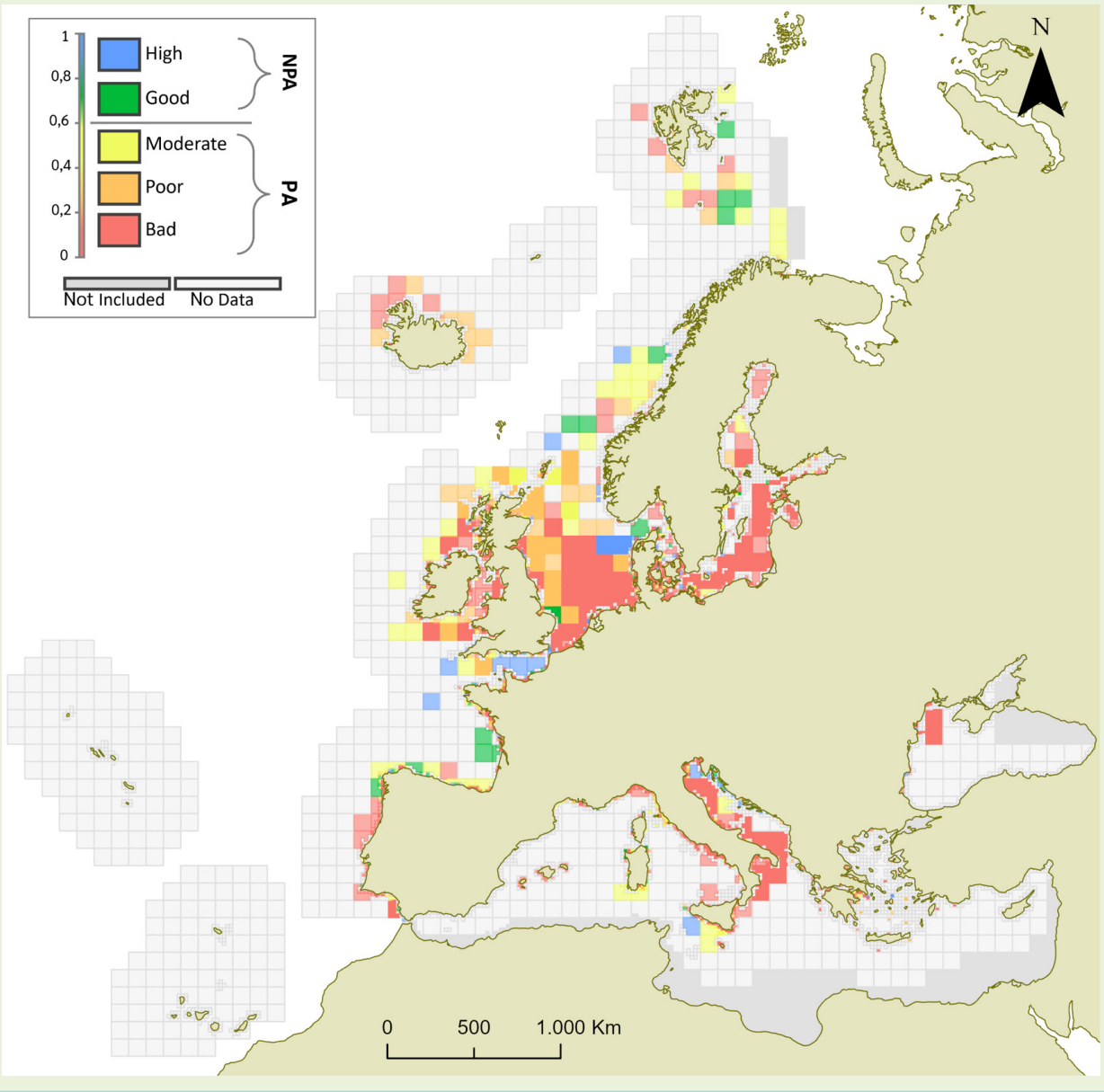

*Notes: Average pressure index for habitats (top) and species groups (bottom), normalized by the spatial extent where they occur. A longer bar means that the habitat or species group is exposed to a greater number of or more intense pressures that it is sensitive to. The green part of the bars represents local pressures caused by sea use and land use in the catchment (like fishing and pollution), whereas the light grey part represents current climate pressures. See SM C3.*

## 3.2 HAZARDOUS SUBSTANCES

Hazardous substances include a wide variety of compounds that are toxic, persistent, and may bio-accumulate, posing risks to marine life, ecosystem functioning, and human health. These substances can be naturally occurring or anthropogenic, and are released through industrial, agricultural, and domestic activities. They can affect marine organisms through contaminated ingestion, and by accumulating in sediments and biota.

Status for hazardous substances was mapped across Europe (Figure 3.5). The assessed areas are mainly in the coastal and shelf areas. A total area of 721.386 km² was assessed across all Europe's regional seas. Of these, 693.554 km² (96 % of the assessed areas) were identified as 'problem areas' due to contamination. The WFD and MSFD require assessments of specific hazardous substances (so-called 'Priority Substances'), but in this report, additional monitored substances (where assessment criteria exist) were included to give a more accurate and robust identification of 'problem areas' (see SM C4).

**Figure 3.5**
Contaminants and mapping of 'problem areas' and 'non-problem areas'



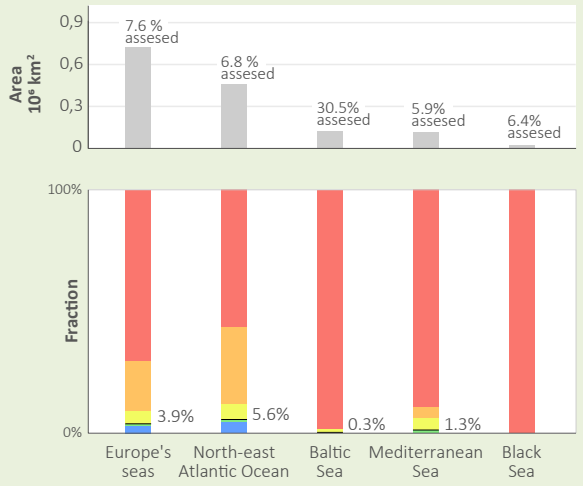

*Notes: These non-problem area/problem area (NPA/PA) classifications are not directly related to those of status in relevant EU water, marine and nature directives. This is because, inter alia, the tool uses 1) a precautionary approach based on the 'one out, all out' principle when integrating indicators, 2) all available EU and regional-level indicator-based contaminants information, and 3) EU and regional threshold values (assessment criteria). This is rather than just using the status aggregation rules, the information that may have been reported and the quality thresholds under those directives. The map also includes the results for cells where only one indicator was available (semi-transparent cells). The integrated assessment is based on the CHASE tool. See SM C4.*

Contamination levels exhibit variability both among basins and across different environmental matrices. In the Baltic Sea, conditions are predominantly problematic, with sediment and biota matrices frequently classified as 'Bad' or ''Moderate'. The primary contributors to these adverse assessments are metals, polycyclic aromatic hydrocarbons (PAHs), and especially organo-halogen compounds such as PBDEs. A similar situation is observed in the Black Sea, where the water matrix is predominantly rated as 'Bad,' attributed to the same categories of pollutants. Furthermore, limited spatial coverage affects the overall assessment in this sea region. The Mediterranean Sea predominantly falls within the 'Bad' and 'Moderate' status categories, but the data coverage is skewed towards coastal areas, with offshore regions still underrepresented. In contrast, the North-east Atlantic Ocean, due to its larger expanse, exhibits a broader distribution of results. The sediment, biota, and water matrices present significant challenges, with over half of the water and biota assessments classified as 'Bad'. Conversely, the bioeffects matrix offers a more favourable outlook, with 'High' status being the most prevalent. Similarly, metals, PAHs, PCBs, organobromines, and other organohalogens are identified as the primary contaminants.

The probability of being in healthy condition in the assessed areas varies among regional seas - the percentage of non-problem areas in the Baltic Sea, Black Sea, Mediterranean Sea, and North-east Atlantic Ocean are 0.3 %, 0 %, 1.3 % and 5.6 % of the area being assessed, respectively (Figure 3.6).

While the integrated assessment offers a comprehensive overview of Europe's seas, the individual matrices yield significant insights. Sediment and biota provide the most extensive coverage, particularly in the Baltic and North-east Atlantic regions. In the Mediterranean, sediment monitoring has shown improvement compared to previous assessments, notably around Italy. Coastal waters are generally well-represented in the water matrix; however, offshore areas remain undersampled in both the Mediterranean and the Black Sea. Furthermore, there is a notable deficiency of water matrix data for the northern Baltic Sea. For further analyses and results, please refer to the Supplementary Material (SM).

**FIGURE 3.6**
European and regional CHASE results




*Notes: The top chart shows the assessed areas in each regional sea. The bottom categorised charts show the percentage of the areas categorised as problematic and non-problematic by the CHASE tool. See SM C4 for additional details regarding the data and methodology.*

## 3.3 MARINE LITTER

Marine litter represents all persistent, synthetic, or processed solid items or fragments that have been discarded, disposed of, or abandoned, either directly into the coastal and marine environments or transported from land to the sea. Most litter in Europe's regional seas originates from land and 16 % comes from maritime activities (EEA & EMSA, 2025). Globally, it was estimated that in 2016 alone between 19 and 23 million tonnes of plastic waste entered the aquatic environment (Borrelle et al., 2020) and in Europe, the EEA estimated that more than 3 million tonnes of plastic waste are mismanaged annually (ETC-BE, 2026).

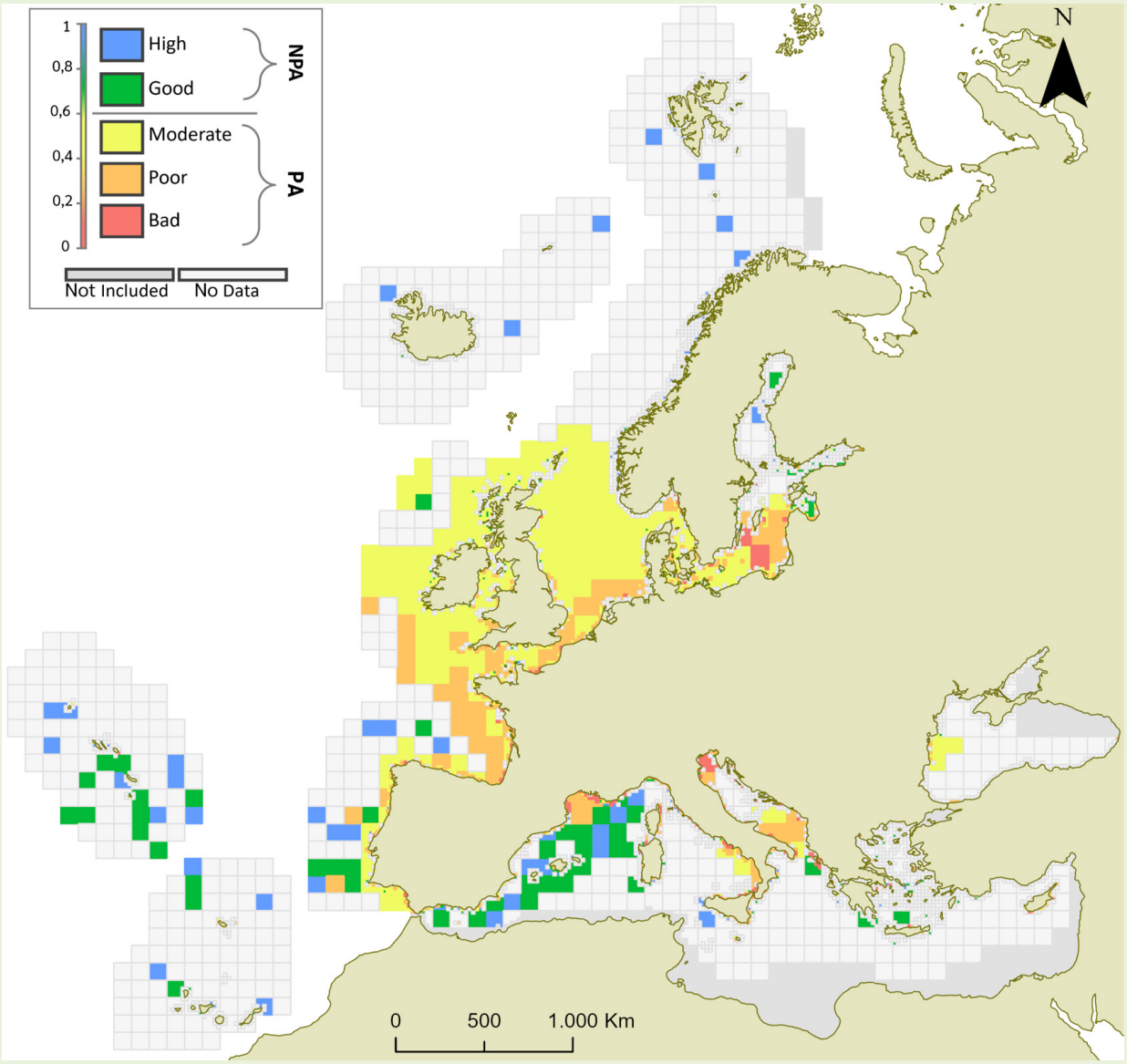
The issue of marine litter and plastic pollution is high on political agendas. It is directly addressed by the Marine Strategy Framework Directive (MSFD), while the recent Zero Pollution Action Plan (ZPAP) includes specific reduction targets for waste generation, for plastic litter at sea and for releases of microplastics to the environment. Many other pieces of European legislation aim at preventing litter pollution by driving changes along the life cycle of plastics, from production and consumption, down to waste management. The Single-Use Plastics (SUP) Directive, for instance, targets commonly found plastic items on European beaches, entailing varied measures to promote circularity, improve waste management, reduce consumption, and encourage more sustainable alternatives of these applications.

Marine litter is closely linked to human needs and sectors. Although plastic production in Europe has stabilized since 2018, plastic waste generation continues to rise faster than GDP, increasing from 12.4 million tonnes in 2010 to 20.3 million tonnes in 2022. Per capita plastic packaging and small plastic items (PPSI) waste generation across Europe rose from 34 kg in 2012 to 44 kg in 2022 (ETC-BE, 2026). The community science initiative of the EEA, Marine Litter Watch (MLW) initiative shows that 86 % of marine litter collected is plastic (Šubelj & Veiga, 2024). Single Use Plastics (SUP) are the most frequent marine litter in the Baltic Sea, Mediterranean Sea, and North-east Atlantic Ocean.

Europe improved its waste management capacity over the last decade. However, reducing mismanaged waste, and subsequent loss of litter to the environment is not achieved yet. Microplastic sources also have not decreased. The EEA estimated that unintentional microlitter releases to the environment increased by 7-9 % between 2016 and 2022 (EEA & JRC, 2025). A comprehensive pan-European study estimated that 626 million floating items enter European regional seas annually from 32 EU and Eurasian coastal countries via rivers, depositing 3,382 tonnes of litter. Several high-income European countries rank among the largest contributors (González-Fernández et al., 2017).

In this assessment, a total area of about 2.67 million km² of Europe's seas was evaluated by the European Marine Litter Assessment Tool (MALT; EEA, 2022c). Of this, around 30 % was classified as 'non-problem areas' (Figure 3.7). For beach litter, only about

**FIGURE 3.7**
Marine litter and mapping of 'problem areas' and 'non-problem areas'




*Notes: These non-problem area/problem area (NPA/PA) classifications are not directly related to those of status in relevant EU directives. This is because, inter alia, the tool uses 1) a precautionary approach based on the 'one out, all out' principle when integrating indicators, 2) all available EU and regional-level indicator-based contaminants information, and 3) EU and regional threshold values (assessment criteria). This is rather than just using the status aggregation rules, the information that may have been reported and the quality thresholds under those directives. See SM C7 for additional details regarding the data and methodology.*

11 % of the assessed area was described as 'non-problem', while for floating micro-litter the situation was much better: 94 % of the area was classified as 'non-problem'. Seafloor litter showed the most concerning results: only 1.8 % of the assessed area was considered as 'non-problem'. The picture differs between regional seas (Figure 3.8). When all indicators were integrated and assessed together, 24 % of the assessed area of the North-east Atlantic Ocean was classified as 'non-problem', and in the Baltic Sea, the share was 18 %. The Mediterranean Sea performed best, with 62 % of its assessed area in 'non-problem' condition, while the Black Sea showed the poorest results, with only 1.2 % of the assessed area classified as 'non-problem'.

EU Member States reported a 29 % decrease in median beach litter from 2015-2016 to 2020-2021 (EC & JRC, 2025). This decrease was found across all regional seas' coastlines but has not been confirmed by data analyses in relation to 'Marine Messages III' – see SM C7. Except for the Baltic Sea, regional values indicate not-good status for the beach macro litter. The EU coastline median in 2020-2021 was 200 items/100m, ten times above the GES threshold. The Black Sea and Mediterranean Sea have the most polluted coastlines, with medians of 684 and 233 items/100m, respectively, in 2020-2021 (EC & JRC, 2025).

In examining marine litter in Europe's seas, three key findings emerged: 1) Marine litter represents a significant large-scale issue, with 'non-problem areas' mainly in offshore regions, 2) data availability needs improvement, particularly in the Black Sea and Mediterranean Sea, and 3) the EU has established a legislative framework to address marine litter across product lifecycles, especially plastics; however, a policy gap remains for riverine litter.

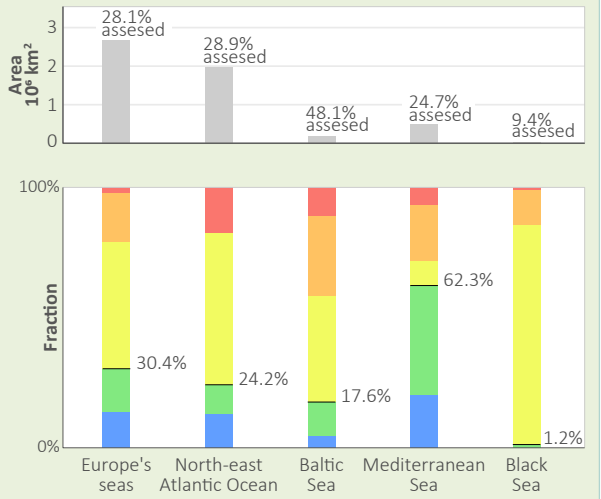
## 3.4 NUTRIENT ENRICHMENT AND EUTROPHICATION

Nutrient enrichment is the excessive input of nutrients like nitrogen and phosphorus into coastal or marine ecosystems, leading to eutrophication, which is a state of increased nutrient levels and excessive aquatic plant growth. This accelerated growth can result in harmful algal blooms (HABs), changes in species assemblages, impaired water quality, lower water transparency, low oxygen levels (hypoxia/anoxia) and damage to marine life, ultimately creating 'dead zones' and impairing environmental status and ecosystem health. Therefore, it often has a negative impact on ecosystem services.

Nutrient inputs to marine ecosystems come from various sources, like river runoff (carrying agricultural fertilizers and household wastewater), atmospheric deposition (e.g. from traffic and animal husbandry), direct discharges (like sewage and aquaculture), and in some areas also ground water. Rivers are a primary transport route for land-based nutrients to marine ecosystems. Atmospheric inputs contribute less but are also a significant source of especially nitrogen. In this report, we present and updated and now European-wide multimetric indicator-based assessment of eutrophication, which is a more direct signal of ecosystem impacts.

Eutrophication status was assessed in an area covering 24.5 % of Europe's seas. The remaining 75.5 % was not assessed due to insufficient data or assessments, or missing threshold values (Figure 3.9, Figure 3.10). For robustness, only assessments based on more than one indicator were counted. However, many of the areas not assessed are offshore waters in the Barents Sea, the Celtic Seas, and the Mediterranean Sea, where eutrophication is unlikely to be a significant issue (Figure 3.9). The assessment of eutrophication showed that 76 % were identified as 'non-problem areas', while 24 % were categorised as 'problem areas', predominantly located in coastal regions where agricultural activities and river run-off exert significant influence. The primary effects of eutrophication are observed in parameters directly influenced by nutrient inputs, such as phytoplankton, benthic fauna communities,

**FIGURE 3.8**
European and regional MALT results

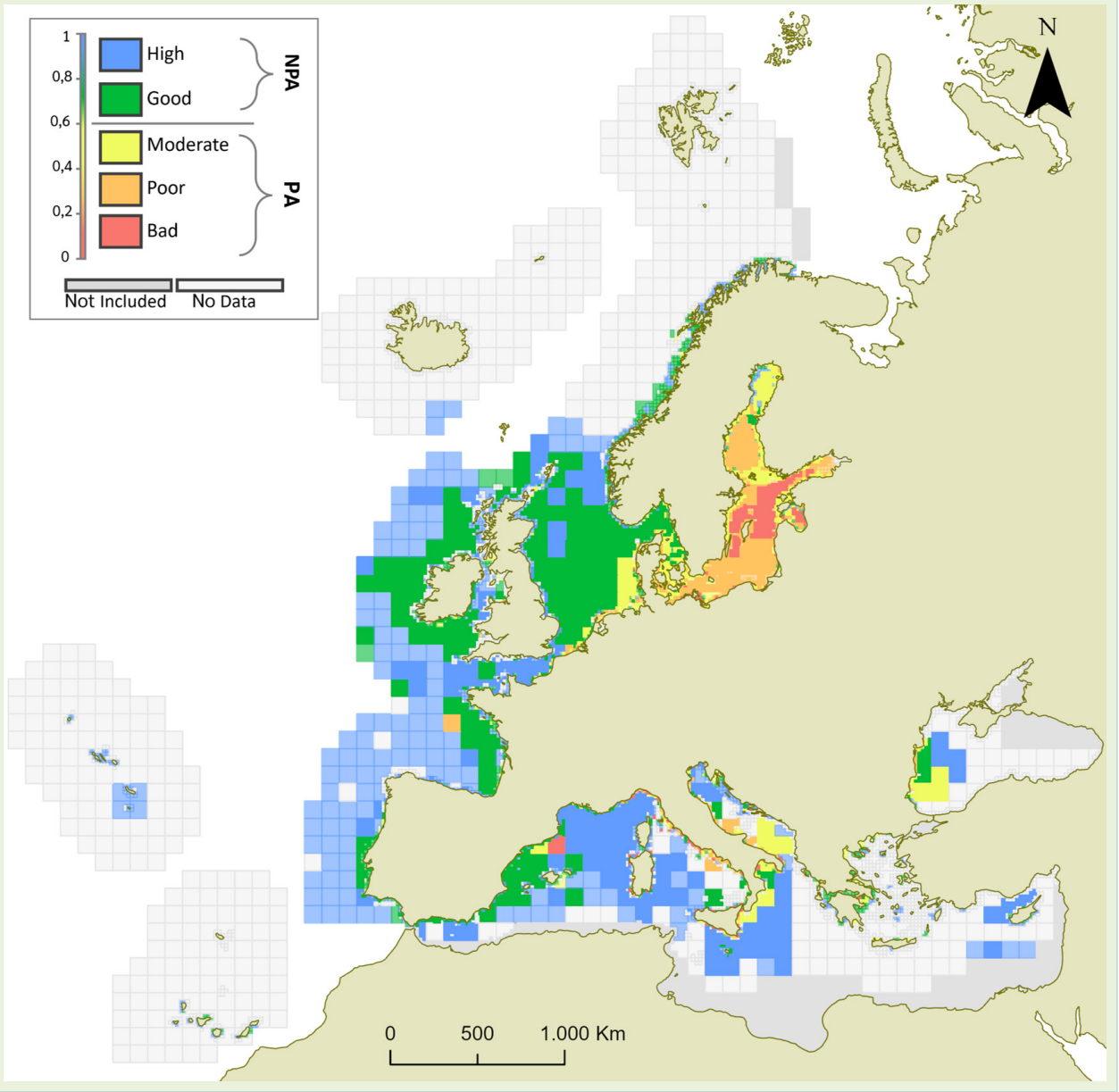



*Notes: The top chart shows the assessed areas in each regional sea. The bottom categorised charts show the percentage of the areas categorised as problem areas and non-problem areas. See SM C7 for additional details regarding the data and methodology.*

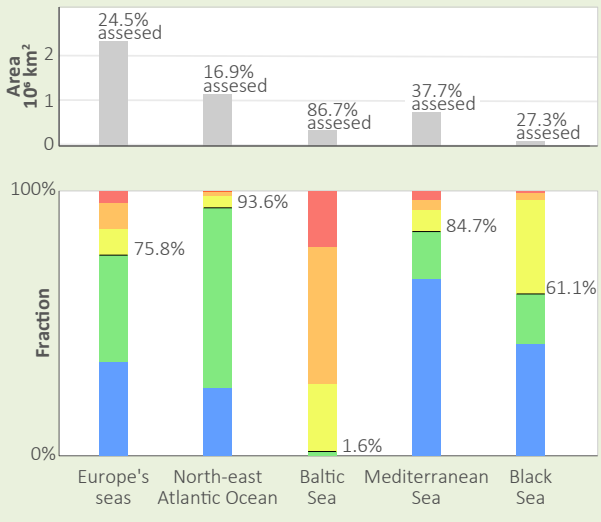
and submerged aquatic vegetation. These parameters exhibit a strong response to nutrient inputs, frequently falling below the threshold values necessary for maintaining GES. Across Europe's seas, the direct effects were indicated as problematic in 19 % of the assessed areas. The indirect effects, including reduced water transparency and oxygen levels, were considered problematic in 16 % of the assessed marine areas.

Regional variations exist in the impacts of elevated nutrient concentrations. The Baltic Sea and the Black Sea exhibit high impacts due to limited water exchange with adjacent seas (Figure 3.0). The assessed area and proportion of categories are depicted in Figure 3.10. The Baltic Sea is most affected by eutrophication, with only 1.6 % of assessed areas classified as non-problematic, primarily in the northwestern region. In the Black Sea, the assessment covers Romanian and Bulgarian waters, of which 61 % are non-problematic. In the North-east Atlantic Ocean, and Mediterranean Sea, most areas are non-problematic (94 % and 85 %, respectively). Problematic areas in the Greater North Sea and North-east Atlantic Ocean are in coastal regions of the English Channel, eastern North Sea outside German and Danish west coasts, and in the Skagerrak and Kattegat areas. In the Mediterranean Sea, problematic areas occur mainly in coastal regions and the Adriatic Sea, though data coverage is limited.

## FIGURE 3.9
Eutrophication and mapping of 'problem areas' and 'non-problem areas'




## FIGURE 3.10
European and regional HEAT results




*Notes: These non-problem area/problem area quality classifications differ from reported status for the EU water, marine and nature directives. This is because the tool uses 1) a precautionary 'one out, all out' principle when integrating indicators, 2) all available EU and regional-level indicator-based eutrophication information, and 3) EU and regional threshold values. It is important to note that the integrated assessment combines data from all categories; when an assessment unit has data from only one category included the result is shown with semi-transparent cells. See SM C5 for additional information.*

*Notes: The top chart shows the assessed areas in each regional sea. The bottom categorised charts show the percentage of the areas categorised as problem areas and non-problem areas. See SM C5 for additional details regarding the data and methodology.*

In examining nutrient enrichment and eutrophication in Europe's seas, several conclusions emerge:

- Eutrophication assessments in Europe are developed regionally, with indicators and methods determined by Regional Seas Conventions. This approach ensures regional coherence but complicates establishing uniform methodology across Europe.
- Eutrophication issues vary by region, with significant problems in the Baltic Sea, several North Sea coastal areas, and the Adriatic Sea. Open marine regions show minimal impact, while populated coastal zones and estuaries face higher eutrophication.
- This study represents the most comprehensive assessment of eutrophication to date in terms of spatial coverage and use of the best available parameters through an integrated, data-driven approach. Still, in some areas, limited monitoring data, threshold values, and comprehensive assessments impede complete evaluation across Europe's seas.

## 3.5 SPECIES EXTRACTION BY COMMERCIAL FISHING

Commercial fishing refers to the harvesting of marine organisms for sale and trade, whether for food consumption, aquaculture feed, pharmaceuticals, or other uses. It is among the most widespread human activities in Europe's seas, with a high ecological footprint on continental shelves, where productive ecosystems support both small-scale and large-scale industrial fisheries.

EU fisheries are managed under the CFP, which aims to restore and maintain fish stocks above levels that can produce maximum sustainable yield (MSY) (EC, 2013). By fishing at MSY levels, it is assumed that a balance is struck between harvesting (fishing mortality) and reproduction (spawning stock biomass), thus maintaining healthy and productive fish populations (Hilborn & Ovando, 2014; Earle, 2021). The CFP complements the MSFD: whereas the CFP assesses fishing mortality (F) and spawning stock biomass (B) separately, the MSFD's Descriptor 3 requires evaluating stocks against three criteria: fishing mortality (D3C1), spawning stock biomass (D3C2), and age or size structure (D3C3). GES is determined by integrating all three; however, full implementation has so far been limited by the lack of operational indicators for D3C3 (Probst, 2023).

Since the last CFP reform in 2013, the EU has made progress towards more sustainable fisheries, largely through science-based quotas and technical measures (e.g. gear restrictions, spatial and temporal closures) (Bastardie et al., 2024). However, widespread overfishing persists throughout Europe's seas, with only 28 % of the assessed stocks fished sustainably and in good biological state (i.e., F/FMSY ≤ 1 and B/BMSY ≥ 1) (EEA, 2024a). Regional disparities are striking (FAO, 2023; STECF, 2025): The North-east Atlantic has seen improvements, with 42 % of stocks meeting GES in 2018, corresponding to around three-quarters of the total catch. In contrast, the Mediterranean Sea and Black Sea continue to face chronic overexploitation, with just 9 % of stocks in GES in 2018, and equating to less than a third of catches (EEA, 2024a). The prevalence of multi-specific, multi-gear fisheries, weak enforcement and governance challenges has hampered progress in these regions (Vasilakopoulos et al., 2014; Cardinale et al., 2017; Cánovas-Molina et al., 2021). The Baltic Sea also presents a particularly alarming case, with several commercially and ecologically important fish stocks in critical condition. Baltic cod stocks have experienced prolonged declines associated with overfishing, hypoxia, food-web changes, and climate-driven ecosystem shifts, while several Baltic herring stocks have also deteriorated markedly in recent years, prompting quota reductions and continued management restrictions (ICES, 2024a; Rosciszewski-Dodgson & Cirella, 2024). Only three of the 13 assessed stocks met GES, although these accounted for over 95 % of landings (EEA, 2024a), largely reflecting catch limits imposed on depleted stocks, including the zero-catch advice on western Baltic spring-spawning herring for 2025 (ICES, 2024a).

Overexploitation is driven by a mix ecological, economic, and political factors. The EU is one of the largest seafood markets globally, importing around 70 % of what it consumes (mainly from Norway), which sustains high demand and reinforces incentives for fleets to maximise catches while competing with lower-cost imports (EUMOFA, 2024). Short-term profit motives and harmful subsidies, such as fuel tax exemptions, continue to sustain unprofitable fleets and excess capacity (Villasante et al., 2022; Guillén et al., 2025). Technological advances in gear efficiency and navigation compound this imbalance, enabling fleets to increase effective fishing pressure faster than capacity cuts can offset (Palomares, 2019; STECF, 2024; Froese et al., 2016). Policy and governance challenges further undermine sustainability. Catch limits (TACs) have frequently been set above scientific advice and lack transparency, enforcement, and compliance of rules such as the landing obligation remains weak and illegal, unreported, and unregulated (IUU) fishing continues, all undermining management (e.g., Carpenter et al., 2016; Voss et al., 2017; ECA, 2022a; Starr, 2023). These structural issues interact with ecological complexity. Climate change and ecosystem shifts, such as the northward movement of mackerel or the decline of Baltic cod, add new uncertainties and mismatches between quotas and actual fishing opportunities (e.g. ICES, 2021; Hidalgo et al., 2022; Erauskin-Extramina et al., 2024;

dos Santos et al., 2024). Mixed fisheries complicate matters further since achieving MSY for one stock may increase risks for others (Kühn et al., 2023).

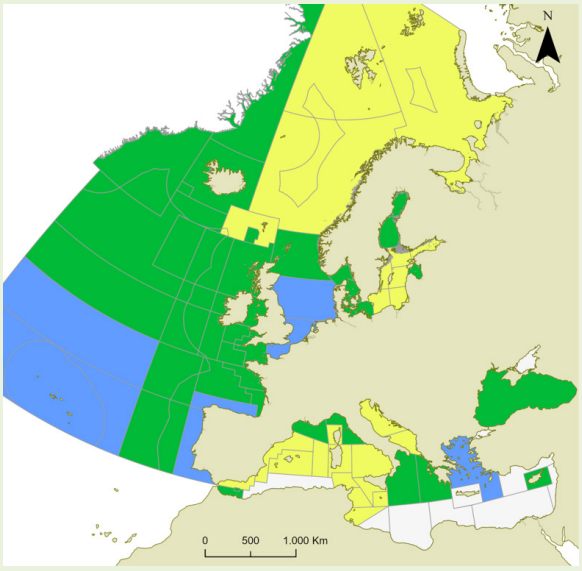
Even when managed at MSY levels, fisheries exert ecosystem-wide pressures (EEA, 2024a). Non-target species, including endangered fish, seabirds, turtles, and marine mammals, are caught as by-catch despite legal protections (Lewison et al., 2014). Discarding continues, wasting resources and altering trophic dynamics, with major uncertainties over current levels (Gilman et al., 2022; Lively & McKenzie, 2023). Ghost fishing from lost, abandoned, or discarded fishing gear (LADFG) adds hidden mortality, particularly from nets, hooks, and lines, as well as pots and traps, which can continue 'fishing' for months to years after being lost (Richardson et al., 2022). Mobile bottom-contacting gears, such as bottom trawling, cause direct physical disturbance to the seabed, damaging habitats such as seagrass meadows and cold-water corals that serve as key nurseries and carbon sinks, reducing resilience to climate change (Kaiser et al., 2006; Jackson et al., 2001; Pauly et al., 2002; ICES, 2024b). Even small-scale, coastal fisheries, often assumed to be lower impact, can exert significant concentrated pressure on coastal biodiversity hotspots, nursery grounds, and spawning areas (Lloret et al., 2018).

Box 3.1 shows fishing pressure (F) analysis results on commercial fish species. Based on assessments of 270 stocks from 54 species, the analysis classifies 2019-2023 outcomes into 'non-problem areas' with sustainably exploited stocks (F/FMSY≤1) and 'problem areas' where overfishing persists (F/FMSY>1). Results show fisheries management has reduced fishing pressure across much of the North-east Atlantic, central Mediterranean, and Black Sea, where most areas are non-problematic. However, problematic areas remain in the Arctic waters, Baltic Sea, Western Mediterranean Sea and Adriatic Sea. While F/FMSY is a powerful indicator of exploitation intensity, it cannot, on its own, capture the status of a stock. When aggregated across multiple stocks, fishing pressure provides insight into the overall effectiveness of management within a region. However, average values can mask important disparities: sustainably fished stocks may offset the poor condition of heavily depleted ones. For example, targeted fisheries on eastern Baltic cod (*Gadus morhua*) have been banned since 2019; yet the stock remains at around 10 % of historic biomass levels (ICES, 2022; Eero et al., 2023). In such cases, low fishing mortality reflects management restrictions imposed on depleted stocks, rather than sustainable exploitation levels. For this reason, fishing pressure should always be interpreted alongside biomass indicators (e.g. B/BMSY), which show whether stocks are in a healthy state and able to sustain exploitation.

**BOX 3.1**

'Fishing pressure' and mapping of 'problem areas' and 'non-problem areas'

The delineation of 'problem areas' and 'non-problem areas' in terms of fishing exploitation, characterized by the ratio of fishing mortality to fishing mortality at maximum sustainable yield (F/FMSY) for commercial fish stocks, is based upon: 1) extant stock assessments (sourced from ICES, STECF, and GFCM), 2) established and consensual assessment criteria (specifically, stock-specific F/FMSY values), and 3) ICES statistical areas and FAO fishing areas in the North-east Atlantic, as well as GFCM Geographical Sub-areas (GSA) for the Mediterranean and Black Sea. Please see SM C8 for more information about data and methods.




## 3.6 NON-INDIGENOUS SPECIES

Non-indigenous species (NIS) are organisms which have been introduced into ecosystems where they do not naturally occur, often due to human activities such as shipping. A specific group of these non-native species, known as invasive alien species (IAS), can cause wider ecological, economic, and social damage. IAS pose a threat because they can outcompete, prey on, and transmit diseases to native species. This can modify biotopes, resulting in decreased biodiversity, disruption of ecosystems, and adverse effects on industries like fisheries and aquaculture. As reported by EEA (2024), ships are the primary route for marine NIS entering via hull fouling, ballast water, and stowaways, accounting for 51.2 % of new introductions. The corridor pathway is second at 14.3 % of introductions, mainly through artificial waterways linking adjacent non-EU waters, such as Red Sea species entering the Mediterranean Sea. Other pathways include accidental transport of live organisms and natural spread from neighbouring non-EU waters (unaided).

Cumulative impacts of invasive species were assessed for Europe's seas (Figure 3.11, see map in SM C6). This assessment shows that impacts of invasive alien species are greatest in the Mediterranean Sea and Black Sea, reflecting high introduction rates. Hotspots included the Aegean Sea, Levantine Sea, and Adriatic Sea. Also, the northern European seas, i.e. the western Baltic and parts of the Greater North Sea, showed notable impacts along coastlines. Europe's coastal waters are more affected than open seas. Enclosed or semi-enclosed seas with high shipping traffic and aquaculture show especially high IAS impacts. More than 26.5 % of Europe's coastal area is estimated to be impacted by IAS, varying per regional sea: 20.6 % in the NE Atlantic, 50.1 % in the Mediterranean Sea, 8.4 % in the Baltic Sea and 56.9 % in the Black Sea, considering only coastal areas of EU Member States and Türkiye. As large offshore areas are not impacted by IAS, only 11.5 % of the total marine area of Europe's seas is estimated as negatively affected by IAS. The current cumulative impact assessment estimates that close to 27 % of Europe's coastal waters are impacted by invasive species against the previously overestimated 50 % (Korpinen et al., 2019). This lower estimation results from finer spatial resolution in the assessment.

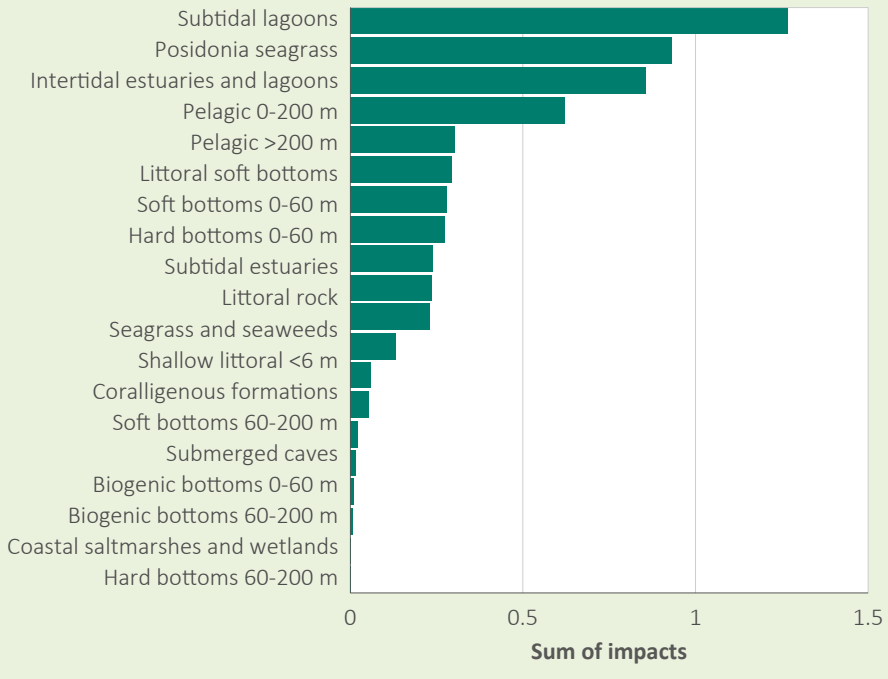
The spread of invasive alien species in European seas has accelerated in recent decades, with more new introductions and expanding ranges of established species (EEA, 2024f). Increases occur across all four marine regions. Coastal and semi-enclosed seas show fastest growth, driven by shipping, aquaculture, and the Suez Canal pathway. Many species are shifting northwards and westwards, reflecting climate change and warmer seas. Comparisons with earlier assessments show that impacts have widened since 2012, particularly in Mediterranean and Black Seas. These trends suggest IAS pressures will continue to grow.

## 3.7 OTHER PRESSURES FROM HUMAN ACTIVITIES

The mapping and analysis of the human impacts on Europe's seas also included noise pollution (continuous and impulsive anthropogenic sound), physical disturbance, and loss of seabed habitats as well as other types of human disturbance affecting ecosystems.

Noise pollution is an increasing human-induced stressor on marine ecosystems, primarily from ships and offshore operations. Tanker and cargo vessels are the main contributors to anthropogenic, low-frequency ocean noise (EEA & EMSA, 2025). Research shows that 91 % of European waters are subjected to shipping noise, with 10 % experiencing high shipping traffic (Tasker, 2016). The sea area experiencing highest levels of noise pollution is the Baltic Sea, followed by the English Channel, the Strait of Gibraltar, the Dardanelles Strait, and parts of the Adriatic Sea (EEA & EMSA, 2025). If mitigation actions are implemented, there is potential for 70 % reduction in underwater noise by 2050 (EEA & EMSA, 2025). Impulsive noises from construction, seismic surveys using air guns, explosions, and sonar affect 8 % of Europe's seas. For certain sea

**FIGURE 3.11**
Habitats impacted by invasive alien species




*Notes: See SM C6 for additional details regarding data and methods.*

areas, especially the North Sea, impulsive noise is expected to increase, e.g. from large-scale construction of off-shore wind farms. Such noise pollution impacts marine organisms, causing behavioural and physiological changes, including stress, habitat degradation, and fragmentation. This concerns also species facing extinction threats (EEA & EMSA, 2025).

Physical disturbance and loss of seafloor refer to seabed changes from human activities like bottom trawling, dredging, and offshore and coastal construction, causing temporary disruptions or permanent habitat alterations (EEA & EMSA, 2025). Loss occurs when physical substrate is permanently removed or altered, with recovery exceeding 12 years. Activities with permanent effects, such as ports, anchorage areas, and dredged shipping lanes, cause ongoing habitat loss and prevent recovery (HELCOM, 2018). About 2 % of Europe's seas face physical loss activities. The largest shares occurred in the Greater North Sea, including Kattegat and English Channel (8 %), Baltic Sea (6 %) and Bay of Biscay and Iberian Coast (6 %). Physical loss has destructive ecological impacts, and recovery may take years to decades after the pressure ceases. Physical disturbance includes activities affecting the seabed for a shorter time, such as bottom-trawling and sediment resuspension by shipping in shallow waters, damaging benthic organisms. About 12 % of Europe's seas are physically disturbed by human activities, but it was not assessed how much of this causes adverse effects. The value is much higher for the shelf areas. The highest shares of disturbed seabed were in the Adriatic Sea (63 %), Greater North Sea (50 %), and Celtic Seas (28 %). These shallow marine regions experience disturbance from demersal fishing, port facility expansion, wake-induced disturbance from ships and dredging. Looking ahead, expanding marine infrastructure, especially offshore wind farms, will most likely result in substantial cumulative habitat loss for seabirds. Many bird species, like guillemots and divers, avoid offshore wind farms up to several kilometres and will thus experience strong cumulative habitat loss.

Other types of human disturbance cause noise, erosion, and visual impacts that affect sensitive species in key coastal breeding, resting, and feeding areas (OSPAR, 2023d; Griffin et al., 2017). Up to 27 % of the European seas' coastline is exposed to this category of pressure. The largest proportions of the affected coastline are in the Bay of Biscay and the Iberian Coast (70 %), Western Mediterranean Sea (66 %), Ionian Sea and Central Mediterranean Sea (45 %), and Adriatic Sea (44 %). However, the Greater North Sea (including Kattegat and the English Channel) and the Baltic Sea had the longest total coastline disturbed by human presence. Coastlines are zones of multiple industrial activities but also human presence in the form of tourism and recreation, increased disturbance becomes evident when coastal areas are built or modified to support the growing needs of coastal populations and visitors (OSPAR, 2023).

# 4. Climate change's toll on marine ecosystems

- Europe's seas are warming faster than management frameworks are adjusting. Sea surface temperatures have risen by 0.3-0.75°C per decade since 1991, driving more frequent and longer marine heatwaves that cause widespread ecosystem losses.
- Acidification is eroding marine resilience. Mean surface pH across Europe's seas has declined by 0.03-0.11 pH units since the 1960s. These trends threaten biodiversity, food webs, and the people and economies depending on them.
- Climate change is currently contributing with 15-20 % of the combined pressures on Europe' seas and is projected to contribute >40 % by 2050. Climate change is expected to become the dominant pressure surpassing all other by 2050. Warming, deoxygenation, and acidification, driven by increasing greenhouse gas emissions, amplify other human pressures accelerating degradation across all regional seas.

Climate change reshapes and degrade Europe's seas through interacting pressures that propagate through ecosystems, societies, and economies. Ocean warming, oxygen loss, and acidification share common drivers, rising greenhouse gases and altered circulation of water masses, but their effects on marine ecosystems multiply through feedback loops. For example, a marine heatwave can weaken populations' ability to resist species invasions, intensify stratification, lower oxygen levels, and accelerate acidification in nearshore waters, triggering events more disruptive to marine life than any factor alone.

Recognizing the cascading nature of these risks is critical for predicting ecological thresholds and for assessing the progress and effectiveness of management measures under the MSFD. Some impacts occur at the 'event' scale (hours to days), like marine heatwaves collapsing benthic communities or 24-hour (diel) pH fluctuations stressing shell forming organisms. Others act over seasonal to decadal scales, including seasonal hypoxia or productivity shifts. Long-term changes, such as shifts in biodiversity regimes e.g. northward movement of species or loss of biogenic reefs, unfold over decades to centuries and may be irreversible on human timescales.

Understanding both short-term shocks and long-term trajectory shifts is critical for protecting and restoring marine habitats, their species, and the ecosystem resilience of Europe's seas, including how MSFD GES objectives are affected. This awareness likely explains the increasing attention to climate change when revising the MSFD (EC, 2022a).

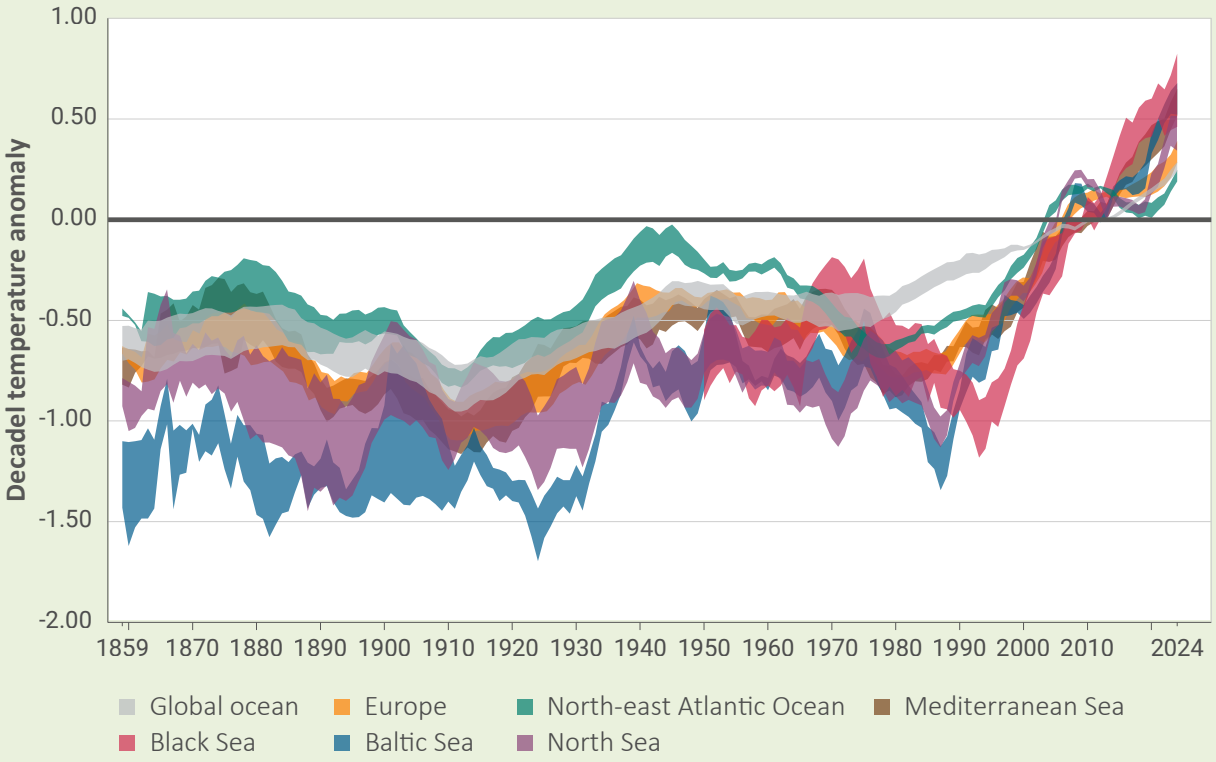
## 4.1 RISING TEMPERATURES

Temperature, in the form of both long-term ocean warming and episodic marine heatwaves, amplify risks. Mean sea surface temperatures (SST) across Europe's seas have risen markedly since 1870, with steepest warming since the late 1970s (Figure 4.1a). Between 1991 and 2024, SST increased by about 0.3 °C per decade in the North Sea, up to 0.5 °C per decade in the Black Sea and up to 0.75°C per decade in the Mediterranean Sea (Atalah et al., 2024; EEA, 2025b). The Baltic Sea has warmed 0.54 °C per decade between 1986-2006 (Belkin, 2009). Since 1970 the global ocean has taken >90 % of excess heat in the climate system (IPCC, 2019). Warming has led to more marine heatwaves, periods of exceptionally high SST, which globally increased from 1925 to 2016 by 17 % in duration and 34 % in frequency (Oliver et. al., 2018), while doubling since 1982 (IPCC, 2019). In the Mediterranean Sea, marine heatwaves have become three times more frequent, and their duration is 50 % greater than in the 1980s (Atalah et al., 2024).

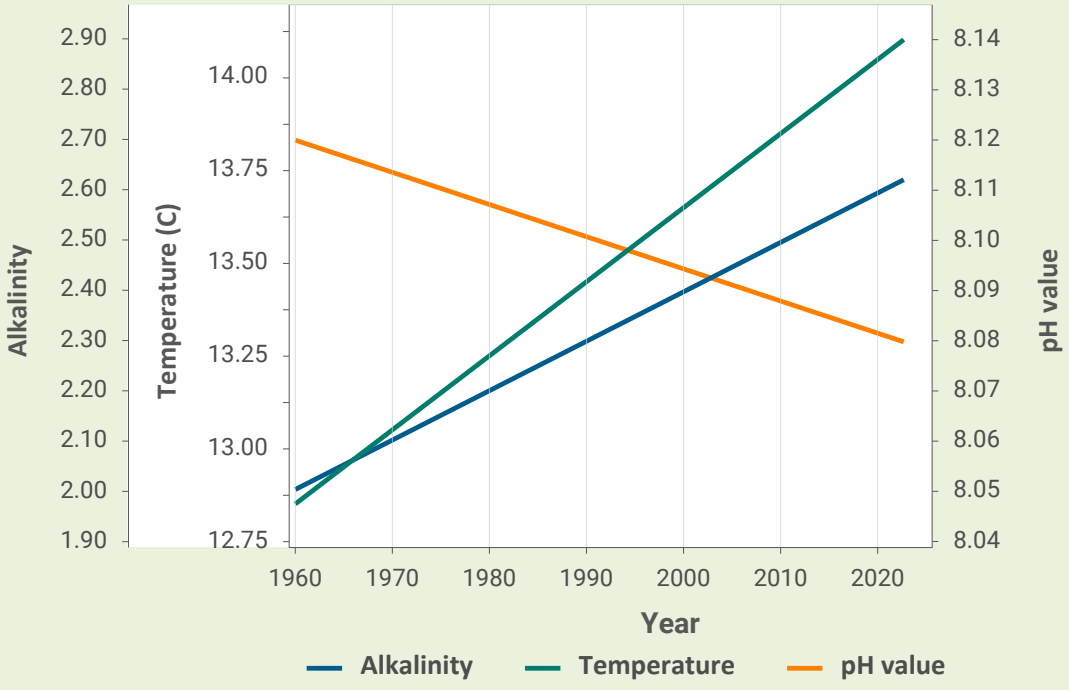
In the Mediterranean Sea, heatwaves have caused mass mortalities in corals, sponges, and seagrass meadows, with recovery spanning years to decades, threatening marine ecosystem health (Gallo et al., 2023; Garrabou et al., 2022; Marbà & Duarte, 2010). In the North Sea and Baltic Sea, warmer summers have shifted plankton communities, disrupted predator-prey dynamics, and altered fish distributions (Beaugrand et al., 2003; Poloczanska et al., 2016; EEA, 2024a; Figure 4.2). These impacts cascade; heat-stressed organisms are more vulnerable to hypoxia, pollutants, and disease, increasing systemic regime shift risks (Hughes et al., 2018; Smale et al., 2019). Globally, marine heatwaves are already impacting marine biodiversity and undermining livelihoods (Smith et al., 2025).

**FIGURE 4.1**
Trends in Sea Surface Temperatures, pH and alkalinity in Europe's seas

**Panel A**




**Panel B**




*Notes: Panel A) EEA, 2025b; panel B) Data originate from EMODNET. See SM C9 for more information.*

**TABLE 4.1**
Climate change impacts on Europe's seas: selected observed changes, ecological consequences and socio-economic implications

| Parameter | Observed change | Key ecological consequences | Socio-economic impact |
|---|---|---|---|
| Sea surface temperature (SST) | SST rising ~0.3–0.75 °C per decade (1991–2024). | Shifts in plankton & fish communities; ecological regime shifts (Figure 4.2). | Aquaculture and tourism losses; fisheries revenue declines; increase coastal hazard exposure. |
| Marine heat waves (MHWs) | Mediterranean Sea MHW frequency increased 3 times, duration up ~50 % since 19804. | Mass mortality of corals, benthic invertebrates, and vegetation. | In 2021, marine heat-waves caused a 50 % collapse of Aegean mussel harvest killing 90 % of mussel seed for the following year[1]. |
| Deoxy-genation | Baltic hypoxic zones up to ~70,000 km²; Black Sea top 100m oxygenated layer decline ~44 % since 1955. | Habitat compression for demersal species; cod spawning failure; jellyfish blooms; nutrient cycling disruption. | Baltic cod price fell 94 % from 2001-2019 as cod became smaller due to several factors[2]. |
| Ocean acidifi-cation | Surface pH down ~0.03 units since 1960s; seasonal aragonite saturation <1.5 projected by 2050 in high-latitude regions. | Weakened calcification in molluscs, pteropods, corals; reduced larval viability; potential impacting ecosystem complexity. | Potential economic impact on shellfish production in Europe is 1 billion USD by 2100[3]. |
| Cascading impacts | Antagonistic interactions between warming, MHWs, deoxygenation, and acidification plus interactions with other activities and pressures. | Regime shifts (e.g., Baltic food-web col-lapse); invasive species spread; system-wide loss of structure and function degrading resilience. | Will impact individuals, communities, society. |

*Notes: [1]Reuters (2021), [2]Orio et al. (2021), [3]Narita & Rehdanz (2017), [4]Atalah et al. (2024).*

**BOX 4.1**
Climate change scenarios for future impacts on marine ecosystems.

Studies of cumulative effects of multiple human pressures and climate has moved from mapping and analyses to scenarios. The current impacts are used as a baseline, and the pressure intensities are either reduced or increased based on the expected developments. Scenarios have been established on different scales, ranging from national studies over European-wide analyses to a recently published global study.

### Case Study 1

Swedish EEZ: Large data sets with the Swedish Symphony MSP tool demonstrate a strategy for tackling climate change in marine spatial planning (Wåhlström et al., 2022). This approach incorporates data on anticipated temperature, salinity, and sea ice coverage from regional ocean climate model forecasts into a pre-existing cumulative impact model. This integration enables evaluation of climate change effects alongside cumulative impacts of ongoing human activities. Results indicate that anticipated climate change by 2100 could present a threat similar in magnitude to combined pressures currently affecting the marine environment.

### Case Study 2

Danish EEZ: Using state-of-the-art data sets for pressures and ecosystem components, the Danish ECOMAR project demonstrated an approach to ecosystem-based maritime spatial planning. Based on a 2020 baseline, ECOMAR developed scenarios for 2030 and 2050, showing no substantial evidence that Danish MSFD implementation will yield significant environmental improvements. The cumulative effect in the Danish Exclusive Economic Zone (EEZ) is projected to be 8 % and 11 % higher in 2030 and 2050, respectively, compared to the baseline (Andersen et al. 2023). Analyses in relation to the Danish MSFD Initial Assessment indicate that 'classical' pressures (e.g. pollution, fishing, and physical disturbance) are expected to decrease due to management efforts. In contrast, 'new' pressures (marine litter, noise, and non-indigenous species) will rise to some extent, while 'climate change' is projected to increase considerably by 2050 (MLM, 2025).

### Case Study 3

Global scenarios from Halpern et al. (2025): This study analysed pressure trajectories projected to 2050 globally, and predicted human impact will potentially double or triple. Coastal habitats within 20 km of coastlines are anticipated to experience higher impacts, while offshore regions expect more rapid increases. For Europe, the study concludes: 1) impacts from fisheries are currently high but projected to increase minimally due to effective management practices, 2) coastal disturbances are projected to decrease slightly in southern Europe, 3) certain areas of the Baltic Sea and regions between Iceland and Norway are projected to experience minor decreases in impacts, and 4) the Mediterranean Sea is expected to undergo rapid increases and significant future impacts. Based on a recalculation of data from Halpern et al. (2025), the increase for Europe will be 75-89 %.

None of the above studies indicate that the combined pressures from multiple human activities and climate change will be reduced in a short term (years) or mid-term (decades) perspective.

## 4.2 DEOXYGENATION

Loss of oxygen (deoxygenation) is a less widely discussed consequence of increased temperatures. Since 1960, the global ocean has lost 2 % of its oxygen content (in some areas more; Levin, 2018), with European trends driven by three factors: a) Warming, reducing oxygen solubility; b) increased stratification, limiting vertical mixing in coastal waters; and c) nutrient-driven eutrophication, increasing biological oxygen demand (Breitburg et al., 2018).

Semi-enclosed seas like the Baltic Sea and Black Sea could be particularly vulnerable to climate change effects, as they already have wide hypoxic deep areas. For example, in the Black Sea, the oxygenated surface layer and cold-water mass have shrunk while the anoxic zone expands up-ward (Capet et al., 2016; Stanev et al., 2019). A halocline traps oxygen-rich water above an anoxic deep layer containing hydrogen sulphide. Studies show this habitable layer has thinned by 44 % since 1955, driven by warming, stratification, and altered circulation, affecting pelagic fish like sprat and anchovy, now confined to a narrower ecological range (Capet et al., 2020).

The biological consequences can be significant. Deoxygenation exerts stress on aquatic organisms across every level of biological organization, ranging from cellular and physiological processes to individual performance, species survival, population dynamics, community structure, and ultimately entire ecosystems (Roman et al., 2024).

Oxygen loss interacts with warming. During marine heatwaves, oxygen solubility drops, stratification strengthens, and biological oxygen demand rises (Breitburg et al., 2018). This combination can transform a chronic oxygen deficit into an acute crisis within weeks. Such events can trigger mass mortality of fish and benthic invertebrates, particularly in coastal waters, isolated bays, lagoons, and fjords. These dynamics indicate that deoxygenation is not just a slow background trend but can produce sudden, large-scale ecosystem disruption (Conley et al., 2007).

## 4.3 OCEAN ACIDIFICATION

The last major direct effect of greenhouse emissions on the ocean–climate system considered here is ocean acidification, a pervasive shift in seawater chemistry altering ecosystems in ways difficult to reverse on human timescales. The ocean has absorbed roughly one-quarter of anthropogenic $CO_2$ emissions since the industrial revolution, buffering atmospheric warming but changing carbonate chemistry in the process (IPCC, 2021). Across Europe's seas, surface pH has declined by approximately 0.03 units since the 1960s compared with 0.11 units since pre-industrial time in the global ocean surface representing about a 30 % increase in acidity (EEA, 2024d; Doney et al., 2020; NOAA, 2018; Figure 4.1b).

This trend accompanies a decline in aragonite saturation state, a key measure of ocean's ability to support calcium carbonate structures. In high-latitude sectors of the North Atlantic and Arctic Ocean, aragonite saturation approaches critical levels and is projected to fall below ~1.5 during seasonal periods by mid-century, with Arctic regimes crossing <1 later under high emissions. Model projections for the Barents Sea show mean aragonite saturation declining from ~2.0 today to ~1.5 under SSP2-4.5, and below 1.5 under SSP5-8.5 by 2050 (AMAP, 2018; Årthun et al., 2025). Such changes are 'likely to be sufficient to drive changes in Arctic organisms and ecosystems to a magnitude that will affect the associated human societies' (AMAP, 2018).

These changes can have species-specific but ecosystem-wide consequences. Acidification reduces calcification rates in bivalves, pteropods, and cold-water corals, erodes the skeletal density of reef-building organisms, and impairs early larval development in commercially important shellfish. Increasing evidence suggests that acidification also disrupts sensory and behavioural functions in fish and invertebrates, affecting predator avoidance, feeding efficiency, and habitat selection (Fabry et al., 2008; Kroeker et al., 2013; Bednaršek et al., 2019). It is estimated that up to 60 % of sub-surface waters to 200 m and over 40 % of surface waters have crossed the ocean-acidification boundary, causing major habitat losses for calcifying species, including polar pteropods (up to 61 %) and coastal bivalves (13 %) (Findlay et al., 2025).

When ocean acidification, sea warming, and deoxygenation act together, their ecological effects are antagonistic and amplifying, not simply additive. Habitat complexity decreases as cold-water coral reefs, calcareous algae, and shell-forming benthos degrade, impoverishing nursery areas and foraging grounds. This diminishes biodiversity, reduces fisheries productivity, and erodes coastal protection from biogenic habitats like mussel beds and seagrass meadows though system level interaction remains difficult to assess and under investigated (Riebesell & Gattuso, 2015; Hassoun et al., 2022). In the Mediterranean Sea, acidification and warming have been linked to slowed seagrass recovery following marine heatwaves (Marbà & Duarte, 2010). Acidification thus represents a quiet but increasing risk from a management and ocean governance perspective, evolving over decades while underpinning cascading impacts seen in Europe's seas. Its effects span ecological, economic,

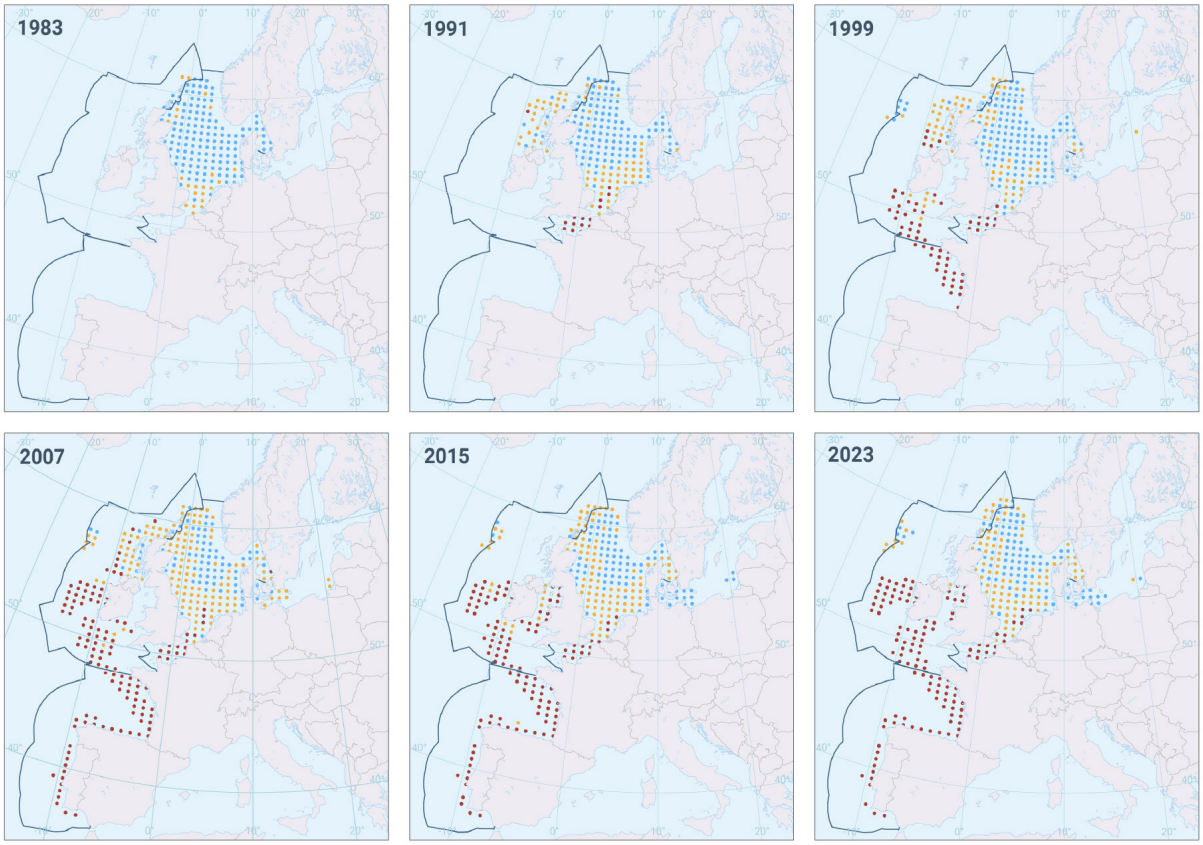
and cultural dimensions, from shellfish aquaculture viability to food-web structures and thus ecosystems and the people depending on their services (AMAP, 2018; Doney et al., 2020; Narita & Rehdanz, 2017). It is thus critical to consider the combined influence of major climate-driven changes, sea surface warming, marine heatwaves, deoxygenation, and acidification, and how they interact with human pressures like eutrophication, overfishing, habitat loss, and pollution. A non-exhaustive summary is captured in Table 4.1, which exemplifies the observed changes, key ecological consequences, and socio-economic impacts of climate change across Europe's seas.

In summary, climate change acts as a pressure amplifier, interacting with land- and sea-based pressures to expand their reach, duration, and intensity. Warming seas may thus redraw ecosystems faster than our governance can adapt; undermining management progress as e.g. marine heatwaves kill local species and allow non-indigenous species to dominate. Ocean acidification erodes the resilience of shell-forming organisms underpinning food webs. Oxygen loss reduces habitable space for marine life, forcing species into smaller, crowded areas where competition, predation and human activities intensify. Even where policies have reduced pressures like nutrient loads or improved fish stock management, climate change can erode these gains by altering the physical or chemical baseline these measures depend on.

## 4.4 FROM SINGLE PRESSURES TO SYSTEM STRESS: CLIMATE CHANGE RESHAPING EUROPE'S SEAS

As climate change accelerates, separate pressures combine into system-wide stress, reshaping Europe's seas faster than current policies may adapt. Pressure amplification operates across scales, from microscopic changes in microbial processes affecting nutrient cycling to ecosystem-level shifts such as fish populations moving North (Figure 4.2). As such, climate change is not a slow background trend but a dynamic driver that strengthens pressure interactions, accelerates degradation, and raises the cost of intervention. The result is a moving target (Figure 2.8) where current solutions may not suffice in the future.

**FIGURE 4.2**
Changes in fish distribution in the North-east Atlantic Ocean, 1982-2023




Reference data: © EuroGeographics, © FAO (UN), © TurkStat Source: European Commission - Eurostat/GISCO

*Source: EEA, 2024a.*

The cumulative effects of anthropogenic climate change 'will likely push' marine ecosystems and species to their resilience limits, if not beyond critical thresholds (IPCC, 2019). Recognizing this is essential if the EU is to secure the improvements already achieved in single sectors or to prevent species and habitats from being overwhelmed by accelerating, system-wide disruption.

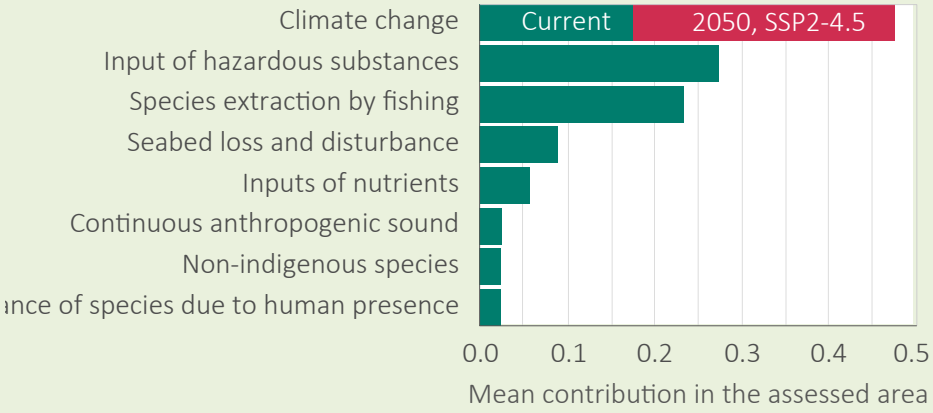
As such, acknowledging the effects of climate change in ocean governance is now more urgent than ever. Climate change will most likely become the dominant pressure on Europe's seas by 2050, with thresholds and tipping point, such as Ocean acidification and Biosphere integrity, already being breached (Box 4.1; PBScience, 2025). Climate-driven pressures will account for nearly half of the total impact from anthropogenic activities on marine ecosystems in 2100 (Wåhlström et al., 2022). Further, based on a recalculation of a European sub-set of the data from Halpern et al. (2025), the projected sum of cumulative anthropogenic impacts on the marine environment is likely to increase between 75 % in 2050 (SSP2-4.5) to 89 % for Europe' seas (SSP5-8.5) compared to 220-260 % for the global ocean with climate change and poorly managed fisheries being the most impactful pressures in all regions (Halpern, et al., 2025; Box 4.1; Figures 4.3 and 4.4). This may be because the EU is already implementing a comprehensive environmental legislative framework. It is pivotal to develop forward-looking governance approaches capable of meeting shifting baselines with resilient, ecosystem-wide solutions embedding climate change better within the MSFD and the GES concept (Nikolaou, et al., 2025; Chapter 5).

The planetary boundaries framework reinforces this warning: with the recent overstepping of the boundary for ocean acidification, seven of nine boundaries have now been exceeded (PBSciences, 2025). Similarly, the world is on track towards an increase of 2.3-2.5°C at the end of the century (UNEP, 2025). Of more concern is that ocean-related boundaries are on trajectories like those preceding past mass extinctions (EEA, 2015a). Although the current crisis has not yet matched the magnitude of the 'Big Five', the trajectories of warming, acidification and oxygen loss now mirror those that preceded them (Song et al., 2021; Deutsch et al., 2024).

Scenarios for Europe's seas indicate that under projected climate conditions for 2050, using shared socio-economic pathway SSP2-4.5 climate-related stressors could contribute substantially to the total combined impacts on Europe's seas (Figures 4.3 and 4.4). Despite a wide range of possible climate trajectories, these findings underline that climate change poses a critical risk to Europe's marine ecosystems. As conditions deteriorate, pressures once considered sustainable under historical baselines risk becoming unsustainable under accelerated warming. To retain marine ecosystem resilience, Europe must therefore rebalance the cumulative load of human pressures, reducing impacts from fisheries, nutrient inputs, contaminants, and area use, to preserve sufficient ecological space for ecosystems to absorb climate-induced stress. Only then can protection and restoration efforts deliver their full potential (Hemraj et al., 2024).

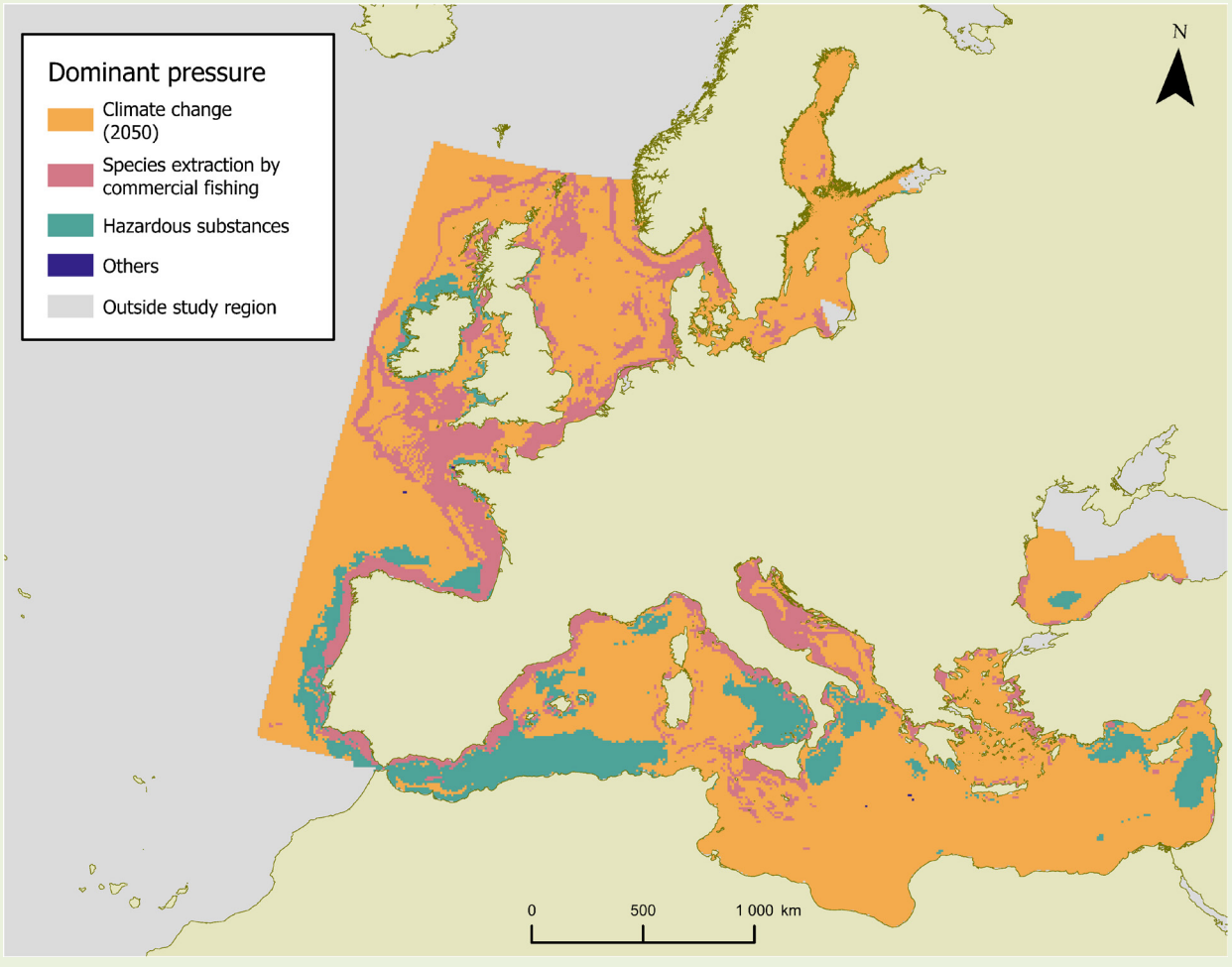
On a more positive note, comparison between the global analysis (Halpern et al., 2025, previous page) and the corresponding European assessment using the EEA assessment grid suggests that the cumulative effects of human pressures by 2050 is comparatively lower in Europe's seas. This may reflect the strength of the EU's environmental framework and the sustained governance efforts already underway. Yet the next step lies in deepening this progress, moving beyond managing individual pressures, to addressing their combined stress within a changing climate. The policy framework is in place; the challenge now is to make its instruments work together, across sectors and scales, to safeguard resilience in a rapidly changing ocean and acknowledging climate change when strengthening the existing legal framework or creating new legislation in the EU. Thus, the challenge ahead is not only to mitigate, and adapt to, climate change, but also to significantly reduce other pressures on our seas, creating the necessary conditions for ecosystem recovery before the limits of current resilience are reached. Only with adequate pressure reduction can we expect long-term protection and restoration efforts to fully deliver (Hemraj et al., 2024) and enable the benefits of achieving climate neutrality. Failure to do so will undermine marine biodiversity, food security and the many ecosystem services supporting people and the economy. This includes weakening the contribution of Europe' seas to the global ocean's role as a major stabiliser of the Earth climate system – thereby exacerbating climate change. The next chapter explores how different solutions can interact to maintain or restore ecosystem resilience.

**FIGURE 4.3**
Projected ranking of pressures in 2050




*Notes: The 2050 scenario is based on a climate change scenario for 2050 using down-scaled climate projections (scenario SSP2-4.5) from Kristiansen et al. (2024), whilst all other pressures are fixed at their current intensities. This approach is identical to the methodology applied by Wåhlström et al. (2022). This figure illustrates the ranking of pressures, please compare with Figure 3.3, which is based on the current climate change pressures.*

**FIGURE 4.4**
Mapping of dominating pressures in 2050




*Notes: This scenario is based on down-scaled climate projections (scenario SSP2-4.5) from Kristiansen et al. (2024), whilst all other pressures are fixed at their current intensities. This approach is identical to the methodology applied by Wåhlström et al. (2022. The map highlight that climate change poses acritical threat in many marine regions and sub-regions. The map shows the dominant pressure in our analyses, but other pressures might also be at critical levels in each location. Conversely, the dominant pressures can be minor locations with few other pressures. See SM C3 for additional information.*

# 5. How to achieve healthy, clean, productive and resilient seas?

- Management measures are mainly well planned, but their implementation is poor. Nutrient reductions, ban on specific contaminants, and improved fisheries regulation have delivered progress, yet slow ecological recovery mean they are insufficient on their own and other pressures are still adversely impacting ecosystems.
- Transformative change will be necessary. Europe could embed planetary boundaries in ocean governance, rethinking subsidies, investment, and markets to reward practices that support ecosystem health and simplify governance models ensuring ecosystem resilience is prioritised.
- Future implementation, including supplementary measures, ought to address total system stress, not individual pressures. To maintain or achieve 'good environmental status', cumulative pressures should be rebalanced across sectors.
- A unique policy window is open now. The Ocean Pact, revisions of the MSFD and MSPD, and the upcoming Ocean Act can unify marine, climate, and economic policies around 'good environmental status' as the marine foundation for sustainability, thus support closing of implementation gaps and making resilience the guiding principle of EU marine and maritime governance.

As documented in previous chapters, Europe's seas are at the frontline of a converging crisis from biodiversity loss, pollution, and climate change. Addressing this crisis requires not just incremental responses to individual activities and their pressures. It requires a systemic understanding of historical, environmental, political, economic, and social forces that shape the state of Europe's marine ecosystems. Experience shows that even the most ambitious policy pledges falter when they remain aspirational rather than binding and fragmented and reactive instead of coherent and proactive (ECA, 2020; EC, 2025b).

What is needed is the implementation of a governance approach outlining clear, actionable, and accountable steps to safeguard Europe's seas, and stimulates operational action and the determination to deliver urgent and tangible progress considering the on-going accelerating changes observed in our seas and societies. The MSFD, European Green Deal, and the European Ocean Pact, and their associated policy instruments provide such a vision for the EU (EC, 2019a; EC, 2025c).

The current governance framework could move beyond managing environmental degradation to actively protecting and restoring ecosystem structure and function following existing obligations (Table 1.1). This would shift focus towards maintaining and supporting the recovery of ecosystem resilience, which, would in turn, support economies, communities, and people. Such a transition requires linking basic measures with ecosystem-scale approaches and advancing transformation that can align governance with wider sustainability transitions at the EU level.

Equally important is avoiding aspirational targets for reducing pressures. Protection, restoration, and developing binding targets should be implemented and enforced. This would ensure that commitments and obligations result into measurable outcomes and the achievement of 'good environmental status' (GES).

This synthesis assessment suggests that there is a potential to foster a transition to improved and coherent marine governance through at strengthened MSFD. The revised MSFD could serve as the integrative backbone of an EU-wide ecosystem-based approach to further embed GES as the boundary condition for the sustainable use of our seas. In parallel, the forthcoming revision of the MSPD provides an opportunity to align spatial planning more explicitly with environmental and sustainability objectives. Thus framed, the MSFD would set the ecological limits for the sustainable use of the seas. MSPD would be the unifying process by which to link the EU's marine and maritime legislation (Table 1.1). MSPD would thus be the spatial tool to deliver on the objectives of the MSFD within the set ecological limits supported by other legislation limiting greenhouse gas emissions.

If developed with such dynamics in mind, the revision of the MSFD can provide the environmental

foundation for the implementation of the Ocean Pact, ensuring that its ambition i) to protect and restore ocean health, and ii) of boosting the long-term competitiveness of the Blue Economy are firmly grounded in ecological boundaries, so ecosystems can continue to function and provide services and associated benefits to people.

Together, the 2030 Biodiversity Strategy, the Ocean Pact, the NRR, the evaluation of the CFP and the revisions of the MSFD and the MSPD create a unique opportunity to move from fragmented action to a coherent governance framework where ecosystem resilience becomes the defining principle of EU ocean policy (ecosystem resilience Box 2.1) – an opportunity that could be fully embraced by the 2026 Ocean Act proposal.

The degradation of ecosystems can be addressed by reducing pressures, implementing protection, and by restoration measures (in that order) with the aim to allow recovery of ecosystem structure and function (Figure 1.1). This will increase their resilience to all pressures, including climate change.

Embedding the maintenance and recovery of ecosystem resilience in EU governance can be achieved through actions at three interlinked levels and with specific target years:

- Basic management measures: These are the standard, one-dimensional, pressure-specific reduction measures tending to promote linear recovery, e.g. reducing nutrient i nputs, managing fisheries, limiting seabed disturbance. They remain essential but as they do not consider the whole ecosystem on their own, they need to be applied in combination with other measures, to protect and restore ecosystem structure and function (e.g. McCrackin et al., 2017; EC, 2025b; Table 5.1).
- Ecosystem-scale approaches: These recognize that pressures interact across temporal and spatial scales, sectors, and with each other. They include the ecosystem-based approach to the management of human activities affecting the marine environment, nature-based solutions to marine challenges, and integrated maritime spatial planning built with nature at its centre (e.g. McLeod and Leslie, 2009; EC, 2021b; Table 5.2; Box 1.1).
- Transformative pathways: These are systemic shifts in the way society interacts with ecosystems to maintain or bring back their resilience. They include a multitude of interventions, ranging from reframing the logic of economic incentives and subsidies, to behavioural changes by consumers, to aligning the use of marine space and resources with the limits for the sustainable growth of human activities on land and at sea (already embedded in the MSFD in the case of economic sectors) to reward the recovery of ecosystem resilience (e.g. Rockström et al., 2009; EC, 2019a; Table 5.3).

Combined, this hierarchy creates an all-inclusive governance model of potential political responses, incremental where needed, integrative where possible, and transformative when viable. The challenge remains to make this governance architecture deliver urgently, with impact, and avoiding divergence from the visionary policy ambitions defined by the European Green Deal and Ocean Pact as the on-going triple crisis unfolds (EEA, 2024c).

Chapter 5 aims to illustrate solutions that can be actionable, and, if implemented in a gradual progression with determination and conviction (decades), can support the maintenance and recovery of ecosystem structure and function and leading to improved ecosystem resilience. This in turn, secures the flow of ecosystem services that people depend upon, such as coastal protection, food provision, climate regulation, and cultural values thus, securing both ecological integrity and human well-being throughout Europe (IPCC, 2019; EEA, 2024d; EC, 2025c).

## 5.1 MANAGING ACTIVITIES: OVERCOMING THE IMPLEMENTATION GAP

Basic management measures as established under EU legislation (named 'basic measures' under the Water Framework Directive but used more widely here) and implemented under national law remain the backbone of the management of human activities affecting Europe's seas. This is despite some remaining weaknesses in implementation (ECA, 2020; EC, 2025b) and their one-dimensional orientation which makes them insufficient to protect and restore the structure and function of marine ecosystems independently. They do, however, promote a reduction of and linear recovery from the key pressures with which they have a one-to-one relationship (Table 5.1).

For example, the measures are used to reduce certain pressures such as pollution with nutrients or contaminants, regulate extraction like fisheries, limit seabed disturbance, hinder introduction of non-indigenous species or restoration of habitats. They can deliver progress when implemented consistently over time, as shown by cleaner waters, signs of recovery in some commercial fish stocks, or restored reef habitats (EEA, 2019; EEA, 2024g; HELCOM, 2023c).

Yet, as highlighted by this report and its messages about the overall state of Europe's seas, such measures are rarely sufficient when acting in isolation. The challenge for their success can also be uneven implementation/-enforcement, lack of integration across policies or between countries, and slow recovery of ecosystems facing accelerating

climate change, as well as the cumulative effects of multiple pressures, as highlighted by the European Commission and the European Court of Auditors (EEA, 2019; ECA, 2020; EC, 2025b).

To overcome such challenges, these basic management measures could be embedded within the wider architecture of an ecosystem-based approach (Box 1.1). This would enable a more systematic approach to addressing the interactions, trade-offs, and synergies between these basic, and other, measures helping sustain and accelerate the recovery of marine ecosystems under changing climatic conditions.

**TABLE 5.1**
Examples of basic, pressure specific measures organised by MSFD descriptors

| Descriptor | Potential weaknesses of current measures | Proposed solutions to improve effectiveness | Expected impacts |
|---|---|---|---|
| Biodiversity (D1) | Conservation fragmented, MPA site management uneven, lack of strict protection, weak enforcement, feature-based approach, extraction of wild species, physical disturbance. | Expand & enforce management of MPAs, strengthen/target species & habitat protection e.g. by implementation/enforcement of strict protection, protect structure and function i.e. protect all features within a site, not only a limited set of e.g. species, active restoration. | Increased biomass & species richness, improve resilience of populations & habitats, improved spillover benefits for fisheries and recreational uses. |
| Non-indigenous species (D2) | More measures to prevent key pathways needed i.e. shipping & corridors, eradication efforts rarely effective. | Implement port monitoring (eDNA) strengthen IMO biofouling/ballast measure, develop rapid response protocols. | Reduced introductions, early detection of high risks, lower long-term management costs. |
| Commercial fish and shellfish (D3) | Overfishing persists, reduce by-catch, MSY not available for >50 % of biological stocks, main activity causing pressure. | Stronger TAC alignment with science, remove harmful subsidies, expand strictly protected PAs (incl. no-take), strengthen gear restrictions. | Rebuilt stocks, higher biomass, improved size & food-web structure, healthy benthic communities, long-term revenue from fisheries. |
| Food webs (D4) | Predator depletion changes trophic cascades, climate extremes impact stability, progress difficult to assess. | Reduce fishing mortality of predators, spatial protection of trophic hotspots, integrate food-web models in MSFD assessments. | Stabilised predator-prey dynamics, lower risk of regime shift, improved ecosystem resilience. |
| Eutrophication (D5) | Diffuse agricultural sources persist, recovery slow & non-linear, the new CAP does not match the ambition for the climate and the environment. Aquaculture not well covered. | Implement science-based & nutrient reduction targets across sectors, integrate WFD & CAP with MSFD, long-term monitoring & adaptive measures, regional sea action plans. | Reduced nutrient input, improved water clarity & oxygenation, recovery of seagrass and benthic habitats, improve fish nurseries & bathing water. |
| Seafloor integrity (D6) | Bottom trawling still widespread, fragmented protection of seabed habitats, inconsistencies between Member States in approach. | Restrict bottom touching gears in MPA and sensitive habitats, expand MPA protection to cover ALL benthic habitats, promote passive gears, designate anchorage areas. | Recovery of benthic habitats, increased carbon storage, improved structure & function of benthic habitats, spillover of benthic biodiversity. |
| Hydrographic conditions (D7) | Impacts poorly monitored, cumulative effects rarely assessed in permitting, no brine 'hot-spots', climate change missing. | Mandate hydrographic modelling in EIAs, require mitigation in MSP, restore migration corridors, map poor diversity areas for desalination. | Reduced disruption of water/sediment flows, improved stability of habitats, better connectivity & less impact. |
| Contaminants (D8/D9) | Legacy substances persist, emerging substances, some hazardous substances not regularly monitored. | Phase out substances e.g. PFAS, enhance WFD priority substances, improve monitoring, develop treatment of pharmaceuticals. | Declined contaminant loads, safer seafood, lower bioaccumulation on apex species. |
| Marine litter (D10) | Nano-, micro- and macroplastics are widespread, end-of-pipe solutions dominate while source-based actions lack. | Strengthen waste management, extend ALDFG to all vessels, ban/restrict SUPs, promote circular economy. | Reduced plastic leakage, fewer ghost nets, declining ingestion/entanglement rates, better resource use. |
| Underwater noise (D11) | Baseline poorly defined, sector-specific measures lack for continuous noise, knowledge of species impact is lacking. | Mandate vessel quieting tech, speed reduction in sensitive areas, temporal & spatial limits on pile driving & seismic surveys. | Lower chronic & acute noise impacts leading to reduced disturbance of marine fauna. |

*Notes: a) Key weaknesses are relevant based on findings from the European Commission and other sources (EC, 2020c; EC, 2025b; ECA, 2017; ECA, 2020; EPRS, 2025b; ICES, 2024). b) MPA: Marine Protected Areas. IMO: International Maritime Organisation. SUP: Single Use Plastics. ALDFG: Abandoned, Lost or otherwise Discarded Fishing Gear. c) For a more comprehensive overview of measures Denmark has, for example, published guidance documents from overviews to dedicated catalogues on marine litter.*

**TABLE 5.2**
Examples of ecosystem-scale interventions organised by relevant MSFD descriptors

| Descriptor | Potential area for improvement | Proposed solutions | Expected impacts |
|---|---|---|---|
| Biodiversity (D1) | Fragmentation between biodiversity protection, fisheries and spatial planning, climate extreme events undermine resilience. | Integrate MSFD, CFP, HB, BD and MSPD better, expand MPA network with focus on representativity, connectivity, structure & function for resilience, include all features, bridge between nature & exploitation legislation (e.g. as fundamental zoning at the scale of marine sub-regions), consider blue carbon & climate MPAs (sanctuaries) as dual climate and biodiversity measure, explore co-existence options. | Coherent, representative & adequate, and well-managed MPA network as integrated part of MSP, restored ecosystem structure & function, improved fisheries, dual biodiversity/ climate benefits, nature enhancement going beyond MPAs. Climate 'sanctuaries' as part of expanding the network. |
| Commercial fish and shellfish (D3) | Single stock management dominates, weak integration of pressure e.g. fisheries with ecosystem health. | Adopt ecosystem-based fisheries management, incorporate MSFD & CFP alignment with GES as boundary for use, integrate food-web & climate drivers. Designate large scale offshore no-take networks of MPAs. | Balanced exploitation, higher sustainable yield, spill-over relevant at commercial scales, resilient fish populations/ stocks. |
| Food webs (D4) | Food web impacts poorly captured by existing indicators, sectoral measures insufficient on their own. | Use ecosystem modelling, embed trophic indicators in MSFD assessments, protect functional groups via MPAs, fisheries, biodiversity policies, and precautionary principle. | More stable food webs, lower risk of collapse/reaching tipping points, improved resilience to cumulative effects. |
| Seafloor integrity (D6) | Spatial measures (like Natura 2000) limited to vulnerable /sensitive habitats, wide-spread bottom trawling[1]. | Apply MSP to designate low impact use areas (representative of marine habitats), combine MSFD GES, HD, CFP, and NRR protection & restoration. | Large-scale seabed restoration, increased ecosystem resilience, sustainable fisheries, improved connectivity. |
| Hydrographical conditions (D7) | Hydrographic changes managed piecemeal, major infrastructure developments are project based, climate driven shifts difficult to include. | Integrate hydrography into MSP, crossborder/ marine sub-region EIA for major infrastructure developments, cumulative impacts part of EIA, eco-engineering for resilience, model large infrastructures together (e.g. sum of bridges, windfarms etc.). | Stable sediment & current regimes, reduced infrastructure conflicts, contributing to structure and function. |
| Marine litter (D10) | Fragmented policies on plastics, weak coordination of source-to-sea measures (litter is not part of WFD). | Mainstream circular economy principles in MSFD/CFP/NRR, litter reduction in regional sea action plan and in river-basin management plans. | Lower plastic leakage at source, systemic waste prevention, cleaner seas (and sea food). |
| Underwater noise (D11) | Weak crossborder coordination. | Integrate noise into MSP, establish sub-region quiet areas e.g. within MPAs, incentivise low noise tech. | Reduced cumulative noise footprint, healthier habitats for marine fauna. |

*Notes: a) Key weaknesses are where relevant based on findings of the European Commission (EC, 2020c; EC, 2025b). b) The framing of ecosystem-scale interventions builds on Box 1.1. literature on EBM e.g. McLeod and Leslie, 2009 and the EU marine policy framework (see abbreviations in Table 1.1). This policy framework highlights the need to integrate human activities, multiple pressures and cumulative impacts across different geographic scales. 1) ICES, 2024.*

**TABLE 5.3**
Examples of transformative pathways organised by MSFD descriptors

| Descriptor & mode | Potential weaknesses of measures | Proposed transformative solutions | Expected impacts |
|---|---|---|---|
| Biodiversity (D1) | Conservation approaches insufficient vs accelerating triple risk pressures. | Embed better biodiversity targets in economic planning, systemic shift toward restoration/recovery economy, strengthen MSFD and MSPD as a backbone to reach marine policy visions. | Biodiversity mainstreamed in all sectors, resilient socio-ecological systems, MSFD GES boundary for sustainable use to inform a coherent zoning approach. |
| Commercial fish and shellfish (D3) | Economic drivers favour short-term extraction; subsidies perpetuate overcapacity & harmful gears | Reframe Blue Economy around zoning and resilience, redirect subsidies for restoration and low impact practices. | Sustainable fisheries integrated with environmental and resilience objectives. |
| Food webs (D4) | Cascading risks not addressed adequately by incremental solutions. | Adopt planetary boundary framing, embed systemic risk approaches in e.g. MSFD & CFP. | Food-webs buffered from climate shocks, healthy seas as a resilience asset. |
| Eutrophication (D5) | Fragmented management efforts along from source-to-sea; nutrient reduction measures can be isolated by sector and spatial scale. | Align EU funding instruments better (CAP, structural/regional funds, LIFE) to require integrated 'source-to-sea' approaches, so that measures e.g. promoting organic farming or restoring inland wetlands directly support recovery in coastal & marine waters. | River basin-wide coherence ensures that measures add up across sectors and regions, delivering larger cumulative reductions in nutrient pressures.<br>Improved ecological recovery of coastal ecosystems, increased efficiency of public spending, and greater resilience to climate-driven variability. |
| Seafloor integrity (D6) | Protection limited in scale and intent, spatial protection measures remain undefined, MPA network designated per site basis. | Develop a representative, coherent, adequate, and well-managed /enforced MPA network with focus on structure and function in addition to vulnerable species and habitats. | Sea-floor integrity safeguarded as a resilience and sanctuary asset. |
| Marine litter (D10) | Incremental bans insufficient, globalised plastic economy persists, plastic treaty not finalised. | EU leadership on global plastics treaty, transform consumption system, integrate circularity into MSFD core. | Systemic reduction of consumption of plastic, long-term elimination of leakage. |

*Notes: The transformative dimension from the sustainability transitions and resilience thinking (Rockström et al., 2009; Folke et al., 2021; EEA, 2021b).*

**BOX 5.1**
Examples of successful management of inputs of hazardous substances

Although Europe's marine waters have seen reduced heavy metal inputs, with mercury and cadmium inputs halving and lead inputs reducing by over two-thirds since the early 1990s, examples of ecosystem-based approach to management strategies are limited to a few successful examples:

**Case Study 1**

Tributyltin (TBT), an organotin biocide extensively used in anti-fouling paints for vessels from the 1960s to 1990s, caused significant environmental issues, particularly affecting marine organisms like molluscs. In 2003, a global ban on organotin compounds on ships was implemented (IMO, 2001). Following this agreement, marine environments showed notable improvements, including reduced contamination levels, decreased TBT-induced imposex in marine snails, and shell deformities in oysters, indicating ecosystem recovery (Beyer et al., 2022).

**Case Study 2**

The prohibition of dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs) has resulted in the recovery of the productivity of the white-tailed eagle (*Haliaeetus albicilla*), measured as the number of nestlings per occupied territory, in certain regions of the Baltic Sea (HELCOM, 2023a).

The Zero Pollution Action Plan (EC, 2021e) represents the EU's central mechanism for reducing contaminant inputs and impacts in marine ecosystems. As part of the European Green Deal, it advances an ecosystem-based approach that seeks to restore ecological integrity by tackling pollution at its source throughout the EU. The plan sets 2030 milestones towards a toxic-free environment by 2050, where pollution pressures no longer compromise the health of people or marine ecosystems.

## 5.2 INTEGRATING ECOSYSTEMS AND MANAGEMENT – SCALING SOLUTIONS ACROSS SECTORS, PRESSURES AND ECOSYSTEMS

Governance of ecosystems should recognise that the cumulative effects of land- and sea-based activities operate at different spatial and temporal scales.

An ecosystem-based approach to the management of human activities thus seeks to address these interactions at the appropriate scale (Box 1.1; Table 5.2) by:

- Including tools such as spatial protection measures, maritime spatial planning, nature-based solutions, or coherent implementation of basic measures at e.g. regional sea level.
- Building on existing governance structures at the river basin and marine (sub)regional levels, such as the Regional Sea Conventions, to ensure effective deployment there.
- Applying a source-to-sea approach that ensures upstream management actions (e.g. according to the WFD and NRR) and this way provide downstream benefits, ultimately benefits in coastal and offshore waters.

This section will highlight examples of implementation of ecosystem-based approaches, thematic or sectorial, in practice trying to combine both emission-focussed measures for e.g. contaminants, and nutrients and the more spatially oriented measures addressing e.g. fisheries or nature protection. It aims at being inspirational rather than exhaustive.

Measures addressing emission-type pressures, such as reduction of contaminant loads or nutrient inputs, show how coordinated, source-to-sea management operating at the regional sea and/or river basin scale can deliver tangible results when maintained over time (Box 5.1). These examples show that when action, monitoring, and implementation efforts align at the regional sea scale, measurable progress can be achieved over time (though it may take decades). Despite such progress, efforts must continue to improve and adapt to be able to address

### BOX 5.2
Examples of successful nutrient management strategies

European countries, Regional Seas Conventions, and the European Commission have for decades addressed the negative impacts of nutrient enrichment and eutrophication through implementation of action plans, legislation, and Nutrient Management Strategies. Some have been successful, at least partially, whilst others have not led to recovery. Below, we highlight some success where nutrient inputs have been reduced and where recovery, at least partially, is assessed and documented:

**Case Study 1**

Danish Action Plans for the Aquatic Environment: In 1987, the Danish government and Parliament enacted an Action Plan with the objective of reducing discharges and losses of Nitrogen and Phosphorus by 50 % and 90 %, respectively. The plan targeted three sectors: i) agriculture, ii) industries, and iii) urban water treatment. Reduction strategies and measures were implemented incrementally, accompanied by nationwide monitoring of discharges and losses, as well as their effects on groundwater, lakes, streams, and coastal waters. These findings were reported annually, and subsequent follow-up actions were agreed upon. The reduction target for phosphorus was achieved in the 1990s, while the target for nitrogen was met around in the early 2000s. For additional information, please see Ærtebjerg et al., 2003; Riemann et al., 2016; Jørgensen et al., 2026.

**Case Study 2**

The northern Adriatic Sea: Consistent measures to reduce urban waste waters, a ban of phosphate in detergents and other measures in the Po and Isonzo river catchments have led to long-term reduction of nutrient inputs to the northern Adriatic Sea.

This has led to well-documented decrease of phytoplankton chlorophyll concentration in the sea area (Mozetič et al., 2010). Using in situ and satellite observations, the study showed multidecadal declining trends of 5-9 % per year from 1970s onwards, especially in the problem areas in the western coastal waters under strong Po River influence. Due to long-term lags the most significant declines were visible only in 2000s. Also, the duration of phytoplankton blooms has shortened. The study found improved eutrophication status in the Northern Adriatic Sea, long regarded as highly eutrophic.

Other examples of successful nutrient management strategies are from the Baltic Sea (see HELCOM, 2010; Andersen et al., 2017; Murray et al., 2019 and the North Sea, where the coverage of the 'problem areas' has been reduced (see OSPAR, 2017; Devlin et al., 2023). Evidence indicates that lower nutrient inputs will result in reduced eutrophication. The cases of Denmark, the northern Adriatic Sea, the Baltic Sea, and the North Sea show that with defined objectives, plans to decrease nutrients, monitoring systems, and regular assessments, progress can be tracked. Furthermore, additional measures for load reductions can be implemented. The transition from eutrophication to recovery depends on determination and enforcement. A lack of progress indicates deficiencies in planning, action (e.g. agreeing on insufficient measures), control, and evaluation.

emerging contaminants or effects from multiple substances as demonstrated by HELCOM or the EU through the EU Zero Pollution Action Plan (EC, 2021e; HELCOM, 2025).

### Moving on to reductions of nutrient inputs these examples illustrate both similarities to contaminants but also add to the complexity of emission-driven pressures:

- Decades of national, regional, and EU regulation and investment, particularly in wastewater treatment but also in lower impact agricultural practices, have delivered substantial reductions in inputs when supported by reduction targets established at the regional level (HELCOM, 2007).
- Yet recovery from nutrient enrichment is slowed by internal nutrient cycling, non-linear ecosystem responses, and the amplifying effects of climate change. Recovery trajectories can take decades if not longer (Murray et al., 2019; Viitasalo & Bonsdorff, 2022).

Persistent, cross-sectoral action at the river basin and regional sea levels driven by the implementation of the MSFD, as facilitated by Regional Sea Conventions, and of the WFD and emission reductions mandated by the Common Agricultural Policy (CAP) and the Nitrates Directive, thus, remains crucial to gradually bend the curve of eutrophication impacts (Box 5.2). Besides the 'thematic' emission-reduction focused responses illustrated above, it is equally important to address pressures that are fundamentally spatial in nature. Fisheries management provides a key example for the need of spatial measures, such as restricting fishing in spawning grounds (operating in addition to other fishing pressure reductions, such as issuing quotas).

Overfishing and mobile bottom fishing practices directly reshape commercial fish/shellfish and other animal communities as well as seabed integrity, while spatial closures, no-take MPA zones and area-based gear restrictions have shown to deliver measurable ecological benefits across the whole marine 'food web' when consistently implemented and enforced (e.g. Van Hoey et al., 2024; Fenberg et al., 2012).

## BOX 5.3
Examples of successful management of commercial exploited fish stocks

While overfishing has historically placed severe pressure on Europe's seas, targeted management measures under the CFP, as well as regional and international cooperation, have led to some notable recovery successes.

These cases demonstrate that, when well-designed, science-based, and properly enforced, fisheries management can restore fish populations to sustainable levels and maintain them within safe biological limits.

### Case Study 1

Atlantic bluefin tuna in the eastern Atlantic Ocean and Mediterranean Sea: By the early 2000s, rampant overfishing and widespread IUU fishing had brought Atlantic bluefin tuna to the brink of collapse.

In 2007, the International Commission for the Conservation of Atlantic Tunas (ICCAT) adopted a 15-year recovery plan, though initial measures, such as TAC reductions and seasonal closures, were insufficient.

Two events in 2009 triggered stronger action: a proposal to list the species as endangered under CITES, thus preventing any international trade, and an independent review concluding that the management of the stock was 'widely regarded as an international disgrace' (Porch et al., 2017). In response, ICCAT imposed deep quota cuts and enhanced monitoring and control.

By 2020, assessments showed strong recovery across Europe, with biomass levels above sustainable thresholds, leading to the adoption of a long-term management plan. While reported catches now align with TACs, unreported and illegal catches remain a concern (ICCAT, 2025).

### Case Study 2

WMMAP: The Western Mediterranean has long been characterized by chronic overexploitation, particularly of demersal species e.g. hake and red mullet.

Recognizing the need for stronger action, the EU adopted the West Med MAP in 2019, the first multi-annual plan in the region. WMMAP introduced effort-based limits, capacity reductions, and technical measures, along spatial and temporal closures, to gradually reduce fishing mortality. Implementation has been difficult due to the predominance of small-scale and mixed fisheries, but early results are encouraging. Assessments indicate declining fishing mortality on several key stocks since 2020 and, in some cases, increases in spawning stock biomass (FAO-GFCM, 2024).

These cases illustrate how sustained and intensive management can reverse decades of overfishing, restore depleted resources, and contribute to long-term ecosystem resilience.

Hilborn et al. (2020) found a strong link between higher 'fishery management index' scores and better stock status worldwide and indeed, some of the most successful recoveries have followed complete fishing bans, highlighting the importance of decisive interventions.

The rebound of Atlantic bluefin tuna illustrates the role of international cooperation, strict enforcement, and science-based quotas in re-building even highly migratory stocks.

The WMMAP highlights that even in regions with deep-seated challenges, legislative reform and effort controls can create conditions for recovery.

Unlike managing pollution from contaminants or nutrients, where reductions at source can propagate through ecosystems, addressing spatial pressures requires more detailed spatial monitoring under the MSFD to support ecosystem-based MSP, as well as governance of access and use of marine ecosystems, while balancing ecological thresholds with socio-economic needs. This highlights the central role of the MSFD, which should operate more coherently with the CFP, the NRR and, in particular, the MSPD to ensure that spatial planning and fisheries regulations can support achievement and maintenance of GES, and the Ocean Pact's priorities of protecting and restoring ocean health and supporting a sustainable Blue Economy (EC, 2025c, Box 5.3).

Beyond the spatial governance of fisheries management, spatial protection through marine protected areas (MPAs) and strictly protected areas offers another essential tool for addressing pressures on species and habitats.

This, if implemented and enforced at scale as required by the NRR, could benefit entire marine ecosystems (EEA, 2015b). Evidence shows that:

- When well-designed, adequately resourced, and effectively enforced, MPAs contribute to the recovery of e.g. the structure of habitats, the rebuilding of depleted fish stocks, and the restoration of food-web functions (EEA, 2015b; Fenberg et al. 2012).
- Strictly protected MPAs increase biomass, diversity, density, and size of species, with spillover effects benefitting adjacent fisheries (Fenberg et al., 2012; Edgar et al., 2014; Hopf et al., 2024; Box 5.4).
- Beyond these effects on biodiversity, MPAs retain ecosystem resilience by buffering against disturbances such as heatwaves or recovery from storm events (Sheehan et al., 2021).

**BOX 5.4**
Marine protected areas in Europe (MPAs)

The EU Member States have mainly designated marine protected areas through the Natura 2000 network supplemented with some national designations. The coverage of marine protected areas doubled to 13.7 % between 2012 and 2024. However, substantial efforts are needed to meet the EU Biodiversity Strategy's goal of installing 10 % of strictly protection of EU marine areas and 30 % protected marine areas by 2030, while ensuring effective management of all protected areas.

**Case Study 1**

The Catalonian coast of Spain provides an example showing how no-take marine protected areas (MPAs) can restore marine ecosystems and support local communities. The first no-take was established at the Medes Islands in the late 1980s and strengthened in 1990. After years of overfishing, fish biomass, fish size, and species richness rebound dramatically. Building on this model, Catalonia expanded protection across the region, and in 2022 designated 20 new no-take or no-demersal-fishing zones covering more than 460 km². The designation of these MPAs typically involved consultations among scientists, managers, and local fishermen, who were increasingly included in co-management processes. Long-term monitoring has shown that well-enforced Catalonian strictly protected areas host several times more fish biomass than adjacent fished areas, particularly of vulnerable, high-value species such as groupers and seabreams. Many of these have also demonstrated spillover effects, with adult fish moving outside the boundaries and improving catches for nearby small-scale fisheries, as documented in other parts of the world, too (Fenberg et al., 2012). Socioeconomic assessments highlight that some fishing communities benefitted not only from better catches but also from growing dive tourism. The most effectively managed reserves show that ecological recovery can be both rapid and durable.

**Case Study 2**

European lobster refugia along the Norwegian Skagerrak coast: In 2006, a network of small coastal MPAs was implemented along the Norwegian Skagerrak coast, providing complete protection to lobster and partial protection to fish. Similar strategies have been used by Sweden, such as in Kåvra, a partially protected area that has banned lobster fishing since 1989 (Perry et al., 2025). Within a few years, lobster abundance, average size, and reproductive output increased significantly inside the refugia compared with adjacent fished areas (Moland et al., 2013). As these effects became apparent, the reserves attracted high public attention and were soon considered a credible supplement to traditional fisheries management. More than 50 lobster reserves have since been implemented in Norway (Knudsen et al., 2022). Tagging and genetic studies further revealed spillover benefits, as lobsters moved across MPA boundaries, enhancing catches in nearby fisheries (Moland et al., 2013; Knudsen et al., 2022). While the refugia have clearly benefited lobster populations, their effects on fish species are less consistent. Moland et al. (2013) observed some positive responses for cod inside the reserves (larger body size and higher occurrence), yet subsequent studies report little or no evidence of spillover to adjacent fisheries (Perry et al., 2025). Overall, the success of the lobster refugia demonstrates how targeted, well-accepted and enforced closures can deliver measurable ecological and socio-economic benefits, while highlighting the importance of scale, design, and complementary management for extending protection to wider fish communities.

However, outcomes from deploying spatial protection measures remain uneven, in particular for partial or multi-use MPAs, which often deliver limited, if any, ecological benefits because:

- Pressures are not sufficiently limited in the MPA, which underscores the importance of aligning site designation with conservation objectives (Gill et al., 2017; Sheehan et al., 2021).
- Protection within MPAs often targets specific features rather than all ecosystem features (habitats, species), and shows limited alignment with fisheries management (ECA, 2020), as seen in the EU Natura 2000 network.

More generally, the lack of planning and management towards the desired conservation objectives, or not enforcing them, can render MPAs as mere 'paper parks'. For example, ecological effectiveness was nearly tripled in MPAs with adequate staffing compared to those with limited capacity (Gill et al., 2017; Aminian-Biquet et al., 2024; ECA, 2020a; Box 5.4).

The EU's Natura 2000 network could, together with new MPA designations, provide the spatial basis for the recovery of marine ecosystem resilience under the following conditions:

- It is properly integrated with MSFD implementation (Art. 13.4) and the achievement of the Biodiversity Strategy 2030 targets of 30 % protection, with 10 % strict protection.
- It protects and restores all elements of marine ecosystem structure and function, i.e. all features, inside a given (Natura 2000) site - beyond the current safeguarding of (only) the sensitive or vulnerable marine species and habitats for which the site was designated.
- It evolves from being a patchwork of individual designated areas to a coherent, representative, adequate, and well-connected network for each marine and/or region.

Framed in such a way, spatial protection measures can go from being a conservation tool to becoming the foundation for coherent spatial planning, or zoning, approach across Europe's seas. Such an approach would enable sustainable use of marine areas by aligning activities with the ecological objectives of each zone.

Ecosystem-based approaches to manage the use of Europe's seas aim at bringing together fragmented sectoral policies and reconcile competing uses amongst other factors, but their success depends on being rooted in deeper, systemic change. As shown here, current efforts remain limited to targeting single pressures, such as emissions of contaminants or the overexploitation of commercial fish and shellfish stocks.

A true ecosystem-based approach must go further. Acknowledging trade-off across management, addressing cumulative effects of multiple pressures, and aligning governance with the appropriate ecological scale across Europe's seas. The challenge, and opportunity, lies in translating this ambition into practice. Section 5.3 explores how some transformative pathways can support delivering such visions.

## 5.3 EMBRACING RESILIENCE THINKING WITHIN EU MARINE GOVERNANCE

Incremental gains from implementing measures are outpaced by the accelerating and cascading impacts of climate change, biodiversity loss, and pollution.

Addressing the triple planetary crisis in Europe's seas require a systems change that goes beyond repairing current ecosystem degradation. It entails re-designing the human-ocean relationship so that marine ecological integrity and societal prosperity are mutually reinforcing (Table 5.3).

This transformation requires:

- Higher levels of political and societal will to realise policy ambitions as well as improved policy and management integration at all levels.
- More socio-economic adaptation from all sectors and not just those most affected.

An example of mechanisms that could promote socio-economic adaptation towards systemic change would be shifts in EU citizen's seafood consumption patterns, where:

- Relevant authorities could consider measures to incentivise local fish and shellfish consumption across the EU. The EU consistently reaches its 'fish dependence day' early in the year (the point at which domestic production can no longer meet demand). After this, the EU relies on imports from third countries, often with significant environmental and socio-economic implications in the countries of origin.
- Consumers of fish/shellfish could re-direct their choices to species that are local and have been sustainably fished.

Resilience approaches can assist re-aligning the governance of marine areas with planetary boundaries, closing the EU marine/maritime implementation gaps by introducing positive economic incentives and removing harmful ones e.g. through simplification and enforcement, affecting consumer behaviour towards marine life, and reframing the economic logic of the (blue) economy to support long-term competitiveness and sustainability. Central to this approach is embedding ecosystem resilience as the guiding principle of a renewed EU marine/maritime governance framework.

While the Ocean Pact extends beyond EU waters, it also demonstrates how the EU can apply its expertise in ocean observations, ocean protection and ecosystem-based approaches to management to support the sustainable use of ocean resources globally.

As such, the Ocean Act are part of how the EU implement 'transformative change defined by IPBES as 'fundamental, system-wide shifts in views, structures, and practices' (IPBES, 2024). Transformative change could involve systemic reform of industrial activities underpinned by clear and actionable transformative pathways. These include redirecting efforts away from harmful subsidies and towards activities that build marine ecosystem resilience, such as habitat restoration (of, e.g., seagrass, kelp, biogenic reefs); payments for ecosystem-services that reward stewardship; and conditional support for low (ecosystem)-impact practices (EEA, 2023b; EC, 2023b).

These reforms (i.e. restoration investment to meet the objectives of the NRR) would contribute to reinforce coherence on subsidies. Currently, subsidies financing activities that harm biodiversity co-exist with efforts to restore it, slowing progress across biodiversity, climate, and competitiveness agendas (EC, 2021a; EC, 2021b, Box 5.5).

Long-term competitiveness of seafood related industries implies sustainable management of resources. For example, dwindling landings of commercial fish and shellfish in Europe's seas since the mid-90s (STECF, 2023), largely caused by long-term overfishing (EEA, 2024a), have led to fewer jobs in the fishing industry and reduced revenues for fishers, amongst other lost benefits compared within sustainable limits (i.e. at Maximum Sustainable Yield). Fishing sustainably in the North-east Atlantic Ocean could have increased fleet profitability by €4.64 billion (Guillén et al., 2016).

Direct economic incentives also have a key role in addressing the crisis of Europe's seas. Recent reforms to the EMFAF and related EU policies highlights how financial instruments can shift from supporting unsustainable practices to strengthening ecosystem resilience. Beyond phasing out harmful

**BOX 5.5**

EU governance support to harmful subsidies and pathways for reform

The EU has committed to phasing out environmentally harmful subsidies (EHS) (EC, 2011; EC, 2019a; EC, 2021f; EC, 2021g; EC, 2022b). Despite these repeated commitments, subsidies that undermine ecosystem resilience persist reinforcing the very drivers of biodiversity loss that EU environmental and sectoral policies seek to address (EEA, 2025c). While some reforms are underway (e.g. CAP eco-schemes, EMFAF restrictions), marine ecosystems continue to face cumulative pressures from multiple sectors directly linked to the main drivers of biodiversity loss, including the agriculture, fossil fuels, fisheries, and mining (Díaz et al., 2019). These sectors benefit not only from public funding but also from the failure to account for the environmental damage they cause, such as greenhouse gas emissions, nutrient pollution, and habitat destruction, which are typically borne by society rather than the polluters themselves (Damania et al., 2023; Reyes-García et al., 2025).

In agriculture, CAP subsidies have long promoted high-input farming, making agriculture a major source of nutrient pollution: only 60 % of nitrogen inputs are absorbed by crops, with the remainder lost to air, soils, and waters, driving eutrophication in Europe's lakes, rivers, and seas (EEA, 2022b). Despite reforms, a large share of the €387 billion CAP budget for 2021–2027 continues to support intensive farming systems that drive biodiversity loss and climate emissions (Pe'er et al., 2019; Pe'er et al., 2020). Such support risks undermining costly restoration measures and nutrient reduction efforts under the MSFD and WFD.

In fisheries, harmful subsidies allow unsustainable and unviable activities to persist, contributing to over-capacity.

Capacity-enhancing and cost reducing subsidies, including fuel tax exemptions, help sustain energy-intensive fleets, perpetuate overfishing, and increase $CO_2$ emissions (Vaughan et al., 2023; Guillén et al., 2025), directly undermining both climate and biodiversity objectives. In 2018, EU fisheries consumed ~2 billion litres of fuel and emitted ~5.2 million tonnes of $CO_2$: fuel tax exemptions alone were estimated at ~€1.14 billion in foregone public revenue, exceeding the fleet's operating profits of €0.8 billion (Carvalho & Guillén, 2021). Although the EMFAF (EC, 2021h) has introduced some safeguards, it still allows support for vessel modernisation, acquisition, and size increases. Framed as safety or efficiency gains, these measures risk increasing capacity and undermining management objectives (ECA, 2020b; Skerritt et al., 2020; Villasante et al., 2022), a risk also recognised in the revised Guidelines for State aid in the fisheries and aquaculture sector as potentially incompatible with sustainability goals (EC, 2023c).

Effective subsidy reform is essential for achieving MSFD 'good environmental status' and restoration targets, recognising that resilient ecosystems underpin long-term competitiveness and economic viability. The EU is developing a methodology for reporting non-energy EHS (EC, 2024b), while fossil fuel subsidies are monitored separately under the Governance Regulation. Progress on phase-out remains slow (EEA, 2025d) and national reform efforts, such as Denmark's and Norway's 2025 attempts to tax fishing fuel, have faced challenges due to competitiveness concerns and enforcement gaps. These experiences highlight the need for coordinated EU-wide action and the reinforcement of global frameworks like the WTO Agreement on Fisheries Subsidies (WTO, 2022).

subsidies, a sustainable Blue Economy requires positive market incentives that align ecological integrity with competitiveness (Box 5.6). The implementation of the Ocean Pact and the next EU Multiannual Financial Framework (2028–2034) offer an opportunity to advance this transformative pathway and embed ecosystem resilience within the EU governance framework.

The 2030 Biodiversity Strategy, the Marine Action Plan, the NRR, the Ocean Pact, the evaluation of the CFP and the upcoming revisions of the MSFD and MSPD together to provide the framework for such a transformation at the governance level (EC, 2021c; EC, 2023a; EC, 2025c), i.e. to move from fragmented action to a coherent EU ocean governance framework.

The ambition to develop an Ocean Act in 2026 creates a unique opportunity to make ecosystem resilience the defining principle of EU ocean governance. Enhanced alignment and synchronisation of EU-marine related policies would provide a stronger and more coherent framework for the protection and sustainable use of Europe`s seas. Building on more than two decades of EU marine policy development and scientific research, such alignment can further reinforce the Marine Framework Strategy Directive by clarifying its role as the overarching environmental framework for the marine environment and by strengthening the use of legally binding environmental objectives to steer sea-use.

Embedding the objective of achieving and maintaining Good Environmental Status across relevant EU policy agendas would help ensure consistency in ambition and implementation, reducing the risk of competing objectives and unintended consequences for marine ecosystems. A more integrated policy approach would also facilitate the scaling up of nature-based solutions and ecosystem restoration across regional seas, in line with ecosystem-based management principles. Collectively, this creates a critical opportunity to halt biodiversity loss and restore marine ecosystems while supporting the Blue Economy, by aligning human activities with ecological objectives defined for different marine areas.

Marine zoning across Europe's seas could be an essential tool to integrate transformative pathways from diverse social and economic systemic transformations and supporting sustainable planning of use of the marine space (Box 5.7).

The current EU policy framework includes a basis for coherent marine zoning and spatial planning across Europe's seas linking MSFD and MSPD objectives with those of the 2030 Biodiversity Strategy, the NRR, the CFP, the Ocean Pact and more. As such, marine zoning could be understood as a spatial expression of ecosystem-based management, structured around a set of complementary zones across Europe's seas. Together, these zones reflect various levels of protection, sustainable use, and restoration, and correspond to the spectrum of human activities listed in Annex III of the MSFD. Viewed systemically, they illustrate how cumulative pressures could be managed within ecological limits while supporting long-term societal benefits.

**BOX 5.6**

Getting the most out of EU economic incentives for marine ecosystem resilience

Evidence shows that biodiversity-positive incentives can reduce pollution, protect marine species and habitats, and restore ecosystems (OECD, 2025). Examples from Europe include:

Fishing license and access fees (e.g. UK, Denmark) generating revenue for conservation and fisheries management.

Marine biodiversity offsets, with the UK's consultation on Marine Net Gain and Dutch practice in Rotterdam harbour compensation schemes serving as EU-leading cases.

Plastic bag levies and taxes, adopted in many EU Member States, have already reduced marine litter and provide a template for broader circular economy measures.

EMFAF-funded innovation grants supporting restorative aquaculture (e.g. mussel and seaweed farming in Germany and the Baltic region) and the adoption of habitat-friendly fishing gear.

Extending and scaling such instruments across the EU would help ensure that public and private finance reward innovation in low-impact aquaculture, ecosystem restorative practices, and circular economy solutions, thereby helping align the competitiveness agenda with ecosystem recovery and resilience.

Such a framework could enable the allocation of spatially explicit environmental objectives across the entire EU marine territory, following four complementary zones:

## ZONE 1

Strictly protected areas form the core of ecological resilience. Human activities are limited to those with negligible impact, primarily for conservation, scientific, or cultural purposes, safeguarding ecosystem structure, and function.

## ZONE 2

Protected areas contribute to maintaining and restoring biodiversity while permitting uses that are demonstrably compatible with conservation objectives. These areas buffer strictly protected zones and support recovery at regional scale.

## ZONE 3

The wider marine area managed under the MSFD objective of good environmental status (GES) represents the space of sustainable use. Here, human activities — including fisheries, maritime transport, and energy production — are permitted provided that cumulative pressures remain within scientifically defined ecological thresholds (see Box 5.8). GES thus functions as an operational boundary for sustainable use.

## ZONE 4

Heavily used or already degraded areas, estimated to represent a limited share of sea space, reflect zones where ecological condition has been substantially altered, for example through intensive seabed disturbance or persistent hypoxia. In these areas, policy focus shifts towards preventing further deterioration, mitigating impacts and, where feasible, enabling ecological restoration and transition.

### BOX 5.7
Marine zoning, a prerequisite for an ecosystem-based approach

Marine zoning is a widely used spatial tool for managing ocean spaces, minimizing conflicts between uses, and maintaining ecosystem services (Mandelberg et al., 2025). It employs integrated, ecosystem-based methodologies and can be supported by the implementation of EU law such as the MSPD and the MSFD.

Key elements of zoning encompass the formulation of national plans with cross-sectoral and land-sea coordination, the utilization of collaborative governance and data-driven decision-making based on ecosystem features, pressures, and human activities (i.e. MSFD Annex III, Table 1, 2a, and 2b), and the integration of environmental protection with sustainable economic activities.

A recently published systematic review on marine zoning (Mandelberg et al., 2025) highlighted that:

Marine zoning serves as a vital mechanism for harmonizing the preservation of marine ecosystems with socioeconomic demands by allocating specific areas for conservation, sustainable practices, and economic pursuits. The review highlights the importance of incorporating sustainable fisheries into zoning strategies and stresses the necessity of accounting for other human activities, such as tourism, coastal development, and renewable energy initiatives, to create more comprehensive marine spatial plans.

It is essential to prioritize management strategies that are both collaborative and adaptable, involving local communities and policymakers. Enhancing tools for mapping and assessing ecosystem services and natural capital will improve decision-making and foster stakeholder cooperation. By addressing such deficiencies, MSP can more effectively align with long-term conservation objectives and ensure the ongoing provision of vital ecosystem services, even amidst changing environmental conditions.

Provide consistency and investment security for marine and maritime enterprises through marine zoning, applied sustainably via EBM and supported by environmental impact monitoring. Marine zoning provides spatial clarity by distinguishing strictly protected areas, multi-use conservation areas, GES managed areas, and intensive use zones, thereby enabling coherent planning aligned with ecological limits and ensuring that environmental protection and sustainable economic uses can coexist.

Taken together, these zones illustrate a governance model that moves beyond sectoral management towards managing cumulative pressures across the full marine system, recognising that ecological integrity underpins climate regulation, food provision, and long-term economic resilience:

- The existing, specific environmental objectives for each of the applicable policy instruments can apply to more than one zone, i.e. they are not spatially exclusive, as for the species protection regime under the Habitats Directive. The current repetition stems from the fact that the definitions and hierarchies of these objectives are not clear in relation to each other, and discussion on differences and overlaps between them has not been fully concluded.
- Some of these objectives could be refined to better fit the requirements of a given zone, e.g. 'strict protection', which could reduce some overlaps, when planned at the EU-level.
- If designed as a coherent network of zones defining sea use not only covering national waters but designed for scaling up to spanning entire regional seas, such zoning system can embed environmental and sustainability objectives across land and sea uses, from fisheries and offshore energy to shipping and tourism, while providing legal clarity and supporting ecosystem resilience as the defining principle of EU marine governance.

The underpinning logic for this marine zoning approach is that:

- Marine biodiversity characteristics, such as species diversity, abundance, average size, and biomass, and, through these, marine ecosystem structure, connectivity, function, and marine ecosystem resilience, improve as pressures are reduced (EEA, 2019; Fenberg et al., 2012).
- Regular monitoring of these biological traits, as part of assessing progress towards the objectives of the MSFD, WFD, BHD and the CFP, should reveal an increasing trend from 'heavily used' to 'strictly protected' zones, reflecting decreasing pressures. If no differences in biological parameters are observed over time across the zones the management measures are ineffective.
- Regular biological monitoring at a representative set of sites in each zone could be combined with broader surveillance of human activities, providing a cost-effective, risk-based approach to modelling areas not monitored regularly.

**BOX 5.8**

Defining the sustainable use of Europe's seas: The threshold values delimiting the Marine Strategy Framework Directive's 'good environmental status'

The goal of the Marine Strategy Framework Directive (MSFD) is for EU marine waters to maintain or achieve 'good environmental status' (GES). Fulfilling GES is not about reverting to pristine conditions across Europe's seas, but about the sustainable development of any human activities that can affect our seas - from land-based agriculture to sea-based fisheries or extraction of marine aggregates.

GES is made specific through 11 'Descriptors', of a sea where pressures from human activities are sustainable because they are compatible with having marine biodiversity, food-webs and – more generally – marine ecosystems that are healthy, clean, productive, and resilient (see MSFD Annex I). Each of these descriptors combines 'state' and 'pressure' constituents ('Criteria') but they can be separated into descriptors of marine 'state', e.g. marine biodiversity (descriptor #1), and of marine 'pressure', e.g. eutrophication (descriptor #5) (EC, 2017). For most of these descriptors, what separates it being at GES from not being at GES is a 'threshold', which can originate at national level but also needs to be agreed at (sub)regional or EU-levels.

There is currently a process for agreeing on (sub) regional or EU thresholds, where Member States and other stakeholders agree on these values, e.g. for noise (descriptor 11) or seafloor integrity (descriptor 6).

The agreed GES threshold values at different scales:

Have been made public (EC, 2024) and application is mandatory for Member States when concluding whether their marine waters are at GES or not for each descriptor.

Define the boundary for the sustainable use of Europe's seas by delineating activities that are compatible with ecosystem limits from those that are not, within an ecosystem-based management framework that accounts for ecological capacity and recovery.

The Maritime Spatial Planning Directive has been working to try to accommodate all relevant human activities per marine area in terms of 'sharable marine space', and not so much on the basis that maintaining or achieving GES should be at the centre of that planning.

*Notes: Threshold values are set per the criteria underpinning each GES Descriptor; there are primary and secondary criteria but only the former 'count' towards GES (see EC, 2017).*

Building on the preliminary EU marine zoning framework outlined here, achieving a zoning approach that embeds marine ecological limits into maritime spatial planning as its fundamental principle can do more than manage competing uses of Europe's seas. It can become the organising principle for how our seas are governed and how they support Europe's citizens.

**BOX 5.9**

MSP as a single planning framework for EU marine and maritime law for reducing the sum of pressures acting upon Europe's seas

The EU currently faces what is, most possibly, its final chance to achieve a true integrated foundation for ecosystem resilience-based ocean governance given the rare moment of alignment provided by the scheduled adoption of the Ocean Act by late 2026 and the associated revision of the MSPD as well as that of the MSFD in 2026.

The application of the Swedish Symphony MSP tool, which includes the full range of human activities in the North Sea and Baltic Sea, has demonstrated that MSP can significantly reduce net cumulative environmental impacts, both at local levels and across entire sea basins, depending on the prioritization of environmental values and the pressures from activities included in MSP (Hammar et al. 2020).

By integrating comprehensive data into a unified decision support system, Cumulative Impact Assessment aids marine planners in understanding the potential environmental consequences of different options, thereby facilitating the practical implementation of ecosystem-based MSP and a zoning approach.

Two MSP scenarios were assessed by Symphony for their environmental impact:

1) the 'Negotiated plans', i.e. the marine spatial plan proposals developed through extensive stakeholder discussions and 2) the 'Eco-alternative plans', which were similar to the negotiated plans but place a stronger emphasis on protecting ecological functions and achieving GES under the MSFD.

By linking the MSFD, MSPD, CFP, NRR, the 2030 Biodiversity Strategy, the nature directives, the Ocean Pact and Europe's climate and energy strategies, such an agenda (Box 5.9):

- Safeguards marine biodiversity, organises the coexistence of economic uses of the sea, and allows for the maintenance and/or recovery of marine ecosystem resilience.
- Helps people and communities ascertain which activities are compatible with the different degrees of protection and use of the ecosystem features occurring in each zone - across local, regional and EU scales.

Supports the setting of priorities of use and develop potential adaptive scenarios balancing community needs and concerns in each coastal or marine area.

# 6. Steps towards restoration of the resilience of Europe's seas

- Europe's seas are in an ecological crisis as cumulative impacts push the limits of resilience. Multiple pressures challenge the capacity of marine ecosystems to function properly, eroding resilience, biodiversity, and the seas' contribution to climate stability and human well-being.
- Bridging the implementation gaps in national Programmes of Measures under the MSFD, WFD, regional action plans, and linking with the MSPD under a unifying legally binding process should be a key priority for achieving healthy, clean, productive, and resilient seas.
- Upcoming policy revisions offer a unique chance to build coherent ocean governance. Aligning the MSFD, MSPD, NRR, CFP, CAP, and the forthcoming Ocean Act – together with reforging the Multiannual Financial Framework to enable their implementation – can establish true 'policy unity', accelerating climate mitigation, reducing pressures to GES levels, and enabling large-scale marine ecosystem recovery.
- Acting now to restore resilience may require substantial effort and funding, but the long-term gains, thriving communities and sustained economic security, far outweigh the cost of inaction.

Europe stands at a crossroads, where the results of the general state of Europe's seas are undeniable - both in terms of the knowledgebase and science supporting it. Overall, the seas are neither healthy, clean, productive nor resilient and this is unlikely to change unless our governance approaches are reformed (Chapters 2, 3 & 4). This is despite a comprehensive EU policy framework already being in place (Chapter 1) and the existence of viable solutions to tackle the situation (Chapter 5).

Indeed, Europe's seas are in crisis. Their state continues to decline as the cumulative pressures from human pressures on land and sea surpass the limits marine ecosystems to function effectively (Chapters 2, 3 & 4). This diminishes their capacity to support people's lives, livelihoods, and the economy more widely. The current crisis is not due to a lack of scientific knowledge of marine conditions or the measures needed to address them; enough knowledge is available to inform action. Instead, as noted by the European Court of Auditors and European Commission, it originates from long-standing gaps in political coherence, implementation, and management failures, as short-term priorities have frequently delayed the decisive, long-term actions needed to reduce pressures and build ecosystem resilience. Renewed political commitment and coherent long-term action remain essential to reverse this trend (e.g. Figure 2.2; CrossGov, 2025; ECA, 2020; EC, 2025b).

The choices made in Europe now and in the next few years will determine whether our seas remain on the path of irreversible loss or move toward the recovery of ecosystem resilience and resilient communities. Such choices will involve significant socio-economic trade-offs, which may be challenging but are necessary to secure the long-term support of Europe's seas for the safety and resilience of communities and the competitiveness of economies across the continent.

This concluding chapter puts the findings from the previous chapters together; synthesising the evidence, insights, and solutions to outline actions needed to restore the resilience of Europe's seas before the current window of opportunity for recovery is missed.

## 6.1 SECURING RESILIENCE: TOWARDS INTEGRATED MARINE GOVERNANCE

Across Europe's seas, examples of recovery and innovation demonstrate that positive change is possible despite challenges concerning policy implementation (Chapter 5). Decades of investment in policy design have created a solid basis for informed decision-making, especially due to EU law like the MSFD and MSPD and associated environmental monitoring, in research under

Mission Ocean and Waters and, in some regions, the Regional Sea Conventions (EC, 2025g; Table 1.1; 5.1; 5.2; 5.3). Overall, the examples show that targeted, coordinated action can deliver results and that the EU has the scientific and legislative capacity, and cooperative mechanisms needed to restore ecosystem resilience.

What is needed now is to fully use this knowledge and experience to make EU governance work towards the desired goal, embracing the need for policy coherence, implementation, and enforcement (Chapters 1 & 5). At the institutional level, the European Commission, with support from Member States, has renewed its focus on simplification, coherence, and closing the implementation gap (EC, 2021d; EC, 2025i).

The above principles are particularly applicable to EU seas, where fewer stakeholders and limited private ownership make simplification more feasible. Streamlined governance, consistent application of EU law and policy (Table 1.1), and stronger coordination between instruments addressing the environment, Blue Economy, and agriculture could unlock the untapped potential for marine ecosystem recovery already embedded in the EU acquis.

Such potential:

- Remains untapped due to traditional divides across policy instruments, such as overlapping mandates, conflicting objectives, spatial competition, temporal misalignments and duplicated administrative procedures (CrossGov, 2025).
- Could be realized through the forthcoming revisions of the MSFD and MSPD, together with the proposed Ocean Act, offering a unique opportunity to translate this potential into action. Simplification here means bridging legal frameworks on strategic planning and co-ordination with sectoral and thematic legislation as one coherent, enforceable system using 'good environmental status' (GES) as the sustainability boundary, while acknowledging that shifting baselines require adaptive management (Figure 2.8).
- Has already been realized in some Member States through emerging governance models, demonstrating how such integration is possible. This type of governance promotes negotiation and co-ownership of outcomes across stakeholders and is key for the collective action needed to restore marine resilience within national waters and across regional seas, as seen in marine zoning elsewhere (Box 5.7).

By aligning maritime and marine policies under shared, enforceable objectives, as in Denmark's integration of agriculture, climate and water policy targets (see MGTP, 2026), the EU could simplify governance, while upholding its high ambition for healthy, clean, productive, and resilient seas.

In this context, simplification implies:

- Preventing duplication at the policy-design stage, ensuring that visions, strategies, and objectives across instruments work together rather than in parallel or in conflict. This would also ease the administrative load for national authorities.
- Confirming that MSFD 'good environmental status' (GES) serves as the single, outcome-driven, enforceable EU boundary for sustainable marine use. This would: 1) set GES as the ecological limit for any land- or sea-based activity affecting Europe's seas and 2) bridge the gap between instruments that plan sea use and those that define what a healthy, clean, and resilient marine environment should look like – areas that often act in isolation.
- Renewed ocean governance will also need to continue ocean observations to provide the scientific evidence base needed to support informed decisions at appropriate spatial scale from local to regional seas.

A stronger connection between observation, monitoring, data access, and policy implementation is essential to translate governance simplification into real environmental recovery:

- Maintaining or achieving GES requires sustained, high-quality observations that inform both MSFD implementation and broader 2030 and 2050 policy goals.
- Existing European dataflows and research – through EMODnet, Copernicus Marine Service, INTERREG, LIFE-Nature, Horizon Europe, and data collected under the EU Control Regulation – already provide valuable knowledge. Their impact would be greater if explicitly aligned with EU legal objectives, in particular GES, and made available under the 'collect once, share many times' principle. Reporting of primary data or assessment results should not be viewed as a burden on Member States, but a meaningful step in measuring progress towards agreed EU objectives.
- The present ongoing efforts towards an EU Digital Twin Ocean (DTO), combining the EMODnet and the Copernicus Marine Service's data as the core of the DTO, could allow for the EU to be a world-leader in ocean governance and especially when linked to e.g. MSFD reporting.

Integrated assessment methodologies, as used across Chapters 2, 3 & 4, provide the spatial backbone for tracking recovery and embedding ecosystem state into maritime spatial planning – an element that could be strengthened in MSPD implementation. These tools convert extensive environmental data into coherent, area-based assessments that link ecosystem state with pressures and human activities. Their spatial outputs demonstrate how science supports management and zoning across Europe's seas (Box 6.1).

Nevertheless, so far, the application of such novel approaches to governance and innovative assessment methodologies remains limited across Europe's seas (Chapters 2, 3 & 4).

## 6.2 DECLINING RESILIENCE: BARRIERS TO SYSTEMIC CHANGE

The main constraint is therefore no longer a lack of data, knowledge, analytical tools, or policy instruments, but rather a set of structural, political, and socio-economic barriers that have hindered the integration of existing knowledge and experience and limited the coherent design and coordinated implementation of EU policy instruments relating to the sea. Although further improvements in the spatial and temporal resolution of the EU's Ocean observations are needed to fully support an ecosystem-based approach to management, these gaps are not the primary barrier. Continued strengthening of ocean observations will thus be essential for future improvements to EU marine and maritime legislation and for enabling the sustainable use of the ocean.

Recent evaluations confirm that the implementation gap in EU marine policy persists. These highlight institutional fragmentation, weak coordination across sectors, overlapping mandates, conflicting objectives, limited accountability, temporal misalignments, and insufficient enforcement – all of which continue to slow the potential recovery of Europe's seas (Albrecht et al., 2025; CrossGov, 2025; ECA, 2020; ECA, 2024; EC, 2025b; Puharinen, 2023). For example, the European Court of Auditors found that, although the EU's network of marine measures is extensive, implementation remains 'wide but not deep,' or 'this legislation [Habitats and Birds directives] does not protect some threatened species' and 'We found, in practice, that the provisions of Article 11 of the CFP and Article 15 of the MSFD had not worked as intended in the areas we examined' (ECA, 2020). Similarly, the European Commission's assessment of Member States' updated programmes of measures concludes that implementation gaps between EU directives and the MSFD requires more work i.e. 'This shows the need for more work to cover these gaps [from other legislative frameworks] when designing MSFD measures' (EC, 2025b).

The gap between the EU's political ambition for halting the loss of biodiversity and achieving healthy, clean, productive and resilient seas, in 'good environmental status', on one hand, and the reality of the implementation of the relevant policy instruments (despite some progress), on the other, can be illustrated by what is happening to its MPA network (Table 6.1).

**BOX 6.1**
Informing EBA/EBM through integrated, area-based status assessments

Europe's seas have here been assessed through a suite of multi-metric indicator-based tools that trans-form complex monitoring data into coherent, area-based evaluations of marine status.

The tools, BEAT (biodiversity), CHASE (contaminants), HEAT (eutrophication), MALT (marine litter) and MESH (ecosystem health), integrate hundreds of national indicators into comparable regional assessments. Together they provide a spatially resolved picture identifying 'problem' and 'non-problem' areas across all of Europe's seas.

These tools make it possible to link ecosystem state to pressures and human activities, creating a direct bridge between environmental status, policy targets, and management tools like maritime spatial planning. For instance, where CHASE identifies chemical contamination hotspots or HEAT detects eutrophication linked to nutrient inputs, these findings can be traced back to land-based or sectoral sources, informing targeted measures under the MSFD, WFD and national programmes.

Over recent years, data access and indicator coverage have improved markedly, but important gaps remain. Offshore monitoring coverage is still uneven, and many chemical substances lack agreed target values, limiting their inclusion in assessments. Further progress depends on strengthening ***in situ*** monitoring and improving access to existing but restricted datasets, particularly for fisheries.

Confidence evaluation is a crucial element of these assessments. While heuristic approaches have been applied in regional frameworks, new statistical methods are being developed to quantify uncertainty more objectively — accounting for spatial, temporal, and methodological variability.

These advances will allow future assessments to express not only the status of Europe's seas but also the confidence with which that status is known — a prerequisite for adaptive management, legal compliance, and credible progress reporting under EU law.

To assess confidence correctly is not only possible by using methods such as the tools described here, but it is also widely applicable by EU Member States thus ensuring an improved comparability among Member States.

Despite the EU's commitment to protect 30 % of its seas and strictly protect 10 % by 2030 (EC, 2019a), and to ensure the network is representative, coherent, adequate, and well-managed, there are challenges with the existing efforts, where:

- Site designation is still insufficient (e.g. in offshore waters) and has not translated into ecological recovery because many protected sites: a) remain open to extractive use, b) lack active management towards removing/reducing pressures, c) are poorly monitored and d) are feature based focussing on single vulnerable habitats or species rather than all features inside a site which would then be aimed at protecting structure and function of ecosystems (Figure 1.1; ECA, 2020; EEA, 2024h).

- The root cause of such failure is fragmented administrative mandates, weak or slow enforcement in, e.g., aspirational targets, designating and enforcing strictly protected areas, inconsistent financing, and insufficient data integration or access to data on how MPAs are doing (ECA, 2020; Oceana, 2025).

Such shortcomings indicate that the EU's MPA governance system is structurally misaligned, i.e., not coherent, with the ambitions of the 2030 Biodiversity Strategy, the Nature Restoration Regulation, and the Marine Strategy Framework Directive. Some of the main systemic gaps that prevent this network from functioning effectively are illustrated below (Table 6.1).

Such examples illustrate that Europe's challenge to resolve the crisis across its seas lies not in the absence of regulatory or policy instruments but in their fragmented and partial execution. Overcoming the barriers, especially implementation gaps, preventing marine ecosystem recovery across Europe's seas thus requires stronger accountability, policy coherence, implementation, and enforcement; supported by transparent monitoring and financial alignment. Without stronger implementation, the EU will continue to find it difficult to translate its ambitious sustainability goals – reflected in the European Ocean Pact's Priority 2 on sustainable Blue Economy competitiveness and Priority 1 on ocean health and restoration (Table 1.1) – into real improvements in marine ecosystem recovery.

**TABLE 6.1**
Illustrative, non-exhaustive examples of governance and implementation gaps in EU marine and maritime policy and how they show in marine protected areas (MPAs)

| Governance or policy implementation gap | Evidence (general and MPA example) | Source |
|---|---|---|
| Incomplete implementation of legal obligations | Several Member States have not fully applied key provisions of the MSFD and MSPD, including implementing sufficient measures for pollution control, halting biodiversity loss and regulating climate change.<br>MPAs: Such gaps lead to protection being only 'on paper' with limited restrictions to human activities in the site. | EC, 2025b;<br>ECA, 2020;<br>Zaucha et al., 2025. |
| Fragmented legal frameworks and over-lapping administrative mandates | Fisheries, energy system deployment, and coastal infrastructure development still operate under separate per-mitting regimes; and Birds and Habitats directives, CFP and MSFD apply different sustainability concepts and lack integrated implementation. Climate change not sufficiently embedded in the MSFD. This leads to antagonistic EU marine/maritime policy objectives.<br>MPAs: The Natura 2000 network focus on a small set of vulnerable species and habitats and do not protect all features in a site. It is thus not designated to fulfil MSFD art. 13 on being adequate, coherent and representative. | Albrecht et al., 2025;<br>CrossGov, 2025a;<br>ECA, 2020;<br>EPRS, 2025a; Gutierrez et al., 2022;<br>Puharinen, 2023;<br>Nikolaou et al., 2025. |
| Weak link between site designation and regulation of human activities there | Antagonistic EU marine/maritime policy objectives perpetuate extractive activities in MPAs as permitting for economic activities can override conservation objectives. Most MPAs, therefore, remain open to trawling, dredging, or infrastructure; thus, maintaining or increasing pressures in areas that are not achieving favourable conservation status nor GES. | Dureuil et al., 2018;<br>ECA, 2020;<br>EC, 2023c;<br>EC, 2025e. |
| Insufficient marine monitoring and data reporting | Offshore marine areas remain under-monitored, while persistent spatial and temporal data gaps constrain assessments of marine ecosystem state. Marine data are not always reported or made available in a sufficiently timely and harmonised manner, and the potential of remote sensing and other Earth-observation technologies remains underused. MPA reporting focuses on areal extent, rather than on ecological condition of the site, or management effectiveness. A certification system for effectively managed MPAs could be established. | Hassoun et al., 2024;<br>EC, 2023d;<br>EC, 2025. |
| Limited management capacity and unclear administrative responsibilities | Fragmented authority and limited resources hinder policy implementation and enforcement as well as adaptive management.<br>>99 % of MPAs have no information on no-take areas,<br>>50 % of MPAs do not report a management plan. | ECA, 2020;<br>Dureuil et al., 2018. |
| Weak EU policy and funding coherence | EMFAF, LIFE and Horizon Europe seldom link funding specifically to MSFD/MSPD goals; subsidies support fleets active inside MPAs. | EPRS, 2022;<br>Vaughan et al., 2023;<br>Guillén et al., 2025. |
| Use of derogations | Exemptions included in policy instruments allow continued, or the restart of, activities in areas not in GES or inside MPAs, undermining potential long-term recovery. | DR, 2025a;<br>DR, 2025b. |
| Weak enforcement and compliance control | AIS/VMS and inspection capacity are insufficient to detect or deter illegal fishing in MPAs; sanctions are rare; fishing fleet data stay difficult to access even under the 'report once, use many times' principle. | ECA, 2022a;<br>Welch et al., 2022 (global);<br>EC, 2025j. |

## 6.3 RESILIENCE OR DECLINE: EUROPE'S CHOICE FOR OUR SEAS

In conclusion, the evidence in this report is unambiguous: despite decades of policy innovation, monitoring, and investment, large parts of Europe's seas remain under severe stress. Marine ecosystems, habitats, and species are still not in good state, and the trajectory of global warming, currently on course for around 2.3-2.5 °C, may push many of them beyond recovery.

While proven solutions exist, progress has been fragmented, slow and often constrained by short-term economic and/or changing political priorities. Climate change is rapidly accelerating adding to every other pressure and eroding the ecological gains achieved so far. The gap between policy implementation and environmental reality continue to widen, underlining the urgent need to turn the European Union's strong legislative framework into coherent, enforceable action capable of maintaining and restoring the resilience of Europe's seas.

The next few years offers a shrinking but unique window for decisive change. Achieving clean, healthy, productive, and resilient seas requires a transformative shift from managing sectors to managing systems, guided by sound science, sustained monitoring, cooperation, and effective enforcement. Policy simplification must strengthen, not weaken, ambition, by considering alignment between the MSFD, MSPD, NRR, HD and forthcoming Ocean Act into a consistent outcome-driven policy framework.

The EU already possesses the ambition, the tools, the knowledge, and the legislation; what is needed now is unity of purpose and scale of effort. Aligning our continent's economic, energy, security, knowledge, and environmental agendas around marine recovery is both a climate imperative and a societal necessity.

With a renewed EU mandate to accelerate emission reductions, targeting a 90 % for domestic cuts in CO2 emissions by 2040, Europe demonstrates its global leadership and capacity to realise the full benefits of a carbon-neutral economy. To do so, the foundations must be secured now by reducing non-climate pressures to levels compatible with 'good environmental status', and by protecting, restoring and rebuilding the resilience of the seas that regulate the climate, while halting biodiversity loss. Doing so is essential for ecosystem and planetary resilience to safeguard the long-term prosperity of EU citizens and the competitiveness of the EU's Blue Economy.

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# List of abbreviations

| Abbreviation | Name |
|---|---|
| BD | Birds Directive |
| BHD | Birds and Habitats Directive (Natura 2000 Directives) |
| BEAT | Biodiversity Assessment Tool |
| CAP | Common Agricultural Policy |
| CEA | Cumulative Effect Assessment |
| CFP | Common Fisheries Policy |
| CHASE | Chemical Status Assessment Tool |
| CIMPAL | Cumulative IMPacts of invasive ALien species |
| Cx | Chapter x |
| EBA | Ecosystem-based Approach |
| EBM | Ecosystem-based Management |
| EEA | European Environment Agency |
| EIONET | European Environment Information and Observation Network |
| EMCCI | European Marine Climate Change Index |
| EU | European Union |
| GES | Good Environmental Status / Good Ecological Status |
| GFCM | General Fisheries Commission of the Mediterranean |
| HD | Habitats Directive |
| HEAT | HELCOM Eutrophication Assessment Tool |
| HELCOM | Helsinki Commission |
| ICES | International Council of the Exploration of the Sea |
| IUCN | International Union of Conservation of Nature |
| MALT | Marine Litter Assessment Tool |
| MESH | Marine Ecosystem Health Assessment Tool |
| MPA | Marine Protected Area |
| MSFD | Marine Strategy Framework Directive |
| MSP | Maritime Spatial Planning |
| MSPD | Maritime Spatial Planning Directive |
| MSY | Maximum Sustained Yield |
| NBS | Nature-Based Solutions |
| NPA | Non-Problem Area |
| NRR | Nature Restoration Regulation |
| OSPAR | OSPAR Commission |
| PA | Problem Area |
| SM | Supplementary Material |
| SoS | State of Europe's seas |
| SSPs | Shared Socio-economic Pathways describe different potential trajectories of global development and greenhouse gas emissions. |
| SSP2-4.5 | SSP2-4.5 represents a 'medium' pathway laying between low- and high emission future and often used as a stabilization scenario: 'moderate' socio-economic change with stabilising population growth and inter-mediate climate policies.<br>It results in a radiative forcing of ~4.5 W/m² by 2100, translating to a global warming of about 2–3 °C above pre-industrial levels. |
| SSP5-8.5 | SSP5-8.5 depicts a world with rapid economic growth driven by heavy reliance on fossil fuels i.e. coal, oil and gas. By 2100, radiative forcing reaches ~8.5 W/m², corresponding to a global warming of 4 °C or more.<br>Although now considered less likely due to shifts in global energy trends, it remains useful as a worst-case scenario for risk assessment, particularly for high-sensitivity marine ecosystems. |
| STECF | Scientific, Technical and Economic Committee for Fisheries |
| UNEP/MAP | United Nations Environment Programme/Mediterranean Action Plan |
| WFD | Water Framework Directive |

# Overview of Supporting Material

The Supplementary Material to the 'Marine Messages III' synthesis assessment comprises of:

- SM1: Updated classifications of 'problem areas' and 'non-problem areas' regarding 'biodiversity' (BEAT- a Descriptor 1 equivalent MIBAT).
- SM2: Updated classifications of 'problem areas' and 'non-problem areas' regarding 'ecosystem health' (MESH – a GES equivalent MIBAT).
- SM3: Updated European-wide CEA/CIA assessment (Cumulative/combined effects) including an updated identification of climate change hot spots and '2050' and 'MSFD' scenarios.
- SM4: Updated classifications of 'problem areas' and 'non-problem areas' regarding 'contaminants' (CHASE – a D8 equivalent MIBAT).
- SM5: Updated classifications of 'problem areas' and 'non-problem areas' regarding 'eutrophication' (HEAT – a D5 equivalent MIBAT).
- SM6: Updated classifications of 'problem areas' and 'non-problem areas' regarding 'marine litter' (MALT – a D10 equivalent MIBAT).
- SM7: Updated CIMPAL assessment (non-indigenous species).
- SM8: New MSY indices and classification of 'problem areas' and 'non-problem areas' regarding managed commercially exploited fish species.
- SM9: Long-term trends in sea surface temperature, alkalinity and pH.
- SM10: Cross-cutting data analyses.
- SM11: Mini-review on environmental trends.
- SM12: Mini-review on solutions.
- SM13: Mini-review on protection vs. restoration.
- SM14: Overview of MIBATs with references.

The Supplementary Material to 'Marine Messages III' is published as:

- Andersen, J.H., S. Korpinen (eds.), E. Bigagli, E.D. Barkardóttir, N. Carvalho, E.T. Harvey, N. Kallio, C.J. Murray, H. Nygård, S.A. Özkan, M. Peterlin, P. Ramon, J. Reker, L. Snoj, H.M. Sommer, A. Stock, H. Teixeira & D. Vaughan (2026): Supplementary Material to 'Marine Messages III' - an overview of data, methods, tools and supporting information. 395 pp.

**European Topic Centre on**
**Biodiversity and Ecosystems**
**https://www.eionet.europa.eu/etcs/etc-be**

*The European Topic Centre on Biodiversity and Ecosystems (ETC-BE) is a consortium of European institutes under contract of the European Environment Agency.*

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# Supplementary Material to 'Marine Messages III'

## - an overview of data, methods, tools and supporting information

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The Supplementary Material to the 'Marine Messages III' synthesis assessment report includes an overview of data, methods and tools applied as well as two mini-reviews and case studies. The purpose of the Supplementary Material is to provide transparency and full documentation of the analyses and results in 'Marine Messages III'. Please note that a special focus has been put on documenting the target values used for the thematic assessments of biodiversity (BEAT-based), contaminants (CHASE-based) and eutrophication (HEAT-based).

**Suggested citation**
Andersen, J.H., S. Korpinen, E. Barkardóttir, E. Bigagli, N. Carvalho, E.T. Harvey, N. Kallio, C.J. Murray, H. Nygaard, S. Özkan, P. Ramon, J. Reker, H.M. Sommer, A. Stock, H. Teixeira & D. Vaughan (2026): Supplementary Material to 'Marine Messages III' - an overview of data, methods, tools and supporting information. 395 pp.

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**DOI**: 10.5281/zenodo.21358681

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# Table of contents


Preface 4

1 Biodiversity and BEAT-based assessment 6

1.1 Introduction 6
1.2 Rationale and policy relevance 6
1.3 Assessment methodology 7
1.4 Data collection and preparation 8
1.5 Assessment of biodiversity using BEAT 11
1.6 Area-weighted BEAT scores 18
1.7 Data quality and limitations 18
1.8 Conclusions 20

2 'Ecosystem health' by the MESH-based assessment 22

2.1 Introduction 22
2.2 Definition and measurement 22
2.3 Rational and policy relevance 23
2.4 Identification of 'problem areas' and 'non-problem areas' 24
2.5 Area-weighted MESH scores 28
2.6 Data quality and limitations 29
2.7 Conclusions 30

3 Combined effects of multiple pressures and climate change 31

3.1 Data and methods 31
3.2 Where is the risk of adverse combined effects highest? 32
3.3 Which pressures have the largest footprint? 36
3.4 Which ecosystem components are under the most pressure? 39
3.5 Conclusions 40

4 Contaminants and CHASE-based assessment 41

4.1 Introduction 41
4.2 Definition and measurement 41
4.3 Data collection and frequency 42
4.4 Trends and analysis 43
4.5 Interpretation and benchmarks 44
4.6 Conclusions 46

5 Eutrophication and HEAT-based assessment 47

5.1 Introduction 47
5.2 Definition and measurement 48
5.3 Rational and policy relevance 49
5.4 Data collection 49
5.5 Identification of 'problem areas' and 'non-problem areas' 50
5.6 Data quality and limitations 53
5.7 Conclusions 53

6 Assessing the cumulative negative impacts of invasive alien species in Europe's seas 55

6.1 Introduction 55
6.2 Data and methods 55
6.3 Results of CIMPAL assessment 63
6.4 Conclusions 68

7 Marine litter and MALT-based assessment 69
7.1 Introduction 69
7.2 Definition and measurement 69
7.3 Rational and policy relevance 70
7.4 Data collection 70
7.5 Identification of 'problem areas' and 'non-problem areas' 71
7.6 Trends 73
7.7 Data quality and limitations 74
7.8 Conclusions 74
8 Towards a new MSY-based assessment tool 75
8.1 Introduction 75
8.2 Definition and measurement 76
8.3 Rational and policy relevance 78
8.4 Results 78
8.5 Data quality and limitations 84
8.6 Conclusions 84
9 Long-term trends in sea surface temperature (SST), pH and alkalinity 85
9.1 Introduction 85
9.2 Data collection and calculations 85
9.3 Temporal trends 86
9.4 Detailed model results 87
9.5 Data quality and limitations 92
9.6 Conclusions 93
10 Cross-cutting data analyses 94
10.1 Introduction 94
10.2 Methods 94
10.3 Results 95
10.4 Discussion 98
10.5 Conclusions 99
11 Mini-review on environmental trends 100
11.1 Introduction 100
11.2 Environmental trends in Europe's seas: Why and how? 102
11.3 Temporal trends in indicators and environmental status 105
12 Mini-review on solutions 149
12.1 Introduction 149
12.2 Methods 149
12.3 Elaboration of the key findings for each MSFD Descriptor 150
12.4 Summary and conclusions 167
13 Case study on the balance between protection and restoration 176
13.1 An analysis of BEAT- vs. HEAT-based identifications of problem and non-problem areas 177
13.2 Conclusions 184
14 Selected MIBAT literature 185
15 References 191
16 Appendices 213

# Preface

The report 'Marine Messages III. State, pressures, and choices for the future of Europe's seas' is a marine synthesis assessment initiated by the European Environment Agency (EEA) and published by the EEA's European Topic Centre on Biodiversity and Ecosystems (ETC BE). It addresses the status of Europe's seas in years 2016-2022 with a special focus on 'biodiversity', 'ecosystem health' and 'combined effects' from multiple human activities, and pressures including 'contamination', 'fishing activities', 'nutrient enrichment', 'marine litter', 'climate change' and other pressures.

This working document is Supplementary Material to 'Marine Messages III', but it can also be read as a stand-alone report. It includes documentation of all results as well as description of the assessment tools applied, calculation principles and additional analyses:

1. Biodiversity and the BEAT-based assessment
2. Ecosystem health and the MESH-based assessment
3. Multiple pressures and CEA/CIA, including climate change and CCI-based assessment
4. Non-indigenous species and CIMPAL-based assessment
5. Contaminant s and CHASE-based assessment
6. Eutrophication and HEAT-based assessment
7. Marine litter and MALT-based assessment
8. Fishing and new Bmsy- and Fmsy-based indices
9. SST, pH and alkalinity

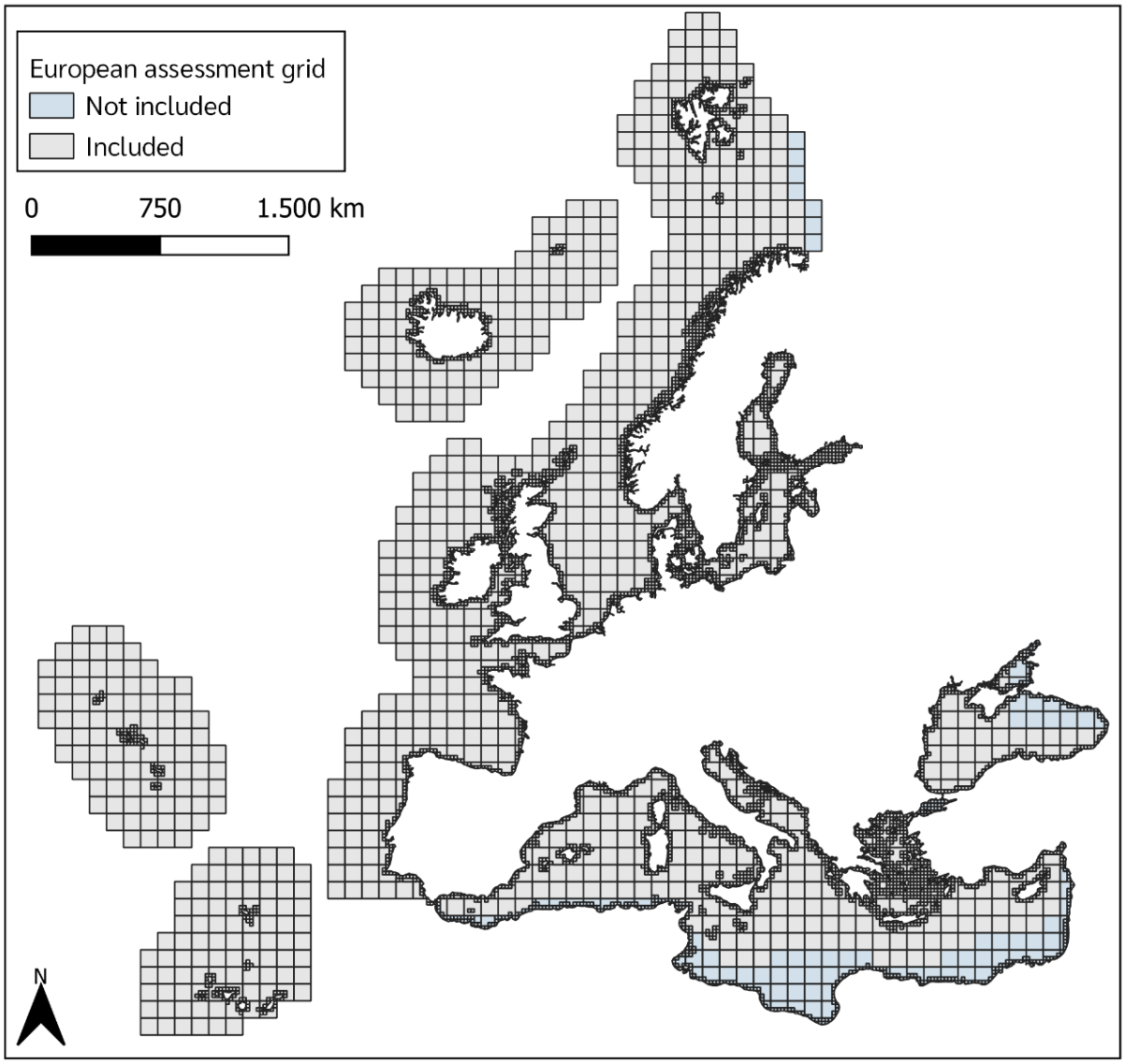
The Supplementary Material also includes four dedicated chapters about:

10. Cross-cutting analyses of the above-mentioned assessment data sets
11. A mini review on environmental trends
12. A mini review on solutions
13. A case study on marine ecosystem restoration vs. protection
14. An overview of the multi-metric indicator-based tools applied in the context of 'Marine Messages III'.

An overview of the scientific literature in which the above multi-metric indicators-based assessment tools (BEAT, MESH, CHASE, HEAT, MALT as well as the CEA/CIA-based Human Impact Indices) are described, documented and previously applied is given in Chapter 13.

Many colleagues have directly or indirectly contributed to the 'Marine Messages III' process, and especially the activities related to the thematic assessments and the mapping and analyses. Sincere thanks are due to: Fábio L. Matos, Stelios Katsanevakis, Yolanda Stranga, Chrysanthi Kalloniati, George Tsirtsis, Marco Nurmi, Heliana Teixeira, Danilo Scannella, Emanuela Spada, Serena Zampardi, Tomaso Fortibuoni, Luca Castriota, Patrizia Perzia, Silvia Livi, Patrizia Borrello, Ana Cristina Cardoso, Chiara Magliozzi, Ivan Deriu, George Harcota, Oana Vlas, Elena Pantea, Laura Boicenco, Elena Bisinicu, Yolanda Sagarminaga, Ángel Borja, Marika Galanidi, Argyro Zenetos, Melissa Dallet, Morten Holm Hansen, Monika Peterlin, Stephane Izoard, Mustafa Aydin, Eda Aydin, Jørgen Nørrevang Jensen, Guillem Chust, Almudena Fontán, Javier Franco, J. Germán Rodríguez, Ainhize Uriarte, Hans Mose Jensen, Stefano Marra and Mustafa Mantikci, Joni Kaitaranta and Helene Frigstad.

The thematic and indicator-based assessments (biodiversity, ecosystem health, contaminants, eutrophication and marine litter) are all anchored in the EEA Assessment Grid, which is 100 x 100 km offshore and 20 x 20 km for coastal waters (see Map 0 on the next page).




*Map 0: EEA assessment units for thematic assessments (biodiversity/BEAT, contaminants/CHASE, eutrophication/HEAT, marine litter/MALT and ecosystem health/MESH). Offshore assessment units are 100 x 100 km and coastal units are 20 x 20 km.*

We hope that this Supplementary Material to 'Marine Messages III' provides ample documentation of methods, data sources and the analyses and results. We believe that the Supplementary Material underlines the importance of science-based assessment tools and their role in support of evidence-based marine governance.

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# 1 Biodiversity and BEAT-based assessment

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This chapter is anchored in preparatory work carried out in 2023 and 2024 and updates carried out in 2025. The work in 2023 and 2024 focused on improving the spatial coverage compared to the identification of 'biodiversity problem areas' and 'non-problem areas' by Vaughan et al. (2019). The updates in 2025 have focused on access to supplementary data sets and getting a better spatial coverage of the assessment.

## 1.1 Introduction

Biodiversity is a fundamental property of ecosystems. It comprises the variety within and among species, both in terms of ecosystem structure and function. Maintaining diverse ecosystems improves the resilience and recovery potential of the ecosystems, securing the delivery of ecosystem services.

Loss of biodiversity is one of the major threats in Europe's marine environment, undermining the capacity of the seas to deliver ecosystem services (Vaughan et al. 2019, EEA 2019). Human-induced pressures, such as over-exploitation of fish stocks, eutrophication and contaminants, reduce the complexity of ecosystems and impact populations, species and communities, as well as the functioning of food webs.

To take appropriate action to protect, preserve or potentially restore degraded ecosystems, identification of areas of concern is important, both in terms of spatial extent, affected ecosystem components and which pressures are causing the problems. Indicators, with known pressure-responses and defined thresholds for good status are instrumental for such an exercise.

This chapter presents the results of a structured, indicator-based and integrated assessment of biodiversity in the Europe's marine waters, using available indicator data in the BEAT+ tool (Andersen et al. 2014). The majority of information stems from regional assessments by the regional sea conventions OSPAR in the North-east Atlantic Ocean, HELCOM in the Baltic Sea and the Barcelona Convention in the Mediterranean Sea, supplemented with data on fish stocks from European Commission's Joint Research Centre, Scientific Technical and Economic Committee for Fisheries (JRC/STECF) and the International Commission for the Conservation of Atlantic Tunas (ICCAT). In coastal areas, indicator data on the ecological quality elements reported under the European Union's Water Framework Directive (EU WFD) was included. The indicator-based approach is supplemented with overviews of EU member states' assessments under the Marine Strategy Framework Directive (MSFD) and assessments by regional sea conventions. The analyses produce an overall assessment of biodiversity in Europe's seas and allow inspecting results for different ecosystem components.

## 1.2 Rationale and policy relevance

Several EU and global policies aim at improving, maintaining, conserving or restoring biodiversity. Among these, the UN Convention on Biological Diversity (CBD) and Sustainable Development Goals (SDGs) identify priorities at a global scale. In Europe, the key policy aiming at halting biodiversity loss is the EU Biodiversity Strategy, with the Nature Restoration Regulation (NRR) setting targets to restore degraded ecosystems. Further, in the marine areas, the Marine Strategy Framework Directive (MSFD) and Water Framework Directive (WFD) in coastal and transitional waters include elements to safeguard biodiversity. In the MSFD, the aim is to achieve good environmental status (GES) through 11 Descriptors, with direct links to biodiversity mentioned in Descriptor 1 (biodiversity), Descriptor 4 (food webs) and Descriptor 6 (sea-floor

integrity). The WFD aims at good ecological status, involving the assessment of biological components in benthic and pelagic habitats.

The Regional Sea Conventions also have their own action plans, aiming at maintaining healthy marine ecosystems:

- the Baltic Sea Action Plan (HELCOM 2021a) in the Baltic Sea,
- the North-east Atlantic Environment Strategy 2030 (OSPAR 2021) in the North-east Atlantic,
- the Mediterranean Strategy for Sustainable Development 2016-2025 (UNEP/MAP 2016) in the Mediterranean Sea, and
- the Strategic Action Plan for the Environmental Protection and Rehabilitation of the Black Sea (BSC 2009).

These support the EU environmental policies but may emphasize regionally specific features, important anthropogenic threats or oceanographic conditions.

## 1.3 Assessment methodology

Environmental conditions, influencing species composition and ecosystem structure, vary across the marine regions in Europe and therefore performing a unified assessment of the state of biodiversity is not trivial. We have applied an indicator-based approach, where region specific indicators with a uniform definition of good environmental status is used as the base of the integrated assessment.

To integrate the indicator results we have used the BEAT tool. In BEAT, the indicators are normalized to a common scale, and each indicator result is expressed as an ecological quality ratio (EQR) value, ranging from 0 (worst) to 1 (best), with the threshold for good environmental status (GES) set at 0.6. We define GES following the MSFD as 'the environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive within their intrinsic conditions, and the use of the marine environment is at a level that is sustainable, thus safeguarding the potential for uses and activities by current and future generations'. When applying EU WFD indicators, we consider good ecological status to equal GES.

The assessment structure is based on the MSFD species and habitat groups. An exception was made for benthic habitats in coastal areas, where it was not evident to which broad habitat types the WFD quality elements should be linked. The benthic habitat is thus assessed based on macrozoobenthos and macrovegetation in coastal areas. For fish, the species group 'Anadromous fish' was added including migratory fish species for which the main pressures can be assumed to be in freshwater spawning areas.

The indicators are assigned to the species or component they represent, and the indicator results are sequentially integrated to species, species groups and groups (Figure 1.1). The overall assessment of biodiversity is displayed as the result of the group being in worst state, i.e. having the lowest EQR value. Spatially the assessment is done using the EEA marine assessment grid, where cells are 20 x 20 km in the coastal area and 100 x 100 km in offshore areas.

The evaluation of the integrated BEAT assessment result is supported by a summary of assessment results by EU member states, as reported under EU MSFD and the EU Habitats Directive, the regional sea convention (RSC) periodic assessments and the IUCN red list assessments.

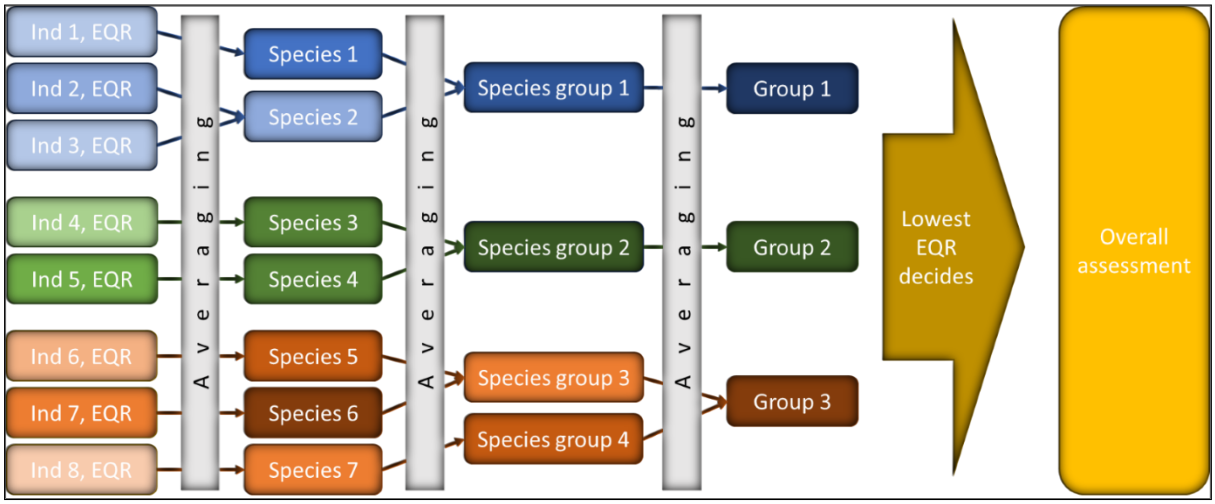


*Figure 1.1 Conceptual figure of the biodiversity assessment tool BEAT.*

## 1.4 Data collection and preparation

The aim of ETC BE task 1.1.14.2. was to collect biodiversity data from Europe's marine areas suitable for an integrated biodiversity assessment using the BEAT tool and summarize assessment results from the EU member states and RSC. For BEAT, this meant collecting biodiversity indicator data, where the indicators have a defined threshold value for GES. The assessment results by member states and RSCs provided an alternative view on the state of marine biodiversity.

### 1.4.1. Indicator-based BEAT assessment

The metadata catalogue produced by ETC BE 2023 task 1.2.1.8 formed the basis for the data collection (Kallenbach et al. 2023). In this data, regional indicator assessments were prioritized. The availability of indicator data differed across the regions and the groups included in the BEAT assessment were birds, mammals, fish, reptiles, cephalopods, benthic habitats and pelagic habitats (Table 1.1).

For the Baltic Sea, the main source of indicator data was the third HELCOM holistic assessment (HOLAS 3) (https://stateofthebalticsea.helcom.fi/). In the North-east Atlantic, including the Greater North Sea, indicator results from the OSPAR Quality Status Report 2023 (https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/) and species status assessments from the committee for biodiversity and ecosystems (https://oap.ospar.org/en/ospar-assessments/committee-assessments/biodiversity-committee/status-assesments/) were included. In the Mediterranean Sea data from the UNEP-MAP Mediterranean Quality Status Report 2023 (https://medqsr2023.info-rac.org/) were applied. In the Black Sea, the BEAT+ assessment is based only on commercial fish stocks and data reported under the WFD. The assessment thus only covers the coastal areas of Bulgaria and Romania.

The BEAT data on commercial fish stocks were based on the latest stock assessments (JRC/STECF 2024) and supplemented with data from the International Commission for the Conservation of Atlantic Tunas (ICCAT) on widely distributed fish species such as tunas and sharks (https://www.iccat.int/en/assess.html).

In coastal areas, we enriched the BEAT data by the ecological quality elements reported under the EU WFD downloaded from the EEA WISE database (https://water.europa.eu/). Data from the 2022 reporting was used, supplemented with data from the 2016 reporting to increase the spatial coverage. Further, data from Nature Index for Norway (https://www.naturindeks.no/) was also used to improve data coverage in the Norwegian Sea and Barents Sea.

In addition to the indicator value and the threshold value, the BEAT needs also the range within which the indicator value is expected to be, i.e. worst condition to best condition. This is used to normalize the indicators in BEAT. In cases where worst and/or best conditions where not known, we applied the methods explained in Nygård et al. (2018) to define these. Where indicator results where categorical or trend-based we also followed Nygård et al. (2018). The Nature Index of Norway do not have defined threshold values but is presented on a scale from 0 to 1, where 1 equals reference condition. For these data we have assumed GES to be at 0.6. All indicator threshold values are presented in Appendix 1.

Indicator data from the different sources were gathered and edited into a common format which held the information about the indicator, the values representing its results and also the Marine Reporting Unit (MRU) code or other spatial information relating the indicator values to certain vector datasets. The process was conducted with Rstudio version 4.2.2. Based on the relation between the indicator and vector dataset, geometry coordinates were extracted to each indicator.

Next, we linked all indicator values from each vector to overlapping grids based on EEA marine assessment grid dataset (mesh20190508.shp). Each overlap created its own grid with one value from the indicator areas. As this process created grids from every overlap, even when the vector only covered a slight part on the grid, we removed grid cells with less than 50 % of its area covered by the vector and then made sure that the coordinates in each grid still matched the original grid coordinates. One exception to this was made with the WFD coastal indicators, since in many cases the assessment area along the coast was so narrow that many water bodies would have been lost. For these, we selected all coastal grids that had any overlap with the indicator.

This method resulted in a table that contained all the relevant information for BEAT analysis, where each row represented one grid cell containing the value from an original indicator overlapping the grid area. The BEAT analysis was done for each grid cell, and the results are presented as maps showing the overall result and separately for each group. The offshore areas of the Black Sea and the Sea of Marmara were excluded as these areas only had fishing mortality data on widely distributed species, thus not properly allowing an integrated assessment.

### 1.4.2. Overviews of the assessments by Member States and regional sea conventions

Data from the 2018 MSFD assessment is available through WISE Marine. The results were presented the same way as used on WISE Marine, namely: 1) the percentage of Member States which reported that GES is met for a particular biodiversity criterion, 2) the percentage not meeting GES, and 3) the percentage unknown.

The catalogue of assessment results from the Member States and RSCs is given in Appendices 2-6.

There are a few differences between the Member State results and RSC results:

- MSFD is reported per Member State (by sub-region) not by sea basin.
- Differences in monitoring between MS's will show different outcomes.
- There is no Bucharest Convention update since 2019 so the primary data here is the same as for the two EU Member States reporting for MSFD.
- MSFD only covers EU Member States – all RSCs include countries outside of MSFD reporting, to a greater or lesser extent; these cases are found from the Gulf of Finland in the Baltic Sea, the OSPAR sub-regions I, III and V, the Black Sea, and all the Mediterranean sub-regions.

*Table 1.1 Summary of collected indicator data for BEAT in the different marine regions. The numbers indicate the number of indicators/species in each region.*

| | Indicator/Assessed group | Baltic Sea | North-east Atlantic | Mediterranean Sea | Black Sea |
|---|---|---|---|---|---|
| Birds | Waterbirds abundance | 60 | 84 | 10 | |
| | Waterbirds distribution | | | 8 | |
| | Waterbirds demographic characteristics | | | 7 | |
| | Marine birds breeding productivity | | 5 | 1 | |
| | Marine birds breeding success | 1 | 20 | | |
| | Birds bycatch | 11 | 4 | | |
| Mammals | Seal abundance | 3 | 4 | 1 | |
| | Seal distribution | 3 | 2 | 1 | |
| | Seal reproduction | 2 | 2 | | |
| | Nutritional status of seals | 1 | 1 | | |
| | Seal demographic characteristics | | | 1 | |
| | Small toothed cetaceans | 1 | 4 | | |
| | Baleen whales | | 5 | | |
| | Otter | | 1 | | |
| | Mammal bycatch | 4 | 3 | | |
| Fish | Coastal fish | 8 | 4 | 1 | 1 |
| | Fish pelagic | 2 | 20 | 10 | 2 |
| | Fish demersal | 3 | 43 | 13 | 4 |
| | Deep sea fish | | 2 | | |
| | Anadromous fish | 2 | 8 | | |
| | Fish size | 1 | 1 | | |
| | Recovery of sensitive fish species | | 59 | | |
| Reptiles | Turtles - Population abundance | | 2 | 2 | |
| | Turtles - Distribution | | | 2 | |
| | Turtles - Demographic characteristics | | | 2 | |
| Cephalopods | Shelf cephalopods | | | 2 | |
| Benthic habitat | Macrofauna | 2 | 1 | 1 | 1 |
| | Macrovegetation | 3 | 5 | 3 | 3 |
| | Near-bottom oxygen conditions | 2 | 1 | | |
| | Condition of benthic habitat communities | | 13 | | |
| | Benthic invertebrate species | | 6 | 9 | 1 |
| | Benthic macrophyte species | | 2 | | |
| | Extent of pressures on benthic habitats | | | 5 | |
| Pelagic habitat | Diatom/dinoflagellate index | 1 | | | |
| | Phytoplankton | 3 | 5 | | 1 |
| | Zooplankton | 1 | 3 | | |
| | Water transparency | 2 | | | |
| | Chlorophyll | 3 | 3 | | |
| | Cyanobacterial bloom index | 1 | | | |

The red list assessment results and the Habitats Directive results were available from 2019. Only for birds the red list has been updated since 2019.

Few examples of trends are available except as qualitative statements. Where possible, this information has been used or in some cases, a comparison between outcomes in 2019 (EEA 2019) and current results was used.

Confidence of the MSFD assessment is based on the percentage of Member States that have assessed and reported on the particular element. For the RSC data, confidence is assessed more formally and is a combination of three slightly different aspects:

- Confidence from having accurate and comprehensive data.
- Confidence in the statements being representative of the regional sea.
- Confidence in the reliability or variability of the assessment

HELCOM is the only source to produce an assessment of confidence for each biodiversity element. Elsewhere, the confidence here is based on indicator specific factors or the proportion of assessment areas where GES is met as opposed to not met and unknowns.

## 1.5 Assessment of biodiversity using BEAT

The BEAT biodiversity assessment covered the majority of Europe's sea areas except for in the Black Sea, where only coastal areas of Bulgaria and Romania where covered. Overall, the status of biodiversity in Europe's seas is degraded, although some areas show good or even high status (Figure 1.2). In the North-east Atlantic the status is generally poor or moderate, but in some coastal areas the status reaches above the GES threshold. In the Baltic Sea, the overall status is poor. In the Mediterranean Sea the status varies from bad to good depending on area. The coastal areas of the Black Sea are generally below the GES threshold.

Inspecting the results separately for coastal and offshore areas indicate similar status on a general level (Figure 1.3). However, the higher spatial resolution reveals higher heterogeneity in the results with status varying from high to bad in coastal areas. The higher resolution can help in identifying the areas mostly affected by loss of biodiversity.

Examining the results at group level reveals differences between regions and groups (Figures 1.4 and 1.5). The status of birds is good in large parts of the European Marine Area. However, in the western Mediterranean Sea, Bay of Biscay and the Iberian Coast, southern Baltic Sea and northern Barents Sea the status is moderate.

The status of fish is assessed to be good in parts of the Mediterranean Sea and in most of the coastal areas in the Baltic Sea and Norway. In the North-east Atlantic the status of fish is moderate, and poor in large parts of the Arctic waters.

Marine mammals reach good status in the Greater North Sea, Celtic Seas, the Iberian coast and in large areas of the Bay of Biscay and along the Norwegian coast. However, in the Mediterranean Sea, Baltic Sea, Wider Atlantic and Arctic waters the status is poor.

The increasing populations of turtles indicates good status for reptiles in the Mediterranean Sea. In the North-east Atlantic, reptiles are assessed to be in poor status. Cephalopods were only assessed in the Adriatic Sea reaching good status in the southern part but showing bad status in the northern parts.

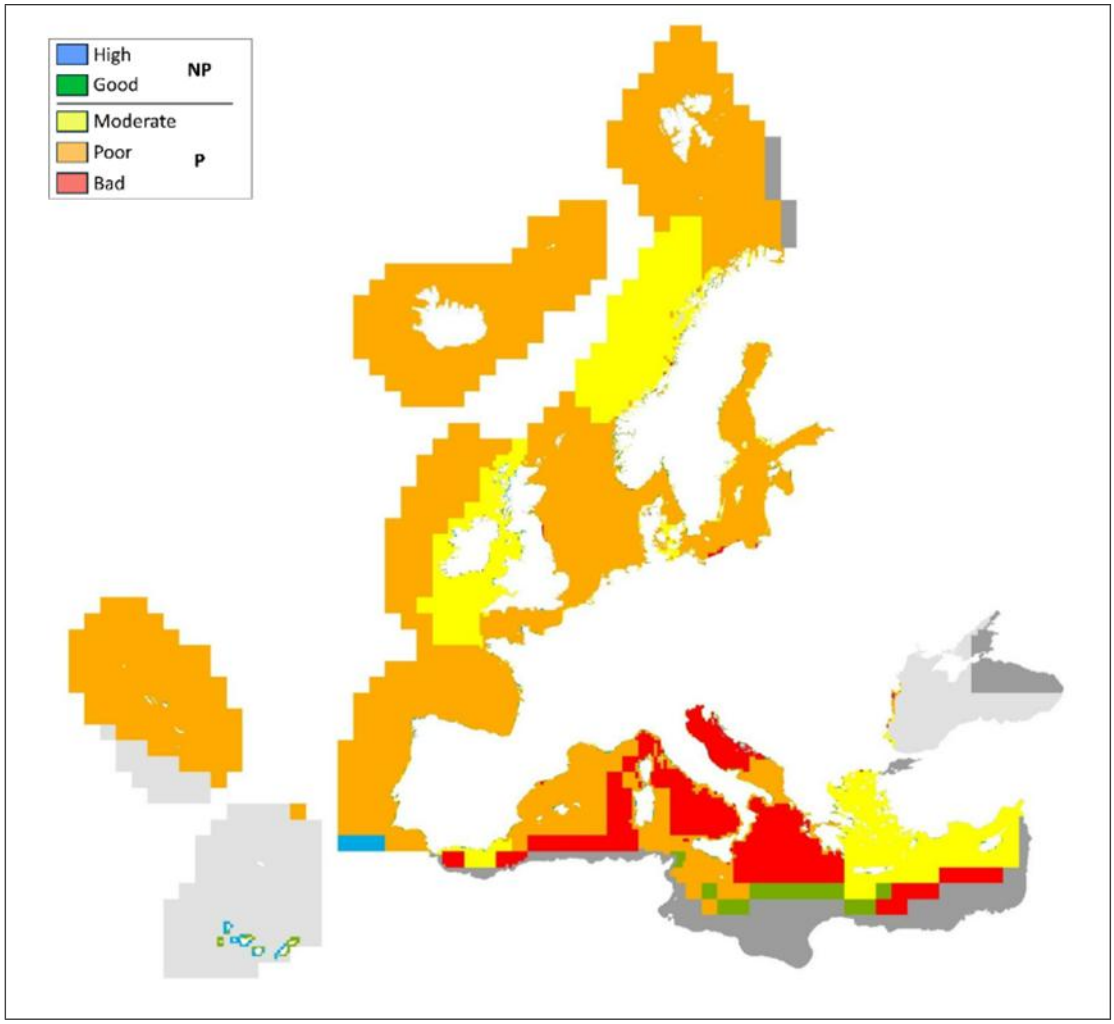


*Figure 1.2 Results of the BEAT assessment. Light grey areas lack data, whereas dark grey areas are not included in the assessment. NP = non-problem areas, N = problem areas.*

Benthic habitats were degraded in most areas of the Baltic Sea, the Black Sea, the Greater North Sea and the Mediterranean Sea. In the Mediterranean Sea, however, the indicator assessment differed from the other areas, estimating the extent of pressures on the broadscale habitat types, thus more indicating the risk of degradation than actual status. In the Bay of Biscay and the Iberian coast, Celtic Seas, Wider Atlantic, Arctic waters and the northern part of the Baltic Sea the status good or high.

Pelagic habitats reach the GES threshold in large areas of the Europe's seas. However, in the Baltic Sea and in many coastal areas of the Greater North Sea and the Black Sea pelagic habitats are degraded, assumingly due to eutrophication.

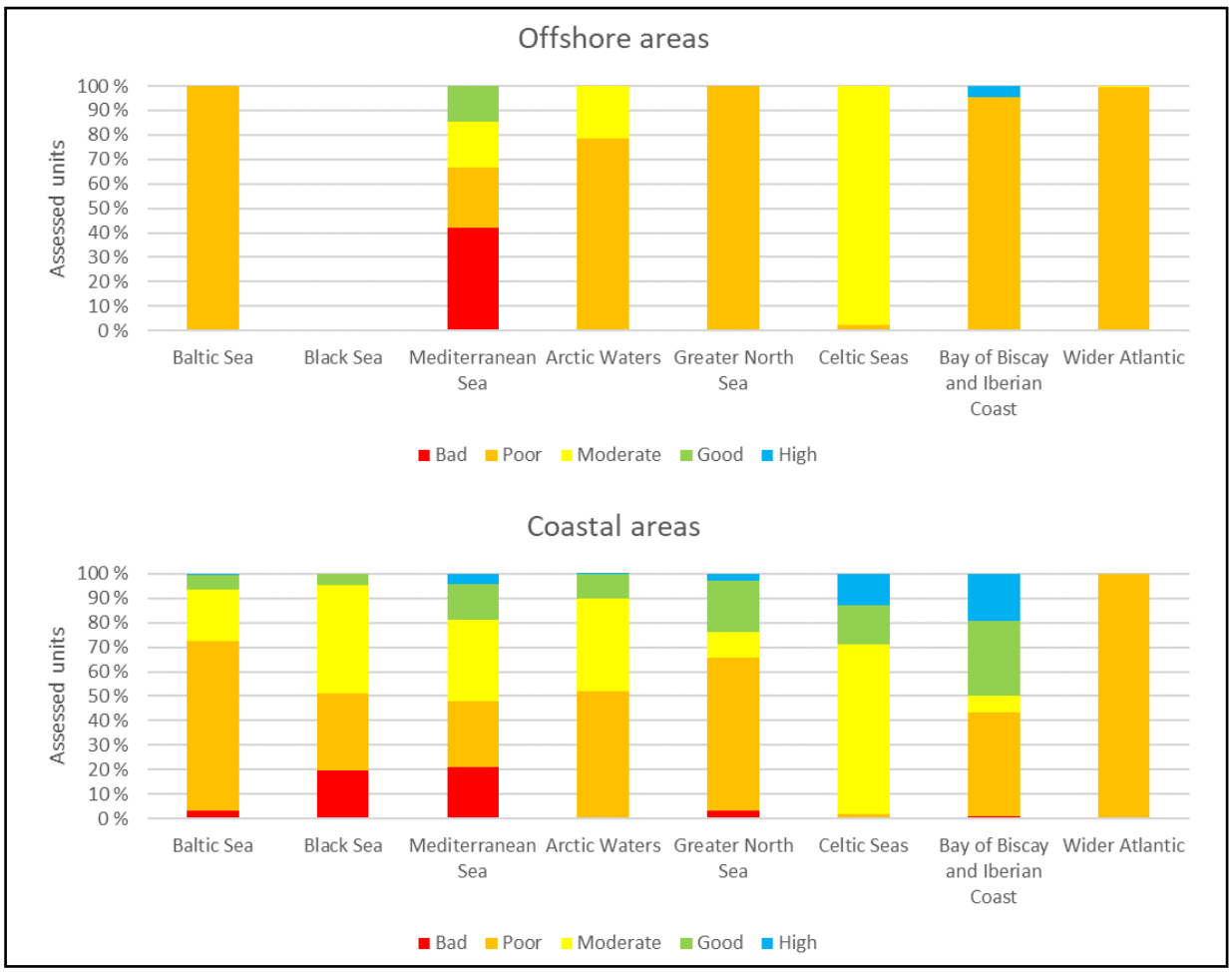


*Figure 1.3 Proportion of assessed grid cells (units) in different status classes presented separately for coastal and offshore areas in the different sea regions.*

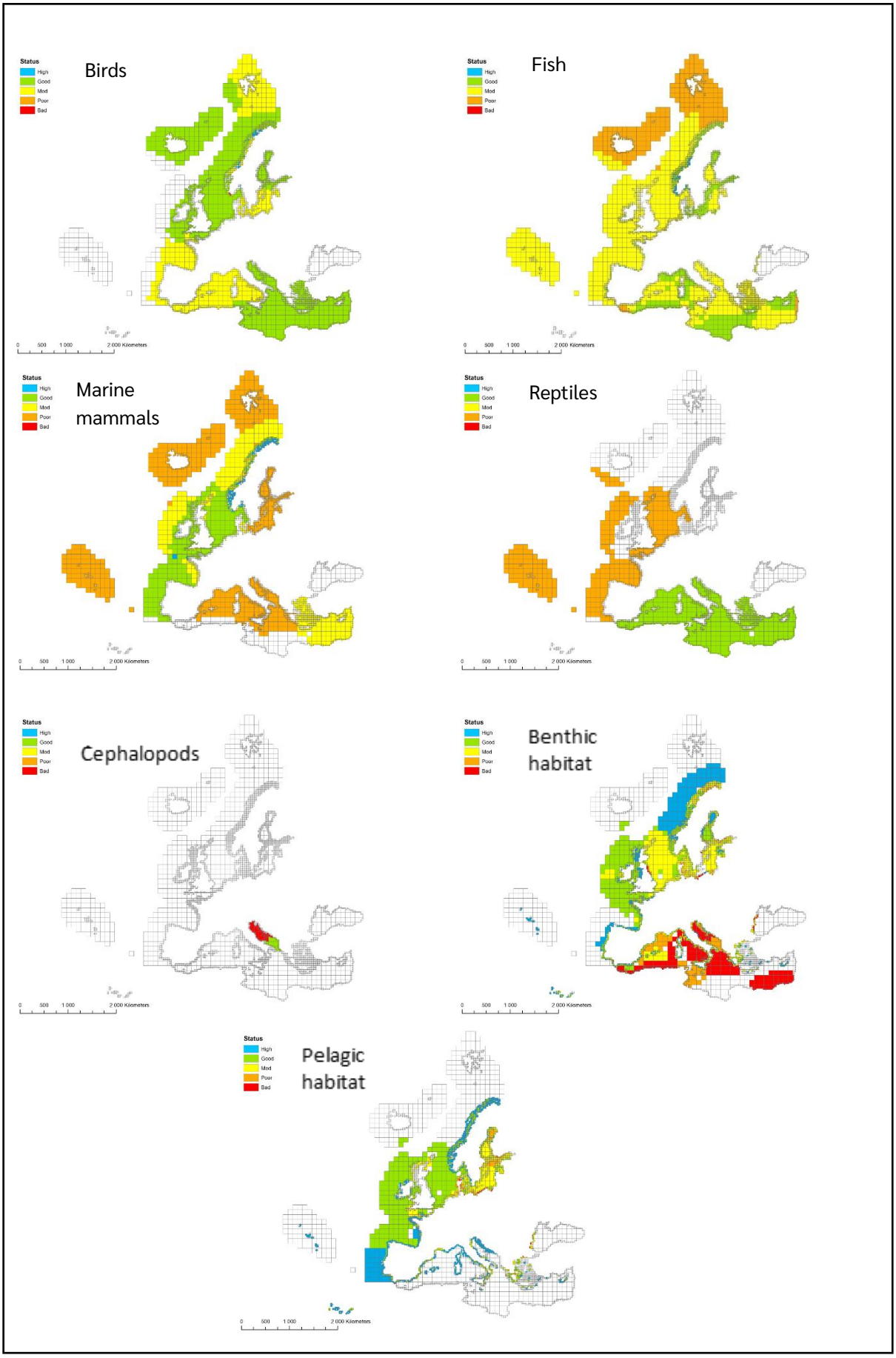


*Figure 1.4 BEAT results presented for the assessed groups.*

*Figure 1.5 Proportion of assessed grid cells (units) in different status classes presented for the assessed groups in the assessed regions.*

***Summary of Member State and RSC assessments***

Identifying the proportion of biodiversity elements in the MSFD reports which achieve GES as opposed to those that do not, focus on MS assessments, not the seas as a whole. While some of these are more optimistic (achieving GES) than the equivalent regional assessment, there are very few areas which could be considered as achieving the goal of reaching GES (Figure 1.6). Examples of GES are the sea floor integrity in the Baltic Sea, the seal assessments in the NE Atlantic and pelagic habitats in the Mediterranean. However, at the regional level, where the status of biodiversity is measured by the RSCs, including input from non-Member States, the picture is almost uniformly bad, with only turtle breeding in the Mediterranean considered to have achieved the targets (Figure 1.7). This is supported by the additional assessments from 2019 for Red List assessments for most marine major groups and also from the Art. 17 reporting from the Habitats Directive. The Red List assessments indicate general trends and particularly where species and habitats are under increasing threat or in decline, though only the Birds Red List has been formally updated since 2019. HELCOM are updating their Red List assessment in 2024 (from a previous one published in 2013 which already identified 3 marine species (two fish and one bird) as regionally extinct. For many biodiversity elements, especially where indicators or thematic assessments point to declines, the risk is that more species or habitats will fall into vulnerable or threatened IUCN Red List categories in the near future. Detailed results from member state and RSC assessments are given in Appendices 2-6.

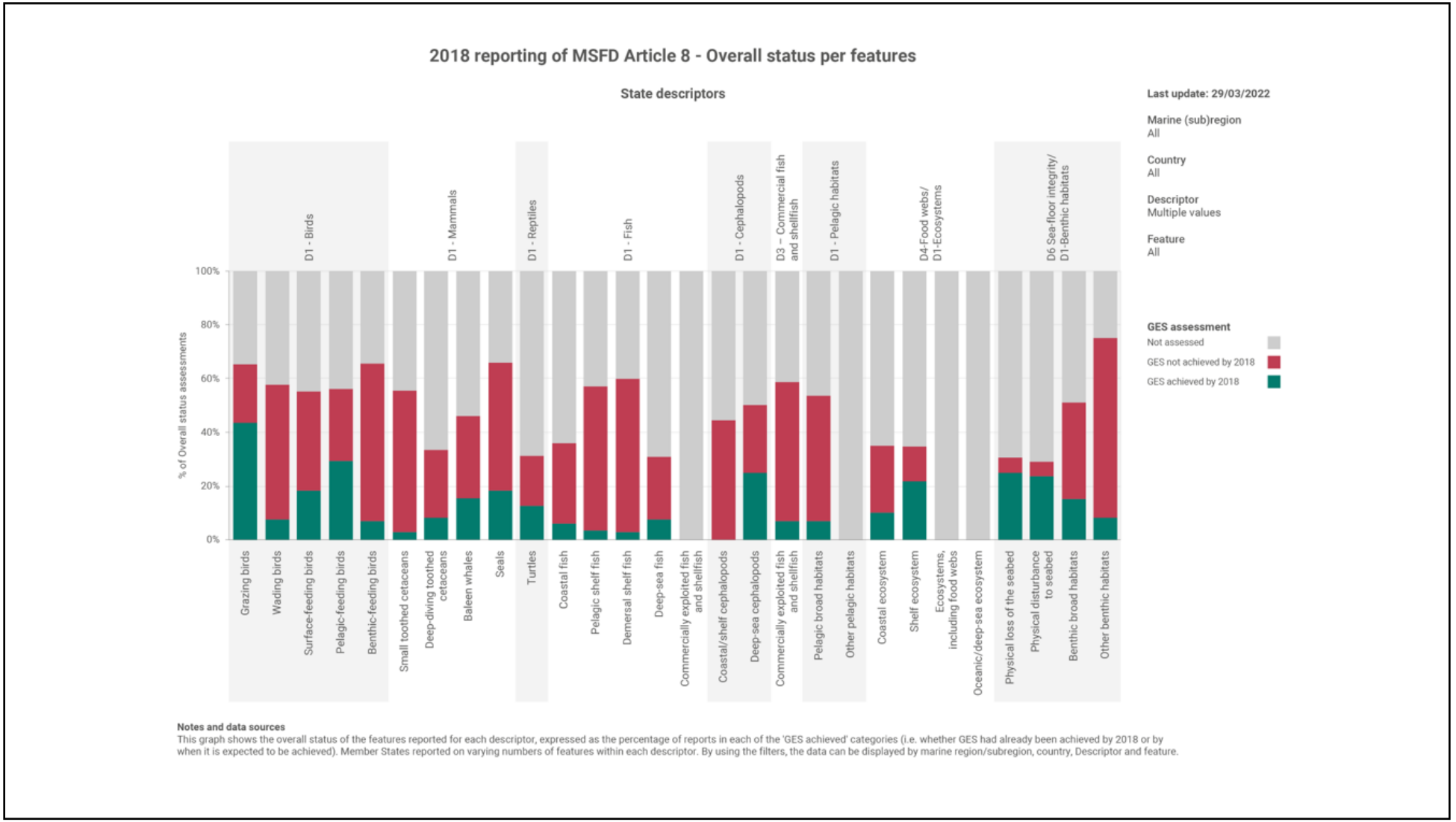


*Figure 1.6 EU Member State assessments. The approach used here is based on similar rationale to that used in reporting the Art. 8 MSFD results on Wise Marine[1] which focuses on how many features reached GES, how many did not and how many were not assessed. The results are based on MS reportings, i.e. only including information reported by MS, not necessarily covering the whole marine area.*

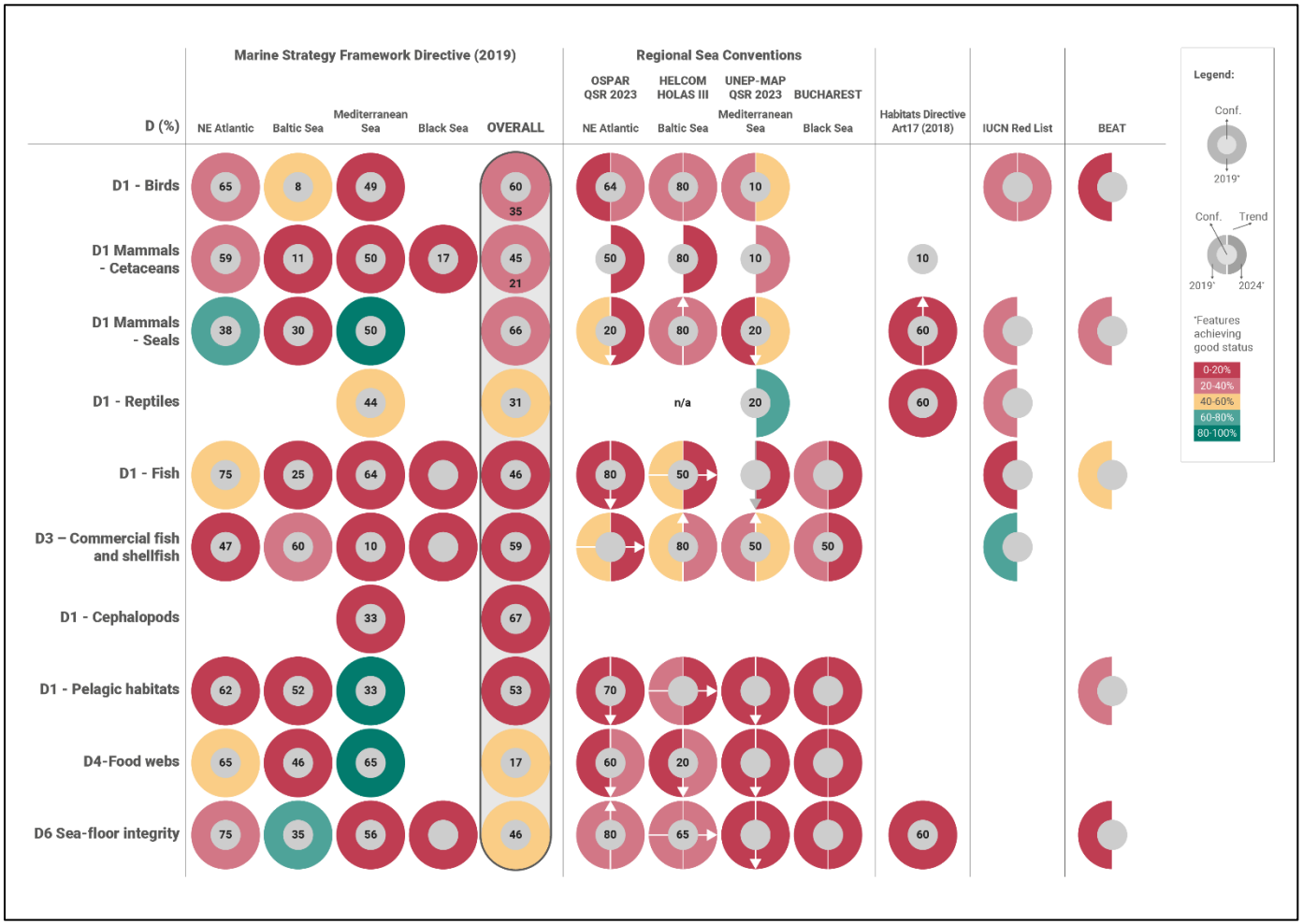


*Figure 1.7 Overall summary of the status of biodiversity in Europe's seas. The MSFD results are summarized from Member States reporting, the regional sea convention (OSPAR, HELCOM, UNEP MAP, Bucharest) assessments are given separately, and the few supporting results from the EU Habitats Directive and the IUCN red list assessments are given on the right side of the figure. The percentages reflect the proportion of features achieving GES, based on MS assessments. Confidence (Conf.) is expressed as percentage of MS assessing the features (for MSFD reporting) or based on the RSC assessments. Detailed outcomes of the analysis can be found in Appendices 2-6.*

## 1.6 Area-weighted BEAT scores

The status of biodiversity in Europe's seas is clearly below the GES threshold, based on the area-weighted BEAT score (Table 1.2). This could be expected, drawing from the large detected 'problem areas' compared to 'non-problem areas' (see Figure 1.2). On a regional level, the picture is the same with all regional seas scoring less than 0.4. Coastal areas receive a slightly higher score than offshore areas. As already noted, the higher assessment resolution in coastal areas allowed better separation of 'problem' versus 'non-problem' areas and the assessment resolution likely also contribute to the result based on area-weighting. However, it is clear that the threats to biodiversity are large-scale and widely distributed across the Europe's seas.

*Table 1.2. Area-weighted BEAT scores assessed for Europe's seas as a whole, separately for coastal and offshore areas and for the regional seas. Areas are based on the grid sizes, i.e. 20x20 km grids in coastal areas and 100x100 km grids in offshore areas.*

| **BEAT Area-weighted scores for** | | **Europe's seas:** | **0,34** |
|---|---|---|---|
| Coastal: | **0,43** | Offshore: | **0,32** |
| Baltic Sea: | **0,35** | Black Sea: | **0,38** |
| Mediterranean Sea: | **0,31** | North-east Atlantic Ocean: | **0,35** |

## 1.7 Data quality and limitations

The integrated assessment of biodiversity in Europe's seas is made based on available indicator data for which a threshold value for good environmental status (GES) could be defined. Most of the included indicators are using the MSFD definition for GES, allowing different types of indicators to be used. The EU WFD thresholds for good ecological status were assumed to be comparable with the GES thresholds. The availability of indicators differed between the marine regions and also spatially within marine regions, thus the number of indicators and assessed species vary between the areas (Figure 1.8). This needs to be considered when interpreting the results. Further, all groups are not represented in all areas, both due natural distribution patterns and/or lack of data. Reptiles were only assessed in the Mediterranean Sea, Greater North Sea, Celtic Sea, Bay of Biscay and the Iberian coast and parts of Macaronesia. Indicators on cephalopods were only available in the Adriatic Sea.

The largest gaps in indicator data were found in the Black Sea, where the only indicators available were from WFD reporting by Bulgaria and Romania and fishing mortality of commercially exploited species. As indicator data on birds, marine mammals or pelagic and benthic habitats were not available in other areas of the Black Sea apart from the coastal waters of Bulgaria and Romania, the integrated biodiversity assessment was only done in this area, as basing the integrated biodiversity assessment solely on fishing mortality was not considered meaningful.

In the Mediterranean Sea, no or very few indicators representing pelagic and benthic habitats were available in offshore areas and in the Aegean-Levantine Sea. In Macaronesia no bird indicators were available and indicators on pelagic and benthic habitats were lacking in offshore areas. Indicators on fish and marine mammals covered only parts of the Macaronesian offshore areas.

Indicators on pelagic habitats were lacking in the Icelandic Sea and offshore areas of the Norwegian Sea and the Barents Sea. Likewise, for benthic habitats, no indicators were available in the Icelandic Sea and

large parts of offshore areas in the Norwegian Sea and the Barents Sea. Also offshore areas of the Bay of Biscay and the Iberian coast lacked benthic habitat indicators.

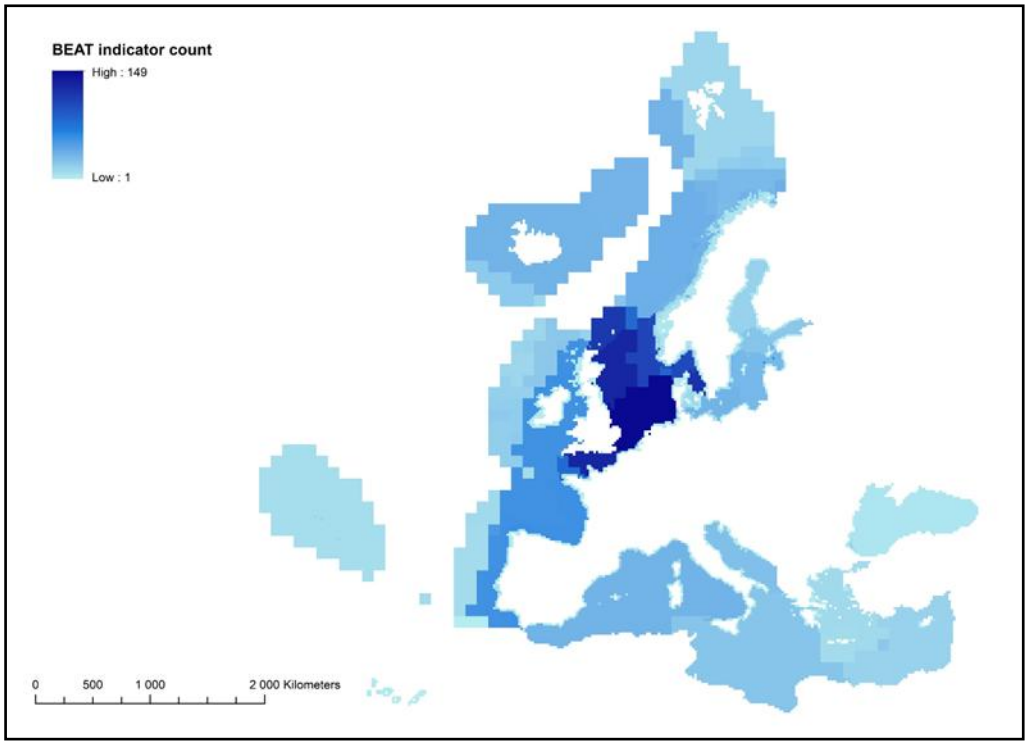


*Figure 1.8 Total number of indicators included in the BEAT+ assessment in different regions.*

To increase the number of included indicators, we have added also categorical and trend-based indicators, for which the status is known but the distance to the threshold value is not as exact as compared to quantitative indicators. Whereas this gives a more complete assessment of biodiversity, it increases the uncertainty of the results.

For the assessment of fish stocks, most indicator data is based on fishing mortality compared to the maximum sustainable yield and for only a part of the stocks data on stock size or structure is included. This means, that even if fishing is at a level not risking the current stock, the assessment can be misleading if the stock is already depleted. Additionally, as some already depleted stocks are not currently fished on, data may be missing (e.g. cod in the Baltic Sea).

The indicator assessments are generally made at the ecologically relevant spatial scale. This means that motile and migrating species are assessed at relatively large scales. The spatial assessment units thus vary between indicators, but generally indicators representing same species groups are done at a similar spatial scale. For this assessment all indicator data were transferred to the EEA marine assessment grid. Down-scaling indicator results from very large assessment units to the grid may not always reflect the true status in each grid cell. This was evident from the comparison between coastal and offshore areas, where the smaller assessment units in coastal areas showed higher spread in the assessment results, whereas such variability may have been averaged out in larger assessment units.

The summary of the existing Member State and RSC assessments was based on a different approach than the BEAT assessment and, hence, the quality considerations are partly different:

- The results are based on existing assessments combining several assessment regions from Member State up to Regional Seas.

- OSPAR and HELCOM assessments use a different approach in integrating species indicators to functional groups, requiring 75% of species to be in GES for the group to be in GES, whereas BEAT+ uses averaged species EQR values. Differences in the assessment results due to the differing approach were particularly seen in assessing the bird status.
- For several biodiversity components, it was noted that where baselines are still being established, it is not yet possible to identify clear trends.
- The previous diagram for Marine Messages II (MMII) included sharks & rays as a separate entry: with the new division of fish data this is no longer possible.
- Specific assessments of invertebrates are also largely absent in this assessment, except for 3 Member States reporting on cephalopods in the Mediterranean Sea, although many of the indicators will include influences on invertebrate populations through predation or anthropogenic pressures.
- Generally, pelagic systems are assessed with relatively low confidence (UNEP-MAP for example states that this is seen as a problem area still)
- Several indicators focus on specific species groups or habitats, e.g. the threatened habitats (listed in Annex I of Habitats Directive) in the Mediterranean Sea, or the commercial fish in the OSPAR region.
- The status of fish in the Mediterranean Sea is one aspect which has improved which the QSR attributes to better management of fish stock.
- However, fish are regarded as in worse state in the OSPAR area than in the 2019 MMII report, because the OSPAR QSR2023 now includes data on non-commercial and Threatened & Declining species, not just commercial data.
- The MSFD data provides the percentage of MS who did not report on a particular element. In the summary assessment table (Figure 1.7), the inverse of % unknown' has been used to give an estimate of '% confidence' of the outcomes of MSFD reporting to allow better alignment with the other assessments. The sometimes low spatial? coverage of elements needs to be accounted for when interpreting the results.

## 1.8 Conclusions

The overall assessment results make it apparent that biodiversity loss is a widespread problem in Europe's seas. This poses several risks for the functioning of the ecosystem, its resilience towards climate change and the provision of the essential goods and services for human societies. It is evident that the EU Member States have not reached their environmental policy objectives in the marine realm.

Our approach to look at the state of biodiversity from two perspectives allows a strong basis for conclusions, though in some cases the different assessment results require understanding differences in the underlying assessment methodologies. A summary is presented below:

- Birds show good status in large areas of the North-east Atlantic Ocean and the Eastern Mediterranean Sea based on the integrated approach, but this is largely based on the good state of grazing birds and pelagic-feeding birds. Wading and benthic-feeding birds indicate poor state in many regions.
- Fish seem not to reach good state in almost any region in Europe. Signs of good status are seen in coastal areas of the Baltic Sea and some areas in the Mediterranean Sea.
- Marine mammals in general are not in good state anywhere in Europe's seas, but seals show good status in the Greater North Sea, Celtic Seas and large parts of the Bay of Biscay and the Iberian coast.
- Reptiles, i.e. two species of turtles, show good status in the Mediterranean Sea. However, turtles in the North-east Atlantic Ocean are not in good status.
- Cephalopods are mainly unassessed, but a few results indicate good status of deep-sea populations, e.g., in the southern part of the Adriatic Sea.

- Benthic habitats provisionally show good status in large parts of the Atlantic waters as well as those areas of the Baltic Sea that do not suffer from hypoxia. Greater North Sea, Mediterranean Sea and Black Sea have large areas disturbed.
- Pelagic habitats tentatively show good status in large parts of the Mediterranean Sea and offshore areas in the North-east Atlantic Ocean. The Baltic Sea and many coastal areas in the North Sea are not achieving good status.

The area-weighted BEAT scores support the interpretations of the results, underlining the degraded status of biodiversity in Europe's seas. Threats to biodiversity are large-scale and widely distributed, affecting all of Europe's regional seas.

Obtaining assessments with high confidence is still challenging across Europe's regional seas. The current RSC assessment reports include a range of mechanisms and methods for assessing biodiversity, both using in-situ biological monitoring data and proxy parameters which focus on changes in particular indicators (e.g. benthic fishing). At the RSC level, the wider geographical context allows a more informed assessment based on multiple pressures, especially where these may originate outside Member States and the MSFD reporting.

# 2 ‘Ecosystem health’ by the MESH-based assessment

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## 2.1 Introduction

Marine ecosystems are under pressure from multiple stressors affecting the overall health of the ocean, despite the efforts from member states of the European Union to implement strategies to achieve ‘good environmental status’ as described in the Marine Strategy Framework Directive (MSFD). Loss of biodiversity, pollution of chemicals, nutrients and marine litter affect the biological diversity and resilience of coastal and marine waters. Identifying problem areas as well as human induced pressures that cause concern has become an integral part of restoring and protecting marine environments. Specifically following the MSFD goal of achieving ‘good environmental status’ (GES) in European marine waters and ensuring sustainable use of marine ecosystems.

This chapter presents the results of a multi-metric indicator-based index assessing the marine ‘ecosystem health’ (MESH) for European coastal, transitional and marine waters. The MESH index builds on the results from the thematic assessment tools BEAT, HEAT, CHASE and MALT. MESH is designed to provide an integrated overview of marine ecosystem health by identifying hotspots across three indicator categories, classified from the four thematic assessment tools.

## 2.2 Definition and measurement

The MESH index is an extension to the existing thematic assessment tools BEAT, HEAT, CHASE and MALT. It operates by organizing indicators from these tools into three nested categories:

- **Category 1**: Biological indicators which include phytoplankton, zooplankton, submerged aquatic vegetation, benthic invertebrates, fish, seabirds, reptiles, and marine mammals
- **Category 2**: Chemical indicators which include heavy metals, persistent organic pollutants, radioactive substances, etc. in various matrices (water, sediment, biota as well as biological effects of contaminants)
- **Category 3**: Supporting indicators which include nutrient concentrations, Secchi depth, oxygen concentrations in bottom water, marine litter etc.

MESH utilizes Ecological Quality Ratio (EQR) results derived from thematic tools. The assessment follows a structured four-step process:

1. Categorization: Parameters from the thematic tools are assigned to one of three nested categories.
2. Aggregation: Mean EQR values are calculated for each category within each assessment unit.
3. Classification: Each category is classified into one of five status classes: $NPA_{High}$, $NPA_{Good}$, $PA_{Moderate}$, $NPA_{Poor}$, and $NPA_{Bad}$.
4. Integration: Overall marine ecosystem health status is determined using the 'one-out-all-out' (OOAO) principle.

A conceptual overview of the methodology is presented in Figure 2.1.

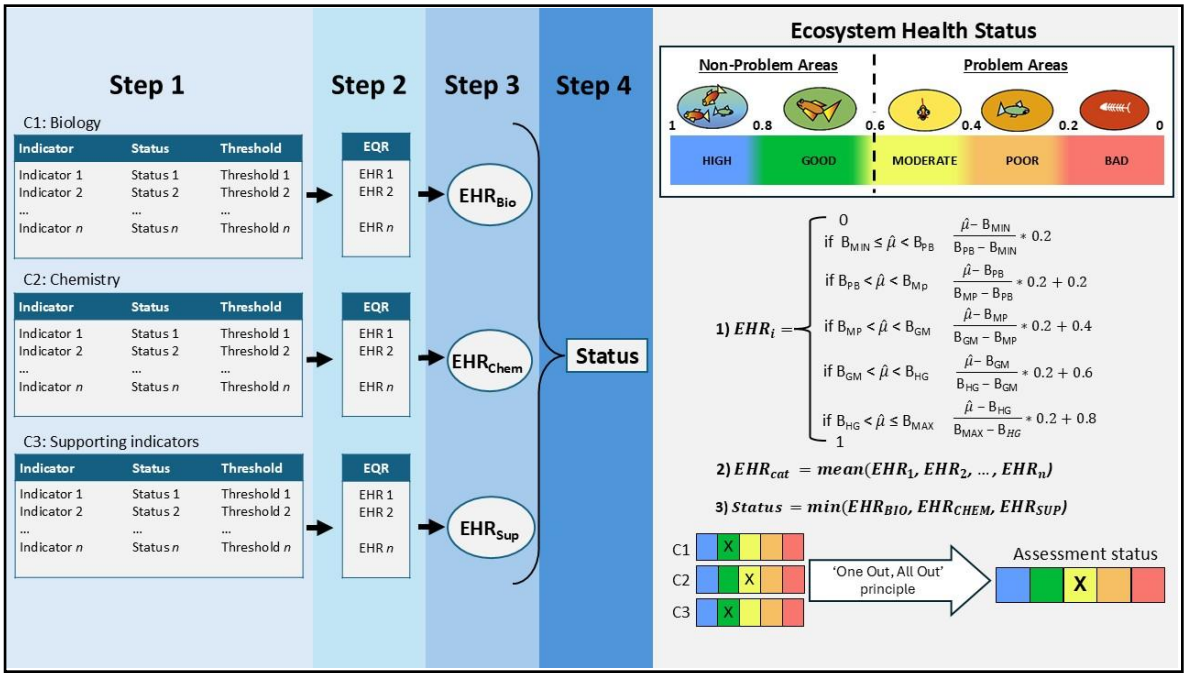


*Figure 2.1 Conceptual diagram of the step-by-step marine ecosystem health (MESH) assessment methodology. The figure illustrates the nested categories from which a single EQR value is found, and the overall status classification is determined from the one-out-all-out principle assigning either High, Good, Moderate, Poor or Bad.*

Due to differences in spatial coverage among the thematic tools, a transparency layer is applied to indicate assessment units where only biological indicators are available. In the subsequent sections these areas will be described as 'partially assessed'. Units with exclusively chemical and supporting indicators are excluded from the MESH assessment. Consequently, assessment units depicted with full opacity represent those where biological indicators were available, in combination with either chemical, supporting, or both indicator types. In the subsequent sections these areas will be described as 'fully assessed'.

## 2.3 Rational and policy relevance

The SFD and the Water Framework Directive (WFD) constitute key components of the European Union's environmental legislation, aiming to achieve GES in marine waters and 'Good Ecological Status' in coastal and inland waters. Both directives are central to Europe's efforts to protect, preserve, and restore aquatic ecosystems, ensuring their functionality for current and future generations. In parallel, regional sea conventions such as HELCOM, OSPAR, and UNEP/MAP support these goals by conducting periodic assessments of the marine environment, focusing on pressures such as pollutants, eutrophication, and human activities.

Building upon the established thematic assessment tools – BEAT, HEAT, CHASE, and MALT – the MESH tool offers a holistic and integrative framework for environmental assessment. Unlike the thematic tools, which focus on specific indicator types (e.g., nutrients in HEAT, hazardous substances in CHASE, or biological elements in BEAT), MESH consolidates these assessments to provide a complete overview of 'Ecosystem Health'. MESH is a science-based, data-driven decision-support tool that enables identification of problem areas by integrating multiple indicator types across spatial units. It facilitates an initial screening of ecosystem status and highlights which indicators require further attention or action, thereby supporting more targeted and efficient policy interventions.

## 2.4 Identification of 'problem areas' and 'non-problem areas'

Figure 2.2 presents the results of the MESH assessment. Spatial coverage is highest in coastal and transitional waters, where biological indicators are accompanied by at least one additional indicator (chemical or supporting). An exception is the Baltic Sea, which exhibits comprehensive coverage across nearly all assessment units (Table 2.1).

When considering only fully assessed units, MESH covers 39% (3.697.234 km2) of the total assessment area. Including partially assessed units, the spatial coverage increases to 85% (8.058.075 $km^2$). Table 2.1 summarizes spatial coverage for the three thematic tools and MESH. In this table, blue values in the MESH row indicate total area coverage (including transparent units), while standard text refers to the fully assessed areas. Spatial coverage in the Black Sea remains limited across all tools, while the Baltic, Northeast Atlantic, and Mediterranean Seas show substantially greater data availability.

Figure 2.2 shows that most European regions are classified in degraded ecological status — i.e., Moderate, Poor, or Bad. The range of status classifications is especially broad in coastal waters, whereas offshore areas tend to show more homogeneous conditions. For example, adjacent coastal units around the United Kingdom, and in the Adriatic and Baltic Seas, range from High to Bad status. In contrast, offshore units typically exhibit less variability. Notably, most high or good status units are found in transparent areas, meaning they were assessed solely on biological indicators.

*Table 2.1 Spatial coverage of thematic assessment tools (Biology, Chemical, Supporting) and the integrated MESH assessment across European marine regions. Values indicate the proportion of the total assessment area (%) where each tool has been applied. For MESH, black values refer to the proportion of the area assessed using all required indicators (biological plus at least one other), while blue values indicate the total area coverage including units assessed using only biological indicators.*

| | Baltic Sea | North Sea | Mediterranean Sea | Black Sea | Europe |
|---|---|---|---|---|---|
| Total assessment area (km2) | 398.219 | 6.779.339 | 1.955.799 | 346.730 | 9.480.088 |
| **Indicator** | | | | | |
| Biology | 100% | 85% | 100% | 2% | 85% |
| Chemical | 55% | 20% | 13% | 8% | 20% |
| Supporting | 97% | 30% | 45% | 25% | 36% |
| **MESH** | 97% | 35% | 47% | 2% | 39% |
| | 100% | 85% | 100% | 2% | 85% |

Applying the classification of Non-Problem Areas (NPA) and Problem Areas (PA), as defined in the Method section, reveals that 81% of the fully assessed areas in Europe are provisionally classified as PA. This spatial pattern is illustrated in Figure 2.2, where PA units are shown in red and NPA units in green. PA classifications dominate across large parts of the Baltic Sea, the North Sea, and the Mediterranean Sea. In contrast, continuous stretches of NPA are only observed in parts of Norway, Portugal, and the United Kingdom. The Black Sea, although limited in coverage (2%), is classified as PA in 98% of the assessed areas. These results underscore the widespread degradation of ecosystem health in Europe's seas, particularly in coastal regions.

The list shown in the upper right-hand corner of Figure 2.2, ranks countries according to the percentage of PA, NPA and areas with no available data within each country's s Exclusive Economic Zone (EEZ), EU member states are highlighted with bold. Countries are ordered from the lowest to the highest percentage of classified PAs, from top to bottom. The value displayed to the right of each country represents its total MESH score.

The ranking tends to favour countries with limited data coverage and relatively small EEZs, which is reflected by the higher positions of countries located in the North-east Atlantic Ocean, the Black Sea, and the eastern Mediterranean. In contrast, countries bordering the Baltic Sea and the southern parts of the North-east Atlantic generally rank among the lowest.

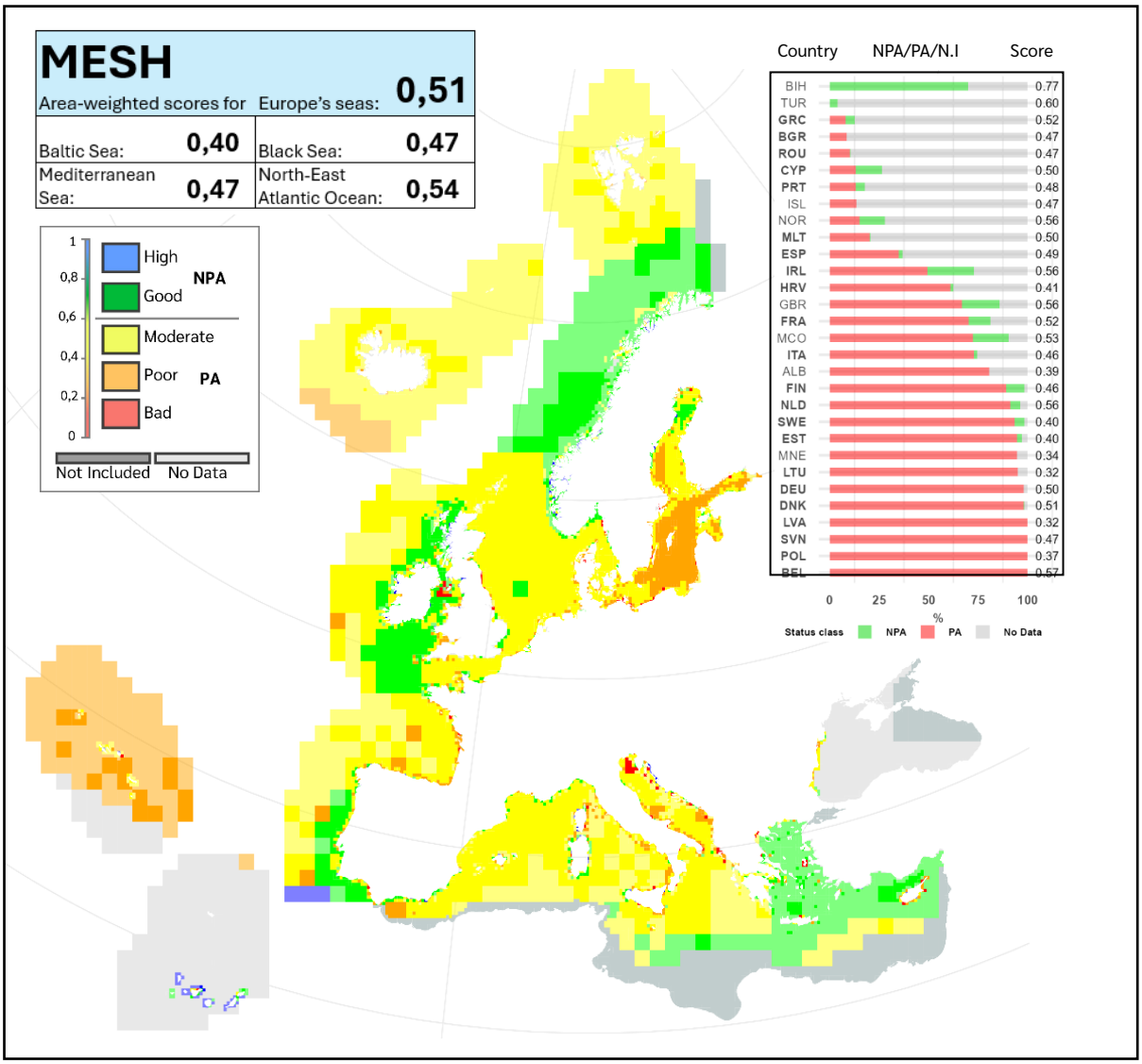


*Figure 2.2 Classification of marine ecosystem health status in Europe's seas. Transparent layers show assessment units assessed only by the biological indicator; full opacity show assessment units with biological plus at least one of chemical or supporting indicators available.*

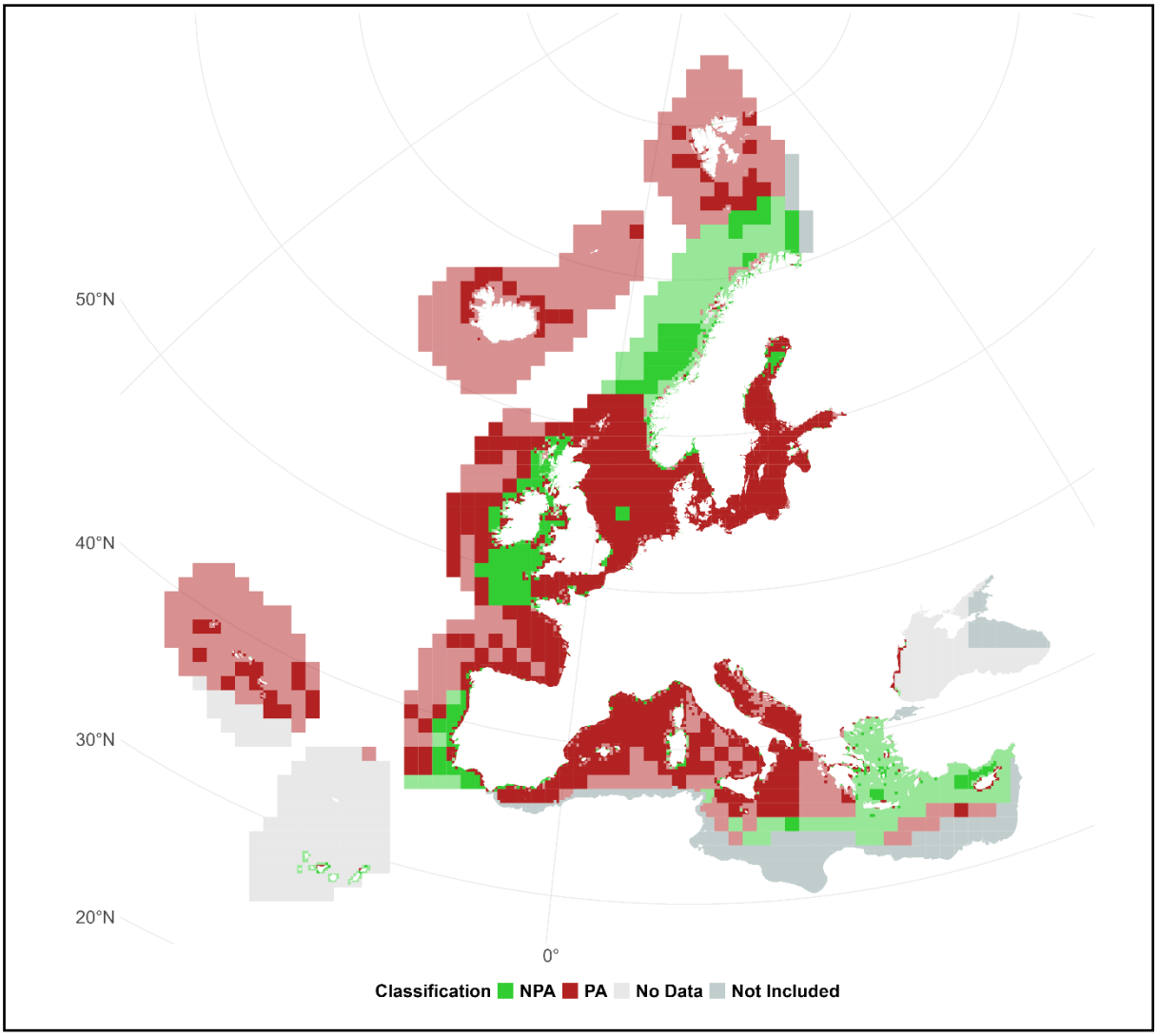


*Figure 2.3 Identification and mapping of problem areas (PA) and non-problem areas (NPA) with respect to the marine ecosystem health (MESH) of Europe's seas.*

Figure 2.4 presents bar charts, for fully assessed areas, showing the total area assessed and the fractions within each status class (High, Good, Moderate, Poor, Bad) for each marine region and for Europe as a whole. Figure 2.4 shows that both High and Bad status are rare, with less than 1% of fully assessed units falling into either category. Most units are classified as Good, Moderate, or Poor. Biological-only assessments suggest a more favorable status (especially in the North-east Atlantic and Mediterranean), but when considering only fully assessed units, the status shifts predominantly toward Moderate and Poor.

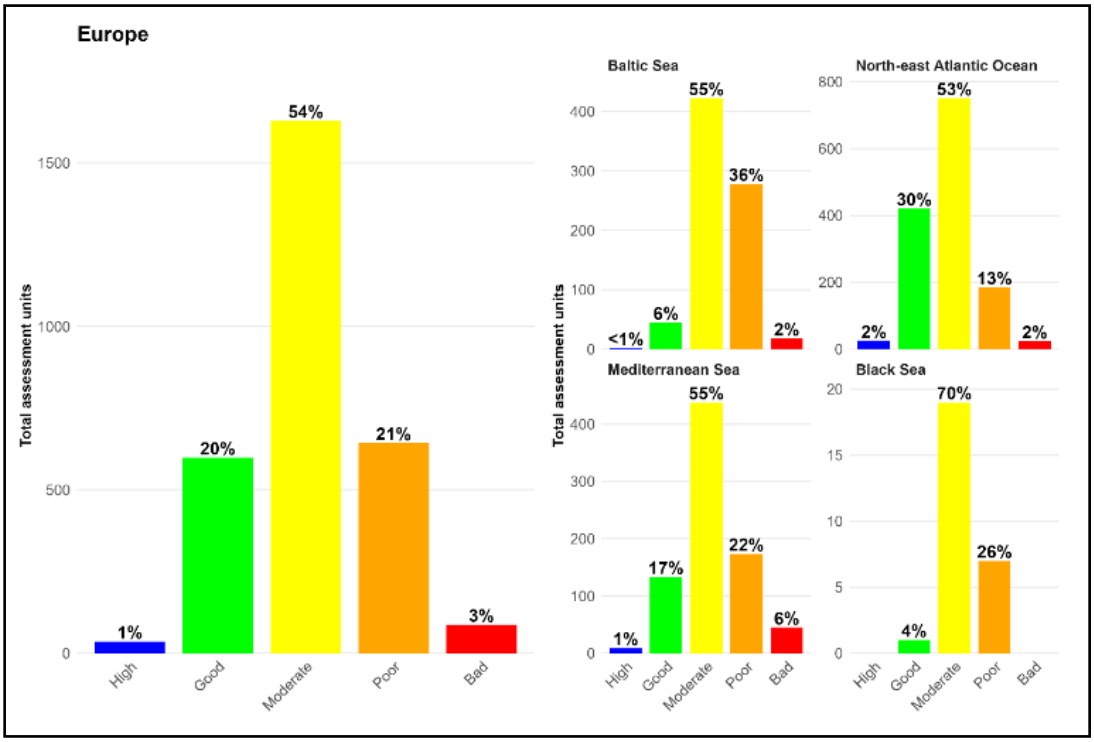


*Figure 2.4 Integrated marine ecosystem health status class for the sum of area assessed. Percentages indicate the total area assessed for each class relative to the total assessed area (e.g., where the biological indicator and at least one of chemical or supporting indicators were available). Areas classified as 'High' and 'Good' are identified as 'non-problem areas' whilst 'Moderate', 'Poor' and 'Bad' are identified as 'problem areas' with respect to marine ecosystem health. Summaries are shown for Europe (left) and the four regions of the Baltic Sea, North-east Atlantic Ocean, Mediterranean Sea and Black Sea.*

Figure 2.5 shows the decisive indicator, that is, the indicator with the lowest status within each assessment unit, which determines the unit's final classification according to the OOAO principle. Across most European marine regions, biology is the most common decisive indicator. However, the Baltic Sea stands out as an exception, where supporting indicators (e.g., nutrients, oxygen) most frequently drive the final status classification. This pattern reflects regional differences in pressure types and indicator availability.

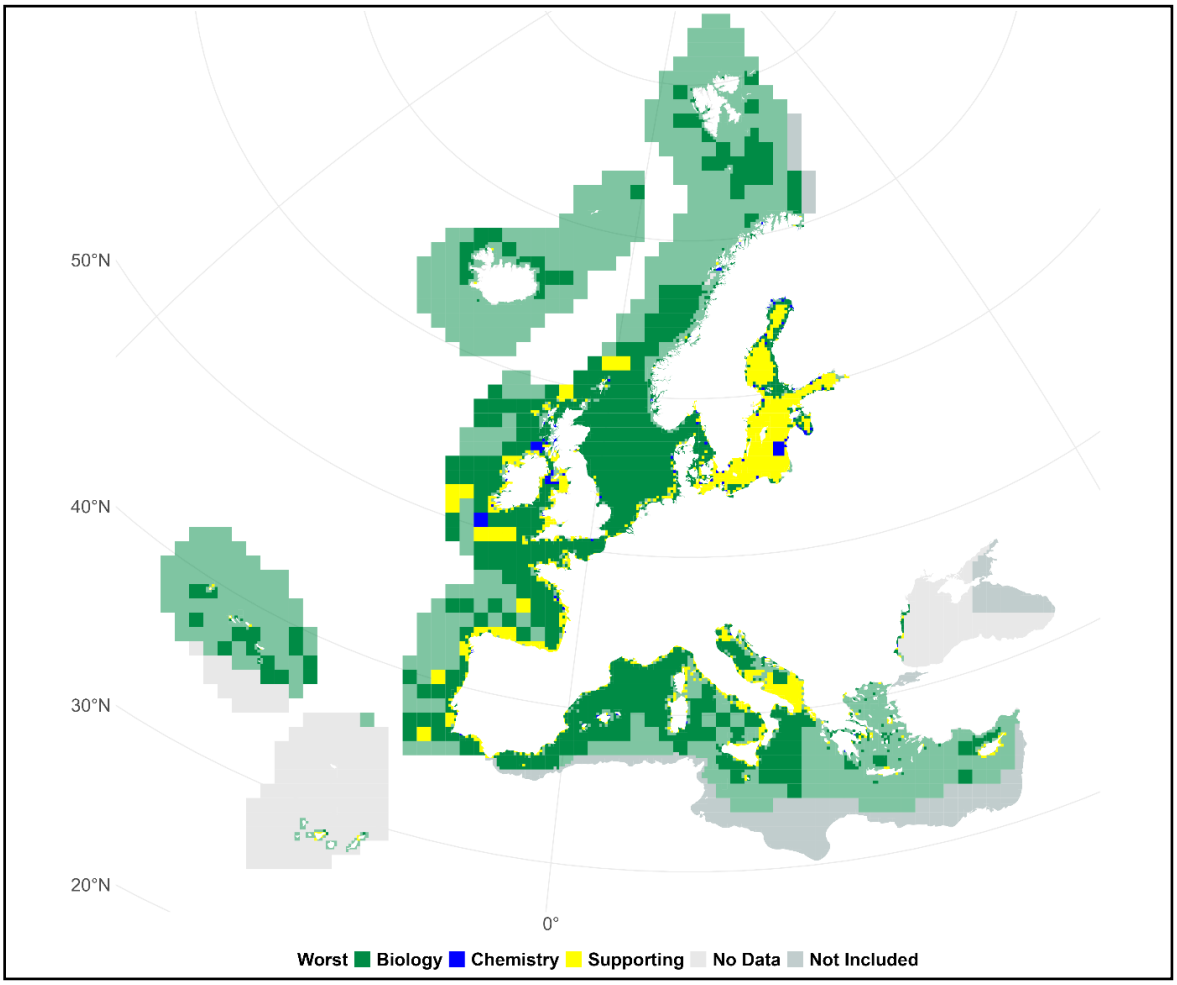


*Figure 2.5 Provisional map of the decisive indicator determining the final classification of each assessment unit in the marine ecosystem health assessment.*

## 2.5 Area-weighted MESH scores

The Marine Ecosystem Health Index (MESH) reveals widespread 'problem areas' across all four European regional seas: the Baltic Sea, the North-east Atlantic, the Mediterranean Sea, and the Black Sea (Figure 2.3). Based on the established status classifications (e.g. EQR), area-weighted MESH scores were calculated for both coastal and offshore waters across Europe's seas (Table 2.2). At the pan-European scale, both coastal and offshore waters fall within the degraded category, with mean scores of 0.49 and 0.51, respectively. These values indicate that ecosystems are in a degraded state widespread and not restricted to nearshore environments alone.

At the regional scale, all four seas similarly exhibit degraded conditions, with only minor differences between coastal and offshore waters. In most regions, the deviation between coastal and offshore scores is within 0.02, indicating broadly comparable pressure levels across zones. An exception is observed in the Baltic Sea, where offshore waters display a noticeably lower score (0.35) than coastal waters (0.44). This difference likely reflects a combination of high offshore environmental pressures and methodological effects related to the spatial structure of the assessment. In particular, the presence of a small number of very large offshore assessment units means that low-status areas exert a strong influence on the area-weighted regional result in the Baltic Sea.

*Table 2.2 Area-weighted MESH scores assessed for coastal and offshore areas of Europe's seas as a whole and for the regional seas. Areas are based on the grid sizes, i.e. 20x20 km grids in coastal areas and 100x100 km grids in offshore areas.*

| Area-weighted MESH scores | | |
|---|---|---|
| | **Coastal** | **Offshore** |
| Europe's seas | 0.49 | 0.51 |
| Baltic Sea | 0.44 | 0.35 |
| North-east Atlantic Ocean | 0.53 | 0.54 |
| Mediterranean Sea | 0.47 | 0.47 |
| Black Sea | 0.47 | NA |

Among the four regional seas, the North-east Atlantic presents the most favourable status, with a score of 0.53 and 0.54 for coastal and offshore waters, respectively. These comparatively higher values are largely driven by the good ecosystem status observed along the northern Norwegian coast, which positively influences the regional average despite localized pressures elsewhere.

In contrast, both coastal and offshore waters of the Mediterranean Sea score 0.47, reflecting the generally poor to bad status prevailing across much of the western and central Mediterranean basin. This consistent degradation across zones suggests that large-scale, basin-wide pressures dominate over local recovery processes.

In the Black Sea, coastal waters score 0.47 based solely on Bulgarian and Romanian monitoring data, highlighting both degraded conditions and significant spatial data limitations. Offshore waters in the Black Sea could not be assessed due to lack of available data.

Overall, the MESH results support the conclusion that Europe's seas are currently in a broadly degraded ecological state. The consistency of low scores across regions and water zones underscores the systemic nature of marine ecosystem pressures.

## 2.6 Data quality and limitations

The data quality and spatial coverage in MESH is linked to the thematic assessment tools (BEAT, HEAT, CHASE and MALT) as it integrates the output of these underlying tools. In particular BEAT constitutes the primary source for biological indicators, which are essential for conducting ecosystem health assessment. However, the thematic tools are based on internationally agreed threshold values and draws from peer-reviewed scientific literature and established national or regional monitoring programs. As such, the data incorporated into MESH has already undergone rigorous quality assurance and validation within the thematic assessments, ensuring high data integrity where available.

Given that MESH uses pre-processed outputs (e.g., EQR), minimal additional data processing is required. Moreover, the harmonized use of the EQR framework across the thematic tools enables comparability and consistency between different indicator types, thereby improving the reliability of the assessment.

However, several limitations apply. Since the availability of data varies substantially between regions and thematic assessment tools, spatial coverage is uneven, with some assessment units lacking sufficient data for full integration. Regions where only biological indicators are available may produce incomplete assessments, while units without biological data are excluded entirely. Additionally, differences in national monitoring strategies, frequency, and indicator selection can introduce inconsistencies across regions and affect the comparability of results.

## 2.7 Conclusions

Based upon the current available data the MESH analysis demonstrates that by integrating indicators from the established thematic assessment tools an overview of the status of the European marine areas can be assessed. The assessment showed that:

- **Widespread degraded ecosystem health status**: 81% of fully assessed areas are classified as problem areas, with non-problem areas confined to small regions along the coasts of northern Norway, Ireland, and Portugal.
- **Area-weighted MESH scores** revealed pan-European degraded status, with mean scores of 0.49 and 0.51, respectively. These values indicate that ecosystems are in a degraded state widespread and not restricted to nearshore environments alone.
- **Uneven data coverage**: The Baltic Sea is the only region with comprehensive indicator coverage, while the eastern Mediterranean and Black Sea contain large data gaps, particularly for chemical and supporting indicators.
- **Indicator patterns**: Biology is the decisive indicator in most regions, except in the Baltic Sea where the supporting indicators more often determine the status.
- **Limitations**: MESH demonstrates the value of combining multiple thematic tools into a unified framework but remains constrained by uneven spatial coverage and inconsistencies among national monitoring programmes.
- **Future needs**: Expanded monitoring, availability of its results and balanced inclusion of biological, chemical, and supporting indicators are essential for more robust and comparable pan-European marine health assessments.

# 3 Combined effects of multiple pressures and climate change

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Europe's seas face many pressures such as climate change, overfishing, pollution, eutrophication, and invasive species (Korpinen et al., 2021). Their combined effects can overwhelm marine ecosystems' resilience (Nagelkerken et al., 2020), yet remain difficult to predict (Côté et al., 2016). This makes multiple pressures a critical threat to marine ecosystems and the benefits they provide for people (Di Marco et al., 2018; IPBES, 2019).

This chapter presents maps of key pressures with updated and improved data and where they coincide with sensitive species and habitats. Such maps are a first step to understanding where human activities might degrade marine ecosystems. They provide a broad view that can help identify the most vulnerable areas, prioritize conservation and restoration efforts, and develop more effective management strategies.

## 3.1 Data and methods

The combined effects analyses presented here build on a simple spatial model that calculates a "multiple pressure index" on a regular grid from three kinds of input data: 1) 'pressure layers' reflecting the spatial distribution of human pressures or activities; 2) 'ecosystem component layers' reflecting the spatial distribution of species groups or broad habitats; and 3) 'sensitivity scores', which are numbers reflecting the sensitivity of each ecosystem component to each pressure (Halpern et al., 2008, 2009). Here, we provide a summary of the data, methods and a full account of results.

The analyses include the spatial distribution of 14 pressures (Table 3.1) and 30 ecosystem components (Table 3.2), in essence, updated versions of the data from Korpinen et al. 2021). These data were obtained from various public sources, often specific to Europe's seas, but sometimes from global data when Europe-specific data were unavailable or not shared (for example, fine-resolution fisheries data for the European Union fleet that were not made available for this report, even though a Directorate-General holds them). The pressure and ecosystem components were mapped on a regular grid with 10 km resolution. All pressures were rescaled to a maximum of 1, and some that were dominated by a few very high values were log-transformed. These are standard preprocessing steps in pressure mapping (Sanderson et al., 2002). However, working with regular grids can lead to an overestimation of the area affected by pressure if that pressure occurs only in part of a grid cell.

For climate pressures, we relied on regionally downscaled temperature and pH projections for an intermediate emission scenario (SSP2-4.5; Kristiansen et al., 2024). This scenario represents a future where the world makes some mitigation efforts and modest improvements in sustainability, but not enough to meet the Paris Agreement's 1.5 °C or 2 °C goals, such that greenhouse gas concentrations stabilize but do not decline by 2100. As a baseline, we used the difference between the 2015-2035 mean and the 1993-2013 mean but also present selected additional analysis using projections for the middle of the 21$^{st}$ century (2040-2060 mean). When rescaling these data, we used the largest projected middle-of-the-century changes to reflect the maximum pressure (as we assume that the sensitivity scores for climate pressure incorporate future threats), such that the current pressure was lower.

The sensitivity scores (Fig. 3.1) came from two expert surveys, one by the European Topic Center Biodiversity and Ecosystems (ETC-BE) and one by the European Topic Center for Inland, Coastal and Marine Waters (ETC-ICM). The ETC-BE scores covered the climate pressures included here (temperature and pH changes), whereas the ETC-ICM data covered all other pressures.

Using these data, the multiple pressure index (Equation 3.1) is calculated separately for each grid cell as the sum of the products of: (1) rescaled pressure intensity P, (2) the prevalence of the rescaled ecosystem component E (e.g., presence–absence, proportion, rescaled abundance, or rescaled species richness), and (3) the sensitivity weight S associated with each pressure-ecosystem component pair. This total is then divided by the sum of the ecosystem component values, ensuring that the index reflects the magnitude of pressures and the sensitivity of ecosystem components, independent of the number of components present within each grid cell:

$$Impact\ index = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m} P_i E_j S_{i,j}}{\sum_{j=1}^{m} E_j} \qquad \text{(Equation 3.1)}$$

A higher value reflects the presence of more pressures, greater pressure intensity, and/or increased sensitivity of local ecosystem components to these pressures. Elevated values therefore denote areas where intense pressures co-occur with species or habitats that are sensitive. Conversely, lower values indicate that pressures are fewer, weaker in intensity, and/or that the local ecosystem components are less sensitive. While this method has well-known limitations (Halpern & Fujita, 2013; Stock & Micheli, 2016), it remains widely used in broad-scale assessments of multiple pressures (Korpinen & Andersen, 2016; Simeoni et al., 2023). It has been widely applied in Europe's seas (e.g., Andersen et al., 2020; Hammar et al., 2020; Holon et al., 2015; Korpinen et al., 2012, 2021; Micheli et al., 2013) and globally (Halpern et al., 2025; Murphy et al., 2024).

Simply mapping where many intense pressures coincide with ecosystem components that are sensitive to them has important limitations (Halpern & Fujita, 2013). For example, marine ecosystems are complex, interconnected and dynamic, yet our analyses neglect species interactions, interactions between stressors, metapopulation dynamics, and other processes that are known to affect how multiple stressor effects play out. As another example, how pressures are categorized affects how much they influence the multiple pressure index: Reflecting fisheries through more separate data layers split by gear type increases their importance in the multiple pressure index, as the maximum effort for each layer is assigned a pressure intensity of 1, and their contributions to the index are summed (Ban et al., 2010). Here, we use a previously published categorization (Korpinen et al., 2021), which however counts bottom trawling several times (through target species extraction, bycatch, and physical disturbance pressure layers). Given that bottom trawling is a high-impact human activity, the strong reflection in the multiple pressure index. These examples illustrate that our combined effects analyses are best interpreted as a coarse, broad-scale spatial summary of current data and expert knowledge, as opposed to providing an exact quantification of combined effects.

## 3.2 Where is the risk of adverse combined effects highest?

The multiple pressure index (Fig. 3.2) quantifies where multiple intense pressures overlap with sensitive habitats and species. The index is dimensionless and should be interpreted comparatively: higher values indicate more pressures, greater pressure intensity, higher sensitivity of present species and habitats, or a combination of these causes.

Under current climate pressures and local pressures — defined as those arising from human use of Europe's seas and catchments rather than global climate change — the index is highest along many coasts, notably the southern North Sea coast, some northern Mediterranean coasts, and other densely populated coastal zones (Fig. 3.2A). Exceptions include higher-latitude and some southern Mediterranean coasts

with lower population density. However, fishing pressure is likely underestimated in coastal regions, because the underlying fishing effort data underrepresent small-vessel activity. Offshore, the index is generally moderate across the continental shelf (e.g., Baltic Sea and especially the Kattegat, North Sea, and some Mediterranean areas like the northern Adriatic Sea). Low values occur mainly in the deeper, offshore areas of the North-east Atlantic Ocean and the Mediterranean Sea. However, the latter partly reflects uncertainty in extrapolating 'hazardous substances' data, potentially underestimating impacts.

*Table 3.1 Summary of pressure layers. The layers and the methods to prepare them are updated from Korpinen et al. (2021).*

| Pressure | Data period | Description and source | Preprocessing |
|---|---|---|---|
| Climate change (four layers: bottom temperature, surface temperature, bottom pH, surface pH) | 1993-2099 (published 2024) | In analyses: absolute difference between 1993-2013 mean (baseline) with 2015-2035 mean (current) and 2040-2060 mean (mid-century) projected for scenario SSP2-4.5 ("middle of the road" socioeconomic pathway with intermediate greenhouse gas emissions). Source: Kristiansen et al. (2024). | Only rescaling |
| Input of continuous sound | 2017-23 | Shipping as a proxy. Source: EMODnet; new data processed as in Kallenbach et al., 2023. | $Log_{10}$ |
| Input of hazardous substances | 2015-23, older data in some assessment units | Statistical model extrapolating 2025 CHASE seawater classification (see Chapter 4) to areas not assessed, based on distance to land and surrounding land use. The extrapolation achieved intermediate accuracy. | Only rescaling |
| Inputs of nutrients | 2013-23 | Statistical extrapolation of 2025 HEAT assessment (see Chapter 5), like for 'hazardous substances'. The extrapolation achieved good accuracy. | Only rescaling |
| Extraction of species by commercial fishing<br>Bycatch by pelagic towed gears<br>Bycatch by bottom-touching mobile gears | 2015-2024 | Based on total fishing hours according to Global Fishing Watch (GFW) data at 0.01 x 0.01 degrees resolution. Because GFW data do not distinguish between bottom and pelagic trawling, we employed a simple machine learning approach to split trawling effort into benthic and pelagic components based on variables such as seabed substrate, slope, and water depth. This approach achieved adequate accuracy. | $Log_{10}$ |
| Physical loss | 2017-2022 (depending on activity causing the pressure) | Composite indicator reflecting offshore installations and windmills, cables, port areas, anchoring areas, dumping locations, and dredged shipping lanes. | $Log_{10}$ |
| Physical disturbance | 2015-2024 (depending on activity causing the pressure) | Composite indicator reflecting maritime traffic (e.g., expansion of port facilities, harbor dredging, ship anchoring, and shipping caused turbidity), demersal fishing, aquaculture, offshore windfarms, oil and gas installations. | $Log_{10}$ |
| Disturbance by human presence | Population: 2015; Land cover: 2018 in EEA-39 countries, 2005 elsewhere | Composite indicator reflecting urbanization of the coastline (artificial land cover) and population density. | $Log_{10}$ |
| Non-indigenous species | 1900-2025 | CIMPAL assessment, including interactions between non-indigenous species (see chapter 6). | $Log_{10}$ |

This index captures chronic, widespread pressures from major land and sea uses and climate change: specifically, species extraction by commercial fishing (target species and bycatch), climate change (temperature and pH changes), hazardous substances, loss and disturbance of the seabed, eutrophication, non-indigenous species, underwater sound from shipping, and densely populated and urbanized coasts. However, it excludes sporadic or emerging activities such as seismic surveys and deep-sea mining.

*Table 3.2 Summary of ecosystem component layers. Layers and the methods to prepare them are updated from Korpinen et al. (2021).*

| Ecosystem components | Data period | Source and external information |
|---|---|---|
| Broad-scale benthic habitats (18 layers) | Published 2023 | Proportion in grid cells. From EUSeaMap, accessed via EMODnet Map Viewer. Distinguishes infralittoral, circalittoral, offshore circalittoral, bathyal, and abyssal seabed as well as various substrates. |
| Seagrasses | 1934-2020 | Proportion in grid cells. UNEP Global Distribution of Seagrasses, 2021 release: https://doi.org/10.34892/x6r3-d211 |
| Cold-water corals and other coralligenous formations | 2020-present | Proportion in grid cells. Kallenbach et al., 2023. Original sources: ICES, EMODnet |
| Seamounts | 2020 | Proportion in grid cells. Kallenbach et al., 2023, Original source: EMODNet |
| Baleen Whales<br>Deep-diving toothed cetaceans<br>Small toothed cetaceans<br>Seals<br>Turtles | 1990-2024 | Species richness according to AquaMaps probabilities of presence (https://www.aquamaps.org/) and OBIS (https://obis.org/). Based on geographic ranges from AquaMaps, but species were set to absent in marine regions that had no records in OBIS, ensuring that species are not assumed to occur in regions with suitable environmental conditions but other biogeographical boundaries (e.g., large whales in the Black Sea). |
| Fish | 2022-2024 | Combination of species richness maps from AquaMaps (https://www.aquamaps.org/) |
| Breeding sea birds | 2013-2017 | Kallenbach et al., 2023. Original source: European Breeding Bird Atlas (EBBA2). |
| Saltmarshes | 1934-2015 | Korpinen et al., 2021. Original data source was UNEP. No newer dated spatial data were available from UNEP. |
| Coastal water column habitat, offshore water column habitat (two layers) | N/A | Korpinen et al., 2021. These pelagic habitats are distinguished only by water depth. |

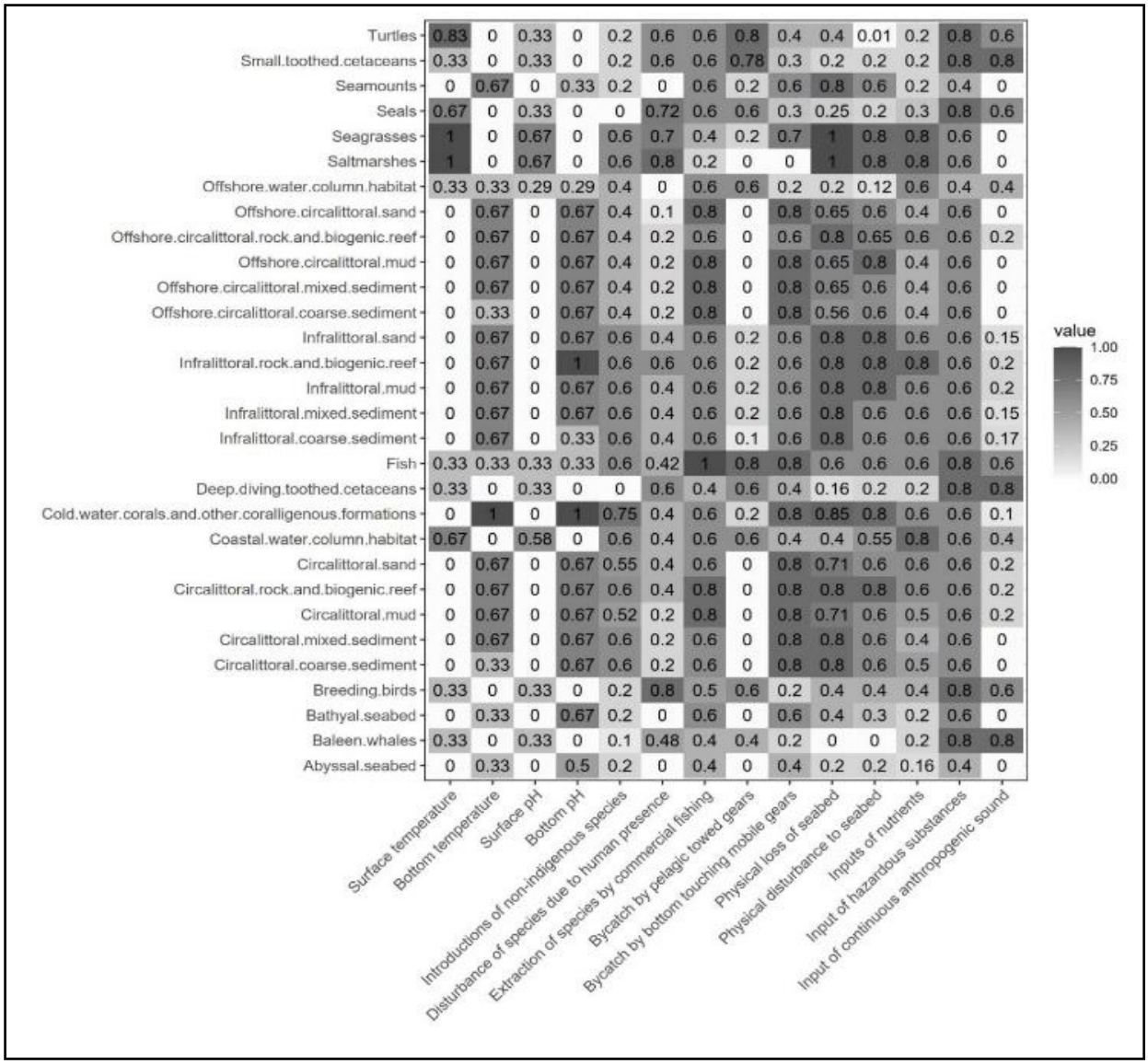


*Figure 3.1 Sensitivity scores based on expert surveys. A high score indicates that, on average, experts from across Europe believe the ecosystem component (columns) is sensitive to the pressure (rows), suggesting a high risk of adverse effects where they occur together.*

Climate change is affecting marine ecosystems everywhere, but especially in the Baltic Sea, parts of the Mediterranean Sea, the North Sea, and the Black Sea (Fig. 3.2B). By the middle of the 21st century, climate pressures are projected to intensify, especially in these same regions, but with a notably larger footprint elsewhere (Fig. 3.2C). Like local pressures, climate pressures are smaller in deeper waters, where changes at the sea bottom occur slower than at smaller depths.

Taken together, these maps suggest that many of Europe's coasts and parts of the continental shelf are at high risk of adverse combined effects of multiple pressures, whereas the deep sea beyond the shelf is, for now, under less pressure.

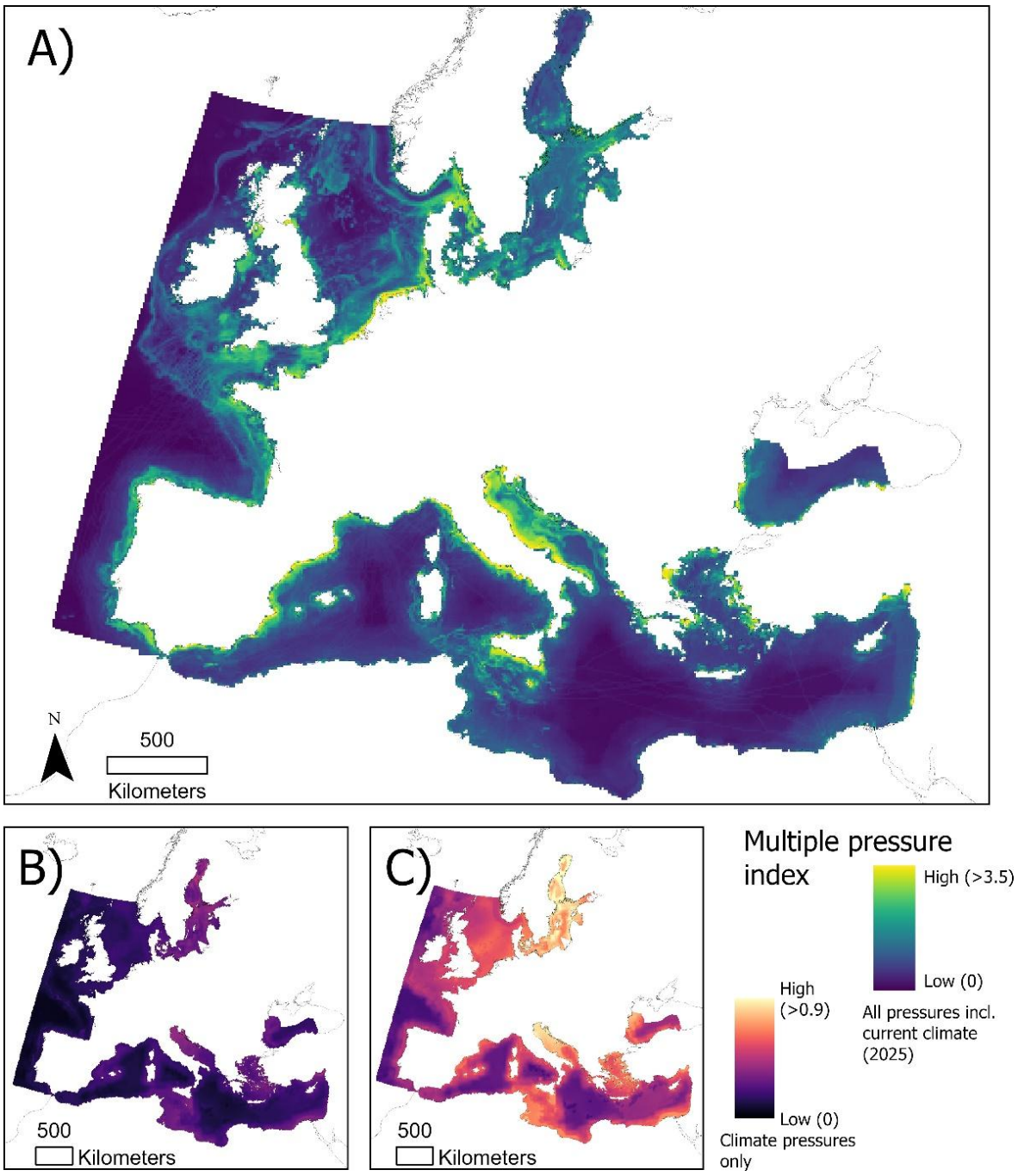


*Figure 3.2 Multiple pressure index for Europe's seas considering local pressures and current (2025) climate pressures (A); considering only current (2025) climate pressures, namely, modeled temperature and pH changes (B); and considering climate pressures projected for the middle of the 21st century under a middle-of-the-road scenario (SSP2-4.5). The index is dimensionless. A high value means that several intense pressures coincide with sensitive species groups and habitats.*

## 3.3 Which pressures have the largest footprint?

Hazardous substances are the pressure with the largest footprint on Europe's seas, followed by species extraction by commercial fishing (including bycatch), and current climate pressures (temperature and pH changes compared to a 1993-2013 baseline, Fig. 3.3). Here, having a large footprint means that the pressure occurs over large areas with sensitive species and habitats. The other pressures had smaller footprints but can pose considerable regional or local risks.

The large footprint of hazardous substances reflects the current CHASE assessment, which suggests that most of Europe's seas have problematic concentrations of one or more contaminants, particularly heavy metals and organic compounds such as polycyclic aromatic hydrocarbons (PAHs). However, it is critical to note that the CHASE assessment applies rather strict criteria when determining problem areas for hazardous substances, and the magnitude of ecosystem-scale effects is hence uncertain. However, established interactions with climate change contribute to a considerable risk associated with hazardous substances (e.g., a warmer environment accelerating metabolism and hence uptake rates and bioaccumulation of contaminants).

The large footprints of fisheries and climate change reflect the large spatial extent of these pressures and longstanding concerns about their impacts on marine ecosystems (Jackson et al., 2001; Poloczanska et al., 2013). Despite progress towards more sustainable fisheries, some fish stocks in Europe remain overexploited (Bastardie et al., 2024; EEA, 2024). Climate change has various complex effects across ecological scales (Woodburn et al., 2025). It can exacerbate or mitigate local pressures, depending on the specific ecological context (Gissi et al., 2021). Its effects are widespread but not uniform. For example, under a moderate emission scenario (SSP2-4.5), some of the largest changes over the next decades are expected in the Baltic Sea (Fig. 3.4).

Eutrophication is a key issue in the Baltic Sea and some coastal areas. Seabed loss and disturbance have a moderate footprint because they occur across Europe's seas, but their spatial extent is more sharply delineated. Non-indigenous species, continuous sound from shipping, and disturbance of species due to human presence contributed the least to the impact index. However, the spatial footprint of a pressure, as defined here, reflects both its geographical extent and the risk it poses to habitats and biota where it occurs. Consequently, pressures with a small footprint can still have devastating local impacts. For example, non-indigenous species are a key threat to the Black Sea and the eastern Mediterranean coastal ecosystems (Korpinen et al. 2019), tourism is estimated to pose a high threat for seabird breeding grounds (Davenport & Davenport 2006) and recreational land use causes underwater biodiversity loss (Virtanen et al. 2024).

While hazardous substances, species extraction by commercial fishing, and climate change contributed most to the multiple pressure index in large areas, each pressure was the most important somewhere in Europe's seas (Fig. 3.5). For example, while having a small footprint overall, non-indigeneous species were the top pressure in parts of the Black Sea. With climate change projected for the middle of the 21st century under a "middle of the road" scenario (SSP2-4.5) but current levels of other pressures, climate change would be a dominant pressure in most of Europe's seas (Fig. 3.6). It is important to note that these maps show which pressure contributed most to the multiple pressure index. In many areas, other intense pressures than the "top pressure" occurred. Conversely, in areas with only minor pressures, even the most important pressure might be mild.

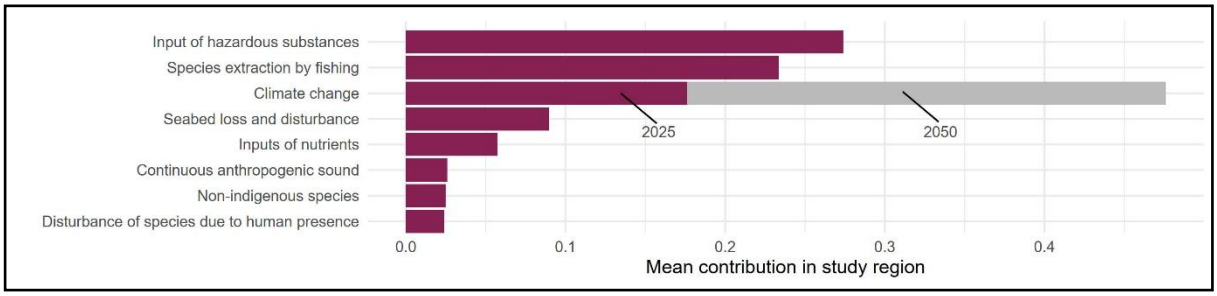


*Figure 3.3 The spatial footprint of key pressures in Europe's seas.*

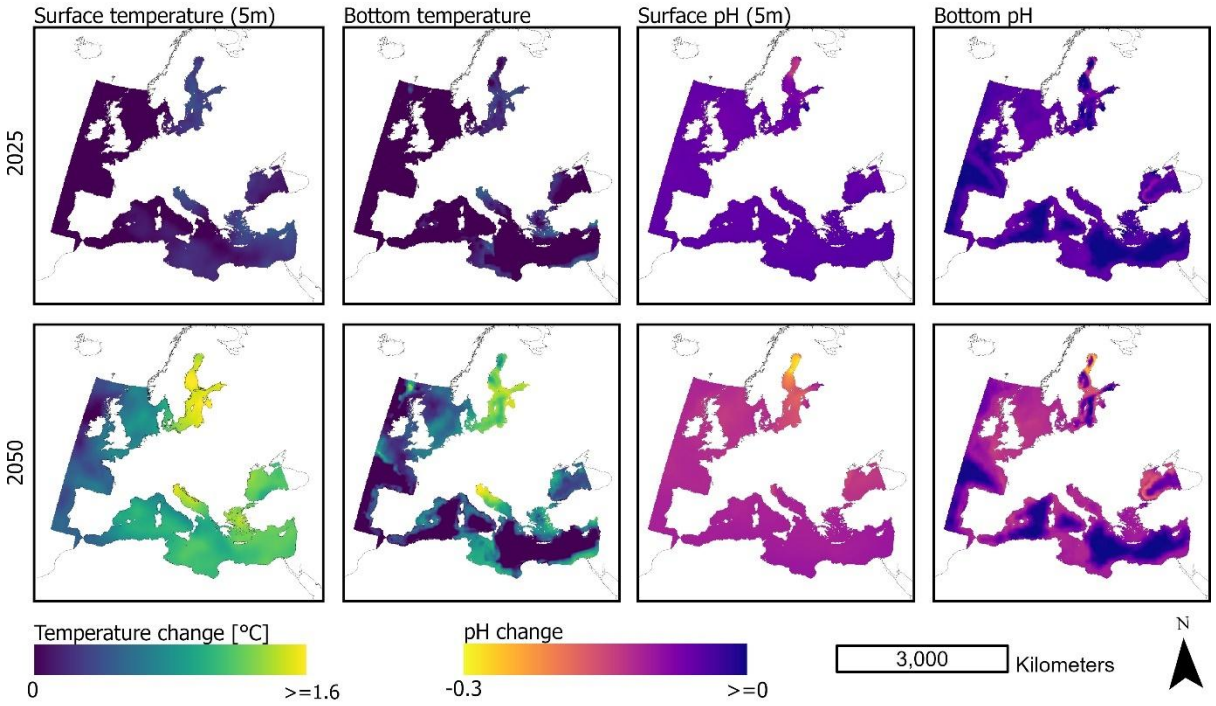


*Figure 3.4 Current changes of temperature and pH (difference of 2015-2035 mean and 1993-2014 mean; top row) and changes projected under a medium emission scenario for the middle of the 21st century (SSP2-4.5; difference of 2040-2060 mean and 1993-2014 mean; bottom row). Climate projections are merged regional projections from Kristiansen et al. (2024).*

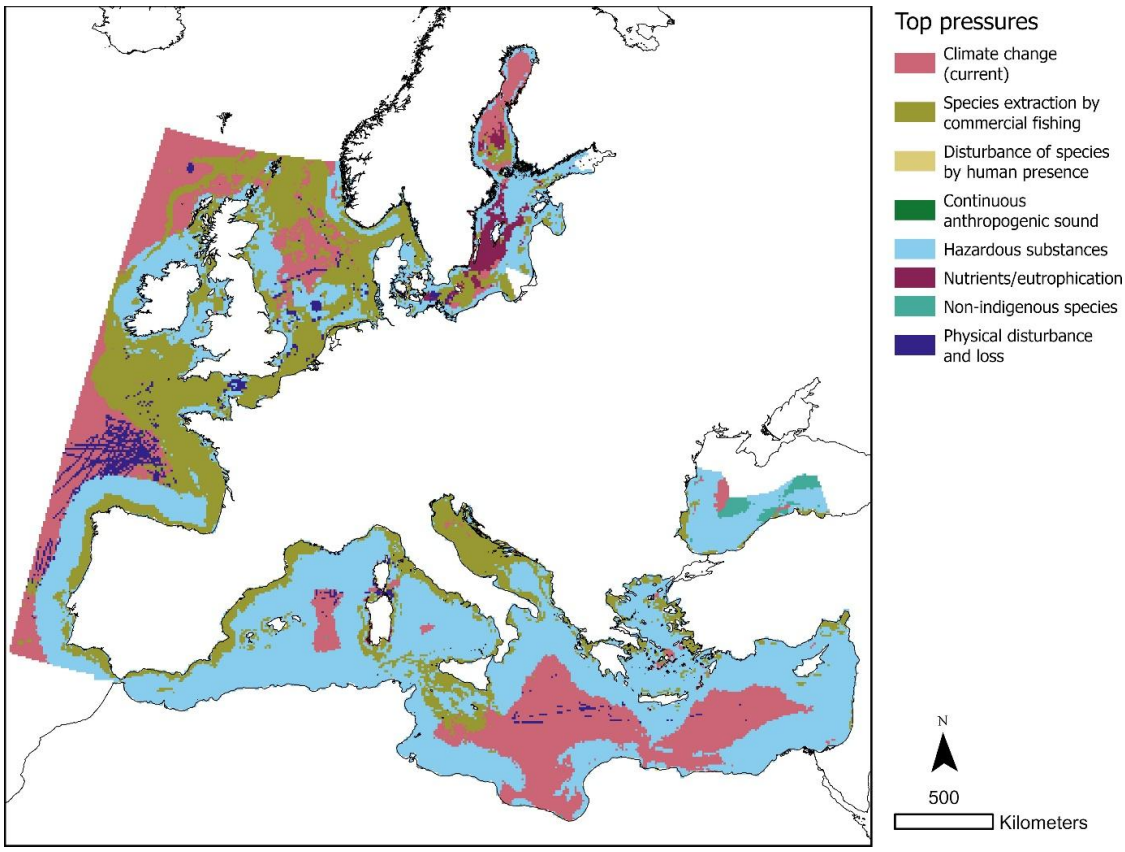


*Figure 3.5 Pressures contributing most to the multiple pressure index considering current climate pressures (temperature and pH changes).*

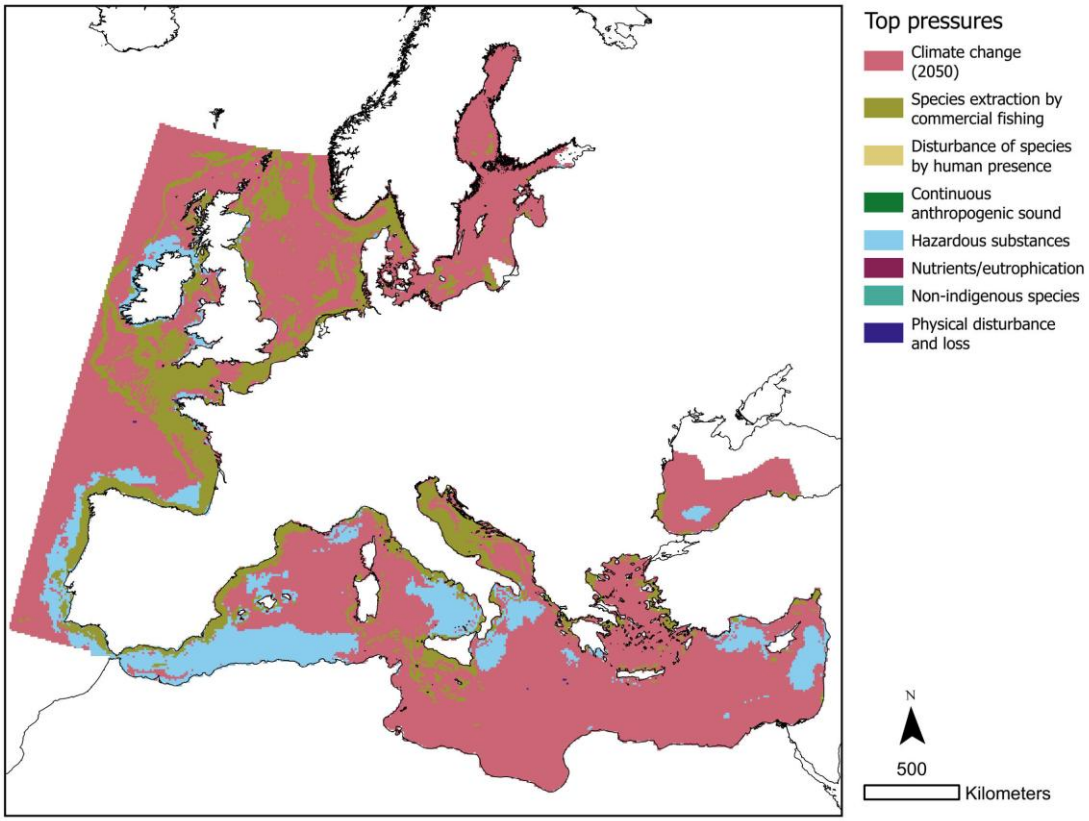


*Figure 3.6 Pressures contributing most to the multiple pressure index considering climate pressures (temperature and pH changes) projected for 2050 under a moderate emission scenario (SSP2-4.5) and current intensity of all other pressures.*

## 3.4 Which ecosystem components are under the most pressure?

All ecosystem components were exposed to several pressures to which they are sensitive, but species groups associated with the coasts and continental shelf were under the most pressure (Fig. 3.7, 3.8). It is hence vital to manage human activities considering the cumulative effects of multiple pressures.

Fish, seabirds, and seals were the species groups under the most pressure. Infra- and circalittoral seabed habitats, coastal pelagic habitats, and biogenic habitats like seagrass meadows and salt marshes were the habitats under most pressure, whereas offshore pelagic and deep-sea benthic habitats were less exposed, reflecting the coastal-offshore gradients of many pressures.

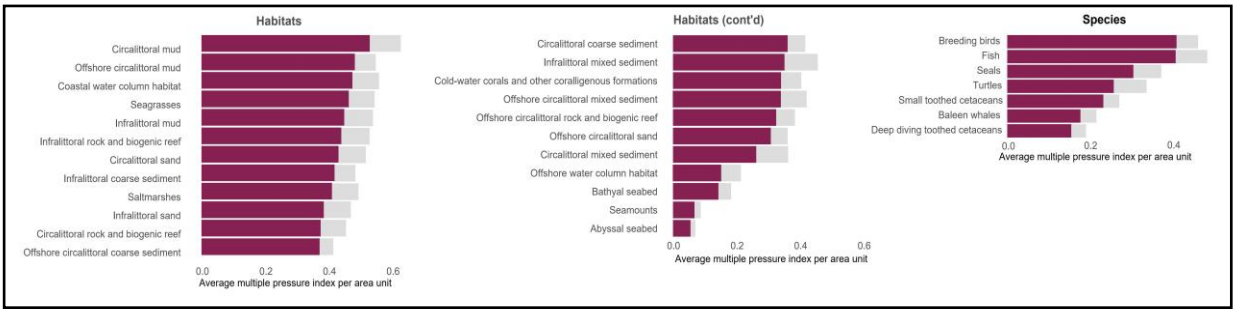


*Figure 3.7 Average pressure index for habitats (left and central columns) and species groups (right column), normalized by the spatial extent in which they occur. A longer bar means that the habitat or species group is exposed to more or stronger pressures that it is sensitive to. The dark red part of the bars represents local pressures caused by sea use and land use in the catchment (like fishing and pollution), whereas the light gray part represents current climate pressures.*

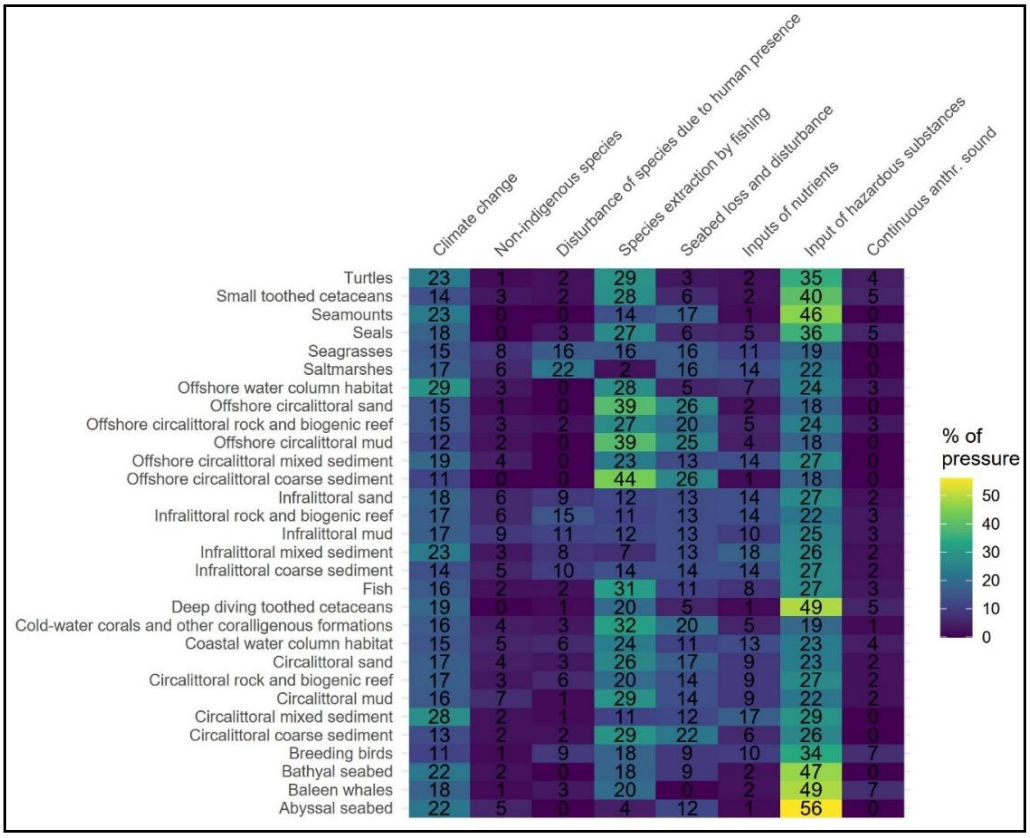


*Figure 3.8 Percentage of each pressure contributing to the multiple pressure index associated with various groups of ecosystem components. For example, 23% of the index value for sea turtles were caused by current climate pressures. A high value means that the ecosystem component is sensitive and exposed to the pressure, relative to all other pressures.*

## 3.5 Conclusions

Mapping the human footprint on Europe's seas showed a widespread risk of adverse combined effects of multiple pressures:

- Many species and habitats are exposed to several pressures that they are sensitive to, especially on the coast and the continental shelf.
- Coastal and biogenic habitats are under the most pressure, whereas deep-sea habitats like the abyssal seabed are, for now, exposed to less pressure.
- Among pressures that can be managed in Europe, hazardous substances and commercial fishing have the largest footprint on Europe's seas. Other pressures can have considerable impacts locally or regionally, like eutrophication in the Baltic Sea.
- Climate change poses a critical and growing risk to Europe's marine ecosystems, given its large spatial footprint and many sensitive species and habitats.

# 4 Contaminants and CHASE-based assessment

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This chapter is anchored in preparatory work carried out in 2023 and 2024 and updates carried out in 2025. The work in 2023 and 2024 focused on improving the spatial coverage compared to the initial identification of 'contamination problem areas' and 'non-problem areas' by Andersen et al. (2020). The updates in 2025 have focused on 1) access to supplementary data sets and getting a better spatial coverage of the assessment and 2) doing the assessment of contaminants with the GES4SEAS toolbox instead of an older version of the CHASE tool.

## 4.1 Introduction

Contaminants encompass an array of substances, including hazardous chemicals, heavy metals, plastics, and other pollutants that find their way into the oceans through various pathways, ranging from industrial discharges to agricultural runoffs. These substances can disrupt the delicate balance of marine ecosystems, affecting not only the flora and fauna that inhabit them but also the communities that depend on these ecosystems for sustenance and livelihoods.

Understanding the extent of contaminant presence in Europe's seas is essential for informed decision-making and effective policy formulation. Monitoring and assessing contaminants provide insights into their sources, pathways, and potential impacts. Moreover, this knowledge can help guide regulatory actions, technological innovations, and societal changes aimed at mitigating the release and effects of contaminants.

This draft briefing delves into the realm of contaminants in Europe's seas, shedding light on the complexities surrounding their presence and efforts undertaken to address them. By examining the data, trends, and policy implications associated with contaminants, we strived to foster a comprehensive understanding of this critical environmental issue. Through collaborative actions, sound policies, and public engagement, we can work towards cleaner and healthier seas for current and future generations.

## 4.2 Definition and measurement

CHASE is a comprehensive, multi-metric indicator-based tool designed for the classification and assessment of the 'chemical status' in marine ecosystems. Its primary purpose was to identify 'problem areas' and 'non-problem areas' regarding hazardous substances and contamination.

This index tool aggregates data from three distinct matrices: seawater, sediment, biota, and includes bioeffects data. Prior to aggregation, the data were normalised. For sediment concentrations, normalisation was performed using reference values for organic substances (organic carbon, $C_{org}$) or metals (aluminium, AL) when available. For biota measurements, normalisation was performed based on the organism and/or tissue. For instance, if a substance is measured in dry weight but its threshold value is in wet weight, the concentration is converted to a wet weight concentration using the dry weight fraction of the organism (EEA, 2019). If the dry weight for a specific observation was unavailable, the average dry weight derived from all measurements for the same species was utilised. If dry weight was not available, the values established by ICES for "typical species-tissue dry weights" for AC basis conversion were employed. If still

no records are available, the average dry weight fraction across all measurements for the same biota "type" was used.

Within each matrix, measurements for multiple substances or indicators were compared with their associated quantitative threshold values to derive the Contamination Ratios (CR) and consequent status, as shown in Figure 4.1. Following the “one out, all out” principle, the matrix displaying the highest degree of contamination determined the overall status of the assessed area. The resulting Contamination Status (CS) allows for the determination of whether it is a 'problem area' (Good, High) or a 'non-problem area' (Moderate, Poor, Bad) (Andersen et al., 2016).

In line with other EEA marine assessments, the area of Europe’s seas is divided into regular grid cells (100 km offshore and 20 km near the coasts).

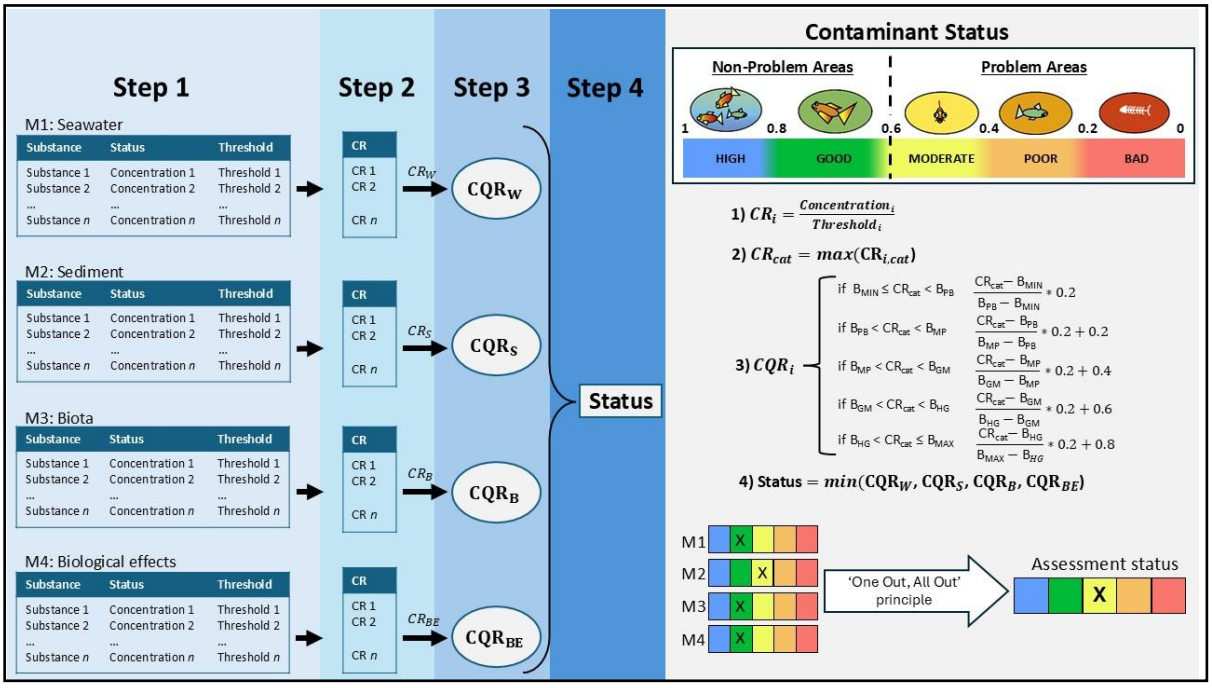


*Figure 4.1 Conceptual representation of the Chemical Status Assessment Tool (CHASE). CQR: Contaminant Quality Ratio, CR: Contaminant Ratio*

## 4.3 Data collection and frequency

Monitoring data for hazardous substances in the marine environment have been gathered from different sources such as the EMODnet, Eionet, EMBLAS, DOME, and DATRAS data portals of the International Council for the Exploration of the Sea (ICES) (Eionet, 2023; EMODnet, 2023; ICES, 2023a, 2023b) and national datasets. The data collected were limited to the period 2013-2023, and included datasets regarding contaminants in the biota, sediment, and marine water.

In addition to the monitoring data, data on the substance- and matrix-specific threshold levels were used. The threshold values included Environmental Quality standards (EQS), ecological quality objectives (EcoQO), Effects Range-Low (ERL), Environmental Assessment Criteria (EAC), and background assessment criteria (BAC) provided by the OSPAR Commission. A list of the threshold values used for the assessment can be found in Appendix 7.

## 4.4 Trends and analysis

A total of 623 assessment units were assessed across all European regional seas with different degrees of coverage (Figure 4.2), based on at least two indicators. Of all the assessment units assessed, 605 (96% of total area assessed) were classified as 'problem areas' and 18 (4% of total area assessed) as "non-problem areas".

Significant changes and patterns were observed in this analysis. See Appendix 8 for assessment maps with a matrix-by-matrix focus. Additionally, integrated assessment by region can be found in Appendix 9. The percentages mentioned in this chapter refer to the area assessed and not the number of grid cells.

In the Baltic Sea, there is a higher frequency of scores within the 'Bad' status, with occasional fluctuations to 'Poor' or 'Moderate'. Overall, the conditions predominantly remain within categories classified as 'problematic'. Of the 100 units evaluated, 99 were designated as 'problem areas' (99%). This is largely attributed to the sediment and biota categories, which are mostly rated as 'Bad' or 'Moderate'.

For the Black Sea, most assessments have focused on coastal areas. In terms of classification, 'Bad' status is the main contributor (100%). This increase in bad status can be attributed to the water matrix. Only 11 assessment units were covered; all of them are 'problem areas'.

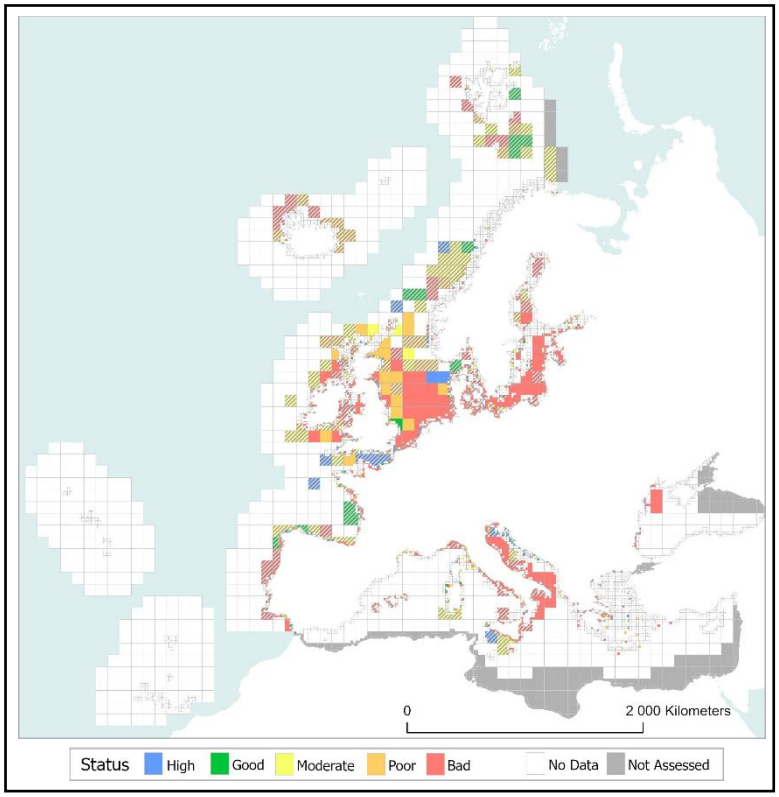


*Figure 4.2 Mapping of CHASE integrated assessment in Europe's seas (2013-2023). Not assessed areas marked as grey on the map. Cells with dashed lines represent results based on only one indicator.*

In the Mediterranean Sea and Adriatic Sea, most observations fall within 'Bad' status for the water matrix, but sediment and biota show a more predominancy of the 'Moderate' status, with most of the assessment units falling in 'problematic' statuses. However, most of the data focused on coastal waters, leaving offshore areas poorly covered. A total of 194 areas were assessed, 6 of which were classified as 'non-problem areas' and 188 as 'problem areas'.

In the North-east Atlantic Ocean, the status classification was more distributed along the assessed area. A total of 318 assessment units were classified, of which 11 were identified as ‘non-problem areas’ (6%), leaving 307 as ‘problem areas’ (94%). Both biota and water matrixes present more than half of the area assessed in a ‘Bad’ status. For sediment, the status distributes mainly between ‘Moderate’ and ‘Bad’ status. On the other hand, bioeffects matrix show a more positive picture, having ‘High’ status as the most representative one with 61 out of the 82 assessment units (90.5%).

The results are presented in the bar chart in Figure 4.3. The results for each matrix provided valuable insights into the overall assessment. As illustrated in Figure 4.4, the sediment and biota matrices have the most comprehensive coverage, especially in the North-east Atlantic Ocean, and the Baltic Sea. In the Mediterranean, sediment coverage has improved, particularly around Italy. Coastal areas are well represented in the seawater matrix; however, offshore areas in the Mediterranean and Black Seas still require better coverage. In addition, there is a notable lack of measurements in the water matrix of the northern Baltic Sea.

It is crucial to remember that the assessment integrates data from these matrices; however, for robustness, if an assessment unit has data from only one matrix, it is not included in the overall analysis.

## 4.5 Interpretation and benchmarks

The findings presented by the CHASE tool provide invaluable insights into the ever-evolving environmental conditions of European seas. It is noteworthy that, according to the assessments, a significant portion of the areas considered still fall under the category of "problem areas," with percentages of 99.7%, 100%, 98.7%, and 94.4% for the Baltic Sea, Black Sea, Mediterranean Sea, and North-east Atlantic Ocean, respectively.

Multiple policy targets for contaminants in the marine environment have been established in accordance with various international agreements and initiatives. These policies have a range of objectives, from “preventing and significantly reducing marine pollution, particularly from land-based activities by 2025” (UN SDG), to aiming for “a Baltic Sea undisturbed by hazardous substances and litter” (BSAP, 2021) or “achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances” (OSPAR, 2023; HELCOM, 2010; HELCOM, 2023a).

These commitments are aligned with the policies of the Marine Strategy Framework Directive. Meeting the established targets is paramount for ensuring the health and sustainability of marine ecosystems and the protection of marine life, as well as contributing to broader environmental objectives. Consequently, there is still a significant way to address the environmental challenges within these regions.

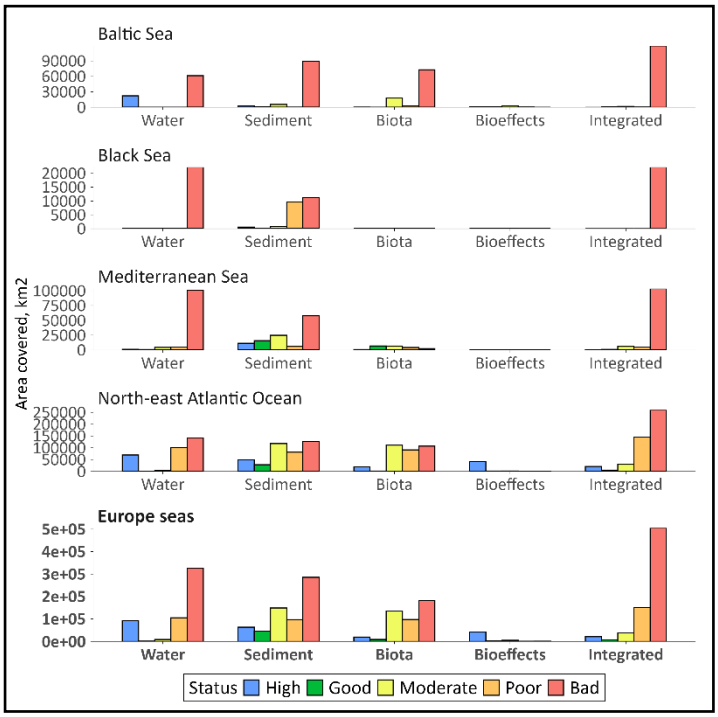


*Figure 4.3 Results of the mapping of "problem areas" and "non-problem areas" based on the CHASE classification.*

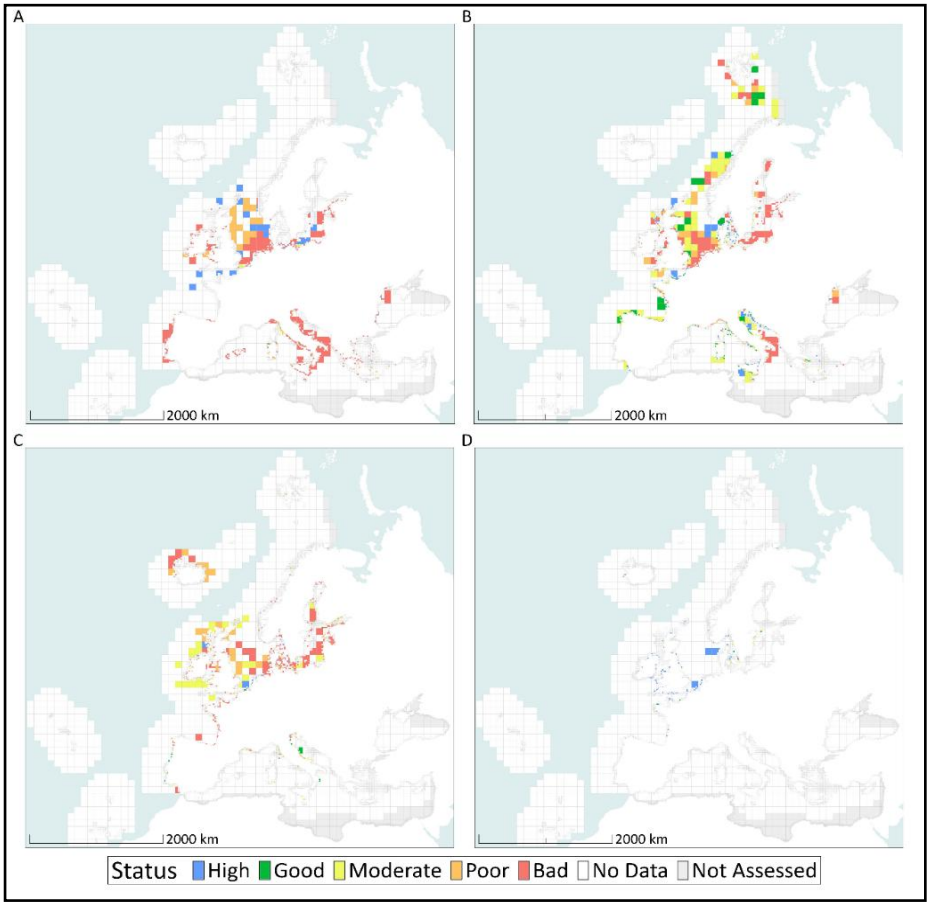


*Figure 4.4 CHASE integrated assessment of Europe's seas for each category. A) Seawater, B) Sediment, C) Biota and D) Biological effects. Not assessed areas marked as grey on the map. Close-up maps can be found in Appendix 9.*

Deficiencies in monitoring data for seawater contamination are notable, particularly in deep-water areas of the Bay of Biscay, the Iberian coast, and the Mediterranean Sea. Additionally, the monitoring data were limited to the southern Baltic Sea for this matrix. Regarding sediment, the available data are concentrated in the Greater North Sea, Baltic Sea, and Celtic Seas, with occasional coverage extending to the Black Sea and the coastal areas of the Mediterranean Sea. Biota monitoring data exhibit data gaps in the Black Sea and Mediterranean Sea regions. Furthermore, data from the Bay of Biscay and the Iberian coast were predominantly located in coastal areas. Bioeffects monitoring data presents the greatest challenge, with limited availability confined to the North-east Atlantic Ocean and the Baltic Sea.

Differences between individual monitoring programs in different regions, and even between countries, pose an additional challenge. The harmonisation and quality assurance of monitoring activities require further improvement for better and more effective assessments of the marine environment and the development of region-specific solutions. Additionally, a more comprehensive range of threshold values is required. Some monitored substances cannot be included in the assessment because of the lack of validated threshold values (Andersen et all., 2022).

## 4.6 Conclusions

The comprehensive assessment across all European regional seas has revealed significant environmental challenges, with 96% of the areas classified as ‘problem areas’. The Baltic Sea, Black Sea, Mediterranean Sea, and North-east Atlantic Ocean all exhibited high percentages of ‘problem areas’, underscoring the effects of marine contamination and its detrimental impact.

Despite various international policies aimed at reducing marine pollution, significant effort is still required to meet these objectives. Data quality and coverage issues, particularly in offshore and deep-water areas, present a major limitation to the assessment efforts. The North-east Atlantic Ocean, and Baltic Sea benefit from extensive monitored areas, while the Mediterranean and Black Seas exhibit significant data gaps, particularly for biota and bioeffects.

The assessment highlights the need for improved harmonization and quality assurance in monitoring activities across different regions and countries. Developing a more comprehensive range of validated threshold values is crucial to include a broader spectrum of monitored substances in future assessments.

Addressing these challenges through enhanced monitoring techniques and expanded geographical coverage is essential for improving the quality and effectiveness of future contamination assessments. This will ultimately contribute to achieving the policy targets set by international agreements and ensuring the health and sustainability of European marine ecosystems.

# 5 Eutrophication and HEAT-based assessment

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This chapter is anchored in preparatory work carried out in 2023 and 2024 and updates carried out in 2025. The work in 2023 and 2024 focused on improving the spatial coverage of the identification of 'eutrophication problem areas' and 'non-problem areas' compared to Andersen et all. (2020). The updates in 2025 have focused on 1) access to supplementary data sets and getting a better spatial coverage of the assessment and 2) doing the assessment of eutrophication with the GES4SEAS toolbox instead of an older version of the HEAT tool.

## 5.1 Introduction

One of the main concerns in Europe's marine environments, primarily in coastal waters, over the last 50 years has been the human-generated excess of nutrients, mainly nitrogen and phosphorous, from industries and agriculture, transported from land to coastal waters via direct runoff and discharge from rivers, leading to nutrient enrichment and eutrophication (EEA, 2019a, 2019b; Helsinki Commission, 2023; OSPAR Commission, 2023). Eutrophication has several definitions as well as a broad shared general understanding of both drivers and effects. However, despite this and the fact that eutrophication has been addressed (but not specifically defined) in several EU directives, a commonly accepted definition of coastal eutrophication remains elusive (Andersen et al., 2006; Nixon, 2009). Here, we will distinguish between 'problem areas' from 'non-problem areas' and define eutrophication as the process whereby water bodies are negatively affected by enrichment of nutrients and organic matter. The ecological responses to this enrichment include increased macroalgal, aquatic plant, and phytoplankton growth, changes in species composition, and often lower biodiversity, leading to an unacceptable deviation from the normal structure, function, and stability of aquatic ecosystems and water quality in comparison to pristine conditions, including reduced light penetration in the water column.

The monitoring of eutrophication and its effects is a significant undertaking for EU member states, and the total assessment results of the water quality classifications of coastal and marine water bodies are significantly affected by this. Each member state reports on a national basis, using general EU guidelines adapted to national conditions. It is important to understand the extent of eutrophication in Europe for informed decision-making and effective policy formulation. Furthermore, knowledge helps formulate the necessary measures, technological innovations, and societal changes aimed at mitigating the ecological effects of water bodies.

This chapter presents the results of a standardised spatially integrated status assessment of eutrophication for all Europe's coastal, transitional and marine waters, where there are available data and defined threshold values so that the waters can be mapped into 'problem areas' or 'non-problem areas'. By analysing the data and evaluating the status assessments and policy impacts related to eutrophication, we aimed to develop a thorough understanding of this severe environmental challenge for all Europe' seas. Through international collaboration, effective policies, and increased public knowledge, we can strive for cleaner and healthier oceans for both the present and future generations.

## 5.2 Definition and measurement

In this study, we are striving to use the same method as much as possible for spatially integrated eutrophication assessment in Europe' seas, covering coastal, transitional, and marine waters, which can then be compared across regional seas. We applied the common one-out-all-out assessment principles and updated the HELCOM Eutrophication Assessment Tool (HEAT). The assessment was performed using the official EEA 100+20 km grid.

The HEAT tool is an indicator-based tool that utilises existing monitoring data together with established indicator-specific threshold values for each eutrophication indicator (e.g. Delvin et al., 2023; Helsinki Commission, 2023). The indicator groups used for the assessment were chlorophyll a concentration (chl-a), nutrient concentrations (Nitrogen and Phosphorous), benthic communities, oxygen, water transparency and submerged aquatic vegetation. They were further divided into three groups: 1) direct effects (effects on chl-a concentration, benthic communities, and submerged aquatic vegetation), 2) indirect effects (effects on water transparency and oxygen depth and levels), and 3) nutrients (concentrations of Nitrogen and Phosphorous).

The spatially integrated eutrophication status was determined using a combination of approaches (Figure 5.1) The HEAT tool was applied in the open Baltic Sea and in the open North-east Atlantic Ocean, where the indicator-specific threshold values employed by the latest HELCOM (HELCOM, 2023a) and OSPAR (OSPAR Commission, 2023) assessments were used. In the Mediterranean Sea, the HEAT tool based on indicator data and threshold values was used for waters where site-specific and waterbody-specific threshold information was available; 2) National assessments were used for the Baltic Sea coastal waters and some national waters in the Mediterranean Sea, based on EU Member States' reported EQR values and the ecological status under the Water Framework Directive or the Marine Strategy Framework Directive, and 3) Equivalent results to those from the HEAT tool assessment published in national reports and scientific publications, were used where either approached 1 or 2 could be applied.

To standardise the analysis across regions, the data were aggregated within the EEA hybrid grid (100+20 km) that covered the study area. The eutrophication indicators applied vary at both the regional and national levels, and the specific indicators used vary according to national legislation. Hence, threshold values are usually provided only for indicators used in national assessments. To ensure robust analysis and data coverage and to avoid using only one year for the integrated assessment, a minimum of three measurements per year per grid cell were required for each eutrophication indicator, ensuring that the results were based on sufficient data. Once gridded, the average values of the relevant indicators were calculated per grid cell per year, allowing for spatially consistent comparisons across different regions. The assessment was done with 1-3 of the categories included. However, the results for grid cells with only one category represented are shown with a brighter colour shade in the results.

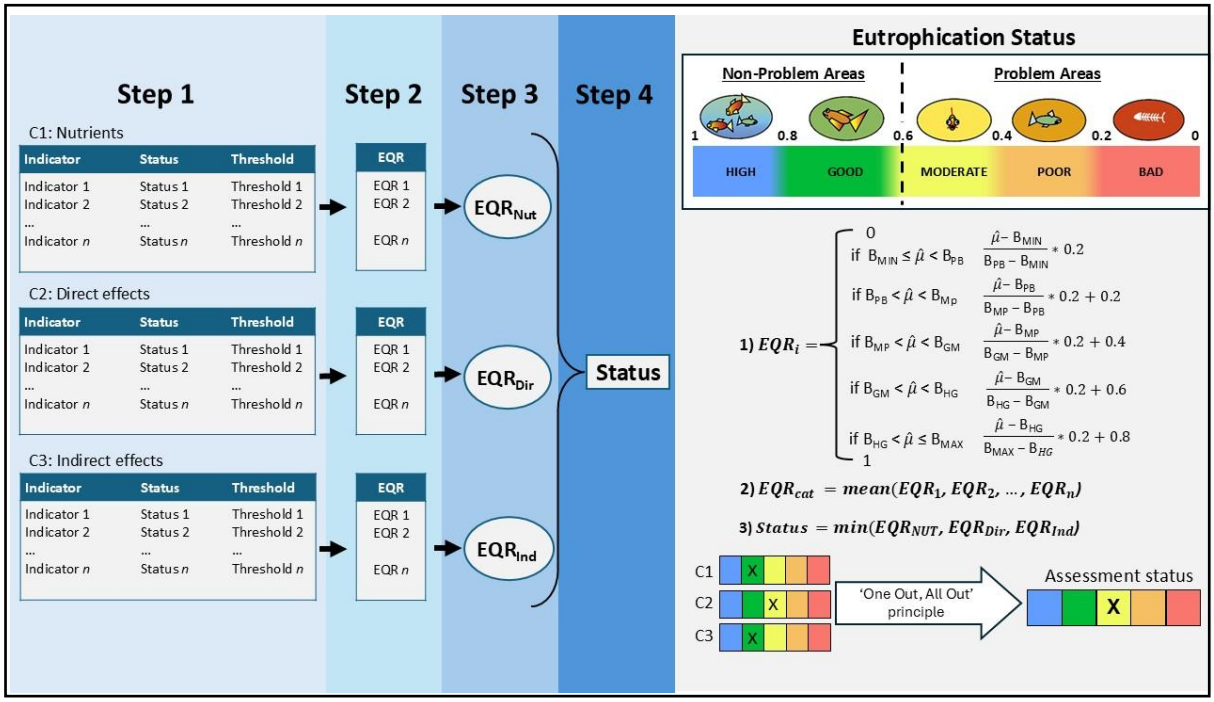


*Figure 5.1 Conceptual figure of the HEAT assessment tools where the EQR values were either (1) calculated by the HEAT tool, (2) applied from provided EQR results per indicator, or (3), applied from provided integrated assessment EQR values.*

## 5.3 Rational and policy relevance

Eutrophication in coastal, transitional, and marine waters is addressed in both the Water Framework Directive and the Marine Strategy Framework Directive, both of which aim to reduce anthropogenic perturbations in ecosystems. The next target of the WFD is to achieve a good ecological status in transitional and coastal surface waters by 2027, and the goal of achieving a good environmental status for marine waters was set to be reached in 2020 within the MSFD. Regional Sea Conventions, such as the Baltic Sea Action Plan and Barcelona Convention, also address the problems of eutrophication and strive to reduce these effects.

By conducting the same assessment over all Europe's waters with the HEAT tool the identification of eutrophication 'problem areas' and 'non-problem areas' helps showcase the spread of the impacts as well as highlighting areas with missing information. The results provide policymakers with a science-based and data-driven knowledge base that can be used to assess whether the measures taken are good enough on a broad scale, if the trends are improving, and if not, which areas need more attention or increased measures. This enables evidence-based decision making. Furthermore, mapping of eutrophication 'problem areas' and 'non-problem areas' also helps visualise the extent of eutrophication and facilitates communication of complex environmental issues to a broader audience.

## 5.4 Data collection

Monitoring data of eutrophication indicators were primarily gathered from international databases, as well as from scientific papers that have applied an integrated HEAT (or similar) assessment. The EEA marine indicator assessment dataset from ICES, EMODnet, Wise-6 (WISE Freshwater), updated in 2024, was used. This dataset contains the available WFD data for eutrophication in transitional, coastal and marine and coastal data for descriptors D5C1 (ammonium ($NH_4$), nitrate ($NO_3$), nitrite ($NO_2$), phosphate ($PO_4$), total nitrogen (TN), and total phosphorus (TP)) and D5C2 (chl-a), sampled at various depths (European Commission, 2024a; European Environment Agency (EEA), 2024; ICES, 2024). The monitoring dataset was

used for the HEAT tool assessment calculations. For coastal areas in the Baltic Sea, nationally reported EQR values provided by the HELCOM Secretariat based on national reporting under the WFD were re-used. This was also the case for some areas in the Mediterranean Sea where Nested Eutrophication Assessment Tool (NEAT) assessments were conducted, and the results were re-used and re-gridded. For the North-east Atlantic Ocean, satellite data was provided by OSPAR for chlorophyll.

Benthic datasets of the assessment results as EQR-values were added from the integrated BEAT assessment and re-used also for the integrated eutrophication assessment.

Indicator-specific threshold values for the good-moderate status class are needed to assess the eutrophication status of each indicator. The threshold values for the North-east Atlantic Ocean were provided by OSPAR and for the open sea in the Baltic Sea by HELCOM. The threshold values for national waters were gathered from national sources or scientific publications, from the Commission decision 2024/721(European Commission, 2024b), the reported thresholds in Article 8 (EEA, 2024), and from the intercalibration of threshold values for the MSFD (Vasilakopoulos et al., 2022).

The focus period in the assessment was 2015-2022, however due to the number of different sources, the temporal coverage varies. Data sets from 2010-2018 were used when newer data or threshold values were not available. For the satellite data, the period was 2014-2020.

## 5.5 Identification of ‘problem areas’ and ‘non-problem areas’

Eutrophication 'problem areas' are waters including the status classifications moderate, poor and bad and 'non-problem areas' are waters classified with good or high status. In total, 24.5 % (1691 grid cells) of the area that covers the Europe’s seas was assessed, and 75.5 % of the area remained unassessed due to insufficient data, assessments, or threshold values (Figure 5.2). However, many of the areas not assessed are offshore including e.g. the Barents Sea, the Celtic Sea and open parts of the Mediterranean Sea, which are 'non-problem areas' with little impact from land-based pollution in terms of eutrophication. Of the assessed grid cells, 685 were classified as 'non-problem areas', representing 76 % of the assessed area and 1006 grid cells were classified as 'problem areas', covering 24 % of the assessed area, covering many of the smaller grid cells (20 km) in coastal areas. The classification of each indicator group and region is shown in Figure 5.3. The percentages mentioned in this section refer to parts of the assessed area and not the number of grid cells, and results based on only one indicator group are not included.

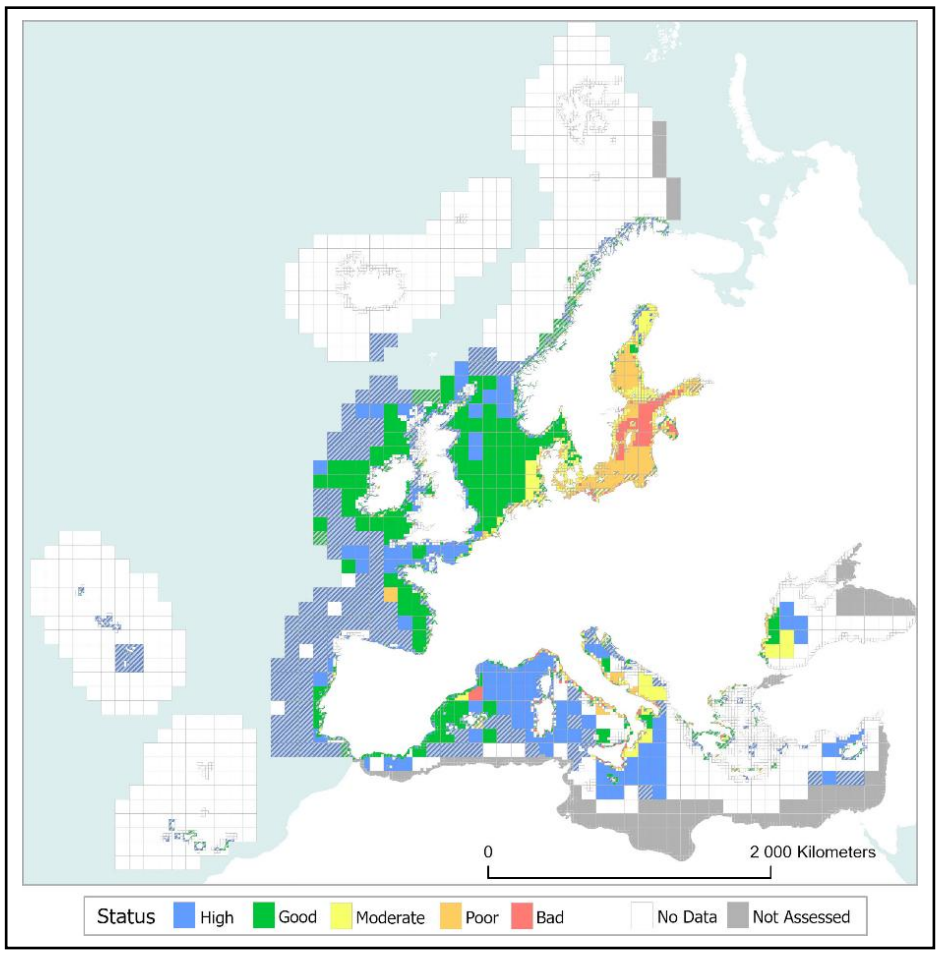


*Figure 5.2 Provisional pan-European integrated HEAT assessment of the Europe' seas. Dashed lines indicate that the assessment is based on one category of indicator groups.*

The Balic Sea stands out as a region with high data coverage (644 grid cells) but also as the regional sea with the largest areas with waters categorised as 'problem areas', almost the whole area is in a problematic state (98 %, 622 grid cells) and only 2 % was classified as 'non-problem areas' (22 grid cells), with the central Baltic in the lowest classification with bad status (Figure 5.2 and 5.3). Areas classified as 'non-problem areas' were found in the North-eastern Baltic Sea. The Baltic Sea is the most studied regional sea in terms of eutrophication, with many negative effects reported, such as massive cyanobacteria blooms in the summer and hypoxia. The drivers for the waters in moderate, poor, or bad status were from all three indicator categories.

In the Black Sea, only Romanian and Bulgarian waters were assessed (Figure 5.2 and 5.3). 61 % (11 grid cells) are categorised as 'non-problem areas' and 39 % (27 grid cells) as 'problem areas', with most grid cells classified as moderate. The indirect effects category was not classified for open seas due to lack of data.

The Mediterranean Sea was assessed using 484 classified grid cells (Figure 5.2 and 5.3). There is a lack of data from the western (Slovenia, Croatian, and Greece) areas. Most of the assessed areas were coastal regions with sporadic open seas data. Out of the assessed area, 15 % (209 grid cells) were classified as 'problem areas'. Hence, almost 85 % (275 grid cells) of the assessed area was classified as 'non-problem areas' belonging to open sea marine areas covered by 100 km grid cells, non-affected by terrestrial run-off etc.

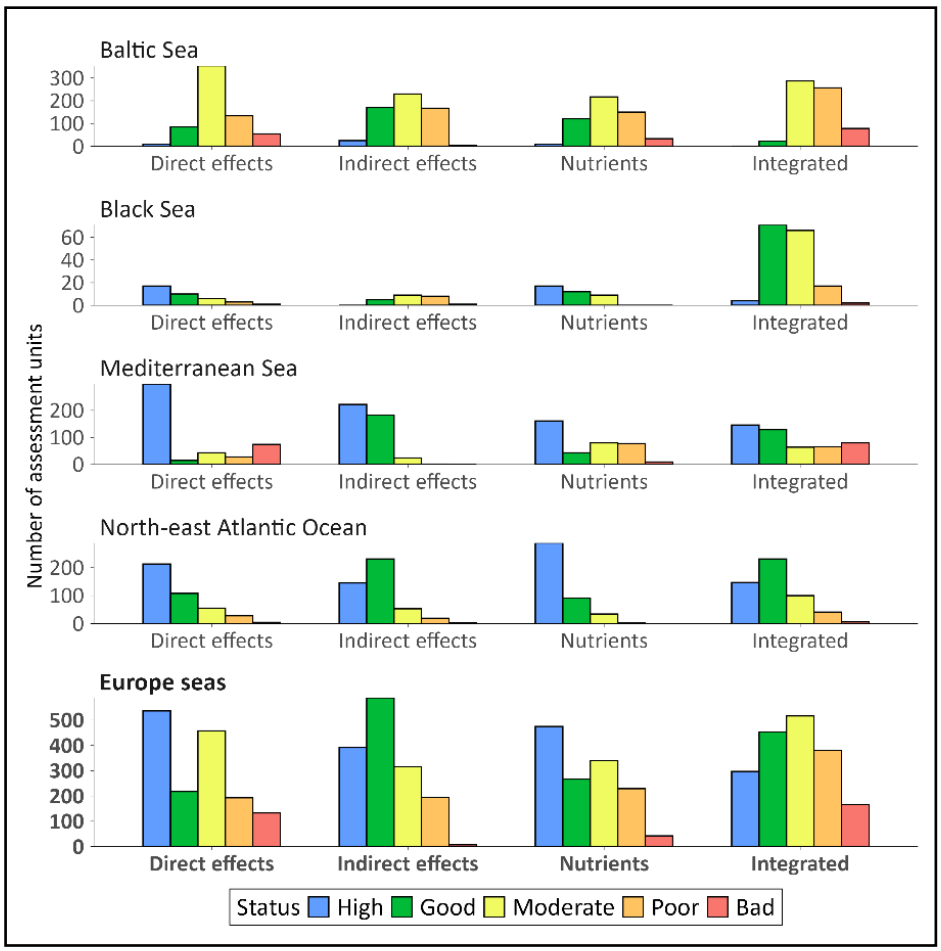


*Figure 5.3 Provisional integrated HEAT assessment by region and pan-European. Please note the different y-axes for different regions. Bar heights represent the number of assessment units, which includes both coastal grid cells (20 km) and offshore grid cells (100 km).*

In the North-east Atlantic Ocean, the opposite trend is seen as in the Baltic Sea and Black Sea (Figure 5.2 and 5.3). 94 % of the assessed areas were classified as good or high status ('non-problem areas'). The 'problem areas' (covering 6 % of the assessed area) are mostly found in coastal waters, such as in the English Channel, and on the east side of the North Sea outside the Danish west coast.

The table containing the threshold values used for the assessment can be found in Appendix 10, and the spatial regional results are presented in Appendix 11.

Mapping the results by category (direct effects, indirect effects, and nutrients) provided important insights into the overall assessment. As shown in Figure 5.4, the area coverage changed depending on the category, with direct effects (Figure 5.4A) being the most extensive and having a high impact on the assessment, particularly in the Baltic Sea, Mediterranean Sea, and Black Sea. The indirect effects category (Figure 5.4B) followed the same pattern, with large effects in the Baltic Sea. This category is largely affected by the inclusion of benthic habitats, such as invertebrates, macroalgae and angiosperms. The nutrient category (Figure 5.4C) contributes to all regional seas and is one of the major causes of eutrophication across the Europe' seas.

It is important to note that the integrated assessment combines data from all categories; when an assessment unit has data from only one category in Figure 5.2, it is shown with dashed lines. This has an important influence in the North-east Atlantic Ocean.

## 5.6 Data quality and limitations

The general data coverage for the indicators within the EEA assessment area was of high quality, featuring extensive spatial coverage in both coastal and offshore marine waters. High-quality datasets were sourced from international databases including ICES, EMODnet, WISE-6 (WISE-Marine), which facilitated the removal of quality-flagged data. For regions that could not be comprehensively assessed owing to limitations in spatial data availability in measurements or threshold values, EQR values for certain indicators in specific areas of the North Sea and Baltic Sea were sourced from OSPAR and HELCOM reports.

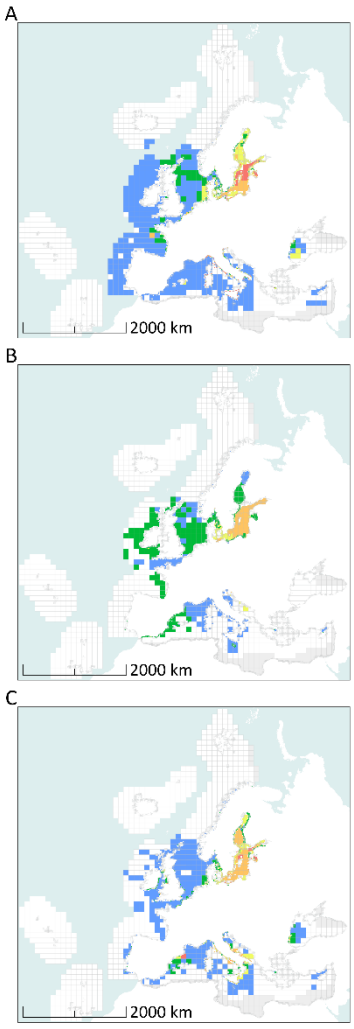


*Figure 5.4 Provisional HEAT assessment divided per indicator category, A) Direct effects, B) Indirect effects, C) Nutrients. The colour code is the same as that in Figure 2.1.*

There are several limitations to the datasets. The absence of threshold values, particularly in the Mediterranean and Black Sea regions, constrains the spatial extent and inclusion of different indicator groups for the assessment. Furthermore, the lack of standardised or intercalibrated pan-European threshold values for indicators means that nationally determined thresholds and use of indicators is utilised, especially for coastal waters. This variability results in the inability to comprehensively assess certain coastal regions, as countries employ different indicators for evaluating eutrophication or use non-inter-calibrated threshold values.

Moreover, the threshold values assigned from large basins to the EEA grid may not reflect the actual environmental reference conditions for that specific area, resulting in overestimation (or underestimation) of the integrated assessment. In addition, using pre-calculated EQR values for coastal waters limits access to the underlying raw data used in these calculations and the transparency of each state of the different indicators and indicator categories. The sourced EQR values are also defined at different levels of integration, with some nations and agencies providing fully integrated assessments, while others report at the descriptor or indicator level. This complicates the streamlining of the final, integrated European assessment. Additionally, in some areas, the assessments produced in this study were based on a single indicator, owing to the aforementioned data limitations. Consequently, the assessment is limited in capturing the complete environmental context and may lead to false positives in the assessment of the ecological conditions of those regions.

Despite the limitations in the dataset, we present a thorough study that maps and visualises the eutrophication status of the Europe´s Sea over all regions based on the current best data available. This enables comprehensive studies across the Regional Sea, as well as within regions.

## 5.7 Conclusions

The assessment of eutrophication across Europe' seas present significant challenges, particularly in the identification of eutrophicated 'problem areas'. With 75.5 % of the area remaining unassessed, several key factors contribute to the difficulty in evaluating these regions.

Although numerous international policies have been implemented to increase the assessed areas, the regional frameworks differ considerably. The Regional Sea Conventions for Europe's seas (Baltic, Black, Mediterranean, and North-east Atlantic) have developed region-specific policies. These conventions often employ different methodologies, leading to a lack of harmonisation between regions and within the same region. This inconsistency makes it difficult to apply a uniform approach for assessing eutrophication, complicating efforts to compare results or to make broad-scale conclusions. There is often a mismatch between the often intercalibrated and agreed procedures in the open sea and the methods and procedures applied to national coastal waters.

Additionally, EU Member States tend to report data in a manner that aligns with specific directives that may not focus on eutrophication. For instance, the WFD primarily emphasises the assessment of 'ecological status', whereas the Nitrates Directive focuses on nitrogen concentrations in coastal waters (Andersen et al., 2014).

To achieve comprehensive pan-European coverage, it is necessary to bridge significant gaps in regional data. These gaps span multiple areas, ranging from inconsistencies in monitoring practices and methodologies to varying ecological threshold values and status reporting across regions. Addressing these gaps is a highly complex task requiring substantial effort, resources, and coordination between member states and policymakers. A harmonized approach will be essential to ensure that all regions are assessed accurately, providing a clearer understanding of the eutrophication problem across Europe' seas.

By applying an integrated approach, we show that it is possible to comprehensively assess the eutrophication status across Europe's seas, and the method facilitates regional comparisons as well as in-depth analysis of the drivers, as the contribution and assessment results from the different indicator groups can be studied.

# 6 Assessing the cumulative negative impacts of invasive alien species in Europe's seas

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## 6.1 Introduction

The vulnerability of marine ecosystems to the introduction and establishment of Non-Indigenous Species (NIS) invading the European seas was assessed by applying the Cumulative Impacts of invasive Alien Species - CIMPAL index (Katsanevakis et al., 2016). This study represents the second pan-European assessment of the cumulative negative impacts on marine biodiversity caused by non-indigenous species, seven years after the first one included in the Multiple pressures and their combined effects in Europe's seas report (Korpinen et al., 2019), where the CIMPAL index was applied to assess and map the cumulative negative impacts of 81 selected species.

Similarly, the current assessment focuses on the identification of the most vulnerable marine regions and/or subregions, sites and habitats to the impacts caused by 126 NIS, while highlighting the most critical species, according to their invasive character in terms of spread and magnitude of impact on biodiversity, and therefore, hereafter, referred to as invasive alien species (IAS).

The new CIMPAL algorithm processes the baseline calculations of the cumulative impacts at smaller scale resolutions (500 m in this study) and only after aggregates results at larger scales (e.g., EEA grid 10x10km). This change provides a more realistic representation of the actual impact footprint and allows for better distinction between sites. It provides final CIMPAL impact scores that are less inflated than those in the previous version (used in the Korpinen et al., 2019 EEA report) but preserves better the magnitude of impact as the assessments are up or downscaled.

## 6.2 Data and methods

**Geographic scope**

The study area considered for this assessment covered the entire European Seas (Figure 6.1), including for the first time the Macaronesia, the Iceland Sea, the Norwegian Sea and the White Sea. The results are presented for the entire area of the regional seas around Europe: the Baltic Sea, the Black Sea, the Northeast Atlantic Ocean and the Mediterranean Sea. Two of these regions are further divided into subregions,

but for this report these subregions were not discriminated. In the Mediterranean Sea the assessment covered its entire area, while in the Black Sea only the EEZ of EU Member States and Turkey were considered for the assessment covered by the grid used.

A baseline resolution of 500 m was used for the calculations of the CIMPAL index, and the results were aggregated a posteriori at a 10 x 10 km scale, following the EEA grid, extended beyond marine regions area to cover coastal ecosystems with high relevance such as beaches, estuaries, coastal lagoons or salt-marshes.

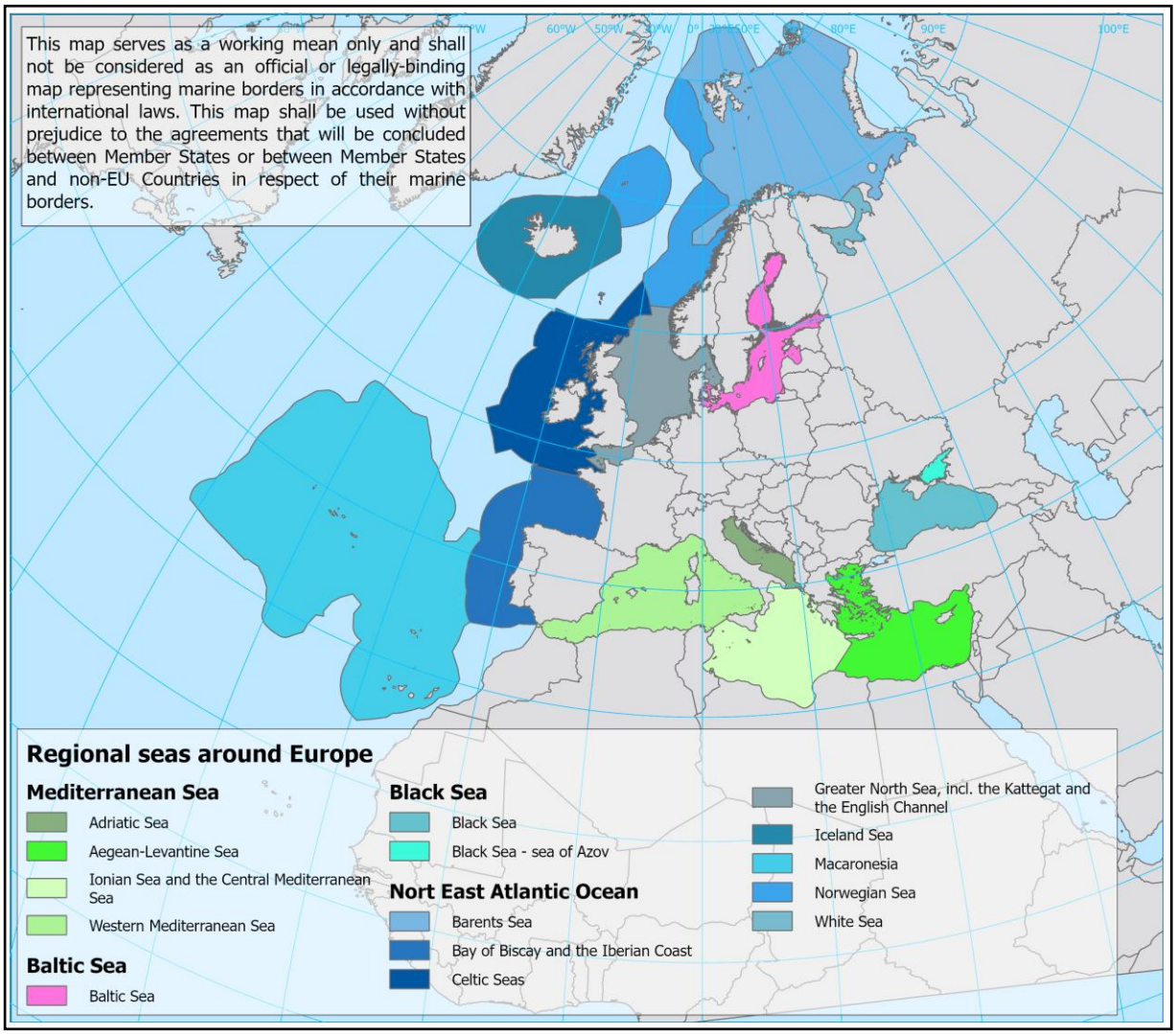


*Figure 6.1 Regional seas around Europe (European Environment Agency, 2022, CC-BY 4.0).*

**Marine habitats**

In this assessment we considered 22 habitats for which we had meaningful spatial mapping and to which species - habitat specific impacts scores could be attributed (Table 6.1). These habitats include marine as well as coastal habitats, as this is the area where most of NIS occurrences are reported. The pelagic habitat, covering both coastal and open-sea regions, was included to analyse the impacts of NIS such as jellyfish and HABs, as these phenomena primarily affect the water column habitats. Nonetheless, other species, e.g. pelagic fish, which have also been reported to negatively impact pelagic environments have also been considered.

*Table 6.1 The 22 habitat categories considered in this assessment for mapping and assigning respective species impact scores. Source of the respective spatial layers identified.*

| Habitat code | Habitat name | Description | Observations | Source |
|---|---|---|---|---|
| Wetlands | Wetlands | Saltmarshes | | EEAE Wetland Ecosystem 2018 v01 |
| EstuCoastLagIntertid | Intertidal banks of estuaries and coastal lagoons | Intertidal flats; coastal saltpans (highly artificial Salinas) | | EEAE Wetland Ecosystem 2018 v01 |
| EstuariesSubtidal | Subtidal areas of estuaries | River estuaries and estuarine waters of deltas | | EEAE Wetland Ecosystem 2018 v01 |
| CoastalLagoons | Subtidal areas of coastal lagoons | Infralittoral zones of estuaries and coastal lagoons | | EEAE Wetland Ecosystem 2018 v01 & EUSeaMap 2023 (data layers merged) |
| LittoralRock | Littoral habitats with hard substrates | Derived from beaches and dunes areas | Possible presence of rock | EEAE Wetland Ecosystem 2018 v01 |
| LittoralSed | Littoral habitats with soft bottoms | Derived from beaches and dunes areas | Possible presence of sand | EEAE Wetland Ecosystem 2018 v01 |
| SeagSeaw | Seagrasses and seaweed beds | See Table "eunis habitat linkage" for the correspondence of habitats included | | EUSeaMap 2016 & SeagrassCover EOV 2023 (data layers merged) |
| Posid | Posidonia oceanica meadows | Includes *P. oceanica* beds and facies of dead "mattes" see Table "eunis habitat linkage" | | EUSeaMap 2023 |
| Corlg | Coralligenous formations | Coralligenous platforms see Table "eunis habitat linkage" | | EUSeaMap 2023 |
| SubmCaves | Submarine caves habitats | Presence of submarine caves | | Giakoumi et al., 2013: grid cells with presence of caves (no. caves per cell; cells = 0 dropped) |
| InfraLit6 | Infralittoral very shallow habitats (<6m) | Marine waters less than six meters deep at low tide | | EEAE Wetland Ecosystem 2018 v01 |
| InfLitBio60 | Infralittoral shallow biogenic habitats (<60m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Reefs (e.g. corals) | EUSeaMap 2023 |
| InfLitRk60 | Infralittoral shallow hard-bottom habitats (<60m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Rock | EUSeaMap 2023 |

| Habitat code | Habitat name | Description | Observations | Source |
|---|---|---|---|---|
| InfLitSd60 | Infralittoral shallow soft-bottom habitats (<60m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Sediment, mud, sand, mixed, coarse | EUSeaMap 2023 |
| CrcLitBio60to200 | Circalittoral habitats of biogenic origin (60-200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Sediment, seabed, mud, mixed, coarse | EUSeaMap 2023 |
| CrcLitRk60to200 | Circalittoral hard-bottom habitats (60-200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Rock | EUSeaMap 2023 |
| CrcLitSd60to200 | Circalittoral soft-bottom habitats (60-200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Sediment, mud, sand, mixed, coarse | EUSeaMap 2023 |
| BatAbBio200 | Bathyal and Abyssal habitats of biogenic origin (>200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | | EUSeaMap 2023 |
| BatAbRk200 | Bathyal and Abyssal hard-bottom habitats (>200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Rock | EUSeaMap 2023 |
| BatAbSd200 | Bathyal and Abyssal soft-bottom habitats (>200m) | See Table "eunis habitat linkage" for the correspondence of habitats included | Sediment, seabed, mud, mixed, coarse | EUSeaMap 2023 |
| Pelagic0to200 | Pelagic waters (0 to 200m) | Water column above seabed shallower than 200 meters depth | | GEBCO |
| Pelagic200m | Pelagic waters (> 200m) | Water column above seabed deeper than 200 meters depth | | GEBCO |

**Invasive Alien Species list (IAS)**

For this European seas CIMPAL assessment we have considered 126 invasive alien species (IAS) (Table 6.2), excluding cryptogenic (Cr) species. The IAS list includes the 81 IAS in the previous 2018 EEA assessment (Korpinen et al., 2019), the 64 IAS in the previous UNEP-MAP regional Assessment for the Mediterranean in 2023 (Teixeira et al., in prep a). In addition, potentially impacting NIS at EU-level, suggested by the research community or Member States, were also considered in this new pan-European assessment. Among the 126 selected, some are NIS commonly present in harmful algal blooms (HABs), and others NIS frequently listed in jellyfish blooms.

Other species have been suggested as of potential interest, such as e.g., *Cladophora patentiramea*, *Eucheilota paradoxica*, or *Paracartia grani grani*, but for which no occurrences were available, thus excluded from this study. Similarly, other species, such as e.g. *Petricolaria pholadiformis*, that may be well established in some European seas, but which are considered to have none or minimal impacts on native biodiversity, were also not considered in the assessment.

**Occurrences data**

The distribution data available for these 126 species spans a large temporal frame, ranging a period from 1818 to 2025, with one earlier record of the species *Magallana gigas* in 1700. However, for this cumulative assessment only occurrences since 1900 were considered.

The species occurrences and distribution data (presence only) often included both point and polygon data per species, which were integrated prior to the assessment. There were n = 209 572 IAS georeferenced data points from all available years and starting from 1900 onwards. To transform point occurrences data into polygon data, we considered a species-specific Dispersion Radius (DP), a mobility trait reflecting daily range expected for a given species (Teixeira et al., in prep b). When information was found in the scientific literature to derive such a DP, a species-specific buffer, equivalent to two times the DP, was set per IAS; otherwise a DP was adopted per functional group based on main features, e.g. for sessile species DP = 1 m or for HABs or jellyfish DP = 5 km was assumed for setting a buffer diameter respectively of 2 m and 10 km with the observed point occurrence in the centre (Table 6.2). In addition to data points, for some HABs and Jellyfish species there were additional entries corresponding to large polygons referring to spatially delimited events, also integrated in the analysis.

*Table 6.2 List of selected NIS (n = 126) and respective dispersion radius (DR; m) used for point occurrences.*

| Kingdom | Phylum | Class | Order | Family | Scientific Name | DR |
|---|---|---|---|---|---|---|
| Animalia | Annelida | Polychaeta | Sabellida | Serpulidae | *Ficopomatus enigmaticus* | 1 |
| | | | | | *Hydroides elegans* | 1 |
| | | | | | *Hydroides ezoensis* | 1 |
| | | | Spionida | Spionidae | *Streblospio gynobranchiata* | 1 |
| | | | | | *Marenzelleria spp.* | 10 |
| | | Branchiopoda | Onychopoda | Cercopagididae | *Cercopagis pengoi* | 100 |
| | | Copepoda | Calanoida | Pseudodiaptomidae | *Pseudodiaptomus marinus* | 5,000 |
| | | | Cyclopoida | Oithonidae | *Oithona davisae* | 100 |
| | | | | Oncaeidae | *Triconia umerus* | 1,000 |
| | | Hexapoda | Diptera | Chironomidae | *Telmatogeton japonicus* | 500 |
| | Arthropoda | Malacostraca | Amphipoda | Caprellidae | *Caprella mutica* | 1 |
| | | | | Gammaridae | *Gammarus tigrinus* | 100 |
| | | | Decapoda | Lithodidae | *Paralithodes camtschaticus* | 100 |
| | | | | Nephropidae | *Homarus americanus* | 100 |
| | | | | Oregoniidae | *Chionoecetes opilio* | 1,000 |
| | | | | Palaemonidae | *Palaemon macrodactylus* | 100 |
| | | | | Panopeidae | *Dyspanopeus sayi* | 100 |
| | | | | | *Rhithropanopeus harrisii* | 100 |
| | | | | Penaeidae | *Metapenaeus monoceros* | 100 |
| | | | | | *Metapenaeus stebbingi* | 100 |
| | | | | | *Penaeus aztecus* | 100 |
| | | | | | *Penaeus japonicus* | 100 |
| | | | | | *Penaeus pulchricaudatus* | 100 |
| | | | | | *Penaeus semisulcatus* | 100 |
| | | | | Portunidae | *Callinectes sapidus* | 1,000 |
| | | | | | *Portunus segnis* | 1,000 |
| | | | | Varunidae | *Eriocheir sinensis* | 100 |
| | | | | | *Hemigrapsus sanguineus* | 100 |
| | | | Isopoda | Sphaeromatidae | *Paracerceis sculpta* | 100 |
| | | | Stomatopoda | Squillidae | *Erugosquilla massavensis* | 100 |
| | | Thecostraca | Balanomorpha | Elminiidae | *Austrominius modestus* | 1 |
| | Bryozoa | Gymnolaemata | Cheilostomatida | Candidae | *Tricellaria inopinata* | 1 |
| | Chordata | Ascidiacea | Aplousobranchia | Clavelinidae | *Clavelina oblonga* | 1 |
| | | | | Didemnidae | *Didemnum vexillum* | 1 |
| | | | Phlebobranchia | Cionidae | *Ciona robusta* | 1 |
| | | | Stolidobranchia | Pyuridae | *Herdmania momus* | 1 |
| | | | | | *Microcosmus squamiger* | 1 |
| | | | | Styelidae | *Botrylloides violaceus* | 1 |
| | | | | | *Polyandrocarpa zorritensis* | 1 |
| | | | | | *Styela clava* | 1 |
| | | | | | *Styela plicata* | 1 |
| | | Teleostei | Acanthuriformes | Siganidae | *Siganus luridus* | 1,000 |
| | | | | | *Siganus rivulatus* | 1,000 |
| | | | Acropomatiformes | Pempheridae | *Pempheris rhomboidea* | 500 |
| | | | Atheriniformes | Atherinidae | *Atherinomorus forskalii* | 10,000 |
| | | | Aulopiformes | Synodontidae | *Saurida lessepsianus* | 10,000 |

| Kingdom | Phylum | Class | Order | Family | Scientific Name | DR |
|---|---|---|---|---|---|---|
| | | | Carangaria incertae sedis | Sphyraenidae | *Sphyraena chrysotaenia* | 10,000 |
| | | | Carangiformes | Carangidae | *Alepes djedaba* | 5,000 |
| | | | | | *Decapterus russelli* | 10,000 |
| | | | | Dorosomatidae | *Herklotsichthys punctatus* | 10,000 |
| | | | Clupeiformes | | *Dussumieria elopsoides* | 10,000 |
| | | | | Dussumieriidae | *Etrumeus golanii* | 10,000 |
| | | | Eupercaria incertae sedis | Nemipteridae | *Nemipterus randalli* | 1,000 |
| | | | Gobiiformes | Gobiidae | *Neogobius melanostomus* | 500 |
| | | | Holocentriformes | Holocentridae | *Sargocentron rubrum* | 100 |
| | | | Mugiliformes | Mugilidae | *Planiliza haematocheilus* | 10,000 |
| | | | | | *Parupeneus forsskali* | 500 |
| | | | Mulliformes | Mullidae | *Upeneus moluccensis* | 500 |
| | | | | | *Upeneus pori* | 500 |
| | | | Perciformes | Scorpaenidae | *Pterois miles* | 500 |
| | | | Scombriformes | Scombridae | *Scomberomorus commerson* | 10,000 |
| | | | Siluriformes | Plotosidae | *Plotosus lineatus* | 1,000 |
| | | | Syngnathiformes | Fistulariidae | *Fistularia commersonii* | 10,000 |
| | | | | | *Lagocephalus sceleratus* | 10,000 |
| | | | Tetraodontiformes | Tetraodontidae | *Lagocephalus suezensis* | 10,000 |
| | | | | | *Torquigener flavimaculosus* | 1,000 |
| | | Hydrozoa | Leptothecata | Aglaopheniidae | *Macrorhynchia philippina* | 1 |
| | | | Rhizostomeae | Cassiopeidae | *Cassiopea andromeda* | 5,000 |
| | Cnidaria | Scyphozoa | | Rhizostomatidae | *Rhopilema nomadica* | 5,000 |
| | | | | | *Rhopilema sp.* | 5,000 |
| | | | Semaeostomeae | Ulmaridae | *Aurelia coerulea* | 5,000 |
| | | | | | *Aurelia solida* | 5,000 |
| | Ctenophora | Nuda | Beroida | Beroidae | *Beroe ovata* | 5,000 |
| | | Tentaculata | Lobata | Bolinopsidae | *Mnemiopsis leidyi* | 5,000 |
| | Echinodermata | Echinoidea | Diadematoida | Diadematidae | *Diadema setosum* | 100 |
| | | Bivalvia | Adapedonta | Pharidae | *Ensis directus* | 1 |
| | | | Arcida | Arcidae | *Anadara kagoshimensis* | 1 |
| | | | | | *Anadara transversa* | 1 |
| | | | Cardiida | Cardiidae | *Fulvia fragilis* | 1 |
| | | | Myida | Myidae | *Mya arenaria* | 1 |
| | | | Mytilida | Mytilidae | *Arcuatula senhousia* | 1 |
| | | | | | *Brachidontes pharaonis* | 1 |
| | | | | Margaritidae | *Pinctada radiata* | 1 |
| | | | Ostreida | Ostreidae | *Magallana gigas* | 1 |
| | Mollusca | | | | *Magallana spp.* | 1 |
| | | | Pectinida | Spondylidae | *Spondylus spinosus* | 1 |
| | | | | Chamidae | *Chama pacifica* | 1 |
| | | | Venerida | Veneridae | *Mercenaria mercenaria* | 1 |
| | | | | | *Ruditapes philippinarum* | 1 |
| | | | | Calyptraeidae | *Crepidula fornicata* | 10 |
| | | | Littorinimorpha | Strombidae | *Conomurex persicus* | 10 |
| | | Gastropoda | | Tateidae | *Potamopyrgus antipodarum* | 10 |
| | | | Neogastropoda | Muricidae | *Rapana venosa* | 50 |
| | | | | | *Urosalpinx cinerea* | 10 |
| | Porifera | Calcarea | Leucosolenida | Amphoriscidae | *Paraleucilla magna* | 1 |
| | Foraminifera | Globothalamea | Rotaliida | Amphisteginidae | *Amphistegina lobifera* | 1 |
| | Heterokontophyta | Bacillariophyceae | Chaetocerotanae | Chaetocerotaceae | *Chaetoceros spp.* | 100 |
| | Myzozoa | Dinophyceae | Gonyaulacales | Pyrocystaceae | *Alexandrium catenella* | 5,000 |
| | | | | | *Alexandrium monilatum* | 5,000 |
| | | | Gymnodiniales | Kareniaceae | *Karenia mikimotoi* | 5,000 |
| Chromista | | Dictyochophyceae | Florenciellales | Florenciellales incertae sedis | *Pseudochattonella verruculosa* | 5,000 |
| | | Pelagophyceae | Sarcinochrysidales | Sarcinochrysidaceae | *Chrysonephos lewisii* | 1 |
| | Ochrophyta | | Dictyotales | Dictyotaceae | *Rugulopteryx okamurae* | 1 |
| | | Phaeophyceae | | | *Stypopodium schimperi* | 1 |
| | | | Fucales | Sargassaceae | *Sargassum muticum* | 1 |
| | | | Laminariales | Alariaceae | *Undaria pinnatifida* | 1 |
| | | Raphidophyceae | Chattonellales | Vacuolariaceae | *Fibrocapsa japonica* | 5,000 |
| | | | | Caulerpaceae | *Caulerpa cylindracea* | 1 |
| | | | | | *Caulerpa taxifolia* | 1 |
| | Chlorophyta | Ulvophyceae | Bryopsidales | Codiaceae | *Codium arabicum* | 1 |
| | | | | | *Codium fragile* | 1 |
| Plantae | | | | | *Codium parvulum* | 1 |
| | | | | Halimedaceae | *Halimeda incrassata* | 1 |
| | | | | | *Asparagopsis armata* | 1 |
| | Rhodophyta | Florideophyceae | Bonnemaisoniales | Bonnemaisoniaceae | *Asparagopsis taxiformis* | 1 |
| | | | | | *Bonnemaisonia hamifera* | 1 |
| | | | Ceramiales | Ceramiaceae | *Acrothamnion preissii* | 1 |

| Kingdom | Phylum | Class | Order | Family | Scientific Name | DR |
|---|---|---|---|---|---|---|
| | | | | | *Antithamnion nipponicum* | 1 |
| | | | | | *Antithamnion pectinatum* | 1 |
| | | | | | *Lophocladia lallemandii* | 1 |
| | | | | Rhodomelaceae | *Polysiphonia morrowii* | 1 |
| | | | | | *Womersleyella setacea* | 1 |
| | | | Gracilariales | Gracilariaceae | *Gracilaria vermiculophylla* | 1 |
| | | | Halymeniales | Grateloupiaceae | *Grateloupia turuturu* | 1 |
| | | | Nemaliales | Galaxauraceae | *Galaxaura rugosa* | 1 |
| | Tracheophyta | Magnoliopsida | Alismatales | Hydrocharitaceae | *Halophila stipulacea* | 1 |

Species occurrence data reported for aggregated period ranges have been split by years (e.g. 2001-2004 –> 2001, 2001, 2003, 2004). Species co-occurring, i.e., with spatial overlap within a same year were considered a single observation and merged where the overlap occurred. The final occurrences used reflect data falling within the study area defined by the EEA marine grid for the European seas and cleaned of duplicate entries (at year level), i.e. eliminating any spatial overlap between species observed within a same year, using the species DP buffer overlap, described above.

The analysis integrated datasets combining information from GBIF, monitoring programs, citizen science initiatives, and the scientific and grey literature as gathered from open and closed sources. The occurrences data came from the following sources: 1) GBIF (queried as of 2025.06.25), 2) from the previous first pan-European assessment of IAS (Korpinen *et al.*, 2019), 3) from a compilation of historical data in the Portuguese mainland marine and coastal (Teixeira & Pinheiro, 2025), and 4) from the latest UNEP-MAP Regional Seas assessment for the Mediterranean in 2023 (Teixeira *et al.*, in prep a).

**Biotic interactions**

CIMPAL calculations with and without biotic interactions between IAS were both considered for comparison. Biotic interactions evidence between IAS in this study was extracted from the Global Biotic Interactions GloBI database (Poelen *et al.*, 2014). The type of interactions found between IAS in our list reflected mostly negative interactions and were predation interactions, where the prey species is harmed and thus the affecting IAS will be reducing that other species population overall impact capacity. No evidence for positive interactions between species in our list were found in the GloBI database. The 58 unique interaction pairs (Table 6.3) reflect such negative interactions affecting 38 species (focus IAS) caused by 22 species (affecting IAS) in our list.

**Impacts evidence**

This European Seas CIMPAL assessment considered only the risk of negative impacts on biodiversity from IAS. We have considered an overall impact magnitude (maximum reported) per species, for IAS, where impact magnitude is based on collected evidence of previous observed impacts of a species across regions and habitats. The impact information reported was translated into a numeric CIMPAL magnitude of impacts (MoI) scale, ranging from 0 to 8, according to Katsanevakis et *al.* (2016). The strength of the evidence (SoE) of documented impacts found for HABs and jellyfish was in general poorly reported; nonetheless both CIMPAL approaches, Precautionary and Uncertainty-Averse, were calculated. In general, IAS information regarding the maximum values of reported Magnitude of Impact for each species-habitat pair was considered. This information was extracted from the Database of Marine IAS Impacts (ShinyApp by Matos & Teixeira, 2025 and Teixeira *et al.*, in prep b). Both MoI and MoI-SoE impact weights were extracted, supporting both Precautionary and Uncertainty-Averse calculations of CIMPAL. For HABs species lacking information on impacts in biodiversity, we assumed 'harmful' as a negative impact risk and considered a default Magnitude of Impact of Moderate (MoI = 2; indicating changes at population level) based on expert judgement (SoE is limited). For the jellyfish species lacking information on impacts in biodiversity, we assumed the jellyfish outburst as posing a risk of negative impacts and considered a default Magnitude of Impact of Moderate (MoI = 2; indicating changes at population level) based on expert judgement (SoE is limited).

*Table 6.3 Invasive alien species (IAS) biotic interactions (BI) based on GloBI evidence (dataset extracted as of June 2025). All interactions refer to predation of the focus species by the affecting species and have a negative association (BI signal).*

| Focus IAS | Affecting IAS | BI signal |
|---|---|---|
| *Alexandrium monilatum* | *Magallana spp.* | -1 |
| *Alexandrium catenella* | *Magallana spp.* | -1 |
| *Alexandrium monilatum* | *Magallana gigas* | -1 |
| *Alexandrium catenella* | *Magallana gigas* | -1 |
| *Anadara transversa* | *Callinectes sapidus* | -1 |
| *Asparagopsis taxiformis* | *Siganus luridus* | -1 |
| *Asparagopsis taxiformis* | *Siganus rivulatus* | -1 |
| *Caulerpa cylindracea* | *Siganus luridus* | -1 |
| *Caulerpa cylindracea* | *Siganus rivulatus* | -1 |
| *Chaetoceros spp.* | *Ruditapes philippinarum* | -1 |
| *Chionoecetes opilio* | *Paralithodes camtschaticus* | -1 |
| *Cladophora patentiramea* | *Rhithropanopeus harrisii* | -1 |
| *Crepidula fornicata* | *Homarus americanus* | -1 |
| *Dyspanopeus sayi* | *Callinectes sapidus* | -1 |
| *Ensis directus* | *Callinectes sapidus* | -1 |
| *Gammarus tigrinus* | *Callinectes sapidus* | -1 |
| *Gammarus tigrinus* | *Mnemiopsis leidyi* | -1 |
| *Halophila stipulacea* | *Penaeus semisulcatus* | -1 |
| *Halophila stipulacea* | *Siganus luridus* | -1 |
| *Hemigrapsus sanguineus* | *Callinectes sapidus* | -1 |
| *Homarus americanus* | *Homarus americanus* | -1 |
| *Magallana spp.* | *Callinectes sapidus* | -1 |
| *Magallana gigas* | *Callinectes sapidus* | -1 |
| *Marenzelleria spp.* | *Mnemiopsis leidyi* | -1 |
| *Mercenaria mercenaria* | *Callinectes sapidus* | -1 |
| *Mercenaria mercenaria* | *Hemigrapsus sanguineus* | -1 |
| *Mercenaria mercenaria* | *Rapana venosa* | -1 |
| *Metapenaeus monoceros* | *Metapenaeus monoceros* | -1 |
| *Metapenaeus monoceros* | *Upeneus moluccensis* | -1 |
| *Metapenaeus stebbingi* | *Metapenaeus monoceros* | -1 |
| *Metapenaeus stebbingi* | *Upeneus moluccensis* | -1 |
| *Mnemiopsis leidyi* | *Beroe ovata* | -1 |
| *Mya arenaria* | *Homarus americanus* | -1 |
| *Mya arenaria* | *Callinectes sapidus* | -1 |
| *Neogobius melanostomus* | *Neogobius melanostomus* | -1 |
| *Oithona davisae* | *Mnemiopsis leidyi* | -1 |
| *Palaemon macrodactylus* | *Palaemon macrodactylus* | -1 |
| *Paralithodes camtschaticus* | *Chionoecetes opilio* | -1 |
| *Paralithodes camtschaticus* | *Paralithodes camtschaticus* | -1 |
| *Penaeus aztecus* | *Decapterus russelli* | -1 |
| *Penaeus aztecus* | *Lagocephalus sceleratus* | -1 |
| *Penaeus aztecus* | *Callinectes sapidus* | -1 |
| *Penaeus japonicus* | *Decapterus russelli* | -1 |
| *Penaeus japonicus* | *Lagocephalus sceleratus* | -1 |
| *Penaeus pulchricaudatus* | *Decapterus russelli* | -1 |
| *Penaeus pulchricaudatus* | *Lagocephalus sceleratus* | -1 |
| *Penaeus semisulcatus* | *Decapterus russelli* | -1 |
| *Penaeus semisulcatus* | *Lagocephalus sceleratus* | -1 |
| *Potamopyrgus antipodarum* | *Neogobius melanostomus* | -1 |
| *Pterois miles* | *Fistularia commersonii* | -1 |
| *Rapana venosa* | *Callinectes sapidus* | -1 |
| *Rhithropanopeus harrisii* | *Callinectes sapidus* | -1 |
| *Rhithropanopeus harrisii* | *Neogobius melanostomus* | -1 |
| *Rhithropanopeus harrisii* | *Palaemon macrodactylus* | -1 |
| *Ruditapes philippinarum* | *Rapana venosa* | -1 |
| *Sargassum muticum* | *Callinectes sapidus* | -1 |
| *Sargassum muticum* | *Siganus luridus* | -1 |
| *Urosalpinx cinerea* | *Callinectes sapidus* | -1 |

For IAS, impacts across different habitat types were considered (Table 6.1). The impacts of HABs and jellyfish attributed by expert judgement were restricted to the pelagic habitats, as little detail as available for further habitat impact scrutiny in most impact evidence. Weights used for scoring the Magnitude of impact for the precautionary and uncertainty averse CIMPAL assessments will be made available as annex.

**CIMPAL index**

The CIMPAL index expanded formula (Equation 6.1) was calculated at a baseline assessment of 500 m and aggregated at 10x10 km grid cell resolution, where a mean CIMPAL per cell was calculated (sensu Teixeira et al., in prep b). This new algorithm accounts for biotic interactions between IAS, that can have an antagonistic or a synergistic effect on another co-occurring IAS effect.

*Equation 6.1:*

$$I_c = \sum_{i=1}^{n}\sum_{j=1}^{m} A_i H_j w_{i,j} \pm \sum_{i=1}^{n}\sum_{k=1}^{n}\sum_{j=1}^{m} A_i A_k H_j w_{i,j} f_{i,k}$$

where: Ic refers to the cumulative impact score in a specific study area cell; $A$i refers to the population state of species i in the specific cell, standardised to range between 0 and 1; $H$j is an index of the extent of habitat j in the cell. $w$i,j is the impact weight of species i at habitat j, estimated as a combination of species i impact magnitude assessment and the strength of the reported evidence. The total number of IAS n and of marine habitats m included in the analysis; Ak represents the population state of species k, an alien species interacting with alien species i, exhibiting either positive or negative effects. Ak values are standardised to range between 0 and 1. fi,k refers to the interaction effect of IAS k on IAS i, taking a value of -1 for maximum negative interactions.

## 6.3 Results of CIMPAL assessment

The 126 selected NIS within the EEA marine area are distributed across all European regional seas but mostly along coastal areas (Figure 6.2). For the Black and the Mediterranean Seas, the knowledge on NIS coverage of areas under non-EU Member States is more limited. NIS distribution, since 1900, includes NIS species that are also considered in many HABs and jellyfish assessments.

Only 11.5 % of the total marine area of the European seas has been negatively affected by IAS. This relatively low percentage reflects also the fact that a huge offshore area was now considered in the assessment. The cumulative impact is much less pronounced in open marine environments, but the impact footprint caused by NIS that negatively affect the biodiversity of marine ecosystems in Europe is very much widespread along coastal waters (Figure 6.3a). More than 26.5% of Europe's coastal area, i.e. their habitats, is estimated to be impacted by invasive alien species, varying per regional sea: 20.6% in the NE Atlantic, 50.1% in the Mediterranean, 8.4% in the Baltic Sea and 56.9% in the Black Sea, here considering only coastal areas of EU Member States and Turkey.

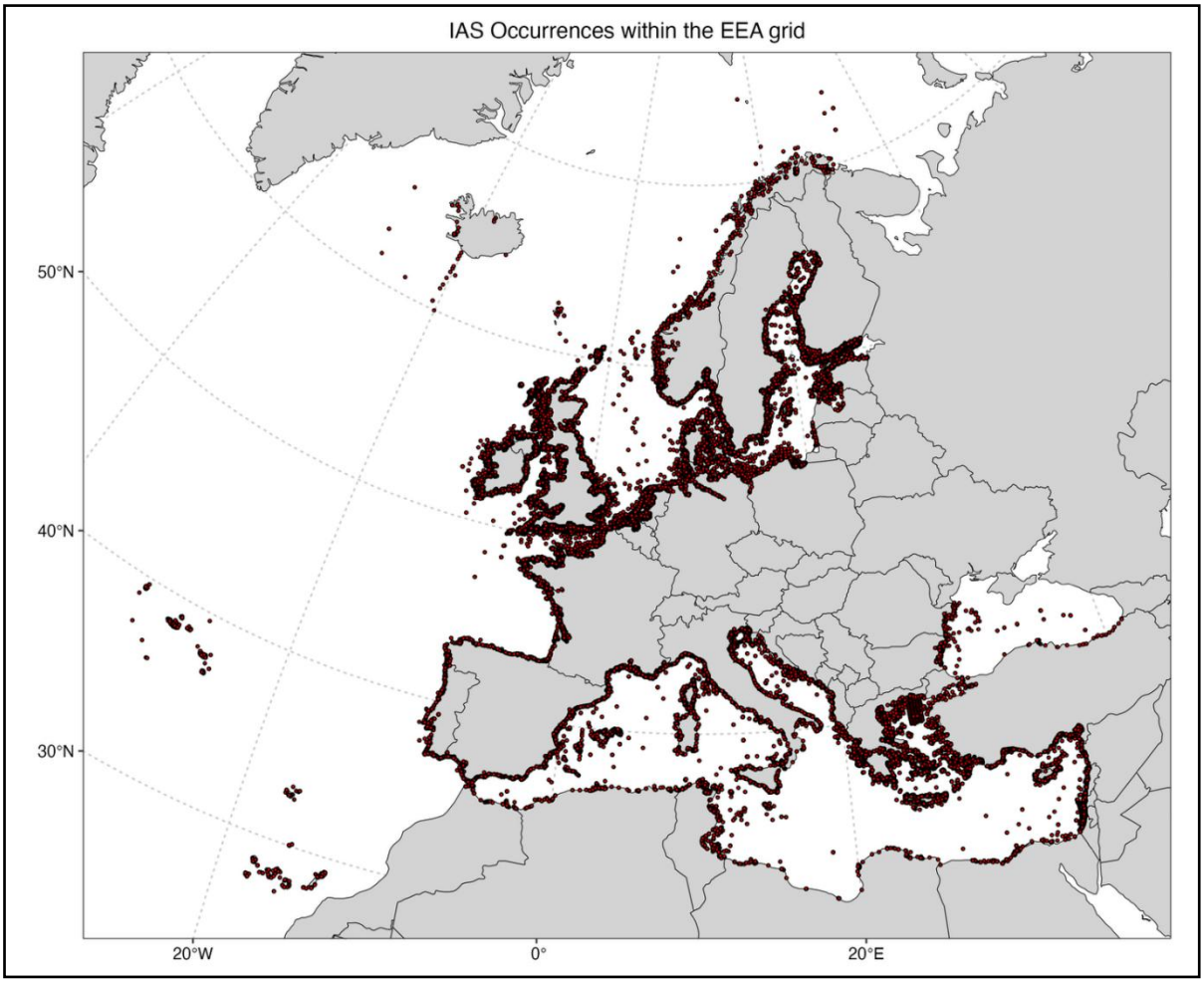


*Figure 6.2 Point occurrences of 126 Invasive Alien Species (IAS) within the area of the European seas since 1900, including nine invasive alien species that often present in Harmful Algal Blooms (HABs) and Jellyfish blooms events.*

The marine regions or subregions most negatively affected by the presence and impacts of IAS are the Aegean Sea and Levantine Sea, the inner Adriatic and the Black Sea, as well as coastal areas along the North Sea in the Atlantic. Considering only the areas (cells) with impacts, a low average impact score (Ic = 3.3) was found across all Europe. The aggregated CIMPAL (10x10km) results, following a Precautionary Approach, showed mean impact scores per grid cell ranging from 0 (no impact) to a maximum of 32.8 ± 8.7 SD (Figure 6.3a). Nonetheless, the cumulative observed impact scores in a single cell can reach very high values (Icmax cumulative per cell = 13113) with a mean cumulative impact score per cell, before area correction, of Icmean cumulative per cell = 1326.5. This means that there can be particular sites within a 100 km2 area (cell) under a very high pressure from the negative impacts caused by IAS, and other areas with minimum or no impact.

These impact scores may change slightly if we take biotic interactions into account (Figure 3b). At this stage, we only found evidence supporting negative biotic interactions between co-occurring IAS, thus the effect of such interactions in this assessment is to reduce the overall mean impact scores observed per cell, with a maximum observed of Icmean = 27.8). This occurs as some IAS predate on others, mitigating some of their negative impacts, i.e. by exerting some population control. Despite that, the overall mean impact observed across impacted areas (Icmean = 3.3) as well as the overall area vulnerable to negative impacts stays the same (11.5%).

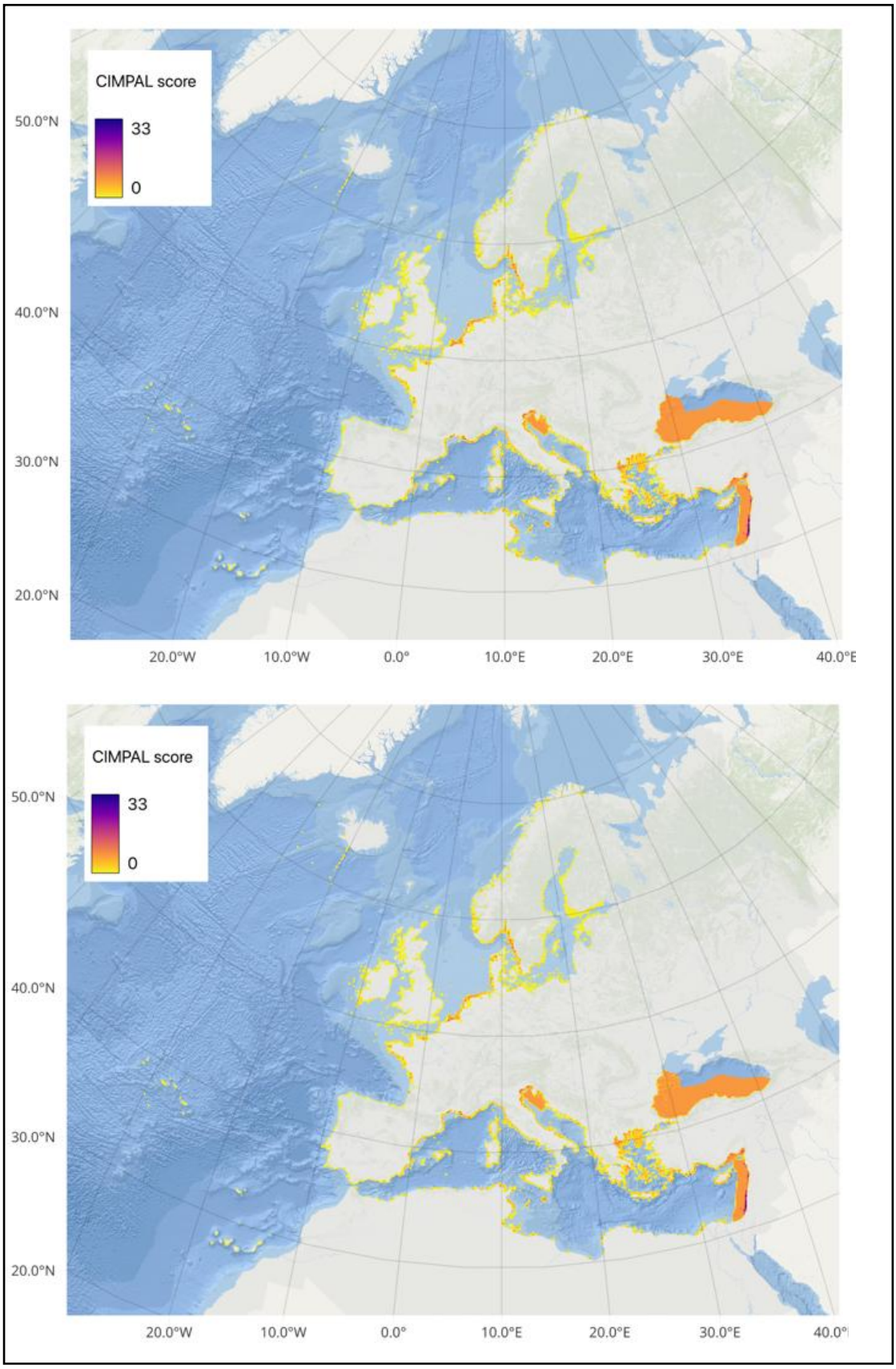


*Figure 6.3 Spatial cumulative negative impacts of invasive alien species (IAS n = 126) observed in European Seas since 1900 to 2025, according to CIMPAL index (mean scores per 10x10km) using a) a Precautionary Approach (top) and b) also acknowledging species biotic interactions (bottom).*

If the CIMPAL index is instead calculated using an Uncertainty-Averse Strategy (Katsanevakis et al., 2016), in which the magnitude of impact of a given species in a particular habitat is downgraded when the evidence supporting that impact information is low, then the CIMPAL scores change in accordance (Figure 4). The difference between both approaches provides a useful confidence map showing the percentage of reduction in the CIMPAL score. This spatially explicit mapping of the uncertainty allows to identify areas where the cumulative impact assessment must be taken with caution, and also areas where further studies should be conducted to better understand the actual nature and magnitude of the negative impacts of IAS on marine biodiversity.

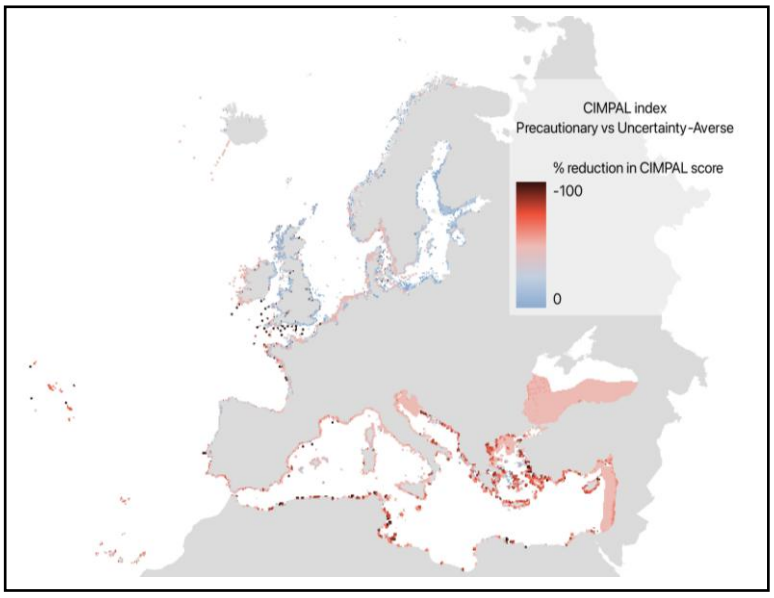


*Figure 6.4 Percentage reduction in CIMPAL index score when using an Uncertainty-Averse Strategy. The areas with a higher observed difference in the cumulative negative impact score (with or close to 100 %) from the Precautionary Approach represent areas where the confidence in the assessment is lower due to limited evidence on impacts supported by the literature and current knowledge.*

A close-up to marine subregions with high impact scores from IAS (**Figure 5**) illustrates how CIMPAL index can provide a useful management tool supporting spatial management.

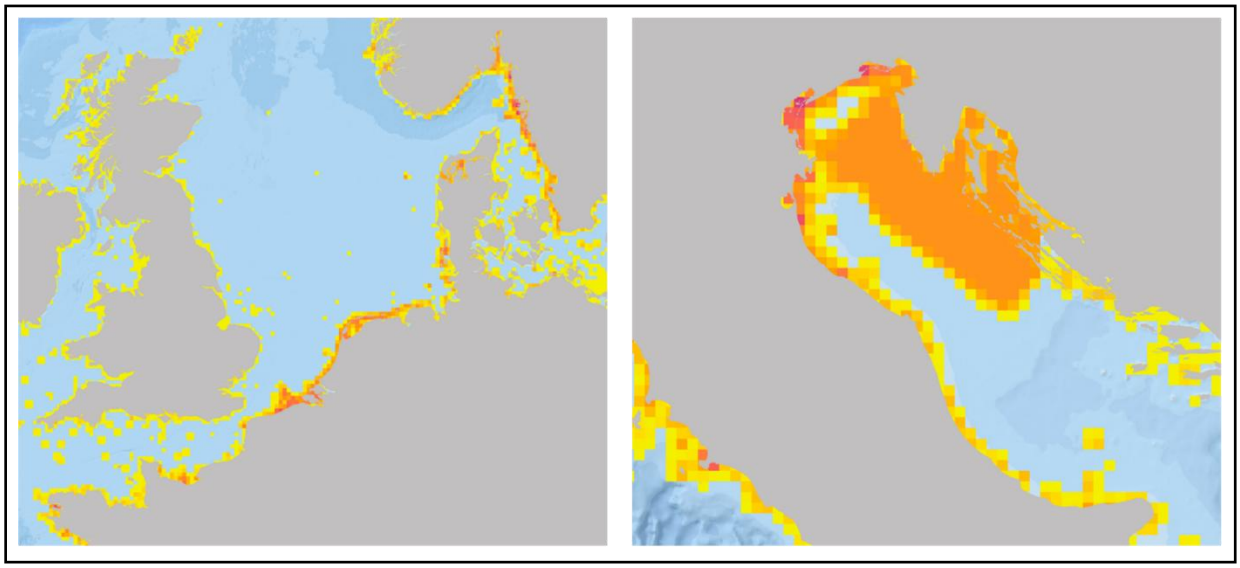

*Figure 6.5 Spatial cumulative negative impacts of invasive alien species observed in a) the Greater North Sea, incl. the Kattegat and the English Channel and in the b) inner Adriatic Sea in the Mediterranean, since 1900 to 2025, according to CIMPAL index (Precautionary Approach without accounting for Biotic Interactions, aggregated at 10x10km).*

**Impacted habitats by invasive species**

The marine habitats are not equally impacted by the 126 species. Figure 6.6 shows how the assessed marine habitats are impacted. Subtidal lagoons, *Posidonia* seagrass meadows, intertidal estuaries and lagoons and surface pelagic habitat are clearly more impacted than other habitat types.

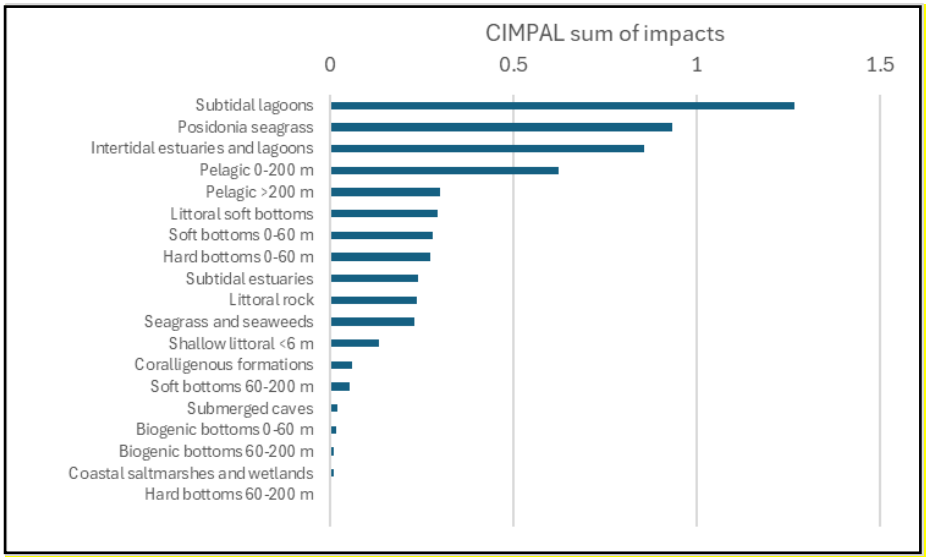


*Figure 6.6 Ranking of marine habitats based on the cumulative impacts from 126 invasive species. The higher cumulative impacts indicate more invasive species with higher ecological impacts within the habitat locations.*

An example of level of impact in one priority habitat across Europe (Figure 6) is that of Seagrasses and Seaweeds, including also *Posidonia oceanica* meadows (Table 2).

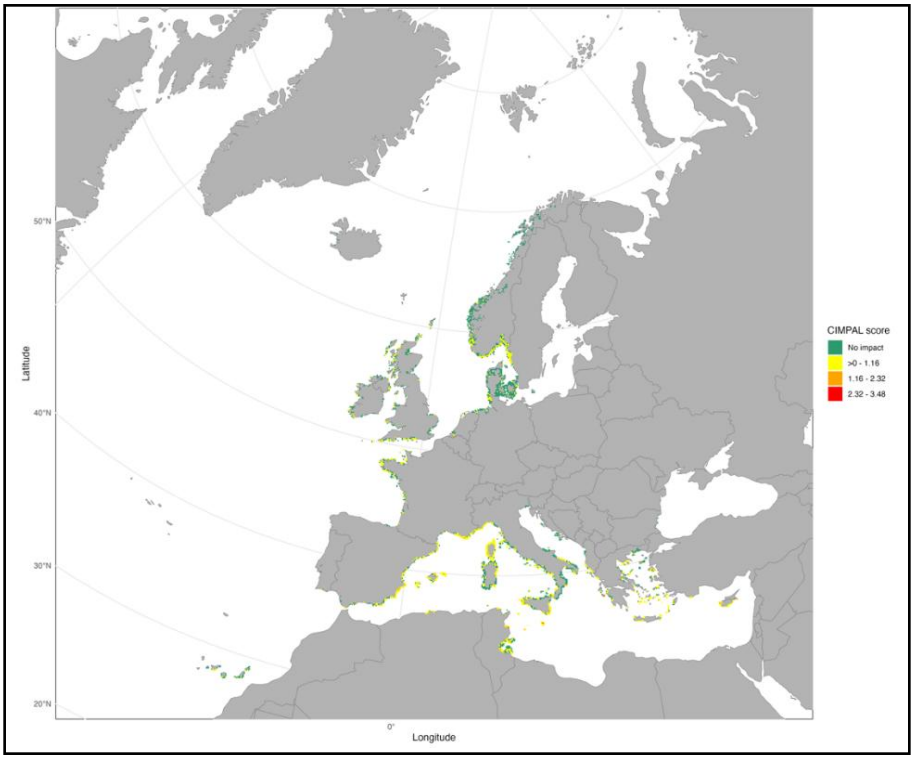


*Figure 6.7 Spatial cumulative negative impacts of invasive alien species observed in Seagrass and Seaweed beds habitats, including also* Posidonia oceanica *meadows, across Europe. CIMPAL mean impact score at 10x10km scale, Precautionary Approach without biotic interactions.*

## 6.4 Conclusions

The current assessment provides a much more realistic evaluation of the actual negative impact footprint of IAS in marine ecosystems and their biodiversity. The current cumulative impact of IAS estimates that close to 27% of Europe's coastal area is impacted by invasive species against the previously overestimated 50 % of coastal area impacted (Korpinen et al., 2019). This is a result of inclusion of a wider area in the assessment, potentially less scrutinised and with less information (e.g., Macaronesia islands, Iceland) but also an improvement of our computation capacity to undertake these large-scale assessments at finer resolutions (from 10x10km to 500m baseline calculations with a posteriori aggregation to 10x10km). We expect to provide from now on a regular reproducible CIMPAL index workflow to allow temporal comparisons and trends analyses. Wide-range assessments pose challenges in terms of data compilation, harmonisation and integration, but allow to test CIMPAL latest implementations towards easier and automated reproducibility of large-scale environmental assessments using standardised indices approaches.

We have compiled different sources of spatial information to generate EU-level updated mapping for 22 habitat categories considered in this study; we have produced an automated workflow for extracting biotic interactions from the Global Biotic Interactions database GloBI (will be made available in GitHub as an open repository); used an automated workflow using the Marine IAS Impacts database ShinyAPP for summarising literature evidence on negative impacts of IAS in biodiversity and extract that information in a standardised way; produced an automated script to extract country level species occurrences from GBIF for countries within European seas area and integrate that data with other sources, removing duplicates based on location and year level (will be made available in GitHub as an open repository). These automated procedures are moving our research towards increased accuracy and reproducibility, and this workflow tested for this pan-European can be re-used in other scales and locations. This is a crucial step towards meeting more effective policy implementation goals.

Nonetheless, there are still scientific challenges to consider when running these wide-scale biological invasions impact assessments, namely the list of species to be considered and the effect of the number of species included in the assessments (see for e.g. Zengeya et al., 2025); the usage of point occurrence vs. area based species and the Dispersion Radius used as buffers to point occurrences; and choice of the relevant temporal and spatial scale of aggregations according to the context and objectives of the assessments.

This pan-European large-scale assessment of the impacts caused by invasive alien species brings the EU closer towards achieving the goals of supporting MSFD implementation and other EU regulations, as well as the Regional Sea Conventions regional assessment programmes and Member States implementation of the MSFD, the EU Regulation on Invasive Alien Species and their national Biodiversity Strategies.

# 7 Marine litter and MALT-based assessment

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This chapter is anchored in preparatory work carried out in 2023 and 2024 and updates carried out in 2025. The work in 2023 and 2024 focused on improving the spatial coverage of the identification of 'marine litter problem areas' and 'non-problem areas' compared to (Veiga et al. 2022) and (Murray et al. 2023). The updates in 2025 have focused on 1) access to supplementary data sets and getting a better spatial coverage of the assessment and 2) doing the assessment with the GES4SEAS toolbox instead of an older version of the MALT tool.

## 7.1 Introduction

Marine litter, in particular its plastic component, has become a major problem for all oceans and seas over the past decades with significant implications for the marine life. Solution of this problem poses a complex and multidimensional challenge. EU Member States have, under the MSFD, initiated monitoring of marine litter including microplastics in Europe's seas mostly focusing on litter on beaches, floating at the sea surface, settled on the seafloor or interactions by marine biota.

This chapter demonstrates the preliminary results from the Marine Litter Assessment Tool (MALT) a multimetric indicator-based assessment tool. The tool is designed to identify and map potential 'problem areas' (PA) and 'non-problem areas' (NPA) regarding marine litter. Such spatial analyses can not only support the implementation of the MSFD but also contribute to the development and implementation of national or regional Marine Litter Action Plans.

## 7.2 Definition and measurement

The Marine Litter Assessment Tool (MALT) is a multi-metric indicator-based status assessment tool. MALT is designed to integrate multiple indicators of pollution by marine litter but is dependent on the availability of accepted threshold values for the counts of litter items (Murray et al., 2023). Three indicators are used in MALT:

i. the count of beach litter items per 100 m, threshold value 20 items per 100 m
ii. the count of seafloor litter items per km2, threshold value[1] 15.4 items/km$^2$
iii. the count of floating micro-litter particles per m3 in surface water samples, threshold value* 10 particles/m$^3$.

For each indicator an Ecological Quality Ratio (EQR) is calculated within the EEA hybrid assessment grid, the grid combines 20 km resolution grid cells in coastal areas and 100 km cells in offshore areas (>20 km from coastline). The EQR is calculated by normalizing the indicators values to a scale from 0 to 1, with five status classes at equal intervals. To normalize the observed value of the indicator parameter to the common EQR scale, at least three indicator values are required: 1) the threshold value, determining the boundary between good and moderate status i.e. the value of the indicator corresponding to an EQR = 0.6. For example, the value of 20 items per 100 m beach; 2) the value of the indicator corresponding to reference

*[1] Note that for (ii) and (iii) the threshold values are not recognized but used for consistency with previous assessment (Veiga et al., 2022).*

conditions (EQR = 1.0). For example, in the case of a count of items of litter, this could be a maximum of one item: 3) the value corresponding to the worst possible case (EQR = 0). Having the normalized EQR value for each of the three indicators, the overall assessment status within an assessment unit is determined by the 'one-out-all-out' (OOAO) principle. If only a single indicator is available, that status classification is applied to the assessment unit. A conceptual illustration of the methodology is shown in Figure 7.1.

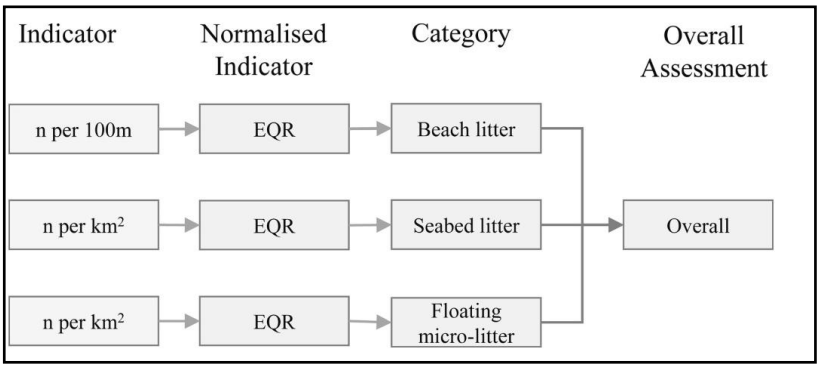


*Figure 7.1 Conceptual illustration of the MALT methodology.*

## 7.3 Rational and policy relevance

For Europe, a turning point for addressing marine litter was the option of the European Union (EU) Marine Strategy Framework Directive (MSFD; Anon., 2008) and the associated two Commission Decisions on criteria and methodological standards on the Good Environmental Status of marine waters (European Comission, 2010; European Commission, 2017). These Decisions specify the 11 MSFD Descriptors and their criteria as determined by the MSFD, including Descriptor 10 'Properties and quantities of marine litter do not cause harm to the coastal and marine environment'. More recently, the EU has adopted the EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' (European Commission, 2021b). The action plan specifies several zero pollution targets to be met by 2030 under EU law, Green Deal ambitions and in synergy with other community initiatives. These targets include reductions of 'plastic litter at sea (by 50%) and microplastics released into the environment (by 30%)'. The general ambition is to support a better understanding of the drivers and pressures related to marine litter, and how these relate to the current state and trends of pollution.

## 7.4 Data collection

Beach litter data was derived from from three different sources: 1) EEA Marine Litter Watch (MLW) (https://www.eea.europa.eu/en/datahub/datahubitem-view/fc3a040f-ee73-4747-97c1-458c02108cf5 2) OSPAR Beach Litter Database (https://odims.ospar.org/en/search/?datastream=marine_litter_beach_monitoring; beachlitter.ospar.org/list) and 3) EMODnet Chemistry (https://emodnet.ec.europa.eu/geoviewer/#!/ ;chemistry/Litter maps). The MLW data contained observations from 2013 to 2021 covering 1,424 individual beaches whilst the OSPAR data covered 124 beaches from 2012 to 2018. EMODnet data contained observations from 2010 to 2020 at 1,225 beaches. There is some overlap between the datasets. All the OSPAR observations were found to be included in the EMODnet dataset whilst 664 beaches were included in both EMODnet and MLW datasets. Where several litter item counts were made on the same beach on different dates, the median of the counts was used

Seafloor litter was extracted from the EMODnet dataset 'European seafloor litter standardized, harmonized and validated datasets 2006/2021 v2021'. The extracted dataset used for the analysis covers 20,551 surveys at 20,021 sites in 22 countries, taken in the period 2010–2021

The floating micro-litter data were extracted from the EMODnet dataset '[European floating micro-litter standardized, harmonized and validated datasets 2011/2020 v2021]'. The extracted dataset used for the analysis covers 839 trawl surveys used on 60 cruises in the period 2011–2020

## 7.5 Identification of 'problem areas' and 'non-problem areas'

The preliminary status results for the integrated MALT assessment and identification of 'problem areas' (PA) and 'non-problem areas' (NPA) are presented in Figure 7.2. The integrated MALT assessment covered 28.1% of the area of Europe's' seas. Status was estimated based on at least two indicators in 22.4% of the total assessment area. Assessment based on three indicators was possible in >0.1% of the total assessment grid. Of the assessed area 30.4% (809,200 $km^2$) was found to be in 'High' or 'Good' status was whilst 'Moderate', 'Poor' or 'Bad' status accounted for 69.6% (1,856,705 $km^2$).

The region with best coverage was the Baltic Sea, where status was determined for 48.1% (191,412 $km^2$) of the total 398,220 $km^2$. Of the assessed area, 33,612 $km^2$ (17.6%) had a 'High' or 'Good' status whilst 157,800 $km^2$ (82.4%) had a status of 'problem area' (i.e., 'Moderate', 'Poor' or 'Bad'). The assessment coverage for the North-east Atlantic was 28.9% (1,958,746 of 6,779,340 $km^2$). Within the assessed area, 24.2 % (474,015 $km^2$) had a 'High' or 'Good' status. 75.8% (1,484,731 $km^2$) were classified as having Moderate', 'Poor' or 'Bad' status, giving the region the second-best status. The region having the best assessed status was the Mediterranean Sea. Here 62.3% (301,172 $km^2$) of the 483,321 $km^2$ assessed were classified as having 'High' or 'Good' status. The remaining 37.7% (182,148 $km^2$) of the assessed area were found to have 'Moderate', 'Poor' or 'Bad status. Assessment coverage for the Mediterranean was 24.7% of the total 1,955,799 $km^2$.

The Black Sea had the poorest coverage of all regions with 32.426 out of 346,730 $km^2$ (9.4%). This was also the region with the worst assessed status. Only 1.2% (400 $km^2$) was found to have 'High' or 'Good' status whilst 98.8% (32.026 $km^2$) had 'Moderate', 'Poor' or 'Bad' status.

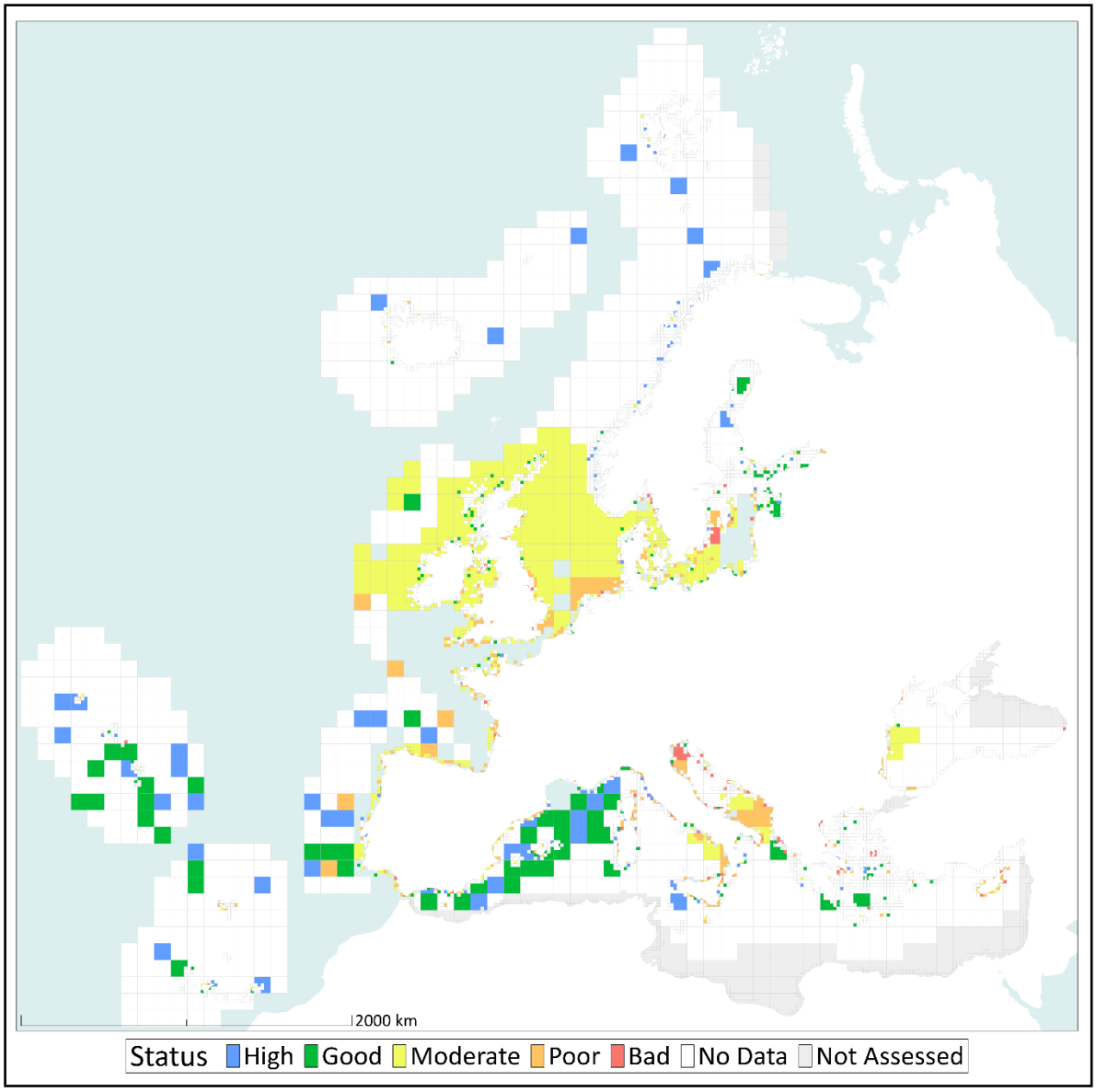


*Figure 7.2 Identification of 'non-problem areas' (classified with 'High' or 'Good' status) and 'potential problem areas' (classified 'Moderate', 'Poor' or 'Bad') with respect to marine litter in Europe's Seas (based on accessible data covering the period 2013 - 2023.*

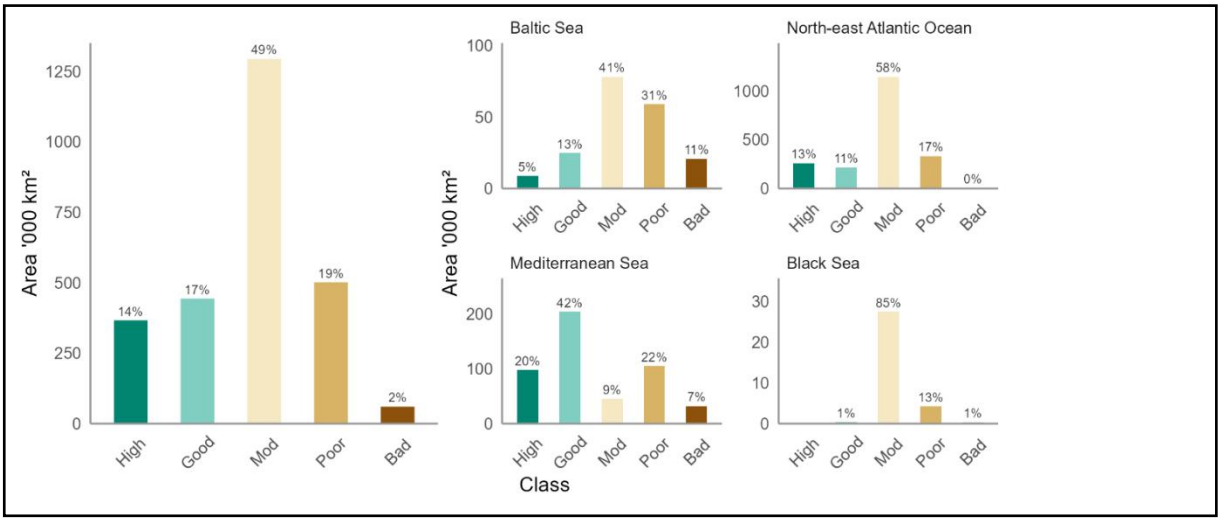


*Figure 7.3 Sum of areas by assessed integrated status class. Areas classified as 'High' and 'Good' are identified as 'non-problem areas' whilst 'Moderate' (labelled 'Mod'),'Poor' and 'Bad' are identified as 'problem areas' with respect to marine litter. Summaries are shown for all areas (left) and the four regions of the Baltic Sea, Northeast Atlantic Ocean, Mediterranean Sea and Black Sea. Percentages indicate the area for each class relative to the area assessed.*

## 7.6 Trends

A comparison of beach litter counts using data collected from EMODNET showed no significant reductions in counts of litter items from the period 2015-2106 to 2020-2021. Comparisons were made including all data across Europe's seas as well as for litter counts only from EU member states. A further 4 comparisons were made by dividing the data from EU countries into the regional seas which they are represented before repeating the analyses (see Fig 7.4).

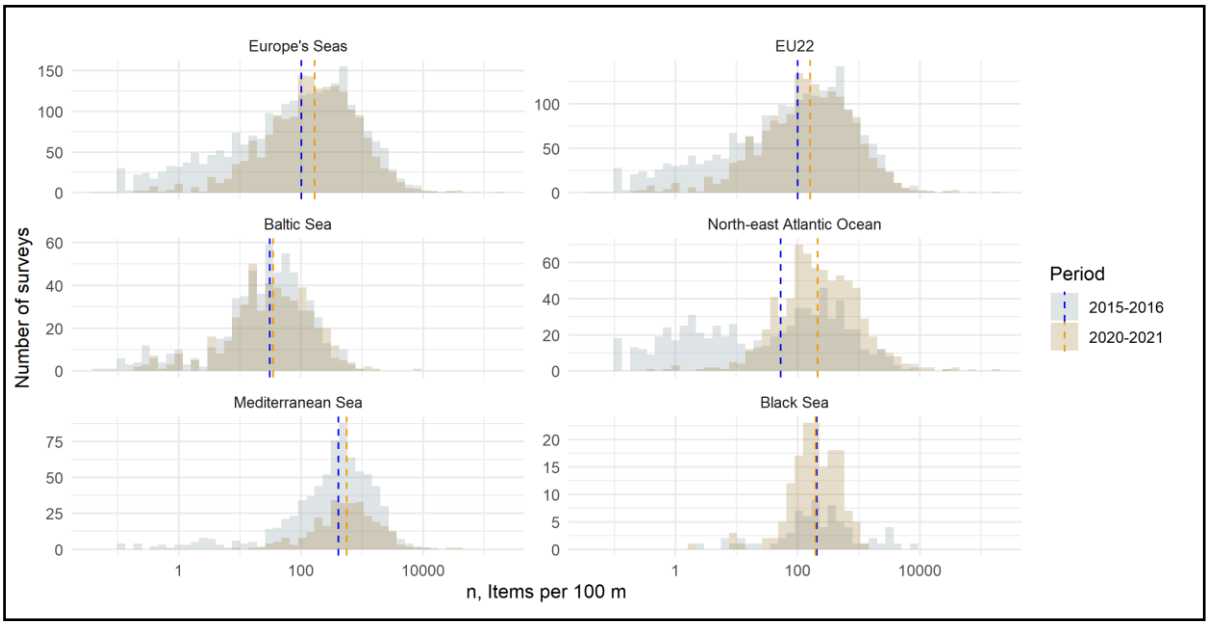


*Figure 7.4 Comparison of beach litter survey counts (no items per 100m) in the periods 2015-2016 and 2020-2021, including data across all of Europe's Seas, using data only from 22 EU member states and within 4 regions. The dotted lines show the median item count for each period.*

## 7.7 Data quality and limitations

MALT is a recent addition to the toolbox of multi-metric assessment methods, alongside BEAT, HEAT, and CHASE—well-established tools applied in multiple international marine assessments. As MALT follows a comparable methodological framework, the primary limitations stem from the quality, completeness, and spatial coverage of the input data rather than from the tool itself. Marine litter was only recently incorporated as an indicator within European environmental assessments under the Marine Strategy Framework Directive (MSFD, Descriptor 10). Consequently, the spatial distribution of available observations is limited, with notable gaps in monitoring coverage across several regions. In addition, threshold values for seabed litter and floating microlitter have not yet been established at the European level, which constrains the possibility for definitive status classification. To address this uncertainty, MALT introduces a classification of 'potential' problem areas—a feature not applied in the other thematic assessment tools. Despite these limitations, the assessment is based upon internationally recognised and quality-controlled datasets, including Marine Litter Watch, OSPAR, and EMODnet Chemistry, thereby enhancing confidence in the reliability of the results. Nonetheless, the limited spatial and temporal coverage as well as absence of threshold values, should be considered when interpreting the findings.

## 7.8 Conclusions

The preliminary MALT assessment reveals that marine litter continues to be a widespread challenge across European seas. While only 28.1% of the total sea area could be evaluated — and only 22.4% with assessments based on more than one indicator — the results within the assessed areas consistently show a predominance of poor status, with ~70% of the assessed areas identified as 'problem area'. Significant regional differences also emerge: in the Baltic Sea, 82.4% of the assessed area was in Moderate–Bad status, while the Black Sea showed the poorest conditions with 98.8% classified as a problem. In contrast, the Mediterranean displayed the highest share of Good–High status (62.3%). These findings demonstrate both the spatial extent of marine litter and the considerable gaps in observational coverage, emphasizing the need for more coordinated and systematic monitoring to support robust, Europe-wide assessments.

# 8 Towards a new MSY-based assessment tool

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This chapter presents the development and initial testing of a prototype Stock Evaluation and Assessment Tool (SEAT), designed to provide an integrated assessment of the sustainability of commercially exploited fish and shellfish stocks across Europe's seas. The tool combines the two operational MSFD Descriptor 3 criteria - fishing pressure (D3C1) and biomass status (D3C2) - using MSY-based (Maximum Sustainable Yield) reference points derived from official stock assessments. By normalising and integrating F/FMSY and B/BMSY indicators, SEAT offers a harmonised, regionally comparable index that reflects the dual pressure-state nature of D3. The prototype is applied across multiple stocks to examine its consistency, spatial coverage and suitability for European-wide, threshold-based assessments. This approach strengthens coherence with other thematic assessment tools and provides a basis for future operationalisation of D3 within an integrated marine assessment framework.

## 8.1 Introduction

The EU Marine Strategy Framework Directive (MSFD; 2008/56/EC) requires Member States to achieve Good Environmental Status (GES) across 11 environmental descriptors. Descriptor 3 (D3) addresses commercially exploited fish and shellfish populations and evaluates their status based on three primary criteria: fishing mortality (D3C1), reproductive capacity via spawning stock biomass (D3C2), and population age/size structure (D3C3). While operational indicators and thresholds for D3C1 and D3C2 are widely applied through MSY-based stock assessments, implementation of D3C3 remains limited, largely due to the absence of harmonised, regionally agreed indicators and reference points.

Fisheries in the EU are managed under the Common Fisheries Policy (CFP), which aims to restore and maintain fish stocks above levels capable of producing Maximum Sustainable Yield (MSY) (EC, 2013). Annual stock assessments provided by the International Council for the Exploration of the Sea (ICES) and the General Fisheries Commission for the Mediterranean (GFCM) generate estimates of fishing mortality (F), spawning stock biomass (SSB), and their associated MSY reference points (FMSY and BMSY). These assessments form the scientific basis for CFP management decisions (e.g., TACs) and the MSFD D3 GES evaluations.

- European-wide multi-metric indicator-based assessments have already been developed for several MSFD descriptors, including Biodiversity (D1), Eutrophication (D5), Contaminants (D8) and Marine Litter (D10) (see EEA 2019a; Murray et al. 2023). To the best of our knowledge, a comparable, harmonised European-wide assessment framework for D3 (commercial fish and shellfish) remains largely absent. While ICES (2012) explored several possible approaches through selected case studies, this work did not result into the development of an operational or MSFD-aligned assessment framework. The objective of this pilot study is therefore to develop and test a prototype index employing i) available assessments and stock-specific MSY reference points, and ii) principles analogous to those applied in the context of the MSFD thematic assessments. In conducting a thematic evaluation of the status of commercial fish and their stocks in Europe's seas, MSY-based reference points serve as assessment criteria (i.e., threshold or target value) to demarcate between 'good' and 'not-good' status, while observed F and SSB values represent monitoring status in a given year - comparable to the threshold-indicator

structure applied in D1, D5, D8, and D10 assessments. Given that both monitoring data and stock-specific assessment criteria are publicly accessible, it is possible to address questions such as:

- What is the status of individual commercially exploited stocks within Europe's seas?
- How does stock status vary across Europe's marine regions?
- Can European scale 'problem areas' and 'non-problem areas' be identified for commercially exploited stocks?

The following sections introduce and test the SEAT tool, which follows the general thematic multi-metric assessment logic, using threshold-based indicators, normalised scoring, spatial aggregation, and identification of 'problem' and 'non-problem' areas. Although SEAT does not replace legal MSFD GES determinations, which are stock-specific and follow the one-out-all-out (OAOO) rule, it offers a complementary tool to support European-scale marine assessments.

## 8.2 Definition and measurement

The SEAT prototype builds on the Maximum Sustainable Yield (MSY) concept, using the two key biological reference points: fishing mortality at MSY (FMSY) and stock biomass at MSY (BMSY, or where unavailable, alternative reference points such as MSYBtrigger or Bpa).

Fishing pressure (F) represents the rate at which fish are removed from a population. The reference point FMSY defines the level of fishing mortality consistent with achieving Maximum Sustainable Yield (MSY) in the long term, and the ratio F/FMSY indicates whether exploitation exceeds sustainable levels (overfishing occurs when $F \geq FMSY$).

Stock biomass (B), typically expressed as spawning stock biomass (SSB), reflects reproductive capacity. BMSY denotes the biomass required to produce MSY, and the ratio B/BMSY indicates whether stock size is sufficient to sustain maximum yields (a stock is considered overfished when $B < BMSY$). While persistent overfishing often results in depleted biomass, pressure and state do not necessarily change in parallel and must therefore be interpreted jointly.

Together, these reference points provide a complementary pressure-state perspective for assessing fisheries sustainability, allowing more informed and balanced fisheries management decisions across European waters.

Under Commission Decision (EU) 2017/848 implementing the Marine Strategy Framework Directive (MSFD), Good Environmental Status (GES) for commercial fish stocks requires that both criteria are met simultaneously: fishing mortality at or below FMSY (D3C1) and biomass at or above BMSY (or Bpa where BMSY is unavailable) (D3C2). In the absence of operational D3C3 indicators, assessments rely on these two criteria under a one-out–all-out approach, whereby failure of either prevents a stock from achieving GES.

**SEAT Methodological Framework**

SEAT operationalises these MSY-based indicators within a harmonised European assessment framework by rescaling F/FMSY and B/BMSY to a continuous 0–1 scale, consistent with other multi-metric tools. Stocks are assigned to a single MSFD (sub)region or ecoregion (hereafter referred to collectively as regions for simplicity) based on their principal distribution, with finer spatial units used where possible. Only stocks with both indicators available for the target period are included.

Figure 8.1 presents a schematic overview of the workflow, from stock level indicators to regional classifications. Each assessed stock is evaluated against the MSFD Descriptor 3 criteria for fishing pressure (D3C1)

and biomass status (D3C2) using MSY-based reference points (FMSY and BMSY). To reflect prevailing status and reduce interannual variability, values averaged over 2019–2023 are used. Stock-level ratios (F/FMSY, B/BMSY) are then normalised using capped MSY thresholds adapted from exploratory ICES (2012) rescaling work: for F/FMSY, values ≤1 score 1 and values ≥1.6 score 0 (linearly interpolated in between and inverted); for B/BMSY, values ≥1 score 1 and values ≤0.6 score 0 (linearly interpolated in between) (Figure 8.1, formulas 1 and 2). These thresholds are not formal MSFD guidance but enable integrated comparison across criteria. The resulting pressure (PR) and state (SR) scores are combined using predefined weights to obtain a composite score for each stock (Figure 8.1, formula 3). Composite scores are then aggregated across stocks within each region to derive a regional-level SEAT index. Regional averages are finally classified using the MSFD five-class GES colour scale (Bad–Poor–Moderate–Good–High), enabling comparison with other thematic descriptor assessments and the identification of 'problem areas' and 'non-problem areas.

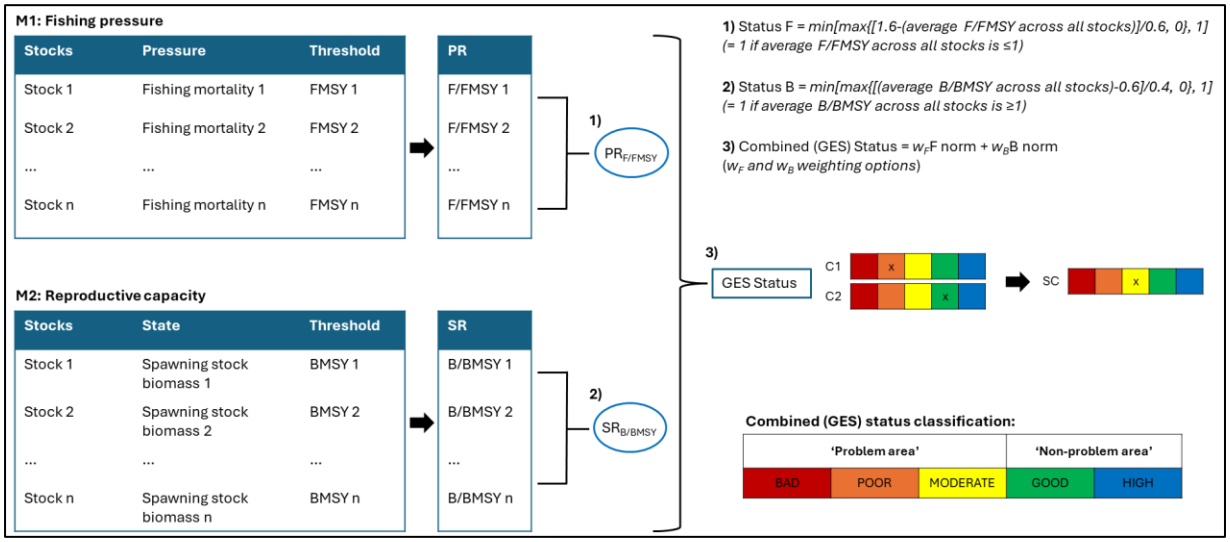


*Figure 8.1 Schematic representation of the SEAT assessment workflow.*

Regional assessments combine the normalised F/FMSY and B/BMSY indicators with equal weights (0.5 each), reflecting their equal importance for stock sustainability. An optional supplementary metric calculates the proportion of stocks meeting both D3C1 and D3C2, consistent with the MSFD's one-out, all-out principle. The composite index is expressed as:$\text{GES}_{\text{combined}} = w_F\, F_{\text{norm}} + w_B\, B_{\text{norm}} + w_P\, P_{\text{GES}}$

**Data sources**

Stock assessment data were obtained from:

- ICES Stock Assessment database https://www.ices.dk/data/assessment-tools/Pages/stock-assessment-graphs.aspx
- STECF 24-01 ad hoc - CFP Monitoring (and Annexes) https://stecf.jrc.ec.europa.eu/documents/d/stecf/stecf-24-01-adhoc-annexes

These data are compiled yearly to produce the EEA indicator on the Status of commercial fish and shellfish stocks in Europe' seas and can be obtained from the MAP-package.zip. Description of the full data processing can be found here: GitHub - ices-tools-dev/ETC-indicators: Functions and notes for creating indicators for the ETC.

Data availability differs across regions. The North-east Atlantic benefits from long-standing, annually updated ICES assessments. In contrast, many GFCM stocks in the Mediterranean follow multiannual

assessment cycles, resulting in variable temporal coverage and fewer stocks with both FMSY and BMSY-based indicators, although recently more consistent.

## 8.3 Rational and policy relevance

The integration of both indicators enhances the policy coherence and relevance of the tool. Although the CFP frames MSY as a biomass-based objective, FMSY provides the operational basis for achieving the CFP's environmental objective of 'restoring and maintaining populations above biomass levels capable of producing MSY' and serves to guide short-term management measures such as annual fishing opportunities (TACs). The CFP does not mandate biomass to always remain above BMSY; rather, it requires that F be set at levels that restore and maintain stocks above BMSY over time. However, managing F alone does not ensure ecological sustainability, as reducing fishing pressure to sustainable levels does not always lead to biomass recovery. In contrast, the MSFD is status-oriented and assesses both pressure (F) and state (B) when determining GES. This places greater emphasis on ecological recovery and recognises that biomass typically responds more slowly to management.

Integrating F/FMSY and B/BMSY within SEAT therefore strengthens policy coherence, as it reflects both exploitation control and the biological condition of stocks. More specifically, it enhances policy relevance by:

- capturing the dual nature of sustainability (pressure + state)
- providing a transparent, transboundary assessment framework
- allowing consistency with other threshold-based descriptors, and
- supplying a complementary tool for evaluating regional progress toward MSFD GES.

## 8.4 Results

**Temporal trends**
For the temporal analysis, three-year rolling averages were calculated across all available stocks, producing smooth European-wide trends that reduce short-term fluctuations and highlight long-term developments.

Figure 8.2, showing European-wide FMSY trends, reveals a marked historical decline in sustainability throughout the second half of the twentieth century, reaching its lowest point during the 1990s when overfishing was widespread. From the early 2000s onwards, however, the trend indicates a steady recovery, which can be linked to successive CFP reforms, more effective quota regulation, and improved management. By 2023, average fishing mortality levels had returned to values consistent with good environmental status, suggesting that exploitation is now broadly sustainable across European waters. In contrast, the BMSY trend tells a more cautious story. Biomass levels declined in parallel with rising fishing mortality but lagged in their recovery. While the reduction of fishing pressure in recent decades has allowed some rebuilding, the average biomass across European stocks only recently approached the boundary of non-problematic status. This discrepancy highlights the ecological inertia of fish populations: while fishing efforts can be reduced quickly through management, the rebuilding of stock biomass requires much longer timeframes.

**Identification of 'problem areas' and 'non-problem areas'**
For the spatial analysis, the most recent five years of data (2019-2023) were averaged for each stock, then aggregated by ICES and GFCM subregions. The resulting values were classified using GES colour scale, which provides a standardised framework for comparing conditions across different marine areas. This

approach allows the temporal and spatial dimensions of fisheries sustainability to be assessed simultaneously, and for both indicators to be compared directly.

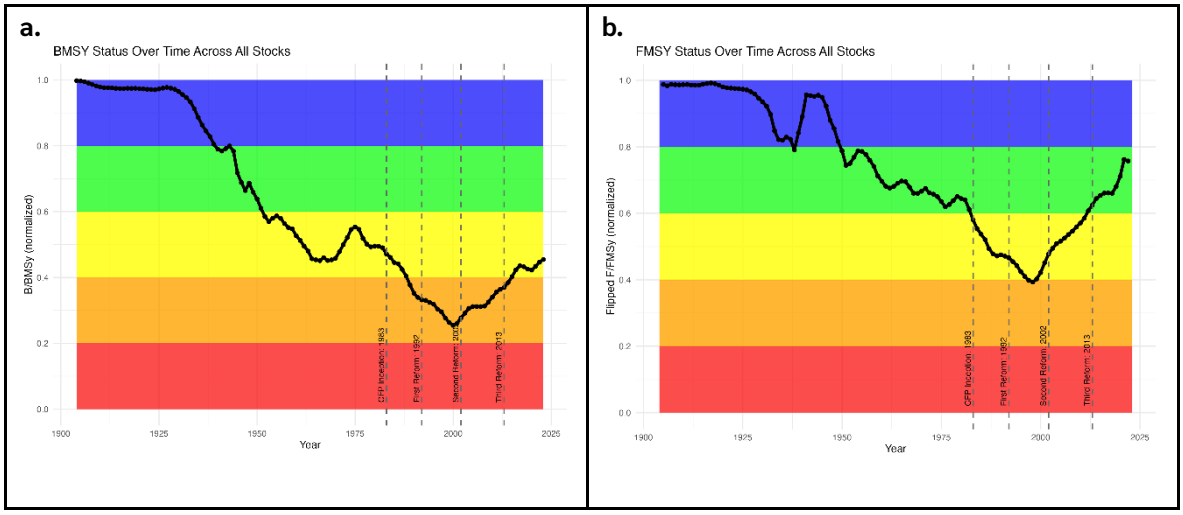


*Figure 8.2 Time-series for both BMSY (a) and FMSY (b) indicators with GES color scale and CFP reforms.*

Figure 8.3 shows the spatial representation of averaged FMSY values and reveals that large areas of the North-east Atlantic have reached favourable conditions, while regions such as the western Mediterranean and the central Baltic remain under moderate pressure. This reflects both the effectiveness of regional management in northern waters and the continued challenges in southern regions, where enforcement and compliance are more difficult.

However, the BMSY map reveals a less optimistic picture. Even in areas where FMSY suggests that fishing mortality is under control, biomass levels often remain below the thresholds required for long-term sustainability. This is particularly evident in the Mediterranean and parts of the Baltic, where persistent low biomass indicates that decades of overfishing have left stocks slow to recover despite reductions in fishing effort. Together, the two maps highlight a mismatch between exploitation levels and stock abundance, underlining the importance of considering both indicators in parallel.

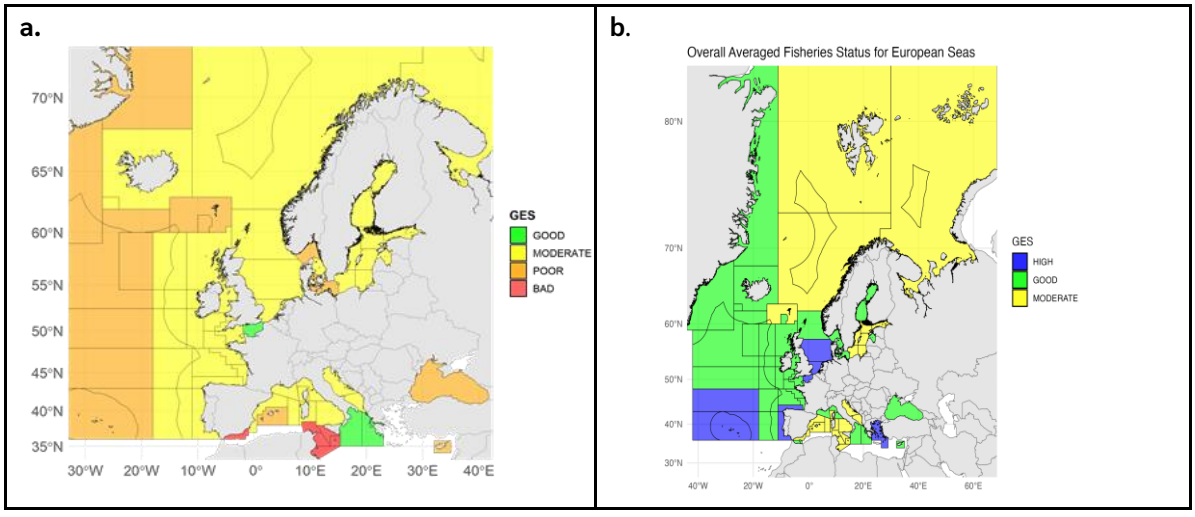


*Figure 8.3 5-year average GES status for European stocks for both BMSY (a) and FMSY (b) indicators.*

When looking at the percentages of stocks following the sustainability criterion for the timeframe of 2019-2023, the difference in sustainability between regions is illustrated. This shows the difference in fisheries management depending on the region of interest. The important data gaps are illustrated in Figure 8.4, showing the limitations of the dataset to accurately describe the situation in European waters. Table 8.1

below illustrates the average value per ecoregion for each and showing the number of stocks with available data for each indicator. Both Figure 8.4 and Table 8.1 provide a clear understanding of the dataset independently of its usage in the analysis for Descriptor 3.

**Results for the SEAT combined index**

Of 187 assessed stocks with at least one MSY-based indicator for 2019-2023, both F/FMSY and B/BMSY values were available for 130 stocks (70%). Of these, 55 stocks met both D3C1 and D3C2 thresholds, representing 29% of all assessed stocks, or 42% of stocks with complete information.

Figure 8.4. highlights substantial regional differences in data coverage and the proportion of stocks meeting MSFD D3 thresholds. In the North-east Atlantic, particularly the Celtic Seas, Greater North Sea, Bay of Biscay & Iberia, and Widely regions, there is a higher number of fully assessed stocks and a larger proportion of stocks meeting both the fishing mortality and biomass criteria. The Baltic Sea, Black Sea and northern areas show more moderate performance, with fewer fully assessed stocks in sustainable condition. In contrast, the Mediterranean regions perform poorly, with a high proportion of overexploited stocks and extensive data gaps, especially in the Central and Eastern Mediterranean, where sustainability remains very low.

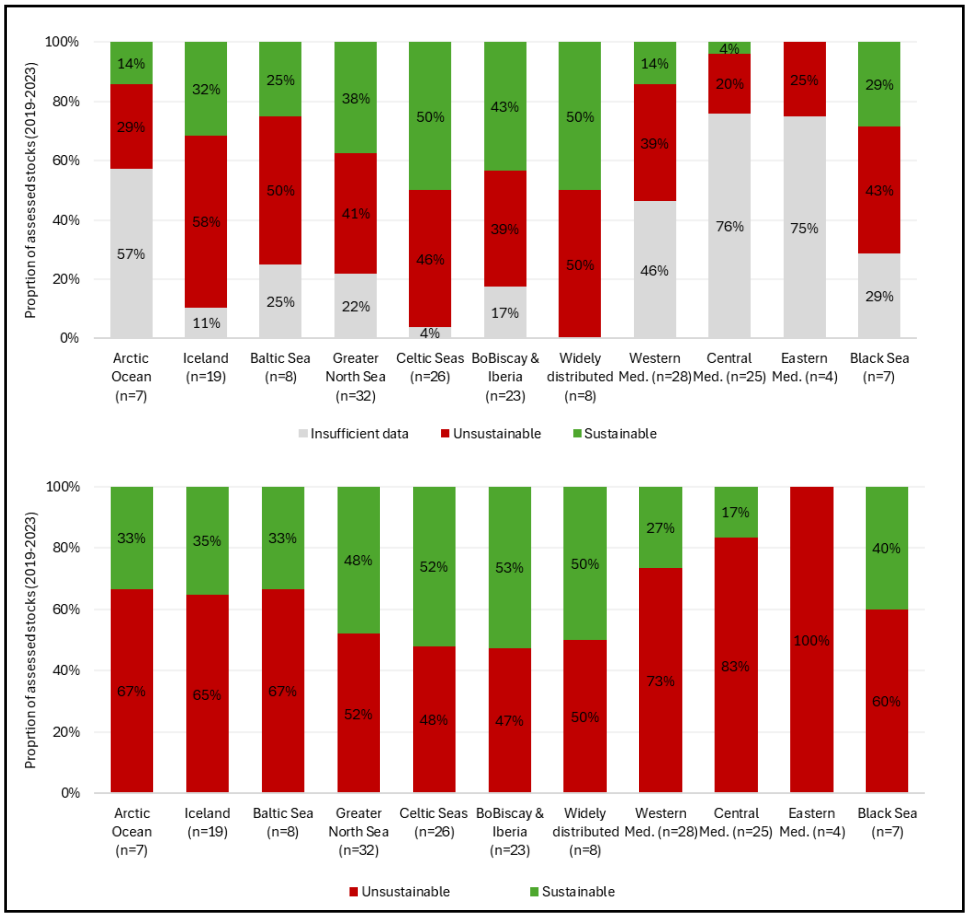


*Figure 8.4 Proportion of assessed commercial fish and shellfish stocks (2019–2023) by data availability and sustainability status across ecoregions, shown for (top) all assessed stocks and (bottom) only stocks with sufficient data to evaluate both fishing mortality (F/FMSY) and biomass (B/BMSY)*

Figure 8.5 illustrates the relationship between F/FMSY and B/BMSY for the 130 stocks with sufficient information to determine GES under criteria D3C1 and D3C2. The distribution of points across the four quadrants of the plot reveals the wide range of stock conditions observed across regions, highlighting cases where fishing pressure and biomass status align as well as diverge.

The lower-right quadrant of the figure (green area) contains stocks that are both sustainably fished and biologically healthy, characterised by fishing pressure at or below FMSY and biomass at or above BMSY. In contrast, the upper-left quadrant (red area) represents stocks experiencing overfishing while already in a depleted state - those where fishing mortality remains above sustainable levels despite biomass being below BMSY. These cases are of particular concern because continued overexploitation undermines the potential for recovery.

In the lower-left quadrant (yellow area) are stocks where fishing pressure has been reduced to levels that should support recovery, yet biomass remains below BMSY. Theses 'rebuilding' stocks may take longer to recover, and in some cases, biomass has been reduced to the point where target fishing is limited to zero or near-zero levels to allow regeneration. Finally, the upper-right quadrant includes stocks with biomass above BMSY but subject to fishing pressure exceeding FMSY. Although these stocks currently meet biomass criteria, the elevated fishing pressure places them at risk of future decline, warranting close monitoring, particularly where biomass is only marginally above the MSY threshold.

*Figure 8.5 Sustainability or 'Kobe' plot showing F/FMSY against B/BMSY ratios for stocks with sufficient information to assess MSFD D3 status, averaged for 2019-2023. Each dot represents an individual stock and is coloured by ecoregion. The diamond indicates the overall mean across all stocks, and the triangle the overall median. The vertical and horizontal reference lines at 1 represent the MSY-consistent thresholds for fishing mortality and biomass, respectively.*

Table 8.1 presents 5-year average values of fishing pressure (F/FMSY) and biomass status (B/BMSY) for all assessed stocks; GES status under the MSFD one-out–all-out (OAOO) rule, including the total number of assessed stocks, the number with complete information on both criteria (F/FMSY and B/BMSY), and the number of stocks meeting both MSFD thresholds ($F \leq FMSY$ and $B \geq BMSY$); and normalised indicator values and SEAT composite scores. Normalised F/FMSY and B/BMSY values (0–1) are derived using capped MSY thresholds (see Section 8.2).

Weighted combinations show the resulting regional SEAT score under alternative weighting schemes: equal weighting of pressure and state (0.5|0.5|0.0), pressure-only (1.0|0.0|0.0), state-only (0.0|1.0|0.0), proportion-of-stocks-at-GES only (0.0|0.0|1.0), and a mixed weighting option (0.35|0.35|0.30). Higher composite values indicate better overall sustainability status. Cells are colour-coded according to the MSFD five-class scale (Bad–Poor–Moderate–Good–High).

### Equal weighting (0.5 pressure / 0.5 state)

Under equal weighting, the highest composite scores are observed in the Celtic Seas, Bay of Biscay & Iberian Coast, Greater North Sea, Widely Distributed stocks, and the Arctic Ocean, all of which reach or exceed a score of 0.90–1.00 (high), indicating comparatively sustainable stock status. Good to moderate scores are found for the Central Mediterranean region (0.84), Iceland (0.50), Eastern Mediterranean (0.51) and the Black Sea (0.50), reflecting mixed performance. The lowest score was found for the Western Mediterranean region (0.15), driven by very high fishing mortality and low biomass levels.

*Table 8.1 Summary of stock-level MSY indicators, GES outcomes and SEAT composite index values for each ecoregion (2019–2023)*

| | Arctic Ocean | Ice-land | Baltic Sea | Greater North Sea | Celtic Seas | BoB-iscay & Iberia | Widely | Western Med. | Central Med. | Eastern Med. | Black Sea |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Average (2019-2023)** | | | | | | | | | | | |
| $F/F_{MSY}$ | 0.84 | 2.02 | 0.91 | 1.11 | 0.94 | 0.83 | 0.78 | 2.25 | 1.04 | 1.08 | 1.16 |
| $B/B_{MSY}$ | 2.83 | 1.42 | 1.69 | 1.50 | 1.60 | 2.05 | 1.43 | 0.72 | 0.90 | 0.67 | 0.71 |
| GES (OOAO) | | | | | | | | | | | |
| N stocks assessed | 7 | 19 | 8 | 32 | 26 | 23 | 8 | 28 | 25 | 4 | 7 |
| N stocks $F/F_{MSY}$ and $B/B_{MSY}$ | 3 | 17 | 6 | 25 | 25 | 19 | 8 | 15 | 6 | 1 | 5 |
| N stocks $F/F_{MSY} \leq 1$ and $B/B_{MSY} \geq 1$ | 1 | 6 | 2 | 12 | 13 | 10 | 4 | 4 | 1 | 0 | 2 |
| Share of stocks at GES | 33% | 35% | 33% | 48% | 52% | 53% | 50% | 27% | 17% | 0% | 40% |
| **Normalised** | | | | | | | | | | | |
| $F/F_{MSY}$ | 1.00 | 0.00 | 1.00 | 0.82 | 1.00 | 1.00 | 1.00 | 0.00 | 0.94 | 0.87 | 0.73 |
| $B/B_{MSY}$ | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.31 | 0.75 | 0.16 | 0.27 |
| **Weighted Contributions $F/F_{MSY}$ \| $B/B_{MSY}$ \| GES%** | | | | | | | | | | | |
| 0.5 \| 0.5 \| 0.0 | 1.00 | 0.50 | 1.00 | 0.91 | 1.00 | 1.00 | 1.00 | 0.15 | 0.84 | 0.51 | 0.50 |
| 1 \| 0.0 \| 0.0 | 1.00 | 0.00 | 1.00 | 0.82 | 1.00 | 1.00 | 1.00 | 0.00 | 0.94 | 0.87 | 0.73 |
| 0.0 \| 1 \| 0.0 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.31 | 0.75 | 0.16 | 0.27 |
| 0.0 \| 0.0 \| 1 | 0.33 | 0.35 | 0.33 | 0.48 | 0.52 | 0.53 | 0.50 | 0.27 | 0.17 | 0.00 | 0.40 |
| 0.35 \| 0.35 \| 0.3 | 0.80 | 0.46 | 0.46 | 0.78 | 0.86 | 0.86 | 0.85 | 0.19 | 0.64 | 0.36 | 0.47 |

### Single-criterion weighting (1/0/0 and 0/1/0)

When pressure and state are considered independently, results diverge noticeably:

- Pressure-only (1/0/0): Most North-east Atlantic regions achieve a high score (1.0) because normalised fishing pressure indicators are close to or at sustainable levels. The Arctic Sea and Western Mediterranean regions score the lowest (0.0), reflecting high fishing mortality.
- State-only (0/1/0): All North-east Atlantic regions achieve 1.0, as normalised B/BMSY values exceed the threshold after capping. By contrast, most of the Mediterranean regions show moderate to bad performance, with the Eastern Mediterranean (0.16) and Western Mediterranean (0.31) reflecting depleted biomass. Only the Central Mediterranean (0.75) reveals a good performance reflecting biomass level close to 1.

### Proportion of stocks at GES (0/0/1)

When the index is based solely on the proportion of stocks meeting both D3C1 and D3C2, regional contrasts become sharper, yet all regions score moderate to poorly because very few stocks simultaneously satisfy both MSFD thresholds. The highest proportions of stocks at GES occur in the Celtic Seas (0.52), Bay of Biscay & Iberian Coast (0.53), and for Widely Distributed stocks (0.50). The Mediterranean regions show the weakest results, with the Eastern Mediterranean scoring the lowest (0.0), indicating that none of the assessed stocks meet both MSFD thresholds.

### Mixed-weight option (0.35/0.35/0.30)

This hybrid weighting, which gives equal emphasis to pressure and state while incorporating the proportion of stocks at GES, produces a more moderate distribution of results. Highest scores again occur in the Celtic Seas (0.86), Bay of Biscay & Iberia (0.86), and Widely Distributed stocks (0.85). Intermediate scores are seen in the Arctic Ocean (0.80), Baltic Sea (0.80) and Greater North Sea (0.78). The Mediterranean regions consistently show low composite values, with the Western (0.19) and Eastern Mediterranean (0.36) performing particularly poorly. Overall, across all weighting schemes, a consistent pattern emerges:

- North-east Atlantic regions generally perform well, regardless of weighting.
- The Mediterranean and, to a lesser extent, the Black Sea perform poorly, especially where biomass is low and data coverage is limited.
- Pressure-only scores are generally higher than biomass-only or GES-proportion scores, reflecting widespread improvements in exploitation rates but slower biomass recovery.

**Comparison with binary MSFD D3 assessments**

Comparing the SEAT combined index with the binary MSFD assessment (using the one-out-all-out rule for D3C1 and D3C2) reveals important differences in how regional performance is ranked. These differences arise because the MSFD approach evaluates each stock as a binary pass or fail, whereas SEAT integrates continuous information on fishing pressure and biomass status.

Under the binary MSFD assessment, the Eastern Mediterranean performs the worst, with 0% of assessed stocks meeting both criteria, reflecting high fishing pressure, low biomass, and a very limited number of stocks with complete information. In contrast, the Western Mediterranean shows a slightly better result (27% of stocks at GES), as a small number of stocks meet both thresholds. However, the SEAT combined index ranks the Western Mediterranean lower than the Eastern Mediterranean. This is driven by the more extreme values of fishing pressure and biomass in the Western Mediterranean (normalised F = 0.0; normalised B = 0.31), which pull the composite score down to 0.15 under equal weighting. The Eastern Mediterranean, despite having no stocks at GES, has slightly less extreme indicator values (F = 0.87; B = 0.16), resulting in a higher composite score (0.51).

This contrast illustrates that the two approaches highlight different aspects of sustainability.

- The binary MSFD assessment reflects legal compliance, highly sensitive to stock-level outcomes and data completeness.
- The SEAT index captures ecological distance to MSY thresholds, providing a continuous measure of regional performance.

As a result, the relative ranking of regions can differ between the two methods, especially in data-poor areas or regions with a small number of assessed stocks.

## 8.5 Data quality and limitations

Key limitations include:

- Uneven data coverage: F/FMSY estimates are generally more complete than B/BMSY, especially for data-poor species.
- Reference point inconsistency:
  - ICES provides MSY Btrigger values
  - GFCM assessments typically reference SSBMSY directly.
  - This complicates cross-regional comparability.
- Temporal lags: biomass responds slowly to reductions in fishing mortality, making immediate improvements difficult to detect.
- Aggregation: regional averages can obscure extreme stock-level outcomes (SEAT's regional index is not intended for MSFD reporting, it is for thematic analysis only)
- Model uncertainty: recruitment assumptions, natural mortality estimation, and model structure influence MSY estimates and therefore indicator calculations.
- Predator–prey and multispecies interactions: achieving GES for all stocks is challenging but especially so in mixed-fisheries and where stocks are ecologically interdependent (e.g. cod–herring–sprat).

These issues must be considered when interpreting SEAT results and when comparing them with MSFD GES determinations.

## 8.6 Conclusions

The combined application of F/FMSY and B/BMSY indicators highlights both the achievements and remaining challenges of MSY-based fisheries management in Europe's seas. On the one hand, declining exploitation rates demonstrate that recent reforms under the Common Fisheries Policy (CFP) have been effective in reducing fishing pressure, with many stocks now harvested at levels consistent with sustainability. On the other hand, biomass recovery remains incomplete and spatially uneven, particularly in the Mediterranean and Baltic Seas. This divergence shows that achieving sustainable exploitation does not automatically result in fully rebuilt or ecologically healthy fish populations. Fishing mortality and biomass indicators therefore capture complementary dimensions of stock status: pressure and state. For a comprehensive assessment under MSFD Descriptor 3, both must be considered together.

The prototype assessment framework developed here (SEAT) demonstrates that a harmonised, European-wide dual-indicator approach is both feasible and informative at regional scale. It provides critical insights into policy progress while revealing ecological shortcomings. Further development whether through refinement of SEAT or expansion into a broader European Marine Fish Assessment Tool (EMFAT) should prioritise:

- improved consistency of biomass reference points across ICES and GFCM regions,
- explicit treatment of uncertainty,
- integration of multispecies and food-web interactions, and
- stronger alignment with the ecosystem-based objectives of the MSFD.

Ultimately, sustainable exploitation represents only one component of achieving Good Environmental Status (GES). Fisheries also generate wider ecosystem pressures, including bycatch, seabed disturbance, habitat degradation, ghost gear, and trophic impacts, which affect multiple MSFD descriptors. Integrating stock-level indicators with ecosystem-level assessments will therefore be essential to ensure healthy, resilient European seas in the long term.

# 9 Long-term trends in sea surface temperature (SST), pH and alkalinity

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*1 NIVA Denmark, Copenhagen, Denmark*

## 9.1 Introduction

The ocean acts as a major reservoir for excess atmospheric heat and $CO_2$ from anthropogenic greenhouse gas emissions (Cheng et al., 2019; Gruber et al., 2019). The uptake of heat and $CO_2$ leads to increasing sea surface temperatures (SST) and ocean acidification, respectively. Many marine species are sensitive to such changes, which can affect their metabolism, distribution, and phenology (Venegas et al., 2023).

While the EU has committed to protecting marine ecosystems and mitigating climate change by reducing greenhouse gas emissions by 50% by 2030 and achieving climate neutrality by 2050 (European Commission, 2020a; European Commission, 2021b), current projections still indicate continued warming and further decreases in ocean pH toward the end of the 21st century (IPCC, 2023).

In addition to temperature and pH, alkalinity plays a key role in regulating the ocean's acid–base balance. It acts as a chemical buffer that mitigates pH fluctuations by neutralizing acids, thereby influencing the extent and rate of ocean acidification. Monitoring changes in alkalinity is therefore essential for understanding the resilience of marine systems to increasing $CO_2$ concentrations.

Historical observations of SST, pH, and alkalinity in European seas provide a crucial basis for assessing long-term trends in these parameters. However, variations in sampling equipment, analytical methods, and laboratory procedures, combined with uneven spatial and temporal coverage, introduce uncertainties into trend estimates. This chapter presents a statistical analysis of temperature, pH, and alkalinity data collected between 1960 and 2023 in European marine and coastal waters. The analysis employs a statistical mixed model (PROC MIXED in SAS EG) to provide a preliminary assessment of long-term trends. Continuous monitoring and analysis of key marine parameters remain essential for understanding how mitigation efforts and policy measures influence the state and resilience of marine ecosystems.

## 9.2 Data collection and calculations

The data were obtained from the EDMODnet ERDDAP, https://erddap.emodnet-physics.eu/erddap/index.html, and only records containing information on longitude, latitude, and collected at depths of a maximum of 10 meters were included. Longitude and latitude data were used to define the type of water, i.e., whether the samples were taken offshore (12 nm or more from the nearest coast), coastal (maximum 1 nm from the nearest coast), or in between.

The data originated from five different regions (the Atlantic, the Baltic Sea, the Black Sea, the North Sea, and the Mediterranean), primarily covering the period from 1960 to 2024. All regions contain samples from this time span. Three datasets were generated based on temperature, pH, and alkalinity. The temperature dataset consisted of 2.6 million observations, the pH dataset of 186,000 observations, and the alkalinity dataset of 36,500 observations.

Before analysis, the samples were aggregated by region, year, month, originator, station, date, depth and location (offshore, coastal, in between). The aggregation aimed to address highly correlated observations,

as some samples were taken only minuts or hours apart at the same station. Part of the spatial differences expected to influence the three parameters under investigation were handled by categorizing them as offshore, coastal, or in between.

### Temperature dataset

Approximately 60% of the raw temperature samples originated from the Baltic Sea. The Atlantic and the North Sea each contributed around 15%, while the Black Sea and the Mediterranean each accounted for about 5% of the total. The proportion of coastal samples (within 1 nm of the coast) compared to the total number of samples in each region also varied considerably. The Atlantic and the Mediterranean had less than 2% coastal samples, the Black Sea and North Sea each had around 10%, and the Baltic Sea had 50% of samples collected within 1 nm from the nearest coast. Regarding the number of temperature observations per date per station, it varied considerably. For most station-date combinations, there were 1–5 temperature observations (98% of the dataset), whereas the remaining 2% had hundreds, and in some cases several thousands, of observations. These unbalanced data were accounted for in the model.

### pH dataset

In the pH dataset, 72% of the samples were collected in the Baltic Sea (33%) and the North Sea (39%). The Atlantic, Black Sea, and the Mediterranean each contributed approximately 10%. Most of the samples from the Atlantic (89%) and the North Sea (77%) were collected offshore. In comparison, about 50% of the samples from the Baltic Sea and the Mediterranean were offshore, while only 29% of the samples from the Black Sea were offshore. In the Black Sea, 48% of the samples were collected between 1 and 12 nm from the coast. In the North Sea 22% of the samples were collected in June. In the four other regions, the samples were distributed evenly across the months.

### Alkalinity dataset

About 50% of the raw alkalinity samples came from the Baltic Sea, 25% from the Black Sea, 25% from the North Sea, and only around 1% from both the Atlantic and the Mediterranean. Roughly half of the samples from the Baltic Sea and the North Sea were collected offshore, whereas only 5% of the Black Sea samples were offshore. In terms of seasonal distribution, 45% of the Atlantic samples were collected in June, with none in December. Samples from the Baltic Sea, the Black Sea, and the North Sea were distributed almost evenly throughout the year. In contrast, the Mediterranean samples were mainly collected in October (31%), with no samples taken in April, November, or December.

It is evident that the data are unevenly distributed in space and time, with multiple originators, sampling gears, platforms, and laboratories involved. These factors may have affected the measured levels of temperature, pH, and alkalinity, and needed to be accounted for in the models (one model per response variable: temperature, pH, and alkalinity). Details on the models are outlined in Section 9.5.

## 9.3 Temporal trends

Trends for temperature, pH, and alkalinity were estimated using three models coded in SAS EG (PROC MIXED). The modeled mean estimate temperature increased from 12.9 °C in 1960 to 14.1°C in 2023, pH level decreased from 8.13 to 8.09 and alkalinity increased from 2.00 to 2.62 (Figure 9.1). Each model included data from all five regions, which were weighed equally when estimating a common trend across regions. For all three parameters—temperature, pH, and alkalinity—significant differences were detected between regions, as well as between summer and winter levels, and between coastal and offshore samples. Details on the modeled estimates for Region, Water Type and Month are described in section 9.5.1 and 9.6.

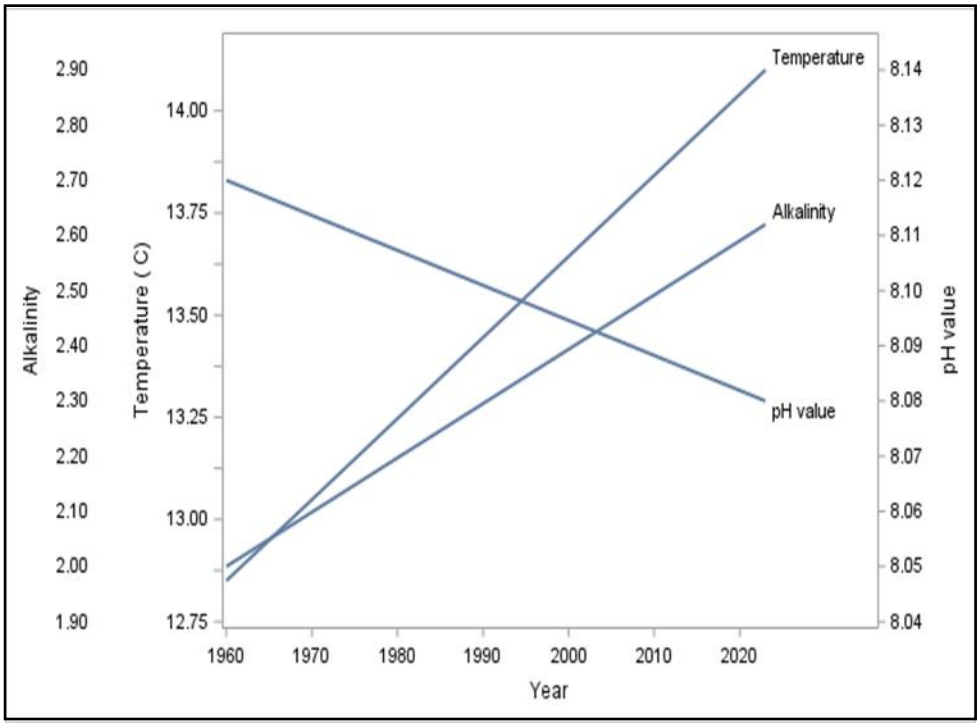


*Figure 9.1: Model estimated temperature, pH and alkalinity*

### Models

Temperature, pH value, and Alkalinity were selected as response variables, all of which were normally distributed and verified by examining the plots of residuals (Appendix 12). The explanatory variables included Region, Year, Month, Water Type, Depth and Originator. Among these, Year was treated as a regressor variable, while Region, Month, Water Type, Depth, and Originator were treated as categorical variables.

Originator was included as a stochastic variable and specified in the random statement, nested within a region. It was modeled as a stochastic effect since samples originating from the same originator are assumed to be more homogenous than those from different originators (e.g., due to being analyzed in the same laboratory, handled by the same personnel, or based on the same stations). Originator was nested within a region because each originator belongs to only one region. The models included the five main effects, their two-way interactions, and a random effect, and were based on aggregated data.

## 9.4 Detailed model results

### Temperature

Assumption testing of the temperature data showed a normal distribution (Appendix 12, Figure 12A). The linear relationship between temperature and year was examined in a preliminary model by including year as a fixed effect. There was, however, no indication of a non-linear structure. The final variables for the temperature model are presented in Table 9.1, including p-values, all of which are < 0.0001. The regions display different temperature levels and regression slopes (Figure 9.2, left). The Baltic Sea and the North Sea have significantly lower temperatures compared to the three other regions. Moreover, the increase in temperature for the Baltic Sea, Black Sea, Mediterranean, and North Sea is significantly greater than for the Atlantic, where changes are minimal. The distance to the nearest coast also has an impact on temperature levels, with coastal areas showing the highest temperatures in the summer period and the lowest in the winter. Examples for February and August are given in Figure 9.2, right. Temperature is strongly

associated with time of year, with the highest values occurring during the summer months (Figure 9.3, left).

*Table 9.1 Temperature variables.*

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effects** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| Year | 1 | 7E5 | 887 | <.0001 |
| Region | 4 | 48E3 | 466 | <.0001 |
| Month | 11 | 71E4 | 31222 | <.0001 |
| Water Type | 2 | 71E4 | 973 | <.0001 |
| Depth | 1 | 71E4 | 760 | <.0001 |
| Day * Month | 12 | 71E4 | 4173 | <.0001 |
| Year * Region | 4 | 68E4 | 391 | <.0001 |
| Region * Month | 44 | 71E4 | 5403 | <.0001 |
| Region * Water Type | 8 | 71E4 | 319 | <.0001 |
| Region * Depth | 4 | 71E4 | 462 | <.0001 |
| Depth * Month | 11 | 71E4 | 1514 | <.0001 |
| Month * Water Type | 22 | 71E4 | 1915 | <.0001 |

From 1960 to 2023, the estimated change in sea surface temperature varied across the five regions (Figure 9.2, left). The Baltic Sea experienced the largest warming of 2.3 °C (from 6.4 °C to 8.7 °C). Secondly, the North Sea increased by 1.8 °C (from 9.2 °C to 11.0 °C), and the Black Sea by 1.6 °C (from 14.3 °C to 15.9 °C). The Mediterranean also warmed by 1.0 °C (from 17.4 °C to 18.4 °C). The North-east Atlantic showed a decrease of -0.6 °C (from 17.0 °C to 16.4 °C). However, the estimate of the change in temperature for the Atlantic is not very stable.

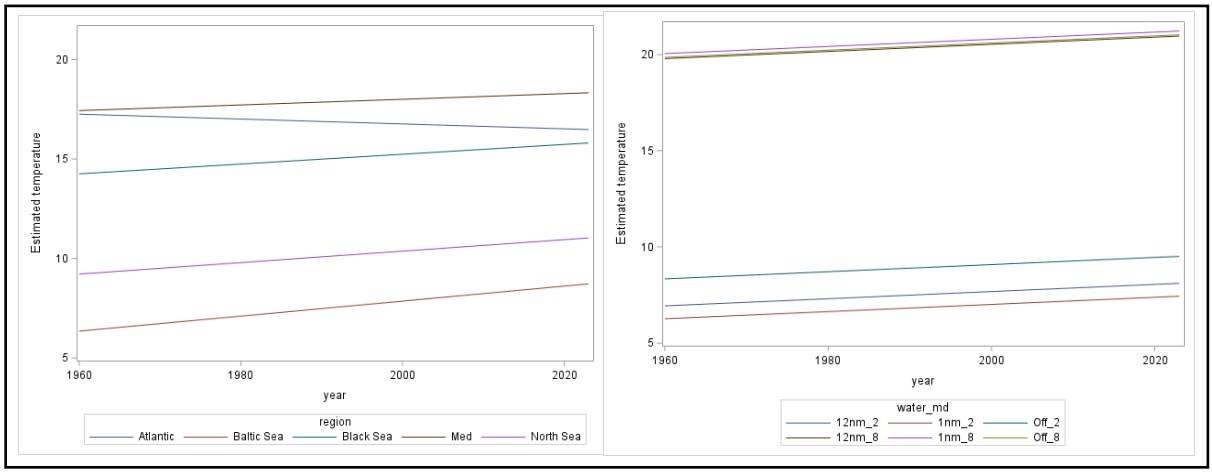


*Figure 9.2: Regional LSmean temperature (left) and offshore (Off), coastal (1nm) and transitional (12nm) waters illustrated for month 2 (February) and month 8 (August) (right) based upon the mixed model.*

The overall estimated temperature for the five regions increased by 1.2 °C (from 12.9 °C to 14.1 °C) between 1960 and 2023 (Figure 9.3, right). Both the overall estimate and the region-specific estimates are based on Least Square Means (LSmeans). When calculating the LSmeans, months are weighed equally; water types are weighed equally and so on; and for the overall estimate, the regions are also weighed equally. Using LSmeans is particularly important in studies with highly unbalanced and incomplete designs—such as when some regions have far more samples than others, when not all months are sampled each year, or when most samples in a region are concentrated in a specific month. Not accounting for such imbalances can lead to biased estimates and potentially misleading conclusions.

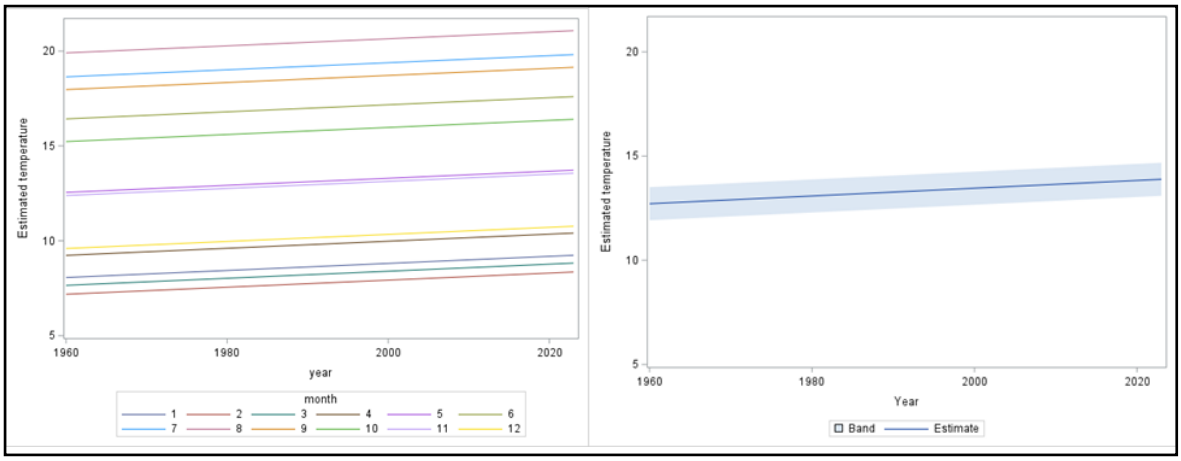


*Figure 9.3 Monthly LSmean temperature (left) and overall LSmean estimate of temperature including 96% confidential band (right) based upon the mixed model.*

If a simpler regression model without the Originator as random effect (but still with the same fixed effekts in the model) had been applied to the same aggregated data used above, the result would have been quite different, yielding an unreliable estimate of the temperature trend for the Black Sea, with an increase of 6.6 °C. Moreover, this high trend for the Black Sea strongly influences the overall estimate, resulting in an overall temperature increase of 2.7 °C. When Originator is included in the model, the estimated trend for the Black Sea decreases from 6.6 °C to 1.6 °C.

The explanation is as follows: certain Originators that have high temperature in most months compared to the rest, e.g. Originator 97 and 131 (Figure 9.4.), occur in the later part of the time series (2012–2022 and 2015-2022, respectively), while they exhibit a slight decrease in temperature over the period for which they have measurements. In other words, the high temperatures reported by these originators do not indicate that temperatures in the Black Sea increased to particularly high levels toward the end of the period from 1960 to 2023 but rather reflect that their stations are located in areas with generally higher baseline temperature levels. Furthermore, the slight decrease observed for Originators 97 and 131 does not imply that temperatures in the Black Sea region declined from 2012 to 2023. Other Originators operating during the same period show increasing temperature trends; therefore, the observed decreases are better interpreted as variation between originators rather than evidence of a regional cooling trend.

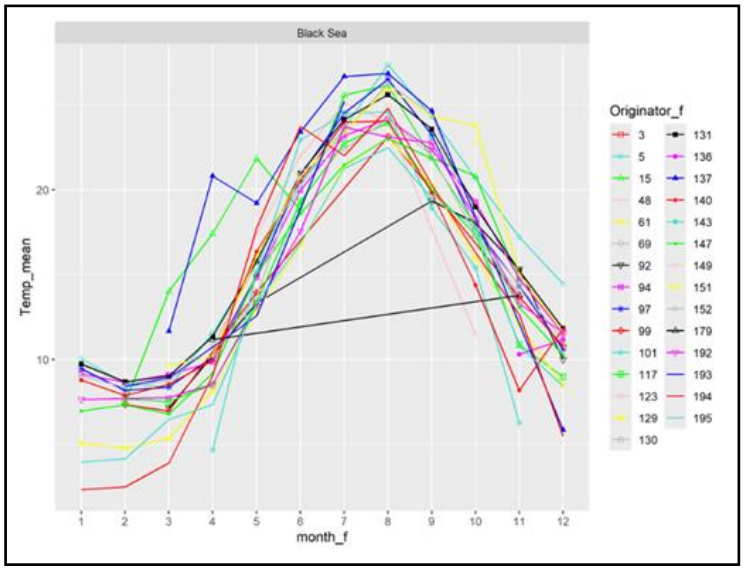


*Figure 9.4 Observed temperature data from the Black Sea as function of month and colored by Originator*

### pH values

Assumption testing of the pH data showed a normal distribution (Appendix 12, Figure 12B). The final model variables for temperature are presented in Table 9.2, including p-values, all of which are < 0.0001 and therefore statistically significant. The regions exhibit different pH levels but share the same regression slopes (Figure 9.5, top left). The Baltic Sea and the Black Sea have significantly higher pH values compared to the three other regions. The distance to the nearest coast also has an impact on pH levels, with samples collected close to the coast showing the lowest pH values (Figure 9.5, top right). As expected, pH is also associated with seasonal variation: the highest values occur during the summer months (April to July), while the lowest values are observed in the winter months (November to February) (Figure 9.5, bottom left).

*Table 9.2 Model variables for pH.*

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effects** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| Year | 1 | 6444 | 10.00 | 0.0016 |
| Region | 4 | 92.7 | 20.20 | <.0001 |
| Month | 11 | 6687 | 3.81 | <.0001 |
| Water Type | 2 | 6434 | 68.53 | <.0001 |
| Region * Month | 44 | 6575 | 9.72 | <.0001 |
| Region * Water Type | 8 | 6560 | 79.88 | <.0001 |

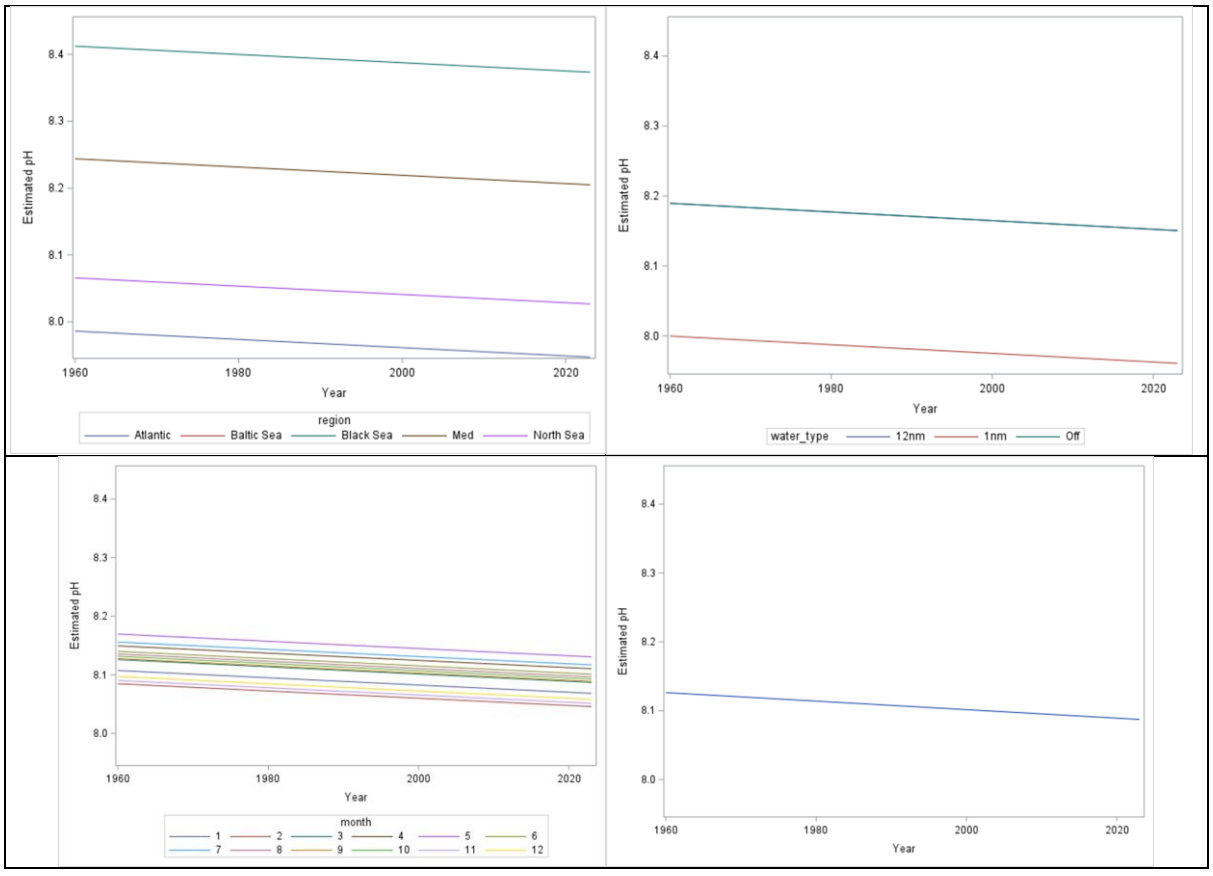


*Figure 9.5 pH LSmeans for Region(top left), Water_type (top right), Month (bottom left), and overall estimate (bottom right).*

From 1960 to 2023, the estimated pH decreased in all regions (Figure 9.7, top left). In the Nort-east Atlantic pH decreased from 7.99 to 7.95, in the Baltic Sea from 7.92 to 7.88, North Sea from 8.07 to 8.03,

Mediterranean from 8.24 to 8.20 and Black Sea from 8.41 to 8.37. The overall pH from 1960 to 2023 decreased by 0.04 units, from 8.13 to 8.09 (Figure 9.7, bottom right). Both the overall estimate and the region-specific estimates are based on Least Square Means (LSmeans). See the section above for an explanation of LSmeans.

If a simple regression model had been applied to the same dataset instead of the mixed model used in the present study, the result would have shown a larger decrease in pH (0.27), illustrated by the red line in Figure 9.8. In contrast, the green line represents the estimated result from the mixed model described above.

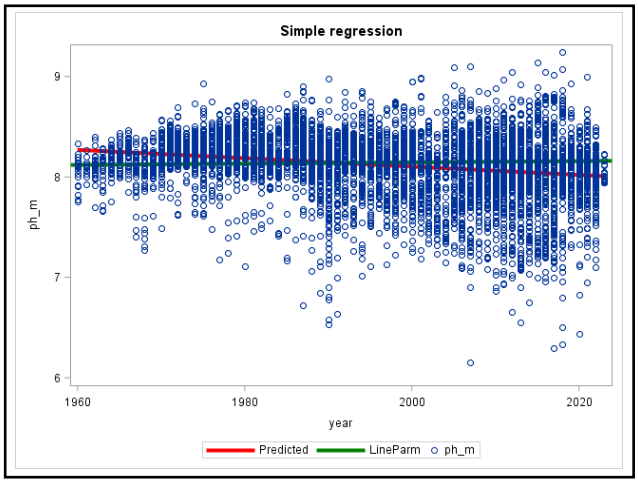


*Figure 9.6 Illustration of aggregated pH data and two predicted regression lines. The red line is from a simple regression model with only Year as the explainable factor, and the green line is from the mixed model.*

### Alkalinity

Assumption testing of the alkalinity data showed a normal distribution (Appendix 12, Figure 12C). The final model variables for temperature are presented in Table 9.3, including p-values, all of which are < 0.0001 and therefore statistically significant. The regions display different levels and regression slopes (Figure 9.10, top left). The Baltic Sea has a significantly lower alkalinity level than the four other regions. Moreover, the increase in alkalinity for the Atlantic, Baltic Sea, and North Sea is significantly lower than for the Mediterranean and the Black Sea.

The distance to the nearest coast also affects alkalinity levels: the closer to the coast, the lower the alkalinity. The lowest levels are observed in June, July, August, and September, while the highest levels occur in January and February. The remaining months show a more mixed pattern, and some months cannot be clearly distinguished in the graph below.

*Table 9.3 Model variables for alkalinity*

| Type 3 Tests of Fixed Effects | | | | |
|---|---|---|---|---|
| **Effects** | **Num DF** | **Den DF** | **F Value** | **Pr > F** |
| Year | 1 | 1279 | 19.99 | <.0001 |
| Region | 4 | 851 | 25.96 | <.0001 |
| Month | 11 | 2962 | 4.90 | <.0001 |
| Water Type | 2 | 2972 | 42.87 | <.0001 |
| Year * Region | 4 | 857 | 28.59 | <.0001 |

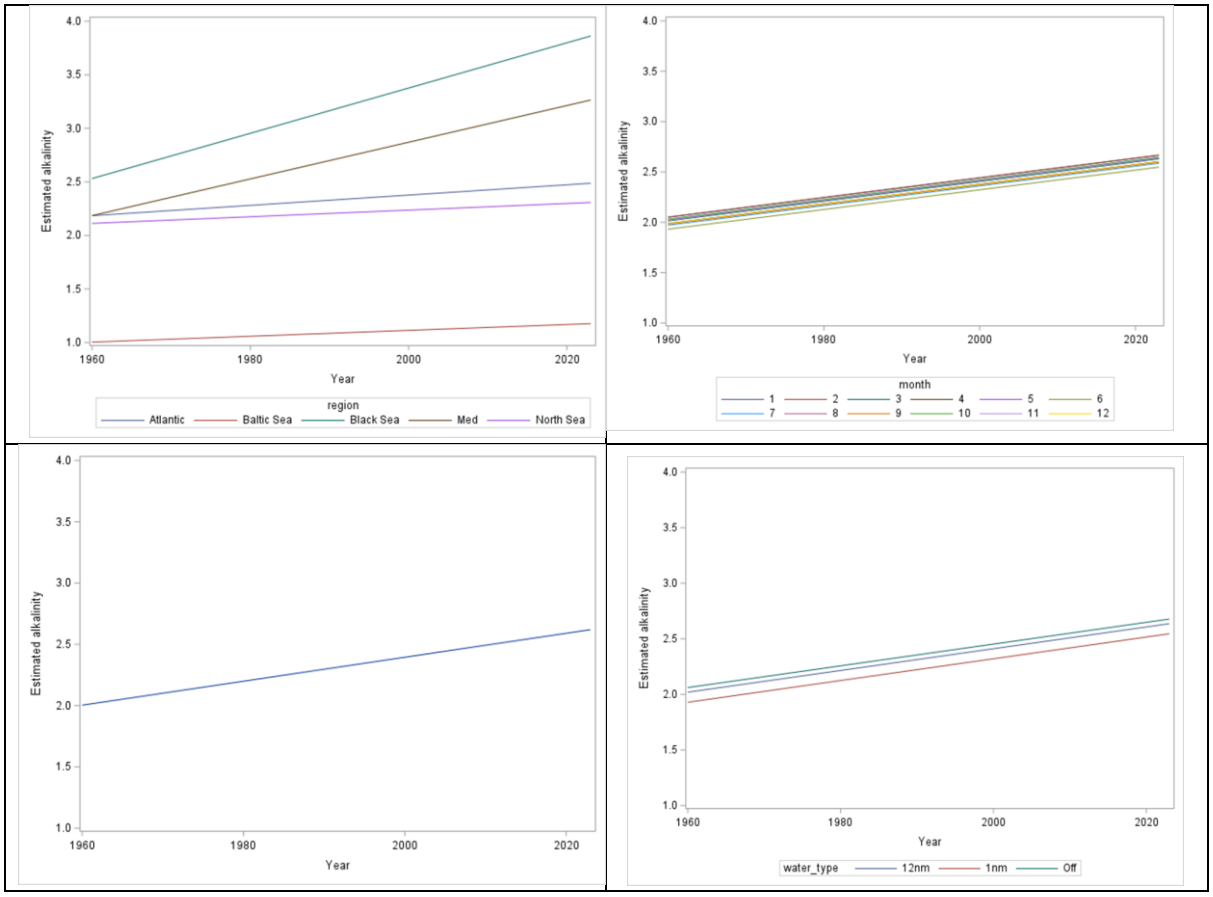


*Figure 9.7 LSmeans values for Region (top left), Water_Type (top right), Month (bottom left), and the overall estimate (bottom right)*

From 1960 to 2023, the estimated change in alkalinity varied across the five regions. The Baltic Sea warmed up by 0.17 (from 1.00 to 1.18) and the North Sea with 0.20 (from 2.11 to 2.31). The Black Sea showed the largest increase of 1.33 (from 2.53 to 3.86). The Atlantic increased by 0.31 (from 2.18 to 2.49), while the Mediterranean increased by 1.08 (from 2.18 to 3.26), however neither of these two were significant.

The overall estimated alkalinity for the five regions increased by 0.62 units (from 2.00 to 2.62) between 1960 and 2023. Both the overall estimate and the region-specific estimates are based on Least Square Means (LSmeans) (see the section on temperature for more details on LSmeans). If a simple regression analysis had been applied for the same aggregated data without accounting for the effects of region, month, and water type, the alkalinity trend would have been estimated to decrease over time (Figure 9.11), from 2.11 to 1.62.

## 9.5 Data quality and limitations

The station names were not reported consistently, which made it meaningless to aggregate the data by station per Year and per Month. Instead, the data were aggregated by Region, Originator, Water_Type, Year, and Month. For the Mediterranean data, information on originator names was not available, which meant that the intra-correlation variance structure for this region could not be accounted for. Consequently, all Mediterranean data were assigned to a single originator labeled *"Unknown."* The names of Originator were also not consistent, however since all originators had a unique number within each region in their names, it was possible to identify all the originators correctly. Only a very small number of originators had two id numbers, in those cases the first number was selected.

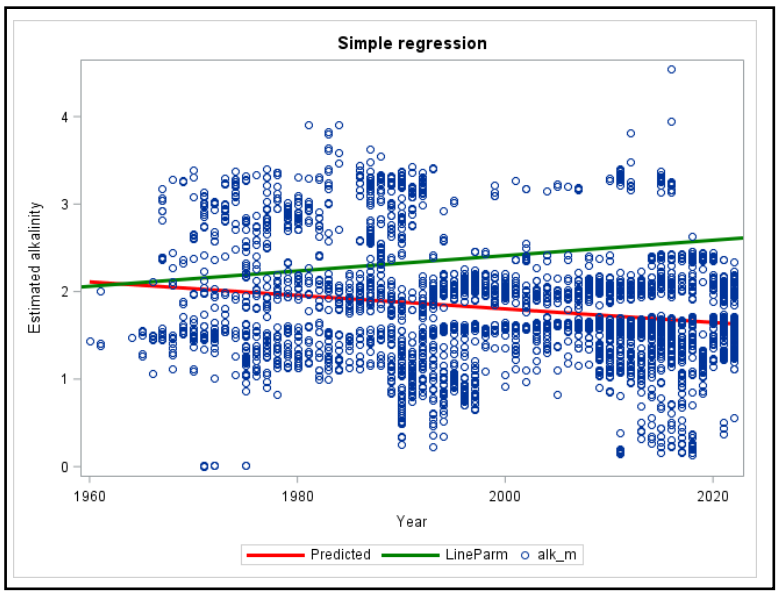


*Figure 9.8 Illustration of aggregated alkalinity data and two predicted regression lines. The red line is from a simple regression model with only Year as the explainable factor, and the green line is from the mixed model.*

A small number of aggregated data points belonging to originators with samples from only one year and one month were excluded from the dataset. This was done to make the model more robust when estimating parameters and conducting tests. The excluded data represented only 0.2% of the aggregated temperature dataset, 0.3% of the aggregated pH dataset, and 0.4% of the aggregated alkalinity dataset.

In addition, a group of non-aggregated temperature data from one originator, covering five stations, was removed from the dataset due to unrealistic or non-representative values (temperatures exceeding 20 °C measured in January and February in the Baltic Sea). For the pH dataset (non-aggregated), a few outlier observations (values below pH 5 and above pH 11) were also excluded.

## 9.6 Conclusions

The overall trend for the five EU regions (the Atlantic, the Baltic Sea, the Black Sea, the Mediterranean, and the North Sea) shows an increase in temperature, a decrease in pH, and an increase in alkalinity over the period 1960–2023. However, clear differences were observed between the regions.

Four regions exhibited a significant increase in temperature over the period, while one region showed no significant change. The largest temperature increases were observed in the Baltic Sea by 1.8 °C, followed by the Mediterranean and the North Sea by 1.6 °C and 1.5 °C, respectively. The Black Sea showed an increase of 1.2 °C, while the Atlantic did not show any significant change in temperature.

For pH, there were no significant differences between the regions; all five showed a similar decrease of 0.04 units. In contrast, alkalinity trends varied between regions. The Black Sea showed the largest increase (1.3 units), followed by the North Sea and the Baltic Sea (0.2 units each). The Atlantic and the Mediterranean did not exhibit significant changes in alkalinity, most likely due to too few data.

# 10 Cross-cutting data analyses

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## 10.1 Introduction

The indicator-based marine ecosystem assessments build on the ecosystem-based approach to manage human activities. In the assessment methods, this means that the underlying indicators and thresholds aim to capture signals of anthropogenic impacts from the monitoring data. In a perfect world with best spatio-temporal data, optimized indicators and accurate thresholds, this would be seen as a close match between pressure impacts and the state assessments. From managerial point of view, such a match is highly desirable, because spatial and temporal accuracy of human activity data is better and its collection more cost-efficient. In the real world, our models to relate pressures and state assessments are still limited. In this chapter, it is analysed how the cumulative impact assessment and eutrophication assessment are capable in explaining the results obtained by the biodiversity assessment and the assessment of ecological status under the EU WFD.

## 10.2 Methods

Many of the analyses in Marine Messages III are data- and tool- based cf. Marine Messages II (Reker et al. 2019) and chapters 2, 3, 4, 5, 6, 7, 8 9 and 10 in this report. The quality and spatial coverages of the data have improved since Marine Messages II and represent not only theme specific state-of-the-art data collection but do also provide opportunities for the above-mentioned specific cross-cutting analyses.

**CEA/CIA**: The information on combined effects of multiple pressures in Europe's seas is presented in chapter 4). The CEA/CIA tool used an R code based on EcoImpactMapper (Stock 2016). This code is in principle identical to the R code included in the GES4SEAS toolbox (see Berg et al., in prep.) and follows Halpern et al. (2008), Korpinen & Andersen 2016 and Korpinen et al. 2021). See Halpern & Fujita (2013) for the strengths and weaknesses.

**HEAT**: The information on eutrophication status and 'eutrophication problem areas' vs. 'eutrophication non-problem areas' are based on an updated European-wide mapping and identification of 'problem areas' and 'non-problem areas' (see chapter 6). HEAT is an indicator-based assessment tool, and the indicators relate to key eutrophication signal representing three groups of indicators: 1) nutrient concentrations, 2) direct effects and 3) indirect effects. For more information about the data on which the analyses are based, please confer with chapter 6. Please also confer with HELCOM (2009), Andersen et al. (2010), Andersen et al. (2011), Fleming-Lehtinen et al. (2015), Andersen et al. (2017), Murray et al. (2018) and EEA (2018) for information about the method and its applications.

**WFD**: EU Member States report the status of coastal and transitional waterbodies every 6 years, and the results are accessible from WISE-Freshwater portal. The geographically widest WFD data is available as categorized status classes (high, good, moderate, poor, bad), whereas more limited results are also available as ecological quality ratios (nEQR) which are numeric values. In this analysis, only the pan-European categorical values were used. The most recent WFD results are used, and data gaps are filled with the previous results, if necessary.

**BEAT**: The ETC BE biodiversity assessment for Europe's seas used the BEAT tool (see chapter 2). Because both the BEAT assessment and the CEA include the phytoplankton chlorophyll, this is removed from the BEAT assessment for this analysis.

## 10.3 Results

The cumulative impact assessment (CIA) was used in its full form, including all the pressure layers and their estimated impacts on multiple ecosystem components. This was compared against the ecological status in coastal waters, using a mean value of CIA grid for a waterbody (Fig. 10.1). Subregional analysis results are shown in Fig. 10.2.

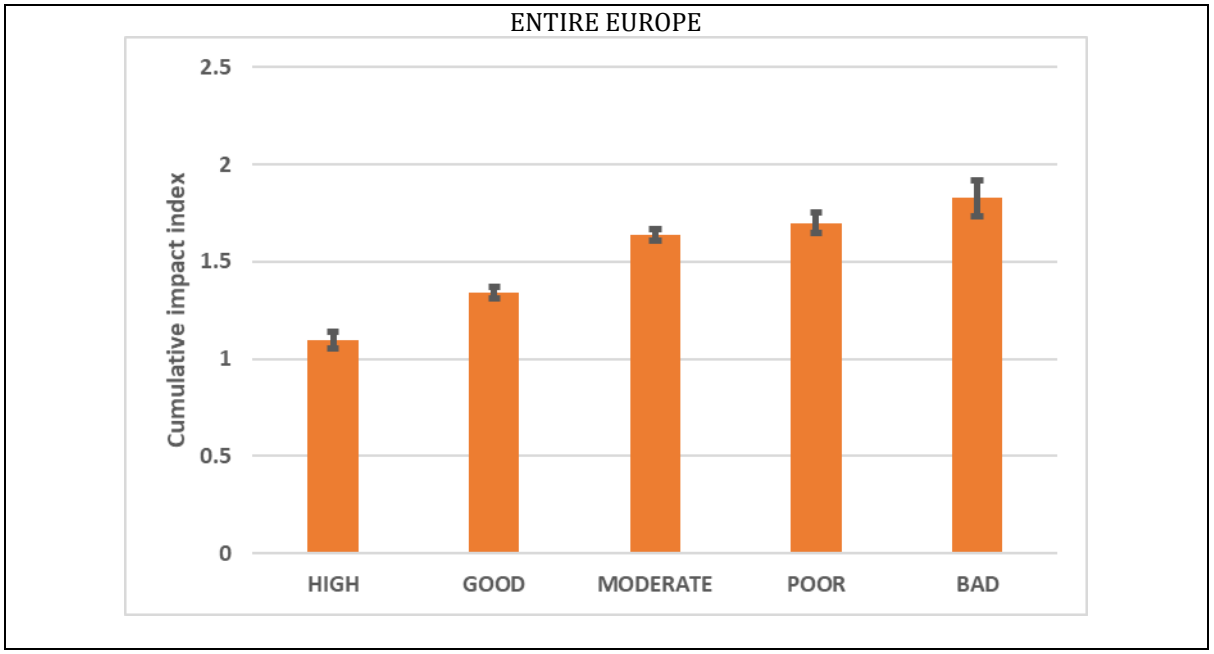


Figure 10.1 Relationship of cumulative impacts and the coastal ecological status assessments of the Water Framework Directive (WFD) in entire Europe.

The cumulative impact assessment (CIA) was also compared with the BEAT Biodiversity assessment (Figure 10.3). The difficulty in this analysis is that the CIA includes multiple pressures which vary between assessment units and the comparison does not show which pressures are acting in each assessment unit. The clearest biodiversity responses to pressure impacts are seen in the Norwegian Sea, Greater North Sea and the Adriatic Sea, where fisheries pressure particularly impacts biodiversity. The Baltic Sea and the Western Mediterranean Sea also show that in low pressure levels the biodiversity status is higher.

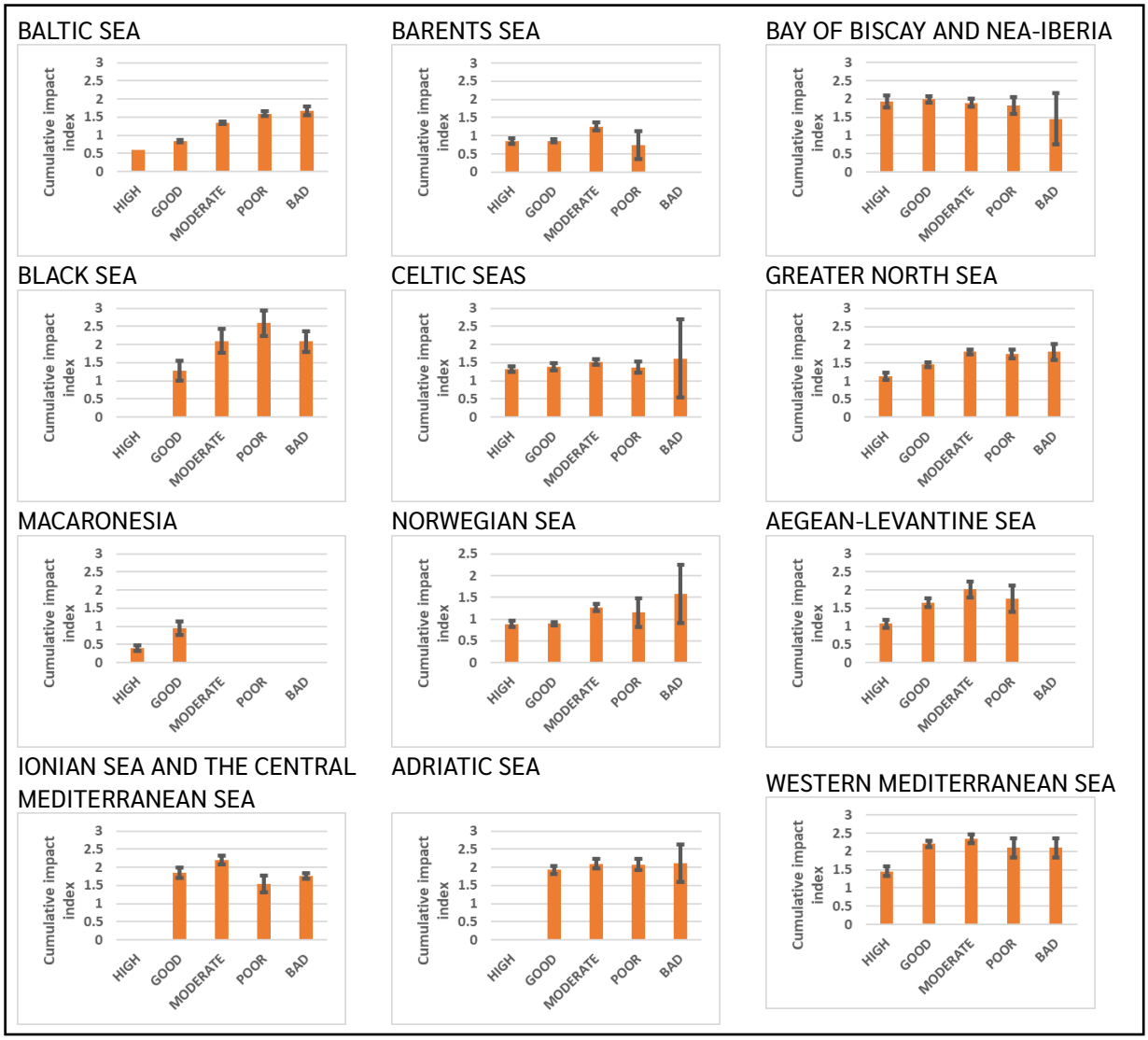


Figure 10.2 Relationship of cumulative impacts and the coastal ecological status assessments under the Water Framework Directive (WFD) in Europe's marine subregions.

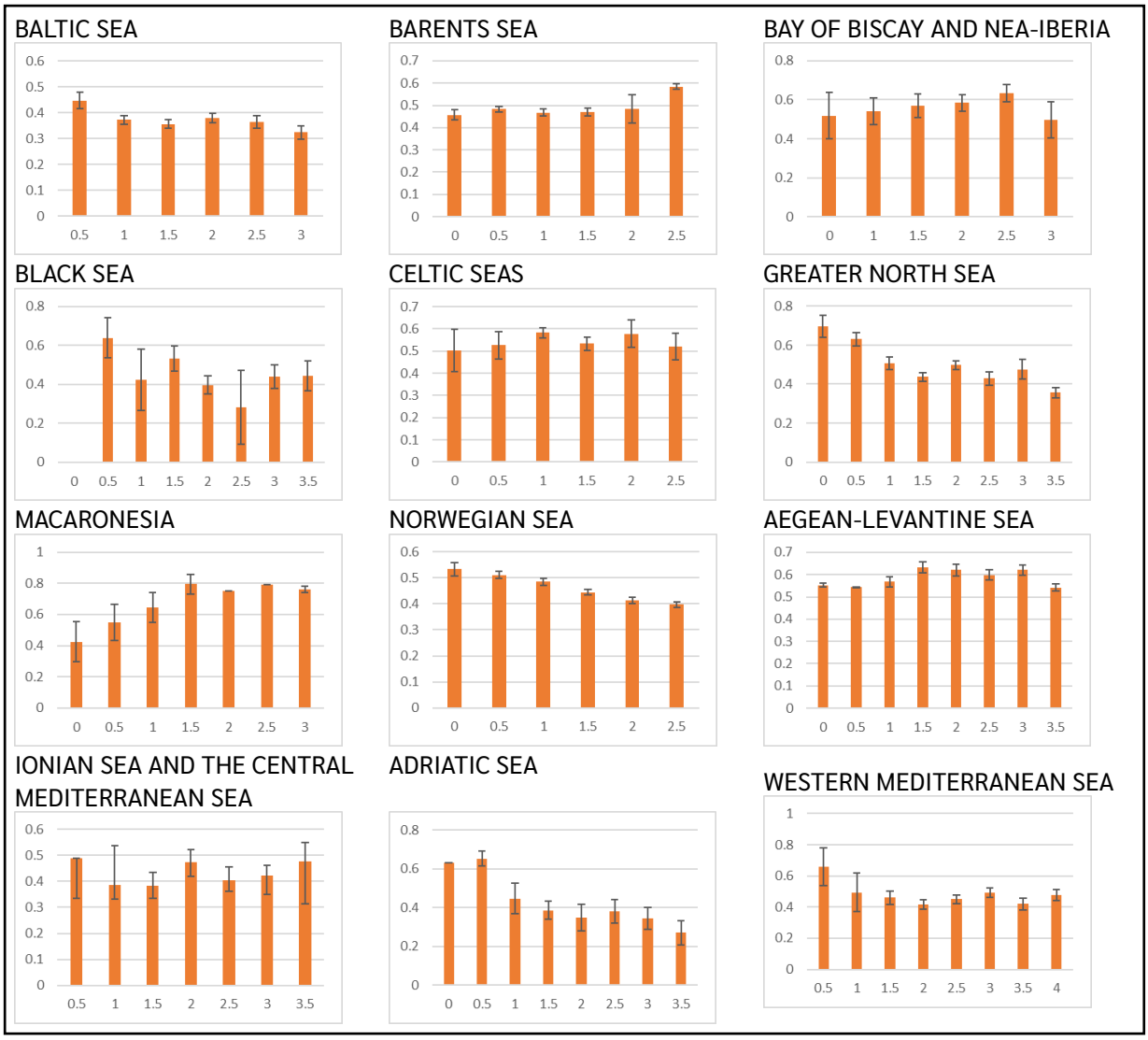


Figure 10.3 Relationship of the cumulative impact assessment (CIA, horizontal axis) and the biodiversity status (BEAT, vertical axis). The higher CIA indicates more pressure impacts and the higher BEAT indicates higher biodiversity status. The BEAT results are shown on the normalized scale from 0 [bad] to 1 [high status]. Some CIA categories are omitted because of too low number of results causing low confidence.

Eutrophication causes severe impacts on marine biodiversity in some marine areas (Sumelius et al. 2025). In the Baltic Sea, it is mentioned as the main pressure for degraded environmental state in the coastal and offshore areas (HELCOM 2023a). In the Adriatic Sea, the western and northern coastal waters are assessed eutrophied due to pollution (UNEP-MAP 2024), in the Black Sea the western coastal waters are eutrophied (REF), and the coastal southern North Sea is assessed as eutrophied (OSPAR 2023). The HEAT assessment of this report gives more detailed results for the eutrophication status. Figure 3 shows the comparison of the HEAT assessment and the biodiversity assessment BEAT.

The results indicate that eutrophication impacts are visible in the biodiversity assessment in subregions where the sea area is enclosed and polluted by several rivers, such as the Baltic Sea, the Black Sea and the Adriatic Sea. In other subregions, the impacts are not as visible.

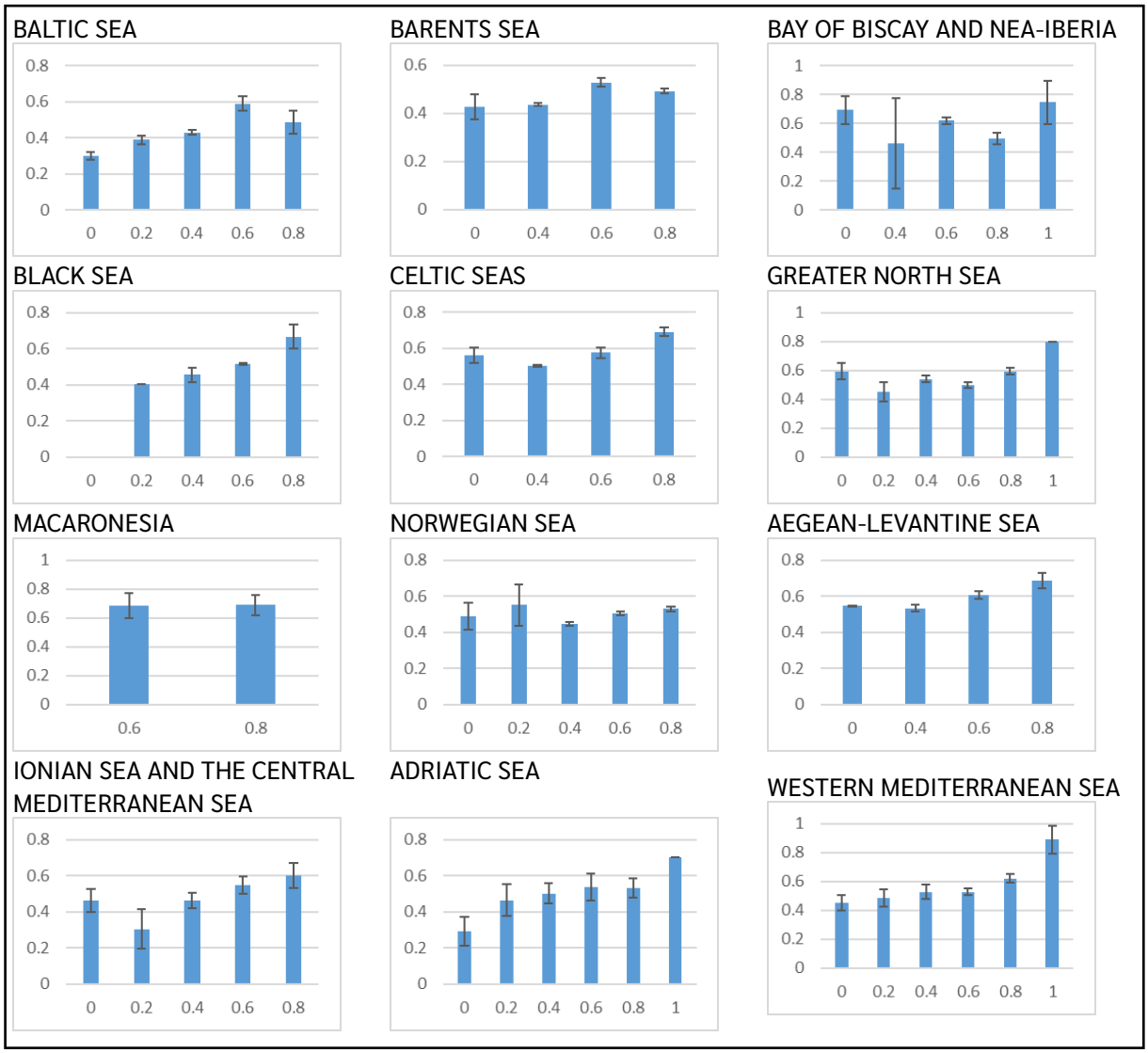


Figure 10.4 Relationship of the eutrophication status (HEAT, horizontal axis) and the biodiversity status (BEAT, vertical axis). Both the HEAT and BEAT results are shown on the normalized scale from 0 [bad] to 1 [high status]. To prevent data overlap, chlorophyll results are shown only in the HEAT assessment. The threshold for good status is indicated in value 0.6 on both axis.

## 10.4 Discussion

The cross-cutting analyses carried three main messages: (1) disturbed environmental status is caused by anthropogenic pressures and this is particularly clear in sea areas where pressures are extensive, (2) sea areas with limited water exchange are vulnerable to impacts of eutrophication on biodiversity, and (3) showing pressure-state responses in oceanic environments would require analyses of specific pressures on targeted species populations.

The cross-cutting analyses are sensitive to autocorrelation by parameters which are included in both the response and explanatory factors of the analysis. To avoid this error, specific care was followed when accepting indicators into the BEAT assessment, because some parameters used in BEAT are also pressure variables representing eutrophication in the CIA. The results of the HEAT-BEAT and CIA-BEAT comparisons are therefore stronger than the CIA-WFD comparison.

It is clear that the environmental conditions of an assessment unit (20 km x 20 km in coastal areas and 100 km x 100 km in offshore areas) greatly influence the analysis and were not removed by statistical

means. This is especially visible in subregions such as Macaronesia where pollution pressures do not accumulate and fisheries impacts would require specific models to see any responses. On the other hand, more enclosed subregions with long pollution history or shallow shelf areas with extensive fisheries pressures show clearer biodiversity impacts with the CIA and the indicator-based tools.

As the data on human activities and pressures are typically more accurate in space and time and well available to most regions, it is recommended to continue model development to utilize this data source and complement status assessments with this data. To better benefit from the pressure data, it is recommended that more specific pressure models are developed to assess specific ecosystem indicators. Using such indicators in multi-metric tools such as BEAT or MESH may give spatially and temporally more accurate overview of the environmental status.

## 10.5 Conclusions

The assessments under the environmental policies have the objective of differentiating anthropogenic impacts from natural stressors, as the management should target human activities. By showing the causality from activities to disturbed environmental state, one can not only show evidence for the need of action but also support state-based indicators by pressure data, which is typically more abundant than the environmental data.

In this report, we found some evidence that the good ecological status in coastal waters is found from areas of lower cumulative pressures, and vice versa. On the other hand, the evidence for offshore waters was weak. This may be methodological challenge with the models used for these analyses. The pressure impacts in offshore waters are typically very targeted, such as fishery impacts on target and non-target species or mining impacts on seafloor. The cumulative impact model in this study comprises all the pressures and estimates their impacts on all the key components of the marine ecosystem. While such broad assessment tools are often useful, it is recommended to apply more targeted tools, too.

# 11 Mini-review on environmental trends

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## 11.1 Introduction

It is well documented that the state of Europe' seas is not as good as it is supposed to be. Large areas of our seas, both coastal and offshore, are neither clean, healthy nor productive. The reasons are a broad range of human activities, both sea-based and land-based, the latter located on the coast or in upstream catchments. In this report, we address environmental trends in Europe's seas for the following reasons: Firstly, to do better, i.e. to improve from 'pictures' of the current state with a specific time window and to look into possibilities at the long-term trends. Secondly, to try to take stock of progress, i.e. does implementation of measures lead to changes in environmental conditions as supposed. Thirdly, as a spin-off, to try to get a better understanding of the current 'distance to target', the gap (if any) between the current status and the target defined by EU's marine polices, e.g. the Marine Strategy Framework Directive (MSFD). Our take on this report has been very simple. Based on experiences from earlier EEA thematic assessments and best practices demonstrated in these, we have for all MSFD descriptors (D1-D11) systematically reviewed literature (primary literature and other reviews) as well as national and regional marine assessments. Our findings are presented and discussed for all MSFD descriptors.

For descriptor D1 'Biodiversity is maintained' or simply 'Biodiversity', there are relatively few long time series of trends in the state of habitats and species across European seas, and those that exist are typically restricted to one or two regions and for a restricted number of taxa. The situation is slightly better in coastal waters which benefit from well-established monitoring for the Water Framework Directive and Habitats and Birds Directives but even here there are relatively few long series: (1) More resources need to be provided especially in the Mediterranean and Black Seas to increase the number of long-term monitoring there, (2) the MSFD would be the obvious vehicle for developing more consistent monitoring within and between marine regions, drawing on experience from the WFD, (3) work by intergovernmental groups such as ICES or the Convention on Migratory Species should be used to develop better long-term trends for transboundary species, and (4) ensuring that access to data should be open and freely available still needs more effort so work by relevant data management organisations in this regarded needs further support.

For descriptor D2 'Non-indigenous species do not adversely alter the ecosystem' or simply 'Non-indigenous species' (NIS), the number of new NIS introductions that has showed a steady increase since the 1950s is now showing a tendency to level off or even decrease in Europe's seas. However, already established NIS keep on expanding their distribution. Shipping activities remain the most important pathway for NIS introductions. Lack of monitoring dedicated to detecting NIS delay discovering introduction events and complicates impact assessment.

For descriptor D3 'The population of commercial fish species is healthy' or simply 'Commercial fish', the data quality and accessibility is very good in the Baltic Sea, North Sea and North-east Atlantic Ocean. Data is scarce in the Black and Mediterranean Seas. Hence, analysis of long-term trends is straight forward in northern and western parts of Europe but not in the southern and south-eastern parts.

For descriptor D4 'Elements of food webs ensure long-term abundance and reproduction' or simply 'Food webs', it is like D1 Biodiversity, difficult to make progress in defining trends for D4 very challenging. The sparsity of knowledge around the state and function of ecosystem components makes it difficult to aggregate data that can be measured against pressure data. Three key challenges remain: (1) Lack of long-term trends for some key trophic guilds or habitats, (2) Spatial imbalances in data availability – strongly focused on northern seas but many more series are needed for the Mediterranean and Black Seas, and (3) Better availability of data – data that are known to exist are not made readily available or submitted to European-scale data hubs (see Borja et al. 2019a).

For descriptor D5 'Eutrophication is minimised' or simply 'Eutrophication', decreasing trends in inputs of nutrients, although still too high, are observed in Europe's seas and signs of improvement in eutrophication status can be seen, although ecosystem recovery is slow. Regional differences exist, with limited water exchange making the Baltic Sea and the Black Sea especially susceptible to eutrophication effects, whereas the eutrophication impacts are more limited to coastal areas in other regional seas. A case study has assessed long-term trends in eutrophication status in the Baltic Sea and revealed that climate change may potentially delay the recovery.

In relation to Descriptor D6 'The sea floor integrity ensures functioning of the ecosystem' or simply 'Seafloor integrity', there is an evident lack of long-term dataset necessary to carry out adequate and robust studies. However, there are some short series of a few years in some proxies and indicators of criteria D6C1 (permanent changes due to anthropogenic action) and D6C2 (temporal changes due to anthropogenic action) that can be considered as a basis for future assessments of the presence of trends. These short series refer to the main sea uses related to D6: fishing footprint, sediment extraction and deposition, and permanent habitat modifications. In addition, it is important to note that specific tools have been developed within ICES (International Council for the Exploration of the Sea) to assess the indicators of criteria within this descriptor, which will make it possible in the future to assess the presence of trends in a homogeneous manner among the different Member States.

Descriptor D7 'Permanent alteration of hydrographical conditions does not adversely affect the ecosystem' or simply 'Hydrographical conditions'. There are not long-term monitoring series on the two criteria required by D7, but proxy indicators, such as sea-level, temperature, salinity, currents and waves. In all the Europe's seas, most of these indicators have showed an increase in the last decades, which is related to global change, rather than local human activities altering the hydrographical conditions.

In relation to descriptor D8 'Concentrations of contaminants give no effects' or simply 'Contaminants', regulations or bans in use of hazardous substances have had a positive effect, although the persistent nature of the compounds and emerging synthetic substances make ecosystem recovery slow. For many contaminants, such as metals and organic pollutants, reductions in input loads are reflected as decreasing concentrations in the environment and also in reduced effects on biota. Both the number of accidental oil spills and the volume of oil spilled have decreased as a result of stricter regulations and improved shipping technology. Three case studies have assessed long-term trends and document that management measures have had a significant positive effect although full recovery may take time.

Descriptor D9 'Contaminants in seafood are below safe levels' or simply 'Contaminants in seafood' is closely related to Descriptor D8 but focuses to those marine species which are used for human

consumption. Therefore, the scope of the species is narrower and the thresholds for good state are defined by the risks for human health. As in D8, the contaminants under D9 also show declining trends. The study from the northern Baltic Sea shows clearly declining concentrations of dioxins and PCBs in herring. The challenge with D9 is to find the common ground between contaminants in environment and the seafood.

In relation to Descriptor D10 'Marine litter does not cause harm' or simply 'Marine litter', there are different approaches to deal with this issue, since at global scale (MARPOL 73/78, UNEP) at a regional scale (OSPAR, HELCOM and Barcelona Convention) and also, at European level (MSFD). However, there is a general lack of knowledge about science, technological development, economy and also public awareness. Thus, there is an evident lack of long-term datasets necessary to carry out adequate and robust studies.

Descriptor D11 'Introduction of energy (including underwater noise) does not adversely affect the ecosystem' or simply 'Introduction of energy, including noise'. Several aspects of Descriptor 11 (i.e., methodologies, units of measurements) have not been developed adequately since MSFD entered into force in 2008. Thus, for the moment, there are no long-term monitoring series on the criteria required by D11, neither methodology nor thresholds values.

Based on the review for the above MSFD descriptors, we can conclude that assessment of temporal trends for most MSFD descriptors is complicated and have to be based on non-reported data, but not impossible. For some descriptors, such and eutrophication (D5) and contaminants (D8) illustrative examples to follow have been presented. Examples for other descriptors will emerge in the coming yeas a time series are expected to be expanded with more year of monitoring.

## 11.2 Environmental trends in Europe's seas: Why and how?

The EU Marine Strategy Framework Directive (MSFD; Anon., 2008) set an ambitious goal of achieving clean, healthy and productive seas providing resources and services in a sustainable manner.

Assessing if the good environmental status (GES) goal has been achieved for the 11 qualitative descriptors is a complex task on which EU Member States must regularly produce assessment of their seas. This have been done twice, and despite gaps in monitoring networks and gaps in data, this goal has not yet been met.

Over the past few years, the European Environment Agency (EEA) has made a significant progress in reporting on the state and health of the marine environment in Europe's seas, e.g., the 'State of Europe's Sea' (EEA 2015), and a suite of thematic assessment reports focusing on contaminants (EEA 2018), eutrophication (EEA 2019b), biodiversity (Vaughan et al. 2019) and ecosystem health (Reker et al. 2020). These assessment reports represent a leaf forward, first of all because they identify 'non-problem areas' and 'problem areas' with respect to their themes.

### 11.2.1. Why address environmental trends in Europe' seas?

Hence, multiple thematic assessment mappings have been carried out, but with a focus on specific time periods. With the recent reporting under the MSFD, times has come to not only assess the state of the European's seas for the 11 descriptors, but also to look for long-term (i.e. >20 yr) monitoring data sets dating back to times before the MSFD was adopted. Why? The answer to this question is simple: We need to keep track of and document improvements in the marine environment of Europe.

This report aims to showcase that the combination of EU legislation, especially Programmes of Measures under the MSFD and Water Framework Directive (WFD), regional marine strategies and action plans as

well as national legislation and policies lead to clean, healthy and productive seas with a good environmental/ecological status and favourable conservation status.

This work is also inspired by the 'Marine Messages II' synthesis report published by the EEA in 2021 (Reker et al. 2020). As part of the identification of successful management activities and measures, Marine Messages II highlighted an example from the Baltic Sea, i.e. the trend-reversal of eutrophication status in the open parts of the Baltic Sea, due to reduction in input of nutrient from upstream catchments (Box 5.3 in Reker et al. 2020). This modelled time series cover the period 1900-2200 and shows how the open parts of the Baltic Sea have changed from being 'non-problem areas' to 'problem areas', affected by nutrient inputs and eutrophication effects (1900-1980), as well as the start of the recovery phase (1980-2010). From 2020 and onwards, the implementation of additional measures will, based on modelling, lead to a Baltic Sea unaffected by eutrophication.

Communicating success stories like the above example is essential when coming to implementation of evidence-based management strategies and to engagement of the public. We do strongly believe in the power of well-documented successes – and therefore we tasked ourselves to systematically screen for the best available long-term data sets showing either the effect of good management practices or the consequences of business-as-usual or non-action.

We are aware that this report only shows the tip of the iceberg knowing that there are many long-term data sets we cannot get access to. However, with this report, the EEA hopes to take the first step toward regularly reporting of environmental trends in Europe's seas. In some years from now, we are confident that this type of reporting will document the successful effects of implementation of EU's marine policies and strategies. Ultimately, such reporting will document recovery trajectories for a broad range of indicators, indices and descriptors and that Europe's seas will become cleaner, healthier and more productive.

### 11.2.2. How have we addressed and mapped environmental trends?

#### *11.2.2.1. Study area*

The European seas are divided into four marine regions: 1) the Baltic Sea, 2) the North-east Atlantic Ocean, 3) the Mediterranean Sea and 4) the Black Sea (Figure 1). Of the 27 Member States within the European Union, 25 have coastlines and marine territories:

1. The Baltic Sea is a brackish inland sea bordered by eight EU Member States and Russia. It consists of the Baltic Sea proper and three large gulfs (Gulf of Bothnia, Gulf of Finland and Gulf of Riga) and is connected to the North Sea through the Kattegat and the Danish Straits (Szymczycha et al. 2019). Losses of nutrients from agricultural catchments and direct discharges from industries and cites have led to a well-documented large-scale eutrophication problem along with impacts from other pressures, in particular fishing, and hazardous substances (Murray et al. 2019). Due to the status as inland sea with reduced water exchange with the North-Atlantic Sea, the Baltic waters have residence time of 25 years. The EU Member States with sea territory within the Baltic Sea have joined forces in the Helsinki Convention (HELCOM) to work for good ecological status in the Baltic Sea. For more information, please confer with HELCOM (2010, 2018a) and Reusch et al. (2018).
2. Covering the European waters from the Barents Sea in the north, over the western sea territories of Iceland, Ireland, Norway and the United Kingdom to the Canary Island in the South, the European part of North-east Atlantic Ocean covers the largest part of the European marine waters. Nine EU Member States border the region along with Iceland, Norway and the United Kingdom. The North-east Atlantic Ocean consists of five sub-regions: Arctic water, the wider North Sea, the Celtic Sea, Bay of Biscay and Iberian Coast, and the wider Atlantic, which is directly connected to the rest of the Atlantic Sea. The North-east Atlantic Ocean provides multiple resources, including biological resources (fish and shellfish) and natural resources (oil & gas, minerals, etc.). The greatest human pressures and threats to the ecosystems are overfishing and pollution. Within OSPAR, the bordering countries cooperate on the

management of the health of the North-east Atlantic marine waters. For more information, please confer with OSPAR (2010, 2017c,d) and Reker et al. (2020).

3. To the south, Europe is separated from Africa by the Mediterranean Sea. The Mediterranean Sea is almost enclosed by the bordering eight EU Member States, North Africa and the Levant to the East. It is connected to the Black Sea via the Turkish Straits, to the Atlantic Ocean via the Strait of Gibraltar and to the Red Sea via the Suez Channel. The Mediterranean Sea contains a rich biodiversity and several endemic species. The Mediterranean Sea serves as one of the most exploited resources by fishing, which has led to high pressures on fish stocks. The countries surrounding the Mediterranean Sea cooperate within the Barcelona Convention (BARCOM) and the UNEP/MAP BARCOM Secretariat to ensure sustainable exploration and a healthy environment within the region. For more information, please confer with UNEP/MAP & Plan Bleu (2020) and EEA (2020).
4. The Black Sea is a large brackish, inland water body bordered to the west by two EU Member States, i.e. Bulgaria and Romania and by Ukraine, Russia, Georgia and Turkey (Todorova et al. 2019). The Black Sea is connected to the Sea of Azov in the north and to the Mediterranean via the Marmara Sea, while many countries drain to the Black Sea via large rivers (Todorova et al. 2019). Nutrient inputs have led to a large-scale eutrophication problem within the Black Sea (Yunev et al. 2017). Black Sea countries cooperate through the Commission on the Protection of the Black Sea Against Pollution (BSC). For more information, please confer with BSC (2019) and EEA (2020).

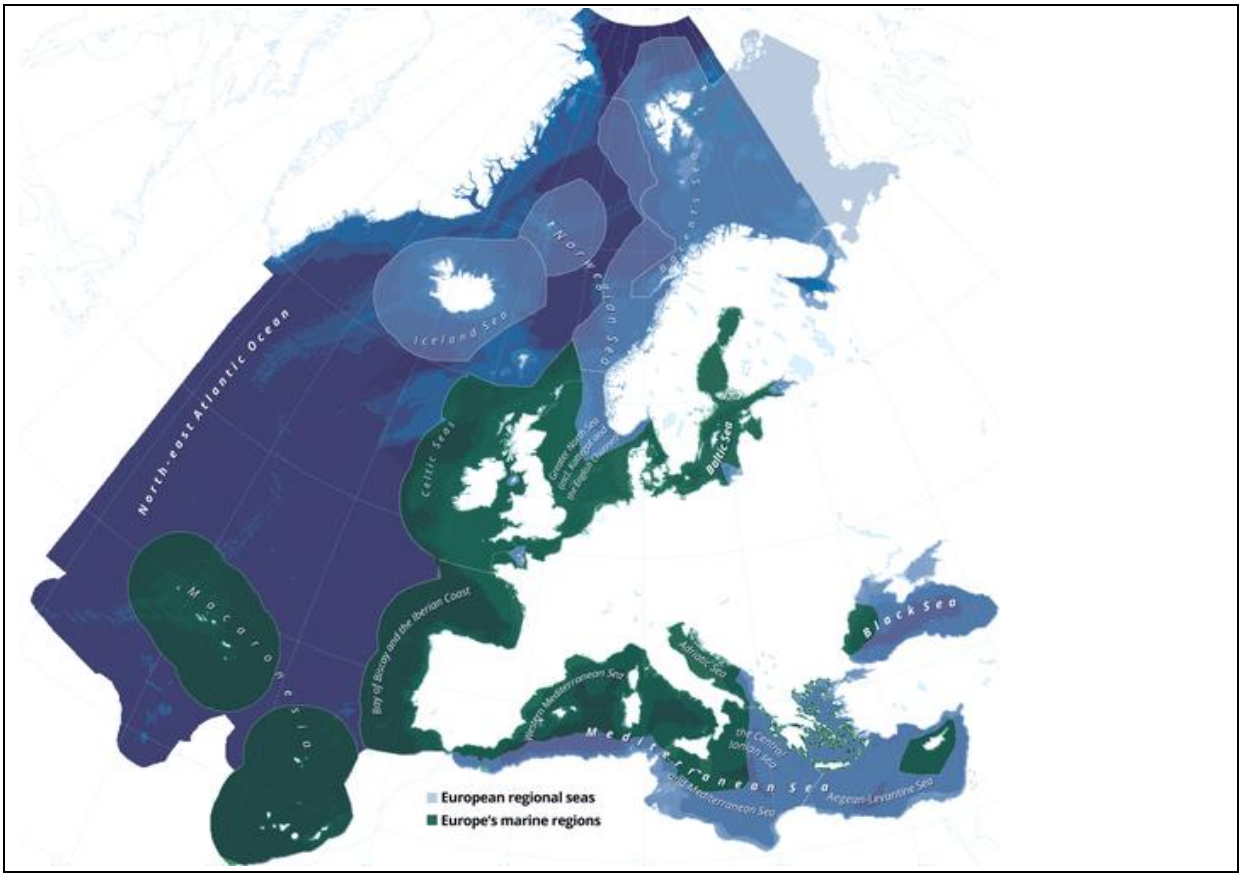



*Figure 11.1 Europe's seas with regions – plus case studies*

### *11.2.2.2. Methods*

Out take on doing this provisional screen for data set illustrating long-term environmental trends in the European marine environment has been straight forward:

- Setting the scene: Firstly, we planned and prioritized. Due to the resources available for the study, we focused on MSFD descriptors and not indicators covered by other directives and policies.

- Meta-review, i.e. a review of existing reviews and assessment reports: Reviewing relevant scientific literature (papers and books), regional assessment reports and pan-European assessments has been made for all descriptors except D9 Contaminants in Seafood,
- Getting access to data: For those descriptors, where interesting long-time series were identified, endeavours have been made to get access to the data behind these. For some descriptors, we have access to relevant data sets, but for other, access to data have been complicated or data simply do not cover what we define as a long-time period (e.g. marine litter and noise).
- Case studies: Four case studies are included in order to demonstrate the power of using multi-metric indicator-based assessment tools in combination with good datasets. Two of the case studies focus on contaminants and an application of the CHASE tool (the HELCOM Chemical Status Assessment Tool, Andersen et al. 2016) in the Nervión Estuary (Spain) and Ranfjorden (Norway) as well as in the eastern parts of the North Sea. Two other case studies focus on eutrophication and an application of the HEAT tool (the HELCOM Eutrophication Assessment Tool, Andersen et al. 2011), one in the open parts of the Baltic Sea and another in the Mersin Bay (Turkey).
- Cross-cutting synthesis: Based on the above four tasks, we have compiled a cross-cutting synthesis of the findings. A special focus has been put on two themes: 1) where we are now in terms of documenting long-term trends for MSFD descriptors, and 2) perspectives and recommendations, the latter targeting actions to improve access to some well-known but at this time inaccessible datasets.

Detailed descriptions of methods used for this report can be found in the Supplementary Material.

#### *11.2.2.3. Data Sources*

This ETC technical report is anchored in multiple data sources ranging for individual studies published in peer-reviewed scientific journals over national monitoring activities to regional and pan-European assessment and synthesis activities:

- Primary literature: Large parts of the reviews are anchored in primary literature, i.e. scientific publications, mostly original research. In some cases, book have been included.
- National monitoring under the MSFD and WFD: The data sets used are to a large extent rooted in national monitoring activities under the WFD or MSFD. These data are provided via EMODnet, ICES or WISE-Marine. In some cases, data from national monitoring have been used to document long-term trends in contaminations status, i.e. in the North Sea (international dataset) and in the Ranfjorden, Norway and the Nervión Estuary, Spain.
- Additional data sets from research activities and/or projects (wherever relevant): One of the case studies presented for D5 eutrophication is anchored in unpublished modelled data provided by BNI (the Baltic NEST Institute) at Stockholm University
- Other types of data and information, i.e. scientific publications, of relevance to the work: Parts of the review are meta-reviews based on published scientific reviews as well as assessments carried out by regional seas conventions. In some cases, data from EEA's activities have been include, for example from EEA's thematic marine assessments.

Detailed descriptions of data used for this report can be found in appendices 13-19.

## 11.3 Temporal trends in indicators and environmental status

This chapter addresses MSFD descriptors 1-11, noting that D 9 'Contaminants in seafood' is dealt with in less detail. We have applied, to the extent possible, a common approach to the review and presentation of selected long-term trends:

- Justification for the selection of indicator(s) and/or index/indices, including relevant references.
- Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range.

- Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, Habitats Directive, etc.), and background policy documents.
- Methodology for indicator and/or index calculation including relevant references.
- Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties
- Key results of the trend analyses for specific indicators and/or index/indices.
- A short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage.

The MSFD descriptors dealt with are:

1. Biodiversity
2. Non-indigenous species
3. Populations of commercial fish species
4. Food webs
5. Eutrophication
6. Sea-floor integrity
7. Alterations to hydrography
8. Contaminants
9. Contaminants in seafood (two examples only)
10. Marine litter
11. Energy and noise

Further, we have to the extent possible focused on covering all European regional seas cf. Fig 1: 1) The Baltic Sea, 2) the Black Sea, 3) the Mediterranean Sea, and 4) The North-east Atlantic Ocean.

### 11.3.1. D1: Biodiversity

The indicator selected to analyse temporal trends on D1 Biodiversity is the Living Planet Index (LPI). This index was selected alongside other global indicators to assess progress towards the Aichi biodiversity targets agreed by the Convention on Biological Diversity's (CBD) in 2010 (Tanzer et al., .

The LPI is an established methodology applied in several international assessments to evaluate trends in biodiversity (e.g. IPBES 2018). The use of this index across a wide range of European marine biodiversity trends is described more fully in the ETC-ICM Technical Report on "Biodiversity in Europe's seas" (Vaughan *et al*., 2019).

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

The LPI is a generalised additive model which aggregates trends in abundance of multiple populations belonging to a particular group (e.g. at species level, or at wider taxonomical level) to find the average trend underlying changes in the group (Loh *et al*. 2005, McRae *et al*. 2008). The LPI can be calculated from time-series of either population size, density (population size per unit area), abundance (number of individuals per sample) or a proxy of abundance (McRae *et al*. 2008). Note that where abundance is mentioned, this can also be surrogated to other measures such as biomass or diversity indices, though care is needed in combining measures which do not correlate with each other through time. As the LPI represents the average trend from a starting point in time, results from indices calculated from different type of data can be compared.

The index includes the following parameters:

- Index values: These represent the average change in population abundance, so it shows the rate of change and not the absolute change in population sizes. For each year, the index value and confidence intervals represent the overall trend in that year compared to the baseline year.

- Baseline year: This is the starting point of the time series or a standard pre-set value. The index value in any given year is always relative to the baseline year.
- Final year: The final year of the index is also set by the availability of data and it is the latest year for which a good amount of data is available.
- Baseline: The index starts at a value of 1. If the LPI and confidence intervals move away from this baseline, there has been an increase or decline compared to the baseline year.
- Confidence intervals: the shaded areas show 95 % confidence intervals. These illustrate how confidence in the trend in any given year relative to the baseline year; in other words, the uncertainty in the LPI is cumulative throughout the time series and the intervals always widen as the uncertainty from each of the previous year is added to the current year.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

For the EU, the overriding policy questions are enshrined in the new EU Biodiversity Strategy 2030 (EUBS2030). This builds on the previous Strategy which ended in 2020 to answer key questions: (i) Are marine habitats recovering? and (ii) Is the resilience of marine ecosystems threatened? EUBS2030 specifically requests Member States to ensure there is no deterioration in conservation trends and status of all protected habitats and species by 2030 (European Commission, 2020a).

To understand whether biodiversity is deteriorating or recovering requires the availability of long-term trends of biodiversity, ideally linked to specific pressure trends. The overall status of marine waters has been assessed most recently in the MSFD, which is the central overarching policy framework for ensuring that Europe's seas reach a GES (Anon., 2008), leading to an assessment reported in 2019 (European Commission, 2020b). This highlighted that GES has not been reached overall, and calls for increased work to improve, among other things, methods, targets and monitoring programmes to improve understanding for the next implementation report.

Trends are also required to be reported under the Birds and Habitats Directives. The Habitats Directive requires statements on future prospects and trends (Council Directive 92/43/EEC) though the majority of trends are reported as unknown. The Birds Directive (Council Directive 2009/147/EC), also requires consideration of status and trends of birds (including seabirds) and their habitats though does not specify indicators or a formal assessment process.

Additionally, the WFD requires assessment of water quality and considers ecological status from specified biological quality elements (BQEs) which are often derived from long-term monitoring data.

Of these directives, only the MSFD covers all species and habitats (in principle at least), though it is possible to combine trends from these different sources.

Finally there are also the global drivers, especially the Aichi Targets under the Convention on Biological Diversity (CBD) which asks five key questions when considering use of an indicator (CBD 2007):

- What is changing and to what extent? (measurement of trends and state)
- Why is it changing? (pressure)
- Why is it important? (goods and service provision)
- What are we doing about it? (response)
- Do we have the means to formulate and implement response measures? (capacity)

This frames the kinds of trends in biodiversity needed for understanding how state of the seas is changing and was a strong driver in using the LPI as a global-level indicator.

***Methodology for indicator and/or index calculation including relevant references.***

LPIs were calculated for the following biodiversity components:

- Species – Birds, Cetaceans, Fish, Seals
- Habitats – Benthic invertebrates, Macroalgae, Macrophytes, Phytoplankton, Zooplankton

For each group, population time series were searched across a range of sources for each regional sea. Due to data availability issues, it was not possible to obtain 20 years long time series for each group, therefore the construction of the LPI was based only on the time period 1999-2014 (15 years). The LPI plots obtained displays variations from the baseline year 1999.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

Input data available to produce LPI for species and habitats are displayed in Table 1. More details are also provided in the Appendix 13 (Table 13A). Not all available data were considered useful to evaluate trends thus only a subset was used to construct the LPIs. It must be noted that data for some biodiversity components are not available for all regional seas, in particular no information was available for the Black Sea. Additionally, in few cases the LPI is built on a low number of populations therefore the confidence in the representativeness of the results is reduced. The most obvious factor is that the majority of the series are for vertebrate species in the NE Atlantic and Baltic Seas, primarily seabirds, seals and fish (Table 1). A notable exception is the presence of longer-term trends for invertebrates in the Baltic Sea where the relatively shallow waters fall within under the area of interest for the WFD. In other marine regions, higher proportions of the water are offshore and consequently monitoring is less intense due to cost and accessibility. This has been recognised in the MSFD Art.20 report by the European Commission (EC 2020b).

Some data sources are established as European data portals providing repositories for long-term data, such as ICES Biodiversity which maintains monitoring data for seabirds and seal abundance and distribution. This portal assembles data supplied by contracting parties to OSPAR (North-east Atlantic) as well as other data from the ICES area but not open access as may be provided by NGOs (ICES, 2021a). The latter point is a general issue with biodiversity data, much of which is managed and gathered by non-governmental agencies, such as NGOs, consultancies and researchers, the level of accessibility is very varied, and each one needs extra effort in acquiring or agreeing data use. Other potential data sources include EMODnet Biology, though this would need to expand to include more trend data.

Collation of data is primarily being driven by EU Directives and the role of both the EEA and the Regional Seas Conventions is significant. While the formal reporting of data under the MSFD for example has been a unifying exercise, the underlying trend data to support assessments and targets is often not submitted to these organisations.

*Table 11.1 Summary of input data available for the calculation of Living Planet Index for species and habitats for each regional sea. Data are displayed as number of populations with number of species shown within brackets. N.a.: not available.*

| | Birds | Cetaceans | Fish | Seals | Benthic In-vertebrates | Macroalgae | Macrophytes | Phytoplankton | Zooplank-ton |
|---|---|---|---|---|---|---|---|---|---|
| Baltic Sea | 22 (2) | na | 31 (4) | 3 (3) | 201 (16) | na | na | 1 (283) | 830 (92) |
| Black Sea | na | na | na | na | na | na | na | na | na |
| North-east Atlantic Ocean | 374 (74) | 2 (2) | 593 (82) | 11 (2) | 32 (1) | 2 (1) | 2 (1) | 1 (1) | na |
| Mediterranean Sea | 9 (4) | na | 7 (4) | na | na | na | na | na | na |

***Key results of the trend analyses for specific indicators and/or index/indices***

Results are divided between species and habitats (Figure 2):

- Birds: Baltic Sea populations appear stable from the baseline year. In contrast, in the NE Atlantic, marine birds' trends are declining. In the Mediterranean Sea, the trend is based on very small population set and is skewed by a single population.
- Marine Mammals: Seal populations show marked changes so that overall seal populations show declining trends in the Baltic Sea from three species, while those in the North Atlantic are increasing from two species. There are not enough time series for cetaceans to be used here
- Fish: in the Baltic Sea, fish populations fluctuate around the baseline with some sign of recovery in the last five years of the time series. Mediterranean populations appear in decline whilst there is a positive trend in the North-east Atlantic.

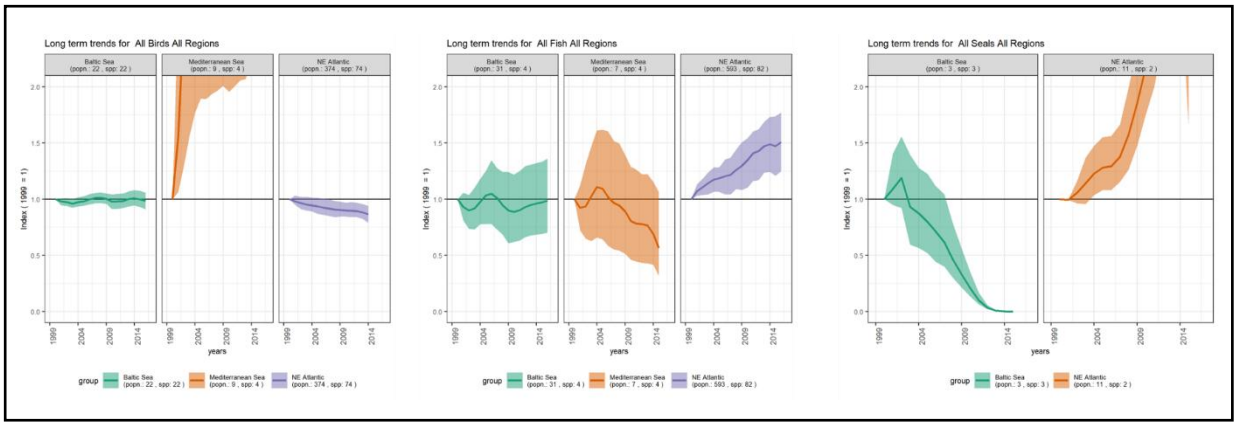



*Figure 11.2 Species trends using Living Planet Index - all regional seas.*

For benthic habitats, there are few available time-series so Figure 3 shows a selection of results. The methods used to measure the trends vary from indices of benthic diversity to Ecological Quality Ratio (EQR) values from benthic indices as well as level of cover for seagrasses. It should be noted that the combined EQR values do not appear to vary over time**,** whereas trends of benthic invertebrates deriving from benthic indices are declining. The level of seagrass extent is slowly improving over time.

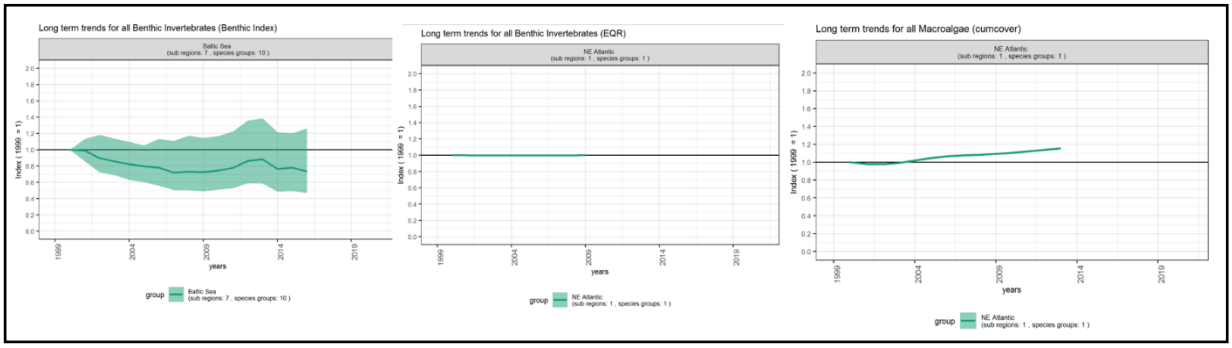



*Figure 11.3 Benthic Habitats trends using Living Planet Index - all regional seas.*

Similarly, for pelagic habitats there are few time series available through others that have been identified in research papers. The picture for these is mixed partly depending on the fact that time series belong to a unique sub-region or are from measures designed to address specific questions or pressure impacts (Figure 4). For example, the increasing trend in Phytoplankton biomass may reflect a specific eutrophication event. More data would be needed to be able to draw firm conclusions.

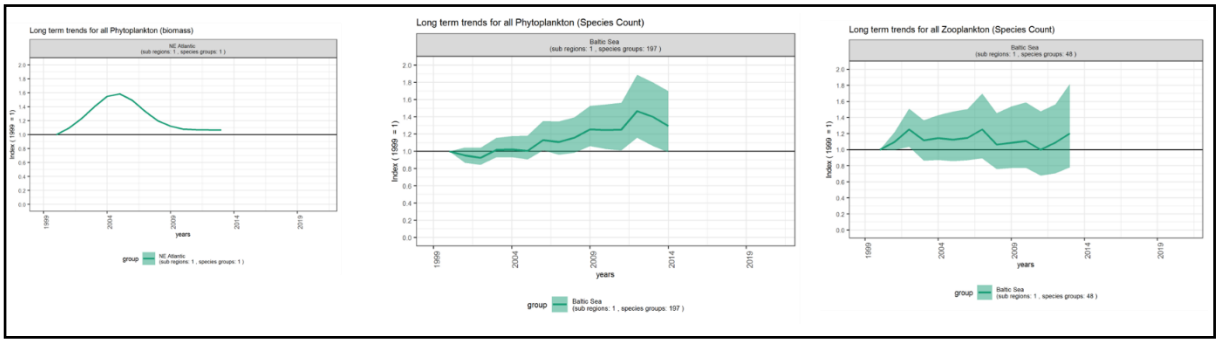



*Figure 11.4 Pelagic Habitats trends using Living Planet Index - all regional seas.*

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

There is no doubt that there are relatively few long time series across the main Europe seas, and those that exist are typically restricted to a few vertebrate species. The exceptions lie mainly in coastal waters covered by the WFD but even here there are relatively few long series. There are particular and known gaps in time series for the Mediterranean and Black Seas which will need to be resolved in order to complete the European picture, but equally large areas of open seas do not have long historical trends or continuous monitoring for biodiversity due to the cost and this is particularly true of the extensive deep sea areas in the NE Atlantic. Providing clear paths to encourage data submission and development of outputs of trends would help to improve this situation, given that long national time series are available such as those used for reporting to the EEA State of Environment Report. The current ETC/ICM task on developing the case for a European Aquatic Biology indicator, focused on the biological quality elements used in WFD assessments is one way of showing benefits to countries to encourage in turn greater coordination and synthesis of the trend data.

### 11.3.2. D2: Non-indigenous species

Non-indigenous species (NIS) are species introduced by human activities to areas outside their natural range. NIS can, if established in the recipient area, pose a threat to the local biodiversity outcompeting native species or changing food web dynamics and functioning. By disturbing the ecosystems, NIS impacts may span further to socio-economic impacts through disrupting the provision of ecosystem services (Katsanevakis et al. 2014). However, impacts of NIS may not always be negative, as also they can have positive effects, such as food provision (Katsanevakis et al. 2014). NIS are found in almost all taxonomic groups, including both plants and animals and ranging from unicellular organisms, such as phytoplankton, to larger organisms, such as vertebrates and even mammals.

Descriptor 2 outlines that NIS introduced by human activities should be kept at levels that do not adversely alter the ecosystems. The primary assessment criterion is the number of newly introduced NIS, which should be minimised and where possible reduced to zero (D2C1). Further, abundance and spatial distribution of invasive species (D2C2) and proportion of a species group or spatial extent of a habitat type adversely affected by invasive NIS (D2C3), are defined as secondary assessment criteria.

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

When NIS are established in an area, it is practically impossible to remove them. Thus, the most effective measures are to prevent introductions and management success of NIS is primarily measured as numbers of newly introduced species. Also, abundance and distribution of established NIS and the proportion of NIS in specific species groups can be used as indicators. The main vectors for introductions of marine NIS are mainly connected to increased maritime activities, such as shipping via ballast water or on the hull of the ships as biofouling. Consequently, NIS are often first discovered in areas close to harbours. Although

NIS introductions happen at a local scale, assessments are generally done at regional level as intra-regional dispersion induce high uncertainty on where the initial introduction took place (HELCOM 2018b).

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

NIS gained global attention in 1992 when the Convention on Biological Diversity (CBD) committed contracting parties to prevent introductions of alien species (CBD 1992). NIS also became an integral part of European marine policy upon enforcement of the MSFD and the EU Regulation on Invasive Alien Species (European Commission, 2014a). Further, the IMO Ballast Water Management Convention entering into force in 2017, requires ships to implement a ballast water management plan, aiming at minimizing the risk for NIS introductions via ballast water transport (IMO 2018).

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

NIS are generally monitored as part of other environmental monitoring programmes, i.e. the monitoring is not targeted at NIS. Thus, the knowledge about new introductions may appear with delay and incidental sightings of NIS are also common as a first record. For example, only 73% of reported marine NIS were recorded in standard monitoring programmes in Denmark (Staehr et al. 2020). Information on NIS introduction events are stored in international databases AQUANIS ("Information system on aquatic non-indigenous and cryptogenic species", https://aquanisresearch.com/) and EASIN ("European Alien Species Information Network", https://easin.jrc.ec.europa.eu/easin". Reports from the periodic assessments of the regional seas, scientific literature and the EEA indicator "Trends in marine non-indigenous species" where used as sources of information in this chapter.

***Key results of the trend analyses for specific indicators***

Increased global trade has led to increased ship transport between continents largening the paths for NIS introductions to avenues. This pattern can be seen in all European regional seas, with increased appearances of NIS through the period 1949-2017 (Figure 5; EEA 2019). A marked increase in NIS introductions is seen in the 1980s, whereas during the last decade the increase has levelled off or even declining number of new introductions are seen. Invertebrates form the largest group of NIS in all regional seas.

In the Baltic Sea, the number of new introductions is decreasing. However, NIS already introduced in the Baltic Sea are expanding their distribution ranges. The latest examples of significant range expansions include the round goby (*Neogobius melanostomus*) and the North American mud crab (*Rhithropanopeus harrisii*), which both have rapidly colonised multiple Baltic sub-basins. With enlarged distribution ranges and increased densities, these species are expected to have a strong impact on the native communities (HELCOM 2018b; EEA 2019). In the Danish part of the Baltic Sea, the relative proportion of NIS increased significantly in both phytoplankton and benthic invertebrate communities in the period 1989-2014 (Staehr et al. 2020).

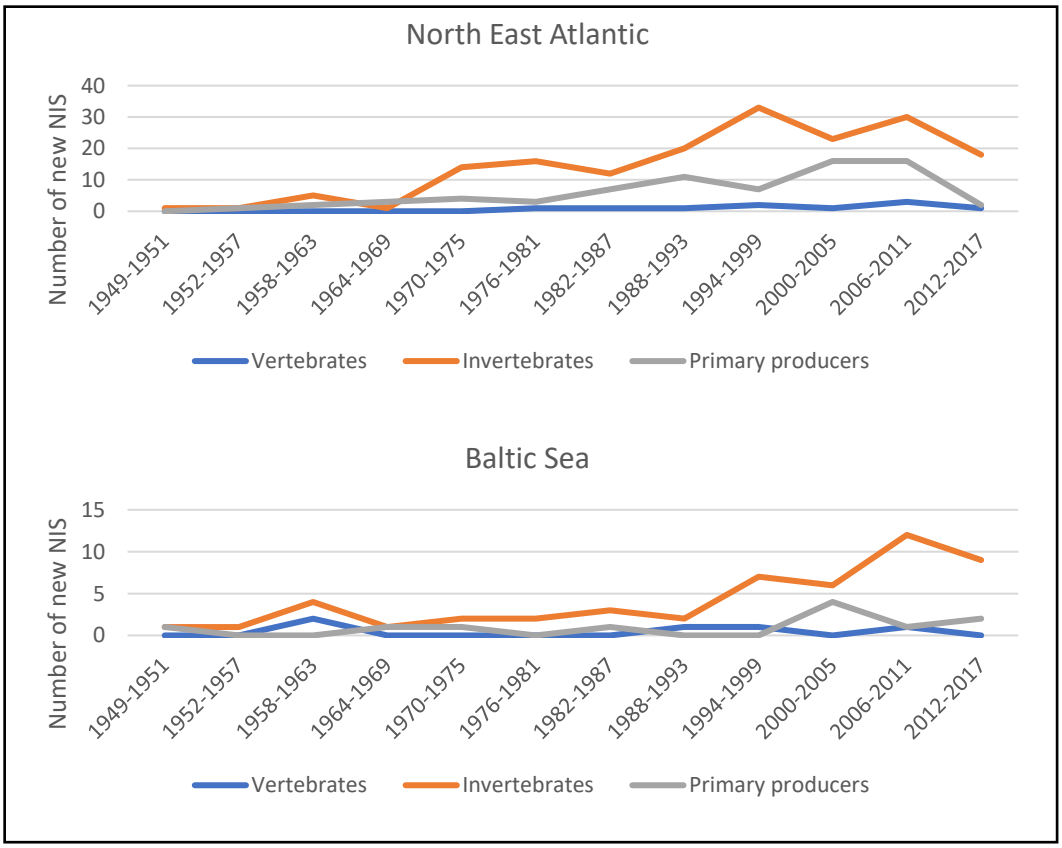
In the North-east Atlantic, new NIS are encountered at a quite constant rate since year 2000. In the Greater North Sea an increase in new introductions was observed, whereas high interannual variation restrict detection of trends in Celtic Seas and Bay of Biscay and Iberian Coast (OSPAR 2017b). In Danish waters in the North Sea and Skagerrak, the proportion of NIS benthic invertebrate community showed a significant increase in the period 1989-2014 (Staehr et al. 2020).

In the Mediterranean Sea the trend in new NIS introductions is increasing with a peak around 2005 (UNEP/MAP 2017 EEA 2019). Whereas Eastern Mediterranean Sea still face an increase in NIS introductions, other parts of the Mediterranean Sea show declining trends (UNEP/MAP 2017). Progress has been

made in documenting NIS introductions and in assessing the pathways of introductions in the Mediterranean Sea, which will facilitate the management of NIS (UNEP/MAP 2017). More than 50% of NIS recorded in the Mediterranean have been shown to enter the area through the Suez Canal (Mannino et al. 2017). With the widening of the Suez Canal in 2015 catering for increased shipping traffic, the potential for new NIS introductions further increased.

In the Black Sea, the trend of new NIS introductions shows a decrease since 2000, but some earlier introduced NIS keep on expanding their distributions and densities (EEA 2019). Past NIS introductions have had major impact on the Black Sea ecosystem by interrupting the food web balance and thus led to reduced fish production in the Black Sea (Kasapoglu et al. 2015). An example is the introduction of the comb jelly *Mnemiopsis leidyi* causing a collapse in the Black Sea anchovy stock (BSC 2019).

Maritime transport is the main vector for marine NIS. Both in the Baltic Sea and in Italian waters shipping related pathways are behind >50% of NIS introductions (Fig 6, Servello et al. 2019). Unaided introductions, i.e. natural dispersion of NIS to neighbouring areas is also an important pathway, highlighting the need for regional cooperation in NIS management. Unaided introductions are the pathway showing most increase in Italian waters and being the most common pathway in the period 2012-2017. In the Baltic Sea transport of NIS via ballast water peaked around 2010, but introductions via ballast water has decreased lately. In Italian waters, however, transport of NIS via ballast water is increasing. The recent increase in NIS introductions through escaping from confinements, observed both in the Baltic Sea and in Italian waters, need attention.



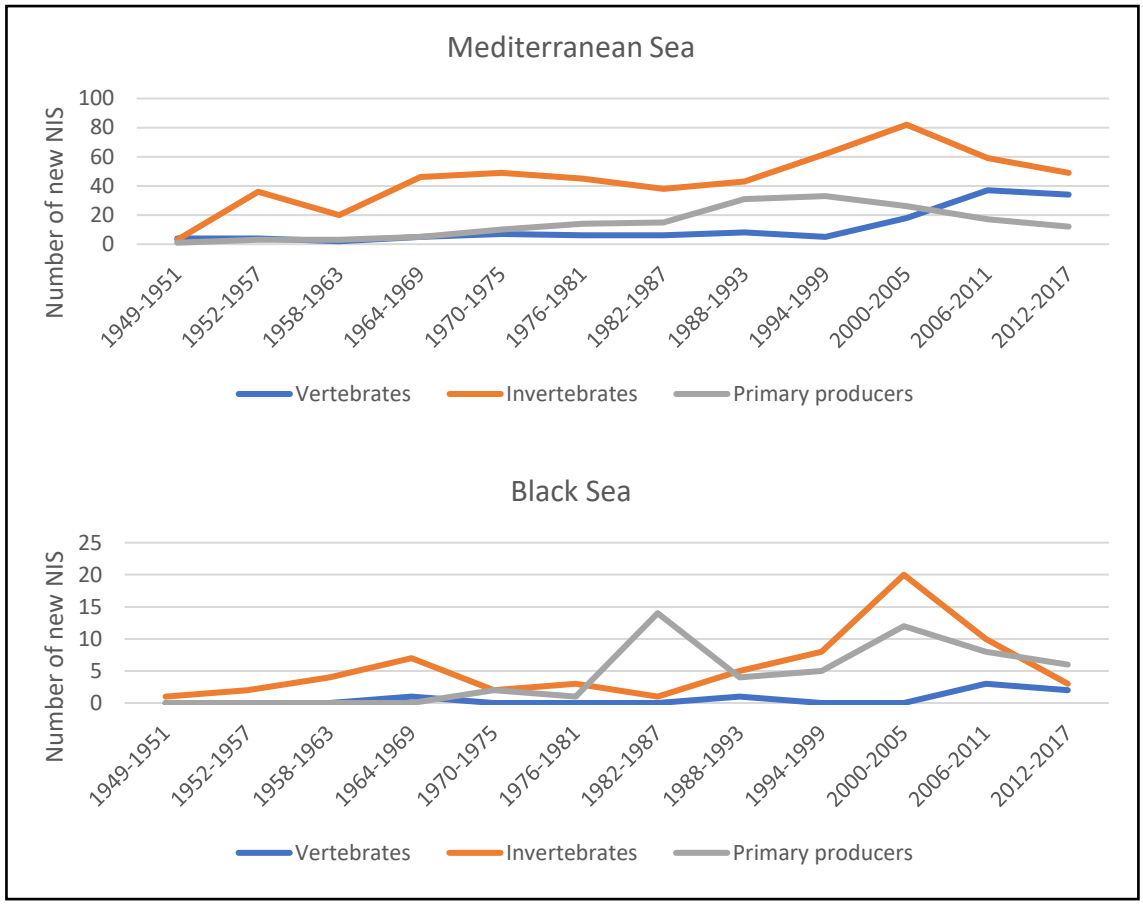



*Figure 11.5 Trends in Non-Indigenous Species (NIS) introductions in the European regional seas 1949-2017 grouped in six-year periods and presented by organism group.*

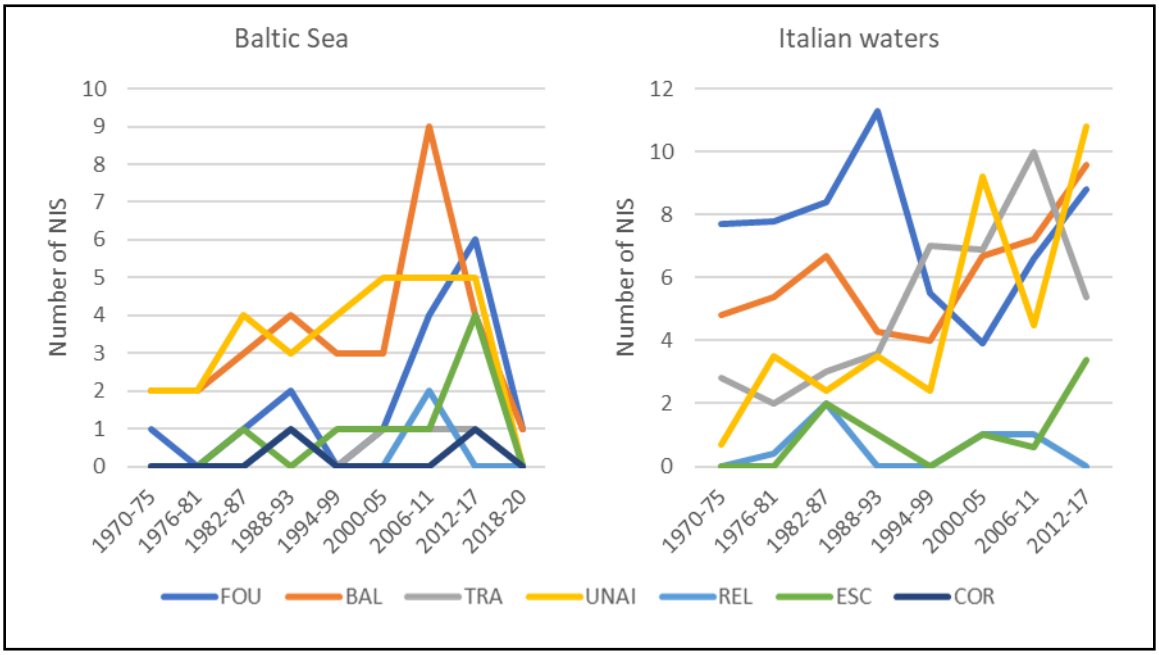



*Figure 11.6 Trends in pathways for Non-Indigenous Species (NIS) introductions in the Baltic Sea (left) and Italian waters (right), where the introduction vector has been defined. FOU = Transport: ship/boat hull fouling, BAL = Transport: ship/boat ballast water, TRA = Transport: other, UNAI = Unaided, REL = Release to nature, ESC = Escape from confinement, COR = Corridor. Sources: Baltic Sea data from ETC/ICM 2021 (update of 'Trends in Marine Non-indigenous Species' indicator), figure from Italian waters modified based on Servello et al. 2019. Note that the last period in the Baltic Sea is only three years.*

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

Although regulative frameworks have been enforced, introductions of NIS are still taking place in all of Europe's seas. Positive signs in terms of lowering number of new introductions are seen, but on the other hand, established NIS keep on expanding their distribution range. Although ballast water treatment has been improved and the IMO regulation has entered into force, it is too early to detect any immediate impact on the number of new NIS introductions.

A general gap in knowledge arising from the assessments of the regional seas is the lack of dedicated monitoring of NIS. NIS is most often only monitored as part of other biological monitoring programmes, meaning that not all habitats, nor all NIS hot spots, are necessarily monitored and NIS are recorded only when already established in an area. NIS impact assessments are complicated as long-term quantitative data often are missing. Further, complex species interactions and the variety of both positive and negative impacts make management difficult.

### 11.3.3. D3: Commercial exploited fish stocks

For this descriptor, focus has been on the data from long-term monitoring of commercial fish stock, especially in the North Sea and Baltic Sea regions. The indicators are well established and can be updated spatially and temporally.

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

Fishing Mortality (F) (The proportion of a fish stock removed by fishing) is generally used as measure for fishing pressure. F is usually expressed in relation to $F_{MSY}$ (the fishing mortality at Maximum Sustainable Yield (MSY)). Spawning Stock Biomass (SSB) is defined as the total biomass of the sexually mature fish in the stock. MSY $B_{trigger}$ is defined as the biomass reference point that triggers a cautious response within the ICES MSY Framework. LFI is defined as the biomass proportion of large fish (e.g. more than 50 cm) of the whole biomass of the catch (Greenstreet et al., 2011). As the size and weight composition is not determined in a catch another index called Large Species Indicator (LSI) has been used. LSI is defined as the biomass proportion of large species (defined by the species $L_{max}$) of the whole biomass.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

The European Commission has laid down the criteria for GES for the various descriptors (European Commission, 2017). Descriptor 3 (Populations of all commercially exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution that is indicative of a healthy stock) are separated into three criteria as listed below. The overview indicates the level of spatial and temporal coverage in the various sea regions.

*Table 11.2 Overview of data and information available for the review of MSFD descriptor 3 from the different marine regions.*

| Criteria | Baltic Sea | North Sea | Atlantic Ocean | Mediterranean Sea | Black Sea |
|---|---|---|---|---|---|
| Fishing mortality | Good | Good | Good | Good | Good |
| Spawning Stock Biomass | Good | Good | Good | Limited | Very limited |
| Proportion of large fish | Limited | Limited | Limited | Very limited | - |

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

The ICES makes assessments of the status of commercial fish stocks in the Baltic Sea, North Sea and Atlantic Sea. These assessments are for most species carried out annually. The F and SSB for each assessed species can be downloaded from the ICES Stock Information Database (ICES 2021b). The ICES

Stock Information Database data are available for the analytically assessed ICES stocks from 2014 onwards. The Standard graphs web services (R scripts) provide the ability to search and retrieve data from database by providing access to the data.

Data and graphs on a more aggregated level can be found in the ICES Ecosystem Overview for each Sea Ecoregion (ICES, 2020a, 2020b, 2020c, 2020d, 2020e, 2020f and 2021c). Time-series of annual relative fishing mortality (F to $F_{MSY}$ ratio) and biomass (SSB to BMSY $B_{trigger}$ ratio) aggregated to fisheries guild (a mixture of behavioral and taxonomic) for benthic, demersal, pelagic, crustacean and elasmobranch stocks are provided. An annex details which species belong to each fish category

One of HELCOM Core Indicator of Biodiversity is the proportion of Large Fish (Oesterwind et al., 2013). However, the most recent data is from 2011. It should be emphasized that the basis for this indicator is data from International Bottom Trawl Survey (IBTS). OSPAR has made an assessment of the proportion of large fish for the North Sea and the Celtic Sea in the period 1983-2016 (OSPAR, 2017f). This assessment is based on IBTS data as in the similar assessment done by HELCOM. The data are made available as Excel sheets on the Joint Nature Joint Nature Conservation Committee (JNCC) webpage.

FAO and the General Fisheries Commission for the Mediterranean (GFCM) has recently published a status report of the Mediterranean and Black Sea Fisheries (FAO, 2020). This report is published every second year. It is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions and through the online platform of the GFCM Data Collection Reference Framework. A study from the eastern part of the Mediterranean Sea provides a shorter time series of LFI from 2008 to 2012 (Edelist et al. 2014). Based on landings from the Northern Adriatic Sea a long time series (1945-2015) of data has been analysed in relation to several indicators (Fortibuoni et al., 2017) one of them being the LSI.

***Key results of the trend analyses for specific indicators*** **Baltic Sea**

Timeseries of data on F to $F_{MSY}$ ratios are shown in Fig. 7a. The data for each stock has been aggregated to species guilds of benthic, demersal and pelagic species. High levels of $F/F_{MSY}$ were observed in the years 1990-2000 followed by a steady decline during the last two decades. For the benthic and pelagic guilds, the $F/F_{MSY}$ are now close to 1 which is the optimal situation. The level for the demersal stocks is still rather high (close to 2) but the decrease since the 1990-2000 is noticeable.

Timeseries of on SSB at MSY $B_{trigger}$ ratios are shown in Fig 7b. The values are relatively high at present whereas the values for the demersal stocks (Cod) are low. The eastern Baltic cod has shown declining condition which has been linked to limited food availability as well as hypoxia and selective fishing pressure.

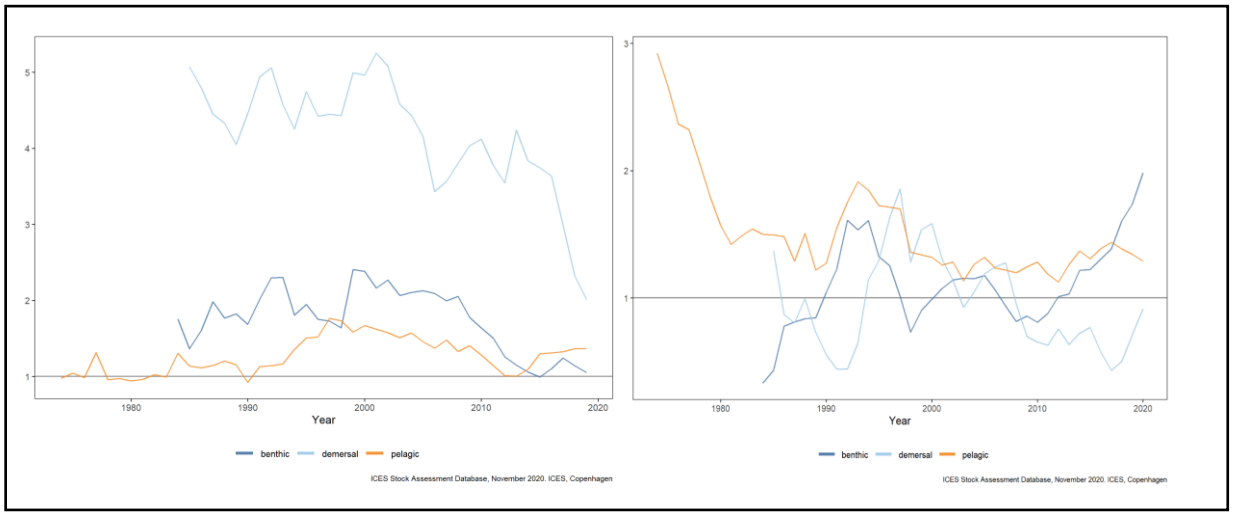



*Figure 11.7 a) F/FMSY for guilds of benthic, demersal and pelagic fish species in the Baltic Sea. b) SSB/MSY Btrigger fore guilds of benthic, demersal and pelagic fish species in the Baltic Sea.*

**Greater North Sea**

Timeseries of data on Fishing mortality (F) as a ratio to the Fishing mortality at Maximum Sustainable Yield ($F_{MSY}$) are shown in Fig. 8a. The data for each stock has been aggregated to species guilds of benthic, demersal, pelagic, and crustacean species. High levels of $F/F_{MSY}$ were observed for benthic, demersal, and pelagic guilds in the years 1990-2000 followed by a steady decline during the last two decades. The crustacean guild shows no clear trend. For all guilds the $F/F_{MSY}$ are now close to 1, which is the optimal situation.

Timeseries of Spawning Stock Biomass (SSB) as a ratio to the Spawning Stock Biomass at MSY $B_{trigger}$ for benthic, demersal, pelagic, crustacean, and elasmobranch guilds are shown in Fig 8b. The values of SSB/MSY $B_{trigger}$ are relatively high for all guilds except for the elasmobranch (Sharks and Rays) guild which are below 1 but seems to increase slowly since 2005.

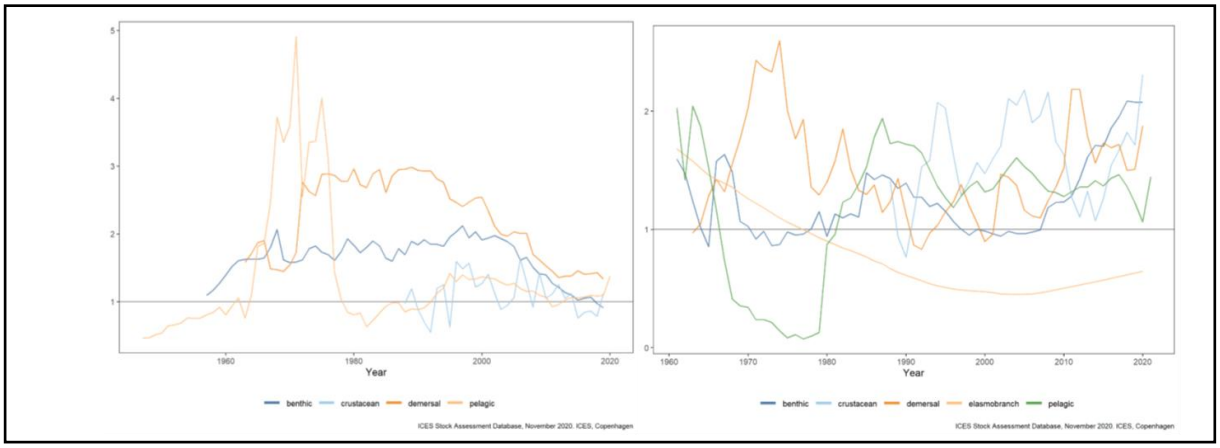



*Figure 11.8 a) F/FMSY for guilds of benthic, demersal, pelagic, and crustacean fish species in the Greater North Sea. b) SSB/MSY Btrigger fore guilds of benthic, demersal, pelagic, crustacean, and elasmobranch fish species in the Greater North Sea.*

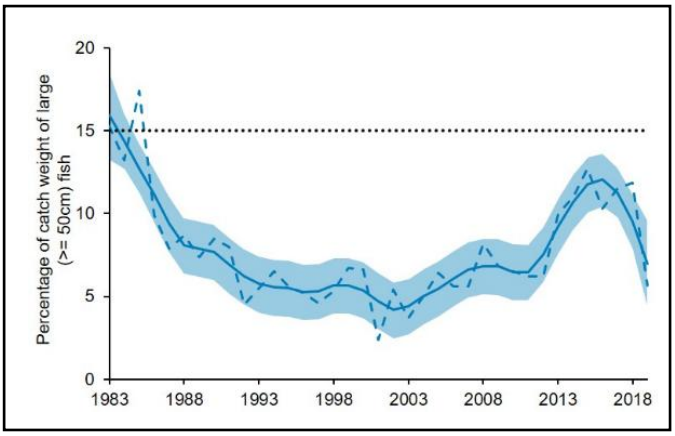



*Figure 11.9 The LFI time series is derived from data from the North Sea. The line graph shows the unsmoothed trend (dashed line) and a LOESS smoothed trend (solid line) with the shaded area showing the 95% confidence intervals around the smoothed trend. The black ho horizontal dashed line shows the assessment target from OSPAR (2017f). LOESS is a non-parametric regression method; it may be understood as standing for "Local regression".*

Data from a trawl survey from the North Sea and the Celtic has been analysed in order to determine temporal development of the LFI index (OSPAR, 2017f; JNCC, 2020). There is a clear sign of recovery of the indicator in the North Sea and parts on the Celtic Sea at least until 2016, however the most recent update for the North Sea has indicated a decline in the latest years (Fig. 9).

**Mediterranean and Black Sea**

A timeseries of data on Fishing mortality for the Mediterranean and Black Sea has been analysed recently (FAO, 2020). Fig. 10 shows the individual $F/F_{MSY}$ ratios for all the individual stocks in the Mediterranean and Black Sea (upper panel) and the average trend for all stocks and the standard error (lower panel). There is a remarkable variation in the individual stocks and some $F/F_{MSY}$ values are very high. The average trend seems to have peaked in 2012 followed by a decrease in the recent years.

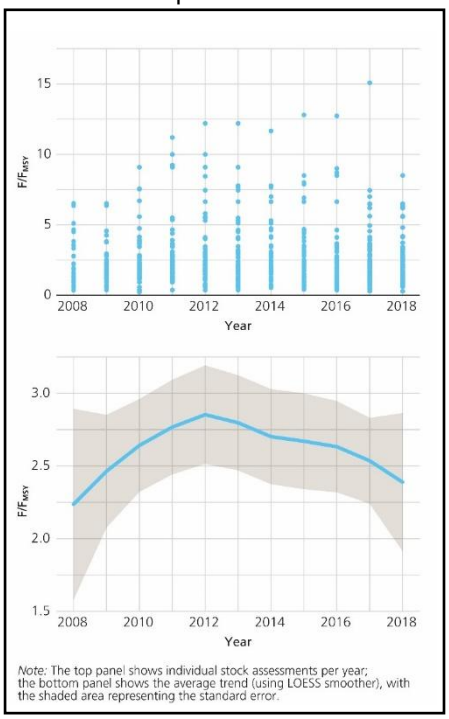



*Figure 11.10. Exploitation ratios (F/FMSY) of all species and management units in the Mediterranean and Black Sea, 2008–2018.*

Studies of LFI in the Mediterranean Sea a scarce and has a limited temporal and spatial coverage. The calculation of LFI demands that the data used contains information of the size distribution of each fish species in the catch. An alternative is to use LSI that indicates the proportion of the catches of large species (with a given max length of e.g. 30 cm) in relation to the small species. It should be noted that there seems to be a strong correlation between LFI and LSI (Shepard et al., 2012). Seven decades of data on the catches in the Northern Adriatic Sea (1945-2014) has been analysed in relation to a suite of ecological indicators among those the LSI (Fortibouni et al., 2017). Significant changes were observed between several periods in the timeseries (Table 2 and Fig. 11). LSI showed a strong decrease in the period 1945-1985 followed by an increase in 1986-1993. In the latest year the LSI has decreased again.

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

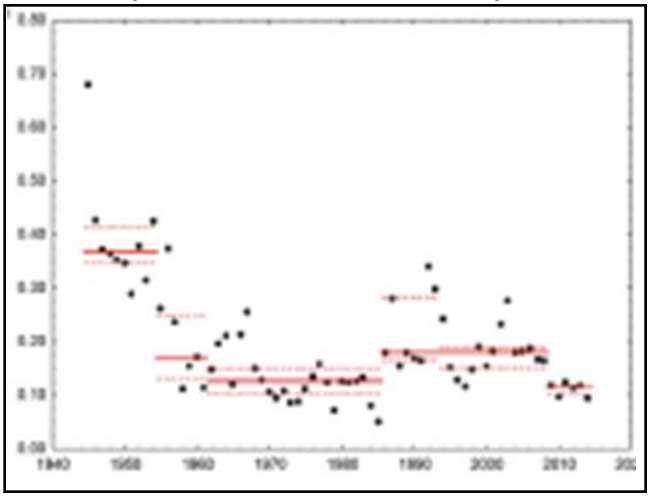


*Figure 11.11. LSI, large species indicator calculated based on landings disaggregated data. Black dots, data; continuous red line, median value in each period identified through the cluster analysis; dotted red lines, interquartile range in each period.*

Improvements of fish stocks in many regional seas have taken place during the last years and fishing mortality is now fished at rates at or below $F_{MSY}$ (Baltic Sea, Greater North Sea, and the Celtic Sea). In the Greater North Sea, naturally mortality is now the main source of mortality of for many species due to a reduction of fishing mortality. In some areas the Fishing Mortality is close to $F_{MSY}$ (Bay of Biscay and the Iberian Coast, and the Norwegian Sea). In the Mediterranean and Black Sea, the fishing mortality is still high but there are signs of improvements.

The spawning stock biomass has similarly increased in many sea regions and in some regions SSB is now above or close to the biomass reference point (Baltic Sea, Greater North Sea, and the Celtic Sea).

The LFI has shown improvements in some areas, however in some other there has been a decrease during the last years. It should be noted that the cause of this decrease is not necessarily due to a decrease in the biomass of large fish but could be due to a high recruitment of smaller fish.

### 11.3.4. D4: Food webs

Food web indicators or indices are in early stages of development so at present there is no universally accepted method as yet for looking at trends across food webs. Two contrasting approaches could be considered:

1) Use of ecosystem models e.g. mass balance systems to simulate and compare time series
2) Combining co-located trends in biodiversity elements at different trophic levels to identify common patterns

For (1), an example is the Ecopath-Ecosim (EwE) suite of models, now widely used in many countries, with a strong background in fisheries (Heymans *et al.,* 2016). However, it does have potential applications beyond fish stocks and has been evaluated for marine management of multispecies systems, such as the North Sea (MacKinson *et al.,* 2009). This approach requires a level of expert judgement on trophic relationships but does provide a holistic functional approach at the ecosystem level.

In (2), the most promising approach is through use of multi-metric assessment tools though these would need augmenting to enable visualisation of time series (see Case Studies). These depend on good availability of targets and thresholds but do not require a functional integration between biodiversity components, which reduces the need for expert judgement. The one used in previous EEA biodiversity assessments is the BEAT+ tool, (Andersen *et al.,* 2014, Vaughan *et al*., 2019) which built on an integrated assessment tool used by HELCOM in the HOLAS assessment process (Nygård *et al*., 2018). This multi-metric approach was evaluated for use by OSPAR using the Nested Environmental status Assessment Tool (NEAT) combining benthic habitats, phytoplankton, fish and higher predators in the EcApRha project, Elliott *et al* 2018 and for the Mediterranean in the MEDCIS project (Borja *et al.,* 2019a).

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

One issue that this highlight is the question of biodiversity spatial assessment units. Unlike for many physico-chemical parameters, or even commercial fish, biodiversity assessment units vary considerable in size, depending on the context. For example, most species assessments are based on knowledge of defined ranges so typically for offshore work, this can be a whole subregion of a regional sea. This has brought a difficulty going forward in that in most cases it is not feasible to separate out UK data from other regional data, as the assessment units are combined.

With present knowledge, the most obvious approach to assessing impact on food webs for D4 is through assembling a range of trends over all relevant regional seas and biodiversity components - in other words, a compilation of the trends identified for D1.

This approach was done in the IPBES regional assessment report on biodiversity and ecosystem services for Europe and Central Asia which focused on different trophic guilds and identified a number of declining trends (IPBES, 2019). This report also noted that the data availability is inadequate for most assessed species.

This has been done successfully for different sub-regional areas in Europe, notably coastal areas in the Baltic Sea through the HOLAS assessment (HELCOM, 2018a) and in the Wadden Sea in the southern North Sea. Here there are long-term trends of specific components which can be correlated specifically with pressure data derived from the same areas. However, such data sets are rare across Europe and not held in a common data facility or exchange system which allows access to these multiple sets.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

In the Revision of the MSFD Commission Decision (European Commission, 2017), the focus was shifted from attributes of species and habitats to assessing a set of characteristics for a defined biological group (or feeding guild), not individual species (see Table 1-1). The workshop developing these criteria also recommended at least three trophic levels, and only one should include fish (ICES, 2014). Thresholds still need to be determined, and the approach now is that they should specifically reflect the level of pressures applied to the groups, linked to pressure indicators for the 'non-biodiversity' Descriptors in MSFD.

However, the objective for Descriptor 4 is slightly different in this revision, given the complexity and gaps in knowledge that still need to be addressed. There has been a strong recommendation in a Commission report that going forward, status assessments should not seek to combine species group and habitat assessments as the default ecosystem approach, but instead to keep these to address specific pressure-state interactions and impacts (Walmsley *et al.,* 2017). In this way, the Food Web indicators are more to identify overall failures and successes in maintaining ecosystem structures and functions. This is then more of a surveillance approach to understand the integrity of marine ecosystems through maintaining food web abundance and biomass trends, and hence seek to understand ecosystem resilience (ICES, 2014).

***Methodology for indicator and/or index calculation including relevant references***

The original BEAT+ tool is potentially able to bring together trend data as described for D1 but acting at specific locations. By integrating data from normalised indicators, and comparing those at specific locations, it is able to identify worst case status measures for different biodiversity components. The results are then linked to a standard grid-based Spatial Assessment Unit (SAU) which is used both for biodiversity and for pressures assessments (Andersen *et al*., 2014)

.

***Key results of the trend analyses for specific indicators and/or index/indices***

The results below are taken from different approaches to integrated assessments. Figure 12 shows the spatial variation produced by the BEAT tool in the 2018 Integrated Baltic Assessment (HOLAS) for 4 main biodiversity components, though these are not strictly linked to food web levels or guilds.

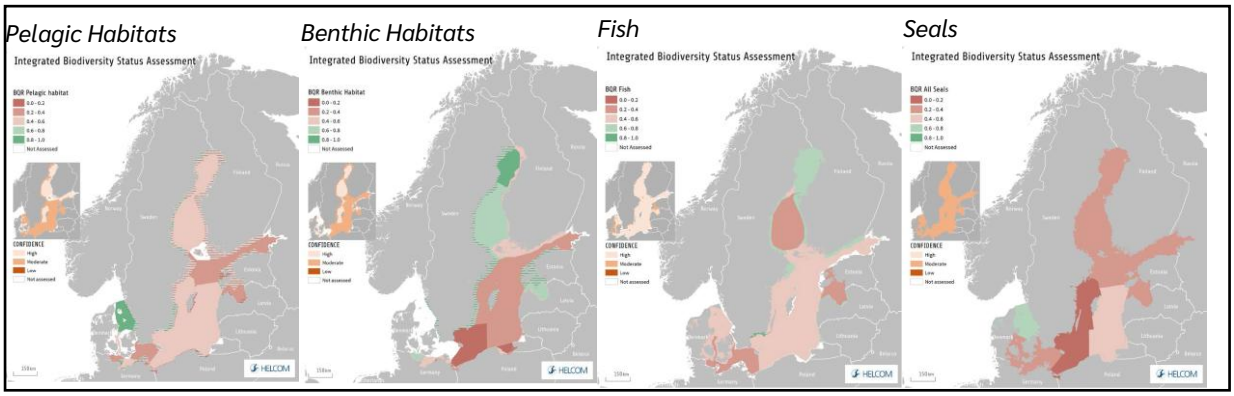



*Figure 11.12 Integrated Assessment of Baltic Sea. Source: (HELCOM, 2018a)*

Two other examples show trends being applied to give overview based on long-term monitoring data in the southern North Sea. Figure 13 shows an integrated assessment of benthic fauna in the Netherlands EEZ undertaken by the Netherlands Statistical Office (CBS 2018), which shows a declining trend when combined into an LPI.

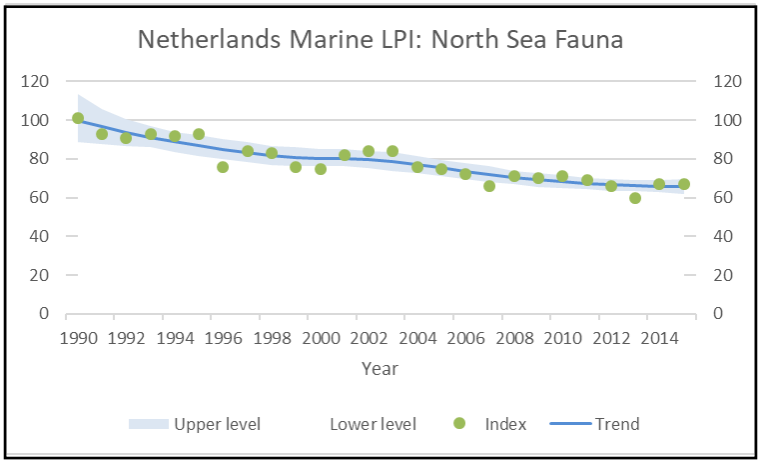



*Figure 11.13 Living Planet Index of North Sea fauna in Netherlands EEZ.*

The first graph in Figure 2-3 is from a review of 50 year monitoring the macrobenthic animals on a 50-km$^2$ tidal-flat area in the Dutch Wadden Sea (Beukema & Dekker, 2020). The graph shows total biomass for two seasons. This covers physico-chemical parameters, phytoplankton, benthic invertebrates and fish. In the figure, the trends shown for winter biomass and water temperature suggest a possible link between the two. While it cannot show a causal correlation at this stage, it indicates the value of bringing together both forms of data to at least allow closer interrogation and research.

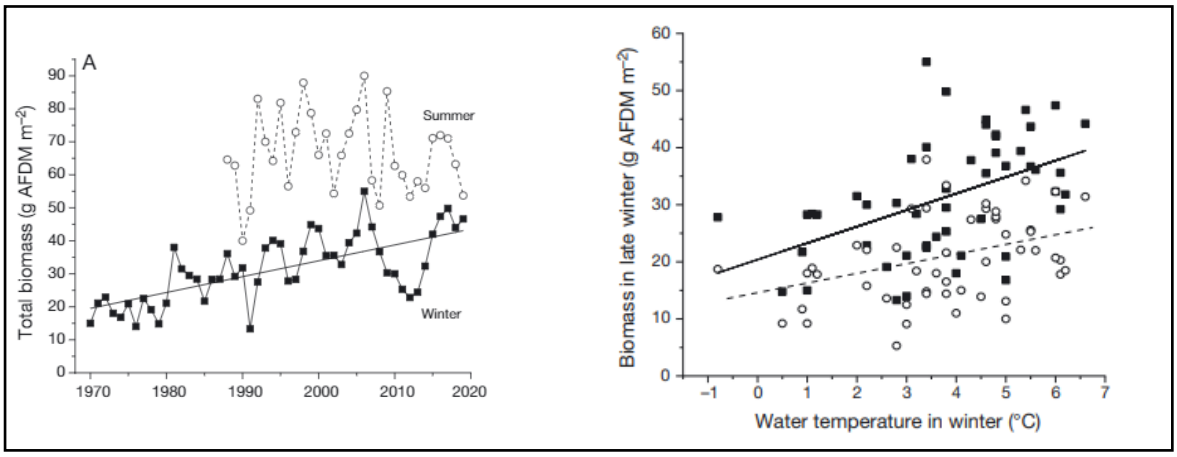



*Figure 11.14 Long-term monitoring of macroinvertebrate biomass in the Wadden Sea. AFDM: Ash free dry matter. Source: Beukema & Dekker 2020*

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

The data gaps identified under D1 make progress in defining trends for D4 very challenging. The sparsity of knowledge around the state and function of ecosystem components makes it difficult to aggregate data that can be measured against pressure data. Three key challenges remain:

1) Lack of long-term trends for some key trophic guilds or habitats
2) Spatial imbalances in data availability – strongly focused on northern seas but many more series are needed for the Mediterranean and Black Seas
3) Better availability of data – data that are known to exist are not made readily available or submitted to European-scale data hubs (see Borja et al 2019a)

### 11.3.5. D5: Eutrophication

Descriptor 5 aims at minimizing human-induced eutrophication in the sea and the adverse effects thereof. Eutrophication, a process where nutrient enrichment increases the supply of organic matter deteriorating the ecosystem, is induced by enhanced availability of nutrients for primary production. Human activities, with agriculture as the main driver in Europe (Eurostat 2017), increase the input of nutrients to the seas. Management measures to battle eutrophication focus largely on reducing the nutrient inputs to the sea, with waterborne nutrient input and atmospheric deposition being the two main pathways for nutrients to the sea. Criteria under D5 comprise both nutrient concentrations and effects of eutrophication. Primary assessment criteria are nutrient concentrations (D5C1), Chlorophyll-*a* concentration (D5C2) and concentration of dissolved oxygen (D5C5), which all should be at levels not indicating adverse eutrophication effects. Further, secondary assessment criteria comprise number, extent and duration of harmful algal blooms (D5C3), water transparency (D5C4), abundance of opportunistic macroalgae (D5C6), species composition and relative abundance or depth distribution of macrophyte communities (D5C7) and species composition and relative abundance of macrofaunal communities (D5C8).

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

Signs of eutrophication can be measured as increased nutrient concentrations in the water column or as effects on the ecosystems. Direct effects of eutrophication include increased primary production, measured as increased chlorophyll-*a* concentrations in the water column or increased growth of opportunistic macroalgae on the seafloor. Indirect effects of eutrophication can be measured as a decrease in water transparency or increased oxygen consumption and oxygen deficiency on the seafloor, but also as changes in species composition in faunal communities (Andersen et al. 2019) Eutrophication and its effects are

measured through a wide selection of indicators. Here, the trend results are presented for the regional seas in three sections: nutrient inputs to the sea, nutrient concentrations in the sea and eutrophication effects on the ecosystem. Sub-regional trends can be found in Appendix 13 (Tables 13B and 13C).

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

As eutrophication is a well-recognized problem, attempts to reduce inputs of nutrients are promoted by several policies. Global initiatives to reduce nutrient enrichment are put forward by the UN 2030 Agenda for Sustainable Development (UN 2015). At European level, the WFD (Anon. 2000) and the MSFD (Anon. 2008) focus on environmental objectives with the aim of attaining a good ecological status (WFD) or a GES (MSFD). WFD focuses on groundwater, freshwater, transitional waters and coastal waters. MSFD focuses on marine waters, including the areas covered by WFD and ensuring compatibility of the directives. The main management focus is on reducing inputs of nutrients stemming from human activities, including both point sources and diffuse sources, to the marine waters. Policies directed especially on nutrient discharges include the Urban Wastewater Treatment Directive (Anon. 1991a) setting requirements for urban wastewater treatment, the Nitrates Directive (Anon. 1991b) aiming at reducing water pollution induced by nitrates from agriculture, and the Industrial Emissions Directive (Anon. 2010) aiming at reducing $NO_x$ emissions and considering the full life cycle of industrial activities.

In addition, the Regional Sea Conventions also have focused efforts to reduce nutrient inputs and mitigate eutrophication effects in their respective sea areas. The Helsinki Commission aims at a Baltic Sea unaffected by eutrophication through the Baltic Sea Action Plan (BSAP; HELCOM 2007a). OSPAR eutrophication strategy aims at achieving and maintaining a healthy marine environment without human induced eutrophication in the North-east Atlantic. The Barcelona Convention in collaboration with the UN Environment Programme Mediterranean Action Plan aims to prevent anthropogenic eutrophication (UNEP/MAP 1980). The Black Sea Convention recognizes nutrient enrichment and eutrophication among the major threats to the marine environment in the Black Sea in the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea (BSC 2009).

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

The main sources of information for temporal trends on eutrophication were the latest periodic assessments of the regional seas and their underlying data:

- Baltic Sea, the second holistic assessment of the Baltic Sea (HOLAS II; HELCOM 2018a)
- North-east Atlantic, the OSPAR's Intermediate Assessment 2017 (IA2017; OSPAR 2017b)
- Mediterranean Sea, the Mediterranean Quality Status Report 2017 (MED QSR 2017; UNEP-MAP 2017)
- Black Sea, the Black Sea State of Environment Report 2009-2014/5 (Black Sea SoER; BSC 2019)

For regional analyses of trends in nutrient concentrations, data from EMODnet Chemistry was used. EMODnet Chemistry provides open access DIVA interpolations of eutrophication parameters, such dissolved nitrogen and phosphorus utilized here. The mean surface water concentrations (0-20 m) were used and only grid cells with data covering more than 50% of years in the time series were included. A detailed description of the methodology of the analyses is found in Appendices 16-19. Data sets were available for the Baltic Sea, Black Sea, Mediterranean Sea, North-east Atlantic and the North Sea.

***Key results of the trend analyses for specific indicators and/or index/indices***

Nutrient loading to the Baltic Sea increased throughout the 20$^{th}$ century, peaking in the early 1980s, when eutrophication was also recognized as a major pressure affecting the Baltic environment (HELCOM 2018a). Through management actions, the input of nutrients from anthropogenic activities have decreased; waterborne nitrogen loading is today at levels like levels in 1960s and waterborne phosphorus

loading equals levels in the 1950s. There are regional differences, with Kattegat and the Danish Straits showing strongest relative decrease in nitrogen loading whereas for phosphorus input the strongest relative decrease is observed in Gulf of Finland (HELCOM 2018a). However, for both nitrogen and phosphorus, the total loading is still above the set maximum allowable level in the Baltic Sea (HELCOM 2018a).

Increased nutrient input transformed north-western Black Sea into a highly eutrophic area from 1960s to 1980s (BSC 2019). In early 1990s, decreased nutrient input led to signs of recovery, although eutrophication symptoms such as monospecific phytoplankton blooms and reduced organic matter recycling capacity still occurred. Phosphate load from the river Danube decreased in the period 1980-2012 (Cozzi et al. 2019).

A significant decreasing trend in nutrient inputs to the North Sea was observed 1988-2014 (OSPAR 2017b, Desmit et al. 2020). The trend was weak for nitrogen, but stronger for phosphorus. In the Bay of Biscay and Iberian coast, a decreasing trend in waterborne phosphorus load was seen 1997-2014 (OSPAR 2017b).

The Mediterranean offshore areas are oligotrophic, not affected by human induced eutrophication, but coastal areas are locally showing eutrophic conditions because of increased nutrient inputs from urban agglomerations (UNEP/MAP 2017). For example, improved wastewater treatment has decreased inputs of Dissolved Inorganic Phosphorous (DIP) in Thau Lagoon on the French coast. Phosphate input to the Mediterranean via the rivers Ebro, Rhône and Po showed decreasing trends 1980-2012, but no trend in Dissolved Inorganic Nitrogen (DIN) or $SiO_4$ was observed (Cozzi et al. 2019). On a regional scale, data availability restricts temporal assessments.

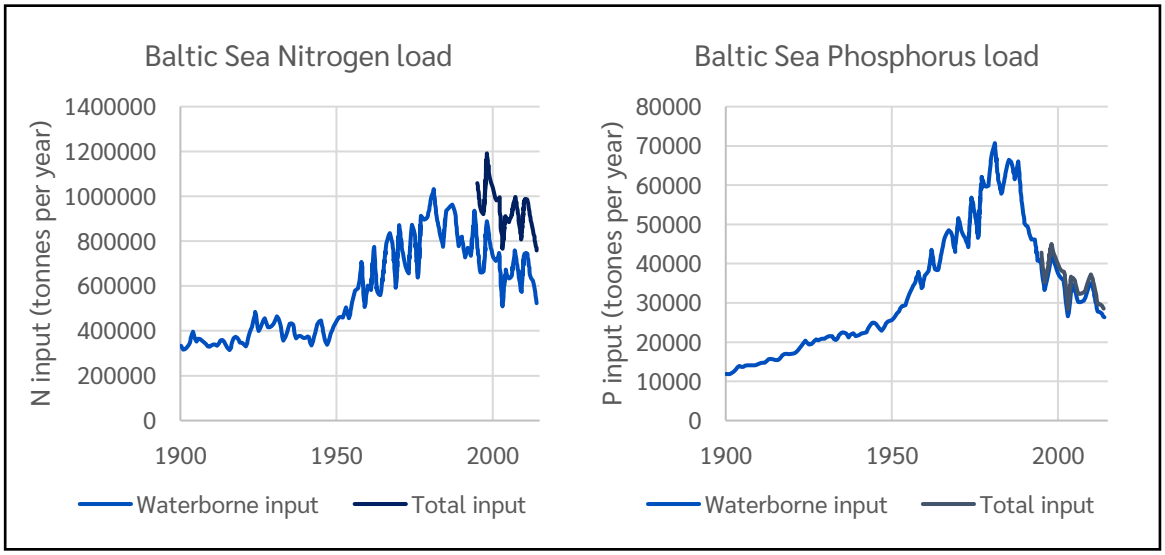



*Figure 11.15 Development of waterborne and total nutrient load to the Baltic Sea. Source: HELCOM 2018a*

Nutrients are consumed during the productive season. To get comparative results of nutrients available in the system, winter concentrations of nutrients available for primary producers (DIN and DIP) are used as indicators. Usually, only surface water concentrations are considered as this is where the nutrients are available for the phytoplankton production.

In the Baltic Sea, winter DIN levels decreased in 1990s and early 2000s and have since stayed at similar levels in most sub-basins. In recent years however elevated concentrations and larger variations in some sub-basins. A marked increase in wintertime DIP concentrations took place in 1960s and 1970s, after which concentrations have remained at high levels. Fluctuations have occurred but no clear trend. In recent years, increased concentrations are observed in Bothnian Sea, Åland Sea, Northern Baltic Proper,

Gulf of Riga and Gdansk Basin. Major Baltic inflows influence DIP concentrations by introducing phosphorus from the deep waters to the waters above the halocline.

In the Black Sea, an improvement in water quality after 1990s is seen, but a system change has led to an ecosystem different from the pristine conditions (BSC 2019). A data series starting in 1959 shows increase in both nitrate and phosphate concentrations to the mid-1980s (Yunev et al. 2007, Daskalov 2003). Recently, in the period 2009-2014, no trend in phosphate values was seen and concentrations were 50-100% higher than in the 1960s (BSC 2019). Silicate concentrations have increased in the period 2009-2014 but are only at 20-30% of concentrations in 1960s. Nitrate concentrations show a decreasing trend with 2014 value representing a 64 % reduction to 1990s average. Recently the nitrite concentration has increased, but ammonium concentration is decreasing (BSC 2019)

In the North Sea, decreasing trends in winter DIN and DIP are seen (Fig. 11.16). On a sub-regional scale, both offshore and coastal areas in the Southern North Sea showed decreasing trends in winter DIN and DIP 1990-2014, whereas no trend was seen in northern North Sea (OSPAR 2017b). Also, in offshore areas of Skagerrak a decreasing winter DIN trend was observed for the same period, whereas no trends were seen in Northern North Sea or in coastal areas of Skagerrak (OSPAR 2017b). In the Wadden Sea, the nitrogen and phosphorus concentrations have decreased during 1981-2012 and now the water exchange with North Sea has a higher influence on nutrient concentrations in the Wadden Sea than the riverine input (Jung et al. 2017).

In the Adriatic Sea, an increase in nutrient levels (N and Si) was observed in the period 1990-2001, but a decreasing trend was seen 2001-2009 (Mozetic et al. 2012, UNEP/MAP 2017). No trend was observed for phosphorus.

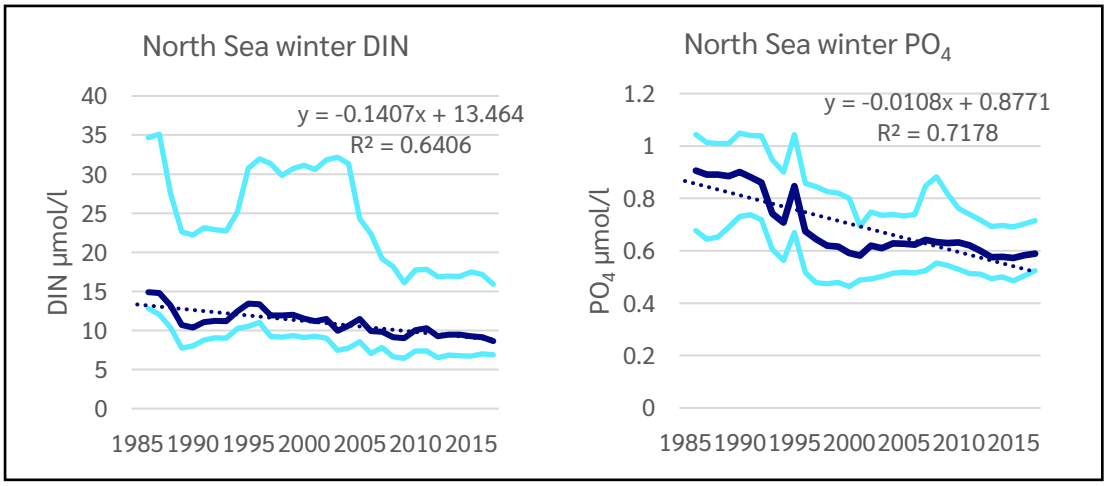



*Figure 11.16 Winter nutrient concentrations in the North Sea based on EMODnet Chemistry data. The darker blue line represents the median value and the light blue lines 10th and 90th percentiles, respectively. The dotted line represents a linear trend for the median values*

In the Baltic Sea an increase in summer Chlorophyll-*a* concentration was seen in most sub-basins in the period 1970-2000. Since 1990 only small changes are seen, although a decreasing trend in the south-western part of the Baltic Sea and an increasing trend in the Bornholm Basin is observed (HELCOM 2018a). Blooms of cyanobacterial bacteria have increased in the Baltic Sea and also the area covered with blooms has increased (cyanoindex indicator). The decreasing trend in water transparency seen over many decades has in recent years levelled off (Fleming-Lehtinen & Laamanen 2012). Oxygen debt has increased (i.e. conditions have deteriorated) below the halocline in all sub-basins since early 1900s (HELCOM 2018a). As

a result of the increased hypoxic areas, benthic macrofauna communities are reduced below the halocline (Villnäs & Norkko 2012).

In the North-east Atlantic, decreasing chlorophyll-a concentrations were observed 1990-2014 in offshore areas of Skagerrak (OSPAR 2017b) and in the North Sea 1988-2016 (Desmit et al. 2020). The interannual variation in blooms of the nuisance phytoplankton species *Phaeocystis* is large in the North Sea, but no temporal trend in bloom occurrences were seen (OSPAR 2017b). In Kattegat improving oxygen conditions were observed 1990-2014 and oxygen depletion is only a local problem in North-east Atlantic (OSPAR 2017b). Improved status of soft bottom benthic communities in coastal areas of Skagerrak from 1990-2010 were found to be related to decreased eutrophication (Trannum et al. 2018).

Long-term trend information on eutrophication effects available in the Mediterranean Sea, show increased primary and secondary production in the Adriatic Sea between 1962-1982 (Solic et al. 1997). Following the decreasing nutrient concentrations, a change to a low Chlorophyll-*a* regime was seen in the Adriatic Sea in 2006 (Mozetic et al. 2012). Also, Giani et al. (2012) report a trend reversal in the Adriatic Sea 2000s with lower Chlorophyll-*a* concentrations and recovering macrobenthic communities due to fewer hypoxic events.

In the Black Sea, the development in nutrient input and concentrations are reflected in eutrophication effects. The phytoplankton blooms increased in the period 1960-1990 (Daskalov 2003), with Chlorophyll-*a* concentrations peaking around 1990 (Yunev et al. 2005). Concurrently, a decrease in transparency and oxygen conditions below the thermocline was seen (Daskalov 2003, Yunev et al. 2005, Yunev et al. 2007). Also changes in the benthic community were seen with decreased red algae distribution and black mussel abundance (Daskalov 2003).

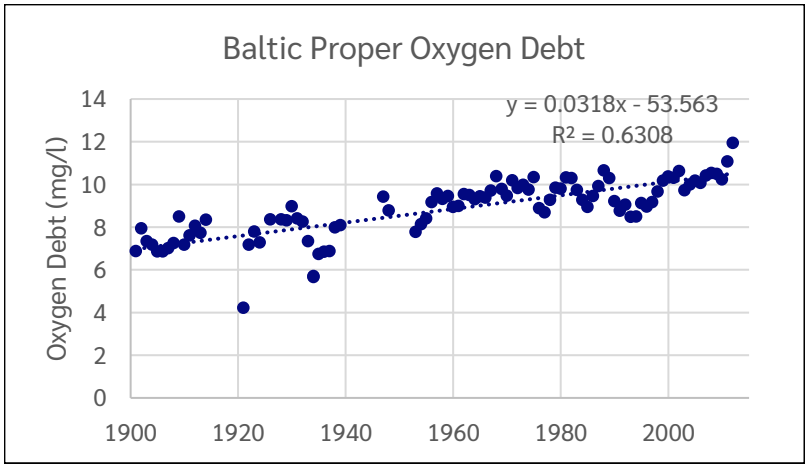



*Figure 11.17 Temporal development of the oxygen conditions in the Baltic Proper. An increasing oxygen debt indicator illustrates deteriorating oxygen conditions. The dotted line represents a linear trend for the indicator value. Source: HELCOM 2018a.*

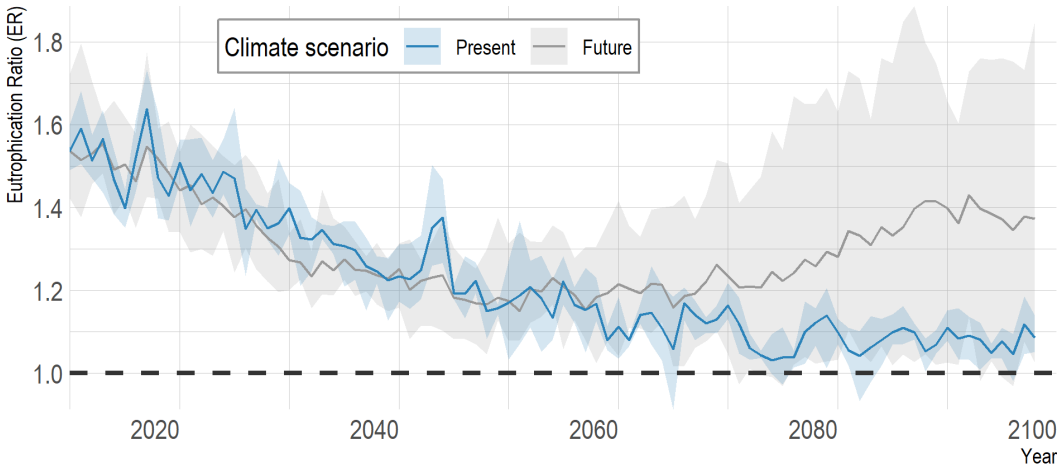
***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

Europe's seas are very different when it comes to eutrophication. The Mediterranean Sea to large parts oligotrophic, whereas the Baltic Sea and Black Sea suffer from chronic eutrophication, although improvement can be seen. In the North-east Atlantic regional differences in eutrophication state occur. Decreasing inputs of nutrients to the sea, because of many successful management decisions, have resulted in improvements in eutrophication status in most of Europe's seas. The recovery from nutrient enrichment is however slow as the gathered nutrient pool is recirculating in the marine ecosystem. Global warming of the seas may counteract eutrophication management measures, as increased temperature accelerates

biologic degradation of organic material and oxygen consumption leading to increased nutrient releases from the sediment. In addition, there will be two case studies, where the HEAT tool is applied in conjunction with long-term data, i.e. one from the Baltic Sea and one from Turkey.

**BOX 11.1 PRESENT AND FUTRURE EUTROPHICATION STATUS OF THE BALTIC SEA**

The Baltic Sea in a brackish inland sea in Northern Europe bordered by Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. It is connected to the North Sea via the Kattegat and the Danish Straits (Little Belt, Great Belt and the Sound). Large parts of the Baltic Sea are affected by nutrient inputs and eutrophication problem areas are widespread. Eutrophication status of the open parts of the Baltic Sea have been studies and reported multiple times (HELCOM 2009, 2010 and 2018a). Recently, future eutrophication status has been estimated (Murray et al. 2019). Here we report preliminary results of HEAT-based assessment of eutrophication status taking not planned reduction of nutrient inputs, but also projected climatic changes into account. The HEAT tool estimates eutrophication status by comparing values of relevant indicators with target values to determine a eutrophication ratio (ER) the aggregated ER determines whether or not the assessment unit (a body of water or a subdivision) is considered to be a eutrophication "problem area" (ER>1.0) or a "non-problem area" (ER<=1.0). Predicted direct effects of eutrophication (winter concentrations of DIN and DIP), direct eutrophication effects (Chl *a* concentration and Secchi depth) as well as indirect effects (Oxygen debt) were calculated in seven basins of the Baltic Sea for six future climate scenarios, using the BALTSEM model (Savchuk et al. 2012), and assuming that nutrient loads to the Baltic are reduced in accordance with the goals set out in the revised Baltic Sea Action Plan. The model results were used as input to the HEAT tool, comparing them with basin-specific threshold values for each parameter (Andersen et al., 2017) allowing us to predict future eutrophication status and to compare it with the status predicted under present climate conditions.




**Future eutrophication status of the Baltic Sea estimated by the HEAT tool for present and future climate scenarios. Lines and shading show, respectively, the average and range for 6 future climate models and 3 present climate models.**

As can be seen in Figure XX, given continued present climate conditions overall eutrophication status in the Baltic approaches "non-problem" status within the next 80 years. For the different future climate scenario models, this status becomes far more uncertain and following improvement in status due to the BSAP will, on average, result in a worsening of eutrophication status during the second half of this century.

Please see the Supplementary Material for additional information.

### 11.3.6. D6: Sea-Floor Integrity

After the European Commission Decision (European Commission, 2017) the relevant pressures related to this descriptor are physical loss and physical disturbance to seabed, and five primary criteria are proposed:

(i) D6C1: "*spatial extent and distribution of physical loss*" (permanent change, i.e., 12 years or more, in $km^2$) of the natural seabed (e.g, changes caused by physical restructuring, infrastructure developments and loss of substrate via extraction of the seabed materials).
(ii) D6C2: "*spatial extent and distribution of physical disturbance pressures"* (i.e., temporary or reversible, in $km^2$) on the seabed (e.g., bottom-trawling fishing).
(iii) D6C3: "*spatial extent of each habitat type which is adversely affected, through change in its biotic and abiotic structure and its functions (e.g. through changes in species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), by physical disturbance"* (in $km^2$).
(iv) D6C4: *"the extent of loss of the habitat type, resulting from anthropogenic pressures, does not exceed a specified proportion of the natural extent of the habitat type in the assessment area."*
(v) D6C5: "*The extent of adverse effects from anthropogenic pressures on the condition of the habitat type, including alteration to its biotic and abiotic structure and its functions (e.g. its typical species composition and their relative abundance, absence of particularly sensitive or fragile species or species providing a key function, size structure of species), does not exceed a specified proportion of the natural extent of the habitat type in the assessment area.*"

As far as we know, there are neither direct monitoring programmes nor long-term series (i.e. >20 yr) regarding the abovementioned criteria. This does not mean that there is no information regarding D6 and indicators that potentially can be associated to this descriptor. As an example, the European Marine Observation and Data Network (EMODnet, www.emodnet-humanactivities.eu) includes data on the intensity and spatial extent of human activities at sea, and therefore, in some cases, Member States may have information that allows them to evaluate the temporal variability in some of the indicators.

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

In 2019, ICES published the report "EU request to advise on a seafloor assessment process for physical loss (D6C1, D6C4) and physical disturbance (D6C2) on benthic habitats" (ICES, 2019a, see also ICES 2019b, 2019c, 2019d). In this document an assessment process that consists in three stages to assess the criteria D6C1, D6C2, and D6C4 (in a way that can be accommodated for the assessment of criterion D6C3).

ICES (2019a) advises that physical loss (D6C1, D6C4) implies an alteration of the physical habitat with a change from one EUNIS level 2 habitat type to another EUNIS level 2 habitat type (https://eunis.eea.europa.eu/habitats.jsp). ICES proposed three main physical pressure subtypes relevant to physical loss: abrasion, removal, and sealing. Hence, the indicators relating D6C1 and D6C4 can be the surface affected with physical loss by each of the pressure subtypes.

ICES (2019a) identified three main pressure subtypes from human activities to physical disturbance (D6C2): abrasion, removal, and deposition. Hence, based on spatial data on activities such as fishing that affects bottom (e.g., with mobile bottom-contacting fishing gears), aggregate extraction, dredging, and dredging disposal, the assessment can be done either in $km^2$, or as a proportion of the total spatial extent of the assessed area/habitat type. Other activities can be relevant in some sites, e.g., scouring around structures or ship propellers can suspend sediments into the water. Hence, the indicators relating to D6C2 can be the surface affected by physical disturbance related to each main affecting activity.

Regarding to D6C3, ICES (2019a) proposed to model the adverse effect of the abrasion and removal on benthic fauna based on previous research (e.g., Hiddink et al., 2019; ICES, 2019f). Moreover, ICES advised doing a quantification of deposition as the volume of sediments deposited, per area and per time.

ICES (2019a) recommended that conducting the assessment of activity (relating to specific pressures) over 6-year cycles instead yearly.

Although ICES (2019a) did not mention D6C5, it should be noted that it is closely linked to D6C3.

It should be noted that ICES (2019a) approach was proposed as a flexible tool. Hence, other indicators that have been proposed for Descriptor 6 can be used in combination with the ICES approach (e.g., Amoroso et al., 2018, Jac et al., 2020; Kazanidis et al., 2020).

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***
As explained above, it is necessary to have a good knowledge of habitat distribution (ideally at least at EUNIS 2 level) and of the spatial distribution of pressures that may be relevant in each area. This, in addition to the intrinsic link with the MSFD, is also related with the maritime spatial planning (Anon., 2014) or satellite-based fishing vessel monitoring systems -VMS- (European Commission, 2011, 2014b). Therefore, sources of information originating from the requirements required by different legislation may be useful for member states in assessing trends in the D6 descriptors. Hence, the availability of information in a systematized form is also of great importance (e.g., EMODnet). It should be considered that part of the information is being carried out in international groups (e.g., OSPAR, ICES, HELCOM, see Appendix 14).

***Methodology for indicator and/or index calculation including relevant references***
Appendix 14 details different indicators in relation to Descriptor 6.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***
With respect to D6C1/D6C4, no long-term series (i.e. >20 yr) have been found available. However, in some cases, Member States have detailed information on the evolution of uses of the marine environment that they can adapt to the assessment requirements of this criterion.

With respect to D6C2, there are some short-time series with respect to the footprint of bottom trawling fishery footprint based on VMS (see e.g., details in Amoroso et al., 2018) or aggregate extraction (see e.g., OSPAR, 2017x and ICES, 2019e). As in the previous criteria, extensive time series may be available to member states.

In relation to D6C3/5, the methodology proposed by ICES (2019a) allows an estimate to be made in those areas where there is a good knowledge of the adverse effects of anthropogenic pressure on the abiotic and biotic conditions of the habitats.

***Key results of the trend analyses for specific indicators and/or index/indices***
As mentioned above, no long series of indicators for the criteria of the After the European Commission Decision (European Commission, 2017) are available. However, member states are collecting systematised information that will allow for long series in the future. One example is the studies carried out by different ICES and OSPAR working groups. For example, Figure 11.18 shows the evolution of quantities of dredged material reported in four European countries. In this case it is not a direct proxy for D6C2, as it does not consider the area affected, but it can be considered as an indirect proxy. Another example of an indirect indicator can be found in Figure 11.19. In this case the potentially affected area is available. On the

contrary, there is a direct indicator of D6C2 (area affected) by two anthropogenic activities. The number of years is too short to be able to study evolutions now.

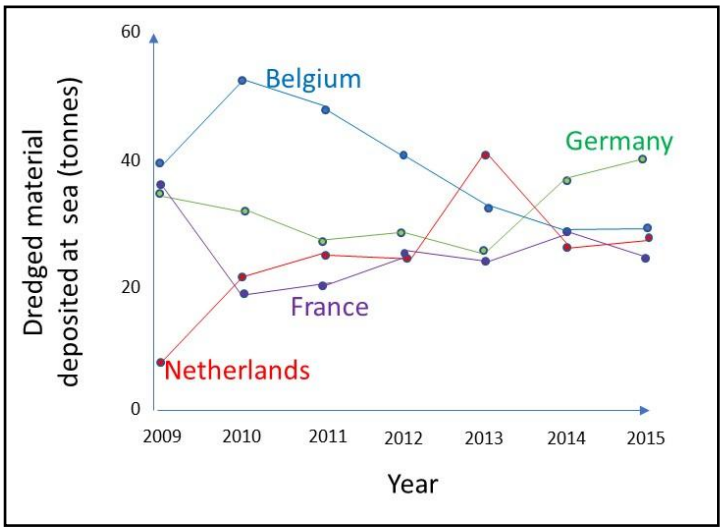



*Figure 11.18 Quantities of dredged material reported as deposited at sea in the OSPAR area, 2009 to 2015, by Contracting Parties. Source of data: OSPAR (2017g) OSPAR annual report on dumping and placement of wastes or other matter at sea in 2015, OSPAR*

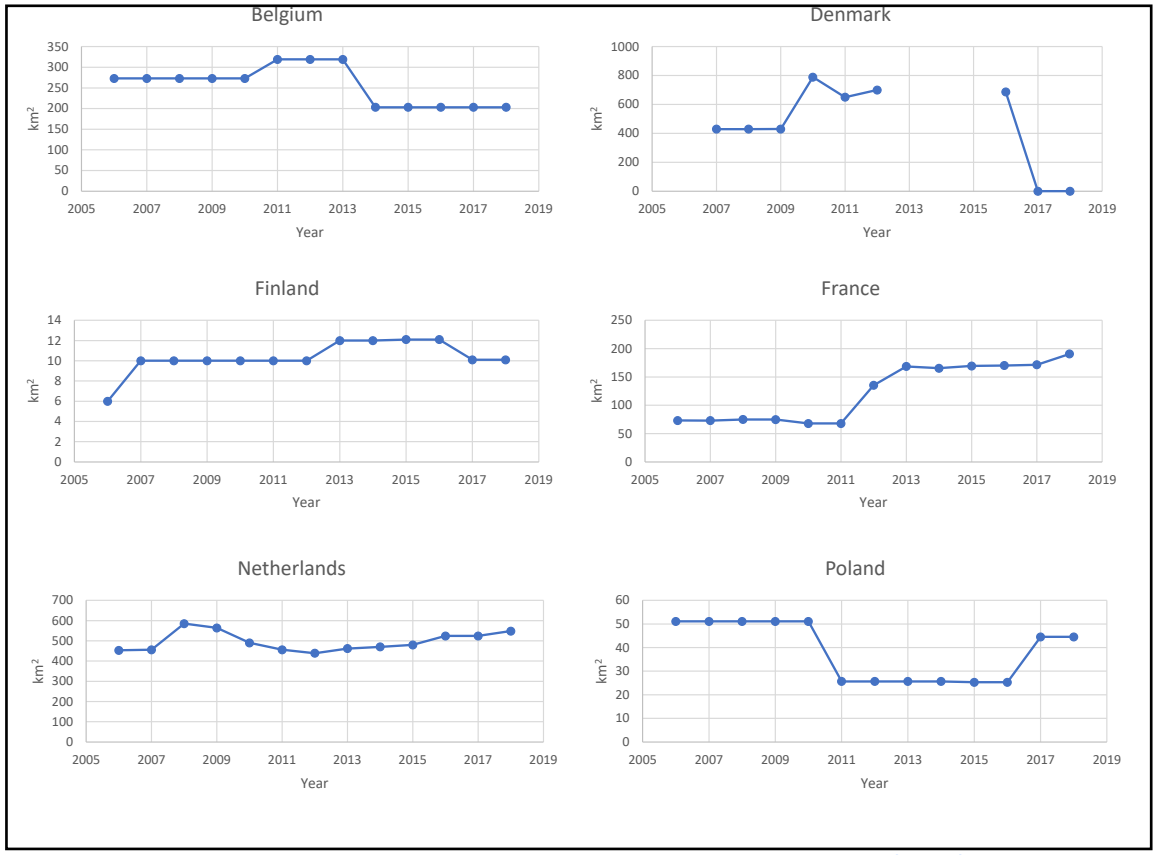



*Figure 11.19. Spatial extent of areas licensed for aggregates extraction. Source of data: ICES (2019b). Workshop on scoping for benthic pressure layers D6C2 - from methods to operational data product (WKBEDPRES1), 24–26 October 2018, ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM: 59-69 pp*

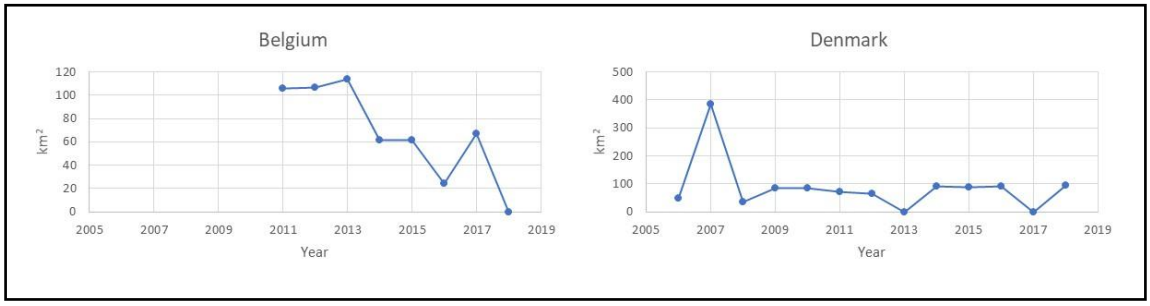



*Figure 20. Area in which aggregates extraction activities occur. Source of data: ICES (2019b). Work-shop on scoping for benthic pressure layers D6C2 - from methods to operational data product (WKBED-PRES1), 24–26 October 2018, ICES HQ, Copenhagen, Denmark. ICES CM 2018/ACOM 59-69 pp*

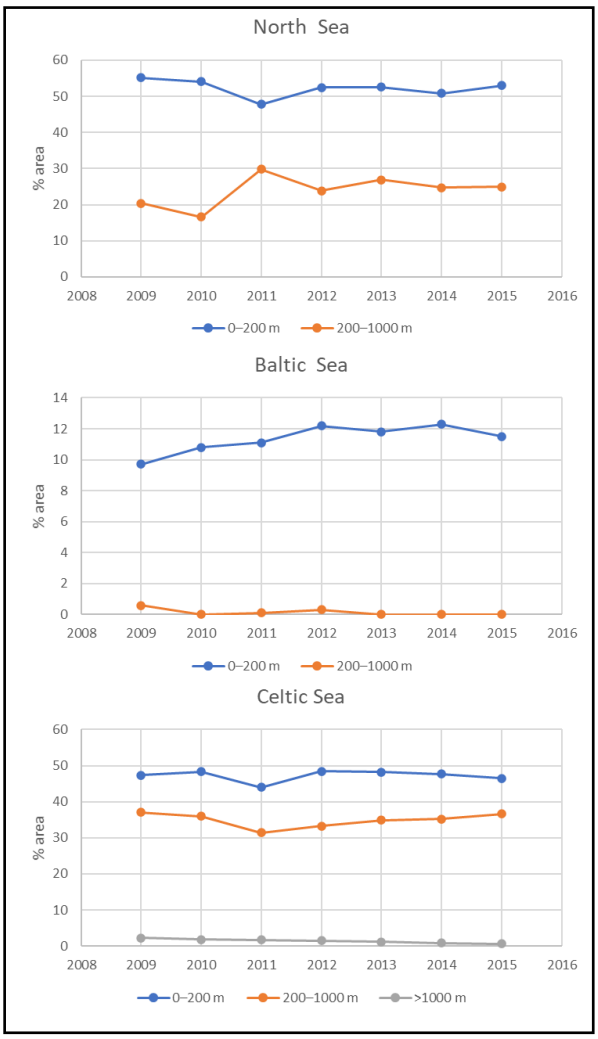



*Figure 11.21 D6x.4. A Footprint area (%) on seabed as an indicator of fishing intensity for mobile bottom con-tacting gears. Source of data: ICES. 2017. Report of the Workshop to evaluate regional benthic pressure and impact indicator(s) from bottom fishing (WKBENTH), 28 February-3 March 2017. Copenhagen, Demark. ICES CM 2017/ACOM: 40-233pp*

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

For the moment, there are not long-term monitoring series (i.e. >20 yr) on the criteria required by D6, but some proxy indicators, such as bottom trawl fishing footprints, surface affected by dredging or offshore

wind farms, etc., can be used by Member Estates. The methodology proposed by ICES (2019a) is flexible and can be applied by those member states that have systematized information.

### 11.3.7. D7: Permanent alteration of hydrographical conditions

After the European Commission (2017), the relevant pressures related to this descriptor are physical loss (due to permanent change of seabed substrate or morphology or to extraction of seabed substrate) and changes to hydrological conditions. For assessing their effects, this Commission Decision proposes two criteria: (i) D7C1: Spatial extent (area in $km^2$) and distribution of permanent alteration of hydrographical conditions (e.g. changes in wave action, currents, salinity, temperature) to the seabed and water column, associated with physical loss of the natural seabed; and (ii) D7C2: Spatial extent (area in $km^2$ or as percentage) of each benthic habitat type adversely affected (physical and hydrographical characteristics and associated biological communities) due to permanent alteration of hydrographical conditions.

However, there are neither direct monitoring programmes nor long spatial and temporal datasets and indicators of the D7 criteria. This descriptor has also difficulties in differentiating impacts from direct anthropogenic activities, global change and climate variability. In turn, the criteria provide guidance on the potential indicators that can be used as base for further determination of the hydrographical alteration, such as changes in temperature, salinity, wave action, currents and sea level (JRC, 2015), that can be affected by human activities. Consequently, changes in temperature, salinity, waves, currents and sea-level have been selected as proxies of the D7. Additional reasons for the selection are availability of long-term recorded observations and identification of most of the proxies as Essential Ocean Variables by the Global Ocean Observing System Expert Panels.

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

Large spatial and temporal datasets of temperature, salinity, waves, currents and sea-level have been selected to detect changes in hydrographical conditions. Changes in thermal regime (e.g. marine heatwaves) have been assessed by temperature distribution, changes in saline regime by salinity distribution, changes in ocean circulation by marine currents, changes in sea state (e.g. storm waves) by significant wave height and changes in the sea-level (e.g., coastal flooding) by the mean sea-level. In some cases, the changes in hydrographical variables have been expressed as a rate of change in units of measured variable per time; in other cases, as cumulative trend, rate of change scaled by the number of years.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

Human activities such as coastal infrastructural development, dredging, sand extraction and desalination can impact on the physical properties of marine waters, after the MSFD (Anon., 2008). Impacts can be seen in changes to sea currents or wave action, tidal regimes, temperature, pH, salinity or turbidity and can all adversely affect marine species and habitats (European Commission, 2017, 2018). Some of the information for assessing this descriptor can come also from the WFD (Anon. 2000) monitoring.

***Methodology for indicator and/or index calculation including relevant references***

As mentioned above, no specific indicators have been developed to assess permanent alteration of hydrographical changes due to anthropogenic pressures. As such, changes in sea temperature, salinity, waves, currents and sea-level caused by anthropogenic climate change and human activities have been analysed.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

The collected datasets come from literature reviews and from public repositories such as EMODnet Physics, IROC (ICES Report on Ocean Climate) data series, NOAA (National Oceanic and Atmospheric

Administration), PSMSL (Permanent Service for Mean Sea Level), CMEMS (Copernicus Marine Environment Monitoring Service), SeaDataNet (Pan-European Infrastructure for Ocean and Marine Data Management), C3S (Copernicus Climate Change Service), among others. Regarding gaps and uncertainties, there are not large coverage datasets for deep waters and before satellite monitoring; those that exist are point measurements and/or short-term datasets. In this context, numerical modelling could be a key component for determining permanent alterations. Therefore, more research work should be committed to develop a common methodology and minimize uncertainties in the impact assessment.

### Baltic Sea

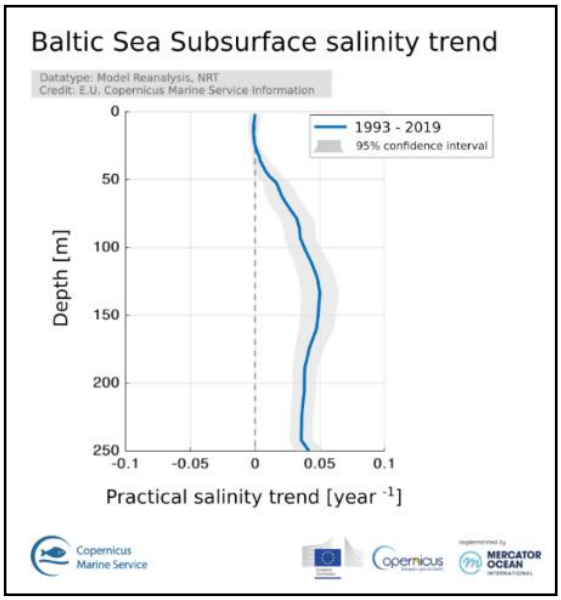



*Figure 11.22 The vertical profile of horizontally averaged subsurface salinity trends for 1993-2019. Ocean salinity from the CMEMS product BALTICSEA_ANALYSIS_FORECAST_PHY_003_006 has been averaged over the Baltic Sea domain. The shaded area shows the 95% confidence interval. See Mulet et al. 2018. Source E.U. Copernicus Marine Service Information*

### Black Sea

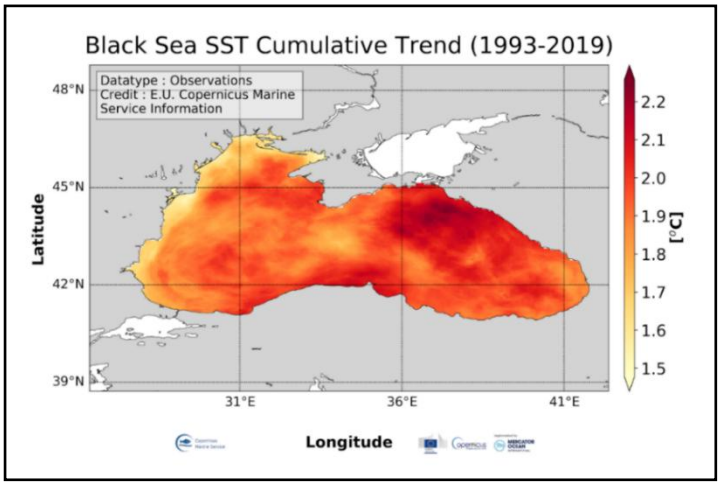



*Figure 11.23 Sea Surface Temperature (SST) cumulative trend over 1993-2019 in the Black Sea. The cumulative trend is the rate of change (°C/year) scaled by the number of time steps. The Black Sea trend map in SST is derived from the CMEMS SST_BS_SST_L4_REP_OBSERVATIONS_010_022 product. The trend is estimated by using the X-11 seasonal adjustment procedure (Pezzulli et al., 2005) and Sen's method (Sen, 1968). See Mulet et al. (2018). Source: E.U. Copernicus Marine Service Information.*

## North-east Atlantic Ocean

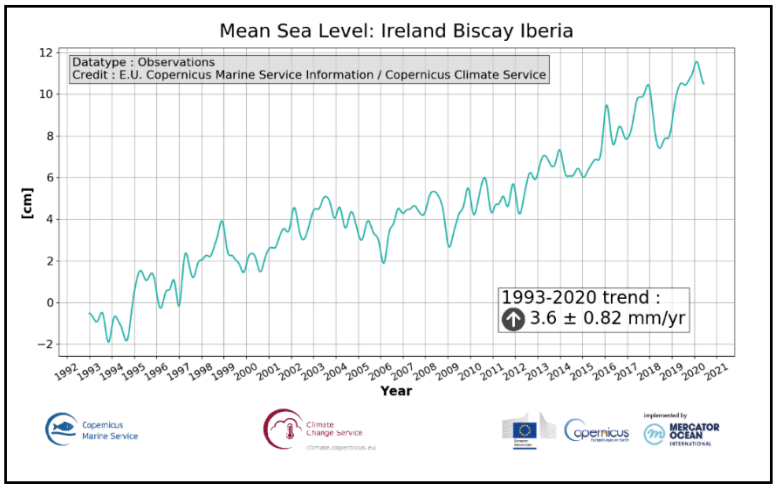



*Figure 11.24 Mean sea level daily evolution since January 1993 from the satellite altimeter observations estimated in the Irish-Biscay-Iberian region, derived from the average of the gridded altimeter sea level maps weighted by the cosine of the latitude. The product is available in the CMEMS catalogue (SEALEVEL_GLO_PHY_CLIMATE_L4_REP_OBSERVATIONS_008_057). See Peltier (2004). Source: E.U. Copernicus Marine Service Information.*

## Mediterranean Sea

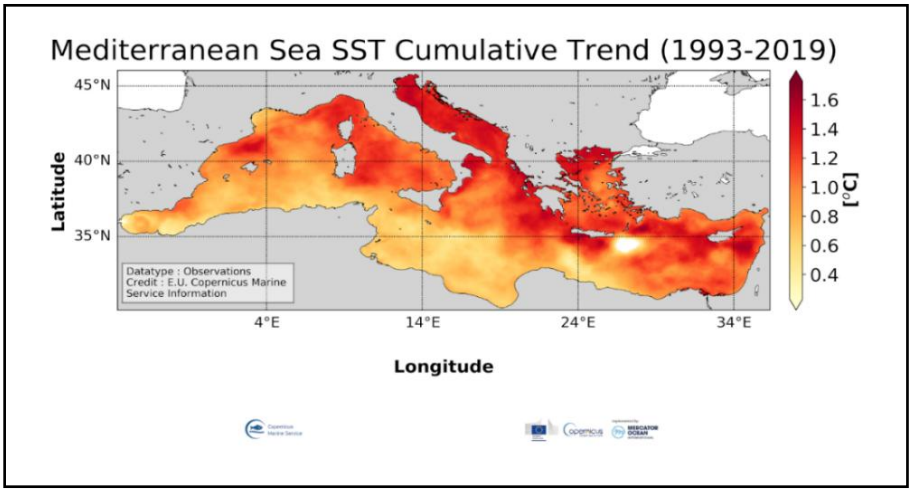



*Figure 11.25 Sea Surface Temperature (SST) cumulative trend over 1993-2019 in the Mediterranean Sea. The cumulative trend is the rate of change (°C/year) scaled by the number of time steps. The Mediterranean trend map in SST is derived from the CMEMS SST_MED_SST_L4_REP_OBSERVATIONS_010_021 product. The trend is estimated by using the X-11 seasonal adjustment procedure (Pezzulli et al., 2005; Pisano et al., 2020) and Sen's method (Sen, 1968). See also Roquet et al. (2016) and Mulet et al. (2018). Source: E.U. Copernicus Marine Service Information.*

***Key results of the trend analyses for specific indicators and/or index/indices***

On a global scale, the first 75 m of the water column have experienced a warming of 0.09-0.13 °C per decade between 1971 and 2010 associated with global warming (IPCC, 2013). Therefore, thermal expansion caused by sea warming and the melting of glaciers and polar ice caps, the global mean sea-level is rising and accelerating: 1.4 mm $yr^{-1}$ in 1901–1990, 2.1 mm $yr^{-1}$ in 1970–2015, 3.2 mm $yr^{-1}$ in 1993–2015, and 3.6 mm $yr^{-1}$ in 2006–2015 (IPCC, 2019). A slight increase in significant wave height (Hs) in average conditions (0.3 cm $yr^{-1}$) and larger in extreme conditions has been also identified (Young and Ribal, 2019).

**Baltic Sea**

Sea temperature: between 1990 and 2005, satellite data indicate an increase in the annual mean SST of 0.8 °C (HELCOM, 2007b), similar to the rate obtained during 1978–2007 (0.4 °C decade$^{-1}$) (Kniebusch et al., 2019). Waves: Dreier et al. (2020) reported trends between -5 % and +9 % of Hs with a return period of 200 years. Sea-level: sea-level trend from tide gauge observations and model reanalysis indicated a rate of 3.4 ± 0.7 mm yr$^{-1}$ for 1993–2014 (Madsen et al. 2019).

**Black Sea**

Sea temperature: the trend in SST since 1981 to 2018 has been around 0.5 °C decade$^{-1}$ (European Environment Agency[2]). Waves: the spatial and temporal analysis of maximum wave height, Hs and mean wave period between 1979 and 2018 showed that wave regime remained quite stable in the western Black Sea, while it tends to increase in the eastern part (Islek et al., 2020). Sea-level: using satellite altimetry data, an increase in sea-level at a rate of 7.6 mm yr$^{-1}$ from 1992 to 2005 has been observed (Kubryakov and Stanichnyi 2013) and at rate of -0.38 to 7.05 mm yr$^{-1}$ from 1993 to 2014 (Avsar et al., 2016) and using tide gauges at rates between 1.2 and 6.6 mm yr$^{-1}$ from 1993 to 2014. Thus, estimation of the Black Sea level change has large uncertainty (Avsar et al., 2016).

**North-east Atlantic Ocean**

Sea temperature: on the southwestern coast of Europe, the SST has been increasing from ~ 0.2 to ~ 0.3 °C decade$^{-1}$ (mostly in summer) (Lima and Wethey, 2012). In the Bay of Biscay (deCastro et al., 2009; Costoya et al., 2015), and in the southeast of the Bay of Biscay (Valencia et al. 2004; González et al., 2008; Goikoetxea et al., 2009), the SST shows warming trends similar to those observed in the North Atlantic, and the entire water column is warming at 0.2 °C decade$^{-1}$ from 1990 to 2009 (Bode et al., 2012). A warming of the surface sea has been detected on the Basque coast since 1980 (Goikoetxea et al., 2009). Waves: in the Bay of Biscay, Hs has increased since 1900 between 0.1 and 0.5 cm yr$^{-1}$ (Ulazia et al., 2017). Over the period 1970-2001, Paris et al. (2014) have identified an increase in Hs of 0.5 cm yr$^{-1}$ in summer and an increase in Hs90 (90$^{th}$ percentile Hs) up to 3 cm yr$^{-1}$ (in autumn). Castelle et al. (2018) revealed a large increase in winter Hs since 1949 in the North-east Atlantic. Sea-level: in the Bay of Biscay, the mean sea-level rise rates are of 2-3 mm yr$^{-1}$ (Caballero et al., 2008; Chust et al., 2009; Leorri and Cearreta, 2009; Marcos et al., 2007) (see also a review in (Chust et al., 2011)).

**Mediterranean Sea**

Sea temperature: warming of sea surface is currently estimated at 0.4 °C decade$^{-1}$ between 1985 and 2006 (+0.3 °C decade$^{-1}$ for the western basin and +0.5 °C decade$^{-1}$ for the eastern basin) (Cramer et al., 2018). An increasing trend in Marine Heat Waves duration has been reported; the longest duration occurred in 2010 in the Levantine Sea, in 2014 in the Adriatic Sean and in 2017 in the Western Mediterranean (Bensoussan et al., 2019). Waves: wave height time series between 1979 and 2018 show regional differences (De Leo et al., 2020). Sea-level: wea-level has risen at a rate of 0.7 mm yr$^{-1}$ between 1945 and 2000 and a sharp increase during the last decades (1993-2011) at a rate of 3 mm yr$^{-1}$ (Tsimplis et al., 2013).

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

As far as we know, there are not long-term monitoring series on the two criteria required by D7, but proxy indicators, such as sea-level, temperature, salinity, currents and waves. Most of these variables are related to global change, rather than local human activities altering the hydrographical conditions. They are useful, since are easy to obtain and have large temporal and spatial coverage (at European scale). On the other hand, numerical modelling has been identified as a key component for determining permanent alterations due to human activities. Therefore, more research work should be committed in order to develop

[2] https://www.eea.europa.eu/data-and-maps/indicators/sea-surface-temperature-3/assessment/#_edn8

a common methodology, to identify the alterations on indicators, due to human activities, as well as the extension affected and to minimise uncertainties in the impact assessment.

### 11.3.8. D8: Contaminants

Descriptor 8 aims at keeping contaminant concentrations at levels that do not induce pollution effects to the environment. Industrialization has remarkably increased the human-induced pollution load on the environment. Intentional releases such as discharges from industrial production or use of pesticides to increase agricultural production, but also the increased risk of acute events from accidental releases, pose a serious threat to ecosystems. According to the criteria under D8 the concentrations of contaminants which may give rise to pollution effects should not exceed the threshold value (D8C1), the health of species and the condition of habitats should not be adversely affected due to contaminants (D8C2), the spatial extent and duration of significant acute pollution events should be minimised (D8C3) and the biological effects of acute events should be minimised or eliminated (D8C4).

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

Contaminants, or hazardous substances, are used as a collective term for synthetic chemicals and heavy metals mobilised by human activities. It is well-known that contaminants cause harmful effects on the ecosystem and although the use of many hazardous substances have been restricted or banned, concentrations remain high in the environment due to the persistent nature of the compounds. Contaminants can be grouped based on their chemical composition. Metals, polyaromatic hydrocarbons (PAHs), tributyltin (TBT), and many persistent organic pollutants (POPs) are commonly considered in marine contaminant monitoring programmes. Concentrations of contaminants are measured in seawater, sediment and biota. Biological effects, such as disruptions in reproduction, are also considered.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

A clean, non-toxic marine environment is the overall aim in both global UN environmental programmes, European EU Directives and in the Regional Sea Conventions policy commitments (Andersen et al. 2019). OSPAR, HELCOM, the Barcelona Convention and the Black Sea Commission have already focused for decades on reducing pollution to the regional seas. At EU level, the REACH regulation (Registration, Evaluation, Authorisation and Restriction of Chemicals) became a fundament for reducing adverse effects from chemicals on the environment. Regarding the marine environment, the WFD sets targets to attain "good chemical status" in coastal waters. The MSFD further aims at keeping contaminant concentrations at levels that do not cause harm to the environment and allow for safe human consumption of seafood.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

The main sources of information for temporal trends on contaminants were the latest periodic assessments of the regional seas and their underlying data:

- Baltic Sea, the second holistic assessment of the Baltic Sea (HOLAS II; HELCOM 2018a)
- North-east Atlantic, the OSPAR's Intermediate Assessment 2017 (IA2017; OSPAR 2017b)
- Mediterranean Sea, the Mediterranean Quality Status Report 2017 (MED QSR 2017; UNEP-MAP 2017)
- Black Sea, the Black Sea State of Environment Report 2009-2014/5 (Black Sea SoER; BSC 2019)

In addition, information was gathered from scientific literature as temporal trends were scarce or time series short for many substances in the regional sea assessment reports. This was especially the case for the Mediterranean Sea and the Black Sea.

***Key results of the trend analyses for specific indicators and/or index/indices***

**Heavy metals**

The comprehensive policy and regulatory frameworks have resulted in decreasing load in heavy metals in the North Sea (OSPAR 2017b), in the Baltic Sea (HELCOM 2018a) and in parts of the Mediterranean Sea (Campillo et al. 2019). Lead shows decreasing trends in biota in Baltic Sea (HELCOM 2018a) exemplified by lead concentrations in herring liver (Fig. 11.26). In OSPAR areas, the trends for lead in fish or shellfish were declining or insignificant (OSPAR 2017b). In the Mediterranean Sea, data from the Spanish coast also show a declining trend of lead in mussel tissue (Fig. 11.27). In the Black Sea, increasing lead concentrations were seen in the period 2006-2018 (Oros 2020). For mercury and cadmium trends seem to be more site-specific with both increasing and decreasing trends occurring both in the Baltic Sea and the Northeast Atlantic (HELCOM 2018a, OSPAR 2017b) and insignificant trends in the Mediterranean and Black Sea (Campillo et al. 2019, Oros 2020).

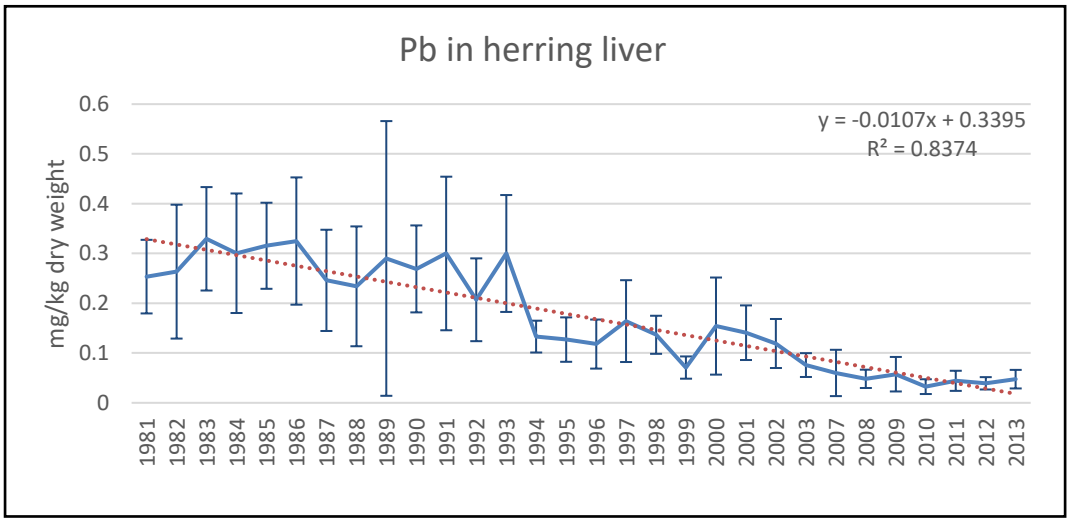



*Figure 11.26 Temporal trend of lead concentration in herring (Clupea harengus) sampled in Landsort in the Baltic Proper. Average values, with error bars denoting the standard deviation. Data from IVL Swedish Environmental Research Institute.*

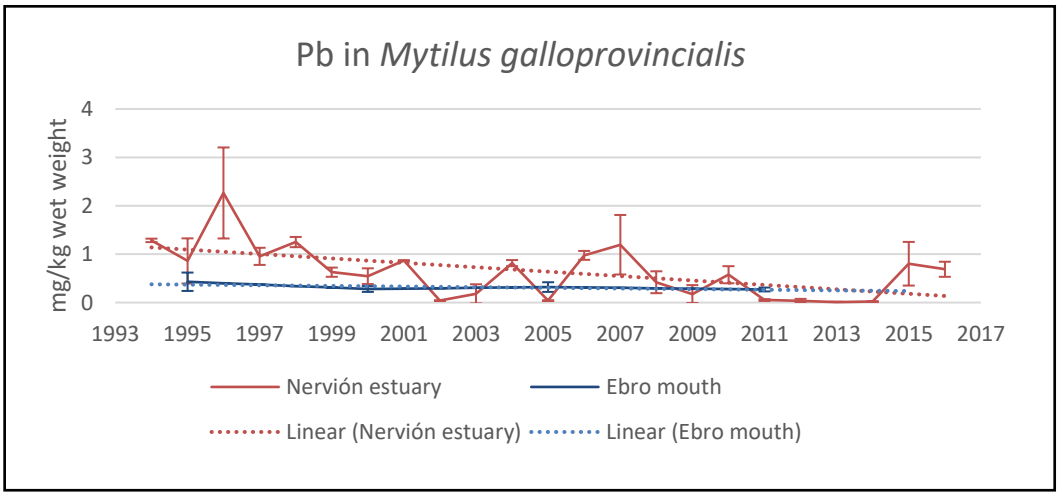



*Figure 11.27 Temporal trend of lead concentration in the black mussel Mytilus galloprovincialis in the estuaries of two Spanish rivers. Nervión estuary is situated in the Bay of Biscay (data provided by AZTI) and Ebro is flowing into the Western Mediterranean Sea (data from Campillo et al. 2019). Average values, with error bars denoting the standard deviation.*

**Polyaromatic hydrocarbons (PAHs)**

In general, accidental both number of accidental oil spills and the volume of oil spilled from shipping activities have decreased because of stricter regulations and improved technology (UNEP/MAP 2017,

HELCOM 2018a). However, illegal oil discharges still occur and although it is difficult to conclude that spills are caused by ships, oil pollution caused by shipping is still of concern. In the North Sea, the volume of oil discharges from offshore oil and gas installations decreased in the period 2009-2014. The concentration of PAHs in fish and shellfish have decreased in the OSPAR area, with significant trends in Southern North Sea, English Channel, Irish and Scottish West Coast, and Iberian Sea (OSPAR 2017b). In sediments a decreasing trend in PAHs was seen in the English Channel and the Gulf of Cadiz. In the coastal waters of the Black Sea, a decrease in PAH concentrations was seen 2009-2014, mainly driven by changes in the Romanian waters (BSC 2019). In the Mediterranean Sea, measurements from sediment in the Adriatic Sea show increasing concentrations of PAHs from 1940s to 1980-1990s, but a decreasing concentration since (Combi et al. 2020). No information on temporal trends of PAH concentrations were found in the Baltic Sea.

**Persistent Organic Pollutants (POPs)**

POPs are used collectively for a variety of synthetic organic substances that persist toxic in the environment long after their discharges. Among the most well-known POPs are polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane (DDT). PCBs have been widely used in e.g. electrical equipment, whereas DDT was used, and is still used in some areas of the world, as a pesticide. Generally, the concentrations of PCBs are decreasing both in the sediment and in biota in North East Atlantic, although problem areas still exist (OSPAR 2017b). In the Baltic Sea, decreasing or stable trends are seen (HELCOM 2018a). Sediment analyses in the Adriatic Sea has revealed an increase in both PCB and DDT concentrations starting in the 1940s and peaking in the 1980s, after which a decrease is seen (Combi et al. 2020). More recently (2001-2006), however, increasing concentrations in the mussel *Mytilus galloprovincialis* are observed along the Italian coast (Andersen et al. 2019). In the Baltic Sea decreasing DDT (and metabolites) concentrations have decreased in the environment, and the decrease in organic pollutants is witnessed in the recovery of white-tailed eagle (*Haliaetus albicilla*) reproduction success (Fig. 27, HELCOM 2018c).

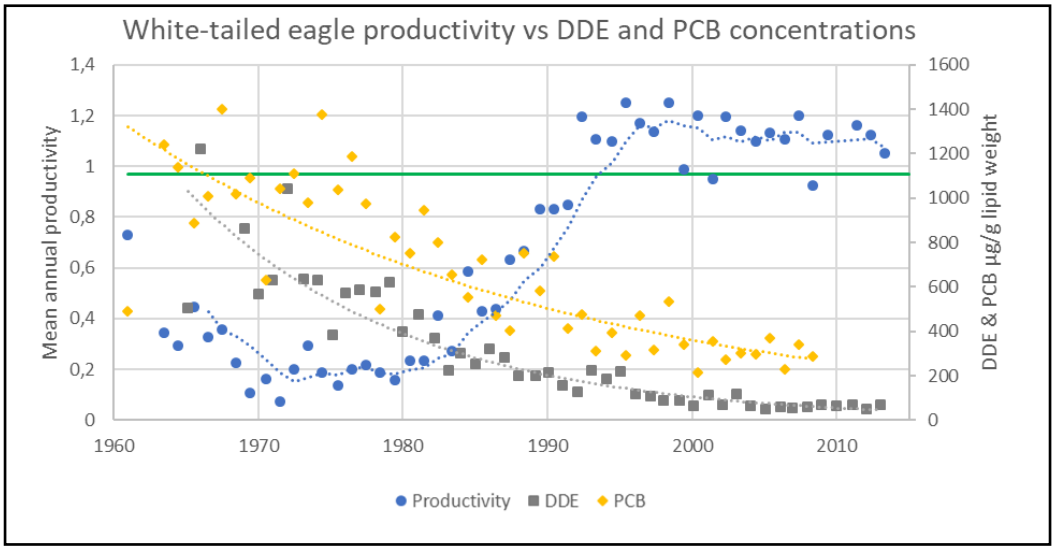



*Figure 11.28 White-tailed eagle (Haliaetus albicilla) productivity (blue dots) in relation to concentration of DDE (gray squares) and PCB (yellow diamonds) in eggs. The blue dotted line shows the moving five-year average of productivity, whereas the gray and yellow dotted lines show decreasing trends in DDE and PCB, respectively, in the northern Baltic Sea. The green line shows the target value of the productivity indicator. Source: HELCOM 2018c.*

Other frequently addressed POPs are polybrominated diethyl ethers (PBDEs) and perfluoroalkyl substances (PFAS). PBDEs are flame-retardants, widely used e.g. in electronic equipment and textiles. Certain PBDE substances have been banned in 2009 as a result of their hormone-disrupting properties. Declining PBDE trends in fish and shellfish were observed in all OSPAR areas, except for Skagerrak and Kattegat,

between 1996-2015 (OSPAR 2017b). In sediments, only Irish Sea showed declining PBDE concentrations, whereas no significant trend could be observed in other OSPAR areas. Also in the Baltic Sea, the PBDE concentrations are decreasing (Bignert et al. 2017). PBDE concentrations in Baltic Sea herring are declining, although the pattern is less clear in coastal areas.

PFAS have surface tension reducing potential and has been used e.g. for water proofing or in fire-fighting foams. The production of most concerning PFAS, such as PFOS, has been phased out since early 2000s, when the toxic and environmentally harmful effects of the substance become evident (Buck et al. 2011). An increasing trend in PFOS concentrations in common guillemot (*Uria aalge*) eggs from the Baltic Sea from 1973-2014 (Fig 28). However, during the last 10 years of the data series a decrease in concentrations is seen, but it is too early to confidently say that the trend has broken (Bignert et al. 2017). In the North Sea and the Irish Sea, concentrations of PFOS in Northern gannet (*Morus bassanus*) eggs also show a pre-2000 increasing trend, whereas trends have been declining since 2000 (Pereira et al. 2021). A similar pattern was also seen in shellfish at the French coast both in the English Channel and Western Mediterranean Sea (Munschy et al. 2019).

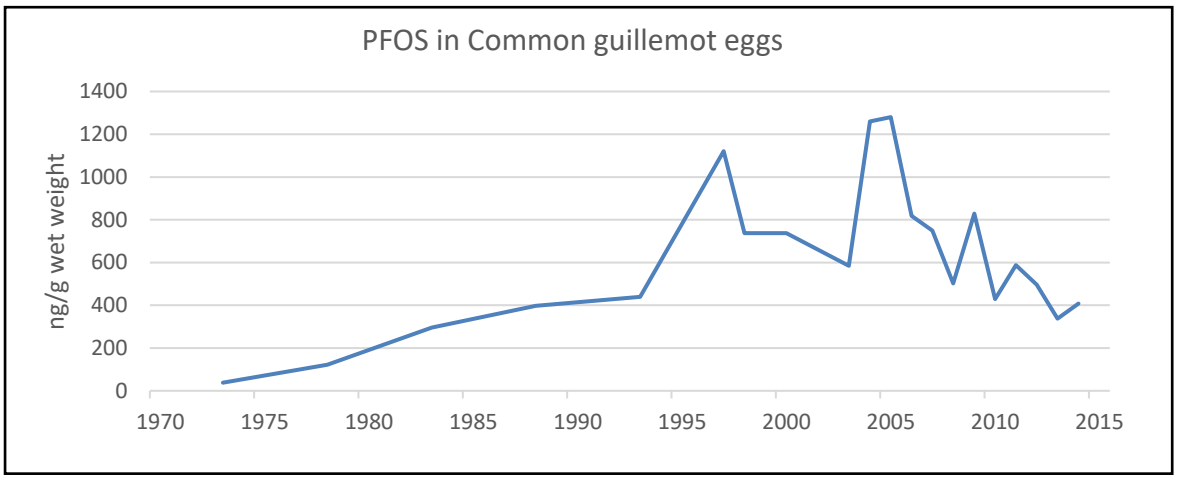



*Figure 11.29 PFOS concentrations retrospectively analysed form common guillemot (Uria aalge) eggs from Stora Karlsö in the Baltic Sea. Data from IVL Swedish Environmental Research Institute.*

**Tributyltin (TBT)**

TBT, a compound earlier widely used in antifouling paint, is known to cause reproduction disorders in e.g. gastropods. The EU ban on using TBT in antifouling paint entering into force in 2008 has led to gradually decreasing concentrations in biota in the Baltic Sea (HELCOM 2018a) and the North Sea (OSPAR 2017b). This is also reflected in declining trends in reproductive disruptions such as gastropod imposex in both in the Baltic Sea and in the North Sea (HELCOM 2018a, OSPAR 2017b). However, TBT accumulated in the sediment may cause a long-lasting source of leakage.

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

The regulative measures that have been put into force have had a positive effect, decreasing the loads of chemicals released to the environment. The decreasing chemical load, exemplified above for lead, PCBs, DDT, PBDEs, PFAS and TBT, are also reflected in declining trends in the marine environment and biota. In most cases, the improvements can be assigned to regulation or bans in use of the substances. However, due to the persistent nature of the contaminants, full recovery of ecosystems may take decades after regulative enforcements. A further concern is that new synthetic substances are continuously being produced, involving a risk for new emerging contamination of the environment. A group of substances that

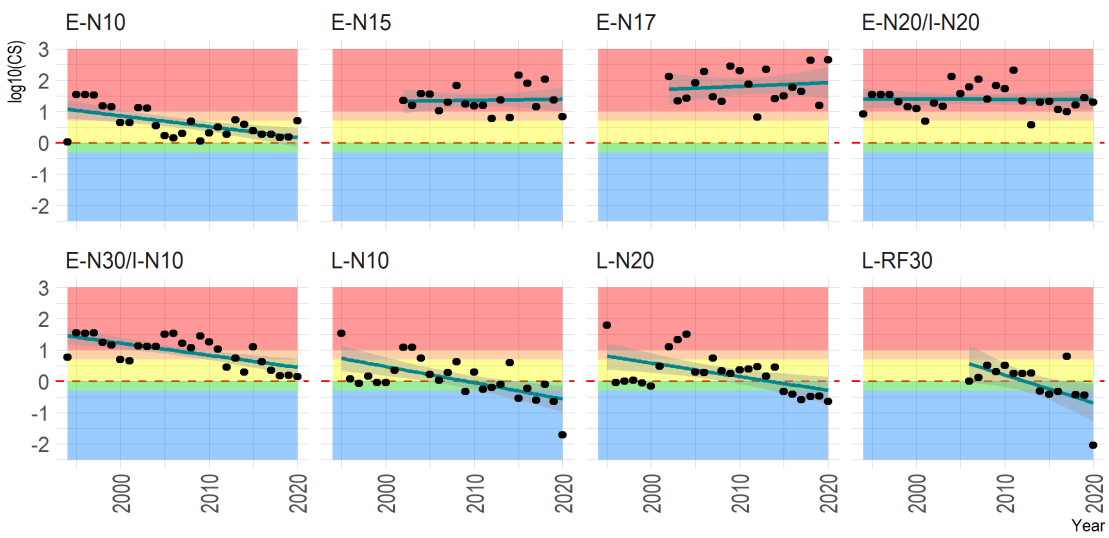
have recently attained attention are pharmaceutical substances passing through waste-water treatment plants and thus entering the marine environment with potential adverse effects on biota.

Data coverage on concentrations of contaminants in the marine environment has improved because of the increased policy requirements, such as the WFD. Yet, long-term trend analyses are mainly restricted to local areas, not necessarily reflecting the overall regional trends. Spatially, trend data for contaminants (openly accessible) are unbalanced in Europe's seas, with better coverage in the northern parts. Sediment cores, however, allow for retrospective analyses of contaminant trends (e.g. Combi et al. 2020), bringing an opportunity to hindcast the development in contaminant pressure in areas where trend data are currently missing.

In addition, there will be two (or three) case studies, where the CHASE tool is applied in conjunction with long-term data, i.e. from the Nervión Estuary (Spain), the southern North Sea and from Ranfjorden (Norway).

**BOX 11.2: TRENDS IN CONTAMINANTS IN THE NERVION ESTUARY, SPAIN**

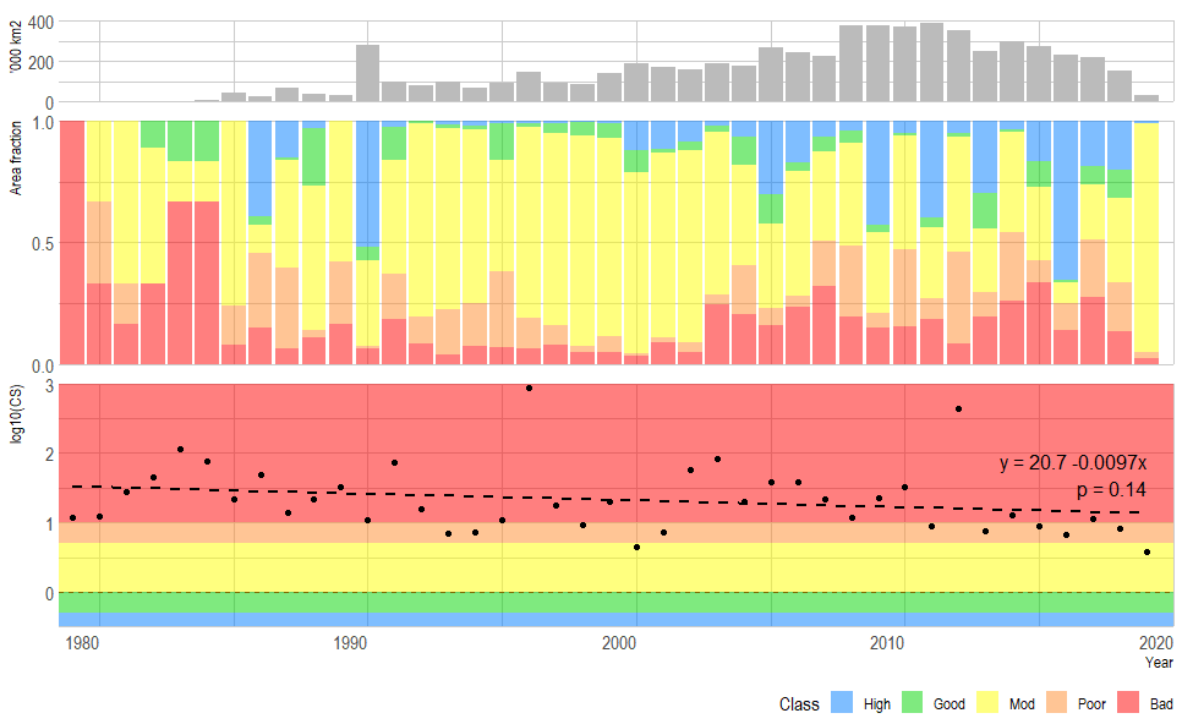
The Nervión estuary is a 22 km long mesotidal system located in the northern coast of Spain, southeastern Bay of Biscay. The basin drains a watershed of 1,700 $km^2$, approximately, with an annual freshwater inflow of about 36 $m^3\ s^{-1}$. The estuary is in the most populated and industrialised area of the Spanish Atlantic coast. Since the middle of the 19$^{th}$ century the area has experienced a very intense industrialisation (mining, iron and steel, shipyards, etc.) and population increase. The original estuary was rapidly reduced in size through land reclamation. For many decades the estuary received wastes from many sources, which significantly degraded its environmental quality; in fact, in the 20$^{th}$ century the system became the most contaminated estuary in the North of Spain, with very high concentrations of nutrients, contaminants and faecal bacteria in the water, hypoxia and even anoxia in the middle and inner reaches, highly contaminated sediments, etc. Biological communities were very impoverished and, indeed, big fauna (fishes, crustaceans) was absent in the innermost estuary. In 1979 a sewerage and water treatment plan were approved. In 1990 a sewage treatment plant (STP) was put into operation, A biological (secondary) treatment started in 2000. As a result of the industrial decline and the implementation of the sewerage scheme the environmental status of the Nervión estuary has progressively improved, as reflected in the water and sediment quality and in the biological communities. Oxygen is not a limiting factor for the biological communities anymore. According to the last assessment of the estuary under the Water Framework Directive, in spite of the good ecological potential, the system does not fulfil the good overall status because it does not comply with the chemical status. The contaminant of main concern is hexachlorocyclohexane (HCH). The CHASE tool calculates a contamination ratio (CR) for each substance, dividing the concentration by the threshold value. The CRs for individual substances are aggregated using the CHASE method to arrive at a contamination sum (CS). This is done separately for substances in (1) water (2) biota and (3) sediment. A score CS > 1 indicates that there is a contamination problem. The category (matrix) having the worst status (highest CS) determines the overall status for the assessment unit (station). The figure below shows the contamination scores calculated for stations on the Nervión estuary from furthest upstream (E-N10) to furthest offshore (L-RF-30). Note that the figure shows CS on a log10 scale, so log10(CS) = 0.0 is equivalent to CS = 1.0 on a normal scale. The most upstream station, shows a downward trend in contamination score, indicating an improvement over time, though the status of "problem area" still applies. Within the inner parts of the estuary, there is clear "problem area" status, which is not improving, likely the result of legacy contamination. However, we can see that in the stations from E-N30 and out into littoral waters there are clear downward trends in contamination scores and there has been a non-problem status in the three outermost stations since 2015.




**Contamination scores (CS) from 1994 to 2019 for stations in the Nervión estuary where log10(CS) > 0 indicates a contamination problem. Biota measurements at I-N20 and I-N10 are combined with sediment and water measurements at, respectively, E-N20 and E-N30 when estimating overall status. Please see the Supplementary Material for additional information.**

**BOX 11.3: TRENDS IN CONTAMINANTS IN THE NORTH SEA**

The wider North Sea is a marginal sea of the Atlantic Ocean and is bounded by the Orkney Islands and east coasts of England and Scotland to the west and by the northern and central European mainland to the east and south. In the north, it is bordered by the Shetland Islands and connects with the Norwegian Sea. In the southwest, beyond the Straits of Dover, the North Sea becomes the channel connecting to the Atlantic Ocean. In the east, it is connected to the Baltic Sea via the Skagerrak and the Kattegat, a narrow strait that separates Denmark from Sweden. Due to intensive fishing pressure, dense human populations and high levels of industrialization, both land-based and sea-based, and agriculture along the shores of the North Sea, the ecosystem health is significantly affected by pollution, top-down control (hunting and fishing), physical disturbance, introduction of non-native species and climate change (OSPAR 2017b; Reker et al. 2020). The CHASE assessment in the North Sea was made on the same assessment grid as "Contaminants in Europe's Seas". As described in BOX 3: TRENDS IN CONTAMINANTS IN THE NERVION ESTUARY, the CHASE tool calculates contamination sum (CS) for substances in 3 categories: water, biota and sediment. The category having the highest CS (worst contamination) determines the overall status for the assessment unit. CS > 1 indicates that there is a contamination problem. Each assessment grid cell was thus assigned a status of "problem area" or "non-problem area" according the CS, with the problem areas further subdivided into "Moderate", "Poor" or "Bad" and non-problem areas into "High" or "Good" status. The results of the assessment show that the area assessed has increased steadily from the early 1980s to close to 400 000 km$^2$ in 2011 and has fallen again to around 200 000 km$^2$. The lower area assessed in 2019 could be due to delays in reporting. There proportion of area assessed estimated to be "non-problem" areas vary considerably from year to year. The trend in average contamination over the entire assessed area, whilst not statistically significant, does appear to be downwards (i.e. improving).



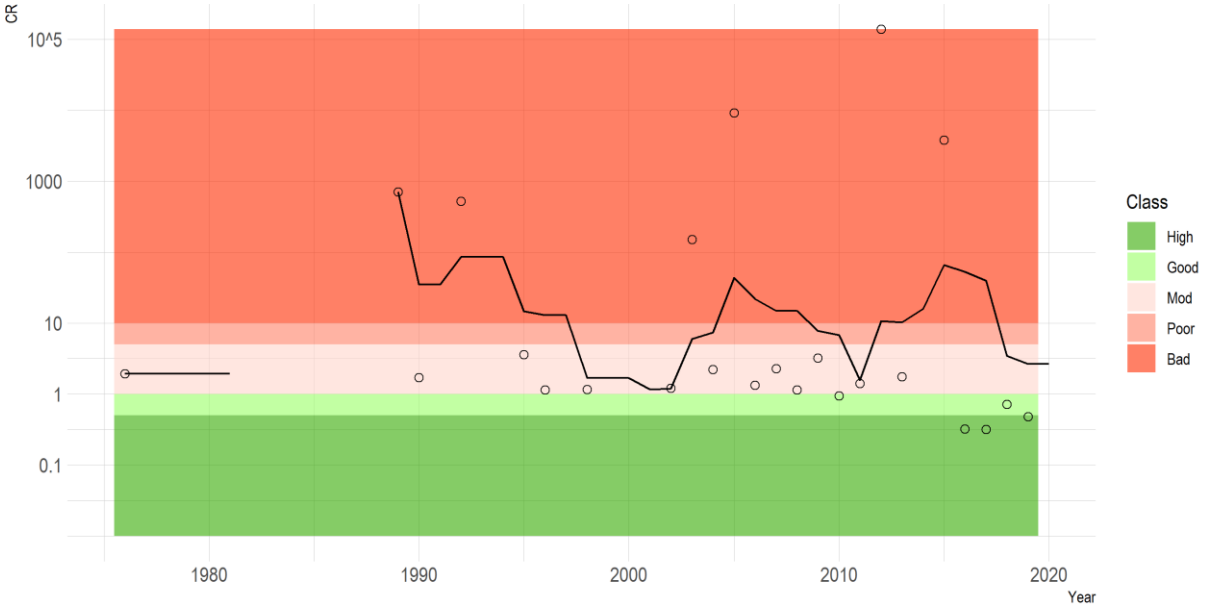

**CHASE Assessment results in the North Sea per year from 1979 to 2019, showing area assessed (top), fraction of assessed area by status class (centre) and average status for the entire assessed area (bottom).**

Please see the Supplementary Material for additional information.

**BOX 11.4: TRENDS IN CONTAMINANTS IN RANFJORDEN, NORWAY**

Ranfjorden is situated in the central Norway and its inner parts are contaminated because of multiple industrial activities in the catchment. Monitoring has been carried out for more than 30 years focusing on measurement of concentrations of selected contaminants in sediments and biota. We have reanalysed these data using CHASE, a tool for identifying problem areas and non-problem areas with respect to contamination. Our analyses document a long-term trend and thus that effort to manage and reduce inputs of contaminants have been somewhat successful.

The fjord was divided into five sections at 5 km distance intervals from the innermost (northern) end of the fjord. Within each section, the contamination score (CS) was calculated each year, following the CHASE method, as can be seen in BOX 3 (NERVION) and BOX 4 (North Sea), with CS > 1 indicating a contamination "problem area". The overall status for the fjord was calculated by taking the average CS for all five sections. There is a great deal of variation in CS from year to year. This variability can be largely attributed to differences in which substances which are measured. However, the overall trend is one of improving status.




**CHASE assessment results Ranfjord from 1976 to 2019: Contamination score (CS) calculated annually (points) and as a 5-year moving average (line)**

Please see the Supplementary Material for additional information.

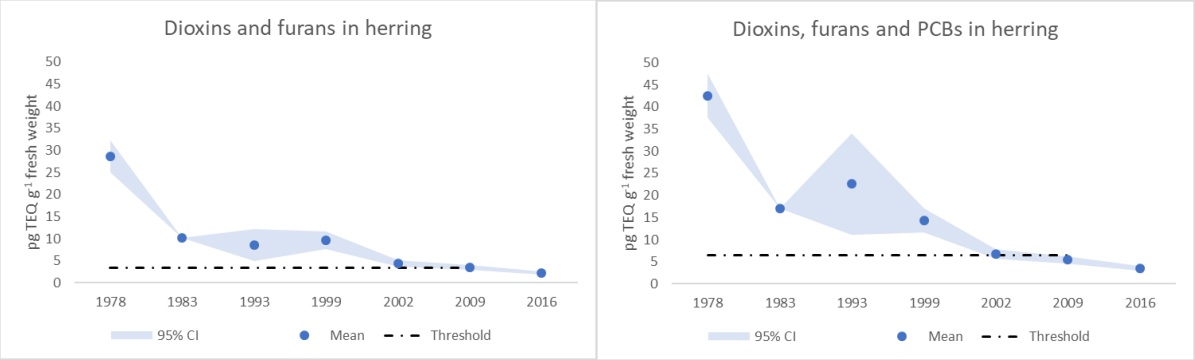
### 11.3.9. D9: Contaminants in seafood

Descriptor 9 focuses on concentrations of contaminants in fish and other seafood, especially of the concentrations do not exceed levels established by EU legislation or other relevant standards. Whilst other parts of the MSFD are about environmental status and ecosystem health, this specific descriptor is sort of entering a grey zone between human health and environmental health.

The assessments under D9 differ from the those under D8 by several key factors, such as which fish stocks to monitor, what size of fish to analyse, how to prepare the samples and where the samples are collected. The obligation of food safety authorities is to monitor seafood products on sale (e.g. on fish markets) and not stocks in the national marine areas. This difference may isolate the D8 and D9 assessments from each other.

**BOX 11.5: TRENDS IN DIOXINS AND PCBs IN HERRING, FINLAND**

The northern Baltic Sea was seriously contaminated by persistent organic pollutants (POP), especially dioxins, furans and polychlorinated bifenyls (PCB), from several pulp mills in the region. The concentrations in herring were 7-10 higher than the current EU food safety thresholds. To protect the citizens, Finland and other Baltic Sea countries set recommendations for limiting seafood consumption, especially fatty fish species such as herring and salmonids. Since awakening to the pollution problem in 1960s-70s, Finland has set stricter permits for industry discharges and even to activities which could disturb the polluted sediments in rivers and estuarine areas. Many of the regulations were agreed on the level of the Baltic Sea in HELCOM. Declines of pollutant levels were already seen in 1980s, and by 2000s it was clear that the concentrations in fish were about to reach the target levels set by the EU. At present, the target levels have been reached (see figure below). Decreased contamination levels are not limited to POPs but have also been seen in heavy metals. Finland has monitored the contamination levels in various seafood fish species and successfully integrated the monitoring with the environmental monitoring of contamination. Co-operation among three governmental research institutes and the food safety agency has resulted in long time series of data, cost-efficiency in monitoring and coherent communication of the state of environment and food safety recommendations.




**Concentrations of dioxins and furans (left) and dioxins, furans and PCBs (right) in herring used for human consumption. All data from Finland's marine areas in the Baltic Sea. Redrawn from Airaksinen et al. (2014) and Airaksinen et al. (2018).**

### 11.3.10. D10: Marine litter

Commission Decision 2017/848[3] defined the input of litter as the unique relevant pressure. The origin of these inputs can be the land or the sea and, in both cases, the identification of the source is very complicated. The Commission Decision also establishes the criteria to assess these inputs and thus, evaluate how far is the GES (*Properties and quantities of marine litter do not cause harm to the coastal and marine environment*). The defined primary criteria are: i) D10C1, *"the composition, amount, and spatial distribution of litter on the coastline, in the surface layer of the water column, and on the seabed, are at levels that do not cause harm to the coastal and marine environment";* and, ii) D10C2, *"the composition, amount and spatial distribution of micro-litter on the coastline, in the surface layer of the water column, and in seabed sediment, are at levels that do not cause harm to the coastal and marine environment".*

After the Commission Decision 2017/848, the second criterion established previously by Commission Decision 2010/477/EU (Impacts of litter on marine life) is now defined as a secondary criterion, and therefore, Member States do not have any obligation to carry out any assessment. Thus, two criteria have been defined as: i) D10C3, *"the amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned";* and ii) D10C4, *"the number of individuals of each species which are adversely affected due to litter, such as by entanglement, other types of injury or mortality, or health effects".*

According to the previous bibliographic review (Excel elaborated in September 2020), the assessment of this descriptor cannot be undertaken under a long-term basis (i.e. > 20 yr), due to the absence of monitoring programmes and data series availability of such length. Galgani et al. (2021), just recently have published an article relative to the abundance and trends of litter in whole oceans, considering several references that complement the previous bibliographic review we did in September 2020. Appendix 15 includes all details in relation to Descriptor 10.

In addition to the bibliographic references previously cited, the information published by the Marine Litter Watch (MLW) (a citizen science action of the European Environment Agency (EEA)) and OSPAR are considered: MLW for litter on beaches and OSPAR in the case of litter on seafloor and biota. In all these cases, dataset present sparse temporal coverage, but, at the same time, guarantee the spatial coverage of the entire study area. The MLW is an EEA initiative to collect quantitative information on marine litter from beaches. MLW not have long-term data series neither normalized result; however, it offers outcomes for all case study areas.

[3] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017D0848*

Finally, the EMODnet data providers website have also been consulted. EMODnet collect, organize and store marine data generated by European institutions and then provides access to those data throughout seven discipline-based themes. According to MSFD Technical Group on Marine Litter advise, EMODnet Chemistry has developed a new database named *pan European Marine Litter Database (MLDB*). This Database contains dataset generated and published by other databases (e.g., OSPAR, DATRAS).

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

As mentioned above, the outcome of bibliographic review shows only few long-term datasets. Table 15A included in Appendix 15 summarized different aspects related to all of them, including: MSFD criteria and indicator studied, localization of the study area (regional sea, location, country), units of measurement for the criteria and data source.

The total number of references or dataset analysed are 14, six are focused on the D10C1, one on D10C2 and other five on D10C3. There are also three references related to two criteria: one "D10C1 + D10C4", one "D10C2 + D10C3" and the last one: "D10C3 + D10C4". Most of them are associated with the presence of marine litter on seafloor and animals; two only with beaches and only one dealing with litter in water column.

Most of the references describe results for the Atlantic area. Two references cover Baltic Sea and two other cover the Mediterranean Sea. Particularly, in the Baltic Sea, the datasets are focused on D10C3 and D10C2, in the Mediterranean on D10C3 and D10C1 (seafloor) and in the Atlantic area all of them. In general, units of measurement of the criteria are consistent with the MSFD.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

It is necessary to obtain a good quantification of marine litter to reach the GES as requested MSFD. As mentioned before, input of litter as the unique relevant pressure and the identification of the source of these inputs is complex. However, it is expected that, as the management of litter improves, the concentration of litter in the sea will decrease.

Actually, there are different approaches to deal with this issue. Thus, at global scale MARPOL 73/78 Convention, London Protocol and the Global Programme of Action for the Protection of the Marine Land-Based Activities (UNEP) are some important examples. At a regional scale, there are three essential agreements: OSPAR, HELCOM and Barcelona Convention. At European level European Marine Strategy Framework Directive is therefore the main specific policy.

***Methodology for indicator and/or index calculation including relevant references***

As shown in Table 15B (see Appendix 15), the revised articles and reports show different methodological approaches. In the case of D10C1 criteria, the most common methodology applied is trawling for the seafloor studies and visual sighting for the beaches. Trawling is carried out according to IBTS protocol and MSFD litter classification system, and visual sighting as defined by OSPAR protocol and MSFD Technical Group on Marine Litter (there is also one case of photographic survey of seafloor). For floating litter and litter in water column the methodology includes bongo net and Continuous Plankton Recorder, respectively.

Stomach content analysis is the main methodology for D10C3 assessment. Seabirds, turtles and cetaceans examined are stranded or by-caught individual. The entanglements of animals and body scars and wounds serve to evaluate the D10C4.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties.***

As shown before, few long-term datasets have been found available (Table 15C in Appendix 15). In most cases, data are free or available previous request. Remarkable the effort done by EEA, collecting, storing and making results available to the public, authorities, professional and businesses through MLW and *pan European Marine Litter Database (MLDB*) developed by EMODnet. However, MLW has neither long-term data series nor normalized results, and EMODnet just starts and only includes dataset generated and published by other databases (OSPAR, DATRAS, etc.). It is expected that in the coming years a consensus may be reached in relation to methodologies and thus, these two data providers can offer high quality, diversified and reliable dataset.

***Key results of the trend analyses for specific indicators and/or index/indices***

According to the results showed in the Table 15D include in Appendix 15, the long-term dataset studies reveal no trends through the years in more than half of the studies (almost 65%). Few of them report increments over time and one shows a decrease. Remarkable also, that only OSPAR and MLW offer outcomes at the European level. The analysis at criteria and compartment or species level reveal:

- D10C1: OSPAR in their analysis at European level has not found any trend along European beaches, but on the contrary, according to the MLW there is a positive trend. As we mentioned before, this is because MLW present datasets with sparse temporal coverage and maybe also due to the lack of normalization of sampling data. Something similar occur in the case of seafloor, while in North Greenland Sea a slight increase is observed by Parga Martinez et al. (2020), OSPAR and Maes et al. (2018) in the North-east Atlantic and North Sea and Gerigny et al. (2019) in the Mediterranean Sea have not detected any trend. In the case of floating macroplastic, Ostle et al. (2019) report a positive trend between 1957 – 2000 and no trend since then.
- D10C2: Beer et al. (2018) not have detected any trend on floating microplastic in the study done in the Baltic Sea. But in the case of sediments, the analysis carried out by Martin et al. (2017) in the Irish continental shelf shows that microplastic deposition is increasing over time.
- D10C3: in the case of litter ingestion no trends detected in cetaceans of Irish water (Lusher et al. 2018), fish species in the Baltic Sea (Beer et al. 2018) and invertebrate species of Rocall Trough (NE Atlantic, West of United Kingdom) (Courtene Jones et al. 2019). According to Domenech et al. (2019), the trend of microplastic ingestion on Mediterranean turtles is slightly decreasing. Finally, levels of plastic ingestion by fulmars in the North Sea increased to mid-1990s and appear to have stabilised (OSPAR 2017e), Van Franeker & Law 2015).
- D10C4: no trends detected in the studies carried out by Parga Martinez et al. (2020) in North Greenland Sea with benthic macrofauna and Lusher et al. (2018) around Irish waters with cetaceans.

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

The issues concerning marine litter are "new" so, exist a general lack of knowledge about different aspects of marine litter. This lack of knowledge is related to science, technological development, economy, public awareness, but also policy makers. The result achieved show a general unknowledge about marine litter sources, emission quantities and composition (input), poor knowledge about marine litter quantities and composition found in all compartments, its distribution, and pathways.

In general, and according to the bibliographic review, there is an evident lack of long-term dataset necessary to carry out adequate and robust studies. Most of the references describe results for Atlantic area, and few focused in Baltic Sea and Mediterranean Sea. There is not any result for Bay of Biscay and Macaronesia. OSPAR and MLW are the only two institutions that include whole European waters in their studies. In relation to secondary criteria, is necessary to define key species according to biogeographical subregions.

A shift in public policies is needed to achieve best knowledge about this Descriptor. It is necessary to develop standardized monitoring plans and analysis methodologies to get homogeneous and robust results. If possible, it would be good having the chance of developing an intercalibration process at European level, such as that undertaken within the WFD.

### 11.3.11. D11: Introduction of energy, including underwater noise

According to Commission Decision 2017/848[4], input of anthropogenic sound and the input of other forms of energy are the main pressures for this descriptor. The Decision also establishes the criteria necessary to assess the effects of these pressures: i) D11C1, *"the spatial distribution, temporal extent, and levels of anthropogenic impulsive sound sources do not exceed levels that adversely affect populations of marine animals";* and ii) D11C2, *"the spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals".*

The assessment of this descriptor is really complicated due to the lack of information about long-term monitoring programmes and data series availability. This does not mean that there is no information regarding D11. As an example, EMODnet (www.emodnet-humanactivities.eu) includes data on the intensity and spatial extent of human activities at sea, and therefore, in some cases, Member States may have information that allows them to evaluate the temporal variability in some of the indicators. Other example is the study by NOAA since 2010, developing tools and methodologies related to underwater noise impacts on marine mammals[5].

It is common in the literature (Širovic et al., 2021; MacGillivray and de Jong, 2021; HELCOM, 2021b; Farcas et al., 2020; JRC, 2014) assess and modelling ambient noise through Automatic Information System (AIS) and impulsive noise registry data. But as well in this case, about long-term monitoring programmes and data series availability does not exist.

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range***

As explained in the first point, it is not possible to provide any result due to the lack of information. Moreover, there are a lot of work to do to solve the gaps related to source identification and methodological and technological developments. The main problem is the lack of knowledge regarding baseline ocean ambient noise (Sirovic et al., 2021). The review elaborated by Colbert (2020) shows how any institution or agreement has yet been able to establish threshold values for those criteria. However, according to the last meeting of Technical Group of Noise (TG-NOISE, an expert group created by of the MSFD), this year 2021, they will publish thresholds for Impulsive Noise and for Continuous Noise (TG-Noise, 2020a).

Conferring to the MSFD, the unit of measurements for the first criterion (D11C1) should be *the number of days per quarter (or per month if appropriate) with impulsive sound sources; proportion (percentage) of unit areas or extent in square kilometres (km$^2$) of assessment area with impulsive sound sources per year*. And for the second criterion (D11C2) *Annual average (or other temporal metric) of continuous sound level per unit area; proportion (percentage) or extent in square kilometres (km$^2$) of assessment area with sound levels exceeding threshold values*.

Several articles present results with sparse temporal and spatial coverage (i.e., Wisniewska et al., 2018; Hermannsen et al., 2019; Farcas et al., 2020); so, obtaining relevant conclusions is very difficult. Sirovic et al. (2021), propose to use as baseline the ocean ambient noise of remote areas. NOAA, in its SoundMap, employs "*Annual average sound fields arising from multiple source types, available on a regional to*

[4] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017D0848*

[5] *https://cetsound.noaa.gov/index*

*ocean-basin scale"* and *shorter-term example "events", which offer a more comprehensive representations of local sound fields during periods of noisy activity"*.

***Policy context and questions – focusing on key policy questions, specific policies (i.e. MSFD, WFD, N2000, etc.), and background policy documents***

It is necessary to obtain a good quantification of indicators to reach the GES as requested by the MSFD. As mentioned before, input of anthropogenic sound and the input of other forms of energy are the main pressures for this descriptor. The identification of sources and the development of methodological approach for the analysis of these inputs are elemental to comply with the obligations described in the MFSD. Technical Group of Noise, an expert group created by the MSFD, has the commitment to assist Member States in the implementation of all issues related to Descriptor 11 requirements. However, there is a few discrepancies related to assessments, methodologies, and unit of measurement between the members of the group (TG NOISE, 2021) therefore, the publication of the official guidelines will delay.

Besides the MFSD, there are also other policies that try to deal with the same issues, some with a global scope and others more regional. Thus, at global scale "*Resolution on Anthropogenic Underwater Noise*[6]*"* adopted by International Whaling Commission in 2018 (to deal with the problems derived from the generation and impact of noise in the marine environment and the species that inhabit it), "*Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Impacts on Marine Life*[7]*"*, guidelines established in 2014 by the International Maritime Organization (non-mandatory) and "*Family Guidelines on Environmental Impact Assessments for Marine Noise-generating Activities*" accepted as Annex of the Resolution 12.14 on Adverse Impacts of Anthropogenic Noise on Cetaceans and Other Migratory Species adopted by Convention on Migratory Species.

At a regional scale, there are two essential agreements: OSPAR and HELCOM Convention. OSPAR adopted an *Ambient Noise Monitoring Strategy* in 2015 and currently is working on the development of impulsive noise risk of impact indicators. HELCOM is at present working *in developing scientifically sound threshold values for underwater noise that are consistent with GES for species and habitats identified as sensitive to noise in the Baltic Sea and (in particular) to further work on the HELCOM input to the process of establishing environmental targets for underwater noise*. Since 2015, OSPAR has developed and maintain the "OSPAR Impulsive Noise Register[8]", register hosted in ICES portal. HELCOM also use this register for storing and sharing its dataset and there is a similar initiative for the Mediterranean Sea under *quietMed project*[9].

***Methodology for indicator and/or index calculation including relevant references***

As mentioned above, TG-Noise has not published guidelines yet. The methodology developed by several European projects (BIAS[10], JOMOPANS[11] and JONAS[12]) will be likely adopted by OSPAR and HELCOM (TG-NOISE, 2021) for status assessment in Regional Seas. And in fact, HELCOM has just published a *Guidelines for monitoring continuous noise*, based on the projects cited previously. OSPAR also has developed a

[6] https://iwc.int/private/downloads/0ymu0VhMN0_3YlwSi-QTcw/RESOLUTION_2018_NOISE.pdf

[7] https://wwwcdn.imo.org/localresources/en/MediaCentre/HotTopics/Documents/833Guidanceonreducingunderwaternoisefromcommercialshipping,.pdf

[8] http://underwaternoise.ices.dk/

[9] http://www.quietmed-project.eu/wp-content/uploads/2019/01/QUIETMED_D4.1_Joint-register-for-impulsive-noise-in-the-MED_final.pdf

[10] https://biasproject.wordpress.com/

[11] https://northsearegion.eu/jomopans

[12] https://www.jonasproject.eu/

methodology for Monitoring and Assessment loud, low and mid-frequency impulsive sound sources in the OSPAR Maritime Region (OSPAR, 2017a).

On the other hand, several authors have different methodological proposals for achieving results according to MSFD and RSC requirements (i.e., Farcas et al., 2020; MacGillivray and de Jong, 2020; Hermannsen et al., 2019). Nonetheless, as commented above, there is a general need of scientific consensus to address specifications and standardised methods for monitoring and assessment as well as units of measurement for the criteria.

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties***

As shown in the previous sections, issues concerning Descriptor 11 (i.e., methodologies, units of measurements) have not been developed adequately since MSFD entered into force in 2008. It is expected that future adoption of practical and feasible guidelines by TG-Noise together with technological development will impose the research around Descriptor 11 needs. Those will allow to produce robust and consistent outcomes which, in turn, will be useful for adopting all required measures needed to reach GES.

***Short summary focusing on key findings, strengths and weakness, the latter also identifying further work to improve indicators, indices and spatial coverage***

For the moment, there are not long-term monitoring series on the criteria required by D11, neither methodology nor thresholds values. In some cases, some proxy indicators, such as vessel traffic can be used by Member States. In the case of thresholds, Member States can use as baseline ocean ambient noise of remote areas. TG-NOISE will publish guidelines for all Member States in 2021.

# 12 Mini-review on solutions

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## 12.1 Introduction

The European marine environment is subject to multiple pressures and impacts from human activities. To address them, in 2008 the EU launched the Marine Strategy Framework Directive (2008/56/EC) as a comprehensive framework to protect the marine environment and ensure the sustainable use of marine goods and services. In 2025, the European Commission published an evaluation of the MSFD (European Commission, 2025b), with the aim to assess the effectiveness, efficiency, coherence, relevance, and EU added value of this policy.

In this context, and with the aim to contribute to the preparation of the upcoming EU marine-related policies, including the European Ocean Pact and the Water Resilience Strategy, this chapter presents a mini-review of selected existing solutions successfully implemented to contribute to the achievement of the Good Environmental Status (GES) of the marine environment, as well as their expected impact. These solutions are presented for each Descriptor of the MSFD:

- D1 - Biodiversity
- D2 – Non-indigenous species
- D3 – Commercially exploited fish and shellfish
- D4 – Marine food webs
- D5 - Eutrophication
- D6 – Seafloor integrity
- D7 – Hydrographic conditions
- D8 – Contaminants
- D9 – Contaminants in seafood
- D10 – Marine litter
- D11 – Energy (including underwater noise).

The proposed solutions are meant as a guide to help Member States identify the most effective actions needed in their marine waters, to be included in the Programme of Measures required by the MSFD.

This report is structured as follows: 1) Section 10.2 presents a short overview of the methodology adopted for this mini-review, 2) Section 10.3 presents the results per Descriptor, and 3) Section 10.4 summarises existing strengths and weaknesses of current MSFD implementation, the proposed solutions to improve MSFD implementation, and their expected impact, for each MSFD Descriptor.

## 12.2 Methods

Key relevant EU documents and reports, including those assessing the implementation of the MSFD, the WFD, and the Nitrates Directive, among others, were extensively consulted. Moreover, a review was performed of existing scientific literature, which was screened using general keywords, such as ‘effectiveness’, ‘solutions’, ‘implementation’, ‘management’, combined with keywords tailored to each Descriptor (e.g., ‘MPAs’, ‘fisheries’, ‘contaminants’, ‘litter’). A total of 10 EU reports were consulted, and 170 scientific articles were reviewed; the full list of the EU reports and of the scientific articles is provided in the Section 10.5 (References).

## 12.3 Elaboration of the key findings for each MSFD Descriptor

### 12.3.1. D1 – Biodiversity

Marine ecological restoration implies action to conserve those ecosystems that are still intact, preventing any type of degradation or damage, and to assist in the recovery of those ecosystems that have been degraded, damaged or destroyed.

*Marine ecological conservation:*
MPAs are generally considered as a pillar for marine conservation. However, in practice the use of MPAs for ecosystem protection and rehabilitation has led to mixed outcomes. This is normally attributed to the considerable variation of the objectives for which they were created, or of the ecological and human contexts in which they are situated, of the degree of involvement of stakeholders, and to how well their management and enforcement is resourced (Pendleton, 2018). Some researchers pointed out that the positive effects of marine reserves typically may take years, decades, or even longer to accumulate (Fenberg, 2012). Moreover, a US 2014-2016 study showed that MPAs may have a limited ability to mitigate the impacts of marine heatwaves on community structure (Smith et al., 2023).

Despite these limitations, several reviews confirmed the effectiveness of MPAs for ecological conservation. A Bayesian review and evaluation of the effects of MPAs on fish and invertebrate populations from 82 published studies on 264 no-take MPAs worldwide showed that globally, MPAs produce positive outcomes, leading to an average increase in biomass, density and size of organisms within their boundaries (Hopf et al. 2024). This is particularly evident for strongly protected MPAs (i.e., those that prohibit commercial activity and allow only light fishing) and fully protected MPAs (i.e., those that prohibit fishing; Lester and Halpern, 2008, Edgar et al., 2014; Gill et al., 2017), which showed to outperform multiple-use MPAs from an ecological standpoint (Rodriguez Rodriguez, 2022), although further data are required to conclude that protection has, on average, led to an increased abundance of studied populations (Hopf et al., 2024). Partial MPAs can also be effective. Sciberras et al. (2013) found significantly higher density and biomass of fish inside 'Partially Protected Areas' relative to open access areas, especially for target species of commercial importance. In fact, MPAs can promote the dispersal of larvae (Harrison et al., 2012) and adults of target and non-target species to areas outside their borders, potentially benefiting both fisheries and biodiversity outside the MPA (Di Lorenzo et al., 2016; Pendleton, 2018).

These findings were confirmed by another meta-analysis conducted for Europe, covering 46 peer-reviewed publications published between 1983 and 2011 from 27 marine reserves, which showed that existing European marine reserves foster significant positive increases in key biological variables (density, biomass, body size, and species richness) compared to areas receiving less protection (Fenberg, 2012). More in detail, European marine reserves increased the biomass and density of organisms (+238% and +116%, respectively), and generated a moderate increase in individual size (+13%) and species richness (+19%)[13]. A notable case is that of Lyme Bay, England, where signs of ecological recovery was observed following demersal-towed fishing bans within the first few years of establishment of the MPA. More in detail, an increase in species richness and population for some macro epi-benthic species was observed in the short term, together with increases in trait diversity and functional redundancy (Davies et al. 2022 as cited by Renn et al, 2024). In particular, an increase of 430% was reported of taxonomic richness of all mobile species, and of 370% in total abundance, inside the MPA, while no sign of recovery was demonstrated for

[13] *As reported by Fenberg (2012), 18 months after the establishment of the first marine reserve in UK, a 3.3-km² coastal reserve off Lundy Island, southwest England, an increase in size and numbers of the commercially important European lobster (Homarus gammarus) was observed, such that, by 2007, legal-sized lobsters were 5 times more abundant and 9% larger within the reserve compared to fished areas nearby [Hoskin et al., 2011]. Likewise, after the establishment in 2008 of the 2.67 km² Lamlash Bay marine reserve, Scotland, but dive surveys in 2010 showed that numbers of juvenile scallops (Pecten maximus) and the age, size and biomass of adult scallops were significantly greater inside the reserve compared to adjacent areas (Howarth et al., 2011).*

exploited invertebrates. Also, benthic ecosystem recovery showed to be faster inside the MPA after storm damage, indicating the potential of MPAs to improve the resilience of benthic fauna to storm events (Sheehan et al. 2021, as cited by Renn et al., 2024).

As for marine mammals, a study by Grau Tomas et al. (2022) confirmed the effects of legal protection on marine mammal populations in several global areas:

- In the Wadden Sea, thanks to the Trilateral Cooperation Agreement in place from 1974, the total population of harbour seals increased from 3,551 individuals in 1974 to 38,126 in 2022 (Jensen et al., 2017; Grau Tomas et al., 2022).
- In Melville Bay, Greenland, similar trends were observed for narwhals, although with a higher uncertainty due to the highly aggregated distribution of the population, which determines high variability among random transects.
- In the Banks peninsula, New Zealand, conservation actions determined an increase in the population of Hector's dolphin (Gormley et al., 2012).
- In the Hawaii, thanks to the establishment of the Hawaiian Island Humpback Whale National Sanctuary to protect critical breeding habitats, a substantial recovery was observed of the Hawaiian humpback whale population by 2005 (Calambokidis et al., 2008).

*Marine ecological restoration:*
A significant number of ecosystem restoration/rehabilitation projects have been performed in Europe and around the globe, showing their potential for success, depending on the methodologies adopted. Danovaro et al. (2025) performed a meta-analysis of 764 active marine restoration interventions globally from 1950 across a wide range of marine habitats worldwide, demonstrating their success in about 64% of cases, measured in terms of evidence of self-sustaining or expansion of the restored habitat-forming species over time. Their analysis also showed that active restoration measures are viable for a large variety of marine habitats, including deep-sea ecosystems, and are highly successful for saltmarshes, tropical coral reefs and habitat-forming species such as animal forests. Success is scalable, as large-scale interventions may be done using multiple interventions at smaller scales. Furthermore, restoration interventions proved to be effective even in areas with persistent human impacts. The restoration methodologies that proved more successful were:

1) A group of innovative methods including: i) new technologies for transplanted habitat-forming species, or using innovative mimicking solutions; ii) refined protocols (e.g., new materials/design and/or targeting the biology of species in different regions); and iii) the combination of species to enhance facilitative interactions.
2) The ongoing maintenance of restored habitats, with a reported 13% success among all restoration cases analysed.
3) Site selection, with a 12% rate of success, particularly when some conditions are fulfilled: a) presence of high ecological connectivity; b) selected sites offer potential refugia for those species sensitive to climate change (such as sites less exposed to thermal stress); and c) the selection emphasizes sheltered sites, which are less prone to certain types of physical disturbance including storms, wave action, erosion, and sedimentation.
4) The creation of buffer areas (i.e., marine protected areas, fishery restricted areas, or other effective area-based conservations measures), surrounding the restored site to remove/mitigate the pressures resulting from human activity.

Phytoremediation was explored in an unused lagoon in England using *Phragmites australis* (Pinchin et al., 2013), although with unclear results. Case studies in Sweden, Finland, and Portugal for *Zostera noltei or Z. marina*, and in the Netherlands for *Spartina anglica* (Oliveira et al., 2024), showed that mimicking key emergent traits, which emerge in clumped individuals or large clones to locally suppress environmental stress (van der Heide et al., 2021), may allow upscaling of restoration in many ecosystems that depend on self-facilitation for persistence, by constraining biological material requirements and implementation

costs (Temmink et al., 2020), although this outcome is strongly context-dependent (van der Heide et al., 2021).

Another successful example was the ecological restoration of a reef offshore habitat, characterised by cavernous boulder reefs, located at Læsø Trindel and Tønneberg Banke in the Kattegat Bay, Denmark, which was performed in the context of an EU-funded project[14]. The target area was restored using natural stones from a quarry in the southern part of Norway, which were distributed over an area of 5 hectares. The activities resulted in an estimated restoration of 6 tonnes of macroalgal vegetation and 3 tonnes of bottom fauna, and of nearly 700 million individuals of fauna. Also, the project induced positive changes in the fish community structure; for example, cod increased on average by three to six times in the reef area, especially in the shallow part of the rebuilt cavernous reefs.

In Europe, several good practices have been adopted for marine restoration, which are targeted, achievable, and are expected to have a direct impact on addressing the pressures of species and habitat disturbance (European Commission, 2025a). Germany focused on the restoration of rocky reefs in areas where fisheries no longer pose a threat and areas which encourage reef interconnectivity, and on fostering the reintroduction of *Sabellaria* reefs in the North Sea. Slovenia defined a measure to implement assigned tourist boat anchoring sites, to restrict the environmental impact of anchoring in a concentrated area. Belgium implemented measures tackling fish migration bottlenecks through the removal of human barriers, such as dams, the tagging of several fish and shark species to identify frequently used areas, and the development of a barrier map for seabird migration routes, to ensure that threats such as wind energy turbines are not constructed in migration pathways. Another example is from Sweden, which has adopted measures to reduce the use of biocide containing anti-fouling paints, and the active phasing out of two-stroke engines and carburetors on recreational boats, thus contributing to reducing the impact of shipping on biodiversity. As for MPAs, Slovenia restricted fishing activities over *Zostera* beds to avoid that gears are caught on the plants and damage them, while Germany designed MPAs explicitly to provide refuge for fish, marine mammals and seabirds. Finally, to address the identified challenges and contribute to the achievement of Good Environmental Status for MSFD Descriptor 1, other specific suggestions were formulated by the European Commission (European Commission, 2025a), to prioritise measures that help limit/reduce greenhouse gas emissions, including by restoring blue carbon ecosystems.

### 12.3.2. D2 – Invasive and Alien Species

Four main groups of solutions have been identified to address and manage marine invasive and alien species: prevention, eradication, management, and other measures (Katsanevakis et al., 2023).

Prevention measures aim to address the main pathways of introduction of invasive and alien species, the most important of which for the EU is shipping (Katsanevakis et al., 2023), mainly through ballast water and biofouling. To this respect, the International Maritime Organisation (IMO) recently introduced the Ballast Water Management Convention (BWMC), which requires ships to adopt a ballast water management plan and treat their ballast waters with an approved treatment system. Biofouling is regulated through IMO's Biofouling Guidelines (2011); however, support is reported as growing around a dedicated IMO Convention including surveillance optimization and hull cleaning (Katsanevakis et al., 2023). While it is outside EU jurisdiction to prevent introduction of invasive and alien species through the Suez Canal, which is the second-most significant introduction pathway for Europe, positive results have been achieved for aquaculture-introduced species, with a noticeable decline in new introductions thanks to the implementation of EU Regulation 708/2007.

Also, monitoring may be seen as a preventive measure, as it is fundamental for early species identification. In fact, the majority of countries globally do not have in place monitoring programmes that focus explicitly on marine non-indigenous species (NIS) and rely instead on existing broad monitoring initiatives (Lehtiniemi et al., 2015). In Europe, the most notable examples of national inventories of marine NIS include

[14] *LIFE06 NAT/DK/000159, "Rebuilding of Marine Cavernous Boulder Reefs in Kattegat".*

Greece (Zenetos et al., 2018, 2020), Italy (Occhipinti-Ambrogi et al., 2011; Servello et al., 2019), Portugal (Chainho et al., 2015), Malta (Evans et al., 2015), Norway (Sandvik et al., 2019), Denmark (Stæhr et al., 2020), and Belgium (Verleye et al., 2020), which have been often developed in the context of international working groups such as those of ICES (ICES, 2022) in the Atlantic and CIESM in the Mediterranean (Katsanevakis et al., 2023). Monitoring is a fundamental measure to address NIS. To be effective, it should be harmonised and coherent at the level of marine basin or region, and should focus on producing knowledge on species distribution, ecology, and evolution (Kleitou et al., 2021). In particular, port monitoring is crucial in the early detection of new arrivals. While some countries have already in place systems for port monitoring, such as Baltic countries implementing HELCOM's port sampling protocol since 2012 (HELCOM, 2023b; Outinen et al., 2021), regular monitoring is lacking in most countries. Examples include Finland, which initiated a port monitoring programme in 2022, and Denmark, which published a port monitoring report in 2022 that was expanded to compare environmental DNA from Invasive and Alien Species across seasons (Knudsen et al., 2022). In the Mediterranean, a study compared environmental DNA (eDNA) levels inferred from metabarcoding with fishing fleet activity to detect Invasive and Alien Species in harbours around Sicily and the northwestern Mediterranean (Aglieri et al., 2023). In the Bay of Biscay, eDNA metabarcoding was utilized on water samples from major ports for Invasive and Alien Species monitoring (Borrell et al., 2017).

The second group of measures focuses on the eradication of one or more invasive and alien species. In literature, this type of measure showed to have limited success (Katsanevakis et al., 2023) and was effective only in case of early detection and rapid management response (Giakoumi, 2019). A review by Katsanevakis et al. (2023) showed that out of 40 cases of implementation of eradication measures, 11 failed to achieve eradication or control targets, and only 6 could be considered successful (none of which from Europe):

1. The use of sodium hypochlorite to eradicate the green alga *Caulerpa taxifolia* from California, USA (Anderson, 2005)
2. The physical removal by divers of the brown alga *Ascophyllum nodosum* from Redwood City, California, USA (Miller et al., 2004)
3. A combination of physical removal by divers and heat treatment to eradicate the brown alga *Undaria pinnatifida* from a sunken trawler in Chatham Islands, New Zealand (Wotton et al., 2004)
4. The eradication of the *sabellid polychaete Terebrasabella heterouncinata* from an intertidal site in California, USA, by removing its main native host (Culver and Kuris, 2000)
5. An extensive chemical treatment, with 187 tonnes of liquid sodium hypochlorite and 7.5 tonnes of copper sulphate, to eradicate the mussel *Mytilopsis sallei* from three sheltered marinas in the Darwin Harbour Estuary, Australia; Bax et al., 2002)
6. Dredging to eradicate the invasive mussel *Perna perna* from a subtidal soft-sediment habitat in central New Zealand (Hopkins et al., 2011).

Eradication may include the commercial use of the invasive or alien species. To this respect, various cases were reported in literature (Katsanevakis et al., 2023):

- Lionfish control in Cyprus, where eradication activities decreased the density and biomass of this species by >50% in the short term through direct removal. A limit of this action was that long-term suppression required repeated removals.
- Eradication of silver-cheeked toad-fish *Lagocephalus sceleratus*, a toxic predatory fish which can cause serious damage to fisheries and human health, in Cyprus. The strategy included compensating small-scale fishermen based on fish and incinerated species biomass. Despite the lack of targeted monitoring, empirical evidence from fishers supported the success of this action in reducing the species' biomass and mitigating its impacts. However, as for lionfish, continuous management is deemed necessary to prevent the population's rebound at high levels (Katsanevakis et al., 2023; Michailidis et al., 2023).

- The suppression of lionfish population through targeted removal in the Western Atlantic Ocean and the Caribbean Sea, which showed to have beneficial effects on native communities (Green et al., 2014; Usseglio et al., 2017).

- The implementation of targeted removal and commercial utilization of dead specimens inside MPAs from the western Mediterranean and the Caribbean Seas showed to effective for population control, even in cases of a high dispersal of the species (Barcelo et al., 2016; Usseglio et al., 2017) and should be adopted for the effective control of invasive species (Giakoumi et al., 2019).
- The use of *Caulerpa taxifolia* and *Caulerpa cylindracea* in biotechnological and pharmacological applications is under development (Mollo et al., 2014). A positive example in this sense is the use of marine invasive algae's bioactive ingredients in cosmetics in the Azores, Portugal (Matos et al., 2024).

Although showing promising results, eradication measures have important drawbacks, which should be acknowledged and addressed. The most important is that such measures may trigger the local community to protect their new source of income and contribute to the persistence and expansion of undesired species (Nuñez et al., 2012). Moreover, no known successful control efforts have been reported in scientific literature for the only two marine species included in the European Union List of Invasive Alien Species of Union concern, i.e., the fish *Plotosus lineatus* and the alga *Rugulopteryx okamurae* (Katsanevakis et al., 2023).

The third group of measures focuses on the management of an invasive or alien species through biological control actions. Some positive examples exist in literature of eradication in early invasion stages, e.g., the case of *Caulerpa taxifolia* in Agua Hedionda Lagoon and Huntington Harbor in California (Anderson, 2005). However, it is widely acknowledged that the widespread use of biocides can impact non-targeted species and affect human health through the food chain (Terlizzi et al., 2001). Similarly, other options, such as biological control using alien predators, parasites, or viral diseases, are strongly opposed by experts and stakeholders, due to fears of irreversible effects on native biodiversity (Katsanevakis et al., 2023).

Lastly, the fourth group includes other types of general measures: awareness raising, and legal revision. Public awareness raises on the problem of invasive and alien species and encouraging their commercial use of IAS has been shown to have the highest applicability and acceptability, low cost, and a medium effectiveness (Kleitou et al., 2021). Examples in this sense include Poland, which is educating aquarists and anglers about the dangers of NIS releases; Ireland, which is implementing an 'Invasive Alien Species Recreational Boating and Watercraft Pathways Action Plan'; Estonia, which is investigating the use of environmental DNA techniques as a potential early warning system (European Commission, 2025a). The second strategy is the review and update of existing legislation. In Europe, voices in literature have been raised (Kleitou et al., 2021; Katsanevakis et al., 2023), asking for the revision of the IAS Regulation to adopt a proactive approach, prioritising prevention and early eradication, including through the elaboration of pre-defined rapid response plans and faster assessment processes, to allow rapid decision-making and avoiding time-consuming species-specific evaluation. Also, additional marine IAS should be in the European List, and existing regulations should be revised to allow physical removal and commercial utilization.

#### 12.3.3. D3 – Commercial Fish and Shellfish

No-take zones are the main tool employed to protect commercial fish and shellfish and ensure their good ecological status. They may be defined as marine areas in which the extraction of living and non-living resources is permanently prohibited, except as necessary for monitoring or research (Jones, 2006). Accordingly, several studies evaluated their effectiveness on the ecological status of commercial fish and shellfish.

In Australia, several studies showed the positive impact of no-take zones on abundance and population of commercial fish; they are summarised in Table 10.1. In parallel, in California, a study on MPAs network concluded that the biomass of species targeted by fishing was positively associated with the level of

regulatory protection, and was greater inside no-take MPAs, while species not targeted by fishing had similar biomass in MPAs and in areas open to fishing (Smith et al., 2025).

In Europe, Van Hoey et al. (2024) reviewed existing studies on the spillover effects of MPAs on local fisheries in the Baltic Sea, North Sea, and European Atlantic Ocean including Macaronesia. While ecological and/or fishery spillovers were reported in 83% of the cases, with 64% that were relevant of commercial fisheries, no concluding evidence was found on the effects of any given characteristic of MPAs on the occurrence of these spillover effects. Pantzar et al. (2018) reviewed 44 studies assessing the economic benefits of MPAs and other spatial protection measures to fisheries, confirming the importance of spillover effects to support catch per unit effort in areas surrounding the areas that are closed to fishing, and evidence of the economic benefits from multi-use MPAs in terms of increased revenues, as a result of reduced competition for space and resources among fishermen. Another study from the Aegean Se (Dimarchopoulou et al., 2018) investigated the effects of a 40-year trawling ban on the status of marine species within a major fishing ground in the Thermaikos Gulf, Aegean Sea. They found a higher biomass in the intermediate and low-pressure areas, as well as increasing maximum and mean total length, thus revealing the great contribution of fishing restrictions on improving the status of demersal populations, by providing a refuge for large individuals and contributing to the gene pool. Similarly, Frid et al. (2021) found evidence of higher total biomass and biomass of commercial fish in the largest and oldest MPAs in the Levantine Sea area of the Mediterranean Sea, supporting the conclusion that restrictions on recreational and commercial fishing within MPAs benefit the recovery of fish populations even in warm waters and when faced with marine invasions.

Another important tool for commercial fish and fisheries is represented by fishing quotas. Branch (2009) assessed the impact of individual transferable fishing quotas (ITQs) on marine ecosystems; this study showed a general decline in the mortality of target species, as catches are closer to Total Allowable Catches (TACs) and because of the decrease in ghost fishing through lost and abandoned gear. Moreover, a decline was reported in high-grading and discarding, which, however, may increase if landings (and not catches) count against ITQs and when there is little at-sea enforcement. Possible negative impacts include collapses, in case TACs are set too high or if catches are routinely allowed to exceed TACs, and an increase in fishing pressure on non-ITQ species, because of spillovers from ITQ fisheries.

*Table 12.1 Evaluation of the effects of no-take zones on abundance and population of commercial fish in the Great Barrier Reef, Australia (source: elaborated from Day, 2020).*

| Study | Main findings |
|---|---|
| Bode et al. (2025) | While comprising 33% of the area, marine reserves are a disproportionate contributor to coral grouper metapopulation and fishery, contributing to 50% more larval supply and catch of coral grouper throughout the whole Reef. This means that, while marine reserves reduce the area accessible to commercial fishers, they contribute one of every two fish to the fishery at present levels of exploitation |
| Evans & Russ (2004), Russ et al. (2008) | Rebound in population of coral trout (*Plectropomus leopardus*) by 31-75% on most reefs that were closed to fishing after only 1.5-2 years |
| Williamson et al. (2004), Harrison et al. (2012), Wen et al. (2013) | No-take zones contribute to biodiversity protection and ecologically sustainable fisheries, by supplying significant recruits to areas both inside and outside the no-take zones, as well as larval export. Also, a 'spill-over' may occur of bigger fish from no-take zones into the adjacent fished areas |
| Lamb et al. (2015) | Four-fold reduction in coral disease prevalence in no-take zones compared to areas where hook and line fishing was allowed. Coral damage and the abundance of abandoned fishing line best explained the differences in disease assemblages between these two types of zoned areas |
| Hopf et al. (2016) | The restructuring of the Coral Reef Fin Fish Fishery implied an enhancement of conservation benefits and the socialization of the fishery cost of rezoning, mitigating the negative impacts on individual fishers. This combined approach showed to be more productive for fish and fisheries than if the rezoning had occurred alone, and comparable to what would have been obtained using effort controls alone |

| Study | Main findings |
|---|---|
| Robbins et al. (2006) | Densities of reef sharks on two 'no-go' Preservation Zone reefs ('pink reefs') were 5 to 40 times greater than those on supposed no-take zones ('green reefs') |
| Ayling & Choat (2008) | • Densities of whitetip reef sharks (*Triaenodon obesus*) were twice as high on no-take zones as on fished Habitat Protection zone reefs ('blue reefs') and were twice as high on 'pink reefs' as on no-take zones.<br>• Grey reef sharks (*Carcharhinus amblyrhynchos*) were four times as abundant on no-take zones as on 'blue reefs', and twice as abundant on 'pink reefs' as on no-take zones.<br>• There were similar patterns in the density of the common coral trout (*Plectropomus leopardus*), including 1.5 times more coral trout on 'green reefs' compared with 'blue reefs', and 2.5 times as many on 'pink reefs' compared with 'green reefs'. |
| Cappo et al. (2010) | Numbers and biomass of fish, sharks, rays, and sea snakes accumulate (through more and larger fish) in submerged shoal habitat in no-take zones, although with variations across regions and species |
| Emslie et al. (2015), Sweatman et al. (2016) | Density, mean length, and biomass of the principal fishery species, coral trout (*Plectropomus* spp.), were consistently greater in no-take zones than on fished reefs in both the short and medium term. Overall, the biomass of coral trout was ~2.5 times higher on no-take zones than on reefs that were open to fishing. The differences in coral trout density and mean size translated into an 89% higher biomass in inshore no-take zones and an 82% higher biomass in offshore no-take zones. However, there were few differences in the density of most non-target fish species, the percentage cover of benthic organisms, or the assemblages of fishes and benthic organisms between NTZs and fished areas |

Moreover, some studies have tried to assess the impact of the removal of harmful fisheries subsidies, that is, government payments that incentivize overcapacity and lead to overfishing (Villasante et al., 2022) on marine fisheries and ecosystems. Da-Rocha et al. (2017) modelled the industrial shrimp fisheries in Mexico and found that the complete elimination of a subsidy will help rebuild the resource biomass, leading to increased levels of sustainable catches, income and wellbeing of fishers, and reducing inequities in income and consumption when fish stocks are not effectively managed (Villasante et al., 2022).

Best practices were reported by Ireland in the context of implementation of the MSFD to manage local stocks, such as supporting sustainable inshore stocks, managing effort management for crab fisheries and of scallop fishing, and protection measures for shellfish species. Italy included, *inter alia*, measures for the management of sport and recreational fisheries, and a moratorium on recreational fishing of specimens of high conservation value species, such as groupers and cob, by recreational and non-professional underwater fishing activities. Sweden introduced a new measure to 'Promote a sustainable size distribution of coastal fish communities to retain important ecological functions in the food web'. Romania implements control requirements on turbot nets used in the fisheries sector (European Commission, 2025a).

#### 12.3.4. D4 – Food webs

Some scientific studies have been conducted, assessing the effectiveness of measures to restore or improve marine trophic connections and food webs, especially inside MPAs.

Eisaguirre et al. (2020) performed a study of phase shifts in the kelp forest of the Northern Channel Islands, California, USA, which was perturbed from the loss of an important sea star predator due to a sea star wasting disease. While prior to the outbreak of the disease, the sunflower sea star exerted strong predation pressures and was able to suppress purple urchin populations effectively, after the outbreak, which functionally extirpated the sunflower star, the ecosystem response depended on the abundance and/or size of remaining predator species. Inside MPAs, the large numbers and sizes of other urchin predators suppressed purple urchin populations, resulting in kelp and understory algal growth. These results demonstrate the value and importance of MPAs in harbouring biodiversity and managing predator guilds as a way to foster trophic redundancy, which can in turn contribute to limit ecosystem phase shifts.

Hamilton and Caselle (2015) examined the impact of exploitation and recovery of California sheephead (*Semicossyphus pulcher)* on size-structure interaction with sea urchin prey in southern California. These authors highlighted the importance of management measures that reduce or remove fishing impacts, such as marine reserves or restrictions to fishing effort, may serve to restore the historical trophic roles of key predators, resulting in increases in density, size and biomass.

Moreover, Kumagai et al. (2024) confirmed the importance of fully protected MPAs in preserving the trophic cascades, promoting the resilience and recovery of kelp forests to marine heatwaves in California, although this effect depends upon region-specific environmental and trophic interactions.

In Europe, a study by Fenberg et al. (2012) showed the value of European MPAs in reestablishing trophic relationships and community interactions that are typical of unfished conditions, highlighting the importance of understanding the variety and complexity of indirect effects on non-target species and ecological processes.

Best practices to protect marine food webs have been reported in the context of implementation of the MSFD. Finland aims to collaborate with other Baltic regions to promote the health of predatory fish populations through fisheries management. Italy implemented a moratorium on recreational fisheries for specimens of high-conservation-value species, such as the red cernia, which is expected to directly reduce their extraction. Finally, Estonia has implemented a measure to reduce the number of fishing gear licenses issued to fishermen in national maritime areas, so as to reduce fishing efforts, whilst considering and reducing any possible socio-economic impacts (European Commission, 2025a).

#### 12.3.5. D5 – Eutrophication

Nutrient pollution is a significant pressure on marine ecosystems. Although there is a good scientific understanding of the sources of nutrient pressure, existing gap analyses lack detail, and the links to other relevant EU policies, such as the WFD, are often weak. Moreover, complete recovery from eutrophication may not be realistic, because of non-linear pressure-response pathways and the interactions among multiple pressures, leading to shifts in baseline conditions and alternative stable regimes. In fact, the time required for system recovery may be long (Duarte, 2009), and baseline conditions may be achieved even decades after the cessation or partial reduction of inputs (McCrackin et al., 2017). To address this, pressures should be reduced well below the original pollution threshold levels (Riemann et al., 2016). A review of 89 case studies on nutrient reduction in lakes and coastal marine ecosystems showed that only 24% of coastal marine areas achieved baseline conditions after the cessation or partial reduction of nutrients (McCrackin et al., 2017, as cited by Devlin et al., 2023a). Furthermore, apart from agricultural sources, marine aquaculture is another significant contributor to direct discharges of waterborne nutrient inputs. Aquaculture installations fall within the scope of the Environmental Impact Assessment (EIA) Directive (2011/92/EU), and are required to comply with the objectives of the MSFD and WFD throughout their operation; however, Devlin et al. (2023b) noted that this sector is not covered by the EU Industrial Emissions Directive (2010/75/EU) or associated Best Available Techniques Reference (BREF) documents.

Climate change adds to this complexity, as it is expected to lead to more frequent and intense floods and droughts, which will result in stronger variations in nutrient inputs and overall increase in nutrient loss from agriculture, as the uptake of nutrients by the crops will fail in some years. Also, higher temperatures reduce the solubility of oxygen (Devlin et al. 2023b). Finally, nutrients may have an impact at long distance, which requires coordinated efforts across countries (Devlin et al. 2023a).

Several countries have addressed these issues in a structured way, providing successful examples of the effectiveness of integrated, long-term policies to tackle freshwater and marine nutrient pollution. One of the most positive examples is that of Denmark, whose nation-wide nutrient reduction strategy, was formulated building on EU and national legislation and implemented since 1985, and with the aim to achieve a 50% reduction of nutrient losses from agriculture, the improvement of urban wastewater treatment, and the limitation of point- and diffuse-source industrial discharges. After more than 30 years, a

considerable reduction was observed of nutrient inputs in several Danish marine water bodies, leading to recovery towards better environmental status (Meilholm and Jørgensen, 2025), initiating a shift towards reduced phytoplankton biomass and increased macroalgae cover in deeper waters, and expansion of eelgrass meadows to deep waters in response to improved water clarity (Riemann et al. 2016).

More in general, in the Baltic Sea, Andersen et al. (2017) confirmed the effectiveness of long-term, multi-decadal efforts to reduce nutrient inputs, primarily through wastewater treatment, entailing first signs of recovery from eutrophication in the Kattegat area, which were indirectly confirmed by the trends in ecological status of benthic macro-invertebrates. Also, for the Baltic Sea, Murray et al. (2019) performed an assessment of the past and present eutrophication status, and prediction of future status from 1850 to 2200. Using modelled concentrations of various eutrophication parameters and applying a multi-metric indicator-based tool, they concluded that the meeting of the nutrient reduction targets set under the Baltic Sea Action Plan (BSAP) will ensure the good environmental status of most Baltic Sea basins (excluding the Gulf of Riga and the Bothnian Bay). They expect that the first basins to reach a healthy state will be Arkona in 2030-2040, followed by Kattegat, Bornholm Basin and the Guld of Finland for 2060-2070, the Danish Straits by about 2090, and the Baltic Proper and Bothnian Sea by 2200.

In the North Sea, the implementation of the Gothenburg protocol to the Convention on Long-Range Transboundary Air Pollution and of relevant EU Directives since 1990, mainly through better wastewater treatment technology, reduction in fertilizer use and of industrial point-source discharges, led to a decrease of phosphorus inputs of almost two thirds and of atmospheric nitrogen, leading to an improvement in the eutrophication status of a larger area of the Greater North Sea. On a negative note, the limited reduction in diffuse nitrogen indicates the need for further efforts to reduce nitrogen inputs, especially from marine aquaculture (Devlin et al., 2023b).

Several studies evaluated the effectiveness of other coordinated, long-term transboundary management strategies to tackle eutrophication, reporting a partial recovery in some systems (Devlin et al., 2023b), with varying recovery times. An overview of the systems investigated, and recovery times is given in Table 10.2 (Borja et al., 2010, Jones and Schmitz, 2009).

*Table 12.2 Recovery time from eutrophication in selected studies (from Borja et al., 2010 and Jones and Schmitz, 2009).*

| Location | Biological elements | Recovery time | Sources |
|---|---|---|---|
| Victoria Harbour, Hong Kong | Macroinvertebrates | >3 years | Shin et al., 2008 |
| Orbetello lagoon, Italy | Macroinvertebrates | >6 years | Lardicci et al., 2001 |
| Mondego estuary, Portugal | Zostera noltei and macroinvertebrates | >4 years | Table 10.1. Evaluation of the effects of no-take zones on abundance and population of commercial fish in the Great Barrier Reef, Australia (source: elaborated from Day, 2020). |
| Tampa Bay (Florida, USA) | Sea grasses | Incomplete after 20 years | Greening and Janicki, 2006 |
| Greifswalder Bodden, Baltic Sea | Macrophyte and phytoplankton biomass | Incomplete after 15 years, despite a reduction of nutrients by 40-50% (eutrophication switched the system from macrophyte- to phytoplankton-dominated) | Munkes, 2005 |
| Northern Baltic Sea | Zoobenthic assemblage | Initial short-term recovery after the algae were removed | Norkko and Bonsdorff, 1996 |
| Moa Point, New Zealand | Stable isotope levels in mussels, seaweed, and limpets | 3 years and 9 months | Rogers, 2003 |

Some countries piloted targeted interventions aimed at controlling nutrient inputs or for nutrient removal:

- Construction of freshwater wetlands. Vymazal (2007) reported that constructed freshwater wetlands achieved a removal of total nitrogen and phosphorus between 40% and 50/60%, depending on the type of wetland (single-stage, vertical-flow, or horizontal-flow).
- Winter-catch crops to remove nutrients from over-enriched soils in the Baltic countries (Andersen et al., 2014).
- Hydrological engineering projects, based on increasing flushing and dilution in semi-enclosed estuaries and lagoons, as well as in intermittently closed and open lakes and lagoons, were reported as successful to reduce nutrients in the Netherlands, New Zealand, Denmark, Australia, India, and Portugal (Duarte and Krause-Jensen, 2018).
- Changes in sluices practices to increase coastal water input in the Skive fjord, Denmark, which enhanced dilution and allowed the establishment of a population of filter feeding bivalves (*Mya arenaria*), contributing to remove plankton and improve water quality (Duarte and Krause-Jensen, 2018). More specifically, mussel farms were reported to remove about 0.6-0.9 t of nitrogen, and 0.03-0.05 t of phosphorus, per hectare per year (Petersen et al., 2016, as cited by Duarte and Krause-Jensen, 2018).
- Seaweed aquaculture, which was reported to remove about 75,000 t of nitrogen and 9,500 t of phosphorus inputs per year, contribute to climate change mitigation and providing economic benefits (Xiao et al., 2017, as cited by Duarte and Krause-Jensen, 2018).
- Actions to enhance seagrass meadows, oyster reefs, mangroves, and salt-marshes, and to lock nutrients in sediments. These actions allow us to remove nutrients from the water column and accumulate part of them in the sediments, provided that these habitats are maintained, enhanced, and harvested (in the case of oysters). Also, they allow to effectively remove great quantities of reactive nitrogen as $N_2$ gas (Duarte and Krause-Jensen, 2018).
- Algal removal. Tested at four intertidal mudflat sites in UK and France, this action proved successful to remove significant amounts of excess nitrogen, proving its medium-high cost-effectiveness in most sites, in the context of blue nitrogen trade schemes (Morrall et al., 2025).

Other best practices reported at the European level include the case of Finland, which is seeking to use recycled manure in biogas production; Germany, which tries to restore and preserve seagrass populations in transitional and coastal waters as a contribution to denitrification through a pilot project in the Outer Ems area; and Sweden, is taking additional measures under the National Emissions Ceiling Directive to reduce atmospheric inputs of nutrients (European Commission, 2025a).

Finally, it is worth mentioning the recent (2025) new Agricultural Policy launched in Denmark, which is expected to be effective in further reducing nitrogen discharge and greenhouse gas emissions from agriculture. Specifically for eutrophication, this new policy includes incentives of USD 100 per tonne to reduce greenhouse gas emissions from nitrogen fertilization of farm fields, such as nitrous oxide.

#### 12.3.6. D6 – Seabed integrity

Commercial bottom fishing is the main driver of impacts on seafloor integrity, inducing habitat loss and cascade effects to higher trophic levels, especially for biogenic and gravel habitats (Van Lancker et al., 2024). In parallel, coastal development, including tourism activities, nourishment to avoid coastal erosion, the building of seawalls and other coastal defence structures, dredging (including the dumping of excavated sediments at sea), and port activities (including port anchoring; Watson et al., 2022), exert multiple pressures on coastal seafloor (Winter, 2017). Management measures to reduce the impacts of these human activities on seafloor and protect ecosystems focus on fishing restrictions on the one side, and on measures to limit/regulate coastal development †, including through spatial protection, on the other side.

In relation to fisheries, Bastardie et al. (2020) applied a spatial modelling platform to evaluate the effects of spatial fishery management measures on the Baltic Sea, with contrasting results. While the closing of areas to fisheries in the Central Baltic Sea did not improve the benthic status of affected species, as it concentrated the fishing effort into core fishing areas, reducing fishing opportunities with further economic impacts, it had a substantial positive impact in the Kattegat, where measures combined the protection of long-lived benthic communities with the mitigation of high-impact fisheries. In the Belgian part of the North Sea, three areas have been designated as bottom integrity zones in the context of the current MSP (2020-2026), with the aim to restrict bottom-disturbing fishing practices; however, results on the effectiveness of this measure are not yet available.

Another measure that proved its potential to address fisheries pressures is the replacement of bottom trawls with passive gears, such as creels. In a study on the Norway lobster fishery in Sweden, Hammarlund et al. (2021) showed that expanding creel area increased the number of creel fishers and pushed some trawlers to leave the fishery, improving the net present value and the environmental performance of the fishery.

In relation to coastal development, some studies (Andresen et al., 2004; Galparsoro et al., 2010) demonstrated the usefulness of detailed seabed information (depths, sediment and bottom types, seabed structures and processes), translated into thematic maps, as a tool to support informed Integrated Coastal Zone Management (ICZM). Furthermore, Carreira et al. (2025) presented several options for the beneficial use of dredged marine sediments: (i) their use as construction material (e.g., cement); (ii) their use for eco-engineering projects, such as wetland (re)construction, beach and dune nourishment, seagrass meadows, artificial shoals and reefs, nature/coastal flood protection islands, bathymetric recontouring, and fill dead-end canals and basins; and (iii) their use on land to replace eroded soils or emend marginal soils for agriculture and forestry purposes. Moreover, these authors support the applicability of these tools in Denmark to ensure sustainable use practices and avoid negative impacts on the seafloor. Also, Morris et al. (2018) showed that the restoration of seagrass and kelp beds entailed a reduction of wave height of 31-70%, thus demonstrating their effectiveness as an eco-engineering solution for coastal defence.

Finally, although not directly related to seafloor ecosystems protection or restoration, it is worth mentioning a study by Epstein et al. (2025), who highlighted the importance of seabed sediments in storing and/or accumulating high densities of organic carbon, and the significant potential and importance of incorporating them into MPA networks to support climate change mitigation, through preventing future releases of stored carbon.

Current practices reported to implement the MSFD in relation to Descriptor 6 on seafloor integrity (European Commission, 2025a) include mainly the designation of protected areas for vulnerable seabed habitats, including Zostera beds, detritus beds and rocky reefs in Slovenia, Sabellaria reefs in Germany, and gravel beds in Belgium. In these areas, it is restricted or forbidden to engage in damaging human activities such as bottom-gear fishing or the dropping of anchors, to allow the passive regeneration of these fragile habitats. Also, active restoration has been reported, such as reef reconstruction in Germany, and the recovery of oyster beds in Belgium. Other types of measures include the implementation of best environmental techniques for dredging in Finland, to ensure the minimization of the impact of trawling on the seabed, and the reduction in the trawl-swept areas in Sweden through the promotion of low impact and selective gears.

#### 12.3.7. D7 – Hydrographic conditions

The hydrographic regime of currents, waves, and sediments may be altered by large-scale human activities, such as coastal defence works, damming of large rivers, land reclamation projects, and by coastal or offshore infrastructures, such as wind farms, ocean energy device arrays and large-scale aquaculture

facilities (Le Moigne, 2014). Especially, the impacts on benthic habitats from fishing is the greatest threat, followed by pollution and litter, aggregate mining, oil and gas, coastal development, tourism, cables, shipping, invasive species, climate change, and construction of wind farms (Harris, 2020).

The main measures to address such topographical changes focus on the limitation of damaging human activities and the return to a previous hydrographical state; however, this may imply a significant loss of invested capital and use benefits (OSPAR, 2012). Hence, it is necessary to carefully consider hydrographic conditions in Environmental Impact Assessments (EIA) and Strategic Environmental Assessments (SEA), for example through modelling of hydrodynamic conditions, of sediment transport and morphological conditions, wave modelling, and habitat mapping and modelling, and, logically, in spatial plans (i.e., MSP and ICZM) and processes (Spiteri, 2015). In particular, MSP should ensure the minimization of the impact of the installation of new offshore structures to marine habitats and biota, e.g., through a licensing system or by requiring the application of the best available techniques during EIA. In this way, it is possible to consider cumulative impacts on any ecosystem component (OSPAR, 2012).

A successful example of consideration of hydrographic conditions in the building of coastal and marine infrastructure is represented by the Øresund bridge connecting Denmark and Sweden. The documentation provided by the building consortium, based on two independent mathematical models developed by the Swedish Meteorological and Hydrological Institute and the Department of Water and Environment, showed that the project achieved the so-called 'zero solution', i.e., an unchanged water flow to the Baltic Sea, thanks to compensation excavations of about 1.5 million cubic meters of soil and sand. Also, measures already adopted in the context of the WFD may be useful to address several aspects covered by Descriptor 7, such as the inclusion of measures to foster fish migration between marine and freshwater areas into local spatial plans, or by facilitating the development of habitats that were lost (OSPAR, 2012).

Strain et al. (2017) conducted a quantitative meta-analysis and qualitative review of 109 studies to compare the efficacy of common eco-engineering approaches (e.g. increasing texture, crevices, pits, holes, elevations and habitat-forming taxa) in enhancing the biodiversity of key functional groups of organisms, across a variety of habitat settings and spatial scales. The results showed that all interventions, with one exception, increased the abundance or number of species of one or more of the functional groups considered, although with a marked variation across groups and habitats. In the intertidal zone, interventions to provide moisture and shade had the greatest effects on the richness of sessile and mobile organisms, and water-retaining features had the greatest effects on species richness. In parallel, in the sub-tidal zones, mall-scale depressions, providing refuge from predators and protection from waves, had higher abundances of sessile organisms, and elevated structures had higher numbers and abundances of fish.

#### 12.3.8. D8 – Contaminants

The greatest priorities in addressing contaminants in the marine environment in the EU are the reduction of chemical pollution from sea-based sources, in particular from hydrocarbon extraction, and from novel substances, including PFAS, pharmaceuticals, and microplastics (European Commission, 2025a). For clarity purposes, microplastics are covered under the corresponding Descriptor 10 (marine litter).

As for sea-based pollution, Polycyclic Aromatic Hydrocarbons (PAH) pose a serious threat to human and ecosystem health. Globally, several actions have been implemented to remediate and restore contaminated sites, using a wide array of techniques and technologies, which, however, proved to have significant limitations. Recently, bioremediation proved to be relatively cost-effective, environmentally friendly, and publicly accepted (Alegbeleye et al., 2017). In particular, Khalid et al. (2021) showed the effectiveness of using halophilic bacteria to bioremediate diesel-contaminated waters. Also, marine-derived fungi proved their effectiveness for the bioremediation of saline environments from several types of PAH (Passarini et al., 2011).

Heavy metals pose serious risk to coastal biota through bioaccumulation and biomagnification. To address this issue, El-Sharkawy et al. (2025) highlighted the importance of prevention, remediation, and restoration strategies, including the sharing of Best Management Practices to minimize the influx of sediment-bound pollutants into ecosystems, remediation techniques such as sediment dredging and capping, phytoremediation (i.e., the use of plants to extract, stabilize, or degrade heavy metals in contaminated soils and sediments) through phytoextraction, rhizo-filtration, and phytostabilization, especially in coastal wetlands, as well as stakeholder engagement and education towards adopting sustainable land use practices. In particular, Alabssawy and Hashem (2024) reviewed successful cases of detoxification of several types of heavy metals by macroalgae, fungi and bacteria, identifying also the main factors influencing the effectiveness of such strategies.

A report by the International Atomic Energy Agency (IAEA) demonstrated a reduction in the levels of lead in the Baltic Sea and of mercury in the Caribbean Sea, thanks to the implementation of effective measures to limit the release of these substances into the marine environment, namely through the banning of leaded petrol and the closure of mercury-discharging plants, respectively (Jones Couture, 2018).

Per- and poly-fluorinated alkyl substances (PFAS) are commonly used in several industrial facilities, commercial households and packaging products (DeLuca et al., 2021), thanks to their water-, stain-, fire-resistant and anti-adherent properties (Lukić Bilela et al., 2023). Due to their environmental persistence, lengthy half-lives, bioaccumulative nature, toxicity and environmental mobility, they have numerous harmful impacts on marine ecosystems through bioaccumulation and biomagnification, particularly affecting apex predators and human health (Lukić Bilela et al., 2023).

In Europe, perfuorooctanesulfonic Acids (PFOS), which are a type of PFAS, have been restricted under the Persistent Organic Pollutants Regulation (2019/2012); moreover, about 200 PFAS have been banned since 2023 through a revision of the REACH Regulation. Also, PFAS are one of the priorities in the EU Chemicals Strategy for Sustainability (CSS). As for the marine environment, PFOA and PFOS are a hazardous priority substance under the WFD and Directive 2013/39/EU on priority substances in the field of water policy. As reported by Lukić Bilela et al. (2023), in the Baltic Sea, PFAS analyses on four fish species and three bird species in 26 monitoring stations and for a time series of 40 years, showed that the introduction of stricter regulations in the early 2000s resulted in the stabilization of PFAS concentrations, followed by a considerable decline in the last ten years of all but two PFAS, namely PFOA(C8) and PFNA(C9). However, concentrations in biota are still 5-230 times higher than the recommended thresholds.

At practical level, some efforts and good practices have been reported in literature to reduce production or impact of PFAS on the environment. In the context of the EU Strategy for the Baltic Sea Region, a Baltic leadership Programme of PFAS ("PFASEout") was launched, with the aim to raise knowledge among decision makers, improve data collection, regulation and public-private collaboration to significantly decrease the release of PFAS in the Baltic catchment area. This platform facilitates knowledge sharing, experience transfer and networking for opportunities in PFAS usage and management, removal, environment impact, policy and regulations (Lukić Bilela et al., 2023). Another good practice around the Baltic Sea is represented by the EU-funded "NonHazCity" project, which enabled nine municipalities to develop their chemical action plans for hazardous substances, and trained dozens of small businesses and households to reduce their emissions. As for the reduction of production, in the USA eight major PFAS manufacturers joined a voluntary programme in 2006, committing to invest in R&D to discontinue the production and use of PFAS (Lukić Bilela et al., 2023).

The mitigation of emissions of pharmaceutical substances into the environment is a very recent concern, and few experiences can be reported addressing this problem and proposing possible solutions. In the Baltic Sea, HELCOM has recognized the need to address this issue at the highest policy-making level

(HELCOM Ministerial Declaration, 2018) and introduced a set of regional policy recommendations to reduce pharmaceuticals' input into aquatic environments. Accordingly, the Baltic Sea regional framework for hazardous substances has been updated to reflect the importance of addressing emerging pollutants in the Baltic Sea Action Plan, while regional cooperation has been promoted through a dedicated platform, the "Baltic Pharma Platform" (Zandaryaa and Frank-Kamenetsky, 2021). This platform brings together projects and stakeholders to facilitate knowledge-transfer and promote coordinated activities.

Also, some measures have been proposed by some Member States to address contaminants in the context of the MSFD (European Commission, 2025a). These include the phase out of the use of lead in recreational fishing gears (Belgium, the Netherlands), the evaluation and management of contaminants released from wrecks (Belgium, Finland), the development of a system for tracking and retrieving containers lost at sea (Germany), and the reduction of contaminants from shipping by supporting local decarbonisation strategies (France)

#### 12.3.9. D9 – Contaminants in Seafood

Descriptor 9 of the MSFD addresses the presence of several contaminants in seafood, listed in Regulation 2023/91515, such as lead, cadmium, mercury, dioxins and polychlorinated biphenyls (PCBs), and perfluoroalkyl substances. The most pressing challenge to achieve GES for this Descriptor is to adapt measures to include the new contaminants and threshold levels included in this Regulation, which updated the older Regulation 1881/2006. To mitigate these impacts, measures are generally in line with those adopted under D8 on contaminants; however, these must be updated to be coherent with the new Regulation. Moreover, climate change poses new threats in relation to seafood contamination. In fact, acidification is expected to affect shell formation. Also, rising temperatures may facilitate mercury uptake in fish, threatening seafood survival, and, in combination with changes in precipitation patterns, increase resistance and incidence of bacteria, viruses, parasites, and fungi. Moreover, the extension of harmful algal blooms may increase areas of shellfish poisoning (Mol and Cosansu, 2022).

Scientific assessments have been performed on the presence of contaminants in seafood in Europe. Garofalo et al. (2025) reported the results of monitoring of the presence of cadmium, lead, and total mercury in European seafood from 2014 to 2023. They found that 2.43% of samples were non-compliant with existing limits set in EU Regulations, with concentrations exceeding the limits for cadmium in cephalopods, and high levels of mercury in marine fish, notably swordfish, sharks, and tuna species, while for lead, only one sample was found to exceed the maximum limits. Although encouraging, these results do not present evidence on the temporal trends. To this respect, Kamman et al. (2023) assessed the temporal trends of mercury levels in fish from the German part of the North Sea from 1995 to 2020, showing an average annual increase of 1.4%, leading to a 41% increase in mercury contamination level within 25 years of monitoring. Another review of existing studies of mercury contamination in the flora and fauna of the Mediterranean Sea (Cinnirella et al., 2019), showed lower values for short-lived fish and higher for large, long-lived species, in any case always below EU requirements, although without providing compelling conclusions on the temporal trends of these concentrations, which seem unaltered across the study period (1975-2020).

Bonito et al. (2016) reviewed the global impact of regulations on concentration of persistent, bioaccumulative and toxic pollutants (PBTs), including namely PCBs, polybrominated diphenyl ethers (PBDEs), organochlorine pesticides (DDTs and CHLs), and mercury (Hg, MeHg), in seafood from 1900 to 2013. The

[15] *Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006.*

results showed a significant decline of about 15-30% per decade across all PBT groups, although with a wide spatial and temporal variation in concentrations.

As for contaminants of emerging concern, i.e., those for which no maximum levels have been laid out in EU regulations, such as brominated flame retardants, endocrine disruptors, toxic element species, pharmaceuticals and personal care products, perfluorinated compounds, microplastics and marine biotoxins, adequate information is lacking, and the assessment of their concentrations and food safety issues is urgent (Vandermeersch et al., 2015). Danopoulos et al. (2020) performed a systematic review and meta-analysis of seafood (molluscs, crustaceans, fish, and Echinodermata) contamination from microplastics. The majority of the studies reviewed reported microplastics contamination, with a content of 0–10:5 microplastics (MPs)/g in molluscs, 0.1–8.6 MPs/g in crustaceans, 0–2.9 MPs/g in fish, and 1 MP/g in Echinodermata, with higher values for molluscs from Asian coasts.

Another important issue is the need to ensure a coordinated approach at marine region/sub-region level, to tackle contaminant pressures. A good example is the collaboration in the context of HELCOM, within the Baltic Sea, where modelling is carried out to inform the Baltic Sea Action Plan and help set pressure reduction targets for four contaminants (mercury, TBT, PFOS and diclofenac). This collaboration has provided greater clarity to Member States concerning the contribution of existing measures and where additional efforts need to be focused in moving towards GES (European Commission, 2025a).

### 12.3.10. D10 – Marine Litter

Löhr (2017) framed the impact of marine litter on the marine environment along multiple pathways, proposing corresponding solutions; they are summarised in Table 10.3.

*Table 12.3 Pathways and potential solutions for marine litter pollution (Löhr et al., 2017).*

| Marine Litter Pollution Pathways | Solutions |
|---|---|
| Macroplastics emitted directly from coastal zones<br>Macroplastics emitted from rivers | Short term: improve waste management; awareness raising; beach and ocean clean-ups;<br>Long-term: circular economy; phase-out non-recoverable plastics; reduction of SUPs |
| Macroplastics from abandoned, lost or otherwise discarded fishing gear (ALDFG) | Short term: Legislation on ALDFG (MARPOL Annex V) should be extended to cover also smaller fishing vessels;<br>Long-term: better design and use of materials, for circular economy |
| Primary microplastics (production of pellets or microbeads used in personal care products, or industrial abrasives both on land and at sea) | Short-term: avoid discharge and spills/accidental losses; ban microbeads<br>Long term: circular economy; develop new technologies and alternative materials |
| Secondary microplastics (weathering and fragmentation of microplastics, tear and wear of tyres, fragmented single-use packaging) | Short term: prevent microplastics entering the ocean; improve wastewater treatment facilities;<br>Long term: circular economy; develop new technologies such as filters for washing machines |

Several studies demonstrated the effectiveness of these and other measures in reducing marine litter and its impacts on the marine environment. In relation to macroplastics, the majority of studies focused on bans or taxes on certain plastic products, especially single-use plastic bags, across several countries (Luis et al., 2010; Dikgang et al., 2012; He, 2012; Jakovcevic et al., 2014; Martinho et al., 2017). One of the first examples was the plastic bag levy introduced in Ireland in 2002, which resulted in a gradual reduction in plastic bag use by 90%, and a reduction in the share of plastic bags in total litter from 5% to 0.22% by 2004 (Oosterhuis et al., 2014). Also, other market-based instruments, such as bottle and container deposit-refund schemes, have been indicated as effective (Hardesty et al., 2014, as cited by Löhr et al., 2017), although their impact on waste reduction may not be clearly established, because of a lack of data

and because it is hard to separate their impact from that of other policies or initiatives (OECD, 2016, as cited by Kirk and Popattanachai, 2018).

An important role may be played by awareness raising campaigns, which can effectively put pressures on plastic producers. For example, the "Beat the Microbead" campaign launched in the USA resulted in the announcement of several manufacturers that they would stop using microbeads in their cosmetic products and in the issue of a federal law to ban microbeads in rinse-off personal care products (Löhr et al., 2017). Willis et al. (2018) report on the effectiveness of education programmes to successfully reduce waste in Europe (Hartley et al., 2015; Veiga et al., 2016), Malaysia (Pudin, 2015) and the USA (Hasan, 2004). Other examples of microbead bans are from L'Oréal, which banned them from their products, and the UK, France, Belgium and Sweden, which issued laws to ban microplastics in face-creams (Williams and Rangel-Buitrago, 2019).

As for microplastics, a review by Fiore et al. (2022) distinguished primary microplastics (i.e., those that are intentionally produced as microscopic particles for direct use, e.g., in cosmetics and abrasives, or as raw materials for the production of larger plastic items), and secondary microplastics (i.e., those that are originated from the degradation of larger plastic items by use, by waste management, or in the environment). Then, they identified two main types of actions to address this issue: the removal of microplastics from the environment, and their interception at source, reviewing existing measures and their effectiveness.

Several technologies exist for the removal of microplastics from open water. The Seabin V5 trash bin skims the water surface by sucking water and intercepting floating debris. While it is suitable for calm water environments, it can catch nearly 4 kg of debris per day and remove an estimated 1.5 tonnes per year. The more than 8,000 sea bins put at work in several places of the world have contributed to collect nearly 3,000 tonnes of waste. Another technology has been developed by the Italian shipowner Grimaldi Group, consisting in a device capable to filter the wash water from shipboard exhaust gas cleaning systems. In several pilot tests, this device collected more than 60,000 microplastic particles on a single trip from Civitavecchia, Italy, to Barcelona, Spain. Finally, to intercept microplastics before these reach open water environments, Membrane BioReactors proved to be especially promising. These devices combine membrane filtration and biological processes to treat the primary effluent, with a removal efficiency between 79% and 99.9% (Bayo et al., 2020; Lares et al., 2018; Talvitie et al., 2017, as cited by Fiore et al., 2022). The main drawback of this technology is that it suffers from rapid clogging and cannot be easily implemented in size-based treatment plants (Hou et al., 2021). Moreover, it does not eliminate it, limiting to discharge microplastics in sewage sludge. Another technology explored is Magnetic Seeded Filtration for the separation of microplastics from dilute suspensions, reaching a separation efficiency of 95% (Rhein et al., 2019). Finally, as for land, 'Hoola One' customisable set of solutions for the removal of micro and macroplastics from beaches proved to be able to recover microplastics up to 1o μm using a buoyancy separation method (Fiore et al., 2022).

Interception at source strictly depends on the source of primary microplastics. 'Operation Clean Sweep' is an international voluntary programme to prevent the loss of plastic granules along the plastics value chain; several associations in Europe and around the world have committed to apply a certification scheme to ensure compliance with the set requirements. As for personal care products, in 2015, the US administration signed a bill against microbeads, the 'Microbead-Free Waters Act', triggering 15 states and 448 brands from 119 different manufacturers to ban and remove microplastics from personal care products. As for marine coatings, some products have been developed, which ensure dust-free abrasive vacuum blasting of surfaces, preventing the release of microplastics (Fiore et al.,2022). For city dust, the 'Tyre Collective developed a device to be combined with vehicle tyres, intercepting 60% of microplastics

emissions. Finally, washing machine filters proved to have an efficiency of 26-100% in blocking microplastics from clothes (Fiore et al., 2022).

In the context of implementation of the MSFD, several Member States reported innovative or promising measures to tackle marine litter. Spain and Germany extended clean-up activities to include seabed and surface water, accompanying these measures with communication activities to raise public awareness. Germany defined a measure to develop containment systems for microlitter. Similarly, Italy defined a measure for the development of prototypes for the purification of plants from microlitter. Estonia defined a measure specifically focusing on treatment of stormwater and wastewater to reduce the amounts of microplastics (European Commission, 2025a),

#### 12.3.11. D11 – Underwater Noise

Increasing levels of underwater noise have multiple impacts on marine fauna (Halliday et al., 2020), not only at physical level, affecting the ability of marine animals to hear and use sound (Clark et al. 2009, Erbe et al. 2016), with possible hearing damage (Southall et al. 2007, 2019, Finneran 2016), but also at behavioural level, causing behavioural disturbance (Nowacek et al. 2007, Southall et al. 2007, 2019, Gomez et al. 2016) or, more in general, representing a chronic stressor for individuals (Rolland et al. 2012).

The main sources of underwater noise are commercial shipping and the offshore oil and gas exploration industry (Cruz et al., 2021). Ships generate lower to medium levels of continuous noise through the propeller, the machinery (i.e. main and auxiliary engines), and the movement of the hull through the water. In parallel, the seismic testing and pile driving used in the offshore oil and gas exploration industry create high-intensity impulsive noise, which can injure marine species. Also, noise produced from offshore wind farms (especially pile driving) may be harmful and disturbing to marine wildlife (Nehls, 2007).

The first obstacle in effectively addressing marine underwater noise is the existence of gaps in scientific knowledge around soundscapes and their variability in time, but also regarding noise-related impacts on biota at population level. There is the lack of science-based, spatially explicit and quantitative assessments of the existing soundscape, making. These imply the difficulty to define the problem in terms of its magnitude and spatial distribution (Bosi et al. 2023), which in turn limits the possibility to determine internationally agreed threshold values. These measures should prioritize the main sources of continuous noise, such as shipping, including through the set-up of low-noise areas for marine species (European Commission, 2025a). Also, measures should be selected on a case-by-case basis, following an assessment of vessel noise footprint and sound maps with information on ship traffic, source levels, and propagation loss as input, as well as on marine fauna distribution and potential impacts (Cruz-Villagran et al., 2025).

Despite these difficulties, measures have been implemented around the world to address the main sources of marine noise.

As for ship-generated noise, there may be technical/design or operational measures. Technical/design measures for new ships include an improved design of the propellers, the isolation of any piece of machinery from the ship structure (Cruz et al., 2021), the reduction of the power requirement, or the installation of devices to generate air bubble curtains around the aft part of the ship hull (Cruz et al., 2021). As for existing ships, a study in the Mediterranean Sea areas close to Barcelona, Spain, and Toulon, France, and in the Atlantic Sea, offshore Brittany, France, showed the effectiveness of retrofitting, for example through elastic mounting devices or improved propellers with higher cavitation inception speed (Audoly et al., 2017). Also, Gassman et al. (2017) reported underwater noise reductions from ships retrofitted for improved fuel efficiency. The reduction of intrinsic noise generated by ships was reported as having a positive impact on the communication and behaviour of harbour porpoise (-21%) and cod (-13/-30%; Audoly et al., 2017).

The main operational measure to reduce underwater noise is to mandate speed reduction, especially of noisiest vessels. Joy et al. (2019) reported a median reduction in sound pressure level of 3.1 dB in case of speed limits of 11 knots, and of up to 11.5 dB for containerships (MacGillivray et al., 2019). More in general, Leaper (2019) estimated that a 10% speed reduction of all ships would result in about 40% lower emission of sound energy, assuming equivalent total cargo carrying capacity (Cruz et al., 2021). Other operational measures, although less effective, include the regulation of ship traffic, especially of the noisiest vessels, either by concentrating or by diluting traffic, grouping vessels in convoys or modifying traffic schemes, especially to foster awareness and behaviour change in shipowners (Audoly et al., 2017). To this respect, it is worth highlighting a good practice from Belgium, which has optimized shipping approach routes during construction/maintenance of offshore wind farms or other offshore infrastructure, to avoid vulnerable areas functioning as a biodiversity hotspot, breeding or nursery spots for several species (European Commission, 2025a).

To avoid the emissions of impulsive noise from offshore hydrocarbon exploration and extraction, some measures have been identified as appropriate, based on the source, site, and species of concern. These include the use of gravity foundations and suction buckets in offshore construction; techniques such as vibroseis, to perform seismic explorations; low-order deflagrations for the clearance of unexploded ordnances; and temporal and spatial restrictions when source mitigation is more challenging, for example in case of sensitive areas, as successfully demonstrated in the UK for harbour porpoise (Thomsen et al., 2021). Especially, marine vibroseis was successfully trialled in different marine environments, showing to generate lower sound levels and less noise at extraneous frequencies (>100 Hz), and is expected to substantially reduce the impact of seismic surveys on marine life, although there are no in situ studies of its effects (Thomsen et al., 2021).

To reduce underwater noise in offshore wind farms, arising from offshore pile driving, Nehls (2007) proposed the construction of a permanent noise barrier around the piles made up from foam or air, which can reduce the radii of physical damage by more than 90% and the radii of disturbance by two-third, thus contributing to a substantial reduction of the negative impacts on marine fauna.

To help mitigate underwater noise, existing studies recommend different strategies: dedicated modelling and field studies of the influence of local conditions on the effectiveness of noise mitigation devices; investigations of the frequency dependencies of sound reduction for fish and marine mammal sensitivities; identify and assess existing constraints to the safe and cost-effective deployment of mitigation measures; and the further development of economic incentives (e.g., in shipbuilding and harbour regulation). To this respect, measures may be included in Maritime Spatial Plans (MSP), as done in Germany with the inclusion of spatial measures in the form of a reservation area for harbour porpoises. In fact, MSP allows to tackle multiple use demands and related conflicts and coexistence possibilities, ad integrate multiple policies, improving connections between planners and noise experts, thus contributing to reach GES targets (Bosi et al., 2023). It is also important to address cross-border impacts, given the transboundary nature of this pressure, and target recreational crafts, which may dominate certain soundscapes.

## 12.4 Summary and Conclusions

The aim of this mini-review was to identify the most effective solutions to contribute to the achievement of GES for European marine waters, in relation to each Descriptor of the MSFD. These identified solutions are meant to provide a guide to Member States, helping them identify actions that may be included in the Programme of Measures required by the MSFD.

A total of 170 studies (plus 10 European Commission reports) were reviewed, covering the global oceans or specific areas of the globe, especially Europe, North America, and Australia. It is worth noting a

significant imbalance in the number of studies related to different MSFD Descriptors, which was also reflected by the number of reviewed solutions. While a high number of studies was retrieved for some Descriptors, such as D2 (non-indigenous species) with 32 studies, D3 (commercial fish and shellfish) with 23 studies, and D1 (biodiversity) and D5 (eutrophication), with 22 studies each, in contrast, only 4 studies were found for D4 (food webs) and D6 (seabed integrity), and 5 studies for D7 (hydrographic conditions). The scope of this mini-review was not meant to be exhaustive, and important scientific articles detailing solutions related to the various MSFD Descriptors may have been overlooked. Future work should integrate the missing references, with a view to provide a more complete picture and a stronger support to MSFD implementation.

Another important finding was related to the horizontal role of climate change in exacerbating certain conditions and triggering potential regime shifts, worsening the ecological status of marine habitats and hindering the achievement of GES, in relation to all MSFD Descriptors.

The identified solutions are briefly summarized below and in Table 10.4, where, for each MSFD Descriptor, a short summary of the main strengths and weaknesses of current MSFD implementation are presented, together with the proposed measures to improve MSFD implementation and contribute to achieve GES, with an indication of their expected impact.

For Descriptor 1 (biodiversity), our mini-review confirmed the effectiveness of MPAs as a fundamental tool for ecological conservation, as it proved to lead to increase in key ecological variables, such as biomass, density, and size of a wide array of organisms, including marine mammals. Also, the success of active and passive ecological restoration projects was confirmed, leading to the self-sustaining or expansion of key habitat-forming species, and underlining the scalability of these approaches and their effectiveness in even in areas with persistent human impacts.

For Descriptor 2 (non-indigenous species), our mini-review identified four types of measures, with variable effectiveness and limitations. Prevention measures are key, and efforts should be strengthened to foster implementation of existing international and EU measures on shipping (ballast waters, biofouling) and on aquaculture (Regulation 708/2007). This includes monitoring, which allows for early species identification, and should be harmonised at marine region/sub-region level. In contrast, eradication measures should be implemented with caution because, although effective, they may lead to the persistence or expansion of the non-indigenous species. Also, management through biological control actions should carefully consider the possible impacts on non-target species and human health through the food chain. Finally, awareness raising may play an important role, thanks to its low cost and medium effectiveness, while legal revision is deemed necessary, to establish a system that allows for prioritisation of prevention and early eradication measures, and to expand the European list to include additional non-indigenous species.

For Descriptor 3 (commercial fish and shellfish), our mini-review identified three measures that may contribute to the GES for this Descriptor: no-take zones, fishing quotas, and the removal of harmful subsidies. The studies reviewed demonstrated that no-take zones have a positive effect on targeted commercial fish and shellfish species, leading to increase in larval supply, population abundance, density and biomass, with positive spillover effects outside those areas. Also, ITQs showed to entail a decline in mortality, high-grading and discarding, provided that TACs are not carefully set and are not allowed to be exceeded. Finally, the removal of harmful subsidies to the fisheries sector, although difficult, may be effective in helping rebuild biomass, ensuring sustainable catches, with positive effects on income and inequality reduction among fishermen.

For Descriptor 4 (food webs), this mini-review identified MPAs as a key tool to preserve or re-establish trophic cascade and community interactions, fostering trophic redundancy and increased resilience to external shocks. Also, the importance of restrictions to fishing effort was highlighted to restore trophic roles and protect/enhance marine food webs.

For Descriptor 5 (eutrophication), existing literature underlines the complexity of pressure-response pathways and interactions among multiple pressures, entailing a long time for recovery, and requiring reducing eutrophication pressures well below the original pollution threshold levels. Climate change will likely worsen this situation, increasing nutrient loss from agriculture and reducing the solubility of oxygen. Our mini-review confirmed the effectiveness of integrated, long-term policies, based on the limitation of industrial discharges, reduction of nutrient losses from agriculture, and improved wastewater treatment, in reducing nutrient inputs and initiating a shift towards better environmental status, which is expected in the medium-long term. Also, innovative measures have been piloted with varying success, including the construction of freshwater wetlands, the use of winter-catch crops, seaweed aquaculture, and algal removal.

For Descriptor 6 (seabed integrity), the few studies identified by our mini-review identified two strands of solutions, addressing the two main drivers of impacts on seabed: i) the limitation of fishing, especially commercial bottom fishing, through the setting of fishing restriction areas (and other similar spatial protection measures) and by replacing fishing tools and techniques, such as using passive gears instead of bottom trawls. However, the effectiveness of these measures did not clearly emerge from the findings of the studies reviewed; and ii) the limitation/regulation of coastal development, including the use of innovative techniques for the reuse of dredged sediments, the restoration of seabed habitats as an eco-engineering tool for coastal defence, and the use of detailed seabed data to support informed ICZM.

For Descriptor 7 (hydrographic conditions), large-scale activities, such as land reclamation, coastal defence works, and damming of large rivers, and coastal/offshore infrastructure (including wind farms and large-scale aquaculture facilities) have been identified as the main pressures affecting coastal and offshore hydrographic conditions. The main measures identified in our literature review focus on the use of SEA and EIA to ensure that the design of these activities and infrastructures does not damage the environment, and of ICZM and MSP to ensure a coordinated implementation of these activities. Also, eco-engineering approaches (e.g. increasing texture, crevices, pits, holes, elevations and habitat-forming taxa) proved to be effective in enhancing the biodiversity of key functional groups of organisms across a variety of habitat settings and spatial scales, and their adoption should be considered.

For Descriptor 8 (contaminants), our mini-review focused on sea-based pollution sources and related contaminants, and on contaminants of emerging concern (PFAs and pharmaceuticals). The results showed the effectiveness of bioremediation using bacteria and fungi to remediate and restore sites contaminated by PAH. As for heavy metals, the sharing of Best Management Practices to minimize the influx of sediment-bound pollutants into ecosystems, as well as remediation techniques (such as sediment dredging and capping, phytoremediation) and stakeholder engagement and education proved to be effective in reducing the concentration of these contaminants in water. As for PFAS, regulations to restrict their use proved effective to reduce concentrations, while notable efforts and good practices have been reported in the Baltic Sea, with the aim to raise knowledge among decision makers, improve data collection, regulation and public-private collaboration. Finally, pharmaceuticals are a very recent concern and few experiences have been reported in literature assessing the problem and proposing possible solutions, with only the case of the "Baltic Pharma Platform" emerging to facilitate knowledge-transfer and promote coordinate activities.

For Descriptor 9 (contaminants in seafood), solutions are generally in line and overlapping with those related to the concentration of contaminants (Descriptor 8). While our mini-review did not allow to assess clear temporal trends in the concentration of contaminants in seafood globally, existing studies point to the need to: i) update measures to tackle the new contaminants and threshold levels set in the most recent EU legislation; ii) consider the extension of assessment, monitoring, and management of contaminants of emerging concern, such as brominated flame retardants, endocrine disruptors, toxic element species, pharmaceuticals and personal care products, perfluorinated compounds, microplastics and marine biotoxins; and iii) ensure a coordinated approach at marine region/sub-region level in tackling pressures from contaminants.

For Descriptor 10 (marine litter), our mini-review identified the need to address inputs of litter from clearly identified pathways, related to macroplastics and microplastics. The measures that proved necessary and effective may be divided into short-term measures (improvement of waste management, fostering awareness, also through beach and ocean clean-ups, and extending legislation on ALDFG to cover smaller fishing vessels), and long-term measures (foster the implementation of circular economy, phase-out non-recoverable plastics, adopt measures and new technologies to intercept the discharge of microplastics at source, such as bans on certain products, adherence to international certifications and voluntary programmes along value chains, washing machine and vehicle tyre filters).

For Descriptor 11 (energy including underwater noise), our mini-review identified the following measures targeting the two main sources of underwater noise, namely commercial shipping and offshore oil & gas extraction. As for shipping, effective measures include the design of new ships, and the retrofitting of existing ones, to reduce noise generation, and operational measures such as speed reduction areas and ship traffic regulation, especially in the framework of MSP. As for oil & gas extraction, several technical measures were found to be effective in reducing underwater noise, such as gravity foundations and suction buckets in offshore construction, techniques such as vibroseis for seismic explorations, temporal or spatial restrictions in sensitive areas, in the framework of EIA/SEA and MSP.

*Table 12.4 Strengths and weaknesses in MSFD implementation, potential solutions and their expected impacts for achieving GES for each MSFD Descriptor.*

| MSFD Descriptor and associated planetary boundary | Strengths and weaknesses of current MSFD implementation | Proposed solutions to improve MSFD implementation | Expected impact of the proposed solutions |
|---|---|---|---|
| **Biodiversity (D1)**<br><br>**Biosphere Integrity** | Several countries have conducted detailed gap analyses, but there is a need for better data to evaluate progress. The most frequently reported pressures are the extraction of wild species, disturbance of species, physical disturbance of the seabed and physical loss of the seabed. | Ensure the conservation of those ecosystems that are still intact through the establishment of a network of coherent, representative, effectively managed MPAs<br>Implement passive and active restoration measures<br><br>Step up action to reduce the bycatch of sensitive species<br>Implement the obligations under the Nature Restoration Regulation as critical contributions to achieving GES<br>Tackle the risks to marine ecosystems from the expansion of offshore renewable energy production, and the cumulative impacts of existing activities at sea, through forward-looking ecosystem-based maritime spatial planning (MSP) | Increases in key biological variables (biomass, density, size, species richness) [D3, D4, D6]<br>Direct positive impact on the abundance of targeted species and on community structure [D3, D4, D6] |
| **Non-Indigenous Species (D2)**<br><br>**Novel Entities** | Some countries have a good understanding of introduction pathways, but in general there is a need for more measures to combat invasive species. Key pathways of NIS introductions are shipping and aquaculture. | Prevention: foster implementation of existing international and EU measures on shipping (ballast waters, biofouling) and on aquaculture (Regulation 708/2007)<br>Strengthen national monitoring, harmonised and coherent at marine region/sub-region level, including port monitoring<br><br>Carefully implement eradication measures, including fostering the commercial use of NIS<br><br>Management through biological control actions<br><br>Foster awareness raising<br><br>Consider the revision of the IAS Regulation to include additional marine NIS, and add provisions for rapid response plans prioritising prevention and early eradication | Reduction of introduction of NIS in EU waters [D1]<br>Monitoring allows early species identification, producing knowledge in support of eradication measures [D1]<br>To be effective, these measures should be based on early detection and rapid management response [D1]<br>Effective, but need to consider possible impact on non-targeted species and human health through the food chain [D1, D3, D9]<br>High applicability and acceptability, low cost and medium effectiveness<br>The inclusion of other species will increase management effectiveness. Response plans will allow faster assessment processes and rapid decision-making |

| MSFD Descriptor and associated planetary boundary | Strengths and weaknesses of current MSFD implementation | Proposed solutions to improve MSFD implementation | Expected impact of the proposed solutions |
|---|---|---|---|
| **Commercial Fish and Shellfish (D3)** | Most countries acknowledge that GES has not been achieved and that there is a need for further measures. There are specific deficiencies related to recreational fishing and the control of smaller fisheries. Fishing is consistently identified as the main activity causing pressure. | Limit the fishing effort in or around MPAs/marine reserves, e.g. through no-take zones | Positive impact on biomass of targeted species, also outside the no-take zone through spillover effects. Positive economic benefits of multi-use MPAs in terms of increased revenues (because of reduced competition among fishermen) [D1, D4, D6] |
| | | Set individual transferable fishing quotas (ITQs) | ITQs may entail a general decline in the mortality of target species, as catches are closer to Total Allowable Catches (TACs) and because ghost fishing through lost and abandoned gear decreases, as well as a decline in high-grading and discarding, provided TACs are not set as too high and catches are not routinely allowed to exceed TACs [D1, D4] |
| | | Remove harmful fisheries subsidies | This will help rebuild resource biomass, contributing to sustainable catches, income and wellbeing of fishers [D1, D4] |
| **Food Webs (D4)**<br><br>**Biosphere Integrity** | There is a general lack of gap analyses and operational targets. Many Member States have not provided a sufficient analysis of food webs, and progress is difficult to assess. | Ensure the conservation of those ecosystems that are still intact through the establishment of a network of coherent, representative, effectively managed MPAs | MPAs harbour great diversity and are key to preserve or re-establish trophic cascades and community interactions, and foster trophic redundancy, contributing to protecting food webs from ecosystem phase shifts and ecosystem resilience and recovery [D1, D3, D6] |
| | | Develop coherent policies between protection, restoration and use applying a precautionary principle | |
| | | Limit the fishing effort in or around MPAs/marine reserves, e.g. through no-take zones | Useful to restore historical trophic roles of key predators [D1, D3, D6] |
| **Eutrophication (D5)** | Nutrient pollution is considered an important source of pressure for marine ecosystems. There is a good understanding of the sources of nutrient pressure, but the gap analyses lack detail, and the link to other relevant policies, such as the WFD, is often weak.<br>Also, marine aquaculture is a significant contributor to direct discharges of | Continue and strengthen implementation of integrated, long-term policies for the reduction of nutrient inputs and nutrient removal | This is key to maintain long-term, multi-decade efforts, given the complex, non-linear pressure-response pathways and the interaction of multiple pressures, leading to shifts in baseline conditions and alternative stable regimes. Pressures should be reduced well below the original pollution threshold levels |

| MSFD Descriptor and associated planetary boundary | Strengths and weaknesses of current MSFD implementation | Proposed solutions to improve MSFD implementation | Expected impact of the proposed solutions |
|---|---|---|---|
| | waterborne nutrient inputs; however, this sector is not covered by EU legislation or BREF documents (Devlin et al. 2023). Climate change is expected to lead to increase in nutrient loss from agriculture and reduction of the solubility of oxygen. | Ensure coordinated efforts at marine region/sub-region level | This will allow to effectively address the transboundary nature of this pressure |
| | | Consider addressing pressures on eutrophication from marine aquaculture, currently not addressed by EU legislation | Reduction of nutrient inputs in specific marine areas |
| | | Consider implementing innovative interventions, such as the construction of freshwater wetlands, engineering projects to increase flushing and dilution in semi-enclosed estuaries and lagoons, the use of winter-catch crops, changes in sluices practices to enhance dilution, seaweed aquaculture, actions to enhance seagrass meadows, mangroves, and salt-marshes to lock nutrients in sediments, and algal removal | These measures have proved to be effective in removing nitrogen and phosphorus from soil and water environments |
| **Seabed Integrity (D6)** | Most countries report measures to protect the seabed and have identified important pressures and activities. However, there are inconsistencies in how Member States approach this descriptor, with many measures overlapping with D1 and D4. | Limit the fishing effort on sensitive seabed habitats, e.g. through no-take zones or designation of protected areas for vulnerable habitats or use of MSFD spatial measures | Protection of long-lived benthic communities and development of healthy structure and functions of such habitats [D1, D3, D4] |
| | | Foster the implementation of best available techniques for activities damaging seabed, such as dredging and fishing (e.g., by replacing bottom trawls with passive gears such as creels, or promoting low-impact and selective gears) | Reduction of negative impacts on seabed by human activities. Fisheries-related measures may encourage fishermen to move away from trawlers, improving the net present value and environmental performance of fishery [D1, D3, D4] |
| | | Promote the active restoration of damaged seabed habitats (including seagrass meadows and kelp beds), also to support coastal defence | Direct positive impact on the abundance of targeted species and on community structure [D1, D3, D4] Positive impacts on coastal defence (e.g., through wave reduction) [D7] |
| **Hydrographical Changes (D7)** | There is a general lack of data and a common forward vision. Several countries report that GES has been achieved, but there is still a lack of a clear timeframe for when this should be reached. | Ensure the consideration of hydrographic conditions in EIA and SEA of activities impacting hydrographic conditions (coastal defence works, damming of large rivers, land reclamation, fishing), and coastal/offshore infrastructures (e.g., wind farms, ocean energy device arrays, large-scale aquaculture facilities), especially in the context of local spatial plans (ICZM, MSP) | EIA/SEA of human activities in the context of ICZM and MSP allow to consider and minimize cumulative impacts on marine habitats and biota [D1, D3, D4, D6] |

| MSFD Descriptor and associated planetary boundary | Strengths and weaknesses of current MSFD implementation | Proposed solutions to improve MSFD implementation | Expected impact of the proposed solutions |
|---|---|---|---|
| | | Consider the implementation of eco-engineering approaches improving structure and function (e.g. increasing texture, crevices, pits, holes, elevations and habitat-forming taxa) | These approaches have the potential to enhance the biodiversity of key functional groups of organisms across numerous habitats and spatial scales [D1, D3, D4, D6] |
| **Contaminants (D8)** | Some countries have made progress in reducing contaminants, but there is generally a lack of comprehensive gap analyses and a clear assessment of the effect of measures. There is a wide variety of contaminants covered. | Foster marine region/sub-region coordinated approaches and platforms to address PFAS and pharmaceuticals, such as the "PFASEout" strategy in the Baltic Sea. Establish threshold values for more substances and account for cocktail effects (?) | These platforms allow to raise knowledge among policy makers, improve data collection, regulation, and public-private collaboration, facilitating knowledge sharing, experience transfer, and networking opportunities |
| | | Foster the adoption of a circular economy approach, as well as net technologies to intercept the discharge of microplastics at source (e.g., by promoting bans on certain products, adherence to international certifications and voluntary programmes along value chains, washing machine and vehicle tyre filters), and their removal from water | Positive impact on marine habitats and species [D9] |
| **Contaminants in Seafood (D9)** | There is a general lack of overview of the current state, and there is a lack of a clear assessment of how measures reduce pressure. Many measures overlap with D8. | Update measures to tackle the new contaminants and threshold levels set in the most recent EU legislation[16] | Strengthen the protection of seafood, including from additional substances |
| | | Consider the extension of assessment, monitoring, and management of contaminants of emerging concern, such as brominated flame retardants, endocrine disruptors, toxic element species, pharmaceuticals and personal care products, perfluorinated compounds, microplastics and marine biotoxins | |

[16] *Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006.*

| MSFD Descriptor and associated planetary boundary | Strengths and weaknesses of current MSFD implementation | Proposed solutions to improve MSFD implementation | Expected impact of the proposed solutions |
|---|---|---|---|
| | | Ensure a coordinated approach at marine region/sub-region level in tackling pressures from contaminants | Such collaborations may provide greater clarity to Member States on the contribution of existing measures and identify additional efforts to reach GES |
| **Marine Litter (D10)** | There has been progress, but there is still a lack of assessment of microplastics and litter in the sea. There is more focus on macro-litter than micro-litter. | For macroplastics, short-term strategies include to improve waste management, foster awareness raising also in connection with beach and ocean clean-ups; in the long term, foster the implementation of circular economy, phase-out non-recoverable plastics | Reduce macroplastics emitted directly from coastal zones and rivers [D8, D9] |
| | | Consider extending legislation on abandoned, lost or otherwise discarded fishing gears (ALDFG) to cover also smaller fishing vessels | Reduce macroplastics inputs from fishing [D3, D8, D9] |
| | | Foster the adoption of a circular economy approach, improve waste management, and foster new technologies to intercept the discharge of microplastics at source (e.g., by promoting bans on certain products, adherence to international certifications and voluntary programmes along value chains, washing machine and vehicle tyre filters), and their removal from water | Reduce primary and secondary microplastics discharge into the water [D8, D9] |
| **Underwater Noise (D11)** | Some countries have addressed the problem, but there is a lack of specific measures to address continuous noise from shipping and other anthropogenic sources.<br><br>Noise produced from offshore wind farms (especially pile driving) may be harmful and disturbing to marine wildlife (Nehls, 2007) | Foster spatially explicit and quantitative assessments of soundscapes and impacts of noise on biota | Increase scientific knowledge of soundscapes and noise-related impacts on biota at population level, supporting the identification of internationally agreed threshold values [D1] |
| | | Consider the implementation of technical/design measures for new ships and or retrofitting of existing ships | Reduce ship-generated noise [D1]<br><br>Maritime spatial planning? |
| | | Promote operational measures to reduce underwater noise, such as speed reduction areas, ship traffic regulation (diluting/grouping ships), also in the context of MSP | |
| | | Foster the implementation of technical measures, such as gravity foundations and suction buckets in offshore construction, techniques such as vibroseis for seismic explorations, temporal or spatial restrictions in sensitive areas, including these measures in EIA/SEA and MSP | Reduce noise emitted from offshore hydrocarbon exploration and extraction [D1] |

# 13 Case study on the balance between protection and restoration

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A recent letter in Science has put highlight on the balance between nature restoration and environmental protection (Hemraj et al. 2024). Based on this, the EEA and its ETC BE have discussed whether it is possible to achieve GES for biodiversity without stressor control, i.e. whether it is possible to achieve GES for biodiversity in so-called 'eutrophication problem areas'. During initial discussions, examples of nature restoration, in particular small-scale restoration of stone reefs in the transition zone between the North Sea and Baltic Sea were used as an example (see Figure 13.1). Restoration of stone reefs is simple and involve building smaller reef structures using large boulders. The outcome is boulder structures, which not only act as shelter for fish, but also as substrate for growth of macroalgae. In some case, the outcome is an accelerated growth of nuisance perennial macroalgae, which is a so-called eutrophication signal counteracting improvements in biodiversity status.

*Figure 13.1 Life below water in Køge Bugt, Denmark where large conglomeration of boulders has been placed in order to support a thriving biodiversity. Photos are kindly provided by Morten Holm Hansen.*

To support further discussions, we present an analysis where we compare indicator-based assessment and identification of 'problem and 'non-problem areas' in relation to both 'biodiversity' and 'eutrophication.

# 13.1 An analysis of BEAT- vs. HEAT-based identifications of problem and non-problem areas

European marine areas are at present given separate designations for their conservation status, ecological status and environmental quality status. This raises several issues related to overlap and potential conflicts between management of the different statuses. For example, whilst it is implicitly assumed that a coastal or marine water body cannot attain 'Favourable Conservation Status' or 'Good Environmental Status' if it is affected by eutrophication or classified as 'eutrophication problem area', this has never been tested. We address this question using published data of assessments in Danish marine waters and open parts of the Baltic Sea as well as a pan-European assessment. Our study shows a strong relationship between assessments of 'biodiversity status' and 'eutrophication status'. Eutrophication encompasses several adverse symptoms and undesirable consequences. We can therefore conclude that if a water body is affected by eutrophication, the conservation status classification under the EC Habitats Directive will automatically be 'unfavourable' and the water body cannot logically reach good ecological and environmental status under other EU Directives. It is hypothesised that if implementation of relevant EU Directives is to be harmonised then so should the determination of the different status definitions, though this remains to be rigorously tested. A harmonised implementation of European marine directives requires integrated management measures to protect and restore marine biodiversity.

### 13.1.1. Introduction

Marine areas are subject to many pressures, both natural and anthropogenic, and if consequences of these are considered important by society then they are regarded as risks (Elliott et al., 2014). Marine biodiversity is at risk, at global, regional and national levels (Coll et al., 2010; Halpern et al., 2012; HELCOM, 2010; Uusitalo et al., 2016) from multiple human activities, each of which have consequences and so require management measures (Elliott et al., 2017). The main activities and pressures causing an impaired status of biodiversity include: i) fisheries, ii) pollutants, iii) physical modifications, resulting in habitat loss, and iv) climate change (Elliott et al., 2017; Halpern et al., 2015, 2008; Korpinen et al., 2012).

Globally, marine management legislation is implemented to control human activities and prevent the adverse effects of the hazards and risks identified. Within Europe, for example, there are many Directives aimed at tackling activities and features in a catchment, water body or sea area (Boyes and Elliott, 2014). Many of those directives have the simple premise of aiming to determine what the features of an area should be like under conditions with no anthropogenic pressures and if there is a deviation or likely to be a deviation from that expected situation then action should be taken unless there is an economic imperative not to do so (Elliott et al., submitted). Hence, management measures are required to remove, reduce, mitigate or compensate for adverse trends and modified structure to improve biodiversity status.

Key policy drivers regarding protection of marine biodiversity in water bodies, regional seas or designated areas in a European context are: (1) The Habitats Directive (HD, Anon., 1992), (2) the Water Framework Directive (WFD, Anon., 2000), and (3) the Marine Strategy Framework Directive (MSFD, Anon., 2008). More specifically, the management of human activities causing discharges, emissions and losses of nutrients, i.e. nitrogen and phosphorus, and subsequently resulting in eutrophication in European marine waters has for decades been addressed by individual sectors separately. This includes the Urban Waste Water Treatment Directive (UWWTD, Anon., 1991a), the Nitrates Directive (ND, Anon., 1991b) and the Integrated Emissions Directive (IED, formerly Integrated Pollution Prevention and Control Directive (IPPC, Anon., 2010)). These pieces of legislation cover, respectively, point-source discharges from urban areas, diffuse run-off from agricultural areas and point source discharges from complex industrial plants. All of these environmental protection directives have their own geographical coverage and there are overlaps between the areas covered (Boyes et al., 2016).

The HD aims to protect wild flora and fauna in Europe and enhance biodiversity through the conservation of natural habitats. The habitats and species protected are identified and defined in Annex I and II, respectively. Areas are designated as Special Areas of Conservation through a set of conservation objectives, which relate to defined (designated) species and/or habitats from those Annexes. Any plan or project, including pollution sources, likely to affect those conservation objectives, needs to be subjected to an Appropriate Assessment to minimise, mitigate or compensate for adverse effects. Despite this, many coastal waters in Northern Europe are identified as eutrophic due to anthropogenic inputs whereby point-source discharges from urban or industrial areas and diffuse discharges, such as from farmland, can have an adverse effect on habitat, species or the environment (HELCOM, 2009). If human activities are deemed to affect the condition of those designated features, then Member States are required to implement management plans to restore these coastal waters to achieve a Favourable Conservation Status (FCS). Member States should therefore monitor habitats and species regarding these designated priority habitat types and priority species.

The adoption of the WFD led to a paradigm shift in the approach to managing human activities affecting aquatic ecosystems. The WFD provides a framework for the protection of ground water, inland surface waters, transitional waters (estuaries) and coastal waters (Anon., 2000). The WFD aims (1) to prevent further deterioration, protect and enhance the environmental status of aquatic systems, and (2) to promote the sustainable use of water, while progressively reducing or eliminating discharges, losses and emissions of pollutants and other pressures for the long-term protection and enhancement of the aquatic environment. The WFD provides national and local authorities with a legal basis for the maintenance and recovery of water quality to achieve Good Ecological Status and Good Chemical Status (GEcS, GCS) for all surface waters and good chemical status for groundwater. Accordingly, the WFD is regarded as the most significant piece of legislation, regarding water policy, produced in recent decades (Hering et al., 2010).

The coastal waters covered by the WFD with respect to biological features are generally limited to surface waters extending one nautical mile on the seaward side from the nearest point on the baseline, from which the breadth of territorial waters is measured. The GEcS is based on the structural features of four biological quality elements – phytoplankton, submerged aquatic vegetation (macroalgae and other macrophytes), benthic invertebrates and fish, each of which can be adversely affected by eutrophication (although fish are included only for inland and transitional waters but not for coastal waters). With respect to chemical features, the areas in question are limited to the surface waters 12 nautical miles from the coast. Open marine waters are not covered by the WFD, but the WFD is likely to influence management of marine ecosystems as all land-based inputs of pollutants pass through the coastal zone to the open marine waters (Borja et al., 2010).

The MSFD (adopted in 2008) aims to achieve Good Environmental Status (GEnS) of the EU marine waters by 2020 and to protect the resource base upon which marine-related economic and social activities depend. Note that the acronym “GES” has been used both for Good Ecological Status and Good Environmental Status and so here we use GEcS and GEnS to avoid confusion (see Borja et al., 2013). The MSFD is the first EU legislative instrument related to the protection of marine biodiversity for all seas, not just designated conservation areas, as it contains the explicit regulatory objective that ‘biodiversity is maintained by 2020, as the cornerstone for achieving GEnS. 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, and mostly covering the marine waters not included in the WFD (Borja et al., 2013, 2010). However, as the MSFD covers all waters from the baseline, there is an overlap of 1 or 12 nautical miles between the two Directives (Boyes et al., 2016). It is therefore imperative that the status definitions between directives are harmonised (Borja et al., 2010). The MSFD focuses on 11 descriptors, including a broad range of biodiversity and ecosystem components and the multiple human pressures potentially impairing the environmental status (Borja et al., 2013). However, management measures to abate eutrophication are achieved through other policy frameworks such as the UWWTD, ND, WFD or, in a Baltic Sea context, the HELCOM Baltic Sea Action Plan

(HELCOM, 2007a). Thus, causes are addressed through certain legal instruments whereas the consequences are assessed through others.

Given the issues outlined above, and to aim for unified management of marine waters, it is imperative that the three types of status – FCS, GEcS and GEnS, should be harmonised. There does appear to be an unstated assumption that this is the case. Despite this, such a harmonisation is neither explicitly required nor has it been tested. Therefore, this study aims to test this assumption by focusing on the relationship between biodiversity status and eutrophication status, based on three European studies covering different scales: national (Denmark; Andersen et al., 2015; Naturstyrelsen, 2012), regional (Baltic Sea; HELCOM, 2010) and pan-European (Uusitalo et al., 2016) levels. This study relies on the availability of indicator-based assessments and the subsequent classification of both 'biodiversity status' and 'eutrophication status'. Information regarding 'eutrophication status' in marine waters in Europe is available through many studies and data repositories. Indicator-based assessments of 'biodiversity status' covering a broad and ecologically relevant range of indicators are, in a European context, not yet as developed as the assessments related to eutrophication. Consequently, synoptic studies of both 'biodiversity status' and 'eutrophication status' are not common. We find this situation difficult to understand since protection of marine biodiversity has been on the European and regional political agenda for decades.

### 13.1.2. Methods

We review, re-analyse and compare three synoptic studies of biodiversity status and eutrophication status (Fig. 1). We do this in marine waters where biodiversity status and eutrophication status have been classified by indicator-based assessment tools, using multiple ecologically relevant indicators.

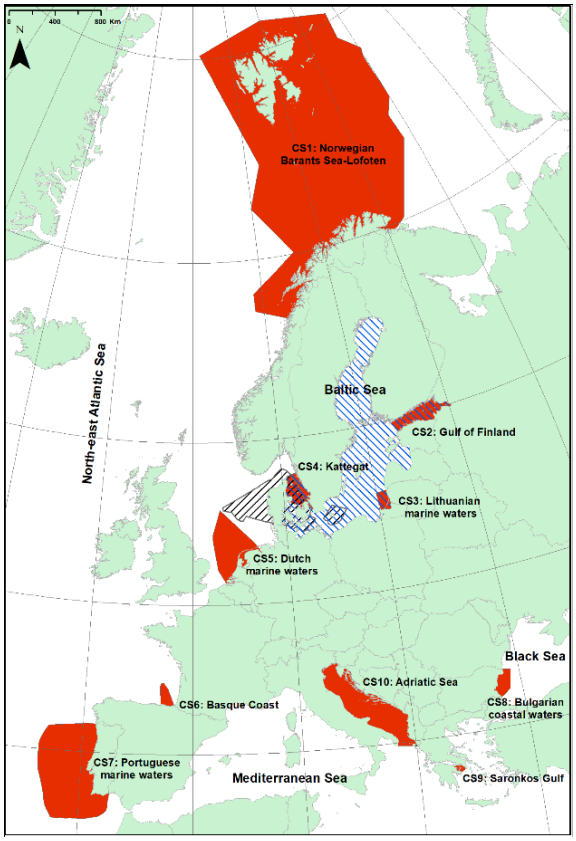


*Figure 13.2 Map of the case study areas. Areas in red are DEVOTES case studies (CS1-10; Uusitalo et al., 2016), the area hatched in blue is the Baltic Sea (HELCOM, 2010) and the area hatched in black shows the Danish marine waters (Naturstyrelsen, 2012).*

The tools used are the eutrophication assessment tool 'HEAT' and the biodiversity assessment tool 'BEAT' (Andersen et al., 2016, 2011; Naturstyrelsen, 2012). HEAT and BEAT classify the eutrophication and biodiversity status, respectively, of an assessment unit into five categories: high, good, moderate, poor and bad, i.e. classes broadly in agreement with those used for the WFD. The classification is based on

calculations of an EQR value (Ecological Quality Ratio, i.e. the ratio of the reference condition and the observed condition) for each indicator. Following this, indicators are aggregated in five groups, or 'criteria', and weighted. The status is shown by comparing the weighted EQR-value with the threshold value between good and moderate for every single group. The final status is thereafter based on a one-out-all-out (OO-AO) principle sensu the WFD, in which a failure in any one group constitutes a failure in the whole system (Borja et al., 2014).

The national study was based on 22 areas within Danish waters with BEAT and HEAT assessments already compiled (see Andersen et al., 2016; Naturstyrelsen, 2012). The assessment of the eutrophication and biodiversity status in the Baltic Sea was similarly based on the HEAT and BEAT tools as described above. Within the Baltic Sea, 189 eutrophication (HELCOM, 2010) and 22 biodiversity (Andersen et al., 2015) assessment units of different character (e.g. stations, sites or basins) were used. In the present study, nine open-water basins from the biodiversity assessment were selected and matched with the corresponding eutrophication assessments units.

The pan-European case study was based on 10 different marine systems, across all European regional seas, covering a broad range of climatic and hydrological conditions and exposures to human activities (Uusitalo et al., 2016). The assessment was based on NEAT (Nested Environmental status Assessment Tool; see Borja et al. (2016)), which hierarchically combines spatial assessment units and habitats with indicators for different ecosystem components to assess the overall biodiversity status in each of the 10 systems. NEAT has an option for calculating the status using eutrophication or biodiversity indicators only. Eutrophication indicators were grouped in components of benthic fauna, phytoplankton, water column habitat, benthic vegetation (without kelp forest extent), and benthic habitat. The NEAT assessment based on the biodiversity indicators was finally compared to the NEAT assessment based on the eutrophication indicators (see Berg et al. (2016); Uusitalo et al. (2016)).

### 13.1.3. Results

The 22 Danish assessment units cover both coastal (n = 16) and open-water (n = 6) water bodies (Figure 1). None of the assessment units was classified as having good biodiversity status, although two of 22 units were classified as non-problem areas with respect to eutrophication (western part of the North Sea and open part of the Skagerrak; Table 2).

The Baltic Sea case study covers nine open-water basins but no coastal water bodies (Figure 1). Two out of nine basins (the Bothnian Bay and the Bothnian Sea) were classified as having a good biodiversity status, while only one basin (the Bothnian Bay) was classified as unaffected by eutrophication (Table 3).

The pan-European case study is based on larger assessment units (from 1,500 to 820,000 km2) compared to the Danish and Baltic case studies and consists of 10 marine systems in the Baltic Sea, Mediterranean Sea, Atlantic Ocean and the Black Sea (Figure 2). Two out of 10 assessment units (Norwegian parts of the Barents Sea and Basque coast) were classified with good biodiversity status, while the eutrophication-related re-assessment reveals that three out of 10 units (the Norwegian parts of the Barents Sea, Basque coast and the Lithuanian parts of the Baltic Sea) were tentatively classified as not affected by eutrophication (Table 3; column named NEATEUTRO). A supplementary classification based on the OO-AO principle sensu the WFD (Table 4), showed that the Norwegian part of the Barents Sea and the Basque coast were the only areas not affected by eutrophication.

*Table 13.1 Normalized assessment of 'biodiversity status' using BEAT (Andersen et al., 2015) and 'eutrophication status' using HEAT (Andersen et al., 2012; Naturstyrelsen, 2012) in Danish waters. Areas 5, 21 and 22 are identical to areas 9, 8 and 7 in Table 3. Colours indicate the status classification result; green = good environmental status, yellow = moderately affected status; red = significantly affected status. No. = total number of indicators. Du. = duplicate indicators that occur in both the HEAT and BEAT assessments.*

| Basin/area | BEAT | | HEAT | | |
|---|---|---|---|---|---|
| | Status | No. | Status | No. | Du. |
| 1. NORTH SEA, eastern parts | 0.73 | 23 | 0.78 | 10 | 1 |
| 2. NORTH SEA, western parts | 0.74 | 25 | 0.62 | 11 | 1 |
| 3. Ringkøbing Fjord | 0.61 | 3 | 0.61 | 4 | 3 |
| 4. SKAGERRAK, open parts | 0.76 | 21 | 0.87 | 10 | 1 |
| 5. KATTEGAT, central parts | 0.57 | 25 | 0.58 | 12 | 3 |
| 6. Limfjorden | 0.50 | 15 | 0.53 | 10 | 10 |
| 7. Mariager Fjord | 0.44 | 2 | 0.44 | 2 | 2 |
| 8. Randers Fjord | 0.42 | 11 | 0.46 | 11 | 11 |
| 9. Isefjorden/Roskilde Fjord | 0.69 | 9 | 0.48 | 5 | 5 |
| 10. The Sound, central parts | 0.64 | 7 | 0.60 | 8 | 7 |
| 11. Fakse Bight/Stevns | 0.63 | 5 | 0.63 | 4 | 4 |
| 12. Aarhus Bight | 0.58 | 7 | 0.60 | 7 | 6 |
| 13. Funen, north of | 0.49 | 8 | 0.49 | 9 | 8 |
| 14. Odense Fjord | 0.37 | 14 | 0.39 | 13 | 11 |
| 15. Sejerø Bight | 0.44 | 1 | 0.44 | 1 | - |
| 16. Kalundborg Fjord | 0.36 | 1 | 0.36 | 1 | - |
| 17. Lillebælt, southern parts | 0.42 | 7 | 0.38 | 8 | 7 |
| 18. Smålandsfarvandet | 0.51 | 10 | 0.51 | 11 | - |
| 19. Rødsand | 0.59 | 3 | 0.61 | 3 | - |
| 20. Hjelm Bight | 0.69 | 5 | 0.57 | 5 | 5 |
| 21. ARKONA BASIN | 0.62 | 14 | 0.66 | 11 | 10 |
| 22. BORNHOLM BASIN | 0.49 | 8 | 0.42 | 5 | 5 |

*Table 13.2 Normalized assessment of 'biodiversity status' using BEAT (Andersen et al., 2015) and 'eutrophication status' using HEAT (Andersen et al., 2011) in the open parts of the Baltic Sea. Areas 7, 8 and 9 are identical to areas 22, 21 and 5 in Table 2. Colour codes and abbreviations as in Table 2.*

| Basin/area | BEAT | | HEAT | | |
|---|---|---|---|---|---|
| | Status | No. | Status | No. | Du. |
| 1. Bothnian Bay | 0.71 | 10 | 0.74 | 5 | 5 |
| 2. Bothnian Sea | 0.67 | 10 | 0.69 | 5 | 5 |
| 3. Gulf of Finland | 0.38 | 11 | 0.36 | 5 | 5 |
| 4. Baltic Proper, north | 0.42 | 12 | 0.25 | 5 | 5 |
| 5. Baltic Proper, east | 0.36 | 14 | 0.42 | 6 | 5 |
| 6. Baltic Proper, southeast | 0.43 | 12 | 0.57 | 13 | 2 |
| 7. Bornholm Basin | 0.49 | 9 | 0.46 | 5 | 5 |
| 8. Arkona Basin | 0.57 | 14 | 0.64 | 11 | 10 |
| 9. Kattegat | 0.55 | 32 | 0.58 | 12 | 12 |

*Table 13.3 Assessment of 'biodiversity status' using NEAT (Uusitalo et al., 2016) and 'eutrophication status' using HEAT where biodiversity indicators are deleted and only eutrophication related indicators used for the classifications in 10 European case studies. Area 2 is identical to area 3 in Table 3 whilst area 4 is identical to area 9 in Table 3 and area 5-9 in Table 2. Colour codes and abbreviations as in Table 2.*

| Basin/area | $NEAT_{BIO}$ | | $NEAT_{EUTRO}$ | | $OO\text{-}AO_{EUTRO}$ | |
|---|---|---|---|---|---|---|
| | Status | No. | Status | No. | Du. | Status |
| 1. Norwegian Barents Sea - Lofoten | 0.64 | 7 | 0.79 | 2 | 2 | 0.79 |
| 2. Gulf of Finland | 0.42 | 7 | 0.34 | 3 | 2 | 0.24 |
| 3. Lithuanian marine waters | 0.36 | 7 | 0.73 | 4 | 2 | 0.14 |
| 4. Kattegat | 0.39 | 7 | 0.40 | 3 | 2 | 0.05 |
| 5. Dutch North Sea | 0.52 | 6 | 0.54 | 1 | 1 | 0.54 |
| 6. Basque coast | 0.68 | 7 | 0.90 | 4 | 2 | 0.74 |
| 7. Portuguese continental waters | 0.57 | 7 | 0.40 | 1 | 1 | 0.40 |
| 8. Black Sea, Varna Bay | 0.50 | 5 | 0.59 | 4 | 2 | 0.44 |
| 9. Saronikos Gulf | 0.52 | 6 | 0.53 | 3 | 2 | 0.50 |
| 10. Adriatic Sea | 0.37 | 3 | 0.26 | 4 | 2 | 0.21 |

The three assessment comparisons (Tables 2-4) indicate strong positive correlations between 'eutrophication status' and 'biodiversity status' (Figure 2), where areas affected by eutrophication (i.e. problem areas) hold a moderate or low biodiversity status.

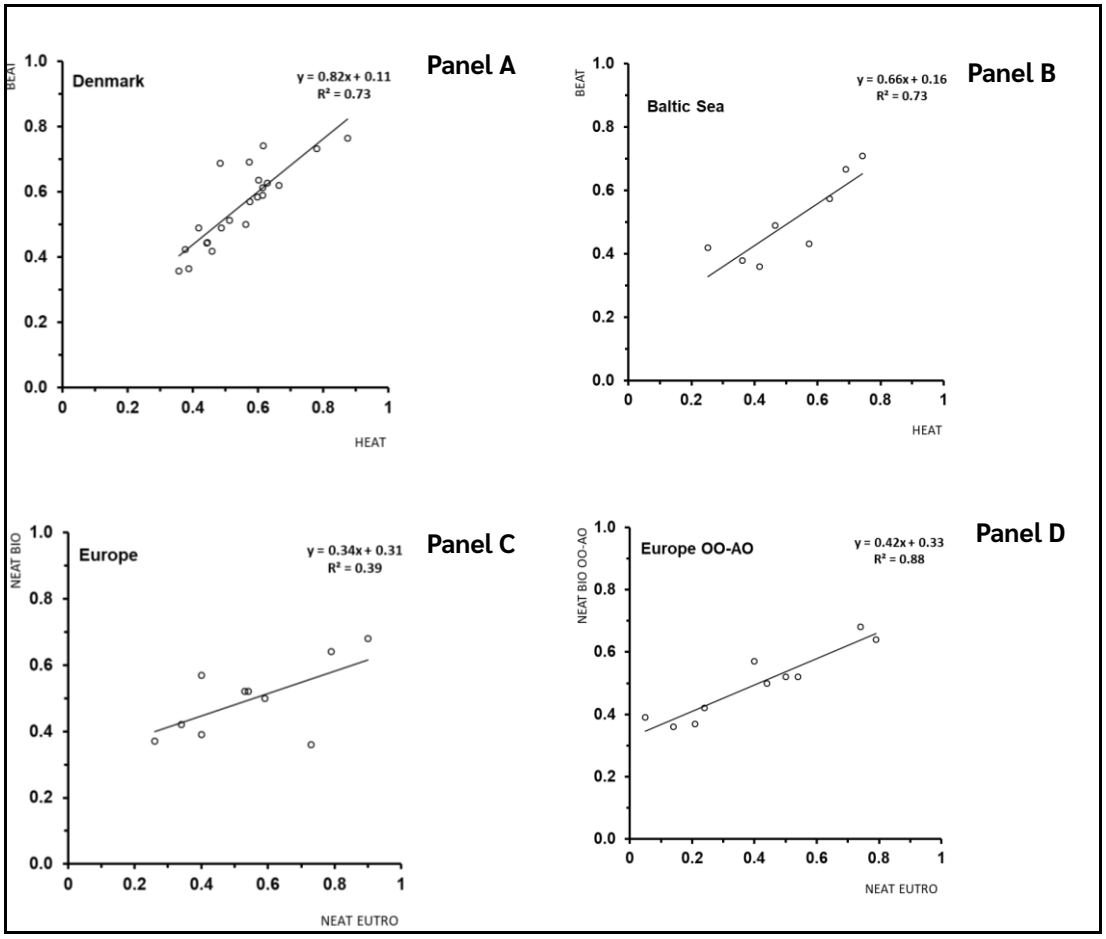


*Figure 13.3 Linear regressions of HEAT on BEAT assessment scores for Danish waters (panel A), HEAT and BEAT assessment scores (minimum assessment score) for Baltic Sea (panel B), NEAT eutrophication and NEAT biodiversity assessment scores in the pan-European case studies (panel C), and NEAT eutrophication and NEAT biodiversity based on the one-out-all-out principle (panel D; OO-AO). The axes values represent normalized scores [0-1.0] of the HEAT, BEAT and NEAT scores. While the pan-European scores are means of all the indicator groups, the Danish and Baltic scores are based on the minimum scores among the indicator groups as defined in (HELCOM, 2010; Naturstyrelsen, 2012).*

### 13.1.4. Discussion and conclusions

This type of study has not previously been attempted because of the poor availability of synoptic and concurrent indicator-based studies of biodiversity status and eutrophication status. Most European coastal waters are well studied with respect to eutrophication. Therefore, the limitation is the access to studies of biodiversity status. To our knowledge, only few EU Member States have reported or published such studies, with many gaps and lack of data (Hummel et al., 2015; Teixeira et al., 2016). Further, we are aware of only a limited number of regional studies (e.g. (HELCOM, 2010) and we are not aware of any broad-scale integrated assessments of marine biodiversity status in a European context, except for the study by Uusitalo et al. (2016).

We consider the data sets used in the present study to be the best available. However, future assessments in relation to the MSFD should lead to more and better biodiversity indicators and thus improve the basis for comparing biodiversity status with eutrophication status. Our three comparisons are well-documented and employ a wide and relevant range of indicators, making them suitable for such comparison. The eutrophication indicators are the same as those used by the Regional Sea Conventions in the context of the WFD and MSFD (HELCOM, 2010; OSPAR, 2010). The biodiversity indicators are not yet used as standard for the MSFD, but they still cover a broad range of biodiversity-related features (fish, seabirds, marine

mammals) and therefore the biodiversity assessments are regarded as robust (Heiskanen et al., 2016; Teixeira et al., 2016).

The agreement between eutrophication problem status and low biodiversity status (Figure 2) agrees with our expectations, although we acknowledge that some degree of dependency will result from the redundant use of some indicators in both assessments. Hence, the eutrophication and biodiversity status assessment may be related because of overlapping indicators, but it is possible that biodiversity and eutrophication assessments were not intended to be completely independent, and indeed the use of similar information thus increases the possibility of double-counting. Given that the number of duplicate indicators in the biodiversity assessment and eutrophication assessments is less than the total number of indicators (Tables 1-3), it is unlikely that the strong correlations are driven entirely by indicator redundancy. This supports the general finding that areas affected by eutrophication are also more likely to have a degraded biodiversity status. This is to be expected if eutrophication is regarded as 'a suite of undesirable consequences' based on the biological structure and functioning (Tett et al., 2013, 2007).

Despite the analysis here, a particular eutrophication status does not imply an identical biodiversity status, or vice versa. Given that attaining GEnS for biodiversity (MSFD Descriptor 1) is an overarching objective of the MSFD, it seems appropriate to analyse whether attaining GEnS with respect to biodiversity would imply that GEnS is met for all other descriptors including eutrophication (MSFD Descriptor 5). Indeed, (Borja et al., 2013) suggested that if an area is in GEnS for D1 (Biodiversity) then by definition all other descriptors must be satisfactory, and vice versa – if an area fails for one of the other descriptors then by definition its biodiversity would not pass GEnS. While this assumption appears logical, it still requires documentation, such as we show here for the eutrophication-biodiversity relationship. Furthermore, failure to attain any one of GEnS, GEcS and FCS will result in a requirement to implement mitigation measures (unless there is an overwhelming economic argument not to do so). Given that an area could be subject to all three of these relevant directives, it is important to investigate whether the results of status determination are coherent across directives. If they are not coherent, and there is a mismatch between GEnS, GEcS and FCS, then this gives ambiguity and doubt as to whether specific measures should be undertaken, especially as those measures could be expensive (e.g. nutrient reduction). This may also increase the chances of litigation either by a country being reported to the European Court of Justice for infraction of the Directive or a company being threatened with prosecution for activities causing reduced status. For example, if the marine waters of a country are deemed to fail a status assessment for a particular directive and the country does not take remedial action then it could face infraction proceedings. However, if the country argues that the status under a different directive had passed the required threshold, then the scientific basis for the failure under the first directive could be challenged.

The comparison of the status required by different Directives has repercussions not only for the measures carried out in response to the assessment but also for the monitoring required to determine the rectification of any adverse status. An assessment showing poor status, when the status is in fact acceptable, could result in expensive monitoring and remediation (denoted Type I error in statistical terms). Similarly, an assessment showing no ill effects, when in fact there is one (Type II), would prevent mitigation and remedial measures being implemented, to the detriment of the environment. A further analysis of this point is beyond the scope of the present study, but poses some interesting questions both for future research, when a wider range of quality data sets from environmental assessments becomes available, and for the legal ramifications of marine assessments and the implementation of directives, including the monitoring needed (Borja and Elliott, 2013).

It is emphasised that coherent implementation of the various EU Directives builds on the assumption that GEnS (of MSFD), GEcS and GCSs (of the WFD), FCS (of the HD), non-exceedance of the assimilative capacity for pollutants (of the (IED(IPPC) Directive), as well as designations of sensitive waters (of the UWWTD) and Nitrate Vulnerable Zones (of the ND) are all harmonised. If these definitions are not consistent then measures designed to address any of them separately are at risk of failure. It is assumed that measures

enacted for the 'sectoral directives' (ND, UWWTD) will achieve the designations required by the holistic directives (MSFD, WFD, HD). However, if this assumption fails then the cost-effectiveness and scientific soundness of the measures are challenged (Börger et al., 2016). The current study presents the first attempt to analyse the potential coherence.

## 13.2 Conclusions

In conclusion, our synoptic assessment of biodiversity and eutrophication status has documented that areas affected by eutrophication also show impaired biodiversity status. This implies that a good or favourable conservation status can only be attained by addressing the eutrophication issue through nutrient load reductions. This also helps to confirm the suggestion by Borja et al. (2013) that by definition if one of the other ten descriptors in the MSFD fails then so will the biodiversity descriptor 1 and vice versa. This implies a need for stronger coordination in implementation of eutrophication-related directives such as the ND and UWTTD, and biodiversity-related directives such as the HD and MSFD, where the biodiversity-related targets need to be related to the measures of ND and UWWTD. The coordination of the Directives has repercussions for their monitoring and for the measures to be carried out if an area fails to achieve good status under a given Directive. This is especially important where the Directives overlap spatially and it could have economic consequences in the form of unnecessary mitigation measures.

# 14 Selected MIBAT literature

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There are no such thing as perfect assessment tools, but some are useful. Marine assessments are approximations of complex dynamics with the aim of communicating about policy objectives. The tools used in this report are science-based communications tools, all are tested and documented and some are widely used. On the following pages, we list the origin of the different tools and key references and encourage interested reader to read them to get a better understanding of how the tools work.

**HEAT**

HEAT, or in full the 'HELCOM Eutrophication Assessment Tool', was developed, tested and applied for the first ever HELCOM thematic assessment of eutrophication in the Baltic Sea. Later on it has been tested, adjusted and operationally applied in the North Sea, Mediterranean Sea and the Black Sea as well as many more limited sea areas. HEAT is well-documented. HELCOM has used it three times in holistic assessments of the Baltic Sea marine environment (HOLAS I in 2010, HOLAS II in 2017 and HOLAS III in 2023), it has been used by the EEA twice and the OSPAR COMPETE tool builds on an operational version of HEAT. The following list includes the mentioned assessment reports but also scientific documentations and applications of the tool. It is good to note that the NEAT tool (Nested Environmental Assessment Tool, Uusitalo et al. 2016) is technically related to HEAT and can also be used to assess eutrophication (e.g., in southern Black Sea, Tan et al. 2023, and Mediterranean Sea, Giani et al. 2024).


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**BEAT**

The first version of the BEAT tool, or in full the 'HELCOM Biodiversity Assessment Tool', was a spin-out tool from the original HEAT tool and tested as part of the HELCOM HOLAS I process (HELCOM 2009). As a follow up on HOLAS I, Denmark tested the tool on a national-wide scale in the Baltic Sea and the North Sea region (Andersen et al. 2014). The BEAT tool was further developed in the Horizon 2020 project DEVOTES and named as NEAT (Nested Environmental Assessment Tool), because in this version the tool can

include different sized and overlapping assessment units. The NEAT was tested for the Europe's seas in multiple pilot areas (Uusitalo et al. 2016). The EEA applied the BEAT tool in the "Biodiversity of Europe's seas" report (Vaughan et al. 2019) which provided key messages to EEA's Marine Messages II (Reker et al. 2019). HELCOM has applied the tool now three times (HELCOM 2009, HELCOM 2018, HELCOM 2023). The tool has been applied to all the four Europe's marine regions.


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**CHASE**

CHASE; or in full the 'Chemical Status Assessment Tool', was developed, tested and applied by HELCOM and used for identification of areas affected by hazardous substances in the Baltic Sea region. HELCOM has used CHASE three times (HOLAS I, HOLAS II and HOLAS III), the EEA two times, the OSPAR has used the CHASE in their 20203 'Quality Status Report', the ANEMONE project tested it in the Black Sea. The tool has been also modified for specific assessment purposes (Lehtonen et al. 2014).

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**MALT**

A prototype of MALT, the 'Marine Litter Assessment Tool' was developed and tested in 2022 in support of the EEA ETC ICM thematic assessment on marine litter in Europe. The tool was published in 2023 (Murray et al. 2023) and is first time applied in the EEA's State of the Seas assessment.


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**MESH**

MESH, or in full 'Marine Ecosystem Health Assessment Tool', builds on the HEAT, BEAT and CHASE tools and is in principle a recombination of indicators from these tools, but in a modified structure (with 3 groups of indicators: 1) Biological, 2) Chemical, and 3) Supporting) enabling identification of problem areas and non-problem areas with regard to 'ecosystem health'. A prototype was developed and tested as part of the HELOMC HOLAS I assessment (called HOLAS tool). Then MESH was included in EEA's Marine Messages II. MESH has so far not been published in scientific literature.

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**CEA/CIA**

Cumulative effects assessments (CEA) or cumulative impact assessments (CIA) used in spatial assessments are mainly anchored in a method developed by Halpern et al. (2008). Related methods were developed in the ODEMM project (e.g. Piet et al. 2023). HELCOM tested the Halpern's method as part of the HELCOM HOLAS I assessment and has developed it further for HOLAS II and HOLAS III. As a North Sea follow up on the HELCOM HOLAS I assessment, Norway, Sweden, Denmark and Germany set up the HARMONY project which led to the application of the tool in the North Sea region (Andersen et al. 2013). Coll et al. (2012) and Micheli et al. (2013) were the first ones to apply it to the Mediterranean Sea and the Black Sea. The EEA has applied the CEA/CIA approach on a European-wide scale in 2019 and 2025. Several local assessments have been carried out in Europe and elsewhere in the World Ocean (e.g. Korpinen & Andersen 2016) and recently it has also been applied to climate change impacts (Wåhlström et al. 2024). The list of literature is too long to be fully covered by this report.


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**CIMPAL**

CIMPAL (Cumulative IMPacts of invasive ALien species) is a spatial, quantitative index that maps the cumulative negative impact of established non-indigenous, often invasive alien species (IAS), on marine habitats by combining species' distribution/abundance, species' impacts on habitats and habitat distribution. The index was first applied in the Mediterranean Sea (Katsanevakis et al. 2016). In the 3rd holistic assessment, HELCOM used CIMPAL to estimate impacts of invasive species in the Baltic Sea (HELCOM 2023). The fist pan-European assessment was made in 2019 under European Topic Centre for Inland, Coastal and Marine Waters for EEA.

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# 16 Appendices

List of appendices:

1. BEAT Threshold values
2. Biodiversity: Detailed results of EU Member States MSFD reporting
3. Biodiversity: NE Atlantic & North Sea – OSPAR QSR 2023
4. Biodiversity: Baltic Sea – HELCOM HOLAS III 2023
5. Biodiversity: Mediterranean Sea – UNEP-MAP QSR 2023
6. Biodiversity: IUCN Red List Assessments
7. CHASE Threshold values
8. CHASE Matrix by matrix assessment
9. CHASE Region by region assessment
10. HEAT Threshold values
11. HEAT Region by region assessment
12. Long-term trend: Plots of residuals from the temperature
13. Environmental trends: Descriptor 5: Analyses of nutrient concentration trends in Europe's seas based on EMOD-net Chemistry data
14. Environmental trends: Descriptor 6: The sea floor integrity ensures functioning of the ecosystem
15. Environmental trends: Descriptor 10: Marine litter does not cause harm
16. Environmental trends: Baltic Sea
17. Environmental trends: Ranfjorden
18. Environmental trends: North Sea
19. Environmental trends: Nervión Estuary
20. Chapter 12 mini review on solutions insert here

# Appendix 1: BEAT Threshold values

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Abundance of waterbirds in the breeding season | Arctic skua | Birds | 0.7 | index | SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Arctic Tern | Birds | 0.7 | index | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Barnacle goose | Birds | 0.7 | index | SEA-001, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Black guillemot | Birds | 0.7 | index | SEA-002, SEA-003, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Caspian tern | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common eider | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common guillemot | Birds | 0.8 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common gull | Birds | 0.7 | index | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common ringed plover | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common shelduck | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Common tern | Birds | 0.7 | index | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Dunlin | Birds | 0.7 | index | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Eurasian oystercatcher | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Goosander | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Great black-backed gull | Birds | 0.7 | index | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Great cormorant | Birds | 0.7 | index | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-013 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Great crested grebe | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Greater scaup | Birds | 0.7 | index | SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Greylag goose | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Herring gull | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Lesser black-backed gull | Birds | 0.7 | index | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Little tern | Birds | 0.7 | index | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Mute swan | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Abundance of waterbirds in the breeding season | Pied avocet | Birds | 0.7 | index | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Razorbill | Birds | 0.8 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Red-breasted merganser | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Ruddy turnstone | Birds | 0.7 | index | SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Sandwich tern | Birds | 0.7 | index | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Tufted duck | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the breeding season | Velvet scoter | Birds | 0.7 | index | SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Bewicks swan | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Black-headed gull | Birds | 0.7 | index | SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Black-throated diver | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Common eider | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Common goldeneye | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Common gull | Birds | 0.7 | index | SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Common pochard | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Common scoter | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Eurasian coot | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Eurasian teal | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Eurasian wigeon | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Goosander | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Great black-backed gull | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Great cormorant | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Great crested grebe | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Greater scaup | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Herring gull | Birds | 0.7 | index | SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Long-tailed duck | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Abundance of waterbirds in the wintering season | Mallard | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Mute swan | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Northern pintail | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Red-breasted merganser | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Red-necked grebe | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Red-throated diver | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Slavonian grebe | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Smew | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Stellers eider | Birds | 0.7 | index | SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Tufted duck | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Velvet scoter | Birds | 0.7 | index | SEA-004, SEA-005, SEA-006, SEA-007, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of waterbirds in the wintering season | Whooper swan | Birds | 0.7 | index | SEA-001, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Black guillemot | Birds | 0.5 | Achieve/Fail | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Black-throated diver | Birds | 0.5 | Achieve/Fail | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Common eider | Birds | 0.5 | Achieve/Fail | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Common scoter | Birds | 0.5 | Achieve/Fail | SEA-002, SEA-003 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Common scoter | Birds | 10 | individuals | SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Common scoter | Birds | 68 | individuals | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Greater scaup | Birds | 15 | individuals | SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Greater scaup | Birds | 59 | individuals | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Long-tailed duck | Birds | 131 | individuals | SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Long-tailed duck | Birds | 869 | individuals | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Red-breasted merganser | Birds | 0.5 | Achieve/Fail | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Red-necked grebe | Birds | 0.5 | Achieve/Fail | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Red-throated diver | Birds | 0.5 | Achieve/Fail | SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Number of drowned mammals and waterbirds in fishing gear | Slavonian grebe | Birds | 0.5 | Achieve/Fail | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Velvet scoter | Birds | 0.5 | Achieve/Fail | SEA-002, SEA-003 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Velvet scoter | Birds | 194 | individuals | SEA-008, SEA-009, SEA-010, SEA-011 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Velvet scoter | Birds | 313 | individuals | SEA-004, SEA-005, SEA-006, SEA-007 | Baltic Sea | HELCOM HOLAS3 |
| White-tailed sea eagle productivity | White-tailed eagle | Birds | 0.59 | index | 19 Eastern Gotland Basin Lithuanian Coastal waters, 22 Eastern Gotland Basin Polish Coastal waters, 24 Gdansk Basin Polish Coastal waters, 26 Bornholm Basin Polish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| White-tailed sea eagle productivity | White-tailed eagle | Birds | 1.64 | index | 10 Northern Baltic Proper Estonian Coastal waters, 12 Gulf of Finland Estonian Coastal waters, 14 Gulf of Riga Estonian Coastal waters, 17 Eastern Gotland Basin Estonian Coastal waters, 1 Bothnian Bay Finnish Coastal waters, 3 The Quark Finnish Coastal waters, 5 Bothnian Sea Finnish Coastal waters, 11 Gulf of Finland Finnish Coastal waters, 8 Åland Sea – Archipelago Sea Finnish Coastal waters, 28 Bornholm Basin German Coastal waters, 31 Arkona Basin German Coastal waters, 32 Bay of Mecklerburg German Coastal waters, 35 Kiel Bight German Coastal waters, 18 Eastern Gotland Basin Latvian Coastal waters, 9 Northern Baltic Proper Swedish Coastal waters, 16 Western Gotland Basin Swedish Coastal waters, 20 Eastern Gotland Basin Swedish Coastal waters, 25 Bornholm Basin Swedish Coastal waters, 29 Arkona Basin Swedish Coastal waters, 2 Bothnian Bay Swedish Coastal waters, 4 The Quark Swedish Coastal waters, 6 Bothnian Sea Swedish Coastal waters, 7 Åland Sea Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| OSPAR B1 - Marine bird abundance | Alca torda | Birds | 0.8 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Anas acuta | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Anas crecca | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Anas platyrhynchos | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Arenaria interpres | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Aythya marila | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Branta bernicla | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Branta leucopsis | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d), Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Bucephala clangula | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Calidris alba | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Calidris alpina | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Calidris canutus | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Calidris ferruginea | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR B1 - Marine bird abundance | Calidris maritima | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Cepphus grylle | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (b), Greater North Sea (c), Greater North Sea (f), The Norwegian sea, Arctic Waters, The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Charadrius alexandrinus | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d), Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Charadrius hiaticula | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d), Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Clangula hyemalis | Birds | 0.7 | index | Arctic Waters, The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Egretta garzetta | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Fratercula arctica | Birds | 0.8 | index | Arctic Waters, Greater North Sea, Greater North Sea (a), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Fulmarus glacialis | Birds | 0.8 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Northern Barents sea, The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Haematopus ostralegus | Birds | 0.7 | index | Greater North Sea, Greater North Sea (c), Greater North Sea (d), Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus argentatus | Birds | 0.7 | index | Arctic Waters, Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, Arctic Waters, Greater North Sea, Greater North Sea (c), Greater North Sea (d), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus canus | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), Arctic Waters, Greater North Sea, Greater North Sea (d), The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus fuscus | Birds | 0.7 | index | Arctic Waters, Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus marinus | Birds | 0.7 | index | Arctic Waters, Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, Arctic Waters, Greater North Sea, Greater North Sea (c), Greater North Sea (d), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus melanocephalus | Birds | 0.7 | index | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Larus ridibundus | Birds | 0.7 | index | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Limosa lapponica | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Limosa limosa | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Mareca penelope | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Mergus serrator | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR B1 - Marine bird abundance | Morus bassanus | Birds | 0.8 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Numenius arquata | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Numenius phaeopus | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Phalacrocorax aristotelis | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea, Arctic Waters, Greater North Sea, Greater North Sea (b), The Norwegian sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Phalacrocorax carbo | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea, Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Phalacrocorax pugnax | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Platalea leucorodia | Birds | 0.7 | index | Greater North Sea, Greater North Sea (c), Greater North Sea (d), Greater North Sea, Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Pluvialis squatarola | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Podiceps cristatus | Birds | 0.7 | index | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Podiceps grisegena | Birds | 0.7 | index | Greater North Sea, Greater North Sea (c) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Recurvirostra avosetta | Birds | 0.7 | index | Greater North Sea, Greater North Sea (c), Greater North Sea (d), Greater North Sea, Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Rissa tridactyla | Birds | 0.7 | index | Arctic Waters, Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Northern Barents sea, The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Somateria mollissima | Birds | 0.7 | index | Greater North Sea, Greater North Sea (b), Greater North Sea (c), Arctic Waters, Greater North Sea, Greater North Sea (b), Greater North Sea (d), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Somateria spectabilis | Birds | 0.7 | index | Arctic Waters, The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Spatula clypeata | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Stercorarius parasiticus | Birds | 0.7 | index | Greater North Sea, Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Stercorarius skua | Birds | 0.7 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Sterna dougallii | Birds | 0.7 | index | Greater North Sea, Greater North Sea (a) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Sterna hirundo | Birds | 0.7 | index | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Sterna paradisaea | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (c), Greater North Sea (d), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Sterna sandvicensis | Birds | 0.7 | index | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (c), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR B1 - Marine bird abundance | Sternula albifrons | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Tadorna tadorna | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Tringa erythropus | Birds | 0.7 | index | Greater North Sea, Greater North Sea (d) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Tringa nebularia | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (d), Greater North Sea (e) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Tringa totanus | Birds | 0.7 | index | Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Uria aalge | Birds | 0.8 | index | Arctic Waters, Celtic Seas, Greater North Sea, Greater North Sea (a), Greater North Sea (b), Greater North Sea (d), Greater North Sea (e), Greater North Sea (f), The Norwegian sea, The Southern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B1 - Marine bird abundance | Uria lomvia | Birds | 0.8 | index | Arctic Waters, The Northern Barents sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Alca torda | Birds | 0.990951 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Alca torda | Birds | 0.991245 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Alca torda | Birds | 0.99153 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Cepphus grylle | Birds | 0.988918 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Fratercula arctica | Birds | 0.991548 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Fratercula arctica | Birds | 0.99192 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Uria aalge | Birds | 0.992648 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Uria aalge | Birds | 0.993228 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Uria aalge | Birds | 0.995268 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine Bird Breeding Productivity | Uria lomvia | Birds | 0.992105 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Fulmarus glacialis | Birds | 0.994073 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Fulmarus glacialis | Birds | 0.994973 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Haematopus ostralegus | Birds | 0.99238 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus argentatus | Birds | 0.988908 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus argentatus | Birds | 0.989392 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus argentatus | Birds | 0.990391 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus canus | Birds | 0.986349 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR B3 - Marine bird breeding success | Larus canus | Birds | 0.990132 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus fuscus | Birds | 0.990675 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus fuscus | Birds | 0.991557 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus fuscus | Birds | 0.992176 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus marinus | Birds | 0.989389 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus marinus | Birds | 0.990953 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus marinus | Birds | 0.991546 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus ridibundus | Birds | 0.982473 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Larus ridibundus | Birds | 0.982475 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Morus bassanus | Birds | 0.992822 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Morus bassanus | Birds | 0.993501 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Morus bassanus | Birds | 0.993535 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Phalacrocorax aristotelis | Birds | 0.980383 | Growth rate | Arctic Waters, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Phalacrocorax aristotelis | Birds | 0.980391 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Phalacrocorax carbo | Birds | 0.98376 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Phalacrocorax carbo | Birds | 0.984375 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Platalea leucorodia | Birds | 0.987053 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Recurvirostra avosetta | Birds | 0.989339 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Rissa tridactyla | Birds | 0.987998 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Rissa tridactyla | Birds | 0.988 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Rissa tridactyla | Birds | 0.988009 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Stercorarius parasiticus | Birds | 0.988943 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Stercorarius skua | Birds | 0.992595 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Stercorarius skua | Birds | 0.994143 | Growth rate | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Stercorarius skua | Birds | 0.994162 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR B3 - Marine bird breeding success | Sterna dougallii | Birds | 0.989564 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna hirundo | Birds | 0.989749 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna hirundo | Birds | 0.989758 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna hirundo | Birds | 0.99314 | Growth rate | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna paradisaea | Birds | 0.989544 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna paradisaea | Birds | 0.990219 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna sandvicensis | Birds | 0.989945 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna sandvicensis | Birds | 0.989971 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sterna sandvicensis | Birds | 0.990175 | Growth rate | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sternula albifrons | Birds | 0.980391 | Growth rate | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR B3 - Marine bird breeding success | Sternula albifrons | Birds | 0.984654 | Growth rate | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2020 - Lesser black-backed gull | Larus fuscus fuscus | Birds | 0.5 | Achieve/Fail | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Balearic shearwater | Balearic shearwater | Birds | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Iberian guillemot | Iberian guillemot | Birds | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Demographic characteristics | Audouins gull | Birds | 1 | survival rate | Adriatic Sea | Croatia | MedQSR2023 |
| Demographic characteristics | Audouins gull | Birds | 1 | survival rate | Western Mediterranean | France | MedQSR2023 |
| Demographic characteristics | Audouins gull | Birds | 1 | survival rate | Adriatic Sea, Central and Ionian Seas, Western Mediterranean | Italy | MedQSR2023 |
| Demographic characteristics | Audouins gull | Birds | 1 | survival rate | Western Mediterranean | Spain | MedQSR2023 |
| Demographic characteristics | Balearic shearwater | Birds | 0.75 | survival rate | Western Mediterranean | Spain | MedQSR2023 |
| Demographic characteristics | Mediterranean storm-petrel | Birds | 0.8 | survival rate | Central and Ionian Seas | Malta | MedQSR2023 |
| Demographic characteristics | Sandwich tern | Birds | 1 | survival rate | Western Mediterranean | France | MedQSR2023 |
| Demographic characteristics | Sandwich tern | Birds | 1 | survival rate | Adriatic Sea | Italy | MedQSR2023 |
| Demographic characteristics | Scopolis shearwater | Birds | 1 | survival rate | Adriatic Sea | Croatia | MedQSR2023 |
| Demographic characteristics | Scopolis shearwater | Birds | 1 | survival rate | Central and Ionian Seas | Greece | MedQSR2023 |
| Demographic characteristics | Scopolis shearwater | Birds | 1 | survival rate | Western Mediterranean, Central and Ionian Seas | Italy | MedQSR2023 |
| Demographic characteristics | Scopolis shearwater | Birds | 1 | survival rate | Central and Ionian Seas | Malta | MedQSR2023 |
| Demographic characteristics | Scopolis shearwater | Birds | 1 | survival rate | Western Mediterranean | Spain | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Demographic characteristics | Slender-billed gulls | Birds | 1 | survival rate | Western Mediterranean | France | MedQSR2023 |
| Demographic characteristics | Yelkouan shearwater | Birds | 1 | survival rate | Adriatic Sea | Croatia | MedQSR2023 |
| Demographic characteristics | Yelkouan shearwater | Birds | 1 | survival rate | Aegean and Levantine Seas | Greece | MedQSR2023 |
| Demographic characteristics | Yelkouan shearwater | Birds | 1 | survival rate | Western Mediterranean | Italy | MedQSR2023 |
| Demographic characteristics | Yelkouan shearwater | Birds | 1 | survival rate | Central and Ionian Seas | Malta | MedQSR2023 |
| Demography, breeding | Osprey | Birds | 1.17 | survival rate | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Audouins gull | Birds | 0.5 | rel. pop. size | Aegean and Levantine Seas | Greece | MedQSR2023 |
| Population abundance | Audouins gull | Birds | 0.9 | rel. pop. size | Adriatic Sea | Croatia | MedQSR2023 |
| Population abundance | Audouins gull | Birds | 0.9 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Audouins gull | Birds | 0.9 | rel. pop. size | Adriatic Sea, Western Mediterranean | Italy | MedQSR2023 |
| Population abundance | Audouins gull | Birds | 0.9 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance | Balearic shearwater | Birds | 0.5 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance | Mediterranean storm-petrel | Birds | 1 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Mediterranean storm-petrel | Birds | 1 | rel. pop. size | Central and Ionian Seas | Malta | MedQSR2023 |
| Population abundance | Sandwich tern | Birds | 0.7 | rel. pop. size | Western Mediterranean | Mediterranean Sea | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Adriatic Sea | Croatia | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Central and Ionian Seas | Greece | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Adriatic Sea, Central and Ionian Seas, Western Mediterranean | Italy | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Central and Ionian Seas | Malta | MedQSR2023 |
| Population abundance | Scopolis shearwater | Birds | 1 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance | Slender-billed gulls | Birds | 0.9 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Slender-billed gulls | Birds | 0.9 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance | Yelkouan shearwater | Birds | 1 | rel. pop. size | Adriatic Sea | Croatia | MedQSR2023 |
| Population abundance | Yelkouan shearwater | Birds | 1 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance | Yelkouan shearwater | Birds | 1 | rel. pop. size | Aegean and Levantine Seas | Greece | MedQSR2023 |
| Population abundance | Yelkouan shearwater | Birds | 1 | rel. pop. size | Adriatic Sea, Central and Ionian Seas, Western Mediterranean | Italy | MedQSR2023 |
| Population abundance | Yelkouan shearwater | Birds | 1 | rel. pop. size | Central and Ionian Seas | Malta | MedQSR2023 |
| Population abundance, breeding | Kentish Plover | Birds | 1 | rel. pop. size | Adriatic Sea | Croatia | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Population abundance, breeding | Kentish Plover | Birds | 1 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance, breeding | Mediterranean shag | Birds | 0.7 | rel. pop. size | Adriatic Sea | Croatia | MedQSR2023 |
| Population abundance, breeding | Mediterranean shag | Birds | 0.7 | rel. pop. size | Aegean and Levantine Seas | Cyprus | MedQSR2023 |
| Population abundance, breeding | Mediterranean shag | Birds | 0.7 | rel. pop. size | Western Mediterranean | France | MedQSR2023 |
| Population abundance, breeding | Mediterranean shag | Birds | 0.7 | rel. pop. size | Western Mediterranean | Spain | MedQSR2023 |
| Population abundance, breeding | Osprey | Birds | 90 | % | Western Mediterranean | France | MedQSR2023 |
| Population abundance, breeding | Osprey | Birds | 90 | % | Western Mediterranean | Italy | MedQSR2023 |
| Population abundance, breeding | Osprey | Birds | 90 | % | Western Mediterranean | Spain | MedQSR2023 |
| Species distributional range | Audouins gull | Birds | 1 | relative area | Adriatic Sea | Croatia | MedQSR2023 |
| Species distributional range | Audouins gull | Birds | 1 | relative area | Adriatic Sea, Central and Ionian Seas, Western Mediterranean | Italy | MedQSR2023 |
| Species distributional range | Mediterranean storm-petrel | Birds | 0.5 | relative area | Central and Ionian Seas | Mediterranean Sea | MedQSR2023 |
| Species distributional range | Mediterranean storm-petrel | Birds | 1 | relative area | Aegean and Levantine Seas | Greece | MedQSR2023 |
| Species distributional range | Sandwich tern | Birds | 1 | relative area | Adriatic Sea | Italy | MedQSR2023 |
| Species distributional range | Scopolis shearwater | Birds | 1 | relative area | Adriatic Sea | Croatia | MedQSR2023 |
| Species distributional range | Scopolis shearwater | Birds | 1 | relative area | Central and Ionian Seas | Greece | MedQSR2023 |
| Species distributional range | Scopolis shearwater | Birds | 1 | relative area | Western Mediterranean, Adriatic Sea, Central and Ionian Seas | Italy | MedQSR2023 |
| Species distributional range | Scopolis shearwater | Birds | 1 | relative area | Central and Ionian Seas | Malta | MedQSR2023 |
| Species distributional range | Yelkouan shearwater | Birds | 1 | relative area | Adriatic Sea | Croatia | MedQSR2023 |
| Species distributional range | Yelkouan shearwater | Birds | 1 | relative area | Aegean and Levantine Seas | Greece | MedQSR2023 |
| Species distributional range | Yelkouan shearwater | Birds | 1 | relative area | Adriatic Sea, Central and Ionian Seas, Western Mediterranean | Italy | MedQSR2023 |
| Species distributional range | Yelkouan shearwater | Birds | 1 | relative area | Central and Ionian Seas | Malta | MedQSR2023 |
| Species distributional range, breeding | Kentish Plover | Birds | 90 | % | Adriatic Sea | Croatia | MedQSR2023 |
| Species distributional range, breeding | Mediterranean shag | Birds | 90 | % | Adriatic Sea | Croatia | MedQSR2023 |
| Species distributional range, breeding | Mediterranean shag | Birds | 90 | % | Adriatic Sea | Italy | MedQSR2023 |
| Species distributional range, breeding | Osprey | Birds | 90 | % | Western Mediterranean | France | MedQSR2023 |
| Species distributional range, breeding | Osprey | Birds | 90 | % | Western Mediterranean | Italy | MedQSR2023 |
| Species distributional range, breeding | Osprey | Birds | 90 | % | Western Mediterranean | Spain | MedQSR2023 |
| Arctic tern | Arctic tern | Birds | 0.6 | index | Vest-Agder, Finnmark | Norway | Nature Index of Norway |
| Atlantic puffin | Atlantic puffin | Birds | 0.6 | index | Sande (M.R.), Herøy (M.R.), Ulstein, Giske, Flatanger, Vikna, Leka, Røst, Værøy, Vardø, Vadsø, Båtsfjord, Gjesvær, Nordsjøen, Norskehavet, Barentshavet | Norway | Nature Index of Norway |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Black guillemot | Black guillemot | Birds | 0.6 | index | Frøya, Sklinna | Norway | Nature Index of Norway |
| Brünnichs guillemot | Brünnichs guillemot | Birds | 0.6 | index | Hammerfest, Måsøy, Nordkapp | Norway | Nature Index of Norway |
| Common gull, coastal | Common gull | Birds | 0.6 | index | Telemark, Vest-Agder | Norway | Nature Index of Norway |
| Common tern | Common tern | Birds | 0.6 | index | Telemark, Vest-Agder | Norway | Nature Index of Norway |
| Cormorant (ssp. carbo) | Cormorant (ssp. carbo) | Birds | 0.6 | index | Hitra, Frøya, Bjugn, Flatanger, Vikna, Leka, Bindal, Sømna, Brønnøy, Vega, Herøy (N.), Dønna, Lurøy, Træna, Rødøy, Meløy, Røst, Hammerfest, Loppa, Hasvik, Måsøy | Norway | Nature Index of Norway |
| Cormorant (ssp. sinensis) | Cormorant (ssp. sinensis) | Birds | 0.6 | index | Østfold | Norway | Nature Index of Norway |
| Eider duck | Eider duck | Birds | 0.6 | index | Østfold, Oslo, Buskerud, Telemark, Vest-Agder, Hordaland, Møre og Romsdal, Nord-Trøndelag, Nordland, Røst, Finnmark, Troms | Norway | Nature Index of Norway |
| Fulmar | Fulmar | Birds | 0.6 | index | Kristiansand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Røst, Værøy, Hammerfest, Loppa, Hasvik, Måsøy, Skagerak, Norskehavet | Norway | Nature Index of Norway |
| Gannet | Gannet | Birds | 0.6 | index | Sande (M.R.), Herøy (M.R.), Ulstein, Giske, Flakstad, Vestvågøy, Vågan, Hadsel, Bø (N), Øksnes, Andøy, Moskenes, Nordsjøen, Norskehavet | Norway | Nature Index of Norway |
| Great black-backed gull | Great black-backed gull | Birds | 0.6 | index | Telemark, Vest-Agder | Norway | Nature Index of Norway |
| Great skua | Great skua | Birds | 0.6 | index | Røst, Værøy, Hammerfest, Måsøy, Nordkapp, Norskehavet, Barentshavet | Norway | Nature Index of Norway |
| Guillemot | Guillemot | Birds | 0.6 | index | Sande (M.R.), Herøy (M.R.), Ulstein, Giske, Flatanger, Vikna, Leka, Hammerfest, Måsøy, Nordkapp, Røst, Værøy, Vardøy, Vadsøy, Båtsfjord, Nordsjøen | Norway | Nature Index of Norway |
| Herring gull | Herring gull | Birds | 0.6 | index | Telemark, Vest-Agder | Norway | Nature Index of Norway |
| Kittiwake | Kittiwake | Birds | 0.6 | index | Sande (M.R.), Herøy (M.R.), Ulstein, Giske, Flatanger, Vikna, Leka, Røst, Værøy, Hammerfest, Måsøy, Nordkapp, Båtsfjord, Vardø, Vadsø | Norway | Nature Index of Norway |
| Lesser black-backed gull (ssp. fuscus) | Larus fuscus (ssp. fuscus) | Birds | 0.6 | index | Sør-Trøndelag, Nordland | Norway | Nature Index of Norway |
| Lesser black-backed gull (ssp. intermedius) | Larus fuscus (ssp. intermedius) | Birds | 0.6 | index | Telemark, Vest-Agder | Norway | Nature Index of Norway |
| Razorbill | Razorbill | Birds | 0.6 | index | Flatanger, Vikna, Leka, Røst, Værøy, Hammerfest, Måsøy, Nordkapp, Norskehavet, Barentshavet | Norway | Nature Index of Norway |
| Shag | Shag | Birds | 0.6 | index | Flatanger, Vikna, Leka, Røst, Værøy, Hammerfest, Måsøy, Nordkapp | Norway | Nature Index of Norway |
| White-tailed sea eagle | White-tailed eagle | Birds | 0.6 | index | Nord-Trøndelag, Hordaland, Sør-Trøndelag, Møre og Romsdal, Sogn og Fjordane, Rogaland, Nordland, Troms, Finnmark, Vest-Agder | Norway | Nature Index of Norway |
| F/Fmsy | Common cuttlefish | Cephalopods | 1 | ratio | 17 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Horned octopus | Cephalopods | 1 | ratio | 18 | Central Mediterranean | JRC / STECF |
| Abundance of coastal fish key groups | Cyprinids | Fish | 0.6 | ind. value | 11: Gulf of Finland Finnish coastal waters, 14: Gulf of Riga Estonian Coastal waters, 15: Gulf of Riga Latvian Coastal waters, 16: Western Gotland Basin Swedish Coastal waters, 18: Eastern Gotland Basin Latvian Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 2: Bothnian Bay Swedish Coastal waters, 24: Gdansk Basin Polish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 4: The Quark Swedish Coastal waters, 6: Bothnian Sea Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Abundance of coastal fish key groups | Mesopredators | Fish | 0.6 | ind. value | 16: Western Gotland Basin Swedish Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 24: Gdansk Basin Polish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Eelpout | Fish | 0.6 | ind. value | 30: Arkona Basin Danish Coastal waters, 33: Mecklenburg Bight Danish Coastal waters, 36: Belts Danish Coastal waters, 38: The Sound Danish Coastal waters, 40: Kattegat Danish Coastal waters, including Limfjord | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Flounder | Fish | 0.6 | ind. value | 16: Western Gotland Basin Swedish Coastal waters, 18: Eastern Gotland Basin Latvian Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 24: Gdansk Basin Polish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 30: Arkona Basin Danish Coastal waters, 33: Mecklenburg Bight Danish Coastal waters, 36: Belts Danish Coastal waters, 38: The Sound Danish Coastal waters, 40: Kattegat Danish Coastal waters, including Limfjord, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Perch | Fish | 0.6 | ind. value | 1: Bothnian Bay Finnish Coastal waters, 11: Gulf of Finland Finnish coastal waters, 14: Gulf of Riga Estonian Coastal waters, 15: Gulf of Riga Latvian Coastal waters, 16: Western Gotland Basin Swedish Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 2: Bothnian Bay Swedish Coastal waters, 24: Gdansk Basin Polish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 3: The Quark Finnish Coastal waters, 4: The Quark Swedish Coastal waters, 5: Bothnian Sea Finnish Coastal waters, 6: Bothnian Sea Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Pike | Fish | 0.6 | ind. value | 16: Western Gotland Basin Swedish Coastal waters, 2: Bothnian Bay Swedish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Pikeperch | Fish | 0.6 | ind. value | 11: Gulf of Finland Finnish coastal waters, 16: Western Gotland Basin Swedish Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 5: Bothnian Sea Finnish Coastal waters, 6: Bothnian Sea Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of coastal fish key species | Whitefish | Fish | 0.6 | ind. value | 16: Western Gotland Basin Swedish Coastal waters, 2: Bothnian Bay Swedish Coastal waters, 4: The Quark Swedish Coastal waters, 6: Bothnian Sea Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Abundance of salmon spawners and smolt | Salmon | Fish | 0.5 | achieve/fail | SEA-017, SEA-016, SEA-015, SEA-010, SEA-007, SEA-009, SEA-011, SEA-013 | Baltic Sea | HELCOM HOLAS3 |
| Abundance of sea trout spawners and parr | Sea trout | Fish | 0.5 | achieve/fail | 1 Bothnian Bay Finnish Coastal waters, 2 Bothnian Bay Swedish Coastal waters, 4 The Quark Swedish Coastal waters, 5 Bothnian Sea Finnish Coastal waters, 6 Bothnian Sea Swedish Coastal waters, 7 Åland Sea Swedish Coastal waters, 8 Åland Sea – Archipelago Sea Finnish Coastal waters, 9 Northern Baltic Proper Swedish Coastal waters, 10 Northern Baltic Proper Estonian Coastal waters, 11 Gulf of Finland Finnish Coastal waters, 12 Gulf of Finland Estonian Coastal waters, 13 Gulf of Finland Russian Coastal waters, 14 Gulf of Riga Estonian Coastal waters, 15 Gulf of Riga Latvian Coastal waters, 16 Western Gotland Basin Swedish Coastal waters, 17 Eastern Gotland Basin Estonian Coastal waters, 18 Eastern Gotland Basin Latvian Coastal waters, 19 Eastern Gotland Basin Lithuanian Coastal waters, 20 Eastern Gotland Basin Swedish Coastal waters, 22 Eastern Gotland Basin Polish Coastal waters, 24 Gdansk Basin Polish Coastal waters, 25 Bornholm Basin Swedish Coastal waters, 26 Bornholm Basin Polish Coastal waters, 27 Bornholm Basin Danish Coastal waters, 29 Arkona Basin Swedish Coastal waters, 30 Arkona Basin Danish Coastal waters, 36 Belts Danish Coastal waters, 31 Arkona Basin German Coastal waters, 32 Bay of Mecklerburg German Coastal waters | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Size structure of coastal fish - Perch | Perch | Fish | 0.6 | ind. value | 11: Gulf of Finland Finnish coastal waters, 14: Gulf of Riga Estonian Coastal waters, 15: Gulf of Riga Latvian Coastal waters, 16: Western Gotland Basin Swedish Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, 2: Bothnian Bay Swedish Coastal waters, 24: Gdansk Basin Polish Coastal waters, 25: Bornholm Basin Swedish Coastal waters, 3: The Quark Finnish Coastal waters, 4: The Quark Swedish Coastal waters, 5: Bothnian Sea Finnish Coastal waters, 6: Bothnian Sea Swedish Coastal waters, 7: Åland Sea Swedish Coastal waters, 8: Åland Sea - Archipelago Sea Finnish coastal water, 9: Northern Baltic Proper Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| OSPAR - Size composition in fish communities | Sub-apex demersal predators | Fish | 0.165 | index | GNSstrat_Atlantis_GNSIntOT1 | North-east Atlantic | OSPAR QSR2023 |
| OSPAR - Size composition in fish communities | Sub-apex demersal predators | Fish | 0.5 | Achieve/Fail | EChanBT3Simple_GNSEngBT3, NI_IBTS_WGS84_CSNIrOT4, BChanBT3, IGFS_WGS84_CSIreOT4, n_48, s_48, Sp_North-WGS84_BBICnSpaOT4, Contour3strata_sector_BBIPorOT4, Sp_Cadiz_WGS84_BBICsSpaOT1, SWC_Q3_WAScoOT3, Porcupine_WGS84, North Sea and Skagerrak (GNSIntOT1, Greater North Sea), Eastern Channel (GNSEngBT3, Greater North Sea), West of Scotland (CSScotOT1, northern Celtic Seas), Irish Sea, Bristol Channel (CSEngBT3, central Celtic Seas), West of Ireland (CSIreOT4, central Celtic Seas), Celtic Sea (CSFraOT4, southern Celtic Seas), Bay of Biscay (BBICFraOT4, northern BoB&IC), Northern Iberian Coast (BBICnSpaOT4, northern BoB&IC), Central Iberian Coast (BBICPorOT4, central BoB&IC), Southern Iberian Coast (BBICSpaOT1, southern BoB&IC), Rockall Bank (WAScoOT3, Wider Atlantic), Porcupine Bank (WASpaOT3, Wider Atlantic) | North-east Atlantic | OSPAR QSR2023 |
| OSPAR - Size composition in fish communities | Sub-apex demersal predators | Fish | 0.508 | index | SWC_Q1_CSScoOT1 | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Alosa spp | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Amblyraja radiata | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Anarhichas lupus | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Anguilla anguilla | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Argyrosomus regius | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Brama brama | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Chelidonichthys lucerna | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Chimaera monstrosa | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Conger conger | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Cyclopterus lumpus | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Dalatias licha | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Dasyatis pastinaca | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Deania calcea | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Recovery in the Population Abundance of Sensitive Fish Species | Dicentrarchus punctatus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Dipturus nidarosiensis | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Dipturus oxyrinchus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Dipturus spp | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Epigonus telescopus | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Etmopterus spinax | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Gadus morhua | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Galeorhinus galeus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Galeus spp | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Helicolenus dactylopterus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Hexanchus griseus | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Hippoglossus hippoglossus | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Hydrolagus mirabilis | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Labrus bergylta | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Lampetra fluviatilis | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Lepidorhombus whiffiagonis | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Leucoraja circularis | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Leucoraja fullonica | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Leucoraja naevus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Lophius budegassa | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Lophius piscatorius | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Molva macrophthalma | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Molva molva | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Mora moro | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Recovery in the Population Abundance of Sensitive Fish Species | Mustelus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Mustelus spp | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Petromyzon marinus | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Phycis blennoides | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Pollachius pollachius | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Raja brachyura | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Raja clavata | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Raja microocellata | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Raja montagui | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Raja undulata | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scophthalmus maximus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scophthalmus rhombus | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scorpaena scrofa | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scyliorhinus canicula | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scyliorhinus stellaris | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Scymnodon ringens | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Sebastes viviparus | Fish | 0.5 | Achieve/Fail | Celtic Seas, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Sparus aurata | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Synaphobranchus kaupii | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Torpedo marmorata | Fish | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Trachyrincus scabrus | Fish | 0.5 | Achieve/Fail | Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| Recovery in the Population Abundance of Sensitive Fish Species | Zoarces viviparus | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2020 - European Sturgeon | European sturgeon | Fish | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Angel shark | Angel shark | Fish | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Basking shark | Basking shark | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Status Assessment 2021 - Common skate | Common skate | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Leafscale gulper shark | Leafscale gulper shark | Fish | 0.5 | Achieve/Fail | Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Portuguese dogfish | Portuguese dogfish | Fish | 0.5 | Achieve/Fail | Arctic Waters, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Spotted ray | Spotted ray | Fish | 0.5 | Achieve/Fail | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Spurdog | Spurdog | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - Thornback ray | Thornback ray | Fish | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2021 - White skate | White skate | Fish | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Allis shad | Allis shad | Fish | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Atlantic salmon | Atlantic salmon | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - European eel | Euopean eel | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Sea lamprey | Sea lamprey | Fish | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast | North-east Atlantic | OSPAR QSR2023 |
| F/Fmsy | Axillary seabream | Fish | 1 | ratio | 25 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Blackspot seabream | Fish | 1 | ratio | 1, 3 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Bogue | Fish | 1 | ratio | 25 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Brushtooth lizardfish | Fish | 1 | ratio | 27 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Comber | Fish | 1 | ratio | 25 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Common cuttlefish | Fish | 1 | ratio | 17 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Common pandora | Fish | 1 | ratio | 25, 27 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Common sole | Fish | 1 | ratio | 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | European anchovy | Fish | 1 | ratio | 7, 9, 16, 17, 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | European hake | Fish | 1 | ratio | 1, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 17, 18, 26 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | European sprat | Fish | 1 | ratio | 29 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Horned octopus | Fish | 1 | ratio | 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Red mullet | Fish | 1 | ratio | 1, 6, 7, 9, 10, 12, 13, 14, 15, 16, 19, 20, 22, 25, 29 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Sand steerbras | Fish | 1 | ratio | 27 | Mediterranean Sea | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| F/Fmsy | Sardine | Fish | 1 | ratio | 3, 6, 7, 9, 16, 17, 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Surmullet | Fish | 1 | ratio | 5, 26 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Turbot | Fish | 1 | ratio | 29 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Axillary seabream | Fish | 1 | ratio | 25 | Eastern Mediterranean | JRC / STECF |
| F/Fmsy | Black-bellied anglerfish | Fish | 1 | ratio | 7, 8.a, 8.b, 8.d, 8.c, 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Blackspot seabream | Fish | 1 | ratio | 1, 3 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Blue ling | Fish | 1 | ratio | 5.b, 6, 7 | Widely | JRC / STECF |
| F/Fmsy | Blue whiting | Fish | 1 | ratio | 1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14 | Widely | JRC / STECF |
| F/Fmsy | Brill | Fish | 1 | ratio | 4, 3.a, 7.d, 7.e | Greater North Sea | JRC / STECF |
| F/Fmsy | Cod | Fish | 1 | ratio | 7.a, 7.e, 7.f, 7.g, 7.h, 7.i, 7.j, 7.k | Celtic Seas | JRC / STECF |
| F/Fmsy | Cod | Fish | 1 | ratio | 4, 6.a, 7.d, 20, 4, 6.a, 7.d, 20, 4, 6.a, 7.d, 20 | Greater North Sea | JRC / STECF |
| F/Fmsy | Common sole | Fish | 1 | ratio | 17 | Central Mediterranean | JRC / STECF |
| F/Fmsy | European anchovy | Fish | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | European anchovy | Fish | 1 | ratio | 16, 17, 18 | Central Mediterranean | JRC / STECF |
| F/Fmsy | European anchovy | Fish | 1 | ratio | 6, 7, 9 | Western Mediterranean | JRC / STECF |
| F/Fmsy | European hake | Fish | 1 | ratio | 12, 13, 14, 15, 16, 17, 18, 19, 20 | Central Mediterranean | JRC / STECF |
| F/Fmsy | European hake | Fish | 1 | ratio | 22 | Eastern Mediterranean | JRC / STECF |
| F/Fmsy | European hake | Fish | 1 | ratio | 1, 5, 6, 7, 8, 9, 10, 11 | Western Mediterranean | JRC / STECF |
| F/Fmsy | European pilchard | Fish | 1 | ratio | 16, 17, 18 | Central Mediterranean | JRC / STECF |
| F/Fmsy | European pilchard | Fish | 1 | ratio | 6, 7, 9 | Western Mediterranean | JRC / STECF |
| F/Fmsy | European sprat | Fish | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | Four-spot megrim | Fish | 1 | ratio | 8.c, 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Haddock | Fish | 1 | ratio | 7.a, 7.b, 7.c, 7.d, 7.e, 7.f, 7.g, 7.h, 7.i, 7.j, 7.k | Celtic Seas | JRC / STECF |
| F/Fmsy | Haddock | Fish | 1 | ratio | 4, 6.a, 20 | Greater North Sea | JRC / STECF |
| F/Fmsy | Hake | Fish | 1 | ratio | 8.c, 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Hake | Fish | 1 | ratio | 4, 6, 7, 3.a, 8.a, 8.b, 8.d | Widely | JRC / STECF |
| F/Fmsy | Herring | Fish | 1 | ratio | 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 28.1, 30, 31 | Baltic Sea | JRC / STECF |
| F/Fmsy | Herring | Fish | 1 | ratio | 7.a south of 52 30N, 7.g, 7.h, 7.j, 7.k, 7.a north of 52 30N | Celtic Seas | JRC / STECF |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| F/Fmsy | Herring | Fish | 1 | ratio | 4, 3.a, 7.d | Greater North Sea | JRC / STECF |
| F/Fmsy | Horse mackarel | Fish | 1 | ratio | 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Horse mackarel | Fish | 1 | ratio | 8, 2.a, 4.a, 5.b, 6.a, 7.a, 7.b, 7.c, 7.e, 7.f, 7.g, 7.h, 7.i, 7.j, 7.k | Widely | JRC / STECF |
| F/Fmsy | Mackerel | Fish | 1 | ratio | 1, 2, 3, 4, 5, 6, 7, 8, 14 | Widely | JRC / STECF |
| F/Fmsy | Megrim | Fish | 1 | ratio | 7.b, 7.c, 7.d, 7.e, 7.f, 7.g, 7.h, 7.i, 7.j, 7.k, 8.a, 8.b, 8.d, 8.c, 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Megrim | Fish | 1 | ratio | 4.a, 6.a, 6.b | Celtic Seas | JRC / STECF |
| F/Fmsy | Piked dog-fish | Fish | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | Plaice | Fish | 1 | ratio | 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 | Baltic Sea | JRC / STECF |
| F/Fmsy | Plaice | Fish | 1 | ratio | 7.a | Celtic Seas | JRC / STECF |
| F/Fmsy | Plaice | Fish | 1 | ratio | 4, 20, 7.d | Greater North Sea | JRC / STECF |
| F/Fmsy | Pollack | Fish | 1 | ratio | 6, 7 | Celtic Seas | JRC / STECF |
| F/Fmsy | Porbeagle | Fish | 1 | ratio | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14 | Widely | JRC / STECF |
| F/Fmsy | Red mullet | Fish | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | Red mullet | Fish | 1 | ratio | 15, 16, 17, 18, 19, 20 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Red mullet | Fish | 1 | ratio | 22, 25 | Eastern Mediterranean | JRC / STECF |
| F/Fmsy | Red mullet | Fish | 1 | ratio | 1, 10, 11.1, 11.2, 6, 7, 9 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Saithe | Fish | 1 | ratio | 4, 6, 3.a | Greater North Sea | JRC / STECF |
| F/Fmsy | Sole | Fish | 1 | ratio | 20, 21, 22, 24 | Baltic Sea | JRC / STECF |
| F/Fmsy | Sole | Fish | 1 | ratio | 8.a, 8.b | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Sole | Fish | 1 | ratio | 7.a, 7.e, 7.f, 7.g | Celtic Seas | JRC / STECF |
| F/Fmsy | Sole | Fish | 1 | ratio | 4, 7.d | Greater North Sea | JRC / STECF |
| F/Fmsy | Sprat | Fish | 1 | ratio | 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32 | Baltic Sea | JRC / STECF |
| F/Fmsy | Spurdog | Fish | 1 | ratio | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14 | Widely | JRC / STECF |
| F/Fmsy | Surmullet | Fish | 1 | ratio | 15, 16 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Surmullet | Fish | 1 | ratio | 5 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Turbot | Fish | 1 | ratio | 29, 29 | Black Sea | JRC / STECF |
| F/Fmsy | Turbot | Fish | 1 | ratio | 4 | Greater North Sea | JRC / STECF |
| F/Fmsy | Undulate ray | Fish | 1 | ratio | 7.d, 7.e | Celtic Seas | JRC / STECF |
| F/Fmsy | White anglerfish | Fish | 1 | ratio | 8.a, 8.b, 8.d, 8.c, 9.a | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Whiting | Fish | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | Whiting | Fish | 1 | ratio | 6.a, 7.a, 7.b, 7.c, 7.e, 7.f, 7.g, 7.h, 7.i, 7.j, 7.k | Celtic Seas | JRC / STECF |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| F/Fmsy | Whiting | Fish | 1 | ratio | 4, 7.d | Greater North Sea | JRC / STECF |
| F/Fmsy | Witch | Fish | 1 | ratio | 4, 3.a, 7.d | Greater North Sea | JRC / STECF |
| B/Bmsy | Blue shark | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| B/Bmsy | Blue shark | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| B/Bmsy | Porbeagle | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| B/Bmsy | Porbeagle | Fish | 1 | Ratio | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | ICCAT |
| B/Bmsy | Shortfin mako shark | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| B/Bmsy | Shortfin mako shark | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| B/Bmsy | Swordfish | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| B/Bmsy | Swordfish | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| F/Fmsy | Albacore | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Albacore | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| F/Fmsy | Atlantic bluefin tuna | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Atlantic bluefin tuna | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | ICCAT |
| F/Fmsy | Bigeye tuna | Fish | 1 | Ratio | Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | ICCAT |
| F/Fmsy | Blue shark | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Blue shark | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| F/Fmsy | Porbeagle | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Shortfin mako shark | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Shortfin mako shark | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| F/Fmsy | Swordfish | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| F/Fmsy | Swordfish | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| SSB/SSBmsy | Albacore | Fish | 1 | Ratio | Mediterranean Sea | Mediterranean Sea | ICCAT |
| SSB/SSBmsy | Albacore | Fish | 1 | Ratio | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Greater North Sea | North-east Atlantic | ICCAT |
| SSB/SSBmsy | Bigeye tuna | Fish | 1 | Ratio | Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | ICCAT |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Atlantic halibut | Atlantic halibut | Fish | 0.6 | index | Kyst nord for 62 grader nord, Barentshavet, Norskehavet | Norway | Nature Index of Norway |
| Atlantic redfish | Atlantic redfish | Fish | 0.6 | index | Norskehavet og Barentshavet | Norway | Nature Index of Norway |
| Atlantic salmon - coasts and rivers | Atlantic salmon | Fish | 0.6 | index | Østfold, Akershus, Buskerud, Vestfold, Telemark, Aust-Agder, Vest-Agder, Rogaland, Hordaland, Sogn og Fjordane, Møre og Romsdal, Sør-Trøndelag, Nord-Trøndelag, Nordland, Troms, Finnmark | Norway | Nature Index of Norway |
| Ballan wrasse | Ballan wrasse | Fish | 0.6 | index | Oslofjorden, Moss-Hvaler, Sandefjord-Holmestrand, Telemark, Vest-Agder, Aust-Agder, Akershus | Norway | Nature Index of Norway |
| Black goby | Black goby | Fish | 0.6 | index | Vestfold, Telemark, Aust-Agder, Vest-Agder | Norway | Nature Index of Norway |
| Blue whiting | Blue whiting | Fish | 0.6 | index | Norskehavet | Norway | Nature Index of Norway |
| Capelin | Capelin | Fish | 0.6 | index | Barentshavet | Norway | Nature Index of Norway |
| Cod - coastal populations | Cod | Fish | 0.6 | index | Nordland, Troms, Finnmark, Sør-Trøndelag, Nord-Trøndelag, Møre og Romsdal, Sogn og Fjordane, Rogaland, Hordaland | Norway | Nature Index of Norway |
| Cod - ocean populations | Cod | Fish | 0.6 | index | Barentshavet, Nordsjøen og Skagerrak | Norway | Nature Index of Norway |
| Corkwing wrasse | Corkwing wrasse | Fish | 0.6 | index | Akershus, Aust-Agder, Telemark, Vest-Agder, Vestfold, Østfold | Norway | Nature Index of Norway |
| Cusk | Cusk | Fish | 0.6 | index | Nordsjøen (hav og kyst), Norskehavet (hav og kyst), Barentshavet (hav og kyst), Skagerrak (hav og kyst), Nordsjøen (hav og kyst), Norskehavet (hav og kyst), Barentshavet (hav og kyst), Skagerrak (hav og kyst) | Norway | Nature Index of Norway |
| Deepwater redfish | Deepwater redfish | Fish | 0.6 | index | Norskehavet, Barentshavet | Norway | Nature Index of Norway |
| Eel | Eel | Fish | 0.6 | index | Østfold, Aust-Agder, Vestfold, Akershus, Telemark | Norway | Nature Index of Norway |
| Greenland halibut | Greenland halibut | Fish | 0.6 | index | Norskehavet, Barentshavet | Norway | Nature Index of Norway |
| Haddock | Haddock | Fish | 0.6 | index | Nordsjøen, Skagerak, Norskehavet, Barentshavet | Norway | Nature Index of Norway |
| Herring - ocean spawning populations | Herring | Fish | 0.6 | index | Norskehavet, Nordsjøen og Skagerrak | Norway | Nature Index of Norway |
| Ling | Ling | Fish | 0.6 | index | Norskehavet (hav og kyst), Nordsjøen (hav og kyst), Barentshavet (hav og kyst), Skagerrak (hav og kyst), Norskehavet (hav og kyst), Nordsjøen (hav og kyst), Barentshavet (hav og kyst), Skagerrak (hav og kyst) | Norway | Nature Index of Norway |
| Mackerel | Mackerel | Fish | 0.6 | index | Norskehavet, Skagerrak, Nordsjøen, Norskehavet, Skagerrak, Nordsjøen | Norway | Nature Index of Norway |
| Norway pout | Norway pout | Fish | 0.6 | index | Nordsjøen, Norskehavet, Skagerak | Norway | Nature Index of Norway |
| Saithe | Saithe | Fish | 0.6 | index | Norskehavet (hav og kyst) | Norway | Nature Index of Norway |
| Salmon in the ocean | Salmon | Fish | 0.6 | index | Norskehavet | Norway | Nature Index of Norway |
| Sandeel | Sandeel | Fish | 0.6 | index | Skagerrak, Nordsjøen | Norway | Nature Index of Norway |
| Young herring (1-2 years) | Herring | Fish | 0.6 | index | Barensthavet ungsild | Norway | Nature Index of Norway |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | BEVL17_15, BEVL17_42, BEVL17_43 | Belgium | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | BG2SE800R020, BG2DO700L017, BG2IU200R1005, BG2DO700L018, BG2IU200L007, BG2IU200L017 | Bulgaria | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | HRJKP007, HRJKP011, HRJKP020, HRJKP024, HRJKP013, HRJKP017, HRJKP022, HRJKP026, HRJKP029, HRJKP004, HRJKP021, HRJKP015, HRJKP016, HRJKP031, HRJKP005, HRJKP006, HRJKP023, HRJKP008, HRJKP009, HRJKP010, HRJKP025, HRJKP027, HRJKP032, HRJKP003, HRJKP012, HRJKP019, HRJKP001, HRJKP028, HRJKP014, HRJKP002, HRJKP018, HRJKP033, HRJKP030, HRP1_2-MIP, HRP1_3-RAP, HRP1_2-CEP, HRP2_3-CE, HRP2_3-KR, HRP2_3-LPP, HRP1_2-JA, HRP2_3-ZR, HRP2_2-MI, HRP2_2-RJP, HRP1_2-NEP, HRP2_2-DR, HRP2_2-NEP, HRP2_2-OM, HRP2_3-KRP, HRP2_3-NE, HRP1_2-DRP, HRP1_3-OM, HRP1_2-RJP, HRP1_2-ZR, HRP2_2-JAP, HRP2_3-RA, HRP2_2-ZR-B, HRP2_2-CE, HRP1_3-KR | Croatia | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | FRFT06, FRFT07, FRFT08, FRFT09, FRFT32, FRGT18, FRGT06, FRGT20, FRGT04, FRGT05, FRGT16, FRKT061, FRLT01, FRHT01, FRGT02, FRGT09, FRGT14, FRGT23, FRKT063, FRKT031, FRKT091, FRAT01, FRFT35, FRGT10, FRGT12, FRGT21, FRGT13, FRKT062, FRLT02, FRHT02, FRHT03, FRHT05, FRKT092, FRFT02, FRGT27, FRFT33, FRGT17, FRGT19, FRKT012, FRHT04, FRGT31, FRHT07, FRKT060, FRFT34, FRKT011, FRGT28, FRHT06, FRFT01, FRGT30, FRGT08 | France | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | DETW_DENI_T1-3990-01, DETW_DENI_T1-3000-01, DETW_DESH_T2-9500-01, DETW_DESH_T1-5000-01, DETW_DENI_T1-4000-01 | Germany | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | IEEA_010_0100, IEEA_060_0100, IEEA_130_0100, IEEA_150_0100, IENB_040_0200, IENW_030_0100, IENW_120_0100, IESE_080_0100, IESE_100_0100, IESE_100_0200, IESE_100_0250, IESE_100_0300, IESE_100_0400, IESE_100_0500, IESE_100_0550, IESE_100_0600, IESE_140_0100, IESH_040_0100, IESH_050_0100, IESH_060_0300, IESH_060_0800, IESH_060_0900, IESH_060_1100, IESW_080_0100, IESW_080_0300, IESW_090_0200, IESW_130_0100, IESW_190_0500, IESW_220_0100, IESW_230_0200, IEWE_160_0100, IEWE_310_0100, IEWE_460_0300, IESE_040_0100, IENW_040_0100, IENW_220_0300 | Ireland | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | IT12R12RMA_FOGLIANO_AT09, IT19TW001297, IT19TW011299, IT19TW01131301, IT19TW011315, IT19TW052302, IT19TW084266, IT19TW084267, IT19TW084268, IT19TW085269, IT19TW085305, IT19TW085306, IT19TW102296, ITR16-004AT08_1, ITR16-007AT08_2, ITR16-014AT08_3, ITR16-018AT08_4, ITR16-183AT04_1, ITR16-185AT03_1, ITR16-191AT09_1, ITR16-191AT09_2 | Italy | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | LT100201100, LT100201200 | Lithuania | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | NL81_2, NL89_WESTSDE_OWL, NL94_11, NL94_9, NL87_1 | Netherlands | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | PLTW20001WB1, PLTW20002WB4, PLTW20003WB5, PLTW20004WB6, PLTW20005WB7, PLTW60001WB2, PLTW60001WB3 | Poland | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | PT03DOU0366, PT01LIM0057, PT06SAD1207, PT04MON0685, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT09SJOT001, PT09SJOT003, PT03DOU0364, PT04VOU0552, PT06MIR1367, PT04LIS0704, PT04VOU0536, PT06MIR1374, PT06SAD1222, PT07GUA1603I, PT06SAD1219, PT05TEJ1100A, PT05TEJ1139A, PT07GUA1629I, PT08RDA1684A, PT09SJOT002, PT01MIN0018, PT04MON0682, PT02CAV0096, PT02CAV0102, PT05TEJ1075A1, PT07GUA1631, PT04VOU0550, PT06MIR1368, PT06SAD1217, PT04MON0688, PT06SAD1211, PT04VOU0514, PT03DOU0370, PT01MIN0023, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT02AVE0135, PT05TEJ1075A, PT08RDA1686 | Portugal | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | ES017MSPFES111T012010, ES017MSPFES111T014010, ES017MSPFES111T018010, ES017MSPFES111T028010, ES017MSPFES111T034010, ES017MSPFES111T042010, ES017MSPFES111T044010, ES017MSPFES111T046010, ES017MSPFES111T046020, ES017MSPFES111T048010, ES017MSPFES111T068010, ES017MSPFES111T068020, ES017MSPFES111T075010, ES018MSPFES085MAT000180, ES018MSPFES118MAT000100, ES018MSPFES145MAT000060, ES018MSPFES194MAT000050, ES018MSPFES145MAT000070, ES018MSPFES085MAT000200, ES018MSPFES234MAT000030, ES070MSPF002120001, ES018MSPFES244MAT000020, ES018MSPFES144MAT000080 | Spain | EEA WISE MARINE |
| QE1-4 - Fish | Coastal fish | Fish | 0.6 | EQR | UKGB510804505600, UKGB520503613602, UKGB530402609201, UKGB540805015500, UKGBNI5NW250030, UKSC200009, UKSC200089, UKSC200139, UKSC200329, UKSC200330, UKGB520503503800, UKGB520503613601, UKGB530905415403, UKGB531106708200, UKGB531207212100, UKSC200103, UKSC200138, UKSC200315, UKSC200332, UKSC200438, UKGB530603911403, UKGB531207112400, UKGBNI5NB010010, UKGBNI5NE100010, UKSC200022, UKSC200090, UKSC200143, UKSC200435, UKSC200436, UKSC200510, UKSC200512, UKGB510804605900, UKGB511006206900, UKGB530603911401, UKGBNI5NB030010, UKSC200003, UKSC200006, UKSC200014, UKSC200165, UKSC200323, UKSC200441, UKGB530402609203, UKGB530804906600, UKGB530905415402, UKGBNI5NW250040, UKSC200008, UKSC200104, UKSC200324, UKSC200333, UKSC200437, UKGB510202110000, UKGB520804415800, UKGB530402609202, UKGB531006114100, UKGB540704116000, UKSC200018, UKSC200073, UKSC200113, UKSC200129, UKSC200320, UKSC200327, UKSC200439, UKGB520704202800, UKGB520804814400, UKGB521006501200, UKGB530603911402, UKGB531207212200, UKSC200007, UKSC200033, UKSC200079, UKSC200328, UKSC200443, UKGB510302509900, UKSC200057, UKSC200316, UKSC200325, UKSC200440, UKSC200442, UKSC200515, UKGB530905415401, UKGB510402703400, UKGB511006115200, UKSC200137, UKSC200322, UKGB541006614800, UKSC200043 | United Kingdom | EEA WISE MARINE |
| Distribution of Baltic seals | Grey seal | Marine mammals | 0.5 | Achieve/Fail | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Distribution of Baltic seals | Harbour seal | Marine mammals | 0.5 | Achieve/Fail | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-010 | Baltic Sea | HELCOM HOLAS3 |
| Distribution of Baltic seals | Ringed seal | Marine mammals | 0.5 | Achieve/Fail | SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Harbour porpoise distribution | Harbour porpoise | Marine mammals | 0.5 | individuals | SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Grey seal | Marine mammals | 26 | individuals | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Harbour porpoise | Marine mammals | 0.1 | individuals | SEA-007, SEA-008, SEA-009, SEA-010, SEA-012, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Harbour porpoise | Marine mammals | 29 | individuals | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Harbour seal | Marine mammals | 0.1 | individuals | SEA-010 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Harbour seal | Marine mammals | 14 | individuals | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006 | Baltic Sea | HELCOM HOLAS3 |
| Number of drowned mammals and waterbirds in fishing gear | Ringed seal | Marine mammals | 0.1 | individuals | SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Number of drowned mammals and waterbirds in fishing gear | Ringed seal | Marine mammals | 10 | individuals | SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Nutritional status of seals - Grey seal | Grey seal | Marine mammals | 35 | mm | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of Harbour porpoise | Harbour porpoise | Marine mammals | 0.5 | trend | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of seals | Grey seal | Marine mammals | 107 | pop. growth | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of seals | Harbour seal | Marine mammals | 109 | pop. growth | SEA-001, SEA-002, SEA-003, SEA-004, SEA-005, SEA-006 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of seals | Harbour seal | Marine mammals | 10000 | individuals | SEA-007, SEA-010 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of seals | Ringed seal | Marine mammals | 0.5 | trend | SEA-011, SEA-012, SEA-013, SEA-014 | Baltic Sea | HELCOM HOLAS3 |
| Population trends and abundance of seals | Ringed seal | Marine mammals | 10000 | individuals | SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Reproductive status of seals | Grey seal | Marine mammals | 90 | % | SEA-002, SEA-003, SEA-004, SEA-005, SEA-006, SEA-007, SEA-008, SEA-009, SEA-010, SEA-011, SEA-012, SEA-013, SEA-014, SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| Reproductive status of seals | Ringed seal | Marine mammals | 90 | % | SEA-015, SEA-016, SEA-017 | Baltic Sea | HELCOM HOLAS3 |
| OSPAR M3 - Seal abundance and distribution | Halichoerus grypus | Marine mammals | 100 | % change | Scotland, England, Northern Ireland, Ireland, Scotland, England, Northern Ireland, Ireland, Wadden Sea, Dutch Delta and subset of France, Wadden Sea, Dutch Delta and subset of France | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M3 - Seal abundance and distribution | Phoca vitulina | Marine mammals | 100 | % change | Southwest Scotland, Southwest Scotland, West Scotland, West Scotland, Western Isles, Western Isles, North coast & Orkney, North coast & Orkney, Shetland, Shetland, Moray Firth , Moray Firth , East Scotland , East Scotland , North-east England , North-east England , Southeast England, Southeast England, Northern Ireland , Northern Ireland , Baie dAuthie, Baie de Somme & Baie des Veys , Baie dAuthie, Baie de Somme & Baie des Veys , Belgium Coast & Dutch Delta , Belgium Coast & Dutch Delta , Wadden Sea , Wadden Sea , Limfjord , Limfjord , Kattegat_Seal, Kattegat_Seal, Iceland_Seal abundance, Iceland Seal abundance, Skagerrak Seal, Skagerrak Seal | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M4 -Abundance and distribution of cetaceans | Balaenoptera acutorostrata | Marine mammals | 0.5 | Achieve/Fail | North-east Atlantic | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M4 -Abundance and distribution of cetaceans | Delphinus delphis | Marine mammals | 0.5 | Achieve/Fail | North-east Atlantic | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M4 -Abundance and distribution of cetaceans | Lagenorhynchus albirostris | Marine mammals | 0.5 | Achieve/Fail | North-east Atlantic | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M4 -Abundance and distribution of cetaceans | Phocoena phocoena | Marine mammals | 0.5 | Achieve/Fail | Greater North Sea, Iberian Peninsula, Irish and Celtic Seas, West Scotland & Ireland | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M4 -Abundance and distribution of cetaceans | Tursiops truncatus | Marine mammals | 0.5 | Achieve/Fail | Coastal East Scotland, Coastal Normandy & Brittany, Irish Sea & Coastal Wales, Shannon Estuary, West Coast of Ireland, North-east Atlantic | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M5 - Grey seal pup production | Halichoerus grypus | Marine mammals | 100 | % change | West Scotland, West Scotland, Western Isles, Western Isles, North coast & Orkney, North coast & Orkney, Moray Firth, Moray Firth, East Scotland, East Scotland, North-east England, North-east England, Southeast England, Southeast England, French North Sea & Channel Coast, French North Sea & Channel Coast, Belgium coast and Dutch Delta, Belgium coast and Dutch Delta, Wadden Sea, Wadden Sea, Iceland, Iceland | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| OSPAR M6 - Marine mammal bycatch | Delphinus delphis | Marine mammals | 985 | Individuals | North-east Atlantic | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Halichoerus grypus | Marine mammals | 3647 | Individuals | Celtic Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Halichoerus grypus | Marine mammals | 7171 | Individuals | North Sea | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Phocoena phocoena | Marine mammals | 0 | Individuals | Iberian Peninsula | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Phocoena phocoena | Marine mammals | 78 | Individuals | West Scotland and Ireland | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Phocoena phocoena | Marine mammals | 82 | Individuals | Irish and Celtic Seas | North-east Atlantic | OSPAR QSR2023 |
| OSPAR M6 - Marine mammal bycatch | Phocoena phocoena | Marine mammals | 1622 | Individuals | Greater North Sea | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2020 - Blue Whale | Blue Whale | Marine mammals | 0.5 | Achieve/Fail | Arctic Waters, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2020 - Bowhead Whale | Bowhead Whale | Marine mammals | 0.5 | Achieve/Fail | Arctic Waters | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2020 - North Atlantic Right Whale | North Atlantic Right Whale | Marine mammals | 0.5 | Achieve/Fail | Arctic Waters, Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Population abundance | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | MADR | Croatia | MedQSR2023 |
| Population abundance | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | LEVS | Cyprus | MedQSR2023 |
| Population abundance | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | IONS, AEGS, LEVS | Greece | MedQSR2023 |
| Population abundance | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | NWMS, TYRS, NADR, MADR, SADR, IONS | Italy | MedQSR2023 |
| Population abundance | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | AEGS, LEVS | Turkey | MedQSR2023 |
| Population demographic characteristics | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | MADR | Croatia | MedQSR2023 |
| Population demographic characteristics | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | LEVS | Cyprus | MedQSR2023 |
| Population demographic characteristics | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | IONS, AEGS, LEVS | Greece | MedQSR2023 |
| Population demographic characteristics | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | NWMS, TYRS, NADR, MADR, SADR, IONS | Italy | MedQSR2023 |
| Population demographic characteristics | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | AEGS, LEVS | Turkey | MedQSR2023 |
| Species distributional range | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | MADR | Croatia | MedQSR2023 |
| Species distributional range | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | LEVS | Cyprus | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Species distributional range | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | IONS, AEGS, LEVS | Greece | MedQSR2023 |
| Species distributional range | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | NWMS, TYRS, NADR, MADR, SADR, IONS | Italy | MedQSR2023 |
| Species distributional range | Mediterranean monk seal | Marine mammals | 0.5 | Achieve/Fail | AEGS, LEVS | Turkey | MedQSR2023 |
| Grey seal | Grey seal | Marine mammals | 0.6 | index | Trøndelag, Nordland | Norway | Nature Index of Norway |
| Harbor seal | Harbour seal | Marine mammals | 0.6 | index | Østfold, Vestfold, Telemark, Aust-Agder, Rogaland, Sogn og Fjordane, Møre og Romsdal | Norway | Nature Index of Norway |
| Harp seal | Harp seal | Marine mammals | 0.6 | index | Barentshavet | Norway | Nature Index of Norway |
| Minke whale | Minke whale | Marine mammals | 0.6 | index | Barentshavet, Nordsjøen, Norskehavet | Norway | Nature Index of Norway |
| Otter, coastal population | Otter | Marine mammals | 0.6 | index | Moss, Fredrikstad, Hvaler, Råde, Rygge, Vestby, Røyken, Hurum, Horten, Tønsberg, Sandefjord, Larvik, Svelvik, Sande (Vestfold), Re, Stokke, Nøtterøy, Tjøme, Porsgrunn, Bamble, Kragerø, Risør, Grimstad, Tvedestrand, Lillesand, Kristiansand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Eigersund, Haugesund, Sokndal, Hå, Klepp, Sola, Bokn, Tysvær, Karmøy, Utsira, Vindafjord, Sveio, Stord, Fitjar, Tysnes, Kvinnherad, Fusa, Os (Hordaland), Sund, Fjell, Meland, Radøy, Bergen, Bømlo, Austevoll, Austrheim, Fedje, Flora, Gulen, Solund, Hyllestad, Fjaler, Bremanger, Selje, Kristiansund, Sande (Møre og Romsdal), Herøy (Møre og Romsdal), Ulstein, Giske, Haram, Sandøy, Fræna, Eide, Averøy, Smøla, Hemne, Snillfjord, Hitra, Frøya, Rissa, Bjugn, Roan, Osen, Namsos, Fosnes, Flatanger, Vikna, Nærøy, Leka, Bodø, Bindal, Sømna, Brønnøy, Vega, Herøy (Nordland), Dønna, Lurøy, Træna, Rødøy, Meløy, Gildeskål, Steigen, Hamarøy, Tysfjord, Lødingen, Tjeldsund, Evenes, Ballangen, Røst, Værøy, Flakstad, Vestvågøy, Vågan, Hadsel, Bø (Nordland), Sortland, Moskenes, Harstad, Tromsø, Kvæfjord, Tranøy, Torsken, Berg, Lenvik, Karlsøy, Lyngen, Skjervøy, Kvænangen, Vardø, Vadsø, Hammerfest, Loppa, Hasvik, Kvalsund, Måsøy, Porsanger Porsángu Porsanki, Lebesby, Gamvik, Berlevåg, Deatnu Tana, Unjargga Nesseby, Båtsfjord, Sør-Varanger, Trondheim, Agdenes, Alstahaug, Alta, Andøy, Arendal, Asker, Askvoll, Halden, Sarpsborg, Ås, Frogn, Drammen, Stavanger, Strand, Hjelmeland, Suldal, Sauda, Askøy, Øygarden, Vågsøy, Aukra, Aure, Ørland, Åfjord, Øksnes, Aurland, Balestrand, Nordkapp, Beiarn, Bærum, Dyrøy, Eidfjord, Etne, Fauske, Forsand, Frosta, Førde, Gáivuotna Kåfjord, Gaular, Gjemnes, Gjesdal, Gloppen, Granvin, Gratangen, Halsa, Hareid, Hemnes, Holmestrand, Høyanger, Høylandet, Ibestad, Jondal, Kvam, Kvinesdal, Lavangen, Leikanger, Leirfjord, Leksvik, Levanger, Lier, Lindås, Luster, Lærdal, Malvik, Masfjorden, Melhus, Midsund, Modalen, Molde, Målselv, Namdalseid, Narvik, Naustdal, Nesna, Nesodden, Nesset, Norddal, Nordreisa, Odda, Oppegård, Orkdal, Oslo, Osterøy, Overhalla, Rana, Randaberg, Rauma, Rennesøy, Salangen, Saltdal, Samnanger, Sandnes, Skaun, Skien, Skodje, Skånland, Sogndal, Steinkjer, Stjørdal, Stordal, Storfjord, Stranda, Stryn, Sula, Sunndal, Surnadal, Sykkylven, Sørfold, Sørreisa, Tingvoll, Ullensvang, Ulvik, Vaksdal, Vanylven, Vefsn, Verdal, Verran, Vevelstad, Vik, Volda, Voss, Ørskog, Ørsta, Ålesund, Årdal, Balsfjord, Eid, Vestnes, Inderøy, Finnøy, Kvitsøy | Norway | Nature Index of Norway |
| Status Assessment 2022 - Leatherback turtle | Leatherback turtle | Reptiles | 0.5 | Achieve/Fail | Greater North Sea, Celtic Seas, Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Status Assessment 2022 - Loggerhead turtle | Loggerhead turtle | Reptiles | 0.5 | Achieve/Fail | Bay of Biscay and Iberian Coast, Wider Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Population abundance | Loggerhead and green turtle | Reptiles | 0.5 | Achieve/Fail | NWMS, ALBS, TYRS, SWMS, ADRS, CENT, IONS, AEGS, LEVS | Mediterranean Sea | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Population demographic characteristics | Loggerhead and green turtle | Reptiles | 0.5 | Achieve/Fail | NWMS, ALBS, TYRS, SWMS, ADRS, CENT, IONS, AEGS, LEVS | Mediterranean Sea | MedQSR2023 |
| Population distribution | Loggerhead and green turtle | Reptiles | 0.5 | Achieve/Fail | NWMS, ALBS, TYRS, SWMS, ADRS, CENT, IONS, AEGS, LEVS | Mediterranean Sea | MedQSR2023 |
| Oxygen debt | Oxygen | Benthic habitats | 0.6 | EQR | SEA-007A - Opensea, SEA-008 - Opensea, SEA-009 - Opensea, SEA-010 - Opensea, SEA-012 - Opensea, SEA-013A - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Secchi Depth | Macrophyte proxy | Benthic habitats | 0.6 | EQR | GER-001, GER-002, GER-003, GER-004, GER-005, GER-006, GER-007, GER-008, GER-009, GER-010, GER-011, GER-012, GER-013, GER-014, GER-015, GER-016, GER-017, GER-018, GER-019, GER-020, GER-021, GER-022, GER-023, GER-024, GER-025, GER-026A, GER-026B, GER-027, GER-028, GER-029, GER-030, GER-031, GER-032, GER-033, GER-034, GER-035, GER-036A, GER-036B, GER-037, GER-038A, GER-038B, GER-039, GER-040, GER-041, GER-042, GER-043, GER-044, GER-111, DEN-001, DEN-002, DEN-006, DEN-016, DEN-017, DEN-018, DEN-024, DEN-025, DEN-028, DEN-029, DEN-034, DEN-035, DEN-036, DEN-037, DEN-044, DEN-046, DEN-047, DEN-048, DEN-049, DEN-059, DEN-062, DEN-068, DEN-072, DEN-074, DEN-080, DEN-082, DEN-083, DEN-084, DEN-085, DEN-086, DEN-087, DEN-089, DEN-090, DEN-092, DEN-093, DEN-101, DEN-102, DEN-103, DEN-105, DEN-108, DEN-109, DEN-110, DEN-113, DEN-114, DEN-123, DEN-124, DEN-125, DEN-128, DEN-137, DEN-138, DEN-140, DEN-141, DEN-142, DEN-144, DEN-145, DEN-146, DEN-147, DEN-157, DEN-158, DEN-159, DEN-160, DEN-165, DEN-200, DEN-201, DEN-204, DEN-205, DEN-206, DEN-207, DEN-209, DEN-212, DEN-214, DEN-216, DEN-217, DEN-219, DEN-222, DEN-224, DEN-231, DEN-232, DEN-233, DEN-234, DEN-235, DEN-236, DEN-238, EST-001, EST-002, EST-003, EST-005, EST-006, EST-007, EST-008, EST-010, EST-011, EST-013, EST-014, EST-016, EST-019, FIN-001, FIN-002, FIN-003, FIN-004, FIN-005, FIN-006, FIN-007, FIN-008, FIN-009, FIN-010, FIN-011, FIN-012, FIN-013, FIN-014, POL-001, POL-002, POL-003, POL-004, POL-005, POL-006, POL-007, POL-008, POL-009, POL-010, POL-011, POL-012, POL-013, POL-014, POL-015, POL-016, POL-017, POL-018, POL-019, SWE-001, SWE-003, SWE-004, SWE-005, SWE-006, SWE-009, SWE-010, SWE-011, SWE-012, SWE-013, SWE-014, SWE-016, SWE-017, SWE-018 | Baltic Sea | HELCOM HOLAS3 |
| Shallow-water oxygen | Oxygen | Benthic habitats | 0.6 | EQR | SEA-001 - Opensea, SEA-002 - Opensea, SEA-003 - Opensea, SEA-004 - Opensea, SEA-005 - Opensea, SEA-006 - Opensea, SEA-007B - Opensea, SEA-011 - Opensea, SEA-013B - Opensea, SEA-015 - Opensea, SEA-016 - Opensea, SEA-017 – Opensea | Baltic Sea | HELCOM HOLAS3 |
| State of the soft-bottom macrofauna community | Macrozoobenthos | Benthic habitats | 0.5 | index | SEA-004 - Opensea, SEA-005 - Opensea, SEA-009 - Opensea, SEA-011 - Opensea, SEA-013 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| State of the soft-bottom macrofauna community | Macrozoobenthos | Benthic habitats | 1.5 | index | SEA-016 - Open sea, SEA-017 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| State of the soft-bottom macrofauna community | Macrozoobenthos | Benthic habitats | 4 | index | SEA-010 - Opensea, SEA-012 - Opensea, SEA-014 - Opensea, SEA-015 – Opensea | Baltic Sea | HELCOM HOLAS3 |
| Concentrations of Dissolved Oxygen Near the Seafloor | Dissolved oxygen (O2) | Benthic habitats | 6 | mg/l | Adour plume, Atlantic Seasonally Stratified, Atlantic, Channel coastal shelf tidal influenced, Coastal FR channel, Coastal IRL 3, Coastal NOR 3, Outer Coastal DEDK, Coastal UK 1, Coastal UK channel, Coastal Waters BC (D5), Channel well mixed, Channel well mixed tidal influenced, Dogger Bank, East Coast (permanently mixed) 2, Elbe plume, Ems plume, Eastern North Sea, German Bight central, Gulf of Biscay coastal waters, Gulf of Biscay shelf waters, Gironde plume, Humber plume, Irish Sea, Intermittently Stratified 1, Intermittently Stratified 2, Kattegat Coastal, Kattegat Deep, Liverpool Bay plume, Meuse plume, Noratlantic Area NOR-NorC2(D5), Noratlantic Area NOR-NorC3(D5), Northern North Sea, Norwegian Trench, Rhine plume, Scheldt plume 1, Scheldt plume 2, Skagerak, Southern North Sea, Seine plume, Scottish Sea, Thames plume | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Circalittoral coarse sediment | Benthic habitats | 0.8 | index | Central North Sea | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Condition of Benthic Habitat Communities: Margalef diversity | Circalittoral coarse sediment | Benthic habitats | 0.8 | index | Southern North Sea, Channel, Kattegat | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Circalittoral mixed sediment | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Circalittoral mud | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Circalittoral sand | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel, Kattegat | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Infralittoral coarse sediment | Benthic habitats | 0.8 | index | Southern North Sea, Channel, Kattegat | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Infralittoral mixed sediment | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Infralittoral mud | Benthic habitats | 0.8 | index | Southern North Sea, Channel, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Infralittoral sand | Benthic habitats | 0.8 | index | Central North Sea | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Infralittoral sand | Benthic habitats | 0.8 | index | Southern North Sea, Channel, Kattegat | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Offshore circalittoral coarse sediment | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Offshore circalittoral mixed sediment | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Offshore circalittoral mud | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Kattegat, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Offshore circalittoral sand | Benthic habitats | 0.8 | index | Central North Sea, Southern North Sea, Channel, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Condition of Benthic Habitat Communities: Margalef diversity | Upper bathyal sediment | Benthic habitats | 0.8 | index | Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| F/Fmsy | Blue and red shrimp | Benthic habitats | 1 | ratio | 1, 2, 5, 6, 9, 10, 11 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Caramote prawn | Benthic habitats | 1 | ratio | 17 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Deep-water rose shrimp | Benthic habitats | 1 | ratio | 1, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, 15, 16, 19, 17, 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Giant red shrimp | Benthic habitats | 1 | ratio | 9, 10, 11, 19, 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Great Mediterranean scallop | Benthic habitats | 1 | ratio | 17 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | 5, 6, 9, 17, 18 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Peregrine shrimp | Benthic habitats | 1 | ratio | 26 | Mediterranean Sea | MedQSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| F/Fmsy | Purple dye murex | Benthic habitats | 1 | ratio | 17 | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Spottail mantis shrimp | Benthic habitats | 1 | ratio | 19, 17, 18 | Mediterranean Sea | MedQSR2023 |
| Overall extent of pressures | Pressure extent | Benthic habitats | 25 | % | MAD-1 north, MAD-1 north, MAD-2 central, MAD-2 central, MAD-2 central, MAD-3 south, MAD-3 south, MAD-3 south, MAD-3 south, MAD-3 south | Mediterranean Sea | MedQSR2023 |
| F/Fmsy | Blue and red shrimp | Benthic habitats | 1 | ratio | 18, 19, 20 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Blue and red shrimp | Benthic habitats | 1 | ratio | 1, 2, 5, 6, 7, 9, 10, 11.1, 11.2 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Deep-water rose shrimp | Benthic habitats | 1 | ratio | 12, 13, 14, 15, 16, 17, 18, 19, 20 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Deep-water rose shrimp | Benthic habitats | 1 | ratio | 1, 5, 6, 7, 8, 9, 10, 11 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Giant red shrimp | Benthic habitats | 1 | ratio | 12, 13, 14, 15, 16, 18, 19, 20 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Giant red shrimp | Benthic habitats | 1 | ratio | 8, 9, 10, 11 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Northern shrimp | Benthic habitats | 1 | ratio | 3.a, 4.a | Greater North Sea | JRC / STECF |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | fu 23, fu 24, fu 25, fu 26, fu 27, fu 31 | Bay of Biscay & Iberia | JRC / STECF |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | fu 11, fu 12, fu 13, fu 14, fu 15, fu 16, fu 17, fu 19, fus 20, fus 21, fu 22 | Celtic Seas | JRC / STECF |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | 15, 16, 17, 18 | Central Mediterranean | JRC / STECF |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | fus 3, fus 4, fu 6, fu 7, fu 8, fu 9 | Greater North Sea | JRC / STECF |
| F/Fmsy | Norway lobster | Benthic habitats | 1 | ratio | 5, 6, 9 | Western Mediterranean | JRC / STECF |
| F/Fmsy | Papa whelk | Benthic habitats | 1 | ratio | 29 | Black Sea | JRC / STECF |
| F/Fmsy | Spottail mantis shrimp | Benthic habitats | 1 | ratio | 17 | Central Mediterranean | JRC / STECF |
| Edible crab | Edible crab | Benthic habitats | 0.6 | index | Rogaland, Sørtrøndelag og Møre og Romsdal, Nordtrøndelag og Helgeland, Vesterålen | Norway | Nature Index of Norway |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Hard seabed vegetation algal index | Macrovegetation | Benthic habitats | 0.6 | index | Alta, Tromsø, Giske, Halden, Moss, Sarpsborg, Fredrikstad, Hvaler, Råde, Rygge, Vestby, Ås, Frogn, Nesodden, Oppegård, Bærum, Asker, Oslo, Røyken, Hurum, Horten, Holmestrand, Tønsberg, Sandefjord, Larvik, Svelvik, Sande (V.), Re, Stokke, Nøtterøy, Tjøme, Porsgrunn, Bamble, Kragerø, Risør, Grimstad, Arendal, Tvedestrand, Lillesand, Kristiansand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Kvinesdal, Eigersund, Haugesund, Sokndal, Suldal, Sauda, Karmøy, Utsira, Vindafjord, Etne, Sveio, Bømlo, Stord, Fitjar, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Kvam, Fusa, Samnanger, Austevoll, Fjell, Askøy, Vaksdal, Osterøy, Meland, Øygarden, Radøy, Lindås, Austrheim, Fedje, Masfjorden, Flora, Gulen, Solund, Hyllestad, Aurland, Lærdal, Årdal, Luster, Askvoll, Fjaler, Gaular, Førde, Naustdal, Bremanger, Vågsøy, Selje, Eid, Gloppen, Stryn, Kristiansund, Vanylven, Sande (M.R.), Herøy (M.R.), Ulstein, Hareid, Volda, Ørsta, Ørskog, Norddal, Stranda, Stordal, Sykkylven, Skodje, Haram, Rauma, Nesset, Midsund, Sandøy, Aukra, Fræna, Eide, Averøy, Surnadal, Halsa, Smøla, Aure, Hemne, Snillfjord, Hitra, Frøya, Ørland, Agdenes, Rissa, Bjugn, Åfjord, Roan, Osen, Orkdal, Skaun, Steinkjer, Levanger, Verdal, Verran, Namdalseid, Bodø, Bindal, Sømna, Brønnøy, Vega, Vevelstad, Herøy (N.), Alstahaug, Leirfjord, Vefsn, Dønna, Lurøy, Træna, Gildeskål, Beiarn, Saltdal, Fauske, Røst, Værøy, Hadsel, Bø (N.), Øksnes, Sortland, Andøy, Moskenes, Harstad, Kvæfjord, Skånland, Bjarkøy, Ibestad, Gratangen, Lavangen, Salangen, Målselv, Sørreisa, Dyrøy, Tranøy, Torsken, Berg, Lenvik, Balsfjord, Karlsøy, Lyngen, Storfjord, Gáivuotna–Kåfjord, Skjervøy, Nordreisa, Kvænangen, Vardø, Vadsø, Kvalsund, Nordkapp, Porsángu–Porsanger, Lebesby, Gamvik, Berlevåg, Deatnu–Tana, Unjárga–Nesseby, Båtsfjord, Sør-Varanger | Norway | Nature Index of Norway |
| Hard seabed vegetation lower growing limit | Macrovegetation | Benthic habitats | 0.6 | index | Rennesøy, Stavanger, Sola, Sandnes, Eigersund, Sokndal, Flekkefjord, Farsund, Lyngdal, Lindesnes, Mandal, Søgne, Kristiansand, Lillesand, Grimstad, Arendal, Tvedestrand, Risør, Kragerø, Porsgrunn, Larvik, Sandefjord, Stokke, Tjøme, Nøtterøy, Tønsberg, Horten, Moss, Rygge, Fredrikstad, Hvaler, Råde, Nesodden, Bærum, Oslo, Hurum, Bamble, Halden, Sarpsborg, Vestby, Ås, Frogn, Oppegård, Asker, Røyken, Holmestrand, Svelvik, Sande (V.), Re, Haugesund, Sveio, Gjesdal, Randaberg, Forsand, Strand, Hjelmeland, Suldal, Finnøy, Bokn, Tysvær, Karmøy, Vindafjord, Etne, Bømlo, Stord, Fitjar, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Kvam, Fusa, Samnanger, Os (Hord.), Austevoll | Norway | Nature Index of Norway |
| Laminaria hyperborea | Laminaria hyperborea | Benthic habitats | 0.6 | index | Vadsø, Alta, Porsanger, Tana, Røst, Værøy, Flakstad, Bø, Andøy, Moskenes, Tromsø, Berg, Berlevåg, Båtsfjord, Skjervøy, Vardø, Kvalsund, Måsøy, Lebesby, Vestvågøy, Vågan, Hadsel, Øksnes, Torsken, Lenvik, Karlsøy, Hammerfest, Loppa, Hasvik, Nordkapp, Gamvik, Steigen, Sør-Varanger, Sørreisa, Nesseby, Nordreisa, Sørfold, Hamarøy, Tysfjord, Tjeldsund, Harstad, Kvæfjord, Bjarkøy, Ibestad, Tranøy, Lyngen, Kvænangen, Lødingen, Ballangen, Sortland, Sømna, Alstahaug, Åfjord, Roan, Osen, Namsos, Flatanger, Vikna, Fosnes, Nærøy, Hitra, Frøya, Ørland, Bjugn, Vestlandet (55 kommuner), Sørlandet (19 kommuner), Leka, Meløy, Dønna, Træna, Bindal, Brønnøy, Vega, Herøy, Rødøy, Lurøy, Gildeskål, Bodø, Nesna, Vevelstad | Norway | Nature Index of Norway |
| Lobster | Lobster | Benthic habitats | 0.6 | index | Østfold, Vestfold, Telemark, Aust-Agder, Vest-Agder, Rogaland, Hordaland, Møre og Romsdal | Norway | Nature Index of Norway |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Mussel | Mussel | Benthic habitats | 0.6 | index | Vardø, Harstad, Oslo, Vestby, Røyken, Horten, Tjøme, Kragerø, Kristiansand, Bømlo, Etne, Halden, Rygge, Karmøy, Suldal, Bergen, Flora, Kristiansund, Nesset, Hitra, Trondheim, Flatanger, Vefsn, Porsgrunn, Sarpsborg, Fredrikstad, Hvaler, Moss, Råde, Ås, Frogn, Nesodden, Oppegård, Bærum, Asker, Hurum, Holmestrand, Tønsberg, Sandefjord, Larvik, Svelvik, Sande (V.), Re, Stokke, Nøtterøy, Bamble, Risør, Grimstad, Arendal, Tvedestrand, Lillesand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Eigersund, Sandnes, Stavanger, Sokndal, Haugesund, Hå, Klepp, Gjesdal, Sola, Randaberg, Forsand, Strand, Hjelmeland, Finnøy, Rennesøy, Kvitsøy, Bokn, Tysvær, Utsira, Vindafjord, Sveio, Stord, Fitjar, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Kvam, Fusa, Samnanger, Os (Hord.), Austevoll, Sund, Fjell, Askøy, Osterøy, Meland, Øygarden, Radøy, Lindås, Austrheim, Fedje, Masfjorden, Gulen, Solund, Hyllestad, Høyanger, Vik, Balestrand, Leikanger, Sogndal, Lærdal, Årdal, Luster, Askvoll, Bremanger, Vågsøy, Selje, Molde, Ålesund, Vanylven, Sande (M.R.), Herøy (M.R.), Ulstein, Hareid, Volda, Ørsta, Ørskog, Norddal, Stranda, Stordal, Sykkylven, Skodje, Sula, Giske, Haram, Vestnes, Rauma, Midsund, Sandøy, Aukra, Fræna, Eide, Averøy, Gjemnes, Tingvoll, Sunndal, Surnadal, Halsa, Smøla, Aure, Hemne, Snillfjord, Frøya, Ørland, Agdenes, Rissa, Bjugn, Åfjord, Roan, Osen, Orkdal, Skaun, Malvik, Steinkjer, Namsos, Stjørdal, Frosta, Leksvik, Levanger, Verdal, Verran, Namdalseid, Fosnes, Vikna, Nærøy, Leka, Bodø, Narvik, Bindal, Sømna, Brønnøy, Vega, Vevelstad, Herøy (N.), Alstahaug, Leirfjord, Dønna, Nesna, Rana, Lurøy, Træna, Rødøy, Meløy, Gildeskål, Saltdal, Fauske, Sørfold, Steigen, Hamarøy, Tysfjord, Lødingen, Tjeldsund, Evenes, Ballangen, Røst, Værøy, Flakstad, Vestvågøy, Vågan, Hadsel, Bø (N.), Øksnes, Sortland, Andøy, Moskenes, Tromsø, Kvæfjord, Skånland, Bjarkøy, Ibestad, Gratangen, Lavangen, Salangen, Målselv, Sørreisa, Dyrøy, Tranøy, Torsken, Berg, Lenvik, Balsfjord, Karlsøy, Lyngen, Storfjord, Gáivuotna–Kåfjord, Skjervøy, Nordreisa, Kvænangen, Vadsø, Hammerfest, Alta, Loppa, Hasvik, Kvalsund, Måsøy, Nordkapp, Porsángu–Porsanger, Lebesby, Gamvik, Berlevåg, Deatnu-Tana, Båtsfjord, Unjárga–Nesseby, Sør-Varanger | Norway | Nature Index of Norway |
| Sea belt | Sea belt | Benthic habitats | 0.6 | index | Vadsø, Alta, Porsanger, Tana, Skjervøy, Vardø, Kvalsund, Måsøy, Lebesby, Vestvågøy, Vågan, Hadsel, Øksnes, Torsken, Lenvik, Karlsøy, Hammerfest, Loppa, Hasvik, Nordkapp, Gamvik, Steigen, Sør-Varanger, Sørreisa, Nesseby, Nordreisa, Sørfold, Hamarøy, Tysfjord, Tjeldsund, Harstad, Kvæfjord, Bjarkøy, Ibestad, Tranøy, Lyngen, Kvænangen, Lødingen, Ballangen, Sortland, Sømna, Alstahaug, Åfjord, Roan, Osen, Namsos, Flatanger, Vikna, Fosnes, Nærøy, Hitra, Frøya, Ørland, Bjugn, Vestlandet (55 kommuner), Sørlandet (19 kommuner), Leka, Meløy, Dønna, Træna, Bindal, Brønnøy, Vega, Herøy, Rødøy, Lurøy, Gildeskål, Bodø, Nesna, Vevelstad | Norway | Nature Index of Norway |
| Shrimps in the ocean | Shrimp | Benthic habitats | 0.6 | index | Skagerrak, Nordsjøen | Norway | Nature Index of Norway |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Soft seabed eutrophication index | Macrozoobenthos | Benthic habitats | 0.6 | index | Halden, Sarpsborg, Moss, Fredrikstad, Hvaler, Råde, Rygge, Vestby, Frogn, Nesodden, Oppegård, Bærum, Asker, Oslo, Drammen, Lier, Røyken, Hurum, Horten, Holmestrand, Tønsberg, Sandefjord, Larvik, Svelvik, Sande (V.), Re, Stokke, Nøtterøy, Tjøme, Porsgrunn, Skien, Bamble, Kragerø, Risør, Grimstad, Arendal, Tvedestrand, Lillesand, Kristiansand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Kvinesdal, Eigersund, Sandnes, Stavanger, Haugesund, Sokndal, Hå, Klepp, Gjesdal, Sola, Randaberg, Forsand, Strand, Hjelmeland, Suldal, Sauda, Finnøy, Rennesøy, Kvitsøy, Bokn, Tysvær, Karmøy, Utsira, Vindafjord, Bergen, Etne, Sveio, Bømlo, Stord, Fitjar, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Kvam, Fusa, Samnanger, Os (Hord.), Austevoll, Sund, Fjell, Askøy, Vaksdal, Osterøy, Meland, Øygarden, Radøy, Lindås, Austrheim, Fedje, Masfjorden, Flora, Gulen, Solund, Hyllestad, Høyanger, Vik, Balestrand, Leikanger, Sogndal, Aurland, Lærdal, Årdal, Luster, Askvoll, Fjaler, Gaular, Førde, Naustdal, Bremanger, Vågsøy, Selje, Eid, Gloppen, Stryn, Molde, Ålesund, Kristiansund, Vanylven, Sande (M.R.), Herøy (M.R.), Ulstein, Hareid, Volda, Ørsta, Ørskog, Norddal, Stranda, Stordal, Sykkylven, Skodje, Sula, Giske, Haram, Vestnes, Rauma, Nesset, Midsund, Sandøy, Aukra, Frænа, Eide, Averøy, Gjemnes, Tingvoll, Sunndal, Surnadal, Halsa, Smøla, Aure, Trondheim, Hemne, Snillfjord, Hitra, Frøya, Ørland, Agdenes, Rissa, Bjugn, Åfjord, Roan, Osen, Orkdal, Melhus, Skaun, Malvik, Steinkjer, Namsos, Stjørdal, Frosta, Leksvik, Levanger, Verdal, Verran, Namdalseid, Fosnes, Flatanger, Vikna, Nærøy, Leka, Bodø, Narvik, Bindal, Sømna, Brønnøy, Vega, Vevelstad, Herøy (N.), Alstahaug, Leirfjord, Vefsn, Dønna, Nesna, Hemnes, Rana, Lurøy, Træna, Rødøy, Meløy, Gildeskål, Saltdal, Fauske, Sørfold, Steigen, Hamarøy, Tysfjord, Lødingen, Tjeldsund, Evenes, Ballangen, Røst, Værøy, Flakstad, Vestvågøy, Vågan, Hadsel, Bø (N.), Øksnes, Sortland, Andøy, Moskenes, Harstad, Tromsø, Kvæfjord, Skånland, Bjarkøy, Ibestad, Gratangen, Lavangen, Salangen, Målselv, Sørreisa, Dyrøy, Tranøy, Torsken, Berg, Lenvik, Balsfjord, Karlsøy, Lyngen, Storfjord, Gáivuotna Kåfjord, Skjervøy, Nordreisa, Kvænangen, Vardø, Vadsø, Hammerfest, Alta, Loppa, Hasvik, Kvalsund, Måsøy, Nordkapp, Lebesby, Gamvik, Berlevåg, Deatnu Tana, Båtsfjord, Sør-Varanger, Ås, Overhalla | Norway | Nature Index of Norway |
| Soft seabed faunal diversity coast | Macrozoobenthos | Benthic habitats | 0.6 | index | Halden, Sarpsborg, Moss, Fredrikstad, Hvaler, Råde, Rygge, Vestby, Frogn, Nesodden, Oppegård, Bærum, Asker, Oslo, Drammen, Lier, Røyken, Hurum, Horten, Holmestrand, Tønsberg, Sandefjord, Larvik, Svelvik, Sande (V.), Re, Stokke, Nøtterøy, Tjøme, Porsgrunn, Skien, Bamble, Kragerø, Risør, Grimstad, Arendal, Tvedestrand, Lillesand, Kristiansand, Mandal, Farsund, Flekkefjord, Søgne, Lindesnes, Lyngdal, Kvinesdal, Eigersund, Sandnes, Stavanger, Haugesund, Sokndal, Hå, Klepp, Gjesdal, Sola, Randaberg, Forsand, Strand, Hjelmeland, Suldal, Sauda, Finnøy, Rennesøy, Kvitsøy, Bokn, Tysvær, Karmøy, Utsira, Vindafjord, Bergen, Etne, Sveio, Bømlo, Stord, Fitjar, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Kvam, Fusa, Samnanger, Os (Hord.), Austevoll, Sund, Fjell, Askøy, Vaksdal, Osterøy, Meland, Øygarden, Radøy, Lindås, Austrheim, Fedje, Masfjorden, Flora, Gulen, Solund, Hyllestad, Høyanger, Vik, Balestrand, Leikanger, Sogndal, Aurland, Lærdal, Årdal, Luster, Askvoll, Fjaler, Gaular, Førde, Naustdal, Bremanger, Vågsøy, Selje, Eid, Gloppen, Stryn, Molde, Ålesund, Kristiansund, Vanylven, Sande (M.R.), Herøy (M.R.), Ulstein, Hareid, Volda, Ørsta, Ørskog, Norddal, Stranda, Stordal, Sykkylven, Skodje, Sula, Giske, Haram, Vestnes, Rauma, Nesset, Midsund, Sandøy, Aukra, Frænа, Eide, Averøy, Gjemnes, Tingvoll, Sunndal, Surnadal, Halsa, Smøla, Aure, Trondheim, Hemne, Snillfjord, Hitra, Frøya, Ørland, Agdenes, Rissa, Bjugn, Åfjord, Roan, Osen, Orkdal, Melhus, Skaun, Malvik, Steinkjer, Namsos, Stjørdal, Frosta, Leksvik, Levanger, Verdal, Verran, Namdalseid, Fosnes, Flatanger, Vikna, Nærøy, Leka, Bodø, Narvik, Bindal, Sømna, Brønnøy, Vega, Vevelstad, Herøy (N.), Alstahaug, Leirfjord, Vefsn, Dønna, Nesna, Hemnes, Rana, Lurøy, Træna, Rødøy, Meløy, Gildeskål, Saltdal, Fauske, Sørfold, Steigen, Hamarøy, Tysfjord, Lødingen, Tjeldsund, Evenes, Ballangen, Røst, Værøy, Flakstad, Vestvågøy, Vågan, Hadsel, Bø (N.), Øksnes, Sortland, Andøy, Moskenes, Harstad, Tromsø, Kvæfjord, Skånland, Bjarkøy, Ibestad, Gratangen, Lavangen, Salangen, Målselv, Sørreisa, Dyrøy, Tranøy, Torsken, Berg, Lenvik, Balsfjord, Karlsøy, Lyngen, Storfjord, Gáivuotna Kåfjord, | Norway | Nature Index of Norway |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | Skjervøy, Nordreisa, Kvænangen, Vardø, Vadsø, Hammerfest, Alta, Loppa, Hasvik, Kvalsund, Måsøy, Nordkapp, Lebesby, Gamvik, Berlevåg, Deatnu Tana, Båtsfjord, Sør-Varanger, Ås, Overhalla | | |
| Soft seabed faunal diversity ocean | Macrozoobenthos | Benthic habitats | 0.6 | index | Barentshavet, Norskehavet, Nordsjøen, Skagerrak | Norway | Nature Index of Norway |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | FI2_LS_011, FI2_SS_002, FI2_SS_012, FI2_SS_021, FI3_SES_035, FI2_LS_004, FI3_LV_003, FI3_MU_110, FI2_SU_030, FI2_LS_008, FI2_SS_019, FI2_SU_020, FI2_LS_003, FI2_LU_010, FI2_SS_026, FI2_SS_003, FI2_SS_013, FI2_SU_010, FI3_LV_006, FI3_LU_040, FI3_SEU_050, FI3_LS_003, FI3_LV_012, FI3_LS_004, FI3_LU_010, FI3_LV_009, FI3_SES_032, FI3_SES_038, FI3_LS_019, FI3_LU_030, FI2_LS_002, FI2_LU_020, FI2_SS_006, FI2_SS_011, FI2_SS_024, FI2_SU_040, FI3_LU_020, FI3_LV_001, FI3_SEU_070, FI3_LU_050 | Finland | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | DECW_DENI_N4-4900-02, DECW_DENI_N2-4900-01, DECW_DESH_B2-9610-07-03A, DECW_DESH_B2-9610-07-04, DECW_DESH_B2-9610-10-02, DECW_DESH_B3-9610-09-07A, DECW_DESH_B3-9610-07-07, DECW_DESH_B3-9610-09-05, DECW_DESH_B3-9610-09-06, DECW_DESH_B3-9610-09-08A, DECW_DESH_B3-9610-09-09, DECW_DEMV_OD_01, DECW_DEMV_WP_14, DECW_DESH_N4-5000-04-02, DECW_DESH_N4-9500-02-02, DECW_DESH_N4-9500-03-02, DECW_DESH_B2-9610-07-01, DECW_DESH_B2-9610-09-01, DECW_DEMV_WP_02, DECW_DESH_N2-9500-01-03, DECW_DEMV_WP_03, DECW_DEMV_WP_07, DECW_DEMV_WP_09, DECW_DESH_N2-9500-01-04, DECW_DESH_B3-9610-07-06, DECW_DESH_B3-9610-09-08B, DECW_DESH_B3-9610-07-05, DECW_DESH_B3-9610-09-03, DECW_DEMV_WP_08, DECW_DEMV_WP_10, DECW_DEMV_WP_13, DECW_DENI_N4-4900-01, DECW_DESH_B2-9610-10-01, DECW_DENI_N2-3100-01, DECW_DEMV_WP_15, DECW_DEMV_WP_21, DECW_DENI_N4-3100-01, DECW_DEMV_WP_11, DECW_DESH_B2-9610-07-02, DECW_DESH_B2-9610-09-02, DECW_DESH_B3-9610-09-04, DECW_DESH_N2-9500-01-05, DECW_DEMV_WP_18, DECW_DEMV_WP_04, DECW_DEMV_WP_16, DECW_DESH_B2-9610-07-03B, DECW_DEMV_WP_17, DECW_DEMV_WP_12, DECW_DEMV_WP_05, DECW_DESH_B2-9610-10-03, DECW_DESH_B3-9610-09-07B, DECW_DESH_N5-5000-04-03, DECW_DENI_N4-5900-01, DECW_DESH_N2-9500-01-06, DETW_DENI_T1-3990-01, DETW_DENI_T1-3000-01, DETW_DESH_T2-9500-01, DETW_DESH_T1-5000-01, DETW_DENI_T1-4000-01, DECW_B3-9610-09-08, DECW_B2-9610-07-03, DECW_B3-9610-09-07 | Germany | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | IEWE_160_0710, IEWE_200_0100, IEWE_120_0100, IESE_040_0100, IESH_060_1000, IEWE_260_0100, IESH_090_0100, IEWE_160_0200, IESE_070_0100, IESE_060_0100, IESW_110_0100, IENW_040_0100, IENW_220_0300 | Ireland | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | MTMTC104, MTMTC107, MTMTC102, MTMTC109, MTMTC101, MTMTC105, MTMTC106, MTMTC108, MTMTC103 | Malta | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | NL81_1, NL89_OOSTSDE_OWL, NL81_10, NL89_ZWIN, NL87_1 | Netherlands | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | PT01COST1N, PT05COST10A, PT08RDA1700, PT05SUL1635, PT05RDW1165A, PT03NOR0732, PT05RDW1166A, PT08RF3, PT08RF1, PT08RF2, PT05COST11A, PT08COST14, PT02COST2, PT04COST7, PT03COST3, PT06COST13, PT08COST15, PT08RF4, PT08RF5, PT06SUL1638, PT05COST89B, PT03DOU0366, PT01LIM0057, PT01NOR0724, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT08RDA1657B, PT04VOU0552, PT06MIR1367, PT04VOU0536, PT06MIR1374, PT06SAD1222, PT06SAD1219, PT05TEJ1100A, PT05TEJ1139A, PT01MIN0018, PT04MON0682, PT02CAV0096, PT07GUA1631, PT04VOU0550, PT06MIR1368, PT06SAD1217, PT04VOU0514, PT01LIM0056, PT01MIN0023, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT02AVE0135, PT04COST89A | Portugal | EEA WISE MARINE |
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | ROCT02_B1, ROCT01_B2, ROCT01_B1, ROCT02_B2 | Romania | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2 - Other aquatic flora | Macrovegetation | Benthic habitats | 0.6 | EQR | ES100MSPFC16, ES100MSPFC4, ES100MSPFC1, ES100MSPFC10, ES100MSPFC14, ES100MSPFC24, ES100MSPFC29, ES100MSPFC6, ES100MSPFC3, ES100MSPFC30, ES100MSPFC5, ES100MSPFC32, ES100MSPFC2, ES100MSPFC25, ES100MSPFC23, ES125MSPFES70LPTI2, ES125MSPFES70LPTI1, ES125MSPFES70LPTII, ES125MSPFES70LPTIV | Spain | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | BG2BS000C1112, BG2BS000C1007, BG2BS000C005, BG2BS000C002, BG2BS000C1113, BG2BS000C1308, BG2BS000C1006, BG2BS000C1011, BG2BS000C1013, BG2BS000C1004, BG2BS000C1010, BG2BS000C1003, BG2BS000C1108, BG2BS000C1208, BG2BS000C1012 | Bulgaria | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | HRJMO005, HRJMO015, HRJMO024, HRJMO029, HRJMO022, HRJMO032, HRJMO033, HRJMO038, HRJMO001, HRJMO006, HRJMO002, HRJMO028, HRJMO062, HRJMO063, HRJMO068, HRJMO035, HRJMO045, HRJMO059, HRJMO065, HRJMO072, HRJMO073, HRJMO078, HRJMO081, HRJMO031, HRJMO036, HRJMO061, HRJMO066, HRJMO044, HRJMO049, HRJMO064, HRJMO069, HRJMO077, HRJMO008, HRJMO013, HRJMO018, HRJMO025, HRJMO030, HRJMO051, HRJMO056, HRJMO060, HRJMO074, HRJMO075, HRJMO079, HRJMO004, HRJMO009, HRJMO014, HRJMO019, HRJMO058, HRJMO070, HRJMO071, HRJMO076, HRJMO021, HRJMO037, HRJMO067, HRJMO080, HRJMO017, HRJMO042, HRJMO020, HRJMO007, HRJMO041, HRJMO046, HRJMO011, HRJMO016, HRJMO050, HRJMO023, HRJMO053, HRJMO057, HRJMO034, HRJMO039, HRJMO003, HRJMO040, HRJMO012, HRJMO027, HRJMO043, HRJMO055, HRJMO048, HRJMO026, HRO423-BSK, HRO423-RIZ, HRO413-LIK, HRO423-KVA, HRO313-BAZ, HRO313-JVE, HRO423-RILP, HRO423-VIK, HRO313-KZ, HRO413-PZK, HRO413-STLP, HRO422-VIS, HRO313-ZUC, HRO412-ZOI, HRO413-RAZ, HRO422-SJI | Croatia | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | CY10-C1, CY6-C4, CY7-C4-HM, CY9-C4, CY8-C4, CY19-C3, CY20-C3, CY21-C3, CY22-C3, CY2-C1, CY17-C2-HM, CY1-C1, CY5-C4 | Cyprus | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | EEEE_1, EEEE_10, EEEE_11, EEEE_12, EEEE_13, EEEE_14, EEEE_16, EEEE_17_2022, EEEE_18_2022, EEEE_2, EEEE_3, EEEE_5, EEEE_6, EEEE_7, EEEE_8, EEEE_9, EEEE_14_2022, EEEE 15, EEEE 4 | Estonia | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | FI2_LS_011, FI2_SS_002, FI2_SS_012, FI2_SS_021, FI3_SES_035, FI2_LS_004, FI3_LV_003, FI3_MU_110, FI2_SU_030, FI2_LS_008, FI2_SS_019, FI2_SU_020, FI2_LS_003, FI2_LU_010, FI2_SS_026, FI2_SS_003, FI2_SS_013, FI2_SU_010, FI3_LV_006, FI3_LU_040, FI3_SEU_050, FI3_LS_003, FI3_LV_012, FI3_LS_004, FI3_LU_010, FI3_LV_009, FI3_SES_032, FI3_SES_038, FI3_LS_019, FI3_LU_030, FI2_LS_002, FI2_LU_020, FI2_SS_006, FI2_SS_011, FI2_SS_024, FI2_SU_040, FI3_LU_020, FI3_LV_001, FI3_SEU_070, FI3_LU_050 | Finland | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | FRDC01, FRDC05, FRDC07G, FRDC09C, FRDC08B, FRDC09A, FRDC10C, FRDC07C, FRDC07A, FREC03AD, FREC03C, FREC03EG, FREC01E, FRFC09, FRFC11, FREC01AB, FREC01C, FREC02D, FRFC02, FRGC12, FRGC26, FRGC03, FRGC07, FRGC39, FRGC42, FRGC47, FRGC06, FRGC11, FRGC32, FRGC16, FRGC44, FRGC34, FRGC36, FRGC01, FRGC05, FRGC20, FRHC15, FRHC01, FRHC12, FRHC17, FRGC49, FRHC03, FRHC09, FRHC18, FRHC04, FRDC07D, FREC03F, FRDC07E, FRDC07F, FREC02AB, FRGC29, FRGC46, FRGC53, FRGC09, FRGC10, FRGC28, FRGC51, FRHC14, FRHC16, FRHC07, FRGC38, FRHC11, FRFC03, FRHC02, FRGC48, FRGC18, FREC04AC, FRDC10A, FRGC50, FRDC07B, FRDC08D, FREC02C, FREC04B, FRGC08, FREC01D, FRGC45, FRGC13, FREC03B, FRFC01, FRHC10, FRHC13, FRGC35, FRFT07, FRFT09, FRGT03, FRGT18, FRGT26, FRGT06, FRGT20, FRGT22, FRGT04, FRGT05, FRGT16, FRGT02, FRGT07, FRGT09, FRGT14, FRGT23, FRGT25, FRGT10, FRGT12, FRGT21, FRGT13, FRGT15, FRGT29, FRGT27, FRGT17, FRGT19, FRGT24, FRGT31, FRGT28, FRHT06, FRGT11, FRFT01, FRGT30, FRGT08 | France | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | DECW_DESH_B2-9610-07-03A, DECW_DESH_B2-9610-07-04, DECW_DESH_B2-9610-10-02, DECW_DESH_B3-9610-09-07A, DECW_DESH_B3-9610-07-07, DECW_DESH_B3-9610-09-05, DECW_DESH_B3-9610-09-06, DECW_DESH_B3-9610-09-08A, DECW_DESH_B3-9610-09-09, DECW_DEMV_OD_01, DECW_DEMV_WP_14, DECW_DESH_N4-5000-04-02, DECW_DESH_N4-9500-02-02, DECW_DESH_N4-9500-03-02, DECW_DESH_B2-9610-07-01, DECW_DESH_B2-9610-09-01, DECW_DEMV_WP_02, DECW_DESH_N2-9500-01-03, DECW_DEMV_WP_03, DECW_DEMV_WP_07, DECW_DEMV_WP_09, DECW_DESH_N2-9500-01-04, DECW_DESH_B3-9610-07-06, DECW_DESH_B3-9610-09-08B, DECW_DESH_B3-9610-07-05, DECW_DESH_B3-9610-09-03, DECW_DEMV_WP_08, DECW_DEMV_WP_10, DECW_DEMV_WP_13, DECW_DESH_B2-9610-10-01, DECW_DEMV_WP_15, DECW_DEMV_WP_21, DECW_DEMV_WP_11, DECW_DESH_B2-9610-07-02, DECW_DESH_B2-9610-09-02, DECW_DESH_B3-9610-09-04, DECW_DESH_N2-9500-01-05, DECW_DEMV_WP_18, DECW_DEMV_WP_04, DECW_DEMV_WP_16, DECW_DESH_B2-9610-07-03B, DECW_DEMV_WP_17, DECW_DEMV_WP_12, DECW_DEMV_WP_05, DECW_DESH_B2-9610-10-03, DECW_DESH_B3-9610-09-07B, DECW_DESH_N5-5000-04-03, DECW_DESH_N2-9500-01-06, DECW_B3-9610-09-08, DECW_B2-9610-07-03, DECW_B3-9610-09-07 | Germany | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | EL0129C0002N, EL0132C0006N, EL0132C0008N, EL0512C0003H, EL0534C0011H, EL0626C0005N, EL0626C0006N, EL0626C0010N, EL1005C0010N, EL1436C0001N, EL0245C0017N, EL0415C0009N, EL0512C0A02N, EL0227C0005N, EL0227C0006N, EL0245C0014N, EL0331C0002N, EL0722C0011N, EL0724C0017N, EL0817C0006N, EL1208C0004N, EL1210C0008N, EL0132C0004N, EL0228C0009N, EL0718C0007N, EL0331C0001N, EL0626C0009N, EL0626C0012N, EL0333C0007N, EL0415C0003N, EL0513C0006N, EL0513C0007N, EL0626C0002N, EL0626C0011N, EL0626C0013N, EL0719C0006N, EL1106C0001N, EL0415C0002N, EL0817C0007N, EL1005C0011H, EL1005C0006N, EL1437C0078N, EL1339C0002N, EL1339C0007N, EL1436C0007N, EL1339C0003N, EL1341C0012N, EL1436C0012N, EL1438C0036N, EL1438C0041N, EL0227C0004H, EL0228C0003N, EL1436C0003N, EL1436C0005N, EL1436C0013N, EL1437C0085N, EL1043C0002N, EL1340C0019N, EL1005C0004N, EL0718C0005N | Greece | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | IEEA_010_0100, IEEA_020_0000, IEEA_050_0100, IEEA_090_0000, IEEA_090_0200, IEEA_100_0000, IENB_040_0100, IENW_120_0000, IENW_120_0100, IESE_100_0000, IESE_140_0100, IESW_020_0000, IESW_020_0100, IESW_050_0000, IESW_060_0000, IESW_080_0000, IESW_090_0200, IESW_100_0100, IESW_180_0000, IESW_190_0000, IESW_210_0000, IESW_220_0000, IESW_230_0200, IEWE_100_0000, IEWE_170_0000, IEWE_200_0000, IEWE_310_0000, IEWE_340_0000, IEWE_400_0000, IEWE_400_0200, IEWE_420_0000, IEWE_420_0300, IEWE_450_0000, IEWE_470_0100 | Ireland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | IT05TPO_3, IT05TPO_4, IT05TPO_5, IT07CW00800801, IT07CW00800804, IT07CW00800906, IT07CW00900907, IT07CW00900909, IT07CW00900911, IT07CW00901012, IT07CW01001013, IT07CW01001013_1, IT07CW01001016, IT07CW01001017, IT07CW01001020, IT07CW01001121, IT07CW01001122, IT07CW01101123, IT07CW01101124, IT089910000000001ER, IT089920000000001ER, IT089930000000001ER, IT089940000000001ER, IT089950000000001ER, IT08-9960000000001ER, IT09R000OM011AC, IT09R000OM013AC, IT09R000OM013AC_1, IT09R000OM14AC, IT09R000TC004AC, IT09R000TC004AC_1, IT09R000TC007AC, IT09R000TC007AC_1, IT09R000TC015AC, IT09R000TC015AC_1, IT09R000TC016AC, IT09R000TC016AC_1, IT12R12FON-ITR_LUNGO_AT03, IT12R12RMA_FOGLIANO_AT09, IT12R12RMA_MONACI_AT03, IT19CW00626, IT19CW02711, IT19CW03431, IT19CW03691, IT19CW04036, IT19CW04088, IT19CW04089, IT19CW04187, IT19CW04286, IT19CW04610, IT19CW0477, IT19CW04794, IT19CW0521, IT19CW0552, IT19CW0583, IT19CW06941, IT19CW07139, IT19CW08153, IT19CW08156, IT19CW08454, IT19CW08455, IT19CW08480, IT19CW08484, IT19CW08581, IT19CW09075, IT19CW09076, IT19CW09248, IT19CW09282, IT19CW09550, IT19CW09551, IT19CW09593, IT19CW09723, IT19TW001297, IT19TW011299, IT19TW01131301, IT19TW01131401, IT19TW011315, IT19TW052302, IT19TW102296, ITATW00000100VN, ITATW00000200VN, ITATW00000300VN, ITATW00000400VN, ITATW00000500VN, ITATW00000600VN, ITATW00000700VN, ITATW00000900VN, ITATW00001000VN, ITATW00001100VN, ITATW00001300VN, ITATW00001400VN, ITATW00001500VN, ITATW00001700VN, ITATW00001800VN, ITATW00001900VN, ITF015CWCILENTO20, ITF015CWCILENTO28, ITF015CWPENSORRENTINA5, ITF015CWPENSORRENTINA6, ITF015CWPENSORRENTINA8, ITF017_CW-A3_CALDOL-POLICASTRO, ITG-0035-AT50060, ITG-0036-AT50070, ITG-0040-AT50090, ITG-0073-AT50110, ITG-0101-AT50120, ITG-0109-AT50150, ITG-0114-AT50200, ITG-0115-AT50212, ITG-0123-AT50260, ITG-0128-AT50300, ITG-0129-AT50310, ITG-0142-AT50320, ITG-0158-AT50330, ITG-0184-AT50360, ITG-0190-AT50390, ITG-0221-AT50490, ITG-0225-AT50500, ITG-0226-AT50550, ITG-0226-AT50570, ITG-0226-AT50580, ITG-0226-AT50590, ITG-0226-AT50600, ITG-0226-AT50610, ITG-0252-AT50650, ITG-0257-AT50740, ITG-0258-AT50760, ITG-0259-AT50780, ITG-0259-AT50782, ITG-0287-AT50830, ITG-0301-AT50870, ITI022-R16-227ACA3S3_1, ITR16-004AT08_1, ITR16-007AT08_2, ITR16-014AT08_3, ITR16-018AT08_4, ITR16-042ACA3S1_2, ITR16-087AT10_1, ITR16-097ACB2S3_2, ITR16-108ACB3S3_2, ITR16-118ACB3S3_3, ITR16-133ACB3S3_5, ITR16-143ACB3S3_6, ITR16-143AT02_1, ITR16-151AT05_1, ITR16-162AT02_2, ITR16-165ACB3S3_11, ITR16-177ACE3S11_1, ITR16-183AT04_1, ITR16-184ACB3S3_14, ITR16-188ACB3S3_16, ITR16-191AT09_1, ITR16-191AT09_2, ITG-0028-MC00170-N, ITG-0190-MC01160-N, ITG-0018-MC00120-N, ITG-0152-MC10080-N, ITR16-101ACB3S3_1, ITR16-176ACB3S3_12, ITR16-201ACA3S3_2, ITF015CWCAPRI, ITF015CWCILENTO22, ITR16-147ACB3S3_7, ITG-0246-MC01520, ITG-0162-MC00840, ITG-0018-MC00110, ITG-0186-MC01130 | Italy | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | LVA, LVCDEV, LVF | Latvia | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | LT100101200, LT100201100, LT100201200, LT100201300 | Lithuania | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | MTMTC104, MTMTC107, MTMTC102, MTMTC109, MTMTC101, MTMTC105, MTMTC106, MTMTC108, MTMTC103 | Malta | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | NO0101000030-1-C, NO0101000030-2-C, NO0101010301-C, NO0101020101-2-C, NO0110010100-C, NO0110010801-C, NO0120010300-4-C, NO0120030201-1-C, NO0121000030-C, NO0130010301-2-C, NO0131020202-C, NO0242000031-C, NO0242010600-C, NO0242010702-1-C, NO0242020501-C, NO0242020900-C, NO0242040101-1-C, NO0242040300-C, NO0260030100-1-C, NO0260040200-C, NO0260040600-C, NO0260040800-C, NO0260050500-C, NO0260050600-C, NO0261010100-C, NO0261040101-11-C, NO0280010800-C, NO0280010900-C, NO0280020100-1-C, NO0280020700-C, NO0301011206-C, NO0301011700-3-C, NO0301020900-C, NO0320040900-10-C, NO0320041200-10-C, NO0321030402-1-C, NO0321030500-11-C, NO0341010301-1-C, NO0361010700-2-C, NO0361050200-4-C, NO0361050800-C, NO0362040800-1-C, NO0362040800-2-C, NO0201010800-C, NO0101030102-1-C, NO0101030600-C, NO0101040200-2-C, NO0320041500-4-C, NO0364030200-C, NO0242040102-C, NO0282012600-C, NO0260030400-C, NO0403040500-1-C, NO0260040900-1-C, NO0260050400-C, NO0301022000-1-C, NO0303010200-C, NO0303010902-3-C, NO0201010900-C, NO0130010202-C, NO0130010700-C, NO0320040900-3-C, NO0320041200-3-C, NO0364020300-2-C, NO0364030502-C, NO0280030100-C, NO0281010800-C, NO0282010400-C, NO0282012200-1-C, NO0261030100-1-C, NO0301020300-1-C, NO0201011300-C, NO0130010301-1-C, NO0101030102-2-C, NO0110020800-1-C, NO0201011000-C, NO0130010201-C, NO0101020601-C, NO0101000032-4-C, NO0101020300-2-C, NO0101030400-C, NO0101030700-C, NO0101040400-4-C, NO0120000034-C, NO0321010100-1-C, NO0101030300-C, NO0101000032-3-C, NO0101030101-6-C, NO0120030100-C, NO0121000300-1-C, NO0110000036-C, NO0242031500-C, NO0242000032-C, NO0242020400-C, NO0121020500-1-C, NO0320040900-4-C, NO0320040900-6-C, NO0320040900-5-C, NO0364010600-C, NO0242011201-C, NO0242050100-2-C, NO0282012200-2-C, NO0260000031-C, NO0260021000-C, NO0260040500-C, NO0260040700-C, NO0362020201-2-C, NO0260040101-C, NO0261030603-6-C, NO0403020602-2-C, NO0403040402-C, NO0261040300-2-C, NO0301020703-C, NO0302012204-C, NO0282012300-1-C, NO0242031600-C, NO0301020200-1-C, NO0301021300-5-C, NO0303011505-2-C, NO0260020900-C, NO0403040401-2-C, NO0261000034-C, NO0261020800-3-C, NO0261030201-2-C, NO0282012300-2-C, NO0403020100-C, NO0282011800-C, NO0301021800-2-C, NO0302012100-C, NO0424020700-C, NO0424030602-C, NO0260010300-C, NO0260030200-C, NO0403020700-C, NO0403040104-1-C, NO0301021400-C, NO0261010800-9-C, NO0301021201-C, NO0423010700-C, NO0424020600-C, NO0424030700-1-C, NO0424020400-C, NO0130010600-C, NO0101010304-C, NO0363031300-4-C, NO0364050102-C, NO0242031200-C, NO0242040700-C, NO0402010700-C, NO0260010501-6-C, NO0261000030-C, NO0261010500-2-C, NO0261010800-4-C, NO0424030300-C, NO0101000031-C, NO0364020700-2-C, NO0301020701-C, NO0101010306-C, NO0120030203-2-C, NO0101030500-C, NO0303011202-4-C, NO0261030400-17-C, NO0301020702-C, NO0301022200-2-C, NO0242040902-C, NO0301021300-1-C, NO0364020100-6-C, NO0130010400-2-C, NO0301021203-1-C, NO0364040200-1-C, NO0101020300-1-C, NO0320041000-8-C, NO0320040900-2-C, NO0261030201-1-C, NO0424020100-19-C, NO0301021300-3-C, NO0110021101-1-C, NO0130000030-2-C, NO0130000300-C, NO0130010400-3-C, NO0131020100-C, NO0130000031-4-C, NO0131010100-1-C, NO0131010300-C, NO0201010300-C, NO0132010202-C | Norway | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | PLCWIIWB6E, PLTW20001WB1, PLTW20002WB4, PLTW20003WB5 | Poland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | PT01COST1N, PT05COST10A, PT08RDA1700, PT09FAICPP1, PT09SMGCI1, PT05SUL1635, PT09TERCPP1, PT09TRICP1, PT05RDW1166A, PT08RF3, PT08RF1, PT08RF2, PT09OCICP1, PT09PICCPP1, PT09SJOCI1, PT05COST11A, PT09FLOCI1, PT09SMGCPP4, PT09GRACI1, PT09GRACPP1, PT08COST14, PT09FAICI1, PT09PICCI1, PT09SMACI1, PT02COST2, PT09TERCP1, PT09SJOCPP1, PT09SMGCPP3, PT04COST7, PT03COST3, PT06COST13, PT08COST15, PT09SMGCPP1, PT09SMGCPP2, PT08RF4, PT08RF5, PT06SUL1638, PT09CORCI1, PT09TERCI1, PT09GRACP1, PT09ORICP1, PT09TERCPP2, PT09FLOCPP1, PT05COST89B, PT09SMACPP1, PT09CORCPP1, PT03DOU0366, PT01LIM0057, PT01NOR0724, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT08RDA1657B, PT09SJOT001, PT09SJOT003, PT04VOU0552, PT06MIR1367, PT06SAD1222, PT06SAD1219, PT05TEJ1139A, PT09SJOT002, PT04MON0682, PT06MIR1368, PT06SAD1217, PT01MIN0023, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT04COST89A | Portugal | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | SI5VT2, SI5VT4 | Slovenia | EEA WISE MARINE |
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | ES017MSPFES111C000010, ES017MSPFES111C000015, ES017MSPFES111C000020, ES017MSPFES111C000030, ES018MSPFES000MAC000020, ES018MSPFES000MAC000070, ES080MSPFC010, ES070MSPF010300050, ES080MSPFC009, ES110MSPFEIMC03M4, ES110MSPFEIMC07M3, ES110MSPFMAMC08M3, ES110MSPFMAMC12M2, ES110MSPFMAMC13M2, ES100MSPFC4, ES018MSPFES000MAC000130, ES080MSPFC004, ES110MSPFMAMC03M2, ES100MSPFC1, ES100MSPFC10, ES100MSPFC14, ES100MSPFC24, ES080MSPFC007, ES080MSPFC011, ES080MSPFC012, ES080MSPFC014, ES080MSPFC015, ES080MSPFC002, ES120MSPFES70GCTIV2, ES110MSPFEIMC04M4, ES110MSPFMAMC15M3, ES100MSPFC29, ES100MSPFC6, ES018MSPFES000MAC000120, ES110MSPFEIMC02M4, ES110MSPFMAMC02M3, ES110MSPFMAMC05M3, ES110MSPFMAMC07M3, ES110MSPFMEMC06M2, ES100MSPFC3, ES100MSPFC5, ES018MSPFES000MAC000050, ES018MSPFES000MAC000060, ES018MSPFES000MAC000100, ES018MSPFES000MAC000110, ES100MSPFC32, ES110MSPFMAMC04M2, ES120MSPFES70GCTI2_1, ES080MSPFC001, ES100MSPFC2, ES100MSPFC28, ES110MSPFFOMC09M3, ES110MSPFMAMC06M2, ES110MSPFMAMC14M3, ES110MSPFMEMC04M4, ES110MSPFMEMC07M3, ES120MSPFES70GCTI1, ES160MSPF404880003, ES160MSPF417050004, ES124MSPFES70TFTI2, ES124MSPFES70TFTI1_1, ES126MSPFES70LGTV, ES122MSPFES70FVTII, ES124MSPFES70TFTIV, ES122MSPFES70FVTIV_1, ES123MSPFES70LZTIV, ES124MSPFES70TFTV_1, ES124MSPFES70TFTII, ES070MSPF002150006, ES070MSPF010300070, ES070MSPF010300120, ES100MSPFC23, ES110MSPFMAMC11M3, ES110MSPFMEMC05M2, ES100MSPFC9, ES018MSPFES000MAC000030, ES018MSPFES000MAC000071, ES018MSPFES000MAC000140, ES080MSPFC013, ES110MSPFMEMCM02, ES100MSPFC12, ES100MSPFC26, ES120MSPFES70GCTII, ES120MSPFES70GCTIV1, ES126MSPFES70LGTII, ES127MSPFES70EHTII, ES070MSPF010300020, ES123MSPFES70LZTII, ES018MSPFES000MAC000080, ES018MSPFES000MAC000090, ES110MSPFMAMC16M3, ES100MSPFC31, ES110MSPFMAMC10M2, ES127MSPFES70EHTI, ES160MSPF404880002, ES110MSPFMAMC09M3, ES110MSPFEIMC01M2, ES070MSPF010300130, ES080MSPFC017, ES110MSPFMAMC01M2, ES070MSPF010300060, ES080MSPFC016, ES110MSPFEFMC08M4, ES150MSPF404900001, ES110MSPFEIMC05M3, ES018MSPFES000MAC000021, ES110MSPFFOMC10M2, ES018MSPFES000MAC000040, ES126MSPFES70LGTI, ES110MSPFEIMC06M4, ES080MSPFC003, ES150MSPF404900002, ES125MSPFES70LPTI2, ES110MSPFMEMC02M3, ES125MSPFES70LPTI1, ES110MSPFMEMC01M2_001, ES125MSPFES70LPTII, ES125MSPFES70LPTIV | Spain | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | SE1E82A04F-9AFF-492D-A1E6-3149841CDE70, SE4259C3FF-286C-4D0A-A08B-CA1F3149CF2C, SE36711B15-677A-45FD-9350-65D6C3736D09, SE19D16CCE-760C-4A16-AF1C-105908B8D133, SE16A044F8-3910-4A50-B53A-F73732C1D3D0, SE1CB1305B-FB7B-4D00-A554-40C46617AF59, SE1F5B23B8-2C72-4A73-96FD-7BC69D46EC3C, SE0B68FE82-4165-4DBE-AC8D-FB556EB381A7, SE00776819-5D5D-49A2-BC5E-38B23E32AA97, SE65E5B59B-D89F-4775-8AC7-D36AD908B1EE, SE760C94E5-30E2-4564-BA69-3FAF60951DB5, SE50ADECA4-050C-44B5-B028-4955072330AA, SE7487D0DF-1B88-4824-A511-1C6EC25AF9EF, SE91E2A9EF-21B2-4139-9F57-DD4132A0C935, SE7D67B6CD-BADA-47BD-807F-16AAAA53EF1D, SE10FCAB23-9A54-4025-8576-90F2827644B8, SE56FD9ECC-17D5-4797-8C11-51B80AE20DC7, SE6B210E53-4CEF-45AD-9A49-24D5804A4139, SEC7B7488F-67DC-49D5-9314-578F5989C323, SE6898640D-E4F7-4578-A110-06447CCA91D7, SE4197F2B2-3564-4AD9-A566-01F6BA24497C, SE7C2D98D9-F5C6-4532-A3AF-3D9EA43F55AD, SEDC6FFE62-0D89-4845-9E9E-BDA081053026, SEE8C215E6-55E6-4D7E-9F23-B00B205F4234, SEA297145C-CAAD-425C-8685-63920BDAC4AC, SEDD159A8F-FB49-42C1-8FB2-7E4A9AD24ABE, SEDE6E1245-0FC7-45C2-A6BF-71FF8BFE4810, SEE5CADF0A-6E3E-4BF9-B2DD-DDF9FCDB3D1F, SECEA66178-C402-4BD2-8C16-514B6E64FED0, SEF5DE007F-EBDD-4C12-8849-21CA3D3E12DF, SECDC185D2-F8A1-4C55-88F2-6BB47705178E, SEFBDB0AEB-A7BF-4837-8BC2-9B9695A6F158, SEF229A7F9-91AA-4134-B934-41F990BAD4B7, SEB2ACC251-4F67-49E0-A42B-6FCE27EDC91C, SE15DAF483-4DF0-4C96-998F-4F905C6F3CAC, SEB23C07CF-C31F-4F63-B2DE-3C8AF9B68053, SEC02F5732-4D8D-4477-87B0-4420522399BD, SE06028A79-292F-45BD-AC25-9C96D38861F5, SEA242C63C-4D96-4862-9EDF-3D5EFC3F6607, SE0847519A-1ED5-4838-A8BF-5469658B9800, SE6DFA09A0-0AFF-4801-9D7B-D6CB68F1B15B, SE640B6B6D-5696-4A08-961A-9D0A005BAA91, SE5F651064-97A2-4344-9C80-08B9EE0B1BA1, SE5329474A-F619-4B4F-A649-03B4ECD5FAD1, SEE07B333D-B3A8-4AEB-9D1A-A0838F9761FF, SE59EC914A-E7B9-4B7D-A892-4DB54C8BF2A7, SEE1910460-7DE8-4791-84B9-C45FA48581C1, SED6E14FAA-7A6C-44BC-9270-9858FF8544D7, SE552500-124461, SE554500-125001, SED794B2ED-2E10-4E5E-A52A-36DB07BB1CD4, SE88888921-8B52-4F0C-9ED3-47A5912C79CD, SE1B2F30B0-9EA8-4B53-B5E9-CCC9C32D28AC, SEA2613CBE-FAB4-4728-9E9B-B00C2C0F4DCA, SE1A80B8DB-5504-449B-AAB4-7BDF72344300, SE1F619F18-3461-4897-AA04-AC9BF660C0B7, SE61022BFF-CBAA-47CF-9EE3-8D2BD7CB64B1, SE0101010301-C, SEDC771381-2368-40C7-A9A2-64AF6CA5E91A, SE555545-124332, SEFD128009-20D5-40DF-8AC6-7720EFB974E5, SE368715D3-1461-4D3C-B7E4-E7AC41A6D57D, SEEED375AB-C5F6-4D2C-96EA-B9F8E76DA7F9, SEF49938DE-1EE0-4563-A7A2-78BD70D805DA, SE9A12B019-6D94-4D2B-87DA-F8280B2B7F8C, SE561030-122821 | Sweden | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-1 - Macroalgae | Macrovegetation | Benthic habitats | 0.6 | EQR | UKGB610807680002, UKGB641211630003, UKGB670807410000, UKGB681010450000, UKGBNI6NE060, UKGBNI6NE200, UKSC200002, UKSC200005, UKSC200047, UKSC200071, UKSC200082, UKSC200086, UKSC200106, UKSC200109, UKSC200127, UKSC200162, UKSC200173, UKSC200174, UKSC200180, UKSC200196, UKSC200199, UKSC200202, UKSC200208, UKSC200209, UKSC200215, UKSC200231, UKSC200237, UKSC200238, UKSC200265, UKSC200270, UKSC200282, UKSC200289, UKSC200291, UKSC200296, UKSC200298, UKSC200300, UKSC200353, UKSC200364, UKSC200372, UKSC200386, UKSC200390, UKSC200397, UKSC200411, UKSC200415, UKSC200416, UKSC200423, UKSC200430, UKSC200432, UKSC200434, UKSC200457, UKSC200465, UKSC200478, UKSC200490, UKSC200503, UKSC200505, UKGB620301100000, UKGB641211171000, UKGB650301440000, UKGB681010360000, UKGBNI6NB030, UKSC200017, UKSC200020, UKSC200024, UKSC200038, UKSC200054, UKSC200063, UKSC200067, UKSC200085, UKSC200108, UKSC200112, UKSC200133, UKSC200134, UKSC200141, UKSC200161, UKSC200193, UKSC200200, UKSC200206, UKSC200214, UKSC200230, UKSC200243, UKSC200244, UKSC200263, UKSC200264, UKSC200286, UKSC200288, UKSC200297, UKSC200308, UKSC200338, UKSC200345, UKSC200380, UKSC200391, UKSC200400, UKSC200402, UKSC200404, UKSC200421, UKSC200426, UKSC200449, UKSC200453, UKSC200469, UKSC200482, UKSC200494, UKSC200500, UKSC200502, UKSC200507, UKGB620806570000, UKGBNI6NE050, UKGBNI6NE070, UKGBNI6NE170, UKGBNI6NE180, UKSC200004, UKSC200029, UKSC200030, UKSC200053, UKSC200056, UKSC200077, UKSC200105, UKSC200119, UKSC200120, UKSC200126, UKSC200135, UKSC200148, UKSC200150, UKSC200163, UKSC200168, UKSC200187, UKSC200211, UKSC200216, UKSC200217, UKSC200218, UKSC200229, UKSC200235, UKSC200240, UKSC200247, UKSC200253, UKSC200260, UKSC200267, UKSC200274, UKSC200309, UKSC200311, UKSC200341, UKSC200342, UKSC200356, UKSC200361, UKSC200368, UKSC200374, UKSC200375, UKSC200383, UKSC200389, UKSC200403, UKSC200410, UKSC200412, UKSC200414, UKSC200444, UKSC200460, UKSC200479, UKSC200491, UKSC200496, UKSC200517, UKGB610807680003, UKGB640523160000, UKGB650503200000, UKGBNI6NE160, UKSC200021, UKSC200032, UKSC200039, UKSC200040, UKSC200044, UKSC200051, UKSC200058, UKSC200064, UKSC200083, UKSC200092, UKSC200100, UKSC200101, UKSC200117, UKSC200130, UKSC200136, UKSC200179, UKSC200181, UKSC200190, UKSC200203, UKSC200232, UKSC200276, UKSC200277, UKSC200283, UKSC200292, UKSC200299, UKSC200306, UKSC200336, UKSC200352, UKSC200371, UKSC200377, UKSC200378, UKSC200385, UKSC200396, UKSC200427, UKSC200446, UKSC200458, UKSC200461, UKSC200466, UKSC200470, UKSC200472, UKSC200474, UKSC200504, UKGB611008590002, UKGB621009580000, UKGB640604640000, UKGB641008220000, UKGB641008260000, UKGB641211172000, UKGB650705150000, UKGB680503713700, UKGBNI6NB010, UKGBNI6NW251, UKSC200001, UKSC200016, UKSC200027, UKSC200042, UKSC200050, UKSC200062, UKSC200066, UKSC200069, UKSC200074, UKSC200098, UKSC200111, UKSC200122, UKSC200140, UKSC200155, UKSC200177, UKSC200183, UKSC200188, UKSC200194, UKSC200213, UKSC200224, UKSC200249, UKSC200255, UKSC200269, UKSC200280, UKSC200302, UKSC200346, UKSC200354, UKSC200366, UKSC200379, UKSC200382, UKSC200388, UKSC200408, UKSC200429, UKSC200455, UKSC200456, UKSC200484, UKSC200497, UKSC200508, UKGBNI6NE080, UKGBNI6NE190, UKSC200011, UKSC200025, UKSC200037, UKSC200041, UKSC200048, UKSC200059, UKSC200061, UKSC200076, UKSC200080, UKSC200084, UKSC200097, UKSC200114, UKSC200132, UKSC200144, UKSC200156, UKSC200164, UKSC200170, UKSC200171, UKSC200185, UKSC200205, UKSC200221, UKSC200226, UKSC200227, UKSC200228, UKSC200234, UKSC200252, UKSC200258, UKSC200273, UKSC200295, UKSC200312, UKSC200318, | United Kingdom | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKSC200321, UKSC200335, UKSC200350, UKSC200394, UKSC200401, UKSC200405, UKSC200418, UKSC200420, UKSC200447, UKSC200467, UKSC200468, UKSC200481, UKSC200486, UKSC200501, UKSC200518, UKGB621009600000, UKGB640704540001, UKGB640807670000, UKGB680301430000, UKGB680806320000, UKGBNI6NE020, UKGBNI6NE090, UKSC200036, UKSC200087, UKSC200093, UKSC200123, UKSC200124, UKSC200131, UKSC200147, UKSC200153, UKSC200158, UKSC200159, UKSC200167, UKSC200176, UKSC200182, UKSC200191, UKSC200220, UKSC200250, UKSC200256, UKSC200257, UKSC200272, UKSC200278, UKSC200285, UKSC200294, UKSC200305, UKSC200343, UKSC200349, UKSC200357, UKSC200358, UKSC200363, UKSC200369, UKSC200376, UKSC200417, UKSC200424, UKSC200450, UKSC200452, UKSC200463, UKSC200485, UKSC200499, UKSC200509, UKSC200516, UKGB650806230000, UKGB651009030000, UKGB681010120000, UKGBNI6NB020, UKGBNI6NE030, UKGBNI6NE140, UKSC200012, UKSC200019, UKSC200023, UKSC200026, UKSC200034, UKSC200045, UKSC200065, UKSC200088, UKSC200110, UKSC200116, UKSC200146, UKSC200149, UKSC200152, UKSC200184, UKSC200197, UKSC200212, UKSC200219, UKSC200223, UKSC200241, UKSC200246, UKSC200262, UKSC200266, UKSC200275, UKSC200303, UKSC200339, UKSC200340, UKSC200347, UKSC200355, UKSC200360, UKSC200367, UKSC200393, UKSC200399, UKSC200407, UKSC200433, UKSC200459, UKSC200462, UKSC200475, UKSC200476, UKSC200487, UKSC200488, UKSC200493, UKSC200513, UKSC200081, UKSC200175, UKSC200248, UKSC200254, UKSC200261, UKSC200268, UKSC200310, UKSC200506, UKSC200102, UKSC200128, UKSC200204, UKSC200251, UKSC200293, UKSC200313, UKSC200351, UKSC200370, UKSC200395, UKSC200428, UKSC200454, UKSC200052, UKSC200055, UKSC200210, UKSC200160, UKSC200225, UKSC200242, UKSC200287, UKSC200451, UKSC200060, UKSC200145, UKSC200178, UKSC200271, UKSC200413, UKSC200015, UKSC200107, UKSC200195, UKSC200222, UKSC200348, UKSC200431, UKSC200448, UKSC200464, UKSC200483, UKSC200125, UKSC200207, UKSC200290, UKSC200307, UKSC200373, UKSC200392, UKSC200398, UKSC200498, UKGB641008180000, UKSC200078, UKSC200142, UKSC200121, UKSC200166, UKSC200169, UKGBNI6NE010, UKSC200028, UKSC200072, UKSC200075, UKSC200233, UKSC200279, UKSC200384, UKSC200409, UKSC200068, UKSC200118, UKSC200192, UKSC200259, UKSC200304, UKSC200334, UKSC200362, UKSC200406, UKSC200422, UKSC200495, UKSC200031, UKSC200046, UKSC200049, UKSC200091, UKSC200381, UKSC200473, UKSC200096, UKSC200099, UKSC200154, UKSC200239, UKSC200284, UKSC200489, UKGBNI6NE040, UKSC200151, UKSC200172, UKSC200425, UKSC200477, UKSC200480, UKSC200157, UKSC200186, UKSC200189, UKSC200198, UKSC200201, UKSC200281, UKSC200301, UKSC200359, UKSC200365, UKSC200387, UKSC200419, UKSC200035, UKSC200115, UKSC200236, UKSC200245, UKSC200331, UKSC200337, UKSC200344, UKSC200445, UKSC200492, UKGB510302203300, UKGB510302402900, UKGB510804415700, UKGB510804505600, UKGB511006511000, UKGB520503503900, UKGB520503613602, UKGB520503713800, UKGB520804315900, UKGB520804706200, UKGB521006109400, UKGB530402609201, UKGB530604011500, UKGB540805015500, UKGB541006608000, UKSC200009, UKSC200089, UKSC200139, UKSC200329, UKSC200330, UKGB510503403500, UKGB510804606100, UKGB511006414900, UKGB520503503800, UKGB520503613601, UKGB521010207600, UKGB531106708200, UKGB531207212100, UKGB540704104800, UKGB540704104900, UKGB540704105000, UKSC200103, UKSC200138, UKSC200315, UKSC200332, UKSC200438, UKGB510302210100, UKGB510804505400, UKGB511006507300, UKGB520503403600, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKGB520503704100, UKGB520710101600, UKGB520804714300, UKGB521006509600, UKGB530804906700, UKGB530905415406, UKGB531006013400, UKGB531207112400, UKGB531207311900, UKGB531207408400, UKGB540805210900, UKSC200022, UKSC200090, UKSC200143, UKSC200435, UKSC200436, UKSC200510, UKSC200512, UKGB510804605900, UKGB511006206900, UKGB520710101700, UKGB521006407200, UKGB530603911401, UKGB541005815300, UKGB580705140000, UKGBNI5NB030010, UKSC200003, UKSC200006, UKSC200014, UKSC200165, UKSC200323, UKSC200441, UKGB510302203200, UKGB511006407100, UKGB520710101900, UKGB520804609000, UKGB520804806300, UKGB520804809100, UKGB521010201000, UKGB521010207500, UKGB530402609203, UKGB530604002300, UKGB530804906600, UKGB530905415402, UKGB530905415405, UKGB531206908100, UKGB531207508800, UKSC200008, UKSC200104, UKSC200324, UKSC200333, UKSC200437, UKGB510202110000, UKGB510503410700, UKGB510503503700, UKGB510804505500, UKGB510804606000, UKGB520804415800, UKGB521010207400, UKGB530402609202, UKGB530905415404, UKGB531006114100, UKGB540704016100, UKGB540704116000, UKSC200018, UKSC200073, UKSC200113, UKSC200129, UKSC200320, UKSC200327, UKSC200439, UKGB510302310200, UKGB510804806400, UKGB511006407000, UKGB520503714000, UKGB520704004700, UKGB520704202800, UKGB520710101800, UKGB520804814400, UKGB521006501200, UKGB530603911402, UKGB531207212200, UKGB541005800600, UKGB541005900900, UKGB570704700000, UKGB580705210000, UKSC200007, UKSC200033, UKSC200079, UKSC200328, UKSC200443, UKGB510302203000, UKGB510302509900, UKGB510804605800, UKGB511006315000, UKGB520704201400, UKGB520704202100, UKGB520710102000, UKGB521006110500, UKGB521006501100, UKGB530503311300, UKGB531207411800, UKGB540804906500, UKGB541005800700, UKGB580705130000, UKSC200057, UKSC200316, UKSC200325, UKSC200440, UKSC200442, UKSC200515, UKGB531005913500, UKGB510402703400, UKGB511006115200, UKSC200137, UKSC200322, UKGB541006614800, UKSC200043 | | |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | BEVL17_15, BEVL17_42, BEVL17_43 | Belgium | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | BG2BS000C1112, BG2BS000C1007, BG2BS000C005, BG2BS000C002, BG2BS000C1113, BG2BS000C1308, BG2BS000C1006, BG2BS000C1011, BG2BS000C1013, BG2BS000C1004, BG2BS000C1010, BG2BS000C1003, BG2BS000C1108, BG2BS000C1208, BG2BS000C1012 | Bulgaria | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | HRJMO005, HRJMO015, HRJMO024, HRJMO029, HRJMO022, HRJMO032, HRJMO038, HRJMO001, HRJMO006, HRJMO002, HRJMO028, HRJMO062, HRJMO063, HRJMO035, HRJMO045, HRJMO059, HRJMO065, HRJMO072, HRJMO073, HRJMO078, HRJMO031, HRJMO061, HRJMO066, HRJMO044, HRJMO064, HRJMO069, HRJMO008, HRJMO013, HRJMO018, HRJMO025, HRJMO030, HRJMO056, HRJMO004, HRJMO009, HRJMO014, HRJMO019, HRJMO058, HRJMO070, HRJMO076, HRJMO021, HRJMO037, HRJMO067, HRJMO017, HRJMO042, HRJMO020, HRJMO007, HRJMO041, HRJMO046, HRJMO016, HRJMO050, HRJMO023, HRJMO053, HRJMO057, HRJMO039, HRJMO003, HRJMO040, HRJMO012, HRJMO027, HRJMO043, HRJMO048, HRJMO026, HRJKP020, HRJKP024, HRJKP017, HRJKP022, HRJKP026, HRJKP031, HRJKP006, HRJKP008, HRJKP009, HRJKP032, HRJKP003, HRJKP034, HRJKP001, HRJKP002 | Croatia | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | CY10-C1, CY6-C4, CY9-C4, CY14-C2-HM, CY12-C2-HM, CY4-C1, CY21-C3, CY22-C3, CY2-C1, CY17-C2-HM, CY1-C1 | Cyprus | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | DKCOAST114, DKCOAST131, DKCOAST138, DKCOAST224, DKCOAST80, DKCOAST123, DKCOAST219, DKCOAST222, DKCOAST68, DKCOAST110, DKCOAST125, DKCOAST45, DKCOAST46, DKCOAST160, DKCOAST216, DKCOAST90, DKCOAST93, DKCOAST29, DKCOAST101, DKCOAST104, DKCOAST113, DKCOAST217, DKCOAST62, DKCOAST82, DKCOAST84, DKCOAST37, DKCOAST44, DKCOAST48, DKCOAST49, DKCOAST201, DKCOAST209, DKCOAST145, DKCOAST212, DKCOAST232, DKCOAST83, DKCOAST85, DKCOAST124, DKCOAST130, DKCOAST142, DKCOAST146, DKCOAST147, DKCOAST236, DKCOAST59, DKCOAST86, DKCOAST87, DKCOAST89, DKCOAST95, DKCOAST56, DKCOAST103, DKCOAST105, DKCOAST108, DKCOAST132, DKCOAST141, DKCOAST144, DKCOAST157, DKCOAST159, DKCOAST214, DKCOAST225, DKCOAST92, DKCOAST204, DKCOAST34, DKCOAST38, DKCOAST102, DKCOAST6, DKCOAST2, DKCOAST154, DKCOAST158, DKCOAST96, DKCOAST24, DKCOAST36, DKCOAST25, DKCOAST47, DKCOAST137, DKCOAST233, DKCOAST129, DKCOAST128, DKCOAST238, DKCOAST72, DKCOAST122, DKCOAST207, DKCOAST16, DKCOAST106, DKCOAST235, DKCOAST206, DKCOAST231, DKCOAST127, DKCOAST165, DKCOAST18, DKCOAST234, DKCOAST35, DKCOAST1, DKCOAST28, DKCOAST208, DKCOAST65, DKCOAST156, DKCOAST213, DKCOAST61, DKCOAST63, DKCOAST26 | Denmark | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | EEEE_14_2022, EEEE_15, EEEE_4 | Estonia | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | FRDC01, FRDC04, FRDC05, FRDC07G, FRDC09C, FRDC02F, FRDC08A, FRDC09A, FRDC10C, FRDC07C, FRDC06A, FRDC06B, FRDC07A, FREC03AD, FREC03C, FREC03EG, FREC01E, FRFC09, FREC01AB, FREC01C, FREC02D, FRFC02, FRGC03, FRGC07, FRGC39, FRGC11, FRGC16, FRHC01, FRHC03, FRHC09, FRDC07D, FRDC09D, FREC03F, FRDC07E, FREC02AB, FRFC06, FRGC53, FRGC28, FRGC48, FRGC18, FREC04AC, FRDC10A, FRDC07B, FRDC08D, FREC02C, FREC04B, FRGC08, FREC01D, FRGC13, FREC03B, FRDC08E, FRFT08, FRGT03, FRHT06, FRGT30 | France | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | DECW_DESH_B2-9610-07-03A, DECW_DESH_B2-9610-07-04, DECW_DESH_B2-9610-10-02, DECW_DESH_B3-9610-09-07A, DECW_DESH_B3-9610-07-07, DECW_DESH_B3-9610-09-05, DECW_DESH_B3-9610-09-06, DECW_DESH_B3-9610-09-08A, DECW_DESH_B3-9610-09-09, DECW_DEMV_OD_01, DECW_DEMV_WP_14, DECW_DESH_N4-5000-04-02, DECW_DESH_N4-9500-02-02, DECW_DESH_N4-9500-03-02, DECW_DESH_B2-9610-07-01, DECW_DESH_B2-9610-09-01, DECW_DEMV_WP_02, DECW_DESH_N2-9500-01-03, DECW_DEMV_WP_03, DECW_DEMV_WP_07, DECW_DEMV_WP_09, DECW_DESH_N2-9500-01-04, DECW_DESH_B3-9610-07-06, DECW_DESH_B3-9610-09-08B, DECW_DESH_B3-9610-07-05, DECW_DESH_B3-9610-09-03, DECW_DEMV_WP_08, DECW_DEMV_WP_10, DECW_DEMV_WP_13, DECW_DESH_B2-9610-10-01, DECW_DEMV_WP_15, DECW_DEMV_WP_21, DECW_DEMV_WP_11, DECW_DESH_B2-9610-07-02, DECW_DESH_B2-9610-09-02, DECW_DESH_B3-9610-09-04, DECW_DESH_N2-9500-01-05, DECW_DEMV_WP_18, DECW_DEMV_WP_04, DECW_DEMV_WP_16, DECW_DESH_B2-9610-07-03B, DECW_DEMV_WP_17, DECW_DEMV_WP_12, DECW_DEMV_WP_05, DECW_DESH_B2-9610-10-03, DECW_DESH_B3-9610-09-07B, DECW_DESH_N5-5000-04-03, DECW_DESH_N2-9500-01-06, DECW_B3-9610-09-08, DECW_B2-9610-07-03, DECW_B3-9610-09-07 | Germany | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | EL0132C0006N, EL0626C0001N, EL1436C0001N, EL0512C0A02N, EL0331C0002N, EL1207C0002N, EL1436C0007N, EL1341C0012N, EL1438C0036N, EL1437C0085N, EL1043C0002N, EL1005C0004N | Greece | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | IEEA_050_0100, IEEA_060_0000, IESE_090_0000, IESE_120_0000, IESE_140_0100, IESH_050_0000, IESH_050_0100, IESW_100_0100, IESW_230_0200, IEWE_420_0300, IEWE_450_0000, IEWE_460_0300, IEWE_470_0100 | Ireland | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | IT07CW00800801, IT07CW00800803, IT07CW00800804, IT07CW00800805, IT07CW00800805_1, IT07CW00800906, IT07CW00900907, IT07CW00900908, IT07CW00900909, IT07CW00900911, IT07CW00901012, IT07CW01001016, IT07CW01001018, IT07CW01001020, IT07CW01001121, IT07CW01001122, IT09R000OM012AC, IT09R000OM013AC, IT09R000OM013AC_1, IT09R000OM14AC, IT09R000TC004AC, IT09R000TC004AC_1, IT09R000TC005AC, IT09R000TC005AC_1, IT09R000TC007AC, IT09R000TC007AC_1, IT09R000TC008AC, IT09R000TC015AC, IT09R000TC015AC_1, IT09R000TC016AC, IT09R000TC016AC_1, IT12CHIA-BACINOFIORA_ACE2, IT12MIG-RIOFIUME_ACB2, IT12PORTOCIRCEO-PSTEND_ACE2, IT12R12RMA_CAPROLACE_AT04, IT12R12RMA_FOGLIANO_AT09, IT12RIOFIUME-PRAT-MARE_ACE2, IT12TORASTURA-TORPAOLA_ACE2, IT19CW00119, IT19CW00626, IT19CW01317, IT19CW02711, IT19CW03431, IT19CW04036, IT19CW04088, IT19CW04089, IT19CW04610, IT19CW0477, IT19CW0489, IT19CW0508, IT19CW0525, IT19CW0526, IT19CW0552, IT19CW0554, IT19CW0583, IT19CW06044, IT19CW06643, IT19CW08156, IT19CW08454, IT19CW08480, IT19CW08484, IT19CW08581, IT19CW09075, IT19CW09076, IT19CW09282, IT19TW001297, IT19TW011299, IT19TW01131301, IT19TW01131401, IT19TW011315, IT19TW052302, IT19TW084266, IT19TW084267, IT19TW084268, IT19TW085269, IT19TW085305, IT19TW085306, IT19TW102296, ITF015CWCILENTO2, ITF015CWCILENTO20, ITF015CWCILENTO24, ITF015CWCILENTO27, ITF015CWCILENTO28, ITF015CWCILENTO8, ITF015CWISCHIA3, ITF015CWISCHIA4, ITF015CWISCHIA5, ITF015CWLITORALEFLEGREO1, ITF015CWLITORALEFLE-GREO8, ITF015CWPENSORRENTINA4, ITF015CWPENSORREN-TINA6, ITG-0018-MC00110-N, ITG-0036-MC00200-N, ITG-0097-MC00430-N, ITG-0104-MC00440-N, ITG-0153-MC00790-N, ITG-0162-MC00840-N, ITG-0181-MC01050-N, ITG-0186-MC01130-N, ITG-0221-MC01290-N, ITG-0226-MC01420-N, ITG-0231-MC01450-N, ITG-0256-MC01640-N, ITG-0311-MC01620-N, ITG-0315-MC10190-N, ITG-0317-MC00140-N, ITI022-R16-227ACA3S3_1, ITR16-087AT10_1, ITR16-108ACB3S3_2, ITR16-118ACB3S3_3, ITR16-125ACB3S3_4, ITR16-133ACB3S3_5, ITR16-143ACB3S3_6, ITR16-160ACB3S3_9, ITR16-165ACB3S3_11, ITR16-177ACE3S11_1, ITR16-182ACB3S3_13, ITR16-184ACB3S3_14, ITR16-187ACB3S3_15, ITR16-188ACB3S3_16, ITR16-191AT09_1, IT18RC26, IT18VV18, ITG-0028-MC00170-N, ITG-0104-MC00500-N, ITG-0164-MC00921-N, ITG-0231-MC01460-N, ITG-0239-MC01470-N, ITG-0190-MC01160-N, ITG-0129-MC00710-N, ITG-0164-MC00860-N, ITG-0164-MC00890-N, ITG-0314-MC10030-N, ITG-0018-MC00120-N, ITG-0152-MC10080-N, ITG-0164-MC00880-N, ITR16-164ACB3S3_10, ITR16-185ACF3S31_1, ITG-0258-MC01660-N, ITG-0258-MC01680-N, IT18RC34, ITF015CWCILENTO25, ITG-0032-MC00180-N, ITG-0129-MC00720-N, ITG-0104-MC00480-N, ITG-0164-MC00922-N, ITR16-101ACB3S3_1, ITF015CWCAPRI, ITG-0104-MC00460-N, ITF015CWCILENTO22, ITF015CWPRO-CIDA8, IT19CW01392, ITG-0283-MC01730, ITG-0014-MC00080, ITG-0036-MC00200, ITG-0007-MC00030, ITG-0045-MC00250, ITG-0162-MC00840, ITG-0317-MC00140, ITG-0018-MC00110, ITG-0186-MC01130 | Italy | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | MTMTC104, MTMTC107, MTMTC102, MTMTC109, MTMTC101, MTMTC106, MTMTC103 | Malta | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | NO0101040400-3-C, NO0101020200-1-C, NO0242030901-2-C, NO0280010400-1-C | Norway | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | PT08RDA1700, PT05SUL1635, PT05RDW1165A, PT03NOR0732, PT05RDW1166A, PT08RF3, PT08RF1, PT08RF2, PT08RF4, PT08RF5, PT06SUL1638, PT01LIM0057, PT01NOR0724, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT08RDA1657B, PT04VOU0552, PT06MIR1367, PT04VOU0536, PT06MIR1374, PT06SAD1222, PT06SAD1219, PT05TEJ1100A, PT05TEJ1139A, PT01MIN0018, PT04MON0682, PT02CAV0096, PT07GUA1631, PT04VOU0550, PT06MIR1368, PT06SAD1217, PT04VOU0514, PT01LIM0056, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT02AVE0135 | Portugal | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | ES080MSPFC010, ES110MSPFEIMC03M4, ES110MSPFEIMC07M3, ES110MSPFMAMC08M3, ES110MSPFMAMC12M2, ES110MSPFMAMC13M2, ES100MSPFC16, ES100MSPFC4, ES080MSPFC004, ES110MSPFMAMC03M2, ES100MSPFC1, ES100MSPFC10, ES100MSPFC14, ES100MSPFC24, ES080MSPFC011, ES080MSPFC012, ES080MSPFC014, ES080MSPFC015, ES110MSPFEIMC04M4, ES110MSPFMAMC15M3, ES100MSPFC29, ES100MSPFC6, ES110MSPFEIMC02M4, ES110MSPFMAMC02M3, ES110MSPFMAMC05M3, ES110MSPFMAMC07M3, ES110MSPFMEMC06M2, ES100MSPFC3, ES100MSPFC30, ES100MSPFC5, ES100MSPFC32, ES110MSPFMAMC04M2, ES100MSPFC2, ES110MSPFFOMC09M3, ES110MSPFMAMC06M2, ES110MSPFMAMC14M3, ES110MSPFMEMC04M4, ES110MSPFMEMC07M3, ES100MSPFC25, ES110MSPFFOMCM01, ES070MSPF010300070, ES100MSPFC23, ES110MSPFMAMC11M3, ES110MSPFMAMCM01, ES110MSPFMEMC05M2, ES080MSPFC013, ES110MSPFMEMCM02, ES070MSPF010300020, ES070MSPF010300030, ES110MSPFMAMC16M3, ES100MSPFC31, ES110MSPFMAMC10M2, ES110MSPFMAMC09M3, ES110MSPFEIMC01M2, ES110MSPFEIMCM01, ES080MSPFC017, ES110MSPFMAMC01M2, ES080MSPFC016, ES110MSPFEFMC08M4, ES110MSPFMAMCM02, ES110MSPFEIMC05M3, ES110MSPFFOMC10M2, ES110MSPFEIMC06M4, ES080MSPFC003, ES018MSPFES145MAT000060, ES018MSPFES194MAT000050, ES018MSPFES145MAT000070, ES018MSPFES085MAT000200, ES018MSPFES234MAT000030, ES018MSPFES244MAT000020, ES018MSPFES144MAT000080, ES110MSPFMEMC02M3, ES110MSPFMEMC01M2_001 | Spain | EEA WISE MARINE |
| QE1-2-2 - Angiosperms | Macrovegetation | Benthic habitats | 0.6 | EQR | UKGB620301100000, UKGB640503300000, UKGBNI6NB030, UKGB640523160000, UKGB650503200000, UKGBNI6NE160, UKGB641008220000, UKGB650705150000, UKGBNI6NW251, UKGB640402492000, UKGB680301430000, UKGBNI6NE140, UKGB641008180000, UKGB510804505600, UKGB520503613602, UKGB530402609201, UKGB540805015500, UKGB541006608000, UKGB510503403500, UKGB520503503800, UKGB520503613601, UKGB530905415403, UKGB531106708200, UKGB531207212100, UKGB520503403600, UKGB531207112400, UKGB510804605900, UKGB511006206900, UKGB521006407200, UKGB530603911401, UKGB580705140000, UKGB521010207500, UKGB530402609203, UKGB530804906600, UKGB530905415402, UKGB510202110000, UKGB510503410700, UKGB520804415800, UKGB530402609202, UKGB530503300300, UKGB531006114100, UKGB540704116000, UKGB520704202800, UKGB520804814400, UKGB521006501200, UKGB530603911402, UKGB531207212200, UKGB570704700000, UKGB510302509900, UKGB530503311300, UKGB541005800700, UKGB531005913500, UKGB530905415401, UKGB511006115200, UKGB541006614800 | United Kingdom | EEA WISE MARINE |
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | BG2IU600R1013, BG2VE106R1801, BG2SE800R020, BG2SE900L027, BG2DO700L017, BG2IU200R1005, BG2RE200R1101, BG2SE200R1101, BG2SE500R1113, BG2DO700L018, BG2IU200L007, BG2IU800R1115, BG2RE200R1201, BG2SE400R1106, BG2RE400R1102 | Bulgaria | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | HRO423-BSK, HRO422-KVV, HRO423-VIK, HRO422-VIS, HRO313-ZUC, HRO423-KOR, HRP2_2-MI, HRP2_2-NEP, HRP2_3-NE, HRP1_3-OM, HRP2_2-JAP, HRP2_2-ZR-B, HRP2_2-CE | Croatia | EEA WISE MARINE |
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | FRLC110, FRLC112, FRLC111, FRLC109, FRDT03, FRDT05B, FRDT11A, FRDT01, FRDT06B, FRDT10, FRDT12, FRDT15A, FRDT15B, FRDT13E, FRDT14A, FRDT06A, FRDT13C, FRDT13H, FRET02, FRDT14C, FRET03, FRDT02, FRDT05A, FRDT11C, FRDT15C, FRET01, FRET04, FRDT11B, FRDT07, FRDT09, FRDT04, FRDT08 | France | EEA WISE MARINE |
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | ITF015TWLAGODILUCRINO, ITF015TWLAGODIMISENO, ITF015TWLAGODIPATRIA, IT19TW055308, ITF015TWLAGODIFUSARO | Italy | EEA WISE MARINE |
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | PLCW20001WB2 | Poland | EEA WISE MARINE |
| QE1-2-3 - Macrophytes | Macrovegetation | Benthic habitats | 0.6 | EQR | PT09FAICPP1, PT09SMGCI1, PT09TERCPP1, PT09TRICP1, PT09OCICP1, PT09PICCPP1, PT09SJOCI1, PT09FLOCI1, PT09SMGCPP4, PT09GRACI1, PT09GRACPP1, PT09FAICI1, PT09PICCI1, PT09SMACI1, PT09TERCP1, PT09SJOCPP1, PT09SMGCPP3, PT09SMGCPP1, PT09SMGCPP2, PT09CORCI1, PT09TERCI1, PT09GRACP1, PT09ORICP1, PT09TERCPP2, PT09FLOCPP1, PT09SMACPP1, PT09CORCPP1, PT09SJOT001, PT09SJOT003, PT09SJOT002 | Portugal | EEA WISE MARINE |
| QE1-2-4 - Phytobenthos | Macrovegetation | Benthic habitats | 0.6 | EQR | BG2IU600R1013, BG2VE106R1801, BG2SE300R1103, BG2SE800R020, BG2IU200R1005, BG2SE500R1113, BG2IU800R1115, BG2RE400R1102 | Bulgaria | EEA WISE MARINE |
| QE1-2-4 - Phytobenthos | Macrovegetation | Benthic habitats | 0.6 | EQR | FRKT061, FRKT031, FRKT091, FRKT092 | France | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | BEVL17_15, BEVL17_42, BEVL17_43, BEFED_CW | Belgium | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | BG2BS000C1112, BG2BS000C001, BG2BS000C1007, BG2BS000C005, BG2BS000C002, BG2BS000C1113, BG2BS000C1308, BG2BS000C1006, BG2BS000C1011, BG2BS000C1013, BG2BS000C1004, BG2BS000C1008, BG2BS000C1010, BG2BS000C1003, BG2BS000C1108, BG2BS000C1208, BG2BS000C1012, BG2IU600R1013, BG2MA100L001, BG2VE106R1801, BG2SE900L037, BG2SE300R1103, BG2SE800R020, BG2SE900L027, BG2DO700L017, BG2IU200R1005, BG2RE200R1101, BG2SE200R1101, BG2SE500R1113, BG2DO700L018, BG2IU200L007, BG2RE200R1201, BG2SE400R1106, BG2IU200L017, BG2IU400R1108, BG2MA107L002, BG2RE400R1102, BG2SE900L028 | Bulgaria | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | HRJMO015, HRJMO029, HRJMO032, HRJMO033, HRJMO038, HRJMO028, HRJMO062, HRJMO063, HRJMO068, HRJMO035, HRJMO045, HRJMO059, HRJMO065, HRJMO072, HRJMO073, HRJMO078, HRJMO081, HRJMO031, HRJMO036, HRJMO061, HRJMO066, HRJMO044, HRJMO049, HRJMO064, HRJMO069, HRJMO077, HRJMO018, HRJMO030, HRJMO051, HRJMO056, HRJMO060, HRJMO074, HRJMO075, HRJMO079, HRJMO019, HRJMO058, HRJMO070, HRJMO071, HRJMO076, HRJMO021, HRJMO037, HRJMO067, HRJMO080, HRJMO017, HRJMO042, HRJMO041, HRJMO046, HRJMO011, HRJMO050, HRJMO053, HRJMO057, HRJMO034, HRJMO039, HRJMO003, HRJMO040, HRJMO027, HRJMO043, HRJMO055, HRJMO048, HRJMO026, HRJKP020, HRJKP024, HRJKP017, HRJKP022, HRJKP026, HRJKP021, HRJKP031, HRJKP010, HRJKP025, HRJKP032, HRJKP012, HRJKP019, HRJKP028, HRO423-BSK, HRO413-LIK, HRO313-BAZ, HRO423-RILP, HRO313-KASP, HRO413-STLP, HRO412-ZOI, HRP2_3-CE, HRP2_3-KR, HRP2_3-LPP, HRP2_2-RJP, HRP2_2-NEP, HRP2_2-OM, HRP2_2-JAP | Croatia | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | CY10-C1, CY6-C4, CY9-C4, CY14-C2-HM, CY15-C2, CY11-C2, CY12-C2-HM, CY13-C2, CY21-C3, CY22-C3, CY2-C1, CY17-C2-HM, CY1-C1, CY3-C2, CY5-C4 | Cyprus | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | DKCOAST114, DKCOAST131, DKCOAST138, DKCOAST140, DKCOAST224, DKCOAST123, DKCOAST219, DKCOAST222, DKCOAST68, DKCOAST121, DKCOAST17, DKCOAST46, DKCOAST160, DKCOAST216, DKCOAST221, DKCOAST90, DKCOAST93, DKCOAST29, DKCOAST217, DKCOAST62, DKCOAST200, DKCOAST44, DKCOAST48, DKCOAST201, DKCOAST209, DKCOAST119, DKCOAST133, DKCOAST136, DKCOAST145, DKCOAST212, DKCOAST232, DKCOAST124, DKCOAST130, DKCOAST142, DKCOAST147, DKCOAST236, DKCOAST59, DKCOAST86, DKCOAST87, DKCOAST56, DKCOAST103, DKCOAST105, DKCOAST132, DKCOAST139, DKCOAST141, DKCOAST144, DKCOAST157, DKCOAST159, DKCOAST214, DKCOAST225, DKCOAST92, DKCOAST204, DKCOAST107, DKCOAST205, DKCOAST6, DKCOAST2, DKCOAST154, DKCOAST96, DKCOAST24, DKCOAST47, DKCOAST137, DKCOAST233, DKCOAST111, DKCOAST129, DKCOAST128, DKCOAST72, DKCOAST122, DKCOAST207, DKCOAST16, DKCOAST235, DKCOAST206, DKCOAST165, DKCOAST234, DKCOAST35, DKCOAST1, DKCOAST120, DKCOAST28, DKCOAST156, DKCOAST213 | Denmark | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | EEEE_1, EEEE_10, EEEE_11, EEEE_12, EEEE_13, EEEE_14, EEEE_16, EEEE_17_2022, EEEE_18_2022, EEEE_19_2022, EEEE_2, EEEE_3, EEEE_5, EEEE_6, EEEE_7, EEEE_8, EEEE_9, EEEE 14 2022, EEEE 15, EEEE 4 | Estonia | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | FI2_LS_011, FI2_SS_002, FI2_SS_017, FI2_SS_021, FI2_SU_050, FI3_LS_016, FI3_MS_013, FI3_MS_014, FI3_MS_020, FI3_SES_016, FI3_SES_021, FI3_SES_022, FI3_SES_034, FI3_SES_035, FI3_SES_042, FI3_SEU_120, FI4_PU_020, FI5_PU_001, FI6_PS_002, FI2_LS_004, FI2_SS_015, FI2_SS_029, FI3_LS_017, FI3_LV_003, FI3_MU_050, FI3_MU_110, FI3_SES_040, FI2_SS_014, FI2_SS_030, FI2_SU_030, FI2_LS_005, FI2_LS_008, FI2_LU_011, FI2_SS_005, FI2_SS_019, FI2_SS_020, FI2_SS_023, FI2_SU_020, FI2_LS_001, FI2_LS_006, FI2_LS_009, FI2_LS_013, FI2_SS_025, FI2_LS_003, FI2_LU_010, FI2_SS_022, FI2_SS_026, FI2_SS_027, FI2_SS_003, FI2_SS_009, FI2_SS_010, FI2_SS_013, FI2_SU_010, FI4_PS_005, FI5_PS_003, FI3_LS_015, FI3_LS_021, FI3_LS_026, FI3_LS_030, FI3_LV_006, FI3_LV_011, FI3_MS_017, FI3_SES_030, FI3_SES_037, FI3_SES_039, FI3_SES_046, FI3_LS_013, FI3_LS_020, FI3_LU_040, FI3_PS_031, FI3_SES_026, FI3_SES_036, FI3_SEU_050, FI3_SEU_060, FI3_LS_003, FI3_LS_012, FI3_LS_024, FI3_LS_025, FI3_LV_012, FI3_MS_018, FI3_SES_012, FI3_SES_031, FI3_LS_004, FI3_LS_006, FI3_LS_023, FI3_LU_010, FI3_LU_060, FI3_LV_005, FI3_LV_009, FI3_PS_023, FI3_PS_029, FI3_PU_070, FI3_SES_017, FI3_SES_032, FI3_SES_038, FI3_SEU_110, FI3_LS_019, FI3_LS_027, FI3_LU_030, FI3_LV_008, FI3_LV_010, FI3_LV_013, FI3_MS_010, FI3_MS_011, FI3_PS_020, FI3_PS_028, FI4_PU_040, FI2_LS_002, FI2_LS_010, FI2_LS_014, FI2_LU_020, FI2_SS_001, FI2_SS_006, FI2_SS_007, FI2_SS_011, FI2_SS_024, FI2_SS_028, FI2_SU_040, FI3_LS_008, FI3_LS_011, FI3_LS_014, FI3_LU_020, FI3_LV_001, FI3_LV_002, FI3_MU_070, FI3_MU_130, FI3_PS_026, FI3_SES_033, FI3_SES_041, FI3_SES_047, FI3_SES_048, FI3_SEU_090, FI4_PS_012, FI4_PS_014, FI4_PS_001, FI4_PS_010, FI5_PS_001, FI5_PS_002, FI6_PU_001, FI6_PS_001, FI8_AAM_034, FI2_LU_021, FI3_SEU_070, FI3_PS_027, FI3_MS_015, FI2_LS_007, FI3_LU_050, FI4_PS_011, FI3_PU_060, FI2_SS_031 | Finland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | FRDC01, FRDC02A, FRDC04, FRDC07J, FRDC05, FRDC07G, FRDC09C, FRDC02C, FRDC02F, FRDC08B, FRDC09A, FRDC09B, FRDC10C, FRDC02E, FRDC07C, FRDC07A, FREC03AD, FREC03C, FREC03EG, FRFC09, FRFC11, FREC01AB, FREC01C, FREC02D, FRFC02, FRGC26, FRGC03, FRGC07, FRGC47, FRGC11, FRGC16, FRGC44, FRGC34, FRGC36, FRGC01, FRGC05, FRGC20, FRHC15, FRHC01, FRHC60, FRJC016, FRLC106, FRMC07, FRMC10, FRLC102, FRLC104, FRLC105, FRMC09, FRMC16, FRIC08, FRHC03, FRHC09, FRHC18, FRHC61, FRMC01, FRLC107, FRLC108, FRHC04, FRMC11, FRMC14, FRIC01, FRIC05, FRJC003, FRJC018, FRJC012, FRIC03, FRJC002, FRMC04, FRMC08, FRIC04, FRJC013, FRMC13, FRIC02, FRIC07B, FRIC11, FRDC07H, FRDC09D, FREC03F, FRDC02D, FRDC07E, FRFC08, FREC02AB, FRFC06, FRGC46, FRGC53, FRGC10, FRGC28, FRHC14, FRHC16, FRMC03, FRMC15, FRLC101, FRMC05, FRMC12, FRJC004, FRJC010, FRIC10, FRJC007, FRGC38, FRMC02, FRHC02, FRGC48, FRLC103, FRGC18, FREC04AC, FRJC017, FRMC06, FRGC50, FRJC011, FREC02C, FREC04B, FREC01D, FRGC45, FRDC02B, FRIC06, FRGC13, FREC03B, FRFC01, FRHC10, FRHC13, FRGC35, FRDT03, FRDT11A, FRDT06B, FRDT10, FRDT15A, FRDT14A, FRDT13C, FRKT061, FRKT063, FRKT031, FRKT091, FRDT02, FRDT05A, FRKT092, FRET01, FRET04, FRKT011, FRDT11B, FRDT07, FRDT04 | France | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | DECW_DENI_N4-4900-02, DECW_DENI_N2-4900-01, DECW_DESH_B2-9610-07-03A, DECW_DESH_B2-9610-07-04, DECW_DESH_B2-9610-10-02, DECW_DESH_B3-9610-09-07A, DECW_DESH_B3-9610-07-07, DECW_DESH_B3-9610-09-05, DECW_DESH_B3-9610-09-06, DECW_DENI_N1-4900-01, DECW_DESH_B4-9610-09-10, DECW_DESH_B3-9610-09-08A, DECW_DESH_B3-9610-09-09, DECW_DESH_B4-9610-07-09, DECW_DEMV_OD_01, DECW_DEMV_WP_06, DECW_DEMV_WP_14, DECW_DESH_N4-5000-04-02, DECW_DEMV_WP_01, DECW_DESH_N4-9500-02-02, DECW_DESH_N4-9500-03-02, DECW_DESH_B2-9610-07-01, DECW_DESH_B2-9610-09-01, DECW_DEMV_WP_02, DECW_DESH_N2-9500-01-03, DECW_DEMV_WP_03, DECW_DEMV_WP_07, DECW_DEMV_WP_09, DECW_DESH_N1-9500-01-01, DECW_DESH_N2-9500-01-04, DECW_DESH_N3-9500-03-01, DECW_DESH_B3-9610-07-06, DECW_DESH_B3-9610-09-08B, DECW_DESH_B4-9610-09-12, DECW_DESH_B3-9610-07-05, DECW_DESH_B3-9610-09-03, DECW_DEMV_WP_08, DECW_DEMV_WP_10, DECW_DEMV_WP_13, DECW_DENI_N4-4900-01, DECW_DENI_N2-3100-01, DECW_DENI_N3-3990-01, DECW_DEMV_WP_15, DECW_DEMV_WP_21, DECW_DENI_N4-3100-01, DECW_DENI_N1-3100-01, DECW_DEMV_WP_11, DECW_DESH_B2-9610-07-02, DECW_DESH_B3-9610-09-04, DECW_DESH_N2-9500-01-05, DECW_DESH_N3-9500-02-01, DECW_DESH_N3-5000-04-01, DECW_DEMV_WP_18, DECW_DEMV_WP_04, DECW_DEMV_WP_16, DECW_DESH_B2-9610-07-03B, DECW_DEMV_WP_17, DECW_DEMV_WP_19, DECW_DEMV_WP_12, DECW_DEMV_WP_05, DECW_DESH_B3-9610-09-07B, DECW_DESH_B4-9610-09-11, DECW_DESH_N5-5000-04-03, DECW_DESH_B4-9610-07-08, DECW_DENI_N4-5900-01, DECW_DENI_N3-4900-01, DECW_DESH_N2-9500-01-06, DECW_DESH_N1-9500-01-02, DETW_DENI_T1-3990-01, DETW_DENI_T1-3000-01, DETW_DESH_T1-5000-01, DETW_DENI_T1-4000-01, DECW_B3-9610-09-08, DECW_B2-9610-07-03, DECW_B3-9610-09-07 | Germany | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | EL0129C0002N, EL0132C0006N, EL0132C0008N, EL0512C0003H, EL0534C0011H, EL0626C0001N, EL0626C0005N, EL0626C0006N, EL0626C0010N, EL0902C0001N, EL1005C0010N, EL1436C0001N, EL1437C0070N, EL1438C0052N, EL0245C0017N, EL0415C0009N, EL0512C0A02N, EL0227C0005N, EL0227C0006N, EL0245C0014N, EL0331C0002N, EL0722C0011N, EL0724C0017N, EL0817C0006N, EL1207C0001N, EL1208C0004N, EL1210C0008N, EL0132C0004N, EL0228C0009N, EL0718C0007N, EL0331C0001N, EL0626C0009N, EL0626C0012N, EL0333C0007N, EL0415C0003N, EL0513C0006N, EL0513C0007N, EL0626C0002N, EL0626C0011N, EL0626C0013N, EL0723C0012N, EL0719C0006N, EL0724C0016N, EL0725C0018N, EL1106C0001N, EL0415C0002N, EL0817C0007N, EL1005C0011H, EL1005C0006N, EL1436C0008N, EL1437C0078N, EL1207C0002N, EL1339C0002N, EL1339C0007N, EL1436C0007N, EL1339C0003N, EL1341C0012N, EL1436C0012N, EL1438C0036N, EL1438C0041N, EL0227C0004H, EL0228C0003N, EL1436C0003N, EL1436C0005N, EL1436C0013N, EL1437C0085N, EL1043C0002N, EL1340C0019N, EL1005C0004N, EL0718C0005N, EL0228T0004N, EL0513T0004N, EL0902T000000002N, EL1208T0004N, EL0132T0003N, EL0129T0002H, EL0228T0001N, EL0245T0001N, EL0902T000000001N, EL0546T0003N, EL0444T0004N, EL0512T0001N, EL0534T0005N, EL0415T0001N, EL0514T0002N, EL0228T0005N, EL0718T0001N, EL1106T0001N, EL0415T0002N | Greece | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | IEEA_010_0000, IEEA_010_0100, IEEA_020_0000, IEEA_090_0000, IEEA_090_0200, IEEA_090_0300, IEEA_090_0400, IEEA_100_0000, IEEA_140_0000, IENB_040_0000, IENB_040_0100, IENW_070_0000, IENW_080_0000, IENW_085_0000, IENW_120_0000, IENW_200_0000, IENW_220_0000, IENW_220_0100, IESE_010_0000, IESE_040_0000, IESE_040_0200, IESE_100_0000, IESE_100_0100, IESE_100_0200, IESE_100_0500, IESE_140_0000, IESE_140_0100, IESH_040_0000, IESH_050_0000, IESH_060_0000, IESH_060_0300, IESH_060_0800, IESH_060_1100, IESW_020_0000, IESW_020_0100, IESW_050_0000, IESW_060_0000, IESW_060_0300, IESW_060_0700, IESW_060_0750, IESW_080_0000, IESW_080_0100, IESW_130_0100, IESW_140_0000, IESW_180_0000, IESW_190_0000, IESW_190_0200, IESW_190_0300, IESW_230_0200, IEWE_160_0100, IEWE_170_0000, IEWE_170_0700, IEWE_200_0000, IEWE_200_0200, IEWE_310_0000, IEWE_340_0000, IEWE_350_0000, IEWE_350_0100, IEWE_350_0200, IEWE_400_0000, IEWE_400_0200, IEWE_420_0000, IEWE_450_0000, IEWE_460_0300, IEWE_470_0100 | Ireland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | IT05CE1_4BIS, IT05TPO_3, IT05TPO_4, IT05TPO_5, IT07CW00800801, IT07CW00800802, IT07CW00800803, IT07CW00800804, IT07CW00800805, IT07CW00800906, IT07CW00900907, IT07CW00900908, IT07CW00900909, IT07CW00900910, IT07CW00900911, IT07CW00901012, IT07CW01001013, IT07CW01001013_1, IT07CW01001014, IT07CW01001015, IT07CW01001016, IT07CW01001017, IT07CW01001018, IT07CW01001019, IT07CW01001020, IT07CW01001121, IT07CW01001122, IT07CW01101123, IT07CW01101124, IT07CW01101125, IT07CW01101126_1, IT089910000000001ER, IT089920000000001ER, IT089930000000001ER, IT089940000000001ER, IT089950000000001ER, IT08-9960000000001ER, IT08-CD1, IT08CD1_ITB, IT08-CD2, IT09N002AR003AC, IT09R000OM009AC, IT09R000OM009AC_1, IT09R000OM010AC, IT09R000OM011AC, IT09R000OM012AC, IT09R000OM013AC, IT09R000OM013AC_1, IT09R000OM14AC, IT09R000TC004AC, IT09R000TC004AC_1, IT09R000TC005AC, IT09R000TC005AC_1, IT09R000TC006AC, IT09R000TC007AC, IT09R000TC007AC_1, IT09R000TC008AC, IT09R000TC015AC, IT09R000TC015AC_1, IT09R000TC016AC, IT09R000TC016AC_1, IT09R000TN001AC, IT09R000TN001AC_1, IT09R019SE002AC, IT09R019SE002AC_1, IT11_R_COSTA_UF14_22_B, IT11_R_COSTA_UF14_22_C, IT11_R_COSTA_UF23_24_A, IT11_R_COSTA_UF25_27_B, IT11-R_COSTA_UF02_01-A, IT11-R_COSTA_UF02_02-A, IT11-R_COSTA_UF03_12-A, IT11-R_COSTA_UF03_12-B, IT11-R_COSTA_UF13_13-A, IT11-R_COSTA_UF14_22-A, IT12BACINOFIORA_ACE2, IT12BACINOFIORA-MIG_ACE2, IT12R12FON-ITR_LUNGO_AT03, IT12R12RMA_FOGLIANO_AT09, IT12R12RMA_MONACI_AT03, IT12R12RMA_SABAUDIA_AT09, IT12RIOFIUME-PRATMARE_ACE2, IT12TORASTURA-TORPAOLA_ACE2, IT12TORPAOLA-PORTOCIRCEO_ACA2, IT12VINDICIO-BACINOGARI_ACE2, IT12ZANNONE_ACA3, IT13IT_12_RICCIO_VASTO_ACB2, IT13IT_12_TRONTO_RICCIO_ACC2, IT13IT_12_VASTO_SANSALVO_ACC2, IT19CW00119, IT19CW00618, IT19CW01124, IT19CW01515, IT19CW01614, IT19CW02213, IT19CW03132, IT19CW03431, IT19CW03690, IT19CW04088, IT19CW04286, IT19CW0477, IT19CW0489, IT19CW0508, IT19CW0525, IT19CW0552, IT19CW0554, IT19CW0583, IT19CW06643, IT19CW06742, IT19CW06941, IT19CW07139, IT19CW07240, IT19CW07646, IT19CW08153, IT19CW08156, IT19CW08454, IT19CW08455, IT19CW08480, IT19CW08484, IT19CW08581, IT19CW09075, IT19CW09248, IT19CW09282, IT19CW09452, IT19CW09549, IT19CW09593, IT19CW09723, IT19CW10222, IT19TW001297, IT19TW084266, IT19TW084267, IT19TW084268, IT19TW085269, IT19TW085305, IT19TW085306, ITACW00000101VN, ITACW00000200VN, ITACW00000300VN, ITACW00000400VN, ITACW00000500VN, ITACW00000600FR, ITACW00000701FR, ITACW00000901FR, ITACW00001501FR, ITACW00001701FR, ITACW00001801FR, ITACW00002101FR, ITATW00000100VN, ITATW00000200VN, ITATW00000300VN, ITATW00000400VN, ITATW00000500VN, ITATW00000600VN, ITATW00000700VN, ITATW00000800VN, ITATW00000900VN, ITATW00001000VN, ITATW00001100VN, ITATW00001300VN, ITATW00001400VN, ITATW00001500VN, ITATW00001600VN, ITATW00001700VN, ITATW00001800VN, ITATW00001900VN, ITATW00002100FR, ITATW00002200FR, ITATW00002400FR, ITATW00002500FR, ITATW00002600FR, ITATW00002800FR, ITATW00002900FR, ITATW00003000FR, ITATW00003400FR, ITATW00003500FR, ITATW00003600FR, ITATW00003700FR, ITATW00003800FR, ITATW00003900FR, ITATW00004100FR, ITATW00004200FR, ITATW00004400FR, ITF015CWGOLFODINAPOLI, ITF015CWGOLFODIPOLICASTRO3, ITF015CWGOLFODIPOLI-CASTRO6, ITF015CWLITORALEFLEGREO, ITF015CWLITORALEFLEGREO2, ITF015CWLITORALEFLEGREO4, ITF015CWLITORALEFLEGREO7, ITF015CWMONTIDISALERNO, ITF015CWMONTIDISALERNO1, ITF015CWPIANASARNO, ITF015CWPIANASELE1, ITF015CWPIANAVOLTURNO, ITF015CWPIANAVOLTURNO1, ITF015CWPIANAVOLTURNO2, ITF017_CW-C3_FLUV-POLICORO, ITF017_CW-F3_FLUV-CAVONE, ITF017_CW-F3_FLUV-METAPONTO, ITG-0004-AT50030, ITG-0004-AT50032, ITG-0035-AT50060, ITG-0036-AT50070, ITG-0038-AT50910, ITG-0040-AT50090, ITG-0073-AT50110, ITG-0101-AT50120, ITG-0109-AT50150, ITG-0114-AT50200, | Italy | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | ITG-0115-AT50211, ITG-0115-AT50212, ITG-0123-AT50260, ITG-0128-AT50300, ITG-0129-AT50310, ITG-0130-AT51010, ITG-0142-AT50320, ITG-0158-AT50330, ITG-0165-AT51000, ITG-0181-AT50350, ITG-0184-AT50360, ITG-0184-AT50380, ITG-0190-AT50390, ITG-0221-AT50420, ITG-0221-AT50460, ITG-0221-AT50490, ITG-0225-AT50500, ITG-0226-AT50550, ITG-0226-AT50570, ITG-0226-AT50580, ITG-0226-AT50590, ITG-0226-AT50600, ITG-0226-AT50610, ITG-0252-AT50650, ITG-0257-AT50740, ITG-0258-AT50760, ITG-0259-AT50780, ITG-0259-AT50781, ITG-0287-AT50830, ITG-0301-AT50870, ITG-0302-AT50011, ITG-0302-AT50012, ITI015-R16-226ACB3S1_1, ITI020-R16-088ACE2S1_5, ITR16-001ACE3S12_1, ITR16-027ACE3S12_3, ITR16-042ACA3S1_2, ITR16-084ACE2S1_1, ITR16-087ACE2S1_2, ITR16-097ACB2S3_2, ITR16-151ACB3S3_8, ITR16-193ACF3S32_1, ITR16-195ACE3S11_2, IT18CS08, IT18CZ42, IT18CZ43, IT18CZ44, IT18CS67, IT18KR55, IT18RC28, IT18RC32, IT18RC35, IT19CW03228, IT18CS03, IT18CS05, IT18CS06, IT18CZ12, IT18CZ13, IT18KR48, IT18RC23, IT18RC27, IT18RC30, IT19CW02834, IT19CW07845, IT19CW10220, IT18RC26, IT19CW04485, IT18RC40, IT19CW07957, IT12PONZA_ACA3, IT18CS63, IT18CZ11, IT18RC25, IT18RC39, IT18VV18, ITF015CWGOLFODINAPOLI1, IT19CW00121, ITG-0028-MC00170-N, ITG-0104-MC00500-N, ITG-0115-MC00530-N, ITG-0164-MC00921-N, ITG-0231-MC01460-N, ITG-0239-MC01470-N, ITG-0174-MC00960-N, ITG-0190-MC01160-N, ITF015CWPIANASELE3, ITG-0016-MC00090-N, ITG-0164-MC00860-N, ITG-0164-MC00890-N, ITG-0221-MC01320-N, ITG-0288-MC01750-N, IT18VV20, ITG-0018-MC00120-N, ITG-0115-MC00520-N, ITG-0152-MC10080-N, ITG-0120-MC00600-N, ITG-0164-MC00880-N, ITG-0221-MC01280-N, ITR16-024ACE3S12_2, ITG-0176-MC01030-N, ITR16-164ACB3S3_10, ITG-0258-MC01660-N, ITG-0283-MC01720-N, IT12PAL-MAROLA_ACA3, IT18CZ41, IT18RC31, IT18VV14, IT18VV16, IT18VV17, ITF015CWPIANASELE2, ITG-0258-MC01680-N, ITR16-081ACA3S1_4, IT18CS04, IT18CS10, IT18CS62, IT18RC34, ITG-0032-MC00180-N, IT18CS02, IT18CZ46, IT18RC22, IT18RC24, IT18RC37, ITG-0115-MC00540-N, IT19CW04038, IT18VV21, ITF015CWLITORALEFLEGREO9, ITG-0104-MC00480-N, ITG-0164-MC00922-N, ITG-0175-MC01000-N, ITI022_C_2, ITI027_F_2, ITR16-194ACF3S32_2, ITR16-014ACA3S1_1, ITR16-054ACA3S1_3, ITR16-196ACE3S11_3, IT18CS01, IT18CS09, ITG-0124-MC00660-N, IT19CW01316, IT18RC29, ITR14_001_B_2, IT18VV19, ITG-0118-MC00580-N, ITG-0104-MC00460-N, IT18VV15, ITG-0281-MC01710-N, ITG-0115-MC00570-N, IT19CW00625, ITG-0168-MC00940-N, ITR16-147ACB3S3_7, IT18CZ45, IT18CS07, IT19CW01392, IT18CZ47, ITF015TWLAGODILUCRINO, IT19TW055310, ITG-0004-AT50031, IT19TW055311, ITF015TWLAGODIPATRIA, IT19TW055308, ITF015TWLAGODIFUSARO, ITACW00002200FR, IT08-CD1_ITC, ITACW00001800FR, ITACW00002000FR, ITG-0283-MC01730, ITACW00001100FR, ITACW00002400FR, ITG-0014-MC00080, ITACW00001500FR, ITACW00001900FR, ITACW00002100FR, ITG-0036-MC00200, ITACW00001000FR, ITACW00001200FR, ITACW00001300FR, ITACW00002300FR, ITACW00000700FR, ITACW00000900FR, ITACW00001600FR, ITACW00001700FR, ITACW00001400FR, ITACW00000800FR | | |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | LVA, LVB, LVCDEV, LVTD, LVTG, LVTL | Latvia | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | LT100101100, LT100101200, LT100201100, LT100201200, LT100201300 | Lithuania | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | MTMTC104, MTMTC107, MTMTC102, MTMTC109, MTMTC101, MTMTC105, MTMTC106, MTMTC108, MTMTC103 | Malta | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | NL81_2, NL89_WESTSDE_OWL, NL94_11, NL94_9, NL95_3A, NL81_1, NL89_OOSTSDE_OWL, NL81_10, NL89_ZWIN, NL81_3, NL95_1A, NL95_2A, NL95_4A, NL87_1 | Netherlands | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | NO0101000030-1-C, NO0101020200-2-C, NO0101020400-3-C, NO0101020500-C, NO0110010300-C, NO0121000030-C, NO0130010301-2-C, NO0201020302-C, NO0242011101-C, NO0242020900-C, NO0242021000-C, NO0260040200-C, NO0260040600-C, NO0260040800-C, NO0260050100-C, NO0260050500-C, NO0261010100-C, NO0280020100-1-C, NO0301011206-C, NO0301011502-C, NO0301020400-C, NO0301020900-C, NO0301022300-1-C, NO0302011100-C, NO0302012202-C, NO0302012203-C, NO0320030200-C, NO0320041000-10-C, NO0321000030-C, NO0321000032-10-C, NO0321030402-1-C, NO0321040100-1-C, NO0361000031-C, NO0361040102-2-C, NO0363020500-C, NO0363020700-3-C, NO0401020100-4-C, NO0401020600-2-C, NO0401030700-1-C, NO0402010300-1-C, NO0403010900-C, NO0403011000-C, NO0403030800-C, NO0420010200-2-C, NO0420020100-10-C, NO0420030101-2-C, NO0420030101-4-C, NO0420030102-2-C, NO0420030402-C, NO0420030700-C, NO0420031000-C, NO0421010400-C, NO0421010600-C, NO0422010400-C, NO0423000030-11-C, NO0423010200-C, NO0423010300-1-C, NO0423011200-C, NO0423011700-C, NO0424020100-20-C, NO0424030100-C, NO0201010800-C, NO0101020900-C, NO0101030101-3-C, NO0130000200-1-C, NO0101010202-1-C, NO0101020104-C, NO0101040200-2-C, NO0110010702-C, NO0110021101-2-C, NO0120030201-2-C, NO0120030202-1-C, NO0120030500-1-C, NO0241000030-C, NO0320010400-C, NO0320020501-C, NO0320041000-2-C, NO0320041500-4-C, NO0320050100-8-C, NO0321000031-1-C, NO0362020100-1-C, NO0362040200-1-C, NO0363010300-4-C, NO0363040200-1-C, NO0363041101-C, NO0363041200-4-C, NO0280020100-3-C, NO0242010101-2-C, NO0242010300-C, NO0242010401-2-C, NO0363050300-5-C, NO0364010300-C, NO0364030600-C, NO0242010800-1-C, NO0242020300-C, NO0242040102-C, NO0280022102-C, NO0401011400-C, NO0401030600-C, NO0402010402-C, NO0402011400-C, NO0402020500-2-C, NO0402020900-1-C, NO0403010600-C, NO0403010700-C, NO0282011200-C, NO0282011900-C, NO0282012100-2-C, NO0282012600-C, NO0260020100-C, NO0260020500-C, NO0260030300-C, NO0403030100-1-C, NO0420010300-C, NO0420020100-8-C, NO0420021700-C, NO0420031200-C, NO0260040900-1-C, NO0260050400-C, NO0261000035-2-C, NO0261010702-4-C, NO0301020602-C, NO0301022000-1-C, NO0302010100-C, NO0302010703-C, NO0302011300-2-C, NO0302011400-1-C, NO0423011100-C, NO0422020100-2-C, NO0422020300-C, NO0423020300-4-C, NO0424000031-C, NO0424010100-2-C, NO0424020100-22-C, NO0424020500-C, NO0303010200-C, NO0303010902-3-C, NO0303011000-2-C, NO0303011400-6-C, NO0303011501-C, NO0321030600-4-C, NO0322010100-1-C, NO0340010200-C, NO0340020301-2-C, NO0340020502-1-C, NO0341011001-C, NO0341011200-C, NO0341020100-C, NO0342000030-C, NO0365000032-2-C, NO0365010300-5-C, NO0365030901-C, NO0201000030-3-C, NO0201020301-C, NO0130000031-3-C, NO0130010203-C, NO0101040200-1-C, NO0101010401-C, NO0101010405-C, NO0101020802-C, NO0131020201-C, NO0131020300-C, NO0132030600-C, NO0120010101-1-C, NO0110010802-C, NO0110020900-C, NO0121000100-2-C, NO0121020100-C, NO0121020201-C, NO0303021004-C, NO0240010204-C, NO0320010100-6-C, NO0320030101-C, NO0320040900-3-C, NO0320041200-3-C, NO0321000031-30-C, NO0360010600-1-C, NO0360020900-2-C, NO0362030100-C, NO0362030300-C, NO0363000032-2-C, NO0363040600-3-C, NO0363042603-1-C, NO0242010101-3-C, NO0242010500-2-C, NO0242010702-2-C, NO0280010201-C, NO0280021100-C, NO0280030100-C, NO0280030302-C, NO0281010201-3-C, NO0281010400-C, NO0281010800-C, NO0281011100-1-C, NO0242030400-C, NO0242031800-1-C, NO0401021000-C, NO0282010400-C, NO0282012200-1-C, NO0260040300-C, NO0260041700-C, NO0402010900-2-C, NO0420030300-4-C, NO0261010200-6-C, NO0261020200-C, NO0261020800-4-C, NO0261030100-1-C, NO0261030300-2-C, NO0301011501-C, NO0301020300-1-C, NO0301021002-1-C, NO0301021300-4-C, NO0201010200-C, NO0130010302-2-C, NO0130010302-3-C, NO0101030101-1-C, NO0101030102-2-C, NO0201020500-2-C, NO0110010402-C, NO0110010600-C, NO0110020800-1-C, NO0110021200-C, NO0424030500-5-C, NO0303010300-2-C, NO0303011000-1-C, NO0303011202-6-C, NO0303021002-2-C, NO0240000300-C, | Norway | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0241000031-1-C, NO0320020400-C, NO0101000032-2-C, NO0101010201-C, NO0101020200-1-C, NO0101020601-C, NO0101020702-1-C, NO0131000030-C, NO0101020702-2-C, NO0101030400-C, NO0101030700-C, NO0110000033-2-C, NO0101040400-4-C, NO0120000034-C, NO0320040500-3-C, NO0240000030-C, NO0320020302-1-C, NO0320020600-C, NO0321010100-1-C, NO0322000030-16-C, NO0341000031-C, NO0342010200-1-C, NO0343010102-C, NO0201010700-2-C, NO0110010703-C, NO0132010100-C, NO0320040700-3-C, NO0321010300-2-C, NO0321020101-C, NO0361030300-C, NO0361030700-2-C, NO0361040800-C, NO0361020100-2-C, NO0362030700-2-C, NO0362000030-2-C, NO0360011100-2-C, NO0362011400-2-C, NO0363010800-1-C, NO0363020900-C, NO0363031100-C, NO0363031700-C, NO0101010203-C, NO0101040300-3-C, NO0110000500-C, NO0101000032-3-C, NO0101021000-2-C, NO0101030101-6-C, NO0101040100-C, NO0342010101-2-C, NO0110021300-C, NO0121000300-1-C, NO0121010100-C, NO0101020400-2-C, NO0132030200-C, NO0132030300-C, NO0363041200-1-C, NO0364000030-3-C, NO0364011300-C, NO0364030402-C, NO0242011102-C, NO0242011402-C, NO0242020100-C, NO0242030301-C, NO0242030901-2-C, NO0242031500-C, NO0242031800-2-C, NO0242040603-C, NO0242040802-4-C, NO0280021000-1-C, NO0280021302-C, NO0280031000-C, NO0280031300-1-C, NO0281000030-C, NO0280011500-C, NO0242000032-C, NO0242010500-1-C, NO0242020400-C, NO0365000030-1-C, NO0365000031-7-C, NO0365010300-3-C, NO0242040103-C, NO0242040107-C, NO0242040400-C, NO0280031401-C, NO0281010300-C, NO0281010500-1-C, NO0281010900-1-C, NO0120020201-C, NO0121000100-1-C, NO0320000031-32-C, NO0320011100-2-C, NO0320040900-4-C, NO0320010600-C, NO0320020100-C, NO0110020800-2-C, NO0320010100-5-C, NO0320030103-C, NO0320030300-10-C, NO0320040900-5-C, NO0401010200-2-C, NO0401010502-6-C, NO0401011202-2-C, NO0401011700-1-C, NO0401020100-1-C, NO0401020400-4-C, NO0401020702-4-C, NO0401030100-3-C, NO0320041000-4-C, NO0320041100-2-C, NO0340020403-C, NO0341000030-5-C, NO0240000200-C, NO0240010201-C, NO0361030202-5-C, NO0360010700-1-C, NO0362010500-2-C, NO0362010800-C, NO0362011200-C, NO0362011300-C, NO0360020100-3-C, NO0360020600-3-C, NO0360020600-5-C, NO0360020700-1-C, NO0362020300-C, NO0363000030-7-C, NO0363010600-3-C, NO0363040200-3-C, NO0364000030-11-C, NO0401010600-C, NO0401010703-C, NO0401020200-C, NO0401020900-C, NO0282011000-C, NO0282012100-3-C, NO0282011101-C, NO0282011300-C, NO0301010302-C, NO0301010501-6-C, NO0301010502-2-C, NO0240000400-C, NO0240000500-C, NO0240010203-C, NO0240010300-C, NO0241000031-2-C, NO0320000030-6-C, NO0320010202-10-C, NO0320041500-3-C, NO0365030200-C, NO0320050501-3-C, NO0321000033-4-C, NO0321030100-1-C, NO0321040100-2-C, NO0322000030-17-C, NO0361030800-2-C, NO0362010600-C, NO0360020700-2-C, NO0363000030-8-C, NO0363011100-2-C, NO0363041102-1-C, NO0280010300-C, NO0280011000-C, NO0242010103-2-C, NO0242011201-C, NO0242020601-1-C, NO0242020702-C, NO0242030200-C, NO0242031000-C, NO0242040500-2-C, NO0242050100-2-C, NO0280021200-C, NO0280021301-C, NO0280021400-C, NO0280021500-C, NO0280031100-C, NO0281010201-4-C, NO0281010202-C, NO0281010600-2-C, NO0282012200-2-C, NO0260000031-C, NO0260020600-C, NO0260021000-C, NO0260040500-C, NO0260040700-C, NO0260041300-C, NO0402000031-C, NO0402020200-C, NO0402020800-C, NO0361030800-1-C, NO0361040700-2-C, NO0361040700-4-C, NO0360011100-1-C, NO0362011000-2-C, NO0362020201-2-C, NO0362040400-2-C, NO0363000030-1-C, NO0363011200-2-C, NO0363031400-C, NO0364000030-2-C, NO0260040101-C, NO0260041400-C, NO0260050802-C, NO0403011100-1-C, NO0420030200-5-C, NO0261010401-C, NO0261020100-1-C, NO0261030603-6-C, NO0261040601-C, NO0403011100-2-C, NO0403040103-C, NO0420021800-C, NO0420030200-1-C, NO0261010600-C, NO0261010701-2-C, NO0261010702-3-C, NO0261030300-4-C, NO0261040300-2-C, NO0401010100-3-C, NO0401021102-C, NO0280011301-C, NO0280020402-1-C, NO0242010103-1-C, NO0280020601-C, NO0280020800-1-C, NO0280022300-C, NO0280030700-C, NO0280031300-2-C, NO0280031402-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0280031600-C, NO0363050300-4-C, NO0365020200-1-C, NO0242011202-C, NO0242011401-C, NO0242020502-C, NO0242020602-1-C, NO0242031400-C, NO0242000030-C, NO0242020200-C, NO0280000030-C, NO0280011302-C, NO0280031300-3-C, NO0281010700-C, NO0364050801-C, NO0242020801-1-C, NO0242020802-C, NO0242030901-1-C, NO0242031701-C, NO0301021800-1-C, NO0423010900-C, NO0423011400-C, NO0422010500-C, NO0422010802-C, NO0422021100-C, NO0422021200-3-C, NO0423000032-C, NO0424010200-2-C, NO0242031600-C, NO0242040500-1-C, NO0242040601-C, NO0301010502-3-C, NO0301011202-C, NO0301011600-6-C, NO0301020200-1-C, NO0302012300-3-C, NO0302012600-C, NO0303010600-C, NO0303010700-C, NO0303011502-C, NO0303011503-1-C, NO0303000033-C, NO0303020800-C, NO0260020700-C, NO0260020900-C, NO0260050200-C, NO0260050302-C, NO0402011300-C, NO0420021300-C, NO0261000034-C, NO0261010200-3-C, NO0261010500-4-C, NO0261010701-1-C, NO0261020800-3-C, NO0261030201-2-C, NO0261030500-1-C, NO0301010800-1-C, NO0401011300-C, NO0282012300-2-C, NO0402021300-2-C, NO0403020100-C, NO0403030100-2-C, NO0403030501-C, NO0282011800-C, NO0301021001-C, NO0301021800-2-C, NO0302012100-C, NO0302012400-2-C, NO0424020700-C, NO0424030400-C, NO0303010100-4-C, NO0303010400-C, NO0303011100-C, NO0303011202-5-C, NO0260010300-C, NO0260030200-C, NO0260041100-C, NO0260050700-C, NO0261010500-3-C, NO0261010702-1-C, NO0261010800-6-C, NO0261010800-8-C, NO0261010902-C, NO0261020800-2-C, NO0261040204-C, NO0403030502-C, NO0420021600-C, NO0420030200-7-C, NO0420030501-2-C, NO0420031600-3-C, NO0421010500-2-C, NO0422010200-C, NO0422020200-5-C, NO0422020700-C, NO0402020900-10-C, NO0402020900-8-C, NO0402021000-2-C, NO0403040300-C, NO0342010200-2-C, NO0301011201-C, NO0301011400-3-C, NO0301021002-2-C, NO0301021400-C, NO0301022000-2-C, NO0302000030-C, NO0302010500-C, NO0302011002-C, NO0423000030-10-C, NO0423011603-C, NO0303011301-C, NO0303011504-C, NO0303011505-1-C, NO0261010800-9-C, NO0261030300-3-C, NO0301010700-3-C, NO0301010800-2-C, NO0301020200-2-C, NO0301020803-C, NO0301021202-C, NO0301021204-C, NO0261030602-C, NO0360010200-5-C, NO0420021100-C, NO0420030102-1-C, NO0422020100-1-C, NO0422020200-6-C, NO0423020200-10-C, NO0424010100-1-C, NO0301021900-C, NO0423010800-C, NO0423011601-C, NO0302012300-4-C, NO0303020702-C, NO0365020200-2-C, NO0341011400-1-C, NO0341020300-C, NO0342010102-4-C, NO0365020500-C, NO0365030700-C, NO0365030100-2-C, NO0420030300-5-C, NO0420030900-C, NO0420040602-1-C, NO0421030700-C, NO0421030800-C, NO0422000031-C, NO0422020600-C, NO0420040602-2-C, NO0421010100-C, NO0421010500-1-C, NO0421031100-1-C, NO0422020802-C, NO0420031600-6-C, NO0422021000-C, NO0424020100-7-C, NO0422021400-C, NO0423010100-C, NO0424010200-1-C, NO0424020100-15-C, NO0201020700-1-C, NO0101010304-C, NO0101010403-C, NO0101030101-2-C, NO0101030800-C, NO0120030500-2-C, NO0320010201-15-C, NO0320010203-2-C, NO0320011100-8-C, NO0320030102-C, NO0361040500-2-C, NO0361050700-C, NO0360000030-C, NO0362000030-1-C, NO0362010400-C, NO0360020100-2-C, NO0360020600-4-C, NO0360020900-1-C, NO0362040300-2-C, NO0363000030-13-C, NO0363000030-2-C, NO0363010700-2-C, NO0363011000-2-C, NO0363031300-4-C, NO0280010400-2-C, NO0280020402-2-C, NO0280020602-C, NO0280020800-2-C, NO0280021900-C, NO0280030400-C, NO0281010100-1-C, NO0363042500-1-C, NO0364050102-C, NO0242010200-C, NO0242010401-1-C, NO0242020601-2-C, NO0242030302-C, NO0242030700-C, NO0242031200-C, NO0281010500-2-C, NO0281010900-2-C, NO0281011100-2-C, NO0282000031-C, NO0242031702-C, NO0282011700-C, NO0401010100-6-C, NO0401010403-2-C, NO0401020701-2-C, NO0402010200-C, NO0402010300-3-C, NO0402010700-C, NO0402010900-1-C, NO0402021100-C, NO0301000031-C, NO0260010501-6-C, NO0260041200-C, NO0261000030-C, NO0261000036-3-C, NO0261010500-2-C, NO0261010800-4-C, NO0261030400-16-C, NO0261030603-5-C, NO0420021900-C, NO0420030502-C, NO0420030600-2-C, NO0421020600-C, NO0421031200-C, NO0422010100-16-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0261040201-C, NO0261040205-C, NO0301010503-C, NO0301011203-C, NO0302010400-C, NO0302011200-C, NO0302011300-4-C, NO0423011000-C, NO0302012400-3-C, NO0303000032-10-C, NO0303011202-2-C, NO0303011302-C, NO0303011400-5-C, NO0303011503-2-C, NO0322010100-2-C, NO0341000035-C, NO0341030100-2-C, NO0341030201-C, NO0342000031-C, NO0364050200-10-C, NO0365000031-3-C, NO0365020100-4-C, NO0365030902-C, NO0423000031-C, NO0423020300-5-C, NO0132000030-C, NO0261030202-C, NO0242010703-C, NO0280020200-C, NO0403030402-C, NO0101040300-4-C, NO0301011100-1-C, NO0322020202-C, NO0424020200-C, NO0362020600-C, NO0301011600-5-C, NO0301021101-C, NO0363040700-6-C, NO0303020100-3-C, NO0302011800-C, NO0101010306-C, NO0260010501-4-C, NO0280011101-C, NO0420020100-2-C, NO0401020600-1-C, NO0201020800-C, NO0260010501-5-C, NO0260040900-2-C, NO0303021002-3-C, NO0302012400-4-C, NO0301011600-3-C, NO0201011100-C, NO0343000030-3-C, NO0361050900-C, NO0260020400-C, NO0242040602-C, NO0261010200-9-C, NO0260020802-C, NO0242020602-2-C, NO0401030100-5-C, NO0261030400-17-C, NO0421031100-2-C, NO0363010700-1-C, NO0301010400-C, NO0422010300-7-C, NO0423011300-C, NO0303021300-C, NO0364040300-5-C, NO0362010101-1-C, NO0360010600-3-C, NO0301010700-5-C, NO0360010600-4-C, NO0365000030-5-C, NO0402011500-C, NO0365020901-2-C, NO0320040700-2-C, NO0280030301-C, NO0302012000-C, NO0365030800-C, NO0401011700-2-C, NO0301011100-2-C, NO0130010400-1-C, NO0321010400-3-C, NO0320010203-4-C, NO0402010102-C, NO0424020100-14-C, NO0242010800-2-C, NO0260010100-2-C, NO0301022200-2-C, NO0422000030-C, NO0261010301-C, NO0201020400-C, NO0281010100-2-C, NO0242030800-C, NO0130010500-C, NO0321030600-1-C, NO0242040801-C, NO0242030303-1-C, NO0261040202-C, NO0101010202-2-C, NO0260030600-C, NO0280021800-C, NO0364011400-C, NO0420021202-1-C, NO0242040902-C, NO0422021300-C, NO0365010601-3-C, NO0403040101-C, NO0363040600-4-C, NO0242030602-C, NO0280022000-C, NO0401020400-3-C, NO0301021300-1-C, NO0402010101-C, NO0401020500-1-C, NO0363042601-C, NO0403040900-C, NO0302010300-C, NO0101010305-C, NO0320050300-4-C, NO0420031500-4-C, NO0320010203-3-C, NO0365000030-4-C, NO0260041600-C, NO0422010100-4-C, NO0364020100-6-C, NO0402021200-C, NO0365020400-2-C, NO0423011500-C, NO0423010600-C, NO0301011205-C, NO0301010700-6-C, NO0321030100-6-C, NO0422010803-C, NO0282010500-C, NO0401011100-C, NO0282000033-C, NO0242031100-C, NO0240010100-C, NO0341020600-4-C, NO0423020200-9-C, NO0420000030-2-C, NO0101030200-C, NO0365010602-1-C, NO0422020400-1-C, NO0320000031-22-C, NO0301010301-C, NO0365020802-C, NO0320030104-C, NO0402020401-3-C, NO0363000030-3-C, NO0242010701-C, NO0401020500-2-C, NO0365020400-1-C, NO0365010602-2-C, NO0281010600-1-C, NO0401030300-1-C, NO0302011600-1-C, NO0303000030-C, NO0242030100-C, NO0360010100-2-C, NO0242010900-C, NO0242020701-C, NO0280011102-C, NO0364040200-1-C, NO0101020105-C, NO0130000101-C, NO0320050502-10-C, NO0242040200-C, NO0261040602-C, NO0260020200-C, NO0420030501-1-C, NO0422020400-2-C, NO0282011500-C, NO0120030600-2-C, NO0242040104-C, NO0364050200-9-C, NO0303010901-C, NO0363042602-C, NO0365011100-5-C, NO0261030603-1-C, NO0320020900-C, NO0363040700-4-C, NO0364030401-C, NO0303010500-C, NO0280030500-C, NO0402010103-C, NO0321000031-33-C, NO0110021000-2-C, NO0403030600-1-C, NO0201000030-2-C, NO0261030500-2-C, NO0261040102-C, NO0242030601-C, NO0303010902-6-C, NO0422020500-C, NO0242050100-1-C, NO0303010902-7-C, NO0301022100-C, NO0365000032-3-C, NO0320041000-8-C, NO0365030400-2-C, NO0303011201-C, NO0363030200-C, NO0343010200-6-C, NO0303020100-1-C, NO0342000032-C, NO0361010500-C, NO0120030600-1-C, NO0402020900-11-C, NO0282012100-6-C, NO0242010402-C, NO0280010202-C, NO0260010502-C, NO0340020501-1-C, NO0420000030-4-C, NO0260041000-C, NO0280000031-C, NO0110010500-C, NO0240010202-C, NO0282010100-C, NO0361010600-C, NO0420030300-6-C, NO0261000032-C, NO0110010701-C, NO0281011200-C, NO0261030201-1-C, NO0424020100-19-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0301021300-3-C, NO0320040200-4-C, NO0320000030-5-C, NO0341030203-C, NO0301021102-1-C, NO0303020900-C, NO0420030600-3-C, NO0420031400-C, NO0401021101-C, NO0365011100-1-C, NO0364030302-C, NO0420030600-5-C, NO0341020500-C, NO0361040101-C, NO0301011300-C, NO0101020801-C, NO0422021200-7-C, NO0240010400-C, NO0242031300-C, NO0401010401-1-C, NO0403040800-2-C, NO0201011400-C, NO0261040101-10-C, NO0121000300-3-C, NO0261040101-9-C, NO0281010201-2-C, NO0242031800-C | | |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | PLCWIIIWB5, PLCWIIIWB7, PLCWIIIWB9, PLCWIIWB4, PLCWIIWB6E, PLCWIIWB6W, PLCWIIWB8, PLCWIWB1, PLCWIWB2, PLCWIWB3, PLTW20001WB1, PLTW20002WB4, PLTW20003WB5, PLTW20005WB7, PLTW60001WB2, PLTW60001WB3, PLTWIVWB4, PLTWVWB6, PLTWVWB7, PLCW20001WB1, PLCW60001WB4, PLCW60001WB3, PLCW20001WB2 | Poland | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | PT08RDA1700, PT09FAICPP1, PT09SMGCI1, PT05SUL1635, PT09TERCPP1, PT09TRICP1, PT05RDW1165A, PT03NOR0732, PT05RDW1166A, PT08RF3, PT08RF1, PT08RF2, PT09OCICP1, PT09PICCPP1, PT09SJOCI1, PT09FLOCI1, PT09SMGCPP4, PT09GRACI1, PT09GRACPP1, PT09FAICI1, PT09PICCI1, PT09SMACI1, PT09TERCP1, PT09SJOCPP1, PT09SMGCPP3, PT09SMGCPP1, PT09SMGCPP2, PT08RF4, PT08RF5, PT06SUL1638, PT09CORCI1, PT09TERCI1, PT09GRACP1, PT09ORICP1, PT09TERCPP2, PT09FLOCPP1, PT09SMACPP1, PT09CORCPP1, PT03DOU0366, PT01LIM0057, PT01NOR0724, PT06SAD1207, PT04MON0685, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT08RDA1657B, PT02LEC0139, PT09SJOT001, PT09SJOT003, PT03DOU0364, PT04VOU0552, PT06MIR1367, PT04LIS0704, PT04VOU0536, PT06MIR1374, PT06SAD1222, PT07GUA1603I, PT06SAD1219, PT05TEJ1100A, PT05TEJ1139A, PT07GUA1629I, PT08RDA1684A, PT09SJOT002, PT01LIM0059, PT01MIN0018, PT04MON0682, PT02CAV0096, PT02CAV0102, PT05TEJ1075A1, PT07GUA1631, PT04VOU0550, PT06MIR1368, PT06SAD1217, PT02AVE0124, PT04MON0688, PT06SAD1211, PT04VOU0514, PT03DOU0370, PT01LIM0056, PT01MIN0023, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT02AVE0135, PT05RDW1166, PT04COST4, PT05RDW1165, PT06COST12, PT04COST89A, PT04COST6, PT05TEJ1075A, PT08RDA1686 | Portugal | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | ROCT02_B1, ROCT01_B2, ROCT01_B1, ROCT02_B2, ROTT02_B1, ROTT03_B1 | Romania | EEA WISE MARINE |
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | SI5VT2, SI5VT4, SI5VT5 | Slovenia | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | ES017MSPFES111C000010, ES017MSPFES111C000015, ES017MSPFES111C000020, ES017MSPFES111C000030, ES017MSPFES111T012010, ES017MSPFES111T014010, ES017MSPFES111T018010, ES017MSPFES111T028010, ES017MSPFES111T034010, ES017MSPFES111T042010, ES017MSPFES111T044010, ES017MSPFES111T045010, ES017MSPFES111T046010, ES017MSPFES111T046020, ES017MSPFES111T048010, ES017MSPFES111T068010, ES017MSPFES111T068020, ES017MSPFES111T075010, ES018MSPFES076MAT000230, ES018MSPFES085MAT000180, ES018MSPFES085MAT000190, ES018MSPFES085MAT000210, ES018MSPFES092MAT000140, ES018MSPFES112MAT000130, ES018MSPFES113MAT000110, ES018MSPFES113MAT000120, ES018MSPFES118MAT000100, ES018MSPFES132MAT000090, ES060MSPF610000, ES060MSPF610001, ES060MSPF610002, ES060MSPF610004, ES060MSPF610005, ES060MSPF610006, ES060MSPF610007, ES060MSPF610008, ES060MSPF610009, ES060MSPF610010, ES060MSPF610011, ES060MSPF610012, ES060MSPF610013, ES060MSPF610014, ES060MSPF610015, ES060MSPF610016, ES060MSPF610017, ES060MSPF610018, ES060MSPF610019, ES060MSPF610020, ES060MSPF610033, ES060MSPF610034, ES060MSPF610035, ES063MSPF005200000, ES063MSPF005200020, ES063MSPF005200030, ES063MSPF005200040, ES063MSPF005200050, ES063MSPF005200060, ES063MSPF005200070, ES063MSPF005200100, ES063MSPF005200110, ES063MSPF005200120, ES063MSPF005200130, ES063MSPF005200140, ES063MSPF005200150, ES063MSPF005200160, ES063MSPF005200170, ES063MSPF005200180, ES063MSPF005200190, ES064MSPF004400200, ES064MSPF004400230, ES064MSPF004400240, ES064MSPF004400250, ES064MSPF004400260, ES064MSPF004400290, ES064MSPF004400300, ES064MSPF004400310, ES064MSPF004400320, ES064MSPF004400330, ES018MSPFES000MAC000020, ES018MSPFES000MAC000070, ES080MSPFC010, ES070MSPF010300050, ES080MSPFC009, ES080MSPFC008, ES110MSPFEIMC03M4, ES110MSPFEIMC07M3, ES110MSPFMAMC12M2, ES100MSPFC4, ES018MSPFES000MAC000130, ES050MSPF014116001, ES080MSPFC004, ES080MSPFC006, ES110MSPFMAMC03M2, ES100MSPFC1, ES100MSPFC10, ES100MSPFC14, ES100MSPFC20, ES100MSPFC24, ES080MSPFC007, ES080MSPFC011, ES080MSPFC012, ES080MSPFC014, ES080MSPFC015, ES080MSPFC002, ES080MSPFC005, ES120MSPFES70GCTIV2, ES110MSPFEIMC04M4, ES110MSPFMAMC15M3, ES100MSPFC19, ES100MSPFC29, ES100MSPFC6, ES018MSPFES000MAC000120, ES110MSPFMAMC02M3, ES110MSPFMAMC05M3, ES110MSPFMAMC07M3, ES100MSPFC30, ES100MSPFC5, ES018MSPFES000MAC000050, ES018MSPFES000MAC000060, ES018MSPFES000MAC000100, ES018MSPFES000MAC000110, ES100MSPFC32, ES110MSPFMAMC04M2, ES120MSPFES70GCTI2_1, ES080MSPFC001, ES100MSPFC2, ES100MSPFC28, ES110MSPFFOMC09M3, ES110MSPFMEMC04M4, ES110MSPFMEMC07M3, ES100MSPFC21, ES100MSPFC22, ES100MSPFC25, ES100MSPFC36, ES124MSPFES70TFTI2, ES124MSPFES70TFTI1_1, ES126MSPFES70LGTV, ES122MSPFES70FVTI1, ES122MSPFES70FVTII, ES124MSPFES70TFTIV, ES122MSPFES70FVTIV_1, ES123MSPFES70LZTIV, ES124MSPFES70TFTV_1, ES124MSPFES70TFTII, ES070MSPF002150006, ES070MSPF002150007, ES070MSPF010300070, ES070MSPF010300090, ES070MSPF010300110, ES070MSPF010300120, ES070MSPF010300040, ES080MSPFC0101, ES100MSPFC23, ES091MSPF896, ES110MSPFMAMC11M3, ES110MSPFMEMC05M2, ES100MSPFC9, ES018MSPFES000MAC000030, ES018MSPFES000MAC000071, ES018MSPFES000MAC000140, ES050MSPF014116000, ES080MSPFC013, ES110MSPFMEMCM02, ES100MSPFC12, ES100MSPFC26, ES100MSPFC27, ES120MSPFES70GCTII, ES126MSPFES70LGTII, ES127MSPFES70EHTII, ES070MSPF002120005, ES070MSPF010300020, | Spain | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | ES070MSPF010300030, ES070MSPF010300100, ES080MSPFC0081, ES123MSPFES70LZTII, ES018MSPFES000MAC000080, ES018MSPFES000MAC000090, ES100MSPFC7, ES110MSPFMAMC16M3, ES100MSPFC15, ES100MSPFC31, ES110MSPFMAMC10M2, ES127MSPFES70EHTI, ES070MSPF010300010, ES110MSPFMAMC09M3, ES110MSPFEIMC01M2, ES070MSPF010300130, ES080MSPFC017, ES040MSPF004000170, ES110MSPFMAMC01M2, ES100MSPFC11, ES100MSPFC37, ES070MSPF010300060, ES080MSPFC016, ES070MSPF010300080, ES050MSPF014114002, ES100MSPFC8, ES110MSPFEIMC05M3, ES018MSPFES000MAC000021, ES018MSPFES000MAC000040, ES126MSPFES70LGTI, ES110MSPFEIMC06M4, ES080MSPFC003, ES100MSPFC17, ES040MSPF004000180, ES018MSPFES145MAT000060, ES018MSPFES194MAT000050, ES040MSPF004000210, ES018MSPFES145MAT000070, ES091MSPF891, ES110MSPFEIMTM02, ES110MSPFMAMT11, ES100MSPFH1002050, ES100MSPFH1100030, ES100MSPFH1789060, ES060MSPF610036, ES091MSPF892, ES110MSPFFOMT03, ES091MSPF1676, ES091MSPF1686, ES100MSPFH1944010, ES110MSPFMEMT01, ES110MSPFMEMT15, ES110MSPFMEMT21, ES110MSPFMAMT08, ES110MSPFMAMT10, ES110MSPFMAMT19, ES110MSPFMAMTM23, ES110MSPFMEMT09, ES110MSPFMEMT17, ES110MSPFMEMT22, ES100MSPFH1100020, ES100MSPFH1800010, ES018MSPFES085MAT000200, ES110MSPFEIMTM03, ES110MSPFMEMT20, ES100MSPFH1050070, ES018MSPFES234MAT000030, ES100MSPFH1913010, ES110MSPFMAMT07, ES100MSPFH1600010, ES100MSPFH1789030, ES100MSPFH1944030, ES091MSPF1673, ES050MSPF013213011, ES110MSPFMAMT15, ES100MSPFH1015010, ES100MSPFH1030060, ES100MSPFH1030090, ES110MSPFMEMTM08, ES050MSPF013213015, ES110MSPFMAMT16, ES110MSPFMAMT20, ES110MSPFMAMTM24, ES110MSPFMEMT11, ES100MSPFH1006020, ES100MSPFH1618010, ES100MSPFH1789010, ES100MSPFH1800020, ES050MSPF013213008, ES050MSPF013213013, ES060MSPF610027, ES060MSPF610028, ES060MSPF610029, ES091MSPF1689, ES091MSPF893, ES110MSPFEIMT01, ES110MSPFFOMTM02, ES110MSPFMAMT09, ES110MSPFMEMT45, ES100MSPFH1030080, ES100MSPFH1944020, ES040MSPF004000200, ES091MSPF1671, ES110MSPFMAMT05, ES110MSPFMEMT18, ES100MSPFH1789020, ES110MSPFMAMT04, ES091MSPF1687, ES040MSPF004000190, ES018MSPFES244MAT000020, ES100MSPFH1789040, ES091MSPF1672, ES110MSPFMEMT02, ES050MSPF013213014, ES091MSPF1684, ES110MSPFMAMT27, ES110MSPFMEMT16, ES018MSPFES144MAT000080, ES110MSPFMEMT06, ES110MSPFFOMT04, ES110MSPFMAMT01, ES110MSPFMAMT25, ES050MSPF013213016, ES110MSPFMEMC02M3, ES125MSPFES70LPTII, ES091MSPF1674, ES091MSPF1688, ES091MSPF1675, ES091MSPF1685 | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | SE62C97DC9-EFE0-424B-8227-96EAB381B02B, SE8A008E1E-AB3D-4C32-B9AE-C0A6382AF635, SEB1420208-9106-4746-9E8F-44376E7311AA, SEF99DDCA5-319E-4F10-A799-8041A7938C79, SE0ABB7227-D729-4A99-8482-31CB09AD8BA1, SE1E82A04F-9AFF-492D-A1E6-3149841CDE70, SE2A8A69B2-60ED-4DE1-A668-7256368CED44, SE36711B15-677A-45FD-9350-65D6C3736D09, SE16A044F8-3910-4A50-B53A-F73732C1D3D0, SE1F5B23B8-2C72-4A73-96FD-7BC69D46EC3C, SE09AC6BA3-3A94-4B0F-90BD-B4F006EB410D, SE2B56DE67-CC73-4CBE-8BF2-323BE06AF9B0, SE0B68FE82-4165-4DBE-AC8D-FB556EB381A7, SE5970DC14-34EF-4422-A11F-18DB86AC2D89, SE0A5F32EA-5EC2-43A5-A8AB-C5D596582BB8, SE00776819-5D5D-49A2-BC5E-38B23E32AA97, SE65E5B59B-D89F-4775-8AC7-D36AD908B1EE, SE760C94E5-30E2-4564-BA69-3FAF60951DB5, SE50ADECA4-050C-44B5-B028-4955072330AA, SE07D744B6-0A7D-4466-9510-0387DE164D69, SE530FFA76-376F-4603-88A6-021338FA6FE0, SE1B223C3D-993A-484B-8044-798F3500B304, SEB103D3FD-5F36-40DE-98B1-B44249F6938E, SE42F6DBA3-270B-499E-9DA9-616A1823AD39, SE56FD9ECC-17D5-4797-8C11-51B80AE20DC7, SE6B210E53-4CEF-45AD-9A49-24D5804A4139, SEC7B7488F-67DC-49D5-9314-578F5989C323, SE83F135E5-6A0F-477B-A70B-20ED9A0E5636, SE4197F2B2-3564-4AD9-A566-01F6BA24497C, SE7C2D98D9-F5C6-4532-A3AF-3D9EA43F55AD, SE367E330A-E8A1-4FD7-8CDD-86BD37A0ABE5, SEB34D997F-E272-4CF5-8183-5F318F3CAD21, SEDC6FFE62-0D89-4845-9E9E-BDA081053026, SEE8C215E6-55E6-4D7E-9F23-B00B205F4234, SEDDB02711-F69E-49F4-B27E-0E79788F21FE, SE44FB6D88-E3B5-4E36-9714-58FDE4021857, SE54DBC9C8-B929-4149-9DFD-CA8AC01FE816, SE5ED23ACF-745C-4922-AF76-B4D1C4E13676, SEA297145C-CAAD-425C-8685-63920BDAC4AC, SEDD159A8F-FB49-42C1-8FB2-7E4A9AD24ABE, SECEA66178-C402-4BD2-8C16-514B6E64FED0, SEC2B03CEE-BBA6-4FC9-8015-9A2FD75D9E08, SEDBE68096-D811-4039-AC8A-A910A166551A, SEF5DE007F-EBDD-4C12-8849-21CA3D3E12DF, SECDC185D2-F8A1-4C55-88F2-6BB47705178E, SEFA18AECE-C611-42A2-9D8E-C996E8842732, SEF229A7F9-91AA-4134-B934-41F990BAD4B7, SEBFA19434-D546-4E78-AF7F-CE6A16D686B9, SE4DA2D8FD-D5BE-4809-B5DD-8B0858D2EFA2, SEB43CB871-0B59-4D4E-93DA-90DAC89F2A3E, SEC054AA80-3D67-4C64-92F8-9DD374A9D089, SEB23C07CF-C31F-4F63-B2DE-3C8AF9B68053, SE374E9A19-00FC-4DD2-A560-20B635F888B5, SEC02F5732-4D8D-4477-87B0-4420522399BD, SED61435C4-553F-4884-9A67-45CB3B765944, SEA242C63C-4D96-4862-9EDF-3D5EFC3F6607, SE0847519A-1ED5-4838-A8BF-5469658B9800, SE04403C1C-A9AC-42AF-9757-C46F60DA6F42, SE5F651064-97A2-4344-9C80-08B9EE0B1BA1, SEF4CB246A-31C4-40E8-B960-C073226DC59B, SE34CD467A-7A87-4135-BE02-E1697ADD498A, SE17B21C3E-78A2-4E2D-B7C2-96632D4ACA55, SEAB535896-CE5B-4B12-8DCC-286DC0976BD1, SE5329474A-F619-4B4F-A649-03B4ECD5FAD1, SEF211D41A-B798-4DF7-A4AF-A339AE3F1F66, SE7F3B5963-8B39-473F-8C99-F98D4B40107E, SEE07B333D-B3A8-4AEB-9D1A-A0838F9761FF, SEBFAB3DF1-76EF-4F2D-9587-9F7233558671, SE59EC914A-E7B9-4B7D-A892-4DB54C8BF2A7, SEE1910460-7DE8-4791-84B9-C45FA48581C1, SED6E14FAA-7A6C-44BC-9270-9858FF8544D7, SE3EDD4353-F03D-4831-8C2A-77B7601916DD, SE552500-124461, SE554500-125001, SED794B2ED-2E10-4E5E-A52A-36DB07BB1CD4, SE1B2F30B0-9EA8-4B53-B5E9-CCC9C32D28AC, SE0E304261-C589-48E3-B1B4-93780D46103E, SEFAE85DC2-A7BC-4B47-82CB-E541C274B791, SEBE17EBA2-D10E-4E99-A14D- | Sweden | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | 8711482AAE4D, SEA2613CBE-FAB4-4728-9E9B-B00C2C0F4DCA, SE1A80B8DB-5504-449B-AAB4-7BDF72344300, SE98A2626C-FDD9-4015-8DC4-8A365BE77E74, SEBD184378-6B22-4499-A321-2D81FFC9A67C, SEC1EA5796-7ECD-4031-9D32-12DA602401FC, SE8F73DEDC-7746-4981-B416-138E4353CD37, SED078BB81-CE02-42C5-B34E-28887670CC84, SE61022BFF-CBAA-47CF-9EE3-8D2BD7CB64B1, SEFBF543C0-E4A2-4405-A2EB-41645472CA42, SE0101010301-C, SEDC771381-2368-40C7-A9A2-64AF6CA5E91A, SE764C79A4-A2C3-4802-9381-F18A1E41B79F, SE3312C95A-AEDB-404E-9723-573F8C90F526, SEE3D30015-4728-4AC2-AD48-93EFC0F5719B, SE0101010201-C, SE555545-124332, SE574050-114780, SE574820-163550, SE590860-113810, SE590900-112300, SE652400-223501, SEC9B60F14-6BEB-43C7-96D9-7A1525104DD8, SE786FB90C-73AA-4CE0-9756-CE8062A98E23, SE562290-124131, SEBF02BDF6-044A-4EB4-B561-A23F9BCD911E, SE561030-122821 | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-3 - Benthic invertebrates | Macrozoobenthos | Benthic habitats | 0.6 | EQR | UKGB610807680002, UKGB620806110002, UKGB620806110003, UKGB640704540003, UKGB641211630003, UKGB670807410000, UKGBNI6NE060, UKGBNI6NE200, UKSC200002, UKSC200005, UKSC200047, UKSC200071, UKSC200082, UKSC200086, UKSC200106, UKSC200109, UKSC200127, UKSC200162, UKSC200173, UKSC200174, UKSC200180, UKSC200196, UKSC200199, UKSC200202, UKSC200208, UKSC200209, UKSC200215, UKSC200231, UKSC200237, UKSC200238, UKSC200265, UKSC200270, UKSC200282, UKSC200289, UKSC200291, UKSC200296, UKSC200298, UKSC200300, UKSC200353, UKSC200364, UKSC200372, UKSC200386, UKSC200390, UKSC200397, UKSC200411, UKSC200415, UKSC200416, UKSC200423, UKSC200430, UKSC200432, UKSC200434, UKSC200457, UKSC200465, UKSC200478, UKSC200490, UKSC200503, UKSC200505, UKGB611008590003, UKGB611010390000, UKGB620301100000, UKGB621010380000, UKGB640503300000, UKGB640704540002, UKGB641008660000, UKGB641211171000, UKGB641211630002, UKGB650301440000, UKGB651009350000, UKGB681010360000, UKGBNI6NB030, UKSC200017, UKSC200020, UKSC200024, UKSC200038, UKSC200054, UKSC200063, UKSC200067, UKSC200085, UKSC200108, UKSC200112, UKSC200133, UKSC200134, UKSC200141, UKSC200161, UKSC200193, UKSC200200, UKSC200206, UKSC200214, UKSC200230, UKSC200243, UKSC200244, UKSC200263, UKSC200264, UKSC200286, UKSC200288, UKSC200297, UKSC200308, UKSC200338, UKSC200345, UKSC200380, UKSC200391, UKSC200400, UKSC200402, UKSC200404, UKSC200421, UKSC200426, UKSC200449, UKSC200453, UKSC200469, UKSC200482, UKSC200494, UKSC200500, UKSC200502, UKSC200507, UKGB620806570000, UKGB650806250000, UKGB671010400000, UKGBNI6NE050, UKGBNI6NE070, UKGBNI6NE170, UKGBNI6NE180, UKSC200004, UKSC200029, UKSC200030, UKSC200053, UKSC200056, UKSC200077, UKSC200105, UKSC200119, UKSC200120, UKSC200126, UKSC200135, UKSC200148, UKSC200150, UKSC200163, UKSC200168, UKSC200187, UKSC200211, UKSC200216, UKSC200217, UKSC200218, UKSC200229, UKSC200235, UKSC200240, UKSC200247, UKSC200253, UKSC200260, UKSC200267, UKSC200274, UKSC200309, UKSC200311, UKSC200341, UKSC200342, UKSC200356, UKSC200361, UKSC200368, UKSC200374, UKSC200375, UKSC200383, UKSC200389, UKSC200403, UKSC200410, UKSC200412, UKSC200414, UKSC200444, UKSC200460, UKSC200479, UKSC200491, UKSC200496, UKSC200517, UKGB620806560000, UKGB640523160000, UKGB650503190000, UKGB650503200000, UKGB650503520001, UKGB650806340000, UKSC200021, UKSC200032, UKSC200039, UKSC200040, UKSC200044, UKSC200051, UKSC200058, UKSC200064, UKSC200083, UKSC200092, UKSC200100, UKSC200101, UKSC200117, UKSC200130, UKSC200136, UKSC200179, UKSC200181, UKSC200190, UKSC200203, UKSC200232, UKSC200276, UKSC200277, UKSC200283, UKSC200292, UKSC200299, UKSC200306, UKSC200336, UKSC200352, UKSC200371, UKSC200377, UKSC200378, UKSC200385, UKSC200396, UKSC200427, UKSC200446, UKSC200458, UKSC200461, UKSC200466, UKSC200470, UKSC200472, UKSC200474, UKSC200504, UKGB611008590002, UKGB621009580000, UKGB640604290000, UKGB641008220000, UKGB641008260000, UKGB641211630001, UKGB650705150000, UKGB680503713700, UKGBNI6NW251, UKSC200001, UKSC200016, UKSC200027, UKSC200042, UKSC200050, UKSC200062, UKSC200066, UKSC200069, UKSC200074, UKSC200098, UKSC200111, UKSC200122, UKSC200140, UKSC200155, UKSC200177, UKSC200183, UKSC200188, UKSC200194, UKSC200213, UKSC200224, UKSC200249, UKSC200255, UKSC200269, UKSC200280, UKSC200302, UKSC200346, UKSC200354, UKSC200366, UKSC200379, UKSC200382, UKSC200388, UKSC200408, UKSC200429, UKSC200455, UKSC200456, UKSC200484, UKSC200497, UKSC200508, UKGB610807680001, UKGB610807680004, UKGB640402491000, | United Kingdom | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKGB640402492000, UKGB641011650000, UKGB650301500001, UKGB650301500002, UKGB650401500004, UKGBNI6NE080, UKGBNI6NE190, UKSC200011, UKSC200025, UKSC200037, UKSC200041, UKSC200048, UKSC200059, UKSC200061, UKSC200076, UKSC200080, UKSC200084, UKSC200097, UKSC200114, UKSC200132, UKSC200144, UKSC200156, UKSC200164, UKSC200170, UKSC200171, UKSC200185, UKSC200205, UKSC200221, UKSC200226, UKSC200227, UKSC200228, UKSC200234, UKSC200252, UKSC200258, UKSC200273, UKSC200295, UKSC200312, UKSC200318, UKSC200321, UKSC200335, UKSC200350, UKSC200394, UKSC200401, UKSC200405, UKSC200418, UKSC200420, UKSC200447, UKSC200467, UKSC200468, UKSC200481, UKSC200486, UKSC200501, UKSC200518, UKGB621009600000, UKGB640704540001, UKGB640807670000, UKGB650301500005, UKGB650704510000, UKGB680301430000, UKGB680806320000, UKGBNI6NE020, UKGBNI6NE090, UKSC200036, UKSC200087, UKSC200093, UKSC200123, UKSC200124, UKSC200131, UKSC200147, UKSC200153, UKSC200158, UKSC200159, UKSC200167, UKSC200176, UKSC200182, UKSC200191, UKSC200220, UKSC200250, UKSC200256, UKSC200257, UKSC200272, UKSC200278, UKSC200285, UKSC200294, UKSC200305, UKSC200343, UKSC200349, UKSC200357, UKSC200358, UKSC200363, UKSC200369, UKSC200376, UKSC200417, UKSC200424, UKSC200450, UKSC200452, UKSC200463, UKSC200485, UKSC200499, UKSC200509, UKSC200516, UKGB610878040000, UKGB620705550000, UKGB641010620000, UKGB650705530000, UKGB650806230000, UKGB650806330000, UKGB651009030000, UKGB680806460000, UKGB681010120000, UKGBNI6NB020, UKGBNI6NE030, UKGBNI6NE140, UKSC200012, UKSC200019, UKSC200023, UKSC200026, UKSC200034, UKSC200045, UKSC200065, UKSC200088, UKSC200110, UKSC200116, UKSC200146, UKSC200149, UKSC200152, UKSC200184, UKSC200197, UKSC200212, UKSC200219, UKSC200223, UKSC200241, UKSC200246, UKSC200262, UKSC200266, UKSC200275, UKSC200303, UKSC200339, UKSC200340, UKSC200347, UKSC200355, UKSC200360, UKSC200367, UKSC200393, UKSC200399, UKSC200407, UKSC200433, UKSC200459, UKSC200462, UKSC200475, UKSC200476, UKSC200487, UKSC200488, UKSC200493, UKSC200513, UKSC200081, UKSC200175, UKSC200248, UKSC200254, UKSC200261, UKSC200268, UKSC200310, UKSC200506, UKSC200102, UKSC200128, UKSC200204, UKSC200251, UKSC200293, UKSC200313, UKSC200351, UKSC200370, UKSC200395, UKSC200428, UKSC200454, UKSC200052, UKSC200055, UKSC200210, UKSC200160, UKSC200225, UKSC200242, UKSC200287, UKSC200451, UKSC200060, UKSC200145, UKSC200178, UKSC200271, UKSC200413, UKGB651010610000, UKSC200015, UKSC200107, UKSC200195, UKSC200222, UKSC200348, UKSC200431, UKSC200448, UKSC200464, UKSC200483, UKSC200125, UKSC200207, UKSC200290, UKSC200307, UKSC200373, UKSC200392, UKSC200398, UKSC200498, UKGB641008180000, UKSC200078, UKSC200142, UKSC200121, UKSC200166, UKSC200169, UKGBNI6NE010, UKSC200028, UKSC200072, UKSC200075, UKSC200233, UKSC200279, UKSC200384, UKSC200409, UKSC200068, UKSC200118, UKSC200192, UKSC200259, UKSC200304, UKSC200334, UKSC200362, UKSC200406, UKSC200422, UKSC200495, UKSC200031, UKSC200046, UKSC200049, UKSC200091, UKSC200381, UKSC200473, UKSC200096, UKSC200099, UKSC200154, UKSC200239, UKSC200284, UKSC200489, UKGB620807080000, UKSC200151, UKSC200172, UKSC200425, UKSC200477, UKSC200480, UKSC200157, UKSC200186, UKSC200189, UKSC200198, UKSC200201, UKSC200281, UKSC200301, UKSC200359, UKSC200365, UKSC200387, UKSC200419, UKSC200035, UKSC200115, UKSC200236, UKSC200245, UKSC200331, UKSC200337, UKSC200344, UKSC200445, UKSC200492, UKGB510804505600, UKGB520503503900, UKGB520503613602, UKGB530402609201, UKGB530604011500, UKGB540805015500, UKSC200009, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKSC200089, UKSC200139, UKSC200329, UKSC200330, UKGB510804606100, UKGB520503503800, UKGB520503613601, UKGB531106708200, UKGB531207212100, UKGB531207312000, UKSC200103, UKSC200138, UKSC200315, UKSC200332, UKSC200438, UKGB510804505400, UKGB520503403600, UKGB520503704100, UKGB520710101600, UKGB520804714300, UKGB531006013400, UKGB531207112400, UKGB531207311900, UKGB531207408400, UKGB540805210900, UKSC200022, UKSC200090, UKSC200143, UKSC200435, UKSC200436, UKSC200510, UKSC200512, UKGB510804605900, UKGB511006206900, UKGB520710101700, UKGB530603911401, UKGB580705140000, UKSC200003, UKSC200006, UKSC200014, UKSC200165, UKSC200323, UKSC200441, UKGB511006407100, UKGB520804609000, UKGB520804809100, UKGB530604002300, UKGB530804906600, UKGB530905415402, UKGB531206908100, UKSC200008, UKSC200104, UKSC200324, UKSC200333, UKSC200437, UKGB510202110000, UKGB510503410700, UKGB510804505500, UKGB510804606000, UKGB520804415800, UKGB530905415404, UKGB531006114100, UKGB540704116000, UKSC200018, UKSC200073, UKSC200113, UKSC200129, UKSC200320, UKSC200327, UKSC200439, UKGB510804806400, UKGB511006407000, UKGB520503714000, UKGB520704202800, UKGB520710101800, UKGB520804814400, UKGB521006501200, UKGB530603911402, UKGB531207212200, UKGB570704700000, UKGB580705210000, UKSC200007, UKSC200033, UKSC200079, UKSC200328, UKSC200443, UKGB510302509900, UKGB520704201400, UKGB530503311300, UKGB541005800700, UKGB580705130000, UKSC200057, UKSC200316, UKSC200325, UKSC200440, UKSC200442, UKSC200515, UKGB530905415401, UKGB510402703400, UKGB511006115200, UKSC200137, UKSC200322, UKGB541006614800, UKSC200043 | | |
| Chlorophyll a | Phytoplankton | Pelagic habitats | 0.6 | EQR | SEA-001 - Opensea, SEA-002 - Opensea, SEA-003 - Opensea, SEA-004 - Opensea, SEA-005 - Opensea, SEA-006 - Opensea, SEA-007A: Opensea, SEA-007B - Opensea, SEA-008 - Opensea, SEA-009 - Opensea, SEA-010 - Opensea, SEA-011 - Opensea, SEA-012 - Opensea, SEA-013A - Opensea, SEA-013B - Opensea, SEA-014 - Opensea, SEA-015 - Opensea, SEA-016 - Opensea, SEA-017 - Opensea, EST-001, EST-002, EST-003, EST-005, EST-006, EST-007, EST-008, EST-009, EST-010, EST-011, EST-013, EST-014, EST-016, EST-019, SWE-001, SWE-003, SWE-004, SWE-005, SWE-006, SWE-007, SWE-008, SWE-009, SWE-010, SWE-011, SWE-012, SWE-013, SWE-014, SWE-015, SWE-016, SWE-017, SWE-018, SWE-020, SWE-021, SWE-024 | Baltic Sea | HELCOM HOLAS3 |
| Chlorophyll a (In-Situ) | Phytoplankton | Pelagic habitats | 0.6 | EQR | GER-021, GER-022, GER-023, GER-024, GER-025, GER-026A, GER-026B, GER-027, GER-028, GER-029, GER-030, GER-031, GER-032, GER-033, GER-034, GER-035, GER-036A, GER-036B, GER-037, GER-038A, GER-038B, GER-039, GER-040, GER-041, GER-042, GER-043, GER-044 | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Chlorophyll a (In-Situ_EO_FB) | Phytoplankton | Pelagic habitats | 0.6 | EQR | DEN-001, DEN-002, DEN-016, DEN-017, DEN-018, DEN-024, DEN-025, DEN-029, DEN-034, DEN-035, DEN-036, DEN-037, DEN-044, DEN-046, DEN-047, DEN-048, DEN-049, DEN-059, DEN-062, DEN-068, DEN-072, DEN-074, DEN-080, DEN-082, DEN-083, DEN-084, DEN-085, DEN-086, DEN-087, DEN-089, DEN-090, DEN-092, DEN-093, DEN-101, DEN-102, DEN-103, DEN-105, DEN-106, DEN-108, DEN-109, DEN-110, DEN-113, DEN-114, DEN-123, DEN-124, DEN-125, DEN-128, DEN-136, DEN-137, DEN-141, DEN-142, DEN-144, DEN-145, DEN-146, DEN-147, DEN-157, DEN-158, DEN-159, DEN-160, DEN-165, DEN-200, DEN-201, DEN-204, DEN-206, DEN-207, DEN-209, DEN-212, DEN-214, DEN-216, DEN-217, DEN-219, DEN-222, DEN-224, DEN-232, DEN-234, DEN-235, DEN-236, DEN-238, POL-001, POL-002, POL-003, POL-004, POL-005, POL-006, POL-007, POL-008, POL-009, POL-010, POL-011, POL-012, POL-013, POL-014, POL-015, POL-016, POL-017, POL-018, POL-019 | Baltic Sea | HELCOM HOLAS3 |
| Chlorophyll a (summer) | Phytoplankton | Pelagic habitats | 0.6 | EQR | FIN-001, FIN-002, FIN-003, FIN-004, FIN-005, FIN-006, FIN-007, FIN-008, FIN-009, FIN-010, FIN-011, FIN-012, FIN-013, FIN-014 | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.77 | index | SEA-008: Opensea Gulf of Gdansk | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.81 | index | SEA-007B: Opensea Pomeranian Bay | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.82 | index | SEA-012: Opensea Northern Baltic Proper | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.83 | index | SEA-007: Opensea Bornholm Basin | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.85 | index | SEA-006: Opensea Arkona Basin, SEA-010: Opensea Western Gotland Basin | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.88 | index | SEA-013A: Opensea Gulf of Finland Western | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.89 | index | SEA-005: Opensea Bay of Mecklenburg, SEA-009: Opensea Eastern Gotland Basin | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.9 | index | SEA-011: Opensea Gulf of Riga | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.91 | index | SEA-013B: Opensea Gulf of Finland Eastern, SEA-014: Opensea Åland Sea | Baltic Sea | HELCOM HOLAS3 |
| Cyanobacterial bloom index | Phytoplankton | Pelagic habitats | 0.92 | index | SEA-015: Opensea Bothnian Sea | Baltic Sea | HELCOM HOLAS3 |
| Diatom/Dinoflagellate index | Phytoplankton | Pelagic habitats | 0.5 | index | SEA-009 | Baltic Sea | HELCOM HOLAS3 |
| Diatom/Dinoflagellate index | Phytoplankton | Pelagic habitats | 0.75 | index | SEA-005, SEA-004 | Baltic Sea | HELCOM HOLAS3 |
| Phytoplankton biomass | Phytoplankton | Pelagic habitats | 0.6 | EQR | EST-001, EST-002, EST-003, EST-005, EST-006, EST-007, EST-008, EST-009, EST-010, EST-011, EST-014, EST-016, EST-019, FIN-002, FIN-004, FIN-005, FIN-007, FIN-009, FIN-011 | Baltic Sea | HELCOM HOLAS3 |
| Phytoplankton biovolume | Phytoplankton | Pelagic habitats | 0.6 | EQR | GER-001, GER-002, GER-003, GER-004, GER-005, GER-006, GER-007, GER-008, GER-009, GER-010, GER-011, GER-012, GER-013, GER-014, GER-015, GER-016, GER-017, GER-018, GER-019, GER-020, GER-111 | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.55 | index | 4: The Quark Swedish Coastal waters, SEA-004: Opensea, SEA-006: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.56 | index | 1: Bothnian Bay Finnish Coastal waters, SEA-001: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.6 | index | 24: Gdansk Basin Polish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.61 | index | SEA-005: Opensea, SEA-008: Opensea, SEA-017: Opensea | Baltic Sea | HELCOM HOLAS3 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.62 | index | 32: Mecklenburg Bight German Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.63 | index | 3: The Quark Finnish Coastal waters, 35: Kiel Bight German Coastal waters, SEA-015: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.65 | index | EST-002: Eru-Käsmu Bay CWB, EST-003: Hara and Kolga Bay CWB, EST-005: Muuga-Tallinna-Kakumäe Bay CWB, EST-006: Pakri Bay CWB | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.66 | index | 15: Gulf of Riga Latvian Coastal waters, 19: Eastern Gotland Basin Lithuanian Coastal waters, EST-001: Narva-Kunda Bay CWB, SEA-007: Opensea, SEA-007B: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.68 | index | 14: Gulf of Riga Estonian Coastal waters, SEA-009: Opensea, SEA-011: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.7 | index | SEA-010: Opensea, SEA-012: Opensea, SEA-013A: Opensea, SEA-013B: Opensea | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.71 | index | 16: Western Gotland Basin Swedish Coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.74 | index | 8: Åland Sea - Archipelago Sea Finnish coastal water | Baltic Sea | HELCOM HOLAS3 |
| Seasonal succession of functional phytoplankton groups | Phytoplankton | Pelagic habitats | 0.79 | index | 11: Gulf of Finland Finnish coastal waters | Baltic Sea | HELCOM HOLAS3 |
| Total phytoplankton biomass | Phytoplankton | Pelagic habitats | 0.6 | EQR | SWE-003, SWE-004, SWE-005, SWE-006, SWE-018, SWE-020, SWE-021 | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 4.66 | µg/ind | SEA-011 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 5.1 | µg/ind | SEA-010 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 8.6 | µg/ind | SEA-013 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 9.8 | µg/ind | SEA-012 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 10.3 | µg/ind | SEA-014 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 14.1 | µg/ind | SEA-009 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 14.9 | µg/ind | SEA-007 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 84 | mg/m3 | SEA-015 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 103 | mg/m3 | SEA-008 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Zooplankton mean size and total stock | Zooplankton | Pelagic habitats | 161 | mg/m3 | SEA-017 - Opensea | Baltic Sea | HELCOM HOLAS3 |
| Changes in Phytoplankton and Zooplankton Communities | Phytoplankton | Pelagic habitats | 0.5 | Achieve/Fail | ASS, ASS, CCTI, CCTI, CUK1, CUK1, CUKC, CUKC, CWAC, CWAC, CWBC, CWBC, CWCC, CWCC, CWM, CWM, DB, DB, ENS, ENS, IRS, IRS, IS2, IS2, KC, KC, KD, KD, L4, L4, LBPM, LBPM, Loch Ewe, Loch Ewe, LPO, LPO, MPM, MPM, Norderney, Norderney, NOR409, NOR409, VIB3708-00001, VIB3708-00001, RKB1, RKB1, VSJ20925, VSJ20925, NOR5503, NOR5503, NT, NT, RHPM, RHPM, Scalloway, Scalloway, Scapa, Scapa, SCHPM1, SCHPM1, SK, SK, SNS, SNS, Stonehaven, Stonehaven, THPM, THPM, ATL, ATL, CIRL, CIRL, CNOR1, CNOR1, CNOR2, CNOR2, CO, CO, CWMTI, CWMTI, ECPM1, ECPM1, ECPM2, ECPM2, GBC, GBC, IS1, IS1, NAAO1, NAAO1, NAAP2, NAAP2, NAAPF, NAAPF, NNS, NNS, SS, SS, ELPM, ELPM, RIB1510007, RIB1510007, VIB3727-00001, VIB3727-00001, E2CO, E2CO | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Changes in Phytoplankton and Zooplankton Communities | Phytoplankton | Pelagic habitats | 0.7 | Proportion | ASS, ATL, CCTI, CIRL, CNOR2, CO, CUK1, CUKC, CWAC, CWBC, CWCC, CWM, CWMTI, DB, ECPM1, ELPM, ENS, IRS, IS1, IS2, KC, KD, L4, LBPM, Loch Ewe, LPO, MPM, NAAO1, NNS, Norderney, NOR409, VIB3708-00001, RKB1, VSJ20925, VIB3727-00001, NOR5503, NT, RHPM, Scalloway, Scapa, SCHPM1, SK, SNS, SS, Stonehaven, THPM | North-east Atlantic | OSPAR QSR2023 |
| Changes in Phytoplankton and Zooplankton Communities | Zooplankton | Pelagic habitats | 0.5 | Achieve/Fail | ASS, ASS, ASS, ASS, ASS, CCTI, CCTI, CCTI, CCTI, CCTI, CUK1, CUK1, CUK1, CUK1, CUK1, CUKC, CUKC, CUKC, CUKC, CUKC, CWM, CWM, CWM, CWM, CWM, DB, DB, DB, DB, DB, ENS, ENS, ENS, ENS, ENS, IRS, IRS, IRS, IRS, IRS, IS2, IS2, IS2, IS2, IS2, KC, KC, KC, KC, KC, KD, KD, KD, KD, KD, L4, L4, L4, L4, L4, Loch Ewe, Loch Ewe, Loch Ewe, Loch Ewe, Loch Ewe, NT, NT, NT, NT, NT, SK, SK, SK, SK, SK, SNS, SNS, SNS, SNS, SNS, Stonehaven, Stonehaven, Stonehaven, Stonehaven, Stonehaven, THPM, THPM, THPM, THPM, THPM, ATL, ATL, ATL, ATL, ATL, CIRL, CIRL, CIRL, CIRL, CIRL, CNOR1, CNOR1, CNOR1, CNOR1, CNOR1, CNOR2, CNOR2, CNOR2, CNOR2, CNOR2, CO, CO, CO, CO, CO, CWMTI, CWMTI, CWMTI, CWMTI, CWMTI, ECPM1, ECPM1, ECPM1, ECPM1, ECPM1, ECPM2, ECPM2, ECPM2, ECPM2, ECPM2, GBC, GBC, GBC, GBC, GBC, IS1, IS1, IS1, IS1, IS1, NAAO1, NAAO1, NAAO1, NAAO1, NAAO1, NAAP2, NAAP2, NAAP2, NAAP2, NAAP2, NAAPF, NAAPF, NAAPF, NAAPF, NAAPF, NNS, NNS, NNS, NNS, NNS, SS, SS, SS, SS, SS, CWAC, CWAC, CWAC, CWAC, CWAC | North-east Atlantic | OSPAR QSR2023 |
| Changes in Phytoplankton and Zooplankton Communities | Zooplankton | Pelagic habitats | 0.7 | Proportion | ASS, ASS, ATL, ATL, CCTI, CCTI, CIRL, CIRL, CNOR2, CNOR2, CO, CO, CUK1, CUK1, CUKC, CUKC, CWM, CWM, CWMTI, CWMTI, DB, DB, ECPM1, ECPM1, ENS, ENS, IRS, IRS, IS1, IS1, IS2, IS2, KC, KC, KD, KD, L4, L4, Loch Ewe, Loch Ewe, NAAO1, NAAO1, NNS, NNS, NT, NT, SK, SK, SNS, SNS, SS, SS, Stonehaven, Stonehaven, THPM, THPM | North-east Atlantic | OSPAR QSR2023 |
| Changes in Phytoplankton and Zooplankton Communities | Zooplankton - gelatinous | Pelagic habitats | 0.5 | Achieve/Fail | KC, KD, L4, Loch Ewe, Stonehaven, NT | North-east Atlantic | OSPAR QSR2023 |
| Changes in Phytoplankton and Zooplankton Communities | Zooplankton - gelatinous | Pelagic habitats | 0.7 | Proportion | KC, KD, L4, Loch Ewe, NT, Stonehaven | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.1 | Ratio | Northern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.2 | Ratio | Eastern North Sea, Kattegat Coastal | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.3 | Ratio | Channel well mixed, Dogger Bank | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.4 | Ratio | Kattegat Deep, Sudatlantic Area SUD-OCEAN(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.5 | Ratio | Channel well mixed tidal influenced, Ocean Waters CO (D5), Scottish Sea | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.6 | Ratio | Outer Coastal DEDK | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.68 | Ratio | Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.7 | Ratio | Adour plume, Coastal UK 1, Intermittently Stratified 2, Skagerak | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.8 | Ratio | Atlantic Seasonally Stratified, Atlantic, Coastal IRL 3, Intermittently Stratified 1, Shannon plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 1.9 | Ratio | Coastal NOR 2, German Bight (deep) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2 | Ratio | Gulf of Biscay shelf waters, Irish Sea, Ocean Waters BO (D5) | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2.1 | Ratio | East Coast (permanently mixed) 1 | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2.3 | Ratio | Channel coastal shelf tidal influenced, Coastal UK channel, Ocean Waters AO (D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2.4 | Ratio | Coastal NOR 3 | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2.7 | Ratio | Coastal NOR 1, Gulf of Biscay coastal waters | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 2.8 | Ratio | Coastal FR channel | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 3.3 | Ratio | Loire plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 3.5 | Ratio | East Coast (permanently mixed) 2 | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 3.7 | Ratio | Elbe plume, Ems plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 3.8 | Ratio | Southern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 3.9 | Ratio | Sudatlantic Area SUD-P1(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 5 | Ratio | Scheldt plume 1 | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 5.1 | Ratio | Seine plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 5.4 | Ratio | Gironde plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 6 | Ratio | Noratlantic Area NOR-NorO1(D5), Noratlantic Area NOR-Plataforma | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 6.8 | Ratio | Rhine plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 7.4 | Ratio | Thames plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 7.7 | Ratio | Noratlantic Area NOR-NorP2(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 8 | Ratio | Meuse plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 8.2 | Ratio | Coastal Waters BC (D5), Coastal Waters CC (D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 8.8 | Ratio | Sudatlantic Area SUD-P2(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 8.9 | Ratio | Scheldt plume 2 | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 9 | Ratio | Liverpool Bay plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 10.6 | Ratio | Humber plume | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 12 | Ratio | Coastal Waters AC (D5), Noratlantic Area NOR-NorC2(D5), Noratlantic Area NOR-NorC3(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 13.5 | Ratio | Noratlantic Area NOR-NorC1(D5)A, Noratlantic Area NOR-NorC1(D5)B, Noratlantic Area NOR-NorC1(D5)C, Noratlantic Area NOR-NorC1(D5)D | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 15.1 | Ratio | Sudatlantic Area SUD-C1(D5) | North-east Atlantic | OSPAR QSR2023 |
| Concentrations of Chlorophyll-a | Chlorophyll-a | Pelagic habitats | 20.3 | Ratio | Sudatlantic Area SUD-C2(D5) | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 4 | µmol/l | Kattegat Deep | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 4.5 | µmol/l | Kattegat Coastal | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 4.7 | µmol/l | Skagerak | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 6.55 | µmol/l | Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 7.2 | µmol/l | Dogger Bank | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 7.3 | µmol/l | Eastern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 8.3 | µmol/l | Channel well mixed | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 9.2 | µmol/l | Coastal NOR 3, Channel well mixed tidal influenced | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 9.3 | µmol/l | Outer Coastal DEDK | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 9.7 | µmol/l | Scottish Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 9.9 | µmol/l | Irish Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 10.1 | µmol/l | German Bight Central | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 10.3 | µmol/l | Northern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 10.9 | µmol/l | East Coast (permanently mixed) 2 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 11 | µmol/l | East Coast (permanently mixed) 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 11.3 | µmol/l | Intermittently Stratified 2 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 11.4 | µmol/l | Coastal IRL 3 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 11.7 | µmol/l | Atlantic Seasonally Stratified, Coastal UK 1, Shannon plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 12 | µmol/l | Channel coastal shelf tidal influenced, Coastal Waters AC (D5), Coastal Waters BC (D5), Coastal Waters CC (D5) | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 12.8 | µmol/l | Coastal UK channel | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 13 | µmol/l | Southern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 13.7 | µmol/l | Intermittently Stratified 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 15 | µmol/l | Noratlantic Area NOR-NorP2(D5) | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 15.1 | µmol/l | Ems plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 15.4 | µmol/l | Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 15.5 | µmol/l | Noratlantic Area NOR-NorC2(D5), Noratlantic Area NOR-NorC3(D5) | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 15.8 | µmol/l | Coastal FR channel | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 16.9 | µmol/l | Thames plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 18.2 | µmol/l | Elbe plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 22 | µmol/l | Noratlantic Area NOR-NorC1(D5)A | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 25.9 | µmol/l | Scheldt plume 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 26.3 | µmol/l | Humber plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 27.3 | µmol/l | Seine plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 29.7 | µmol/l | Rhine plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 33.3 | µmol/l | Scheldt plume 2 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIN | Pelagic habitats | 40.7 | µmol/l | Meuse plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.45 | µmol/l | Kattegat Coastal | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.48 | µmol/l | Kattegat Deep | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.59 | µmol/l | Outer Coastal DEDK | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.6 | µmol/l | Coastal FR channel, Eastern North Sea, Norwegian Trench | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.61 | µmol/l | Ems plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.62 | µmol/l | German Bight Central | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.64 | µmol/l | Channel coastal shelf tidal influenced, Skagerak | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.66 | µmol/l | Channel well mixed | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.68 | µmol/l | Coastal NOR 3 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.69 | µmol/l | Channel well mixed tidal influenced | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.7 | µmol/l | Noratlantic Area NOR-NorP2(D5), Southern North Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.71 | µmol/l | Northern North Sea | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.72 | µmol/l | Elbe plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.73 | µmol/l | Coastal UK channel | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.76 | µmol/l | Dogger Bank | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.77 | µmol/l | Coastal IRL 3 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.78 | µmol/l | East Coast (permanently mixed) 1, Irish Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.8 | µmol/l | Coastal Waters AC (D5), Coastal Waters BC (D5), Coastal Waters CC (D5), Scottish Sea | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.82 | µmol/l | Coastal UK 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.84 | µmol/l | Atlantic Seasonally Stratified, Shannon plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.86 | µmol/l | East Coast (permanently mixed) 2, Intermittently Stratified 2 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.9 | µmol/l | Intermittently Stratified 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.91 | µmol/l | Seine plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.97 | µmol/l | Noratlantic Area NOR-NorC2(D5), Noratlantic Area NOR-NorC3(D5) | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 0.98 | µmol/l | Atlantic | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1 | µmol/l | Noratlantic Area NOR-NorC1(D5)A | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.02 | µmol/l | Scheldt plume 2 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.04 | µmol/l | Thames plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.15 | µmol/l | Rhine plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.16 | µmol/l | Humber plume | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.31 | µmol/l | Scheldt plume 1 | North-east Atlantic | OSPAR QSR2023 |
| Winter Nutrient Concentrations | DIP | Pelagic habitats | 1.35 | µmol/l | Meuse plume | North-east Atlantic | OSPAR QSR2023 |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| Phytoplankton (Chlorophyll A) | Phytoplankton | Pelagic habitats | 0.6 | index | Sør-Varanger, Vadsø, Vardø, Båtsfjord, Berlevåg, Gamvik, Lebesby, Nordkapp, Måsøy, Hammerfest, Hasvik, Loppa, Kvænangen, Tromsø, Karlsøy, Lenvik, Berg, Torsken, Bjarkøy, Harstad, Andøy, Sortland, Tjeldsund, Lødingen, Ballangen, Narvik, Hamarøy, Tysfjord, Vågan, Bø (N.), Steigen, Bodø, Gildeskål, Meløy, Rødøy, Lurøy, Herøy (N.), Alstahaug, Vega, Vevelstad, Brønnøy, Sømna, Bindal, Vestvågøy, Vikna, Leka, Flatanger, Namsos, Trondheim, Agdenes, Bjugn, Frøya, Hemne, Hitra, Osen, Roan, Rissa, Snillfjord, Ørland, Aukra, Averøy, Eide, Fræna, Giske, Gjemnes, Halsa, Haram, Hareid, Herøy (M.R.), Kristiansund, Midsund, Molde, Sande (M.R.), Sandøy, Skodje, Smøla, Stordal, Stranda, Sula, Sykkylven, Ulstein, Tingvoll, Vestnes, Ørskog, Ålesund, Askvoll, Fjaler, Flora, Gulen, Hyllestad, Selje, Solund, Vågsøy, Askøy, Austrheim, Bergen, Fedje, Fitjar, Fjell, Meland, Sund, Sveio, Øygarden, Farsund, Arendal, Bamble, Kragerø, Porsgrunn, Horten, Larvik, Nøtterøy, Sande (V.), Sandefjord, Svelvik, Tjøme, Hurum, Røyken, Fredrikstad, Halden, Moss, Råde, Sarpsborg, Hvaler, Skjervøy, Lyngen, Tranøy, Balsfjord, Dyrøy, Ibestad, Skånland, Hadsel, Oslo, Bærum, Frogn, Oppegård, Holmestrand, Ørsta, Vanylven, Volda, Nesodden, Asker, Risør, Ås, Tønsberg, Re, Stokke, Grimstad, Tvedestrand, Lillesand, Kristiansand, Mandal, Flekkefjord, Søgne, Lindesnes, Lyngdal, Eigersund, Sandnes, Stavanger, Haugesund, Sokndal, Gjesdal, Sola, Randaberg, Forsand, Strand, Hjelmeland, Suldal, Finnøy, Rennesøy, Kvitsøy, Bokn, Tysvær, Karmøy, Vindafjord, Etne, Stord, Tysnes, Kvinnherad, Jondal, Odda, Ullensvang, Eidfjord, Ulvik, Granvin, Frosta, Leksvik, Kvam, Fusa, Samnanger, Os (Hord.), Vaksdal, Osterøy, Radøy, Masfjorden, Høyanger, Vik, Balestrand, Leikanger, Sogndal, Aurland, Lærdal, Årdal, Luster, Gaular, Førde, Naustdal, Eid, Gloppen, Stryn, Norddal, Rauma, Nesset, Sunndal, Surnadal, Skaun, Malvik, Steinkjer, Stjørdal, Levanger, Verdal, Verran, Namdalseid, Leirfjord, Vefsn, Dønna, Nesna, Hemnes, Rana, Træna, Beiarn, Saltdal, Fauske, Sørfold, Evenes, Røst, Værøy, Flakstad, Moskenes, Gratangen, Lavangen, Salangen, Målselv, Sørreisa, Storfjord, Gáivuotna–Kåfjord, Nordreisa, Alta, Kvalsund, Porsángu–Porsanger, Deatnu–Tana, Unjárga–Nesseby, Kvæfjord, Øksnes, Fosnes, Nærøy, Orkdal, Åfjord, Aure, Bremanger, Bømlo, Austevoll, Lindås, Vestby, Rygge | Norway | Nature Index of Norway |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | BEVL17_42, BEFED_CW | Belgium | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | BG2BS000C1112, BG2BS000C001, BG2BS000C1007, BG2BS000C005, BG2BS000C002, BG2BS000C1113, BG2BS000C1308, BG2BS000C1006, BG2BS000C1011, BG2BS000C1013, BG2BS000C1004, BG2BS000C1008, BG2BS000C1010, BG2BS000C1003, BG2BS000C1108, BG2BS000C1208, BG2BS000C1012, BG2MA100L001, BG2PR900L020, BG2IU600L018, BG2PR100L003, BG2SE900L037, BG2SE900L027, BG2DO700L017, BG2PR100L001, BG2IU200L007, BG2IU200L017, BG2MA107L002, BG2PR100L002, BG2PR900L019, BG2SE900L028 | Bulgaria | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | HRJMO005, HRJMO015, HRJMO024, HRJMO029, HRJMO022, HRJMO032, HRJMO033, HRJMO038, HRJMO001, HRJMO006, HRJMO002, HRJMO028, HRJMO062, HRJMO063, HRJMO068, HRJMO035, HRJMO045, HRJMO059, HRJMO065, HRJMO072, HRJMO073, HRJMO078, HRJMO081, HRJMO031, HRJMO036, HRJMO061, HRJMO066, HRJMO044, HRJMO049, HRJMO064, HRJMO069, HRJMO077, HRJMO008, HRJMO013, HRJMO018, HRJMO025, HRJMO030, HRJMO051, HRJMO056, HRJMO060, HRJMO074, HRJMO075, HRJMO079, HRJMO004, HRJMO009, HRJMO014, HRJMO019, HRJMO058, HRJMO070, HRJMO071, HRJMO076, HRJMO021, HRJMO037, HRJMO067, HRJMO080, HRJMO017, HRJMO042, HRJMO020, HRJMO007, HRJMO041, HRJMO046, HRJMO011, HRJMO016, HRJMO050, HRJMO023, HRJMO053, HRJMO057, HRJMO034, HRJMO039, HRJMO003, HRJMO040, HRJMO012, HRJMO027, HRJMO043, HRJMO055, HRJMO048, HRJMO026, HRJKP007, HRJKP011, HRJKP020, HRJKP024, HRJKP013, HRJKP017, HRJKP022, HRJKP026, HRJKP029, HRJKP004, HRJKP021, HRJKP015, HRJKP016, HRJKP031, HRJKP005, HRJKP006, HRJKP023, HRJKP035, HRJKP008, HRJKP009, HRJKP010, HRJKP025, HRJKP027, HRJKP032, HRJKP003, HRJKP012, HRJKP019, HRJKP034, HRJKP001, HRJKP028, HRJKP014, HRJKP002, HRJKP018, HRJKP033, HRJKP030, HRO423-BSK, HRO423-RIZ, HRO413-LIK, HRO423-KVA, HRO423-MOP, HRO313-BAZ, HRO313-JVE, HRO313-NEK, HRO422-KVV, HRO423-RILP, HRO423-VIK, HRO313-KZ, HRO313-MMZ, HRO413-PZK, HRO313-KASP, HRO412-PULP, HRO413-STLP, HRO422-VIS, HRO313-ZUC, HRO412-ZOI, HRO413-RAZ, HRO423-KVJ, HRO413-PAG, HRO423-KOR, HRO423-KVS, HRO422-SJI, HRP1_2-MIP, HRP1_3-RAP, HRP1_2-CEP, HRP2_3-CE, HRP2_3-KR, HRP2_3-LPP, HRP1_2-JA, HRP2_3-ZR, HRP2_2-MI, HRP2_2-RJP, HRP1_2-NEP, HRP2_2-DR, HRP2_2-NEP, HRP2_2-OM, HRP2_3-KRP, HRP2_3-NE, HRP1_2-DRP, HRP1_3-OM, HRP1_2-RJP, HRP1_2-ZR, HRP2_2-JAP, HRP2_3-RA, HRP2_2-ZR-B, HRP2_2-CE, HRP1_3-KR | Croatia | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | CY10-C1, CY6-C4, CY9-C4, CY14-C2-HM, CY15-C2, CY11-C2, CY19-C3, CY20-C3, CY12-C2-HM, CY13-C2, CY16-C2, CY21-C3, CY22-C3, CY2-C1, CY17-C2-HM, CY18-C2, CY1-C1, CY3-C2, CY5-C4 | Cyprus | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | DKCOAST114, DKCOAST131, DKCOAST138, DKCOAST140, DKCOAST224, DKCOAST80, DKCOAST123, DKCOAST219, DKCOAST222, DKCOAST68, DKCOAST110, DKCOAST121, DKCOAST125, DKCOAST17, DKCOAST45, DKCOAST46, DKCOAST160, DKCOAST216, DKCOAST221, DKCOAST90, DKCOAST93, DKCOAST29, DKCOAST101, DKCOAST104, DKCOAST113, DKCOAST217, DKCOAST62, DKCOAST82, DKCOAST84, DKCOAST200, DKCOAST37, DKCOAST44, DKCOAST48, DKCOAST49, DKCOAST201, DKCOAST209, DKCOAST57, DKCOAST119, DKCOAST133, DKCOAST136, DKCOAST145, DKCOAST212, DKCOAST232, DKCOAST83, DKCOAST85, DKCOAST124, DKCOAST130, DKCOAST142, DKCOAST146, DKCOAST147, DKCOAST236, DKCOAST59, DKCOAST86, DKCOAST87, DKCOAST89, DKCOAST95, DKCOAST56, DKCOAST103, DKCOAST105, DKCOAST108, DKCOAST132, DKCOAST139, DKCOAST141, DKCOAST144, DKCOAST157, DKCOAST159, DKCOAST214, DKCOAST225, DKCOAST92, DKCOAST204, DKCOAST34, DKCOAST38, DKCOAST102, DKCOAST107, DKCOAST205, DKCOAST6, DKCOAST2, DKCOAST154, DKCOAST158, DKCOAST96, DKCOAST24, DKCOAST36, DKCOAST25, DKCOAST47, DKCOAST137, DKCOAST233, DKCOAST111, DKCOAST129, DKCOAST128, DKCOAST238, DKCOAST72, DKCOAST122, DKCOAST207, DKCOAST16, DKCOAST106, DKCOAST235, DKCOAST206, DKCOAST231, DKCOAST127, DKCOAST165, DKCOAST18, DKCOAST234, DKCOAST35, DKCOAST109, DKCOAST1, DKCOAST120, DKCOAST28, DKCOAST74, DKCOAST208, DKCOAST78, DKCOAST76, DKCOAST70, DKCOAST156, DKCOAST71, DKCOAST213, DKCOAST41, DKCOAST64, DKCOAST69, DKCOAST75, DKCOAST81, DKCOAST61, DKCOAST63, DKCOAST26 | Denmark | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | EEEE_1, EEEE_10, EEEE_11, EEEE_12, EEEE_13, EEEE_14, EEEE_16, EEEE_17_2022, EEEE_18_2022, EEEE_19_2022, EEEE_2, EEEE_3, EEEE_5, EEEE_6, EEEE_7, EEEE_8, EEEE_9, EEEE 14 2022, EEEE 15, EEEE 4 | Estonia | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | FI2_LS_011, FI2_SS_002, FI2_SS_012, FI2_SS_017, FI2_SS_021, FI2_SU_050, FI3_LS_005, FI3_LS_016, FI3_LS_031, FI3_LS_034, FI3_MS_013, FI3_MS_014, FI3_MS_020, FI3_SES_016, FI3_SES_021, FI3_SES_022, FI3_SES_034, FI3_SES_035, FI3_SES_042, FI3_SES_043, FI3_SEU_120, FI4_PS_007, FI4_PS_016, FI4_PU_020, FI4_PU_030, FI5_PU_001, FI6_PS_002, FI8_AAM_058, FI8_AAY_040, FI8_AAY_060, FI2_LS_004, FI2_SS_015, FI2_SS_029, FI3_LS_017, FI3_LS_033, FI3_LV_003, FI3_MS_019, FI3_MU_050, FI3_MU_100, FI3_MU_110, FI3_SES_015, FI3_SES_040, FI2_SS_004, FI2_SS_014, FI2_SS_030, FI2_SU_030, FI2_LS_005, FI2_LS_008, FI2_LS_012, FI2_LU_011, FI2_SS_005, FI2_SS_019, FI2_SS_020, FI2_SU_020, FI2_LS_001, FI2_LS_006, FI2_LS_009, FI2_LS_013, FI2_SS_008, FI2_SS_018, FI2_SS_025, FI2_LS_003, FI2_LU_010, FI2_SS_022, FI2_SS_026, FI2_SS_027, FI2_SS_003, FI2_SS_009, FI2_SS_010, FI2_SS_013, FI2_SU_010, FI4_PS_005, FI5_PS_003, FI5_PS_004, FI3_LS_015, FI3_LS_021, FI3_LS_026, FI3_LS_030, FI3_LS_032, FI3_LV_006, FI3_LV_011, FI3_MS_017, FI3_MS_023, FI3_SES_030, FI3_SES_037, FI3_SES_039, FI3_SES_045, FI3_SES_046, FI3_LS_013, FI3_LS_020, FI3_LS_022, FI3_LS_028, FI3_LU_040, FI3_MU_090, FI3_PS_031, FI3_SES_026, FI3_SES_036, FI3_SEU_050, FI3_SEU_060, FI3_LS_003, FI3_LS_010, FI3_LS_012, FI3_LS_018, FI3_LS_024, FI3_LS_025, FI3_LV_012, FI3_MS_018, FI3_MS_022, FI3_PU_050, FI3_SES_012, FI3_SES_020, FI3_SES_025, FI3_SES_031, FI3_LS_001, FI3_LS_004, FI3_LS_006, FI3_LS_023, FI3_LU_010, FI3_LU_060, FI3_LV_005, FI3_LV_009, FI3_PS_023, FI3_PS_024, FI3_PS_029, FI3_PU_070, FI3_PU_080, FI3_SES_017, FI3_SES_019, FI3_SES_032, FI3_SES_038, FI3_SEU_110, FI3_LS_019, FI3_LS_027, FI3_LU_030, FI3_LU_070, FI3_LV_008, FI3_LV_010, FI3_LV_013, FI3_MS_010, FI3_MS_011, FI3_MU_120, FI3_PS_020, FI3_PS_022, FI3_PS_028, FI3_SES_028, FI3_SES_044, FI4_PS_003, FI4_PU_040, FI2_LS_002, FI2_LS_010, FI2_LS_014, FI2_LU_020, FI2_SS_001, FI2_SS_006, FI2_SS_007, FI2_SS_011, FI2_SS_024, FI2_SS_028, FI2_SU_040, FI3_LS_002, FI3_LS_008, FI3_LS_011, FI3_LS_014, FI3_LU_020, FI3_LV_001, FI3_LV_002, FI3_MS_012, FI3_MU_070, FI3_MU_130, FI3_PS_026, FI3_SES_029, FI3_SES_033, FI3_SES_041, FI3_SES_047, FI3_SES_048, FI3_SES_049, FI3_SEU_090, FI4_PS_002, FI4_PS_012, FI4_PS_015, FI4_PU_010, FI4_PU_050, FI4_PS_014, FI4_PS_017, FI4_PS_001, FI4_PS_010, FI5_PS_001, FI5_PS_002, FI6_PU_001, FI6_PS_001, FI8_AAM_006, FI8_AAY_002, FI8_AAI_008, FI8_AAM_013, FI8_AAY_054, FI8_AAM_052, FI8_AAY_037, FI8_AAY_046, FI8_AAY_051, FI8_AAM_007, FI8_AAM_057, FI8_AAY_014, FI8_AAI_031, FI8_AAM_050, FI8_AAM_061, FI8_AAY_039, FI8_AAY_044, FI8_AAY_053, FI8_AAY_055, FI8_AAM_005, FI8_AAY_036, FI8_AAM_011, FI8_AAM_033, FI8_AAM_034, FI8_AAM_047, FI8_AAM_059, FI8_AAM_035, FI8_AAI_012, FI8_AAY_056, FI2_LU_021, FI3_SEU_070, FI3_PS_027, FI3_PS_030, FI3_SES_024, FI3_MS_015, FI3_MS_021, FI8_AAY_038, FI8_AAM_048, FI8_AAY_004, FI8_AAY_001, FI3_LU_050, FI3_SES_010, FI4_PS_011, FI3_PU_060, FI2_SS_031, FI3_SES_027, FI3_SEU_080, FI3_MU_080, FI8_AAY_045 | Finland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | FRDC01, FRDC02A, FRDC04, FRAC02, FRDC07J, FRDC05, FRDC07G, FRDC09C, FRDC02C, FRDC02F, FRDC08A, FRDC08B, FRDC09A, FRDC09B, FRDC10C, FRDC02E, FRDC07C, FRAC04, FRDC06A, FRDC06B, FRDC07A, FREC03AD, FREC03C, FREC03EG, FREC01E, FRFC09, FRFC11, FRAC05, FREC01AB, FREC01C, FREC02D, FRFC02, FRFC05, FRGC12, FRGC26, FRGC03, FRGC07, FRGC39, FRGC42, FRGC47, FRGC06, FRGC11, FRGC32, FRGC16, FRGC37, FRGC44, FRGC34, FRGC36, FRGC01, FRGC05, FRGC20, FRHC15, FRHC01, FRHC08, FRHC12, FRHC60, FRGC49, FRMC17, FRLC106, FRMC07, FRMC10, FRLC102, FRLC104, FRLC105, FRMC09, FRIC07A, FRIC08, FRHC03, FRHC09, FRHC18, FRHC61, FRMC01, FRLC107, FRLC108, FRHC04, FRMC11, FRMC14, FRIC01, FRIC05, FRJC003, FRJC018, FRJC012, FRIC03, FRJC001, FRJC002, FRMC04, FRMC08, FRIC04, FRJC005, FRJC013, FRJC014, FRMC13, FRIC02, FRIC07B, FRIC11, FRDC07D, FRDC07H, FRDC09D, FREC03F, FRDC02D, FRDC07E, FRDC07F, FRDC07I, FRFC08, FREC02AB, FRFC06, FRGC33, FRGC46, FRGC53, FRGC09, FRGC10, FRGC28, FRGC51, FRHC14, FRHC16, FRMC03, FRMC15, FRLC101, FRMC05, FRMC12, FRJC004, FRJC010, FRIC10, FRJC006, FRJC007, FRJC008, FRJC009, FRHC07, FRGC38, FRHC11, FRFC03, FRMC02, FRHC05, FRHC02, FRGC48, FRLC103, FRGC18, FREC04AC, FRJC017, FRJC019, FRFC07, FRDC10A, FRMC06, FRGC17, FRGC50, FRDC07B, FRDC08D, FRJC011, FREC02C, FREC04B, FRGC24, FRGC08, FRAC01, FREC01D, FRFC10, FRGC45, FRAC03, FRDC02B, FRIC06, FRDC08C, FRGC52, FRGC13, FREC03B, FRFC01, FRHC10, FRHC13, FRDC08E, FRGC54, FRGC35, FRDT03, FRDT05B, FRDT11A, FRDT01, FRDT06B, FRDT10, FRDT12, FRDT15A, FRDT15B, FRDT13E, FRDT14A, FRDT21, FRDT06A, FRDT13C, FRDT13H, FRET02, FRDT14C, FRFT07, FRFT08, FRGT03, FRGT18, FRGT06, FRGT20, FRGT16, FRET03, FRGT02, FRGT07, FRGT14, FRJT001, FRDT02, FRDT05A, FRDT11C, FRAT01, FRGT21, FRGT13, FRGT15, FRDT15C, FRET01, FRFT02, FRET04, FRGT17, FRGT19, FRHT06, FRDT11B, FRDT07, FRDT09, FRFT01, FRDT04, FRGT08, FRDT08, FRJC015 | France | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | DECW_DENI_N4-4900-02, DECW_DENI_N2-4900-01, DECW_DESH_B2-9610-07-03A, DECW_DESH_B2-9610-07-04, DECW_DESH_B2-9610-10-02, DECW_DESH_B3-9610-09-07A, DECW_DESH_B3-9610-07-07, DECW_DESH_B3-9610-09-05, DECW_DESH_B3-9610-09-06, DECW_DENI_N1-4900-01, DECW_DESH_B4-9610-09-10, DECW_DESH_B3-9610-09-08A, DECW_DESH_B3-9610-09-09, DECW_DESH_B4-9610-07-09, DECW_DEMV_OD_01, DECW_DEMV_WP_06, DECW_DEMV_WP_14, DECW_DESH_N4-5000-04-02, DECW_DEMV_WP_01, DECW_DESH_N4-9500-02-02, DECW_DESH_N4-9500-03-02, DECW_DESH_B2-9610-07-01, DECW_DESH_B2-9610-09-01, DECW_DEMV_WP_02, DECW_DESH_N2-9500-01-03, DECW_DEMV_WP_03, DECW_DEMV_WP_07, DECW_DEMV_WP_09, DECW_DESH_N1-9500-01-01, DECW_DESH_N2-9500-01-04, DECW_DESH_N3-9500-03-01, DECW_DESH_B3-9610-07-06, DECW_DESH_B3-9610-09-08B, DECW_DESH_B4-9610-09-12, DECW_DESH_B3-9610-07-05, DECW_DESH_B3-9610-09-03, DECW_DEMV_WP_08, DECW_DEMV_WP_10, DECW_DEMV_WP_13, DECW_DENI_N4-4900-01, DECW_DESH_B2-9610-10-01, DECW_DENI_N2-3100-01, DECW_DENI_N3-3990-01, DECW_DEMV_WP_15, DECW_DEMV_WP_21, DECW_DENI_N4-3100-01, DECW_DENI_N1-3100-01, DECW_DEMV_WP_11, DECW_DESH_B2-9610-07-02, DECW_DESH_B2-9610-09-02, DECW_DESH_B3-9610-09-04, DECW_DESH_N2-9500-01-05, DECW_DESH_N3-9500-02-01, DECW_DESH_N3-5000-04-01, DECW_DEMV_WP_18, DECW_DEMV_WP_04, DECW_DEMV_WP_16, DECW_DESH_B2-9610-07-03B, DECW_DEMV_WP_17, DECW_DEMV_WP_19, DECW_DEMV_WP_12, DECW_DEMV_WP_05, DECW_DESH_B2-9610-10-03, DECW_DESH_B3-9610-09-07B, DECW_DESH_B4-9610-09-11, DECW_DESH_N5-5000-04-03, DECW_DESH_B4-9610-07-08, DECW_DENI_N4-5900-01, DECW_DENI_N3-4900-01, DECW_DESH_N2-9500-01-06, DECW_DESH_N1-9500-01-02, DECW_B3-9610-09-08, DECW_B2-9610-07-03, DECW_B3-9610-09-07 | Germany | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | EL0129C0002N, EL0132C0006N, EL0132C0008N, EL0512C0003H, EL0534C0011H, EL0626C0001N, EL0626C0005N, EL0626C0006N, EL0626C0010N, EL0902C0001N, EL1005C0010N, EL1436C0001N, EL1437C0070N, EL1438C0052N, EL0245C0017N, EL0415C0009N, EL0512C0A02N, EL0227C0005N, EL0227C0006N, EL0245C0014N, EL0331C0002N, EL0722C0011N, EL0724C0017N, EL0817C0006N, EL1207C0001N, EL1208C0004N, EL1210C0008N, EL0132C0004N, EL0228C0009N, EL0718C0007N, EL0331C0001N, EL0626C0009N, EL0626C0012N, EL0333C0007N, EL0415C0003N, EL0513C0006N, EL0513C0007N, EL0626C0002N, EL0626C0011N, EL0626C0013N, EL0723C0012N, EL0719C0006N, EL0724C0016N, EL0725C0018N, EL1106C0001N, EL0415C0002N, EL0817C0007N, EL1005C0011H, EL1005C0006N, EL1436C0008N, EL1437C0078N, EL1207C0002N, EL1339C0002N, EL1339C0007N, EL1436C0007N, EL1339C0003N, EL1341C0012N, EL1436C0012N, EL1438C0036N, EL1438C0041N, EL0227C0004H, EL0228C0003N, EL1436C0003N, EL1436C0005N, EL1436C0013N, EL1437C0085N, EL1043C0002N, EL1340C0019N, EL1005C0004N, EL0718C0005N, EL0513T0004N, EL0902T000000002N, EL1208T0004N, EL0546T0003N, EL0534T0005N, EL0415T0001N, EL0514T0002N | Greece | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | IEEA_010_0000, IEEA_010_0100, IEEA_020_0000, IEEA_050_0100, IEEA_060_0000, IEEA_060_0100, IEEA_070_0000, IEEA_090_0000, IEEA_090_0200, IEEA_090_0300, IEEA_090_0400, IEEA_130_0100, IEEA_150_0100, IENB_040_0000, IENB_040_0100, IENB_040_0200, IENW_030_0100, IENW_050_0100, IENW_080_0000, IENW_085_0000, IENW_100_0000, IENW_120_0000, IENW_120_0100, IENW_200_0000, IENW_220_0000, IENW_220_0100, IENW_220_0500, IESE_040_0000, IESE_040_0200, IESE_040_0300, IESE_090_0000, IESE_100_0000, IESE_100_0100, IESE_100_0200, IESE_100_0250, IESE_100_0300, IESE_100_0400, IESE_100_0500, IESE_100_0550, IESE_100_0600, IESE_140_0000, IESE_140_0100, IESH_040_0000, IESH_050_0000, IESH_050_0100, IESH_060_0100, IESH_060_0200, IESH_060_0300, IESH_060_0600, IESH_060_0700, IESH_060_0800, IESH_060_0900, IESH_060_1100, IESW_020_0000, IESW_020_0100, IESW_020_0500, IESW_050_0000, IESW_060_0000, IESW_060_0300, IESW_060_0400, IESW_060_0700, IESW_060_0750, IESW_060_0800, IESW_060_0900, IESW_060_0950, IESW_080_0000, IESW_080_0100, IESW_080_0300, IESW_090_0000, IESW_090_0200, IESW_100_0000, IESW_100_0100, IESW_130_0100, IESW_140_0000, IESW_170_0000, IESW_180_0000, IESW_190_0000, IESW_190_0200, IESW_190_0300, IESW_210_0000, IESW_220_0000, IESW_220_0100, IESW_230_0200, IEWE_100_0000, IEWE_160_0100, IEWE_170_0000, IEWE_170_0700, IEWE_200_0000, IEWE_200_0200, IEWE_200_0600, IEWE_200_0700, IEWE_200_1100, IEWE_310_0000, IEWE_310_0100, IEWE_340_0000, IEWE_350_0000, IEWE_350_0100, IEWE_350_0200, IEWE_350_0300, IEWE_390_0100, IEWE_400_0000, IEWE_400_0200, IEWE_420_0000, IEWE_420_0300, IEWE_450_0000, IEWE 460 0300, IEWE 470 0100, IESH 090 0100 | Ireland | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | IT05CE1_4BIS, IT05TPO_3, IT05TPO_4, IT05TPO_5, IT07CW00800802, IT07CW00800803, IT07CW00800804, IT07CW00800805, IT07CW00800906, IT07CW00900907, IT07CW00900908, IT07CW00900909, IT07CW00900910, IT07CW00900911, IT07CW00901012, IT07CW01001013, IT07CW01001014, IT07CW01001015, IT07CW01001016, IT07CW01001017, IT07CW01001018, IT07CW01001019, IT07CW01001020, IT07CW01001121, IT07CW01001122, IT07CW01101124, IT07CW01101125, IT07CW01101126, IT089910000000001ER, IT089920000000001ER, IT089930000000001ER, IT089940000000001ER, IT089950000000001ER, IT08-9960000000001ER, IT08-CD1, IT08CD1_ITB, IT08-CD2, IT09N002AR003AC, IT09R000OM009AC, IT09R000OM009AC_1, | Italy | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | IT09R000OM010AC, IT09R000OM011AC, IT09R000OM012AC, IT09R000OM013AC, IT09R000OM013AC_1, IT09R000OM14AC, IT09R000TC004AC, IT09R000TC004AC_1, IT09R000TC005AC, IT09R000TC005AC_1, IT09R000TC006AC, IT09R000TC007AC, IT09R000TC007AC_1, IT09R000TC008AC, IT09R000TC015AC, IT09R000TC015AC_1, IT09R000TC016AC, IT09R000TC016AC_1, IT09R000TN001AC, IT09R000TN001AC_1, IT09R019SE002AC, IT09R019SE002AC_1, IT11_R_COSTA_UF14_22_B, IT11_R_COSTA_UF14_22_C, IT11_R_COSTA_UF23_24_A, IT11_R_COSTA_UF25_27_A, IT11_R_COSTA_UF25_27_B, IT11-R_COSTA_UF02_01-A, IT11-R_COSTA_UF02_02-A, IT11-R_COSTA_UF03_12-A, IT11-R_COSTA_UF03_12-B, IT11-R_COSTA_UF03_12-C, IT11-R_COSTA_UF13_13-A, IT11-R_COSTA_UF14_22-A, IT12BACINOFIORA_ACE2, IT12BACINO-FIORA-MIG_ACE2, IT12BACINOGARI_ACE2, IT12CHIA-BACINO-FIORA_ACE2, IT12GRONERONE-TORASTURA_ACA2, IT12LI-DOPINI-GRONERONE_ACC2, IT12MIG-RIOFIUME_ACB2, IT12PORTOCIRCEO-PSTEND_ACE2, IT12PRATMARE-RI-OTORTO_ACF2, IT12PSTEND-VINDICIO_ACA2, IT12R12FON-ITR_FONDI_AT07, IT12R12FON-ITR_LUNGO_AT03, IT12R12RMA_CAPROLACE_AT04, IT12R12RMA_FOGLI-ANO_AT09, IT12R12RMA_MONACI_AT03, IT12R12RMA_SABAU-DIA_AT09, IT12RIOFIUME-PRATMARE_ACE2, IT12RIOTORTO-LI-DOPINI_ACE2, IT12TORASTURA-TORPAOLA_ACE2, IT12TORPAOLA-PORTOCIRCEO_ACA2, IT12VINDICIO-BACINO-GARI_ACE2, IT13IT_12_RICCIO_VASTO_ACB2, IT13IT_12_TRONTO_RICCIO_ACC2, IT13IT_12_VASTO_SANSALVO_ACC2, IT19CW00119, IT19CW02213, IT19CW03690, IT19CW04286, IT19CW0477, IT19CW0552, IT19CW06941, IT19CW09075, IT19CW09248, IT19CW09282, IT19CW09549, IT19CW09593, IT19CW09723, IT19CW10222, IT19TW001297, IT19TW011299, IT19TW01131301, IT19TW01131401, IT19TW011315, IT19TW052302, IT19TW084266, IT19TW084267, IT19TW084268, IT19TW085269, IT19TW085305, IT19TW085306, IT19TW102296, ITACW00000101VN, ITACW00000200VN, ITACW00000300VN, ITACW00000400VN, ITACW00000500VN, ITACW00000600FR, ITACW00000701FR, ITACW00000901FR, ITACW00001501FR, ITACW00001701FR, ITACW00001801FR, ITACW00002101FR, ITATW00000100VN, ITATW00000200VN, ITATW00000300VN, ITATW00001800VN, ITATW00001900VN, ITATW00002100FR, ITATW00002200FR, ITATW00002400FR, ITATW00002500FR, ITATW00002600FR, ITATW00002800FR, ITATW00002900FR, ITATW00003000FR, ITATW00003400FR, ITATW00003500FR, ITATW00003600FR, ITATW00003700FR, ITATW00003800FR, ITATW00003900FR, ITATW00004100FR, ITATW00004200FR, ITATW00004400FR, ITF015CWCILENTO11, ITF015CWCILENTO2, ITF015CWCI-LENTO20, ITF015CWCILENTO8, ITF015CWGOLFODINAPOLI, ITF015CWGOLFODIPOLICASTRO3, ITF015CWLITORALEFLE-GREO, ITF015CWLITORALEFLEGREO1, ITF015CWLITO-RALEFLEGREO4, ITF015CWLITORALEFLEGREO6, ITF015CWLITORALEFLEGREO7, ITF015CWMONTIDISALERNO, ITF015CWPENSORRENTINA, ITF015CWPENSORRENTINA5, ITF015CWPENSORRENTINA6, ITF015CWPIANASARNO, ITF015CWPIANASARNO1, ITF015CWPIANASELE1, ITF015CWPIANAVOLTURNO, ITF015CWPIANAVOLTURNO1, ITF015CWPIANAVOLTURNO2, ITF015CWPIANAVOLTURNO3, ITF015CWPIANAVOLTURNO5, ITF015CWPOSILLIPO, ITF015CWVESUVIO, ITF015CWVESUVIO1, ITF017_CW-A3_CAL-DOL-POLICASTRO, ITF017_CW-C3_FLUV-POLICORO, ITF017_CW-D3_FLUV-POLICASTRO-CASTROCUCCO, ITF017_CW-F3_FLUV-CAVONE, ITF017_CW-F3_FLUV-META-PONTO, ITG-0001-MC00010-N, ITG-0004-MC00020, ITG-0004-MC00020-N, ITG-0018-MC00100-N, ITG-0018-MC00110-N, ITG-0036-MC00200-N, ITG-0045-MC00250-N, ITG-0073-MC00370, ITG-0073-MC00370-N, ITG-0097-MC00430, ITG-0097-MC00430-N, ITG-0104-MC00440-N, ITG-0104-MC00450, ITG-0122-MC00620-N, ITG-0129-MC00730, ITG-0129-MC00730-N, ITG-0153-MC00790, ITG-0153-MC00790-N, ITG-0157-MC00800, ITG-0162-MC00840-N, ITG-0174-MC00990, ITG-0174-MC00990-N, ITG-0176-MC01021-N, ITG-0181-MC01050-N, ITG-0182-MC01070, ITG-0182-MC01070-N, ITG-0186-MC01130-N, ITG-0192-MC01200, ITG-0192-MC01200-N, ITG-0211-MC01211, ITG-0218-MC01270-N, ITG-0221-MC01290-N, ITG-0221-MC01350, ITG-0221-MC01350-N, ITG- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | 0221-MC01370, ITG-0222-MC01380, ITG-0222-MC01380-N, ITG-0226-MC01420, ITG-0226-MC01420-N, ITG-0231-MC01450, ITG-0241-MC01480-N, ITG-0246-MC01510, ITG-0250-MC01530, ITG-0250-MC01530-N, ITG-0251-MC01540-N, ITG-0253-MC01580, ITG-0253-MC01580-N, ITG-0256-MC01640, ITG-0256-MC01640-N, ITG-0283-MC01730-N, ITG-0300-MC01780, ITG-0300-MC01780-N, ITG-0300-MC01790-N, ITG-0302-MC01800, ITG-0311-MC01600, ITG-0311-MC01610-N, ITG-0311-MC01620-N, ITG-0315-MC10190, ITG-0317-MC00140-N, ITI020-R16-088ACE2S1_5, ITR16-004AT08_1, ITR16-007AT08_2, ITR16-014AT08_3, ITR16-018AT08_4, ITR16-084ACE2S1_1, ITR16-087ACE2S1_2, ITR16-087ACE2S1_3, ITR16-087ACE2S1_4, ITR16-090ACB2S3_1, ITR16-097ACB2S3_2, ITR16-143AT02_1, ITR16-162AT02_2, ITR16-183AT04_1, ITR16-185AT03_1, ITR16-191AT09_1, ITR16-191AT09_2, IT18CS61, IT18CS64, IT18CS08, IT18CZ42, IT18CZ43, IT18CZ44, IT18KR51, IT18CS58, IT18CS67, IT18KR49, IT18KR55, IT18KR57, IT18RC28, IT18RC32, IT18RC35, IT19CW03228, IT18CS03, IT18CS05, IT18CS06, IT18CZ12, IT18CZ13, IT18KR48, IT18KR50, IT18RC23, IT18RC27, IT18RC30, IT19CW02834, IT19CW07845, IT19CW10220, IT18KR56, IT18RC26, IT18RC38, IT19CW04485, IT18RC40, IT19CW07957, IT12PONZA_ACA3, IT18CS60, IT18CS63, IT18CZ11, IT18KR52, IT18KR54, IT18RC25, IT18RC33, IT18RC39, IT18VV18, ITF015CWGOLFODINAPOLI1, IT19CW00121, ITG-0028-MC00170-N, ITG-0104-MC00500-N, ITG-0115-MC00530-N, ITG-0164-MC00921-N, ITG-0231-MC01460-N, ITG-0239-MC01470-N, ITG-0174-MC00960-N, ITG-0269-MC01690-N, ITG-0305-MC10220-N, ITG-0190-MC01160-N, ITG-0245-MC01490-N, ITF015CWPIANASELE3, ITG-0016-MC00090-N, ITG-0047-MC00270-N, ITG-0129-MC00710-N, ITG-0164-MC00860-N, ITG-0164-MC00890-N, ITG-0221-MC01320-N, ITG-0288-MC01750-N, IT18VV20, ITG-0314-MC10030-N, ITG-0018-MC00120-N, ITG-0115-MC00520-N, ITG-0152-MC10080-N, ITG-0054-MC00271-N, ITG-0120-MC00600-N, ITG-0164-MC00880-N, ITG-0221-MC01280-N, ITR16-024ACE3S12_2, ITG-0176-MC01030-N, ITG-0246-MC01500-N, ITR16-164ACB3S3_10, ITR16-185ACF3S31_1, ITG-0305-MC10230-N, ITG-0258-MC01660-N, ITG-0283-MC01720-N, ITG-0291-MC01760-N, IT12PALMAROLA_ACA3, IT18CZ41, IT18KR53, IT18RC31, IT18RC36, IT18VV14, IT18VV16, IT18VV17, ITF015CWPIANASELE2, ITG-0252-MC01550-N, ITG-0258-MC01680-N, ITG-0269-MC01700-N, ITR16-081ACA3S1_4, IT12VENTOTENE_ACA3, IT18CS04, IT18CS10, IT18CS62, IT18RC34, ITF015CWCILENTO25, ITG-0032-MC00180-N, ITG-0058-MC00280-N, ITG-0062-MC00310-N, IT18CS02, IT18CS59, IT18CZ46, IT18RC22, IT18RC24, IT18RC37, ITG-0115-MC00540-N, ITG-0129-MC00720-N, IT19CW04038, IT18VV21, ITF015CWLITORALEFLEGREO9, ITG-0067-MC00320-N, ITG-0067-MC00330-N, ITG-0073-MC00360-N, ITG-0104-MC00480-N, ITG-0164-MC00922-N, ITG-0175-MC01000-N, ITI022_C_2, ITI027_F_2, ITR16-101ACB3S3_1, ITR16-176ACB3S3_12, ITR16-194ACF3S32_2, ITR16-201ACA3S3_2, ITG-0315-MC10200-N, ITR16-014ACA3S1_1, ITR16-054ACA3S1_3, ITR16-196ACE3S11_3, IT18CS01, IT18CS09, ITG-0124-MC00660-N, IT18CS65, IT19CW01316, ITG-0039-MC00240-N, ITF015CWCILENTO26, IT18RC29, ITR14_001_B_2, ITF015CWCAPRI, IT18VV19, IT18CS66, ITG-0192-MC01190-N, ITG-0311-MC01590-N, ITG-0118-MC00580-N, ITG-0104-MC00460-N, IT18VV15, ITF015CWCILENTO22, ITG-0281-MC01710-N, ITG-0115-MC00570-N, IT19CW00625, ITG-0071-MC00340-N, ITG-0168-MC00940-N, ITR16-147ACB3S3_7, IT18CZ45, ITF015CWPROCIDA8, IT18CS07, ITG-0183-MC01090-N, IT19CW01392, IT18CZ47, ITACW00002200FR, IT08-CD1_ITC, ITACW00001800FR, ITACW00002000FR, ITG-0283-MC01730, ITACW00001100FR, ITACW00002400FR, ITG-0014-MC00080, ITACW00001500FR, ITACW00001900FR, ITACW00002100FR, ITG-0036-MC00200, ITACW00001000FR, ITACW00001200FR, ITACW00001300FR, ITACW00002300FR, ITG-0007-MC00030, ITG-0045-MC00250, ITACW00000700FR, ITACW00000900FR, ITACW00001600FR, ITACW00001700FR, ITG-0162-MC00840, ITG-0317-MC00140, ITACW00001400FR, ITG-0018-MC00110, ITG-0186-MC01130, ITACW00000800FR | | |
| QE1-1 - Phytoplankton | Phyto-plankton | Pelagic habitats | 0.6 | EQR | LVA, LVB, LVCDEV, LVF, LVTD, LVTG, LVTL | Latvia | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phyto-plankton | Pelagic habitats | 0.6 | EQR | LT100101100, LT100101200, LT100201100, LT100201200, LT100201300, LT100201400 | Lithuania | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phyto-plankton | Pelagic habitats | 0.6 | EQR | MTMTC104, MTMTC107, MTMTC102, MTMTC109, MTMTC101, MTMTC105, MTMTC106, MTMTC108, MTMTC103 | Malta | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phyto-plankton | Pelagic habitats | 0.6 | EQR | NL81_2, NL89_WESTSDE_OWL, NL94_11, NL94_8, NL94_9, NL95_3A, NL81_1, NL89_OOSTSDE_OWL, NL81_10, NL89_ZWIN, NL81_3, NL95_1A, NL95_2A, NL95_4A, NL87_1 | Netherlands | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phyto-plankton | Pelagic habitats | 0.6 | EQR | NO0101000030-1-C, NO0101000030-2-C, NO0101020101-1-C, NO0101020200-2-C, NO0101020500-C, NO0101021000-1-C, NO0110000035-C, NO0110010300-C, NO0110010801-C, NO0120000032-3-C, NO0120010300-4-C, NO0240000100-C, NO0242011000-C, NO0242020900-C, NO0242021000-C, NO0260040200-C, NO0260040600-C, NO0260040800-C, NO0260050100-C, NO0260050500-C, NO0261010100-C, NO0261020100-2-C, NO0280010900-C, NO0280020100-1-C, NO0280020700-C, NO0301011206-C, NO0301011502-C, NO0301020900-C, NO0320010202-9-C, NO0320040500-16-C, NO0320040600-C, NO0320040900-10-C, NO0321000032-10-C, NO0321010200-C, NO0341010301-1-C, NO0361010100-C, NO0362040800-1-C, NO0362040800-2-C, NO0362040900-C, NO0363020500-C, NO0363020700-3-C, NO0364000030-10-C, NO0364030100-2-C, NO0364030301-C, NO0402010300-1-C, NO0403020500-2-C, NO0403040104-3-C, NO0403040104-4-C, NO0423010300-1-C, NO0423011200-C, NO0424000030-C, NO0424020100-21-C, NO0424030500-3-C, NO0201010500-C, NO0101020900-C, NO0101030102-1-C, NO0101020104-C, NO0101020701-5-C, NO0132030400-C, NO0120000031-1-C, NO0101040200-2-C, NO0120000031-3-C, NO0120010300-3-C, NO0120010400-C, NO0120030201-2-C, NO0121000033-C, NO0303021102-C, NO0240000600-C, NO0241000030-C, NO0320010400-C, NO0320020302-2-C, NO0320021000-C, NO0320000031-13-C, NO0320000031-30-C, NO0320010202-7-C, NO0320040300-C, NO0320040800-5-C, NO0320040900-7-C, NO0320041000-2-C, NO0320041300-1-C, NO0320041500-4-C, NO0320050402-C, NO0320050501-1-C, NO0320050501-4-C, NO0321000031-25-C, NO0321000031-26-C, NO0321030100-5-C, NO0361040300-2-C, NO0361040500-1-C, NO0361050100-C, NO0360010500-2-C, NO0362000031-C, NO0360010700-3-C, NO0362010200-C, NO0362010300-C, NO0360020100-1-C, NO0362020201-1-C, NO0360020600-1-C, NO0361010200-C, NO0361020300-1-C, NO0361020800-1-C, NO0361030202-1-C, NO0362020500-4-C, NO0362040700-3-C, NO0362041000-3-C, NO0363010300-2-C, NO0363020200-1-C, NO0363030301-C, NO0363030900-2-C, NO0363031000-1-C, NO0363031201-C, NO0363040100-C, NO0363040700-2-C, NO0363040900-C, NO0280020502-C, NO0242010101-2-C, NO0242010102-C, NO0242010300-C, NO0242010401-2-C, NO0363042400-1-C, NO0363042603-5-C, NO0363050300-7-C, NO0363050600-C, NO0364000030-8-C, NO0364010300-C, NO0364011000-3-C, NO0364011500-C, NO0364011700-C, NO0364020200-C, NO0364021202-3-C, NO0242010800-1-C, NO0242040105-C, NO0280031500-C, NO0282000030-C, NO0401010401-4-C, NO0401010502-3-C, NO0401011000-C, NO0401030500-1-C, NO0402010600-2-C, NO0402020401-4-C, NO0402021600-C, NO0282010700-C, NO0260000032-C, NO0260020500-C, NO0403030700-C, NO0403040500-1-C, NO0420000031-C, NO0420021000-C, NO0420022300-C, NO0420022500-C, NO0420030401-3-C, NO0420040701-C, NO0260041800-C, NO0260050400-C, NO0261020700-C, NO0261040207-C, NO0301022000-1-C, NO0421000031-C, NO0421020300-C, NO0421020700-C, NO0424030200-C, NO0424030700-2-C, NO0303010200-C, NO0303020200-1-C, NO0321030300-C, NO0321030500-12-C, NO0321030500-2-C, NO0321030600-4-C, NO0322000030-13-C, NO0322030100-4-C, NO0340000030-3-C, NO0340010100-C, NO0340010200-C, NO0340020502-1-C, NO0341010400-C, NO0341010600-C, NO0341011200-C, NO0360010200-3-C, NO0364050304-1-C, NO0364050401-2-C, NO0401010300-2-C, NO0365010201-2-C, NO0365011200-C, NO0365020100-1-C, NO0365020602-C, NO0365020902-5-C, NO0365030100-1-C, NO0365030300-C, NO0365031000-2-C, NO0424020300-C, NO0201000030-3-C, NO0130000031-3-C, NO0131010500-C, NO0101010401-C, NO0101020802-C, NO0110000037-2-C, NO0110010401-C, NO0110020400-C, NO0121020500-2-C, | Norway | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0320000031-7-C, NO0320010201-3-C, NO0320040500-10-C, NO0320041100-1-C, NO0320041200-3-C, NO0320041400-C, NO0320041600-1-C, NO0320050100-7-C, NO0320050502-5-C, NO0320050700-C, NO0321000031-32-C, NO0321010300-4-C, NO0321030500-8-C, NO0361030600-C, NO0361031200-C, NO0361040700-3-C, NO0361050600-C, NO0360011600-1-C, NO0360020300-2-C, NO0360020400-5-C, NO0360020500-2-C, NO0361030201-C, NO0362020400-C, NO0362030800-C, NO0363010200-C, NO0363010500-C, NO0363030602-2-C, NO0363031500-C, NO0363031600-C, NO0363032100-C, NO0363040700-1-C, NO0363041200-3-C, NO0363041700-C, NO0364000030-5-C, NO0364000030-6-C, NO0364000030-7-C, NO0364010800-2-C, NO0364010800-4-C, NO0242010101-3-C, NO0242010500-2-C, NO0242010702-2-C, NO0364020100-1-C, NO0364020400-1-C, NO0364020601-C, NO0364021202-1-C, NO0364030100-1-C, NO0364040501-C, NO0365000030-2-C, NO0365010101-C, NO0365010201-1-C, NO0365010300-4-C, NO0365010502-C, NO0365011000-C, NO0365011100-3-C, NO0242040106-1-C, NO0242050600-C, NO0401010501-2-C, NO0260010400-1-C, NO0402010500-C, NO0402010800-C, NO0402021400-2-C, NO0402021700-C, NO0403020800-C, NO0420020500-C, NO0420030401-2-C, NO0420040500-C, NO0421020100-C, NO0261000036-2-C, NO0261010200-6-C, NO0261020301-C, NO0261030100-1-C, NO0261030300-2-C, NO0261040500-C, NO0301021300-4-C, NO0301021600-C, NO0260010200-C, NO0201020100-1-C, NO0130000031-1-C, NO0110000034-1-C, NO0120000033-C, NO0110010600-C, NO0110020600-C, NO0121000500-C, NO0121000700-C, NO0121020202-C, NO0121020400-C, NO0320000030-3-C, NO0320000031-15-C, NO0320010201-8-C, NO0320030300-14-C, NO0302011701-C, NO0303011202-6-C, NO0303020400-C, NO0201020100-2-C, NO0241000031-1-C, NO0101020601-C, NO0101020702-1-C, NO0132010300-C, NO0201000031-C, NO0201020900-C, NO0130000102-2-C, NO0131000030-C, NO0101000032-4-C, NO0101020702-2-C, NO0101030400-C, NO0101030700-C, NO0110000032-1-C, NO0110000033-1-C, NO0110000038-1-C, NO0110000038-2-C, NO0120000034-C, NO0120010502-1-C, NO0121000600-C, NO0110021103-C, NO0121010200-C, NO0320000031-10-C, NO0320000031-24-C, NO0320010800-C, NO0320011000-6-C, NO0320030300-12-C, NO0320030300-9-C, NO0320040100-5-C, NO0320040400-3-C, NO0320040500-3-C, NO0240000030-C, NO0320020202-C, NO0320040500-6-C, NO0320050100-4-C, NO0320050200-C, NO0320050300-1-C, NO0320050502-3-C, NO0321000031-22-C, NO0321030500-10-C, NO0321040201-4-C, NO0322000030-16-C, NO0340020301-1-C, NO0341000030-2-C, NO0341010700-1-C, NO0341020700-4-C, NO0341030202-1-C, NO0342010300-C, NO0132010100-C, NO0110000701-C, NO0320040100-1-C, NO0320040100-4-C, NO0320040700-3-C, NO0320041200-11-C, NO0320041200-2-C, NO0320050403-C, NO0321000031-14-C, NO0321010300-2-C, NO0321020200-C, NO0321030100-3-C, NO0321030401-C, NO0321030402-2-C, NO0321030500-6-C, NO0340020001-1-C, NO0340020502-2-C, NO0341000032-C, NO0361030900-C, NO0361040200-C, NO0361050200-3-C, NO0360010200-6-C, NO0360010700-2-C, NO0360011200-2-C, NO0360011300-1-C, NO0362030402-1-C, NO0362030602-3-C, NO0362030700-2-C, NO0362040300-1-C, NO0363000031-3-C, NO0363020300-C, NO0363030602-5-C, NO0363031300-3-C, NO0363041200-5-C, NO0363041403-2-C, NO0363042603-4-C, NO0360011400-3-C, NO0360020400-1-C, NO0360021000-C, NO0361010700-1-C, NO0361020700-C, NO0361020900-C, NO0362030200-C, NO0362040400-1-C, NO0101010500-C, NO0101020701-6-C, NO0101030300-C, NO0101040300-3-C, NO0110000400-C, NO0131010100-3-C, NO0132010400-C, NO0131010400-C, NO0101000032-3-C, NO0101021000-2-C, NO0101030101-6-C, NO0120000031-2-C, NO0120020100-3-C, NO0121000032-C, NO0121000300-2-C, NO0121010500-2-C, NO0340020001-2-C, NO0341000033-C, NO0341010101-1-C, NO0341010301-2-C, NO0341010800-C, NO0341011100-C, NO0341030202-4-C, NO0341030402-C, NO0341030403-C, NO0342010102-5-C, NO0360010300-C, NO0110021102-C, NO0121020700-C, NO0303021003-1-C, NO0101020400-2-C, NO0110000030-C, NO0110000100-C, NO0110000300-C, NO0110020200-C, NO0110020300-C, NO0363041900-2-C, NO0363042300-2-C, NO0363042700-1-C, NO0364020100-3-C, NO0364030501-1-C, NO0364040502-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0364050101-C, NO0364050301-1-C, NO0401010300-1-C, NO0242030901-2-C, NO0242031500-C, NO0280021600-C, NO0363050300-6-C, NO0364000030-4-C, NO0242010500-1-C, NO0364010800-5-C, NO0364011900-C, NO0364020400-2-C, NO0364020602-C, NO0364040100-4-C, NO0401010100-1-C, NO0365010102-C, NO0365020300-C, NO0365020902-3-C, NO0280031200-C, NO0280031401-C, NO0120010502-2-C, NO0120020203-C, NO0120020300-C, NO0121020500-1-C, NO0320000030-1-C, NO0320000031-34-C, NO0320010201-10-C, NO0320010201-16-C, NO0320011100-2-C, NO0320030300-6-C, NO0320040200-3-C, NO0320040900-4-C, NO0320040900-6-C, NO0320010600-C, NO0110020800-2-C, NO0320000031-11-C, NO0320010201-2-C, NO0320040100-8-C, NO0320040200-1-C, NO0320040800-4-C, NO0320041800-C, NO0401010702-C, NO0401011600-C, NO0303021202-C, NO0320041600-2-C, NO0320050502-7-C, NO0320050800-C, NO0321000031-21-C, NO0321000031-28-C, NO0322000030-4-C, NO0340020100-2-C, NO0340020202-C, NO0340020401-C, NO0341010900-1-C, NO0341020200-C, NO0343010101-C, NO0240000200-C, NO0240010500-C, NO0361050300-C, NO0362000032-C, NO0360011300-2-C, NO0362011400-1-C, NO0360020400-3-C, NO0361030100-C, NO0361030202-3-C, NO0362020203-C, NO0362040700-1-C, NO0363000031-1-C, NO0363010400-2-C, NO0363010800-3-C, NO0363010900-2-C, NO0363011100-3-C, NO0363030302-C, NO0363031202-C, NO0363032000-C, NO0363040600-2-C, NO0363041401-C, NO0363041500-2-C, NO0363041500-5-C, NO0363041800-1-C, NO0363041900-1-C, NO0363042000-2-C, NO0363042200-C, NO0363042400-2-C, NO0363042700-2-C, NO0363050700-C, NO0364010100-C, NO0364010600-C, NO0364011000-1-C, NO0364011600-C, NO0364011800-C, NO0364020500-C, NO0364021100-C, NO0401010401-3-C, NO0401010800-2-C, NO0401011201-C, NO0401011500-C, NO0401020801-C, NO0401021600-C, NO0282011400-C, NO0282012000-C, NO0282010200-C, NO0301000030-C, NO0240000700-C, NO0241000031-2-C, NO0320000031-26-C, NO0320000031-28-C, NO0320011000-4-C, NO0320011100-3-C, NO0320011100-5-C, NO0320030300-11-C, NO0320030300-16-C, NO0320040100-7-C, NO0320050100-2-C, NO0321010100-2-C, NO0321010500-C, NO0320050401-3-C, NO0320050600-C, NO0321000031-17-C, NO0321000032-7-C, NO0321040201-3-C, NO0322030100-3-C, NO0322030300-C, NO0361030400-C, NO0361050200-2-C, NO0360010500-1-C, NO0362010102-C, NO0362010500-3-C, NO0360020200-C, NO0360020300-3-C, NO0362020500-1-C, NO0362030500-C, NO0362030601-C, NO0362030700-4-C, NO0363010300-1-C, NO0363021102-C, NO0363030900-1-C, NO0363041500-1-C, NO0363041500-4-C, NO0363042300-1-C, NO0363042603-3-C, NO0280010500-C, NO0242010103-2-C, NO0242011201-C, NO0242031000-C, NO0242050100-2-C, NO0242050200-C, NO0280020401-C, NO0280020501-C, NO0282012401-C, NO0260021000-C, NO0260040500-C, NO0260040700-C, NO0261000031-C, NO0401030400-C, NO0401031000-C, NO0360020400-2-C, NO0360020400-4-C, NO0360020500-1-C, NO0361010300-C, NO0361020300-2-C, NO0361020600-C, NO0362020201-2-C, NO0362040500-C, NO0362041000-4-C, NO0363000030-5-C, NO0363020200-2-C, NO0363030602-1-C, NO0363031300-1-C, NO0363032200-C, NO0363032300-1-C, NO0363041102-2-C, NO0363042000-4-C, NO0363042101-C, NO0363042103-C, NO0363042603-6-C, NO0363050500-C, NO0364000030-2-C, NO0364010200-C, NO0364010800-1-C, NO0364020300-1-C, NO0364021000-C, NO0364021202-5-C, NO0260040101-C, NO0260050301-C, NO0260050802-C, NO0402020500-1-C, NO0403020601-2-C, NO0403030300-C, NO0420010100-C, NO0420020200-C, NO0420022400-C, NO0261010401-C, NO0261030604-C, NO0403010300-C, NO0403020602-2-C, NO0403040402-C, NO0403040600-C, NO0420030300-2-C, NO0261010600-C, NO0261010901-C, NO0261020302-C, NO0261030203-C, NO0261030300-4-C, NO0401010800-1-C, NO0401020802-C, NO0280020900-3-C, NO0280030900-C, NO0363050300-2-C, NO0363050800-C, NO0364010800-3-C, NO0364011100-C, NO0364030700-1-C, NO0364040300-2-C, NO0401010200-1-C, NO0364050700-C, NO0364050802-C, NO0365010300-2-C, NO0365010400-2-C, NO0365010800-2-C, NO0365010900-2-C, NO0365011500-C, NO0242011202-C, NO0242020602-1-C, NO0242030303-2-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0242030902-C, NO0242000030-C, NO0280021700-C, NO0280030800-C, NO0281010700-C, NO0364021202-6-C, NO0364021202-7-C, NO0364040200-5-C, NO0364050301-2-C, NO0364050302-C, NO0364050403-C, NO0364050500-C, NO0365010202-C, NO0365010300-1-C, NO0365010400-1-C, NO0365010800-1-C, NO0365010900-1-C, NO0365011100-6-C, NO0365011100-8-C, NO0242020803-C, NO0242030901-1-C, NO0302010701-C, NO0302010702-C, NO0302010902-C, NO0421030603-C, NO0282011600-C, NO0282012402-C, NO0301010601-C, NO0301011202-C, NO0301020300-2-C, NO0301020601-C, NO0302010600-1-C, NO0423000030-4-C, NO0302012300-3-C, NO0303020300-C, NO0303020602-C, NO0260020900-C, NO0260030100-4-C, NO0402021300-1-C, NO0402021500-C, NO0403010500-C, NO0403020602-1-C, NO0403030401-C, NO0403040200-C, NO0403040700-C, NO0403040800-1-C, NO0420020800-C, NO0420021400-C, NO0261010200-3-C, NO0261010302-C, NO0261010903-C, NO0261020500-C, NO0301011000-1-C, NO0301011204-C, NO0401010900-C, NO0282010800-C, NO0401010502-5-C, NO0401011202-1-C, NO0401020701-1-C, NO0401021500-C, NO0401030202-C, NO0403020100-C, NO0403020200-C, NO0282012100-5-C, NO0301021102-2-C, NO0302011702-C, NO0303010100-4-C, NO0303010800-C, NO0303020601-C, NO0301010700-2-C, NO0260030100-3-C, NO0260030200-C, NO0260040103-C, NO0261020400-C, NO0420010400-C, NO0420020300-C, NO0420021600-C, NO0420040100-2-C, NO0420040702-C, NO0421010700-C, NO0421030500-C, NO0260010600-1-C, NO0260020300-C, NO0260040102-C, NO0260041500-C, NO0402020100-C, NO0402020402-C, NO0402021000-2-C, NO0403010400-C, NO0403020601-1-C, NO0403020900-C, NO0403040104-1-C, NO0341010302-C, NO0341010700-2-C, NO0341011400-2-C, NO0341020700-3-C, NO0342010101-1-C, NO0343010200-3-C, NO0360010200-4-C, NO0301021400-C, NO0301021700-C, NO0301022000-2-C, NO0302010802-C, NO0302011600-2-C, NO0302011900-C, NO0424030601-C, NO0303011301-C, NO0303011400-3-C, NO0261010800-9-C, NO0301010700-3-C, NO0301010902-C, NO0301010903-C, NO0301020500-C, NO0301020802-C, NO0261030603-2-C, NO0420020600-C, NO0303020701-C, NO0420021201-C, NO0420030102-1-C, NO0420040300-C, NO0420040400-C, NO0421010800-C, NO0421010900-C, NO0421030200-8-C, NO0422010100-2-C, NO0423010700-C, NO0424020600-C, NO0303000032-2-C, NO0365030500-3-C, NO0365030600-C, NO0430000000-C, NO0321020102-C, NO0321040201-2-C, NO0321040202-C, NO0322000030-15-C, NO0322020201-C, NO0322030200-C, NO0340000030-2-C, NO0340020002-C, NO0340020201-C, NO0341000036-C, NO0341010101-2-C, NO0341010102-C, NO0365010201-3-C, NO0365020801-2-C, NO0341011400-1-C, NO0341030401-C, NO0343010200-2-C, NO0343010200-5-C, NO0360010400-1-C, NO0364021201-1-C, NO0364021202-10-C, NO0364040503-2-C, NO0365010601-5-C, NO0365010602-3-C, NO0365011100-7-C, NO0365011400-C, NO0365020100-3-C, NO0365020902-1-C, NO0365030400-1-C, NO0365031000-1-C, NO0420040601-C, NO0421000030-C, NO0421031400-C, NO0421000032-6-C, NO0421010100-C, NO0421020200-C, NO0424020400-C, NO0420022100-C, NO0421010300-C, NO0421020502-C, NO0421021100-C, NO0421030100-C, NO0422010600-C, NO0422010703-C, NO0365020902-2-C, NO0365020902-4-C, NO0260010100-1-C, NO0201010600-C, NO0131010200-C, NO0101021100-C, NO0110020700-C, NO0120010300-1-C, NO0120020100-2-C, NO0120030204-C, NO0121000031-C, NO0320010202-3-C, NO0320010500-C, NO0320020700-C, NO0320020800-C, NO0320011000-5-C, NO0320011100-1-C, NO0320040500-5-C, NO0320041000-11-C, NO0320041500-1-C, NO0320041700-C, NO0321000031-13-C, NO0321000031-31-C, NO0321000032-5-C, NO0321010400-1-C, NO0321010400-4-C, NO0321030200-2-C, NO0361030202-4-C, NO0361031100-C, NO0361040102-1-C, NO0361040600-C, NO0361050500-C, NO0362010500-1-C, NO0360011600-2-C, NO0362020100-2-C, NO0361010400-C, NO0361020200-C, NO0361020800-2-C, NO0361030202-2-C, NO0362020202-C, NO0362020500-3-C, NO0362020500-5-C, NO0362030402-2-C, NO0362040200-2-C, NO0362041000-2-C, NO0363010100-C, NO0363010300-7-C, NO0363010900-1-C, NO0363011000-2-C, NO0363030500-C, NO0363031300-4-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0363041000-C, NO0363041300-C, NO0280030600-C, NO0363041500-3-C, NO0363042102-C, NO0363050400-C, NO0364010400-C, NO0364010900-C, NO0364011000-2-C, NO0364020800-1-C, NO0364021202-2-C, NO0364021202-8-C, NO0364021202-9-C, NO0364040400-C, NO0364040503-1-C, NO0364050102-C, NO0242010200-C, NO0242011300-C, NO0242020801-2-C, NO0242030500-C, NO0242040802-5-C, NO0242041000-C, NO0282010300-C, NO0282010600-C, NO0401010501-1-C, NO0401021400-C, NO0401030201-C, NO0402020600-C, NO0402021100-C, NO0403010100-C, NO0403010800-C, NO0403011200-C, NO0403030200-C, NO0403030600-2-C, NO0260000033-C, NO0260010501-6-C, NO0260030700-C, NO0261000036-3-C, NO0261010500-2-C, NO0261010800-4-C, NO0261030601-C, NO0403030900-C, NO0403031000-C, NO0403040102-1-C, NO0420030401-4-C, NO0421011000-C, NO0421030900-C, NO0421031300-C, NO0422010100-16-C, NO0301010602-C, NO0301011203-C, NO0301020801-C, NO0302011200-C, NO0424020100-10-C, NO0303000032-8-C, NO0303011202-2-C, NO0303011302-C, NO0322010200-C, NO0322010300-C, NO0322020300-C, NO0322030100-2-C, NO0341000030-6-C, NO0341010103-C, NO0360010100-1-C, NO0364050304-2-C, NO0365010601-6-C, NO0365020700-C, NO0422010900-3-C, NO0132000030-C, NO0261030202-C, NO0363010600-2-C, NO0362041200-2-C, NO0360011400-2-C, NO0402011100-C, NO0360020800-C, NO0201010100-C, NO0281010201-1-C, NO0301010901-2-C, NO0320010201-13-C, NO0363030601-C, NO0362030700-1-C, NO0320041000-9-C, NO0320010202-6-C, NO0421021000-C, NO0361031000-C, NO0302011800-C, NO0362020500-2-C, NO0363042000-1-C, NO0363010300-6-C, NO0302010200-C, NO0363011000-1-C, NO0361020100-1-C, NO0360011400-1-C, NO0261020600-C, NO0360010800-C, NO0363040500-C, NO0361040400-C, NO0131010100-2-C, NO0260010501-4-C, NO0402020700-C, NO0120030203-2-C, NO0280010100-C, NO0260010501-5-C, NO0342010102-2-C, NO0302012400-4-C, NO0364000030-9-C, NO0320010100-4-C, NO0364020800-2-C, NO0343000030-3-C, NO0320040500-7-C, NO0364011200-C, NO0130000102-1-C, NO0261010800-2-C, NO0242030304-C, NO0421020400-C, NO0420040800-C, NO0362041200-1-C, NO0261030400-17-C, NO0422010702-C, NO0362040100-C, NO0401030800-C, NO0320041900-C, NO0320050401-4-C, NO0341000034-C, NO0364050402-C, NO0320010900-C, NO0403020500-1-C, NO0363010600-1-C, NO0365010700-C, NO0322000030-11-C, NO0303020500-1-C, NO0341030300-C, NO0320000031-12-C, NO0320000031-25-C, NO0364050303-C, NO0321000032-9-C, NO0320040700-2-C, NO0341010500-C, NO0365000031-6-C, NO0120020202-C, NO0320030400-C, NO0301010501-5-C, NO0303020200-2-C, NO0302000031-C, NO0420021202-2-C, NO0361050400-C, NO0365000031-1-C, NO0320041200-9-C, NO0242010800-2-C, NO0280022200-C, NO0363040300-C, NO0261010301-C, NO0201021000-C, NO0401010402-C, NO0110000034-2-C, NO0130000200-2-C, NO0364010702-C, NO0364040300-1-C, NO0360010600-2-C, NO0120020100-1-C, NO0420031100-C, NO0242030303-1-C, NO0402020300-C, NO0420031300-C, NO0364010500-C, NO0341011300-C, NO0403040500-2-C, NO0365011600-C, NO0365020601-C, NO0364040100-2-C, NO0401020300-C, NO0301010901-1-C, NO0423000030-7-C, NO0280011200-C, NO0401030900-C, NO0261040300-1-C, NO0365031100-C, NO0360010400-2-C, NO0363030800-C, NO0421030602-C, NO0301021300-1-C, NO0320000031-4-C, NO0363030602-4-C, NO0401000030-2-C, NO0403040102-2-C, NO0363030400-C, NO0364040200-2-C, NO0260010600-2-C, NO0201020200-C, NO0365020901-1-C, NO0363040802-C, NO0320040500-9-C, NO0341010303-C, NO0320050401-2-C, NO0282000032-C, NO0401010701-C, NO0360011500-2-C, NO0365030500-1-C, NO0301020100-C, NO0132030500-C, NO0421020501-C, NO0260000034-C, NO0101010305-C, NO0341020400-C, NO0401000030-1-C, NO0110000037-1-C, NO0420022600-C, NO0280010700-C, NO0260010504-C, NO0260000030-C, NO0403020400-1-C, NO0360011000-C, NO0363030100-2-C, NO0364020100-6-C, NO0402021200-C, NO0420022000-C, NO0320050502-8-C, NO0363020600-1-C, NO0360011200-1-C, NO0362030700-3-C, NO0421020900-C, NO0363030702-C, NO0303011507-C, NO0303021002-4-C, NO0364040200-4-C, NO0420021500-C, NO0420030800-C, NO0320030300-15-C, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | NO0121020600-2-C, NO0242031100-C, NO0363031800-C, NO0361000030-C, NO0365011300-1-C, NO0365011100-2-C, NO0365010501-C, NO0320020502-C, NO0361040300-1-C, NO0362030401-C, NO0320050502-9-C, NO0363020600-2-C, NO0360020300-1-C, NO0101040500-C, NO0242050700-C, NO0260020801-C, NO0320011000-2-C, NO0340020501-2-C, NO0320010100-1-C, NO0362011100-C, NO0320010201-11-C, NO0341011002-C, NO0420022200-C, NO0363042500-2-C, NO0242010701-C, NO0403000030-C, NO0110020500-C, NO0401010502-2-C, NO0101030101-5-C, NO0360011300-3-C, NO0280010600-C, NO0281010600-1-C, NO0201010400-C, NO0301021203-1-C, NO0402011000-C, NO0320040500-15-C, NO0364021202-4-C, NO0303000030-C, NO0110000702-C, NO0403020400-2-C, NO0340000030-4-C, NO0341030100-1-C, NO0402000030-C, NO0242010900-C, NO0242040901-C, NO0361020400-C, NO0365011300-2-C, NO0365000032-8-C, NO0101020105-C, NO0110021000-1-C, NO0363042000-3-C, NO0363010800-2-C, NO0362030602-1-C, NO0420031500-2-C, NO0260050900-C, NO0260000035-C, NO0422010100-13-C, NO0301010202-C, NO0242040200-C, NO0403010200-C, NO0402020900-5-C, NO0364021201-2-C, NO0363021000-C, NO0363030701-C, NO0364050404-C, NO0280011400-C, NO0302012500-C, NO0303010901-C, NO0321040300-3-C, NO0420020900-C, NO0120020400-1-C, NO0402011200-C, NO0363030303-C, NO0362040700-2-C, NO0363000032-1-C, NO0343000030-2-C, NO0132030100-C, NO0201000030-2-C, NO0421030200-3-C, NO0131020400-C, NO0402020401-1-C, NO0110000600-C, NO0261010200-8-C, NO0261040102-C, NO0364040100-1-C, NO0302010801-C, NO0320020201-C, NO0363050200-C, NO0340020100-1-C, NO0420020700-C, NO0403020300-C, NO0363032300-2-C, NO0421020800-C, NO0303011201-C, NO0343010200-6-C, NO0321030500-4-C, NO0365020801-1-C, NO0420040900-C, NO0424020800-C, NO0303021001-C, NO0365030500-2-C, NO0402020900-11-C, NO0401030300-2-C, NO0260010502-C, NO0320010202-2-C, NO0322000030-2-C, NO0362030602-2-C, NO0360011500-1-C, NO0402010300-4-C, NO0402021400-1-C, NO0261040206-C, NO0240010202-C, NO0282012500-C, NO0321030600-5-C, NO0361030500-C, NO0363041402-C, NO0421030601-C, NO0281011200-C, NO0261030201-1-C, NO0320041200-4-C, NO0364012000-C, NO0365000032-7-C, NO0363040801-C, NO0320050100-9-C, NO0301010201-C, NO0341030203-C, NO0342000033-C, NO0402010401-C, NO0420030600-3-C, NO0320020301-C, NO0364020900-C, NO0321000033-3-C, NO0363041800-2-C, NO0363020400-C, NO0363040400-C, NO0321030200-5-C, NO0322020100-C, NO0365010601-2-C, NO0303000032-11-C, NO0363010400-1-C, NO0341000030-4-C, NO0322000030-8-C, NO0363040200-4-C, NO0420020400-C, NO0280022101-C, NO0341020600-5-C, NO0303010300-1-C, NO0302011500-C, NO0303021201-C, NO0320011100-7-C, NO0301011300-C, NO0360010900-C, NO0362040600-C, NO0363000031-2-C, NO0130000030-1-C, NO0121020600-1-C, NO0121010500-1-C, NO0261040101-10-C, NO0261040101-9-C, NO0121020300-C | | |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | PLCWIIIWB5, PLCWIIIWB7, PLCWIIIWB9, PLCWIIWB4, PLCWIIWB6E, PLCWIIWB6W, PLCWIIWB8, PLCWIWB1, PLCWIWB2, PLCWIWB3, PLTW20001WB1, PLTW20002WB4, PLTW20003WB5, PLTW20005WB7, PLTW60001WB2, PLTW60001WB3, PLTWIVWB4, PLTWVWB6, PLTWVWB7 | Poland | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | PT01COST1N, PT08RDA1700, PT09FAICPP1, PT09SMGCI1, PT01COST20, PT05SUL1635, PT09TERCPP1, PT09TRICP1, PT05RDW1165A, PT04COST5, PT03NOR0732, PT05RDW1166A, PT08RF3, PT08RF1, PT08RF2, PT09OCICP1, PT09PICCPP1, PT09SJOCI1, PT05COST11A, PT09FLOCI1, PT09SMGCPP4, PT09GRACI1, PT09GRACPP1, PT08COST14, PT09FAICI1, PT09PICCI1, PT09SMACI1, PT02COST2, PT09TERCP1, PT09SJOCPP1, PT09SMGCPP3, PT04COST7, PT03COST3, PT08COST15, PT08COST17, PT09SMGCPP1, PT09SMGCPP2, PT08RF4, PT08RF5, PT06SUL1638, PT09CORCI1, PT09TERCI1, PT09GRACP1, PT09ORICP1, PT09TERCPP2, PT09FLOCPP1, PT07COST18, PT09SMACPP1, PT08COST16, PT09CORCPP1, PT07COST19, PT03DOU0366, PT01LIM0046, PT01LIM0057, PT01NOR0724, PT06SAD1207, PT04MON0685, PT04VOU0547, PT01MIN0019, PT06SAD1210, PT05TEJ1116A, PT08RDA1657B, PT02LEC0139, PT09SJOT001, PT09SJOT003, PT03DOU0364, PT04VOU0552, PT06MIR1367, PT04LIS0704, PT04VOU0536, PT06MIR1374, PT07GUA1603N, PT06SAD1222, PT07GUA1603I, PT06SAD1219, PT05TEJ1100A, PT05TEJ1139A, PT07GUA1629I, PT08RDA1684A, PT09SJOT002, PT01LIM0059, PT01MIN0018, PT04MON0682, PT02CAV0096, PT02CAV0102, PT05TEJ1075A1, PT07GUA1631, PT04VOU0550, PT06MIR1368, PT06SAD1217, PT02AVE0124, PT02AVE0129, PT04MON0688, PT06SAD1211, PT04VOU0514, PT03DOU0370, PT01LIM0056, PT01MIN0023, PT08RDA1701, PT07GUA1632I, PT04MON0681, PT02AVE0135, PT05RDW1166, PT04COST4, PT05RDW1165, PT06COST12, PT04COST89A, PT04COST6, PT05TEJ1075A, PT08RDA1686 | Portugal | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | ROCT02_B1, ROCT01_B2, ROCT01_B1, ROCT02_B2, ROTT02_B1, ROTT03_B1 | Romania | EEA WISE MARINE |
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | SI5VT2, SI5VT3, SI5VT4, SI5VT5 | Slovenia | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | ES017MSPFES111C000010, ES017MSPFES111C000015, ES017MSPFES111C000020, ES017MSPFES111C000030, ES017MSPFES111T012010, ES017MSPFES111T014010, ES017MSPFES111T018010, ES017MSPFES111T028010, ES017MSPFES111T034010, ES017MSPFES111T042010, ES017MSPFES111T044010, ES017MSPFES111T045010, ES017MSPFES111T046010, ES017MSPFES111T046020, ES017MSPFES111T048010, ES017MSPFES111T068010, ES017MSPFES111T068020, ES017MSPFES111T075010, ES060MSPF610000, ES060MSPF610001, ES060MSPF610002, ES060MSPF610003, ES060MSPF610004, ES060MSPF610005, ES060MSPF610006, ES060MSPF610007, ES060MSPF610008, ES060MSPF610009, ES060MSPF610010, ES060MSPF610011, ES060MSPF610012, ES060MSPF610013, ES060MSPF610014, ES060MSPF610015, ES060MSPF610016, ES060MSPF610017, ES060MSPF610018, ES060MSPF610019, ES060MSPF610020, ES060MSPF610021, ES060MSPF610023, ES060MSPF610024, ES060MSPF610025, ES060MSPF610026, ES060MSPF610033, ES060MSPF610034, ES060MSPF610035, ES060MSPF610037, ES063MSPF005200000, ES063MSPF005200010, ES063MSPF005200020, ES063MSPF005200030, ES063MSPF005200040, ES063MSPF005200050, ES063MSPF005200060, ES063MSPF005200070, ES063MSPF005200080, ES063MSPF005200100, ES063MSPF005200110, ES063MSPF005200120, ES063MSPF005200130, ES063MSPF005200140, ES063MSPF005200150, ES063MSPF005200160, ES063MSPF005200170, ES063MSPF005200180, ES063MSPF005200190, ES063MSPF005200550, ES063MSPF005200570, ES064MSPF004400200, ES064MSPF004400210, ES064MSPF004400220, ES064MSPF004400230, ES064MSPF004400240, ES064MSPF004400250, ES064MSPF004400260, ES064MSPF004400270, ES064MSPF004400280, ES064MSPF004400290, ES064MSPF004400300, ES064MSPF004400310, ES064MSPF004400320, ES064MSPF004400330, ES064MSPF004400340, ES014MSPF9, ES010MSPFES000MAC000020, ES018MSPFES000MAC000020, ES010MSPFES000MAC000010, ES018MSPFES000MAC000070, ES014MSPF8, ES080MSPFC010, ES070MSPF010300050, ES080MSPFC009, ES080MSPFC008, ES080MSPFC0102, ES014MSPF19A, ES014MSPF4, ES014MSPF50, ES014MSPF51, ES110MSPFEIMC03M4, ES110MSPFEIMC07M3, ES110MSPFMAMC08M3, ES110MSPFMAMC12M2, ES110MSPFMAMC13M2, ES100MSPFC16, ES100MSPFC4, ES018MSPFES000MAC000130, ES050MSPF014116001, ES080MSPFC004, ES080MSPFC006, ES014MSPF15A, ES014MSPF6, ES014MSPF7, ES014MSPF19C, ES014MSPF2, ES014MSPF15C, ES014MSPF53, ES110MSPFMAMC03M2, ES100MSPFC1, ES100MSPFC10, ES100MSPFC14, ES100MSPFC20, ES100MSPFC24, ES080MSPFC007, ES080MSPFC011, ES080MSPFC012, ES080MSPFC014, ES080MSPFC015, ES080MSPFC002, ES080MSPFC005, ES120MSPFES70GCTIV2, ES110MSPFEIMC04M4, ES110MSPFMAMC15M3, ES110MSPFMAMCP02, ES100MSPFC19, ES100MSPFC29, ES100MSPFC6, ES120MSPFES70GCAMM_1, ES018MSPFES000MAC000120, ES110MSPFEFMCP03, ES110MSPFEIMC02M4, ES110MSPFMAMC02M3, ES110MSPFMAMC05M3, ES110MSPFMAMC07M3, ES110MSPFMEMC06M2, ES100MSPFC3, ES100MSPFC30, ES100MSPFC5, ES018MSPFES000MAC000050, ES018MSPFES000MAC000060, ES018MSPFES000MAC000100, ES018MSPFES000MAC000110, ES100MSPFC32, ES110MSPFMAMC04M2, ES120MSPFES70GCTI2_1, ES080MSPFC001, ES091MSPF895, ES100MSPFC18, ES100MSPFC2, ES100MSPFC28, ES014MSPF14, ES014MSPF17, ES014MSPF47, ES110MSPFFOMC09M3, ES110MSPFMAMC06M2, ES110MSPFMAMC14M3, ES110MSPFMEMC04M4, ES110MSPFMEMC07M3, ES100MSPFC21, ES100MSPFC22, ES100MSPFC25, ES150MSPF417060003, ES014MSPF16, ES014MSPF5, ES110MSPFEIMCP02, ES110MSPFFOMCM01, ES110MSPFMAMCP01, ES100MSPFC36, ES124MSPFES70TFTI2, ES126MSPFES70LGTIII, ES122MSPFES70FVAMM, ES123MSPFES70LZTIII, ES124MSPFES70TFTI1_1, ES126MSPFES70LGTV, | Spain | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | ES122MSPFES70FVTI1, ES122MSPFES70FVTII, ES124MSPFES70TFTIV, ES122MSPFES70FVTIV_1, ES123MSPFES70LZTIV, ES124MSPFES70TFTV_1, ES124MSPFES70TFTII, ES070MSPF002150006, ES070MSPF002150007, ES070MSPF010300070, ES070MSPF010300090, ES070MSPF010300110, ES070MSPF010300120, ES070MSPF010300040, ES080MSPFC0101, ES100MSPFC23, ES123MSPFES70LZAMM, ES110MSPFMAMC11M3, ES110MSPFMAMCM01, ES110MSPFMEMC05M2, ES100MSPFC9, ES018MSPFES000MAC000030, ES018MSPFES000MAC000071, ES018MSPFES000MAC000140, ES040MSPF004000160, ES050MSPF014116000, ES080MSPFC013, ES014MSPF10, ES014MSPF11, ES014MSPF13, ES014MSPF15B, ES014MSPF48, ES124MSPFES70TFTIII, ES127MSPFES70EHTIII, ES110MSPFEIMCP01, ES110MSPFMEMCM02, ES100MSPFC12, ES100MSPFC26, ES100MSPFC27, ES120MSPFES70GCTII, ES120MSPFES70GCTIV1, ES126MSPFES70LGTII, ES127MSPFES70EHTII, ES070MSPF002120005, ES070MSPF010300020, ES070MSPF010300030, ES070MSPF010300100, ES070MSPF010300140, ES080MSPFC0041, ES080MSPFC0081, ES123MSPFES70LZTII, ES018MSPFES000MAC000080, ES018MSPFES000MAC000090, ES014MSPF3, ES100MSPFC7, ES110MSPFMAMC16M3, ES124MSPFES70TF_AMM1, ES120MSPFES70GCTIII, ES100MSPFC15, ES014MSPF52, ES100MSPFC31, ES110MSPFMAMC10M2, ES127MSPFES70EHTI, ES122MSPFES70FVTIII, ES070MSPF010300010, ES110MSPFMAMC09M3, ES110MSPFEIMC01M2, ES110MSPFEIMCM01, ES124MSPFES70TF_AMM2, ES070MSPF010300130, ES080MSPFC017, ES110MSPFEFMCP04, ES040MSPF004000170, ES080MSPFC0161, ES110MSPFMAMC01M2, ES100MSPFC11, ES100MSPFC37, ES070MSPF010300060, ES080MSPFC016, ES110MSPFEFMC08M4, ES070MSPF010300080, ES120MSPFES70GCAMM_2, ES050MSPF014114002, ES110MSPFMAMCM02, ES014MSPF12, ES100MSPFC8, ES110MSPFEIMC05M3, ES018MSPFES000MAC000021, ES110MSPFFOMC10M2, ES014MSPF19B, ES091MSPF894, ES018MSPFES000MAC000040, ES126MSPFES70LGTI, ES014MSPF49, ES110MSPFEIMC06M4, ES080MSPFC003, ES100MSPFC17, ES014MSPF18, ES018MSPFES087MAT000160, ES018MSPFES087MAT000170, ES040MSPF004000180, ES018MSPFES145MAT000060, ES018MSPFES194MAT000050, ES018MSPFES200MAT000040, ES040MSPF004000210, ES018MSPFES145MAT000070, ES063MSPF005200560, ES080MSPFT0302, ES080MSPFT0202, ES014MSPF35, ES014MSPF40, ES110MSPFEIMTM02, ES110MSPFMAMT11, ES060MSPF610036, ES014MSPF26, ES014MSPF32, ES014MSPF42, ES014MSPF54, ES014MSPF33, ES014MSPF43, ES110MSPFFOMT03, ES010MSPFES505MAT000270, ES080MSPFT0201, ES110MSPFMEMT15, ES110MSPFMEMT21, ES110MSPFMAMT08, ES110MSPFMAMT10, ES110MSPFMEMT09, ES110MSPFMEMT17, ES110MSPFMEMT22, ES050MSPF012100004, ES110MSPFMEMT20, ES018MSPFES234MAT000030, ES110MSPFMAMT07, ES050MSPF013213007, ES050MSPF013213006, ES050MSPF013213009, ES050MSPF013213011, ES014MSPF34, ES014MSPF37, ES014MSPF44, ES110MSPFMAMT15, ES110MSPFMEMTM08, ES050MSPF013213015, ES014MSPF36, ES110MSPFMAMT16, ES110MSPFMAMT20, ES110MSPFMAMTM24, ES110MSPFMEMT11, ES050MSPF013213004, ES050MSPF013213008, ES050MSPF013213013, ES060MSPF610027, ES060MSPF610028, ES060MSPF610029, ES010MSPFES503MAT000260, ES110MSPFEIMT01, ES110MSPFMAMT09, ES110MSPFMEMT45, ES050MSPF013213010, ES040MSPF004000200, ES014MSPF25, ES014MSPF28, ES014MSPF30, ES014MSPF31, ES014MSPF39, ES014MSPF41, ES014MSPF45, ES110MSPFMAMT05, ES110MSPFMEMT18, ES110MSPFMAMT04, ES050MSPF013213005, ES040MSPF004000190, ES018MSPFES244MAT000020, ES110MSPFMEMT02, ES050MSPF013213014, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | ES110MSPFMAMT27, ES080MSPFT0301, ES110MSPFMEMT16, ES018MSPFES144MAT000080, ES018MSPFES087MAT000150, ES110MSPFMEMT06, ES014MSPF27, ES014MSPF29, ES110MSPFMAMT25, ES014MSPF38, ES050MSPF013213016, ES125MSPFES70LPTI2, ES110MSPFMEMC02M3, ES125MSPFES70LPTI1, ES125MSPFES70LPTIII, ES110MSPFMEMC01M2_001, ES125MSPFES70LPTII, ES125MSPFES70LPTIV | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | SE17B83204-EFA8-43DD-B9FB-7AB5E7816DFE, SE62C97DC9-EFE0-424B-8227-96EAB381B02B, SEB1420208-9106-4746-9E8F-44376E7311AA, SEB62354AD-0C2F-40C8-BC73-8189EA1AFBEF, SEF99DDCA5-319E-4F10-A799-8041A7938C79, SE1E82A04F-9AFF-492D-A1E6-3149841CDE70, SE053D3E0D-6DC6-4EF9-86CF-B4996DE9295A, SE1C0F1AC7-2976-4FAD-B8E8-7F5B5D59B6A4, SE20A42416-4FCE-47ED-BBF7-EF4F4B6A6EC3, SE23F05C72-B3C9-4C6D-A98B-3EB1440A9A6D, SE44DC0522-7C7A-41D6-A38F-AEB6971027DD, SE3A3C0F11-DD00-4A07-B641-19C3590086D4, SE262962BB-EC9B-4C10-B504-20E1BB5A98AA, SE45C46A2E-674D-41A7-8528-B24529A2E08C, SE6ED30512-4C45-4E65-ABC9-0AD8A88EE8F6, SE504BD08B-EC42-49D3-A25C-D3DFB743A184, SE30273074-7EA6-4AE6-868A-FF0635F956BA, SE2A8A69B2-60ED-4DE1-A668-7256368CED44, SE5C554806-8BC1-4C0D-AB12-B7BEB966CB59, SE66F4C832-FBB7-40B9-A41B-5E29E07E6B49, SE72FC1381-7DC2-40C7-8DA7-04D8F735AD29, SE538BCA41-D665-4C49-B1A3-2E0D35ED19F8, SE4259C3FF-286C-4D0A-A08B-CA1F3149CF2C, SE36711B15-677A-45FD-9350-65D6C3736D09, SE431B4EB5-7FD4-4B45-834D-F59C22EA3CCB, SE6BE462BD-A040-4070-BB86-601A2D4FB568, SE8F8296A6-42AD-4DC3-8682-D9A77AAB6DFC, SE56EBBB98-65C0-4544-9991-7B003A85C5A3, SE8614CB30-210D-4A26-8A05-4F83A1B6BFF3, SE77DE27A3-CE19-4B79-9E6E-0827FAE23B62, SE77FE7C64-BCBD-444C-BFA9-917ADFC16955, SE9DAF9D44-25F9-45C3-B151-CAE801DF757E, SE9F445B31-715A-44BF-8098-FCE59AA36023, SE88F70B3D-91E5-4FE3-BC5B-A679DA9F1E50, SEAF70D2EE-678E-40F8-B89B-E825D839394B, SE93F0B62A-6255-4D87-A41C-7333AD5F0DE7, SE8C0BB073-75AA-48D9-99F3-CED1A224F601, SE950D208F-3CEB-4AAE-80F7-66031AE84D6E, SEC5C97FBD-041D-49A0-823B-24CF5FA076CD, SE961B7997-DFBA-41D6-A283-387159C4889B, SE95ECA748-AB15-4F45-9AFA-E6318C11A5B0, SEA33BCB99-140C-4E66-B00F-5A2D3DDBA069, SEDC3BDC4E-FB8F-48C7-8396-FC1F4A86ABA2, SED37AAFEB-D2BA-40BC-B757-550A62A23665, SEC6C9486B-70D2-405E-8FBB-41C1765466EB, SEB4616DD1-6CC8-4D07-8AB3-806AB4AC9599, SEEBB9EEBE-76B5-4AC1-9D01-2BA0CC84A54E, SE0A089129-074E-4AC2-909E-7D297897EFCB, SE0CBE8D72-DE4C-4636-9F9B-0517FA951578, SE00A404B4-5B5D-4BFF-8BC2-D926E9C13B42, SE23B87999-D900-4349-BF56-05AD75884D61, SE0A5411D9-27D4-4A37-B879-520CF24A16CD, SE13D27867-9ED5-42A5-9C19-2BC512886992, SE16A044F8-3910-4A50-B53A-F73732C1D3D0, SE123F3D9C-E43D-4827-9E4B-96F281BD35B6, SE397FC952-DD5F-4DE1-B8D6-C39FE27BF2CD, SE39D0E199-F342-48C2-AF7B-E1562AEF6E49, SE2FD8A1B4-D9BF-40DF-9E79-3FB591ACA762, SE274DA422-18B7-4551-9533-30A8F5EF55BE, SE44ED66E9-1549-457E-87DC-8F45942058D2, SE39CC4296-D82A-49AB-9E47-7F0CE95AF429, SE6512EE8F-FC93-4479-8C70-0720FE00A5F4, SE655FD282-9C88-4186-A9E2-EC301ADE5D79, SE5D11E7A4-BD0F-4C3B-A251-18EE70A47630, SE294D759A-6491-48F4-B063-B1C8BD3C86B5, SE65E9D53F-9F40-4A07-842E-9599AC1A3C91, SE3F6598CE-D9B4-4A7C-9AD9-F6F89F5A67F2, SE2AEFB7B5-88B1-42F5-BB1A-AA20CC485FE4, SE048C5EB2-E51D-429A-8888-0A9D3E327E76, SE1AF83C27-C062-4831-9537-270CB44EC0CA, SE1CB1305B-FB7B-4D00-A554-40C46617AF59, SE1F5B23B8-2C72-4A73-96FD-7BC69D46EC3C, SE09AC6BA3-3A94-4B0F-90BD-B4F006EB410D, SE01BFACF1-84D8-4B19-8891-434BDF857112, SE2B56DE67-CC73-4CBE-8BF2-323BE06AF9B0, SE160E5E93-4F0F-4654-84AE-BD06D39229C7, SE08A25864-5AC3-446B-827A- | Sweden | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | F659A926F81E, SE1C10C14F-9433-4438-A131-C23020FA291C, SE0B68FE82-4165-4DBE-AC8D-FB556EB381A7, SE118B0F92-A370-45B3-B2CD-5FC2F0AB9628, SE120E3E3C-99F1-48E5-B5B7-8AAFA9749E5F, SE0E618FCF-8EF0-4BE7-86F3-FD5CADD6AEA1, SE1B4A4BD4-01A7-4F17-93E2-1894D9E807C1, SE1CA8BAFC-BB49-4F1E-82DB-AC6772688441, SE422815E0-AE0F-42E0-914A-0C4514345E29, SE6B38AD38-57F2-4BBD-B3AC-FC8CD254EC62, SE235BB1CB-1D5F-4F21-BB7D-98D711F37673, SE2235800F-7757-47EA-AE7C-A41AC7753C88, SE16837EAD-2E28-4795-A8A3-2C07CA191E5A, SE5970DC14-34EF-4422-A11F-18DB86AC2D89, SE0A5F32EA-5EC2-43A5-A8AB-C5D596582BB8, SE0A612053-1970-4EFE-ABBF-191BABF5DEB6, SE45AB3217-EC69-43BF-9F6E-5817630E34AF, SE13697EA6-C769-4C1C-A0D1-0D27F2903428, SE6AC19A73-910E-4109-A0BD-3A154DEDD606, SE2D8F04B6-D733-4B1B-8E11-BAECA2B3241C, SE441690A4-110A-40D1-9179-8033B9319D43, SE64B0A44C-E6B3-4A07-ACE8-78D6A0109E53, SE2E4CB201-38F5-48CB-BCF3-385FCAC6FDA1, SE00776819-5D5D-49A2-BC5E-38B23E32AA97, SE305600F5-CAEA-46AF-80FF-A3E505684DE4, SE5B4ADA58-D6BD-4491-A8FB-DF910C988C19, SE185149D0-3D19-471B-8CAE-23E8BE6943B5, SE0AECA684-8CEA-4354-9303-DA90C1921699, SE00DB5C27-011E-4E9C-8534-CBFF14FC207C, SE11FC64B9-3467-426E-8E4F-FA4F37539B96, SE12D26F89-F9AB-4A9B-8838-D9E43D375E18, SE65E5B59B-D89F-4775-8AC7-D36AD908B1EE, SE2436AAD4-4EB2-40D9-97E5-597F17ADB843, SE9A094173-495C-4319-8EDA-807425FF1E51, SE9C02BA91-2CB7-45FC-B3F8-68A99C56EDF2, SE7203DB0C-1376-4745-BBA4-D7D5AD0A72CB, SE313B0876-D806-4D2E-9A9F-EE1BE3601A35, SE42AF2033-D2D3-4A74-B78E-5F1AC8CE406E, SE4B4806ED-57D3-44FC-8F03-00904E0254F7, SE5455B097-5CDC-429A-ACB2-0D38BF33BAC3, SE760C94E5-30E2-4564-BA69-3FAF60951DB5, SE43F84E91-F4C2-4454-A59F-1C7CAAEF1D2E, SE50ADECA4-050C-44B5-B028-4955072330AA, SE4806A757-FEAA-429E-A0D9-A5B8B90EF681, SE40E0DD74-B31E-462F-848E-00F2983DD3A4, SE07D744B6-0A7D-4466-9510-0387DE164D69, SE0D92A09A-D690-42DB-8022-5ED8D05309B4, SE8F408BDE-C7D4-40AC-B870-E535F870EE35, SE2F955046-3BF5-4FA9-A037-CF79214398AF, SE267B5E7A-5436-4528-878E-9E154DC34DF5, SE3B6CFDDB-9177-4FB5-B577-DC005AF155BB, SE3C8E9519-762C-4E7F-A25B-41E2CCA66905, SE4ACDFC66-96D9-481E-9E29-B0855186FE4D, SE51C31013-0707-4ADF-850D-4879CDF50150, SE9C0AF723-B39F-4C0E-ACD6-E7AEE26F8195, SE9B42D9E4-0355-4F97-94AE-A688F7940156, SE64634455-3CE5-4F10-A547-EBD902983304, SE7487D0DF-1B88-4824-A511-1C6EC25AF9EF, SE6CA25C51-26B0-42E2-A7E0-607A1BE257FD, SE6D28B7AE-092B-468C-B487-97F0DE05FDEF, SE8793498F-F24E-402E-A9DB-A65BB103F009, SE87DA8B70-66E8-477A-9E85-DCAC326D4219, SEA4D209FA-1529-433B-981C-4CF8ABC76BE3, SE1DA138CD-6843-406D-920A-30468C373FA0, SE49BFB954-CFB9-4294-92F9-85D410335E6E, SE530FFA76-376F-4603-88A6-021338FA6FE0, SE69A3C20F-B99C-4F34-9F15-9726D91CFA8E, SE58B2F919-6486-4EA1-B152-2CC9814EB346, SE15FFB133-772C-437A-BCC9-F3A051CD5EDC, SE6ED5F8DF-3C76-420A-894B-6E5B02E36AEC, SE5BAA6D22-87AA-4B72-9191-2ACBEFAE6833, SE7108C29A-540D-4CA5-BAF2-F88873E96550, SE88BC54FA-C1F8-43EA-916F-17369EBBA826, SE91E2A9EF-21B2-4139-9F57-DD4132A0C935, SE7C668CB1-CA70-4BF9-AEF3-782AF0916234, SE8455711D-7E54-4011-93B0-6368B6D32AD9, SE37E49357-78FF-469E-A1F8- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | E31B49CCAEFE, SE37FDE259-84BD-435E-BE2E-869736F39C76, SE56B37D6B-D5CF-4C2C-B16B-154ED480E8C4, SE7D67B6CD-BADA-47BD-807F-16AAAA53EF1D, SE69E97BEB-8289-4FB9-88BA-6F176A707778, SE4BA63F88-547A-4FEC-8F51-366318243B33, SE7613AC0E-7DA0-4E41-9A14-50DBDD41A397, SE1B223C3D-993A-484B-8044-798F3500B304, SE10FCAB23-9A54-4025-8576-90F2827644B8, SE2302B366-7612-46FD-9299-E3E97BD59AE2, SEB103D3FD-5F36-40DE-98B1-B44249F6938E, SE6D50B891-B509-47F3-8E79-57F9D6A4A720, SE42F6DBA3-270B-499E-9DA9-616A1823AD39, SE543BA5A8-C681-45BE-933B-3878BBE69455, SE6C2FFA97-99B7-4DF4-84D5-472B5F3893D5, SE4EC43484-C673-4506-B40C-225837751856, SE8290CAF2-DAE1-4984-8F16-B1E6AC754F4C, SE9C1562A4-3DC4-468E-8AEC-243BDF1F89D1, SE822F6487-D33F-4696-B3FE-33190A494103, SEBB07FC8A-3AF1-45A3-B216-9CBE1C7D902E, SE3E3C779B-1642-4EC4-9E6C-8DE8D69ECB9C, SE47C9F3D2-DDC0-45FC-917D-339A43208E1E, SE8839F993-134A-477A-A70F-7531851D1415, SE9E1E3E60-599A-4163-AC9B-AD6D53A7F25D, SE56FD9ECC-17D5-4797-8C11-51B80AE20DC7, SE7294F0FE-37BE-41B3-B5AB-5222F98B2457, SE95D9227B-CAF2-4AC9-A691-B361D7964C73, SEA7A9A5D0-867F-454E-A61C-9B7FEF398A9E, SE93A012E3-B7C8-429F-BEF8-551A55213928, SE8226CA92-CA83-4331-94CF-4C7AF4DDAEAA, SE51ECB43B-AF42-4C5B-A47F-C852603981F2, SE40A69E58-20FF-4823-B5CB-47F62289B7E2, SE41073D5A-5AB8-4F0C-B75E-FC59BE104055, SE27415F1C-0ACB-4686-A49D-3D5D2ADA141A, SE6B210E53-4CEF-45AD-9A49-24D5804A4139, SEA857C7F8-4CA0-4715-8ECE-B534EFD447B9, SE3B265D44-BE5B-4F7D-A4FC-0CCD1F218636, SE6481799F-24D8-41AA-9BE8-F0022E74F221, SEB1106DC3-F1CC-4AFB-B9A6-4F601C0CF45E, SE61454886-80C2-403C-9EC5-7E35AC983843, SEDE77B229-3ACF-4472-8702-1FB3B25208A8, SEAAF486EB-F745-4043-A921-510F30A60433, SEAB83A1C0-39B0-4F89-AA10-07932063033A, SEB68D8C80-8117-4410-A02A-3055B752AE2E, SE97B08B3C-E9ED-43F9-A2B2-F3AEAF83C6A3, SEA9530BF5-6034-4FB5-81D3-60FBDE545B7F, SEDD6B589C-A7A5-4E88-B32C-39DEF2AA5A40, SEBCC6ED11-1E8A-49A9-9E3C-7B7CDD358E4F, SEC82E3242-B1B0-40A5-8C42-61AF3D1BFFC8, SED30F3A3E-3F28-4C24-83BC-A18AF5748B0D, SE7BDADC6A-E638-4873-8202-D7AD561C3DC6, SE8F036A26-D497-46D4-AD7A-0815F360D97C, SE9ADFEA9A-CFFA-468C-9174-DD5A9CEB0EE2, SE5FA07AAA-637A-4B0E-9C1E-BF2250A8AF19, SE5D67F35F-0AA7-4662-BFEC-3D412C699F93, SE63F8DFFA-1E91-45C2-9A71-3CF5BECC02C2, SE4F6FCA13-7B03-4730-BCB1-F1FB2EC687D4, SE6E8F9E88-305E-4E8A-9228-E0D1A0F48399, SE8A2EB1F4-FDED-4A70-A0F2-8AAB6C334981, SE9E20BB73-BCB7-4D9B-8ABE-CFEA122CA49A, SEE05B8E84-B3CD-482A-A74C-64941939106D, SEE1B0EA66-8055-4E07-A541-C07E65E7BAAF, SED62C57CB-767C-4760-97FD-37BFC6B1EE29, SEADD8F087-B080-452D-9B19-646230D085B1, SED20E4049-339A-411F-917E-A677F50DD506, SE6115F404-10CF-4FAE-8EAE-7E8CB4B7AD92, SEB59EE505-3DCF-406D-937C-F3D45BF8A3E5, SEC7B7488F-67DC-49D5-9314-578F5989C323, SEE8726B19-7510-4753-B7C5-CB3BF4BD8037, SEA8DBA9E2-56D5-4739-BDF0-4BB5AC85DEAF, SEC788F3D0-84E3-4D4F-B068-422771445DBB, SEDE2EC7BE-458A-4E75-81F0-191B092A031F, SED57FDEB0-7BDE-41E2-BA63-60DEB713BA82, SECBE16830-34AB-4D0D-BF65-1167D4A1E8FE, SEE227348A-838E-41F2-B797-ABCFE7EF298A, SEE2EFD753-4F25-4D9A-ADC3-17FBC84974FF, SEE34DD154-EAD1-4CA5-AED7- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | A52F57859AFC, SEC75D7AAC-7479-4B84-A8CA-B78011C1E13C, SE6098EEE7-7F0C-4D1D-9791-3B0AB84CB9AB, SEDDFB3619-C43C-4A8C-B0B0-2AF648F19BA8, SECB8F9108-074B-4645-AFE3-A02CD99440F4, SE535BF32C-1567-4742-B8BC-D260ABF7C9AC, SE6D3C9250-3044-44B3-9720-5E4FC2BF6060, SE7B442EF6-5B73-43BE-9337-5D06B19945FA, SE83F135E5-6A0F-477B-A70B-20ED9A0E5636, SE3F45461E-D788-4007-8FE4-1687F0EC47C1, SE3F5ED431-197D-44C4-9EA5-276CEA23361E, SE3E0CD380-ECB1-4714-A069-F0EEBAFC36B7, SEC0156443-21D0-471A-9C90-E0F2D2E9DFDB, SEE1C723C7-F294-4E11-95CE-E688692233F5, SE4BB378FA-9A0D-40BE-B07A-52B81B38B726, SE2D9CF8E3-2F6F-40B4-8905-BE08FCF04BDD, SE38AFA132-1243-42E8-A137-723274A2CD86, SE4197F2B2-3564-4AD9-A566-01F6BA24497C, SE95287216-F12F-4D53-81E6-D7623AD09393, SE7C2D98D9-F5C6-4532-A3AF-3D9EA43F55AD, SE7C5062BC-C68D-4D68-A9FC-A052416C2A53, SEB0F8789F-4EDA-48BD-BBE1-CC1B8921228A, SE29A2E1D7-2076-45F5-BD6C-FB9F91DC3C57, SE367E330A-E8A1-4FD7-8CDD-86BD37A0ABE5, SE68A62ADE-C375-420A-A4EF-9A5584F4A278, SE4AC1A747-7140-47EB-8B2D-BC2AF1ED47E7, SEC623B63A-7C32-4C57-9393-B04E3A684358, SEDC6FFE62-0D89-4845-9E9E-BDA081053026, SE6C1F3836-E3A4-4A96-90E3-34404F911794, SE9AE67896-F024-483C-88DB-218F31556F69, SE5724765A-D3C1-4DEB-9029-D0B2ED21FE0A, SEE8AA5382-0341-478F-BA1C-CE9197B31862, SE8BFB5945-C444-4C0A-9BE6-884214351F9B, SE8BD5AAB2-DCF2-44C8-9E82-024D58FA429A, SE946EA167-BCA4-48D2-B042-698A870FA7B4, SE3717F29D-E645-4BCC-A534-DC03226F592A, SEE991E649-8E0F-4F7E-94F2-52542D3F5EA3, SEA204F7CD-00C7-4698-B453-745A64ADD70C, SEA35DBDBF-2FA8-41AB-9EFC-9570C17DCF35, SE9716FAFA-AC86-472C-AB8C-B72197500F9F, SE8A8931A2-38F1-4082-AA82-979DFD2B6C97, SE93A482FD-6218-46B4-BC7E-0007B262803B, SEA4E6EF7F-8F2E-4969-AC67-05032B616D44, SE9F84458E-13DD-431A-B51A-C1487986242F, SEA6ADC4F5-4C84-40A3-8260-1AAC5345CDBA, SED1EAA10D-45F9-4503-9D94-4A9AFDA8DE39, SE946EE526-2A57-4765-9E75-6B00A8E5EEC2, SE8CFA94E6-9CDE-40C6-8980-BCF3721B0E1C, SEA2EB1E4C-79B6-43A8-A87A-22A2BDD0DFBB, SEDF08FD28-D471-4A67-B4AE-34C3F7478C96, SEE1E1C844-7762-4695-A91D-59271A15BC30, SEE8C215E6-55E6-4D7E-9F23-B00B205F4234, SEC6B69408-FC80-4FC0-8733-72ACECFBC995, SED1CE851A-1B22-4A9B-BA8E-74DFCDB6F94E, SEDC9EE019-F7F4-4A50-84BE-84AF7962502D, SECC608ECD-716A-4967-917B-2E00A522DD44, SEBA39AB07-F5F9-4DE4-A79A-9B8BD7102B44, SED578077B-0405-4953-9E17-E7C52CDC5B98, SEDDB02711-F69E-49F4-B27E-0E79788F21FE, SEE07C437A-B9A1-4A66-9319-00B6779B67B5, SEB69E10F8-0672-4047-9B68-62EBC54BCD5C, SED7D4885E-0075-4080-AC7D-58B9936042DB, SE03CC75CC-1344-48F8-B8AE-B80C3F654FE5, SE0EF7A48A-6C8B-4CA5-B9ED-D4A286C263C2, SE04C56951-7435-41E5-8541-E48EB4C9A2A8, SE1B375CC7-EA66-40FC-909E-37B7978BF664, SE1E06BDB8-2618-45E6-8F2B-3AC1CEC65ACE, SE112DAA24-C175-4DFE-A509-2B6E1A19A23A, SE11DE26EB-2CCD-4163-82E9-167FA5839512, SE0FE6B45D-2AD4-4005-819D-602F18DF998D, SE221B7D8F-28C8-4200-B836-FB60556EC4B3, SE44FB6D88-E3B5-4E36-9714-58FDE4021857, SE13973294-5C44-46BC-AEC2-F6E753A3545F, SE16B5A4BE-BB08-4E2F-A8EE-7948B3F45E34, SE2F9AE930-10AA-4E68-8808-E557C76007FC, SE486B4298-E3E4-490C-A3F4-B9BF6EE06FAE, SE67DEE09C-1E9F-42F3-B051- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | 8C40975A4986, SE68F2F7B8-64C8-4BD9-8056-C8A6F48BB705, SE3518A96D-68F6-4A4F-8C78-D4A6E9B6813F, SE40A687E6-EEB5-4673-B53F-CA62B95BD6E9, SE35AF21F1-6F30-4721-9CEC-915D7C6A1CEE, SE2C273790-85DB-4B50-83BC-9A4AE0C47C85, SE54DBC9C8-B929-4149-9DFD-CA8AC01FE816, SE2CE046ED-8B78-4EB2-BB71-14983227CD6F, SE7A069665-6F47-4E2C-A49F-5370ABA5FC74, SE5ED23ACF-745C-4922-AF76-B4D1C4E13676, SE84E4FD2D-3BAF-4573-B676-8F0D2EF69265, SE6DBA02B2-A2F6-4F5C-9937-47A16F1F52B3, SE56E87951-06A3-4EAC-9EF4-F8CFE686ED6A, SE7F49DA31-BF6A-4F9A-81C1-DD0DFDE86766, SE8A8ED9A9-8245-44B4-B4DE-DB4B195A92B1, SEA029634A-CC53-4099-9260-41F90FC150D6, SEA297145C-CAAD-425C-8685-63920BDAC4AC, SEA8580E73-544B-4F58-9052-99412F6B2406, SEDD159A8F-FB49-42C1-8FB2-7E4A9AD24ABE, SEA72318E4-E32A-4057-94F4-C07C84AB048D, SECA24EDEE-005B-4093-ACB4-4667F992ACDC, SEBF32225F-243A-4270-B1D2-5F3B8DEEC9CF, SEABCF408E-2D41-4B02-9AFB-D05F08038BEB, SEDE6E1245-0FC7-45C2-A6BF-71FF8BFE4810, SEAC60AFB9-1679-41D1-8105-97F4BC19AE80, SEE27C5B5F-891F-4961-AC9D-8E97029C9D5F, SEC2385F36-BC96-4506-8648-165B1A1F3AC1, SECCCFA512-037F-47D7-A2C9-BE112C874495, SECD2796FE-5AE4-4CF6-AF17-D65A1D043F42, SEBE9DF8D2-8C1E-4011-9BC8-6E331160962F, SEEA1474A5-BD8D-4547-8232-52227B462B96, SEE2B8C49E-1079-49AA-A007-028C398EA51F, SEE3128FC1-6A44-41A1-899C-B91184D26BDD, SEDABE2E79-A994-44D8-A5FC-09C798A2F2B7, SEE5CADF0A-6E3E-4BF9-B2DD-DDF9FCDB3D1F, SEAC10B7E7-50CF-434F-8533-77AE4A22AE16, SECBD33FE3-C2DA-46EC-8940-4644DE324405, SEE19DEC9A-9C11-40CD-986D-925DC10C4403, SECEA66178-C402-4BD2-8C16-514B6E64FED0, SEF2E56E46-6A07-487A-8BD7-6230BF5DD447, SEDA6F756B-1B93-4FB3-AF97-3AA5BF782208, SECFB0772C-FC6D-4B11-B655-29E6D5550C56, SEF45E9E52-791F-4B4E-BA23-F8B8E7317B19, SEF31FA15D-C115-4D8C-958F-D6308F758B15, SEC435DC99-31DD-49A8-8333-F4988C53405D, SEFDEBF727-6A5F-45E2-A808-12955DD6EE10, SEDBE68096-D811-4039-AC8A-A910A166551A, SEC03E2DCD-4F8F-42A8-B918-32F02A1EA7D1, SEC3CF4ACF-8570-4E6B-9B92-FCA08EB4943E, SEB8CB8F00-2303-4005-ACCF-93834AD8F704, SEC38C9C04-C08C-4434-8572-07EDED8228BA, SEF5B41C30-6ADC-43D5-8374-B35652F339C1, SEF5DE007F-EBDD-4C12-8849-21CA3D3E12DF, SEDBB507CD-8283-494C-9D50-74429946016E, SEFE81EAE5-E57B-4A33-AFA0-1D1F2680552C, SEF5BA4168-EA87-4E71-B602-265C65035DE4, SEFFC613C1-48FD-45D3-A1BE-A42880B026C5, SEB9E26432-B0A6-4064-9ADE-15CFA77B6283, SECDC185D2-F8A1-4C55-88F2-6BB47705178E, SEF4AE593A-6FF3-4824-9FAC-3C9FD5909B32, SEB8F1CFB8-6D9C-4D62-88E2-DF9E631545E0, SEF6115856-2565-4755-B9C1-AD2DCF3FE846, SEF70A3005-9DA3-434B-A70E-0305EA256106, SEFBDB0AEB-A7BF-4837-8BC2-9B9695A6F158, SEFD334953-2AEF-4FA8-9B7F-BC692339D0DE, SEF83DAC5D-5E49-4D7A-97B2-AD26F0951D7C, SEFA18AECE-C611-42A2-9D8E-C996E8842732, SEFB51B0A2-B380-476A-96B4-49BD0F0C47E4, SECDE33401-9F25-43C8-8284-A238C1C1005F, SEC3C1394F-25C9-40DA-8E71-081198B47775, SEF0D0A71C-4925-4BEC-89D2-41BC112AF3EC, SEF5BE168D-4FC1-4318-8410-968A298FE87B, SEE2FEB7A1-973A-4444-B98D-9DDCDF27FEB6, SEADB0E787-A3D4-442A-BAAB-77C4D9C310AE, SEFB52D061-66A4-483A-9FBA-33E6FB577F2D, SEFB9CEFF9-4D88-417D-A115-D9D6F302F91C, SEFC73A0DC-95BF-4EBF-AC4E- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | 6095ED6EDD72, SEF41A7158-8EC6-4201-B5C9-3E5F8541198B, SEF4BB2739-5E5D-44ED-AC68-9F8347A0C767, SEFCB47516-F1E7-4909-9BBF-08DF01D74F04, SEFD5E745D-3111-41D0-A534-BD709AB425EE, SEC48FEA9A-80A2-4598-9347-E0C6F12F6D76, SEFF5D2732-5DBC-4DED-8793-AAE3301566A9, SEF229A7F9-91AA-4134-B934-41F990BAD4B7, SEFF3E628C-1B6B-4724-8031-3C951DA6A85F, SEF18FCBD0-58B4-481F-B1C2-CD6175A2342D, SEF466FD53-95BF-4D91-B1E0-59E112BC48D4, SED092E22A-D6BD-4034-8D41-9096F5501E93, SEF5666272-0A94-4752-88B6-AB4FEB21F33A, SEF961F5B0-BA26-421F-BC9C-4BBC49E12230, SEFA3036BC-8289-47D3-B83C-D4334F4B47BC, SEA3524355-8936-4A87-86FB-F94708C06C43, SED0C803EE-6E7F-4184-BFFB-BCD16844E034, SE085EB585-5EAA-4FBD-8642-E5496FEF2410, SE8717D4C1-46E0-4A7B-9F9B-1B89875A4274, SEB2ACC251-4F67-49E0-A42B-6FCE27EDC91C, SEBAC23882-516D-4BF3-B9AA-DBFBBF64458C, SE9BB846DF-52E0-46F7-96C9-1E06A22F6E67, SEC78B9F68-9C81-46FD-891E-4F24E72B142D, SE1F2DA749-8B65-49C6-85EF-8B552B8134A7, SEBEC84670-195F-4456-961A-B634B214D12D, SEBFA19434-D546-4E78-AF7F-CE6A16D686B9, SE945F61AB-7463-41BE-9B47-9203E79CC3AE, SE2E87322D-4687-4324-BBC4-B289F246F522, SE55D15D36-1D5D-4E86-A356-92521D68F7EC, SE8917F37B-8673-469E-AD82-CB5295F2108E, SEEEDEA328-26AE-44BC-8187-6C2552946A1E, SE4DA2D8FD-D5BE-4809-B5DD-8B0858D2EFA2, SE4D9DC49A-9CB0-44AA-9FCF-A104F396EF79, SEFD79A35E-99F6-4D3A-9269-80539E4A1077, SE903A6B81-1A1F-4009-A7E5-2D36EBF0D209, SEC6F2DEB4-D752-471D-9A4D-D398AE1BDBD2, SEC0B30851-9774-41E5-994F-9E40C86E135C, SEB70FC8D2-39BF-4030-851A-571A24B88D74, SEB43CB871-0B59-4D4E-93DA-90DAC89F2A3E, SE7F89E2E2-4E86-44A3-9D55-FE32BDC33184, SEDCB2D6A5-BEA4-4432-B88C-64D72AFEA24A, SEC8583BFD-CF18-4CB4-92EE-3CFFF291B0C5, SE8789C1EC-BECB-42F7-839A-A0EAC4B286CE, SE5057137B-F944-43D1-BE87-BFAA385885AD, SE2B62E698-ADEC-404C-A01E-E40E0B7DA672, SE01E1F097-C4E8-460C-8BE9-48CF7F6C001A, SE300EF99C-EF25-454D-9339-E98D57D41DAA, SE5A3F6D76-CB49-4874-A496-875EC87E1409, SEFF5A660D-1139-4600-B2C5-6BB5B1BA6559, SEC054AA80-3D67-4C64-92F8-9DD374A9D089, SE5AB3EA7B-8E16-46F7-A564-0E2B4FF76D34, SEA6DB9275-E191-4423-BF03-F49F221C57F2, SEE1E2C4BB-2020-4848-9F3F-0ED515BADD1A, SE8E9069C1-38D5-4C85-AFB6-5A8ECC671676, SE3A7523CF-ADA8-455C-8095-B370DC30DFBD, SE80443C35-1C7B-416C-AEF1-BC907DBAD772, SE15DAF483-4DF0-4C96-998F-4F905C6F3CAC, SEF51B4D87-0AD3-43B5-B283-8EFC017ACFA0, SE05F405C7-BB3B-41F8-8453-497756B92BDD, SE2FD276CD-6A6A-48CD-8447-D5853AAF3C5E, SE5741EC57-1D00-4949-BE11-63E9130B31AD, SE9F40D638-CDE8-4B9D-BFA2-42FD18009E82, SEB23C07CF-C31F-4F63-B2DE-3C8AF9B68053, SE374E9A19-00FC-4DD2-A560-20B635F888B5, SE4C4A16DD-D848-4607-833E-8F9BE6CFA12C, SEC02F5732-4D8D-4477-87B0-4420522399BD, SEECA7F73F-51F7-4F09-94DD-2073D7D9C1AF, SED61435C4-553F-4884-9A67-45CB3B765944, SE9D782BEF-5111-4B23-9262-DA573670EBF8, SEB5566F2B-ADE9-40AC-AA3F-5594D3A1DF7D, SEA242C63C-4D96-4862-9EDF-3D5EFC3F6607, SEE7A03746-48EA-487A-822F-C95EFDB35425, SE3B80A4A9-1AC8-45F4-AA99-3512F2856BF9, SE3FB32706-075C-4216-AB9E-291707D34A60, SE0410FF30-D852-4EEB-99A2-31BCC522ED04, SE5B9C54CA-34AD-45C7-BC19-EF554CBBC794, SE854B89EF-DCCB-4B0B-B00B- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | B93C9F062A6D, SECC7C85A3-5E67-44C6-A64C-D297C110CC09, SEF79066B1-EF4C-42B0-8026-0A1966AC3CD4, SEF73D09A8-2364-4915-80E1-511FD1A4986F, SEE8E15509-9383-490F-BC58-43ABE19C17F3, SE3FE3D8D7-E0C1-4E12-9E6D-3D0E91302C49, SE9DE94695-08ED-4BC4-B774-5330F6D27EB0, SEBF5779A6-B402-4202-8C07-B93C30E82F54, SEF9F923F6-0270-4536-9A33-8E9674406D0E, SE07AD2A09-51A2-40D7-9D79-988098D05FB2, SE6C51298E-5C03-4C23-85E2-79161D5FA4CA, SE0847519A-1ED5-4838-A8BF-5469658B9800, SE01F8D2CA-A9D9-4815-B8B8-D9E7645E9B37, SE04403C1C-A9AC-42AF-9757-C46F60DA6F42, SEE836C576-3051-41DE-91C0-2CFB6E24A7A2, SE13F5A309-7DEC-4D77-AD33-4BD84A85D458, SE0A02C6B0-4ACF-42F2-884E-5E818159277A, SE32582F37-5B1C-4BA5-9CC0-C5171BA1CEEF, SE7732C42A-0B22-408F-AAA6-6C052EE0914E, SE26EAB5BE-BEB7-4944-8835-D2A5FE5B4DE7, SE7A1E773E-9E72-426D-9280-9CA6C598B44C, SEDD32C380-1E82-42FC-B0C2-6D1D9167641B, SEFBC7943E-1C33-4ED1-9943-1C13DEAC2CC6, SE6DFA09A0-0AFF-4801-9D7B-D6CB68F1B15B, SE773815D7-B674-45FA-9644-7C01AEE92C51, SE95227651-2645-4BFA-83F5-70C61C16AE6C, SED94A1641-80C0-40B4-AD10-35E8B00E0447, SE5F651064-97A2-4344-9C80-08B9EE0B1BA1, SE6A023BCF-431D-4F7D-B794-04F09C1DB296, SE2876837C-655B-4A6F-9EBF-BC69D00E914B, SE1D43FAAC-E31F-4D4F-B611-B86036D4358E, SE1416720D-A8FF-42D6-BA9D-EFC62EB45AFC, SECE3D31BE-87AC-4222-8267-02B7B2488EE7, SEC2D96626-C036-4DF8-BCBF-D6BAF65628B5, SEF4CB246A-31C4-40E8-B960-C073226DC59B, SEF0DFB6C1-38BD-401E-A930-A42716C88838, SE82054378-07B8-46FB-9B47-0E4CD07CA538, SE5CA46A28-2E6C-4C9A-86BB-385F59206710, SE68C9999D-4146-4E39-A404-121677D9970E, SE34CD467A-7A87-4135-BE02-E1697ADD498A, SE660846A5-B1E5-477B-AB14-7F6FFE7B5FD2, SEF8C1FB24-2737-4B68-83A0-DE9E89BF2940, SE4EF9EE9D-0D66-4E60-8035-657D7AF73F63, SEDA60A8F6-45E6-43C0-8EF2-EF7946AA249F, SE1AD7E126-85A5-4589-9741-06029A945002, SEEE96FDA5-A99E-439B-BA42-E361D5617197, SEC48C863A-93D8-4718-8BC2-C8F72E789C51, SED0022819-DBCD-4222-85F2-482C80A21016, SEF6EE3D3E-8D68-48DB-9141-FB9D8D7E23C6, SEC3591FDF-73FF-46D7-8E81-40231CC1CFD4, SEF6E8E519-4EBD-4F26-84C1-957955B5B2DF, SEEFB07275-05B9-4353-8131-B7835808C554, SEA12F45C1-FBDB-491E-9672-ECBFC28EC492, SE17B21C3E-78A2-4E2D-B7C2-96632D4ACA55, SE945AC6A4-1FF9-4488-A5DF-3910E764A143, SE462AAA91-6C09-4122-9CC7-53973476438E, SE114C717C-892C-45AF-A8E4-62D8742898A4, SEAECE8174-DD3F-4325-8163-17E5AEF8B61D, SEB6990AE0-65C7-48C9-A4E0-B12894AF9793, SE7D14C690-F2F5-43FF-A2C1-FA4AD9CA4CE1, SEAB535896-CE5B-4B12-8DCC-286DC0976BD1, SE5329474A-F619-4B4F-A649-03B4ECD5FAD1, SEF211D41A-B798-4DF7-A4AF-A339AE3F1F66, SEFA771D54-F7DF-4829-9F83-E5EACAB5349F, SE925ABD29-742A-4777-A88A-93A2750D9FB1, SEAB4A34AA-0704-4886-964B-613E9BBB10FE, SE3F684FEA-536F-4C29-8EA4-9771DB9BDCEC, SEAF3A0D41-BE9E-4A05-988C-576B39676933, SE4BF5634A-DBCF-4AC7-96A8-472C56B2565A, SE104965C1-B341-404E-92DB-9C6B81CE8713, SE7F3B5963-8B39-473F-8C99-F98D4B40107E, SECED0BF5A-A358-431B-A281-1F466A1A7938, SEE07B333D-B3A8-4AEB-9D1A-A0838F9761FF, SEB11F2BC8-9AEB-4703-A578-ABC7DA1994BE, SE3537B57E-B614-4E37-8728-4E58D6F3B3E4, SE939044B6-A818-4789-8205-067D9C60FBB3, SED48A1E20-DD7A-4916-B8A3- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | CF1C30049065, SEBFAB3DF1-76EF-4F2D-9587-9F7233558671, SE59EC914A-E7B9-4B7D-A892-4DB54C8BF2A7, SEE1910460-7DE8-4791-84B9-C45FA48581C1, SEE4DA5536-5A47-46F6-AD01-85E01F12C3A8, SE3675B0AB-E9BC-4EF3-9419-5BF927CAB31B, SEE9107678-B8BE-4174-A9A7-91284829B2F7, SEAEE4F93A-FB86-43FD-9B6A-F4975AF84920, SED6E14FAA-7A6C-44BC-9270-9858FF8544D7, SEF2459468-B506-495F-B656-E396C05AD5E9, SE9EE875A5-9ED2-45C9-8FE6-25A7698F3A72, SE6ED91508-D003-44CE-9361-C347FA91E721, SE3EDD4353-F03D-4831-8C2A-77B7601916DD, SEB37F8862-9D4E-4D4F-A276-4D307B38B6D5, SEF5C2065A-4E92-4444-BEE7-48152F81A239, SE4EE82414-74EE-403E-AAAD-07CF21E102F2, SE552500-124461, SE554500-125001, SED794B2ED-2E10-4E5E-A52A-36DB07BB1CD4, SE88888921-8B52-4F0C-9ED3-47A5912C79CD, SE1B2F30B0-9EA8-4B53-B5E9-CCC9C32D28AC, SE0E304261-C589-48E3-B1B4-93780D46103E, SEBB41A73E-4663-4220-B9D7-9EA5F1A09CE3, SE4DA2DA35-DB1A-4093-AC1F-1F8827BBCF96, SED48EA79E-7F33-4A60-ABBF-E249B5EF1175, SEFAE85DC2-A7BC-4B47-82CB-E541C274B791, SEBE17EBA2-D10E-4E99-A14D-8711482AAE4D, SE653840-247900, SE7E9E088C-C829-46F2-B6E4-F58204D282E8, SEA2613CBE-FAB4-4728-9E9B-B00C2C0F4DCA, SE1A80B8DB-5504-449B-AAB4-7BDF72344300, SE98A2626C-FDD9-4015-8DC4-8A365BE77E74, SEBD184378-6B22-4499-A321-2D81FFC9A67C, SE1F619F18-3461-4897-AA04-AC9BF660C0B7, SEC1EA5796-7ECD-4031-9D32-12DA602401FC, SE899CE441-7A43-44A8-BC9D-E1E233E1FA7D, SEBF27F653-F793-4C81-8614-D4200A1CDF96, SE86B95435-3687-4E28-B2E6-ED7211673FDC, SE8E95412C-4CB9-495A-8AE7-B4A16F4BCD28, SE02B291E9-43F3-4A86-9A1B-105D748E8863, SE7413CC39-E1C2-4AC7-BD79-D8D215120B99, SE2E5427F8-AC25-483C-8973-C16AB0A5F58D, SEE6FCC41E-BACE-45D8-9B2C-B7BC70D7ABA1, SE654130-249500, SEFBC49BC0-F986-4FBF-BAD6-92219AD45F62, SE34161E8A-117D-4986-B9C6-07497B21BC00, SED078BB81-CE02-42C5-B34E-28887670CC84, SE61022BFF-CBAA-47CF-9EE3-8D2BD7CB64B1, SE74B63E7B-8A21-4196-90E9-199B6C40651F, SEFBF543C0-E4A2-4405-A2EB-41645472CA42, SE453AE5B5-473C-4132-A8DA-C87148DD35A2, SE0D383F2D-7164-4C7F-B964-083BC6D7CB2B, SEBAC49A13-3517-45E1-BE70-BAA05BFE59DD, SEA4EFCE9D-5B3B-484D-99C7-9644DA92BFDE, SE645000-213500, SEF5442341-77A3-4ACC-8F4F-456FA9F4473D, SE653415-221340, SEA6409D7E-616D-414F-81BA-363DE6631B38, SE0168E4B1-FB77-40D8-91D6-8F0E1E79E936, SE0101010301-C, SE765EE34E-940B-4767-8618-5A0BA1363F05, SE7B6BF65D-5A7A-4557-BB37-DE696DBEB3A5, SEDC771381-2368-40C7-A9A2-64AF6CA5E91A, SE764C79A4-A2C3-4802-9381-F18A1E41B79F, SE4C1AD9BE-350A-4D9A-9A85-B456AED99173, SE3312C95A-AEDB-404E-9723-573F8C90F526, SEE3D30015-4728-4AC2-AD48-93EFC0F5719B, SE7B43F7FA-D06C-46B7-AD89-C6E7BD022196, SE218F0D6B-479E-4CB4-8672-F7BD9EB8A83D, SE5AC5BA37-9390-4020-B4C8-8C7B46DF47F0, SE645500-212000, SE35945E11-F397-4D82-A16E-E67CA3FE56E5, SE8A3CD363-E787-468F-8EAF-BA8ECF2F1506, SEBBB1E744-FD94-480A-9D6C-B8CB0EA44569, SE654416-230000, SE654560-246250, SE555545-124332, SE574050-114780, SEFD128009-20D5-40DF-8AC6-7720EFB974E5, SE1BD8DF74-4633-4086-B6D5-3DFB8FE45CD5, SED4DF6B2E-8030-45DB-B250-DDD35560DC18, SE34F48155-A27A-4F60-90DC-22939759D215, SE8786C83C-1A53-4E81-8836-7E211B46D9A2, SE98091C5E-1D9A-4DE4-B45A-9CEED1B7DAF1, SE87F5D293-D4E5-44C3-8CEE-B5438AD05323, SE3F2D4182-FF4E-49DF-B0CF-1C36A7685305, SED1797F5B-A5DB-4824-909E-1F92D87E22D4, SEBF95DE97-9DCE-4CA7-8BD8- | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | 3630F59036D0, SE652400-223501, SE82119F2A-5027-4A07-9836-36BA0669D79A, SE4EB4DD39-F273-4550-84B0-A45A25C22870, SEF3ADA022-6412-4944-8F3E-8608BD093A3B, SE368715D3-1461-4D3C-B7E4-E7AC41A6D57D, SECB2F056F-83C9-418E-8690-EE58294A47A8, SEEED375AB-C5F6-4D2C-96EA-B9F8E76DA7F9, SEF49938DE-1EE0-4563-A7A2-78BD70D805DA, SEC9B60F14-6BEB-43C7-96D9-7A1525104DD8, SE786FB90C-73AA-4CE0-9756-CE8062A98E23, SE2D43339D-B338-4742-9926-985257D0D916, SE9FC7D716-089F-4E29-9FC4-DD42AD1C2A57, SEE3D5F335-3BF1-4183-AAB5-176AA16254D7, SE652020-211930, SE67A3620F-7E55-4D48-9A82-E924510BCA3D, SE96AEB7A4-B97E-4B7A-8AC0-2CA9E50C9983, SE654640-233190, SE562290-124131, SE91A45811-D3D9-48C9-BE86-F83E5A9E120B, SE71FA9465-64B9-4483-B413-4C7541732E53, SE9A12B019-6D94-4D2B-87DA-F8280B2B7F8C, SE5AC931E3-98E2-4A38-836C-0481444029A6, SED7068507-B53D-49A1-B48B-15865D677CB2, SEB341E452-8D67-462E-BF89-2A0CB598CDC0, SE3BB54846-AD72-40C3-9957-C13064F418FC, SE8822ADF4-C1D5-473B-9C38-C616EA1DF9D0, SEE949AC0C-A9D0-4750-984F-0289C60C2E00, SE228FFC6A-2291-4DE6-8D43-F4A90AD76117, SE7DCB2B06-5A3D-4E44-86BE-98137AE4B0B8, SE3371EB42-4C7C-4AE0-B8F4-44EC89202F1C, SE82401A81-F842-4B4B-90E1-AD382957472C, SEB0A6FE15-5EF3-48D8-B688-47511237892D, SE561030-122821, SEE9F86496-DCFA-4BD2-BB68-71E8E348B7F4 | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| QE1-1 - Phytoplankton | Phytoplankton | Pelagic habitats | 0.6 | EQR | UKGB610807680002, UKGB620806110003, UKGB640603690000, UKGB640704540003, UKGB641211630003, UKGB670807410000, UKGBNI6NE060, UKGBNI6NE200, UKSC200002, UKSC200005, UKSC200047, UKSC200071, UKSC200082, UKSC200086, UKSC200106, UKSC200109, UKSC200127, UKSC200162, UKSC200173, UKSC200174, UKSC200180, UKSC200196, UKSC200199, UKSC200202, UKSC200208, UKSC200209, UKSC200215, UKSC200231, UKSC200237, UKSC200238, UKSC200265, UKSC200270, UKSC200282, UKSC200289, UKSC200291, UKSC200296, UKSC200298, UKSC200300, UKSC200353, UKSC200364, UKSC200372, UKSC200386, UKSC200390, UKSC200397, UKSC200411, UKSC200415, UKSC200416, UKSC200423, UKSC200430, UKSC200432, UKSC200434, UKSC200457, UKSC200465, UKSC200478, UKSC200490, UKSC200503, UKSC200505, UKGB611008590003, UKGB620301100000, UKGB620806110001, UKGB640503300000, UKGB641008660000, UKGB641211171000, UKGB641211630002, UKGB650301440000, UKGB681010360000, UKGBNI6NB030, UKSC200017, UKSC200020, UKSC200024, UKSC200038, UKSC200054, UKSC200063, UKSC200067, UKSC200085, UKSC200108, UKSC200112, UKSC200133, UKSC200134, UKSC200141, UKSC200161, UKSC200193, UKSC200200, UKSC200206, UKSC200214, UKSC200230, UKSC200243, UKSC200244, UKSC200263, UKSC200264, UKSC200286, UKSC200288, UKSC200297, UKSC200308, UKSC200338, UKSC200345, UKSC200380, UKSC200391, UKSC200400, UKSC200402, UKSC200404, UKSC200421, UKSC200426, UKSC200449, UKSC200453, UKSC200469, UKSC200482, UKSC200494, UKSC200500, UKSC200502, UKSC200507, UKGB620806570000, UKGB650806250000, UKGB671010400000, UKGBNI6NE050, UKGBNI6NE070, UKGBNI6NE170, UKGBNI6NE180, UKSC200004, UKSC200029, UKSC200030, UKSC200053, UKSC200056, UKSC200077, UKSC200105, UKSC200119, UKSC200120, UKSC200126, UKSC200135, UKSC200148, UKSC200150, UKSC200163, UKSC200168, UKSC200187, UKSC200211, UKSC200216, UKSC200217, UKSC200218, UKSC200229, UKSC200235, UKSC200240, UKSC200247, UKSC200253, UKSC200260, UKSC200267, UKSC200274, UKSC200309, UKSC200311, UKSC200341, UKSC200342, UKSC200356, UKSC200361, UKSC200368, UKSC200374, UKSC200375, UKSC200383, UKSC200389, UKSC200403, UKSC200410, UKSC200412, UKSC200414, UKSC200444, UKSC200460, UKSC200479, UKSC200491, UKSC200496, UKSC200517, UKGB610807680003, UKGB620806560000, UKGB640523160000, UKGB650503190000, UKGB650503200000, UKGB650503520001, UKGBNI6NE160, UKSC200021, UKSC200032, UKSC200039, UKSC200040, UKSC200044, UKSC200051, UKSC200058, UKSC200064, UKSC200083, UKSC200092, UKSC200100, UKSC200101, UKSC200117, UKSC200130, UKSC200136, UKSC200179, UKSC200181, UKSC200190, UKSC200203, UKSC200232, UKSC200276, UKSC200277, UKSC200283, UKSC200292, UKSC200299, UKSC200306, UKSC200336, UKSC200352, UKSC200371, UKSC200377, UKSC200378, UKSC200385, UKSC200396, UKSC200427, UKSC200446, UKSC200458, UKSC200461, UKSC200466, UKSC200470, UKSC200472, UKSC200474, UKSC200504, UKGB611008590002, UKGB640604290000, UKGB640604640000, UKGB641008220000, UKGB641211630001, UKGB650503520003, UKGB650705150000, UKGB650806420000, UKGB680503713700, UKGBNI6NB010, UKGBNI6NW251, UKSC200001, UKSC200016, UKSC200027, UKSC200042, UKSC200050, UKSC200062, UKSC200066, UKSC200069, UKSC200074, UKSC200098, UKSC200111, UKSC200122, UKSC200140, UKSC200155, UKSC200177, UKSC200183, UKSC200188, UKSC200194, UKSC200213, UKSC200224, UKSC200249, UKSC200255, UKSC200269, UKSC200280, UKSC200302, UKSC200346, UKSC200354, UKSC200366, UKSC200379, UKSC200382, UKSC200388, UKSC200408, UKSC200429, UKSC200455, UKSC200456, UKSC200484, UKSC200497, UKSC200508, UKGB610807680001, UKGB610807680004, UKGB640402491000, UKGB640402492000, | United Kingdom | EEA WISE MARINE |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKGB641011650000, UKGBNI6NE080, UKGBNI6NE190, UKSC200011, UKSC200025, UKSC200037, UKSC200041, UKSC200048, UKSC200059, UKSC200061, UKSC200076, UKSC200080, UKSC200084, UKSC200097, UKSC200114, UKSC200132, UKSC200144, UKSC200156, UKSC200164, UKSC200170, UKSC200171, UKSC200185, UKSC200205, UKSC200221, UKSC200226, UKSC200227, UKSC200228, UKSC200234, UKSC200252, UKSC200258, UKSC200273, UKSC200295, UKSC200312, UKSC200318, UKSC200321, UKSC200335, UKSC200350, UKSC200394, UKSC200401, UKSC200405, UKSC200418, UKSC200420, UKSC200447, UKSC200467, UKSC200468, UKSC200481, UKSC200486, UKSC200501, UKSC200518, UKGB611008590001, UKGB621009600000, UKGB640704540001, UKGB640807670000, UKGB650503520002, UKGB650704510000, UKGB680301430000, UKGB680806320000, UKGBNI6NE020, UKGBNI6NE090, UKSC200036, UKSC200087, UKSC200093, UKSC200123, UKSC200124, UKSC200131, UKSC200147, UKSC200153, UKSC200158, UKSC200159, UKSC200167, UKSC200176, UKSC200182, UKSC200191, UKSC200220, UKSC200250, UKSC200256, UKSC200257, UKSC200272, UKSC200278, UKSC200285, UKSC200294, UKSC200305, UKSC200343, UKSC200349, UKSC200357, UKSC200358, UKSC200363, UKSC200369, UKSC200376, UKSC200417, UKSC200424, UKSC200450, UKSC200452, UKSC200463, UKSC200485, UKSC200499, UKSC200509, UKSC200516, UKGB620705550000, UKGB650806230000, UKGB650806330000, UKGB651009030000, UKGB680806460000, UKGBNI6NB020, UKGBNI6NE030, UKGBNI6NE140, UKSC200012, UKSC200019, UKSC200023, UKSC200026, UKSC200034, UKSC200045, UKSC200065, UKSC200088, UKSC200110, UKSC200116, UKSC200146, UKSC200149, UKSC200152, UKSC200184, UKSC200197, UKSC200212, UKSC200219, UKSC200223, UKSC200241, UKSC200246, UKSC200262, UKSC200266, UKSC200275, UKSC200303, UKSC200339, UKSC200340, UKSC200347, UKSC200355, UKSC200360, UKSC200367, UKSC200393, UKSC200399, UKSC200407, UKSC200433, UKSC200459, UKSC200462, UKSC200475, UKSC200476, UKSC200487, UKSC200488, UKSC200493, UKSC200513, UKSC200081, UKSC200175, UKSC200248, UKSC200254, UKSC200261, UKSC200268, UKSC200310, UKSC200506, UKSC200102, UKSC200128, UKSC200204, UKSC200251, UKSC200293, UKSC200313, UKSC200351, UKSC200370, UKSC200395, UKSC200428, UKSC200454, UKSC200052, UKSC200055, UKSC200210, UKSC200160, UKSC200225, UKSC200242, UKSC200287, UKSC200451, UKSC200060, UKSC200145, UKSC200178, UKSC200271, UKSC200413, UKSC200015, UKSC200107, UKSC200195, UKSC200222, UKSC200348, UKSC200431, UKSC200448, UKSC200464, UKSC200483, UKSC200125, UKSC200207, UKSC200290, UKSC200307, UKSC200373, UKSC200392, UKSC200398, UKSC200498, UKGB641008180000, UKSC200078, UKSC200142, UKSC200121, UKSC200166, UKSC200169, UKGBNI6NE010, UKSC200028, UKSC200072, UKSC200075, UKSC200233, UKSC200279, UKSC200384, UKSC200409, UKSC200068, UKSC200118, UKSC200192, UKSC200259, UKSC200304, UKSC200334, UKSC200362, UKSC200406, UKSC200422, UKSC200495, UKSC200031, UKSC200046, UKSC200049, UKSC200091, UKSC200381, UKSC200473, UKSC200096, UKSC200099, UKSC200154, UKSC200239, UKSC200284, UKSC200489, UKGBNI6NE040, UKSC200151, UKSC200172, UKSC200425, UKSC200477, UKSC200480, UKSC200157, UKSC200186, UKSC200189, UKSC200198, UKSC200201, UKSC200281, UKSC200301, UKSC200359, UKSC200365, UKSC200387, UKSC200419, UKSC200035, UKSC200115, UKSC200236, UKSC200245, UKSC200331, UKSC200337, UKSC200344, UKSC200445, UKSC200492, UKGB510804505600, UKGB520503503900, UKGB520503613602, UKGB520503713800, UKGB530402609201, UKGB530604011500, UKGB540805015500, UKGBNI5NW250030, UKSC200009, UKSC200089, UKSC200139, UKSC200329, UKSC200330, UKGB520503613601, UKGB530905415403, UKGB531106708200, UKGB531207212100, UKSC200103, | | |

| *Indicator* | *Species* | *Group* | *Threshold* | *Unit* | *Original spatial unit(s)* | *Country/Region* | *Source* |
|---|---|---|---|---|---|---|---|
| | | | | | UKSC200138, UKSC200315, UKSC200332, UKSC200438, UKGB520503403600, UKGB520710101600, UKGB530603911403, UKGB531006013400, UKGB531207112400, UKGBNI5NB010010, UKGBNI5NE100010, UKSC200022, UKSC200090, UKSC200143, UKSC200435, UKSC200436, UKSC200510, UKSC200512, UKGB510804605900, UKGB511006206900, UKGB520710101700, UKGB530603911401, UKGB580705140000, UKGBNI5NB030010, UKSC200003, UKSC200006, UKSC200014, UKSC200165, UKSC200323, UKSC200441, UKGB520804609000, UKGB520804809100, UKGB530402609203, UKGB530604002300, UKGB530804906600, UKGB530905415402, UKGB531206908100, UKGBNI5NW250040, UKSC200008, UKSC200104, UKSC200324, UKSC200333, UKSC200437, UKGB510202110000, UKGB510503410700, UKGB520804415800, UKGB530402609202, UKGB530503300300, UKGB531006114100, UKGB540704016100, UKGB540704116000, UKSC200018, UKSC200073, UKSC200113, UKSC200129, UKSC200320, UKSC200327, UKSC200439, UKGB510080077000, UKGB520503714000, UKGB520704004700, UKGB520704202800, UKGB520710101800, UKGB520804814400, UKGB521006501200, UKGB530603911402, UKGB531207212200, UKGB570704700000, UKGB580705210000, UKSC200007, UKSC200033, UKSC200079, UKSC200328, UKSC200443, UKGB510302509900, UKGB520710102000, UKGB530503311300, UKSC200057, UKSC200316, UKSC200325, UKSC200440, UKSC200442, UKSC200515, UKGB531005913500, UKGB530905415401, UKGB510402703400, UKGB511006115200, UKSC200137, UKSC200322, UKGB541006614800, UKSC200043 | | |

# Appendix 2: Detailed results of EU Member States MSFD reporting

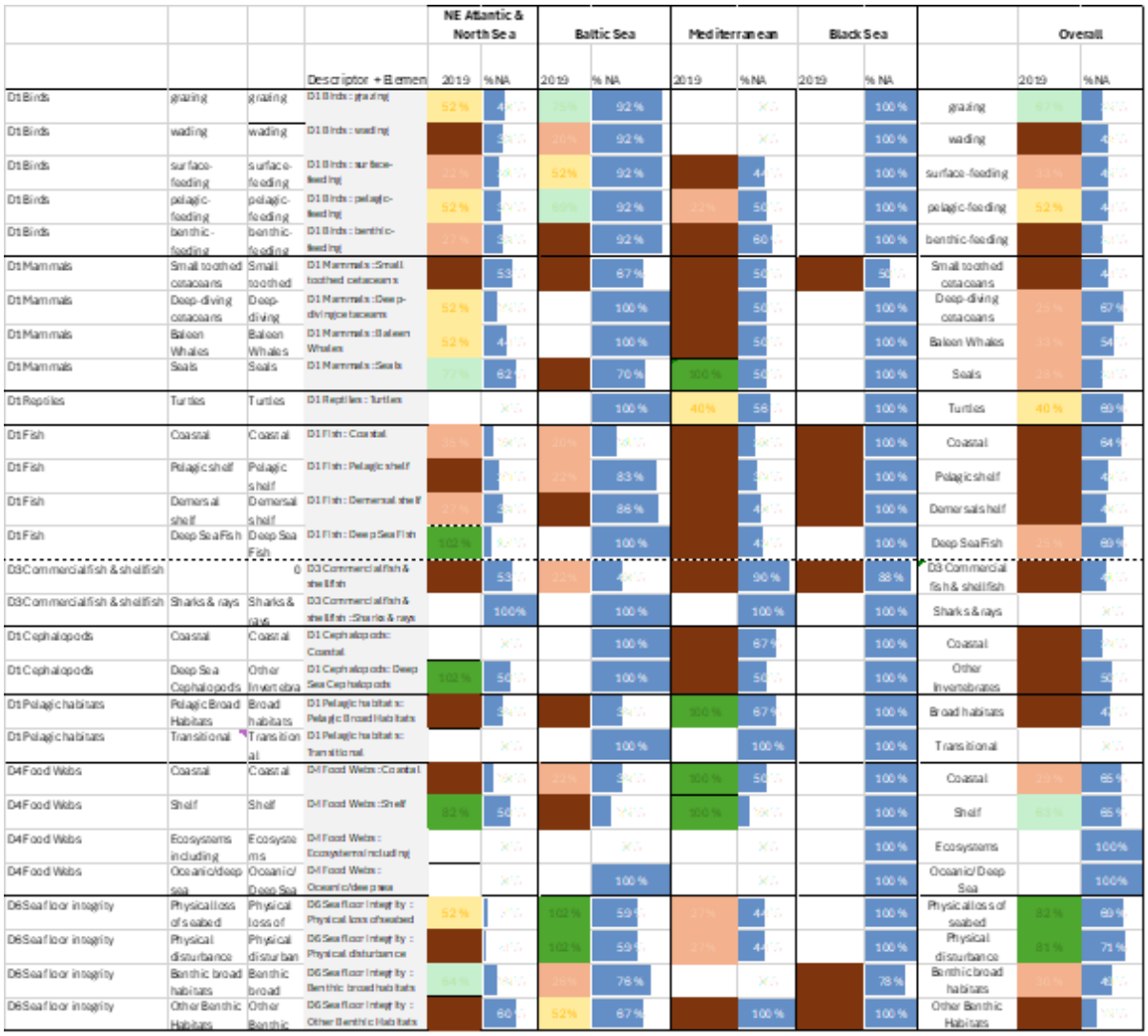

*Figure 2A. Detailed assessment results of the biodiversity elements in the marine regions. Key: dark green (>80%) = good status, light green (60-80%) = between good and moderate, yellow (40-60%) = moderate/mixed status, light brown (20-40%) = between moderate and bad status, dark brown (<20%)= bad status. The blue bars indicate the amount of data missing (not assessed, not known or not relevant), i.e. indirectly indicate the confidence of the summary result.*

# Appendix 3: Biodiversity - NE Atlantic & North Sea – OSPAR QSR 2023

*Table 3A: Summary of assessments from OSPAR QSR 2023*

| Ecosystem Component | OSPAR QSR2023 |
|---|---|
| Mammals - Seals | **Status Bad** - Seals in the Greater North Sea (Region II) were not in good environmental status. The status of seals in the Celtic Seas remains unknown due to limited data and time series. The status of the grey seal remains good across Greater North Sea and Celtic Seas, although still reflecting the recovery from previous depletion. The status of seals as a species group (harbour seal and grey seal) in the Greater North Sea is not good, and overall is unknown in the Celtic Seas. Similarly, based on the indicator assessments for the abundance and distribution of the harbour seal species, the status is not good in the Greater North Sea owing to more than 25% (4 out of 12) of the associated assessment units not achieving the threshold values given the declining populations, and inconclusive in the Celtic Sea owing to uncertainty in the status of the species within Northern Ireland. While data from Arctic Waters were gathered as part of the common indicators for these species, the outputs are not included in this integration. This is because data for Arctic Waters seals were limited to a single country and so cannot be used to report on status at the wider Arctic Seas scale.<br><br>**Comment:** For seals, the integrated assessment was based on Seal Abundance and Distribution (M3) and Grey Seal Pup Production (M5) and, for grey seal, also on Marine Mammal By-catch (M6). Each common indicator was assessed in each assessment unit as threshold achieved, threshold not achieved, inconclusive, or unknown. In the common indicator assessments Seal abundance and distribution (M3) and grey seal pup production (M5) for seal species, an assessment could be inconclusive if confidence intervals spanned the threshold value, and it was not possible to confidently determine whether a generated trend was achieving or not achieving the threshold values. An indicator outcome was considered unknown (NA) if there were no data or insufficient data to compute a trend within an assessment unit. Unknown outcomes were not considered for aggregation or integration, whereas inconclusive outcomes were considered from aggregation. |
| Mammals - Cetaceans | **Status Bad** - The status of small toothed cetaceans is not good in the Greater North Sea, Celtic Seas and Bay of Biscay and Iberian Coast. This is largely due to the not good status of each species in relation to the assessed mortality rate from incidental by-catch within the Regions, but is also due to the status outcome of coastal bottlenose dolphin and harbour porpoise within the Bay of Biscay and Iberian Coast, and of harbour porpoise within Celtic Seas under Abundance and distribution of cetaceans (M4). The harbour porpoise, also on the OSPAR Threatened and/or Declining Species and Habitats list, was assessed by applying the common indicators for abundance and distribution (M4) and by-catch (M6). The status of all other species groups (baleen whales and deep-diving toothed cetaceans) in the OSPAR Maritime Area (with data available only in the Greater North Sea (Region II), Celtic Seas (Region III) and Bay of Biscay and Iberian Coast (Region IV)) remains unknown due to limited data and time series.<br><br>**Comment:** For cetacean species functional groups, the integrated assessments were based on the common indicators for Abundance and Distribution of Cetaceans (M4) and Marine Mammal By-catch (M6). The possible assessment outcomes for each common indicator in every assessment unit were threshold achieved, threshold not achieved, and unknown. These indicator assessments were first aggregated across AUs overlapping a Region, then integrated per species. Unknown outcomes (NA) due to insufficient data to compute a trend, or due to a null value within an assessment unit, were considered for aggregation or integration.<br><br>The confidence of the assessment for marine mammals (covering both seals and cetaceans) is medium in the Greater North Sea because of the limited number of species groups assessed, but the results of the assessments are mostly in consensus; the confidence is low in the Celtic Seas and Bay of Biscay and Iberian Coast due to medium agreement and either limited evidence or no data available to carry out common indicator assessments. |

| Ecosystem Component | OSPAR QSR2023 |
|---|---|
| Birds | **Status Bad** - Marine birds in the OSPAR Maritime Area are not in good status. Widespread declines in breeding productivity and population abundance have been observed in all OSPAR Regions assessed. Most marine birds were already not in good status in 2010, but additional deterioration has been observed for many species in the current assessment.<br><br>**Comments:** The integrated status of marine bird species was assessed with the help of indicators for: (a) breeding and non-breeding abundance, and (b) breeding productivity for five species groups in four OSPAR Regions. Good environmental status was not achieved for surface-feeding birds (Regions I, II, III, IV), water column-feeding birds (Regions I, II, III, IV), benthic-feeding birds (Regions I, II, III) and wading feeding birds (Regions II, III). Good status was achieved by grazing feeding birds in Regions I, II, and III. The overall status is not good for marine birds in Regions I, II, III, and IV. No assessment could be made of Region V. Results were provided only at Regional Scale.<br><br>The confidence of the assessment is high for all regions except Region IV, where it is considered to be medium because of the limited number of species assessed and the reduced temporal data available in this Region. |
| Fish - Bony fish | **Status Bad** - OSPAR directly or indirectly assessed the population status of 316 marine fish across coastal, demersal, pelagic and deep-sea groups. This assessment was conducted by integrating commercially exploited marine fish stocks and sensitive species of conservation concern. None of the fish groups in any of the regions assessed was found to be in good environmental status. Arctic Waters (Region I) and Wider Atlantic (Region V) were not assessed. In addition, the status of fish listed by OSPAR as threatened and/or declining was assessed where possible; with some exceptions, these were found to have remained in poor status. Many of the fish are of unknown status. This refers to stocks for which assessments were attempted but for which definitive results were not available.<br><br>**Note:** The method for the OSPAR common indicator "recovery of sensitive fish species" changed since the IA2017 to compute changes in particularly rare species previously not assessed. The method to identify species- specific thresholds also changed since IA 2017.<br>**Note 2:** The QSR2023 integrated assessment does not include results from the indicator "Proportion of Large Fish" (Large Fish Index). The latest large fish index indicator assessment however showed that long-term declines are evident in the Greater North Sea and Celtic Seas. No change was found in the Bay of Biscay and Iberian coast or Wider Atlantic. The recoveries noted in IA2017 stalled prior to 2020 and thresholds were not met in the North Sea or West of Scotland subdivisions. (Proportion of Large Fish Assessment). |
| Fish - Elasmobranchs | **Note 3:** the fish groups considered in the QSR2023 integrated assessment are a mix of bony fish and elasmobranch species. Results specific for bony fish and elasmobranch species can however be extracted from some tables reported in the TS (e.g. Table S.1 -S.4) and POSH status assessments. |
| Cephalopods | **Not Assessed** |
| Reptiles | **Status Unknown** - The present status assessment is based on limited data (both spatially and temporally), and the population trends cannot be reliably determined. Limited population data have been generated by the indicator assessment produced for the QSR for “Litter ingested by sea turtles” in the Bay of Biscay and Iberian Coast Region. Observations of marine turtles in the OSPAR Maritime Area suggest that incidences of loggerhead turtles, particularly juveniles in the Wider Atlantic Region, are increasing slightly, while leatherback turtles appear to be decreasing slightly across the Greater North Sea, Celtic Seas, and Bay of Biscay and Iberian Coast Regions.<br>Relatively little is known about the status of marine turtles. There is a high incidence of litter ingestion by sea turtles in the Bay of Biscay, Azores and Macaronesia, but with regional differences.<br><br>**Comments:** This first assessment of the Common Indicator “marine litter ingested by sea turtles” indicates a high incidence of litter ingestion by sea turtles in OSPAR Regions IV, V, and Macaronesia, but with regional differences. Still at the initial stage, the use of this new OSPAR Common Indicator provides the first baseline for further monitoring and evaluation of trends. The approach will enable the evaluation of the efficiency of reduction measures, including some specific actions such as the ban of certain single use plastics. |

| Ecosystem Component | OSPAR QSR2023 |
|---|---|
| Benthic habitats | **Status Low** - Anthropogenic pressures have caused changes in the extent, distribution, condition and functioning of benthic habitats, with increased degradation in some, particularly those highly sensitive to human pressures. This assessment, both for broad-scale habitats and those identified as threatened and declining, shows that many are in poor status, although some areas also show good status for a specific pressure and impact (eutrophication). All but one of the eighteen benthic habitats that OSPAR has identified as threatened and/or declining show no signs of improvement in the regions where they occur. Some habitats (e.g., oyster beds and seagrass beds) also show a decrease in distribution and extent in some Regions.<br><br>**Comment:** Status is labelled as "low" for benthic habitats (rather than "bad") due to the lack of an integrated assessment for this biodiversity component. The assessments of the state of broad-scale and listed benthic habitats in the OSPAR Maritime Area have been undertaken using a variety of indicators and assessment methods applied at different scales. Most of the indicators have been further developed and improved since the IA17. The spatio-temporal coverage of these assessments is limited, which in turn limits the comparability of the results. Results at sub-division scale are presented as text in the TS.<br><br>**Confidence:** The availability of habitat data and the limited access to high-resolution pressure data from anthropogenic activities present a key challenge to the assessment of benthic ecosystems. Currently, there are large areas of OSPAR Regions with very limited or no monitoring data. Pressure-state-impact relationships, particularly in regard to exposure levels and the recovery of some sensitive habitats, are not always well understood. This and data paucity are the key factors affecting the levels of confidence in the assessments results.<br>There is some evidence available for selected areas of the Arctic Waters and the Wider Atlantic, but this is limited to third party assessments, the status of some of the OSPAR threatened and/or declining habitats and pilot assessments of candidate indicators. |
| Pelagic habitats | **Status Bad** - Due to widespread changes linked to human pressures across multiple pelagic habitat types with medium to high confidence, the three OSPAR Regions considered in the indicator assessments were all in not good environmental status |

# Appendix 4: Biodiversity - Baltic Sea – HELCOM HOLAS III 2023

*Table 4A: Summary of Biodiversity Assessments from HELCOM HOLAS III*

| ***Element*** | ***Status*** | ***Confidence*** | ***Trend*** | ***Indicators*** | ***QSR Assessment*** |
|---|---|---|---|---|---|
| *Pelagic Habitats* | Poor | .5 (not stated) | Down | | Phytoplankton not good. No good status in any of 14 open sea sub-basins 2016-2021 |
| *Benthic Habitats* | Moderate | .65 | Down | | Status based on – status of soft-bottom macrofauna, O2 in shallow water, oxygen debt & cumulative impact 10 out of 13 sub-regions in poor – bad condition (mainly in S Baltic) |
| *- Physical loss* | Good | .5 | stable | | In most of the sub-basins, the estimated potential loss of seabed area is clearly below 1%, based on data reported for the assessment period. |
| *- Physical disturbance* | Fair | .5 | Down | | Based on SPIA pressure layer |
| *Birds* | | | | | Many bird species characteristics of the Baltic Sea have decreased in abundance over the past few decades. |
| *- Wading* | Poor | .8 | Level | Waterbirds wintering;<br>Waterbirds breeding;<br>Waterbirds breeding success; | The status of benthic feeders and waders is not good in any part of the Baltic Sea |
| *- Benthic* | Fair | .8 | Level | | |
| *- Grazing* | Fair | .8 | Down | | Grazing feeders do not have good status in the Kattegat, the Northern Baltic Proper or the Åland Sea. |
| *- Pelagic* | Fair | .8 | Down | | Pelagic feeders have good status in several sub-basins. |
| *- Surface* | Poor | .8 | Down | | Surface-feeders have good status only in the Gulf of Bothnia. |
| *Marine Mammals - Seals* | Poor | .9 | | Trend/Abundance<br>Distribution<br>Nutritional status | Not good status. Grey & harbour seals increasing in numbers in some place but not achieving thresholds<br>Quality of ringed seal data down due to climate factors |
| *Cetaceans* | Bad | .8 | Down | Trend/Abundance<br>Distribution | Harbour porpoises in bad state. Listed as Critically Endangered on Red List |
| *Food Webs* | Fair | .2 | Down | | Changes observed but not quantitative. Available evidence shows several examples of food web disruption and putative tipping points are cause for concern. |
| *Fish - commercial* | Fair | .1 | Down | | 4 / 15 commercial stocks have GES, declining for 3, unchanged for one<br>Only north open sea sub-region is good |
| *Fish – coastal* | Bad | .1 | Down | | Integrated status for coastal fish is good in 2/22 assessed coastal areas<br>Population structure now being assessed |

## Deriving overall status

The approach here has been to use the primary assessments in the HOLAS III report and where possible, to assess overall status on the basis of "how many assessment units have achieved GES compared to those that haven't?". The confidence in this is then prvoided by the number of units which are "unknown". If there are units where the biodiversity component does not exist, this would need to be factored in, but that has not been the case so far.

*Table 4B: Status of biodiversity elements by HELCOM water basin*[2]

## NOTES ON BIODIVERSITY STATUS IN THE BALTIC SEA

The knowledge base of this holistic assessment is more comprehensive than that of previous HELCOM assessments. Several uncertainties have been reduced, and assessment approaches improved. Unfortunately, the results show only little or no improvement in the state of the Baltic Sea environment in 2016-2021.

1. **Pelagic habitats**, including phytoplankton and zooplankton, do not have good status in any open sea sub-basin. The status is most deteriorated in the central and northern Baltic Sea, and the situation has worsened in the Bothnian Bay. Four out of thirteen assessed coastal areas have good status for phytoplankton. When eutrophication indicators are also included in the assessment, no open sea or coastal pelagic habitats have good integrated status.
2. **Benthic habitats** generally do not have good status in the southern Baltic Sea, while their status is good in open sea areas in the northernmost sub-basins. Oxygen conditions are worsening. The oxygen debt below the halocline is increasing in all basins, especially in the Baltic Proper, and the increase between the previous and current assessment periods was very steep. Most coastal areas do not have good status.
3. **For fish,** only four out of fifteen assessed commercial stocks have good status. The status has declined for three stocks, improved for one and remained unchanged for eight stocks that were also assessed in the previous assessment period. The integrated status of coastal fish is good in only two of the twenty-two assessed areas, representing a worsened situation.
4. **Waterbirds** do generally not have good status, although there is variability between groups with different feeding behaviours. The status of benthic feeders and waders is not good in any part of the Baltic Sea. Surface-feeders have good status only in the Gulf of Bothnia. Grazing feeders do not have good status in the Kattegat, the Northern Baltic Proper or the Åland Sea. Pelagic feeders have good status in several sub-basins. Many bird species characteristic of the Baltic Sea have decreased in abundance over the past few decades.
5. **Marine mammals** are represented by four species in the Baltic Sea. Grey seals and harbour seals are increasing in some areas, but the indicators for population growth rates, as well as reproductive and nutritional status, do not reach threshold values. Behavioural change in the ringed seal, possibly explained by a warming climate, has impaired the quality of monitoring data to evaluate its status in the Bothnian Bay. The status of the harbour porpoise is not good.
6. **Food web** assessments address the species interactions and energy flows that support ecosystem health. Changes in the status of a food web occur through impacts on its interacting species as these are mediated to other species and trophic guilds. Major changes in the abundance and biomass of species, driven by human pressures, have been associated with changes in the food webs of the Baltic Sea in recent times, and several examples of food web disruptions and putative tipping points are a cause for concern.

# Appendix 5: Biodiversity - Mediterranean Sea – UNEP-MAP QSR 2023

The UNEP-MAP 2023 QSR provides assessments of biodiversity elements to meet 2 specific objectives:

Ecological Objective 1 (EO 1) (Biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions)

Ecological Objective 3 (EO3, Populations of commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock)

For EO1, there are 5 Common Indicators (CI), 2 for habitats, 3 for species.

CI 1: Habitat distributional range

CI2: Condition of the habitat's typical species and communities

CI3: Species distributional range (related to marine mammals, seabirds, marine reptiles)

CI4: Population abundance of selected species (related to marine mammals, seabirds, marine reptiles)

CI5: Population demographic characteristics (body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles)

For EO3, there are 3 common indicators:

CI7: Spawning stock biomass

CI8: Landings

CI9: Fishing mortality

Note that Ecological Objective 4 (EO4, Food Webs) has not been used in this assessment. Neither are there assessments provided for Pelagic Habitats.

## Summary of Assessments

*Table 5A. Overall Assessment Biodiversity Elements to meet Ecological Objectives 1 and 3*

| ***Element*** | ***Status*** | ***Confidence*** | ***Trend*** | ***Common Indicator*** | ***UNEP-MAP data*** |
|---|---|---|---|---|---|
| *Monk Seal* | .5 | .2 | | **CI3** | GES achieved for countries where breeding occurs since 2010, not for others. Breeding stable, moderate expansion in range |
| | | | | **CI4** | |
| | | | | **CI5** | Insufficient data |
| *Cetaceans* | 0.3 small-toothed<br>0.1 others | | | | Not possible to assess GES. ACCOBAMS survey<br>IUCN Red List assessments show most cetacean populations are significantly threatened except 2 widespread spp (bottlenose & striped) where status improved since mid-2000. |
| *Seabirds* | .5 | .1 | | | For many populations, GES is reached but lacks truly quantitative integrated assessment across entire region. Some endemic spp fail to reach GES targets at least in relation to some Cis |
| *Turtles* | .75 | .25 | | | Meet GES in relation to CI3,4,5. / Turtle distribution increasing (loggerhead nesting). Needs standardisation of monitoring |
| | | | | **CI4** | Nesting levels (proxy for population abundance) stable or increasing |
| | | | | **CI5** | Sex ratios favourable from available data (one characteristic susceptible to climate change) |
| *Fish* | .4 | .5 | up | **CI-7** | Biomass of some species increasing due to management, other not 44% of stocks with low biomass, 37% high |
| | | | | **CI-8** | No change except after 2019 (Covid)<br>10% reduction in overexploitation since 2012 & continuous decrease in pressure since 2012 |
| *Benthic Habitats* | | | | **CI-1** | There are limited benthic habitat maps, so assessment based on 3 specific & widespread habitats (coralligenous algae, maerl and *Posidonia*)<br>The assessment uses a proxy measure on extent of pressures, which shows that for different zones:<br>Coastal: several and severe pressures<br>Shelf: between coast & 1000m, the main pressure is bottom trawling or dredging<br>Deep sea: Trawling banned below 1000m so assumed low impact. |
| | | | | **CI-2** | No assessment |

| *Element* | *Status* | *Confidence* | *Trend* | *Common Indicator* | *UNEP-MAP data* |
|---|---|---|---|---|---|
| | | | | | **Comments:**<br>In the current IMAP there is a gap regarding the monitoring of deep-sea ecosystems (either pelagic or benthic). **No deep-sea pelagic or benthic habitats are for the moment assessed or monitored within the ecosystem approach** |
| | | | | | **Specific pelagic habitats (upwelling areas, fronts and gyres) and pelagic ecosystems (phyto and zooplankton) could be integrated in EO 1 indicators.** Work is ongoing to define parameters allowing the use of phyto and zooplankton for relevant IMAP biodiversity indicators and to define pelagic habitats. Indicators for pelagic habitats are not easy to develop and appear also to be a difficult task for the MSFD45. |

# Notes on Mediterranean Biodiversity Status

### Mammals – Monk seal

The UNEP-MAP 2023 QSR present both strengths and limitations in the assessments of distributional range, population abundance and population demographic characteristics of monk seal across the Mediterranean Basin. Based on most recent data, the species is slowly expanding its distributional range and known breeding zones continuously used. The assessment concluded that GES is achieved regarding distributional range in countries where monk seal breeding has been reported since 2010. In countries where repeated sightings of monk seal are reported but no breeding takes place GES is not considered achieved. The lack of baseline estimates for monk seal population abundance, however, restricts the validation of the potential species expansion taken place in recent years. Regarding monk seal population demographic characteristics, availability of key demographic data needed for an accurate assessment remain limited, due to lack of long-term monitoring and logistical limitations in access to the seals in remote locations.

### Mammals - Cetaceans

There are 25 cetacean species in the Mediterranean Sea, all exposed to various human pressures impacting the r conservational status.The lack of baseline/reference data on their population restricts assessing whether the cetacean species achieve GES. The IUCN Red List assessment 2018-2021, however, elavuated most of the cetacean populations in the Mediterranean Sea as significantly threatened. Exceptions are the wide-spread species common bottlenose dolphin (Tursinops truncatus) and striped dolphin (Stenella coeruleoalba), whose status has improved during the last two decades.

### Seabirds

Seabirds are an important component of the Mediterranean ecosystem and the region's biodiversity, with several endemic or near endemic taxa. Seabirds are mainly situated on the top of the marine food web and are highly mobile. As they breed on land, they contribute to the exchange of nutrients between land and sea. In the UNEP-MAP 2023 QSR concluded that GES can be considered achieved for many populations of various species, when applying a modern baseline approach. However, limitations in data quality restricts fully quantitative assessments of GES across the whole region. Further, several species, including some of the endemic taxa specifically under conservation concern, fail to achieve GES in relation to some of the considered common indicators. Facing multiple pressures both at sea and on land and representing different functional groups, these species are considered as regional indicators and sentinels for the health of the Mediterranean ecosystem.

### Marine turtles

The UNEP-MAP 2023 QSR conclude that marine turtles can be considered as achieving GES in relation to distributional range, population abundance and population demographic characteristics based on both assessment results, research literature and conservational actions taking place. Both loggerhead turtles and green turtles are expending their distribution outside their traditional ranga and also the nesting area are increasing. Abundances are evaluated as stable or increasing. The demographic characteristics that

can adequately be monitored, hatchling sex ratio, is considered to be favourable, although climate change laikely impacts this parameter. Gaps in monitoring and data reporting, and limitated use of standard methods across Mediterranean countries, highligths the need for further developments to improve the conservatino status of marine turtles.

### Fish (Commercial)

Assessments based on Ecological Objective 3: Common Indicators 7, 8 and 9

The assessment of commercial fish in relation to spawning stock biomass show that decreased fishing pressure has improved the status for some species, while no change is yet seen in other species. Across the Mediterranean Sea, 44 percent of the stocks were assessed to have low relative biomass levels, whereas 19 percent had intermediate and 37 percent high biomass levels. Capture fisheries production (total landings) decreased, likely as a result of the COVID 19 pandemic, in the 2020. In total, the fisheries production in the Mediterranean Sea was 743 100 tonnes.

Regarding fishing mortality, overexploitation of stocks has decreased during the last ten years, particularly for key species under management plans. Nevertheless, most commercial species are still overexploited and to reach sustainable levels the fishing mortality would need to be halved. Most stocks are continually fished outside their biologically sustainable limits. The number of overexploited stocks has decreased by 10 percent since 2012. Most considerably some priority species under management plans show declined fishing mortality over the last ten years, such as European hake (-39 percent) and common sole (-75 percent). However, increased fishing mortality has taken place in certain stock, such as commercially important blue and red shrimp in some parts of the Mediterranean.

### Benthic Habitats

The seabed and its benthic habitats are a key component of the Mediterranean's marine ecosystem. It holds a high diversity of marine communities and species and provides a range of essential ecosystem services including provision of seafood, natural coastal protection and carbon sequestration.

In the UNEP-MAP 2023 QSR only a preliminary assessment of seabed habitats was possible, due to available distribution maps only for three key habitats (Coralligenous, Maerl/rhodoliths and *Posidonia oceanica* meadows) in a limited number of countries. The assessment was done at a broad scale and focusing on assessing extent of pressures as a proxy for impacts on seabed habitats. Available data and information show that the seabed is exposed to severe pressure especially in the coastal zone, where extensive areas have lost their natural habitat. The main pressures in coastal areas are building of coastal infrastructure and sea defences. In offshore areas, all the way down to 1000 m depth, the main pressure on seabed habitat comes from fishing activities using bottom trawl and dredges. This pressure causes wide-spread and extensive disturbance to seabed habitats. Below 1000 m depth, fishing activities are banned, providing safeguards for sensitive deep-sea habitats throughout the Mediterranean Sea.

## Appendix 6: BEAT IUCN Red List Assessments

### Overall assessment

An updated assessment of the Red List classification for European Birds was undertaken in 2021 by Birdlife International with support from the European Commission[3] . Figure 2 shows the overall summary across Europe, divided by bird groups, of which the third one is for seabirds & other waterbirds. This shows that 35% of the species are declining across Europe, compared to 19% increasing.

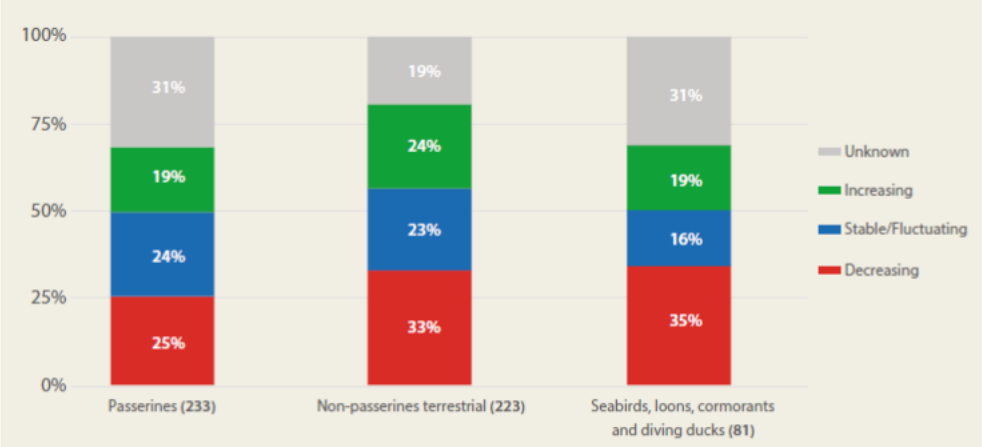


**Figure 6.** Differences in proportion of species trends between passerines, non-passerines (excl. seabirds, diving ducks, loons and cormorants) and non-passerines associated with the marine environment (seabirds, diving ducks, loons and cormorants) in Europe. In brackets, number of species per group, in graph, proportion of trend direction per group.

European Red List of Birds 2021

*Figure 6A. IUCN Red List 2021 for Seabirds*

# Mediterranean Sea

*Table 6A: IUCN Red List assessments status comparison for cetacean species representative for the GES assessment*

| Species | Previous IUCN Red List status | | IUCN Red List status following the 2018-2021 assessments | | Change in the status since mid-2000s |
|---|---|---|---|---|---|
| ***Globicephala melas*** | Mediterranean subpopulation | **Data Deficient** | Inner Mediterranean subpopulation | **Endangered** | NA |
| | | | Strait of Gibraltar subpopulation | **Critically Endangered** | NA |
| ***Grampus griseus*** | Mediterranean subpopulation | **Data Deficient** | Mediterranean subpopulation | **Endangered** | NA |
| ***Tursiops truncatus*** | Mediterranean subpopulation | **Vulnerable** | Inner Mediterranean subpopulation | **Least Concern** | ↑ |
| | | | Gulf of Ambracia subpopulation Critically | **Endangered** | ↓ |
| ***Delphinus delphis*** | Mediterranean subpopulation | **Endangered** | Inner Mediterranean subpopulation | **Endangered** | ↔ |
| | | | Gulf of Corinth subpopulation Critically | **Endangered** | ↔ |
| ***Stenella coeruleoalba*** | Mediterranean subpopulation | **Vulnerable** | Mediterranean subpopulation | **Least Concern** | ↑ |
| | | | Gulf of Corinth subpopulation | **Endangered** | ↓ |
| ***Balaenoptera physalus*** | Mediterranean subpopulation | **Vulnerable** | Mediterranean subpopulation | **Endangered** | ↓ |
| ***Physeter macrocephalus*** | Mediterranean subpopulation | **Endangered** | Mediterranean subpopulation | **Endangered** | ↔ |
| ***Ziphius cavirostris*** | Mediterranean subpopulation | **Data Deficient** | Mediterranean subpopulation | **Vulnerable** | NA |

**Status:** ↑ - status improved; ↓ - status worsened; ↔ - status unchanged; NA - not applicable

# Appendix 7: CHASE Threshold values

*Table 7A: Updated threshold values for sediment. All units are ug/kg dry weight basis. Norm=normalisation method.*

| ***Substances*** | ***CAS num.*** | ***Value*** | ***Norm.*** | ***Reference*** |
|---|---|---|---|---|
| Aclonifen | 74070-46-5 | 76 | | EQS - EQS Datasheet 2011 |
| Anthracene | 120-12-7 | 85 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |

| *Substances* | *CAS num.* | *Value* | *Norm.* | *Reference* |
|---|---|---|---|---|
| Arsenic | 7440-38-2 | 8200 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| BDE100 | 189084-64-8 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE153 | 68631-49-2 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE154 | 207122-15-4 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE183 | 207122-16-5 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE209 | 1163-19-5 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE28 | 41318-75-6 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE47 | 5436-43-1 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE66 | 189084-61-5 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE85 | 182346-21-0 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| BDE99 | 60348-60-9 | 0.05 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| Benzo[a]anthracene | 56-55-3 | 261 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Benzo[a]pyrene | 50-32-8 | 430 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Benzo[ghi]perylene | 191-24-2 | 85 | 2.5 % $C_{org}$ | ERL - OSPAR (CEMP 2088/2009) |
| Cadmium | 7440-43-9 | 1200 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| Chrome | 7440-47-3 | 81000 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| Chrysene (Triphenylene) | 218-01-9 | 384 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Copper | 7440-50-8 | 34000 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| Cypermethrin | 52315-07-8 | 0.0033 | | EQS - EQS Datasheet 2011 |
| DDE (p,p') | 72-55-9 | 0.09 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| Dibenzothiophene | 132-65-0 | 190 | 2.5 % $C_{org}$ | ERL - OSPAR (CEMP 2088/2009) |
| Dieldrin | 60-57-1 | 0.19 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Fluoranthene | 206-44-0 | 600 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| gamma-HCH | 58-89-9 | 0.13 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| Hexabromo-cyclododecane (HBCDD) | | 170 | | EQS - EQS Datasheet 2011 |
| Hexachlorobenzene | 118-74-1 | 0.16 | 2.5 % $C_{org}$ | BAC - Quality status report 2023 (OSPAR) |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | 240 | 2.5 % $C_{org}$ | ERL - OSPAR (CEMP 2088/2009) |
| Lead | 7439-92-1 | 47000 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| Mercury | 7439-97-6 | 150 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| Naphtalene | 91-20-3 | 160 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Nickel | 7440-02-0 | 21000 | 5% Al | ERL - Quality status report 2023 (OSPAR) |
| PCB-101 | 37680-73-2 | 3 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-118 | 31508-00-6 | 0.6 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-138 | 35065-28-2 | 7.9 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-153 | 35065-27-1 | 40 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-180 | 35065-29-3 | 12 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-28 | 7012-37-5 | 1.7 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| PCB-52 | 35693-99-3 | 2.7 | 2.5 % $C_{org}$ | EAC - Quality status report 2023 (OSPAR) |
| Phenanthrene | 85-01-8 | 240 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| Pyrene | 129-00-0 | 665 | 2.5 % $C_{org}$ | ERL - Quality status report 2023 (OSPAR) |
| TBTIN (TBSN+) | 36643-28-4 | 0.8 | 2.5 % $C_{org}$ | EQS - Quality status report 2023 (OSPAR) |
| Trifluralin | 1582-09-8 | 3140 | | EQS - EQS Datasheet 2005 |
| Zinc | 7440-66-6 | 150000 | 5% Al | ERL - Quality status report 2023 (OSPAR) |

*Table 7B: Updated threshold values for water. All units are ug/l.*

| ***Substances in Water*** | ***CAS num.*** | ***Value*** | ***Reference*** |
|---|---|---|---|
| 1,2-Dichloroethane | 107-06-2 | 10 | EQS - 2013/39/EU AA-EQS Marine water |
| Aclonifen | 74070-46-5 | 0.012 | EQS - EQS Datasheet 2011 |
| Alachlor | 15972-60-8 | 0.3 | EQS - 2013/39/EU AA-EQS Marine water |
| Anthracene | 120-12-7 | 0.1 | EQS - 2013/39/EU AA-EQS Marine water |
| Arsenic | 7440-38-2 | 3.5 | EAC - OSPAR 2004 Lower EAC |
| Atrazine | 1912-24-9 | 0.6 | EQS - 2013/39/EU AA-EQS Marine water |
| Benzene | 71-43-2 | 8 | EQS - 2013/39/EU AA-EQS Marine water |
| Benzo[a]anthracene | 56-55-3 | 0.0012 | EQS - Danish Proposed EQS |
| Benzo[a]pyrene | 50-32-8 | 0.00017 | EQS - 2013/39/EU AA-EQS Marine water |
| Bifenox | 42576-02-3 | 0.0012 | EQS - 2013/39/EU AA-EQS Marine water |
| C10-13 Chloroalkanes | 85535-84-8 | 0.4 | EQS - 2013/39/EU AA-EQS Marine water |
| Cadmium | 7440-43-9 | 0.2 | EQS - 2013/39/EU AA-EQS Marine water |
| Carbon-tetrachloride | 56-23-5 | 12 | EQS - 2013/39/EU AA-EQS Marine water |
| Chlorfenvinphos | 470-90-6 | 0.1 | EQS - 2013/39/EU AA-EQS Marine water |
| Chlorpyrifos (Chlorpyrifos-ethyl) | 2921-88-2 | 0.03 | EQS - 2013/39/EU AA-EQS Marine water |
| Chrome | 7440-47-3 | 25 | EAC - OSPAR 2004 Lower EAC |
| Copper | 7440-50-8 | 0.02 | EAC - OSPAR 2004 Lower EAC |
| Cybutryne / Irgarol | 28159-98-0 | 0.0025 | EQS - EQS datasheet 2011 |
| Cyclodiene pesticides: Aldrin, Dieldrin, Endrin, Isodrin | | 0.005 | EQS - 2013/39/EU AA-EQS Marine water |
| Cypermethrin | 52315-07-8 | 0.0000082 | EQS - EQS Datasheet 2011 |
| DDT (p,p') | 50-29-3 | 0.01 | EQS - 2013/39/EU AA-EQS Marine water |
| DDT Total | | 0.025 | EQS - 2013/39/EU AA-EQS Marine water |
| DEHP | 117-81-7 | 1.3 | EQS - 2013/39/EU AA-EQS Marine water |
| Dichloromethane | 75-09-2 | 20 | - |
| Dichlorvos | 62-73-7 | 0.0000558 | EQS - EQS Datasheet 2011 |
| Dicofol | 115-32-2 | 0.000032 | EQS - 2013/39/EU AA-EQS Marine water |
| Diuron | 330-54-1 | 0.2 | EQS - 2013/39/EU AA-EQS Marine water |
| Endosulfan | 115-29-7 | 0.0005 | EQS - 2013/39/EU AA-EQS Marine water |
| Fluoranthene | 206-44-0 | 0.0063 | EQS - 2013/39/EU AA-EQS Marine water |
| Heptachlor and heptachlor epoxide | | 0.00000001 | EQS - 2013/39/EU AA-EQS Marine water |
| Hexabromo-cyclododecane (HBCDD) | | 0.0008 | EQS - EQS Datasheet 2011 |
| Hexachlorobutadiene | 87-68-3 | 0.044 | EQS - EU EQS Datasheet |
| Hexachlorocyclohexanes (incl. Lindane) | 608-73-1 | 0.002 | EQS - 2013/39/EU AA-EQS Marine water |
| Isoproturon | 34123-59-6 | 0.3 | EQS - 2013/39/EU AA-EQS Marine water |
| Lead | 7439-92-1 | 1.3 | EQS - 2013/39/EU AA-EQS Marine water |
| Naphtalene | 91-20-3 | 2 | EQS - 2013/39/EU AA-EQS Marine water |
| Nickel | 7440-02-0 | 8.6 | EQS - 2013/39/EU AA-EQS Marine water |
| Nonylphenols (4-Nonylphenol) | | 0.3 | EQS - 2013/39/EU AA-EQS Marine water |
| Octylphenols ((4-(1,1',3,3'-tetra-methylbutyl)-phenol)) | 140-66-9 | 0.012 | EQS - 2013/39/EU AA-EQS Marine water |
| PCB-101 | 37680-73-2 | 0.00002 | EAC - Proposed EAC, OSPAR SIME 2008 |
| PCB-118 | 31508-00-6 | 0.000026 | EAC - Proposed EAC, OSPAR SIME 2008 |

| *Substances in Water* | *CAS num.* | *Value* | *Reference* |
|---|---|---|---|
| PCB-138 | 35065-28-2 | 0.00002 | EAC - Proposed EAC, OSPAR SIME 2008 |
| PCB-153 | 35065-27-1 | 0.001 | EAC - Proposed EAC, OSPAR SIME 2008 |
| PCB-180 | 35065-29-3 | 0.0002 | EAC - Proposed EAC, OSPAR SIME 2008 |
| Pentachlorobenzene | 608-93-5 | 0.0007 | EQS - 2013/39/EU AA-EQS Marine water |
| Pentachlorophenol | 87-86-5 | 0.4 | EQS - 2013/39/EU AA-EQS Marine water |
| PFOS | 1763-23-1 | 0.00013 | EQS - 2013/39/EU AA-EQS Marine water |
| Phenanthrene | 85-01-8 | 1.3 | EQO - OSPAR EcoQO |
| Pyrene | 129-00-0 | 0.023 | EQO - OSPAR EcoQO |
| Quinoxyfen | 124495-18-7 | 0.015 | EQS - EQS Datasheet 2011 |
| Simazine | 122-34-9 | 1 | EQS - 2013/39/EU AA-EQS Marine water |
| TBTIN (TBSN+) | 36643-28-4 | 0.0002 | EQS - 2013/39/EU AA-EQS Marine water |
| Terbutryn | 886-50-0 | 0.0065 | EQS - EQS Datasheet 2011 |
| Tetrachloro-ethylene | 127-18-4 | 10 | EQS - 2013/39/EU AA-EQS Marine water |
| Trichloro-benzenes | 12002-48-1 | 0.4 | EQS - EQS datasheet 2005 |
| Trichloro-ethylene | 79-01-6 | 10 | EQS - 2013/39/EU AA-EQS Marine water |
| Trichloro-methane | 67-66-3 | 2.5 | EQS - 2013/39/EU AA-EQS Marine water |
| Trifluralin | 1582-09-8 | 0.03 | EQS - 2013/39/EU AA-EQS Marine water |
| Zinc | 7440-66-6 | 1 | EAC - OSPAR 2004 Lower EAC |

*Table 7C: Updated threshold values for biota. All units are ug/kg but the basis might vary. Basis WW= wet weight, DW=dry weight, LW = lipid weight*

| *Substances in Biota* | *CAS num.* | *Basis* | *Value* | *Biota type* | *Reference* |
|---|---|---|---|---|---|
| Aclonifen | 74070-46-5 | WW | 6667 | Biota | EQS - EQS Datasheet 2011 |
| alpha-HCH | 319-84-6 | DW | 0.64 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| Anthracene | 120-12-7 | WW | 92222 | Shellfish | EQS - EQS datasheet 2011 |
| Arsenic | 7440-38-2 | WW | 83 | Biota | EQS - VGE Ineris |
| Benzo[a]anthracene | 56-55-3 | DW | 80 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Benzo[a]pyrene | 50-32-8 | DW | 600 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Benzo[ghi]perylene | 191-24-2 | DW | 110 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Bifenox | 42576-02-3 | WW | 25000 | Biota | EQS - EQS Datasheet 2011 |
| C10-13 Chloroalkanes | 85535-84-8 | WW | 16600 | Biota | EQS - EQS Datasheet 2005 |
| Cadmium | 7440-43-9 | WW | 500 | Crustacean | MPC - Quality status report 2023 (OSPAR) |
| Cadmium | 7440-43-9 | WW | 26 | Fish | BAC - Quality status report 2023 (OSPAR) |
| Cadmium | 7440-43-9 | DW | 960 | Shellfish (Mytilus) | BAC - Quality status report 2023 (OSPAR) |
| Cadmium | 7440-43-9 | DW | 3000 | Shellfish (Oysters) | BAC - Quality status report 2023 (OSPAR) |
| Chlorfenvinphos | 470-90-6 | WW | 33 | Biota | EQS - EQS Datasheet 2005 |
| Chlorpyrifos (Chlorpyrifos-ethyl) | 2921-88-2 | WW | 67 | Biota | EQS - EQS Datasheet 2005 |
| Chrysene (Triphenylene) | 218-01-9 | DW | 8.1 | Shellfish | BAC - Quality status report 2023 (OSPAR) |

| *Substances in Biota* | *CAS num.* | *Basis* | *Value* | *Biota type* | *Reference* |
|---|---|---|---|---|---|
| Copper | 7440-50-8 | DW | 6000 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| Cybutryne / Irgarol | 28159-98-0 | WW | 230 | Biota | EQS - EQS Datasheet 2011 |
| Cypermethrin | 52315-07-8 | WW | 3330 | Biota | EQS - EQS Datasheet 2011 |
| DDE (p,p') | 72-55-9 | DW | 0.63 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| DDE (p,p') | 72-55-9 | WW | 0.1 | Fish | BAC - Quality status report 2023 (OSPAR) |
| DEHP | 117-81-7 | WW | 3200 | Biota | EQS - EQS Datasheet 2005 |
| Dichlorvos | 62-73-7 | WW | 22 | Biota | EQS - EQS Datasheet 2011 |
| Dicofol | 115-32-2 | WW | 33 | Biota | EQS - EQS Datasheet 2011 |
| Dioxins | | WW | 0.0012 | Fish | EQS - Quality status report 2023 (OSPAR) |
| Endosulfan | 115-29-7 | WW | 1000 | Biota | EQS - EQS datasheet 2005 |
| Fluoranthene | 206-44-0 | DW | 110 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| gamma-HCH | 58-89-9 | WW | 0.29 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| gamma-HCH | 58-89-9 | WW | 1.1 | Fish liver | EAC - Quality status report 2023 (OSPAR) |
| Heptachlor and heptachlor epoxide | | WW | 33 | Biota | EQS - EQS datasheet 2011 |
| Hexabromocyclododecane (HBCDD) | | WW | 167 | Biota | EQS - EQS datasheet 2011 |
| Hexachlorobenzene | 118-74-1 | DW | 0.63 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| Hexachlorobenzene | 118-74-1 | WW | 16.7 | Fish | EQS - Quality status report 2023 (OSPAR) |
| Hexachlorobutadiene | 87-68-3 | WW | 55 | Fish | EQS - 2013/39/EU EQS Biota |
| Hexachlorocyclohexanes (incl. Lindane) | 608-73-1 | WW | 33 | Biota | EQS - EQS Datasheet 2005 |
| Indeno[1,2,3-cd]pyrene | 193-39-5 | DW | 2.4 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| Lead | 7439-92-1 | WW | 500 | Crustacean | MPC - Quality status report 2023 (OSPAR) |
| Lead | 7439-92-1 | DW | 26 | Fish | BAC - Quality status report 2023 (OSPAR) |
| Lead | 7439-92-1 | DW | 1300 | Shellfish | BAC - Quality status report 2023 (OSPAR) |
| Mercury | 7439-97-6 | WW | 20 | Biota | EQS - Quality status report 2023 (OSPAR) |
| Naphtalene | 91-20-3 | DW | 340 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Nonylphenols (4-Nonylphenol) | | WW | 10000 | Biota | EQS - EQS Datasheet 2005 |
| Octylphenols ((4-(1,1',3,3'-tetra-methylbutyl)-phenol)) | 140-66-9 | WW | 10000 | Biota | EQS - EQS Datasheet 2005 |
| PCB-101 | 37680-73-2 | LW | 121 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| PCB-118 | 31508-00-6 | LW | 25 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| PCB-138 | 35065-28-2 | LW | 317 | Shellfish | EAC - Quality status report 2023 (OSPAR) |

| Substances in Biota | CAS num. | Basis | Value | Biota type | Reference |
|---|---|---|---|---|---|
| PCB-153 | 35065-27-1 | LW | 1585 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| PCB-180 | 35065-29-3 | LW | 469 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| PCB-28 | 7012-37-5 | LW | 67 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| PCB-52 | 35693-99-3 | LW | 108 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Pentachlorobenzene | 608-93-5 | WW | 367 | Biota | EQS - EQS Datasheet 2005 |
| Pentachlorophenol | 87-86-5 | WW | 1830 | Biota | EQS - EQS Datasheet 2005 |
| PFOS | 1763-23-1 | WW | 33 | Biota | EQS - Quality status report 2023 (OSPAR) |
| Phenanthrene | 85-01-8 | DW | 1700 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Pyrene | 129-00-0 | DW | 100 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Quinoxyfen | 124495-18-7 | WW | 13333 | Biota | EQS - EQS Datasheet 2011 |
| SBDE6 | | WW | 0.0085 | Biota | EQS - Quality status report 2023 (OSPAR) |
| TBTIN (TBSN+) | 36643-28-4 | DW | 12 | Shellfish | EAC - Quality status report 2023 (OSPAR) |
| Terbutryn | 886-50-0 | WW | 67 | Biota | EQS - EQS Datasheet 2011 |
| Trichloro-benzenes | 12002-48-1 | WW | 4000 | Biota | EQS - EQS Datasheet 2005 |
| Trifluralin | 1582-09-8 | WW | 6700 | Biota | EQS - EQS Datasheet 2005 |
| Zinc | 7440-66-6 | DW | 63000 | Shellfish | BAC - Quality status report 2023 (OSPAR) |

*Table 7D: Updated threshold values for biological effects*

| Substances in Biological effects | Unit | Value | Specie | Reference |
|---|---|---|---|---|
| Lysosomal membrane stability (LMS) | mins | 10 | | Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 0.3 | Littorina littorea | Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 0.3 | Buccinum undatum | EAC - Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 0.3 | Nassarius reticulatus | EAC - Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 2 | Neptunea antiqua | EAC - Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 2 | Nucella lapillus | EAC - Quality status report 2023 (OSPAR) |
| Vas Deferens Sequence Index | VDSI | 0.1 | Peringia ulvae | Quality status report 2023 (OSPAR) |

# Appendix 8: CHASE matrix by matrix assessment

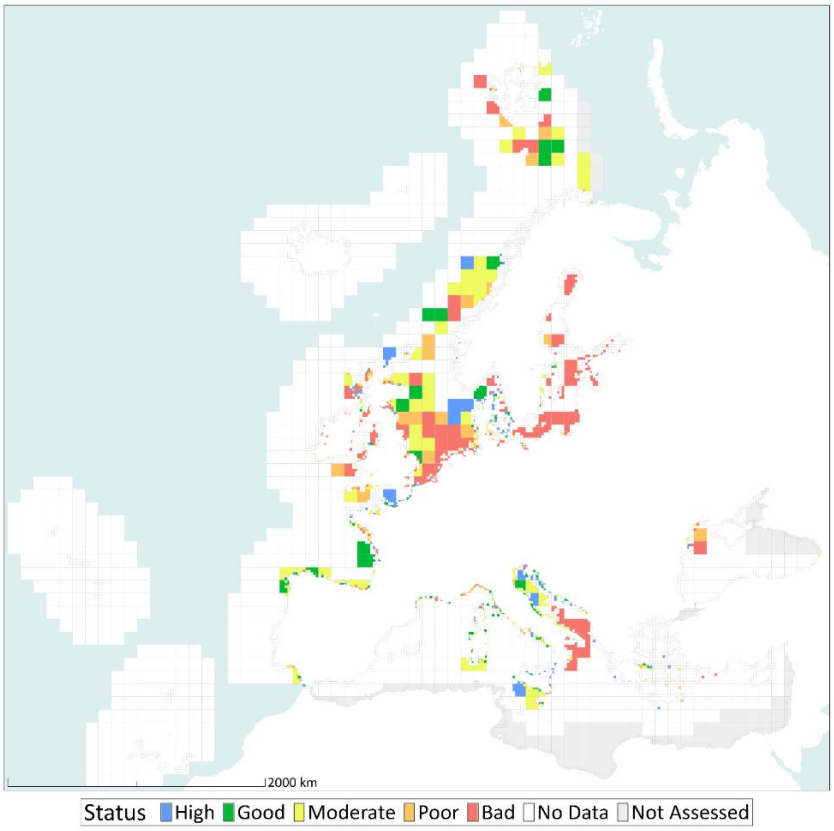


*Figure 8A: Sediment matrix assessment*

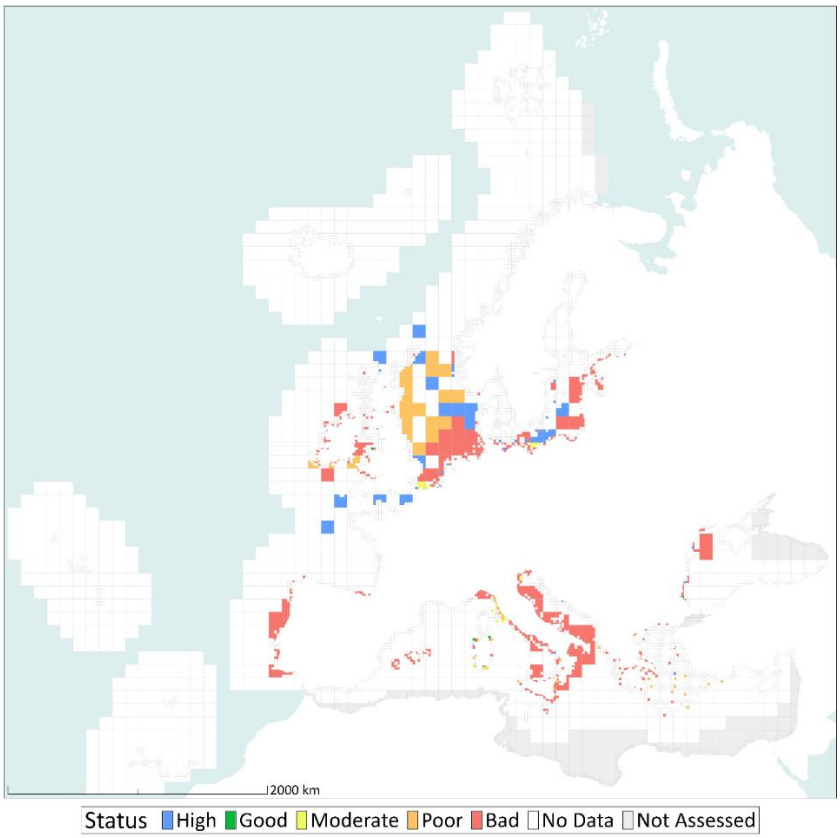


*Figure 8B: Water matrix assessment*

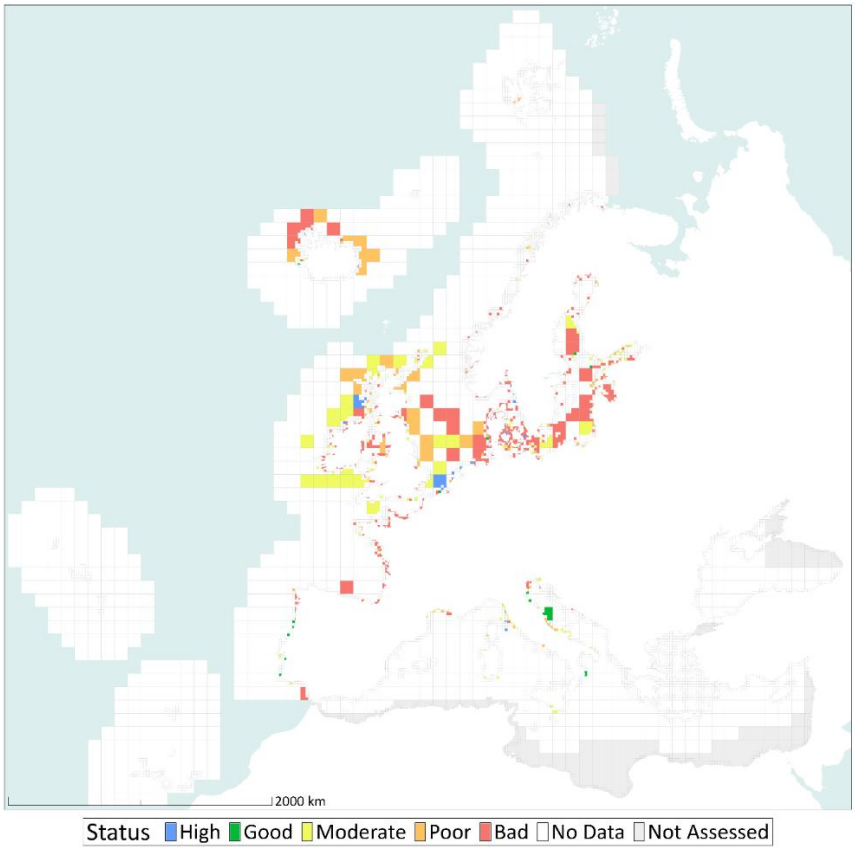


*Figure 8C: Biota matrix assessment*

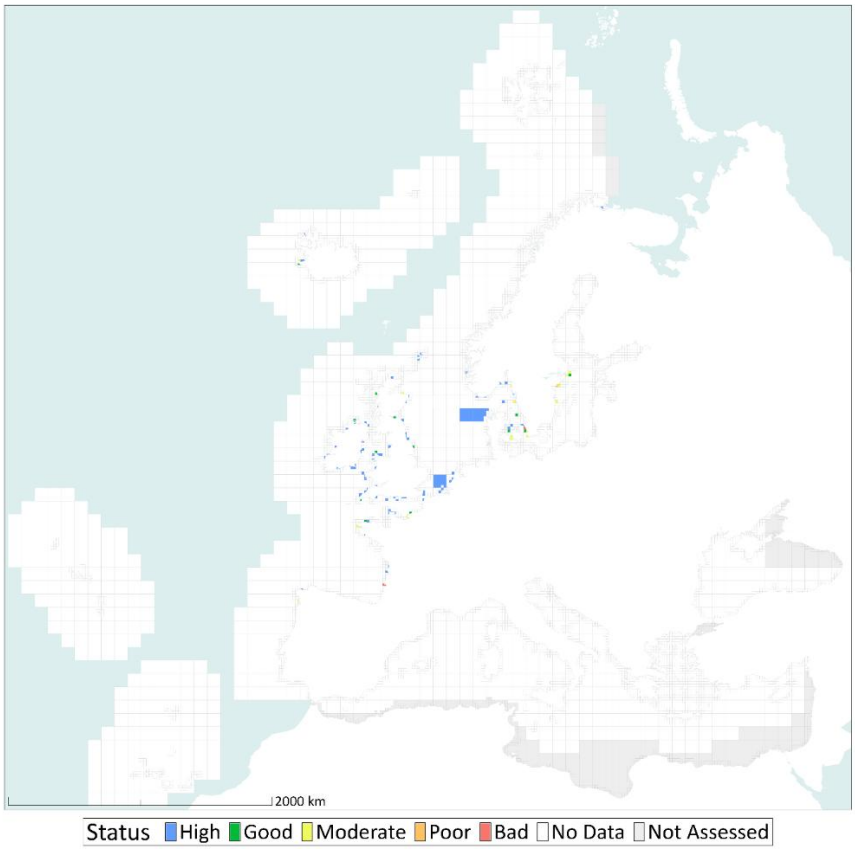


*Figure 8D: Bioeffects matrix assessment*

# Appendix 9: CHASE region by region assessment

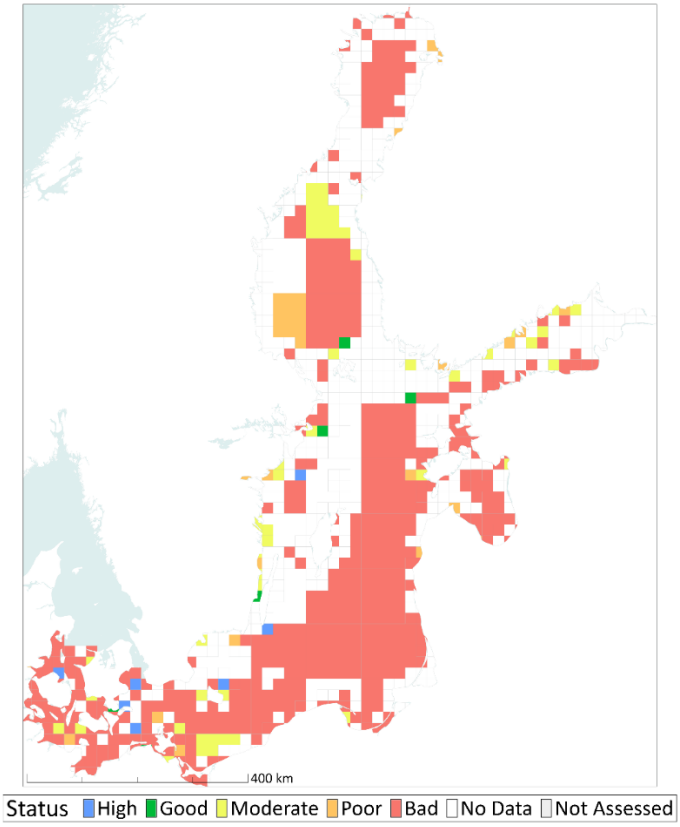


*Figure 9A: Baltic Sea region integrated assessment*

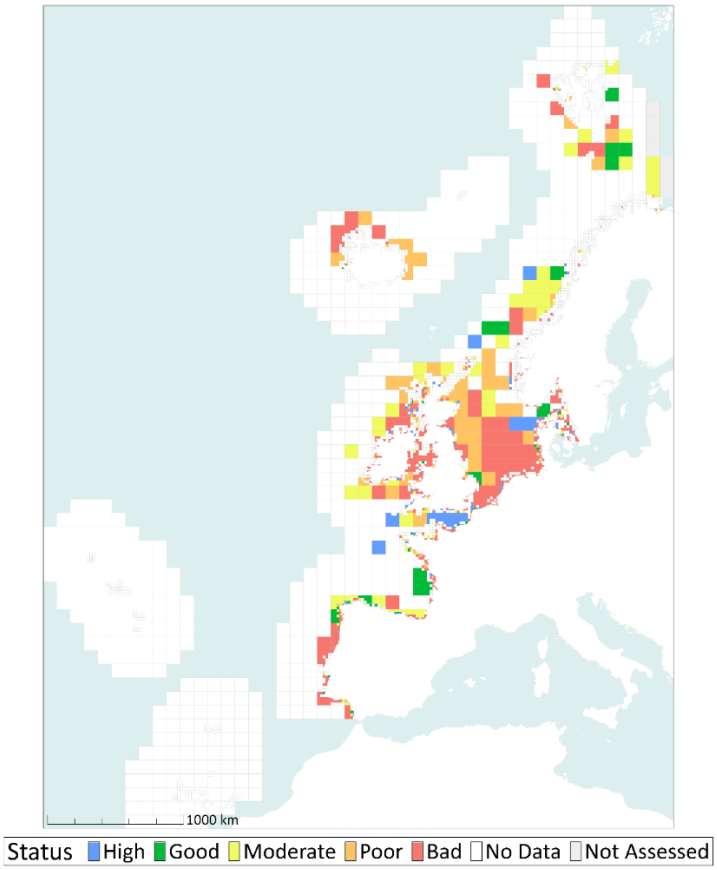


*Figure 9B: North-east Atlantic Ocean region integrated assessment*

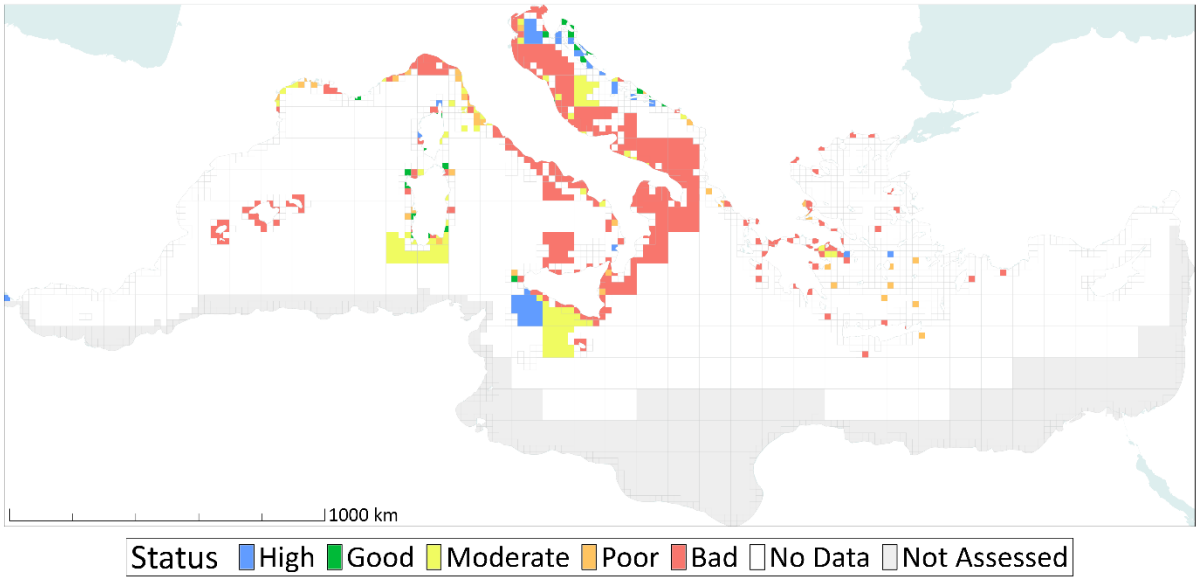


*Figure 9C: Mediterranean Sea region integrated assessment*

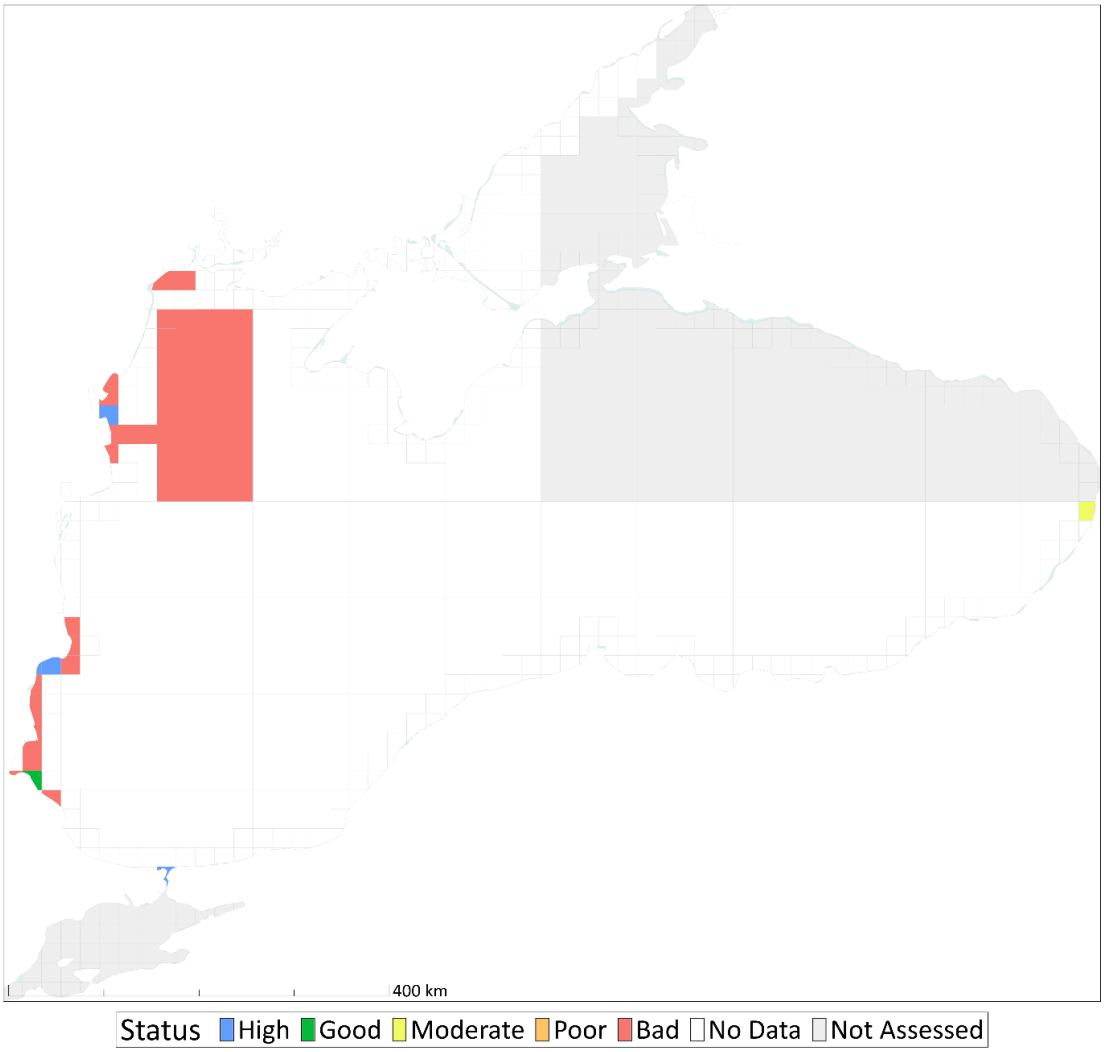


*Figure 9D: Black Sea region integrated assessment*

# Appendix 10: HEAT threshold values

*Table A10 Threshold values HEAT for the North-east Atlantic Ocean and Mediterranean Sea.*

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 1.5 | ug/l | MRU MAD-HR-MRU_2 | Croatia | Article 8 European Environment Agency |
| CHL-A | 1.5 | ug/l | MRU MAD-HR-MRU_3 | Croatia | Article 8 European Environment Agency |
| CHL-A | 0.64 | ug/l | MRU MAD-HR-MRU_4 | Croatia | Article 8 European Environment Agency |
| CHL-A | 0.64 | ug/l | MRU MAD-HR-MRU_5 | Croatia | Article 8 European Environment Agency |
| DIN | 15 | umol/l | MRU MAD-HR-MRU_2 | Croatia | Article 8 European Environment Agency |
| DIN | 15 | umol/l | MRU MAD-HR-MRU_3 | Croatia | Article 8 European Environment Agency |
| DIN | 15 | umol/l | MRU MAD-HR-MRU_4 | Croatia | Article 8 European Environment Agency |
| DIN | 15 | umol/l | MRU MAD-HR-MRU_5 | Croatia | Article 8 European Environment Agency |
| Oxygen | 11 | mg/l | MRU MAD-HR-MRU_2 | Croatia | Article 8 European Environment Agency |
| Oxygen | 11 | mg/l | MRU MAD-HR-MRU_3 | Croatia | Article 8 European Environment Agency |
| Oxygen | 11 | mg/l | MRU MAD-HR-MRU_4 | Croatia | Article 8 European Environment Agency |
| Oxygen | 11 | mg/l | MRU MAD-HR-MRU_5 | Croatia | Article 8 European Environment Agency |
| Phosphate | 0.25 | umol/l | MRU MAD-HR-MRU_2 | Croatia | Article 8 European Environment Agency |
| Phosphate | 0.25 | umol/l | MRU MAD-HR-MRU_3 | Croatia | Article 8 European Environment Agency |
| Phosphate | 0.25 | umol/l | MRU MAD-HR-MRU_4 | Croatia | Article 8 European Environment Agency |
| Phosphate | 0.25 | umol/l | MRU MAD-HR-MRU_5 | Croatia | Article 8 European Environment Agency |
| TP | 0.6 | umol/l | MRU MAD-HR-MRU_2 | Croatia | Article 8 European Environment Agency |
| TP | 0.6 | umol/l | MRU MAD-HR-MRU_3 | Croatia | Article 8 European Environment Agency |
| TP | 0.6 | umol/l | MRU MAD-HR-MRU_4 | Croatia | Article 8 European Environment Agency |
| TP | 0.6 | umol/l | MRU MAD-HR-MRU_5 | Croatia | Article 8 European Environment Agency |
| CHL-A | 0.25 | ug/l | MRU MAL-CY-MS | Cyprus | Article 8 European Environment Agency |
| NH4 | 0.55 | umol/l | MRU MAL-CY-MS | Cyprus | Article 8 European Environment Agency |
| NO3 | 0.62 | umol/l | MRU MAL-CY-MS | Cyprus | Article 8 European Environment Agency |
| Oxygen | 4 | mg/l | MRU MAL-CY-MS | Cyprus | Article 8 European Environment Agency |
| Phosphate | 0.07 | umol/l | MRU MAL-CY-MS | Cyprus | Article 8 European Environment Agency |
| CHL-A | 10 | ug/l | WMS Coastal 1 | France | Lefebvre & Devreker, 2020 |
| CHL-A | 3.6 | ug/l | WMS Coastal 2A | France | Lefebvre & Devreker, 2020 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 1.8 | ug/l | WMS Coastal 3W | France | Lefebvre & Devreker, 2020 |
| CHL-A | 1.22 | ug/l | WMS Coastal W | France | Lefebvre & Devreker, 2020 |
| CHL-A | 2 | ug/l | WMS Intermediate | France | Lefebvre & Devreker, 2020 |
| CHL-A | 1.44 | ug/l | WMS Offshore | France | Lefebvre & Devreker, 2020 |
| DIN | 20.3 | umol/l | WMS Intermediate | France | Lefebvre & Devreker, 2020 |
| DIN | 8.7 | umol/l | WMS Offshore | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal 1 | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal 2A | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal 3 | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal 3W | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Coastal W | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Intermediate | France | Lefebvre & Devreker, 2020 |
| Oxygen | 3 | mg/l | WMS Offshore | France | Lefebvre & Devreker, 2020 |
| Phosphate | 0.56 | umol/l | WMS Intermediate | France | Lefebvre & Devreker, 2020 |
| Phosphate | 0.24 | umol/l | WMS Offshore | France | Lefebvre & Devreker, 2020 |
| TURB | 10 | NTU | WMS Coastal 1 | France | Lefebvre & Devreker, 2020 |
| TURB | 45 | NTU | WMS Coastal 3 | France | Lefebvre & Devreker, 2020 |
| TURB | 5 | NTU | WMS Intermediate | France | Lefebvre & Devreker, 2020 |
| TURB | 2 | NTU | WMS Offshore | France | Lefebvre & Devreker, 2020 |
| CHL-A | 6.3 | ug/l | WT I Zone 1 coastal | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 3.1 | ug/l | WT I Zone 1 offshore | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 1.2 | ug/l | WT II Zone 2 | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 1.5 | ug/l | WT IIA (Adriatic) Zone 2 coastal | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 0.64 | ug/l | WT IIIA (Adriatic) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 0.48 | ug/l | WT IIIW Zone 3 | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 0.48 | ug/l | WT IIIW (West) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 1.2 | ug/l | WT IIW (West) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| DIN | 15.6 | umol/l | WT I Zone 1 | Italy | Erika Magaletti (ISPRA) |
| DIN | 6.9 | umol/l | WT II Zone 2 | Italy | Erika Magaletti (ISPRA) |
| DIN | 6.9 | umol/l | WT IIA (Adriatic) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| DIN | 1.6 | umol/l | WT III Zone 3 | Italy | Erika Magaletti (ISPRA) |
| DIN | 1.6 | umol/l | WT IIIA (Adriatic) Zone 3 | Italy | Erika Magaletti (ISPRA) |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| DIN | 1.6 | umol/l | WT IIIW (West) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| DIN | 6.9 | umol/l | WT IIW (West) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT IA (Adriatic) Zone 1 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT II Zone 2 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT IIA (Adriatic) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT III Zone 3 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT IIIW (West) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| Oxygen | 3 | mg/l | WT IIW (West) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.55 | umol/l | WT I Zone 1 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.76 | umol/l | WT II Zone 2 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.48 | umol/l | WT IIA (Adriatic) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.35 | umol/l | WT III Zone 3 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.26 | umol/l | WT IIIA (Adriatic) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.35 | umol/l | WT IIIW (West) Zone 3 | Italy | Erika Magaletti (ISPRA) |
| TP | 0.76 | umol/l | WT IIW (West) Zone 2 | Italy | Erika Magaletti (ISPRA) |
| CHL-A | 0.6 | EQR G/M | FMZ | Malta | Borja et al., 2021 |
| CHL-A | 0.6 | EQR G/M | TER | Malta | Borja et al., 2021 |
| CHL-A | 0.6 | EQR G/M | WFD | Malta | Borja et al., 2021 |
| Nutrients | 0.6 | EQR G/M | FMZ | Malta | Borja et al., 2021 |
| Nutrients | 0.6 | EQR G/M | TER | Malta | Borja et al., 2021 |
| Nutrients | 0.6 | EQR G/M | WFD | Malta | Borja et al., 2021 |
| Oxygen | 0.6 | EQR G/M | FMZ | Malta | Borja et al., 2021 |
| Oxygen | 0.6 | EQR G/M | TER | Malta | Borja et al., 2021 |
| Oxygen | 0.6 | EQR G/M | WFD | Malta | Borja et al., 2021 |
| Photic limit | 0.6 | EQR G/M | FMZ | Malta | Borja et al., 2021 |
| Photic limit | 0.6 | EQR G/M | TER | Malta | Borja et al., 2021 |
| Photic limit | 0.6 | EQR G/M | WFD | Malta | Borja et al., 2021 |
| CHL-A | 0.6666667 | EQR G/M | ASS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CCTI | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CFR | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CIRL | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 0.6666667 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CUK1 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CUKC | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CWM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | CWMTI | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | ECPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | ECPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | GBCW | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | GBSW | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | GDPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | HPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | IRS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | LBPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | LPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAC1A | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAC2 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAC3 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAO1 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAP2 | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | NAAPF | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 0.6666667 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 0.6666667 | EQR G/M | THPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ASS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CCTI | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CFR | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CIRL | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CUK1 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CUKC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CWAC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CWBC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CWCC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CWM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | CWMTI | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ECPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ECPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | HPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | IRS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| DIN | 0.6666667 | EQR G/M | NAAC1A | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | NAAC2 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | NAAC3 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | NAAP2 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | OWAO | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | OWBO | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | OWCO | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SCHPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SHPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SPM | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| DIN | 0.6666667 | EQR G/M | THPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ADPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ASS | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CCTI | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CFR | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CIRL | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CUK1 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CUKC | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CWBC | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CWM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | CWMTI | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ECPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Oxygen | 0.6 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | GBCW | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | GBSW | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | GDPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | HPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | IRS | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | LBPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | NAAC2 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | NAAC3 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SCHPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SHPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SPM | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| Oxygen | 0.6 | EQR G/M | THPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ASS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CCTI | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CFR | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CIRL | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CUK1 | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Phosphate | 0.6666667 | EQR G/M | CUKC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CWAC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CWBC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CWCC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CWM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | CWMTI | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ECPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ECPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | HPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | IRS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NAAC1A | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NAAC2 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NAAC3 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | NAAP2 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | OWAO | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | OWBO | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | OWCO | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SCHPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SHPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Phosphate | 0.6666667 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SPM | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| Phosphate | 0.6666667 | EQR G/M | THPM | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | NAAC2 | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | NAAC3 | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| Secchi depth | 0.75 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| TN | 0.6666667 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| TN | 0.6666667 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ADPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ASS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ATL | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CCTI | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CFR | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CNOR3 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CODEDK | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CUKC | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CWM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | CWMTI | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | DB | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ECPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ELPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | EMPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | ENS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | GBC | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | GBCW | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | GBSW | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | GDPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | IS1 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | IS2 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | KC | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | KD | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | LPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | MPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | NNS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | NT | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | NAAO1 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | NAAPF | OSPAR basins | OSPAR COMP 4 2022 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| TP | 0.6666667 | EQR G/M | RHPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SCHPM1 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SCHPM2 | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SK | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SNS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SPM | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | SS | OSPAR basins | OSPAR COMP 4 2022 |
| TP | 0.6666667 | EQR G/M | THPM | OSPAR basins | OSPAR COMP 4 2022 |
| CHL-A | 6 | ug/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 1.99 | ug/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 1.99 | ug/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 0.68 | ug/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 0.68 | ug/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 2.89 | ug/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 2.89 | ug/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 1.8 | ug/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 1.8 | ug/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 11.11 | ug/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 11.11 | ug/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 11.11 | ug/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 11.11 | ug/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 1.8 | ug/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 1.8 | ug/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 0.6 | ug/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 0.6 | ug/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 0.26 | ug/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 0.26 | ug/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 12 | ug/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 1.5 | ug/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 1.5 | ug/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 6 | ug/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 0.4 | ug/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 0.4 | ug/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 3.4 | ug/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-A | 3.4 | ug/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| CHL-A | 10 | ug/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 1.22 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 1.22 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.36 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.36 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 0.32 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 0.32 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| NH4 | 2.7 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.7 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.1 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.1 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.9 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.9 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 2.3 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 1.83 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 1.83 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NH4 | 3.89 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.87 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| NO2 | 0.46 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.46 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.16 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.16 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.15 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.15 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.4 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.4 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.7 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.7 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.5 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.5 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.1 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.1 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.4 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.4 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 0.65 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.65 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO2 | 1 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 1 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| NO2 | 0.65 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO2 | 0.65 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 2.76 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 2.76 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 1.28 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 1.28 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 3.58 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 3.58 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 7.74 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 3.65 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 3.65 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 14 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 14 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 14 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 14 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 6.45 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 6.45 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 0.9 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| NO3 | 0.9 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 0.3 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 0.3 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 2.1 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 2.1 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 7.1 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 7.1 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 6.3 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 6.3 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 0.5 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 0.5 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 5.5 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 5.5 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 6.13 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 6.13 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 3.35 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 3.35 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 1.9 | umol/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 1.9 | umol/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 3.4 | umol/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 3.4 | umol/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| NO3 | 6.13 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| NO3 | 6.13 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Oxygen | 5 | mg/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Oxygen | 5 | mg/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Oxygen | 5 | mg/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.53 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.53 | umol/l | MRU ALBC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Phosphate | 0.53 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.53 | umol/l | MRU ALBC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.28 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.28 | umol/l | MRU ALBO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.17 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.17 | umol/l | MRU ALBO2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.23 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.23 | umol/l | MRU ALBP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.53 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.53 | umol/l | MRU ALBP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVDE | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.38 | umol/l | MRU LEVMM | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU LEVON | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU LEVOS | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.7 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| Phosphate | 0.7 | umol/l | MRU NORC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.6 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.6 | umol/l | MRU NORC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.5 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.5 | umol/l | MRU NORC3 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.1 | umol/l | MRU NORO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.4 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.4 | umol/l | MRU NORP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.65 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.65 | umol/l | MRU SURC1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.18 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.18 | umol/l | MRU SURC2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.4 | umol/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.4 | umol/l | MRU SURO1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.6 | umol/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.6 | umol/l | MRU SURP1 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| Phosphate | 0.65 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Levantino-Balear, Real Decreto 817/2015 |
| Phosphate | 0.65 | umol/l | MRU SURP2 | Spain | Jesus Mercado (CSIC), MITECO DM Noratlantica, Real Decreto 817/2015 |
| SECCHI | 6.1 | metre | MAD-SI-MRU-11 | Slovenia | Article 8 European Environment Agency |
| CHL-A | 1.5 | ug/L | MAD-SI-MRU-11 | Slovenia | Article 8 European Environment Agency |
| CHL-A | 1.5 | ug/L | MAD-SI-MRU-12 | Slovenia | Article 8 European Environment Agency |
| SECCHI | 6.1 | metre | MAD-SI-MRU-12 | Slovenia | Article 8 European Environment Agency |
| CHL-SAT | 1.718 | ug/l | ADPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.8 | ug/l | ASS | North-east Atlantic Ocean | OSPAR |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-SAT | 1.835 | ug/l | ATL | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.335 | ug/l | CCTI | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.813 | ug/l | CFR | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.793 | ug/l | CIRL | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.746 | ug/l | CNOR1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.93 | ug/l | CNOR2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.357 | ug/l | CNOR3 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.6 | ug/l | CODEDK | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.705 | ug/l | CUK1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.267 | ug/l | CUKC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 12 | ug/l | CWAC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 8.2 | ug/l | CWBC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 8.2 | ug/l | CWCC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.306 | ug/l | CWM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.454 | ug/l | CWMTI | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.321 | ug/l | DB | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.092 | ug/l | ECPM1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 3.53 | ug/l | ECPM2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 3.7 | ug/l | ELPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 3.7 | ug/l | EMPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.2 | ug/l | ENS | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.9 | ug/l | GBC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.663 | ug/l | GBCW | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.02 | ug/l | GBSW | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 5.41 | ug/l | GDPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 10.6 | ug/l | HPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.96 | ug/l | IRS | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.8 | ug/l | IS1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.74 | ug/l | IS2 | North-east Atlantic Ocean | OSPAR |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-SAT | 1.185 | ug/l | KC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.4 | ug/l | KD | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 9.02 | ug/l | LBPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 3.342 | ug/l | LPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 8.013 | ug/l | MPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 13.5 | ug/l | NAAC1A | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 13.5 | ug/l | NAAC1B | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 13.5 | ug/l | NAAC1C | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 13.5 | ug/l | NAAC1D | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 12 | ug/l | NAAC2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 12 | ug/l | NAAC3 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 6 | ug/l | NAAO1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 7.7 | ug/l | NAAP2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 6 | ug/l | NAAPF | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.1 | ug/l | NNS | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.68 | ug/l | NT | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2.3 | ug/l | OWAO | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 2 | ug/l | OWBO | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.5 | ug/l | OWCO | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 6.761 | ug/l | RHPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 15.1 | ug/l | SAAC1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 20.3 | ug/l | SAAC2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.4 | ug/l | SAAOC | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 3.9 | ug/l | SAAP1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 8.8 | ug/l | SAAP2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 5.04 | ug/l | SCHPM1 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 8.929 | ug/l | SCHPM2 | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.8 | ug/l | SHPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.722 | ug/l | SK | North-east Atlantic Ocean | OSPAR |

| *Indicator* | *Value* | *Units* | *Region* | *Country* | *Source* |
|---|---|---|---|---|---|
| CHL-SAT | 3.76 | ug/l | SNS | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 5.11 | ug/l | SPM | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 1.463 | ug/l | SS | North-east Atlantic Ocean | OSPAR |
| CHL-SAT | 7.4 | ug/l | THPM | North-east Atlantic Ocean | OSPAR |

*Table 16.1: Threshold values for the Baltic Region.*

| Indicator | Value | Units | Region | Country | Source |
|---|---|---|---|---|---|
| DIN | 5 | umol/l | SEA-001 | Baltic Sea | HELCOM |
| DIN | 5 | umol/l | SEA-002 | Baltic Sea | HELCOM |
| DIN | 3.3 | umol/l | SEA-003 | Baltic Sea | HELCOM |
| DIN | 5.5 | umol/l | SEA-004 | Baltic Sea | HELCOM |
| DIN | 4.3 | umol/l | SEA-005 | Baltic Sea | HELCOM |
| DIN | 2.9 | umol/l | SEA-006 | Baltic Sea | HELCOM |
| DIN | 1.8 | umol/l | SEA-007A | Baltic Sea | HELCOM |
| DIN | 5.53 | umol/l | SEA-007B | Baltic Sea | HELCOM |
| DIN | 4.2 | umol/l | SEA-008 | Baltic Sea | HELCOM |
| DIN | 2.6 | umol/l | SEA-009 | Baltic Sea | HELCOM |
| DIN | 2 | umol/l | SEA-010 | Baltic Sea | HELCOM |
| DIN | 5.2 | umol/l | SEA-011 | Baltic Sea | HELCOM |
| DIN | 2.9 | umol/l | SEA-012 | Baltic Sea | HELCOM |
| DIN | 3.3 | umol/l | SEA-013A | Baltic Sea | HELCOM |
| DIN | 4.3 | umol/l | SEA-013B | Baltic Sea | HELCOM |
| DIN | 2.7 | umol/l | SEA-014 | Baltic Sea | HELCOM |
| DIN | 2.8 | umol/l | SEA-015 | Baltic Sea | HELCOM |
| DIN | 3.7 | umol/l | SEA-016 | Baltic Sea | HELCOM |
| DIN | 5.2 | umol/l | SEA-017 | Baltic Sea | HELCOM |
| TN | 17.4 | umol/l | SEA-001 | Baltic Sea | HELCOM |
| TN | 21 | umol/l | SEA-002 | Baltic Sea | HELCOM |
| TN | 17.3 | umol/l | SEA-003 | Baltic Sea | HELCOM |
| TN | 16.4 | umol/l | SEA-004 | Baltic Sea | HELCOM |
| TN | 16.7 | umol/l | SEA-005 | Baltic Sea | HELCOM |
| TN | 19.5 | umol/l | SEA-006 | Baltic Sea | HELCOM |
| TN | 16.05 | umol/l | SEA-007A | Baltic Sea | HELCOM |
| TN | 23.8 | umol/l | SEA-007B | Baltic Sea | HELCOM |
| TN | 18.8 | umol/l | SEA-008 | Baltic Sea | HELCOM |
| TN | 16.5 | umol/l | SEA-009 | Baltic Sea | HELCOM |
| TN | 15.1 | umol/l | SEA-010 | Baltic Sea | HELCOM |
| TN | 28 | umol/l | SEA-011 | Baltic Sea | HELCOM |
| TN | 16.2 | umol/l | SEA-012 | Baltic Sea | HELCOM |
| TN | 18.7 | umol/l | SEA-013A | Baltic Sea | HELCOM |
| TN | 22.3 | umol/l | SEA-013B | Baltic Sea | HELCOM |
| TN | 15.6 | umol/l | SEA-014 | Baltic Sea | HELCOM |

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| TN | 15.7 | umol/l | SEA-015 | Baltic Sea | HELCOM |
| TN | 17.3 | umol/l | SEA-016 | Baltic Sea | HELCOM |
| TN | 16.9 | umol/l | SEA-017 | Baltic Sea | HELCOM |
| DIP | 0.49 | umol/l | SEA-001 | Baltic Sea | HELCOM |
| DIP | 0.59 | umol/l | SEA-002 | Baltic Sea | HELCOM |
| DIP | 0.42 | umol/l | SEA-003 | Baltic Sea | HELCOM |
| DIP | 0.57 | umol/l | SEA-004 | Baltic Sea | HELCOM |
| DIP | 0.49 | umol/l | SEA-005 | Baltic Sea | HELCOM |
| DIP | 0.36 | umol/l | SEA-006 | Baltic Sea | HELCOM |
| DIP | 0.28 | umol/l | SEA-007A | Baltic Sea | HELCOM |
| DIP | 0.4 | umol/l | SEA-007B | Baltic Sea | HELCOM |
| DIP | 0.36 | umol/l | SEA-008 | Baltic Sea | HELCOM |
| DIP | 0.29 | umol/l | SEA-009 | Baltic Sea | HELCOM |
| DIP | 0.33 | umol/l | SEA-010 | Baltic Sea | HELCOM |
| DIP | 0.41 | umol/l | SEA-011 | Baltic Sea | HELCOM |
| DIP | 0.25 | umol/l | SEA-012 | Baltic Sea | HELCOM |
| DIP | 0.5 | umol/l | SEA-013A | Baltic Sea | HELCOM |
| DIP | 0.68 | umol/l | SEA-013B | Baltic Sea | HELCOM |
| DIP | 0.21 | umol/l | SEA-014 | Baltic Sea | HELCOM |
| DIP | 0.19 | umol/l | SEA-015 | Baltic Sea | HELCOM |
| DIP | 0.1 | umol/l | SEA-016 | Baltic Sea | HELCOM |
| DIP | 0.07 | umol/l | SEA-017 | Baltic Sea | HELCOM |
| TP | 0.64 | umol/l | SEA-001 | Baltic Sea | HELCOM |
| TP | 0.95 | umol/l | SEA-002 | Baltic Sea | HELCOM |
| TP | 0.68 | umol/l | SEA-003 | Baltic Sea | HELCOM |
| TP | 0.41 | umol/l | SEA-004 | Baltic Sea | HELCOM |
| TP | 0.45 | umol/l | SEA-005 | Baltic Sea | HELCOM |
| TP | 0.48 | umol/l | SEA-006 | Baltic Sea | HELCOM |
| TP | 0.55 | umol/l | SEA-007A | Baltic Sea | HELCOM |
| TP | 0.74 | umol/l | SEA-007B | Baltic Sea | HELCOM |
| TP | 0.6 | umol/l | SEA-008 | Baltic Sea | HELCOM |
| TP | 0.45 | umol/l | SEA-009 | Baltic Sea | HELCOM |
| TP | 0.45 | umol/l | SEA-010 | Baltic Sea | HELCOM |
| TP | 0.7 | umol/l | SEA-011 | Baltic Sea | HELCOM |
| TP | 0.38 | umol/l | SEA-012 | Baltic Sea | HELCOM |
| TP | 0.54 | umol/l | SEA-013A | Baltic Sea | HELCOM |
| TP | 0.56 | umol/l | SEA-013B | Baltic Sea | HELCOM |
| TP | 0.28 | umol/l | SEA-014 | Baltic Sea | HELCOM |
| TP | 0.24 | umol/l | SEA-015 | Baltic Sea | HELCOM |
| TP | 0.24 | umol/l | SEA-016 | Baltic Sea | HELCOM |
| TP | 0.18 | umol/l | SEA-017 | Baltic Sea | HELCOM |
| Chla | 1.5 | ug/l | SEA-001 | Baltic Sea | HELCOM |
| Chla | 1.7 | ug/l | SEA-002 | Baltic Sea | HELCOM |
| Chla | 1.2 | ug/l | SEA-003 | Baltic Sea | HELCOM |
| Chla | 2 | ug/l | SEA-004 | Baltic Sea | HELCOM |
| Chla | 1.8 | ug/l | SEA-005 | Baltic Sea | HELCOM |

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| Chla | 1.8 | ug/l | SEA-006 | Baltic Sea | HELCOM |
| Chla | 1.55 | ug/l | SEA-007A | Baltic Sea | HELCOM |
| Chla | 2.86 | ug/l | SEA-007B | Baltic Sea | HELCOM |
| Chla | 2.2 | ug/l | SEA-008 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | SEA-009 | Baltic Sea | HELCOM |
| Chla | 1.2 | ug/l | SEA-010 | Baltic Sea | HELCOM |
| Chla | 2.7 | ug/l | SEA-011 | Baltic Sea | HELCOM |
| Chla | 1.65 | ug/l | SEA-012 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | SEA-013A | Baltic Sea | HELCOM |
| Chla | 2.3 | ug/l | SEA-013B | Baltic Sea | HELCOM |
| Chla | 1.5 | ug/l | SEA-014 | Baltic Sea | HELCOM |
| Chla | 1.5 | ug/l | SEA-015 | Baltic Sea | HELCOM |
| Chla | 2 | ug/l | SEA-016 | Baltic Sea | HELCOM |
| Chla | 2 | ug/l | SEA-017 | Baltic Sea | HELCOM |
| TN | 22.5 | umol/l | GER-001 | Baltic Sea | HELCOM |
| TN | 22.5 | umol/l | GER-002 | Baltic Sea | HELCOM |
| TN | 22.5 | umol/l | GER-003 | Baltic Sea | HELCOM |
| TN | 19.5 | umol/l | GER-004 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-005 | Baltic Sea | HELCOM |
| TN | 19.5 | umol/l | GER-006 | Baltic Sea | HELCOM |
| TN | 38.1 | umol/l | GER-007 | Baltic Sea | HELCOM |
| TN | 38.1 | umol/l | GER-008 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-009 | Baltic Sea | HELCOM |
| TN | 18 | umol/l | GER-010 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-011 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-012 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-013 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-014 | Baltic Sea | HELCOM |
| TN | 18 | umol/l | GER-015 | Baltic Sea | HELCOM |
| TN | 38.1 | umol/l | GER-016 | Baltic Sea | HELCOM |
| TN | 38.1 | umol/l | GER-017 | Baltic Sea | HELCOM |
| TN | 18 | umol/l | GER-018 | Baltic Sea | HELCOM |
| TN | 18 | umol/l | GER-019 | Baltic Sea | HELCOM |
| TN | 38.1 | umol/l | GER-020 | Baltic Sea | HELCOM |
| TN | 19.7 | umol/l | GER-021 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-022 | Baltic Sea | HELCOM |
| TN | 15 | umol/l | GER-023 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-024 | Baltic Sea | HELCOM |
| TN | 19.7 | umol/l | GER-025 | Baltic Sea | HELCOM |
| TN | 37.1 | umol/l | GER-026A | Baltic Sea | HELCOM |
| TN | 37.1 | umol/l | GER-026B | Baltic Sea | HELCOM |
| TN | 37.1 | umol/l | GER-027 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-028 | Baltic Sea | HELCOM |
| TN | 15 | umol/l | GER-029 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-030 | Baltic Sea | HELCOM |
| TN | 15 | umol/l | GER-031 | Baltic Sea | HELCOM |

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| TN | 19.7 | umol/l | GER-032 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-033 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-034 | Baltic Sea | HELCOM |
| TN | 15 | umol/l | GER-035 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-036A | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-036B | Baltic Sea | HELCOM |
| TN | 19.7 | umol/l | GER-037 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-038A | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-038B | Baltic Sea | HELCOM |
| TN | 15 | umol/l | GER-039 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-040 | Baltic Sea | HELCOM |
| TN | 14.3 | umol/l | GER-041 | Baltic Sea | HELCOM |
| TN | 19.7 | umol/l | GER-042 | Baltic Sea | HELCOM |
| TN | 37.1 | umol/l | GER-043 | Baltic Sea | HELCOM |
| TN | 37.1 | umol/l | GER-044 | Baltic Sea | HELCOM |
| TN | 17.7 | umol/l | GER-111 | Baltic Sea | HELCOM |
| TP | 0.73 | umol/l | GER-001 | Baltic Sea | HELCOM |
| TP | 0.73 | umol/l | GER-002 | Baltic Sea | HELCOM |
| TP | 0.73 | umol/l | GER-003 | Baltic Sea | HELCOM |
| TP | 0.65 | umol/l | GER-004 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-005 | Baltic Sea | HELCOM |
| TP | 0.65 | umol/l | GER-006 | Baltic Sea | HELCOM |
| TP | 1.42 | umol/l | GER-007 | Baltic Sea | HELCOM |
| TP | 1.42 | umol/l | GER-008 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-009 | Baltic Sea | HELCOM |
| TP | 0.62 | umol/l | GER-010 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-011 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-012 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-013 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-014 | Baltic Sea | HELCOM |
| TP | 0.62 | umol/l | GER-015 | Baltic Sea | HELCOM |
| TP | 1.42 | umol/l | GER-016 | Baltic Sea | HELCOM |
| TP | 1.42 | umol/l | GER-017 | Baltic Sea | HELCOM |
| TP | 0.62 | umol/l | GER-018 | Baltic Sea | HELCOM |
| TP | 0.62 | umol/l | GER-019 | Baltic Sea | HELCOM |
| TP | 1.42 | umol/l | GER-020 | Baltic Sea | HELCOM |
| TP | 0.52 | umol/l | GER-021 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-022 | Baltic Sea | HELCOM |
| TP | 0.5 | umol/l | GER-023 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-024 | Baltic Sea | HELCOM |
| TP | 0.52 | umol/l | GER-025 | Baltic Sea | HELCOM |
| TP | 1.1 | umol/l | GER-026A | Baltic Sea | HELCOM |
| TP | 1.1 | umol/l | GER-026B | Baltic Sea | HELCOM |
| TP | 1.1 | umol/l | GER-027 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-028 | Baltic Sea | HELCOM |
| TP | 0.5 | umol/l | GER-029 | Baltic Sea | HELCOM |

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| TP | 0.44 | umol/l | GER-030 | Baltic Sea | HELCOM |
| TP | 0.5 | umol/l | GER-031 | Baltic Sea | HELCOM |
| TP | 0.52 | umol/l | GER-032 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-033 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-034 | Baltic Sea | HELCOM |
| TP | 0.5 | umol/l | GER-035 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-036A | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-036B | Baltic Sea | HELCOM |
| TP | 0.52 | umol/l | GER-037 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-038A | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-038B | Baltic Sea | HELCOM |
| TP | 0.5 | umol/l | GER-039 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-040 | Baltic Sea | HELCOM |
| TP | 0.44 | umol/l | GER-041 | Baltic Sea | HELCOM |
| TP | 0.52 | umol/l | GER-042 | Baltic Sea | HELCOM |
| TP | 1.1 | umol/l | GER-043 | Baltic Sea | HELCOM |
| TP | 1.1 | umol/l | GER-044 | Baltic Sea | HELCOM |
| TP | 0.59 | umol/l | GER-111 | Baltic Sea | HELCOM |
| Chla | 2.9 | ug/l | GER-001 | Baltic Sea | HELCOM |
| Chla | 2.9 | ug/l | GER-002 | Baltic Sea | HELCOM |
| Chla | 2.9 | ug/l | GER-003 | Baltic Sea | HELCOM |
| Chla | 1.6 | ug/l | GER-004 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-005 | Baltic Sea | HELCOM |
| Chla | 1.6 | ug/l | GER-006 | Baltic Sea | HELCOM |
| Chla | 19.4 | ug/l | GER-007 | Baltic Sea | HELCOM |
| Chla | 19.4 | ug/l | GER-008 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-009 | Baltic Sea | HELCOM |
| Chla | 3.6 | ug/l | GER-010 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-011 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-012 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-013 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-014 | Baltic Sea | HELCOM |
| Chla | 3.6 | ug/l | GER-015 | Baltic Sea | HELCOM |
| Chla | 19.4 | ug/l | GER-016 | Baltic Sea | HELCOM |
| Chla | 19.4 | ug/l | GER-017 | Baltic Sea | HELCOM |
| Chla | 3.6 | ug/l | GER-018 | Baltic Sea | HELCOM |
| Chla | 3.6 | ug/l | GER-019 | Baltic Sea | HELCOM |
| Chla | 19.4 | ug/l | GER-020 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-021 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-022 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-023 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-024 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-025 | Baltic Sea | HELCOM |
| Chla | 2.4 | ug/l | GER-026A | Baltic Sea | HELCOM |
| Chla | 2.4 | ug/l | GER-026B | Baltic Sea | HELCOM |
| Chla | 2.4 | ug/l | GER-027 | Baltic Sea | HELCOM |

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| Chla | 1.95 | ug/l | GER-028 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-029 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-030 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-031 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-032 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-033 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-034 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-035 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-036A | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-036B | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-037 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-038A | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-038B | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-039 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-040 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-041 | Baltic Sea | HELCOM |
| Chla | 1.95 | ug/l | GER-042 | Baltic Sea | HELCOM |
| Chla | 2.4 | ug/l | GER-043 | Baltic Sea | HELCOM |
| Chla | 2.4 | ug/l | GER-044 | Baltic Sea | HELCOM |
| Chla | 7.9 | ug/l | GER-111 | Baltic Sea | HELCOM |
| DIN | 75 | umol/l | POL-001 | Baltic Sea | HELCOM |
| DIN | 75 | umol/l | POL-002 | Baltic Sea | HELCOM |
| DIN | 27.14286 | umol/l | POL-003 | Baltic Sea | HELCOM |
| DIN | 1.857143 | umol/l | POL-004 | Baltic Sea | HELCOM |
| DIN | 10.71429 | umol/l | POL-005 | Baltic Sea | HELCOM |
| DIN | 10.71429 | umol/l | POL-006 | Baltic Sea | HELCOM |
| DIN | 12.85714 | umol/l | POL-007 | Baltic Sea | HELCOM |
| DIN | 16.07143 | umol/l | POL-008 | Baltic Sea | HELCOM |
| DIN | 22.85714 | umol/l | POL-009 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-010 | Baltic Sea | HELCOM |
| DIN | 10.71429 | umol/l | POL-011 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-012 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-013 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-014 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-015 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-016 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-017 | Baltic Sea | HELCOM |
| DIN | 16.42857 | umol/l | POL-018 | Baltic Sea | HELCOM |
| DIN | 7.142857 | umol/l | POL-019 | Baltic Sea | HELCOM |
| TN | 135.7143 | umol/l | POL-001 | Baltic Sea | HELCOM |
| TN | 135.7143 | umol/l | POL-002 | Baltic Sea | HELCOM |
| TN | 70 | umol/l | POL-003 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-004 | Baltic Sea | HELCOM |
| TN | 28.57143 | umol/l | POL-005 | Baltic Sea | HELCOM |
| TN | 28.57143 | umol/l | POL-006 | Baltic Sea | HELCOM |
| TN | 19.28571 | umol/l | POL-007 | Baltic Sea | HELCOM |

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| TN | 28.57143 | umol/l | POL-008 | Baltic Sea | HELCOM |
| TN | 37.85714 | umol/l | POL-009 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-010 | Baltic Sea | HELCOM |
| TN | 28.57143 | umol/l | POL-011 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-012 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-013 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-014 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-015 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-016 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-017 | Baltic Sea | HELCOM |
| TN | 28.57143 | umol/l | POL-018 | Baltic Sea | HELCOM |
| TN | 21.42857 | umol/l | POL-019 | Baltic Sea | HELCOM |
| DIP | 0.947653 | umol/l | POL-001 | Baltic Sea | HELCOM |
| DIP | 0.947653 | umol/l | POL-002 | Baltic Sea | HELCOM |
| DIP | 0.473826 | umol/l | POL-003 | Baltic Sea | HELCOM |
| DIP | 0.031588 | umol/l | POL-004 | Baltic Sea | HELCOM |
| DIP | 0.189531 | umol/l | POL-005 | Baltic Sea | HELCOM |
| DIP | 0.189531 | umol/l | POL-006 | Baltic Sea | HELCOM |
| DIP | 0.368532 | umol/l | POL-007 | Baltic Sea | HELCOM |
| DIP | 0.368532 | umol/l | POL-008 | Baltic Sea | HELCOM |
| DIP | 0.368532 | umol/l | POL-009 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-010 | Baltic Sea | HELCOM |
| DIP | 0.252707 | umol/l | POL-011 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-012 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-013 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-014 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-015 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-016 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-017 | Baltic Sea | HELCOM |
| DIP | 0.252707 | umol/l | POL-018 | Baltic Sea | HELCOM |
| DIP | 0.157942 | umol/l | POL-019 | Baltic Sea | HELCOM |
| TP | 4.842809 | umol/l | POL-001 | Baltic Sea | HELCOM |
| TP | 4.842809 | umol/l | POL-002 | Baltic Sea | HELCOM |
| TP | 3.874247 | umol/l | POL-003 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-004 | Baltic Sea | HELCOM |
| TP | 1.129989 | umol/l | POL-005 | Baltic Sea | HELCOM |
| TP | 1.129989 | umol/l | POL-006 | Baltic Sea | HELCOM |
| TP | 1.355986 | umol/l | POL-007 | Baltic Sea | HELCOM |
| TP | 1.452843 | umol/l | POL-008 | Baltic Sea | HELCOM |
| TP | 1.452843 | umol/l | POL-009 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-010 | Baltic Sea | HELCOM |
| TP | 1.065418 | umol/l | POL-011 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-012 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-013 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-014 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-015 | Baltic Sea | HELCOM |

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| TP | 0.968562 | umol/l | POL-016 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-017 | Baltic Sea | HELCOM |
| TP | 1.226845 | umol/l | POL-018 | Baltic Sea | HELCOM |
| TP | 0.968562 | umol/l | POL-019 | Baltic Sea | HELCOM |
| Chla | 20 | ug/l | POL-001 | Baltic Sea | HELCOM |
| Chla | 20 | ug/l | POL-002 | Baltic Sea | HELCOM |
| Chla | 23.2 | ug/l | POL-003 | Baltic Sea | HELCOM |
| Chla | 2 | ug/l | POL-004 | Baltic Sea | HELCOM |
| Chla | 3.76 | ug/l | POL-005 | Baltic Sea | HELCOM |
| Chla | 3.76 | ug/l | POL-006 | Baltic Sea | HELCOM |
| Chla | 3.8 | ug/l | POL-007 | Baltic Sea | HELCOM |
| Chla | 5.5 | ug/l | POL-008 | Baltic Sea | HELCOM |
| Chla | 7.5 | ug/l | POL-009 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-010 | Baltic Sea | HELCOM |
| Chla | 3.15 | ug/l | POL-011 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-012 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-013 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-014 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-015 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-016 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-017 | Baltic Sea | HELCOM |
| Chla | 3.15 | ug/l | POL-018 | Baltic Sea | HELCOM |
| Chla | 1.9 | ug/l | POL-019 | Baltic Sea | HELCOM |
| DIN | 6.716418 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| DIN | 6.716418 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| DIN | 5.970149 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| DIN | 5.970149 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| DIN | 3.826866 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| DIN | 4.568657 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| DIN | 3.370149 | umol/l | SWE-008 | Baltic Sea | HELCOM |
| DIN | 4.655224 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| DIN | 4.889552 | umol/l | SWE-012 | Baltic Sea | HELCOM |
| DIN | 8.065672 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| DIN | 2.98806 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| DIN | 4.432836 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| DIN | 13.54925 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| DIN | 6.274627 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| DIP | 0.597015 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| DIP | 0.597015 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| DIP | 0.597015 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| DIP | 0.597015 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| DIP | 0.376119 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| DIP | 0.373134 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| DIP | 0.377612 | umol/l | SWE-008 | Baltic Sea | HELCOM |
| DIP | 0.383582 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| DIP | 0.383582 | umol/l | SWE-012 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| DIP | 0.404478 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| DIP | 0.373134 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| DIP | 0.28209 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| DIP | 0.256716 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| DIP | 0.195522 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| TN W | 22.02658 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| TN W | 22.75443 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| TN W | 22.07792 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| TN W | 22.07792 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| TN W | 20.33452 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| TN W | 22.16071 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| TN W | 20.74881 | umol/l | SWE-008 | Baltic Sea | HELCOM |
| TN W | 22.37647 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| TN W | 22.84881 | umol/l | SWE-012 | Baltic Sea | HELCOM |
| TN W | 27.63214 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| TN W | 23.77381 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| TN W | 23.11765 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| TN W | 21.63133 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| TN W | 22.22771 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| TN W | 22.33038 | umol/l | SWE-025 | Baltic Sea | HELCOM |
| TN S | 15.65195 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| TN S | 14.71948 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| TN S | 15.58442 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| TN S | 15.58442 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| TN S | 19.5 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| TN S | 19.93117 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| TN S | 19.77403 | umol/l | SWE-008 | Baltic Sea | HELCOM |
| TN S | 20.32949 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| TN S | 19.98846 | umol/l | SWE-012 | Baltic Sea | HELCOM |
| TN S | 23.03077 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| TN S | 19.95897 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| TN S | 20.47308 | umol/l | SWE-015 | Baltic Sea | HELCOM |
| TN S | 21.59474 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| TN S | 21.30658 | umol/l | SWE-017 | Baltic Sea | HELCOM |
| TN S | 21.38533 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| TN S | 20.12308 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| TN S | 20.12692 | umol/l | SWE-021 | Baltic Sea | HELCOM |
| TN S | 23.72051 | umol/l | SWE-024 | Baltic Sea | HELCOM |
| TN S | 16.31818 | umol/l | SWE-025 | Baltic Sea | HELCOM |
| TP W | 0.888462 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| TP W | 0.883333 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| TP W | 0.897436 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| TP W | 0.897436 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| TP W | 0.726087 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| TP W | 0.742029 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| TP W | 0.728986 | umol/l | SWE-008 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| TP W | 0.675758 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| TP W | 0.681818 | umol/l | SWE-012 | Baltic Sea | HELCOM |
| TP W | 0.825758 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| TP W | 0.60303 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| TP W | 0.574648 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| TP W | 0.521127 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| TP W | 0.490625 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| TP W | 0.882051 | umol/l | SWE-025 | Baltic Sea | HELCOM |
| TP S | 0.55493 | umol/l | SWE-001 | Baltic Sea | HELCOM |
| TP S | 0.553521 | umol/l | SWE-003 | Baltic Sea | HELCOM |
| TP S | 0.56338 | umol/l | SWE-004 | Baltic Sea | HELCOM |
| TP S | 0.56338 | umol/l | SWE-005 | Baltic Sea | HELCOM |
| TP S | 0.405405 | umol/l | SWE-006 | Baltic Sea | HELCOM |
| TP S | 0.402703 | umol/l | SWE-007 | Baltic Sea | HELCOM |
| TP S | 0.401351 | umol/l | SWE-008 | Baltic Sea | HELCOM |
| TP S | 4.651351 | umol/l | SWE-011 | Baltic Sea | HELCOM |
| TP S | 0.425676 | umol/l | SWE-012 | Baltic Sea | HELCOM |
| TP S | 0.512162 | umol/l | SWE-013 | Baltic Sea | HELCOM |
| TP S | 0.42027 | umol/l | SWE-014 | Baltic Sea | HELCOM |
| TP S | 0.437838 | umol/l | SWE-015 | Baltic Sea | HELCOM |
| TP S | 0.3625 | umol/l | SWE-016 | Baltic Sea | HELCOM |
| TP S | 0.351389 | umol/l | SWE-017 | Baltic Sea | HELCOM |
| TP S | 0.35 | umol/l | SWE-018 | Baltic Sea | HELCOM |
| TP S | 0.330435 | umol/l | SWE-020 | Baltic Sea | HELCOM |
| TP S | 0.328986 | umol/l | SWE-021 | Baltic Sea | HELCOM |
| TP S | 0.513514 | umol/l | SWE-024 | Baltic Sea | HELCOM |
| TP S | 0.557746 | umol/l | SWE-025 | Baltic Sea | HELCOM |
| Chla | 2.807018 | ug/l | SWE-001 | Baltic Sea | HELCOM |
| Chla | 1.492537 | ug/l | SWE-003 | Baltic Sea | HELCOM |
| Chla | 1.492537 | ug/l | SWE-004 | Baltic Sea | HELCOM |
| Chla | 1.525424 | ug/l | SWE-005 | Baltic Sea | HELCOM |
| Chla | 1.802985 | ug/l | SWE-006 | Baltic Sea | HELCOM |
| Chla | 2.174627 | ug/l | SWE-007 | Baltic Sea | HELCOM |
| Chla | 1.940299 | ug/l | SWE-008 | Baltic Sea | HELCOM |
| Chla | 2.089552 | ug/l | SWE-009 | Baltic Sea | HELCOM |
| Chla | 2.089552 | ug/l | SWE-010 | Baltic Sea | HELCOM |
| Chla | 2.329851 | ug/l | SWE-011 | Baltic Sea | HELCOM |
| Chla | 2.241791 | ug/l | SWE-012 | Baltic Sea | HELCOM |
| Chla | 2.907463 | ug/l | SWE-013 | Baltic Sea | HELCOM |
| Chla | 2.089552 | ug/l | SWE-014 | Baltic Sea | HELCOM |
| Chla | 2.089552 | ug/l | SWE-015 | Baltic Sea | HELCOM |
| Chla | 2.295082 | ug/l | SWE-016 | Baltic Sea | HELCOM |
| Chla | 2 | ug/l | SWE-017 | Baltic Sea | HELCOM |
| Chla | 2.27377 | ug/l | SWE-018 | Baltic Sea | HELCOM |
| Chla | 2.280702 | ug/l | SWE-020 | Baltic Sea | HELCOM |
| Chla | 1.263158 | ug/l | SWE-020 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| Chla | 2.068966 | ug/l | SWE-021 | Baltic Sea | HELCOM |
| Chla | 1.293103 | ug/l | SWE-021 | Baltic Sea | HELCOM |
| Chla | 3.001493 | ug/l | SWE-024 | Baltic Sea | HELCOM |
| Chla | 1.19403 | ug/l | SWE-024 | Baltic Sea | HELCOM |
| SECC | 7.6 | m | SEA-001 | Baltic Sea | HELCOM |
| SECC | 8.5 | m | SEA-002 | Baltic Sea | HELCOM |
| SECC | 8.2 | m | SEA-003 | Baltic Sea | HELCOM |
| SECC | 7.4 | m | SEA-004 | Baltic Sea | HELCOM |
| SECC | 7.1 | m | SEA-005 | Baltic Sea | HELCOM |
| SECC | 7.2 | m | SEA-006 | Baltic Sea | HELCOM |
| SECC | 7.1 | m | SEA-007A | Baltic Sea | HELCOM |
| SECC | 7.1 | m | SEA-007B | Baltic Sea | HELCOM |
| SECC | 6.5 | m | SEA-008 | Baltic Sea | HELCOM |
| SECC | 7.6 | m | SEA-009 | Baltic Sea | HELCOM |
| SECC | 8.4 | m | SEA-010 | Baltic Sea | HELCOM |
| SECC | 5 | m | SEA-011 | Baltic Sea | HELCOM |
| SECC | 7.1 | m | SEA-012 | Baltic Sea | HELCOM |
| SECC | 5.9 | m | SEA-013A | Baltic Sea | HELCOM |
| SECC | 5.3 | m | SEA-013B | Baltic Sea | HELCOM |
| SECC | 6.9 | m | SEA-014 | Baltic Sea | HELCOM |
| SECC | 6.8 | m | SEA-015 | Baltic Sea | HELCOM |
| SECC | 6 | m | SEA-016 | Baltic Sea | HELCOM |
| SECC | 5.8 | m | SEA-017 | Baltic Sea | HELCOM |
| Coastal_SECC | 3.8449 | m | GER-001 | Baltic Sea | HELCOM |
| Coastal_SECC | 3.8449 | m | GER-002 | Baltic Sea | HELCOM |
| Coastal_SECC | 3.8449 | m | GER-003 | Baltic Sea | HELCOM |
| Coastal_SECC | 4.0661 | m | GER-004 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-005 | Baltic Sea | HELCOM |
| Coastal_SECC | 4.0661 | m | GER-006 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.4238 | m | GER-007 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.4238 | m | GER-008 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-009 | Baltic Sea | HELCOM |
| Coastal_SECC | 2.9013 | m | GER-010 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-011 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-012 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-013 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-014 | Baltic Sea | HELCOM |
| Coastal_SECC | 2.9013 | m | GER-015 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.4238 | m | GER-016 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.4238 | m | GER-017 | Baltic Sea | HELCOM |
| Coastal_SECC | 2.9013 | m | GER-018 | Baltic Sea | HELCOM |
| Coastal_SECC | 2.9013 | m | GER-019 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.4238 | m | GER-020 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-021 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-022 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-023 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| Coastal_SECC | 7.2 | m | GER-024 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-025 | Baltic Sea | HELCOM |
| Coastal_SECC | 6.1 | m | GER-026A | Baltic Sea | HELCOM |
| Coastal_SECC | 6.1 | m | GER-026B | Baltic Sea | HELCOM |
| Coastal_SECC | 6.1 | m | GER-027 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-028 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-029 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-030 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-031 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-032 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-033 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-034 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-035 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-036A | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-036B | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-037 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-038A | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-038B | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-039 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-040 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-041 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.2 | m | GER-042 | Baltic Sea | HELCOM |
| Coastal_SECC | 6.1 | m | GER-043 | Baltic Sea | HELCOM |
| Coastal_SECC | 6.1 | m | GER-044 | Baltic Sea | HELCOM |
| Coastal_SECC | 1.8516 | m | GER-111 | Baltic Sea | HELCOM |
| SECC | 1.9 | m | POL-001 | Baltic Sea | HELCOM |
| SECC | 1.9 | m | POL-002 | Baltic Sea | HELCOM |
| SECC | 0.75 | m | POL-003 | Baltic Sea | HELCOM |
| SECC | 1.5 | m | POL-004 | Baltic Sea | HELCOM |
| SECC | 4.5 | m | POL-005 | Baltic Sea | HELCOM |
| SECC | 4.5 | m | POL-006 | Baltic Sea | HELCOM |
| SECC | 4.5 | m | POL-007 | Baltic Sea | HELCOM |
| SECC | 3 | m | POL-008 | Baltic Sea | HELCOM |
| SECC | 3.75 | m | POL-009 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-010 | Baltic Sea | HELCOM |
| SECC | 3.5 | m | POL-011 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-012 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-013 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-014 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-015 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-016 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-017 | Baltic Sea | HELCOM |
| SECC | 3.8 | m | POL-018 | Baltic Sea | HELCOM |
| SECC | 5.6 | m | POL-019 | Baltic Sea | HELCOM |
| Coastal_SECC | 5.52 | m | SWE-001 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.98 | m | SWE-003 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| Coastal_SECC | 7.98 | m | SWE-004 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.5 | m | SWE-005 | Baltic Sea | HELCOM |
| Coastal_SECC | 7 | m | SWE-006 | Baltic Sea | HELCOM |
| Coastal_SECC | 7 | m | SWE-009 | Baltic Sea | HELCOM |
| Coastal_SECC | 7 | m | SWE-010 | Baltic Sea | HELCOM |
| Coastal_SECC | 6.8138 | m | SWE-011 | Baltic Sea | HELCOM |
| Coastal_SECC | 7.0847 | m | SWE-012 | Baltic Sea | HELCOM |
| Coastal_SECC | 5.7015 | m | SWE-013 | Baltic Sea | HELCOM |
| Coastal_SECC | 7 | m | SWE-014 | Baltic Sea | HELCOM |
| Coastal_SECC | 4.9 | m | SWE-016 | Baltic Sea | HELCOM |
| Coastal_SECC | 7 | m | SWE-017 | Baltic Sea | HELCOM |
| Coastal_SECC | 3.14292 | m | SWE-018 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-001 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-002 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-003 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-004 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-005 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-006 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-007 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-008 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-009 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-010 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-011 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-012 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-013 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-014 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-015 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-016 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-017 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-018 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | POL-019 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-001 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-004 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-005 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-006 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-011 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SWE-012 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-007A | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-008 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-009 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-010 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-012 | Baltic Sea | HELCOM |
| DOXYDEBT | 0.6 | EQR boundary | SEA-013A | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-001 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-002 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-003 | Baltic Sea | HELCOM |

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|---|---|---|---|---|---|
| Oxy_min | 0.6 | EQR boundary | SEA-004 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-005 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-006 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-007B | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-011 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-013B | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-015 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-016 | Baltic Sea | HELCOM |
| Oxy_min | 0.6 | EQR boundary | SEA-017 | Baltic Sea | HELCOM |

*Table 16.2: Threshold values for the Black Sea region.*

| Indicator | Value | Units | Region | Country | Source |
|---|---|---|---|---|---|
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DOXY | 60 | Percentage | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIN | 10.5 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| SECCHI | 6.8 | metre | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |

| | | | | | |
|---|---|---|---|---|---|
| CHLA-A | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHLA-A | 2.79 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| DIP | 0.23 | umol/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| CHL-A | 4.11 | ug/L | BLK_RO_RG_MT01 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 5.97 | ug/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| CHLA-A | 3.31 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_CT | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |

| | | | | | |
|---|---|---|---|---|---|
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO3 | 107.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 | 7.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| SECCHI | 2 | metre | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NO2 | 2.14 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 11.88 | ug/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| CHLA-A | 3.23 | umol/L | BLK_RO_RG_TT03 | Romania | Article 8 European Environment Agency |
| NH4 (spring) | 0.9 | umol/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (summer) | 110 | Percentage | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.15 | umol/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 4.7 | metre | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 5.2 | metre | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.3 | umol/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.5 | ug/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.7 | umol/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 3.4 | ug/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.12 | ug/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 1 | umol/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.15 | ug/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |

| | | | | | |
|---|---|---|---|---|---|
| NO3 (summer) | 0.3 | ug/L | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (spring) | 116 | Percentage | BLK-BG-AA-EmineMas-lennos | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 1 | umol/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 4.7 | metre | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.7 | umol/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.9 | umol/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 3.4 | ug/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.3 | ug/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (summer) | 110 | Percentage | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (spring) | 116 | Percentage | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.15 | umol/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.15 | ug/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.3 | umol/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.5 | ug/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.12 | ug/L | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 5.2 | metre | BLK-BG-AA-Gala-taEmine | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.7 | umol/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 1 | umol/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.3 | umol/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (summer) | 110 | Percentage | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.3 | ug/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 4.7 | metre | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 3.4 | ug/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.12 | ug/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.5 | ug/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.15 | umol/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.9 | umol/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (spring) | 116 | Percentage | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.15 | ug/L | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 5.2 | metre | BLK-BG-AA-KaliakraGa-lata | Bulgaria | Article 8 European Environment Agency |

| | | | | | |
|---|---|---|---|---|---|
| DIP (spring) | 0.15 | umol/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 3.4 | ug/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.12 | ug/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.9 | umol/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (spring) | 116 | Percentage | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 1 | umol/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.5 | ug/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.7 | umol/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.15 | ug/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (summer) | 110 | Percentage | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.3 | ug/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.3 | umol/L | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 4.7 | metre | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 5.2 | metre | BLK-BG-AA-Sivribu-runKaliakra | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 4.7 | metre | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.7 | umol/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.9 | umol/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.3 | ug/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 3.4 | ug/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (summer) | 110 | Percentage | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.3 | umol/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.12 | ug/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| DOXY surface (spring) | 116 | Percentage | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 1 | umol/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.15 | umol/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.5 | ug/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.15 | ug/L | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 5.2 | metre | BLK-BG-AA-Maslennos-Rezovo | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.5 | umol/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 1.4 | ug/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.6 | umol/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |

| | | | | | |
|---|---|---|---|---|---|
| NO2 (summer) | 0.08 | ug/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 1.2 | ug/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.25 | ug/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 6.5 | metre | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 0.5 | umol/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.08 | ug/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.08 | umol/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 7.7 | metre | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.1 | umol/L | BLK-BG-AA-Shelf | Bulgaria | Article 8 European Environment Agency |
| NO2 (spring) | 0.08 | umol/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| NO3 (spring) | 0.5 | umol/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| NH4 (spring) | 0.5 | umol/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| Transparency (spring) | 10 | metre | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| CHL-A (spring) | 0.4 | ug/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| NO2 (summer) | 0.08 | ug/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| DIP (spring) | 0.1 | umol/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| CHL-A (summer) | 0.36 | ug/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| DIP (summer) | 0.08 | ug/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| NH4 (summer) | 0.6 | umol/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| NO3 (summer) | 0.25 | ug/L | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |
| Transparency (summer) | 13 | metre | BLK-BG-AA-OpenSea | Bulgaria | Article 8 European Environment Agency |

# Appendix 11: HEAT region by region assessment

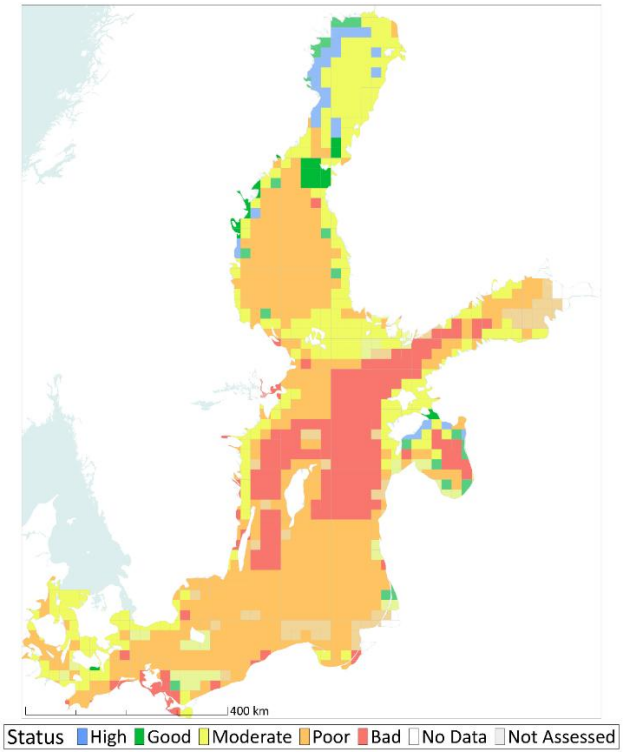


*Figure 11A: Baltic Sea region integrated assessment*

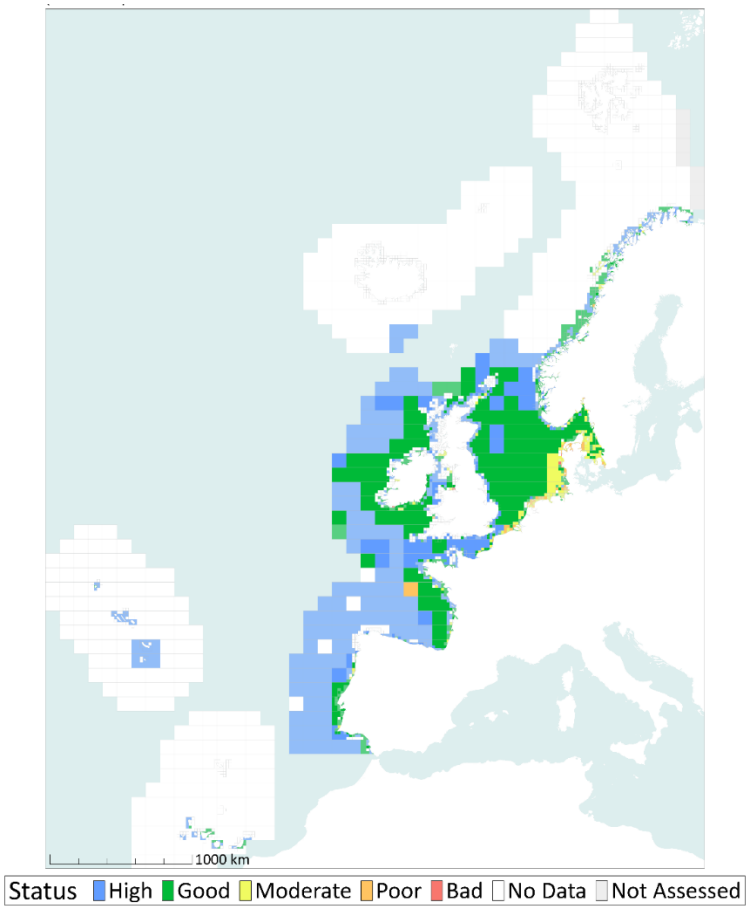



*Figure 11B: North-east Atlantic Ocean region integrated assessment*

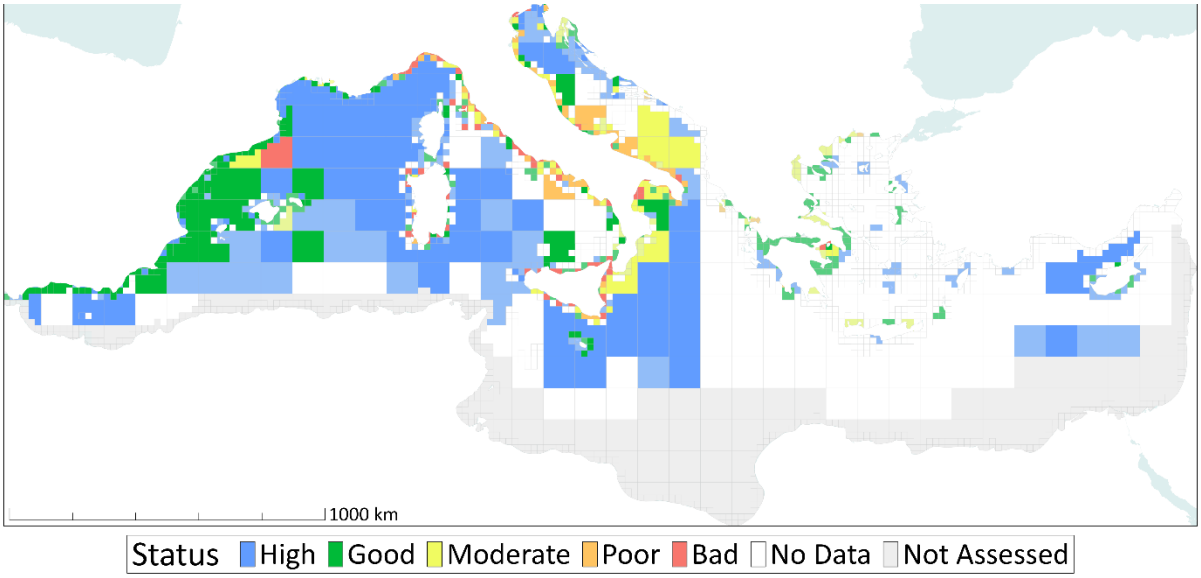



*Figure 11C: Mediterranean Sea region integrated assessment*

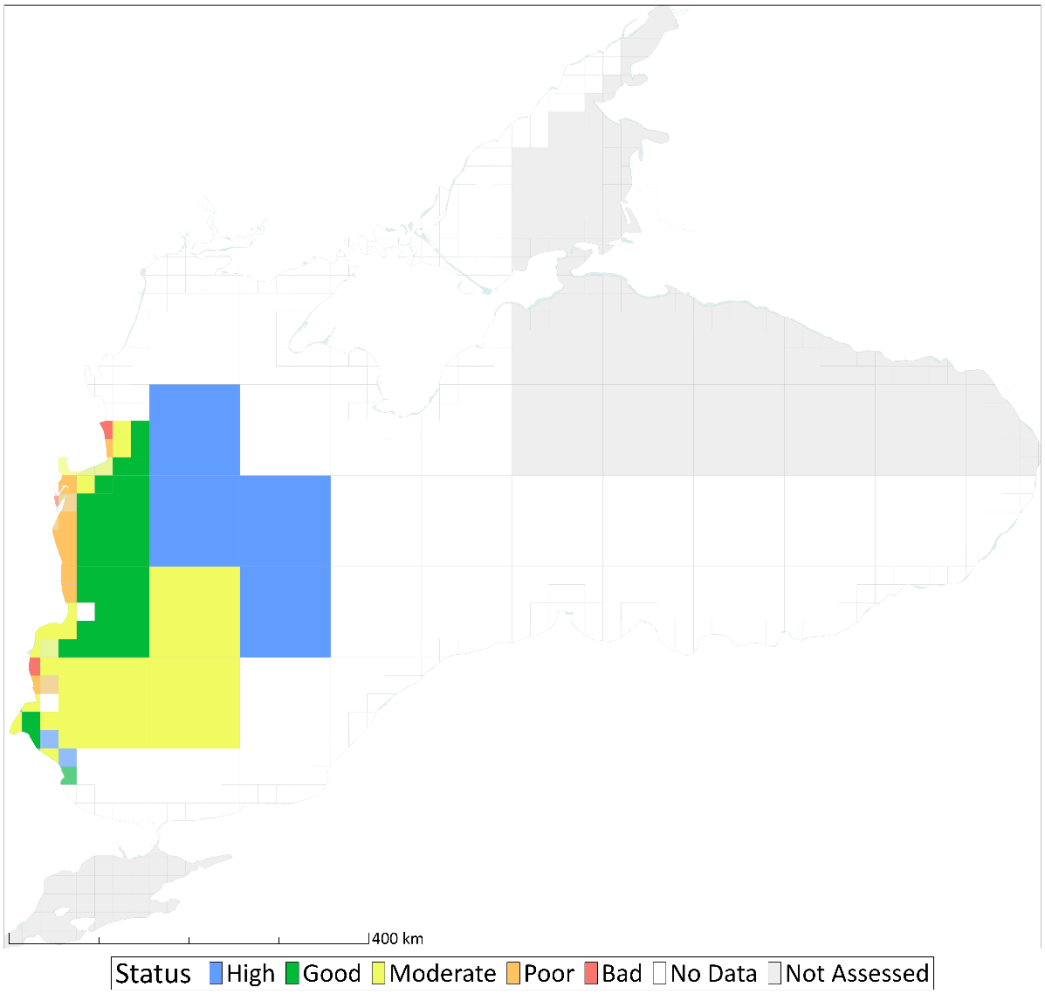



*Figure 11D: Black Sea region integrated assessment*

# Appendix 12: Plots of residuals from the temperature (A), pH (B) and alkalinity (C) model

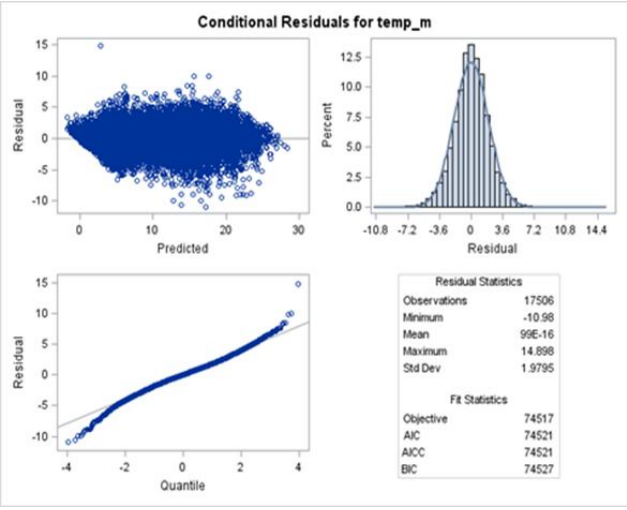



*Figure 12A: residual plot for temperature*

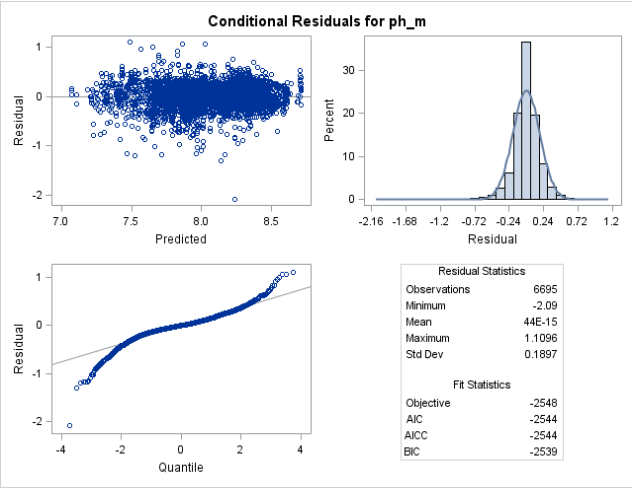



*Figure 12B: residual plot for pH*

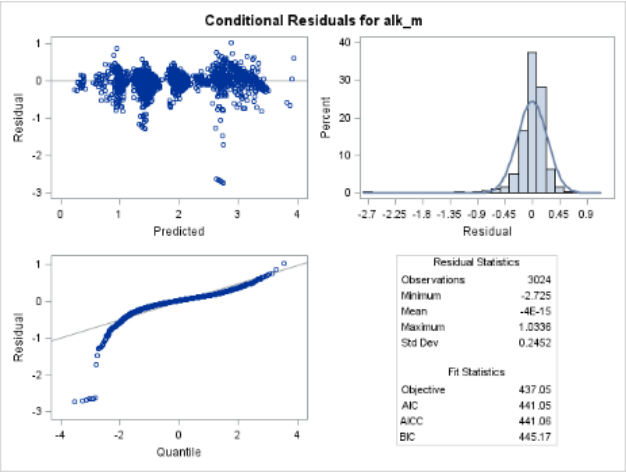



*Figure 12C: residual plot for alkalinity*

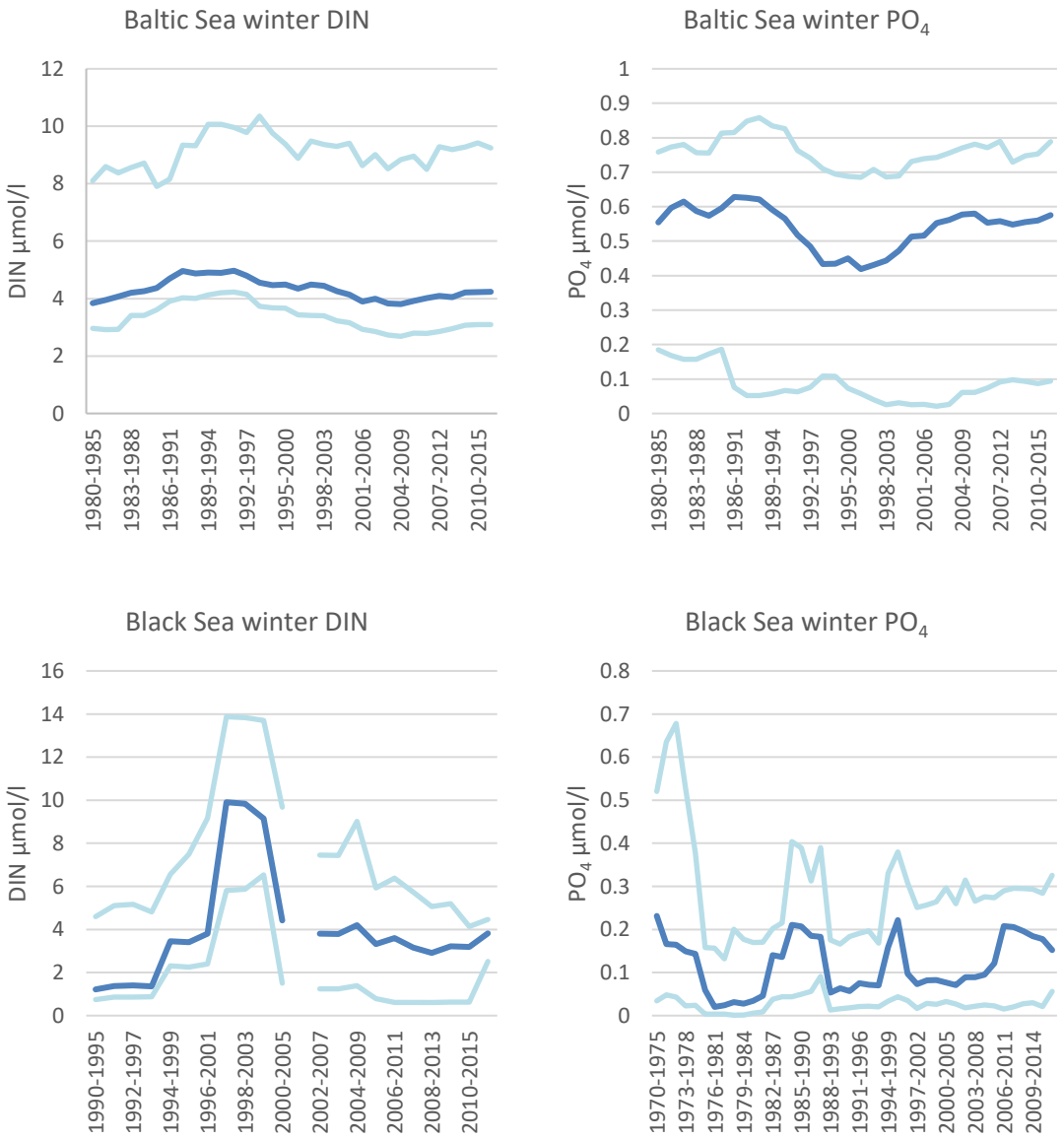
# Appendix 13: Descriptor 5 - Analyses of nutrient concentration trends in Europe's seas based on EMODnet Chemistry data

EMODnet Chemistry provide open access DIVA interpolations (Troupin et al. 2012, Beckers et al. 2014) of eutrophication parameters, such dissolved nitrogen and phosphorus. The underlying data for the DIVA analyses consist on compilations of numerous datasets collected within the EMODnet Chemistry consortium. EMODnet Chemistry provide netCDF files separately for each sea region. The analyses are made on a spatial grid (cell size varying depending on sea region; table xx) and for specific depth layers. A 6-year running average for the parameters is used. For the trend analyses on nutrient concentrations in this report, the netCDF files containing the DIVA results for winter season were downloaded from the EMODnet Chemistry portal (https://www.emodnet-chemistry.eu/). To avoid misinterpretations resulting from the interpolation, i.e. poor underlying data coverage, results exceeding a relative error threshold of 0.5 were masked. Mean surface water data (0-20 m) were used, as this is where the nutrients are available for primary producers. Due to incoherent data availability through the analysed time period, cells with data in less than 50% of year in the time series were excluded. The results are presented as median values, but including also 10$^{th}$ and 90$^{th}$ percentiles to show the variability within the sea region. Results for the North Sea are presented in the main part of this report, whereas results for the other sea regions is presented here in the annex.

*Table 13A: Background information on the EMODnet datasets used in the analyses.*

| ***Sea region*** | ***Temporal coverage*** | ***Grid cell size*** | ***Winter months*** |
|---|---|---|---|
| Baltic Sea | 1980-2016 | 0.1 degrees | December-February |
| North Sea | 1980-2017 | 0.1 degrees | December-February |
| Mediterranean Sea | 1990-2016 | 0.125 degrees | January-March |
| Black Sea | 1990-2016 | 0.05 degrees | December-February |
| North East Atlantic Ocean | 1988-2017 (DIN)<br>1967-2017 (DIP) | 0.1 degrees | January-March |

**Results**



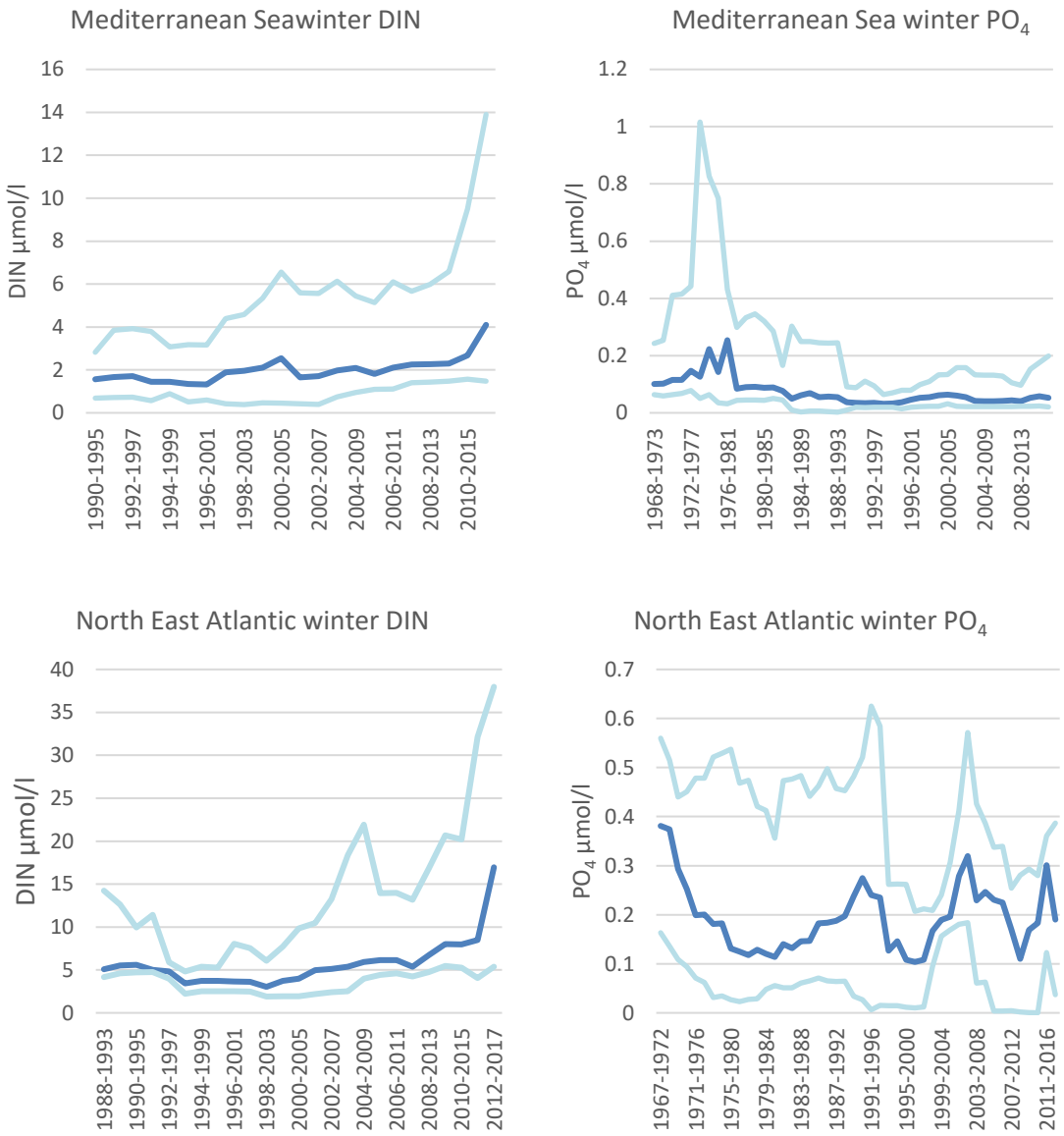



*Table 13B: Sub-regional trends in eutrophication indicators in the Baltic Sea 1990-2016. DIN = dissolved inorganic nitrogen (Dec-Feb), Total N = total nutrient concentration (Jan-Dec), DIP = dissolved inorganic phosphorus (Dec-Feb), Total P = total phosphorus concentration (Jan-Dec), Chlorophyll-a = Chlorophyll-a concentration (Jun-Sep), Water clarity = Secchi depth (Jun-Sep). + shows an increasing trend, - a decreasing trend and = no significant trend observed. Cells colored green show improvement in terms of eutrophication, whereas red cells indicate a degrading trend. Source: HELCOM 2018.*

| ***Sub-area*** | ***DIN*** | ***Total N*** | ***DIP*** | ***Total P*** | ***Chlorophyll-a*** | ***Water clarity*** |
|---|---|---|---|---|---|---|
| *Kattegat* | = | - | = | = | - | + |
| *Great Belt* | - | - | = | - | - | + |
| *The Sound* | - | - | = | = | - | = |
| *Kiel Bay* | - | - | = | - | - | = |
| *Bay of Mecklenburg* | - | = | = | = | = | = |
| *Arkona Basin* | - | = | = | = | = | - |
| *Bornholm Basin* | = | + | = | + | + | - |
| *Gdansk Basin* | - | + | = | = | = | = |
| *Eastern Gotland Basin* | - | + | = | = | = | = |
| *Western Gotland Basin* | - | = | = | + | = | - |

| Sub-area | DIN | Total N | DIP | Total P | Chlorophyll-a | Water clarity |
|---|---|---|---|---|---|---|
| Gulf of Riga | = | - | = | = | = | = |
| Northern Baltic Proper | = | - | = | + | = | - |
| Gulf of Finland | = | - | = | = | = | = |
| Åland Sea | - | - | + | = | = | = |
| Bothnian Sea | - | - | = | = | = | = |
| The Quark | - | - | = | = | = | = |
| Bothnian Bay | - | = | = | = | = | = |

*Table 13C: Sub-regional trends in eutrophication indicators in the North-east Atlantic (OSPAR area) 1990-2016. DIN = winter dissolved inorganic nitrogen, DIP = winter dissolved inorganic phosphorus, Chlorophyll-a = Chlorophyll-a concentration (Mar-Sep), Algae blooms = blooms of nuisance phytoplankton Phaeocystis, Oxygen = dissolved oxygen near the seafloor (Jul-Oct) + shows an increasing trend, - a decreasing trend and = no significant trend observed. Cells colored green show improvement in terms of eutrophication, whereas red cells indicate a degrading trend. Source: OSPAR 2017; HELCOM, 2018; Beckers et al, 2014; Troupin et al., 2012.*

| Sub-area | DIN | DIP | Chlorophyll-a | Algae blooms | Oxygen |
|---|---|---|---|---|---|
| Northern North Sea coastal | = | = | = | NA | NA |
| Northern North Sea offshore | = | = | = | NA | NA |
| Southern North Sea coastal | - | - | = | = | NA |
| Southern North Sea offshore | - | - | = | NA | NA |
| Skagerrak | NA | NA | NA | NA | = |
| Skagerrak coastal | = | = | = | NA | NA |
| Skagerrak offshore | - | = | - | NA | NA |
| Kattegat | - | = | | NA | + |
| Kattegat coastal | NA | NA | - | NA | NA |
| Kattegat offshore | NA | NA | = | NA | NA |
| Sound | - | = | NA | NA | = |
| Celtic Seas | NA | NA | NA | NA | = |
| Celtic Seas coastal | NA | NA | = | NA | NA |
| Celtic Seas offshore | NA | NA | + | NA | NA |
| English Channel | NA | NA | NA | NA | NA |
| Bay of Biscay and Iberian Coast | NA | NA | NA | NA | NA |

# Appendix 14: Descriptor 6 - The sea floor integrity ensures functioning of the ecosystem

*Table 14A: Indicator and source.*

| Criteria | Indicator | Overview | Source |
|---|---|---|---|
| D6C1/D6C4 | Abrasion ($km^2$ / % of surface). | The spatial extent of physical loss due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |
| D6C1/D6C4 | Removal ($km^2$ / % of surface). | The spatial extent of physical loss due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |

| | | | |
|---|---|---|---|
| D6C1/D6C4 | Sealing ($km^2$ / % of surface). | The spatial extent of physical loss due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |
| D6C2 | Abrasion ($km^2$ / % of surface). | The spatial extent of physical disturbance due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |
| D6C2 | Removal ($km^2$ / % of surface). | The spatial extent of physical disturbance due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |
| D6C2 | Deposition ($km^2$ / % of surface). | The spatial extent of physical disturbance due to different anthropogenic pressures. Segmented per habitat type. | ICES. https://doi.org/10.17895/ices.advice.5742 |
| D6C3/D6C5 | Method for assessing the risks to benthic habitats by towed bottom-fishing gears. | Relative benthic status (RBS) is derived based upon: i) fishing intensity, ii) habitat type, and iii) parameters for impact and recovery rates (obtained from meta-analyses of multiple experimental studies). | Pitcher et al., 2017 https://doi.org/10.1111/2041-210X.12705 |
| D6C3/D6C5 | Population Dynamic Model (PDM) | The PDM approach estimates the fishing impact related to the total reduction in community biomass due to abrasion from fishing) to the locally assumed carrying capacity. | ICES. 2019. Interim Report of the Working Group on Fisheries Benthic Impact and Trade-offs (WGFBIT), 12–16 November 2018, ICES Headquarters, Copenhagen, Denmark. ICES CM 2018/HAPISG:21. 74 pp. |
| D6C3/D6C5 (and others) | A plethora of indicators are used, e.g.: areal extent of rocky seafloor/vulnerable habitats distribution and condition of habitat forming species, abundance of coral colonies alive, abundance of corals (excluding reef building corals), density of biogenic reef forming | Nested Environmental status Assessment Tool (NEAT) is used in combination with other tools. | Kazanidis et al., 2020 https://doi.org/10.1016/j.ecolind.2020.106624 |

| | | | |
|---|---|---|---|
| | species, ratio of live versus dead/over-grown coral cover. | | |
| D6C3/D6C5 | Biological traits analysis (BTA) | Nine (9) biological traits wre used related to the life history, morphology and behaviour of taxa. Temporal variation in taxonomic composition (based on Bray-Curtis distance) was also done. | Clare et al., 2015 http://dx.doi.org/10.1016/j.marenvres.2015.03.012 |
| D6C3/D6C5 | Traits and community structure. | It is explored variability in abundance, species number, species richness, evenness, ES(50), Shannon H', % Southern species, % Northern species, % Arctic-boreal species, % Temperate species, % Interface feeder, % Sand licker, % Surface deposit feeder, % Subsurface deposit, % Suspension feeder, % Predator, and community structure. | Kröncke 2011 https://doi.org/10.1016/j.ecss.2011.06.015 |
| D6C3/D6C5 | Surface of *Zostera noltii* meadows' area, several biological indices. | It is explored variability in AZTI's Marine Biotic Index (AMBI), Taxonomic Diversity, Berger–Parker, Margalef index, Shannon–Wiener index, Infaunal Trophic Index (ITI), Exergy. | Patrício et al. 2009 https://doi.org/10.1016/j.marenvres.2009.04.001 |

**Fisheries Benthic Impact Tools (FBIT)**

- Source: https://github.com/ices-eg/FBIT
- References: ICES (2020): https://doi.org/10.17895/ices.pub.5955
- Brief description: this software (implemented as an R package) models the impact of bottom trawl fishing activities based upon the population dynamic model (Pitcher et al., 2017 https://doi.org/10.1111/2041-210X.12705 ).

**icesVMS**

- Source: https://github.com/ices-tools-prod/icesVMS
- References: Rees (2003): https://doi.org/10.5670/oceanog.2003.52
- Brief description: this software (implemented as an R package) helps to the exploration of data based on VMS/Logbook databases. It is required for the use of FBIT.

**NEAT**

- Sources: http://www.devotes-project.eu/neat/ https://www.azti.es/productos/software-neat-nested-environmental-status-assessment-tool/
- References: Kazanidis et al. (2020): https://doi.org/10.1016/j.ecolind.2020.106624
- Brief description: this software was developed for assessing the environmental status of marine areas according to the European Marine Strategy Framework Directive (MSFD).

# Annex 15: Descriptor 10 - Marine litter does not cause harm

***Description of the indicator(s) and/or index/indices used in the trend analyses, including definitions, units and, if relevant, scale/range.***

*Table 15A: Criteria, indicator(s), spatial range of distribution, units of measurements and sources of dataset reviewed (Source: modified from Galgani et al. 2021).*

| Criteria | Indicator | Regional Sea | Location | Country | Units of measurement for the criteria | Source |
|---|---|---|---|---|---|---|
| D10C1 | Macroplastics | Atlantic | NE Atlantic | -- | items/tow (number, %), Number entanglements $m^{-2}$, Macroplastic entanglements per area covered, tow and per km; | Ostle et al., 2019 |
| D10C1 | Marine litter | Atlantic | North Sea, UK waters | UK | Items $km^{-2}$, spatial distribution, item composition | Maes et al., 2018 |
| D10C1 | Marine litter | Atlantic | OSPAR area | Seven Contracting Parties | Items size, composition, Items $km^{-2}$, spatial distribution | OSPAR, Composition and Spatial Distribution of Litter on the Seafloor |
| D10C1 | Marine litter | Mediterranean | French Mediterranean Waters | France | Items $km^{-2}$, items $km^{-1}$, kg $km^{-2}$ | Gerigny et al., 2019 |
| D10C1 | Marine litter | Atlantic | OSPAR area | Various | Items size, composition, items $100m^{-1}$, spatial distribution | OSPAR Beach Litter - Abundance, Composition and Trends |
| D10C1 | Marine litter | Atlantic | European coast | Various | Items size, composition, items $100m^{-1}$, Items $km^{-2}$, spatial distribution | MLW (EEA initiative) |
| D10C1 + D10C4 | Marine litter | Atlantic | North Greenland Sea (Hausgarten observatory) | Greenland | Item size, colour, composition; number of items; Items $km^{-2}$; Proportion of individuals affected by litter | Parga Martínez et al. 2020 |
| D10C2 | Microplastics | Atlantic | Irish continental shelf | Ireland | Item size, colour, composition; number of items; microplastic deposition rate | Martin et al., 2017 |
| D10C3 | Micro and meso plastics | Atlantic | NE Atlantic / Rocall Trough | West of United Kingdom | abundance of microplastics per gr of wet weight soft tissue, microplastic ingestion, polymer diversity (Shannon-Weiner H'), total number of unique polymer types ingested by each species and grouped | Courtene Jones et al., 2019 |
| D10C3 + D10C2 | Marine litter | Baltic Sea | Bornholm Basim | Between Poland, Sweden, Danmark | Item size, color, composition; number of particles $m^{-3}$ of filtered sea water; number of particles/digestive tract | Beer et al., 2018 |
| D10C3 | Marine litter | Mediterranean | Valencia Coast (Western Mediterranean) | Spain | Weight (g) debris in each digestive content (dry weight (in gr) and wet volume (in ml); number of items, body burden | Domènech et al., 2019 |
| D10C3 | Microplastics | Atlantic | OSPAR area | Various | Items size, colour, composition, total mass of plastic in individual stomachs, and the | OSPAR, Plastic Particles in Fulmar |

| Criteria | Indicator | Regional Sea | Location | Country | Units of measurement for the criteria | Source |
|---|---|---|---|---|---|---|
| | | | | | percentage of stomachs exceeding the 0.1g critical level | Stomachs in the North Sea |
| D10C3 + D10C4 | Macroplastics | Atlantic | Irish waters | Ireland & Northern Ireland (UK) | Size of debris/plastic; number of items; body distribution of marine litter; number of items/individual; colour of microplastic<br>number of individuals affected (lethal; sub-lethal) per species | Lusher et al., 2018 |

**Methodologies for indicator and/or index calculation including relevant references and trends.**

*Table 15B: Criteria, indicator(s), species or compartment analysed, duration of the dataset, sampling frequency, applied methodology and source of information. Source: modified from Galgany et al., 2021). CPR: Continuous Plankton Recorder; MLW: Marine Litter Watch.*

| *Criteria* | *Indicator* | *Compartment/species* | *Period (duration)* | *Frequency* | *Methods* | *Source* |
|---|---|---|---|---|---|---|
| D10C1 | Macroplastics | Floating/ subsurface | 1957–2016 | Continuous | Debris trapped in towed CPR, 16,725 tows | Ostle et al., 2019 |
| D10C1 | Marine litter | Seabed | 1992–2017 | Continuous | 17–150 stations $yr^{-1}$, Trawling, MSFD classification | Maes et al., 2018 |
| D10C1 | Marine litter | Seafloor | 2012 - 2014 | Anual | Trawl surveys, IBTS protocol | OSPAR, Composition and Spatial Distribution of Litter on the Seafloor |
| D10C1 | Marine litter | Sea floor | 1994–2017 (except 2007) | Continuous | Trawling, 1,902 hauls, MSFD classification system | Gerigny et al., 2019 |
| D10C1 | Marine litter | Beach | 2001 - today | Irregular | Visual, Ospar protocol | OSPAR Beach Litter - Abundance, Composition and Trends |
| D10C1 | Marine litter | Beach | 2014 - 2019 | Irregular | Visual, MSFD classification | MLW (EEA initiative) |
| D10C1 + D10C4 | Marine litter | Seafloor<br>Benthic macrofauna | 2002 - 2017 | Continous | Photographic survey<br>OFOS Specifications | Parga Martínez, et al., 2020 |
| D10C2 | Microplastics | Sediment | 2014 - 2015 | Various | Core liners of 66 mm diameter, microplastic size: 250-5000 µm, Dense media floatation (sodium polytungstate & dry sieving of sediment subsamples) | Martin et al., 2017 |

| *Criteria* | *Indicator* | *Compartment/species* | *Period (duration)* | *Frequency* | *Methods* | *Source* |
|---|---|---|---|---|---|---|
| D10C3 | Micro and meso plastics | Ingested by seabirds (fulmars,) | 1979–2012 | Irregular (stranded individuals) | OSPAR regular protocol (mass and number), visual sorting, 973 samples stranded | Van Franeker and Lavender Law, 2015 |
| D10C3 | Microplastic | Ingested microplastics by two deep-sea benthic invertebrates | 1976-2015 | Continuous (except 1996-2012) | Digestion of tissues, FTIR characterisation, Contamination addressed | Courtene Jones et al., 2019 |
| D10C3 + D10C2 | Marine litter | Floating/ingested microplastics (Atlantic herring and sprat) | 1987–2015 | Continuous | 245 stations of plankton (bongo) and trawling, 814 samples stomach content, visual sorting, needle test, | Beer et al., 2018 |
| D10C3 | Marine litter | Ingested by sea turtles | 1995–2016 | Irregular (stranded individuals/ fishermen bycacth | MSFD classification system | Domènech et al., 2019 |
| D10C3 | Microplastics | Ingested by Fulmar | 2005 - 2014 | various | OSPAR protocol | OSPAR, Plastic Particles in Fulmar Stomachs in the North Sea |
| D10C3 D10C4 | Macroplastics | Entanglement/ Ingested by cetaceans | 1990–2015 | Irregular (stranded individuals/ fishermen bycacth | Stomach content | Lusher et al., 2018 |

***Data sources, including access to science-based target values as well as a provisional assessment of gaps and uncertainties.***

*Table 15C: Criteria, indicator(s), source and data provider information (Source: modified from Galgani et al, 2021). MLW: Marine Litter Watch.*

| *Criteria* | *Indicator* | *Source* | *Data provider* |
|---|---|---|---|
| D10C1 | Macroplastics | Ostle et al., 2019 | As excel in the supplementary data, from CPR |
| D10C1 | Marine litter | Maes et al., 2018 | https://www.cefas.co.uk/data-and-publications/dois/North-east-atlantic-seafloor-litter-data/ |
| D10C1 | Marine litter | OSPAR, Composition and Spatial Distribution of Litter on the Seafloor | https://odims.ospar.org/ |
| D10C1 | Marine litter | Gerigny et al., 2019 | MEDiterranean International Trawl Survey (MEDITS) scientific programme |
| D10C1 | Marine litter | OSPAR Beach Litter - Abundance, Composition and Trends | https://odims.ospar.org/ |
| D10C1 | Marine litter | MLW (EEA initiative) | https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/marine-litterwatch/data-and-results/marine-litterwatch-data-viewer |
| D10C1 + D10C4 | Marine litter | Parga Martínez, et al_2020 | https://doi.pangaea.de/10.1594/PANGAEA.912471 |
| D10C2 | Marine litter | Martin et al, 2017 | Data will be made available on request |

| *Criteria* | *Indicator* | *Source* | *Data provider* |
|---|---|---|---|
| D10C3 | Microplastics | Van Franeker and Lavender Law, 2015 | Data will be made available on request |
| D10C3 | Micro and meso plastics | Courtene Jones et al., 2019 | Data will be made available on request |
| D10C3 + D10C2 | Microplastic | Beer et al., 2018 | Data will be made available on request |
| D10C3 | Marine litter | Domènech et al., 2019 | Supplementary data |
| D10C3 | Microplastics | OSPAR, Plastic Particles in Fulmar Stomachs in the North Sea | https://odims.ospar.org/ |
| D10C3 + D10C4 | Marine litter | Lusher et al., 2018 | As excel in the supplementary data |

***Key results of the trend analyses for specific indicators and/or index/indices***

*Table 15D: Criteria, indicator(s), compartments affected, trends and source information (Source: modified from Galgani et al., 2021). MLW: Marine Litter Watch.*

| *Criteria* | *Indicator* | *Compartment/species* | *Trends* | *Source* |
|---|---|---|---|---|
| D10C1 | Macroplastics | Floating/ subsurface | Increase since 1957, no trend since 2000, no change in Arctic waters | Ostle et al., 2019 |
| D10C1 | Marine litter | Seabed | No detectable trend | Maes et al., 2018 |
| D10C1 | Marine litter | Seafloor | No trends | OSPAR, Composition and Spatial Distribution of Litter on the Seafloor |
| D10C1 | Marine litter | Sea floor | No regular increase but higher levels in 1999-2001 and since 2012 | Gerigny et al., 2019 |
| D10C1 | Marine litter | Beach | No trends | OSPAR Beach Litter - Abundance, Composition and Trends |
| D10C1 | Marine litter | Beach | Increase through the years | MLW (EEA initiative) |
| D10C1 + D10C4 | Marine litter | Seafloor<br>Benthic macrofauna | Litter density clearly increased over time; no clear temporal trend in material composition; the size of litter varied significantly over time; Plastic is the main material type and comes mostly in small size | Parga Martínez, et al., 2020 |
| D10C2 | Marine litter | Sediment | Trend of a rapid decrease in microplastic abundance with sediment depth observed within the fisheries near Galway supports the assumption that microplastic deposition is increasing over time | Martin et al., 2017 |
| D10C3 | Microplastics | Ingested by seabirds (fulmars,) | Increase to mid-1990s; stable in the last decade; significant decrease of pellets | Van Franeker and Lavender Law, 2015 |
| D10C3 | Micro and meso plastics | Ingested microplastics by two deep-sea benthic invertebrates | No trend | Courtene Jones et al., 2019 |
| D10C3 + D10C2 | Microplastic | Floating/ingested microplastics (Atlantic herring and sprat) | No change in floating or ingested microplastics | Beer et al., 2018 |
| D10C3 | Marine litter | Ingested by sea turtles | Slight decrease | Domènech et al., 2019 |
| D10C3 | Microplastics | Ingested by Fulmar | Levels of plastic ingestion by fulmars in the North Sea appear to have stabilised at around 60% of individuals exceeding the 0.1 g level of plastic ingestion specified in the OSPAR long-term goal definition | OSPAR, Plastic Particles in Fulmar Stomachs in the North Sea |
| D10C3 + D10C4 | Marine litter | Water column / Ingested by cetaceans | No trend for ingestion of litter and entanglement | Lusher et al., 2018 |

# Appendix 16: Baltic Sea

The Baltic Sea in a brackish inland sea in Northern Europe bordered by Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden. It is connected to the North Sea via the Kattegat and the Danish Straits (Little Belt, Great Belt and the Sound). Large parts of the Baltic Sea are affected by nutrient inputs and eutrophication problem areas are widespread. Eutrophication status of the open parts of the Baltic Sea have been studies and reported multiple times.

Figure 16A show the basis-specific results, on which Box x is based:

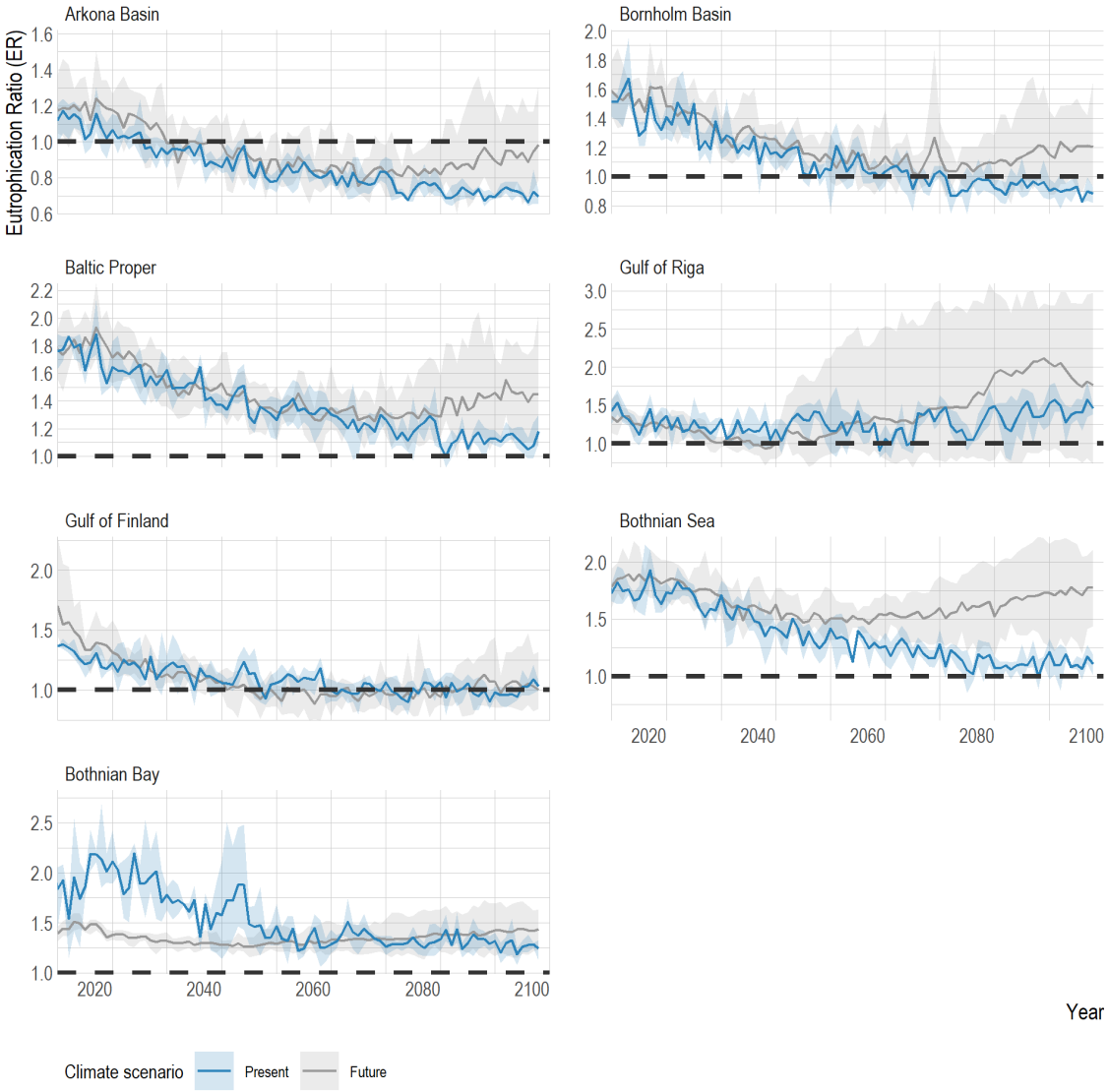



*Figure 16A:* Future eutrophication status for seven basins of the Baltic Sea estimated by the HEAT tool for present and future climate scenarios. Lines and shading show, respectively, the average and range for 6 future climate models and 3 present climate models. ER>1.0 indicates a eutrophication problem.

# Appendix 17: Ranfjorden

The Ranfjord is situated in Nordland county in northern Norway. The Ranfjord is 67 km long and has maximum depth of 540 meters. In the innermost part of the Ranfjord lies Mo i Rana city in Rana municipality.

River Ranelva, a 130 km long watercourse, has its outlet in the innermost part of the Ranfjord. The river transports a water volume of approximately 290 $m^3$ per sec. to the fjord. The mountain area in Rana has rich resources of metals and minerals. Ore prospecting and ore extraction has been an important activity in Rana. Iron works was established at Rana in 1899. Today Rana Gruber extracts iron from mines in Rana. Mine tailings from the ore processing is discharged to the fjord at approximately 120 meters depth. The flotation chemical Lilaflot D817M has been used in the extraction process and has been discharged to the fjord with the mine tailings. Lilaflot D817M is toxic to aquatic organisms. Rana Gruber stopped using the flotation chemical Lilaflot D817M in 2017.

In Mo i Rana city there are several metal smelters and metal processing companies. The metal industry companies have for many years had discharges of heavy metals and polycyclic aromatic hydrocarbons (PAH) to the Ranfjord. There are also landfills on the industry sites, and other areas with contaminated soil. Leachate from landfills and contaminated soil contains metals and PAHs. In Mo i Rana there is a company for handling and treatment of contaminated masses, production waste and environmental harmful materials. A closed mine is being used as landfill for these waste materials. Leachate from landfills and contaminated soil drains out to the Ranfjord. The inner part of the Ranfjord has become polluted by heavy metals and PAHs due to the local industry. The environmental authorities in Norway have given the Ranfjord high priority for sediment remediation actions, but this has not been done due to the ongoing high pollution from the local industry.

Levels and trends of contaminants in blue mussels in the inner part of the Ranfjord have been monitored since the early 1990-ies. The monitoring of contaminants in blue mussels was for many years done on a national monitoring project (Green et al. 2015), and from 2015 this monitoring was carried out as operational monitoring on behalf of the local industry (Øxnevad & Hjermann 2020). Bulk samples of blue mussels have been analysed for heavy metals PAHs and other organic compounds. Contaminants in sediments in the Ranfjord have been monitored since the 1980-ies in national monitoring programmes and on behalf of local industry (Green et al. 1993, Helland et al. 1994, Øxnevad & Bakke 2013, Øxnevad et al. 2019). Ecological status has been monitored in the Ranfjord since 1992 by monitoring of soft bottom fauna (Øxnevad et al. 2019).

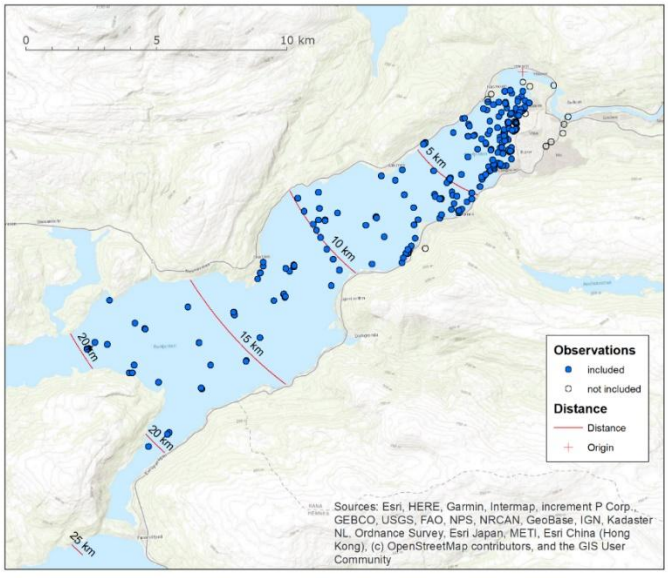



*Figure 17A:* Observations from Ranfjord, showing the division into 5 km intervals, measured from the northern end of the fjord.

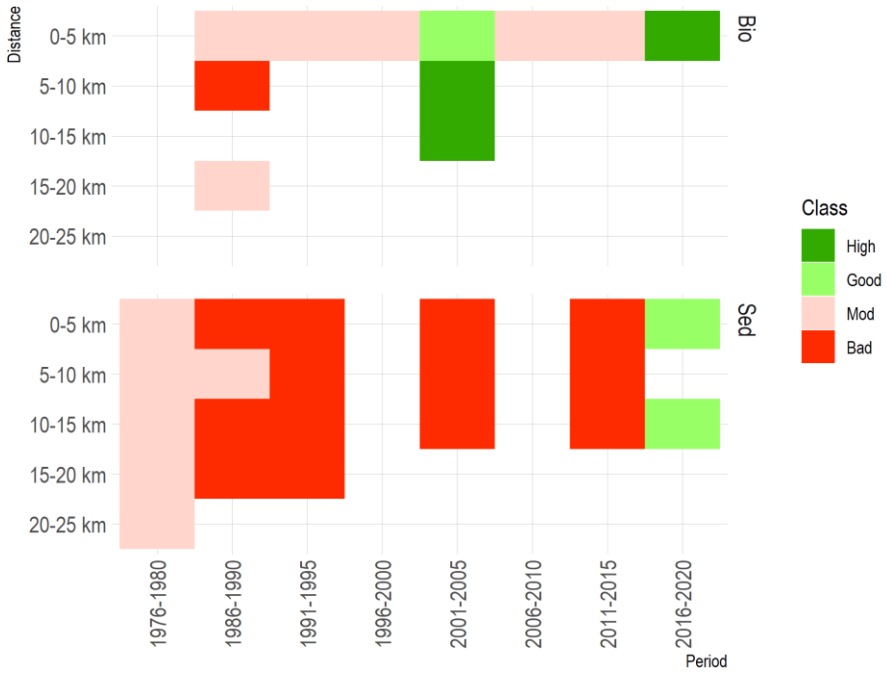



*Figure 17B: CHASE classifications for 5 km sections of fjord over 5-year periods from 1976*

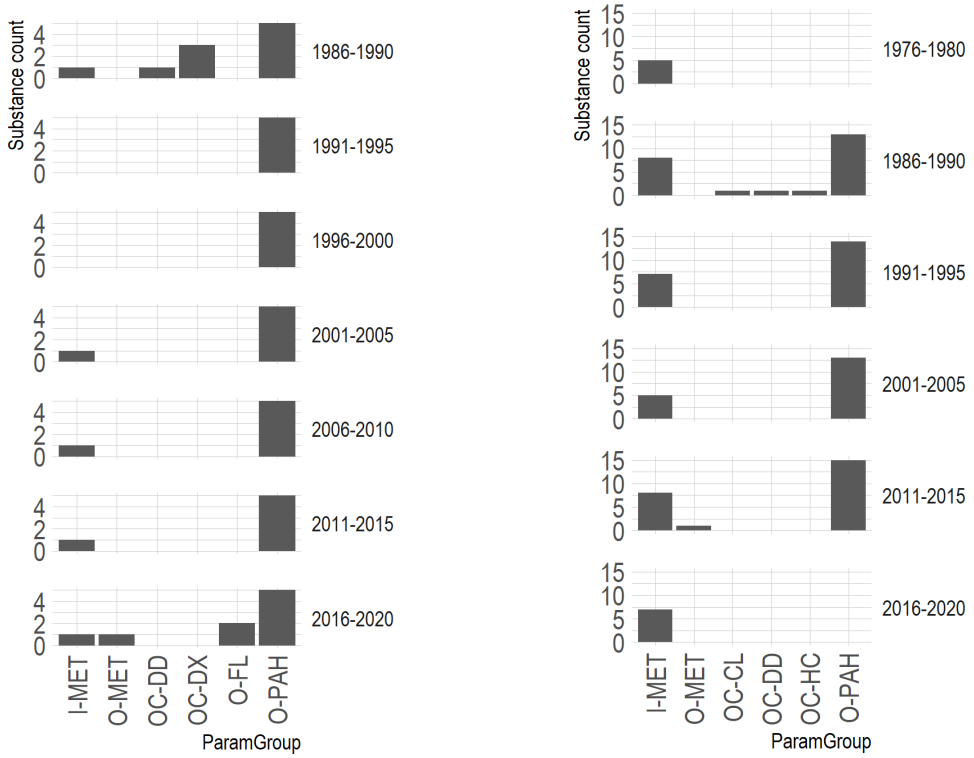



*Figure 17C:* Counts by substance group of the number of different substances measured in biota (left) and sediment (right) I-MET: metals, O-MET: organo-metallic compounds, OC-CL: chlorinated compounds, OC-DD: DDTs, OC-DX: dioxins, OC-HC: hexachlorocyclohexanes, O-FL: fluorinated compounds, O-PAH: poly-cyclic aromatic hydrocarbons.

# Appendix 18: North Sea

For the purpose of this report the definition used for the North Sea is the subregion 'Greater North Sea, incl. the Kattegat and the English Channel' as defined for the Marine Strategy Framework Directive[17]. The 'Greater North Sea, incl. the Kattegat and the English Channel' subregion borders Belgium, Denmark, France, Germany, Great Britain, Norway, Sweden and The Netherlands.

The 'Greater North Sea, incl. the Kattegat and the English Channel' is a temperate coastal shelf sea with a deep channel in the northwest, a permanently thermally mixed water column in the south and east, and seasonal stratification in the north.

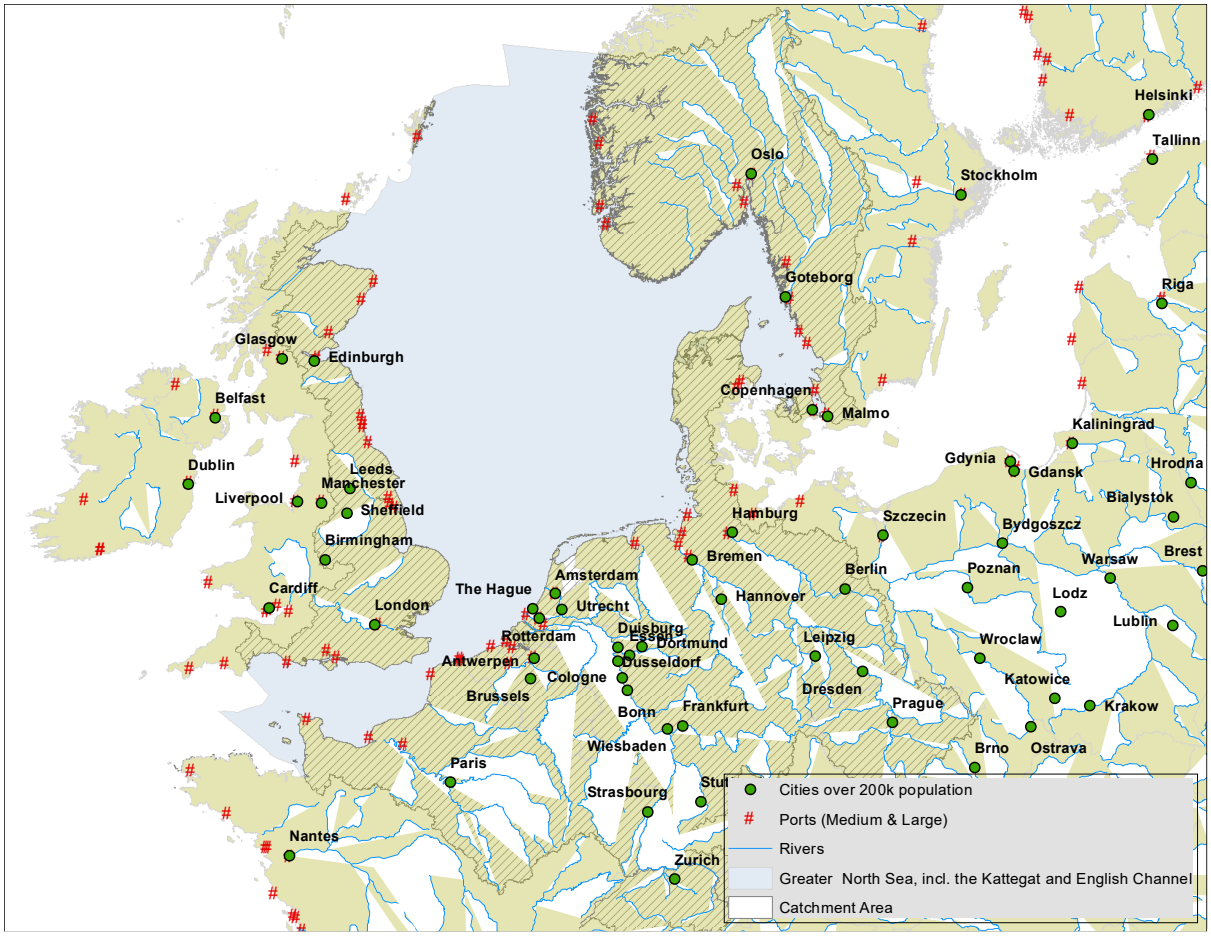



*Figure 18A:* Greater North Sea, including the Kattegat and the English Channel' subregion with indication of the catchment area and major cities.

The 'Greater North Sea, incl. the Kattegat and the English Channel' subregion consists of four key areas[18]:

- Northern North Sea (depths 0–500 m) is strongly influenced by oceanic inflow and has a deep channel in the east. The majority of the area is stratified in summer. The dominant human activities are fishing and oil and gas production.
- Southern North Sea (depths 0–50 m) is characterized by large river inputs and strongly mixed water. The dominant human activities are fishing, shipping, ports, gas production, wind farms, and aggregate (sand) extraction.

[17] *Marine regions and subregions under the Marine Strategy Framework Directive, EEA 2021, (Marine regions and subregions under the Marine Strategy Framework Directive — European Environment Agency (europa.eu))*

[18] *ICES Ecosystem Overviews, Greater North Sea Ecoregion, ICES 2020*

- The Skagerrak and Kattegat forms the link to the Baltic Sea and is less saline and less tidal than the rest of the ecoregion. The water column is usually mixed. The dominant human activities are fishing, shipping, and wind farms.
- The English Channel joins the southern North Sea to the Atlantic. It is usually mixed and heavily influenced by wind events. The dominant human activities are fishing, shipping, and aggregate (gravel) extraction.

Data on contaminants in biota, sediment and seawater in the 'Greater North Sea, incl. the Kattegat and the English Channel' has been provided by ICES and originates from a range of countries and institutes. Data has mainly been prepared for the OSPAR CEMP and HELCOM COMBINE monitoring programmes, but also data gathered through projects and various working group activities are included. Data references are listed below. All data was extracted from ICES databases on 17 August 2020.

Data was mapped to stations from the ICES Station Dictionary[19] based on datatype (biota, sediment or seawater), geographic position and date. Only stations that has been flagged for temporal trend monitoring were used for the mapping. In cases where more than one station in the ICES Station Dictionary matches data, then one with the closest distance has been selected.

For the mapping of stations to data the following selection criteria were used:

1. For data having been monitored for OSPAR and HELCOM stations from Denmark, France, Ireland, Norway, Sweden, United Kingdom and Spanish data after 2004, the station has been looked up based on match with submitted station name, temporal range of the station. Only stations flagged for OSPAR and HELCOM monitoring purposes were used

2. For data having been monitored for OSPAR and HELCOM from other countries the station lookup has been based on geographic location and the temporal range of the station. Only stations flagged for OSPAR and HELCOM monitoring purposes were used

3. If 1 and 2 did not result in a station match the station lookup has been based on submitted station name, geographic location and temporal range of the station

4. If 1, 2 and 3 did not result in a station match the station lookup has been based on geographic location and temporal range of the station

Criteria 1 and 2 are identical to the ones used for the OSPAR MIME annual trend assessment, selection 3 and 4 are added to facilitate data from other monitoring programmes (e.g. national monitoring) or OSPAR and HELCOM monitoring data that do not match with a station flagged for OSPAR and HELCOM monitoring.

Data references to acknowledge:

- British Oceanographic Data Centre, Joseph Proudman Building, Liverpool, United Kingdom
- Data supplied by The British Oceanographic Data Centre on behalf of the UK Marine Assessment and Reporting Group
- Bundesamt für Seeschiffahrt und Hydrographie, Hamburg, Germany
- Bundesanstalt für Gewässerkunde, Federal Institute of Hydrology, Koblenz, Germany
- Bundesforschungsanstalt für Fischerei, Institut für Fischereiökologie, Hamburg, Germany
- Centre for Environment, Fisheries and Aquaculture Science, Burnham Laboratory, Burnham-on-Crouch, United Kingdom
- DHI Water and Environment, Hørsholm, Denmark
- Fisheries Research Services, Marine Laboratory, Aberdeen, United Kingdom
- Geological Survey of Sweden, Uppsala, Sweden

[19] *ICES Station Dictionary (https://www.ices.dk/data/tools/Pages/Station-dictionary.aspx)*

- Göteborg University, Department of Analytical and Marine Chemistry, Göteborg, Sweden
- IFREMER, Centre de Brest, Plouzané, France
- IFREMER, Centre de Nantes, DEL/PC, Nantes Cédex 3, France
- ILVO Fisheries, Institute for Agricultural and Fisheries Research, Oostende, Belgium
- Institut für Ostseeforschung, Warnemünde, Rostock-Warnemünde, Germany
- Institute of Marine Research, Bergen-Nordnes, Norway
- Irish Marine Institute, Fisheries Research Centre, Abbotstown Laboratory Complex, Dublin 15, Ireland
- Landesamt für Landwirtschaft, Lebensmittelsicherheit und Fischerei, Mecklenburg- Vorpommern, Rostock, Germany
- Landesamt für Umwelt, Naturschutz und Geologie in Mecklenburg-Vorpommern, Mecklenburg-Vorpommern, Güstrow, Germany
- Landesforschungsanstalt für Landwirtschaft und Fischerei, Mecklenburg-Vorpommern, Gülzow (LFA), Germany
- Management Unit of the North Sea and Scheldt Estuary, Mathematical Models, Brussels, Belgium
- National Environmental Research Institute, Chemical and Community data, Roskilde, Denmark
- National Institute for Coastal and Marine Manageme, The Hague, The Netherlands
- National Institute of Nutrition and Seafood Research (NIFES), Bergen, Norway
- Naturhistoriska Riksmuseet, Miljøgiftsgruppen PMK, Stockholm, Sweden
- Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz, Betriebsstelle Hannover-Hildesheim, Hildesheim, Germany
- Niedersächsischer Landesbetrieb für Wasserwirtschaft, Küsten- und Naturschutz, Direktion, Dienstgebäude Norden, Norden, Germany
- Niedersächsisches Landesamt für Ökologie, Forschungsstelle Küste, Norderney, Germany
- Norwegian Institute for Water Research, Oslo, Norway
- Regional Center "Monitoring of the Arctic" of Roshydromet, Laboratory of Analytical Chemistry, St. Petersburg, Russia
- Rijksinstituut voor Vissery Onderzoek, Ijmuiden, The Netherlands
- Rijks-Kwaliteitsinstituut voor land- en tuinbouwprodukten, Wageningen, The Netherlands
- Rijkswaterstaat, Monitoring en Laboratorium, Lelystad, The Netherlands
- Ringkøbing Amtskommune Danmark, Vandmiljøafdelingen, Ringkøbing, Denmark
- Scottish Office Agriculture, Environment and Fisheries Department, Freshwater Fisheries Laboratory, Pitlochry, United Kingdom
- State Agency for Agriculture, Environment and Rural Areas Schleswig-Holstein Schleswig-Holstein, Schleswig-Holstein, Flintbek, Germany
- Swedish Environmental Research Institute, IVL Svenska Miljöinstitutet, Göteborg, Sweden
- Swedish Meteorological and Hydrological Institute, Oceanographic Unit, Vastra Frolunda, Sweden
- Swedish University of Agricultural Sciences, Department of Aquatic Resources, Oregrund, Sweden
- Wageningen IMARES, Ijmuiden, The Netherlands
- Wassergütestelle Elbe, Hamburg, Germany

# Appendix 19: Nervión Estuary

The Nervión estuary is located on the northern coast of Spain, south-eastern Bay of Biscay. It is a meso-tidal system with a semidiurnal tidal regime and drains a watershed of 1,700 $km^2$, approximately, with an annual freshwater inflow of about 36 $m^3$ $s^{-1}$. Residence time is high: theoretically, river flow would take 1 to 2 months to infill the mean volume of the estuary (Valencia et al., 2004).

The system is 22 km long and two areas can be distinguished: a 15 km long, narrow and relatively shallow channel (maximum depth of about 10 m), that crosses the metropolitan area of the city of Bilbao, and a semi-enclosed coastal embayment, with an area of approximately 20 $km^2$ and a maximum depth of about 30 m.

The tide is the most important and predictable factor affecting the hydrological patterns in the Nervión estuary (González et al., 2004). However, river flow is also a significant factor that controls the estuarine hydrology and, in particular, haline stratification. The inner part is highly stratified all year round, but stratification weakens gradually towards the outer part, where, at bottom, salinity values approach those of the surrounding shelf waters (35.0 to 35.7). Under unusual high river flow conditions, however, the entire channelized zone may be filled by freshwater at low tide, and the strongest salinity gradient moves to the outer zone (Valencia et al., 2004).

In the Nervión estuary the exploitation of abundant local iron ore led to the early industrial development during the mid-19$^{th}$ century. The first iron and steel industries were established in the middle estuary over reclaimed marshes in 1854 (García-Merino, 1987). The area experienced an intense industrial growth (mining, steel factories, shipyards, chemical products, etc.) together with a population increase. The original estuary was rapidly reduced in size through land reclamation. In addition, the estuary received wastes from many sources, which significantly degraded its environmental quality (Borja et al., 2006; González-Oreja and Saiz-Salinas, 1998; Iriarte et al., 1998; Uriarte and Borja, 2009). In fact, in the 20$^{th}$ century the system became the most contaminated estuary in the North of Spain, with very high concentrations of nutrients, contaminants and faecal bacteria in the water, hypoxia and even anoxia in the middle and inner reaches, highly contaminated sediments, etc. Biological communities were very impoverished and, indeed, big fauna (fishes, crustaceans) was absent in the innermost estuary.

In 1979 a sewerage scheme was approved. The main objective of this plan was the recovery of the aquatic life, as well as the rehabilitation of the beaches located in the outer area of the system for the public use. A Water Quality Standard (WQS) based on oxygen was established at 60% saturation. In 1990 a sewage treatment plant (STP) was put into operation with a physicochemical (primary) treatment; since then, the treated waters are discharged in the Galindo tributary, in the middle estuary. Meanwhile, the population served by the sewerage system and the volume of water treated in the Galindo STP progressively increased. A biological (secondary) treatment came in operation in 2001. Afterwards, the sewerage scheme has progressively expanded with the connection of different districts of the metropolitan area. Nowadays a population of almost 1 million inhabitants is connected to the sewerage system; anyway, improvements to the system are being carried out (storm water retention tanks, new STP in the basin, etc.).

The original morphology of the estuary has been historically modified by land reclamation, diking, scoring, dredging activities to maintain the navigation on the channel, etc. Due to these alterations the Nervión estuary is a heavily modified water body, according to the Water Framework Directive (WFD).

To assess the evolution of the environmental quality of this estuary, two monitoring programmes were put into operation by the Bilbao Water Authority and the Basque Water Agency in 1990 and 1995, respectively. In this way, many physico-chemical and biological components of water and sediments have been monitored (e.g. Borja et al., 2006; Cuevas et al., 2016; Díez et al., 2009; Larreta et al., 2013; Seoane et al., 2005; Uriarte and Borja, 2009). These monitoring programmes have been carried out continuously.

As a result of the industrial decline and the implementation of the sewerage scheme, the environmental status of the Nervión estuary has progressively improved, as reflected in the water quality (Garcia-Barcina et al., 2006; Pouso et al., 2018a; Capilla, 2008; García-Barcina et al., 2006; Hess et al., 2001; Pouso et al., 2018b; Wise and Comrie, 2005), the quality of sediments (Fdez-Ortiz de Vallejuelo et al., 2010; Irabien et al., 2018), the benthic community ((Borja et al., 2006; Díez et al., 2009) and the fish community (Uriarte and Borja, 2009).

Of special importance was the improvement in the oxygen conditions; for many decades' oxygen deficiency was, by far, the most limiting factor for the biological communities in the middle and inner estuary. In fact, the WQS was not fulfilled. After the entrance into operation of the biological treatment in 2001 oxygen levels have progressively increased and nowadays the WQS is fulfilled along all the system; hence, oxygen is not a limiting factor for the biological communities anymore.

Another important issue are the services the estuary provides to society. Nowadays the beaches located in the outer area of the system present good conditions for bathing and users perceive the improvement of the quality of the waters and its relationship with the sewerage. The economic value related to the recreational use of the beaches has been estimated in 3.5 M € per year (summer season). This represents 100% of the maintenance costs of the beaches plus 12% of the annual sewerage costs (Pouso et al., 2018b).

According to the last assessment of the estuary under the Water Framework Directive (Borja et al., 2020), in spite of the good ecological potential, the system does not fulfil the good overall status because it does not comply with the chemical status. The contaminant of main concern is hexachlorocyclohexane (HCH).

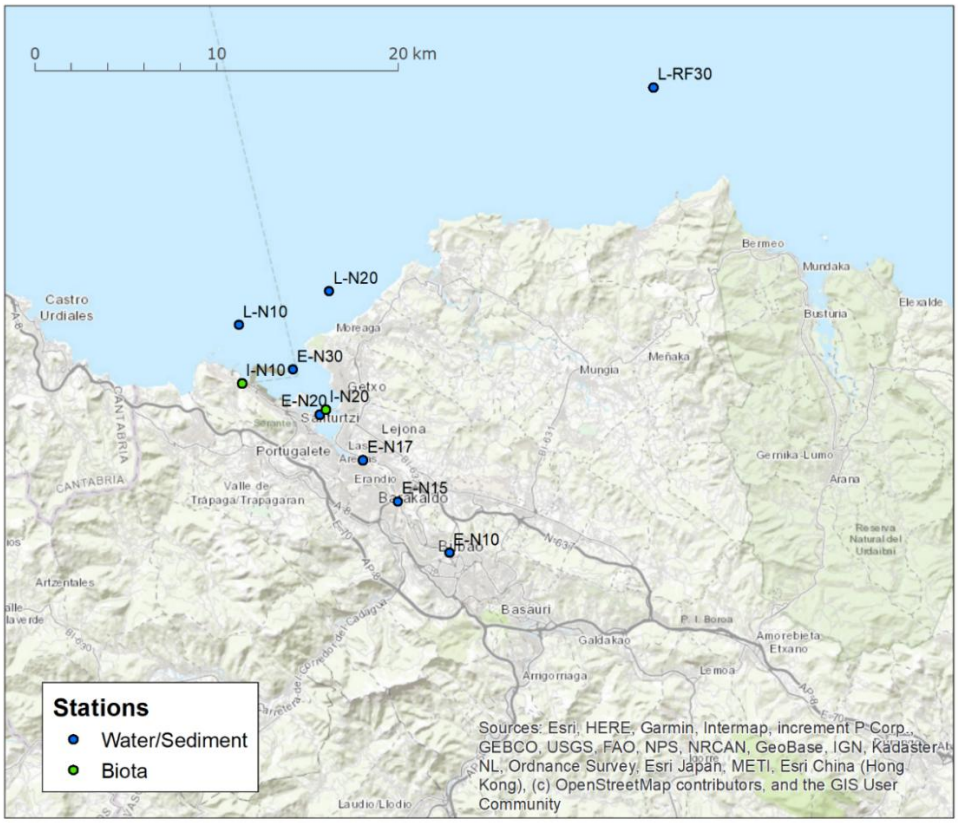



*Figure 19A:* Map of sampling stations within the Nervión estuary and adjacent coastal area.

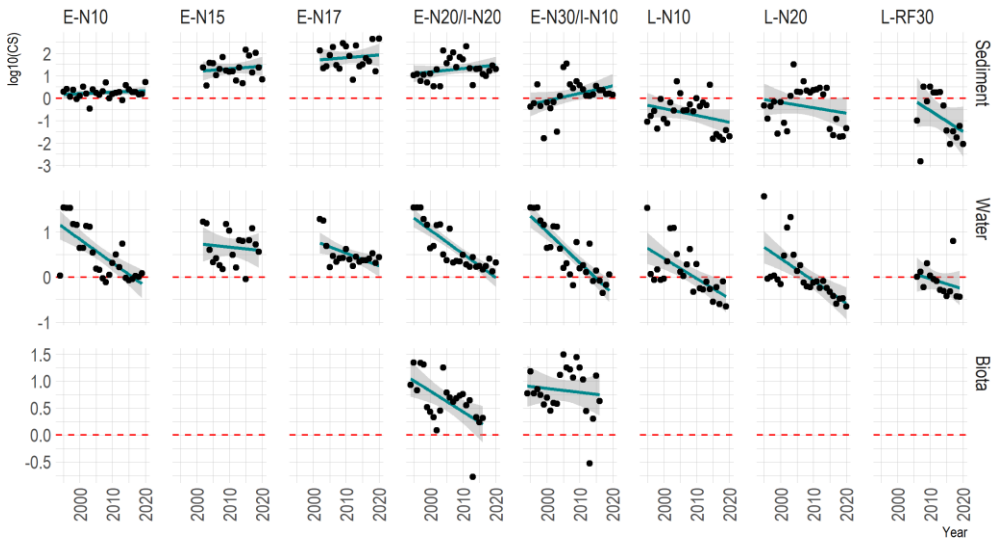



*Figure 19B:* CHASE assessment in categories Sediment, Water and Biota, within the Nervión estuary