



Initial Assessment of European Seas based on Marine Strategy Framework Directive Article 8 reporting

Summary report



ETC/ICM Technical Report 1/2015

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This European Topic Centre on Inland, Coastal and Marine Waters (ETC/ICM) Technical Report has been prepared by ETC ICM partners, based on Marine Strategy Framework Directive Article 8 reporting. Data for analysis were taken from the electronic database on MSFD Article 8. The report aims at providing an overview of topics and problem areas of EU Seas as reported by Member States. It has been subject to a European Environment Agency (EEA) member country review. The contents of this publication do not necessarily reflect the official opinions of the EEA, European Commission or other institutions of the European Communities. Neither the ETC/ICM nor any person or company acting on behalf of the ETC/ICM is responsible for the use that may be made of the information contained in this report.

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Abbreviations

CFP	Common Fisheries Policy
EEA	European Environment Agency
ETC ICM	European Topic Centre for Inland, Coastal and Marine Waters
GES	Good Environmental Status
MSFD	Marine Strategy Framework Directive 2008/56
WFD	Water Framework Directive
MPAs	Marine Protected Areas

Executive summary

Background and context

The aim of the Marine Strategy Framework Directive 2008/56 ('MSFD') (EC, 2008), often referred to as the Marine Directive, is to achieve Good Environmental Status (GES) of the EU's marine waters by 2020. MSFD requires Member States to put in place the necessary management measures, to protect and conserve the marine environment, prevent its deterioration, and, where practicable, restore marine ecosystems in areas where they have been adversely affected. The implementation process runs in 6 year cycles during which Member States are required to take several steps.

23 Member States (Belgium, Bulgaria, Cyprus, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Croatia, Ireland, Italy, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, Romania, Sweden, Slovenia, United Kingdom) had to provide information on the initial assessment (Article 8 of the directive), on the determination of GES (Article 9) and on the establishment of environmental targets and associated indicators (Article 10) in 2012.

Data analysis of the initial assessments (Article 8) as reported by Member States in 2012 was undertaken by the EEA (ETC ICM) with the aim to summarise messages given by initial assessments about the European marine environment. Initial assessments provided information on:

- Analysis of features and characteristics, including physical features and features relating to biodiversity such as habitats, species and functional groups (Article 8-1a);
- Analysis of the predominant pressures and impacts, including human activity, on the environmental status. (Article 8-1b);
- An economic and social analysis of the use of those waters' characteristics (Article 8-1c).

This ETC/ICM Technical Report gives an overview and summary of the detailed data analysis which is provided in three internal supplements to the Technical report:

- ETC ICM, 2014 a: Ana Jesus, Rebecca Oliver, Beth Stoker (JNCC), Monika Peterlin (IWRS). Initial Assessment of European Seas based on Marine Strategy Framework Directive Article 8 reporting: **Analysis of features and characteristics reported under MSFD 8.a**. Magdeburg: European Topic Centre on inland, coastal and marine waters, 2014.
- ETC ICM, 2014 b: Monika Peterlin (IWRS), Theo Pins, Claudette Spiteri (Deltares), Frank Thomsen (DHI), GerJan Piet (IMARES), (HCMR), Hans Mose Jensen (ICES), Andreja Palatinus (IWRS), Norman Green (NIVA), Lidija Globevnik (TC vode). Initial Assessment of European Seas based on Marine Strategy Framework Directive Article 8 reporting: **Pressures and impacts reported under MSFD Art 8.b**. Magdeburg: European Topic Centre on inland, coastal and marine waters, 2014.
- ETC ICM, 2014 c: Benjamin Boteler and Manuel Lago (Ecologic Institute), GerJan Piet and Harriet van Overzee (IMARES), Monika Peterlin and Špela Petelin (IWRS). Initial Assessment of European Seas based on Marine Strategy Framework Directive Article 8 reporting: **Economic and social analysis of the use of marine waters Art 8.c**. Magdeburg: European Topic Centre on inland, coastal and marine waters, 2014.

Supplement reports can be made available upon request.

Constraints on confidence due to data gaps and methodology issues

This data report reflects the fact that data are only partially available for some Member States, and that some Member State have not reported or reported too late to be included in this analysis. The quality of the assessment relies on the quality of the Member States' reports and data delivery. There are examples of very good, high quality reporting. However, there are many gaps in knowledge, lack of coherent methodologies for assessment, many reporting gaps or contradictions that can lead to wrong and/or incomplete assessments. Only 66% of the EU sea area was covered by this 1st reporting cycle. The additional problem is that more than 70% of the maritime boundaries between EU Member States are not agreed (EC, 2014).

The confidence in the results presented based on MSFD data analysis is mostly low. However, compared to the situation before the MSFD, there has been a significant improvement of the knowledge base and increased transparency by bringing together information on status, pressures and impacts on marine waters as well as on the use and socio-economic aspects of the four regional seas.

Caution is advised concerning country and regional comparisons, as results may be affected by the methodology approach used by individual Member States. Likewise, it is not advisable to draw detailed conclusions based on the presented results, as there is a lack of comparability of the information reported on most topics among Member States. Nevertheless, it is the authors' opinion that the main European overview of the assessment of Europe's marine waters reflects the reality emerging from the current state of knowledge.

Status of features and characteristics reported under MSFD

Over 500 different features and characteristics were reported by Member States under Article 8(1a) of the MSFD Initial Assessment. The nature of the reporting by Member States presented a number of challenges when analysing the reported information. For example, Member States have reported on different species and habitats and not against a standardised list of features. Furthermore, in the reported information there are no estimates of extent for benthic and water column habitats, nor are there population size estimates for species and functional groups. This means a weighted aggregation of reported information cannot be undertaken. This is because it is not known how much of a feature (i.e. either extent for habitats, or population size for species) is present within a given assessment area. However, it was possible to calculate from the individual feature assessments reported by Member States the number (and therefore percentage) of features in Good Environmental Status per biodiversity component. For each feature reported Member States were required to assess whether a feature was: (1) in Good Environmental Status, (2) not in Good Environmental Status; (3) in an 'other' status (i.e. a different status typology was used); or (4) in unknown status. These assessments are referred to as 'GES' assessments in this report. For physical features, the information reported is primarily descriptive and it is not possible to aggregate or summarise this information.

Seabed habitats

Over 76% of the GES assessments made by Member States are 'unknown', and there is limited reported information for the Black Sea. 'Physical damage', 'physical loss' and 'biological disturbance' are reported as the three most important pressures affecting seabed habitats across Europe.

Water column habitats

Over 46% of the 'GES' assessments made by Member States are 'unknown', and no information was reported for the Black Sea. Nutrient and organic matter enrichment', 'physical loss', and 'biological

disturbance’ are the three most important pressures adversely affecting water column habitats at European level.

Marine invertebrates

Over 47% of the ‘GES’ assessments made by Member States are ‘unknown’, and no information was reported for the Black Sea or the Baltic Sea, and all the information reported for the Mediterranean Sea fall into the ‘unknown’ category. ‘Biological disturbance’, ‘physical loss’, and ‘interference with hydrological processes’ are the three most important pressures adversely affecting marine invertebrates at European level.

Marine fish

Over 40% of the ‘GES’ assessments made by Member States are ‘unknown’. ‘Biological disturbance’ and ‘physical loss’ are the two most important pressures adversely affecting marine fish at European level.

Marine reptiles

Over 56% of the ‘GES’ assessments made by Member States are ‘unknown’, and no information was reported for the Black Sea or the Baltic Sea due to the limited distribution or absence of marine reptiles in these Regional Seas. ‘Other physical disturbance’ and ‘biological disturbance’ are the two most important pressures adversely affecting marine reptiles at European level.

Seabirds

Over 40% of the ‘GES’ assessments made by Member States are ‘unknown’, and no information was reported for the Black Sea. ‘Biological disturbance’, ‘physical loss’, and ‘contamination by hazardous substances’ are the three main pressures adversely affecting seabirds at European level.

Marine mammals

Over 54% of the ‘GES’ assessments made by Member States are ‘unknown’. Biological disturbance’, ‘other physical disturbance’, and ‘contamination by hazardous substances’ are the main three pressures adversely affecting marine mammals at European level.

Physical features

Physical features (e.g. topography and bathymetry of the seabed; sea temperature; ice cover; and salinity) are described by Member States for less than 22.8% of the EU marine assessment units, and the information reported is primarily descriptive. Data and information availability varies across different physical features, Member States and Regional Seas. Increasing recent trends for sea surface and sea bottom temperatures are reported across all regional seas. Sea surface and sea bottom temperatures are expected to rise in the future in all assessment units where a meaningful assessment was made. At European level, decreasing recent trends are reported for ice cover extent and duration for 2% of assessment units.

Pressures and impacts assessment – summary of key messages

Physical loss

Most countries recognised the problem of physical loss, but assessment is generally not performed consistently over the EU marine areas. 23% of EU waters were reported under low level of pressure from physical loss. Level of pressure and impact was not reported for 75% of EU waters. Reported data refer mainly to the NE Atlantic and the Baltic Sea. Most EU waters were not assessed with relevant criteria. Main activities, causing the pressure at EU level are land claim and flood defence, port construction, solid waste disposal, renewable energy production and aquaculture. Features, impacted by physical loss are mainly predominant habitats, physical/chemical elements – transparency, current velocity, nutrient and oxygen levels and fish.

Physical damage

The reporting by the MSs on physical damage suffered from huge differences between the MSs or regions in the availability of information and when available in interpretation. The reporting shows that the proportion of the region where the pressure occurs and is impacted differs considerably between regions varying between 1% in the Mediterranean to 97% in the NEA. The habitats mostly affected at an EU level were the shallow sandy and muddy habitats but this only reflects how often these habitats occurred in the database. As neither the proportion of the area where the habitat occurs is known nor the proportion of the habitat area impacted this does not provide any relevant information. In all regions fisheries was identified as the main human activity causing physical damage except in the Black Sea where this was dredging.

Marine litter

All Member States recognised the problem of marine litter, but assessment is generally not performed consistently over the EU marine areas. Member States rather reported on quantities and trends of marine litter mostly on shore and seabed litter. Conclusion on an overall trend is not taken, since very few data is available in each region. Features, impacted by marine litter are mainly predominant habitats, marine biota (turtles, cephalopods). At EU level impact from marine litter was most frequently observed on marine shelves. Despite the fact, that boundary values for marine litter indicators are not determined yet, Member States reported their assessment of status in several areas, based on expert judgement. 18% of Member States reported not good status due to litter pollution of shorelines; no Member State reported good status related to this type of litter. 6% of Member States reported good status and 14% not good status related to litter on a seabed. Main activities, causing the pressure of marine litter at EU level are shipping, tourism recreation, fisheries, urban and industry.

Underwater noise

Most of the 23 EU Member States comprising marine waters have returned information on noise. Yet, very little information has been provided on the status, status trend, and confidence of the noise pressure level for the various Member States. Overall the impulsive noise pressure seems to be increasing while the pressures from continuous sound seem to be more stable. Yet, one should take great care when concluding on an overall trend as very few data is available in each region. Considering the activities causing the highest noise pressure, shipping was by far the most frequently ranked activity, followed by renewable energy, oil and gas activities as well as research surveys. Regionally, shipping was reported to be the largest pressure in the Mediterranean, the Baltic and the NE Atlantic. In the Mediterranean defence as well as oil and gas were also seen as a larger issue than the other activities, whereas in the NE Atlantic Ocean the second largest pressure comes from renewable energy. Only Germany reported on the status trend for both impulsive and continuous

noise pressure (both reported to be ‘not good’). Despite the lack of information on GES and trends the feedback on activities and hence pressures causing noise was quite comprehensive. As the MSFD indicators are essentially pressure indicators, one of the key information needs was addressed in this initial reporting phase. The EU’s further advice will greatly increase the standardisation of terms, monitoring methods and data analysis procedures. Thus, it is likely that reporting and analysis will improve in the future.

Extraction of fish and shellfish

The percentage of area affected by the pressure differs immensely between Member States, even within regions. Overall in the EU occurrence of the pressure of extraction of fish was reported for approximately 60% of the area of which about half indicated the pressure occurred in 5–25% of the area, and one-third 75–100% of the area. There is broad agreement on the main human activity causing the pressure, i.e. fisheries. Marked differences exist in the availability of indicators and reference levels between regions. In the NEA approximately half of the regional sea (according to 2013 data) could be assessed, in the Mediterranean only about one quarter.

Beside fish and shellfish assessment, several countries also reported on other ecosystem components (e.g. seaweed, other functional groups). The impact of pressure should be reported in terms of the proportion of species impacted, not in area-based measure since distinguishing fishing categories while expressing in terms of % area without some aggregate measure prevents an assessment of the occurrence of the overall pressure.

Microbial pollution

The pressure of microbial pollution is measured via the limit values for bacteria under the Bathing Water Directive and via the limit values for the Shellfish Directive. 18% of EU waters were reported with a low proportion of assessed bathing waters not meeting lower limit values. The level of pressure on bathing waters was not reported for 22% of EU waters. No reported data came from the Black Sea Region.

14% of EU waters were reported with a medium (5–25%) level of pressure from microbial pollution for assessed Shellfish waters, where waters are not meeting lower limit values. In 8% of EU waters a high (75–100%) level of pressure was reported.

There are no specific GES criteria listed for microbial pathogens. The main activities, causing microbial pollution at EU level are urban, agriculture/forestry and industry, aquaculture, tourism/recreation and shipping.

Hazardous substances

Between 14 and 36% of the total area of marine waters surrounding Europe was actually assessed and reported regarding the hazardous substances pollution (percentage is different for each type of hazardous substances). The assessment is generally not performed consistently over the EU marine areas even though nearly all Member States recognised the problem. Considering that most countries have national programmes and participate in regional sea conventions where assessments have been made, and also considering that some hazardous substances are ubiquitous it is surprising that the reporting of status is not more complete with respect to whether or not the status is good.

Impacts related to synthetic hazardous substances were most frequently observed in shallow water substrates and unspecified functional groups, fish and birds. Very few elements impacted are reported for the open seas.

Activities that most affected the levels of these substances in decreasing order were: industry, urban development, shipping, agriculture/forestry and oil/gas. Tourism and solid waste disposal ranked lowest. However, it should be noted that the data does not distinguish which hazard substance type these activities impact.

Non-synthetic hazardous substances

15 Member States reported information on non-synthetic hazardous substances. Overall the result at EU level indicates that 18% of waters are exposed to low or medium pressure (i.e. <5%) related to non-synthetic hazardous substances. In 19% of EU waters hazardous substance impact is decreasing, while in 5% of marine waters the trend is stable and in 3% of the waters the trend is increasing.

Synthetic hazardous substances

15 Member States reported information on synthetic hazardous substances. Overall the result at EU level indicates that 4% of waters are exposed to low or medium pressure related to synthetic hazardous substances. In 15% of EU waters hazardous substance impact is decreasing, while in 2% of marine waters the trend is stable, and in 1% of the waters the trend is increasing.

Radionuclide hazardous substances

11 Member States reported information on radioactive hazardous substances. Data were reported only for a small share of marine waters surrounding Europe. Only in the Baltic Sea 50% of waters were assessed. 41% of the Baltic Sea is subject to a high level of pressure from radionuclide substances.

In 32% of EU waters hazardous substance impact is decreasing, while in < 1% of marine waters the trend is increasing.

Hazardous substances in seafood

Only 5 Member States reported information on hazardous substances in seafood. Data were reported only for a small share of marine waters surrounding Europe. The results available indicate that 6% of waters are exposed to low or medium pressure (i.e. <5%) for non-synthetic and synthetic hazardous substances.

Acute pollution events

15 Member States reported information on acute pollution events. Overall the result at EU level indicates that 11% of waters are exposed to low pressure (i.e. <1%) related to acute pollution events. In 10% of EU waters hazardous substance impact is decreasing, while in 14% of marine waters the trend is stable and in 10% of the waters the trend is increasing. Activities that most affected the levels of these substances are shipping followed by dumping of munitions and ports. The assessment is generally not performed consistently over the EU marine areas even though most Member States recognised the problem.

Hydrological processes

13 Member States reported mostly partial information on hydrological processes. High level of pressure due to hydrological processes alteration was reported for the Mediterranean, where 30% of the area is under a high level of pressure (75%–100% altered conditions). NE Atlantic (70% of area under pressure) and Baltic Sea (62% of the regional sea area) have a large proportion of areas exposed to a low level of pressure (<1%).

Overall, at EU level, 45% of marine waters were reported under a low level of pressure from hydrological processes. Main activities, causing the pressure of hydrological processes at EU level are industry, ports and land reclamation/coastal defence.

Nutrients and organic enrichment

17 Member States reported information on nutrients and organic enrichment. The level of pressures, trends and confidence levels with respect to nutrient concentrations are reported for about half of the EU marine waters. In about 1/3 of the marine waters, the pressure (nutrient concentration) is reported to occur in >5% of the marine waters of Member States. A stable pressure or decreasing trend for nutrient concentrations and loads is observed in 50% of EU marine waters. As for organic matter, most Member States reported that the level of pressure is unknown or not reported. Strong impacts on water column and seabed habitats, extending to >25% of the surface area of an assessment area are reported for 5% of the total EU marine waters.

At EU level, the three most reported impacted elements concern physical/chemical features (oxygen level, water transparency and nutrient levels). The most important activity related to this pressure is Agriculture/Forestry, although this was not reported for the Black Sea. Urban & Industry and Aquaculture in the Mediterranean Sea are the other main activities causing nutrient organic matter enrichment.

The Baltic Sea has the highest proportion of marine waters which are not in good status due to nutrient levels extending to over 54% of the total surface area, direct effects of nutrient enrichment are observed over 52% of the area, indirect effects of nutrient enrichment are observed on 33% of the area.

48% of EU waters were assessed regarding eutrophication, mainly reporting on nutrient levels and direct effects of nutrient enrichment. At EU level, 11% of marine waters are reported to be in good status, and approximately 7% are reported as being in the not good status category regarding nutrient levels. 19% of EU marine waters are reported as in good status regarding direct effects of nutrient enrichment and 12% regarding indirect effects. 6% of EU marine waters are reported as in not good status regarding direct effects of nutrient enrichment and 3% regarding indirect effects of nutrient enrichment. For 52% of EU marine waters the information on nutrient and organic enrichment is unknown or not reported

Non-indigenous species

There is a lack of coherence between inventories in country databases, review papers and reporting under MSFD on the pressure due to non-indigenous species. Assessment of GES was feasible only by countries with advanced knowledge that have developed relevant indicators such as the Baltic Countries by employing the bio-pollution index. For all other countries the trend in the introduction of non-indigenous species is used as a proxy to the trends in GES. Reporting is inconsistent between Member States and is not comprehensive. Shipping ranked first as a human activity responsible for most non-indigenous species introductions (63.2% of the countries) while aquaculture scored second everywhere else other than in the Black Sea.

Economic and social analysis of the use of marine waters – summary of key issues

Significant socio-economic data on Gross Added Value (GVA) and employment was provided by Member States. However, differences in reporting (i.e. names of sectors, reporting standards) suggest that the data as currently presented is not robust and consistent. According to the data reported, the European maritime economy is valued at Euro 159 billion (GVA).

Information on the dependencies of the use/activity in assessment areas on ecosystem services (predominant habitat types and functional groups) were reported for the UK only while information

on methodology is provided for Latvia, Sweden, and the UK. The three most reported ecosystem services in the UK are seabed habitats – all (18%), demersal fish (15%), and demersal elasmobranchs (10%). The most important pressures impacting (adversely affecting) ecosystems or theme per assessment area were identified in the UK as interference with hydrological processes (16%), selective extraction of species including non-target catches, contamination by hazardous substances and physical damage, all reported 12%.

Little information was gathered through the reporting process on the costs of degradation, although seven Member States reported this information to be relevant and reported some information on costs of degradation.

1 Introduction

1.1 Scope of MSFD, WFD and Marine Conventions

The MSFD outlines a transparent, legislative framework for an ecosystem-based approach to the management of human activities which supports the sustainable use of marine goods and services.

Marine waters' are defined in the MSFD (Article 3) as (i) waters, the seabed and subsoil of the area where a Member State has and/or exercises jurisdictional rights and (ii) coastal waters as defined by Directive 2000/60/EC (WFD) for particular aspects of the environmental status of the marine environment that are not already addressed through WFD or other Community legislation. Marine waters under the sovereignty and jurisdiction of Member States of the European Union include waters in the Mediterranean Sea, the Baltic Sea, the Black Sea and the North-east Atlantic Ocean, including the waters surrounding the Azores, Madeira and the Canary Islands.

Data analysis presented in this report was performed for data reported from Member States on Initial assessment (Article 8). Elements, which were required to be addressed in the Initial assessment, are presented in Annex III of MSD – Indicative lists of characteristics, pressures and impacts. Data analysis presented in this report does not include analysis of information reported on the determination of Good Environmental Status (GES) (Article 9) and on the establishment of environmental targets and associated indicators (Article 10), but includes links between Initial assessment (MSFD, Annex III) and 11 qualitative descriptors for determining of GES, according to MSFD Annex I of as reported by Member States.

MSFD should be applied at national, regional and EU level in a coherent and strategic manner in four European Marine Regions, including: the Convention for the Protection of the Marine Environment in the North-East Atlantic of 1992 (further to earlier versions of 1972 and 1974), the Convention on the Protection of the Marine Environment in the Baltic Sea Area of 1992 (further to the earlier version of 1974), the Convention for the Protection of Marine Environment and the Coastal Region of the Mediterranean of 1995 (further to the earlier version of 1976), the Convention for the Protection of the Black Sea of 1992.

The MSFD is complementary to a number of other key Directives and legislation at the European level. Most important are links to the EU Water Framework Directive (EC, 2000), , which addressed fresh waters, transitional and coastal waters up to 1 nautical mile (nm). Coastal waters are covered by MSFD provisions for aspects of the environmental status of the marine environment that are not addressed through the Water Framework Directive. The EQS Directive (EC, 2013), addresses pollution to territorial waters, 12 nm from the shore.

Other relevant legislation includes also the EU Habitats Directive, the EU Birds Directive and the Common Fisheries Policy (CFP). Relevant commitments undertaken at the World Summit on Sustainable Development and under the Convention on Biological Diversity should also be taken into account.

The MSFD does not state a specific programme of measures that Member States should adopt to achieve GES, except for the establishment of Marine Protected Areas (MPAs).

1.2 Reporting of Initial assessments under MSFD

This report is based on electronic data reported by Member States about their initial assessments under the MSFD. Initial assessments have been designed to address comprehensive relationships among human activities (drivers), pressures and impacts caused by human activities at large and the state of the marine environment. The aim of this report is to present an overview of results, derived from reported data on Initial assessments in a comprehensive manner at Member State, regional and EU level. We have not attempted in any way to put MSFD reported data into a wider context, although it is known that in many areas presented the knowledge is richer than the reported information represents.

23 countries had the obligation to report their work under the MSFD implementation process. In this report data from 19 Member States are included (Belgium, Bulgaria, Cyprus, Germany, Denmark, Estonia, Greece, Spain, Finland, France, Ireland, Italy, Lithuania, Latvia, Netherlands, Romania, Sweden, Slovenia, United Kingdom), while 4 Member States (Croatia, Malta, Poland, Portugal), are not included, since they did not report early enough to be included in the 'June 2013 database'.

The database for this report is from June/July 2013 at which date not all Member States had fully completed their reporting.

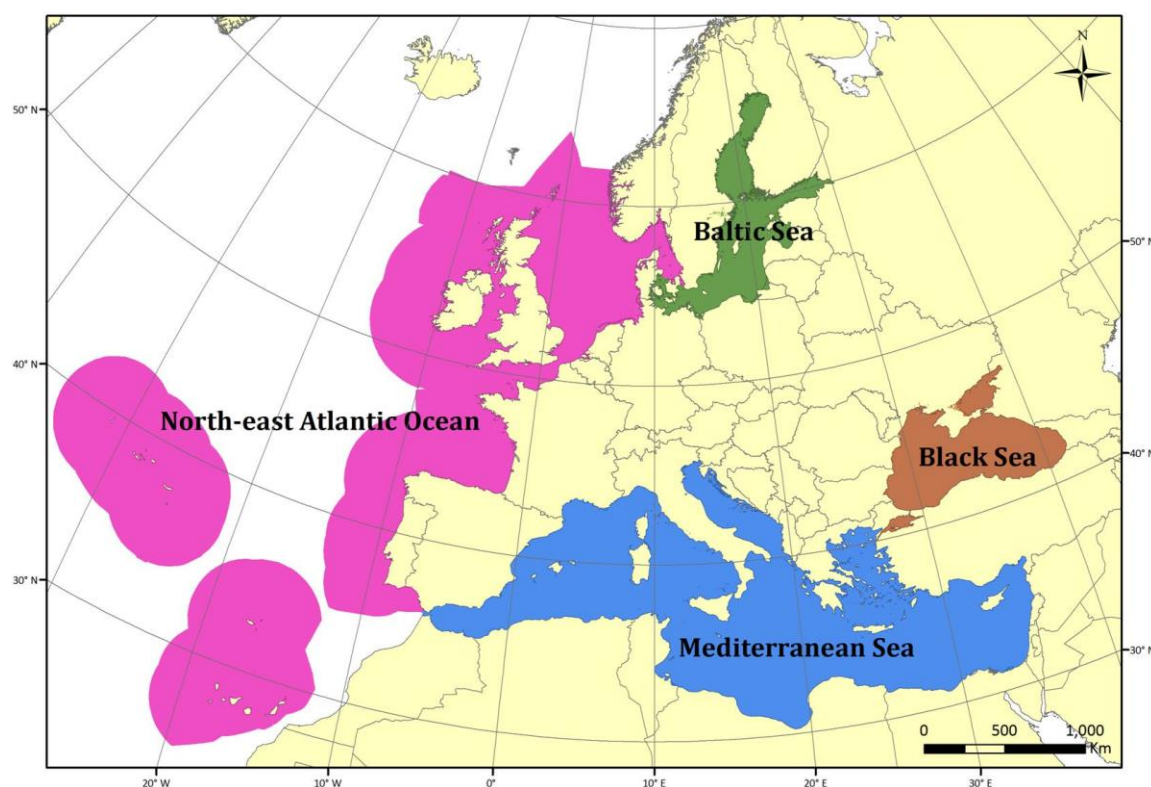
1.3 Geographical setting

Overall the area of regional seas surrounding Europe covers 11 220 000 km² (data from 2013). In this report data analysis is presented for 4 319 988 km² as reported under MSFD.

Reporting resulted in a complex exercise, where 102 reporting sheets with over 12342 entry rows were reported and analysed (database from June 2013). The database includes data from 23 countries in 4 regional seas. The geographical unit used for the reporting was the Marine Unit, which is a subdivision of national territory of a marine (sub) region.

The area of reported Marine Units was extracted from the GIS reported data and used for the analysis as much as possible. The reported EU seas area is divided up into 208 Marine Units, ranging in size from 162km² to 488763km². For more information on geographical setting see report (ETC/ICM, 2014b)

Map 1.1: Map of regional seas surrounding Europe (data from June 2013).



1.4 Approach to analysis of reported data

The difference in nature of the assessed topics resulted in a large heterogeneity in the level of detail of the assessment. The methods used for the assessment are described in the technical part of chapters 2.4 for each topic. The report is structured in line with a structure of reported data (EC, 2012) for Initial assessments, which provided information on:

- Analysis of features and characteristics, including physical features and features relating to biodiversity such as habitats, species and functional groups (Article 8-1a);
- Analysis of the predominant pressures and impacts, including human activity, on the environmental status. (Article 8-1b);
- An economic and social analysis of the use of those waters' characteristics (Article 8-1c).

1.4.1 Features and characteristics

A summary of the data and information reported by EU Member States in 2012 under Article 8(1a), analysis of features and characteristics, of the Marine Strategy Framework Directive (MSFD) Initial Assessment is provided. However, it was not possible to provide summaries across all features and characteristics. The summaries presented here are supported by a more detailed and thorough analysis of the reported data and information, which is available in the supplementary report – ETC ICM, 2014 a.

Types of analysis undertaken of the information on features and characteristics reported by Member States in 2012 under Article 8(1a):

- Physical features – only categorical information analysed.
- Habitats – information analysed by ‘biodiversity component’.
- Functional groups – information analysed by ‘biodiversity component’.
- Species – information analysed by ‘biodiversity component’.
- Eco-systems – information not analysed due to inconsistencies and incomplete reporting (i.e. over 80% of assessments unknown or not reported).
- Non-indigenous species inventory – inventory included alongside the assessment of pressures and impacts done under Article 8(1b)(ETC/ICM, 2014b).
- Other features – information not analysed because the reporting consisted of descriptive information not comparable across Member States.

Table 1.1 shows for each Member State what was reported (green: reported, orange – partially reported and red – not reported).

Table 1.1: Summary of reported data on characteristics at the Member State level (Annex III, Table 1).

Member State	Seabed habitats	Water column habitats	Marine invertebrates	Marine fish	Marine reptiles	Seabirds	Marine mammals
Belgium	Green	Green	Red	Green	Red	Green	Green
Bulgaria	Red	Red	Red	Red	Red	Red	Red
Cyprus	Green	Green	Green	Green	Green	Green	Green
Germany	Green	Green	Red	Green	Red	Green	Red
Denmark	Green	Red	Red	Green	Red	Green	Green
Estonia	Green	Red	Red	Green	Red	Green	Green
Greece	Green	Red	Red	Red	Green	Green	Green

Member State	Seabed habitats	Water column habitats	Marine invertebrates	Marine fish	Marine reptiles	Seabirds	Marine mammals
Spain ^(a)	MWE, ABI	All regions	MWE	MWE, ABI	MWE, ABI	MWE, ABI	MWE, ABI
Finland							
France							
Croatia							
Ireland							
Italy							
Lithuania							
Latvia							
Malta							
Netherlands							
Poland							
Portugal							
Romania							
Sweden							
Slovenia							
United Kingdom							

Note: Green means that information on the feature has been reported by a country for all relevant regional seas. Orange means that the reporting of the feature was not done by a country for all their relevant regional seas and red means that no reporting by a country has been done on the feature.

^(a) MWE – Western Mediterranean Sea, ABI – Bay of Biscay & Iberian Coast, AMA – Macaronesia

1.4.2 Pressures and impacts

Reporting of pressures and impacts includes 12 topics:

1. Physical loss
2. Physical damage
3. Underwater noise
4. Marine litter
5. Interference with hydrological processes
6. Contamination by hazardous substances
7. Acute pollution events
8. Nutrients and organic matter enrichment
9. Microbial pathogens
10. Non-indigenous species
11. Extraction of species
12. Marine acidification (reported data very limited and are not presented in the report)

For each of the topics four aspects were addressed:

- description of characteristics of the pressure in terms of percentage of area that is exposed to the pressure, trends in development of the pressure and confidence levels,
- impacts on marine ecosystem by identification of impacted elements ,
- link to main human activities causing the pressure and
- assessment of the pressures with relevant elements and link to descriptors for the determination of GES.

The table shows for each Member State what was reported (green – reported, orange – partially reported and red – not reported).

Table 1.2: Summary of reported data on pressures and impacts at the Member State level (Annex III, Table 2).

Member State	Physical loss	Physical damage	Noise	Marine litter	Microbial pathogens	Extraction of fish and shellfish	Contamination by hazardous substances (synthetic, non-)	Contamination by hazardous substances - radionuclides	Contamination by hazardous substances - acute pollution events	Interference with hydrological processes	Nutrients and organic matter enrichment	Non-indigenous species
Belgium	Green	Red	Yellow	Green	Yellow	Red	Red	Red	Red	Green	Green	Green
Bulgaria	Red	Green	Red	Red	Red	Red	Red	Red	Red	Red	Red	Green
Cyprus	Green	Green	Green	Red	Red	Green	Red	Red	Red	Green	Green	Green
Germany	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Denmark	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

Member State	Physical loss	Physical damage	Noise	Marine litter	Microbial pathogens	Extraction of fish and shellfish	Contamination by hazardous substances (synthetic, non-)	Contamination by hazardous substances - radionuclides	Contamination by hazardous substances - acute pollution events	Interference with hydrological processes	Nutrients and organic matter enrichment	Non-indigenous species
Estonia												
Greece												
Spain												
Finland												
France												
Croatia												
Ireland												
Italy												
Lithuania												
Latvia												
Malta												
Netherlands												
Poland												
Portugal												
Romania												
Sweden												
Slovenia												
United Kingdom												

Note: Green means that information on the feature has been reported by a country for all relevant regional seas. Orange means that the reporting of the feature was not done by a country for all their relevant regional seas and red means that no reporting by a country has been done on the feature.

1.4.3 Socio-economic analysis

This report presents the data and analysis of information on human activities (economic and social analysis of marine waters), ecosystem services (economic and social analysis of marine waters) and the cost of degradation. What is presented here is a summary of the main data submitted by the Member States. There are significant issues and questions regarding the consistency and robustness of the data stemming from *inter alia* definitions used by Member States and reporting errors. These have not been altered for reporting purposes. In regard to human activities a wealth of data on Gross Added Value (GVA) and employment was provided by Member States. However, due to major reporting differences such as names and classifications of sectors it remains challenging to provide a robust overall picture of the European marine economy. Information on the dependencies of activities in assessment areas on ecosystem services (predominant habitat types and functional groups) were only reported for one Member State while information on methodology is provided for three. Finally, very little information was gathered through the reporting process on the costs of degradation, although seven Member States reported this information to be relevant.

1.5 Limitations of the report

Limitations of the report refer only to the reporting on Initial assessment by Member States. Wider context of limitations is not elaborated.

1.5.1 Features and Characteristics

Over 500 different biodiversity features (i.e. habitats, species and functional groups) were reported by Member States under Article 8(1a) of the MSFD Initial Assessment. In addition, twenty six ecosystems were assessed in the 2012 initial assessment database. Due to inconsistencies and incomplete reporting within this characteristic (i.e. over 80% of assessments unknown or not reported), ecosystem assessments were not included in this report.

Initial examination of the information reported by Member States for biodiversity features identified two fundamental challenges in aggregating and synthesising this information across individual marine regions and/or sub-regions:

- Member States have reported on different species and habitats lists and not against a standardised list of biodiversity features. This resulted in different terminology being used for equivalent biodiversity features (e.g. shallow mud versus shallow sub-littoral mud), making direct comparisons between Member States very difficult unless assumptions are made.
- The lack of area estimates for habitats and population estimates for species and functional groups in Marine Units (assessment units) means that a weighted aggregation of reported information cannot be undertaken. This is because it is not known how much of a biodiversity feature is present within a given assessment area. For example, in assessment Area A sub-tidal sand could cover 50km² or it could cover 5km²; and when combining this information with assessment Area B where sub-tidal sand covers 100km² it is essential to know which area value is correct for assessment Area A. Experience from the EC Habitats Directive Article 17 bio-geographical assessments highlights the difficulties in aggregating information and the need for biodiversity feature area or population estimates to weight assessments at national level (European Topic Centre on Biological Diversity, 2008).

1.5.2 Pressures and impacts

- Analysis was prepared based on geographical data reported and based on division of regional seas surrounding Europe to Marine Regions in June 2013. Only MSFD reported data were used in the analysis, without considering other possible data sources.
- It was not possible to prepare analysis of all the reported aspects based on the size of assessed areas, because some types of information did not allow such analysis of all aspects. Therefore the analysis of impacted elements and activities is prepared based on numbers of assessment units.
- Reporting of the data was performed based on numbers of Marine Units or based on numbers of features. Size of marine units (in km²), which is mainly used for the analysis, was extracted from reported geographical data, where overlapping areas are taken into account.
- Comparability of results has not been assured by comparison or calibration of methods, used by different Member States or in different regional seas in 2012 reporting. Therefore results should only be used for information purpose, not for any decision making process.
- Reporting of pressures and impacts levels was prepared to a large extent based on the spatial distribution of pressures and assessed in many cases based on expert opinions.

1.5.3 Socio-economic analysis

There are significant issues and questions regarding the consistency and robustness of the data stemming from *inter alia* definitions used by Member States and reporting errors. This review focuses on what was reported in the database, while the Initial Assessments (i.e. reports) were not reviewed in this exercise. In many instances the Member States used different names of reporting features (i.e. the names of uses / activities). These have not been altered for reporting purposes due to lack of clear definitions of activities uses and to demonstrate the challenges of reported data. It is assumed that Member States followed the guidance documents and procedures provided by the Commission as well as the requirements of the Initial Assessment and reporting. At the same time, it is possible that Member States had different interpretations of the guidance documents.

2 Characteristics

2.1 Overview

2.1.1 Biodiversity features

Over 500 different biodiversity features (i.e. habitats, species and functional groups) were reported by Member States under Article 8(1a) of the MSFD Initial Assessment.

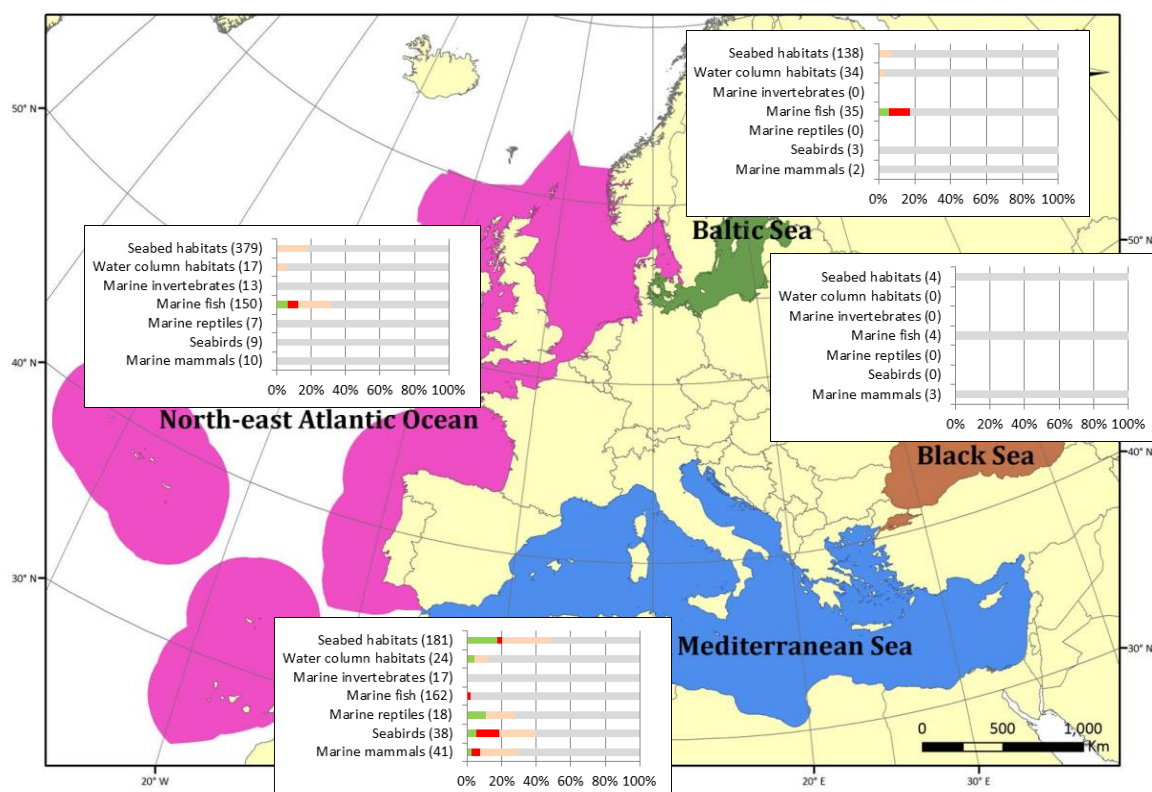
To be able to synthesise and aggregate the information reported by Member States for biodiversity features across individual marine regions and/or sub-regions, the information reported was analysed by ‘biodiversity component’. Seven biodiversity components were identified to capture both the breadth of biodiversity found in European seas and the breadth of biodiversity features reported under Article 8(1a) of the MSFD. Each reported biodiversity feature was thus assigned to one of the following 7 biodiversity components: seabed habitats; water column habitats; marine invertebrates; marine fish; marine reptiles; seabirds; and marine mammals.

For each biodiversity component the following aspects were reported both at the EU and Regional level:

1. Analysis of the current state and trends (recent and future) of habitats, species and functional groups in relation to natural physiographic, geographic and climatic conditions, for each of the relevant MSFD Commission Decision (EC, 2010) criterion, and associated confidence.
2. Assessment of Good Environmental Status (GES) of habitats, species and functional groups for each of the relevant MSFD Commission Decision criterion and overall GES, associated trends and confidence (Figure 2.1).
3. Most important pressures affecting habitats, species and functional groups (Figure 2.2).

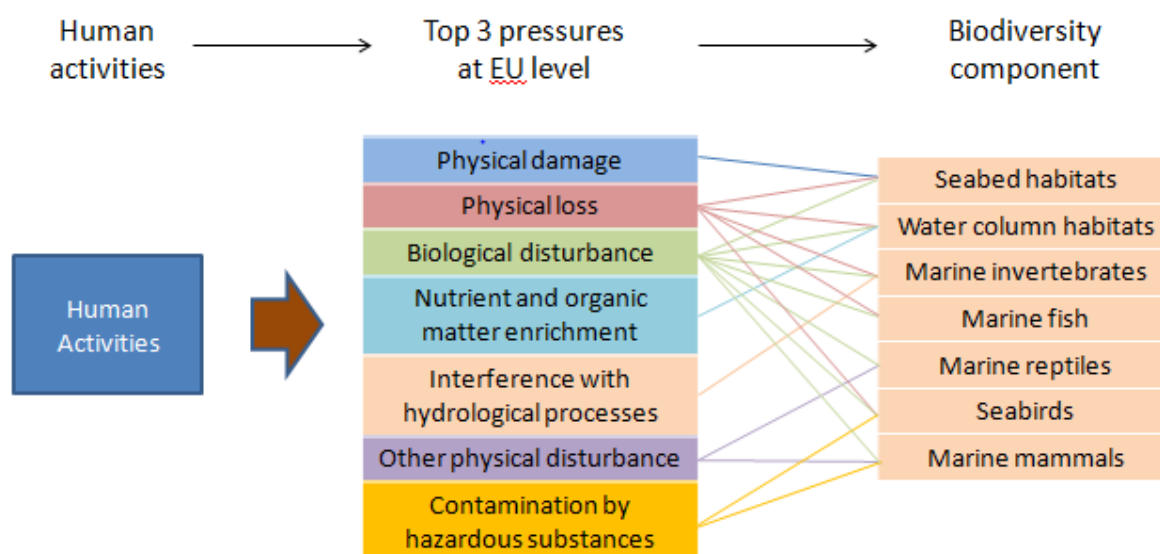
In this summary, key messages are only presented for two of the three aspects, including the assessment of GES (see number 2 above) and the most important pressures (see number 3 above). Report (ETC/ICM, 2014a) presents the analyses for all three aspects, including the analysis of current state and trends in relation to prevailing conditions.

Figure 2.1: Overall status assessment of the biodiversity features reported by EU Member States as part of the 2012 MSFD Initial Assessment



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 379 seabed habitat assessments reported in the NE Atlantic Ocean, 311 were considered to be unknown with respect to GES (i.e. Member States reported on these habitats but were unable to determine their overall status). The associated confidence rating of the information is rarely high.

Figure 2.2: Linkages between biodiversity components and the three most important pressures affecting each component at EU level



It is important to note that the information presented in this summary represents the number and/or percentage of reported biodiversity features in a given category for a given biodiversity component, and NOT the true proportion of a biodiversity component in a given category. This is because (1) Member States have reported on different species and habitat lists and not against a standardised list of features; and (2) there are no area estimates for habitats and no population estimates for species and functional groups in the assessment units. In addition, for the biodiversity features it is not possible to quantify what was not reported (i.e. we don't have a count of the number of biodiversity features that should have been reported on). For example, in the seabed habitats analysis the information reported shows that 76% of seabed habitats are 'unknown' in terms of GES. This means that of the 702 seabed habitats reported across Europe, 536 were considered to be unknown with respect to GES (i.e. Member States reported on these habitats but were unable to determine their overall status).

Physical features

Under Article 8(1a) of the MSFD Initial Assessment Member States described physical features and characteristics for only 22.8% of the Marine Units. The physical features and characteristics reported by Member States include topography and bathymetry of the seabed; sea temperature (surface and near-bottom) and trends; ice cover (duration/extent) and trends; current velocity; upwelling; wave exposure; mixing characteristics; turbidity and trends; transparency and trends; residence time; salinity and trends. The reported information includes descriptive, categorical and more detailed information on the physical features and characteristics of the marine environment.

This summary presents key messages for physical features and characteristics of the marine environment based on the categorical information reported by Member States.

2.2 Seabed habitats

European Seas are home to a rich and diverse range of seabed habitats, from the coral reefs found in the cold, dark depths of the North East Atlantic Ocean (Photo 2.1) to the sea grass meadows found in the clear, warm waters of the Mediterranean Sea. The nature of seabed communities depends on a number of environmental factors, including light, energy and the type of seabed substrate.

Photo 2.1: Cold-water coral reef (*Lophelia pertusa*) in the North-East Atlantic Ocean

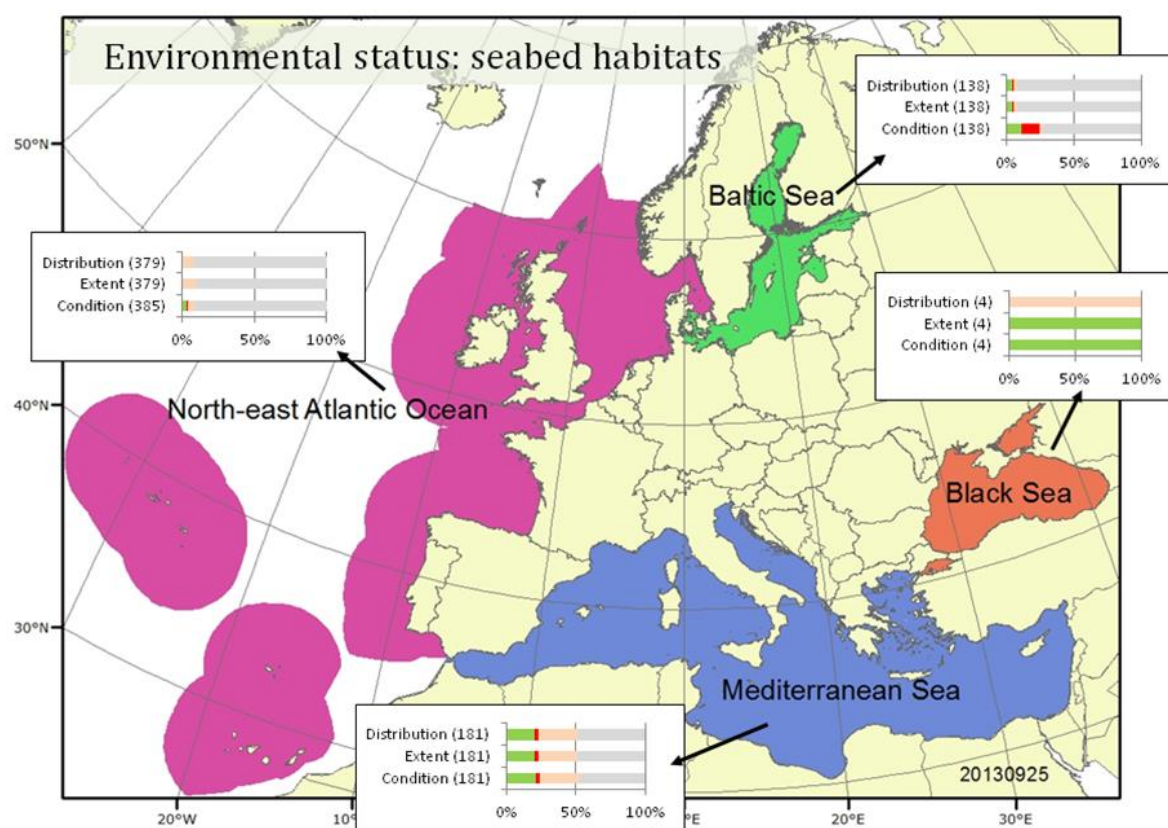


Photo: © JNCC

Key messages for seabed habitats

- Over 76% of the ‘GES’ assessments for seabed habitats are ‘unknown’ for all criteria (see Figure 2.3).
- For seabed habitats condition is the criterion with more assessments of ‘not good’ reported.
- Most assessments of ‘good’ environmental status for seabed habitats have a ‘stable’ trend, whilst the few assessments of ‘not good’ for seabed habitats normally have a ‘declining’ trend.
- Member States do not report on the use of GES or ‘other’ indicators for most assessments of seabed habitats.
- The three GES indicators most used to report on seabed habitats are 1.5.1 Habitat area, 1.6.1 Condition of the typical species and communities, and 1.4.1 Habitat distributional range.
- There is limited reported information for seabed habitats in the Black Sea.

Figure 2.3: Percentage of reported seabed habitats in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 138 seabed habitat assessments reported in the Baltic Sea, 101 were considered to be unknown with respect to the condition criterion (i.e. Member States reported on these habitats but were unable to determine their condition). The associated confidence rating of the information is rarely high.

Main pressures on seabed habitats

- ‘Physical damage’ (see 3.3 Physical damage), ‘physical losses’ (see 3.2 Physical loss) and ‘biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species) are reported as the three most important pressures affecting seabed habitats at European level.
- The most important pressures affecting seabed habitats vary across regional seas. ‘Physical loss’ is considered the most important pressure in both the Baltic and the Black Sea. In the Mediterranean Sea the most important pressure is ‘physical damage’, whilst in the NE Atlantic Ocean the most important pressure is ‘biological disturbance’.

2.3 Water column habitats

Water column habitats, in contrast to seabed habitats, are truly 3-dimensional in their character and vary continuously over time and space (Photo 2.2). Salinity and temperature are both important environmental factors in characterising water column habitats.

Photo 2.2: Mediterranean jelly or fried egg jellyfish in the water column (*Cotylorhiza tuberculata*).



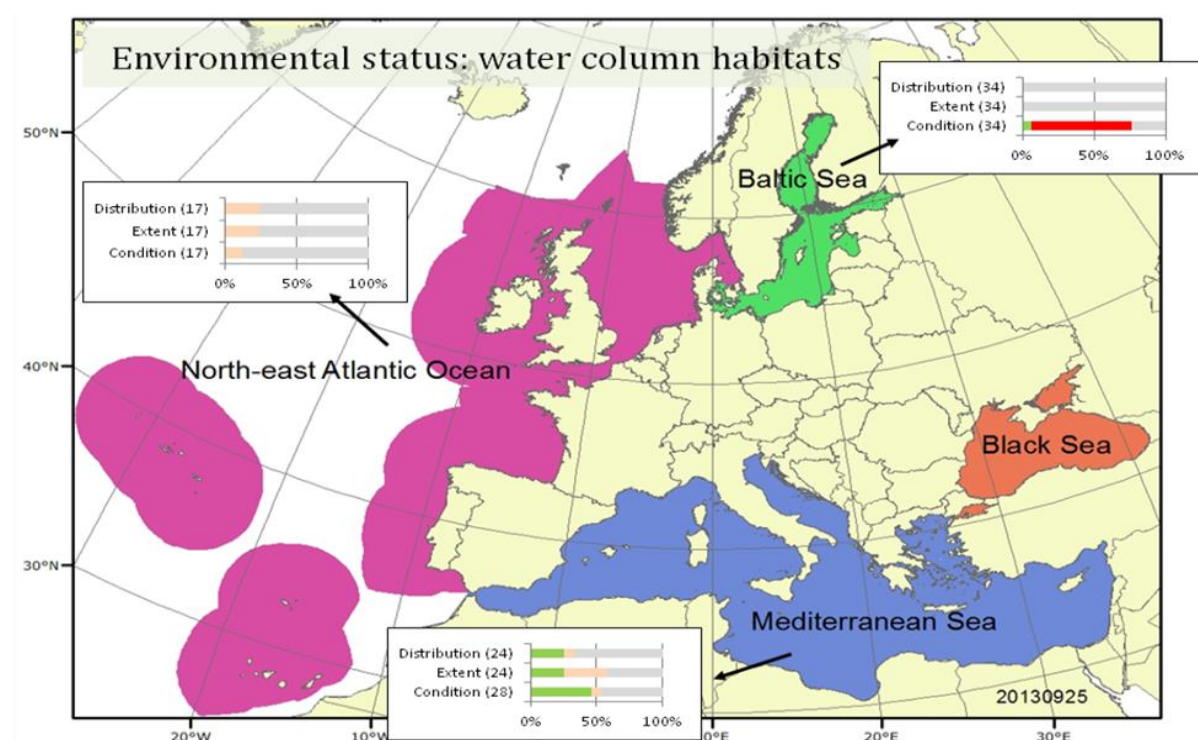
Photo: © T. Makovec, National institute of biology – Marine biology station Piran

Key messages for water column habitats

- Over 46% of the ‘GES’ assessments for water column habitats are ‘unknown’ for all criteria (Figure 2.4).
- For water column habitats condition is the only criterion with assessments of ‘not good’ reported (30%).
- All water column habitat assessments of ‘good’ have a ‘stable’ or ‘unknown’ trend, whilst all assessments of ‘not good’ have an ‘unknown’ trend.

- The trend ‘declining’ is only reported for the condition water column habitat assessment of ‘other’.
- The two GES indicators most used to report on water column habitats are 1.6.3. Physical, hydrological and chemical conditions and 1.6.2 Relative abundance and/or biomass.
- No water column habitat information was reported for the Black Sea.

Figure 2.4: Percentage of reported water column habitats in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown). The figures in parenthesis are the number of reported features. This means that of the 17 water column habitat assessments reported in the NE Atlantic Ocean, 15 were considered to be unknown with respect to the condition criterion (i.e. Member States reported on these habitats but were unable to determine their condition). The associated confidence rating of the information is rarely high. No information was reported for the Black Sea.

Main pressures on water column habitats

- ‘Nutrient and organic matter enrichment’ (see 3.11 Nutrients and organic matter enrichment), ‘physical loss’ (see 3.2 Physical loss), and ‘biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species) are the three most important pressures adversely affecting water column habitats at European level (note: no information was reported for the Black Sea).
- ‘Nutrient and organic matter enrichment’ is the most important pressure adversely affecting water column habitats both in the Baltic and in the Mediterranean Sea, whilst in the NE Atlantic Ocean the most important pressure affecting water column habitats is ‘physical loss’.

2.4 Marine invertebrates

Marine invertebrates represent a hugely diverse group of animals, including for example: jellyfish, sea anemones, corals, lobsters, crabs, shrimp, barnacles, starfish (), brittle stars, sea urchins, shellfish, sponges, squid, and octopus. Marine invertebrates lacking a backbone, or vertebral column, and rely on other strategies for support such as hydrostatic pressure, exoskeletons, shells, and in some, glass spicules.

Photo 2.3: Seven armed starfish (*Luidia ciliaris*) and black brittlestars (*Ophiocomina nigra*) on bedrock with Devonshire cup corals (*Caryophyllia smithii*)

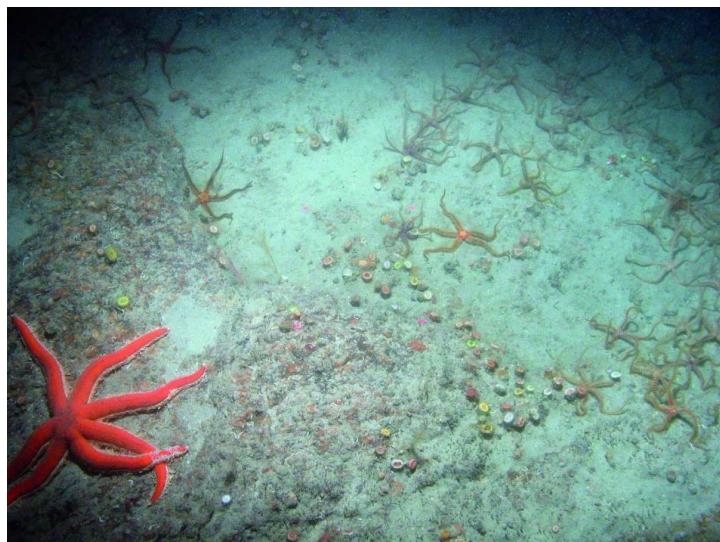
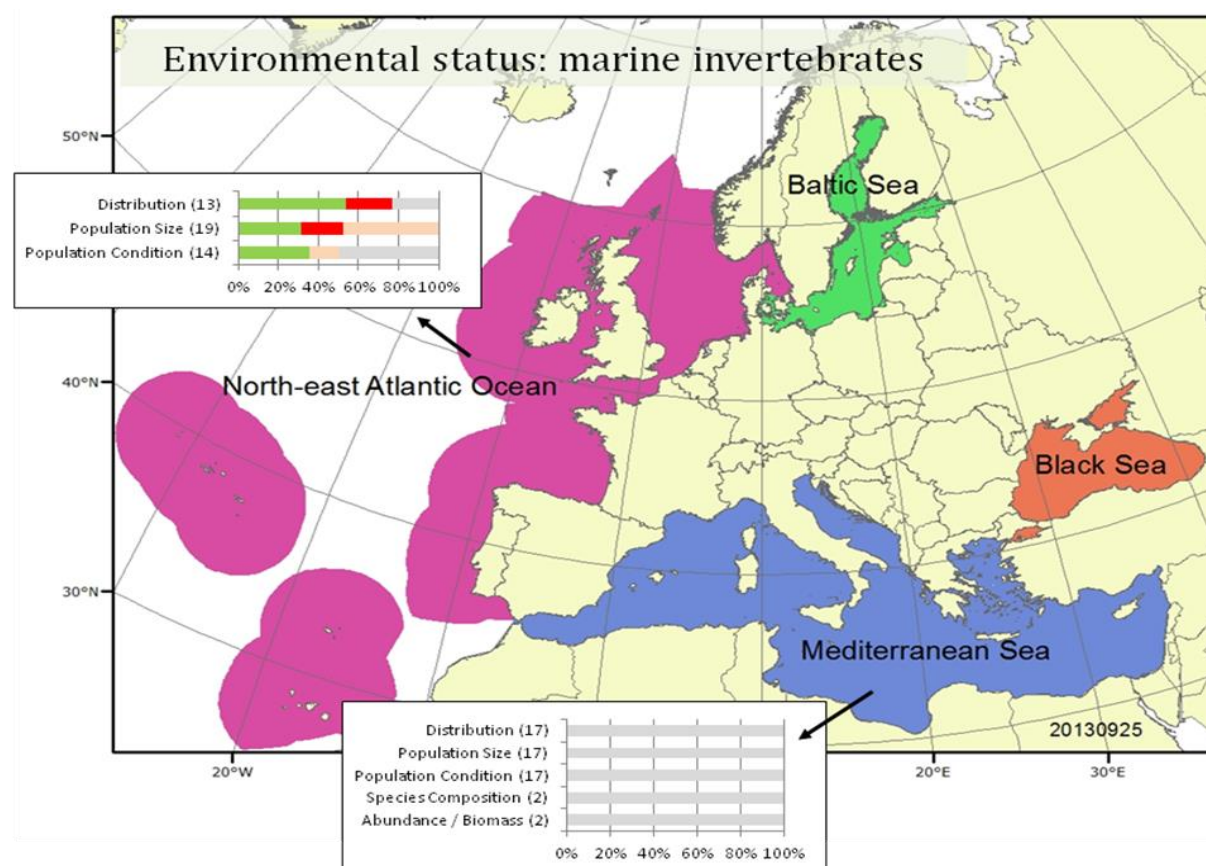


Photo: © JNCC/Cefas

Key messages for marine invertebrates

- Over 47% of the ‘GES’ assessments for marine invertebrates are ‘unknown’ for all criteria (see Figure 2.5).
- Population size (11%) and distribution (10%) are the only criteria with ‘not good’ assessments reported for marine invertebrates.
- The three GES indicators most used to report on marine invertebrates are 1.2.1 Population abundance, 1.1.1 Species distributional range, and 1.1.2 Species distributional pattern.
- No information was reported for marine invertebrates in the Black Sea or the Baltic Sea, and all the information reported for marine invertebrates in the Mediterranean Sea falls into the ‘unknown’ category.

Figure 2.5: Percentage of reported marine invertebrates in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 17 marine invertebrate assessments reported in the Mediterranean Sea, 17 were considered to be unknown with respect to the population condition criterion (i.e. Member States reported on these species but were unable to determine the condition of their populations). The associated confidence rating of the information is rarely high. No information was reported for the Black Sea or the Baltic Sea.

Main pressures on marine invertebrates

- ‘Biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species), ‘physical loss’ (see 3.2 Physical loss), and ‘interference with hydrological processes’ (see 3.10 Interference with hydrological processes) are the three most important pressures adversely affecting marine invertebrates at European level (note: no information was reported for the Black Sea or the Baltic Sea).
- The pressure ‘Interference with hydrological processes’ for marine invertebrates is only reported for the Mediterranean Sea and not for the NE Atlantic Ocean.

2.5 Marine fish

Marine fish are found throughout European seas, and their distribution and relative abundance is affected by many factors. The group marine fish includes fish (Photo 2.4), eels, lampreys, sharks and skates.

Photo 2.4: Saithe (*Pollacius virens*) hunting over soft sediment

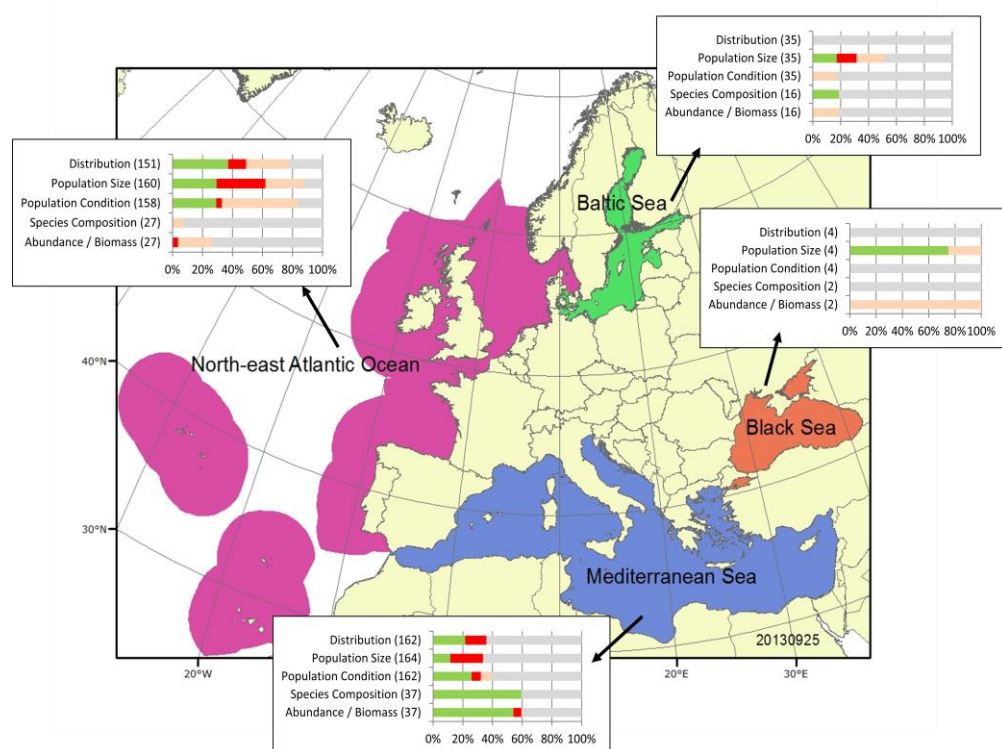


Photo: © JNCC/Cefas

Key messages for marine fish

- Over 40% of the ‘GES’ assessments for marine fish are ‘unknown’ for all criteria (see Fig. 2–6).
- For marine fish population size is the criterion with more assessments of ‘not good’ reported.
- Most marine fish assessments of ‘good’ environmental status have an ‘improving’ or ‘stable’ trend, whilst for the marine fish assessments of ‘not good’ there isn’t a clear pattern.
- The three GES indicators most used to report on marine fish are 1.2.1 Population abundance, 1.1.1 Species distributional range, and 1.3.1 Population demographics.

Figure 2.6: Percentage of reported marine fish in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 4 marine fish assessments reported in the Black Sea, 4 were considered to be unknown with respect to the population condition criterion (i.e. Member States reported on these species but were unable to determine the condition of their populations). The associated confidence rating of the information is rarely high.

Main pressures on fish

- ‘Biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species), and ‘physical loss’ (see 3.2 Physical loss) are the two most important pressures adversely affecting marine fish at the European level.
- ‘Biological disturbance’ is the most important pressure adversely affecting marine fish across all regional seas.

2.6 Marine reptiles

In Europe, marine turtles can be found in two of our four regional seas – the Mediterranean Sea and the North East Atlantic Ocean. In the Mediterranean Sea, the green turtle (*Chelonia mydas*) (Photo 2.5) and the loggerhead turtle (*Caretta caretta*) are known to nest on beaches. Another three species of marine turtle are considered to be visitors to the Mediterranean Sea and the North East Atlantic Ocean. The leatherback turtle (*Dermochelys coriacea*), the largest of all living marine turtle species, is the most regularly sighted visiting Europe’s seas.

Photo 2.5: Green turtle (*Chelonia mydas*)

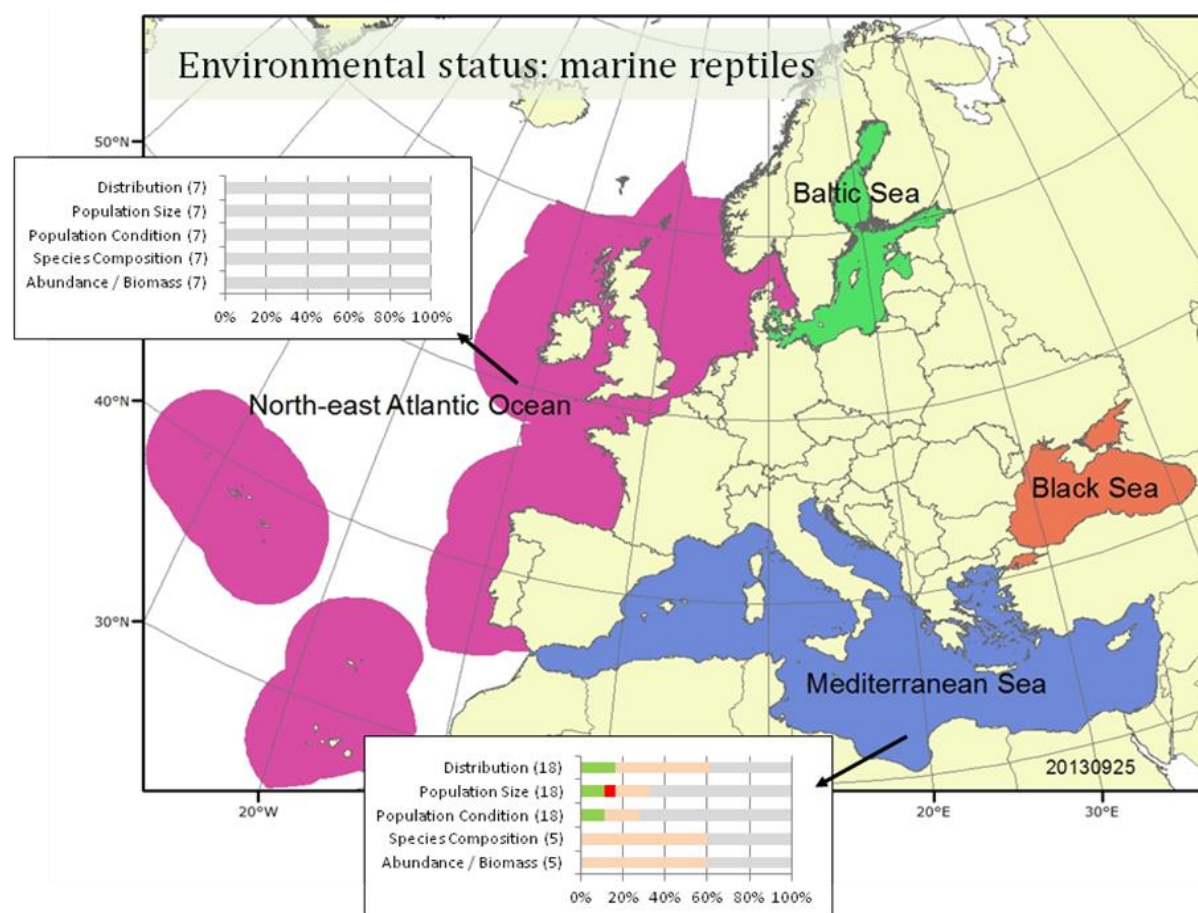


Photo: © Beth Stoker

Key messages for marine reptiles

- Over 56% of the ‘GES’ assessments for marine reptiles are ‘unknown’ for all criteria (see Figure 2.7).
- For marine reptiles population size (4%) is the only criterion with a ‘not good’ assessment.
- All marine reptile assessments of ‘good’ environmental status have an ‘improving’ or ‘stable’ trend, whilst the only marine turtle assessment of ‘not good’ has a ‘declining’ trend associated with it.
- The three GES indicators most used to report on marine reptiles are 1.3.1 Population demographics, 1.1.1 Species distributional range, and 1.2.1 Population abundance.
- All the information reported for marine reptiles in the NE Atlantic Ocean fall in the ‘unknown’ category.
- No information was reported for the Black Sea or the Baltic Sea due to the limited distribution or absence of marine reptiles in these regions.

Figure 2.7: Percentage of reported marine reptiles in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 7 marine reptile assessments reported in the NE Atlantic Ocean, 7 were considered to be unknown with respect to the population condition criterion (i.e. Member States reported on these species but were unable to determine the condition of their populations). The associated confidence rating of the information is rarely high. No information was reported for the Black Sea or the Baltic Sea due to the limited distribution or absence of marine reptiles in these Regional Seas.

Main pressures on reptiles

- ‘Other physical disturbance’ (see 3.4 Marine litter and 3.5 Underwater noise) and ‘biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species) are the two most important pressures adversely affecting marine reptiles at European level (note: no information was reported for the Black Sea or the Baltic Sea).
- For the Mediterranean Sea the most important pressure adversely affecting marine reptiles is ‘other physical disturbance’, whilst for the NE Atlantic the most important pressure is ‘biological disturbance’.

2.7 Seabirds

Seabirds are birds that have fully adapted to life within the marine environment, and include petrels, gannets, cormorants, skuas, gulls, terns and auks (Photo 2.6). Large numbers of seabirds occur in European waters all year round, but most spend the majority of their lives at sea. They feed both at the ocean's surface and below it, feeding mainly on fish, squid and plankton, picking detritus from the surface, or foraging on exposed intertidal areas. Most seabirds nest in colonies, which can vary in size from a few dozen birds to millions.

Photo 2.6: Kittiwake (*Rissa tridactyla*) in flight

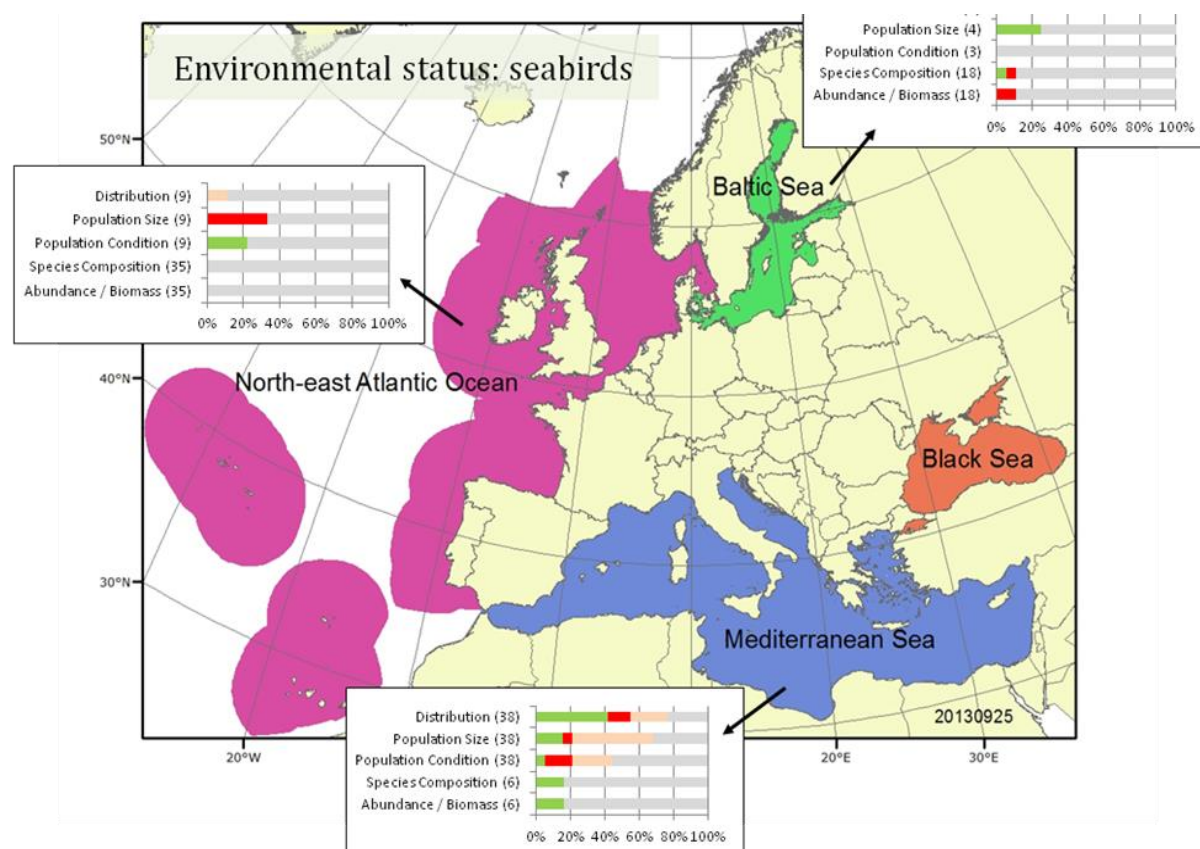


Photo: © Ben Dean

Key messages for seabirds

- Over 40% of the 'GES' assessments for seabirds are 'unknown' for all criteria (see Figure 2.8).
- For seabirds' population condition is the criterion with more assessments of 'not good' reported.
- Most assessments of 'good' environmental status for seabirds have an 'improving' or 'stable' trend, whilst most assessments of 'not good' have a declining trend associated with them.
- The four GES indicators most used to report on seabirds are 1.2.1 Population abundance, 1.2 Population size (criterion level), 1.1 Species distribution (criterion level) and 1.1.1 Species distributional range.
- No seabird information was reported for the Black Sea.

Figure 2.8: Percentage of reported seabirds in relation to categories of GES for each MSFD Commission Decision criterion per Regional Sea



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 38 seabird assessments reported in the Mediterranean Sea, 21 were considered to be unknown with respect to the population condition criterion (i.e. Member States reported on these species but were unable to determine the condition of their populations). The associated confidence rating of the information is rarely high. No information was reported for the Black Sea.

Main pressures on seabirds

- ‘Biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species), ‘physical loss’ (see 3.2 Physical loss), and ‘contamination by hazardous substances’ (see 3.8 Hazardous substances) are the three main pressures adversely affecting seabirds at European level (note: no information was reported for the Black Sea).
- ‘Biological disturbance’ is the most important pressure adversely affecting seabirds across all regional seas.

2.8 Marine mammals

Marine mammals are found in all of Europe’s seas, and the group includes whales, dolphins, porpoises, seals (Photo 2.7) and even otters. Only one species of marine mammal, the harbour porpoise, is known to occur in all four European regional seas.

Photo 2.7: Grey seal cow (*Halichoerus grypus*)

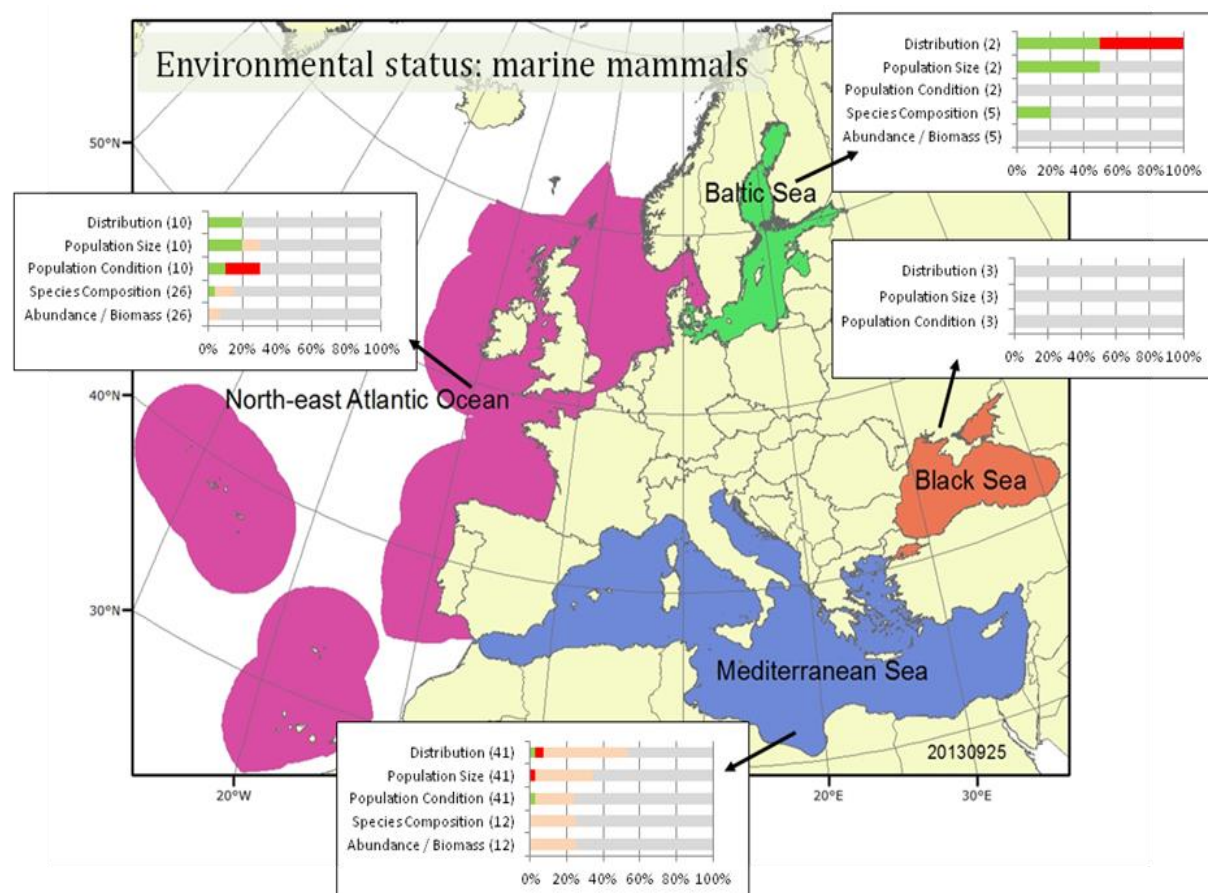


Photo: © Natural England/ Paul Keene

Key messages for marine mammals

- Over 54% of the ‘GES’ assessments for marine mammals are ‘unknown’ for all criteria (see Figure 2.9).
- For marine mammals distribution is the criterion with more assessments of ‘not good’ reported.
- Most assessments of ‘good’ environmental status for marine mammals have a ‘stable’ trend.
- The three GES indicators most used to report on marine mammals are 1.2.1 Population abundance, 1.1.1 Species distributional range, and 1.3.1 Population demographics.

Figure 2.9: Percentage of reported marine mammals in relation to categories of GES for each MSFD Commission Decision criterion per Regional level



Note: Green = good, red = not good, orange = other and grey = unknown. The figures in parenthesis are the number of reported features. This means that of the 2 marine mammal assessments reported in the Baltic Sea, 2 were considered to be unknown with respect to the population condition criterion (i.e. Member States reported on these species but were unable to determine the condition of their populations). The associated confidence rating of the information is rarely high.

Main pressures on mammals

- ‘Biological disturbance’ (see 3.6 Extraction of fish and shellfish, 3.7 Microbial pathogens and 3.12 Non-indigenous species), ‘other physical disturbance’ (see 3.4 Marine litter and 3.5 Underwater noise), and ‘contamination by hazardous substances’ (see 3.8 Hazardous substances) are the main three pressures adversely affecting marine mammals at European level.
- ‘Biological disturbance’ is the most important pressure adversely affecting marine mammals across all regional seas.

2.9 *Physical features*

The physical features reporting aimed to capture information on essential physical features and characteristics in the marine environment. The reporting allowed reporting of descriptive, categorical and more detailed information. The following information was collected:

- Topography and bathymetry of the seabed (Descriptive)
- Sea surface temperature and trends (Descriptive & Categorical)
- Near-bottom temperature and trends (measurements approximately 2m from sea bottom) (Descriptive & Categorical)
- Ice cover (duration/extent) and trends (Descriptive & Categorical)
- Current velocity (Descriptive)
- Upwelling (Descriptive)
- Wave exposure (Descriptive)
- Mixing characteristics (Descriptive)
- Turbidity and trends (Descriptive & Categorical)
- Transparency and trends (Descriptive & Categorical)
- Residence time (Descriptive)
- Salinity and trends (Descriptive & Categorical)

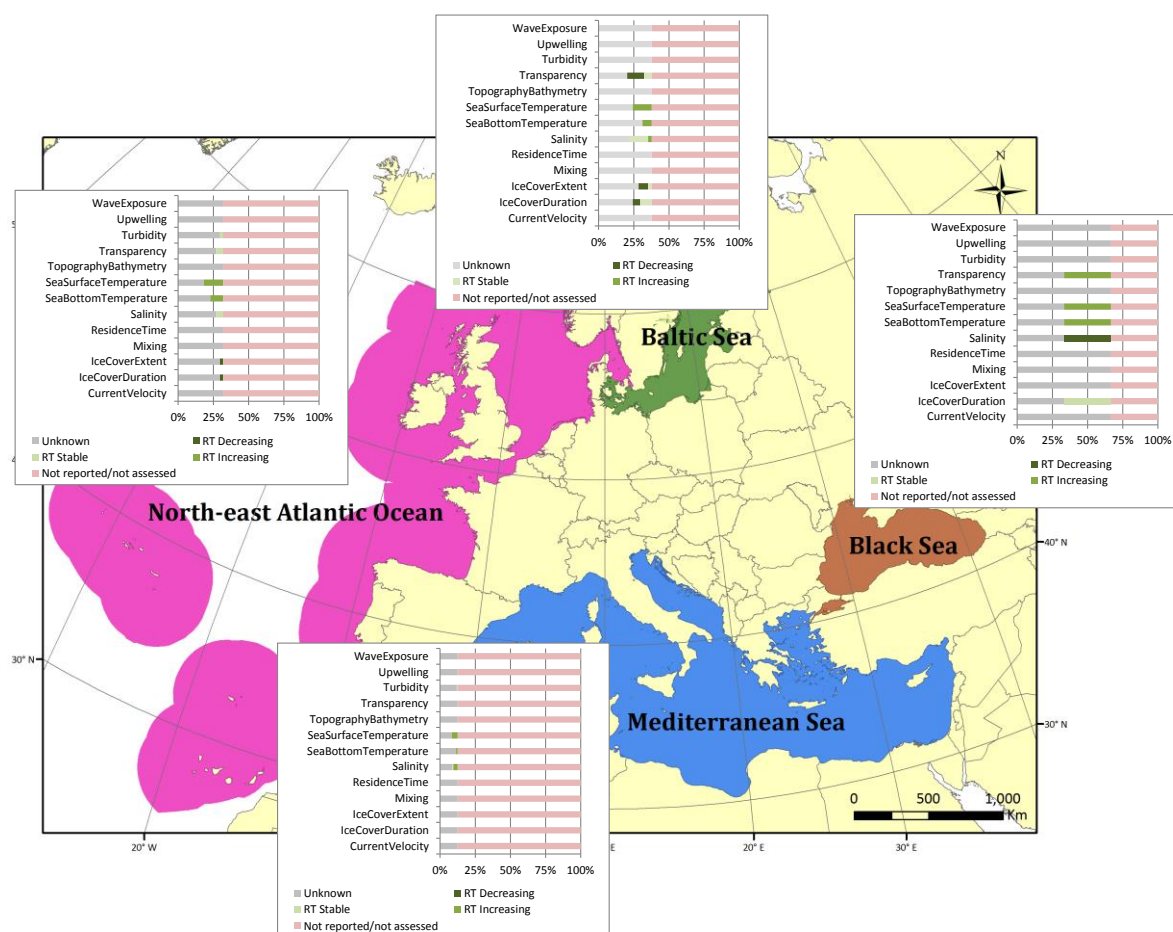
Member States reported mainly descriptive data for all physical features. Categorical data were reported only for ice cover and for the assessment of trends together with information on the time frame for which data were available.

Data are presented based on numbers of marine units. Overall, physical features were described for less than 22.8% of the EU marine assessment units.

Key messages

- Physical features are described for less than 22.8% of the EU marine assessment units, and the information reported is primarily descriptive.
- Data and information availability varies across different physical features, Member States and Regional Seas (see Figure 2.10).
- The longest datasets are recorded for salinity (110 years), sea surface temperature (100 years), ice cover (80 years), sea bottom temperature (50 years), and turbidity (40 years).
- Increasing recent trends for sea surface and sea bottom temperatures are reported across all regional seas (see Figure 2.10). For sea surface temperature, the percentage of assessment units reported with increasing sea surface temperatures ranges from 4% in the Mediterranean, to 14% in the Baltic Sea and NE Atlantic Ocean, and 33% in the Black Sea.
- Information about expected future trends is very scarce. Based on the information provided for approximately 10% of marine units, an increase in water temperature is consistently predicted across all regional seas.
- At European level, decreasing recent trends are reported for ice cover extent and duration for 2% of assessment units. Ice cover extent and duration are expected to decrease in the future in 2% of the marine assessment units.
- Decreasing transparency is reported in the Baltic Sea for 12% of assessment units.

Figure 2.10: Recent trends for physical features at a regional level.



Note: Dark green – recent trend is decreasing, medium dark green – trend is increasing; light green – no trend, stable, grey = unknown and orange – not reported. The figure shows the percentage of marine area reported in different categories. The associated confidence rating of the information is rarely high.

2.10 Confidence and limitations

One of the major limitations associated with the information reported by Member States is the high number of ‘unknown’ conclusions. In addition, for biodiversity features, where the category ‘other’ is used it is not possible to tell whether or not a particular biodiversity component is in GES. The data gaps in Member States' reports resulted in a fragmented overview of the state of the marine environment and highlight the challenge of establishing robust baselines against which future assessment can be compared.

In addition, the methods and/or approaches adopted for the assessments were generally not coherent neither comparable across Member States, making the analysis of the reported information difficult.

Confidence assessments of the information reported are limited, and their availability varies across features, Member States and Regional Seas. It is not possible to draw clear patterns. This is exacerbated by the high number of ‘unknown’ conclusions mentioned above.

The confidence in the regional and sub-regional analyses of the information reported by Member States is affected by the inconsistencies and limitations of the reported information, and the nature of the assumptions required to undertake such analyses.

Biodiversity features

Two major limitations in the information reported by Member States for biodiversity features make it impossible to directly synthesise and aggregate the information reported per marine region and/or sub-region:

- Member States have reported on different species and habitat lists and not against a standardised list of biodiversity features. This resulted in different terminology being used for equivalent biodiversity features (e.g. shallow mud versus shallow sub-littoral mud), making direct comparisons between Member States very difficult unless assumptions are made; and
- The lack of area estimates for habitats and population estimates for species and functional groups in assessment units means a weighted aggregation of reported information cannot be undertaken. This is because it is not known how much of a biodiversity feature is present within a given assessment unit ^(b). Experience from the EU Habitats Directive Article 17 bio-geographical assessments highlights the difficulties in aggregating information and the need for biodiversity feature area or population estimates to weight assessments at national level (European Topic Centre on Biological Diversity, 2008).

Physical features

Major limitation around the information reported by Member States is that reporting does not entail actual data, but mostly a description of the data available. Therefore only categorical data for trends assessment were analysed for all elements.

2.11 Areas for improvement

From a features and characteristics point of view, when planning for future assessments, it is important that adequate consideration is given to:

- The need to make effective use of existing assessments and best available information;
- The need to identify key gaps in knowledge and information and how these can be addressed in a suitable timeframe;
- The need to develop reporting guidance that allows for a coherent and consistent assessment approach, which can deliver comparability of results across Member States;
- The need for adopting a standardised list of biodiversity features;
- The need to resolve the issues affecting the spatial delimitation of MSFD assessment units (e.g. gaps, overlaps, different jurisdictions); and
- The need to capture area information to allow for a weighted aggregation of the reported information.

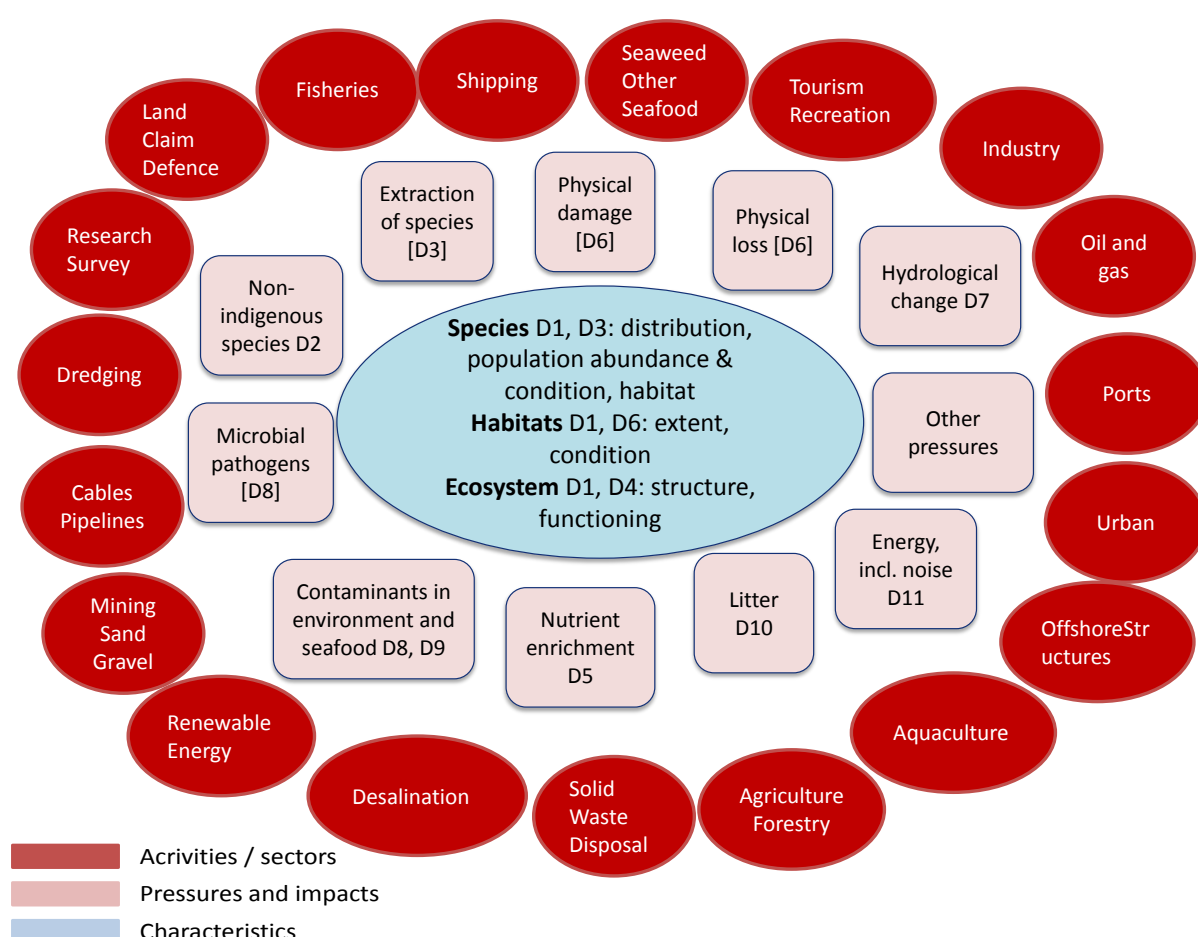
^(b) For example, in assessment unit A sub-tidal sand could cover 50km² or it could cover 5km²; when combining this information with assessment unit B where sub-tidal sand covers 100km² it is essential to know which area value is correct for unit A.

3 Pressures and impacts

3.1 Overview

A pressure can be described as the mechanism (physical, chemical or biological) through which a human activity has the potential to have a direct or indirect impact on any part of the ecosystem. The degree of the impact depends upon various factors, such as the intensity and spatial and temporal distribution of the pressure. State descriptors – so called features and characteristics – are components of an ecosystem which are sensitive to the pressure and can be impacted directly or indirectly. The cumulative impacts, deriving from all the pressures, affecting the component need to be assessed to determine whether the state of the environment is good or not (EC, 2011).

Figure 3.1: The figure shows topics addressed in the initial assessment reports, ranging from characteristics, pressures and impacts as well as activities/sectors, causing pressures on the marine environment.



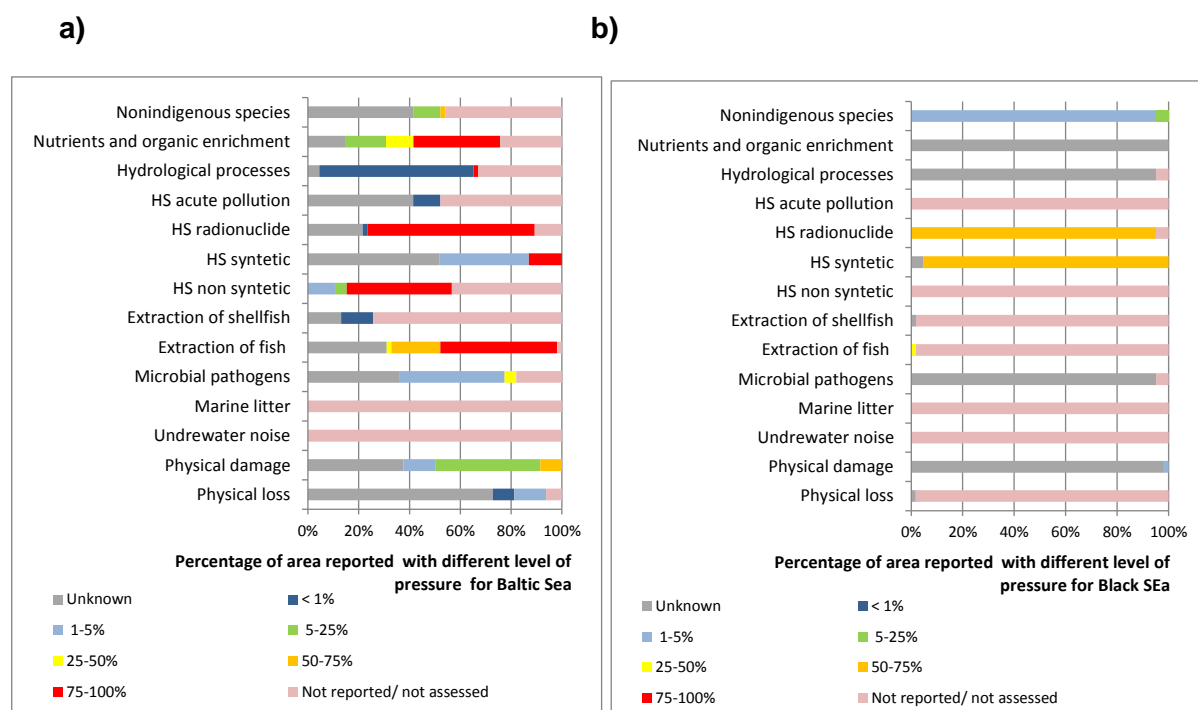
Characteristics of pressures and impacts

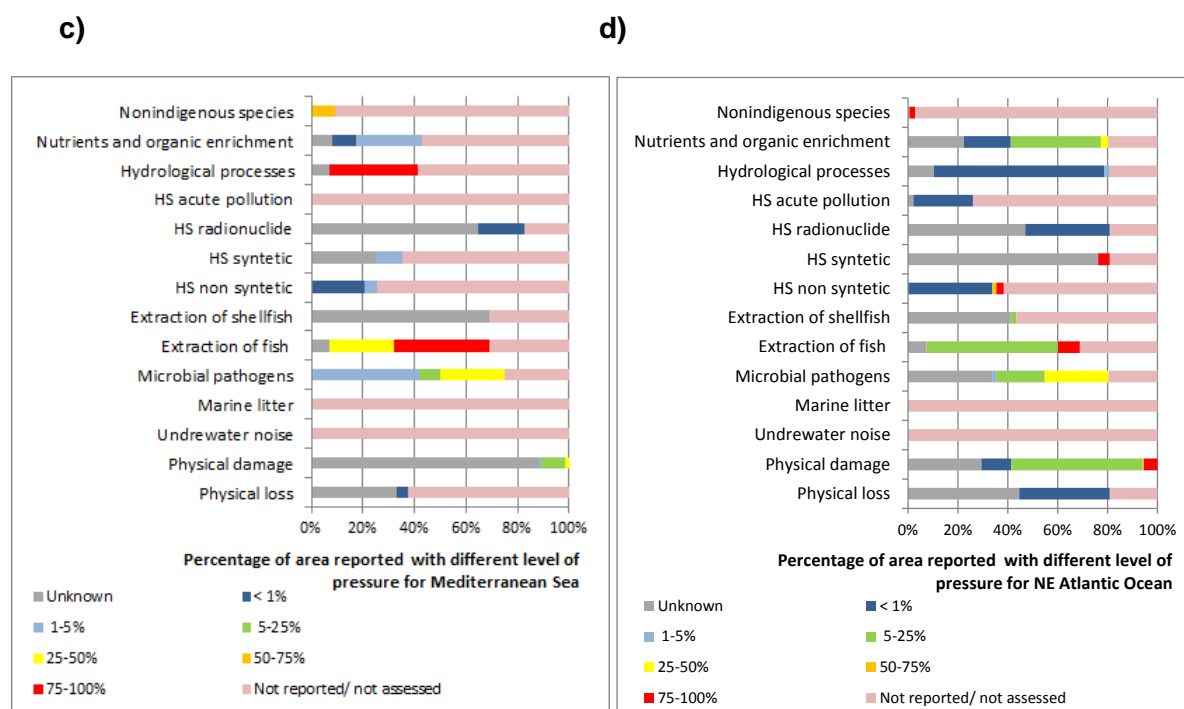
Member States reported characteristics of the pressure in terms of proportion of the assessment area which is subject to the pressure. The intensity of the pressure is reported in terms of area exposed to the pressure in each assessment area (Figure 3.2). Data were aggregated at regional level. Results differ significantly among four regional seas:

- In the Baltic Sea the pollution with radionuclides is considered to be the most extensive, being reported in high intensity (75–100% of area assessed) for 65% of the Baltic Sea area; nutrient enrichment, extraction of fish and hazardous substances pollution have also been reported as intense in almost 40% of the region.
- Data reported for the Black Sea cover a small proportion of the region and are therefore not interpreted here.
- In the Mediterranean region the extraction of fish and alteration of hydrological processes was reported as most intensive (75–100% of area assessed) for over 30% of the EU–Mediterranean sea; hydrological processes alteration was reported for the Adriatic Sea, Ionian Sea & Central Mediterranean Sea and Aegean-Levantine Sea.
- In the NE Atlantic ocean physical damage was reported as the most pervasive, although the high intensity pressure (covering 75–100% of area assessed) is identified over 5% of the regional sea; pressure related to extraction of fish is also present in a high proportion of the region (61%), although the high intensity pressure (covering 75–100% of the area assessed) is identified over 8% of the regional sea.

No spatial information was reported for Marine litter pollution and underwater noise.

Figure 3.2: Percentage of area under different intensity of pressures reported in regional seas.





Note: Proportion of the assessment area which is exposed to the pressure: <1%; 1–5%; 5–25%; 25–50%; 50–75%; 75–100%; Unknown/not assessed. Regional distribution of different levels of pressure for each pressure reported is presented for a) Baltic Sea, b) Black Sea, c) Mediterranean Sea and d) NE Atlantic Ocean.

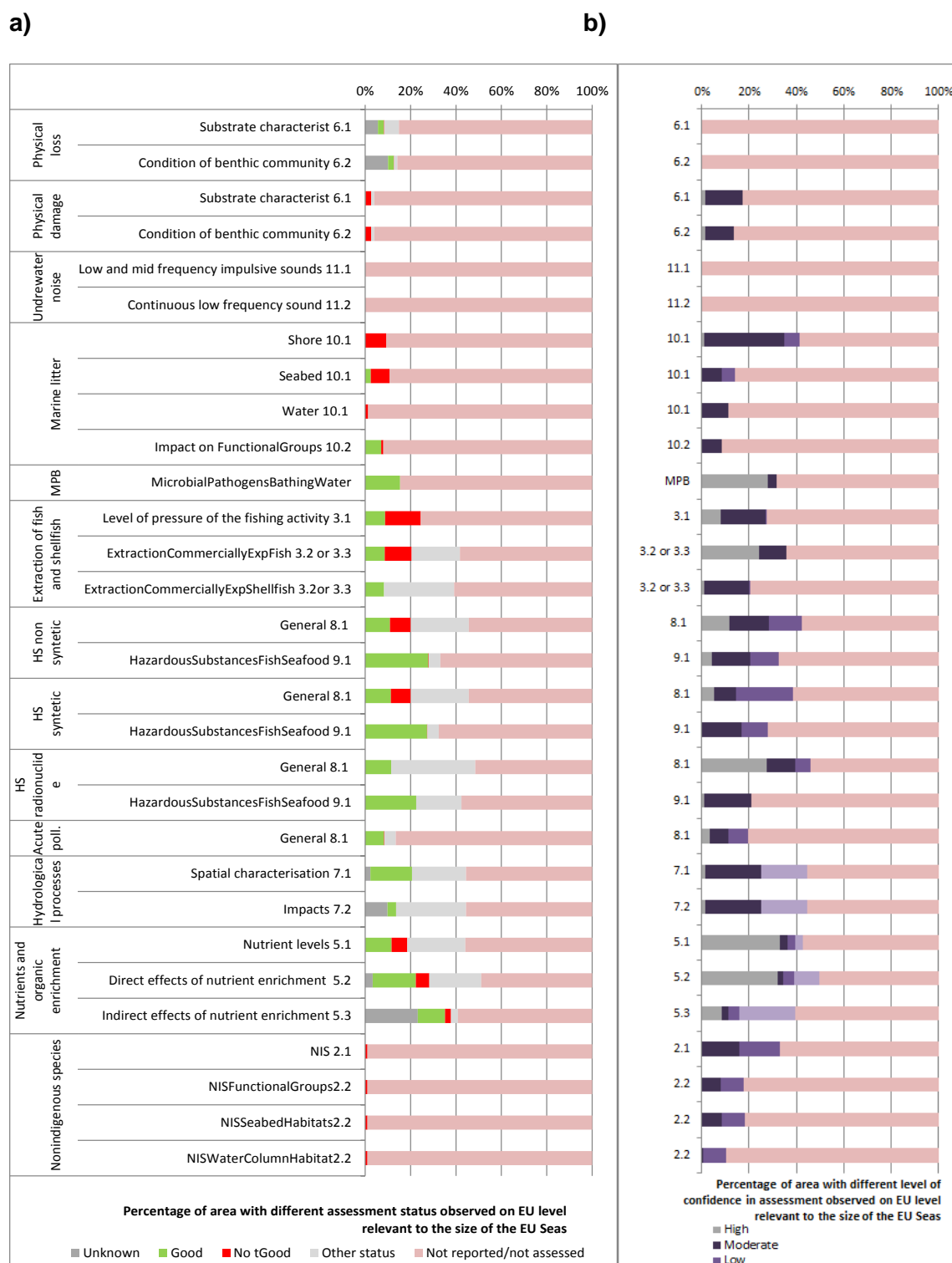
The highest confidence was reported for microbial pathogens information (high confidence reported for 27% of EU waters), where regular monitoring has been ongoing for several decades. Confidence level reported for other topics varies among regional seas. High level of confidence is reported in data on the extraction of fish and on nutrient and organic enrichment in the Baltic Sea (fish 56%, nutrients 28%) and in the Mediterranean Sea (fish 37%, nutrients 23%). Confidence in the assessment and reporting of hydrological processes assessment is highest in the Mediterranean (35%) as well as in NE Atlantic Ocean (21%). Highest confidence in the assessment of physical loss and physical damage was reported in the NE Atlantic Ocean (33% for each pressure).

Assessment of pressures

Initial assessment is expected to support the determination of good environmental status (GES) and definition of environmental targets and associated indicators, set up to enable progress towards achieving GES. GES is described with 11 Descriptors, covering characteristics of the marine environment as well as pressures and impacts as shown in the figure (Figure 3.3 and 3.4).

Data in the reporting of assessment of pressures in relation to descriptors for the determination of GES are scarce for many topics; a low percentage of EU marine area is assessed. From the data reported on status it can be concluded that fisheries are a major pressure at EU level. Additionally marine litter, pollution with hazardous substances and nutrients enrichment were reported as a cause of a not good status at EU level in several cases (Figure 3.3a). Reporting on confidence level is also of a low geographical coverage; overall confidence in the assessment is reported as high mainly only in the so called ‘traditional topics’ assessment, i.e. of hazardous substances pollution, nutrient enrichment and extraction of fish and pollution by microbial pathogens (Figure 3.3b).

Figure 3.3: Percentage of area reported in relation to assessment of pressures with different categories of GES criteria for each MSFD Commission Decision criterion and related confidence level reported, aggregated at EU level.

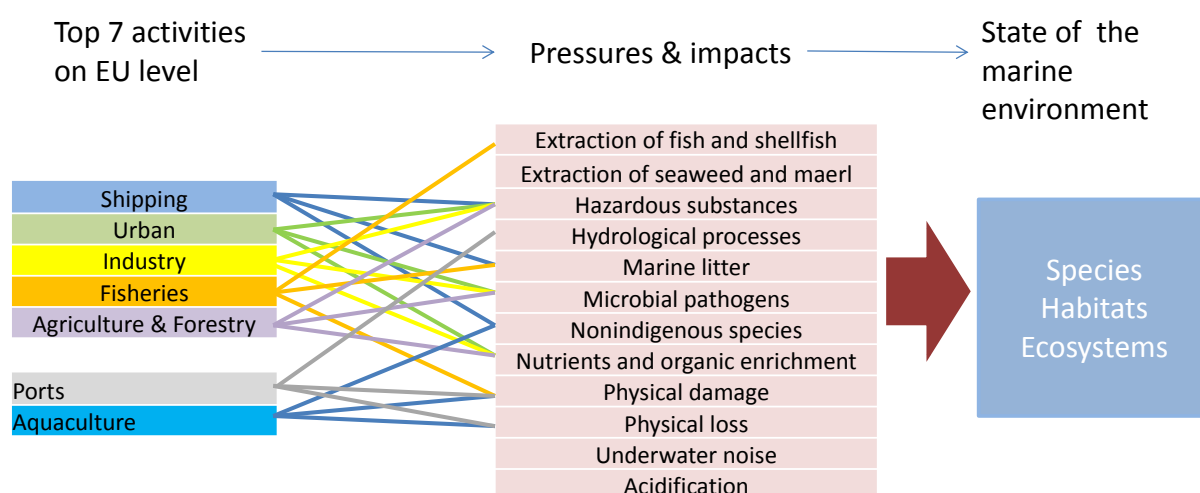


Note: Proportion of marine area assessed in different categories of status is presented on graph (a) Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. Associated confidence rating of the information is presented on graph b). Grey = unknown, dark violet = high confidence, medium violet = moderate confidence, light violet = low confidence, orange = not reported.

Activities causing pressures

We extracted information about the reporting of links among activities vs. pressures and impacts (Figure 3.4). Most pressures/impacts are caused by several different activities (for example hazardous substances come from shipping, urban areas, industry, agriculture and forestry), which makes it in many cases very difficult to select proper and effective management measures.

Figure 3.4: Schematic presentation of linkages among sectors, pressures & impacts and state of the marine environment identified based on the MSFD data analysis.



3.2 Physical loss

Physical loss refers to the long-term alteration or loss of the natural seafloor areas to a man-made substrate, the conversion of a marine habitat to terrestrial through land claim or the loss of biogenic substrate as a result of sealing or smothering. Activities that cause physical loss (sealing) include land claim and new construction of infrastructure, the footprint of a wind turbine or oil or gas platform on the seabed (Photo 3.1). Physical loss due to smothering or a combination of sealing and smothering are caused by dumping at sea where the resulting sedimentary habitat differ structurally from the pre-dumping state, creation of artificial reefs, protection of pipes and cables using rock dumping and concrete mattress reinforcement techniques or discharge of cuttings piles from offshore drilling activities.

The main concern for management purposes is the magnitude of impacts of human activities on seafloor substrates structuring the benthic habitats. High proportion of European coastline has been developed historically. Most countries have estimated losses of coastal wetlands and sea grasses exceeding 50% of the original area with peaks above 80% for many regions (Airoidi and Beck, 2007)

Photo 3.1: Example of physical loss – reclaimed area used for construction of port facilities



Photo: © Battelino L., IWRS

Key messages

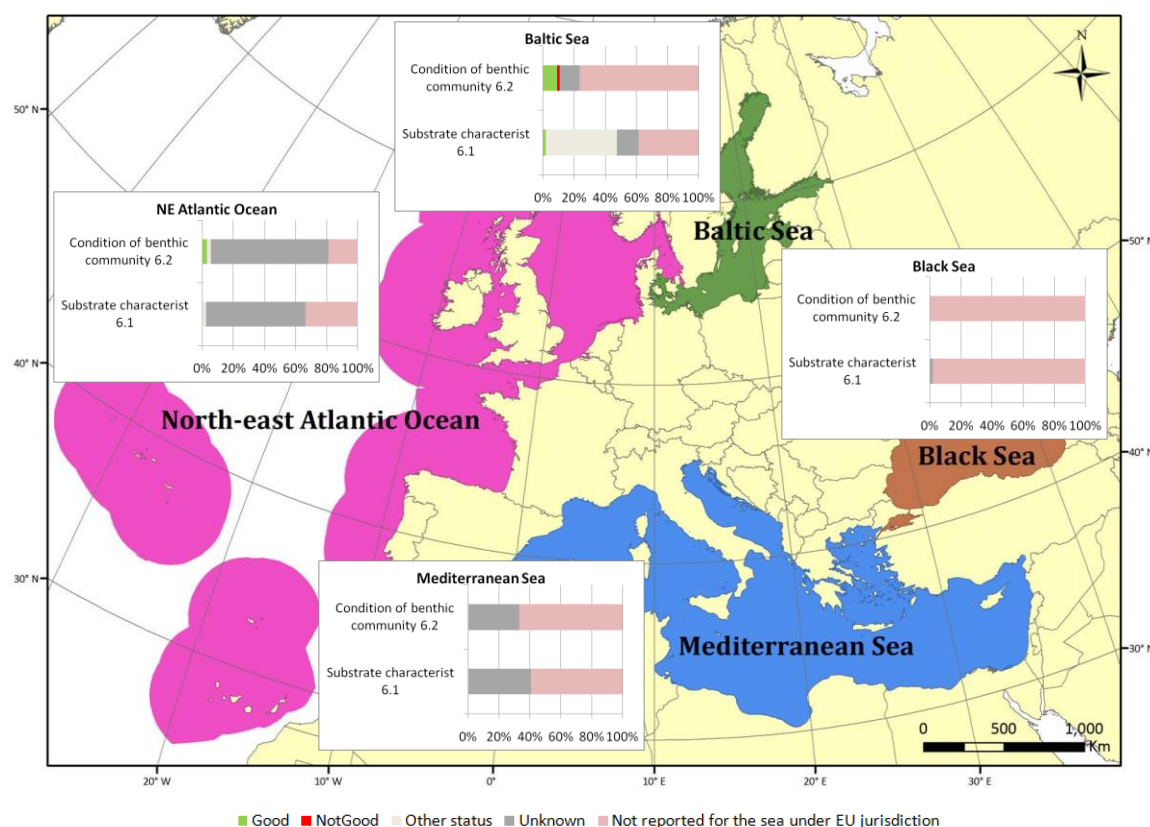
- 16 Member States reported information on physical loss.
- 23% of EU waters were reported under a low level of pressure from physical loss. The level of pressure and impact was not reported for 75% of EU waters. Reported data refer mainly to the NE Atlantic and Baltic Sea (Figure 3.5).
- Features, impacted by physical loss are mainly predominant habitats, physical/chemical elements – transparency, current velocity, nutrient and oxygen levels and fish.
- Most countries recognised the problem of physical loss, but assessment is generally not performed consistently over the EU marine areas. Over 90% of EU waters were not assessed with criteria Substrate characteristic (6.1) and Condition of benthic community (6.2) in relation to physical loss. Overall, 2% of EU waters are reported as being in good status regarding criteria 6.2 and 3% regarding criteria 6.1
- Main activities, causing the pressure at EU level are land claim and flood defence, ports construction, solid waste disposal, renewable energy production and aquaculture.

Overall confidence in the assessment is low, since only a small share of EU seas have been assessed regarding physical loss.

Proposals for improvement of reporting and analysis in the future

The dataset reported about physical loss gives some estimation of which sectoral activities are taking place within regional seas. Spatial sectoral data should be collected at regional and EU level to give a proxy for the determination of the area of possible physical loss. Regionally coordinated methods for the assessment should be further developed to expand baseline data in order to identify, assess and prioritise pressure/sector relationships to support the establishment of appropriate targets and indicators.

Figure 3.5: Percentage of reported criteria 6.1 and 6.2, used for assessment of physical loss for each MSFD Commission Decision criterion per Regional level.



Note: MSFD objective is that human pressures on the seabed do not hinder the ecosystem components to retain their natural diversity, productivity and dynamic ecological processes, having regard to ecosystem resilience. Criteria for monitoring are 6.1 Physical damage, having regard to substrate characteristics and 6.2 Condition of benthic community.) The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

3.3 Physical damage

Physical damage includes three pressures, i.e. abrasion, siltation or the extraction of non-living material causing an alteration of the seafloor habitat. Abrasion is the erosive action that occurs when there is a physical interaction of human activities with the seafloor and with seabed fauna/flora causing physical damage and/or mortality (e.g. from trawling or anchoring)(White et al., 2013). Siltation is the change in the concentration and/or distribution of suspended sediments in the water column from e.g. runoff, dredging or trawling (see figure). Extraction of non-living material includes sand and gravel (aggregates) extraction and the removal of surface substrates for exploration of seabed and subsoil. Because of its widespread nature fishing is known to be the most important human activity causing physical damage to the seafloor(Halpern et al., 2008; Jackson et al., 2001). The main fishing gears utilised on the continental shelves are towed bottom trawls causing physical damage mostly through the pressures abrasion and siltation. The impact of a bottom trawl will depend on the size of the gear, their penetration depth as well as the speed and distance over which the gear is towed. Because these gears are heavy their contact with the seafloor is likely to cause structural changes in benthic habitats by altering sediment structure or removing biogenic structures such as corals or biogenic reefs. The disturbance of the sediment may cause changes in the geo-chemical processes in the seafloor(Duplisea et al., 2001). Re-suspension of organic material (Pilskaln et al., 1998) may affect the nutrient and carbon fluxes from the sediment, and consequently affect primary

production and eutrophication. Over the years technological innovations and the increase in size and power of fishing vessels and their gear have allowed bottom trawl fisheries to extend their activities into previously un-trawlable grounds (Morato et al., 2006) thereby further increasing the damaged area.

Dredging is the main human activity causing physical damage through the extraction of non-living material. Because this activity is not widespread it is assumed to cause less physical damage when expressed in terms of area but because it penetrates much deeper into the seafloor its local impact is more severe than that of trawling even up to the point where physical damage turns into physical loss and everything that constitutes the habitat is removed.

Photo 3.2: Fishing related damage to the seafloor

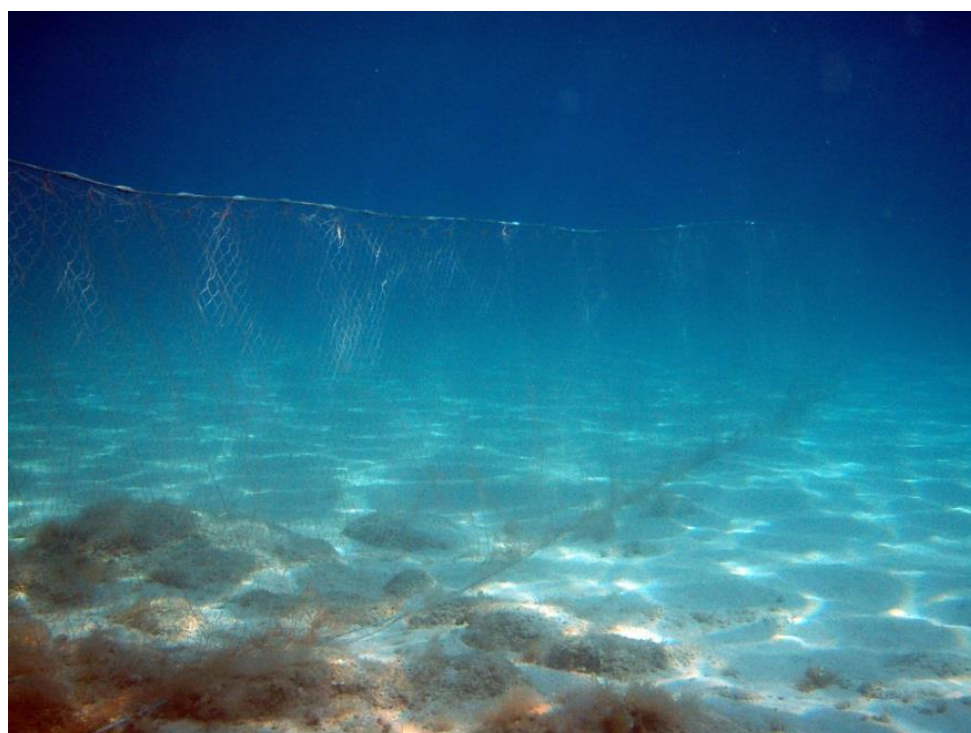
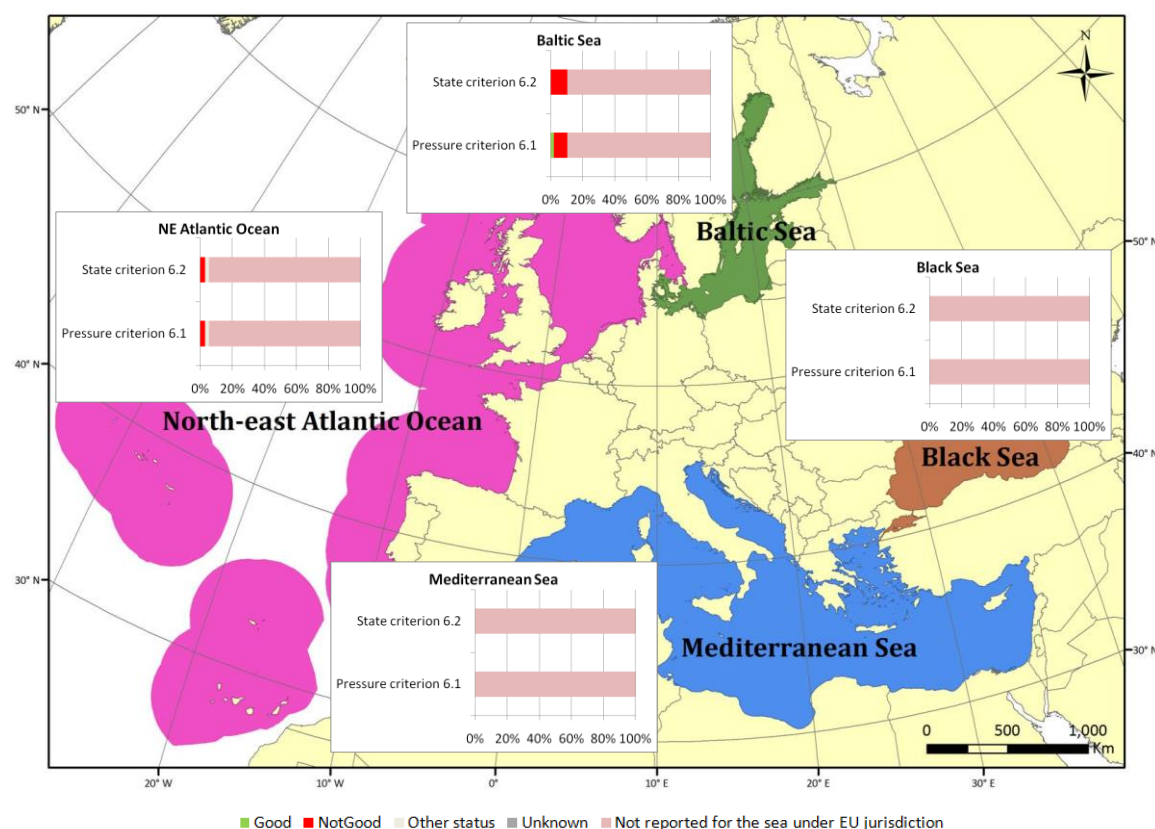


Photo: © T.Makovec, National institute of biology - Marine biology station Piran

Key messages

- 15 Member States reported physical damage
- The reporting by the Member States on physical damage suffered from huge differences between the Member States or regions in the availability of information and when available in interpretation. The reporting shows that the proportion of the region where the pressure occurs and is impacted differs considerably between regions varying between 1% in the Mediterranean to 97% in the NEA. For Europe as a whole this is 85%.
- The habitats mostly affected at an EU level were the shallow sandy and muddy habitats but this only reflects how often these habitats occurred in the database. As neither the proportion of the area where the habitat occurs is known nor the proportion of the habitat area impacted this does not provide any relevant information.
- In all regions fisheries was identified as the main human activity causing physical damage except in the Black Sea where this was dredging.

Figure 3.6: Percentage of reported criteria 6.1 and 6.2, used for assessment of physical damage for each MSFD Commission Decision criterion per Regional level.



Note: Criteria for monitoring are 6.1 Physical damage, having regard to substrate characteristics and 6.2 Condition of benthic community. The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

Proposals for improvement of reporting and analysis in the future

Clear guidance on how to determine the area where the pressure occurs and what constitutes an impacted area. Starting point should be the calculation of indicators that describe the area covered and/or impacted for all major human activities (i.e. fishing and dredging as a minimum).

3.4 Marine litter

Marine litter is defined as any persistent, manufactured or processed solid material (regardless of size) discarded or unintentionally lost, disposed of or abandoned, that ends up in the marine and/or coastal environment. It includes, but is not limited to, plastic, metal, glass, concrete and other construction materials, paper and cardboard, rubber, textile, timber and hazardous materials, such as munitions, asbestos and medical waste. Semi-solid remains of mineral and vegetable oils, paraffin and chemicals are not included in the definition (Galgani et al., 2010). Plastic litter is considered to be the most problematic type of marine litter.

Photo 3.3: Marine litter accumulated on a remote island in the Adriatic



Photo: © Lastovska cove, Mljet 2007 (source: Floating Marine Litter Without Boundaries: a Threat to the Coves of Mljet Island (Croatia), Željko Kwokal and Branko Štefanović)

There are many impacts that marine litter has on marine life and human society. Of the 120 marine mammals species listed on the IUCN list, 54 (45%) were reported to have interacted (ingestion and/or entanglement) with marine litter (Piha et al., 2011). Over 260 species are known to ingest or become entangled in plastic debris and there are widespread reports of harmful effects. Social harm includes reduction in recreational, aesthetic or educational values of an area as well as risks to human health. Economic harm includes direct costs and loss of income due to marine litter and affects a range of marine sectors (including aquaculture, agriculture, fisheries, shipping, leisure boating), power generation and industrial use, local authorities and tourism (Mouat et al., 2010).

Key messages

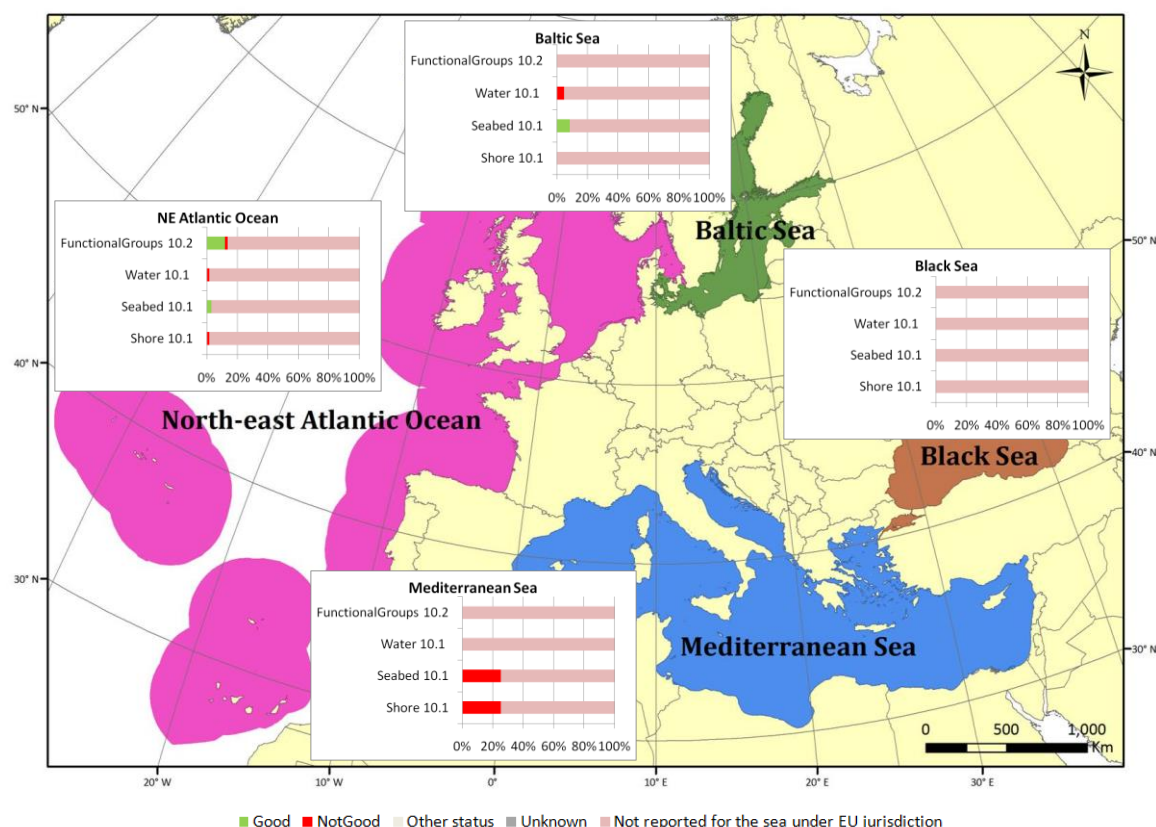
- 16 Member States reported information on marine litter.
- Extent of area under the pressure was not reported. Member States rather reported on quantities and trends of marine litter mostly on shore and seabed litter.
- Only four Member States reported on the level of impact, mostly on the impact of functional groups.
- Quantities of litter washed ashore and/or deposited on coastlines are reported as stable in 20% of EU waters. Similarly, quantities of litter deposited on the sea-floor are reported as stable in 21% of EU waters (Figure 3.7).
- Features, impacted by marine litter are mainly predominant habitats, marine biota (turtles, cephalopods). At EU level impact from marine litter was most frequently observed in marine shelves.
- All Member States recognised the problem of marine litter, but assessment is generally not performed consistently over the EU marine areas. No Member State reported 'good' status, 18% of the Member States reported 'not good' status for shore litter. 6% of Member States

reported good status and 14% ‘not good’ status on seabed litter. Many times the status was not assessed or was described with words, mostly using negative connotations.

- Main activities, causing the pressure at EU level are shipping, tourism recreation, fisheries, urban and industry.

Overall confidence in the assessment is low, since only a small proportion of the EU’s seas have been assessed regarding marine litter.

Figure 3.7: Percentage of reported criteria 10.1 and 10.2, used for assessment of marine litter for each MSFD Commission Decision criterion per Regional level.



Note: Criteria for monitoring are 10.1 Characteristics of litter in the marine and coastal environment, where three indicators are observed – (i) Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source (10.1.1); (ii) Trends in the amount of litter in the water column (including floating at the surface) and deposited on the sea-floor, including analysis of its composition, spatial distribution and, where possible, source (10.1.2); (iii) Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro-plastics) (10.1.3) and 10.2 Impacts of litter on marine life – Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis). The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

Proposals for improvement of reporting and analysis in the future

Coordinated approach in synchronized assessment methodologies is strongly needed across Europe. Data on micro-plastic pollution and the level of impact are extremely scarce and need to be reported in wider areas. Better coordination is needed within Member States to gather all existing data. Science based approaches should be encouraged in gathering data on marine litter across European seas.

3.5 Underwater noise

Due to the very efficient transmission of acoustic waves underwater, marine taxa use sound as their prime sense for communication, location, navigation and orientation among others. Humans introduce sound into the marine environment in many ways, either intentionally, for example using loud and impulsive sounds for geophysical exploration or for navigation (seismic surveys and sonar), or unintentionally as a by-product of other activities (for example during marine construction or shipping activities). These sounds can affect marine life in various ways: they can lead to various behavioural responses and can obscure (mask) biologically relevant signals such as communication calls. Given that the overall received acoustic energy (= the acoustic dose) is high enough, sound can lead to hearing loss, either temporarily or even permanently, there can be injuries of auditory and other organs and finally – and this happens usually at very high received doses – marine life can die due to sound impacts (Gill et al., 2012).

Photo 3.4: Dolphins are very sensitive to sound disturbance



Photo: © Tilen Genov, Morigenos, Piran, Slovenia

Due to the overall limited knowledge on noise impacts two main issues that should be covered by the MSFD are (Tasker et al., 2010):

- Acute exposure to loud, low and mid frequency impulsive sounds (pile driving, seismic surveys etc.) leading to gaps in distribution of marine life due to behavioural avoidance
- Chronic exposure to continuous low frequency sound (shipping) leading to communication difficulties and potentially stress

Based on these issues, two indicators have been suggested; one for the registration of low frequency and high intensity impulsive sounds over defined temporal and spatial scales, the other as a means to monitor trends in ambient noise at selective areas.

Key messages

- 16 of the 23 Member States comprising marine waters have returned information on noise ($\approx 70\%$). 13 out of the 23 Member States have provided a full return ($\approx 57\%$).
- Very little information has been provided on the status, status trend, and confidence of the noise pressure level for the various Member States.
- There were more reports on trends in impulsive noise pressures compared to continuous. Overall the impulsive noise pressure seems to be increasing while the pressures from continuous sound seem to be more stable. Yet, one should take great care when concluding on an overall trend as very few data is available in each region.
- Considering the activities causing the highest noise pressure it was found that 17 Member States provided information in one way or the other.
- Shipping was by far the most frequently ranked activity causing noise pressure in the assessment, followed by renewable energy, oil and gas activities as well as research surveys. These three activities are also the ones with the largest resulting weight (defined as the sum of the rankings for the activity across regions). Shipping was also the only activity which the majority of the Member States (11) reported on.
- Regionally, shipping was reported to be the largest pressure in the Mediterranean, the Baltic and the NE Atlantic. In the Mediterranean defence as well as oil and gas were also seen a larger issue than the other activities, whereas in the NE Atlantic Ocean the second largest pressure came from renewable energy (possibly due to the increased construction and operation of offshore wind farms in that region).
- Only Germany reported on status trend for both impulsive and continuous noise pressure (both reported to be 'not good')
- With regards to the criteria and indicators determining GES, it has been found that the most common indicator used in the Member States were the ones set forth by the EU Comm. decision (EC, 2010) for the impulsive and continuous noise pressure, respectively.

Proposals for improvement of reporting and analysis in the future

Considering that underwater noise is a relatively new issue that involves still many uncertainties on impacts and their biological long term consequences, the patchy feedback by Member States is not surprising. It has to be pointed out though that the information on activities and hence pressures causing noise was quite comprehensive. As the MSFD indicators are essentially pressure indicators, one of the key information needs was addressed in this initial reporting phase. The EU has now provided very detailed further advice on the implementation of the MSFD (Dekeling et al., 2013). This will greatly increase the standardisation of terms, monitoring methods and data analysis procedures. Thus, it is likely that reporting and analysis will improve in the future.

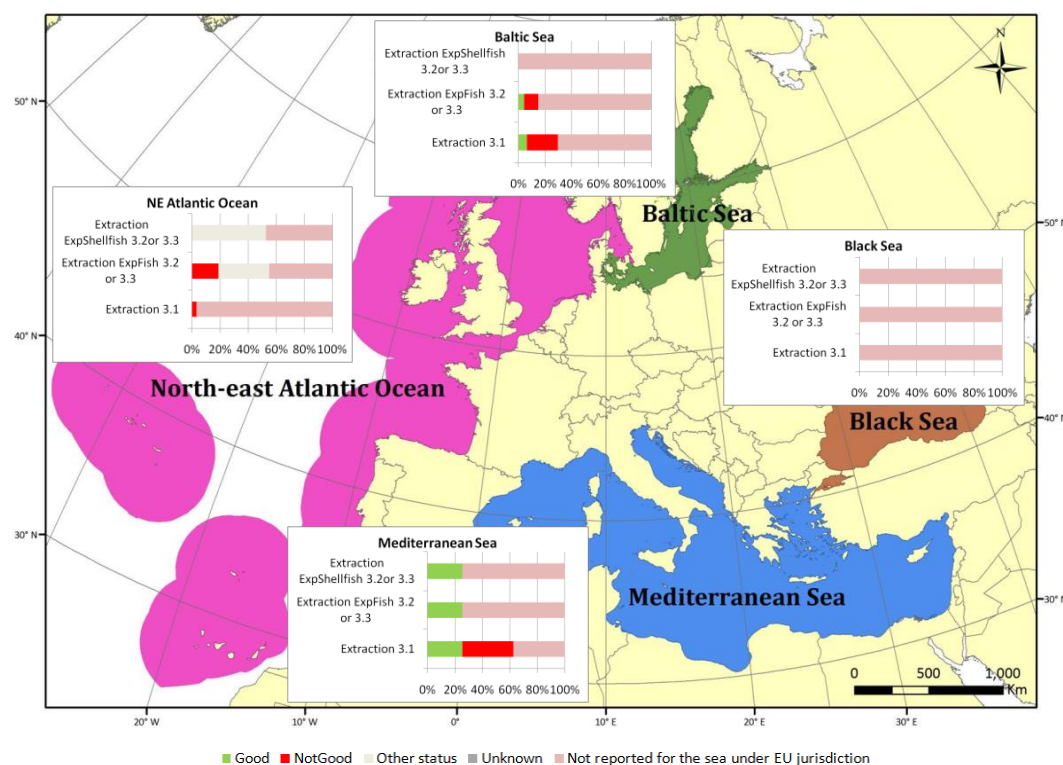
3.6 *Extraction of fish and shellfish*

This involves the extraction (and subsequent mortality) of fish or shellfish from their natural habitat, including incidental non-target catch (e.g. by commercial fishing, recreational angling and collecting/harvesting). Note that as currently phrased this is a subset of what is covered by the MSFD pressure "selective extraction of species, including incidental non-target catches" which also includes other ecosystem components such as marine mammals, seabirds or cephalopods.

Key messages

- 16 Member States reported on occurrence of the pressure, only 8 provided (partial) semi-quantitative information on fishing pressure
- Proportion of area affected by the pressure differs immensely between Member States, even within regions (Figure 3.8)
- Overall in the EU occurrence of the pressure on fish was reported for approximately 60% of the area of which about half indicated the pressure occurred in 5–25% of the area, and one-third 75–100% of the area. These values were based on one worst case example per Marine unit.
- For shellfish this was mostly unknown or not reported.
- Broad agreement on the main human activity causing the pressure, i.e. fisheries
- Marked differences in the availability of indicators and reference levels between regions. In the NE Atlantic Ocean approximately half could be assessed, in the Mediterranean about one quarter.

Figure 3.8: Percentage of reported criteria 3.1, 3.2 and 3.3, used for assessment of fish stocks for each MSFD Commission Decision criterion per Regional level.



Note: For this descriptor, the three criteria for assessing progress towards good environmental status are the following: 3.1 Level of pressure of the fishing activity, 3.2 Reproductive capacity of the stock, 3.3 Population age and size distribution. 8 indicators are used to describe stated criteria. This applies for all the stocks covered by Council Regulation (EC) No 199/2008^(c) (within the geographical scope of Directive 2008/56/EC) and similar obligations under the Common Fisheries Policy. The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

^(c) OJ L60, 5.3.2008, p.1.

Proposals for improvement of reporting and analysis in the future

It should be clear if this pressure is indeed supposed to cover only fish and shellfish as several countries also reported on other ecosystem components (e.g. seaweed, other functional groups).

The impact of pressure should be reported in terms of the proportion of species impacted, NOT in some area-based measure. In order to avoid double counting (where different Member States report on the same stock occurring in their waters) this should be regionally coordinated. Distinguishing fishing categories while expressing in terms of % area without some aggregate measure prevents an assessment of the occurrence of the overall pressure.

3.7 *Microbial pathogens*

Microbial pathogens (Greek: “pathos” means disease, “genos” means birth) are any microorganism that causes disease and include bacteria, viruses, protozoa and fungi. They represent the lower level of the trophic web and are the only reference to bacterial component in the marine environment. Reported data are obtained from the monitoring under the Bathing Water Directive and under the Shellfish Directive. Activities that contribute to introduction of microbial pathogens into marine environment include urban, agriculture/forestry and industry. Some pathogens occur naturally in marine waters. Others are carried into waterways via sewage effluents, agriculture and storm water runoff, industrial processes, and others. Rivers discharging into coastal areas may carry abundant micro-organisms from these diverse sources. Weather conditions (storms) have a great impact on quantities of microbial pathogens discharged into the marine environment. These data are being collected on a regular basis in the monitoring under Bathing Water Directive and under the Shellfish Directive.

Photo 3.5: Underwater outflow from a wastewater treatment plant (a) and microbial pathogens (b)

a)



(b)



Photo: © Valentina Turk, National institute of biology – Marine biology station Piran)

Key messages

- 14 Member States reported information on microbial pathogens.
- 18% of EU waters were reported with a proportion of 1–5% of the assessed bathing waters not meeting lower limit values (guide values) obtained from existing reporting to other Directives. The level of pressure on bathing waters was not reported for 22% of EU waters. No reported data came from the Black Sea Region.
- 14% of EU waters were reported with a proportion of 5–25% of assessed Shellfish water not meeting lower limit values. Additionally 20% of waters were reported as 25–50% and 8% of waters as 75–100% of the assessed Shellfish water not meeting lower limit values.
- Features, impacted by microbial pathogens were not reported.
- There are no specific GES criteria listed for microbial pathogens. Member States reported pressure status for microbial pathogens against GES descriptor on contaminants in fish and seafood for human consumption.
- Main activities, causing the pressure at EU level are urban, agriculture/forestry and industry, aquaculture, tourism/recreation and shipping.

3.8 Hazardous substances

The term hazardous substances refers to non-synthetic, synthetic or radionuclide substances that are a risk for the marine environment or risk to human health through consumption of seafood. Non-synthetic hazardous substances (e.g. heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs) and synthetic hazardous substances (e.g. priority substances under Directive 2000/60 which are relevant for the marine environment such as pesticides, anti-foulants, pharmaceuticals, resulting in e.g. losses from diffuse sources, pollution by ships, atmospheric deposition and biologically active substances) are typically toxic, persistent and can accumulate in the food chain. They can also be carcinogenic, mutagenic or cause reproductive failure. Some have endocrine disrupting properties.

Radionuclide contamination is potentially harmful because of radioactive decay which results in the emission of ionising radiation. The degree of harm depends on the concentration and the energy and type of radiation emitted as well as the proximity to an organism. The effects can range from slight tissue irritation to burns. Prolonged exposure can lead to cancer, perhaps years after exposure has ceased.

Pressures, impacts, activities

Some of these substances are toxic and can bio-accumulate. The redistribution of these substances through human activities can result in concentrations undesirable to the environment or human health.

Non-synthetic substances can be found naturally in the environment, while synthetic substances considered in this group are man-made and not found naturally in the environment. Synthetic substances clearly bring important benefits to society, however like naturally occurring substances, some of them are toxic and can bio-accumulate.

3.8.1 General for hazardous substances

The Member States have to consider the substances or groups of substances, where relevant for the marine environment, that:

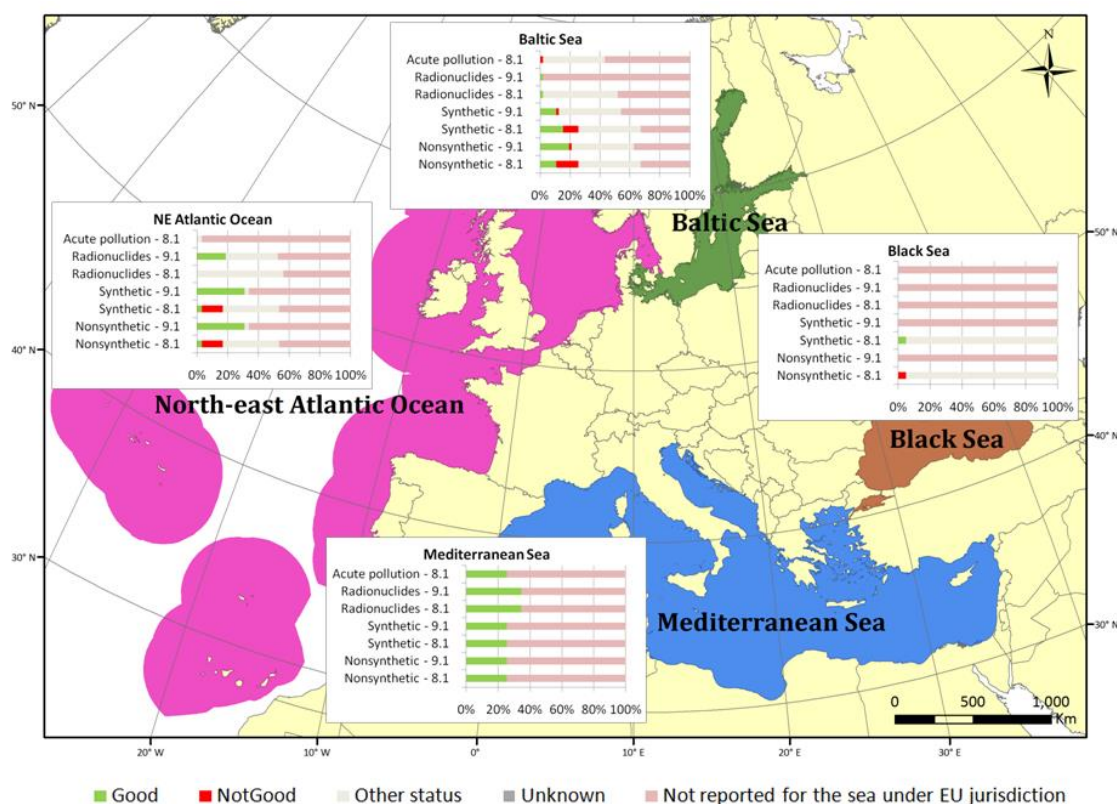
- a) exceed the relevant Environmental Quality Standards set out pursuant to Article 2(35) and Annex V of Directive 2000/60/EC in coastal or territorial waters adjacent to the marine region or sub-region, be it in water, sediment and biota, and/or
- b) are listed as priority substances in Annex X to Directive 2000/60/EC and further regulated in Directive 2008/105/EC of the European Parliament ^(d) and of the Council 3, which are discharged into the concerned marine region, sub-region or subdivision, and/or
- c) are contaminants and their total releases (including losses, discharges or emissions) may entail significant risks to the marine environment from past and present pollution in the marine region, sub-region or subdivision concerned, including as a consequence of acute pollution events following incidents involving for instance hazardous and noxious substances.

Key messages

- Pressure related to synthetic hazardous substances was most frequently observed in shallow water substrates. Impacted elements reported in shallow waters were unspecified functional groups, fish and birds. Very few elements impacted are reported in deeper waters.
- Activities that most affected the levels of these substances in decreasing order were: industry, urban development, shipping, agriculture/forestry and oil/gas. Tourism and solid waste disposal ranked lowest. However, it should be noted that the data does not distinguish which hazardous substance type these activities impact.
- Only between 14 and 36% of the total area where an assessment was made, was actually given a status of 'Good', 'not good', or that the status was graded in some other fashion ('Other status'). The assessment is generally not performed consistently over the EU marine areas even though nearly all Member States recognised the problem (Figure 3.9).
- Considering that most countries have national programmes and participate in regional sea conventions where assessments have been made, and also considering that some hazardous substances are ubiquitous it is surprising the reporting of status is not more complete with respect to whether or not the status is good.

^(d) the list of 33 substances or groups of substances in this directive has been replaced by the directive 2013/39/EU where the list has expanded from 33 to 45. Though at the time of the reporting and preparation of this report (summer/autumn of 2013) directive 2013/39/EU was not taken into account yet.

Figure 3.9: Percentage of reported criteria 8.1 and 9.1, used for assessment of hazardous substances pollution for each MSFD Commission Decision criterion per Regional level.



Note: For this descriptor, the two criteria for assessing progress towards good environmental status are presented: 8.1 Concentration of contaminants and 9.1 Levels, number and frequency of contaminants. The Member States have to consider the substances or groups of substances, where relevant for the marine environment, that: (i) exceed the relevant Environmental Quality Standards set out pursuant to Article 2(35) and Annex V of Directive 2000/60/EC in coastal or territorial waters adjacent to the marine region or sub-region, be it in water, sediment and biota, and/or (ii) are listed as priority substances in Annex X to Directive 2000/60/EC and further regulated in Directive 2008/105/EC ^(e) of the European Parliament and of the Council, which are discharged into the concerned marine region, sub-region or subdivision, and/or (iii) are contaminants and their total releases (including losses, discharges or emissions) may entail significant risks to the marine environment from past and present pollution in the marine region, sub-region or subdivision concerned, including as a consequence of acute pollution events following incidents involving for instance hazardous and noxious substances. The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

3.8.2 Non-synthetic hazardous substances

Non-synthetic substances are compounds such as heavy metals, hydrocarbons, resulting, for example, from pollution by ships and oil, gas and mineral exploration and exploitation, atmospheric deposition, riverine inputs.

^(e) the list of 33 substances or groups of substances in this directive has been replaced by the directive 2013/39/EU where the list has expanded from 33 to 45. Though at the time of the reporting and preparation of this report (summer/autumn of 2013) directive 2013/39/EU was not taken into account yet.

Key messages

- 15 out of the 23 Member States reported information on non-synthetic hazardous substances. The largest share (100%) of marine waters of the regional sea surrounding Europe is not covered in the Black Sea and to a lesser degree also in the NE Atlantic Ocean and the Mediterranean Sea (about 80%).
- Overall the result at EU level indicates that 18% of waters are exposed to low or medium pressure (i.e. <5%) related to non-synthetic hazardous substances. In 19.3% of EU waters hazardous substance impact is decreasing, while in 5.2% of marine waters the trend is stable and in 2.8% of the waters the trend is increasing.
- Cross checking of reported data shows, that ‘high’ confidence is reported for areas under highest pressure (50–75% area affected). ‘Low’ confidence is reported for over 70% of the area with low impact (<1% of area).

3.8.3 Synthetic hazardous substances

Synthetic compounds are those, which are man-made and do not enter the environment via natural processes. Substances relevant for the marine environment such as pesticides, anti-foulants, pharmaceuticals, resulting, for example, from losses from diffuse sources pollution by ships, atmospheric deposition and biologically active substances (*e.g.* priority substances under Directive 2000/60/EC);

Key messages

- 14 out of the 23 Member States reported information on synthetic hazardous substances. The largest share of marine waters of the regional sea surrounding Europe that is not covered is the NE Atlantic Ocean (about 95%) and to a lesser degree also the Mediterranean Sea (about 90%). Over 50% of the Baltic Sea has been rated; 32% of this sea is subject to 1–5% impact.
- Overall result at EU level indicates that 4.3% of waters are exposed to low or medium pressure (i.e. <5%) related to synthetic hazardous substances. In 15.1% of EU waters hazardous substance impact is decreasing, while in 2.3% of marine waters the trend is stable and in 0.1% of the waters the trend is increasing.
- ‘Moderate’ confidence is reported for areas under highest pressure (75–100% area affected). No ‘high’ confidence was reported. ‘Low’ confidence is reported for over 42% of the area with low or moderate impact (<5% of area).

3.8.4 Radionuclide hazardous substances

Artificial radionuclides (synthetic substances) are discharged as radioactive substances from the nuclear sector. Discharges of radioactive substances from the offshore industry and other non-nuclear sectors are naturally occurring radionuclides (non-synthetic substances).

Key messages

- 13 out of the 23 Member States reported information on radioactive hazardous substances. The largest share (100%) of marine the regional sea is not covered in the Black Sea and to a lesser degree also in the NE Atlantic Ocean and the Mediterranean Sea (about 80%). Over 50% of the Baltic Sea has been rated. 41% of this sea is subject to 75–100% impact.
- Overall result at EU level indicates that 19% of waters are exposed to low pressure (i.e. <1%) related to radionuclide hazardous substances. In 32% of EU waters hazardous substance impact is decreasing, while in <1% of marine waters the trend is increasing.
- ‘High’ confidence is reported for areas under lowest pressure (<1% area affected). ‘Low’ confidence is not reported.

3.8.5 Hazardous substances in seafood

This descriptor relates to methodological standards to protect human health and EU food limit values apply. This descriptor requires that contaminants in fish and other seafood for human consumption do not exceed levels established by Community legislation or other relevant standards. Associated monitoring is usually based on fish and shellfish taken from the market and therefore it is often difficult to link contamination clearly with the source. Combined monitoring for the purpose of descriptor 8 may be possible for shellfish, but not for fish.

Key messages

- Only 5 out of the 23 Member States reported information on non-synthetic and synthetic hazardous substances in seafood. The largest share (100%) of marine waters is not covered in the Black Sea and Mediterranean Sea. Only 11.6% of the Baltic Sea and 7.5% of the NE Atlantic Ocean were reported as to having a degree of impact.
- The results available indicate that about 6% of waters are exposed to low or medium pressure (i.e. <5%) for non-synthetic and synthetic hazardous substances. ‘High’ confidence is reported for areas of unknown impact. ‘Low’ confidence is reported for over 100% of the area with relatively low impact (1–5% of area).
- Only 2 Member States reported information on non-synthetic hazardous substances in seafood, and only one reported on the level of pressure (their entire area as <1%). The results available indicate that 16% of waters are exposed to low pressure (i.e. <1%) related to radionuclide hazardous substances in fish seafood.

3.8.6 Proposals for improvement of reporting and analysis in the future

There is a general and important need to provide reliable and consistent data. More data is needed especially from the Baltic Sea and to a lesser degree Mediterranean Sea. This would provide a better means to assess the level, trends and impact of hazardous substances on a pan-European scale. There is also a need to understand the combined effect of hazardous substances. The impact of climate change on the transport and mobilization of these substances is little known and this gap in knowledge needs to be addressed. Furthermore, we need a better understanding of the links between sources, pathways and environmental status. In this regard the impact on the deep sea environment is in particular need.

3.9 Acute pollution events

This refers to acute pollution events following significant incidents spills of oil and oil products or spills of chemicals (OSPAR, 2012) for example hazardous and noxious substances. Hence, such events can mean that concentrations of non-synthetic or synthetic substances can be a risk for the marine environment or risk to human health through consumption of seafood. Chemicals can be toxic, persistent and can accumulate in the food chain. They can also be carcinogenic, mutagenic or cause reproductive failure or have endocrine disrupting effects.

Key messages

- 15 out of the 23 Member States reported information on acute pollution events, however only two reported impact and pressure. Seven Member States reported on trends whereof one reported trends to be upward: The other countries either reported decreasing trends or no trends.
- Overall result at EU level indicates that 11% of waters are exposed to low pressure (i.e. <1%) related to acute pollution events. In 10.1% of EU waters, hazardous substance impact is decreasing, while in 14.4% of marine waters the trend is stable and in 10.2% of the waters the trend is increasing.
- Areas under pressure due to non-synthetic hazardous substances pollution were most frequently observed in shallow waters. Very few elements impacted are reported in deeper waters.
- Activities that most affected the levels of these substances were shipping followed by dumping of munitions and ports.
- Only 0.1–9.8% of the total area where an assessment was made was actually given a status of ‘Good’, ‘not good’, or that the status was graded in some other fashion (‘Other status’). The assessment is generally not performed consistently over the EU marine areas even though most Member States recognised the problem.

Proposals for improvement of reporting and analysis in the future

There is a general need to agree on uniform methods to assess categories of acute pollution events. The need wide spread but based on the available data, more prominent in the Mediterranean Sea and Black Sea. Improvement in methods and submission of reliable and consistent data would provide a better means to assess the level, trends and impact of these events on a pan-European scale.

3.10 Interference with hydrological processes

“Hydrological processes” refers to permanent physical changes in the marine environment caused by human activities, such as changes in the thermal or salinity regimes, changes in the tidal regime, sediment and freshwater transport, current or wave action, and changes in turbidity. These can cause an alteration in the hydrographical conditions. All these changes may lead to modifications of the physical and chemicals characteristics of the marine waters and consequently effects on marine ecosystems. These types of changes are normally triggered by building activities, such as extension of the coast, building of artificial islands or other infrastructural works in the marine environment (such as outfalls from power stations, bridges to islands, offshore installations) (EC, 2011).

Photo 3.6: Permanent physical changes in the marine environment caused by human activities: Afsluitdijk dam



Photo: © <https://beeldbank.rws.nl>, Rijkswaterstaat.

Key messages

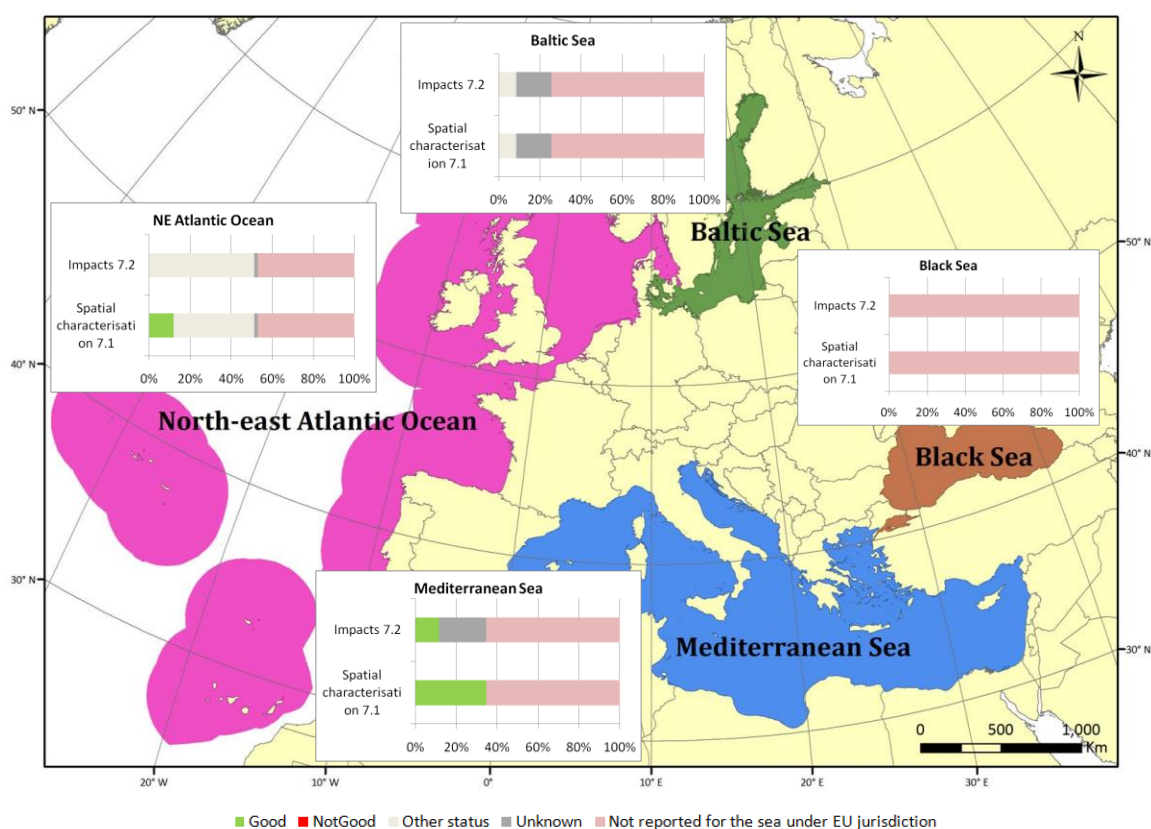
- 16 out of the 23 Member States reported information on hydrological processes.
- Only 10 Member States reported on the level of pressure, the other Member States reported that the level is unknown or not assessed.
- 45% of EU waters were reported under low level of pressure from hydrological processes. The level of pressure and impact was not reported for 30% of EU waters. High level of pressure due to hydrological processes alteration was reported for the Mediterranean, where 30% of the area is under a high level of pressure (75%–100% altered conditions). NE Atlantic (70% of area under pressure) and Baltic Sea (62% of the regional sea area) have a large proportion of area exposed to a low level of pressure (<1%).
- Reporting on features impacted by hydrological processes was very limited. Impacted features are mainly physical and chemical characteristics of the water column habitat, benthic habitat characteristics, physical and chemical characteristics of the water column habitat, and functional groups such as birds, fish, mammals and reptiles.
- Assessment is not performed consistently over the EU marine areas (Figure 3.10).
- Only few Member States have reported on the status, most Member States have reported that status is unknown or have reported other statuses other than good/not good. A status classified as ‘not good’ has not been reported.
- Main activities, causing the pressure at EU level are industry, ports and land reclamation/coastal defence. In the Mediterranean the temperature and salinity increase has been attributed to the global changes as well as to regional scale anthropogenic activities, the latter consisting of damming the major rivers of the Mediterranean and the Black Seas.
- Overall confidence in the assessment is low, since only a small proportion of the area of the EU’s seas has been assessed.

Proposals for improvement of reporting and analysis in the future

A more coherent approach to this pressure is needed, as different interpretations of the human activities and associated pressures that fall under this topic have been used now. Most of the MSs have only included pressures related to human activities such as large infrastructural works, renewable energy, outfalls etc., but some have considered pressures caused by global warming.

Regionally coordinated methods for the assessment should be further developed.

Figure 3.10: Percentage of reported criteria 7.1 and 7.2, used for assessment of permanent alteration of hydrographical conditions for each MSFD Commission Decision criterion per Regional level.



Note: For this descriptor, the two criteria for assessing progress towards good environmental status are presented: 7.1 Spatial characterisation of permanent alterations and 7.2 Impact of permanent hydrographical changes. The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

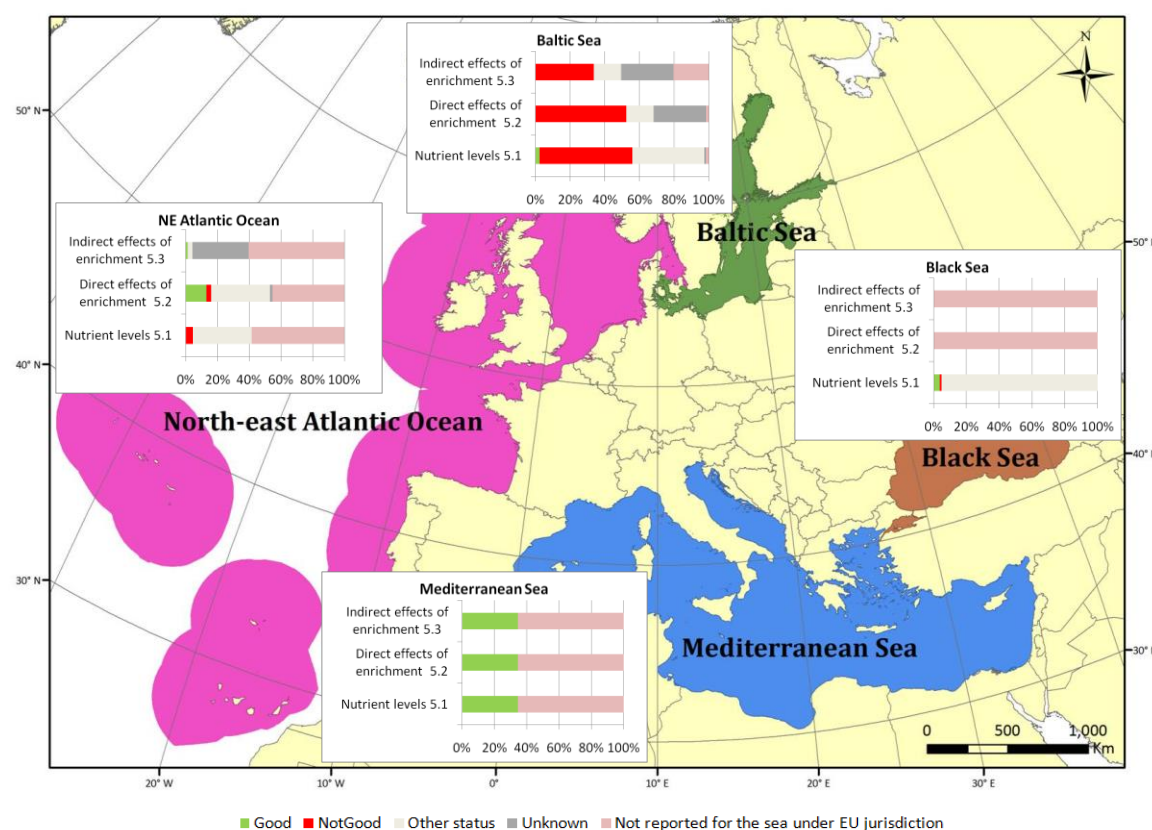
3.11 Nutrients and organic matter enrichment

This pressure refers to the enrichment of the marine environment with inorganic nutrients (nitrogen, phosphorus) or organic matter, and reporting includes the direct and indirect effects of nutrient enrichment. Reporting included also information about trends in loads of nitrogen, phosphorus and organic matter.

Eutrophication is a process driven by enrichment of water by nutrients, especially compounds of nitrogen and/or phosphorus, leading to: increased growth, primary production and biomass of algae, changes in the balance of organisms; and water quality degradation. The consequences of eutrophication are undesirable if they appreciably degrade ecosystem health and/or the sustainable provision of goods and services (Ferreira et al., 2010).

Nutrient enrichment is the causative factor promoting eutrophication. Nutrient enrichment in marine waters mainly caused by inputs from land-based point and diffuse sources and atmospheric deposition. Other localized sources at sea include aquaculture and shipping. Inputs of fertilizers, manure, leaching of other nitrogen and phosphorus-rich substances from agriculture and urban wastewater are amongst the major land-based contributors. Once released into freshwater, nutrients are transported downstream and ultimately discharged to coastal and marine waters. Sources of organic matter include urban wastewater, mariculture and riverine inputs.

Figure 3.11: Percentage of reported criteria 5.1, 5.2 and 5.3, used for assessment of nutrients and organic matter enrichment for each MSFD Commission Decision criterion per Regional level.



Note: For this descriptor, three criteria for assessing progress towards good environmental status are presented: 5.1 nutrients levels, 5.2 direct effects of nutrient enrichment and 5.3. indirect effects of nutrient enrichment. The figure shows the percentage of marine area reported in different categories. Green = good, red = not good, light grey = other status and dark grey = unknown, orange = not reported. The associated confidence rating of the information is rarely high.

Key messages

- 17 out of the 23 Member States reported information on nutrients and organic enrichment.
- The level of pressures, trends and confidence levels with respect to nutrient concentrations are reported for about half of the EU marine waters.
- In about 1/3 of the marine waters, the pressure (nutrient concentration) is reported to occur in >5% of the marine waters of Member States. A stable pressure or decreasing trend for nutrient concentrations and loads is observed in 50% of EU marine waters.
- As for organic matter, most Member States reported that the level of pressure is unknown or not reported.
- Strong impacts on water column and seabed habitats, extending to >25% of the surface area of an assessment area are reported for 5% of the total EU marine waters.
- At EU level, the three most reported impacted elements concern physical/chemical features (oxygen level, water transparency and nutrient levels).
- The most important activity related to this pressure is Agriculture/Forestry, although this was not reported for the Black Sea. Urban and Industry, and Aquaculture in the Mediterranean Sea are the other main activities causing nutrient organic matter enrichment.
- The Baltic Sea has the highest proportion of marine waters which are not in good status due to nutrients and organic enrichment, ranging from 30–50% of the total surface area for criteria Nutrients levels (5.1), Direct effects of nutrient enrichment (5.2) and Indirect effects of nutrient enrichment (5.3) (Figure 3.11).

At EU level, 10–20% of marine waters are reported to be in ‘good’ status, and approximately 5% are reported as ‘not good’ status. For more than 80% of the waters, status is reported as ‘other status’, ‘unknown’, or ‘not assessed’.

Proposals for improvement of reporting and analysis in the future

A more coherent approach to this pressure seems possible, considering the work that has already been done by regional sea conventions. Regionally coordinated approaches to ensure that all available information is used for assessments should be further developed.

3.12 *Non-indigenous species*

Non-indigenous species (NIS) (also called alien, exotic, non-native) are species introduced outside their historic or native range, which might survive and subsequently reproduce. Their presence in the given region is due to deliberate or unintentional introduction resulting from human activities. Natural dispersal attributed to climate change or dispersal by ocean currents does not qualify a species as a Non-indigenous species.

In many cases non-indigenous species do not harm the regional ecology and economy. However, in certain cases, they are rapidly spreading or have demonstrated their potential to spread elsewhere, and have an adverse effect on ecosystem functioning and/or ecosystem services. These are called “**invasive alien species** (IAS) and may have serious negative consequences for their new environment. They represent a major threat to native plants and animals in Europe, causing damage worth millions of euros every year (photo 3.7). Species of unknown origin which cannot be ascribed as being native or alien are termed **cryptogenic** species. They may also demonstrate invasive characteristics and are included in invasive alien species assessments.

Photo 3.7: a) The Australian tubeworm *Ficopomatus enigmaticus* and b) the compound sea squirt *Didemnum vexillum* on a yacht hull

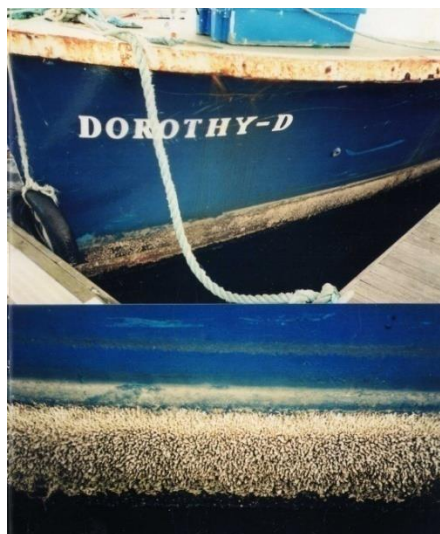


Photo: © Dan Minchin. The Australian tubeworm *Ficopomatus enigmaticus* fouling of boat hull



Photo: © Damien Offer. The compound sea squirt *Didemnum vexillum* on a yacht hull

Non-indigenous species are frequently recorded in ports or at aquaculture sites. Marked geographic patterns depending on the pathway of introduction were revealed, with specific countries acting as gateways to alien invasions. Shipping is the most important pathway of introduction at Pan-European level (Katsanevakis et al., 2013), especially near large ports. Aquaculture has been highlighted as the main activity for introduction of NIS in France and Italy. Among other activities, corridors, appears to be a key pathway for Cyprus and Greece only (dispersal of NIS introduced via the Suez Canal). Tourism/Recreation ranks second in Lithuania and Croatia, whereas Renewable Energy was considered a significant factor for NIS introductions in Belgium next to shipping.

Although there is no doubt that invasive species have modified marine ecosystems, evidence for most of the reported impacts is weak, as it is based on expert judgement or dubious correlations, while a few of the reported impacts were inferred via manipulative or natural experiments (Katsanevakis et al., 2014). A need for stronger inference is evident, to improve our knowledge base of marine biological invasions and how better to inform managers.

Key messages

- Compilation of the information on Non-indigenous species reported by 19 Member States revealed that efforts for monitoring and reporting alien species vary among EU countries.
- Lack of coherence between inventories in country databases, review papers and reporting in IA for MSFD
- Lack of interpretation of the terms invasive, alien vs range expansion.
- Shipping ranked first as a human activity responsible for most NIS introductions (63.2% of the countries) while aquaculture scored second everywhere else but the Black Sea.

- In general, the evidence for impacts of the ‘worst’ invaders was severely lacking. The declining status of impacts on the functional groups is directly concluded from the increasing rate of introduction and spread of invasive species (particularly so in the Eastern Mediterranean) whereas impacts on the bed habitat are indirectly concluded based on the aforementioned trends.
- Assessment of GES was feasible only by countries with advanced knowledge, that have developed relevant indicators such as the Baltic Countries by employing the bio-pollution index (Olenin et al., 2007). For all other countries the trend in introduction is used as a proxy to the trends in GES.

Conclusively, assessment of the descriptor Non-indigenous species is mostly unknown due to the lack of qualitative data in the vast majority of Member States. Moreover, reporting is inconsistent between Member States and is not comprehensive.

Proposals for improvement of reporting and analysis in the future

- There is need for further harmonization of monitoring efforts and improvement of reporting, to effectively support relevant European policies.
- Invasive species management requires prioritization, which should be based on informed and quantified assessment of the potential ecological and economic costs of species (both positive and negative), considered in the proper context of the invader and ecosystem.

4 Socio-economic analysis

4.1 Overview

This chapter summarizes the data and information on uses and activities (i.e. socio-economics), ecosystem services, and costs of degradation as assessed through the Marine Strategy Framework Directive (MSFD) Art. 8 Initial Assessment reporting period. Only data reported through the reporting sheets was assessed. This summary is supported by a more detailed and thorough analysis of the reported data and information, which is available in supplementary report (ETC/ICM, 2014c).

Photo 4.1: Different uses of the seas



Photo: © T. Makovec, National Institute of Biology – Marine Biology Station Piran

4.1.1 General data issues

Several general data issues were identified in the reporting sheets, these include:

- Data gaps (e.g. missing Member States, data not reported, other issues);
- Lack of standardization and harmonization (e.g. employment numbers vs FTE, the use of different/alterd terminology, ambiguity in language, reporting errors, challenges in interpreting the data), methodology questions (e.g. definition of employment in sectors);
- Potential reporting errors (e.g. the use of commas vs periods as number separators in reporting sheets is not explicit);
- In addition to being scarce, data on aspects such as costs of degradation is not easily compared and assessed; and
- Data is static, for only one year, which does not support an assessment of trends.

4.1.2 Methodologies

- The majority of reporting Member States (17) used the marine water accounts approach to conduct the assessment of the use of marine waters, while three Member States used the ecosystem services approach. The UK reported information for both methods.
- The Member States reported using different methodologies proposed by WG ESA to calculate the costs of degradation (cost-based approach, thematic approach, ecosystem services approach).

4.2 Human activities

Following the Working Group on Economic and Social Assessment's (WG ESA, 2010) guidance document for the Initial Assessment of the MSFD the use of marine waters is defined as any human activity using or influencing the marine space and/or ecosystem goods and services provided by marine waters.

Photo 4.2: Industrial Port in Slovenia

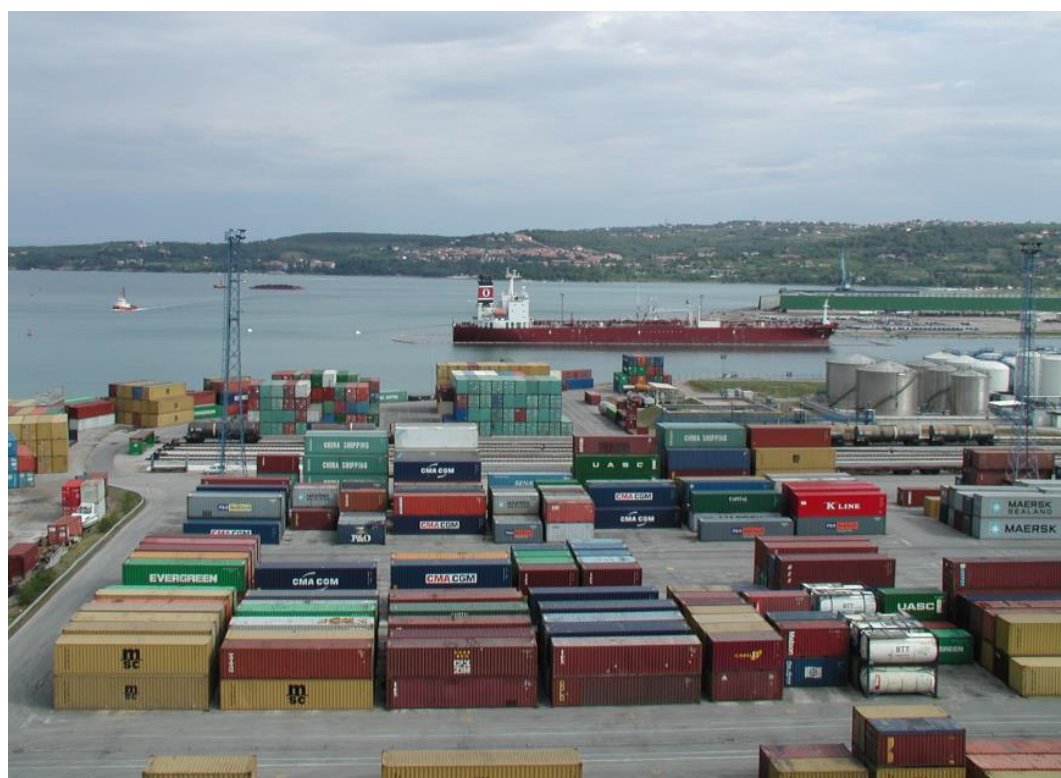


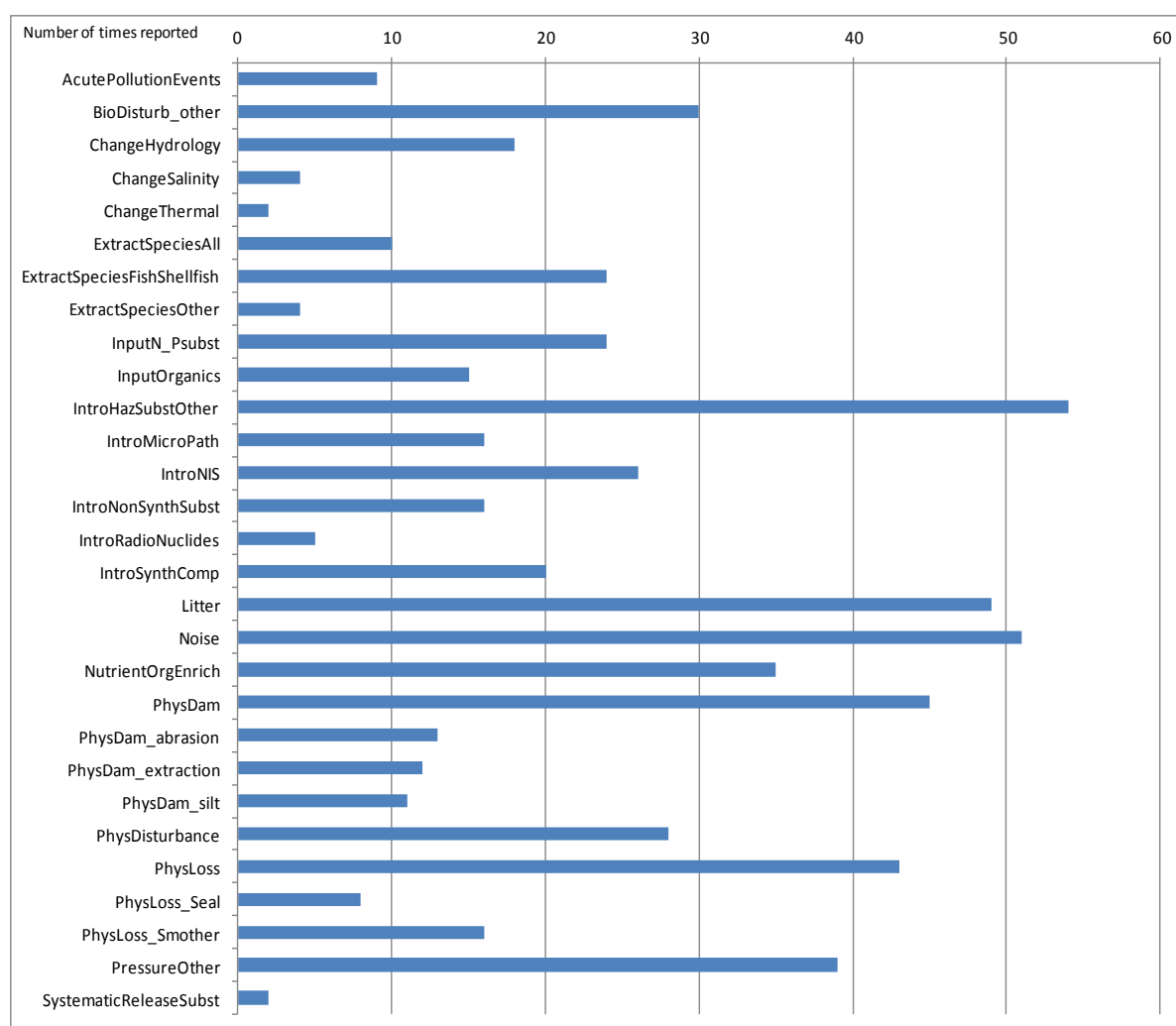
Photo: © Monika Peterlin, IWRS

Key messages

- Significant socio-economic data on added value (GVA) and employment was provided by Member States. However, differences in reporting (i.e. names of sectors, reporting standards) suggest that the data as currently presented is not robust and consistent.

- According to the data reported, the European maritime economy is valued at Euro 159 billion (GVA). Of this the oil and gas industry accounts for about Euro 58.5 billion, ports for about Euro 39.7 billion and agriculture and forestry about Euro 23 billion.
- Reported estimates of the European maritime economy suggest it provided 5.9 million jobs and about 1 billion Full Time Equivalents (FTEs). Member State data on employment is reported in both the number of persons employed and FTEs which makes the data not comparable and cannot be aggregated. An issue with the data exists in regard to FTEs and employment in the European maritime economy. This makes the result (number) seem exceptionally high. This is because recent studies looking at the maritime economy (e.g. Blue Growth study (Ecorys et al., 2012) have presented lower numbers (5.4 million employed by maritime activities). This report aims to highlight this as a data issue and does not suggest that this is a realistic estimate of employment in the European maritime economy. The reasoning for the data issue is currently not known, and it may lie with the actual reported information (i.e. a counting error) or a lack of clarity with what is reported.
- The habitat types and functional groups (ecosystem elements) which marine uses and activities depend on to operate were reported. Coastal fish was the most reported ecosystem element and was reported as 4.9% of the total, while pelagic fish were reported as 4.6%. Shallow sub-littoral mixed sediment, shallow sub-littoral sand and water column habitats were all reported as 4.3% of the total. In addition, some habitats and species groups provided in the guidance were not reported as dependent for uses and activities. These are: upper bathyal rock and biogenic reef, lower bathyal rock and biogenic reef, upper bathyal sediment, abyssal rock and biogenic reef, abyssal sediment, reduced salinity water, ice-associated habitats, special habitats-all), birds (all marine species), ice-associated birds, and mammals (all marine species). Other categories also not used include MS-defined habitat (from convention lists) and MS-defined species.
- The pressures reported in Europe from human uses and activities include contamination by hazardous substances, reported as 4.8% of the total, noise 4.5% and litter 4.4%. Those pressures identified in the guidance which were not reported included the extraction of species, which are: maerl extraction, seaweed harvesting, marine acidification and pressure – other. See figure below.

Figure 4.1: Reported pressures from human uses or activities



Note: The figure shows the number of times that the pressures were reported as relevant by Member States.

4.3 Ecosystem services

Following the Working Group on Economic and Social Assessment's (WG ESA, 2010) guidance document for the Initial Assessment of the MSFD *ecosystem services* are defined as goods and services – benefits – that the ecosystem provides to human beings. Ecosystem services can be separated into final and intermediate services.

Key messages

- Information on the dependencies of the use/ activity in assessment areas on ecosystem services (predominant habitat types and functional groups) were reported for the UK only.
- The three most reported ecosystem services in the UK are seabed habitats – all (18%), demersal fish (15%), and demersal elasmobranchs (10%). Information on methodology is provided for Latvia, Sweden, and the UK.

- The most important pressures impacting (adversely affecting) ecosystems or theme per assessment area were identified in the UK. The main pressures on ecosystem services reported are interference with hydrological processes (16%), selective extraction of species including non-target catches, contamination by hazardous substances and physical damage, all reported 12%.

4.4 Cost of degradation

Following the Working Group on Economic and Social Assessment's (WG ESA, 2010) guidance document for the Initial Assessment of the MSFD *Cost of degradation* is the welfare foregone, reflecting the reduction in value of the ecosystem services provided compared to another state.

- Little information was gathered through the reporting process on the costs of degradation, although seven Member States reported this information to be relevant and reported some information on costs of degradation.
- No data was reported on the links between the costs of degradation and dependencies of ecosystem services and predominant habitat types.
- The majority of Member States did not report on costs of degradation and pressures on ecosystem services, although some limited information was collected.
- The data collected on costs of degradation and uses was highly limited and that which is available is provided as descriptions containing mostly qualitative and included limited quantitative information.

4.5 Confidence in the assessment

The data collected in this report provides an indication of the type of information collected thus far in the MSFD reporting process in regard to Art. 8 and the economic and social assessment.

In many instances the Member States used different names of reporting features (i.e. the names of uses / activities). These have not been altered for reporting purposes due to lack of clear definitions of activities uses and to demonstrate the challenges of reported data. Another issue in regard to the data is the use of commas vs periods as number separators in reporting sheets, which is often not explicitly explained. It is assumed that Member States followed the guidance documents and procedures provided by the Commission as well as the requirements of the Initial Assessment and reporting. At the same time, it is possible that Member States had different interpretations of the guidance documents.

Thus it can be said that a pan-European or regional economic and social assessment of MSFD waters cannot be completed in a robust matter given the current state of the reported data.

The main issues identified from the reported data include:

- Data gaps (e.g. missing Member States, data not reported, other issues). These issues, include
 - The lack of data and information reported on characteristics of the use of marine waters.
 - Missing information in regard to the ranking of pressures in order of importance stemming from the uses/activities (done only in a very limited number of cases).
 - For the UK, the database does not provide an explanation of which ecosystem services the methodology is in respect to, while this can often be deducted from the description this is not

always the case. In some cases, assessment of change in ecosystem services is provided in the cost of degradation reporting.

- In some instances information from Member States was only provided in national languages and has not been translated.
- Limited data was reported in regard to the rank of the pressures impacting ecosystem services.
- The data reported in regard to the link between uses and ecosystem services was limited in that not all uses / activities were given an estimated monetary value.
- Some Member States used a methodology to calculate costs of degradation but did not report which methodology was selected.
- There is a knowledge or information gap regarding the links between the costs of degradation and the dependencies of ecosystem services and predominant habitat types.
- The data collected on costs of degradation and uses was highly limited and that which is available is provided as descriptions containing mostly qualitative and included limited quantitative information. Those Member States which did not report include: Bulgaria, Croatia, Denmark, France, Greece, Ireland, Italy, Malta, Poland, Portugal, Slovakia, Slovenia, and Sweden.
- Lack of standardization and harmonization (e.g. employment numbers vs FTE, the use of different/alterd terminology, ambiguity in language, reporting errors, challenges in interpreting the data), methodology questions (e.g. definition of employment in sectors)
- Potential reporting errors (e.g. the use of commas vs periods as number separators in reporting sheets is not explicit)
- In addition to being scarce, data on aspects such as costs of degradation is not easily compared and assessed.
- Data is static, for only one year, which does not support an assessment of trends.

4.6 *Proposals for improvement*

The data reported in the MSFD process show many issues in terms of data gaps, lack of standardization and harmonization, and reporting errors making it difficult to assess and apply the information. These data issues mean that additional data flows are needed to conduct a pan-European economic and social assessment. Some research reports where social and economic data have been gathered include the Blue Growth study commissioned by DG mare (Ecorys et al., 2012) and the FP7 project PERSEUS which focuses on the Mediterranean and Black Seas (PERSEUS, 2015), as well as other research focusing on economic and social data and assessments.

At the same time, improved data monitoring and gathering at the European level may be needed to improve the MSFD process of social and economic data reporting. Eurostat, the Commissions statistical office, collects relevant data for a pan-European social and economic assessment of marine and maritime activities. Yet, some issues with Eurostat data also exist. These include:

- Missing data (e.g. ports is not a statistical sector)
- Data is often aggregated/resolution is ‘too low’ (i.e. including activities on land; or non-relevant activities)
- NACE codes do not differentiate between land and sea-based activities (e.g. mining)

- Data availability varies across years and Member States (or MSFD marine regions)
- Ambiguity in language

Given the identified challenges in regard to data, a process to assess and improve marine and maritime data collection, monitoring, and reporting is needed to improve assessments of European marine areas. Such a process should focus on the reporting requirements of the MSFD, and the above mentioned data issues identified in the reporting process as well as those identified at the European level (i.e. Eurostat). In a first step, an assessment to identify data, and thus data gaps, should be made, and then efforts should be made to fill in those data gaps through coordination (i.e. collection) efforts and where needed through additional research.

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