



# PROTECTING OUR OCEAN - EUROPE'S CHALLENGES TO MEET THE 2020 DEADLINES

## OVERVIEW OF DATA AND METHODS FOR THE ASSESSMENTS ON MARINE PROTECTION IN THE EU

Marine Protected Areas (MPAs) are tools designed to provide spatial protection for specific species, habitats or processes in marine ecosystems. The first stage of MPA development, the legal designation of an area for marine protection, has been extensively surveyed in Europe.<sup>1</sup> However, the following stages of developing a management plan, implementing it and ensuring effective management of the MPA to achieve the conservation objectives for the protected species and habitats has not previously been assessed at the EU level. Mere designation of an area as an MPA does not yet provide any biodiversity protection, therefore assessing the following steps is crucial for understanding the actual protection provided to the marine environment.

According to internationally agreed goals, which the EU and its Member States have signed up to, 10% of the ocean must be effectively protected by 2020 (Convention on Biological Diversity Aichi target 11 and the United Nations Sustainable Development Goal 14). With only a year left to reach this goal, this assessment focussed on management plan development for the designated MPAs. MPA management plan data, readily available across international and regional databases, was used as a proxy for an MPA taking the first steps towards an area effectively protecting marine habitats and species. In an ideal world this assessment would also reveal the MPAs already under efficient protection (carrying out actions for conservation and/or active nature restoration that results in actual protection), but due to the lack of detailed reporting and transparency on the MPAs this assessment could not be carried at the EU level.

The outcome of the assessment is poor. In the final year before the 2020 deadline for 10% of the ocean to be protected the European seas significantly lack appropriate biodiversity protection. Only 1.8% of the EU seas are covered by MPAs with management plans, despite 12.4% of the EU marine area being designated for protection. Eleven EU Member States have not reported any management plans for their MPAs and are unlikely to reach the target of 10% in the remaining year. A further eight Member States have management plans for less than 10% of their marine area, which means that one year before the deadline, a total of 19 of the 23 marine EU Member States are not yet meeting the set targets. In addition to this, the existing MPA network is poorly designed. A well designed network would support ecological coherence, which links the individual MPAs to form a network providing biodiversity protection also outside the border of the MPAs. However, this assessment shows that the current MPA networks in the Baltic Sea, the North East Atlantic and the Mediterranean Sea are not supporting ecological coherence, and are failing to provide wider network protection.

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<sup>1</sup> **HELCOM 2010.** Towards an ecologically coherent network of well-managed Marine Protected Areas – Implementation report on the status and ecological coherence of the HELCOM BSPA network. Baltic Sea Environmental Proceedings No. 124B.; **OSPAR 2017.** 2016 Status Report on the OSPAR Network of Marine Protected Areas. Biodiversity Series 693/2017.; **WWF 2015.** An assessment of the network of marine protected areas in the Celtic Seas. 30pp.; **HELCOM 2016.** Ecological coherence assessment of the Marine Protected Area network in the Baltic. Baltic Sea Environmental Proceedings No. 148.; **Agnesi et al. 2017.** Spatial Analysis of Marine Protected Area Networks in Europe's Seas II, ed. Kunitzer, A. ETC/ICM Technical Report 4/2017, 41pp.

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# 1. DEFINITION OF ASSESSMENT AREA AND DATA SOURCES

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Written by ETC-UMA

## 1.1. ASSESSMENT AREA

In assessing progress of marine protection in the EU, this study examined designation, management plan development and ecological coherence of the European Marine Protected Areas (MPA) network. The assessment area was defined as the marine and coastal waters of the 23 marine Member States of the European Union (Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom). The assessment area covers the coastal zone, territorial waters (TW) up to 12 nautical miles and the Exclusive Economic Zone (EEZ) up to 200 nautical miles from the European continent. However, for Greece the assessment only covered the Greek territorial sea (i.e. from the coastline out to 6 nautical miles), as neither Greece nor Turkey has declared an EEZ in the Mediterranean Sea.<sup>2</sup> Overseas territories outside the European continental shelf were not included in this assessment, as the assessment focuses on the protection of the European marine environment. Delineation of the assessment was based on the spatial layers of marine boundaries available from World EEZ v10, World 12 nautical miles zone and World Internal Waters (Figure 1 and Table 1).<sup>3</sup> Finally, the European Environment Agency coastline layer was used as reference to delimitate the terrestrial extent of the assessment area.

The assessments were carried out per country and per regional sea. The country assessments were based on the internal and territorial waters (TW) and Exclusive Economic Zone (EEZ) of each country. The regional seas were separated by the following boundaries:

- **Baltic Sea and North East Atlantic:** The southern limit of the Kattegat was defined as the boundary between the Baltic Sea and the North East Atlantic, including the Kattegat as part of the North East Atlantic.<sup>4</sup>
- **North East Atlantic and Mediterranean Sea:** The Strait of Gibraltar was considered as the boundary between the North East Atlantic and the Mediterranean Sea.
- **Mediterranean Sea and Black Sea:** The Bosphorus Strait was considered as the boundary between the Mediterranean Sea and the Black Sea.

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<sup>2</sup> The assessment area follows that used in MPA assessments carried out by the European Environment Agency, for example Agnesi et al. 2017. Spatial Analysis of Marine Protected Area Networks in Europe's Seas II, ed. Kunitzer, A. ETC/ICM Technical Report 4/2017, 41pp.

<sup>3</sup> Claus et al. 2019. Flanders Marine Institute. Marine Regions accessed at <http://www.marineregions.org> on 2019-02-11

<sup>4</sup> This follows the regional sea division outlined in the Marine Strategy Framework Directive. Note that this differs from the division used by the Regional Sea Conventions, as both HELCOM and OSPAR include the MPAs in the Kattegat in their respective regional seas.

## MPA Assessment Area

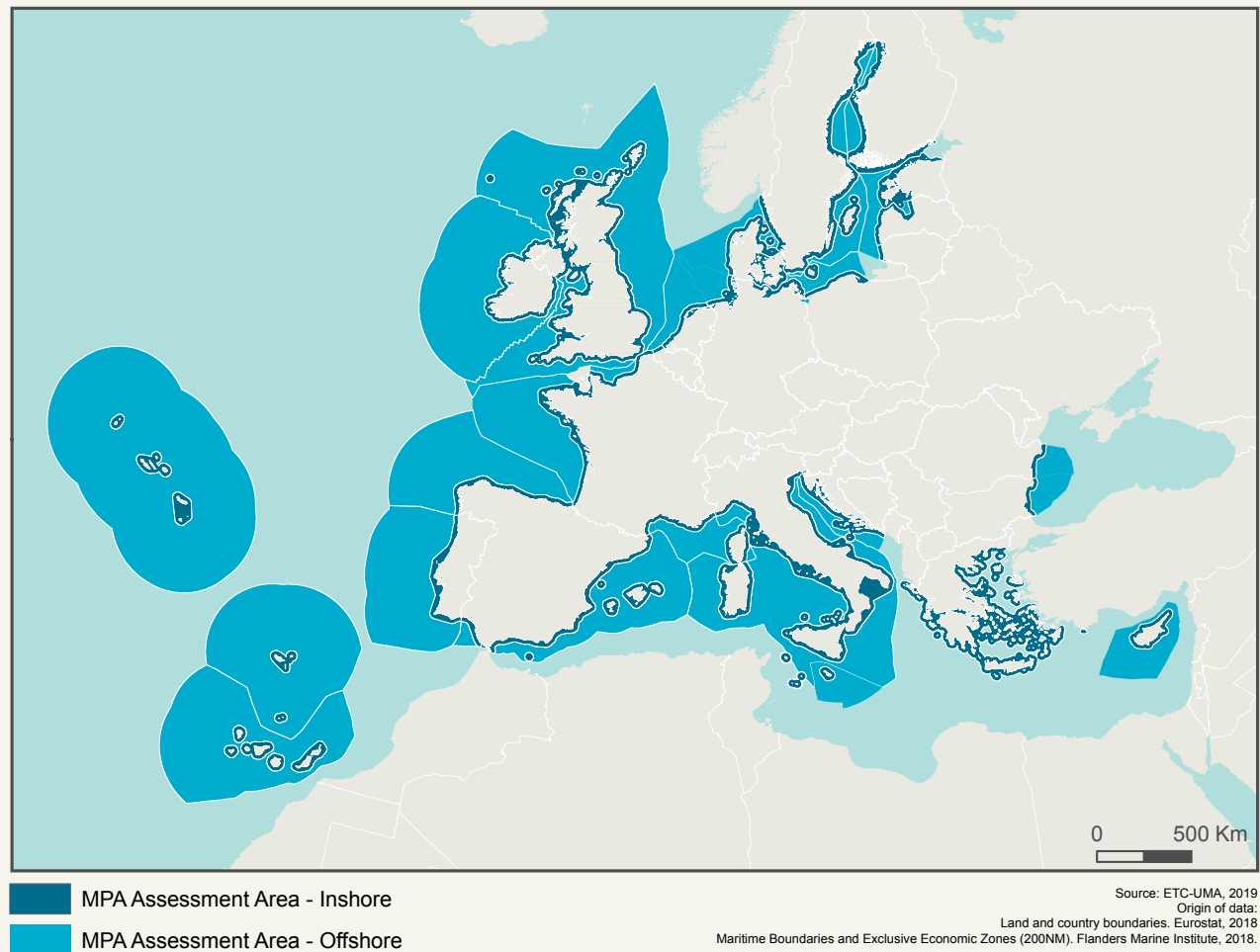


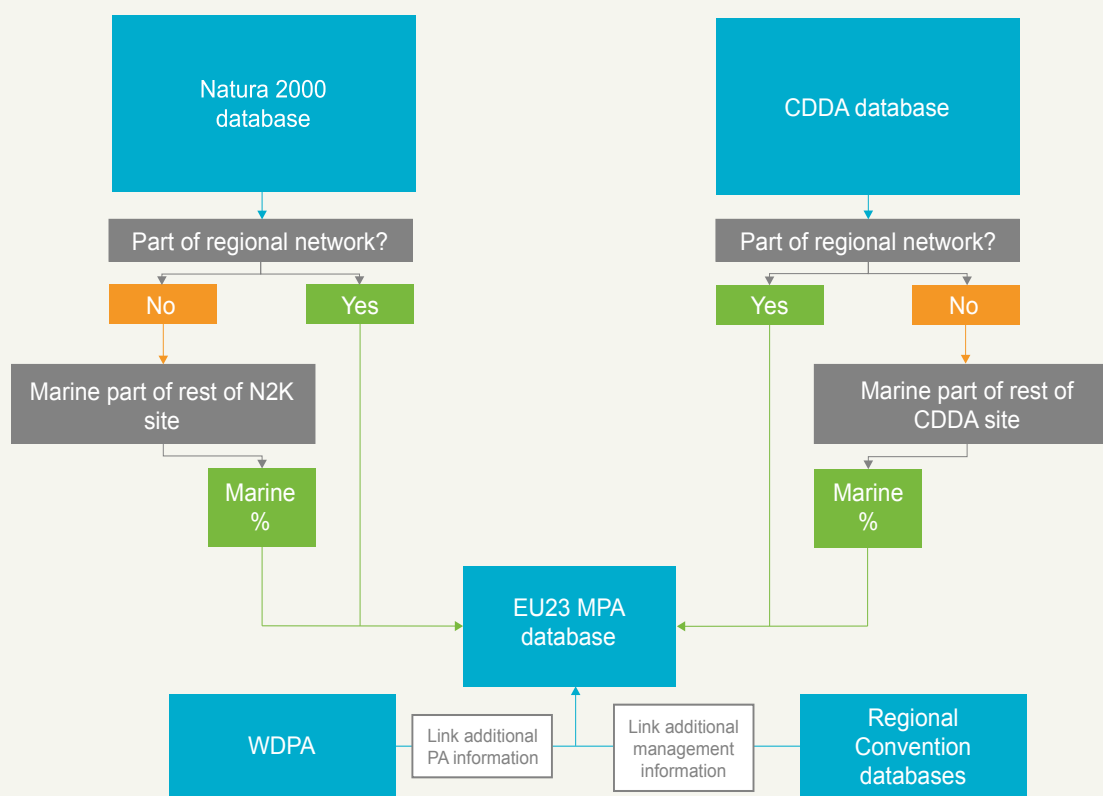
Figure 1. The assessment area.

## 1.2. DATA SOURCES FOR ASSESSING MPAs

To calculate the total protected area in the EU waters of the four regional seas, the MPA assessment considered the maximum spatial extent of MPAs using data available from the Natura 2000 map viewer and Standard Data Form, the CDDA database and the spatial databases of regional conventions of HELCOM, OSPAR and the Barcelona Convention. The Black Sea Convention does not provide a specific spatial MPA database (Table 1). Possible MPA designations include 1) Special Areas of Conservation (SACs); 2) Sites of Community Importance (SCIs); 3) Special Protection Areas (SPAs); 4) Ramsar sites; 5) Biosphere Reserves; 6) in the Mediterranean Special Protection Areas of Mediterranean Importance (SPAMIs); 7) Nationally designated MPAs or PAs with some marine area; 8) OSPAR sites; and 9) HELCOM sites. No national databases were included in this assessment, due to scattered availability and widely variable data formats and language.

The MPA surface area for this assessment was defined as all protected areas included in the regional MPA networks and those Natura 2000 sites or national designated areas (CDDA) which, not being included in regional networks, have a marine coverage. Following this approach only the marine parts of MPAs were included within the spatial assessment. Marine parts were defined according to the EEA Coastline Layer for use for this assessment (Figure 2).

Reporting on the Natura 2000 sites is mandatory under EU law, and the information on Natura 2000 sites is collectively updated each December at the same time as the CDDA database. Reporting to the databases of the regional sea conventions is agreed on through recommendations produced together with the Member States of the regional sea conventions.



**Figure 2.** Decision tree used to build the EU 23 MPA database.

Due to differences in spatial data geometry (scale and level of detail), small artefacts were automatically generated that contained a very low percentage of marine area. These elements were negligible in terms of total surface as they represented less than 0.05% of the total area of MPAs derived from the assessment. In order to reduce potential confounding or cascading errors, artefacts smaller than 0.5km<sup>2</sup> in size or covered by less than 1% of marine surface were excluded from the assessment. In addition, information reported by the Natura 2000 database was used to identify those Natura 2000 sites and CDDA fragments that truly correspond to protected areas where marine habitats or species occur.<sup>5</sup> With these data it was possible to eliminate larger polygons that do not actually correspond to marine areas.

<sup>5</sup> For a list of habitats and species taken into account, please see Annex 2 in **EEA 2015**. Spatial analysis of marine protected area networks in Europe's seas. EEA Technical Report 17/2015, 66pp.

**Table 1.** Data sources used in this assessment.

Dataset	Format	Reference Date	Spatial Coverage	Source	Data Url (Metadata)
<b>World Internal Waters v2, World 12 Nautical Miles Zone v2, World EEZ v10</b>	Shapefile	2018	Global	VLIZ	<a href="http://www.marineregions.org/downloads.php">http://www.marineregions.org/downloads.php</a> ( <a href="http://www.marineregions.org/eezmethodology.php">http://www.marineregions.org/eezmethodology.php</a> )
<b>World Database on Protected Areas</b>	File Geodatabase	2018	Global	UN Environment WCMC	<a href="https://www.protectedplanet.net/">https://www.protectedplanet.net/</a> ( <a href="https://protectedplanet.net/c/wdpa-manual">https://protectedplanet.net/c/wdpa-manual</a> )
<b>Natura 2000 vector</b>	Shapefile	12/2017	EU28	EEA	<a href="https://www.eea.europa.eu/data-and-maps/data/natura-9">https://www.eea.europa.eu/data-and-maps/data/natura-9</a> ( <a href="https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search?sessionId=8D099E3CA1153D9250F17506917843E3#/metadata/1930b66c-18a1-4de8-834d-55bccf533646">https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search?sessionId=8D099E3CA1153D9250F17506917843E3#/metadata/1930b66c-18a1-4de8-834d-55bccf533646</a> )
<b>Natura 2000 database</b>	MSAccess database	12/2017	EU28	EEA	<a href="https://www.eea.europa.eu/data-and-maps/data/natura-9">https://www.eea.europa.eu/data-and-maps/data/natura-9</a> ( <a href="https://www.eea.europa.eu/data-and-maps/data/natura-9#tab-metadata">https://www.eea.europa.eu/data-and-maps/data/natura-9#tab-metadata</a> )
<b>CDDA database</b>	MSAccess database	12/2017	EU28	EEA	<a href="https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-european-data">https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-european-data</a> ( <a href="https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-metadata">https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-metadata</a> )
<b>CDDA vector</b>	Shapefile	12/2017	EU28	EEA	<a href="https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-european-data">https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-european-data</a> ( <a href="https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search?sessionId=8D099E3CA1153D9250F17506917843E3#/metadata/c6d98fda-796e-40c0-b953-d716a8db1df5">https://sdi.eea.europa.eu/catalogue/srv/eng/catalog.search?sessionId=8D099E3CA1153D9250F17506917843E3#/metadata/c6d98fda-796e-40c0-b953-d716a8db1df5</a> )
<b>HELCOM vector</b>	Shapefile	02/2018	HELCOM MS	HELCOM	<a href="http://mpas.helcom.fi/apex/f?p=103:1::::(http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/d27df8c0-de86-4d13-a06d-35a8f50b16fa)">http://mpas.helcom.fi/apex/f?p=103:1::::(http://metadata.helcom.fi/geonetwork/srv/eng/catalog.search#/metadata/d27df8c0-de86-4d13-a06d-35a8f50b16fa)</a>
<b>OSPAR vector</b>	Shapefile	2018	OSPAR MS	OSPAR	<a href="https://odims.ospar.org/layers/geonode:Marine_protected_area__OSPAR____Global_view__polygon_">https://odims.ospar.org/layers/geonode:Marine_protected_area__OSPAR____Global_view__polygon_</a> ( <a href="https://odims.ospar.org/geoportal/rest/document?id=%7BBAD14881-6F03-43F9-BF7E-6CC8253F8C1A%7D">https://odims.ospar.org/geoportal/rest/document?id=%7BBAD14881-6F03-43F9-BF7E-6CC8253F8C1A%7D</a> )
<b>MAPAMED</b>	Shapefile	04/2017	Barcelona Convention MS	MedPAN / SPA-RAC	<a href="http://medpan.org/main_activities/mapamed/">http://medpan.org/main_activities/mapamed/</a>
<b>EUSEAMAP</b>	Raster / Shapefile	2018	Global	EMODnet	<a href="https://www.emodnet-seabedhabitats.eu/">https://www.emodnet-seabedhabitats.eu/</a> <a href="http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/02a444c8-bd2d-4e15-8e69-806059103760">http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/02a444c8-bd2d-4e15-8e69-806059103760</a>

## 2. MPA DEVELOPMENT

Written by ETC-UMA

The EU MPA assessment distinguishes between three classes of MPA development: 1) Designated MPAs, 2) MPAs with a management plan and 3) Effectively managed MPAs (Table 2).

**Table 2.** Terminology of MPA development used in this assessment (by WWF).

<b>Designated MPAs</b>	refers to all areas that have been designated for marine protection. This is the <b>starting point</b> for marine protection.
<b>MPAs with a management plan</b>	are areas that have been designated for marine protection and are reported to have an implemented or officially endorsed management plan. This is the <b>first step</b> on the way for an MPA to be developed to protect the marine environment.
<b>Effectively managed MPAs</b>	are areas that have been designated, have an implemented management plan and are carrying out actions for conservation and/or active nature restoration that results in <b>actual protection</b> .

### 2.1 DESIGNATED MPAS

The area designated as an MPA was defined in terms of total MPA coverage in km<sup>2</sup> and percentage of marine area by country, regional sea, and for all European EU waters (chapter 1.2). The percentage of no-take area in designated MPAs was not calculated as the information was not uniformly available across all MPAs. The World Database on Protected Areas includes information regarding no-take areas only in some Italian MPAs, but overall, information regarding no-take areas is lacking or inconsistent across publicly available databases on regional or EU level.

### 2.2. MPAS WITH A MANAGEMENT PLAN

Information on the management plan status is reported only in three of the five databases used for this report (HELCOM MPA database, OSPAR MPA database and the Natura 2000 Standard Data Form). Neither the CDDA nor the MAPAMED databases include information about management plans, however, they account for only 5% of the total MPA coverage in the EU marine area, while the three aforementioned databases reporting on MPA management together account for 95% of the total MPA coverage. The data for the assessment of management plans comes from the tabular databases that are linked to the spatial MPA database by the MPA code (Natura 2000 sitecode, HELCOM and OSPAR ID).

The reporting to the HELCOM and OSPAR MPA databases distinguishes between different phases of management plans (under preparation, finalised but not implemented and implemented/officially endorsed) while the Natura 2000 database only reports information on the existence of management plans, without clarifying the status of implementation. For the purpose of this assessment information from HELCOM and OSPAR MPA databases overrode the information from the Natura 2000 database, and information from the Natura 2000 Standard Data Form was only used for MPAs not reported to these two regional seas databases (in practice all MPAs in the Mediterranean Sea and Black Sea, and some MPAs in the Baltic Sea and the Northeast Atlantic).

In MPAs where the HELCOM or OSPAR databases indicated partial implementation of the management plan, and spatial identification of those parts was possible based on the Natura 2000 or CDDA database, the parts reported to have a management plan were considered managed in this assessment. If this identification was not possible, the whole MPA was considered not managed.

The *OSPAR MPA database*<sup>6</sup> reports MPA management plan information for the North-East Atlantic with the following attributes (answering the question “Are the measures to achieve the conservation objectives being implemented?”):

- ‘Yes’ = The MPA has an implemented/officially endorsed management plan.
- ‘Partial’ = Only some parts of the MPA has an implemented management plan. In the assessment these MPAs were considered not to have an implemented management unless the part of the MPA with the management plan (e.g. nature reserve or national park identified via CDDA database) could be spatially identified.
- ‘No’ = The MPA has no management plan in place.
- ‘No response’ = No response reported in the database, defined as no management plan for this assessment.
- ‘Unknown’ = Defined as no management plan for this assessment.

The *HELCOM MPA database*<sup>7</sup> reports MPA management information in the field labelled ‘Status’ in the overview table, with the following attributes:

- ‘Designated and managed’ = The MPA has an implemented/officially endorsed management plan.
- ‘Designated and partly managed’ = Only some parts of the MPA has an implemented management plan. In the assessment these MPAs were considered not to have an implemented management unless the part of the MPA with the management plan (e.g. nature reserve or national park identified via CDDA database) could be spatially identified.
- ‘Designated’ = The MPA has no management plan in place.

The *Natura 2000 database*<sup>8</sup> is based on the Standard Data Form which includes a section on Site Management (section 6) and specifically requires information on the Management Plan (Field 6.2 of the Standard Data Form).<sup>9</sup> This information is available in the field “Management Status” that was used to calculate the proportion of MPA area with management plan in force, using the following attributes:

- ‘Y’ = Management plan exists for the MPA.
- ‘P’ = Management plan is in preparation for the MPA, defined as no management plan for this assessment.
- ‘N’ = Management plan does not exist for the MPA.
- ‘No value’ = no management plan information reported in the database, defined as no management plan for this assessment.

<sup>6</sup> [http://mpa.ospar.org/home\\_ospar/mpa\\_datasheets](http://mpa.ospar.org/home_ospar/mpa_datasheets)

<sup>7</sup> <http://mpas.helcom.fi/apex/f?p=103:1>

<sup>8</sup> <https://www.eea.europa.eu/data-and-maps/data/natura-9#tab-european-data>

<sup>9</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011D0484&from=EN>



The results of the MPA management plan assessment describes the official endorsement of MPA management plans in the Baltic Sea and the North-East Atlantic, whereas for the Mediterranean and the Black Sea MPAs only the existence of a management plan is described. This is a result of the different reporting formats in the MPA databases available in Europe. Due to artefacts created in the assessment especially around small coastal areas management of less than 0.5% of a country’s marine area was rounded down to 0% management.

### 2.3. EFFECTIVELY MANAGED MPAS

The spatial coverage of effectively managed MPAs could not be assessed, as information on these is not available in the public databases for all 23 marine EU Member States. Effective management of an MPA requires that the management plan is fully implemented, and that actions for conservation and/or active nature restoration that result in actual protection are carried out. This level of information is scarcely available throughout Europe, and no such data is reported in the publicly available databases used in this assessment.<sup>10</sup> Therefore information on MPA management plans (chapter 2.2) was used as a proxy for MPA progress, as it reflects the first step of an area designated as an MPA to develop into an area providing effective protection to the marine environment.

### 2.4. RESULTS OF ASSESSING MPA DEVELOPMENT

*Written by WWF*

In all regional seas individually, as well as in the entire EU marine area, over 10% of the seas have been designated for marine protection. However, when looking at the management plan development, the results are significantly lower. In the Mediterranean Sea, the Black Sea and the North-east Atlantic there are MPA management plans for less than 2% of the entire sea basin, while in the Baltic Sea the corresponding number is 6.4%. For all EU seas combined, the result is very low; only 1.8% of the entire marine area is covered by MPAs with a management plan.

This assessment shows that 19 of 23 marine EU Member States are falling short from having MPA management plans for 10% of their marine area, and 11 Member States have not developed and reported any management plans for their marine areas. Only four Member States have MPA management plans for over 10% of their marine area, however, it should be noted that this assessment does not reveal the content of efficiency of those management plans.

Due to different national definitions on what constitutes as an MPA, as well as shapefile specific differences used in the national calculations, the coverage of designated MPAs may deviate slightly from national reporting. The calculation used in this assessment was created for a pan-European MPA assessment, with the primary objective of comparing EU Member States with each other through a unified assessment (chapter 1). For exact national results, please consult the relevant national WWF office or national authorities.

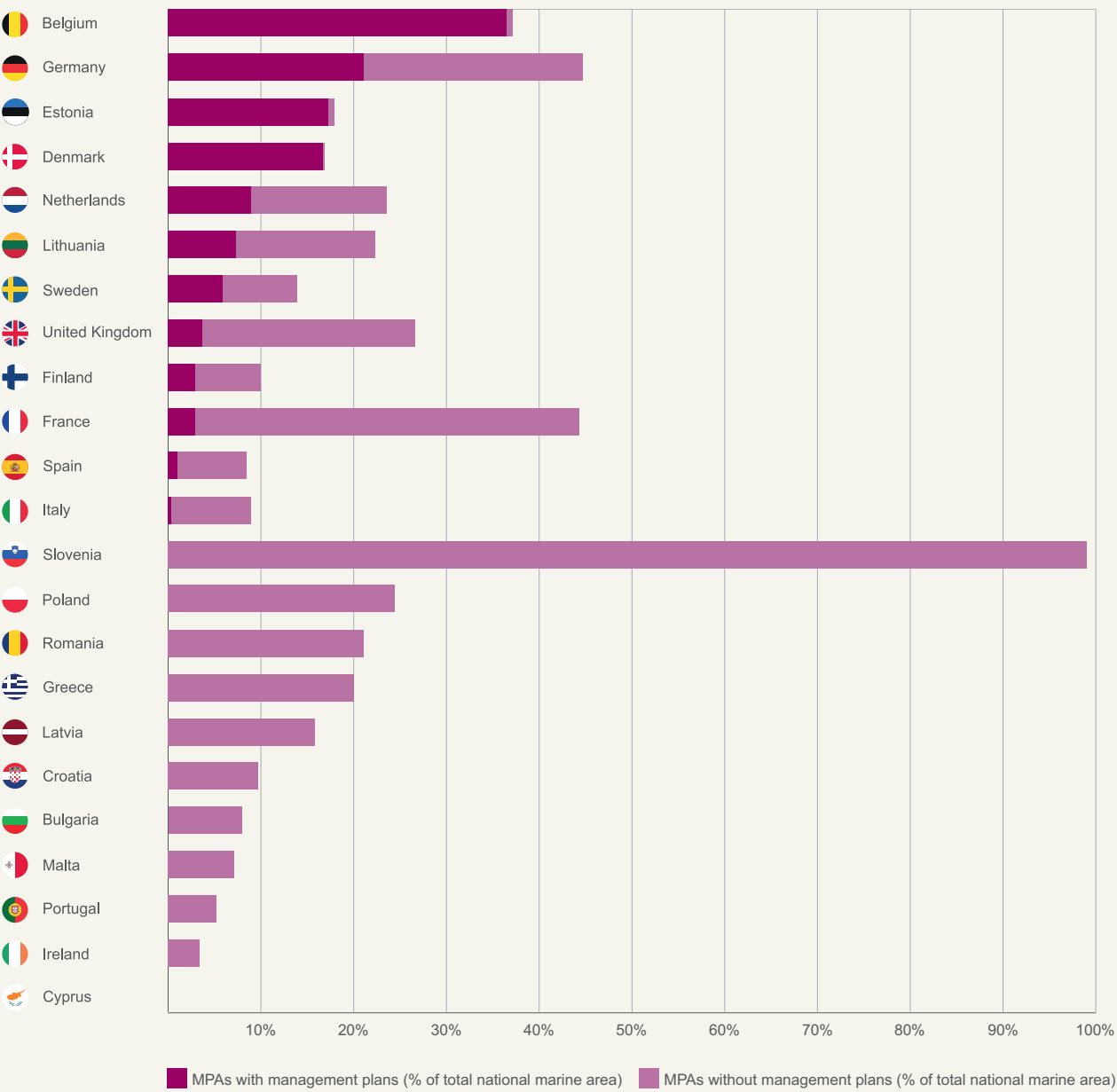
For further discussion on the results, please refer to the main report (pages 14-19 and 28-29).

**Table 3.** The coverage of MPAs with a management plan is still well below 10% in all regional seas, and only 1.8% for the entire EU marine area. Coverage of designated MPAs varies from 11.7 and 16.4% in between the regional seas.

	Designated MPAs (coverage of marine areas)	MPAs with management plan (coverage of marine areas)
EU marine area	12.4%	1.8%
Baltic Sea	16.4%	6.4%
NE Atlantic Ocean	11.7%	1.7%
Mediterranean Sea	13.5%	0.8%
Black Sea	14.0%	0.1%

<sup>10</sup> For the Dutch marine area this information was available and is presented on page 17 of the main report.

### MPAs with and without management plans in the EU



**Figure 3.** Almost half of all marine EU Member States have not developed and reported any management plans for their MPAs, and only four Member States have management plans for more than 10% of their marine area.

### 3. ECOLOGICAL COHERENCE OF MPA NETWORKS IN THE EU

Written by ETC-UMA

Ecological coherence of the MPA networks was assessed per each regional sea and calculated based on the three criteria of representativity, replication and connectivity, using modelled spatial habitat data (chapter 3.1). The three criteria must be met at the same time and were defined as:

1. **Representativity**, which ensures that the MPA network protects the typical and unique nature in each sea basin, meaning that all habitats found in the sea basin must also be represented within the MPA network. To be representable the MPA network should include different biogeographical zones and depth zones of the marine environment, and should reflect the full range of habitats, including all organizational levels of biodiversity. This assessment examined the proportional coverage of habitats within the MPA network. **The target for the representativity assessment was that at least 30% of each habitat type found in the regional sea must be represented within the MPA network, based on scientific advice and aligned with IUCN's Global Conservation Standards for Marine Protected Areas.**<sup>11, 12</sup>
2. **Replication**, which acts as the insurance of the network, ensures that there are several copies of the natural habitats in the MPA network, and that these copies are not clustered together in only one MPA. This assessment examined the number of times a habitat was replicated in different MPAs within the regional seas' MPA network. Higher replication of habitats in the network generally signifies a network that is robust to risks and impacts (both natural and anthropogenic). **The target of this replication assessment was that each habitat would occur at least four times within the MPA network of the regional sea, based on previous large scale assessments.**<sup>13, 14</sup>
3. **Connectivity**, which acts as the glue of the MPA network, ensures that the individual MPAs of the network are close enough to each other to allow for species and their larvae to move between MPAs hosting their required habitat type. This allows for persistence of ecological communities and populations by enabling species or their larvae to seek refuge within the MPA network if needed. By ensuring connectivity of all habitats in a sea basin the MPA network supports the survival of all species present, including species whose different life stages depend on different habitats. Connectivity assessments are scale dependent, and need to be adjusted for the scale of each individual dataset; assessments carried out at a smaller geographical scale than this one traditionally include more detailed data on for example sea currents required for connectivity analyses. Unfortunately this data is not available for an assessment at sea basin level, and therefore an assessment of proximity was used as a proxy for connectivity, as has been done in previous large scale assessments.<sup>12, 13</sup> A 20 km distance was used as the maximum limit for dispersal.<sup>15</sup> **The Connectivity assessment examined the number of connections between the same habitat in different MPAs within the regional sea MPA network (distance of a connection <20 km, and habitat patch size >0.5 km<sup>2</sup>). The target of this connectivity assessment was that 80% of all habitats should have at least 20 or more connections each** (further developed from assessments carried out by the HELCOM regional sea convention and the European Environment Agency).<sup>12, 13</sup>

Previous local and regional assessments of ecological coherence have also included additional criteria such as adequacy, resilience, viability and management. The definitions of these additional criteria are not as fixed as for the three main criteria, as they partly overlap and vary between assessments. Therefore this pan-European assessment focuses on the three main criteria.<sup>12, 13, 16</sup>

11 IUCN WCPA 2018. Applying IUCN's Global Conservation Standards to Marine Protected Areas (MPA) [https://www.iucn.org/sites/dev/files/content/documents/applying\\_mpa\\_global\\_standards\\_final\\_version\\_050418.pdf](https://www.iucn.org/sites/dev/files/content/documents/applying_mpa_global_standards_final_version_050418.pdf)

12 Sala et al. 2018. Assessing real progress towards effective ocean protection. Marine Policy 91: 11-13.

13 HELCOM 2016. Ecological coherence assessment of the Marine Protected Area network in the Baltic. Balt. Sea Environ. Proc. No. 148

14 Agnesi et al. 2017. Assessing Europe's Marine Protected Area networks - Proposed methodologies and scenarios, ed. Kunitzer, A. ETC/ICM Technical Report 2/2017, 72pp.

15 Shanks et al. 2003. Propagule dispersal distance and the size and spacing of marine reserves. Ecological Applications 13 (Supplement): 159-169.; Abdulla et al. 2008. Status of Marine Protected Areas in the Mediterranean Sea. IUCN, Malaga and WWF, France, pp. 152.; Shanks 2009. Pelagic Larval Duration and Dispersal Distance Revisited. Biol Bull. 216(3): 373-85.; Rodríguez-Rodríguez 2016. Marine protected area design patterns in the Mediterranean Sea: Implications for conservation. Marine pollution Bulletin 110 (1), 335-342.

16 Rees et al. 2015. Assessment of the Ecological Coherence of the MPA Network in the Celtic Seas: A report for WWF-UK by the Marine Institute, Plymouth University and The Marine Biological Association of the United Kingdom. pp 165.

### 3.1. DATA SOURCES FOR THE ECOLOGICAL COHERENCE ASSESSMENT

The ecological coherence assessment is based on the EMODnet Seabed Habitat layers (EUSeaMap)<sup>17</sup> as this represents the most complete and harmonised coverage of the distribution of marine benthic habitats for the EU marine area. It includes 90 EUNIS habitat classes and types of benthic seabed habitats. For this assessment, these were aggregated to 33 habitat super classes (Table 3) based on their ecological community and function, bathymetry, substrate type and biogeography (regional sea). It should be noted that EMODnet data are based on both observed and modelled data. Although rigorous and standardized, there are some areas that present a higher level of uncertainty over others given the lack of field data and extrapolations generated through habitat models.

The detailed MPA layer (chapter 1.2) was post-processed to obtain both homogenous MPA patches and separate MPA polygons that make up multipolygons. A distinction was made between single MPAs, but the original MPA layer was also modified in cases where MPA patches (single spatial features) from one source (e.g. OSPAR) were attached to a neighbouring MPA patch from another source (e.g. CDDA), considering them as one MPA patch for this spatial assessment. This was considered reasonable since ecological coherence is assessed by comparing representativity, replicates and connections of protected polygons, not administrative units.

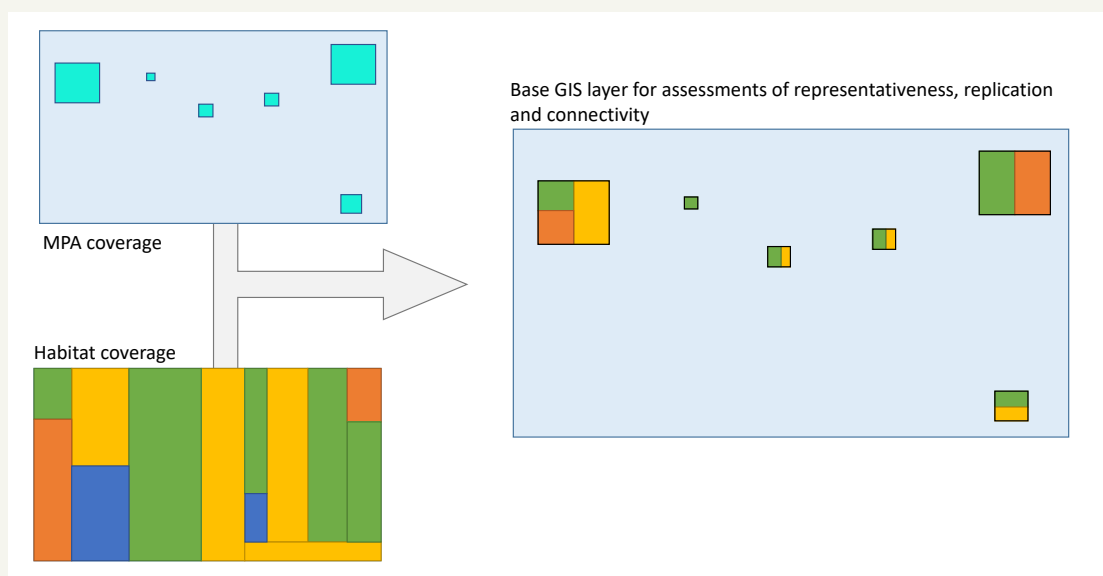
Habitat super classes		
A. Abyssal soft and mixed substrate	A. Infralittoral coarse substrate	BA. Baltic Circalittoral hard substrate
A. Deep-sea bed	A. Infralittoral soft and mixed substrate	BA. Baltic Infralittoral hard substrate
A. Deep-sea hard substrate	A. Thenea muricata	BS. Black Sea Bathyal soft and mixed substrate
A. Deep-sea soft and mixed substrate	A. Cymodocea beds	BS. Black Sea Deep Circalittoral soft and mixed substrate
A. Deep Circalittoral hard substrate	AM. Atlantic and Mediterranean Circalittoral hard substrate	BS. Black Sea Circalittoral hard substrate
A. Deep Circalittoral coarse substrate	AM. Atlantic and Mediterranean Infralittoral hard substrate	BS. Black Sea Infralittoral hard substrate
A. Deep Circalittoral soft and mixed substrate	M. Mediterranean Bathyal soft and mixed substrate	BS. Black Sea Infralittoral coarse substrate
A. Circalittoral hard substrate	M. Mediterranean biocoenosis	BS. Black Sea Infralittoral soft and mixed substrate
A. Circalittoral coarse substrate	M. Mediterranean Coralligenous	BS. Black Sea Shallow circalittoral seabed
A. Circalittoral soft and mixed substrate	M. Mediterranean Shelf edge	BS. Black Sea Shallow circalittoral soft and mixed substrate
A. Infralittoral hard substrate	M. Posidonia habitat	

**Table 4.** The 33 habitat super classes used in the assessments of representativity, replication and connectivity (derived from 90 EUNIS habitats).

<sup>17</sup> EUSeaMap: <http://www.emodnet.eu/seabed-habitats> and <http://gis.ices.dk/geonetwork/srv/eng/catalog.search#/metadata/02a444c8-bd2d-4e15-8e69-806059103760>

### 3.2. METHODOLOGY FOR THE ECOLOGICAL COHERENCE ASSESSMENT

The assessment of **representativity and replication** of marine biodiversity was carried out by overlapping surface layers of MPAs with the habitat super class layer described in chapter 3.1 (Figure 3). Using the resulting GIS information, the number of habitat super classes and their total surface was calculated at the regional level, and compared against the corresponding numbers within the regional sea MPA network. Based on this assessment, the value for representativity (habitat coverage) and replication (habitat patch number) were obtained. In both assessments only MPA patches higher or equal to 0.5 km<sup>2</sup> were used. The representativity results were presented as the habitats of which at least 30% of the total habitat surface was included in the MPA network. The replication results were presented as the number of habitat super classes which occurred at least four or more times within the different MPAs of the MPA network.<sup>18</sup>



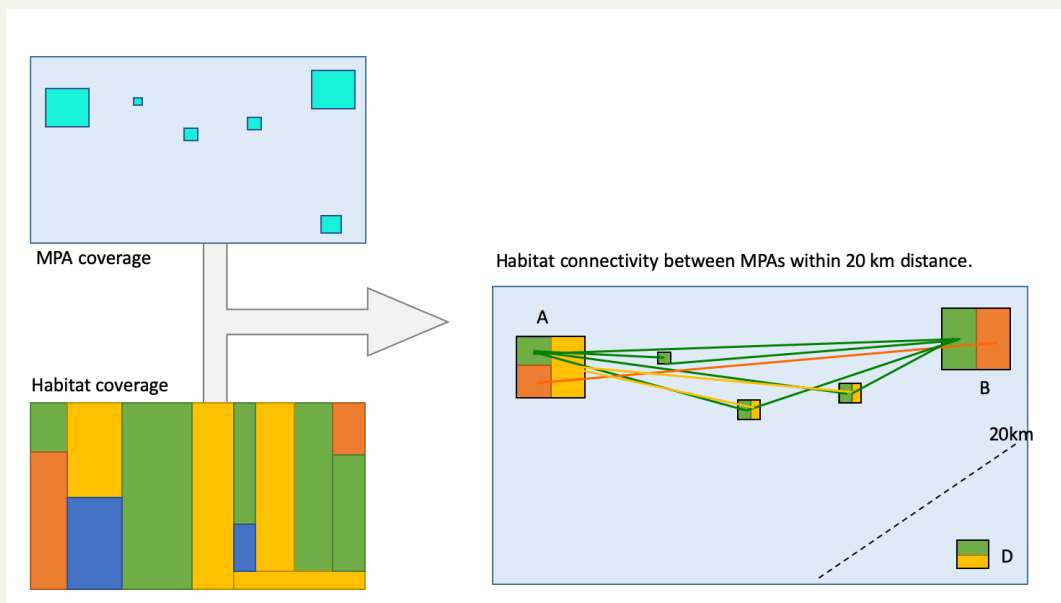
**Figure 4.** Schematic illustration of the GIS data overlay.

Proximity of the already mentioned habitat super class patches in different MPAs was used as a proxy for **connectivity**. The assessment, which was developed from the connectivity assessment carried out by the HELCOM regional sea convention,<sup>13</sup> was done with the following boundary conditions:

- The centroid of each habitat patch was used for the distance calculation, thus requiring the longest possible distance between two MPAs<sup>19</sup>
- 20 km dispersal distance was used as the cut-off value<sup>15</sup>
- Processing was done on the regional sea level calculating the distance from one patch of habitat type A to all other patches of habitat type A in the regional sea MPA network (with cut-off at 20 km) (Figure 4).

<sup>18</sup> **HELCOM 2010.** Towards an ecologically coherent network of well-managed Marine Protected Areas – Implementation report on the status and ecological coherence of the HELCOM BSPA network. Baltic Sea Environmental Proceedings No. 124B.; **HELCOM 2016.** Ecological coherence assessment of the Marine Protected Area network in the Baltic. Baltic Sea Environmental Proceedings No. 148.; **Agnesi et al. 2017.** Assessing Europe's Marine Protected Area networks - Proposed methodologies and scenarios, ed. Kunitzer, A. ETC/ICM Technical Report 2/2017, 72pp.

<sup>19</sup> **Foster et al. 2014.** Assessing the Ecological Coherence of the Channel MPA Network. Report prepared by the Marine Institute for the Protected Area Network Across the Channel Ecosystem (PANACHE) project. INTERREG programme France (Channel) England funded project, 156pp.



**Figure 5.** Schematic illustration of the connectivity assessment.

Following this approach, MPAs lacking the habitat super class in question were ignored. The total number of habitats with 20 or more connections was divided by the total number of habitats present in the regional sea area to get the proportion of habitat super classes that are connected to each other in the regional sea MPA network. The connectivity result was presented as the percentage of habitat super classes which had at least 20 connections within a 20 km distance in the regional sea MPA network.

### 3.3. RESULTS OF THE ECOLOGICAL COHERENCE ASSESSMENT

*Written by WWF*

Ecological coherence is measured against strict cut off lines, where each criterion must be met with 100% success and all three criteria must be achieved simultaneously. The results of the representativity, replication and connectivity assessments show that no MPA network in the regional seas fulfil all of the goals set for these three criteria (Table 4). Representativity scores are low or very low in all regional seas, while replication scores are slightly better; the North-east Atlantic MPA network already shows high enough replication, while the Baltic Sea and the Mediterranean Sea networks are 12-17% away from the required levels of replication. Connectivity of the MPA network is very low in the Mediterranean Sea, and still 38-38% away from the required levels in the Baltic Sea and the North-east Atlantic.

For further discussion on the results, please refer to the main report (pages 22-25 and 28-29).

Regional Sea (number of habitats)	Representativity	Replication	Connectivity	Ecological coherence reached?
Baltic Sea (8)	25%	88%	63%	No
NE Atlantic (13)	54%	100%	62%	No
Mediterranean Sea (18)	33%	83%	17%	No


**Table 5.** The results of the calculations for the assessments of representativity, replication and connectivity, which together determine that the regional sea MPA networks do not display ecological coherence. Each criterion must be met with 100% success and all three criteria must be achieved simultaneously for the network to be ecologically coherent. Green = criterion is met (scores 100%); orange = criterion is not met but shows progress (scores over 60 %); red = criterion is not met and is very far away from being fulfilled (scores less than 60%).



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The data collection and analyses for this assessment, as well as writing the first draft of this Technical Annex, were carried out by the European Topic Centre at the University of Malaga (ETC-UMA).

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