ETC/ICM Technical Report 2/2017

# Assessing Europe's Marine Protected Area networks

## Proposed methodologies and scenarios

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## List of Acronyms

| | |
|---|---|
| CBD | International Convention on Biodiversity |
| CDDA | Common Database on Designated Areas |
| DG-ENV | Directorate-General for the Environment |
| DG-Mare | Directorate-General for Maritime Affairs and Fisheries |
| EEA | European Environment Agency |
| ETC / BD | European Topic Center on Biological Diversity |
| ETC / ICM | European Topic Center on Inland and Coastal Marine Waters |
| EUNIS | European Nature Information System |
| HD | Habitats Directive |
| HELCOM | Baltic Marine Environment Protection Commission - Helsinki Commission |
| IUCN | International Union for Conservation of Nature |
| MEG | Marine Expert Group |
| MedPAN | Network of marine protected area managers in the Mediterranean Sea |
| MPA | Marine Protected Area |
| MSFD | Marine Strategy Framework Directive |
| MSP | Marine Spatial Planning Directive |
| OSPAR | Convention for the protection of the marine environment of the north-east Atlantic |
| OOAO | One out all out principle |
| QA/QC | Quality assured / Quality checked |
| N2K | Natura 2000 |
| RAC/SPA | Regional Activity Centre for Specially Protected Areas |
| RSC | Regional Sea Convention |
| SAC | Special Areas of Conservation |
| SCI | Site of Community Importance |
| SPA | Special Protection Area |
| SPAMI | Specially Protected Area of Mediterranean Importance |
| UNEP-MAP | United Nations Environment Programme - Mediterranean Action Plan |
| WWF | World Wide Fund for Nature |

## Executive summary

'Ecological coherence' is a term increasingly used to describe the ultimate goal in the design, establishment and assessment of marine protected area (MPA) networks. There are several EU-level policy drivers that call for the establishment of an ecologically coherent network of MPAs across Europe's seas – most notably Article 13.4 of the Marine Strategy Framework Directive (MSFD) and the EU Biodiversity Strategy to 2020. By drawing on existing approaches put forward by the Regional Sea Conventions (RSCs) of relevance to European seas, this report presents a proposed methodological framework for the assessment of MPA networks in a European context to help inform the role that MPAs (and MPA networks) play in the delivery of EU-level reporting requirements.

Section 2 of this report reviews the principles, criteria and indicators applied by RSCs to undertake ecological coherence assessments. In undertaking this exercise, we have identified that there are five key principles that are common place in RSC eco-coherence assessment methodologies:

- REPRESENTATIVITY – ensuring the range of marine habitats and species for which MPAs are considered appropriate are protected within MPAs and ensuring MPAs occupy at least 10% of sea area within different regions (with the rationale being the political target set out under Aichi Target 11 of the CBD).
- REPLICATION – ensuring a sufficient number of occurrences of a given feature are protected within MPAs and ensuring replication reflects what is known about a given features' biogeographic range.
- CONNECTIVITY – ensuring individual MPAs are well-connected in terms of facilitating the exchange of species and ensuring adequate propagule/egg dispersal. In practice, however proximity analysis between MPAs in terms of minimum distance thresholds are applied due to a lack of understanding of how to assess connectivity in a scientifically meaningful way.
- ADEQUACY – RSCs vary in considering the principle of adequacy, but this tends to refer to ensuring individual MPAs are a specific minimum size and considering exposure to pressures associated with human activities that could affect the conservation status of protected features of individual MPAs. Minimum proportions of specific habitats and species to be included in an MPA network are also discussed under the principle of adequacy.
- MANAGEMENT – the importance of effective management of MPAs in achieving an ecologically coherent network. Across the RSCs, this is considered a conceptually separate aspect to ecological coherence.

Drawing on the findings of Section 2, Section 3 provides a review of the datasets available to support an MPA ecological coherence assessment at the EU-level and Section 4 presents a 'three-tiered' proposed approach to an assessment framework for European seas:

- TIER 1 – Target-based pan European and EU regional assessments of MPA representativity (percentage coverage of MPAs across different depth classes and distances from the coast and of benthic broad-scale habitats)
- TIER 2 – Multi-target scenario-based Pan European and EU regional assessments of replication of specific habitats and species of interest and proximity analysis between MPAs across a range of distance thresholds derived from the RSCs. An analysis of MPA size class is also presented.
- TIER 3 – Case studies indicating further improvement to MPA network assessments. This final tier presents examples of work that could be used to further develop and improve on MPA network assessments across European seas into the future.

Section 5 presents an overview of outputs from the assessment routines outlined in Table 4.1 based on the proposed three-tiered approach and Section 6 explores options around the presentation of outputs from such an assessment; including the exploration of quantitative and semi-quantitative approaches.

The caveats behind the available data and approaches have revealed several recommendations that are important to consider in moving forward with an EU-level MPA network assessment. These are described in detail within Section 7 of this report but summarised here:

- Clarifying the requirements of EU level policy drivers in considering MPA network assessments – Most notably the specific requirements of Article 13.4 of the MSFD with respect to MPA network reporting.
- Including biology in the consideration of seabottom habitat and species protection within EU MPA networks - Expansion of pan-European spatial mapping efforts that would allow more ecologically meaningful assessments to be undertaken in the future. This should focus on addressing gaps in spatial coverage of modelled broad-scale seabed habitats, undertaking EUNIS Level 4 habitat mapping, and collating distribution maps of species for which MPAs are considered an appropriate conservation measure.
- Moving towards assessing protection, not just spatial overlap - Improved reporting on MPAs across underlying databases to infer the target of protection for specific habitats and species would aid the accuracy of MPA network assessments.
- Further definition of the scope for replication of revised broad habitats – Based on improved understanding of the biology of specific habitats and species rather than just generically-set targets.
- Moving towards network connectivity, rather than proximity - In an ideal world, specific information about species larval phases and dispersal patterns, in combination with data-rich oceanographic models, would be combined to develop a clearer picture of the potential interchange of biological diversity between MPAs.
- Further exploration of appropriate criteria under the network principles of 'adequacy' and 'management' - A consistent approach to generating and reporting information pertaining to MPA management and adequacy should be considered for roll out across all EU MPAs by drawing on progress and ideas put forward by the RSCs.
- Streamlining the availability of spatial and tabular data on EU MPAs – The N2K, CDDA and Regional Sea Convention databases are all proposed for use as source data for information on EU MPAs within this report. Ideally, there would be a data flow process developed centrally within the EU that draws in an automated way necessary attribute data into a centralised EU MPA database from which such MPA assessments can draw from into the future.
- Generating a centralised database of 'other area-based measures' as well as EU MPAs - Both the CBD and MSFD infer that not just MPAs in their strictest definition can be considered to contribute to EU MPA networks. Effort should be invested in developing a common definition of 'other area-based measures' in an EU context and a centralised database produced of such areas, the features they are considered to protect, and the likelihood of persistence of management that affords protection to said features.

# 1 Introduction

## 1.1 Background and purpose of this report

The European Topic Centre for Inland, Coastal and Marine Waters (ETC/ICM) has over the past two years developed a methodology to define a harmonised dataset of Marine Protected Areas (MPAs) in Europe's seas based on the analysis of spatial and tabular data reported by Member States within the framework of EU-reporting fora and at the regional sea convention level. This work has led to the definition of a baseline statistical analysis of MPA network distribution across Europe's seas. This spatial analysis refers to the MPA network established by EU countries by the end of 2012. The results of the analysis have led to the publication of a European Environment Agency (EEA) policy briefing on the status and future perspectives of MPA networks across Europe (EEA, 2015a) while the extensive explanation regarding the methodology and findings are compounded into an EEA Technical report (EEA, 2015b). Both reports were developed to support the European Commission's progress report (COM, 2015) on MPAs to the European Parliament and to the Council under Article 21 of the Marine Strategy Framework Directive (MSFD). Part of the baseline analysis on the MPA statistics was also used for the definition of an EEA MPA indicator measuring the progress made towards the CBD Aichi target 11. It is the intention of this work to set the context behind further defining a proposed assessment framework for assessing the 'ecological coherence' of EU MPA networks.

'Ecological coherence' is the term increasingly used under various marine policy instruments to summarise in a conceptual manner the ultimate goal in the design, establishment and assessment of marine protected area (MPA) networks. It is considered to be an overarching concept, encompassing within it a number of different principles and associated criteria (Deltares, 2014) that need to be met in order to conclude as to whether or not an MPA network can be considered to be ecologically coherent.

Descriptions of what an ecologically coherent network of MPAs is have been formulated by Regional Sea Conventions (RSC) operating in European seas. By drawing on existing Regional Sea Convention (RSC) efforts to assess the 'ecological coherence' of networks to date, this report presents a proposed methodological framework for the assessment of MPA networks in a European context to help inform the role MPAs (and MPA networks) play in the delivery of reporting requirements under several EU-level policy drivers – most notably the Marine Strategy Framework Directive (MSFD) (Article 13.4) and the EU Biodiversity Strategy to 2020.

In meeting this aim, the report:

- Reviews the principles, criteria and indicators applied by Regional Sea Conventions (RSCs) to undertake ecological coherence assessments (Section 2);
- Discusses the extent to which these principles, criteria and indicators can be applied in a European context based on the availability of European-wide datasets (Section 3);
- Proposes a methodological framework and associated procedures that could be operationalised to undertake an assessment of the EU MPA networks (Sections 4 and 5), as well as a review of ways in which the outputs of such an assessment can be presented (Section 6); and
- Concludes with a series of recommendations to help guide further work in this area at an EU-level (Section 7).

The report has not been in EIONET consultation as it does not include national data nor provides any national statistic. However, it will act as a supporting document for future EEA assessments of marine protected areas which will be consulted through the EIONET network.

## 1.2 EU policy context

**EC Birds and Habitats Directives**

The principle of a coherent ecological network of protected areas was first introduced into EU legislation by the Habitats Directive & Wild Birds Directives, which identifies the role of Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) as a means through which habitats and species of community interest can be maintained or restored at a favourable conservation status. Collectively, SACs and SPAs comprise the Natura 2000 (N2K) network – a network of sites established for the conservation of specific habitats and species listed within the Annexes of the Directives. The Natura 2000 network is established on the basis of specific criteria and is subject to specific evaluations regarding the sufficiency of the network.

This report does not undermine the sufficiency assessment of the Natura 2000 network in any way – but it is notable that the use of particular criteria such as representativity and adequacy (i.e. the use of SACs and SPAs for the protection of proportions of specific features listed within the Directives) are used to evaluate sufficiency of the network.

**The Marine Strategy Framework Directive**

The principle EU-level policy driver underpinning an assessment of MPA networks is the Marine Strategy Framework Directive (MSFD). Art.13.4 of the MSFD requires Member States to reach or maintain good environmental status through specific programmes of measures, amongst which is the establishment of spatial protection measures. Art 13.4 states that:

*"Programmes of measures established pursuant to this Article shall include spatial protection measures, contributing to coherent and representative networks of marine protected areas, adequately covering the diversity of the constituent ecosystems, such as special areas of conservation pursuant to the Habitats Directive, special protection measures pursuant to the Birds Directive, and marine protected areas as agreed by the Community or Member States concerned in the framework of international or regional agreements to which they are parties".*

There are several observations with regards to the wording of Art 13.4 that should be considered in developing a proposed methodological framework for an assessment of MPA networks at the EU-level.

Firstly, it appears that reference to 'spatial protection measures' is a reflection of the wording in Aichi Target 11 under the International Convention on Biological Diversity (CBD) whereby contributions may also include area-based conservation measures that do not necessarily constitute MPAs [(1)].

Secondly, it is unclear whether Article 13.4 of the MSFD requires a) an assessment of the contribution that spatial protection measures (SPAs, SACs, Regional Sea Convention designations, national MPA designations and other types of spatial protection measures) make to 'adequately covering the diversity of constituent ecosystems' or b) whether it requires an assessment of the degree to which EU MPA networks are 'coherent and representative'.

**For the purposes of this report, the latter has been assumed – but this requires clarification from the European Commission.** This interpretation is reinforced by the emphasis placed in the preamble of the Directive itself concerning the need to establish and maintain ecologically representative networks of MPAs as a guarantee of ensuring the conservation of marine biodiversity. This interpretation is also reinforced by

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(1) *"By 2020 at least 10 per cent of coastal and marine areas are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures".* It is notable that notion 053 of the IUCN is calling for an amendment to this target to reflect an increase in fully protected MPAs to cover at least 30% of the oceans by 2030. For more information, see: https://portals.iucn.org/congress/motion/053

the MSFD Article 21 Commission Report that calls to 'further develop an EU methodology for the assessment of MPA network coherence and representativity'[(2)].

**EU Biodiversity Strategy to 2020**

The EU Biodiversity Strategy to 2020 reflects the commitments made by the EU in 2010 with respect to the CBD and its Strategic Plan for the period 2011-2020, which in defining its Aichi target 11, cited above, calls on the protection of at least 10% of coastal and marine areas. The EU Biodiversity Strategy takes stock of the CBD commitments and defines its marine species and habitat protection objectives (Target 1) as follows [(3)]:

- Complete the Natura 2000 network and ensure its good management
- Make sure Natura 2000 sites obtain sufficient funding
- Raise awareness of Natura 2000, get citizens involved and improve the enforcement of the nature directives
- Make the monitoring and reporting of the EU nature law more consistent, relevant and up-to-date; provide a suitable ICT tool for Biodiversity

**Maps presented in the report**

The maps presented in the report should be used on the following basis:

a. They are intended for the sole purposes of supporting the assessment of marine protected areas by Member States, stakeholders and the European Commission and its agencies.
b. Please note that neither the European Commission, the European Environment Agency nor its European Topic Centre for Inland, Coastal and Marine waters has competence in the geographical demarcation of EU Member States' borders. This is also the case for establishing the limits of the continental shelf of EU Member States, where international law applies. According to UNCLOS art. 76 (8), only the coastal State is competent to establish the outer limits of its continental shelf. It is to act on the basis of the recommendations of the Commission on the Limits of the Continental Shelf.
c. The maps and tables provided in this report and resulting from the evaluation of the available datasets are not intended to influence or question any ongoing negotiations occurring in UNCLOS or jurisdictional issues regarding maritime boundaries pertaining to EU Member States or to non-EU countries.
d. Please note that non-EU countries have not been consulted in the preparation of these maps. Some claims by EU-Member States to marine waters, particularly to Continental Shelf areas, may be contested by non-EU-countries. The claims for extended continental shelf from Spain are not represented in these maps.
e. Neither the European Commission, the European Environment Agency nor its European Topic Centre for Inland, Coastal and Marine waters is responsible for the use that may be made of the information provided in the tables and maps in this report. As such, there is a disclaimer associated with all maps: This map serves as a working tool only and shall not be considered as an official or legally-binding map representing marine borders in accordance with international law. This map shall be used without prejudice to the agreements that will be concluded between Member States or between Member States and non-EU states in respect of their marine borders.
f. EEA will continue to update the maps as and when new information is made available by EU Member States (e.g. as part of their on-going dialogue with neighbouring states, or when new agreements are reached under UNCLOS) and/or requested by DG ENV to further provide technical support to the MSFD CIS process.

For more information on the European marine regions, please refer to the EEA web-page https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions#tab-documents.

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[(2)] See http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/implementation/pdf/marine_protected_areas.pdf

[(3)] http://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm

# 2 A review of efforts to assess MPA ecological coherence of relevance at an EU-scale

The aim of this report is to attempt to define an assessment framework for MPA networks at the level of the European seas. Therefore, we approached this by using the spatially widest 'building blocks' underpinning this, i.e. the approaches taken by the Regional Sea Conventions – which in geographical terms cover the majority of the MSFD EU Regions. We are, however, aware of the development of national guidelines for the assessment of MPA network coherence (e.g. Natural England and JNCC, 2010) as well as national (Carr *et al.,* 2014) and sub-regional (Rees *et al.,* 2015) efforts to assess MPA networks. In addition, the majority of Member States have also informed the development of Regional Sea Convention approaches in their contribution to these Conventions as Contracting Parties. As such, they are most likely to reflect an approach that is agreeable at a European level. Furthermore, in 2014 a study commissioned by DG ENV to a consortium of European partners, defined a methodology for evaluating the coherence of the European MPA networks (Deltares, 2014). The study described the guiding principles behind the establishment and assessment of MPAs as contained in international instruments such as the Convention on Biological Diversity, Regional Sea Conventions and the EU nature directives. The present report also draws on the conclusions of this latter report with particular emphasis on defining the concept of the ecological coherence and the proposals it makes in terms of scoring the potential assessment results.

In order to review existing Regional Sea Convention efforts to assess ecological coherence of relevance to the development of an EU-level assessment framework, a workshop was held from 25th–26th June, 2015 in ISPRA, Rome. Participants to the workshop were ETC/ICM partners ISPRA, JNCC, SYKE, TC-Vode and EEA who have been involved in MPA analyses within the ETC/ICM and also in Regional Sea Conventions' MPA network assessments. Discussions during the workshop led to the production of a comparison table listing the principles and associated criteria used by Regional Sea Conventions in their present or imminent assessments of MPA ecological coherence (see table 2.1). This was further refined as part of an MPA Regional Workshop on 20th April 2016 in Copenhagen, Denmark with wider representation of experts from Regional Sea Conventions and Member States. At the time of writing, during fall 2016, a full overview of the approach being undertaken for the 2016 MPA network assessment for the Mediterranean was not available.

This section of the report provides an overview of Regional Sea Convention approaches under OSPAR (covering the North-east Atlantic Ocean), HELCOM (covering the Baltic Sea) and the Barcelona Convention (covering the Mediterranean Sea). To the best of the authors' knowledge, there has been no active progress in MPA network assessments under the Bucharest Convention covering the Black Sea.

Over the past decade, the Regional Sea Conventions have placed significant effort in attempting to transfer the concept of ecological coherence into operational principles and associated criteria that might be used to make inferences as to whether or not their MPA networks can be considered ecologically coherent. This began in 2003, with the OSPAR and HELCOM Regional Sea Conventions jointly defining, within their programmes of work, the objective of establishing ecologically coherent and well-managed MPA networks.

## 2.1 OSPAR

OSPAR (2006) recommends that an assessment of MPA ecological coherence should be centred around five key principles: 'features', 'representativity', 'connectivity', 'resilience' and 'management' (see box 1).

Several attempts to run MPA ecological coherence assessments have occurred since 2008 within OSPAR, the most recent being documented in 2013 (OSPAR, 2013). On the basis of past assessments, the OSPAR Commission is planning to run an MPA coherence assessment in 2017 based on data reported by Contracting Parties up to and including the end of 2016. The criteria and thresholds that will be used for the 2017 assessment are provided in table 2.1.

**Box 1 – OSPAR principles for assessing the ecological coherence of MPA networks (derived from OSPAR, 2006)**

***Features*** – MPAs should be designated in areas that best represent the range of habitats, species and ecological processes in the OSPAR Maritime Area. Proportions of features that should be protected by the MPA network may be higher for particularly threatened and/or declining features.

***Representativity*** – MPAs should protect examples of the same features across their known biogeographical extent to reflect known sub-types. EUNIS Level 3 habitats are stated as a potentially useful way of characterising the OSPAR Maritime Area for the purposes of including biogeographic variation in the network.

***Connectivity*** – In the absence of dispersal data, connectivity may be approximated by ensuring the MPA network is well distributed in space. Where scientific understanding is further developed, the MPA network should reflect locations where a specific path between identified places is known (e.g. critical areas of a life cycle for a given species).

***Resilience*** – Replication of features in separate MPAs in each biogeographic area is desirable where possible. The appropriate size of a site should be determined by the purpose of the site and be sufficiently large enough to maintain the integrity of the feature(s) for which it is selected.

***Management*** – OSPAR MPAs should be managed to ensure the protection of the features for which they were selected and to support the functioning of an ecologically coherent network.

## 2.2 HELCOM

The HELCOM MPA ecological coherence assessments in the Baltic Sea have been based on the measurement of four assessment criteria (representativity, adequacy, replication and connectivity) (HELCOM, 2010, 2016; see Box 2). The assessment criteria were developed and the first assessment in the Baltic Sea was carried out in 2006 under the Baltic-wide EU INTERREG IIIB project called BALANCE (HELCOM, 2006; Piekäinen and Korpinen, 2007). The latest assessment of the HELCOM MPA network was completed in 2016 based on the same criteria as that of 2010 but with some changes generated as part of discussions under the HELCOM MPA expert group (HELCOM, 2015). The criteria and thresholds used for the 2016 assessment are provided in table 2.1.

**Box 2 – HELCOM principles for assessing the ecological coherence of MPA networks (derived from HELCOM 2010; 2015; 2016)**

***Representativity*** – assesses, in general, the MPA network coverage with respect to different features: basin and sub-basin, the coastal, intermediate and offshore zones, selected species and biotope complexes.

***Replication*** – is a criterion that assesses the replication of protected conservation features in the network on the overall and at sub basin level.

***Adequacy*** – is a concept that usually describes the analysis of quality aspects of single MPAs. It includes the sub criteria for MPA size and quality, of which the latter can be examined via several pressures and human activities causing pressures threatening the conservation objectives of the MPAs. In the 2016 assessment, the pressures and activities will be assessed as a supporting criterion.

***Connectivity*** – of MPAs has been called the 'glue of the network' and it measures whether a group of MPAs can be called a network. Connectivity ensures that species' migrations and dispersal is covered by the MPA network. In the HELCOM assessment, connectivity is assessed for a set of selected conservation features by using simple proximity analyses (25, 50 and 100 km distances) between their occurrences.

## 2.3 Barcelona Convention

Under the Barcelona Convention, the secretariat of the Convention's protocol dealing with MPAs and marine biodiversity, UNEP/MAP RAC-SPA, supported a joint study coordinated by IUCN, WWF and MedPAN, which attempted to assess the ecological coherence of the MPA network across the Mediterranean Sea based on the evaluation of five key principles: representativity, replication, connectivity, adequacy, and management effectiveness (Gabrie *et al.,* 2012 – see Box 3). Even though this assessment was not carried out directly by the convention or protocol's secretariat, anything referring to the outcomes of this study or its future reiteration will be here on referred to as the Barcelona Convention assessment. A new assessment is being planned in 2016, using the same five key principles. It is likely that some criteria, such as connectivity and adequacy, will be described qualitatively. The most recent information pertaining to the criteria and thresholds that will be used for the 2016 assessment are provided in table 2.1.

**Box 3 – BARCELONA Convention principles for assessing the ecological coherence of MPA networks (derived from Gabrié *et al.*, 2012; http://www.medpan.org/en/mediterranean-mpa-status; UNEP-MAP RAC-SPA, 2014)**

***Representativity*** –MPA coverage of biodiversity components (species, habitats and ecological processes) across the Mediterranean basin and surface coverage of MPAs within and outside territorial waters. The assessment procedure should consider the quality and effectiveness of the protection objectives for each MPA.

***Replication –*** assesses the replication of features (species, habitats and ecological processes) more than once in the network in each biogeographic region.

***Connectivity*** –MPA networks should be distributed to favour population connectivity of the organisms contained within a given region. Targets for MPA spacing are adopted as a proxy for connectivity using best practice of no more than 40 to 80 km where possible between component MPAs.

***Adequacy*** –MPA size with regard to species and biotopes for which an MPA was created. The MPA network should be of adequate size to deliver its ecological objectives and ensure the ecological viability and integrity of populations, species and communities (the proportion of each feature included within the MPA network should be sufficient to enable its long-term protection and/or recovery).

***Management effectiveness*** – centres on the assessment of the conservation objectives for which a single MPA was created.

**Table 2.1 Comparison of Regional Sea Convention MPA network ecological coherence principles and associated criteria**

| Network principle | Equivalent OSPAR principle(s) | OSPAR criteria[a] | Equivalent HELCOM principle | HELCOM criteria[b] | Equivalent Barcelona Convention principle | Barcelona Convention criteria[c] |
|---|---|---|---|---|---|---|
| **Representativity** | Representativity | MPAs, in combination with other relevant spatial measures as deemed appropriate, cover at least 10% in area of all Dinter biogeographic provinces | Representativity | MPA coverage is at least 10% of the basin and the sub-basins and of the coastal sea, outer coastal sea and the open sea zones. MPA coverage is at least ≥20% of the common benthic landscapes, and 60% of rare landscapes. | Representativity | MPA coverage is at least 10% of: basin, the 12 nautical mile zone, the open sea (beyond 12 nautical miles)[d]<br>MPA coverage is measured with respect to: 8 ecoregions, EMODnet Broad Scale Habitats, marine mammals, marine turtles and Important Bird Areas[e] |
| **Replication** | Features & Resilience | MPAs represent all EUNIS Level 3 habitat classes and OSPAR T&D species and habitats for which MPAs are considered appropriate more than once in all relevant biogeographic provinces where a given feature is present[f] | Replication | At least 4 MPAs include each of the selected species and habitats in the network At least 4 patches of each benthic landscape type (x30) (min. 0.24km$^2$) are protected in the network | Replication | More than one MPA shall contain examples of a given feature (species, habitats and ecological processes) in the given ecoregion |

[a] Based on Madrid Criteria as agreed at BDC 2015

[b] Based on 2016 assessment (HELCOM, 2015) https://portal.helcom.fi/default.aspx

[c] Based on 2016 assessment

[d] UNEP/MAP-RAC/SPA 2009 (http://www.rac-spa.org/sites/default/files/doc_pwmcpa/pwmcpa_en.pdf)

[e] UNEP-MAP-RAC/SPA. 2010. (http://medabnj.rac-spa.org/images/stories/Publications/overview_report.pdf)

[f] Note that OSPAR 'Madrid Criteria' originally stipulated an assessment of EUNIS Level 3 habitat protection within the 2017 OSPAR MPA network assessment. However, following a meeting of the Contracting Parties in 2015 we agreed this would not be possible for the 2017 assessment but would still form part of the aspiration for future assessments within OSPAR

| Network principle | Equivalent OSPAR principle(s) | OSPAR criteria[a] | Equivalent HELCOM principle | HELCOM criteria[b] | Equivalent Barcelona Convention principle | Barcelona Convention criteria[c] |
|---|---|---|---|---|---|---|
| **Connectivity** | Connectivity | MPAs are geographically well-distributed, with a maximum distance of up to 250km for nearshore/coastline, 500km for offshore and 1000km for the high seas areas between MPAs | Connectivity | Number of connections between the same type of benthic landscape patches (minimum size 0.24 $km^2$) when a connection is less than i) 25 km or ii) 50 km. Target: 50% of landscape patches have ≥20 connections<br><br>Number of connections between species habitats (minimum size 0.24 $km^2$) when a connection distance is set for each species' dispersal range. Target: 50% of species habitats have ≥20 connections | Connectivity | No assessment will be made but a proximity study will be conducted, considering only legally-binding nationally designated MPAs with a management structure in place.<br><br>A literature review will be conducted to produce a synthesis of main scientific findings regarding connectivity in the Mediterranean Sea |
| **Adequacy** | Resilience | Site size is considered a site-based rather than a network-based principle within OSPAR and so not considered in the context of a network assessment | Adequacy | ≥80% of MPAs have the minimum size of 30 $km^2$ (marine area) or 10 $km^2$ (terrestrial area) | Adequacy | To be defined. |
| Management | Management | In development as a separate area to MPA eco-coherence. A pilot exercise is being undertaken based on a self-assessment questionnaire for Contracting Parties to complete. This covers questions such as 'is management documented?', 'are management measures in place?', 'is a monitoring plan active'?, and 'is there evidence of protected features moving towards their conservation objectives?' | Management | To be defined. | Management effectiveness | A questionnaire has been sent to MPA directors focusing on the collection of management data. The analysis will depend on the results obtained with this questionnaire. The questionnaire is based on the IUCN/WWF methodology for the evaluation of management effectiveness[g] |

[g] https://portals.iucn.org/library/efiles/documents/2013-018.pdf

## 2.4 Efforts to develop a pan-European assessment approach report

Though methods to assess MPA networks have been developed all over the Europe, the only attempt to propose a pan-European assessment framework was recently published by Deltares (2014). In this report the authors proposed a method to assess ecological coherence of the European MPA network. To that end, they reviewed the criteria used in Regional Sea Conventions, in international assessments outside the EU and in some national assessments. They proposed that ecological coherence be measured on the basis of four criteria and a number of sub-criteria (see table 2.2). In order to be comparable across Europe's seas, the project aimed at a similar set of assessment criteria and a structured assessment methodology. This was achieved by proposing a quantitative and hierarchical approach where the four primary criteria were divided into further sub-criteria and these were subsequently implemented through 'indicators', i.e. sub-criteria which were made operational with the assessment methods, numeric target values and data. The assessment result was obtained after integration of the indicators and the ecological coherence was assessed as a percentage deviation from the quantitative targets. The integration of the criteria and sub-criteria was considered important in order to obtain an easily communicable assessment result.

**Table 2.2 Overview of the main criteria, subcriteria and indicators proposed in the Deltares 2014 report for a European wide assessment method (modified from Deltares, 2014)**

| Main criteria | Sub criteria | Indicator |
|---|---|---|
| Representativity | Coverage of MPAs in the marine region | Proportion total area MPAs / total area |
| | Coverage of MPAs in eco-regions/sub-regions | MPA area divided by the ecoregion area (for each ecoregion separately) |
| | Representativity of depth zones | MPA area divided by the area of the depth zones (for n zones separately) |
| | Representativity of conservation features | Proportion of MPA area including a feature (for n features separately) |
| Adequacy | MPA size | Proportion of MPAs ≥20 $km^2$ (the size may be agreed to be something else) |
| | Level of protection | Proportion of sites falling under management category 2 (e.g. no take area) as proposed in Section 2.4 |
| Connectivity | Connectivity of MPAs | Number of MPAs connected by 50 km distance (the distance can be agreed to be something else) |
| Replication | Replication of sites per feature | Number of MPAs including a selected feature (for n features separately) |

## 2.5 Key findings of relevance to an EU-level assessment

A summary of the network principles and associated criteria and thresholds underpinning MPA ecological coherence assessments within each active Regional Sea Convention are set out in table 2.1. It is not surprising that the principles and criteria proposed at a pan-European level by Deltares (2014) are mostly coherent with those considered by RSCs. There are key synergies but also differences that are important to highlight in the context of drawing together a proposed assessment framework which is applicable at an EU-level:

- All three Regional Sea Conventions assess the percentage surface coverage of MPAs within a given region, sub-region or at various distances from the coast (often citing the need for ≥10% surface coverage with the rationale being the political target set out under Aichi Target 11 of the CBD). In addition, all three Regional Sea Conventions cite the need to protect the range of features (habitats, species and ecological processes) within their respective regions. Collectively, these criteria have been badged under the network principle of **REPRESENTATIVITY**.
- All three Regional Sea Conventions refer to the need to ensure that a sufficient number of examples of a given feature are protected within an MPA network and that this should reflect what

is known about the features' biogeographic range in a given region or sub-region. This is often referred to under the network principle of **REPLICATION** [(11)].

- Whilst ensuring individual MPAs are well-connected in terms of facilitating the exchange of species and ensuring adequate propagule/egg dispersal is cited as being of importance across all three active Regional Sea Conventions, in practice there is a lack of sufficient information at a Regional Sea Convention level to undertake such an analysis. Instead proximity analysis is often used as a proxy under the network principle of **CONNECTIVITY**.
- Whilst MPA size is seen as an important factor to consider in MPA design, the Regional Sea Conventions vary in terms of how this is treated in the context of a network assessment. OSPAR does not consider MPA size to be an important factor in the context of an assessment of a network, as MPA sizing would have been considered in the context of site design to ensure the ecological integrity of the feature(s) an individual MPA is intended to protect. HELCOM does set a minimum size requirement for MPAs as part of a network. It is unknown at present whether this criterion will be considered in the 2016 Barcelona Convention network assessment. MPA size is often referred to under the network principle of **ADEQUACY**[(12)].
- MPA 'quality' is specifically referred to under HELCOM as an important consideration under the principle of **ADEQUACY** – approximated by the exposure of protected features to pressures associated with human activities that could threaten the achievement of conservation objectives.
- Proportion of features is also something that has been considered at a national level under several MPA network initiatives under the principle of adequacy (e.g. in the UK – see Natural England & JNCC (2010)[(13)] underpinned by the scientific findings of Rondinini (2011)[(14)]). In 2014 the Barcelona Convention, in drawing on the guidance set forth by the latter initiatives, suggests that in designing an MPA network aspects such as the proportion of each feature included within the MPA network capable of enabling its long term protection / recovery should be considered. This network principle is defined as **ADEQUACY**.
- All three Regional Sea Conventions refer explicitly to the importance of effective management of sites in achieving an ecologically coherent network – but this is considered conceptually separate from a network-level assessment of ecological coherence and refers more specifically to tracking progress of individual MPAs towards achieving their conservation objectives. These types of considerations are referred to under the broader principle of **MANAGEMENT**. It is notable that both OSPAR and the Barcelona Convention are attempting to collect and record such information in order to make a judgment against the degree to which their networks are 'well-managed' – with the OSPAR assessment of management effectiveness due to be reported in 2017. However, the questions being asked are not comparable and do not allow for a comprehensive review at the European level. Until standardised and shared datafields containing information on 'MPA management' (e.g. progress with the implementation of management plans/measures, monitoring plans and information on the degree to which conservation objectives have (or have not) been achieved) are introduced into all pertinent MPA databases (i.e. N2K, CDDA, RSCs), it is likely that no overall European assessment can be considered to assess MPA management with any degree of confidence.

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(11) 'Resilience' under OSPAR.
(12) 'Resilience' under OSPAR.
(13) http://jncc.defra.gov.uk/PDF/100705_ENG_v10.pdf
(14) http://jncc.defra.gov.uk/page-5813

# 3 Overview of available datasets to support an assessment of European MPA networks

As acknowledged by the Regional Sea Conventions of geographical relevance to the European marine area, the feasibility of undertaking MPA network assessments at a large spatial scale requires having access to well-managed and consistent data sources. This section of the report provides an overview of available datasets to support an EU-level MPA network assessment.

## 3.1 Assessment areas

The proposed units which set the geographical boundary underpinning the proposed EU MPA network assessment framework are the EU marine regions and subregions defined for the purposes of applying the MSFD. The extent of the subregions has been object of inter-service consultation within the Commission and Eionet consultation. Furthermore, the European marine regions and subregions as defined by the MSFD and the Marine Spatial Planning Directives are considered to be ecologically relevant because they account for variation in environmental factors such as large-scale oceanographic processes. Map 3.1 indicates the extent of the MPA assessment area in each EU marine region and subregion as well as the relative extent of each Regional Sea Convention area [(15)].
The assessment areas are further defined according to three buffer belts that indicate the distance from the coast (hereon referred to as 0-1NM, 1-12NM, 12 NM- END) defined in the EEA report on marine protected area spatial statistics (EEA, 2015b).

## 3.2 MPA datasets

The MPA datasets available for use at the EU level are the marine Natura 2000, CDDA derived sites and Regional Sea Convention databases. MPAs established under these three frameworks are potentially different because they are defined according to different conservation objective features (i.e. Habitats and Bird Directives' species and habitats of community importance as opposed to RSC features of regional conservation importance). In some regions the degree of overlap between sites established under these frameworks, such as the marine Natura 2000 versus the CDDA sites or the CDDA sites versus the RSC sites, can be moderately high depending on the interpretation given by Member States in incorporating European or regional conservation objectives into nationally designated MPA policies (EEA, 2015b).

The assessment scenarios that will be generated by the present exercise will be based on the MPA datasets described in the EEA report on marine protected area spatial statistics (EEA, 2015b) which refer to data reported by Member States at the end of 2012. Future MPA network assessment re-runs will be able to rely on the availability of the same type of network data because Natura 2000 and CDDA spatial and tabular data are reported annually and can be accessed from the EEA portal (http://www.eea.europa.eu/data-and-maps/data/). Updated RSC MPA data can be obtained directly through the respective RSC databases. The assessment procedure foresees use of the spatial datasets which are joined to the respective site's tabular information.

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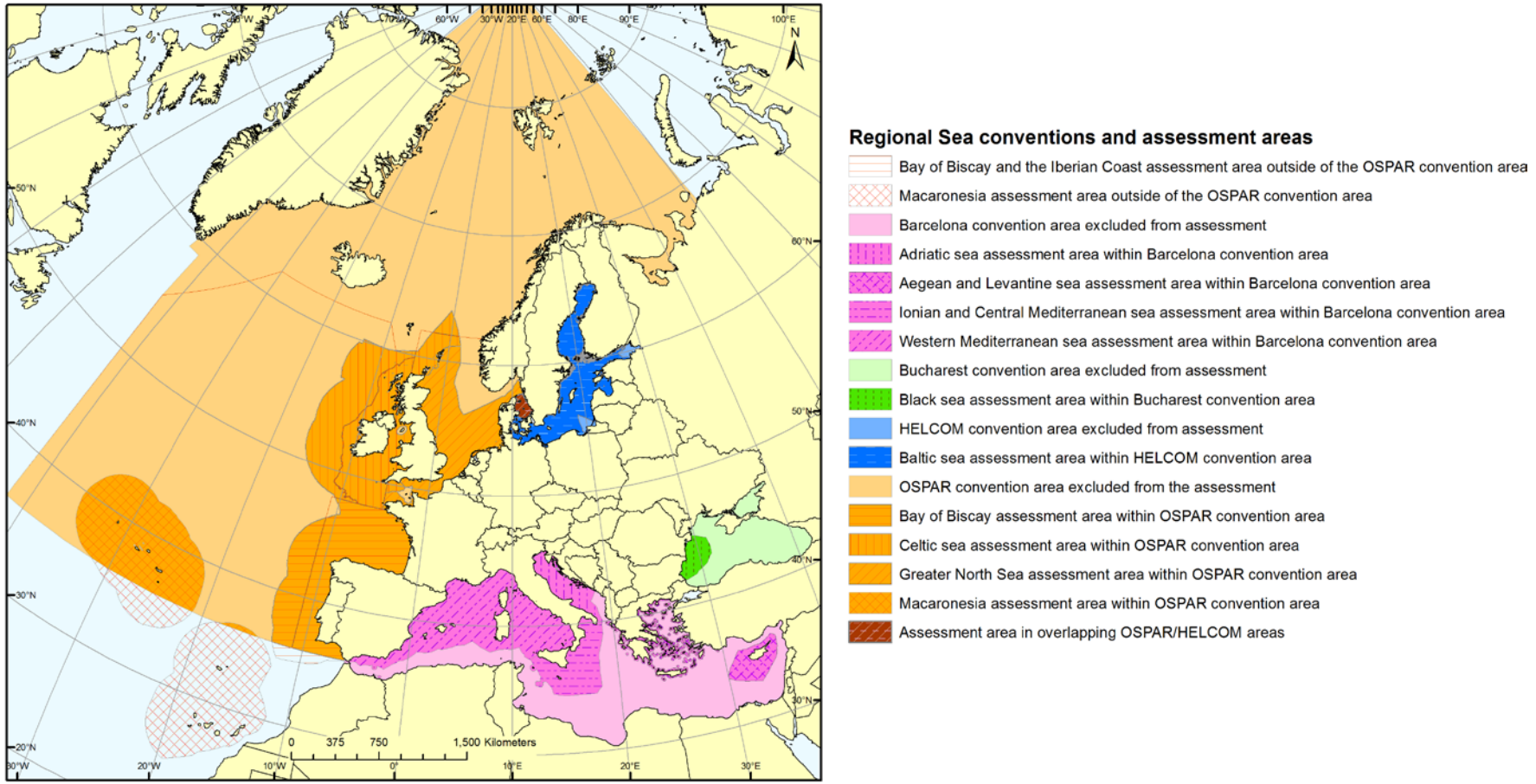
[(15)] It is important to note that in some cases the surface area extent of the marine regions and subregions does not fully match that for which the European States have full legal competence. For example, in the Adriatic and the central Mediterranean and Ionian Sea, MPAs can be established in the territorial waters which extend 12 nautical miles from the coast for countries such as Italy and 6 nautical miles for Greece. Spatial measures of protection / management for areas lying beyond these territorial waters may not be established through national legislation but within the framework of international agreements such as international FAO's General Fisheries Commission for the Mediterranean (i.e. for the establishment of Fishery Restriction Areas) or the Barcelona Convention (i.e. for the establishment of offshore MPAs).

**Map 3.1 EEA MPA assessment areas according to EU marine regions and subregions and boundaries of Regional Sea Convention areas**




Notes: This map serves as a working tool only and shall not be considered as an official or legally-binding map representing marine borders in accordance with international law. These maps shall be used without prejudice to the agreements that will be concluded between Member States or between Member States and non-EU states in respect of their marine borders.

Source: MSFD_Marine_Subregions_draft_EU_EEZ_20130614 (ETC/ICM); Barcelona convention area: http://forum.eionet.europa.eu/etc-icm-consortium/library/subvention-2014/tasks-and-milestones-2014/1.6.1.-spatial-reference-layers/milestone-1-spatial-reference-layers-msfd/justification-delineation-msfd-article-4-marine-regions-and-subregions-internal; Bucharest convention area: boundaris defined in http://www.blacksea-commission.org/_tda2008-document3.asp; HELCOM convention area: http://maps.helcom.fi/website/mapservice/index.html; OSPAR convention area: http://odims.ospar.org/odims_data_files/ .

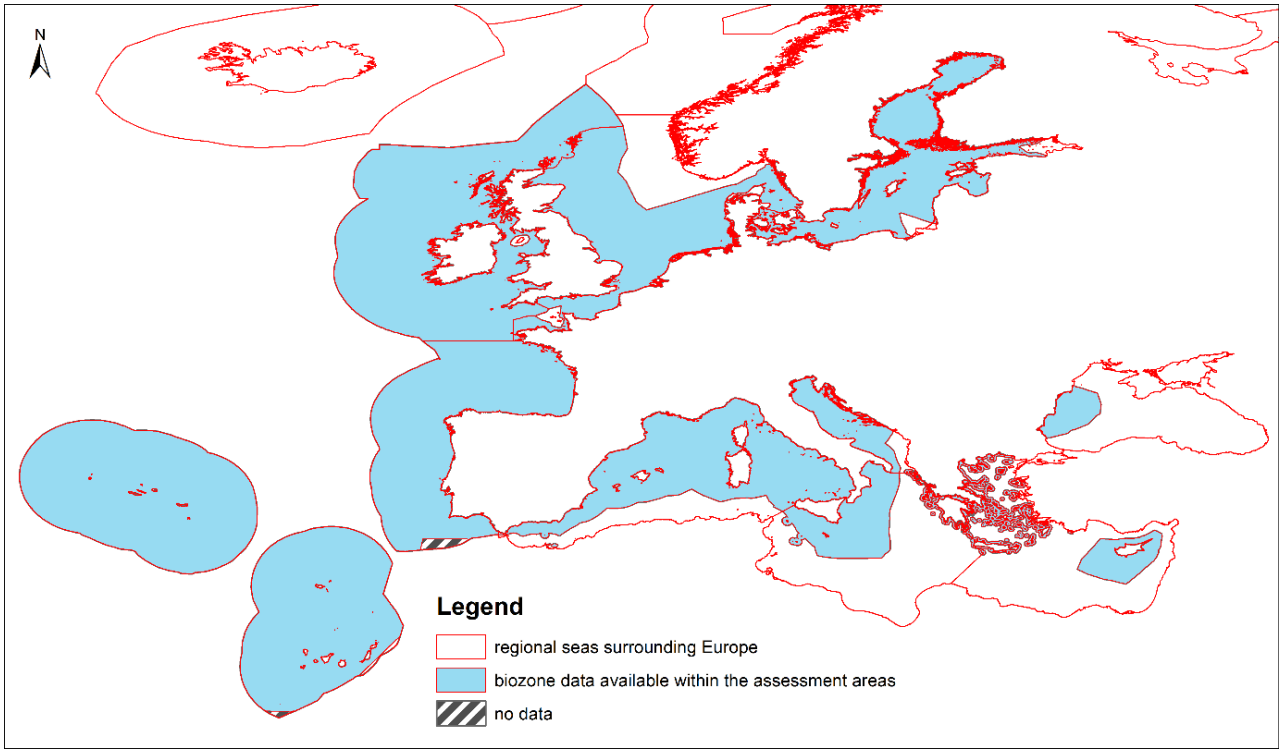
## 3.3 European-wide datasets of marine features

In order to attempt to assess the MPA network coherence, screening of data sets providing exhaustive spatial coverage of the marine biological features is necessary in order to define the feasibility of assessing the network with respect to the distribution of the features of a given basin. The species groups considered within the framework of MSFD reporting could be the common units with which to evaluate the network across the EU. However the paucity of pan-European spatial and harmonized datasets on marine species' distribution hinders this type of evaluation at present. MSFD Broad (ex-predominant) Habitats and EUNIS Level 3 Habitat Classes are the 'common units' that can depict marine benthic habitats at the finest level of detail across the EU Marine Regions. These habitat types can be can be derived from the EMODnet[16] spatial product deliveries as EMODnet represents the most harmonized pan-European spatial data describing the sea bottom and its habitat types.

**Biological depth zones**

The EMODnet final delivery on broad-scale seabed habitats and substrate represents the best spatial data that can be used to assess network coverage against biological depth zones. The coverage of the EMODnet biological zone maps, with respect to the MPA assessment areas is shown in map 3.2. Biological zone definition is available for all European marine subregions with the exception of two small portions in the southern part of the Iberian Peninsula and in the southern part of Macaronesia.

**Map 3.2 Availability of the modelled benthic biological zones from EMODnet products in the Regional Seas surrounding Europe**



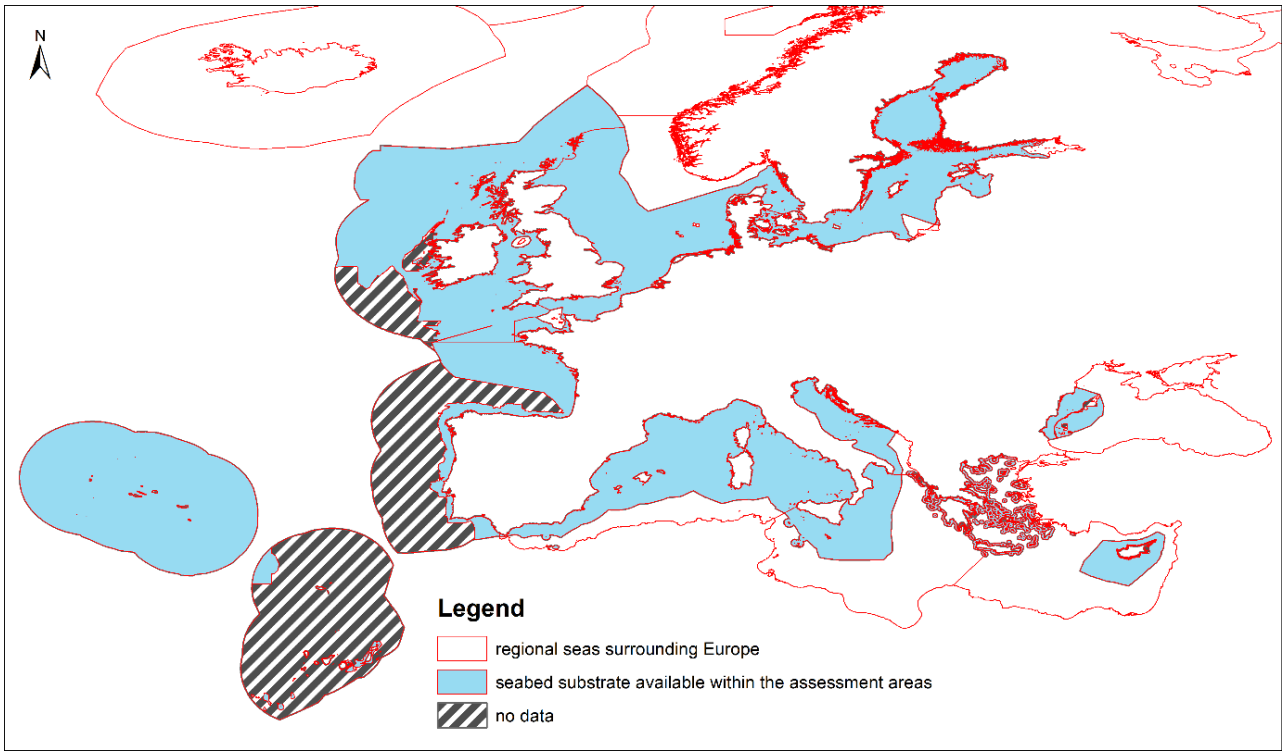

Notes: This map serves as a working tool only and shall not be considered as an official or legally-binding map representing marine borders in accordance with international law. These maps shall be used without prejudice to the agreements that will be concluded between Member States or between Member States and non-EU states in respect of their marine borders.

[16] http://www.emodnet.eu/seabed-habitats

**Modelled broad scale habitats**

The EMODnet broad scale habitat maps produced within the framework of the EUSEAMAP projects are the most exhaustive spatial dataset available containing benthic broad scale habitat distribution in Europe's seas. The geographic coverage of the EMODnet habitat final delivery (which is different from that of biological zone definition) with respect to the MPA assessment areas is shown in map 3.3. This map indicates the availability of complete coverage of broad scale modelled habitats in the Baltic Sea, North Sea, Black Sea and all the subregions of the Mediterranean Sea. However, the EMODnet broad scale habitat map has large gaps in parts of Macaronesia (Canaries and Madeira), as well as the Bay of Biscay and Iberian coast, and the southwestern part of the Celtic sea. These gaps are due to the absence of substrate information. This implies that MPA assessment outcomes based on benthic habitat data will have gaps for these areas.

**Map 3.3 Availability of the modelled broad scale benthic habitat from EMODnet products in the Regional Seas surrounding Europe**




Notes: This map serves as a working tool only and shall not be considered as an official or legally-binding map representing marine borders in accordance with international law. These maps shall be used without prejudice to the agreements that will be concluded between Member States or between Member States and non-EU states in respect of their marine borders.

In areas where modelled broad scale habitat maps are available an option could be to run the assessment scenario using the EMODnet broad-scale habitats. However the resulting MPA network assessment would not be comparable from one subregion to another given that the EMODnet broad-scale habitat types are different amongst subregions. In fact each EMODnet modelled broad scale habitat types refer to specific peculiar biological features (i.e. specific benthic communities or biocoenosis) occurring at a regional sea level and as such cross comparison of network representativity of the single broad scale habitats amongst Europe's seas will not be possible on a one to one habitat basis.

A particular aspect worth considering is the degree to which EMODnet modelled broad-scale habitat categories can be cross-walked into the MSFD predominant habitat typologies. First of all let us accept the assumption that the 'predominant benthic habitat types', as defined by the Commission Staff Working Paper (European Commission, 2011) can be replaced by the "broad" habitat groups defined by the ongoing review process proposed by the European Commission (2016). This basically entails the substitution of the terms "shallow sublittoral" and "shelf sublittoral", indicated in the Commission Staff Working Paper (SEC,

2011) with the respective terms “infralittoral” and “circalittoral”. The European Commission has proposed that these MSFD benthic habitats, in their revisited definition, be indicated as MSFD broad habitat groups (European Commission, 2016).

It must be remembered that EMODNET broad-scale habitats were modelled, in different ways at each regional sea level, by intercepting single or multiple substrate classes (Folk 7 categories: sand, muddy sand, mud, sandy mud, mixed, coarse, hard bottoms) with the biological zone partitioning and arrays of other environmental parameters (i.e. energy, light, salinity). The analysis of the EMODnet modelled broad-scale habitat types, when crosswalked against the broad habitat groups, indicates that in some regions, such as the Mediterranean and the Black Sea, some broad-scale habitats were modelled taking into consideration more than one substrate class. As a consequence the modelled broad-scale habitat types do not crosswalk unambiguously into the MSFD broad habitat groups.

The Emodnet seabed habitat delivery does provide a MSFD predominant habitat layer. However the attributes of the predominant habitat categories indicate that the habitats refer to the initial predominant categories defined by the Commission Staff Working Paper (European Commission, 2011). The MSFD predominant habitat categories, regardless of whether one considers them as defined by the Commission Staff Working Paper (2011), or in the revised version (European Commission, 2016), both differentiate bathyal and abyssal habitats into two substrate classes (hard / biogenic vs. soft bottoms) rather than considering the five substrate classes (4 soft bottoms and 1 hard) described in the shallower biological zones. Since the EMODnet modeled bathyal and abyssal broad scale habitats are described according to the Folk 5 substrate classes, where available, these sediment classes should always be considered.

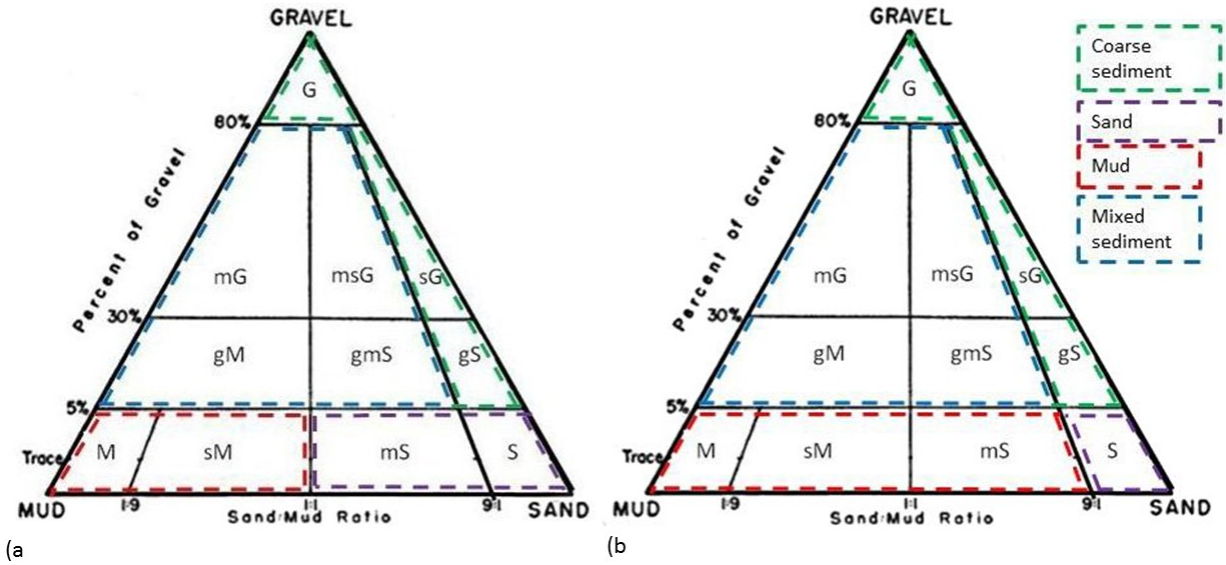
The MSFD predominant habitat classification also differentiates the bathyal zone in two subzones. Considering that not all European basins are characterised by modeled upper and lower bathyal (EMODnet models the Atlantic bathyal in three subzones: upper, middle and lower, while only one bathyal is modeled in the Mediterranean and Black Seas), it is not possible to consider the bathyal habitats based on two bathyal subdivisions.

In light of the above considerations, the EMODNET seabottom habitat delivery be used in an alternative way so that MPA network coverage is analysed with respect to specific features, that are commonly shared between marine regions. The EMODnet seabottom habitats are described according to the Folk 5 or Folk 7 sediment classification and are sorted according to biological (depth) zones [(17)]. These habitat features can be intersected to obtain a habitat list that contains a further level of detail with respect to the MSFD broad habitats and that can also be crosswalked into the broader MSFD broad habitat categories where such circumstances arise. Table 3.1 lists the proposed habitat classes and indicates their relationship to the MSFD broad habitats. The habitat map is constructed by using the EMODnet 2016 delivered biological zone definition (infralittoral, circalittoral, bathyal, abyssal zones) and the Folk 5 substrate classes (mud, sand, coarse, mixed, hard bottoms) that are described in each modeled habitats’ attribute table and which refer to the considered original substrate polygons. On the basis of this approach a total of 20 habitat classes are identified in each EU marine region / subregion (five habitat classes per each of the above-mentioned biological zones). The only exception is in the Mediterranean Sea where the substrate layer considered also provides information on the presence of *Posidonia* and *Cymodocea* beds. This implies that in this subregion the total number of considered habitats is 22. For the purpose of the present report we will refer to these proposed habitat classes as “revised broad habitats”. While not necessarily addressing the univocal biological features of each basin, the revised broad habitats allow to assess the MPA network at the highest level of available pan-European spatial resolution and allow cross comparison of network coverage from one basin to another.

[(17)] http://www.emodnet-geology.eu/emodnet/srv/eng/progress#wp3

It is worthwhile noting that in the EMODNET Phase I and II deliveries (Cameron & Askew, 2011; Populus et al., 2017) the sandy mud and muddy sand Folk classes that characterize the modeled seabed habitat types are not attributed, with a consistent rule, to the broader Folk 5 mud and sand categories throughout the different regions. In the Mediterranean and Black sea regions, sandy mud is attributed to the Folk 5 mud class and muddy sand to the sand class (figure 3.1a) while in the North-East Atlantic Ocean and Baltic Sea regions both sandy mud and muddy sand are attributed to the Folk 5 mud sediment class (figure 3.1b) . The revised broad habitat layer used for the MPA assessment was constructed for each region on the basis of the above mentioned classification rules. The procedure developed to convert EMODnet seabed habitats in the revised broad ~~scale~~ habitats is described in Annex 1.

**Figure 3.1 Differences in the attribution of overall Folk sediment classes (in black) with respect to Folk 5 sediment classes (in colour) in the EMODnet modelled broad scale benthic habitat delivery (a Mediterranean and Black Sea; b North-East Atlantic Ocean and Baltic Sea) (Modified from Populus et al.,2017)**




The MSFD broad habitat categories proposed by the European Commission also identify pelagic habitats. In the current EU proposal they are 'variable salinity', 'coastal', 'shelf' and 'oceanic/beyond shelf'. Coastal, shelf and oceanic/beyond shelf could be identified through the boundaries of some of the biological zone partitions delivered by EMODnet (i.e. infralittoral as a proxy of coastal, circalittoral as proxy of shelf, bathyal and abyssal as proxy of oceanic/beyond shelf). However no pan-European spatial delineation or even textual definition of the pelagic broad habitat groups is available. As this is the situation, we will not yet include these to the assessment scheme, but note that the marine zones can be later adapted to the pelagic habitats, if necessary.

**Table 3.1 Proposed assessment habitat classes (revised broad habitats) based on the crosswalk of MSFD broad habitat types with respect to EMODnet Folk 5 substrate and seabed biological zone classes**

| MSFD broad habitat groups (alias ex- MSFD predominant habitats) | EMODnet Folk5 seabed substrate types and biological zones (Revised broad habitats) |
|---|---|
| Littoral rock and biogenic reef | N/A |
| Littoral sediment | N/A |
| N/A | Posidonia meadows |
| N/A | Cymodocea meadows |
| Infralittoral rock and biogenic reef | Infralittoral rock |
| Infralittoral coarse sediment | Infralittoral coarse sediment |
| Infralittoral sand | Infralittoral sand |
| Infralittoral mud | Infralittoral mud |
| Infralittoral mixed sediment | Infralittoral mixed sediment |
| Circalittoral rock and biogenic reef | Circalittoral rock and biogenic reef |
| Circalittoral coarse sediment | Circalittoral coarse sediment |
| Circalittoral sand | Circalittoral sand |
| Circalittoral mud | Circalittoral mud |
| Circalittoral mixed sediment | Circalittoral mixed sediment |
| Upper bathyal rock and biogenic reef | Bathyal rock |
| Upper bathyal sediment | Bathyal coarse |
| | Bathyal sand |
| | Bathyal mud |
| | Bathyal mixed sediment |
| Lower bathyal rock and biogenic reef | *N/A no upper and lower bathyal biological zone partitioning is available in EMODnet seabed habitats (except Atlantic)* |
| Lower bathyal sediment | |
| Abyssal rock and biogenic reef | Abyssal rock |
| Abyssal sediment | Abyssal coarse |
| | Abyssal sand |
| | Abyssal mud |
| | Abyssal mixed sediment |

# 4 Proposing a methodological framework for an assessment of EU MPA networks

Based on the findings presented in Sections 2 (in terms of Regional Sea Convention approaches as the appropriate building blocks for an EU-level MPA assessment methodology) and Section 3 (in terms of reviewing available EU-wide datasets to support such an assessment), this section puts forward a proposed methodological framework for a European assessment of MPA networks (see table 4.1). The decisions made are largely a reflection of:

- what makes sense in ecological terms and with assessment units that allow cross-comparison across basins;
- datasets available to support an EU-level assessment;
- apparent synergies across the Regional Sea Convention approaches;
- the needs dictated by the contents of marine policy directives such as the MSFD.

We have divided the proposed assessment framework presented in table 4.1 into three 'tiers' of assessment:

**Tier 1** – characterized by assessment procedures that address univocal assumptions: all three MPA networks are considered all together (Natura 2000, CDDA, RSCs) at an overall European scale and at each biogeographic region scale, comparable aspects and features are considered across all regional seas, univocal targets and thresholds are used for each assessment trial.

**Tier 2** – characterized by assessment procedures that address univocal assumptions as in Tier 1 with the exception that more than one target value is considered for any assessment so that more than one assessment scenario is produced for any given exercise. The considered targets refer to values used by RSCs in their past regional network assessments.

**Tier 3** – characterized by specific assessments that consider subsets of MPAs screened on the basis of specific aspects or tabular information. This tier analyses specific aspects that cannot be assessed for all MPA networks due to missing information from some MPA datasets. The intent is to indicate how future improvements of databases and reporting on MPAs can improve European MPA assessment exercises.

## 4.1 Tier 1 – Target-based pan European and EU regional assessments

- REPRESENTATIVITY – **≥10% percentage coverage of MPAs across the EU marine region, at region /subregion level, in three distance belts from the coast (0-1NM, 1-12NM, 12 NM- END) and in 4 different biozones (infralittoral, circalittoral, bathyal, abyssal).**

This is a reflection of common approaches across all three active Regional Sea Convention approaches and of the Aichi target 11 under the CBD. It also reflects a recommendation based on a review by Olsen *et al.,* (2013) on science needs and priorities for achieving ecologically coherent networks in Europe; that MPAs should encompass a range of depths and environmental gradients. We fully understand that Aichi Target 11 also makes reference to other area-based measures contributing to the 10% target as well as MPAs, but there is no available information with which to encorporate other area-based measures into the assessment at the current time. Likewise, there is no formal EU definition of what 'area-based measures' means in an EU context.

- REPRESENTATIVITY – **≥20% or 60% coverage of revised broad habitats derived from EMODnet**

Ideally, we acknowledge that an assessment of network coverage for the biological components involving benthic habitats should be carried out at EUNIS Level 4 (which is where biological communities are introduced in this habitat classification). However, considering that the EUNIS habitat classification scheme is currently in the process of revision and that no harmonised EUNIS level 4 habitat map is available for

Europe's seas, the interim assessment will be done at a broader scale. We consider that the revised broad habitats as defined through the work of EMODnet and described in chapter 3 represent an equivalent measure and the best available pan-European spatial data capable of presenting the 'range of habitats' present within the EU marine regions. The revised broad habitats intersect information on biological benthic zone with Folk 5 sediment class categories and reflect habitats at a basin level. The spatial layer used can be compared to a EUNIS level 3 (version revised in 2016) compliant map with the sole exception that the new version of EUNIS divides the circalittoral and bathyal into upper and lower subzones while EMODnet habitats do not contain this subdivision.

The 20% target is derived from the methodology that is applied to assess marine Natura 2000 network sufficiency (ETC/BD 1997, 2009) whereby 20% habitat coverage is arbitrarily used to define the Natura 2000 sufficiency coverage for the Directive's non-priority habitats. The Natura 2000 sufficiency coverage approach also foresees that at least 60% of the Community priority habitats be included in the network. Though this is not a legally binding target, we believe that it is more appropriate to raise the target to at least 60% when assessing a revised broad habitat that is univocally defined as a priority habitat. HD priority habitats are *Posidonia* meadows (habitat 1120) and coastal lagoons (habitat 1150). *Posidonia* meadows are the only revised broad habitat that can be associated to a HD priority habitat and as such they will be assessed with a 60% target.

## 4.2 Tier 2 – Multi target scenario-based Pan European and EU Regional assessments

- REPLICATION – **number of revised broad habitat replicates in the MPA network in each EU marine regions/subregions**

The ethos underpinning the principle of replication is to best safeguard protection of the range of habitats, species or ecological processes within a network. From an ecological point of view, it would make sense for such an assessment of replication to be based on features considered of conservation importance within particular EU marine regions. In their respective MPA network assessments, Regional Sea Conventions consider the sufficient replication of protection of features of conservation importance within each geographic subregion (i.e. Mediterranean ecoregions and sub-basins, OSPAR regions and Dinter biogeographic provinces, HELCOM subbasins). In so doing regional assessments measure the degree to which a feature is protected with sufficient replicates throughout a wide geographic area in order to guarantee the viability of the feature throughout space. Assesment of the feature's replication thus acts in synergy with representativity and connectivity to guarantee that it is protected sufficient times throughout the feature's geographic range, in sufficient quantity and in protected areas that are sufficiently close enough to guarantee viability. From a benthic habitat point of view EUNIS Level 4 habitats represent the level at which biological variation in seabottom habitat types can be accounted for. However as mentioned above, an assessment of replication of features cannot be run at a EUNIS level 4 level due to the paucity of spatial data and an inability to determine from available datasets whether such features are afforded protection within a given MPA. In the present pan-European assessment it is proposed to measure the degree of replication of each revised broad habitat class within each EU marine region / subregion.
The replication scenarios will be generated considering two target values referring to minimum number of replicates. The first one refers to the target used in the OSPAR approach, whereby if more than 1 revised broad habitat occurs in the MPA network region / subregion the criterion is considered to be reached. The second scenario refers to the target used in the HELCOM approach whereby if if at least 4 revised broad habitats occur in the MPA network the criterion is reached.

- CONNECTIVITY – **Proximity analysis of revised broad habitats between MPAs**

The connectivity criterion is developed so as to assess the degree of proximity of revised broad habitats contained within the MPA network at a regional / subregional level. The connectivity scenarios will be evaluated considering the distance of each broad habitat polygon within the MPA network against a series of distance target values. Since the revised broad habitats are inherently tied to a benthic zonation scheme

(infalittoral, circalittoral, bathyal, abyssal) the resulting scenario assessments are indicative of potential habitat connectivity with respect to the distance from the coast. This implies that the scenario assessments for connectivity do not need to be interpreted against buffer distance belt considerations. The target distance values that will be considered for the scenario assessments will reflect those used in previous and current RSC assessments (see table 2.1) with respect to distance from the coast. They are attributed on the basis of the biological zones in which the revised broad habitat types are found (infralittoral: 25, 50, 100 km, circalittoral: 50, 100, 250 km, bathyal/abyssal: 100, 250, 500 km). It is also proposed that the proximity analysis of each protected revised broad habitat take into consideration the degree of gaps that exist, within any given region / subregion and for each resulting target scenario, between protected revised broad habitats that are connected. The OSPAR convention approach that defines a tolerated value of up to 10 gaps between MPAs containing connected protected habitat (OSPAR, 2008) is considered reasonable and is introduced in the proximity analysis. For each generated scenario assessment, we assume that the target is reached if ≥75% of protected revised broad habitat is connected within each region / subregion.

- ADEQUACY – **MPA size**

The adequacy principle is assessed by providing an overview of MPA size according to different target values (0-5 $km^2$, 5-30 $km^2$, 30-100 $km^2$, and ≥100 $km^2$). The proposed target value classes indicate MPA size trends above and below the Helcom assessment target, which foresees that most MPAs have a surface area of at least 30 $km^2$, and the minimum 100 $km^2$ size target indicated by Edgar *et al.* (2014) as one of five features critical to the conservation success of MPAs. A <5 $km^2$ size category is also proposed to flag potential warnings on the assumption that MPAs that are small tend to not be characterized by species' and habitat diversity and guarantee population viability. A threshold is applied to determine the goodness of the MPA size assessment for two targets: 75% of the sites should be ≥5 $km^2$, which is a very conservative value compared to scientific studies of the the required MPA size (see the review by Deltares 2014). The same threshold is applied to the ≥30 $km^2$ target in order to produce an overall European evaluation with respect to the HELCOM assessment procedure.

## 4.3 Tier 3 – Case studies indicating further improvement to MPA network assessments

- REPRESENTATIVITY – **marine Natura 2000 and a case study from the Western Mediterranean Sea**

In Tier 1 we considered the coverage of revised broad habitats with respect to all MPAs. The evaluation of representativity of sea bottom habitats however, should be based on the assumption that MPAs have conservation objectives centered on sea bottom habitat protection. However not all of the considered MPA databases have attributes that allow to select MPAs based on this prerequisite. For the purposes of this part of the assessment framework, it is proposed to:

a) Run a comparison between revised broad habitat representativity of marine Natura 2000 sites against that of Natura 2000 sites established merely for benthic marine habitats. This will be run for all EU subregions and will allow comparison of representativity targets reached for all sites as opposed to sites selected for benthic habitat protection.
b) Run a revised broad habitat representativity of all MPAs in the Western Mediterranean Sea (CDDA, RSC, Natura2000) whose conservation objectives involve seabed habitat protection. The output will be compared to the overall Western Mediterranean Sea output for revised broad habitat representativity described in Tier 1.

The purpose of these Tier 3 assessments is to indicate how further refinements of the tabular databases (CDDA and all RSC) could allow, in the future, to identify whether or not EUNIS Level 3 habitat types and revised broad habitat types are considered to represent a protected feature of a given MPA. This adds confidence to the assessment outcome.

- MANAGEMENT – **a case study on marine Natura 2000 sites age versus management plan**

Although not directly linked to the measurement of MPA network coherence, one of the criteria used to assess MPA networks at international and regional sea level is the evaluation of management effectiveness. This principle links to the Aichi 11 target which has been explained in section 1. From a theoretical point of view a network could be designed so as to be most adequate in terms of its capacity to: represent the diversity of constituent elements of a given region, cover a sufficient size and replicate of habitat and species types, contain protected areas sufficiently close enough to guarantee the connectivity and exchange of species from one protected area to another. However, a pivotal aspect that needs to be evaluated in order to assess the coherence of the network with respect to the conservation objectives for which it was established is its capacity to deliver conservation benefits through an effective functioning and management. This is where measurement of management effectiveness becomes an important component to measure the strength of the network.

Existing literature has advocated that MPA age can be used as a generic proxy to evaluate management effectiveness and some studies have indicated that the minimum MPA age threshold of 10 years can be considered indicative of the existence of sufficient management measures / plans and consequent MPA effectiveness (Gabrie et al. 2012; Edgar *et al.* 2014). This approach, however, has been subject of debate especially in cases in which the MPA establishment process does not foresee the strict implementation of site management tools following the MPA designation act. The analysis of MPA effectiveness would be best inferred by evaluating aspects such as the existence of management plans and type of management / conservation measures put in place.

One of the limits to assessing any aspect regarding MPA networks in European seas is the high heterogeneity among the different tabular databases which influences the options available for running statistical elaborations involving specific parameters. This situation can require specific data treatment in order to evaluate the entire network components in a comparable way; often times this involves making a-priori assumptions and/or using proxy variables. A specific hindrance in evaluating management effectiveness of marine protected areas at regional level is that not all MPA databases (CDDA, RSCs, Natura 2000) contain data fields with information regarding the existence of MPA management measures / plans. At present the only European marine MPA reporting procedure that boasts a database with data fields for site establishment and the existence of a management plan is that related to the Natura 2000 network. The Natura 2000 reporting procedure foresees compiling information on: the existence of a site management plan, the name of the management plan and respective url address where the plan may be downloaded. Compilation of these fields is mandatory as of 2015. The present exercise investigates the scenario assessment which results when one evaluates the marine Natura 2000 network with respect to the MPA 10 year age threshold as opposed to that resulting from the assessment of the existence of a site specific management plan, as proxy for the evaluation of management effectiveness.

**Table 4.1 Proposed methodological framework for assessing the coherence of EU MPA networks**

| Network principle | Criteria | Target | Thresholds | Rationale | Limitations |
|---|---|---|---|---|---|
| **Tier 1 – Target-based pan European and EU regional assessments** | | | | | |
| **1. Representativity** | 1.1 Percentage coverage of MPAs across the EU Maritime Area | ≥10% coverage of MPAs in EU Maritime Area | Reached ≥ 10%<br>Not reached <10% | Reflects common approaches across all three active Regional Sea Convention approaches and CBD Aichi target 11. | 10% is a political, rather than an ecological target |
| | 1.2 Percentage coverage of MPAs in each EU marine region | ≥10% coverage of MPAs in each EU marine region | | | |
| | 1.3 Percentage coverage of MPAs at various distances from the coast within each EU marine region | ≥10% coverage in the coastal zone (0-.1 NM), territorial waters (1-12 NM), and offshore (12 nautical miles to end of EU marine region) | | | |
| | 1.4 Percentage coverage of MPAs in each biological depth zone within each EU marine region | ≥10% coverage in the infralittoral, circalittoral, bathyal and abyssal zones within each EU marine region | | | |
| **2. Representativity** | 2.1 Percentage coverage of revised broad habitats within each EU marine region | ≥20% coverage in each EU marine region, ≥60% Posidonia in the Mediterranean sea | Reached ≥20%<br>Not reached <20%<br><br>Posidonia - ≥60% reached<br><60% not reached | Revised broad Habitats selected as best available EU-wide information on seabottom habitats. 20% (60% Posidonia) is a reflection of the Natura 2000 network sufficiency targets. | Not the most biologically meaningful approach, but the best available EU-level datasets.<br><br>EU MPA datasets do not currently indicate whether revised broad habitats are considered to be protected within MPAs. |
| **Tier 2 – Multi target scenario-based Pan European and EU regional assessments** | | | | | |
| **3. Replication** | 3.1 Number of MPAs containing each revised broad habitat | More than one MPA in each marine region / sub-region for each revised broad habitat | More than one = reached<br>less than 2 = Not reached | Reflects the replication principle applied by Regional Sea Conventions. | RSCs consider features of conservation interest (species, habitats) within sub-regions (i.e. ecoregions) of their assessment area but it is not possible to undertake this type of approach consistently at the EU-level. |
| | | At least 4 MPAs in each marine region / sub-region for each revised broad habitat | More than 3 = reached<br>less than 4 = Not reached | | |

| Network principle | Criteria | Target | Thresholds | Rationale | Limitations |
|---|---|---|---|---|---|
| **4. Connectivity (proximity)** | 4.1 Proximity of infralittoral revised broad habitats contained in MPAs | Infralittoral broad habitats are no futher apart than than 25/50/100km in each EU marine region | Percentage of broad habitats included in MPAs lying in proximity value for each scenario range is given.<br>75% threshold applied to each scenario.<br>Reached ≥ 75%<br>Not reached <100% | Reflect the range of proximity analysis approaches used as a proxy for connectivity by the Regional Sea Conventions.<br>All broad habitats contained in MPAs should be connected | Same as above, but also that proximity analysis is a relatively crude measure for the ecological connectedness of MPA networks |
| | 4.2 Proximity of circalittoral revised broad habitats contained in MPAs | Circalittoral broad habitats are no futher apart than 50/100/250km in each EU marine region | | | |
| | 4.3 Proximity of revised bathyal and abyssal broad habitats contained in MPAs | Bathyal / Abyssal Broad habitats are no further apart than 100/250/500 km in each EU marine region | | | |
| **5. Adequacy** | 5.1 MPA size | Proportion of MPAs in each marine region /sub-region which are <5 $km^2$, 5-30 $km^2$, 30-100 $km^2$, and ≥100 $km^2$ | Reached ≥75% sites are ≥5 $km^2$ and ≥30 $km^2$<br>Not reached <75% are ≥5 $km^2$ and ≥30 $km^2$ | | |
| **Tier 3 – Case studies indicating further improvement to MPA network assessments** | | | | | |
| **6. Representativity** | 6.1 Percentage coverage of revised broad habitats within marine N2K sites selected for sea bottom habitats in each EU marine region compared against all marine Natura 2000 sites | ≥20% coverage in each EU marine region, ≥60% Posidonia in the Mediterranean | Reached ≥20%<br>Not reached <20%<br><br>Posidonia - ≥60% reached <60% not reached | Revised broad habitats selected as best available EU-wide information on seabottom habitats. 20% (60% Posidonia) a reflection of Natura 2000 network sufficiency targets | Not the most biologically meaningful approach, but the best available EU-level seabed habitat datasets |
| | 6.2 Percentage coverage of revised broad habitats within ALL MPAs selected for sea bottom habitats in the Western Mediterranean sea | ≥20% coverage in each EU marine region, ≥60% Posidonia | As above | As above | As above |
| **8. Management and effectiveness of N2K** | 6.2 Percentage of N2K sites older than 10 years versus percentage of sites with management plans | none | | | |

# 5 Assessment routines and results

This section provides an overview of the methodological assessment framework undertaken for each criterion based on the available datasets and the results obtained from each evaluation.

## 5.1 Tier 1 – Target-based pan European and EU regional assessments

**CRITERIA 1.1-4**: Overall percentage coverage of MPAs across the EU marine area and within each EU marine region /subregion. Percentage coverage of MPAs, at various distances from the coast and within different depth zones within each EU region / subregion

INPUT DATA: EU Maritime Area, EU Marine Regions, buffer distance belts (0-1NM, 1-12NM, 12NM-END), Biological zones (infralittoral, circalittoral, bathyal, abyssal), derived from EMODnet seabed habitat map), designated MPAs in Europe (N2K, CDDA and RSCs).

ROUTINE: Spatial MPA network data layers are merged into a unique layer. Surface area of the different MPAs are overlaid so that surface areas are counted only once in instances where MPAs overlap. The procedure to estimate the percentage coverage of MPAs is the one described in the EEA technical report 2015b. Python scripts will run a spatial analysis using ArcGIS (ESRI inc.).

CAVEATS: The spatial/tabular datasets used for the assessment against the criterion are affected by several caveats. The MPA shoreline boundary derived from coastlines provided by EU Member States is often poor. The MPA polygon's position in some cases may shift because of several cartographic issues such as incorrect projection systems. Spatial/tabular datasets are often not well compiled thereby affecting site selection.

RESULTS: A map with histograms in each EU Region illustrating whether MPA coverage in distance from the coast and depth classes reaches the 10% target, percentage values in each EU Region for overall percentage coverage (map 5.1). This is accompanied by tables showing similar data (table 5.1 to 5.3).

**CRITERIA 1.1 & 1.2**

**Table 5.1 Percentage coverage of MPAs across the EU marine Area and in each EU marine region**

| MPA assessment area regions, subregions, and overall EU marine area | % covered by MPAs |
|---|---|
| **Baltic Sea** | **13.5** |
| **North-East Atlantic Ocean** | **4.2** |
| Celtic Sea | 4.4 |
| Greater North Sea incl. Kattegat and English Channel | 17.9 |
| Bay of Biscay and the Iberian Coast | 3.2 |
| Macaronesia | 0.8 |
| Mediterranean Sea | 9.5 |
| **Western Mediterranean Sea** | **15.6** |
| Ionian Sea and Central Mediterranean Sea | 1.6 |
| Adriatic Sea | 2.0 |
| Aegean-Levantine Sea | 2.6 |
| **Black Sea** | **4.5** |
| **Total EU marine area** | **5.9** |

Source: table 3.7, EEA 2015b

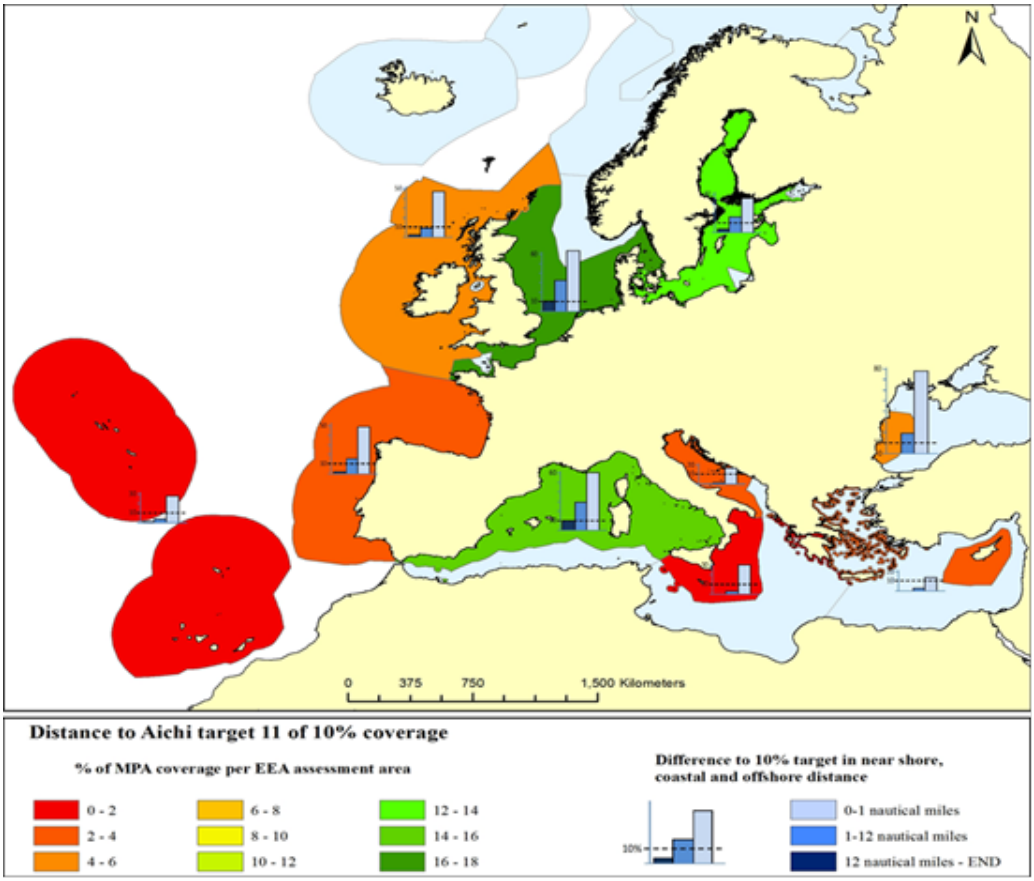
**CRITERION 1.3**

**Table 5.2 Percentage cover of MPAs in nearshore, coastal and offshore waters in European marine regions**

| MPA assessment area regions and subregions | % of 0-1 NM zone covered by MPAs | % of 1-12 NM zone covered by MPAs | % of 12 NM-END covered by MPAs |
|---|---|---|---|
| **Baltic Sea** | **36.1** | **16.4** | **3.9** |
| **North-East Atlantic Ocean (inside 200 NM)** | **52.1** | **16.4** | **2.3** |
| Celtic Sea | 47.5 | 8.9 | 2.3 |
| Greater North Sea incl. Kattegat and English Channel | 63.4 | 32.4 | 11.2 |
| Bay of Biscay and the Iberian Coast | 48.9 | 15.8 | 1.7 |
| Macaronesia | 28.0 | 4.0 | 0.6 |
| **Mediterranean Sea** | **30.6** | **14.2** | **6.1** |
| Western Mediterranean Sea | 60.4 | 29.6 | 10.1 |
| Ionian Sea and Central Mediterranean Sea | 30.5 | 2.7 | --- |
| Adriatic Sea | 17.0 | 1.4 | --- |
| Aegean-Levantine Sea | 14.2 | 2.4 | --- |
| **Black Sea** | **77.9** | **19.3** | **---** |
| **Total** | **40.2** | **15.6** | **3.0** |

Source: table 3.8, EEA 2015b

**Map 5.1 MPA percentage coverage(criteria 1.1, 1.2 and 1.3 combined)**




Notes: This map serves as a working tool only and shall not be considered as an official or legally-binding map representing marine borders in accordance with international law. These maps shall be used without prejudice to the agreements that will be concluded between Member States or between Member States and non-EU states in respect of their marine borders.

**CRITERION 1.4**

**Table 5.3 Percentage coverage of MPAs in each biological depth zone within each EU marine region (NP = Biozone is not present in the region/subregion)**

| MPA assessment area regions and subregions | Infralittoral | Circalittoral | Bathyal | Abyssal |
|---|---|---|---|---|
| **Baltic Sea** | **39.97** | **8.26** | **NP** | **NP** |
| **North-East Atlantic Ocean (inside 200 NM)** | **59.40** | **9.71** | **3.51** | **0.28** |
| Celtic Sea | 51.49 | 4.21 | 4.25 | 0.06 |
| Greater North Sea incl. Kattegat and English Channel | 71.60 | 13.68 | 41.68 | NP |
| Bay of Biscay and the Iberian Coast | 43.28 | 12.85 | 3.77 | 0.16 |
| Macaronesia | 30.19 | 22.33 | 2.28 | 0.34 |
| **Mediterranean Sea** | **33.35** | **12.53** | **8.10** | **6.22** |
| Western Mediterranean Sea | 57.07 | 29.43 | 15.34 | 6.22 |
| Ionian Sea and Central Mediterranean Sea | 31.54 | 3.44 | 0.23 | NP |
| Adriatic Sea | 9.94 | 1.17 | 0.03 | NP |
| Aegean-Levantine Sea | 16.20 | 3.65 | 1.26 | NP |
| **Black Sea** | **74.93** | **4.29** | **NP** | **NP** |
| **Total** | **45.36** | **9.74** | **5.76** | **0.74** |

**CRITERION 2.1**: Percentage coverage of the revised broad habitats within each EU marine region

INPUT SOURCE: EU Marine Regions, EMODnet seabed habitat, designated MPAs in Europe (N2K, CDDA and RSCs)

ROUTINE: The procedure requires the evaluation of the percentage of each revised broad habitats occurring within MPAs in each EU Marine Region. This is evaluated by intersecting the MPA layer with each habitat layer in order to obtain the coverage of each habitat type within MPAs. The revised broad habitat classes are generated from the EMODnet seabed habitat layer (see par 4.1.2).

CAVEATS: MPAs may not provide adequate protection to seabed habitat types included within their boundaries due to different conservation MPA objectives or possible inadequate management measures.
Substrate and habitat maps are not available for some areas of some Atlantic EU Marine Regions (see map 3.2).
The broad-scale modelled map has a 250 m pixel resolution so coverage of small-scale or patchy habitats (i.e. infralittoral muddy sand, hard bottoms) will likely be under-represented. MPA coverage of these habitat types could be underestimated or not picked up at all. Littoral habitats have a small extension and are not represented in broad scale habitat maps so representativity of habitats occurring in this depth zone is excluded from analysis.

RESULTS: A table describing the % of each revised broad habitat type included in the MPA network per EU marine region. Colour denotes whether target reached (≥20%) or not reached (<20%) (*Posidonia oceanica* = 60%) (table 5.4).

Table 5.4 indicates that most biogeographic regions are characterized by a high percentage cover of infralittoral revised broad habitats that greatly surpasses the criterion target (the highest value reaching an exceptional 83.79%). The same target sufficiency trend is observed in most subregions. The only exception to this trend appears in the Adriatic sea and in the Aegean and Levantine sea where the percentage of protected infralittoral revised broad habitats is most often below 20%. In the other biological zones remarkedly fewer revised broad habitats reach the 20% coverage target. Generally speaking there is a decreasing % coverage trend from the shelf to offshore which indicates that the Member State protection efforts have been principally focused to the shallower waters.

**CRITERION 2.1**

**Table 5.4. Percentage coverage of the revised broad habitats within each EU marine region (NP = Revised broad habitat is not present in the region/subregion)**

| MPA assessment area regions and subregions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Ms | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 29.33 | 44.74 | 59.53 | 36.03 | 28.92 | NP | NP | 17.80 | 19.88 | 23.39 | 4.10 | 6.61 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| **North-East Atlantic Ocean (inside 200 NM)** | 35.44 | 55.39 | 68.99 | 58.49 | 48.28 | NP | 62.59 | 17.74 | 7.27 | 10.06 | 5.47 | 15.25 | 11.41 | 12.76 | 6.62 | 3.08 | 5.16 | 0.15 | 0.00 | 0.79 | 0.64 | 0.87 |
| Celtic Sea | 40.48 | 40.87 | 69.21 | 64.94 | 42.35 | NP | NP | 15.91 | 4.06 | 2.73 | 3.00 | 5.29 | 26.45 | 13.55 | 7.43 | 3.46 | 4.37 | 0.00 | NP | 17.64 | 0.04 | 1.16 |
| Greater North Sea incl. Kattegat and English Channel | 57.67 | 63.87 | 77.45 | 57.44 | 57.19 | NP | NP | 46.54 | 9.35 | 13.63 | 6.25 | 16.12 | NP | NP | 0.00 | 41.73 | 39.58 | NP | NP | NP | NP | NP |
| Bay of Biscay and the Iberian Coast | 13.92 | 41.36 | 37.23 | 57.04 | 14.73 | NP | NP | 13.78 | 28.72 | 10.52 | 7.82 | 22.31 | 17.95 | 0.00 | 6.93 | 6.38 | 0.59 | 0.18 | NP | 0.64 | 0.77 | NP |
| Macaronesia | 27.24 | 37.42 | 28.97 | 50.60 | 19.22 | NP | 62.59 | 17.06 | 10.38 | 41.33 | 38.48 | 7.13 | 3.86 | 10.65 | 4.63 | 1.87 | 6.41 | 0.15 | 0.00 | 0.01 | 0.71 | 0.87 |
| **Mediterranean Sea** | 39.90 | 38.91 | 25.36 | NP | 19.24 | 62.55 | 17.17 | 18.04 | 42.48 | 10.82 | 12.70 | 2.95 | 3.33 | 58.82 | 28.63 | 7.38 | 0.08 | NP | 48.77 | 42.39 | 4.79 | NP |
| Western Mediterranean Sea | 57.16 | 53.43 | 51.12 | NP | 77.17 | 62.82 | 29.63 | 21.33 | 48.70 | 24.08 | 31.98 | 34.85 | 5.67 | 87.52 | 36.46 | 14.19 | 0.94 | NP | 48.77 | 42.39 | 5.16 | NP |
| Ionian Sea and Central Mediterranean Sea | 33.74 | 38.90 | 28.22 | NP | 55.33 | 52.75 | 19.40 | 4.60 | 26.42 | 3.83 | 3.12 | 1.82 | 0.08 | 3.51 | 4.62 | 0.14 | 0.00 | NP | NP | NP | 0.00 | NP |
| Adriatic Sea | 18.92 | 10.27 | 8.95 | NP | 14.95 | 64.97 | 1.87 | 26.41 | 6.22 | 1.09 | 0.94 | 3.45 | NP | NP | 7.70 | 0.00 | NP | NP | NP | NP | NP | NP |
| Aegean-Levantine Sea | 2.53 | 5.06 | 10.34 | NP | 1.01 | 76.36 | NP | 1.09 | 3.34 | 4.47 | 3.55 | 3.21 | 0.00 | 0.03 | 20.18 | 0.72 | 3.15 | NP | NP | NP | NP | NP |
| **Black Sea** | 59.94 | 76.57 | 83.79 | 57.11 | 67.99 | NP | NP | 67.87 | 10.28 | 2.24 | 5.51 | 1.16 | NP | NP | NP | 0.00 | NP | NP | NP | NP | 0.00 | 0.00 |
| **Total** | 34.06 | 49.02 | 54.37 | 42.39 | 30.82 | 62.55 | 19.60 | 17.79 | 8.66 | 10.85 | 7.06 | 8.17 | 9.45 | 16.38 | 12.82 | 5.61 | 4.68 | 0.15 | 48.76 | 6.60 | 1.38 | 0.84 |

Habitat legend: I, C, B and A = infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx = rock, coarse, sand, mud, mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds

## 5.2 Tier 2 – Multi target scenario-based Pan European and EU regional assessments

**CRITERION 3.1** Number of MPAs containing each revised broad habitat

INPUT SOURCE: MSFD region and subregions, designated MPAs in Europe (N2K, CDDA and RSCs), revised broad habitat (derived from EMODnet seabed habitat map)

ROUTINE: The procedure evaluates the occurrence of each seabed habitat within the established MPA network. This is evaluated by spatially joining the the revised broad habitat layer with the MPA layer in order to count the number of MPAs containing each broad habitat. As the MPAs established under different networks can overlap, the occurrence counts of overlapping MPAs containing a given revised broad habitat are removed from the total count replications in order to avoid over-estimation. The potential bias that remains inherent in this procedure is that, in some cases, the number of replicates could still be under-estimated. A specific manual check and correction is therefore carried out for all those situations where the results showed replication results that were close to the scenario targets.

CAVEATS: Replication of revised broad habitats across a bioregion is weak as revised broad habitats could contain many potential features of conservation interest. Replication should be used to assess if enough replicates of biological features are protected within distinct subzones across a wide region in order to guarantee that protection distribution is widely dispersed across a given region. All three RSCs measure replication of features of conservation interest across smaller subareas of each regional sea. This works in synergy with representativity and connectivity. Since no consistent approach to detecting subareas (or ecoregions) exists across all regional seas and only broad habitat data is available, the present exercise can only measure the distribution of revised broad habitats under protection across the marine regions, thereby weakening the detection capacity for replication at a finer geographic level of subdivision and in term of features of conservation interest.
Same caveats were identified in criterion 2.1.

RESULTS: Table showing the reached/not reached target for both scenarios (i.e. when more than one replication = scenario 1 is reached = indicated with R and a yellow cell; when at least 4 replicates = scenario 2 is reached = indicated with R and a green cell; less than 2 replicates = no target reached = indicated with NR within a red cell (table 5.5).

Table 5.5 indicates that most biogeographic regions/subregions are characterized by a high replication rate of infralittoral and circalittoral revised broad habitats. All infralittoral habitats reach one of the replication targets, the majority of which is reached with the highest replication target. A close target obtainment is observed for almost all circalittoral habitats with the exception of 3 habitats which do not reach either of the two targets. Attainment of replication target, for either target, drastically decreases in the deeper biological zones and is markedly low in the abyssal habitats.

**Table 5.5 Replication of the revised broad habitats within each EU marine region (Green = more than 4 replicates; Yellow = 2 or 3 replicates; Red = less than 2 replicates; Grey = Revised broad habitat not present in the region / subregion)**

| MPA assessment area regions and subregions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Bs | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltic Sea | | | | | | | | | | | | | | | | | | | | | | |
| Celtic Sea | | | | | | | | | | | | | | | | | | | | | | |
| Greater North Sea incl. Kattegat and English Channel | | | | | | | | | | | | | | | | | | | | | | |
| Bay of Biscay and the Iberian Coast | | | | | | | | | | | | | | | | | | | | | | |
| Macaronesia | | | | | | | | | | | | | | | | | | | | | | |
| Western Mediterranean Sea | | | | | | | | | | | | | | | | | | | | | | |
| Ionian Sea and Central Mediterranean Sea | | | | | | | | | | | | | | | | | | | | | | |
| Adriatic Sea | | | | | | | | | | | | | | | | | | | | | | |
| Aegean-Levantine Sea | | | | | | | | | | | | | | | | | | | | | | |
| Black Sea | | | | | | | | | | | | | | | | | | | | | | |

Habitat legend: I, C, B and A= infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx =rock, coarse, sand, mud mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds

**CRITERIA 4.1-3**: Proximity of infralittoral, circalittoral, bathyal and abyssal revised broad habitats contained in MPAs

INPUT SOURCE: MSFD region and subregion, MPA (N2K, CDDA and RSCs), EMODnet seabed habitat map.

ROUTINE: The revised broad-scale habitats present in the MPAs are selected. A point feature of the boundaries of each dissolved polygon representing the revised habitat is created and used as input data in a *cost distance with barriers* analysis. This involves using a distance, set to half of each scenario target value. Since the proximity is evaluated only where 2 or more revised broad habitat sites occur, cost distance polygons containing only 1 feature are deleted from the generated layer. The latter layer, rapresents the connected zones and is used to select the revised habitats contained in MPAs which are considered as being connected (under the influence of polygon of the same revised habitat). The percentage of connected area for each revised broad habitat ($\%_{ch}$) is calculated using the following formula:

$$\%_{ch} = \frac{\left(\frac{S_{ch}}{S_b}\right)}{\left(1 + \left(\frac{n-1}{25}\right)\right)}$$

Where $S_{ch}$ is the cumulative connected surface for a specific protected revised broad habitat per marine region / subregion;
$S_b$ is the total surface of the revised broad habitat included in the MPA network at region / subregion level;
n is the number of connected zones per marine region / subregion containing revised habitat in MPAs that are connected according to the specific scenario.

The denominator of the formula was identified after several test trials on the data. It allows to take into account the number of gaps observed when applying each connectivity target. The introduced weighting factor (25) was formulated because it allows, in cases of 10 or more gaps, to reduce the connected surface by about 25% the original value. The emphasis on 10 gaps represents the conceptual tolerated limit of gaps in the network and stems from the OSPAR approach (2008). The 25% reduction obtained in situations where the number of gaps are potentially high reduces the connectivity value to a point below the application of the ≥75% threshold for proposed connectivity sufficiency.

TARGET: 25/50/100 km (target scenarios for infralittoral habitats); 50/100/250 km (for circalittoral habitats); 100/250/500 km (for bathyal and abyssal habitats)

CAVEATS: Caveat related to input data identified for criterion 2.1. Other caveats are related to the methodological assumptions needed to estimate the percentage of connected areas (i.e. connectivity between sites which benefit from larval/species exchange is here interpreted as proximity between areas, sites cannot be selected on the basis of what is its protection goal, weighting factor due to gaps presence, etc). Examining spatial coverage, as opposed to actual protection of seabed habitat types, does not provide an accurate representation of the degree to which seabed habitat types are protected by MPAs.

RESULTS: Table showing the percentage of each connected revised habitat within MPAs according to each target scenario in the different subregions (table 5.6). The cell

colours are used to express whether each resulting habitat connectivity target (three different target scenarios are provided for each habitat type and indicated with the codes S1-S3 referring to the target values defined in the target section above for each biological zone) has been reached based on the following threshold rule:
≥75% of habitat contained in MPAs is connected = target reached (green)
<75% = target not reached (red)
Histograms indicating the percentage of connected habitats within MPAs per region/subregion are also provided with visual indication on sufficiency according to the distance to threshold (figure 5.1 to 5.10).

The results of the proximity analysis of protected revised broad habitats, presented in table 5.6, indicates a general low attainment of the scenario targets in inshore habitats as opposed to offshore ones. Infralittoral habitats generally do not meet the proximity targets even when considering the widest proximity target (100 km) in most regions except the Adriatic Sea, the Aegean Levantine Sea and the Black Sea. Circalittoral habitats generally do not meet the first proximity target but do reach the targets generated in the two wider distance scenarios. On the other hand, proximity targets are reached for most of the deeper habitats.

The proximity results have to be interpreted with caution and taking into due consideration: the target trends observed in the habitat representativity criterion assessment results, the physical factors that may play a role in the overall results as well as the proposed assessment methodology. In the infralittoral zone, where representativity assessments indicate a very high percentage of broad habitat cover, proximity values for all three distance scenarios are most often below target. This result may be influenced by: the fact that large surface areas of infralittoral habitats are protected, that the individual habitat distribution is composed of small patches distributed over large extenses, and the morphological complexity of the shoreline which can introduce physical barriers contributing to the identification of several groupings of protected habitat polygons (and consequent high number of gaps). In such conditions, despite a high protection effort for individual habitat coverage, the analysis methodology may paradoxically generate a lower proximity result between protected features.

The assessment exercise allowed to define a formula for estimating the percentage of proximity reached by a protected revised broad habitat considering both protected connected habitats and the number of connected zones. Given the above mentioned factors, which are likely to influence the overall infralittoral habitat proximity results, it may be useful to consider the usage of more appropriate thresholds for tolerated connected zone gaps as well as the overall threshold values used to assess target attainment.

Furthermore in the proximity analysis different parameters could be considered in the future, in this regards there are numerous examples of subregional or even national approaches to the assessment of MPA network connectivity that can help set the aspirations for more sophisticated and ecologically meaningful assessments into the future. For example, Johnsson *et al.* (2016) in a study of MPA network connectivity in the Kattegat region used population dynamics and oceanographic data to develop a biogeographic model that could be used to select optimal locations for a well-connected MPA network.

**Table 5.6 Proximity of infralittoral, circalittoral, bathyal and abyssal revised broad habitats contained in MPAs (NA = Revised broad habitat is not protected so the proximity cannot be evaluated; NP = Revised broad habitat is not present in the region/subregion)**

| MPA assessment area regions and sub-regions | Scenario | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Bs | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baltic Sea | Sc1 | 44.4 | 32.6 | 36.8 | 31.2 | 39.0 | NP | NP | 67.6 | 55.5 | 62.5 | 54.3 | 73.5 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| | Sc2 | 60.9 | 55.1 | 53.2 | 43.4 | 59.4 | NP | NP | 89.3 | 86.2 | 80.6 | 78.1 | 92.6 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| | Sc3 | 83.3 | 92.6 | 67.6 | 55.9 | 73.4 | NP | NP | 100.0 | 100.0 | 96.2 | 92.6 | 100.0 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| Celtic Sea | Sc1 | 43.8 | 39.0 | 33.8 | 43.6 | 46.6 | NP | NP | 65.4 | 59.5 | 51.0 | 51.5 | 50.9 | 100.0 | 88.0 | 80.9 | 96.2 | 96.2 | NA | NP | 100.0 | 100.0 | 0.0 |
| | Sc2 | 65.8 | 56.7 | 55.6 | 54.3 | 60.1 | NP | NP | 95.6 | 92.6 | 96.2 | 71.0 | 83.3 | 100.0 | 88.0 | 96.2 | 92.6 | 96.2 | NA | NP | 100.0 | 100.0 | 0.0 |
| | Sc3 | 96.2 | 86.1 | 86.2 | 69.4 | 77.9 | NP | NP | 99.4 | 100.0 | 100.0 | 88.8 | 92.6 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | NA | NP | 100.0 | 100.0 | 0.0 |
| Greater North Sea incl. Kattegat and English Channel | Sc1 | 58.1 | 42.3 | 41.0 | 42.2 | 49.0 | NP | NP | 69.4 | 69.4 | 64.1 | 56.6 | 60.9 | NP | NP | NA | 100.0 | 100.0 | NP | NP | NP | NP | NP |
| | Sc2 | 73.5 | 64.1 | 62.5 | 49.0 | 62.5 | NP | NP | 83.3 | 83.3 | 92.6 | 67.5 | 75.7 | NP | NP | NA | 100.0 | 100.0 | NP | NP | NP | NP | NP |
| | Sc3 | 78.1 | 75.8 | 89.3 | 69.4 | 71.4 | NP | NP | 96.2 | 100.0 | 96.2 | 89.3 | 89.3 | NP | NP | NA | 100.0 | 100.0 | NP | NP | NP | NP | NP |
| Bay of Biscay and the Iberian Coast | Sc1 | 64.1 | 65.7 | 59.5 | 55.2 | 75.4 | NP | NP | 80.6 | 89.3 | 73.5 | 71.4 | 83.3 | 96.2 | NA | 92.6 | 92.6 | 100.0 | 0.0 | NP | 100.0 | 94.9 | NP |
| | Sc2 | 80.6 | 80.6 | 83.3 | 69.4 | 80.4 | NP | NP | 86.2 | 92.6 | 86.2 | 83.3 | 92.6 | 96.2 | NA | 96.2 | 96.2 | 100.0 | 0.0 | NP | 100.0 | 100.0 | NP |
| | Sc3 | 89.3 | 86.2 | 96.1 | 80.6 | 83.3 | NP | NP | 96.2 | 96.1 | 96.2 | 96.2 | 96.2 | 96.2 | NA | 96.2 | 96.2 | 100.0 | 0.0 | NP | 100.0 | 100.0 | NP |
| Macaronesia | Sc1 | 56.7 | 69.9 | 57.2 | 0.0 | 70.3 | NP | 80.0 | 69.4 | 66.3 | 71.4 | 100.0 | 88.2 | 78.1 | 4.2 | 78.1 | 79.9 | 86.2 | 96.2 | NA | 0.0 | 89.3 | 54.6 |
| | Sc2 | 73.3 | 71.2 | 69.1 | 0.0 | 85.4 | NP | 85.9 | 86.2 | 83.3 | 83.3 | 100.0 | 96.2 | 96.2 | 4.5 | 92.6 | 96.2 | 100.0 | 96.2 | NA | 0.0 | 96.2 | 98.4 |
| | Sc3 | 89.3 | 85.9 | 89.3 | 0.0 | 96.2 | NP | 96.2 | 96.2 | 92.6 | 92.6 | 100.0 | 100.0 | 96.2 | 96.2 | 96.2 | 96.2 | 100.0 | 96.2 | NA | 0.0 | 100.0 | 98.4 |
| Western Mediterranean Sea | Sc1 | 32.5 | 42.3 | 42.4 | NP | 91.2 | 43.6 | 50.6 | 55.5 | 54.3 | 62.5 | 65.8 | 100.0 | 86.2 | 80.6 | 73.5 | 86.2 | 100.0 | NP | 100.0 | 100.0 | 0.0 | NP |
| | Sc2 | 54.3 | 55.5 | 69.4 | NP | 91.2 | 65.8 | 68.6 | 75.8 | 73.5 | 92.6 | 80.6 | 100.0 | 96.2 | 89.3 | 92.6 | 100.0 | 100.0 | NP | 100.0 | 100.0 | 0.0 | NP |
| | Sc3 | 75.8 | 73.5 | 96.1 | NP | 91.2 | 89.3 | 83.2 | 100.0 | 96.2 | 96.2 | 100.0 | 100.0 | 96.2 | 92.6 | 96.2 | 96.2 | 100.0 | NP | 100.0 | 100.0 | 0.0 | NP |
| Ionian Sea and Central Mediterranean Sea | Sc1 | 76.0 | 96.2 | 57.2 | NP | 100.0 | 49.5 | 67.4 | 70.2 | 100.0 | 75.3 | 64.0 | 100.0 | 100.0 | 100.0 | 86.2 | 18.8 | 0.0 | NP | NP | NP | NA | NP |
| | Sc2 | 81.5 | 96.2 | 70.2 | NP | 100.0 | 64.1 | 89.2 | 77.7 | 100.0 | 82.9 | 65.7 | 100.0 | 100.0 | 100.0 | 92.6 | 86.2 | 0.0 | NP | NP | NP | NA | NP |
| | Sc3 | 86.1 | 96.2 | 81.9 | NP | 100.0 | 78.1 | 96.2 | 100.0 | 100.0 | 92.6 | 86.2 | 100.0 | 100.0 | 100.0 | 96.2 | 89.3 | 0.0 | NP | NP | NP | NA | NP |
| Adriatic Sea | Sc1 | 83.1 | 85.5 | 58.6 | NP | 90.5 | 80.6 | 95.3 | 96.2 | 86.3 | 74.8 | 73.5 | 93.3 | NP | NP | 0.0 | NA | NP | NP | NP | NP | NP | NP |
| | Sc2 | 86.2 | 85.7 | 75.8 | NP | 89.3 | 83.3 | 95.3 | 96.2 | 86.3 | 85.1 | 89.3 | 93.3 | NP | NP | 0.0 | NA | NP | NP | NP | NP | NP | NP |
| | Sc3 | 86.2 | 90.5 | 92.6 | NP | 92.6 | 86.2 | 95.3 | 96.2 | 100.0 | 96.2 | 100.0 | 96.2 | NP | NP | 0.0 | NA | NP | NP | NP | NP | NP | NP |
| Aegean-Levantine Sea | Sc1 | 96.2 | 81.1 | 46.7 | NP | 47.4 | 42.5 | NP | 96.2 | 72.1 | 59.5 | 47.2 | 96.1 | NA | 0.0 | 88.0 | 74.1 | 0.0 | NP | NP | NP | NP | NP |
| | Sc2 | 96.2 | 84.2 | 65.8 | NP | 47.4 | 54.3 | NP | 96.2 | 92.6 | 65.8 | 59.5 | 96.1 | NA | 0.0 | 92.6 | 76.5 | 0.0 | NP | NP | NP | NP | NP |
| | Sc3 | 96.2 | 84.2 | 69.4 | NP | 90.8 | 62.5 | NP | 100.0 | 92.6 | 75.8 | 64.1 | 96.1 | NA | 0.0 | 96.2 | 78.9 | 0.0 | NP | NP | NP | NP | NP |
| Black Sea | Sc1 | 96.2 | 100.0 | 100.0 | 96.2 | 100.0 | NP | NP | 100.0 | 97.9 | 100.0 | 96.2 | 100.0 | NP | NP | NP | NA | NP | NP | NP | NP | NA | NA |
| | Sc2 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | NP | NP | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | NP | NP | NP | NA | NP | NP | NP | NP | NA | NA |
| | Sc3 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | NP | NP | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | NP | NP | NP | NA | NP | NP | NP | NP | NA | NA |

Habitat legend: I, C, B and A = infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx = rock, coarse, sand, mud mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds
Scenario distances (Sc1, Sc2 and Sc3) are respectively: 25/50/100 km (infralittoral); 50/100/250 km (circalittoral); 100/250/500 km (bathyal and abyssal)

**Figure 5.1. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Adriatic Sea MPAs**

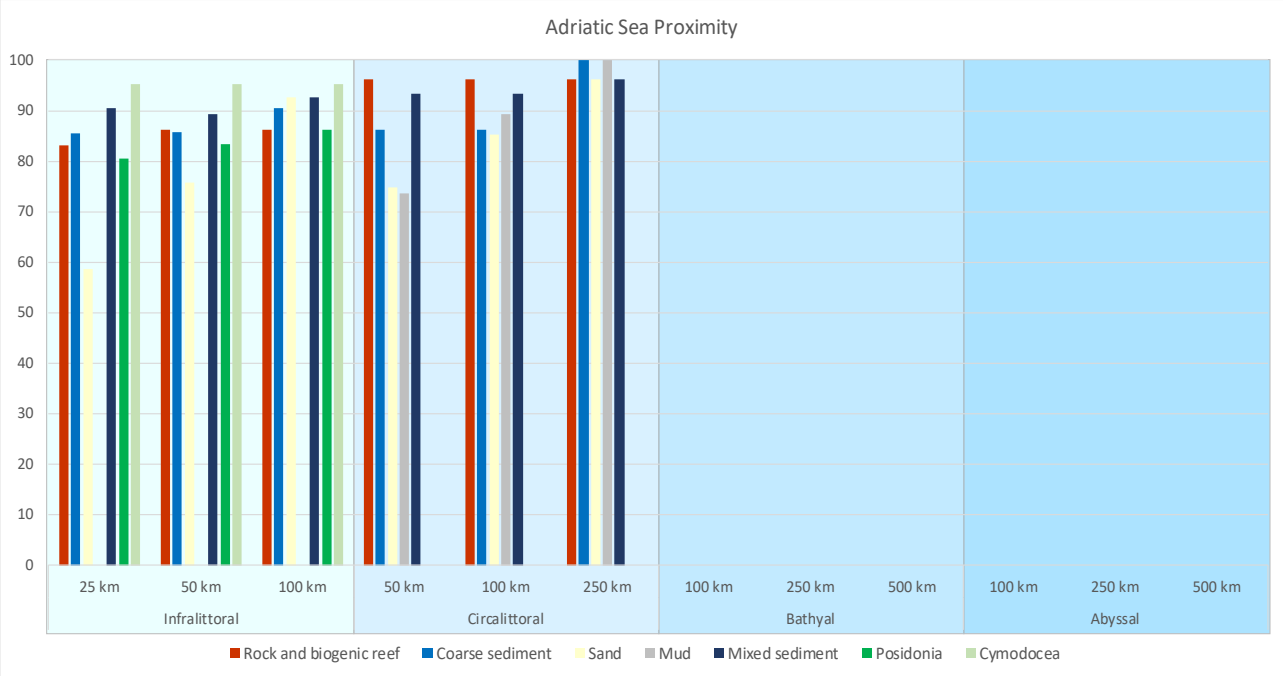



**Figure 5.2. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Aegean-Levantine Sea MPAs**

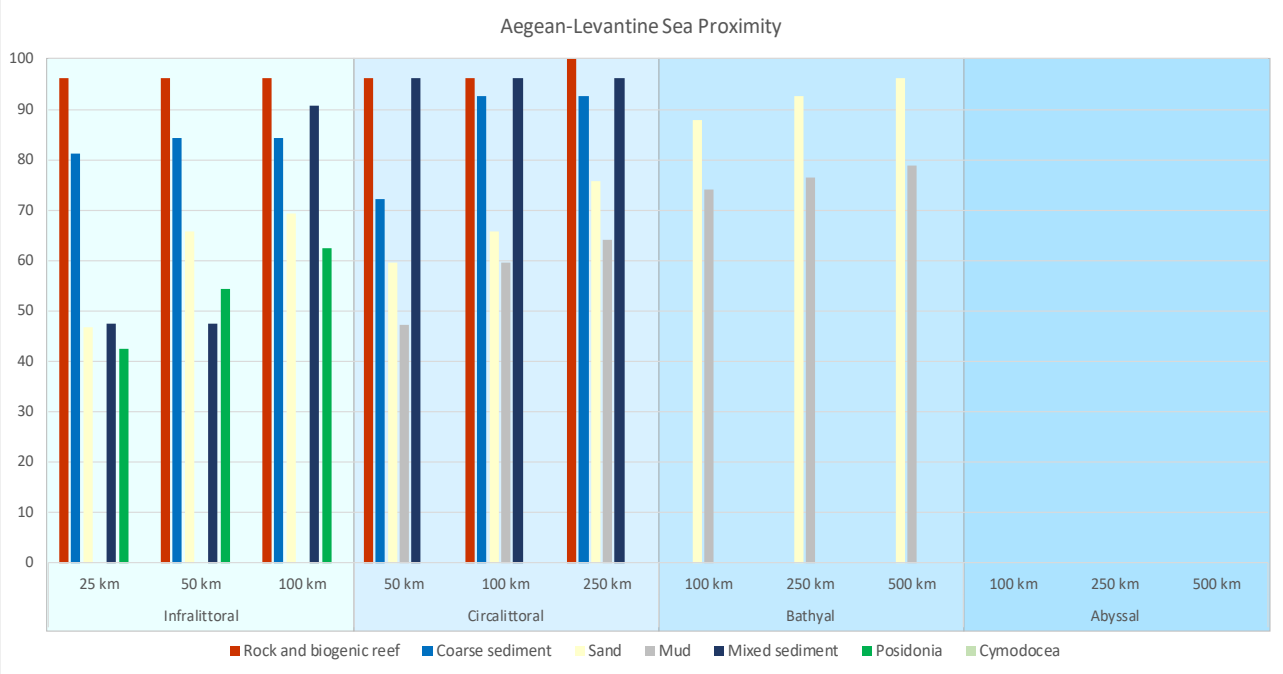


**Figure 5.3. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Baltic Sea MPAs**

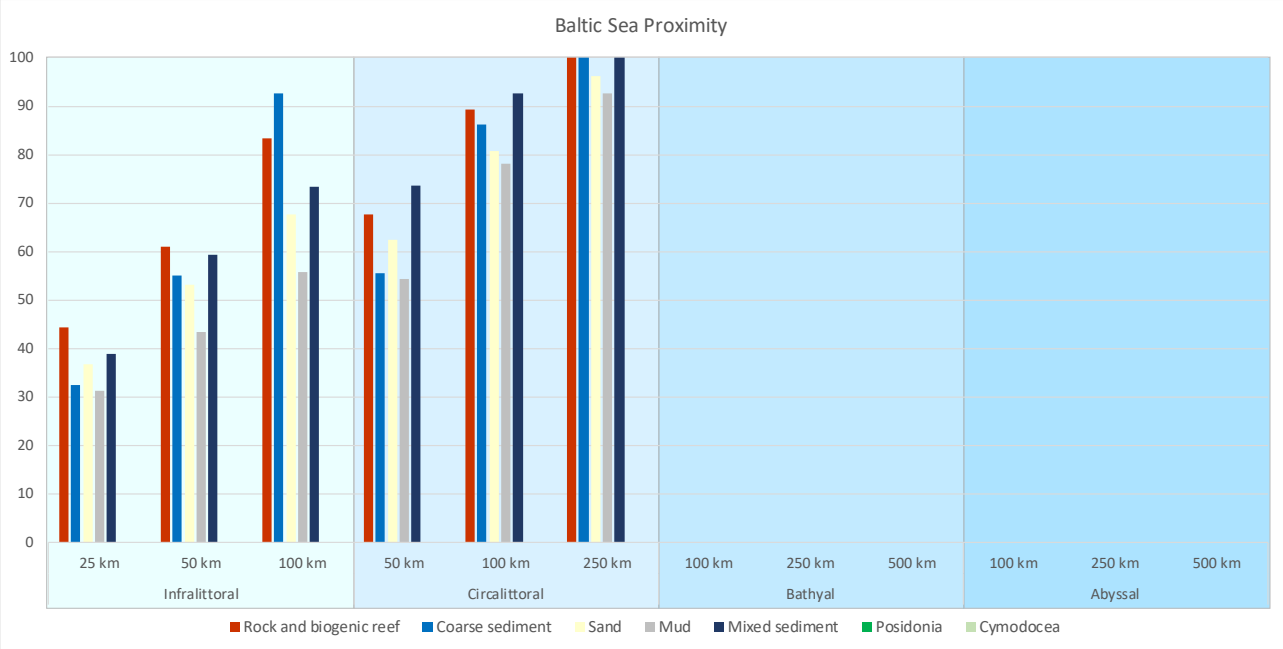



**Figure 5.4. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Bay of Biscay and the Iberian Coast MPAs**

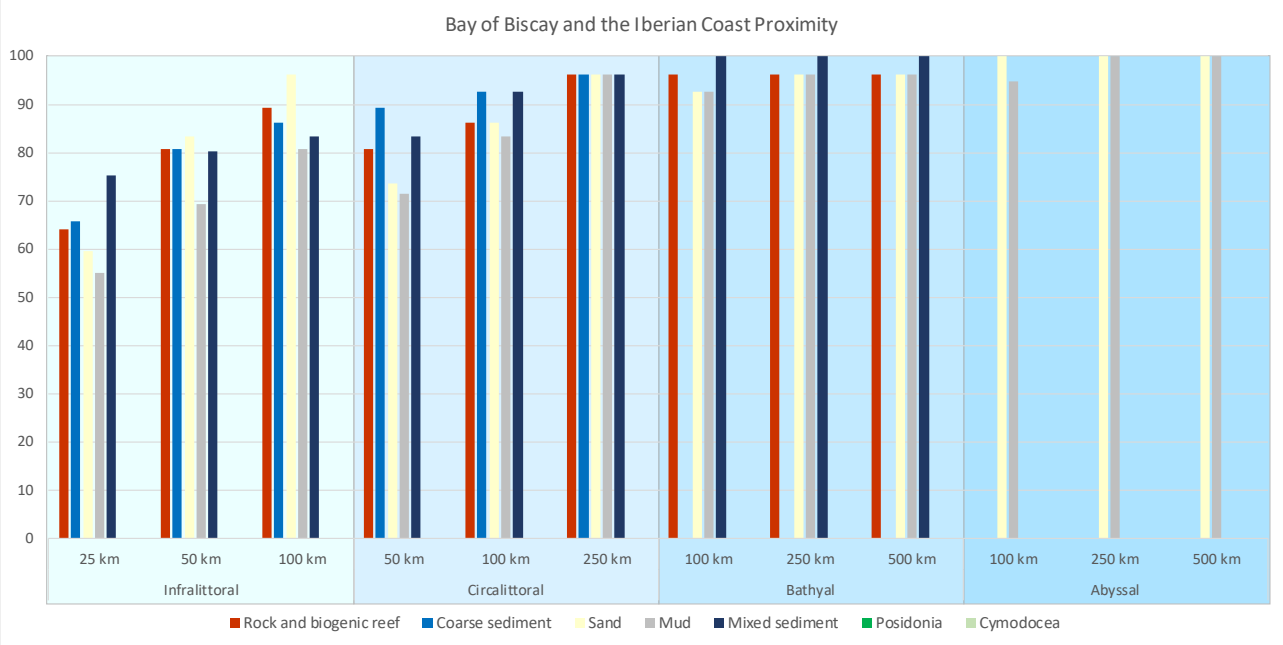


**Figure 5.5. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Black Sea MPAs**

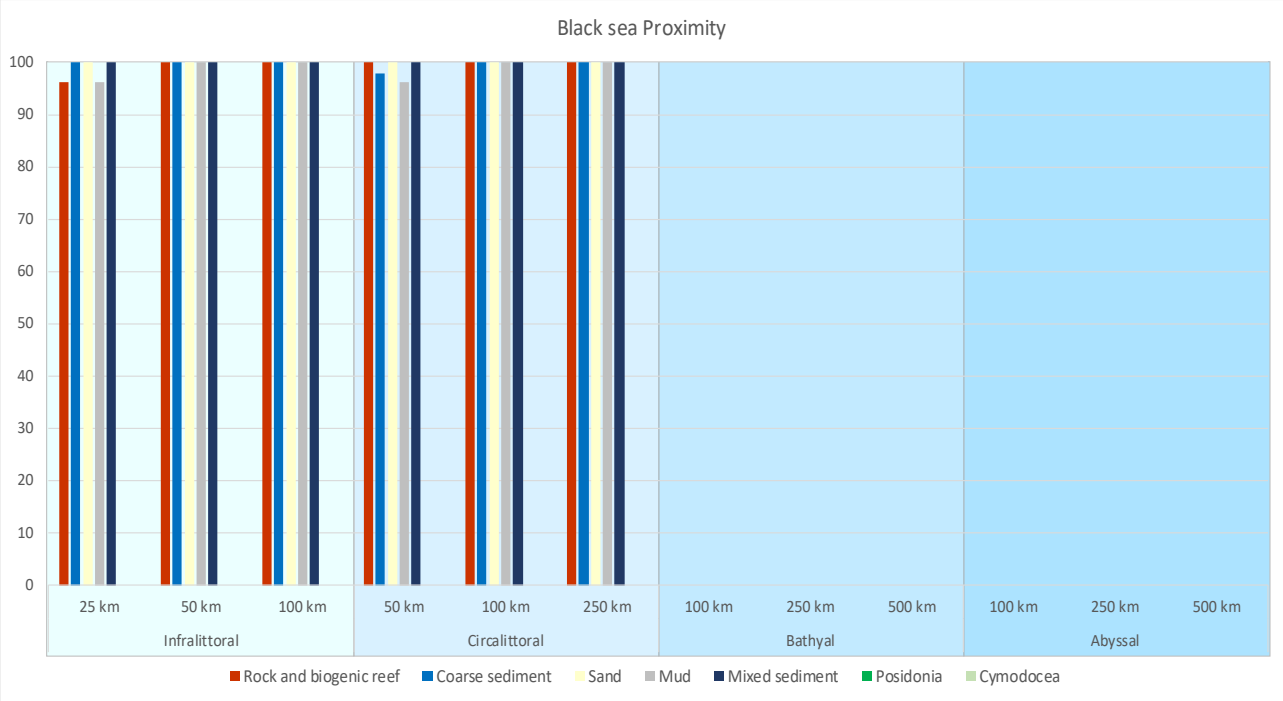



**Figure 5.6. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Celtic Sea MPAs**

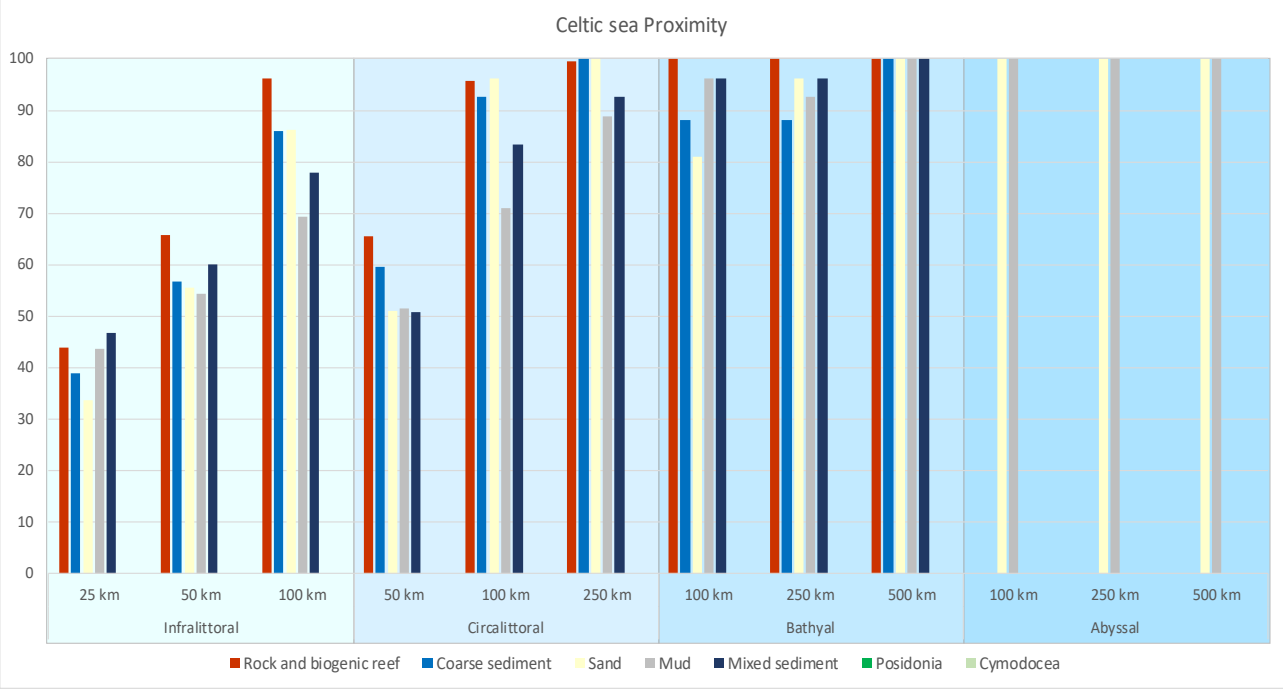


**Figure 5.7. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Greater North Sea incl. Kattegat and English Channel MPAs**

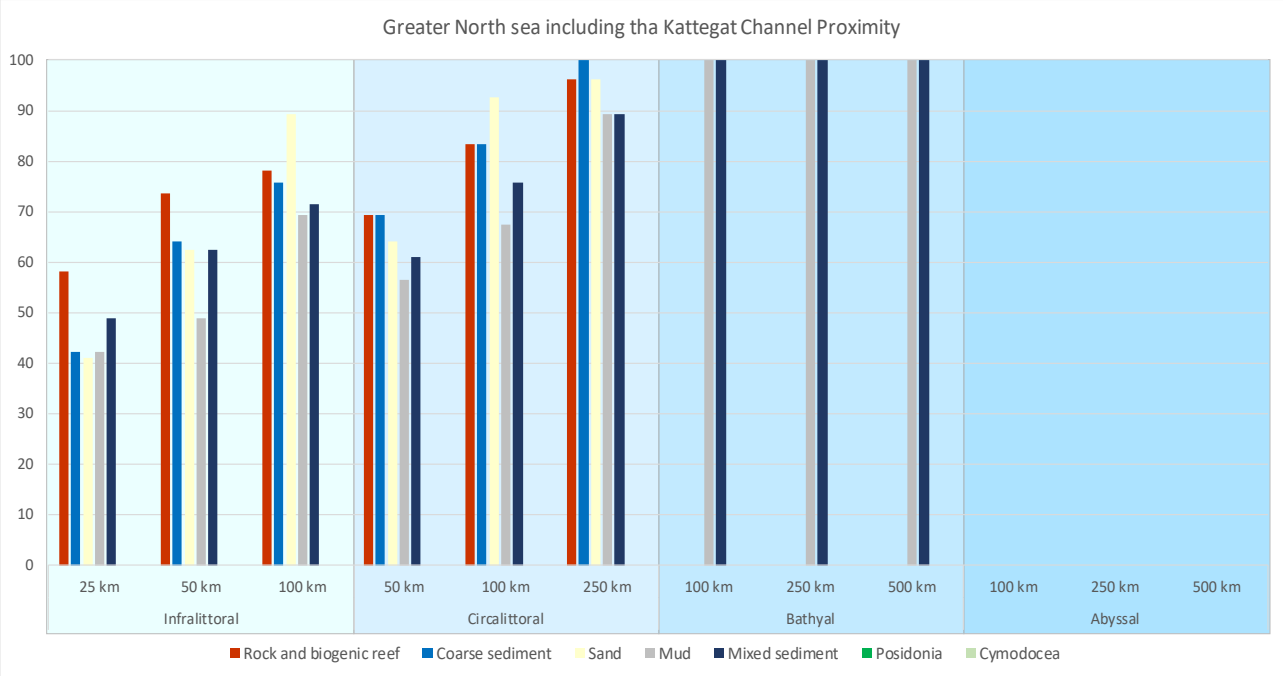



**Figure 5.8. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Ionian Sea and Central Mediterranean Sea MPAs**

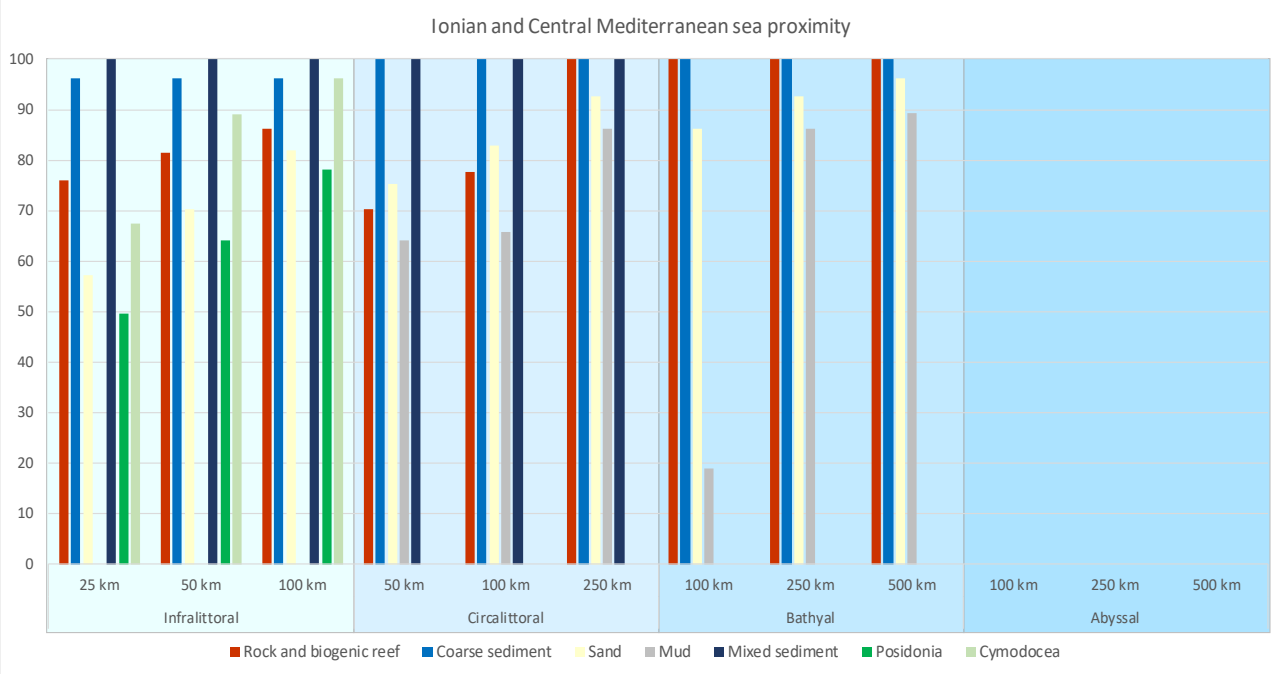


**Figure 5.9. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Macaronesia MPAs.**

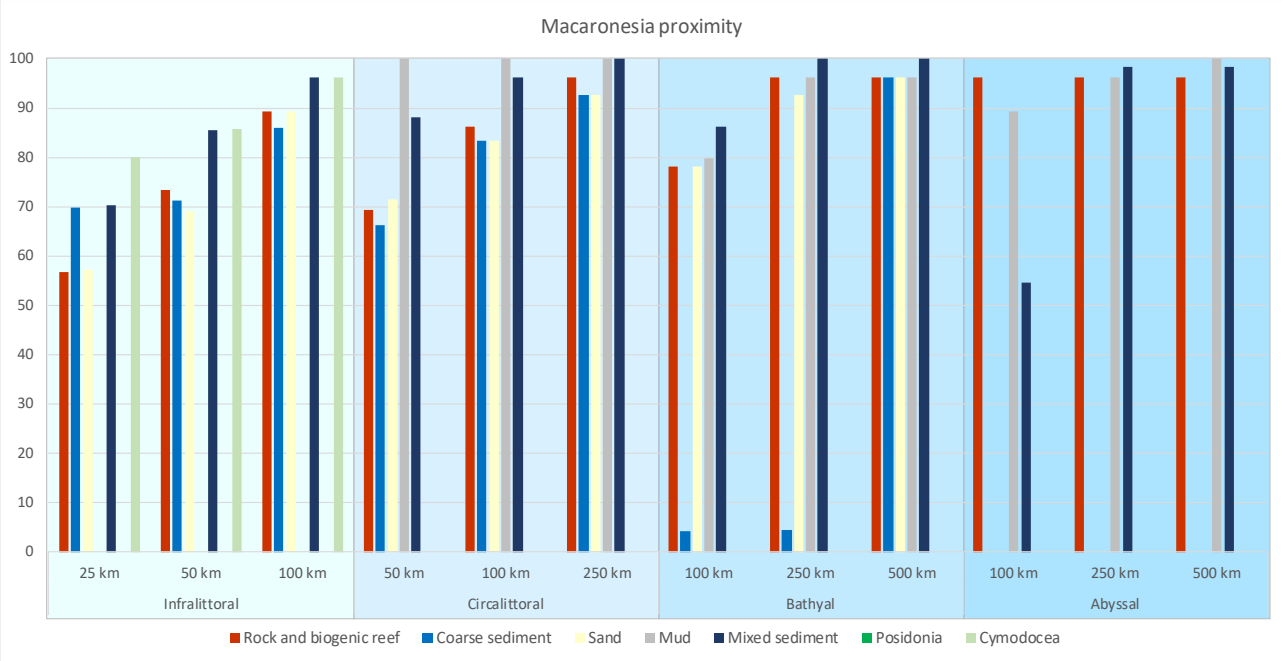
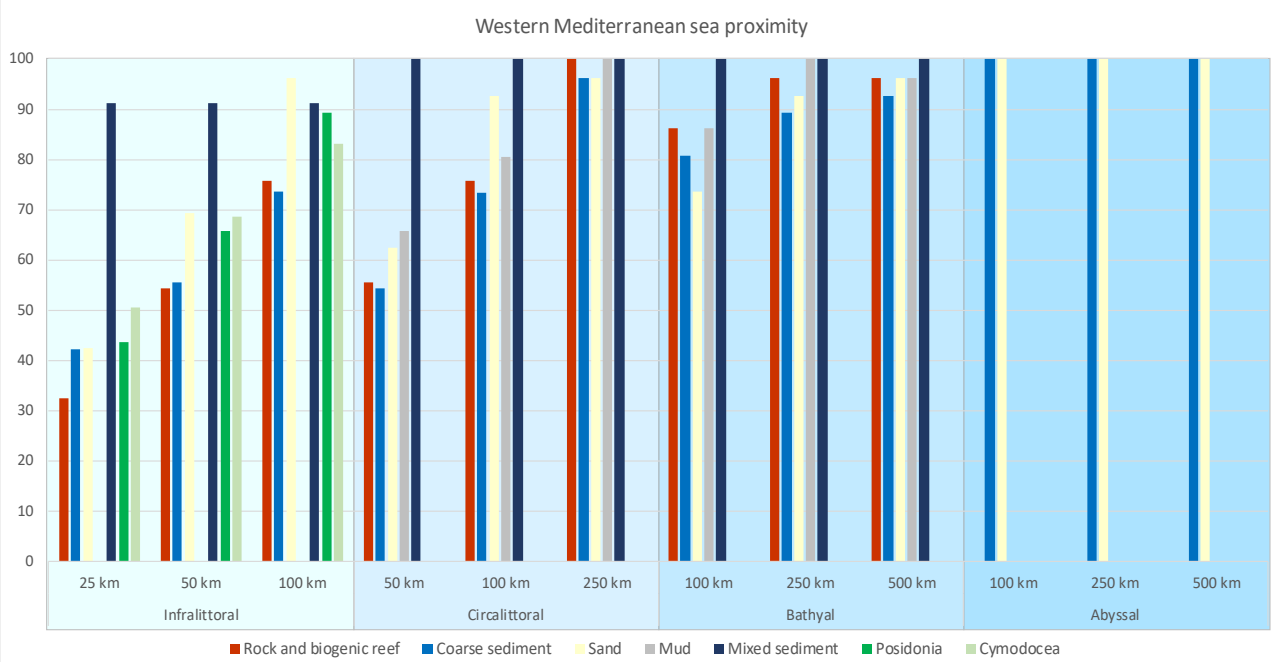



**Figure 5.10. Bar chart of the percentage of connected area for each revised broad habitats and scenarios in the Western Mediterranean Sea MPAs.**




**CRITERION 5:** MPA size

INPUT SOURCE: EU marine regions, designated MPAs in Europe (N2K, CDDA, RSCs)

ROUTINE: The size values are calculated by considering the surface area extents of all sites present in each marine region and subregion (*sensu* MSFD). The marine surface areas are obtained by measuring the extent of all sites regardless of the presence of overlap (both partial and complete) with other polygons belonging to other sites. This means

that the resulting values include the evaluation of surface area extent of MPAs that may be totally or partially juxtaposed to other MPAs. The procedure is run in ArcGIS using an automated sequence of commands managed by a specifically designed python script (Adequacy_size.py). The script allows the batch extractions from the spatial sub-regional geodatabases containing the marine site layers of the number of sites belonging to the following size classes:

- CLASS1 < 5 $km^2$
- CLASS2 ≥= 5 – < 30 $km^2$
- CLASS3 ≥= 30 – < 100 $km^2$
- CLASS4 ≥= 100 $km^2$

CAVEATS: A high number of small MPAs may result due to cartographic errors (i.e. a shift caused by wrong projection, poor shoreline data, poor datum definition). This is likely for CDDA sites which were selected only through spatial database query. Small polygons that introduce bias may be present for marine SPAs (selected on the basis of $N0_2$ and $N0_3$ habitat classes) which are coastal but result as marine due to the above shifts.

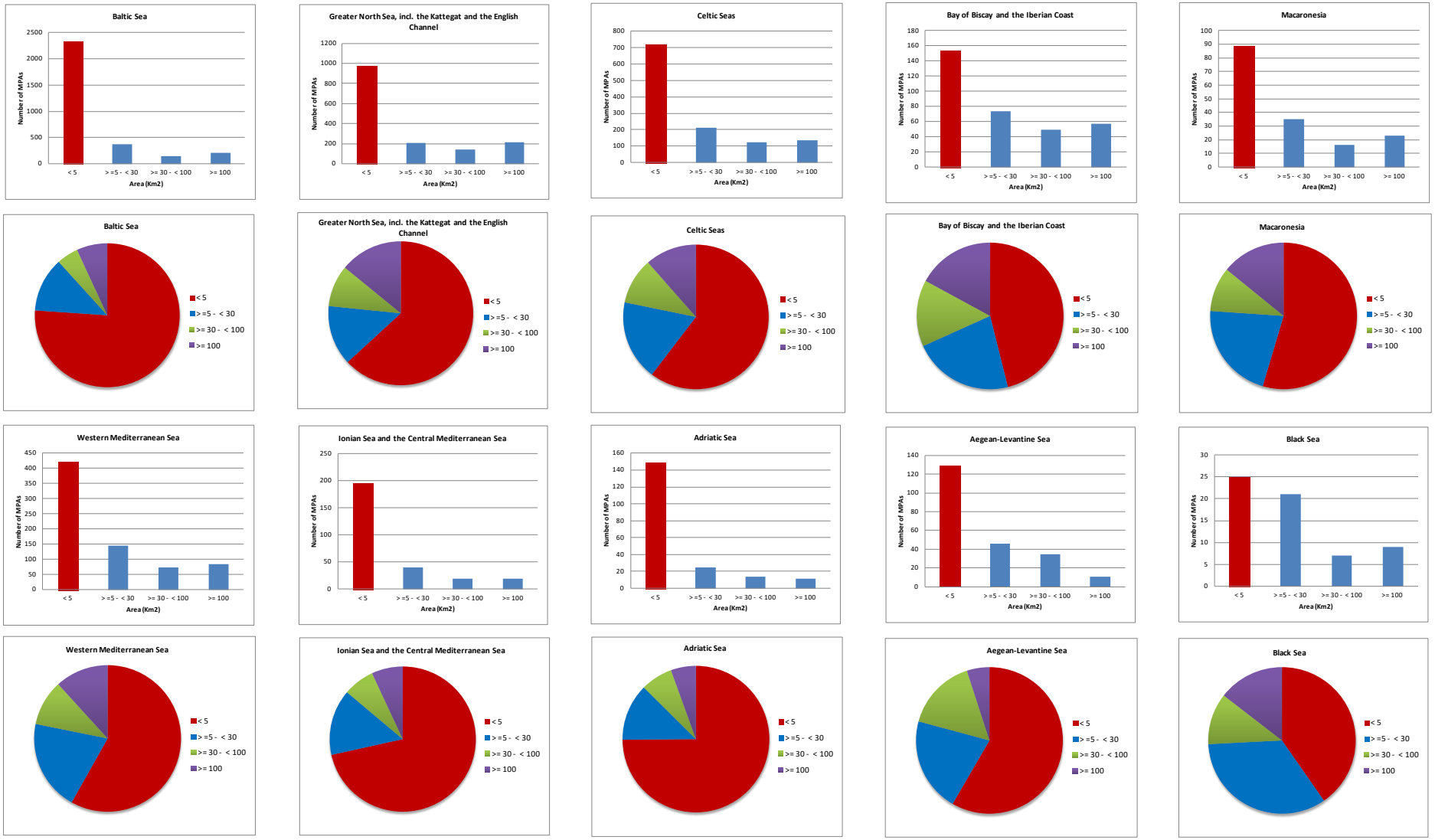
RESULTS: A table where the number of MPAs per class size is reported for each EU marine region. This table also provides the percentage of MPAs ≥5 and ≥30 $km^2$. The threshold rule to measure adequacy is based on the assumption that target is reached when ≥75% of sites are larger than the two proposed targets: 5$km^2$ and 30 $km^2$ for any given region / sub-region (table 5.7). An area frequency distribution histogram and pie chart indicating size class distribution per marine region is also provided (figure 5.11).

Both table 5.7 and figure 5.11 clearly highlight the predominance of small MPAs in every regions/subregion. The application of the ≥75% of ≥5 $km^2$ MPA rule does not indicate an adequate MPA size distribution in any region. The histograms in figure 5.11 indicate a general decreasing size trend from class1 to class3. In most regions there is a marginally higher total number of class 4 MPA size. The only exception to this trend appears to be in the Adriatic Sea and Aegean-Levantine sea subregions where class 4 MPAs are fewer than class 3.

**Table 5.7 Number of sites belonging to each size class per European regional seas/sub-regions and percentage of sites at threshold**

| European regional seas and sub-regions (sensu MSFD) | N° of sites in size Class1 (≤ 5 $km^2$) | N° of sites in size Class2 (5–30 $km^2$) | N° of sites in size Class3 (30–100 $km^2$) | N° of sites in size Class4 (≥ 100 $km^2$) | % Sites ≤ 5 $km^2$ | % Sites ≥ 5$km^2$ | % Sites ≥ 30$km^2$ |
|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 2320 | 372 | 148 | 210 | 76.1 | 23.9 | 11.7 |
| **Celtic Seas** | 721 | 213 | 123 | 137 | 60.4 | 39.6 | 21.8 |
| Greater North Sea, incl. the Kattegat and the English Channel | 969 | 206 | 143 | 216 | 63.2 | 36.8 | 23.4 |
| Bay of Biscay and the Iberian Coast | 154 | 74 | 49 | 57 | 46.1 | 53.9 | 31.7 |
| Macaronesia | 89 | 35 | 16 | 23 | 54.6 | 45.4 | 23.9 |
| **Mediterranean Sea** | | | | | | | 21.8 |
| Western Mediterranean Sea | 421 | 145 | 73 | 85 | 58.1 | 41.9 | 13.9 |
| Ionian Sea and the Central Mediterranean Sea | 196 | 40 | 19 | 19 | 71.5 | 28.5 | 12.6 |
| Adriatic Sea | 149 | 25 | 14 | 11 | 74.9 | 25.1 | 20.8 |
| Aegean-Levantine Sea | 129 | 46 | 35 | 11 | 58.4 | 41.6 | 25.8 |
| **Black Sea** | 25 | 21 | 7 | 9 | 40.3 | 59.7 | 11.7 |

## Figure 5.11. Area-frequency distribution of MPAs by european regional seas and subregion



## 5.3 Tier 3 – Case studies indicating further improvement to MPA network assessments

**CRITERION 6.1**: Percentage coverage of the revised broad habitats within marine N2K sites selected for seabottom habitat protection in each EU marine region compared to coverage against all marine N2K sites.

INPUT SOURCE: EU Marine Regions, EMODnet seabed habitat, marine N2K sites.

ROUTINE: Marine N2K sites are screened to exclude all those marine N2K sites whose tabular data indicate that they only protect species (i.e. all SPAs, all SCIs/SACs selected only for marine species). The procedure requires the evaluation of the percentage of each revised broad habitat occurring within the filtered N2K sites as well as the entire marine N2k database. Revised broad habitat classes are generated from EMODnet seabed habitat layer (see par 4.1.2). Each of the two N2K site layers (screened versus not screened) is intersected with the habitat layer in order to compute percentage habitat in each of the two layers.

CAVEATS: Substrate and habitat maps are not available for some areas of some Atlantic EU Marine Regions (see map 3.2).
The broadscale modelled map has a 250 m pixel resolution so coverage of small-scale or patchy habitats (i.e. infralittoral hard bottoms) will likely be under-represented. MPA coverage of these habitat types could be underestimated or not picked up at all. Littoral habitats have a small extension and are not represented in broad scale habitat maps so representativity of habitats occurring in this depth zone is excluded from analysis.

RESULTS: A table describing the % of each revised broad habitat type included in the N2K network established for marine habitats compared to that obtained with the overall N2K network, per EU marine region. Colour denotes whether target reached (≥20%) or not reached (<20%) (Posidonia = 60%) (table 5.8) .

The comparison between the representativity values calculated using the complete N2K marine site dataset and the N2K sites selected for the presence of marine habitats are similar in terms of target attainment for most revised broad habitat. This is due to the relatively small percentage differences obtained at single revised broad habitat surface area level. Selection of N2K sites for marine habitats results in 3 more infralittoral and 3 circalittoral habitats not attaining the 20% target coverage and for 1 Posidonia habitat not attaining the 60% coverage. In these cases the non attainment of the target is driven by the fact that the complete N2K site habitat coverage is very close to the 20% target to begin with and drops below target once the query is carried out.

**Table 5.8 Percentage coverage of the revised broad habitats within each EU marine region in: a) all marine N2K sites and b) marine N2K sites established for marine habitats (NP = Revised Broad habitat is not present in the region/subregion)**

**a)**

| MPA assessment area regions and subregions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Ms | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 18.5 | 43.8 | 59.1 | 32.3 | 25.5 | NP | NP | 13.1 | 19.0 | 22.9 | 3.7 | 5.7 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| **North-East Atlantic Ocean (inside 200 NM)** | 31.9 | 52.5 | 67.3 | 55.2 | 45.5 | NP | 53.7 | 14.9 | 9.7 | 9.8 | 5.1 | 14.5 | 9.4 | 12.2 | 5.6 | 2.2 | 2.6 | 0.0 | 0.0 | 0.8 | 0.1 | 0.0 |
| Celtic Sea | 21.2 | 31.7 | 62.5 | 56.7 | 30.8 | NP | NP | 12.6 | 3.2 | 2.4 | 2.3 | 3.1 | 26.4 | 13.5 | 7.4 | 3.5 | 4.4 | 0.0 | NP | 17.6 | 0.0 | 1.1 |
| Greater North Sea incl. Kattegat and English Channel | 53.5 | 62.2 | 76.7 | 54.4 | 56.5 | NP | NP | 39.3 | 17.4 | 13.5 | 6.0 | 15.8 | NP | NP | 0.0 | 41.7 | 39.6 | NP | NP | NP | NP | NP |
| Bay of Biscay and the Iberian Coast | 44.6 | 40.8 | 37.3 | 56.7 | 14.1 | NP | NP | 13.3 | 28.7 | 10.4 | 7.8 | 22.3 | 17.9 | 0.0 | 6.9 | 6.4 | 0.6 | 0.2 | NP | 0.6 | 0.8 | NP |
| Macaronesia | 14.2 | 33.7 | 17.8 | 23.3 | 2.7 | NP | 53.7 | 8.2 | 9.4 | 3.0 | 38.5 | 2.4 | 0.5 | 0.4 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Mediterranean Sea** | 33.0 | 24.6 | 18.5 | NP | 17.3 | 52.7 | 9.6 | 11.7 | 24.0 | 5.8 | 3.2 | 2.8 | 2.4 | 3.1 | 8.5 | 0.6 | 0.1 | NP | 0.0 | 0.0 | 0.0 | NP |
| Western Mediterranean Sea | 47.4 | 34.0 | 36.4 | NP | 77.2 | 50.8 | 9.3 | 11.7 | 27.4 | 12.0 | 6.2 | 34.9 | 4.0 | 4.4 | 6.9 | 0.9 | 0.9 | NP | 0.0 | 0.0 | 0.0 | NP |
| Ionian Sea and Central Mediterranean Sea | 24.1 | 38.9 | 24.5 | NP | 55.3 | 50.2 | 19.2 | 3.6 | 26.4 | 3.3 | 3.1 | 1.8 | 0.1 | 3.5 | 4.4 | 0.1 | 0.0 | NP | NP | NP | 0.0 | NP |
| Adriatic Sea | 18.1 | 0.1 | 4.0 | NP | 9.6 | 64.4 | 1.6 | 26.4 | 0.0 | 0.5 | 0.6 | 0.2 | NP | NP | 7.7 | 0.0 | NP | NP | NP | NP | NP | NP |
| Aegean-Levantine Sea | 2.5 | 5.0 | 10.3 | NP | 1.0 | 76.3 | NP | 1.1 | 3.3 | 4.5 | 3.5 | 3.2 | 0.0 | 0.0 | 19.0 | 0.7 | 3.2 | NP | NP | NP | NP | NP |
| **Black Sea** | 59.9 | 76.6 | 83.8 | 57.1 | 68.0 | NP | NP | 64.8 | 9.9 | 2.1 | 5.5 | 1.2 | NP | NP | NP | 0.0 | NP | NP | NP | NP | 0.0 | 0.0 |
| **Total** | 28.0 | 45.6 | 51.6 | 38.9 | 27.5 | 52.7 | 11.9 | 14.5 | 10.5 | 9.8 | 4.2 | 7.3 | 7.7 | 11.5 | 6.5 | 1.2 | 2.3 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 |

**b)**

| MPA assessment area regions and subregions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Ms | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 17.6 | 36.5 | 50.5 | 29.7 | 19.4 | NP | NP | 11.6 | 13.8 | 15.4 | 2.8 | 4.3 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| **North-East Atlantic Ocean (inside 200 NM)** | 27.7 | 49.0 | 56.1 | 41.8 | 28.7 | NP | 53.7 | 12.7 | 7.4 | 8.5 | 3.9 | 7.9 | 9.4 | 12.2 | 4.1 | 2.0 | 2.6 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| Celtic Sea | 16.7 | 23.9 | 48.2 | 44.6 | 28.6 | NP | NP | 10.9 | 2.8 | 1.7 | 1.6 | 2.9 | 26.4 | 13.5 | 7.4 | 3.5 | 4.4 | 0.0 | NP | 17.6 | 0.0 | 1.1 |
| Greater North Sea incl. Kattegat and English Channel | 48.0 | 59.1 | 64.0 | 37.0 | 33.0 | NP | NP | 36.6 | 13.8 | 12.4 | 5.3 | 12.6 | NP | NP | 0.0 | 41.7 | 39.6 | NP | NP | NP | NP | NP |
| Bay of Biscay and the Iberian Coast | 40.7 | 38.5 | 33.1 | 52.4 | 14.0 | NP | NP | 10.4 | 13.5 | 6.0 | 4.8 | 6.5 | 17.9 | 0.0 | 3.2 | 2.5 | 0.6 | 0.2 | NP | 0.0 | 0.0 | NP |
| Macaronesia | 11.9 | 33.3 | 16.9 | 15.5 | 2.7 | NP | 53.7 | 8.1 | 9.4 | 2.8 | 38.5 | 2.4 | 0.5 | 0.4 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Mediterranean Sea** | 31.3 | 24.3 | 17.2 | NP | 17.3 | 52.4 | 9.6 | 11.3 | 21.4 | 5.4 | 2.1 | 2.8 | 2.4 | 2.8 | 8.5 | 0.6 | 0.1 | NP | 0.0 | 0.0 | 0.0 | NP |
| Western Mediterranean Sea | 45.0 | 33.7 | 33.9 | NP | 77.2 | 50.8 | 9.2 | 11.4 | 24.4 | 11.0 | 3.4 | 34.9 | 4.0 | 3.9 | 6.9 | 0.9 | 0.9 | NP | 0.0 | 0.0 | 0.0 | NP |
| Ionian Sea and Central Mediterranean Sea | 24.1 | 38.9 | 24.0 | NP | 55.3 | 50.2 | 19.2 | 3.6 | 26.4 | 3.3 | 3.1 | 1.8 | 0.1 | 3.5 | 4.4 | 0.1 | 0.0 | NP | NP | NP | 0.0 | NP |
| Adriatic Sea | 15.8 | 0.1 | 3.0 | NP | 9.6 | 56.5 | 1.6 | 24.5 | 0.0 | 0.4 | 0.6 | 0.2 | NP | NP | 0.0 | 0.0 | NP | NP | NP | NP | NP | NP |
| Aegean-Levantine Sea | 2.5 | 5.0 | 9.6 | NP | 1.0 | 76.3 | NP | 1.1 | 3.3 | 3.9 | 3.2 | 3.2 | 0.0 | 0.0 | 18.7 | 0.7 | 3.2 | NP | NP | NP | NP | NP |
| **Black Sea** | 34.4 | 36.7 | 61.6 | 52.1 | 30.9 | NP | NP | 27.9 | 2.6 | 1.2 | 5.0 | 0.3 | NP | NP | NP | 0.0 | NP | NP | NP | NP | 0.0 | 0.0 |
| **Total** | 25.0 | 40.5 | 43.7 | 33.5 | 20.3 | 52.4 | 11.9 | 12.5 | 8.0 | 8.3 | 3.2 | 4.9 | 7.7 | 11.5 | 5.4 | 1.1 | 2.3 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |

(Habitat legend: I, C, B and A= infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx =rock, coarse, sand, mud mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds).

**CRITERION 6.2**: Percentage coverage of the revised broad habitats within all MPAs established for seabottom habitat protection in the western Mediterranean sea region.

INPUT SOURCE: EU Marine Regions, EMODnet seabed habitat, western Mediterranean MPAs (N2K, CDDA, RSC sites)

ROUTINE: All western Mediterranean MPAs are screened so as to retain only those sites whose establishment objectives / management measures involve seabed habitat conservation. This implies screening all CDDA and SPAMI sites on a one to one basis and researching their establishment / management statute through a websearch so as to retain all those that involve seabed habitat protection. The N2K sites screened for criterion 6.1 and lying in the western Mediterranean are also considered. The screened CDDA, SPAMI and SCIs are considered as a distinct layer. The percentage of each revised broad habitat occurring within the latter layer is computed so as to obtain a revised broad habitat representativity assessment with higher confidence. The result of the assessment is compared against the one obtained in criterion 2.1.

CAVEATS: The broadscale modelled map has a 250 m pixel resolution so coverage of small-scale or patchy habitats (i.e. infralittoral hard bottoms) will likely be under-represented. MPA coverage of these habitat types could be underestimated or not picked up at all. Littoral habitats have a small extension and are not represented in broad scale habitat maps so representativity of habitats occurring in this depth zone is excluded from analysis.

RESULTS: A table describing the % coverage of each revised broad habitat type included both in all the MPAs and in the MPA network established for seabed habitats. Cell colour of each assessed habitat denotes whether target reached (≥20%) or not reached (<20%) (Posidonia = 60%) (table 5.9)

**Table 5.9 Percentage coverage of the revised broad habitats in: a) all Western Mediterranean Sea MPAs and b) Western Mediterranean Sea MPAs established for marine habitats**

| Revised broad habitats | % coverage in all MPAs | % coverage in MPAs for marine habitats |
|---|---|---|
| Infralittoral rock | 57,16 | 48,16 |
| Infralittoral coarse sediment | 53,43 | 34,52 |
| Infralittoral sand | 51,12 | 35,46 |
| Infralittoral mud | NP | NP |
| Infralittoral mixed sediment | 77,17 | 77,17 |
| Posidonia beds | 62,82 | 51,45 |
| Cymodocea beds | 29,63 | 9,35 |
| Circalittoral rock and biogenic reef | 21,33 | 12,21 |
| Circalittoral coarse sediment | 48,70 | 28,54 |
| Circalittoral sand | 24,08 | 12,58 |
| Circalittoral mud | 31,98 | 8,41 |
| Circalittoral mixed sediment | 34,85 | 34,85 |
| Bathyal rock | 5,67 | 4,10 |
| Bathyal coarse | 87,52 | 6,47 |
| Bathyal sand | 36,46 | 7,02 |
| Bathyal mud | 14,19 | 1,16 |
| Bathyal mixed sediment | 0,94 | 0,94 |
| Abyssal rock | NP | NP |
| Abyssal coarse | 87,52 | 6,47 |
| Abyssal sand | 42,39 | 0,00 |
| Abyssal mud | 5,16 | 0,00 |
| Abyssal mixed sediment | NP | NP |

Screening of the overall western Mediterranean MPAs in order to assess revised broad habitat coverage within the network only when MPAs are established for the purpose of seabed habitat conservation reveals that the obtained habitat percentage cover is almost always much lower than that obtained when analyzing all MPAs, regardless of their seabed protection objectives. In the latter case only 31% of revised broad habitats do not reach the optimal representativity target in the western Mediterranean. However, when assessing only MPAs whose mandates or management contain seabed habitat conservation measures, the percentage of revised broad habitats included in the networks that do not reach the target increase more than twofold (68%). This substantial difference evidences the importance that assessments be made on MPA subsets adequately screened with respect to the assessment questions that are being raised. In the case of the western Mediterranean sea, absence of data fields containing specific protection objective information in the CDDA database, and lack of a centralized tabular SPAMI database, required additional investigations to be carried out through a websearch so as to screen each MPA on a one to one basis, thus revealing the need for future work on MPA database improvement. A word of caution should also be placed on the actual surface area present within the MPA boundaries that actually benefits from seabed protection measures. In cases in which MPAs are characterized by multiple zonation schemes, only a portion of the MPAs surface area may actually lie under specific management regime. An accurate seabed habitat representativity assessment is possible only if the MPA databases (tabular and spatial) allow to identify which portion(s) of the MPA polygon(s) is/are subjected to specific measures.

**CRITERION 7.1:** Percentage of N2K sites older than 10 years versus the percentage of sites with management plans

INPUT SOURCE: EU Marine Regions, Natura 2000 sites and tabular data.

ROUTINE: The N2K database reported at the end of 2015 is queried and marine sites are extrapolated as illustrated in the procedure reported by EEA (2015b). Tabular information on year of site establishment is queried in order to sort Natura 2000 sites and to compute the percentage of marine sites older than 10 years (date of establishment prior to 31/12/2005) as opposed to sites established during the last 10 years for every given biogeographic region. Further queries are made concerning the reported existence of a management plan.

The procedure is run in ArcGIS using an automated sequence of commands managed by a specifically designed process using model builder. In this procedure the marine sites are joined using the site code with the table "Natura2000sites" in order to extract the information about site age and with the table "management" for collecting the information concerning the existence of management plans. The methodology to define site age is the same as that used in the ETC/ICM deliverable on MPA hindcasting (ETC /ICM, 2014). This procedure assigns the age of each site by considering on first instance the values contained in the tabular datafields "Date_Prop_SCI" and "Date_SPA". In cases where these fields are both empty, the value reported in "Date_Compilation" is considered. The presence of a management plan is assessed for each site by considering the presence of information in the following fields: Manag_Status; Manag_Plan_URL and Manag_plan. One aspect to mention is that datafield "Manag_status" allows for the following options: Y (presence of management), N (absence of management) or P (management in preparation) but also "-". In this latter case, if the associated field "Manag_Plan_URL" was filled, it was assumed that a management plan is active, if not, it was assumed that the site is not managed. The resulting query results are joined in a unique summary table. This table contains, per each subregion, the total number of sites, the number of sites where a management plan is established, and the number of sites without management plan. The table also divides the sites according to the MPA age threshold (≥ or < 10 years since site establishment). The data is analysed so as to first define the percentage of sites older and younger than 10 years. Sites are also considered in terms of percentage of sites with: a management plan, a management plan in preparation, with no management plan or for which no data was reported. This is analysed for all the marine sites irrespective of their age (date of establishment) and also for sites older and younger than the 10 year old threshold.

CAVEATS: This criterion is affected by many biases, first of all the year of establishment is a very indirect way of measuring management efficacy, furthermore the information of date of establishment is not present in all the datasets. Another caveat could be introduced in cases where no dates pertaining to site establishment are recorded. This condition could be estimated in N2K through the percentage of use of the "date_compilation" field, whereas in CDDA by the frequency of empty YEAR field.

RESULTS: Histograms indicating the proportion of MPAs older and younger than 10 years. (figures 5.12 and 5.13).

**Figure 5.12 Percentage of marine Natura 2000 sites older and younger than 10 years per biogeographic region and on the overall**

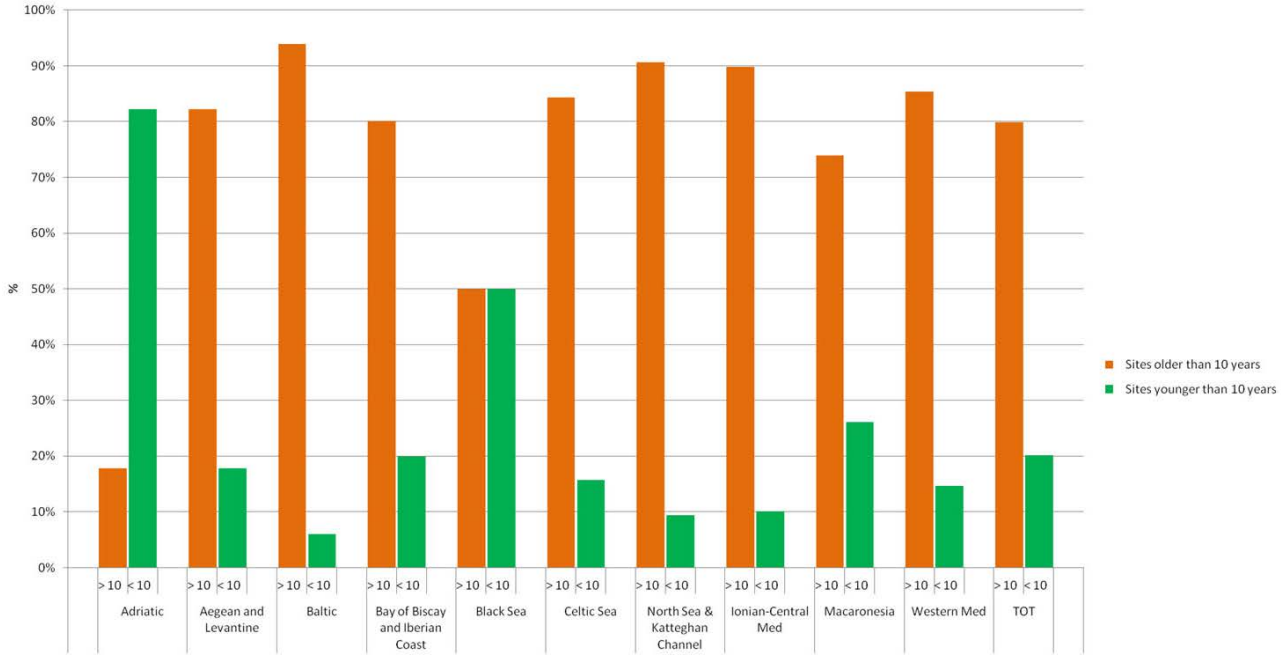


**Figure 5.13 Inferring MPA effectiveness through MPA age versus information on the existence of site management plans**

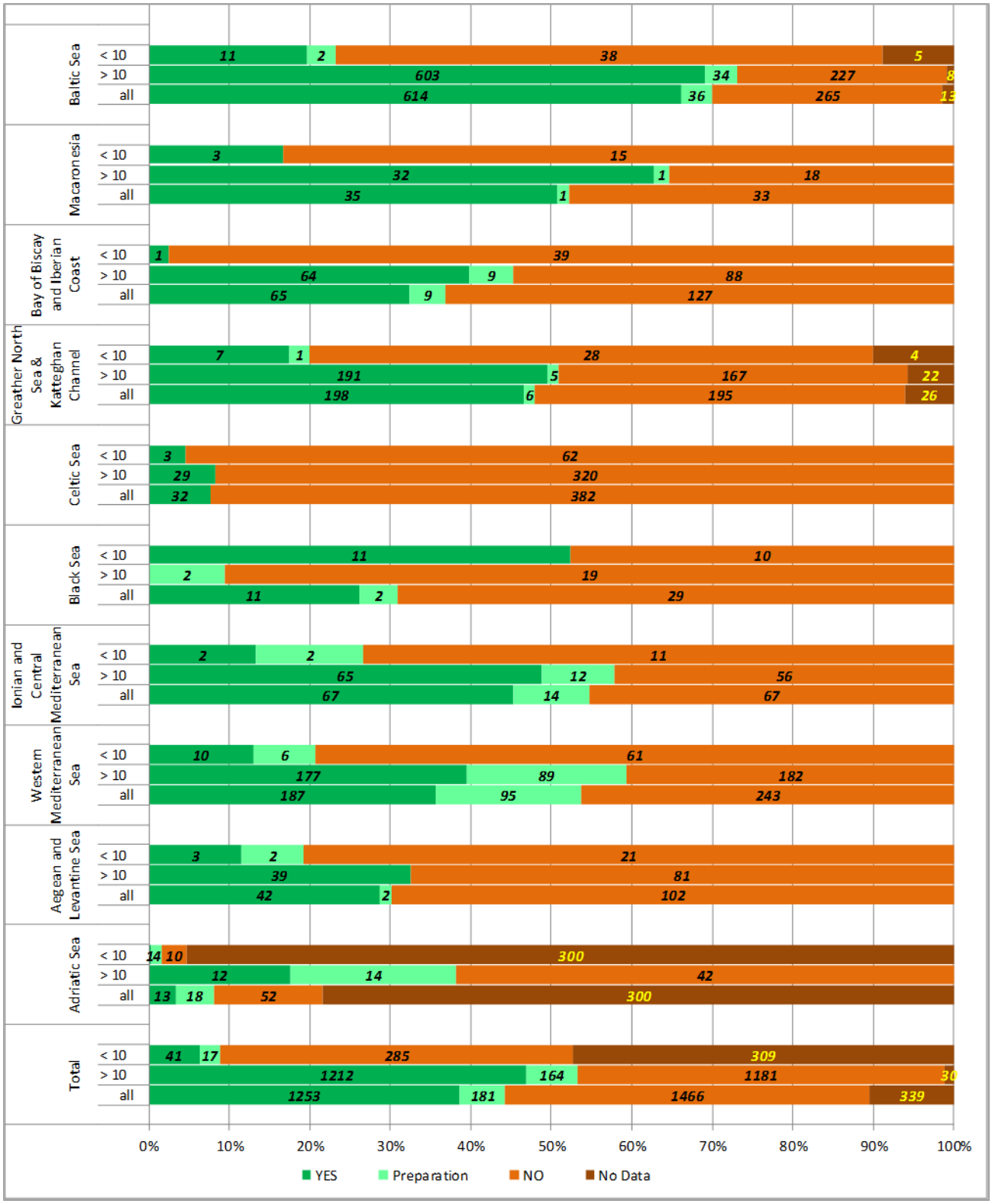



Figure 5.12 indicates that most biogeographic regions are characterized by a high percentage (over 70%) of marine N2K sites older than 10 years. Therefore if the 10 year age threshold is considered for inferring management effectiveness, based on the assumption that old sites have operative management plans/measures, then one could assume that most biogeograpic regions have an effective management scheme which will guarantee that conservation objectives are met. The only exceptions would appear to be

the regions hosting countries for which the Habitats Directive has recently come into force, such as the Black Sea or the Adriatic Sea where most sites are inevitably below the 10 year threshold.

Figure 5.13 indicates that the biogeographic regions with marine N2K sites with highest percentage of management plans that are existing / in preparation are the Baltic (70% of sites) followed by the Ionian-Central Mediterranean, Macaronesia and Western Mediterranean (50% or more). The Adriatic and Celtic sea are the biogeographic regions with the lowest percentage of sites with management plans. This is not surprising for the Adriatic as the recent accession of Croatia into the EU and recent establishment of marine N2K sites influences this scenario.

If one compares the percentage of overall N2K sites with management plans / in preparation against the percentages of N2K sites older than 10 years that have management plans, one notices that the percentage values for these two categories are oftentimes not markedly different within some biogeographic regions. This implies that in these regions most management plans are established several years (and possibly well beyond 10 years) after site establishment and management plans very seldom are put in place for sites younger than 10 years. While the Baltic, North Sea and Ionian sea are the regions with highest percentage of sites older than 10 years (more than 90% of sites are older than 10 years), only 70% of Baltic sites have management plans / in preparation and only 50% of North Sea and Ionian – Central Mediterranean sites have management plans. In the Celtic sea more than 80% of sites are older than 10 years but less than 10% of these older sites have management measures / plans in place. On the overall these figures indicate that if the 10 year age threshold is considered as a proxy of MPA effectiveness, intended as high likelihood of a management plan being in place, evidence shows that the likelihood of a region having at least 75% of older sites with management plans in place is not met.

It must be noted that a rapid test was conducted on the same dataset by considering as age threshold 20 years and analyzing the resulting percentage of sites characterized by the presence of management plans. In this scenario, despite the duplication of the age threshold, the detected increase in management plan existence / in preparation was marginal. Given the variety of legal interpretations over the obligation to implement site management measures pursuant to Natura 2000 site establishment, it appears doubtful that inferences can be made concerning management plan implementation if one were to consider only MPA age. This suggests that the site age cannot be used as proxy for the evaluation of the management effectiveness.

Another aspect worthy of notice lies in the number of observed No Data records (“Null” values in the N2K database) in the management plan database fields in some regions (i.e. Adriatic, Baltic, North Sea). The “null” values represent about 10% of the sites and they occur mainly in the Adriatic sea (this is due to the Croatian sites that have been recently been established). This indicates that, at present, Member States have the option to decline reporting information on the existence of site management plans, by leaving the data field blank. This aspect should be further investigated and object of discussion at policy implementation consideration level so that data reporting on this subject become mandatory. One of the principal benefits of a reporting process and database management is the level of control that can be exerted over the reporting obligations. It is clear that information on the existence of site specific management plans is the first step towards attempting to understand whether MPA networks are actually functioning to potentially deliver their conservation benefits. It would therefore seem wise to foresee that compilation of the N2K datafields concerning this aspect be fully completed with no derogation allowing for “no data” records in order to fully understand the potential management capacity that the network has.

Other problems in database compilation were detected during data processing for management plan existence. Numerous Swedish sites report the replicated name of the actual site in the fields “Manag_Plan” which clearly indicates a reporting error. This type of inaccuracy can prevent the correct elaboration of the data and as such attention on how to improve the QA/QC of the reporting to avoid such errors would be beneficial.

The above exercise is directed at N2K sites in order to ascertain the degree to which N2K sites can be considered to be under the influence of management schemes and therefore on the road to MPA conservation effectiveness. No analogous assessment can at present be run on RSC and CDDA marine sites as datafields involving the existence of site management plans do not exist in the respective databases. Future efforts at adapting existing MPA databases so as to contain such datafields would allow to describe the overall network capacity to strive towards MPA management effectiveness.

The above illustrated Tier 3 assessment centered on ascertaining the degree to which N2K sites can be considered to be under the influence of management schemes and therefore on the road to MPA conservation effectiveness. However it would be optimal to improve the overall MPA database reporting so as to assess other aspects relating to the implementation of adequate conservation measures, on the existence of monitoring schemes capable of detecting whether MPAs are effectively delivering with resulting improved conservation statuses of their protected features. Some RSCs have begun assessing these specific aspects.
In 2016, OSPAR undertook an exercise to collate information on the degree to which OSPAR MPAs may be considered to be 'well-managed'(OSPAR, 2017). Whilst there is no formal agreement on what constitutes 'well managed' in terms of an MPA – a questionnaire was developed that poses four key questions that reflect progress around the implementation cycle of an MPA:

- **A – Is MPA managem**ent documented? This question explores whether information concerning the management of an OSPAR MPA has been published. Management in this context is interpreted as conservation objectives for protected features, documented known pressures and threats that could affect protected features, a list of management actions that may need to be undertaken to address known pressures and threats, and finally spatial information on the distribution of protected features within a given OSPAR MPA.
- **B – Are measures to achieve conservation objectives being implemented?** This question explores whether specific management actions have been identified and put into place by site managers to address known pressures and threats by a legal mechanism or other effective means.
- **C – Is monitoring in place to assess if measures are working?** This question explores whether specific monitoring focussed on the ecological status of protected features of OSPAR MPAs has taken place, or as a minimum a means of monitoring the compliance of site users with implemented measures.
- **D – Is the MPA moving towards or has it reached its conservation objectives?** This question explores whether information collected on the ecological status of the protected features of OSPAR MPAs support the achievement, or movement towards achieving, a sites conservation objectives.

As part of the data collection exercise, Contracting Parties were asked to answer each question with a *Yes*, *Partially*, *No* or *Unknown* response and to provide brief additional information that help justifies the response for each of their OSPAR MPAs. 80% of OSPAR MPAs were reported against in the 2016 data call. A summary of the results are provided in figure 5.14 below.

**Figure 5.14 Results of the assessment of OSPAR MPA management effectiveness (From OSPAR, 2017).**

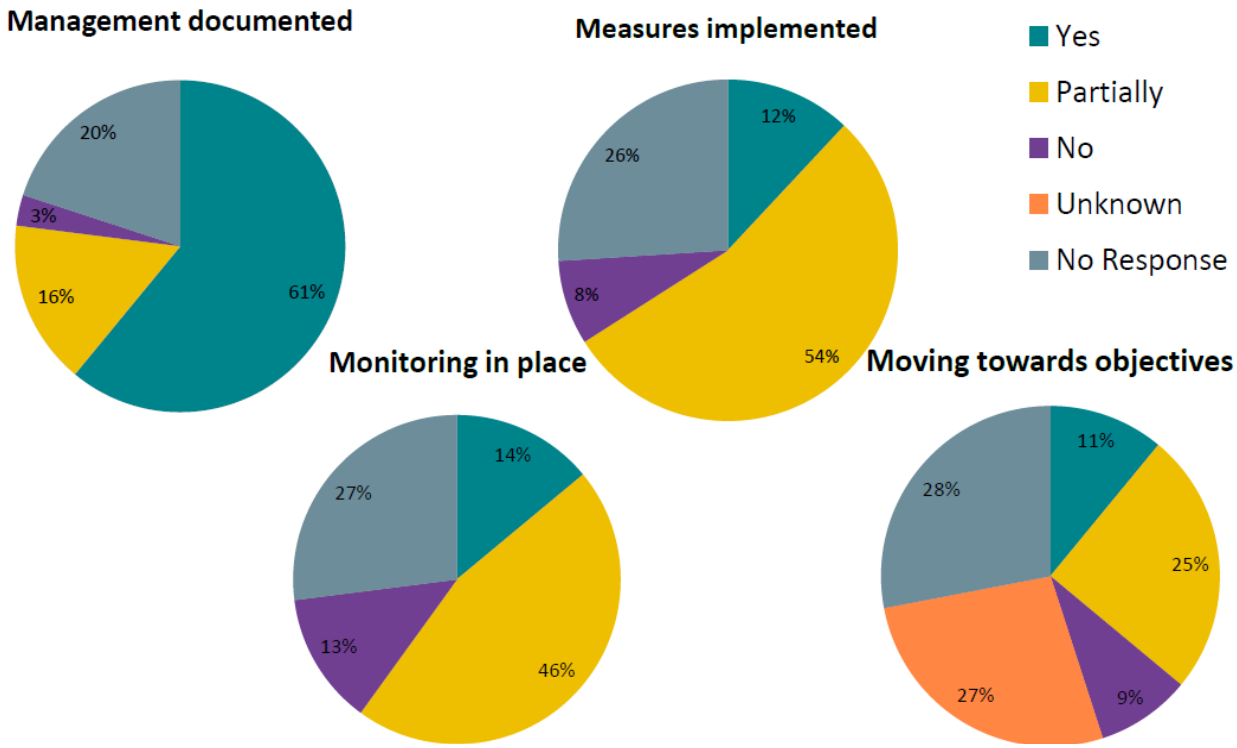



Figure 5.14 shows that nearly two-thirds of the OSPAR MPA network has full management information in place that is publicly documented, with a further 16% of OSPAR MPAs having partial management information in place which is publicly documented. The latter is largely due to conservation objective updates taking place or because work is ongoing to identify the management actions that may be required to address the known pressures and threats to the protected features of OSPAR MPAs. Figure 5.14 also indicates that whilst there is progress on taking management action and implementing measures to achieve the conservation objectives of the protected features of OSPAR MPAs, such actions are largely only partially completed across the OSPAR Maritime Area; a similar picture emerged concerning the implementation of monitoring studies for OSPAR MPAs. Consequently, the predominant response to whether OSPAR MPAs are moving towards achieving their conservation objectives is 'unknown' because site-specific data on the ecological status of the protected features of OSPAR MPAs are not available.

Work moving forward should focus on the implementation of all management measures that Contracting Parties feel are required to achieve the conservation objectives of the protected features of OSPAR MPAs. In parallel, long-term monitoring studies should also be established to evaluate the effectiveness of such management measures in order to state with greater confidence whether the conservation objectives of the protected features of OSPAR MPAs have been achieved. Finally, work should progress on improving methods of evaluating the degree to which the OSPAR MPA network is well-managed to support a more sophisticated assessment that can be fed into the OSPAR Quality Status Report. This should build on sound ecological data to determine whether or not the OSPAR MPA network is delivering a genuine conservation benefit to targeted habitats, species and ecological processes.

The type of approach adopted by OSPAR is a simple yet effective mechanism by which information on MPA management might accumulated for the purposes of considering EU-level management effectiveness; at least as a starting point. It would therefore seem appropriate to review all the MPA database reporting procedures so as to comprehend future data reporting mechanisms that involve management effectiveness information by drawing on the OSPAR experience in assessing management effectiveness.

# 6 Options for presenting the outputs of an assessment of EU MPA networks

The proposed methodological framework for the assessment of EU MPA networks as presented in table 4.1 is presented in a hierarchical structure with specific criteria under each network principle. Given that a significant number of outputs are generated as a result of applying the proposed assessment framework (as highlighted in Section 5), it would be sensible to consider existing practice in presenting integrated assessments of MPA networks which are applicable at an EU level. More specifically, the assessment outputs related to Tier 1 evaluations provide a single result for each unit assessed under each criterion, thereby calling for an approach that integrates the results.

## 6.1 Introduction to integrated assessments

Experience from integrated assessment tools has shown that fairly simple integration methods can give robust assessment results (Andersen et al. 2015a, b). For instance, the HELCOM integrated assessments of eutrophication, biodiversity and hazardous substances were based on assessment tools which integrated quantitative indicators and the associated thresholds for desired status (HELCOM 2009, 2010 c, d). A recent study showed that the integrated biodiversity status was highly correlated with the anthropogenic pressures in the Baltic Sea sub-basins (Andersen et al. 2015 a). In another recent study, the integrated eutrophication status of the Baltic Sea was calculated retrospectively for several decades and the status successfully correlated with the long-term changes in nutrient loads to the sea area (Andersen et al. 2015 b).

In the past, integrated assessments have been accused of lacking transparency, producing single figures or outputs that may be misinterpreted if not accompanied by supporting background information. To overcome this, the ultimate objective would be to maximise transparency in the assessment outcome whilst at the same time being able to provide sufficient contextual information without the key messages of a given assessment being lost. In the remainder of this section, we draw on the experience of Deltares (2014) who explored the use of 'scorecards' as a means of presenting MPA network assessment ouputs in an EU context as part of their work. We present two alternatives respectively; a fully quantitative approach based on weighted criteria, and a semi-quantitative approach.

It is important to emphasise of course that the final decision on how to present the outcomes of an assessment will rest in the specific questions being asked. Until there is some degree of clarity on the questions being asked of MPA networks at a European level (to inform e.g. the MSFD and EU Biodiversity Strategy) it remains difficult to select one particular approach over another.

## 6.2 Quantitative scorecard approach

The quantitative scorecard works at the level of the indicators which are the features contained in each criterion that are the object of the assessment. Indicator assessments are based on the comparison between the measured value of the indicator and a defined target. According to the Deltares (2014) approach, the ratio which results from the latter relationships is subsequently weighted by an uncertainty factor for the data, targets and methods used to assess each indicator. The overall assessment result for a criterion is then obtained by averaging the individual indicators.

Table 6.1. below illustrate an example of how this type of a scorecard can be applied to the criteria. The values indicated in the table are based on the results of representativity criteria indicated in section 5 for the western Mediterranean. The percent coverage of each indicator falling under each criterion is indicated in the first column. The targets considered are the 10% coverage for criteria 1.1–1.3. Criterion 1.4 is assessed using different coverage target values to measure sufficiency for broad-scale habitats. All but one revised broad habitat are assessed against a 20% coverage. This means that if the network does not guarantee a minimum 20% coverage for a specific habitat, the respective indicator assessment is classified as insufficient. The only revised broad habitat type that can be associated entirely to a priority HD habitat

type is Posidonia beds (habitat 1120). In this case the 60% target threshold coverage is used to test representativity of the network for this habitat type. The coverage to target value is calculated as a ratio.

The Deltares (2014) approach involved scoring each indicator assessment for the following uncertainty factors: data, target and method involved. This scoring was carried out through the application of a correction value of 1, 0.75 and 0.5 corresponding, respectively to LOW, MODERATE and HIGH uncertainty for each of the factors. In the Deltares (2014) approach, the uncertainty affected the assessment result of each single indicator by weighting it with the 'correction' value. If weighting for uncertainty is chosen to not be automatically introduced , another approach would be to show the uncertainty (or confidence) separately and not to weight each indicator assessment by the uncertainty factors (i.e. data, target and methodology used). In such a case the result of each indicator should be taken as it is (the column 'Ratio' in table 6.1) and the uncertainty is presented separately. The rationale of this latter approach is that the responsibility of interpreting the assessment lies in the end-user's choice to consider the direct assessment result on its own or take stock of the uncertainty weight introduced by the potential sources of error. In other words, it is the readers' choice to judge and interpret the assessment result. If the weighted approach is used, a transparent description is provided regarding how the uncertainty was estimated and how the assessment result is affected by the uncertainty. If the unweighted approach is used, the shortages of the assessment are kept separate from the result. The latter approach has been used in the HELCOM integrated assessments (HELCOM 2009, 2010 c, d).

In our test case (table 6.1), we attempted to apply the correction factors to the representativity criteria assessments of the Western Mediterranean Sea. In order to compensate situations where each specific 'exceeding indicators assessments' could override the low scoring indicator assessments a method for standardising the resulting "ratio" was introduced. This implied setting a ceiling of 1 for indicator assessment values whenever the target was surpassed (column 'limited ratio'). This avoids biasing the overall criterion average in situations where many habitats yield coverage values that greatly exceed the target threshold reference condition for sufficiency, and override the insufficiency generated by smaller coverage values of few habitat types. This means that averaging of all the "rescaled" indicators would always fall below 1.0 if any indicator falls short of reaching the target, irrespective of whether we choose the option of weighting for uncertainty or not.

Uncertainty weighting was introduced for each indicator assessment. The EMODnet seabed habitat confidence value could not be used because it is expressed on a three-tier confidence assessment (high, medium, low) for each single modelled cell. It is therefore difficult to interpolate such values on an overall basin level and place these in the scorecard with a global value for each revised broad habitat. We therefore propose as an example to rank the uncertainty of data to 1.0 except for habitats characterised by hard bottoms which were scored 0.75 (moderate uncertainty) because we believe that the 250m pixel resolution of the EMODnet map is not adequate for portraying the exhaustive presence of hard bottoms (given that rocky bottoms in this region are unlikely to have a surface area extension big enough to be adequately portrayed in this scale map) and because the EMODnet substrate data layer does not provide an exhaustive description of the hard bottom distribution in the basin. Target uncertainty weights were 1.0 (low uncertainty) except for the revised broad habitat types which can potentially contain at least one assemblage (i.e. biocoenosis, *facies*, association) considered of conservation importance at RSC level. For these habitats a weight of 0.75 (moderate uncertainty) was applied on the assumption that the 20% target may not be ambitious enough given that an assemblage of conservation importance may be present within these revised broad habitat types. Methodology uncertainty weights of 0.75 (moderate uncertainty) were applied to the representativity criteria for each biological zone due to the uncertainty that the MPAs each have management plans and adequate management measures in place. Methodology uncertainty weights of 0.75 were applied to each revised broad habitat assessment because the habitat coverage methodology does not consider whether the MPAs were established for seabed habitat conservation. The argumentations over such weighting choices are not exhaustive, they need to be object of further discussion, and they are therefore to be considered proposals. The resulting weighted ratio is then corrected for through the same "standardisation" procedure as was done to the unweighted original ratio. This leads to a corrected uncertainty ratio (column "Limited weighted ratio).

**Table 6.1 Example of scorecard development for the representativity principle and respective criteria for the Western Mediterranean Sea.** Key: 'Ratio' is the 'Indicator result %' divided by 'Target threshold %'. In 'Limited ratio' as well as in the Limited weighted ratio, the 'Ratio' cannot exceed 1.0. 'Uncertainty' columns give three uncertainty estimates (1.0 = low, 0.75 = moderate and 0.5 = high), the average of which can be used to weight the 'Weighted average'.

| Criterion | Representativity indicator name | Indicator result % | Target threshold % | Ratio | Limited ratio | Uncertain data | Uncertain target | Uncertain method | Weighted ratio | Limited weighted ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.2 | Sub-region | 15,60 | 10 | 1,56 | 1,0 | 1 | 1 | 1 | 1,56 | 1,0 |
| 1.3 | 0-1 NM | 60,38 | 10 | 6,04 | 1,0 | 1 | 1 | 1 | 6,04 | 1,0 |
| 1.3 | 1-12 NM | 29,58 | 10 | 2,96 | 1,0 | 1 | 1 | 1 | 2,96 | 1,0 |
| 1.3 | 12NM - END | 10,14 | 10 | 1,01 | 1,0 | 1 | 1 | 1 | 1,01 | 1,0 |
| **Average criterion** | | | | **2,89** | **1,0** | | | | **2,89** | **1,0** |
| 1.4 | infralittoral | 57,07 | 10 | 5,71 | 1,0 | 1 | 1 | 0,75 | 4,28 | 1,0 |
| 1.4 | circalittoral | 29,43 | 10 | 2,94 | 1,0 | 1 | 1 | 0,75 | 2,21 | 1,0 |
| 1.4 | bathyal | 15,34 | 10 | 1,53 | 1,0 | 1 | 1 | 0,75 | 1,15 | 1,0 |
| 1.4 | abyssal | 6,22 | 10 | 0,62 | 0,62 | 1 | 1 | 0,75 | 0,47 | 0,47 |
| **Average criterion** | | | | **2,70** | **0,91** | | | | **2,03** | **0,87** |
| 2.1 | Infralittoral rock | 57,16 | 20 | 2,86 | 1,0 | 0,75 | 0,75 | 0,75 | 1,21 | 1,0 |
| 2.1 | Infralittoral coarse | 53,43 | 20 | 2,67 | 1,0 | 1 | 1 | 0,75 | 2,00 | 1,0 |
| 2.1 | Infralittoral sand | 51,12 | 20 | 2,56 | 1,0 | 1 | 0,75 | 0,75 | 1,44 | 1,0 |
| 2.1 | Infralittoral mixed | 77,17 | 20 | 3,86 | 1,0 | 1 | 0,75 | 0,75 | 2,17 | 1,0 |
| 2.1 | Posidonia meadows | 62,82 | 60 | 1,05 | 1,0 | 1 | 1 | 0,75 | 0,79 | 0,79 |
| 2.1 | Cymodocea beds | 29,63 | 20 | 1,48 | 1,0 | 1 | 1 | 0,75 | 1,11 | 1,0 |
| 2.1 | Circalittoral rock | 21,33 | 20 | 1,07 | 1,0 | 0,75 | 0,75 | 0,75 | 0,45 | 0,45 |
| 2.1 | Circalittoral coarse | 48,7 | 20 | 2,44 | 1,0 | 1 | 1 | 0,75 | 1,83 | 1,0 |
| 2.1 | Circalittoral sand | 24,08 | 20 | 1,20 | 1,0 | 1 | 0,75 | 0,75 | 0,68 | 0,68 |
| 2.1 | Circalittoral mud | 31,98 | 20 | 1,60 | 1,0 | 1 | 1 | 0,75 | 1,20 | 1,0 |
| 2.1 | Circalittoral mixed | 34,85 | 20 | 1,74 | 1,0 | 1 | 0,75 | 0,75 | 0,98 | 0,98 |
| 2.1 | Bathyal rock | 5,67 | 20 | 0,28 | 0,28 | 0,75 | 0,75 | 0,75 | 0,12 | 0,12 |
| 2.1 | Bathyal coarse | 87,52 | 20 | 4,38 | 1,0 | 1 | 1 | 0,75 | 3,28 | 1,0 |
| 2.1 | Bathyal sand | 36,46 | 20 | 1,82 | 1,0 | 1 | 1 | 0,75 | 1,37 | 1,0 |
| 2.1 | Bathyal mud | 14,19 | 20 | 0,71 | 0,71 | 1 | 0,75 | 0,75 | 0,40 | 0,4 |
| 2.1 | Bathyal mixed | 0,94 | 20 | 0,05 | 0,05 | 1 | 1 | 0,75 | 0,04 | 0,04 |
| 2.1 | Abyssal coarse | 48,77 | 20 | 2,44 | 1,0 | 1 | 1 | 0,75 | 1,83 | 1,0 |
| 2.1 | Abyssal sand | 42,39 | 20 | 2,12 | 1,0 | 1 | 1 | 0,75 | 1,59 | 1,0 |
| 2.1 | Abyssal mud | 5,16 | 20 | 0,26 | 0,26 | 1 | 1 | 0,75 | 0,19 | 0,19 |
| **Average criterion** | | | | **1,82** | **0,86** | | | | **1,19** | **0,77** |

We did not test other options to weight indicators. Weighting of indicators could also be carried out by area, functional importance or by conservation priority. In an area-based weighting, more weight would be

given to those benthic broad-scale habitats which have larger area in the assessment area and, thus, would be the predominant features of the region. However, this approach would not have much scientific support as it is not only the dominance of a habitat but its functions that have the positive significance on the marine environment. In the weighing by functional importance, the focus would be on giving more weight for those broad-scale habitats which support higher quantities of marine biodiversity and food web than other broad-scale habitats. The challenge of this approach lies in the availability of exhaustive knowledge on the functional importance of the broad-scale habitats and it may be more relevant to assess this for more detailed habitat types. In the weighting by conservation priority, one can give more weight to those indicators which potentially contain conservation features of high priority. The latter approach is feasible and may provide important messages for further development of the MPA network.

## 6.3 Semi-quantitative scorecard approach

An alternative, or possibly supplementary, approach to the quantitative scorecard approach illustrated in table 6.1 is one which provides a more qualitative illustration of assessment outputs, but still considers underlying confidence in each assessment routine, input data and target values. Although this approach does not attempt to aggregate or weight assessment outputs to result in an overall score, it does provide a more accessible means of taking action based on the results of an assessment and therefore potentially provides a more valuable means by which decision-makers can take appropriate action to further develop MPA networks.

In table 6.2, each overall network principle and associated individual criteria assessment results are reported with a brief comment to help contextualise the outcomes of each assessment. Concerning the example listed for representativity in table 6.2 below, the overall assessment result per criteria (where aggregating outputs of indicator is required e.g. coverage of MPAs in the nearshore, territorial and offshore waters within a given EU Region) could be based broadly on the following routine:

- 'Target Reached' – All criteria are considered to be reached;
- 'Moving towards target' – The majority (50% or in excess of 50%) of criteria are considered to reach their threshold value;
- 'Not moving towards target' – The majority (less than 50%) of criteria are not considered to have reached their threshold value.

One aspect of this approach which would need further discussion in the appropriate fora is the percentage threshold used to define the boundary between the"moving towards target" and "not moving towards target" class. In the above mentioned example we have chosen the 50% of criteria as the threshold point. However, a more conservative approach (*i.e.* 75% , 90% etc.) would lead to an overall stricter evaluation of distance to target and thereby influence the overall semi-quantitative scoring.

Importantly, at the end of each of the criteria rows, confidence is scored based on underlying input data, principle targets and methodology undertaken to generate the assessment output with corresponding comments provided for each. This is important to aid future developments and aspirations for improving the EU-level assessment framework.

It is not felt appropriate to further aggregate the overall criteria assessment results into an overall score using the semi-quantitative approach outlined in table 6.2. Instead, an overall summary statement is proposed as a means to capture the outcomes of the overall principle assessment.

**Table 6.2 Example of semi-quantitative summary statistics of an MPA network assessment for the western Mediterranean alongside underlying confidence.**

| TIER 1 REPRESENTATIVITY & ADEQUACY– percentage coverage of MPAs and seabottom habitat types | | Assessment Result | Comments |
|---|---|---|---|
| **EU Region** | | **Target Reached** | Percentage cover of MPAs in the EU Region far exceeds the 10% threshold value standing at 23%. |
| **Nearshore, territorial and offshore waters** | | **Target Reached** | Percentage cover of MPAs in the nearshore, territorial and offshore waters areas exceeds the 10% threshold value in all cases, with a greater proportion in the nearshore and terrestrial waters areas by comparison to offshore waters. |
| **Biological depth zones** | | **Moving towards target** | MPAs exceed the 10% threshold in all zones except the abyssal. |
| **Revised broad habitats** | | **Moving towards target** | Most revised broad habitats reach MPA coverage target (n=15) attainment with the exception of 3 bathyal and 1 abyssal habitat |
| **CONFIDENCE** | Underlying data | **High-moderate** | High-moderate confidence in input sediment data but poor resolution for hard bottoms and biological zone boundaries. |
| | Target | **Low** | 10% target based on a political, rather than scientific grounds.<br>20% target based on Natura 2000 approach for seabottom habitat types, does not contain considerations of likelihood of features of conservation interest. |
| | Methodology | **Moderate** | MPAs are not screened for existence of management plans and management effectiveness.<br>MPAs do not necessarily protect the occurrence of seabottom habitat types where they interesect with MPA boundaries. |

**SUMMARY:** Although the overall distribution of MPAs in the Western Mediterranean appears to be close to the targets of each criterion, the degree of confidence lying behind the targets and methodology is low and this undermines the overall confidence of the assessment results.

# 7 Recommendations

The work presented in this report considers the development of a proposed methodological framework for the assessment of EU MPA networks (sections 2 & 4), reviews the available datasets which are available to support an EU-level MPA assessment (section 3) and considers how such an assessment might be undertaken and presented (sections 5 & 6). The outcomes of running the proposed methodology have provided an overall analysis of the networks with respect to common comparable elements. The assessment exercise has provided different assessment scenarios that provide room for debate on the status of the networks when more than one conservation objective is considered. The caveats behind the available data and approaches have also revealed several recommendations that are important to consider in moving forward with an EU-level MPA network assessment:

- **Clarifying the requirements of EU level policy drivers in considering MPA network assessments** – As identified in Section 1.2, MPA networks are mentioned under Article 13.4 of the MSFD, the EU Biodiversity Strategy and sufficiency of European marine N2K Sites are considered in the context of the EC Birds and Habitats Directives. A piece of work is required, in coordination with the European Commission, to help define, to a finer level of detail, the different requirements of MPA network reported information in fulfilling the requirements of each of these EU-level policy drivers.
- **Including biology in the consideration of seabottom habitat and species protection within EU MPA networks** – The current approach to using the revised broad habitats, though it contains biological zone and substrate attributes that provide for a general ecological differentiation, considers the physical characteristics of seabottom habitat types across EU Regions and not associated biological communities. Even so, in some portions of the assessed subregions there are large substrate data gaps or coarse substrate data quality. It is very clear that the baseline spatial data against which the MPA networks are currently assessed has large gaps as far as data quality and biology are concerned. This report recommends the further expansion of pan-European spatial mapping efforts that would allow more ecologically meaningful assessments to be undertaken in the future. More specifically this should focus on:
  - Improved and completed spatial coverage of basic physical parameters necessary to model broad scale seabed habitats
  - EUNIS Level 4 habitats across EU waters
  - Species (particularly those of conservation / management importance for which MPAs are usually established) distribution maps which are currently missing from the proposed assessment. Future efforts centered on aligning MS MSFD reporting obligations in terms of spatial data on species distribution (according to functional groups) would allow to assess the network for this aspect.
- **Moving towards assessing protection, not just spatial overlap** – The approach to assessing the proportion of seabottom habitats within with MPAs in sections 4 and 5 of this report examines spatial overlap and not actual protection (albeit removal of MPAs from the analysis considered to afford protection to species only does infer a slight increase in the confidence of the assessment outputs). Improved reporting on MPAs across the different databases indicating the conservation and protection objectives as well as the protection effectiveness would allow to assess in finer detail the actual attainment of target protection.
- **Further definition of the scope for replication of revised broad habitats** – Regional Sea Convention replication assessments rely on the measurement of the degree of replication of biological features with respect to regional ecoregions or subregions. Coordination with RSC conventions to define the comparability of regional ecoregions with respect to replication assessments of revised broad habitats would allow to improve the future replication assessment of broad habitats at a finer geographic scale thereby providing better insight into the distance to target for this criterion.
- **Moving towards network connectivity, rather than proximity** – The approach put forward in this report, as well as all three Regional Sea Conventions, have resorted to the use of proximity analysis to make inferences about the degree to which MPA networks are well connected. In an ideal world, specific information about species larval phases and dispersal patterns, in combination with data-

rich oceanographic models, would be combined to develop a clearer picture of the potential interchange of biological diversity between MPAs. There are several good examples of this at a sub-regional level (e.g. from a study in the Kattegat) from which to draw on and it is recommended that significant effort goes into further development and collation of such models and life histories information into the future at an EU-wide level. This is an EU-level recommendation also put forward by Olsen *et al.,* (2013) in their review of science needs for MPA networks across Europe.

- **Further exploration of appropriate criteria under the network principles of 'adequacy' and 'management**' – Regional Sea Conventions differ greatly in their assessment of adequacy and management as part of MPA network assessments – although all three Regional Sea Conventions consider these principles to be an important component of overall network coherence. Whilst this report proposes the use of 'exploratory' work involving MPA size classes and reporting on management plan existence as proxies under these two principles, we would recommend that a consistent approach to generating and reporting information pertaining to MPA management be considered for roll out across all EU MPAs (potentially taking inspiration from approaches being used across the North-east Atlantic and Mediterranean Regional Sea Conventions). We would also recommend that adequacy assessment details be further discussed with respect to the possibility of introducing a more site-based conservation requirement approach as has been advocated by some RSCs. More specifically this could entail a framework that maintains the proposed size target classes, in line with RSC prerogatives, but that assesses the MPAs' adequacy with respect to the requirements of the biological features contained within each MPA. In order to pursue this line, information on biological features contained in each MPA should be made available through a harmonised data reporting mechanism spanning across all considered EU MPAs. Crosswalking of the adequacy requirements of the principal regional sea biological features (*i.e.* protected species, functional species, habitats of conservation interest, etc.) with respect to the proposed adequacy target classes could be optimally carried out within the framework of the pertinent RSC fora.
- **Streamlining the availability of spatial and tabular data on EU MPAs** – The N2K, CDDA and Regional Sea Convention databases are all proposed for use as source data for information on EU MPAs within this report. The Tier 3 assessments have evidenced the importance of evaluating certain MPA characteristics in order for the assessments to be more complete and credible and they have also highlighted how not all MPA databases provide the necessary information. Ideally, there would be a data flow process developed centrally within the EU that draws in an automated way necessary attribute data into a centralised EU MPA database from which such MPA assessments can draw from into the future. Given that this may represent a too ambitious goal in the medium term, efforts should be made to harmonise MPA database reporting so that all the databases report comparable information required for the exhaustive conduction of an MPA assessment. This should include, amongst others aspects: standardised tabular and spatial data with QA/QC procedures, the objectives of MPA establishment, the protected features of each MPA,the year the MPA was designated; the existence of management plans and information on progress towards implementing appropriate management, monitoring and assessment of conservation status (see also recommendation around management above), MPA size (in a standard unit of area measurement) and a list of MSFD Broad Habitats and EUNIS Level 3 habitat classes considered to cross-walk to protected features (as per the recommendation above).
- **Generating a centralised database of 'other area-based measures' as well as EU MPAs** – Both the CBD and MSFD infer that not just MPAs in their strictest definition can be considered to contribute to EU MPA networks. Effort should be invested in developing a common definition of 'other area-based measures' in an EU context and a centralised database produced of such areas, the features they are considered to protect, and the likelihood of persistence of management that affords protection to said features. This will enable such areas to be built into further assessments in the future.

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# Annex 1

**Selection procedure to convert EMODnet seabed habitats in the revised broad scale habitat**

The following selection procedure was set up for selecting the revised Broad habitats from the EMODnet habitat delivery. These will be used for running the representativity (Tier 1 and 3) and connectivity (Tier 2) assessments.

The EMODnet seabed habitat delivery was expected for the end of September but it was made available at the end of October in its final revised version. Since ISPRA is a partner of the project a working version limited to the Mediterranean Sea was made available with the objective to study the layer structure. This allowed to start writing the procedures needed both for the estimation of representativity of each broad habitat types by sub-region and both for the proximity scenarios.

A procedure was written to use the original EMODnet seabed habitat delivery according to the consideration described in par. 3.4. This procedure works in ArcGIS using a sequence of commands managed by a specifically designed python script, the main steps are the following:

- Selection and subsequent removal of all the habitat modeled as “Uncertain” or ”Unknown”
- Addition of text fields which will contain the broad habitat types, "BROADHAB"(containing the abbreviation code for a specific revides broad habitat) and "BROADHAB_DESC" (complete revised broad habitat description);
- Calculation of these fields, based on the information stored in the original EMODnet seabed layer on biozone and substrate, using the following procedure;

```
fieldName1 = "BIOZONE_MOD"
  fieldName2 = "BROADHAB"
  fieldName3 = "BROADHAB_DESC"

  expression1 = "Reclass(!BIOZONE!)"
  expression2 = "hab(!BIOZONE_MOD!,!Substrate!)"
  expression4 = "hab(!BIOZONE_MOD!,!ORIG_HAB!)"

  codeblock1 = """def Reclass(Bioz):
    if (Bioz == 'Infralittoral'):
      a = "Infralittoral"
    elif (Bioz =='Circalittoral'):
      a = "Circalittoral"
    elif ('circalittoral' in Bioz):
      a = "Circalittoral"
    elif ('bathyal' in Bioz):
      a = "Bathyal"
    else:
      a = "Abyssal"
    return a """


  codeblock2 = """def hab(bio, sub):
    if bio == "Infralittoral":
      a = "Infr_"
    elif bio ==  "Circalittoral":
      a = "Circ_"
    elif bio ==  "Bathyal":
```

```
        a = "Bath_"
    else:
        a = "Abys_"
    if ('Coarse' in sub):
        b = "Coar"
    elif ('Cymodocea' in sub):
        b = "Cym"
    elif ('Posidonia' in sub):
        b = "Pos"
    elif sub == 'Fine mud':
        b = "Mud"
    elif sub == 'Mixed sediment':
        b = "Mix"
    elif sub == "Mud to muddy sand":
        b = "Mud"
    elif sub == "Rock or other hard substrata":
        b = "Rock"
    elif sub == "Sand":
        b = "Sand"
    else:
        b = "Mud"
    return "{0}{1}".format(a,b)"""

codeblock3 = """def hab(bio, sub):
    if bio == "Infralittoral":
        a = "Infralittoral"
    elif bio ==  "Circalittoral":
        a = "Circalittoral"
    elif bio ==  "Bathyal":
        a = "Bathyal"
    else:
        a = "Abyssal"
    if ('Coarse' in sub):
        b = "Coarse sediment"
    elif ('Posidonia' in sub):
        b = "Posidonia"
    elif sub == 'Fine mud':
        b = "Mud"
    elif sub == 'Mixed sediment':
        b = "Mixed sediment"
    elif sub == "Mud to muddy sand":
        b = "Mud"
    elif sub == "Rock or other hard substrata":
        b = "Rock"
    elif sub == "Sand":
        b = "Sand"
    elif sub == "Sandy mud to muddy sand":
        b = "Mud"
    else:
        b = "Cymodocea"
    return "{0} {1}".format(a,b)"""
```

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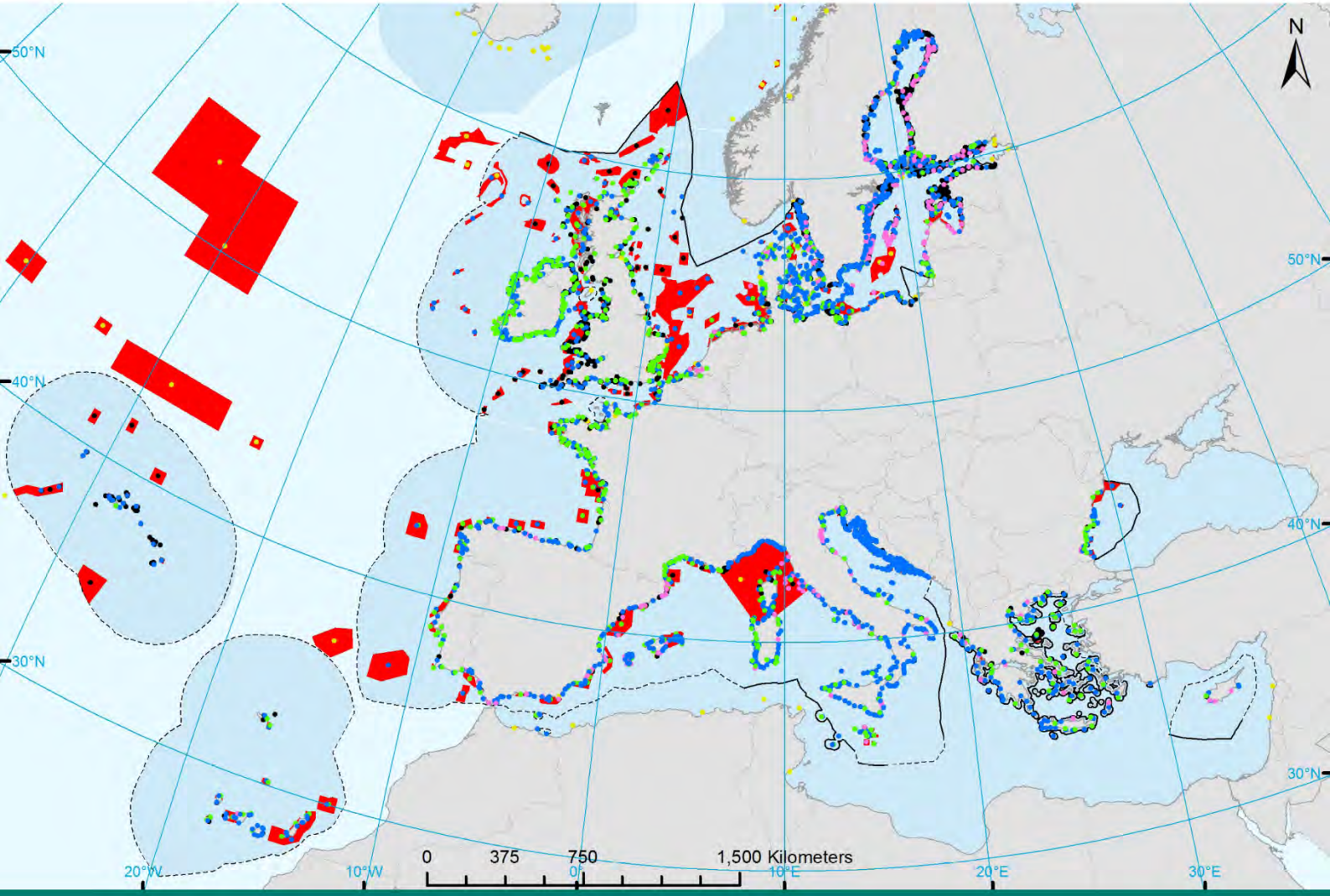
**European Environment Agency**
**European Topic Centre on Inland, Coastal and Marine Waters**

ETC/ICM Technical Report 4/2017

# Spatial Analysis of Marine Protected Area Networks in Europe's Seas II, Volume A, 2017

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**European Environment Agency**
**European Topic Centre on Inland, Coastal and Marine Waters**

**Cover picture**: Map 3.4 'Distribution of MPA networks in MPA assessment areas of the European regional seas'

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## Contents

## List of maps, figures and tables

## List of Acronyms

| | |
|---|---|
| CDDA | Common Database on Designated Areas |
| EEA | European Environment Agency |
| EEZ | Economic Exclusive Zone established under UNCLOS framework |
| EPZ | Ecologic Protection Zone established under UNCOS framework |
| ETC/ICM | European Topic Centre on Inland and Coastal Marine Waters |
| HELCOM | Baltic Marine Environment Protection Commission - Helsinki Commission |
| MPA | Marine Protected Area |
| MSFD | Marine Strategy Framework Directive |
| NDSs | National Designated Sites |
| N2K | Natura 2000 |
| OSPAR | Convention for the protection of the marine environment of the north-east Atlantic |
| RAC/SPA | Regional Activity Centre for Specially Protected Areas |
| RSC | Regional Sea Convention |
| SCI | Site of Community Importance |
| SPA | Special Protection Area |
| SPAMI | Specially Protected Area of Mediterranean Importance |

**Marine regions/sub-regions:**

| | |
|---|---|
| ADRI | Adriatic Sea |
| AELE | Aegean and Levantine Sea |
| BALT | Baltic Sea |
| BBIC | Bay of Biscay and Iberian Coast |
| BLAC | Black Sea |
| CELT | Celtic Sea |
| GNKE | Greater North Sea, incl. the Kattegat and the English Channel |
| ICME | Ionian and Central Mediterranean Sea |
| MACA | Macaronesia |
| NEAO | North-East Atlantic Ocean |
| WMED | Western Mediterranean Sea |

# 1 Aims and scope of the report

This technical report presents an overview of the spatial distribution of marine protected areas (MPAs) in Europe's seas established as of 2016 (excluding overseas territories). It represents a rerun and advancement of the spatial statistics run by ETC/ICM on MPA reported data in 2012 (EEA 2015a) and as such provides insight on the observed changes in European MPAs established in the four years period 2013–2016.

ETC/ICM work on MPA assessments in recent years has provided groundwork of EEA MPA policy briefings (EEA, 2015b) and has underpinned the EEA's supporting role to the Commission on progress reporting on MPAs. More specifically ETC/ICM work in the past years focused on defining the methodology for defining EU MPAs based on the analysis of tabular and spatial data reported through EEA and RSC reporting fora which led to the generation of preliminary MPA spatial statistics (ETC/ICM 2015a). Recent ETC/ICM work proposed a pan-European methodology for assessing MPA network coherence consisting of different levels of assessment measuring the overall network against: a) single thresholds in order to describe the representativity of the network at different levels of detail and b) against more than one threshold in order to describe the network in terms of the regionally agreed principles of adequacy, connectivity and replication (ETC/ICM, 2017). This report represents ETC/ICM progression of work on the assessment of MPA networks consisting in the reiteration of updated statistics on MPAs based on improved assessment methodologies in order to describe the progress made on a European scale in the time period 2013–2016.

The report contains a detailed explanation of the methodology and datasets used and the reasoning for producing the spatial statistical analysis. The report therefore covers aspects concerning data handling issues experienced during the analysis with particular reference to methodological approaches used that differ from those used in the previous reported MPA statistics (EEA, 2015a).

The networks of MPAs taken into account in the analysis are those established under the framework of:

1. The EU Nature Directives, i.e. the Habitats and Birds Directives (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora; and Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds), recorded in the Natura 2000 (N2K) database.
2. National designations, i.e. nationally designated sites (NDSs) recorded in the Common Database on Designated Areas (CDDA).
3. The Regional Sea Conventions (RSCs) encompassing Europe's regional seas and containing EU waters.

It is important to note that the above MPA categories are rarely mutually exclusive (for example RSC sites often overlap directly with Natura 2000 sites). This has been accounted for in the results presented within this report.

It is important to note that the Regional Sea Conventions (RSCs) encompassing EU waters are the:

- Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention);
- Convention for the Protection of the Marine Environment of the North-east Atlantic (OSPAR Convention);
- Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean sea (Barcelona Convention)
- Convention on the Protection of the Black Sea against Pollution (Bucharest Convention)

As indicated by EEA (2015) the conservation of species and habitats through the establishment of MPAs is a common mandate shared by all four RSCs, however, at present only the first three conventions have defined a process through which Contracting Parties establish and report on MPAs of regional importance.

MPAs established under these three RSC frameworks are thus considered in the framework of the present analysis.

The MPA assessment area used for the purpose of the present report are based on the same assumptions illustrated in the EEA 2015 report whereby the marine extension considers the 200 nautical mile (NM) limit from the EU coastline or one of equidistance to neighbouring countries with the exception of the 6 NM limit considered for Greece. MPAs established by MS beyond these boundaries are not considered for the purpose of the present report.

Regional boundaries within the MPA assessment area have been harmonised with the biogeographic boundaries established under the Habitats Directive and the boundaries reported by EU Member States under the Marine Strategy Framework Directive (MSFD). Hence, the MPA assessment areas report the names of the regions and sub-regions referred to in MSFD reporting mechanisms.

# 2 Data sets and methodology

Chapter 2 contains information on the data sets and methodologies used to define the base shapefiles (MPA assessment areas divided according to regions and sub-regions and buffer distance belts) and the different MPA networks considered for the MPA analysis and reiteration of statistics of European MPAs. It also defines the data and methods used to define the surface area extension of marine waters of EU Member States, on the basis of data reported by EU Member States under the MSFD in 2013 and afterwards.

## 2.1 Data sets

Table 2.1 provides an overview of the datasets used to support the analysis. The baseline information analysed in the report is based on MPA data reported either at the end of 2016 (N2K data) or at the beginning of 2017 and made publicly available by mid-2017. All the datasets used for the analysis were set to the coordinate system LAEA 52N 10E – ETRS 89 (Lambert Azimuthal Equal Area as projection and European Terrestrial Reference System 1989 as geodetic reference system) in accordance with European guidelines (INSPIRE, 2014; EEA, 2008; Annoni et al., 2001) using version 10.1 of ArcGIS (ESRI inc.). The GIS analyses that were run in order to compile the statistical tables and for producing the maps were processed mainly using Python scripts.

**Table 2.1 GIS and tabular data sets used for the layout preparation and for the analysis**

| Description of data layer | Name of the database version | Version date /download | Source; Link to Source; Obtained from |
|---|---|---|---|
| **Assessment areas and units** | | | |
| European coastline shapefile | EEA_Coastline_20170228 | 28/02/2017 | EEA CWS; S:\Common workspace\Marine\MarineRegions_layer\MSFD_layers_for_publication_20170228.gdb |
| Boundaries of European Seas | Regional_seas_extended_version_20170228 | 28/02/2017 | EEA CWS; S:\Common workspace\Marine\MRU\Spatial_units.gdb |
| Marine Region | MarineRegions | 26/04/2017 | EEA; https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions |
| Marine Sub-regions | MarineSubregions | 26/04/2017 | EEA; https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions |
| Extension of Member State declared marine waters | MSFD_Marine_Subregions_Watercolumn_EEZ_20170228 | 28/02/2017 | EEA CWS; S:\Common workspace\Marine\MarineRegions_layer\MSFD_layers_not_published_20170228.gdb |
| Country terrestrial borders | CNTR_RG_100K_2010_XK (Country borders) | | GISCO(Geographical Information and maps) by Eurostat (European Commission); © EuroGeographics for the administrative boundaries; http://epp.eurostat.ec.europa.eu/portal/page/portal/gisco_Geographical_information_maps/popups/references/administrative_units_statistical_units_1 |
| Country terrestrial borders | CNTR_RG_01M_2010_XK (Country borders) | | GISCO (Geographical Information and maps) by Eurostat (European Commission); © EuroGeographics for the administrative boundaries; http://epp.eurostat.ec.europa.eu/portal/page/portal/gisco_Geographical_information_maps/popups/references/administrative_units_statistical_units_1 |
| EMODnet broadscale seabed habitat map for Europe (EUSeaMap) | R20170615_EUSeaMap2016.zip | 06. 15. 2017 | http://www.emodnet-seabedhabitats.eu/default.aspx?page=1953 |
| **Designation types** | | | |
| Natura 2000 tabular database | PublicNatura2000End2016.mdb | 06. 04. 2017 | EEA; http://www.eea.europa.eu/data-and-maps/data/natura-8 |
| Natura 2000 shapefile | Natura2000_end2016 | 06. 04. 2017 | EEA; https://www.eea.europa.eu/data-and-maps/data/natura-8#tab-gis-data |
| OSPAR Convention MPAs shapefile | ospar_polygon_wdpa_simplified.shp | July 2017 | Downloaded on request the version containing data up to 2016; http://carto.mpa.ospar.org/1/ospar.map |
| Helsinki Convention MPA (BSPA) shapefile | HELCOM_MPAs_2017_ETRS89_LAEA.shp | March 2017 | HELCOM; http://mpas.helcom.fi/apex/f?p=103:1 |
| Barcelona Convention MPA (SPAMI) shapefiles | SPAMIs_End2016_ETRS89_LAEA | January 2017 | RAC/SPA secretariat; www.rac-spa.org |
| CDDA tabular database | CDDA_v15.mdb | 09. 18. 2017 | EEA: https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12 |
| CDDA shapefile | CDDA_v15_Shapefile.zip | 09. 18. 2017 | https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-12#tab-gis-data |

## 2.2 Definition of MPA assessment areas

The spatial extent of the MPA assessment areas was defined as in EEA, 2015a. The spatial extent is considered as being the marine waters surrounding the EU countries whose outer limit is defined by the 200NM boundary from the coast (possibly coinciding with formally recognized EEZ or EPZ boundaries) or by the presence of a boundary defined by an agreed treaty. Since no formal boundary of this map exists, the boundary of the maritime area submitted by EU Members States under MSFD Articles 8, 9 and 10 to the

Eionet Central Data Repository (CDR) was considered a valid proxy and the decision was taken to use the latest MSFD Region/Sub-region boundary shapefile published by EEA in 2017[1]. It is to be remembered here that the delineation of the marine regions and sub-regions has been under development since 2010. It is based on multiple inputs from representatives from EU Member States participating in groups defined under the MSFD Common Implementation Strategy (CIS) as well as by the outputs of the reporting under the MSFD Initial Assessment and Marine Regions as well as ICES advice. The latest marine regions and sub-regions spatial layers were agreed by EU Member States in the MSFD Committee in November 2016 and have been through a Commission inter-service consultation with all DG's led by DG ENV (ETC/ICM, 2017). The boundaries between marine regions and sub-regions are, to the extent possible, harmonised with existing boundaries established under the Regional Sea Conventions, the biogeographic boundaries established under the Habitats Directive and the boundaries of marine waters reported by EU Member States under the MSFD. The inner boundary of all regions and sub-regions has used the "EEA coastline for analysis"[2]. These spatial layers allow us to define the offshore boundary of the MPA assessment areas and they represent the surface area that for the scope of this work is considered to be the EU portion of European seas. The above mentioned geographical boundaries indicate the limit between the marine regions (i.e. Baltic, North-east Atlantic Ocean, Mediterranean, Black Sea) and, where relevant, the sub-regions (i.e. in the Mediterranean sea: the Western Mediterranean, Ionian Sea and Central Mediterranean Sea, Adriatic Sea, Aegean-Levantine Sea) as interpreted within the implementation framework of the MSFD and more specifically with respect to the marine spatial areas for which EU Member States have claimed their commitment to define and guarantee GES. The **MPA assessment areas** reported in the spatial statistics report are therefore referred to throughout the report based on the names of the different **marine regions/sub-regions in which they lie**.

The MPA regional assessment areas do not include the extended continental shelf beyond 200 NM where some MS have advanced seabed/subsoil claims. It also does not extend beyond the 6NM territorial water extension claimed by Greece. Readers should therefore be aware that the report does not contain information on MPAs lying in areas beyond national jurisdiction (ABNJs). In so doing the report informs on the protection effort offered by MPA establishment in marine waters where MSs exercise full rights over the management of activities conducted in the water column and subsoil, in other words areas where eco-systemic management is feasible. The maps and tables provided in this report and resulting from the evaluation of the available datasets are not intended to influence or question any ongoing negotiations occurring in UNCLOS or jurisdictional issues regarding maritime boundaries pertaining to EU Member States or to non-EU countries.

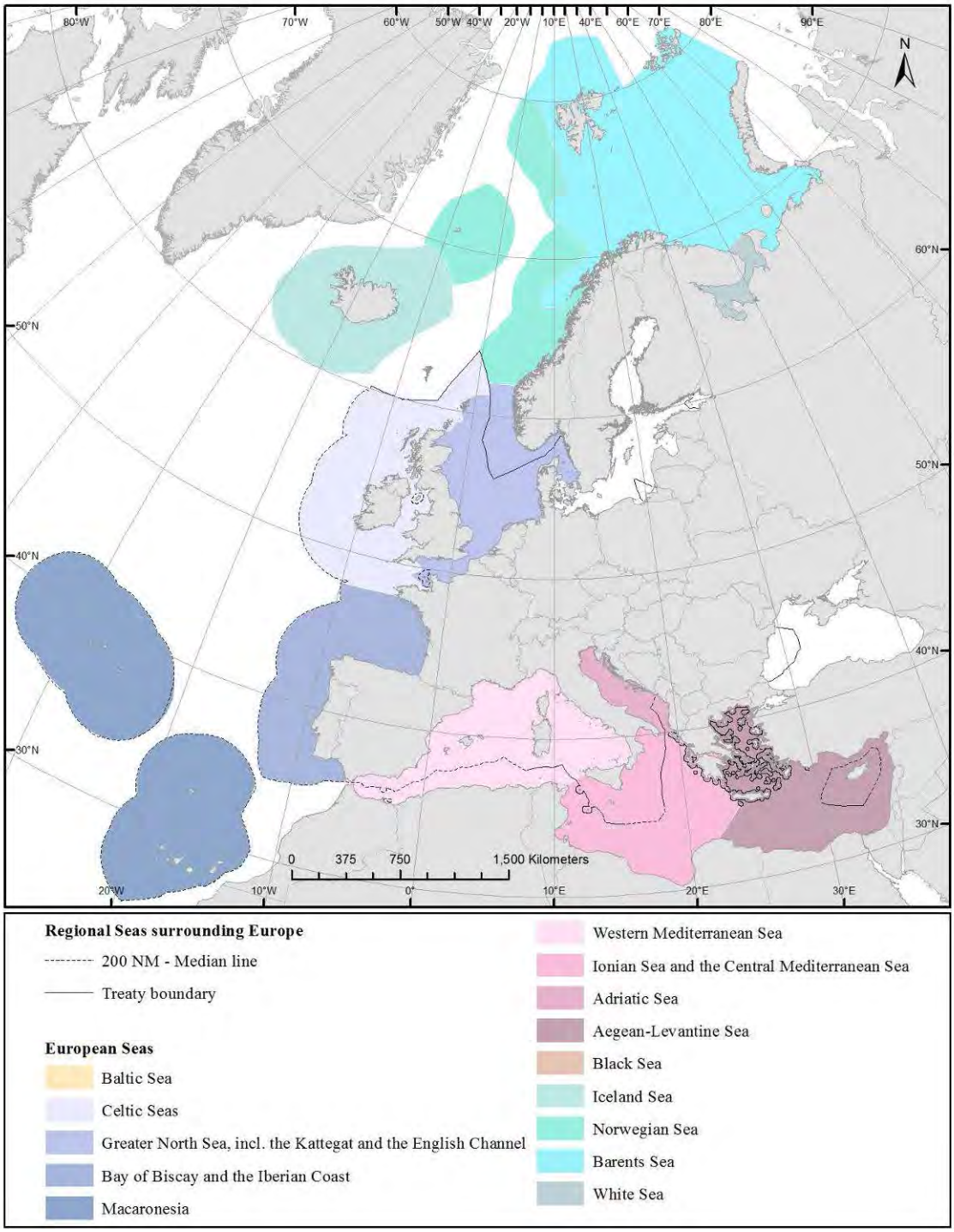
Map 2.1 illustrates the extent of European seas extending between the coasts of EU and third countries, and the MPA assessment areas as defined according to the above mentioned regional/sub-regional boundaries. It is to be noted that the boundaries used in this report only reflect assessment boundaries and do not represent the official maritime boundaries of EU Member States.

For the sake of clearer reading, MSFD regions and sub-regions are reported, where necessary, in the tables and text with the following acronyms: Adriatic (ADRI), Aegean-Levantine Sea (AELE), Baltic Sea (BALT), Bay of Biscay and the Iberian Coast (BBIC), Black Sea (BLAC), Celtic Sea (CELT), Greater North Sea, Kattegat and the English Channel (GNKE), Ionian and Central Mediterranean Sea (ICME), Macaronesia (MACA), Western Mediterranean Sea (WMED).

[1] The spatial data is publicly accessible on the following link: https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions-1/#tab-gis-data

[2] Available at https://www.eea.europa.eu/data-and-maps/data/msfd-regions-and-subregions

**Map. 2.1 EEA MPA assessment area delimited by the Regional Seas surrounding Europe and identified according to the European Seas region**




## 2.3 Creation of buffer zones and correction of the coastline

The most recent version of the EEA coastline, published at a scale of 1:100 000, was overlaid on the MPA assessment area (MSFD sub-region shapefile using the same methodology as described in EEA 2015 in order to generate buffer distance belts (hereafter referred to as buffer zones) of the following sizes for each marine region/sub-region:

a) 0–1NM
b) 1–12 NM
c) 12 NM to the end of the MPA assessment zone

In order to facilitate reading these buffer zones will be hereon individually referred to, respectively, with the terms: nearshore, territorial and offshore. The buffer zones are constructed in order to describe the pattern of protection effort exerted from a nearshore to offshore perspective.

The differences in delineation between the 2013 coastline (used in the EEA 2015 assessment) and the latest (2017) coastline layer have been introduced only by three countries (Sweden, Finland and Greece). In Sweden, the delineation involved the replacement of more than 1500 $km^2$ of previously coastal areas, extending west of Stockholm, with terrestrial areas. In Finland and Greece the changes are rather marginal and in total do not exceed 1 $km^2$.

## 2.4 Calculation of reference surface area values

The total surface area (in square kilometers) of the MPA assessment areas, regions and sub-regions (EU section of sea in Table 2.2 below) was calculated so as to inform on their extent with respect to the broader extension of the European regional seas. The surface area extent of the nearshore, territorial and offshore zones are also reported. These figures are used in order to exact the proportion of sea area occupied by MPAs. It should be noted that some of the EU regional sea areas are different to those documented in the 2012 MPA statistics (EEA, 2015a) due to the use of a more updated EEA coastline and the redefinition of some of the MSFD sub-region boundaries. Results of the spatial extents of each marine component are listed in Table 2.2. Names of regions are indicated with cells in light grey background and bold type and sub-regions are indicated with cells in white background and normal text.

**Table 2.2 Surface area ($km^2$) of marine regions and sub-regions, EU section of the sea and area of near shore (0–1 nautical mile), territorial (1–12 nautical miles) and offshore (beyond 12 nautical miles to the edge of EU waters)**

| European Regional Seas and sub-regions (*sensu* MSFD) | Sea surface area ($km^2$) | EU part of sea ($km^2$) | Near shore zone | Territorial zone | Offshore zone |
|---|---|---|---|---|---|
| **Baltic Sea** | 392,215 | 368,720 | 51,028 | 151,441 | 166,250 |
| **North East Atlantic Ocean (NOEA)** | 7,929,712 | 4,082,719 | 57,529 | 352,942 | 3,672,248 |
| Celtic Sea[(a)] | 934,873 | 930,900 | 26,063 | 131,624 | 773,225 |
| Greater North Sea incl. Kattegat & English Channel | 654,179 | 491,305 | 19,053 | 101,288 | 370,965 |
| Bay of Biscay and the Iberian Coast | 803,350 | 803,350 | 8,425 | 57,553 | 737,359 |
| Macaronesia | 1,857,164 | 1,857,164 | 3,989 | 62,477 | 1,790,698 |
| **Mediterranean** | 2,516,652 | 1,274,892 | 55,470 | 341,921 | 877,501 |
| Western Mediterranean | 846,003 | 659,989 | 15,691 | 145,904 | 498,396 |
| Ionian Sea and Central Mediterranean Sea | 773,032 | 240,068 | 8,317 | 49,768 | 181,981 |
| Adriatic Sea | 139,784 | 120,069 | 10,466 | 48,505 | 61,098 |
| Aegean-Levantine Sea | 757,833 | 190,382 | 19,722 | 87,923 | 82,736 |
| **Black Sea** | 473,894 | 64,384 | 1,274 | 9,821 | 53,290 |
| **Total** | **11,312,472** | **5,790,715** | **165,301** | **856,125** | **4,769,289** |

[(a)] Celtic Seas – overlapping submissions of 148 994 $km^2$ to UNCLOS from UK and Kingdom of Denmark (not included in the sea surface area calculation above)

Calculation of country marine waters per buffer zone was carried out using the same methodology as described in EEA, 2015, with the exception that the shapefile relating to country borders prepared in 2017 by ICES under ETC/ICM work program 1.6.1.a was used for the purpose of this report.

## 2.5 Preparation of the shapefiles belonging to the different networks

The methodology and the procedure used for selecting the marine N2K sites from the 2016 tabular and spatial data, and the Regional Sea conventions MPA shapefiles are the same as those outlined under Section 2.6 of the EEA, 2015 report with the exception that the databases used are the updated ones indicated in table 2.1.

The selection of CDDA marine sites used for the purpose of the present report differs from that used in the previous EEA spatial statistics (EEA, 2015a). In the latter report the marine CDDA sites were selected by querying the CDDA spatial database on the basis of the 5% ex-Barometer rule which entailed considering those marine sites that lay within the MPA assessment area so long as no more than 5% of their surface area lay on land. At the time, there was no CDDA data field providing information on site general environmental characteristics and marine sites could only be approximated using this spatial selection procedure. However, as of 2015, the modifications introduced to the tabular reported data allow Member States to indicate the presence of marine areas present within a given site. The CDDA tabular database was therefore screened in order to filter marine sites on the basis of the site's declared ecosystem typology (marine, terrestrial or both). Sites flagged as having "marine" or "both" were considered as marine and the resulting selection was then joined to the spatial database using the "sitecode" field. The MPA assessment areas layer was used to select only those sites falling within the region/sub-region MPA assessment area.

It is important to note that a test comparison was run on the CDDA_end 2015 to evaluate the amount of discrepancy obtained, in terms of the number of marine sites and surface area, between the spatial selection procedure based on the ex-Barometer 5% rule versus the above mentioned tabular selection. The results of this comparison indicated that the 5% rule selection did not select the entire set of truly marine sites and 45% of the selected sites were not truly marine. However, despite this bias in the number of sites erroneously interpreted as marine, the surface area overestimation of marine sites introduced by the past methodology is minimal (only 5.8% of the area considered in the 2012 selection procedure belongs to sites that are not marine) and as such the introduction of a new and more accurate selection procedure is not expected to interfere with the detection of trends of newly established marine CDDA sites in the period 2013–2016.

## 2.6 Extraction and calculation of statistical information from MPA databases

The spatial statistics were carried out in ArcGIS; the procedures were automated by a series procedure developed in Python language. The basis of the analysis is the same of that defined for the analysis based on the 2012 data set, however the scripts were readjusted when needed.

The estimated and extracted statistical information from the spatial databases were the number of sites and total surface area, which allow us to estimate coverage. All parameters were extracted and reported according to each buffer zone and biological zones per marine region/sub-region.

The reasoning behind the analysis is the same of that developed and described in previous documents (EEA, 2015a and ETC/ICM, 2017) however, it is worthwhile emphasizing the following aspects:

- Counts of the total number or total area of sites per distance belt from the coast or biological zone refer to any site or part of any given site lying within a distance belt from the coast or biological zone. The grand total in each zone may therefore contain sites whose extension spans across more than one zone.
- The total area coverage (in $km^2$) accurately represents the spatial extent of a network, considering the areas of overlap between overlapping sites as a unique value, so as to prevent duplication of surface area counts for such areas.
- The percentage of surface area is calculated with respect to the surface area measurement of the MPA assessment area region/sub-region provided in Table 2.2.

- The representativity of the overall MPA network is described by measuring the network's capacity to reach:
  - the 10% Aichi target 11 at regional/sub-regional, buffer zone, and biological zone levels
  - the 20/60% target at the revised broad habitats level (as defined in ETC/ICM 2017)
  - The percentage of protected coverage increase of the biological depth zone and revised broad habitats is visualized in the tables using the following thresholds: >4% increase ☺; increase between 0 and 4 % 😐; no increase observed, ☹

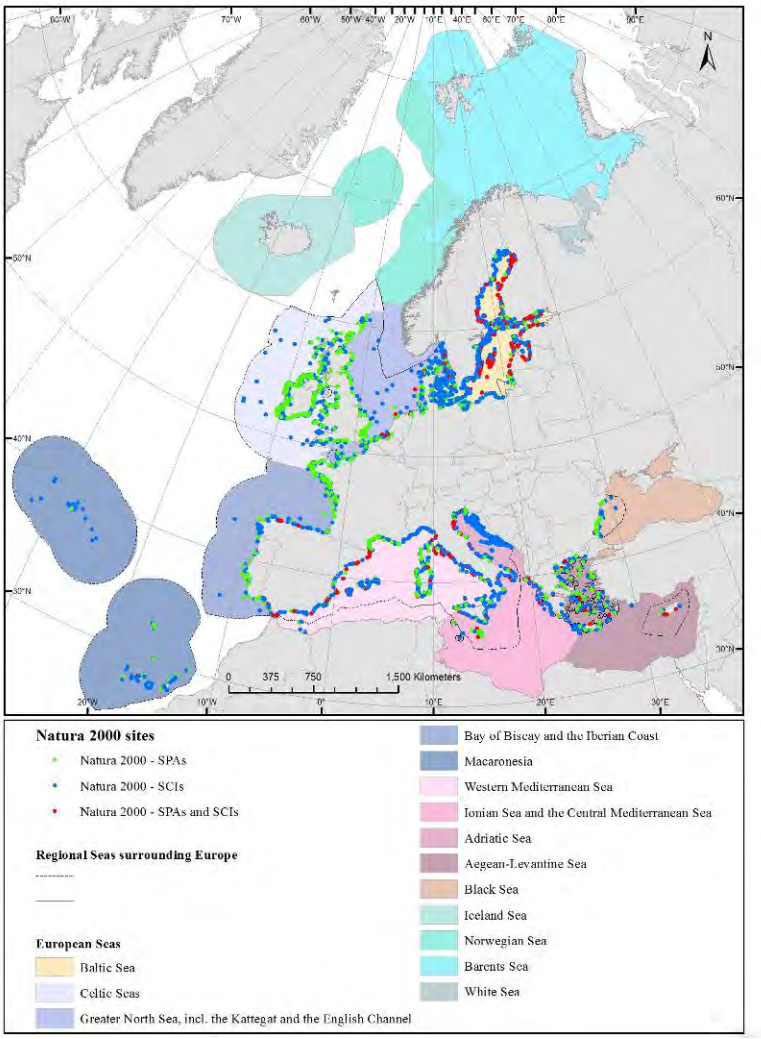
# 3 Results

In this section of the report, we present the percentage and surface area coverage of MPA networks across EU regions for Natura 2000 sites, Regional Sea Convention Sites and National designations individually and collectively – presenting information in each case on percentage and surface area coverage of MPAs across buffer zones from the coast, biological depth zones and considering the coverage of revised broad habitats.

## 3.1 Natura 2000 network

The overall distribution of marine N2K sites throughout Europe is represented in Map 3.1. Sites are graphically reported as SCIs, SPAs and SCIs combined with SPAs (typology C).

**Map 3.1 Natura 2000 areas (SCIs and SPAs) in European marine regions**




An overview of the total number, area coverage and percentage cover of marine Natura 2000 sites per MPA region/sub-region is presented in Table 3.1 together with number and area of SCIs and SPAs and their percentage area overlap.

The total number refers to the spatially distinct sites present in a given area, so as to avoid duplicating the count of sites that lie exactly over one another (as in the case of site category C, which represents an SCI and an SPA overlapping exactly). The total number of SCIs and SPAs refers to the site polygons defined by the selection procedure as marine SCIs or as marine SPAs; the sum of these two will therefore always be bigger than the total number of N2K sites indicated in the first column of the table for any given region/sub-region.

The total area coverage (in square kilometers) represents the actual spatial extent of both networks combined (SPAs and SCIs), considering the areas of overlap between SPAs and SCIs as a unique value, in order to prevent duplication of surface area counts for such areas. The total area of the respective SCIs and of the SPAs was obtained by measuring the extent of any polygon with SCI or SPA attributes, regardless of whether a polygon overlapped a polygon belonging to another category. Because of this, the sum of the total area of SCIs and that of SPAs is always bigger than the calculated total area covered by the N2K network. The percentage of overlap is obtained by calculating the surface area overlap of SCIs and SPAs with the respect to the total coverage of the N2K network.

The values indicated in italic and bold text in Table 3.1 indicate 2016 values that are equal or lower than those reported in the previous spatial statistics report (EEA, 2015a) referring to the 2012 reported data. The number of increased or decreased sites with respect to the 2012 reported data is reported with a +/- sign in the column adjacent to the total number of sites reported for in 2016. The lower number of SCIs and SPAs in the Greater North Sea, including the Kattegat and the English Channel region reported for in 2016 is due to the revised MSFD boundary definition of this sub-region which has led to a reduction in the extension of the GNKE sub-region. The observed lower number of sites in the Aegean and Levantine Sea sub-region instead is more likely due to two reasons: an improvement in the tabular and spatial data records reported and an improved EEA coastline. In fact, corrections introduced to the tabular reports of marine features or a more accurate coastline can lead to lower marine site counts that could account for this discrepancy. Despite the lower values in site counts in both these regions, it is to be noted that the percentage surface area coverage is nevertheless higher in 2016 than that reported in 2012 for GNKE. This can be interpreted as a result of the establishment of new sites as well as the overall regional change in size which can account for a higher overall proportion coverage. The lower percentage of overlap between SCIs and SPAs observed in most regions/sub-regions instead can be attributed to the increase in spatial designation of sites that do not share SCI and SPA designation areas.

**Table 3.1 Total number, surface area, percentage cover, increases and percentage overlap of marine N2K sites (SCIs, SPAs) in European marine regions**

| MPA assessment area regions/sub-regions | Total n° of N2K sites | Trend Total n° of N2K sites | N° of SCIs | N° of SPAs | Area covered by N2K (Km²) | % covered by N2K | % increase since 2012 | Area of SCIs (Km²) | Area of SPAs (Km²) | % of over-lap |
|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 856 | +86 | 739 | 303 | 56,039 | 15 | 2.9 | 45,323 | 48,161 | **66.8** |
| **North East Atlantic Ocean** | 1,082 | +77 | 691 | 432 | 290,172 | 7 | 3.4 | 245,329 | 110,785 | ***20.5*** |
| Celtic Sea | 443 | +70 | 269 | 174 | 70,127 | 8 | 3.7 | 67,085 | 11,020 | ***2.4*** |
| Greater North Sea incl. Kattegat & English Channel | ***381*** | ***-20*** | ***250*** | ***159*** | 114,122 | 23 | 5.6 | 101,672 | 43,763 | ***27.4*** |
| Bay of Biscay and the Iberian Coast | 201 | +18 | 127 | 86 | 78,685 | 10 | 6.6 | 53,801 | 44,300 | ***24.7*** |
| Macaronesia | 69 | +11 | 52 | 18 | 27,238 | 1 | 1.4 | 22,771 | 11,701 | ***26.6*** |
| **Mediterranean** | 1,169 | +314 | 984 | 299 | 62,941 | 5 | 2.5 | 39,471 | 41,553 | ***28.7*** |
| Western Mediterranean | 524 | +34 | 424 | 174 | 44,926 | 7 | 3.8 | 24,516 | 33,970 | ***30.2*** |
| Ionian Sea and Central Mediterranean Sea | 155 | +6 | 133 | 35 | 6,667 | 3 | 1.4 | 4,480 | 4,186 | ***30.0*** |
| Adriatic Sea | 361 | +281 | 336 | 42 | 6,531 | 5 | 4.1 | 6,050 | 2,103 | ***24.8*** |
| Aegean-Levantine Sea | ***137*** | ***-7*** | ***96*** | ***51*** | ***4,818*** | 3 | 0.0 | ***4,424*** | ***1,293*** | ***18.7*** |
| **Black Sea** | 44 | +4 | 29 | 18 | 9,156 | 14 | 9.7 | 8,636 | 2,183 | ***18.2*** |
| **Total** | 3,149 | +482 | 2,441 | 1051 | 418,308 | 7 | 3.2 | 338,759 | 202,682 | ***27.9*** |

Table 3.1 indicates that:

- **The overall N2K coverage across European seas has almost doubled from the 4% coverage observed in 2012 to 7% coverage by the end of 2016.**
- **The highest increase in terms of numbers of N2K sites is in the Mediterranean region and Adriatic sub-region.**
- **The highest increase in terms of percentage coverage of N2K sites has been within the Black Sea, which now has 14% N2K site percentage coverage.**
- **The only region/sub-region with no additional N2K site designations between 2012 and 2016 has been within the Aegean-Levantine Sea.**

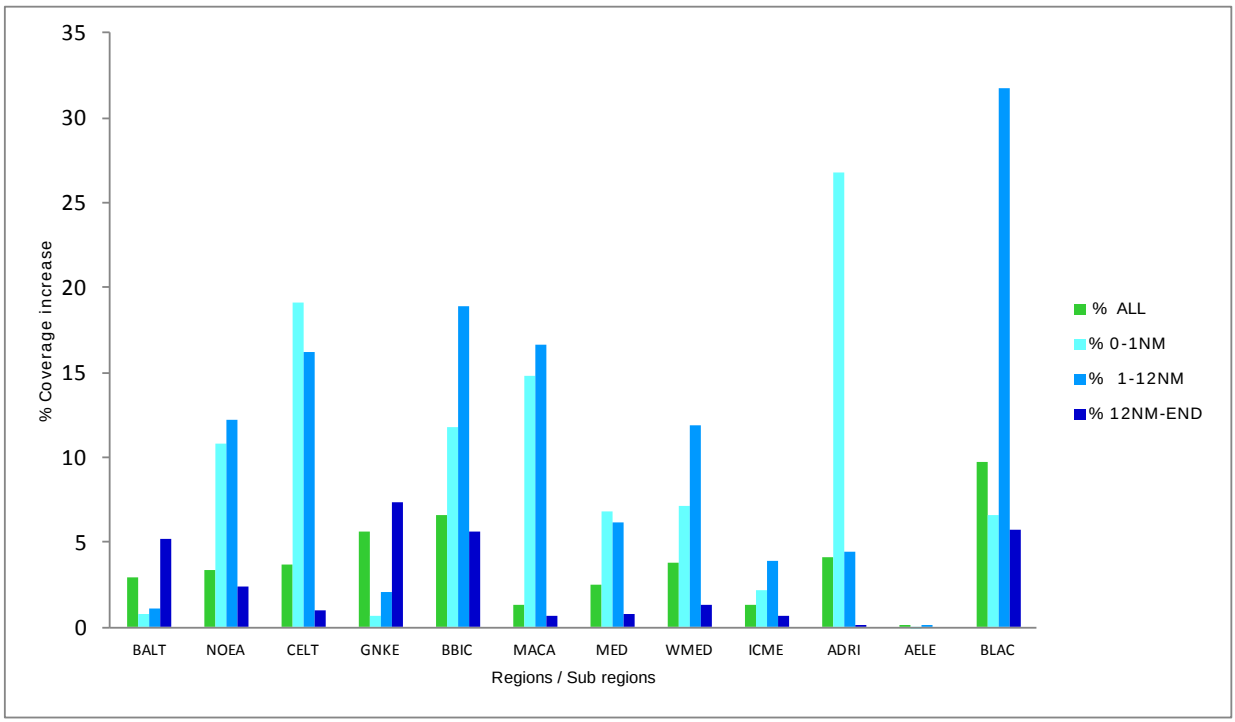
Table 3.2 indicates the surface area and percentage cover of the N2K sites per EU region/sub-region at varying distances from the coast (nearshore, territorial and offshore waters). The values indicated in bold and italic text indicate surface area and percentage coverages that are equal or lower than those reported for the same region/sub-region in 2012 (EEA, 2015a).

**Table 3.2 Surface area, percentage cover and percentage of increase since 2012 of N2K sites in nearshore, coastal and offshore waters in European marine regions and sub-regions**

| MPA assessment area regions/sub-regions | Nearshore zone covered by N2K | | | Territorial zone covered by N2K | | | Offshore zone covered by N2K | | |
|---|---|---|---|---|---|---|---|---|---|
| | Area ($km^2$) | % coverage | % increase since 2012 | Area ($km^2$) | % coverage | % increase since 2012 | Area ($km^2$) | % coverage | % increase since 2012 |
| **Baltic Sea** | **16,158** | **31.7** | **+0.8** | **24,802** | **16.4** | **+1.1** | **15,079** | **9.1** | **+5.2** |
| **North East Atlantic Ocean** | **30,907** | **53.7** | **+10.8** | **97,381** | **27.6** | **+12.2** | **161,884** | **4.4** | **+2.4** |
| Celtic Sea | 13,287 | 51.0 | +19.1 | 31,656 | 24.1 | +16.3 | 25,184 | 3.3 | +1.0 |
| Greater North Sea incl. Kattegat & English Channel | ***11,366*** | 59.7 | +0.7 | ***34,003*** | 33.6 | +2.1 | 68,754 | 18.5 | +7.3 |
| Bay of Biscay and the Iberian Coast | 5,014 | 59.5 | +11.8 | 19,842 | 34.5 | +18.9 | 53,828 | 7.3 | +5.6 |
| Macaronesia | 1,240 | 31.1 | +14.8 | 11,879 | 19.0 | +16.6 | 14,118 | 0.8 | +0.7 |
| **Mediterranean** | **17,374** | **31.3** | **+6.8** | **37,373** | **10.9** | **+6.1** | **8,194** | **0.9** | **+0.8** |
| Western Mediterranean | 8,300 | 52.9 | +7.2 | 29,686 | 20.3 | +11.8 | 6,940 | 1.4 | +1.3 |
| Ionian Sea and Central Mediterranean Sea | 2,430 | 29.2 | +2.2 | 2,993 | 6.0 | +3.9 | 1,244 | 0.7 | +0.7 |
| Adriatic Sea | 3,865 | 36.9 | +26.8 | 2,656 | 5.5 | +4.5 | 10 | 0.0 | 0.0 |
| Aegean-Levantine Sea | ***2,779*** | ***14.1*** | 0.0 | 2,039 | ***2.3*** | 0.0 | 0 | 0.0 | 0.0 |
| **Black Sea** | **1,076** | **84.5** | **+6.6** | **5,004** | **51.0** | **+31.8** | **3,076** | **5.8** | **+5.8** |
| **Total** | **65,516** | **39.6** | **+6.3** | **164,560** | **19.2** | **+7.9** | **188,232** | **3.9** | **+2.2** |

Figure 3.1 indicates the percent coverage increase per region/sub-region and per buffer zone between 2012 and 2016. There is no marked percentage increase observed in AELE. **Higher percentage increase is generally observed in the second buffer belt with the exception of the Celtic and Adriatic seas**.

**Figure 3.1 Percentage cover increase of marine N2K sites between 2012 and 2016**




A cross comparison of the overall results contained in the EEA, 2015b statistics and the statistics contained in Table 3.2 and Figure 3.1 indicates that:

- **There has been a percentage coverage increase in N2K sites of 6.3%, 7.9% and 2.2% respectively in the nearshore, coastal and offshore zones within European seas.**
- **The highest increase in percentage cover of N2K sites in the nearshore area has been within the Adriatic sub-region.**
- **The highest increase in percentage cover of N2K sites in the territorial seas area has been within the Black Sea region.**
- **The highest increase in percentage cover of N2K sites in the offshore area has been within the Greater North Sea incl. Kattegat & English Channel sub-region.**
- **The only region/sub-region with no change between 2012 and 2016 has been within the Aegean-Levantine Sea.**

## 3.2 National Designated Sites

Table 3.3 reports information on the total number of sites and total surface area coverage (in kilometres squared) of the marine National Designated Sites (NDSs) established in each of the MPA assessment area regions and sub-regions. The values indicated in bold and italic text indicate the total number of sites, surface area and percentage coverages that are lower than those reported for the same region/sub-region in 2012 (EEA, 2015a). The percentage increase refers to the period 2013–2016. The percentage NDSs network overlapping the marine N2K network was also calculated for each MPA assessment marine region.

The lower values observed across the MPA assessment areas are related to the different approach used for the selection of marine NDS sites in 2016. Although the new selection procedure reduces the total number of site counts throughout all the MPA assessment areas, the percentage surface area coverage of the network observed from 2013 to 2016 is in any case increasing.

**Table 3.3 Surface area and percentage cover of marine NDSs in MPA assessment areas, and percentage overlap with the EU N2K network**

| MPA assessment area regions and sub-regions | Total no of sites | Area covered (km2) | % covered by NDSs | % increase | % of nearshore zone covered by NDSs | % of territorial zone covered by NDSs | % of offshore zone covered by NDSs | % area overlap with N2K |
|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | ***1720*** | **24,443** | **6.6** | **+0.5** | **19.2** | **8.1** | **1.4** | ***88.5*** |
| **North East Atlantic Ocean** | ***770*** | **164,186** | **4.0** | **+2.8** | ***24.4*** | **7.7** | **3.4** | ***29.6*** |
| Celtic Sea | ***261*** | 68,398 | 7.3 | +6.3 | ***14.6*** | 5.6 | 7.4 | ***9.2*** |
| Greater North Sea incl. Kattegat & English Channel | ***374*** | 49,989 | 10.2 | +5.4 | 40.5 | 14.2 | 7.5 | ***62.4*** |
| Bay of Biscay and the Iberian Coast | ***80*** | 10,148 | 1.3 | +0.8 | 23.0 | 6.8 | 0.6 | 96.3 |
| Macaronesia | ***58*** | 35,650 | 1.9 | +1.2 | ***15.0*** | 2.2 | 1.9 | 4.1 |
| **Mediterranean** | ***218*** | **50,321** | **3.9** | **+0.8** | **13.3** | **9.7** | **1.1** | **32.0** |
| Western Mediterranean | ***102*** | 42,150 | 6.4 | +1.4 | 31.0 | 19.7 | 1.7 | 21.6 |
| Ionian Sea and Central Mediterranean Sea | ***37*** | 4,759 | 2.0 | +1.4 | 13.4 | 4.8 | 0.7 | 87.7 |
| Adriatic Sea | ***48*** | 1,135 | 0.9 | 0.0 | 7.1 | 0.8 | 0.0 | 58.9 |
| Aegean-Levantine Sea | ***31*** | 2,277 | 1.2 | 0.0 | 3.4 | 1.8 | 0.0 | ***94.1*** |
| **Black Sea** | ***5*** | ***83*** | ***0.1*** | **-2.1** | ***1.3*** | ***0.7*** | **8.0** | **100.0** |
| **Total** | ***2597*** | **239,033** | **4.1** | **+2.2** | **18.9** | **8.5** | **2.9** | ***36.2*** |

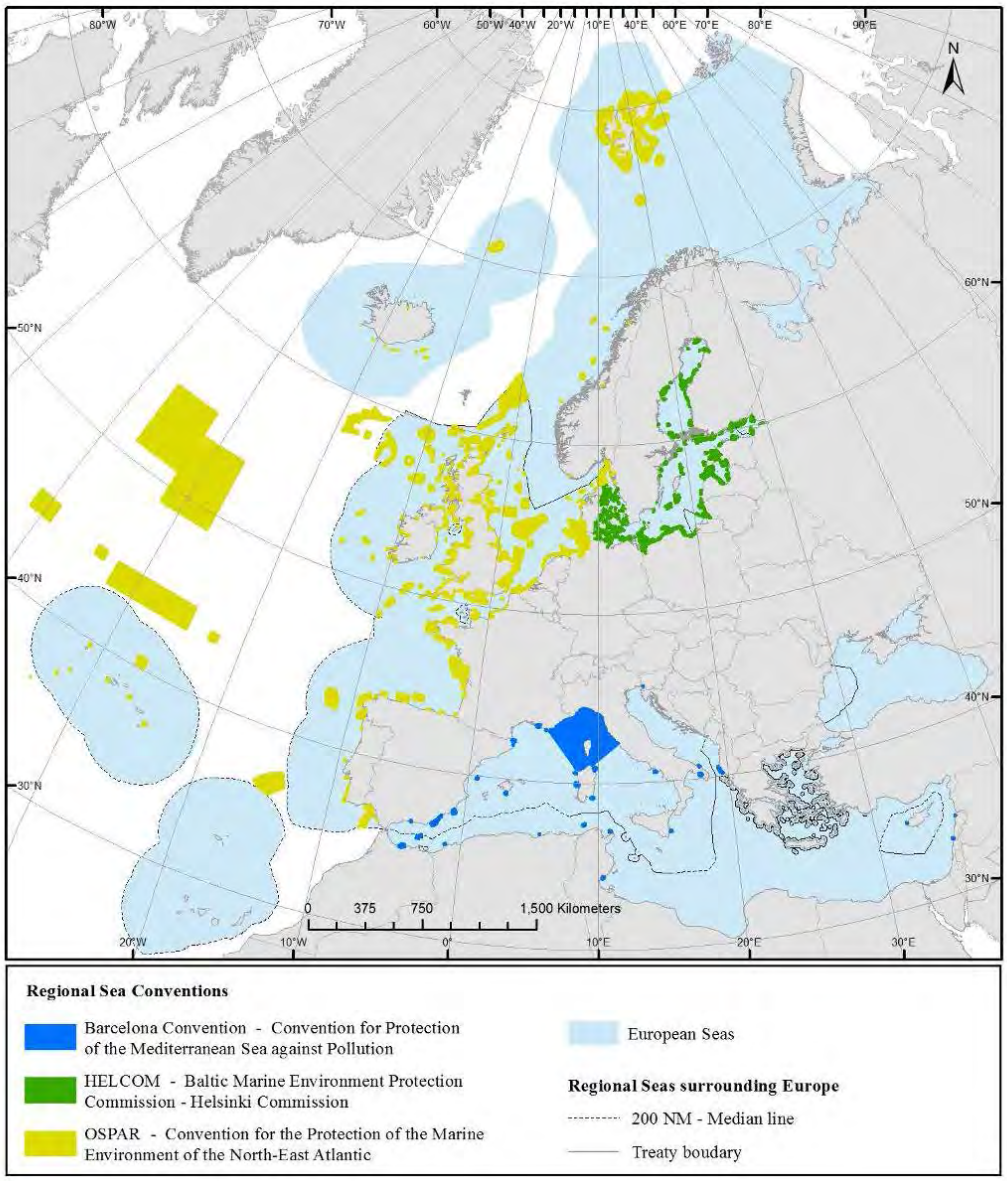
Table 3.3 indicates that:

- **The overall NDS coverage across European seas increased by ~2 % from 2012 to 2016**
- **Majority of NDSs are located in the coastal zone and their coverage steadily decreases towards offshore**
- **About one third of the NDS area is also designated as N2K; Highest percentage area overlap is observed in the Baltic Sea, Bay of Biscay and the Iberian Coast, Ionian Sea and Central Mediterranean Sea, Aegean-Levantine Sea and Black Sea**

## 3.3 MPA networks established under the Regional Sea Conventions

The distribution of RSC MPAs within and outside the MPA assessment area regions and the European seas is represented in Map 3.2.

**Map 3.2 MPAs established under the Regional Sea Conventions, within and outside MPA assessment areas**




The total surface area of the RSC site polygons, considering those lying within the European Regional Sea boundaries and in the MPA assessment area regions (considered as being the EU waters of the EU Regional Seas) are reported in Table 3.4. The total surface area of the RSC site polygons in the European Regional Seas is close to 370 000 km$^2$. Within the boundaries of the MPA assessment area regions (considered as being the EU waters of the EU Regional Seas), the MPA surface area is ca. 367 000 km$^2$.

The percentage of surface area extent of each RSC network was calculated with respect to the surface area measurement of the respective EU Regional Seas and MPA assessment marine regions. It is worthwhile noting that the OSPAR and HELCOM conventions both exert their jurisdiction in the Kattegat area of the GNKE sub-region (see Map 3.3). Consequently, the surface area value of the RSC network in this portion of the MPA assessment area regions contains a surface area of overlap between the OSPAR and HELCOM

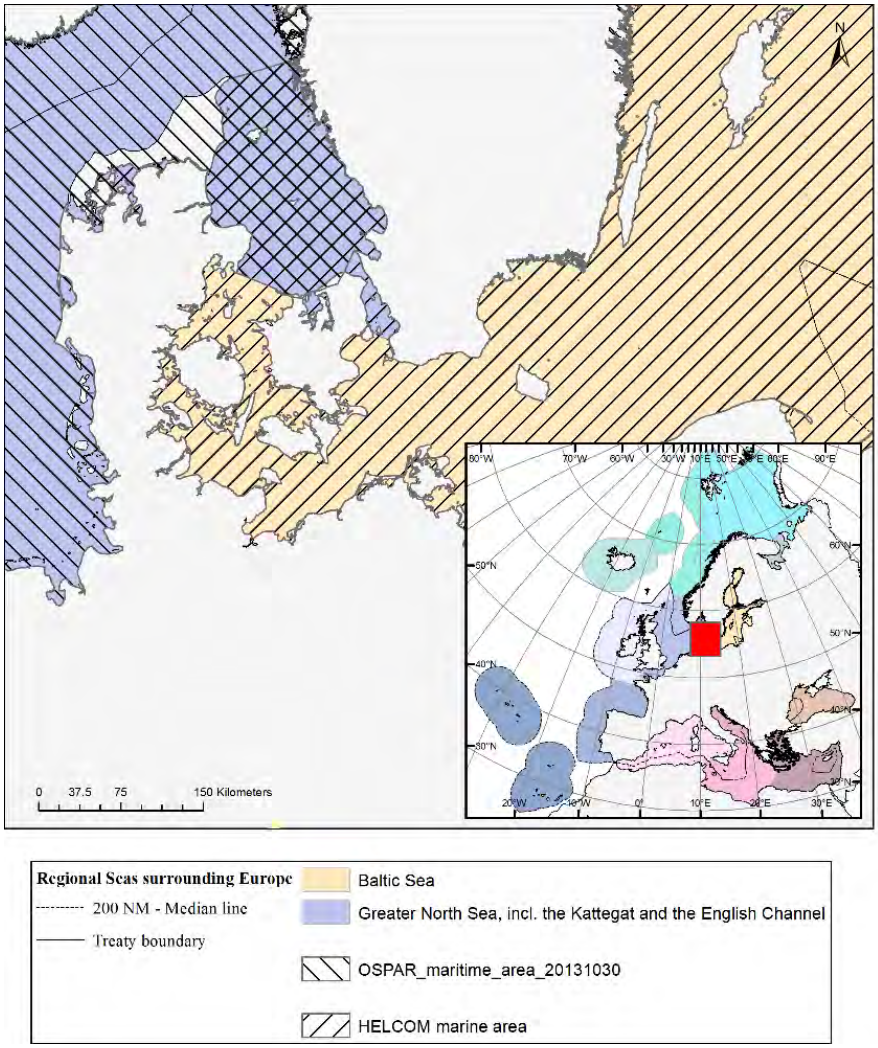
network. The surface area of the HELCOM MPAs that lie in the Kattegat is 5717 km$^2$. 92.4% of this surface area overlaps with OSPAR sites. The percentage of RSC network overlapping the N2K network was also calculated for each MPA assessment marine region.

**Table 3.4 Total surface area, percentage cover of RSC sites in European regional seas and MPA assessment area regions, and overlap with EU N2K network**

| RSC name | Regional Sea | Area of RSC network in European Seas | Area of RSC network in MPA assessment area regions | % cover of RSC network in European Sea | % cover of RSC networks in MPA assessment area regions | RSC network % overlap with N2K in MPA assessment area regions |
|---|---|---|---|---|---|---|
| **Helsinki** | Baltic Sea | **43150** | **42235*** | **11,0** | **11,5** | **93,7** |
| **OSPAR** | North East Atlantic Ocean | **236102** | **235633** | **3,0** | **5,8** | **64,1** |
| **Barcelona** | Mediterranean Sea | **89854** | **89209** | **3,6** | **7,0** | **10,1** |

**Note:** * excluding Kattegat area: the MPA surface area in the entire Convention area is 48 867 km$^2$

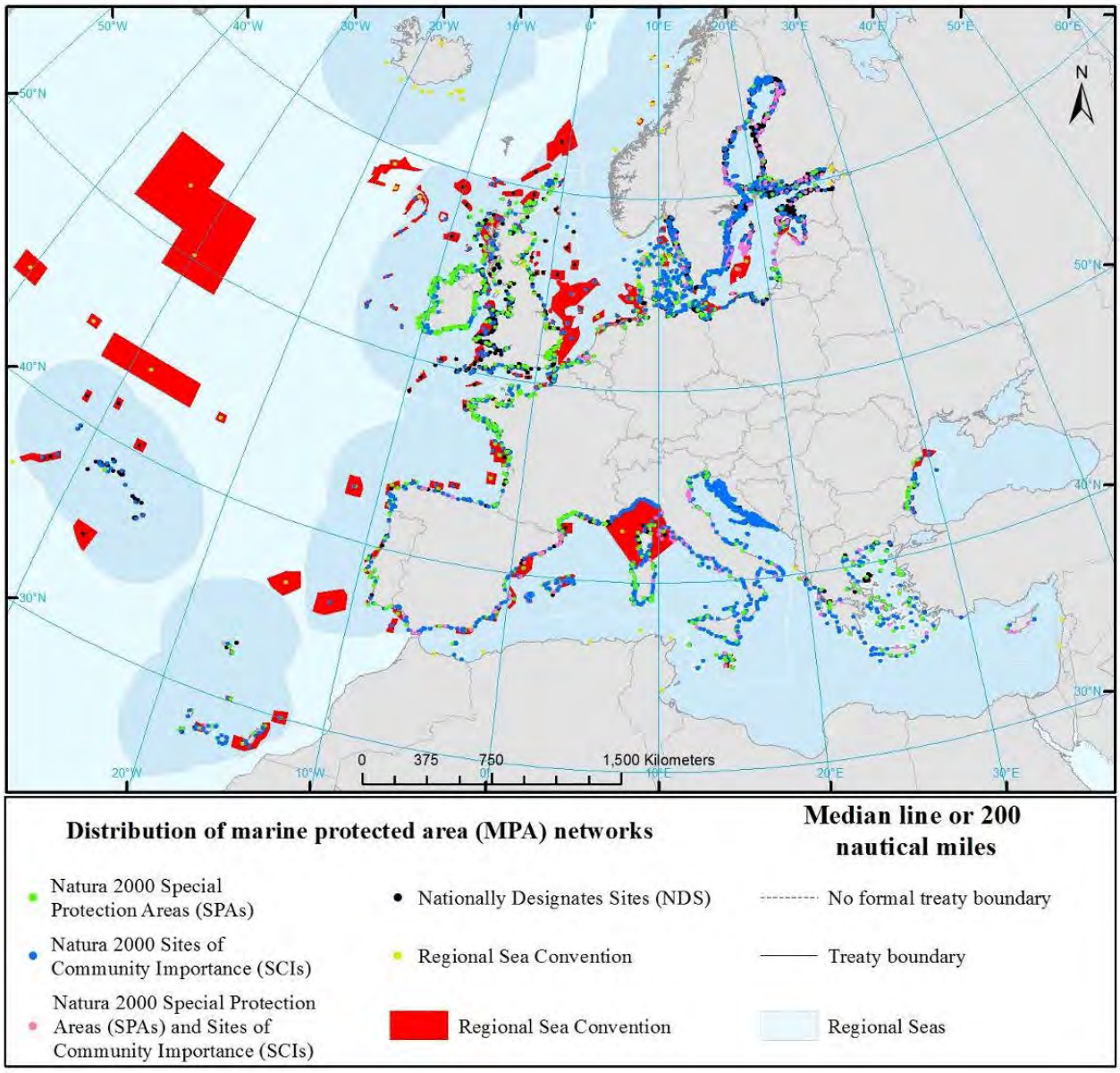
**Map 3.3 Area of HELCOM and OSPAR overlap**



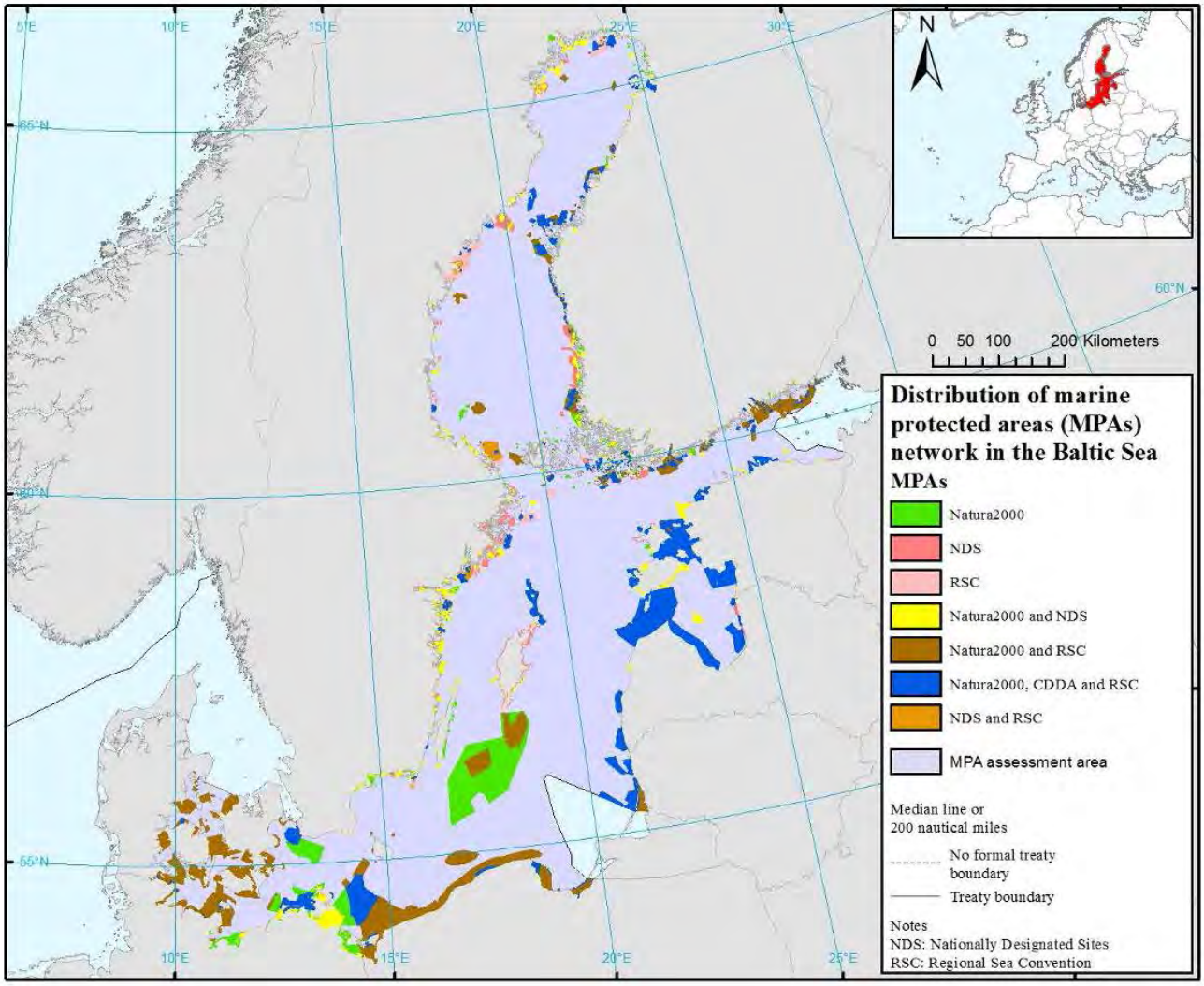
## 3.4 European MPA networks

In this section the MPAs established in the context of all the different considered networks (N2K, NDSs and RSC) are considered as a unique network and are hereafter referred to as MPAs. Map 3.4 presents the distribution of these MPAs but, to facilitate viewing; regional and sub-regional maps are reported subsequently in Maps 3.4.a to 3.4.j. The latter also allow portraying the overlap between sites of the three different networks.

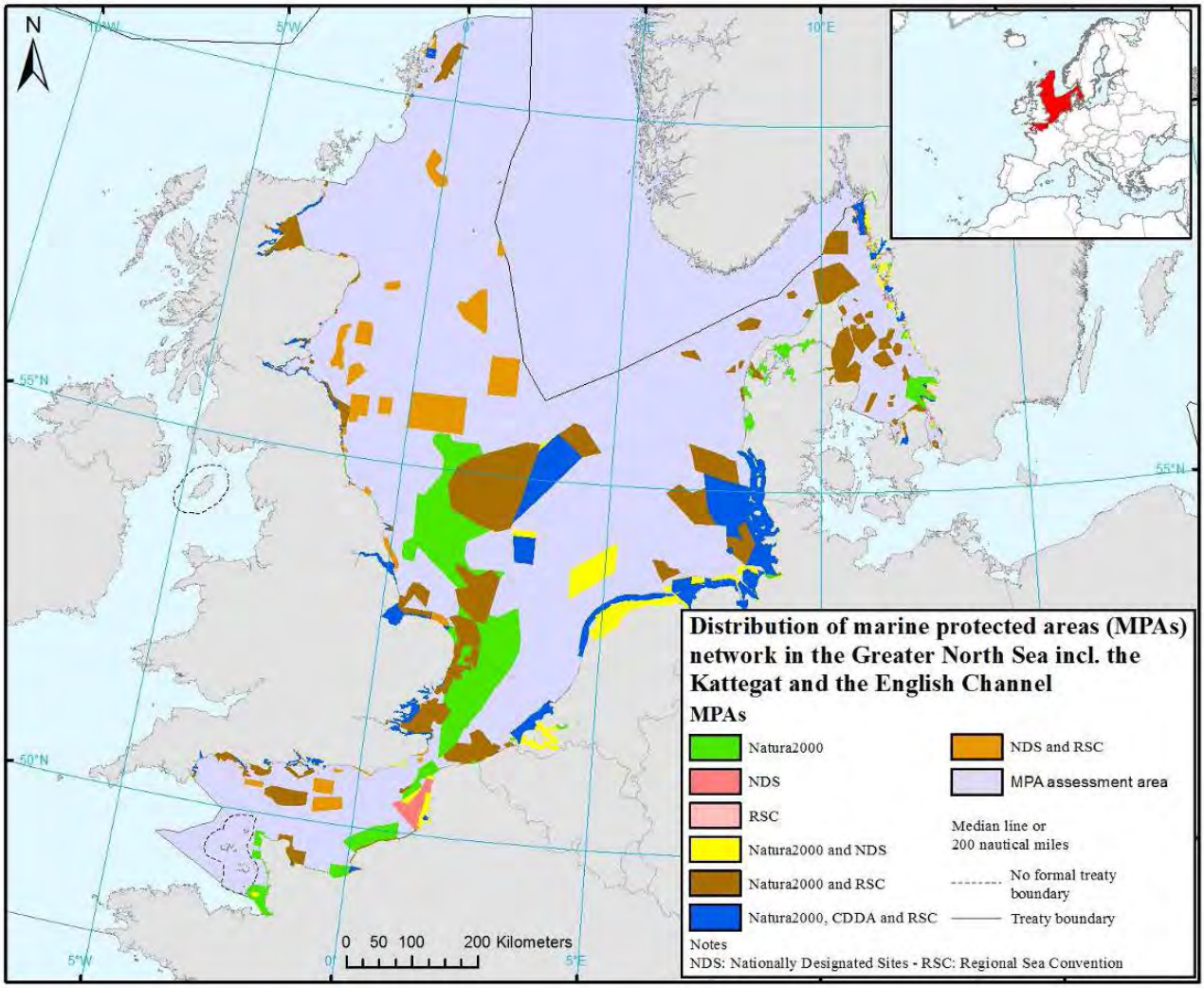
**Map 3.4. Distribution of MPA networks in MPA assessment areas of the European regional seas**



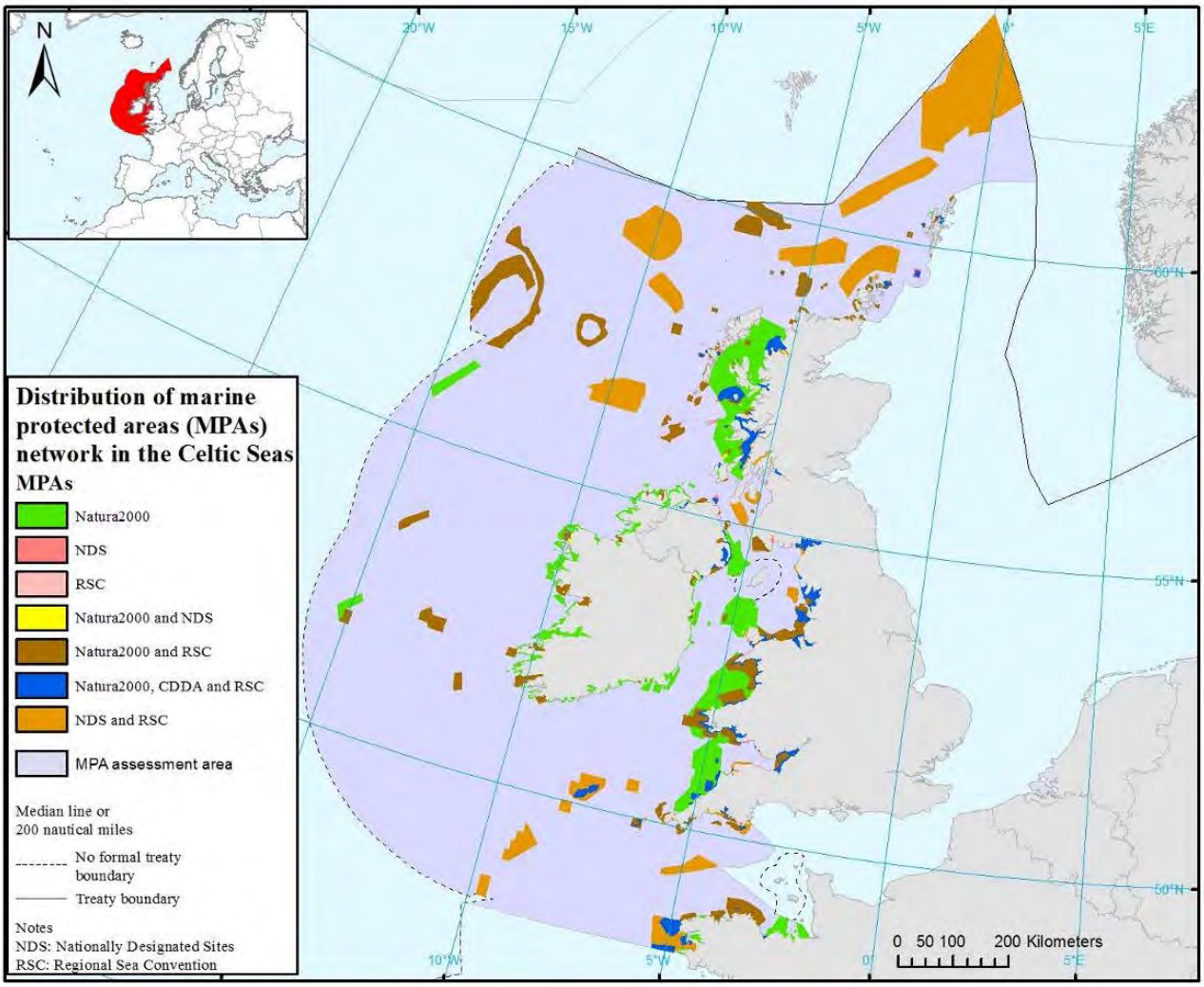
**Map 3.4.a Distribution of MPA networks in the Baltic Sea marine region**



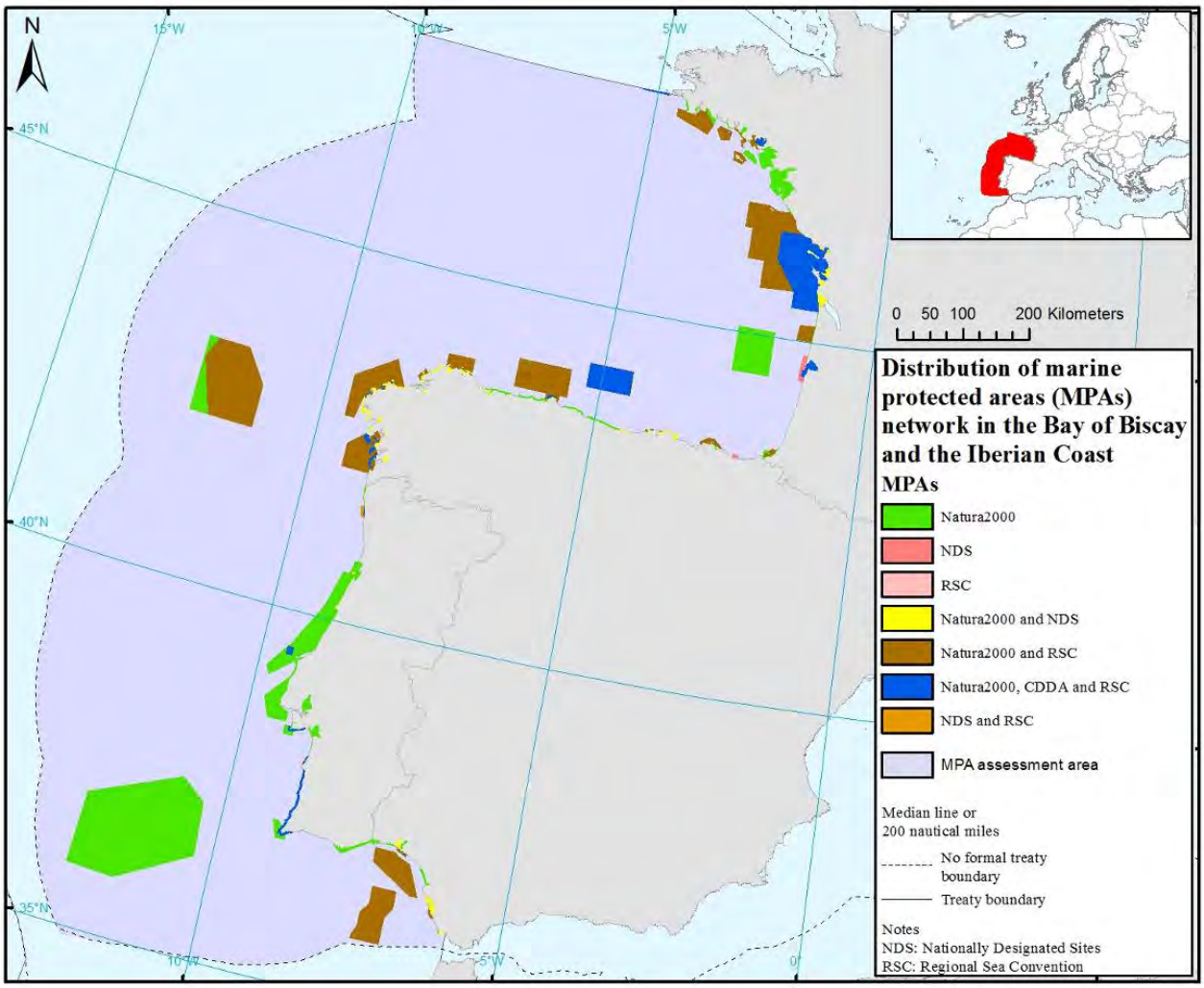
**Map 3.4.b Distribution of MPAs in the Greater North Sea including the Kattegat and English Channel marine sub-region**



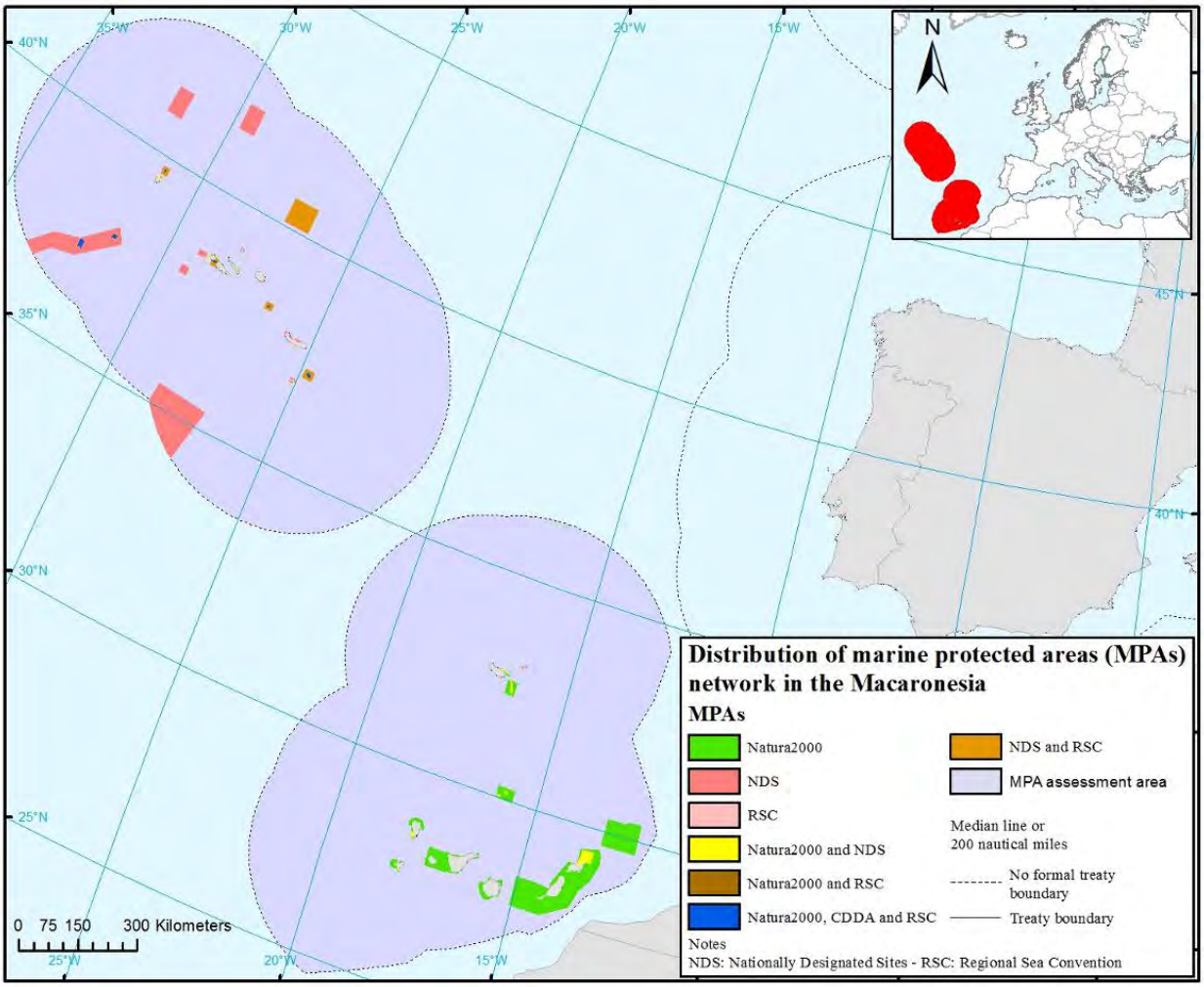
**Map 3.4.c Distribution of MPAs in the Celtic Seas sub-region**



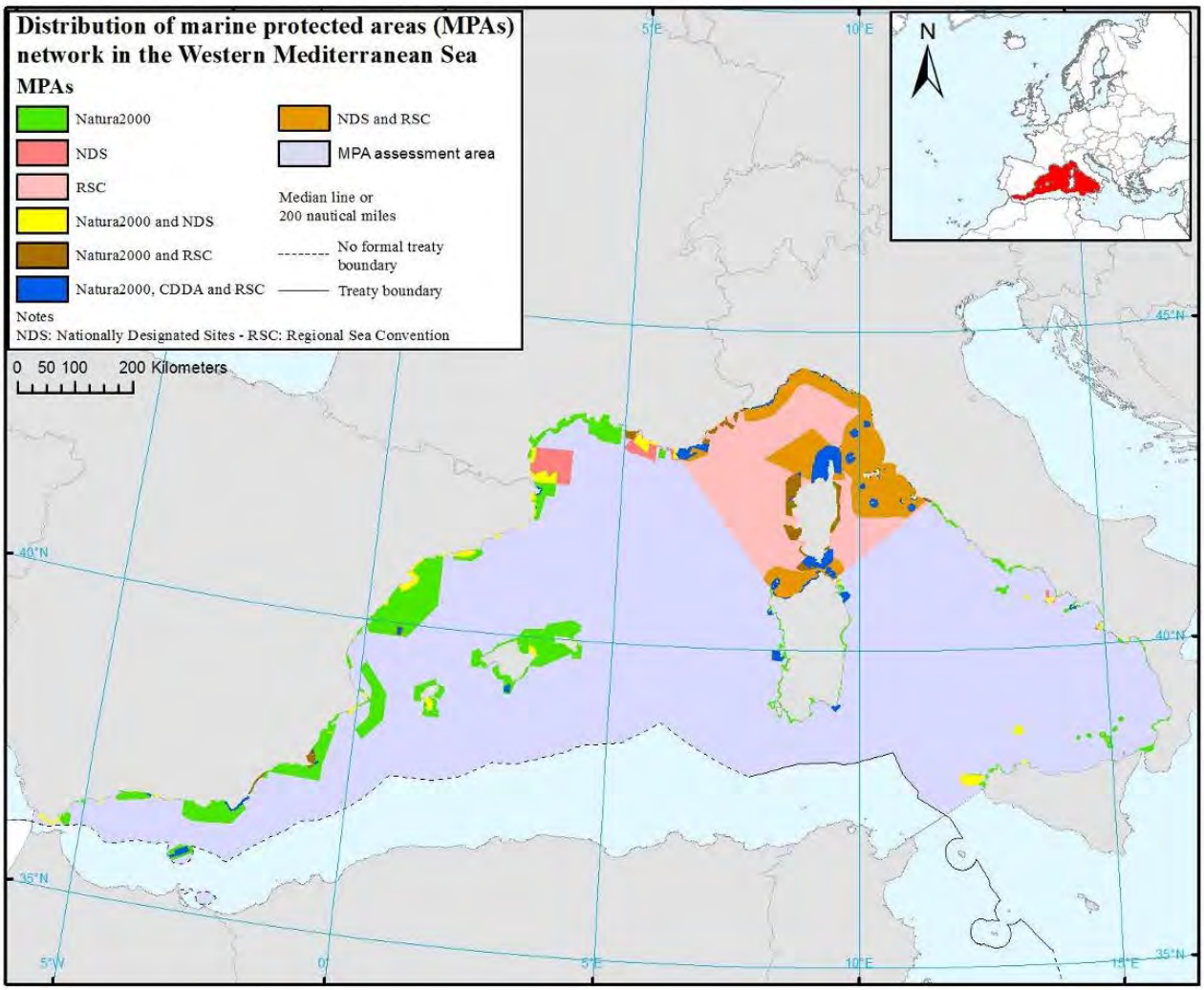
**Map 3.4.d Distribution of MPAs in the Bay of Biscay and the Iberian Coast**



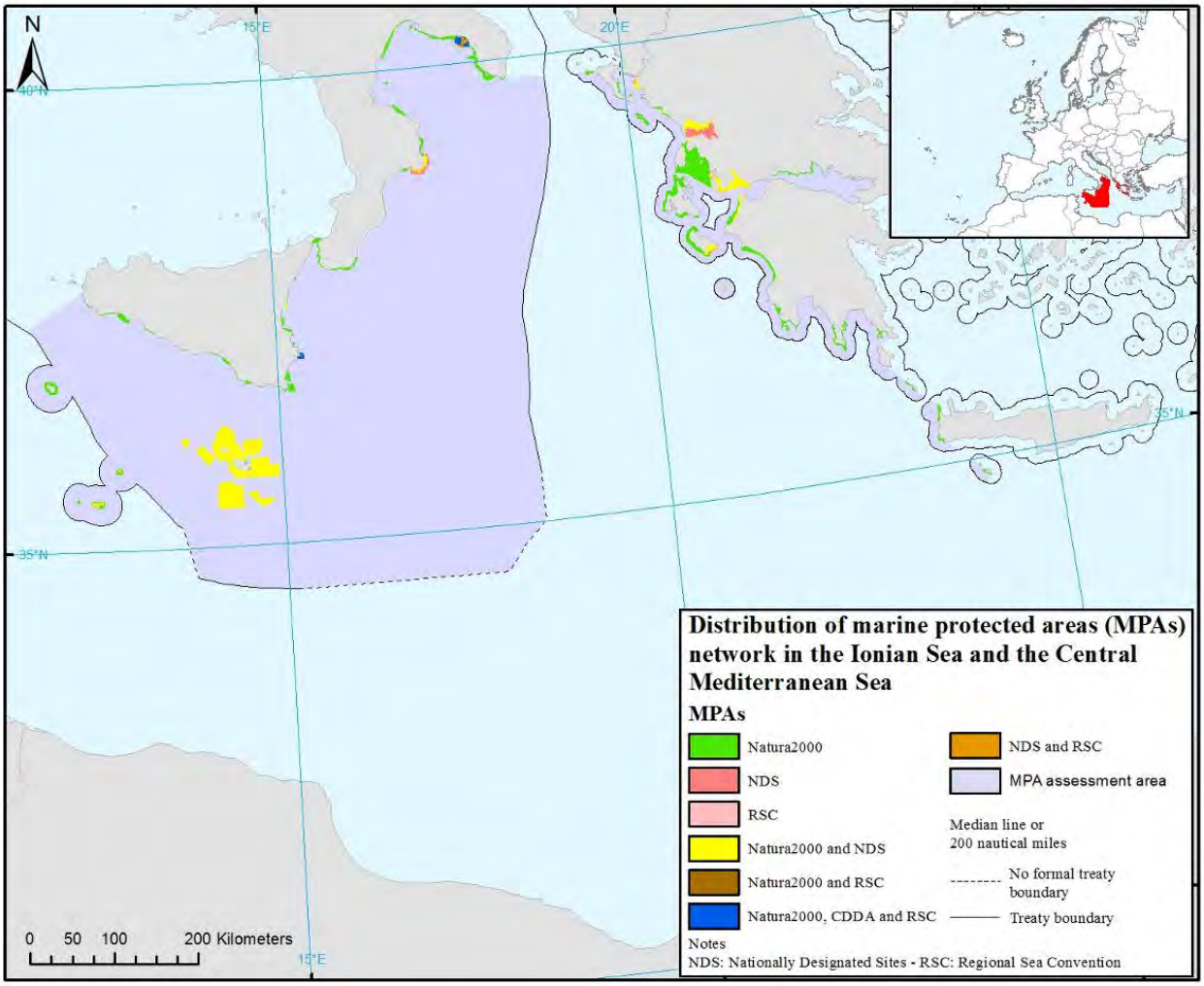
**Map 3.4.e Distribution of MPAs in the Macaronesia sub-region**



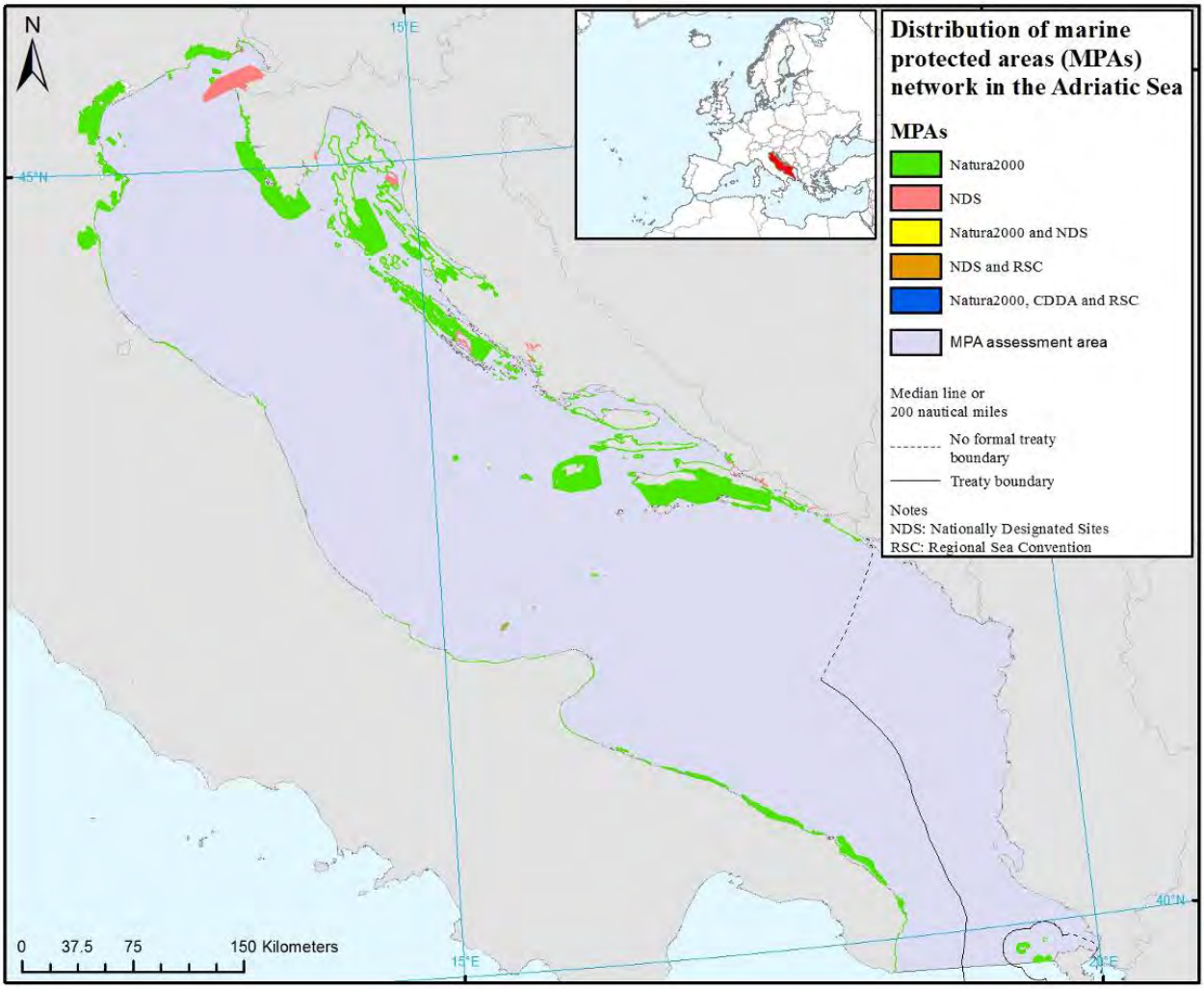
**Map 3.4.f Distribution of MPAs in the Western Mediterranean Sea**



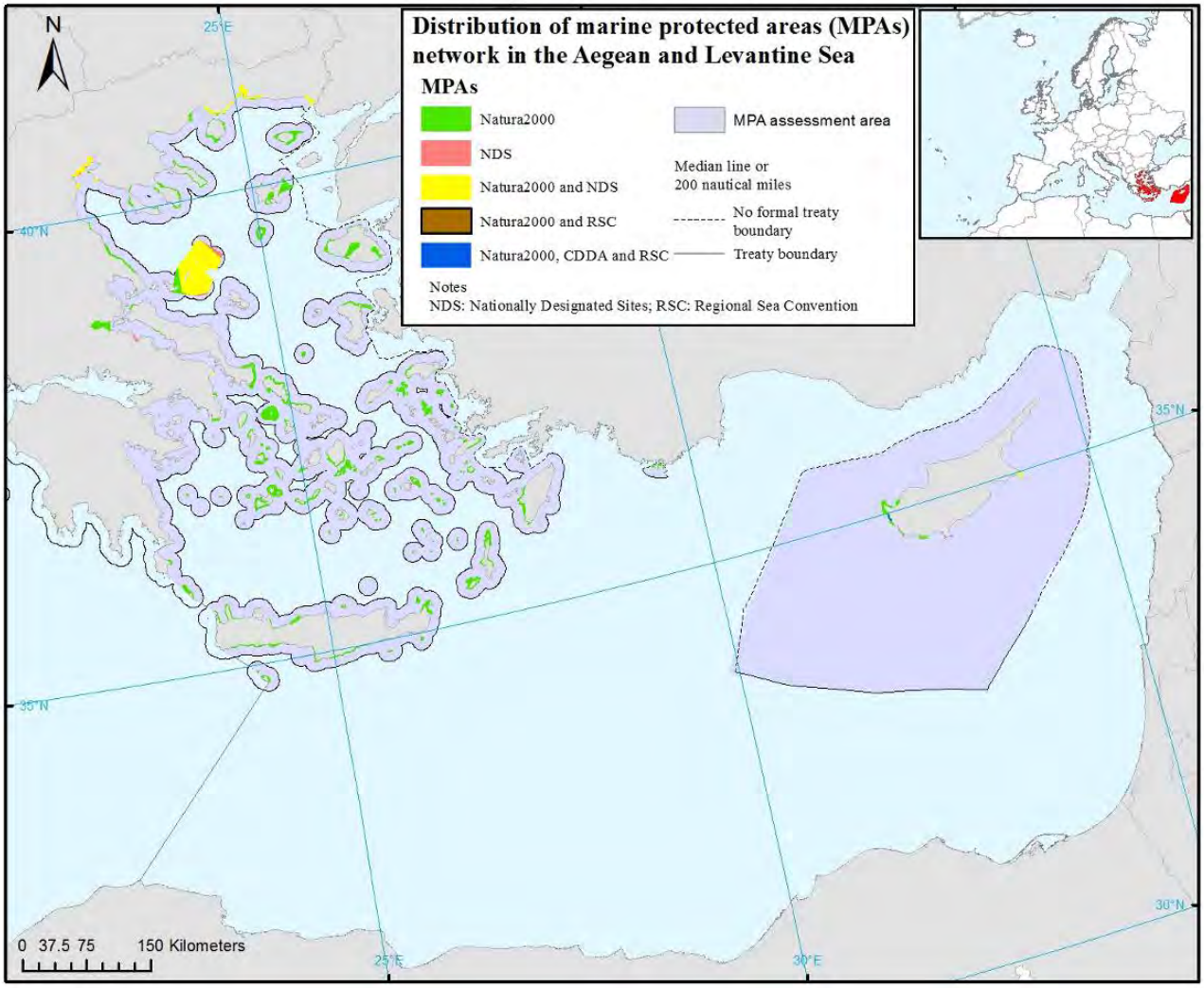
**Map 3.4.g Distribution of MPAs in the Ionian Sea and the Central Mediterranean Sea**



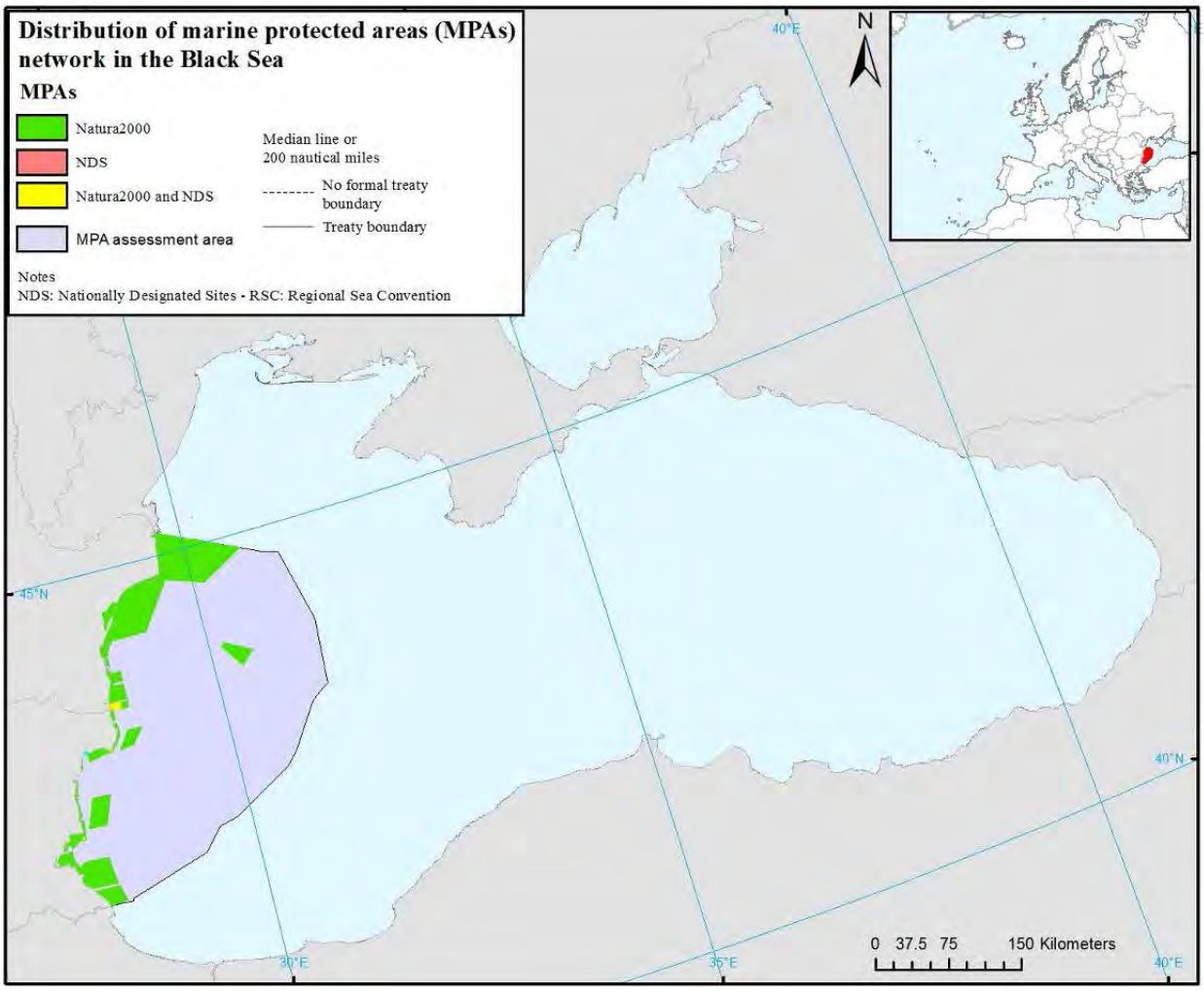
**Map 3.4.h Distribution of MPAs in the Adriatic Sea**



**Map 3.4.i Distribution of MPAs in the Aegean and Levantine Sea**



**Map 3.4.j Distribution of MPAs in the Black Sea**



### 3.4.1 MPA representativity

Table 3.5 provides statistics on the spatial extent of the MPA networks combined, considering the eventual areas of MPA overlap between networks as a unique value so as to avoid duplication of surface area counts for such areas. The percent surface area coverage for the entire network is calculated with respect to the surface extent of the MPA assessment area region/sub-region. The percent increase refers to that observed for the period end 2012–2016 while the percent overlap indicates how much of the overall network extension is affected by the overlap of two or more networks. Figures reported in bold and italic refer to values that are equal or lower to values indicated for the same region in the 2012 statistics (EEA 2015).

The lower values of the total number of sites observed in 2016 compared to 2012 are mostly to be attributed to: the revised marine CDDA site selection procedure, updated EEA coastline and sub-region boundary shifts.

**Table 3.5 Surface area, percentage cover and percentage of increase of MPA networks in MPA assessment area regions and sub-regions (N2K, NDSs and RSC sites)**

| MPA assessment area regions and sub-regions | Area covered by MPAs (km²) | % covered by MPAs | % increase | Total no of sites | % area overlap with N2K |
|---|---|---|---|---|---|
| **Baltic Sea** | **60,827** | **16.5** | **+3.0** | ***2,718*** | ***71.7*** |
| **North East Atlantic Ocean** | **406,229** | **9.9** | **+5.7** | ***2,306*** | ***60.6*** |
| Celtic Sea | 132,400 | 14.2 | +9.8 | ***906*** | ***74.5*** |
| Greater North Sea incl. Kattegat & English Channel | 133,216 | 27.1 | +9.2 | ***967*** | ***74.2*** |
| Bay of Biscay and the Iberian Coast | 79,140 | 9.9 | +6.7 | ***321*** | ***53.2*** |
| Macaronesia | 61,473 | 3.3 | +2.5 | ***134*** | ***11.0*** |
| **Mediterranean** | **148,759** | **11.7** | **+2.2** | **1,412** | ***32.3*** |
| Western Mediterranean | 129,559 | 19.6 | +4.0 | ***646*** | ***31.6*** |
| Ionian Sea and Central Mediterranean Sea | 7,252 | 3.0 | +1.4 | ***194*** | 58.9 |
| Adriatic Sea | 6,997 | 5.8 | +3.8 | 411 | 9.6 |
| Aegean-Levantine Sea | 4,951 | 2.6 | 0.0 | ***169*** | 43.3 |
| **Black Sea** | **9,156** | **14.2** | **+9.7** | ***49*** | ***0.9*** |
| **Total** | **624,971** | **10.8** | **+4.9** | ***6,788*** | ***54.1*** |

Table 3.5 indicates that:

- **The lower number of sites does not influence in any case the MPA surface area which has increased in the 4 year period in all regions/sub-regions (total increase across all regions of 4.9%)** with the exception of the Aegean and Levantine sub-region.
- In 2012 only one European region had reached Aichi target. In the last four year period great advancement is recorded in terms of MPA coverage in the four regional seas: **three European regions now surpass the 10% Aichi target and in the North East Atlantic Ocean (NOEA) is very near to target (9.9%)**.
- Sub-regional coverage in the NOEA and the Mediterranean Sea is still not homogeneous: **1 out of 4 NOEA sub-regions and 3 out of 4 Mediterranean sub-regions have MPA coverages that are far below the 10% Aichi target**, indicating that protection effort is not evenly distributed amongst sub-regions.

Table 3.6 reports the surface area cover of the combined network per distance belt from the coast in each of the MPA assessment area regions and sub-regions. The percent increase columns indicate the increase observed in coverage during the period ending 2012–2016.

**Table 3.6 Surface area, percentage cover and percentage increase (2012–2016) of MPAs in nearshore, coastal and offshore waters in European marine regions and sub-regions**

| MPA assessment area regions and sub-regions | Area (km²) of 0–1 NM zone covered by MPAs | Area (km²) of 1–12 NM zone covered by MPAs | Area (km2) of 12 NM – END zone covered by MPAs | % of nearshore zone covered by MPAs | % increase | % of territorial zone covered by MPAs | % increase | % of offshore zone covered by MPAs | % increase |
|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | ***18850*** | 26887 | 15090 | 36.9 | +0.8 | 17.8 | +1.4 | 9.1 | +5.2 |
| **North East Atlantic Ocean** | 33156 | 105470 | 267603 | 57.6 | +5.5 | 29.9 | +13.5 | 7.3 | +5.0 |
| Celtic Sea | 14288 | 36201 | 81911 | 54.8 | +7.3 | 27.5 | +18.6 | 10.6 | +8.3 |
| Greater North Sea incl. Kattegat & English Channel | ***12153*** | 36703 | 84360 | 63.8 | +0.4 | 36.2 | +3.8 | 22.7 | +11.5 |
| Bay of Biscay and the Iberian Coast | 5138 | 20094 | 53907 | 61.0 | +12.1 | 34.9 | +19.1 | 7.3 | +5.6 |
| Macaronesia | 1577 | 12471 | 47425 | 39.5 | +11.5 | 20.0 | +16.0 | 2.6 | +2.0 |
| **Mediterranean** | 20154 | 69783 | 58822 | 36.3 | +5.7 | 20.4 | +6.2 | 6.7 | +0.6 |
| Western Mediterranean | 10633 | 61358 | 57569 | 67.8 | +7.4 | 42.1 | +12.5 | 11.6 | +1.5 |
| Ionian Sea and Central Mediterranean Sea | 2729 | 3279 | ***1244*** | 32.8 | +2.3 | 6.6 | +3.9 | 0.7 | +0.7 |
| Adriatic Sea | 3992 | 2995 | ***10*** | 38.1 | +21.1 | 6.2 | +4.8 | ***0.0*** | |
| Aegean-Levantine Sea | ***2801*** | 2150 | ***0*** | 14.2 | | 2.4 | 0.0 | ***0.0*** | |
| **Black Sea** | 1076 | 5004 | ***3076*** | 84.5 | +6.6 | 51.0 | +31.7 | 5.8 | +5.8 |
| **Total** | 73236 | 207144 | 344591 | 44.3 | +4.1 | 24.2 | +8.6 | 7.2 | +4.2 |

Table 3.6 indicates that:

- **MPA network has expanded in all buffer zones with overall percentage increases of 4.1, 8.5 and 4.2% for the nearshore, territorial and offshore zones of the European seas.**
- **MPA cover in the nearshore and territorial zones surpass the Aichi target in all regions and sub-regions with the exception of the ICME, ADRI and AELE sub-regions of the Mediterranean Sea.**
- **The Aichi target is still not reached in any of the offshore zones for European regions, but has been met in some sub-regions: CELT, GNKE and WMED.**

Table 3.7 illustrates the percentage cover resulting from sites established only under a single MPA network type and the percentage cover resulting from the overlap of sites designated under two or more network designations. The objective of this table is to indicate the degree of complementarity of each network type with respect to the overall MPA coverage resulting in each region and sub-region. Generally speaking, MPA overall coverage is the result of site establishment under more than one network.

**Table 3.7 MPA percentage surface area coverage and the contribution of relative network percentage cover and percentage overlap in MPA assessment area regions/sub-regions**.

| MPA assessment area regions and sub-regions | % surface area cover all MPAs | % N2K contribution | % CDDA contribution | % RSC contribution | % shared network contribution |
|---|---|---|---|---|---|
| **Baltic Sea** | **16.5** | **21.6** | **3.5** | **3.2** | **71.7** |
| **North East Atlantic Ocean** | **9.9** | **31.5** | **7.8** | **0.1** | **60.6** |
| Celtic Sea | 14.2 | 25.1 | 0.3 | 0.1 | 74.5 |
| Greater North Sea incl. Kattegat & English Channel | 27.1 | 24.1 | 1.5 | 0.2 | 74.2 |
| Bay of Biscay and the Iberian Coast | 9.9 | 46.3 | 0.4 | 0.1 | 53.2 |
| Macaronesia | 3.3 | 42.0 | 47.0 | 0.0 | 11.0 |
| **Mediterranean** | **11.7** | **29.3** | **3.8** | **34.7** | **32.3** |
| Western Mediterranean | 19.6 | 25.1 | 3.5 | 39.8 | 31.6 |
| Ionian Sea and Central Mediterranean Sea | 3.0 | 34.4 | 6.7 | 0.0 | 58.9 |
| Adriatic Sea | 5.8 | 83.8 | 6.6 | 0.0 | 9.6 |
| Aegean-Levantine Sea | 2.6 | 54.0 | 2.7 | 0.0 | 43.3 |
| **Black Sea** | **14.2** | **99.1** | **0.0** | **0.0** | **0.9** |
| **Total** | **10.8** | **31.0** | **6.3** | **8.7** | **54.1** |

Table 3.7 indicates that:

- **The percentage of network contribution to the shared percentage cover varies from one region to another and is generally high with the exception of the Macaronesia, Adriatic and Black Sea regions/sub-regions where sites established under two or more networks varies from 0.9 to 11%.**
- **N2K is the network which contributes most significantly to the overall attainment of MPA coverage as a single network on its own.**
- **Sites established only as CDDA or RSC instead contribute with lower percentages. This is likely due to the fact that in order to be established under RSC frameworks sites need to first be established under national designations of various types that are independent of N2K establishment frameworks.**
- **The exception to the above is in the Macaronesia region where sites are established either as N2K or CDDA, RSC sites are under 0% and a very small percentage of overlapping MPAs exists.**

Another representation of the distance from the 10% protection coverage indicated in Aichi target 11 is in Map 3.5. The colour of the sub-region represents this distance, covering all the MPAs occurring in the respective sub-region. The superimposed bar charts provide the same information estimated according to buffer zones, with the 10% value indicated with a dashed line.

**Map 3.5 Distance to 10% coverage target for each marine region and sub-region and for each buffer zone**

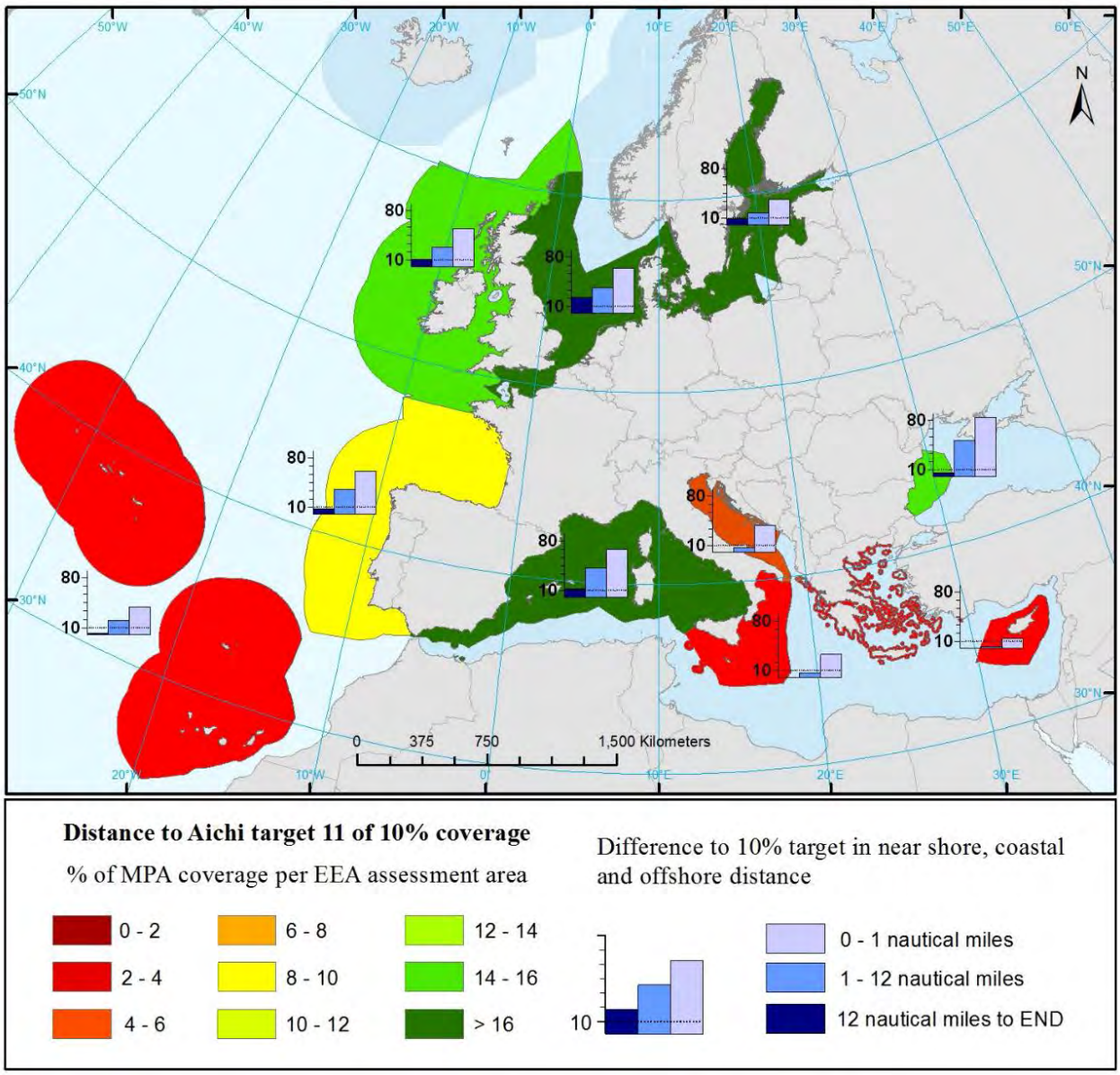


Table 3.8 illustrates the percentage cover of the MPA network with respect to modelled biological (depth) zone boundaries.

**Table 3.8 Percentage coverage of MPAs in each biological depth zone within each EU marine region (NP = Biozone is not present in the region/sub-region)**

| MPA assessment area regions and sub-regions | Infralittoral | Circalittoral | Bathyal | Abyssal |
|---|---|---|---|---|
| **Baltic Sea** | **40.4** | **11.7** | **NP** | **NP** |
| **North East Atlantic Ocean (NOEA)** | **64.3** | **19.8** | **15.0** | **2.2** |
| Celtic Seas | 57.3 | 14.5 | 17.5 | 0.3 |
| Greater North Sea, incl. the Kattegat and the English Channel | 72.3 | 23.7 | 41.6 | NP |
| Bay of Biscay and the Iberian Coast | 51.4 | 22.8 | 18.0 | 4.6 |
| Macaronesia | 61.8 | 52.0 | 10.8 | 1.5 |
| **Mediterranean** | **40.6** | **22.1** | **9.3** | **6.3** |
| Western Mediterranean Sea | 65.0 | 50.0 | 17.2 | 6.3 |
| Ionian Sea and the Central Mediterranean Sea | 33.2 | 8.5 | 1.2 | NP |
| Adriatic Sea | 27.6 | 4.3 | 0.0 | NP |
| Aegean-Levantine Sea | 16.2 | 3.7 | 1.3 | NP |
| **Black Sea** | **67.1** | **23.4** | **0.7** | **NP** |
| **Total** | **48.7** | **18.7** | **12.0** | **2.5** |

In summary Table 3.8 indicates that:

- **The MPA network appears to be reaching the 10% in all the infralittoral zones and most of the circalittoral zones of European regions and sub-regions with the exception of 3 of the 4 Mediterranean sub-regions (ICME, ADRI, AELE).**
- **Aichi coverage is reached in all of the bathyal zones of the NOEA and in the WMED while it is not reached in the remaining sub-regions.**
- **Aichi target is not reached in any of the abyssal zones of the regions/sub-regions.**

Table 3.9 illustrates the Aichi target achievement of the MPAs per biological depth zone while considering at the same time the rate of coverage increase observed during the four-year period (2013–2016). Percent increase trends over 4% are qualified positively on the assumption that yearly increases in coverage should be at least 1% per year in order to reach the 10% target in ten years. Trend increases lower than 4% indicate a lower rate of protection effort and as such are qualified with a graphic representation indicating intermediate effort. No increase in trends is represented with the lowest rating.

**Table 3.9 Aichi target 11 achievement by MPAs network in each biological depth zone (green/red) and percentage of coverage increase with respect to 2012 coverage (>4% increase ☺; increase between 0 and 4 % 😐; no increase observed, ☹).**

| MPA assessment area regions and sub-regions | Infralittoral | Circalittoral | Bathyal | Abyssal |
|---|---|---|---|---|
| **Baltic Sea** | 😐 | 😐 | | |
| **North East Atlantic Ocean** | ☺ | ☺ | ☺ | 😐 |
| Celtic Seas | ☺ | ☺ | ☺ | 😐 |
| Greater North Sea, incl. the Kattegat and the English Channel | 😐 | ☺ | 😐 | |
| Bay of Biscay and the Iberian Coast | ☺ | ☺ | ☺ | ☺ |
| Macaronesia | ☺ | ☺ | ☺ | 😐 |
| **Mediterranean** | ☺ | ☺ | 😐 | 😐 |
| Western Mediterranean Sea | ☺ | ☺ | 😐 | 😐 |
| Ionian Sea and the Central Mediterranean Sea | 😐 | ☺ | 😐 | |
| Adriatic Sea | ☺ | 😐 | 😐 | |
| Aegean-Levantine Sea | 😐 | 😐 | 😐 | |
| **Black Sea** | 😐 | ☺ | 😐 | |
| **Total** | 😐 | ☺ | ☺ | 😐 |

In so doing, Table 3.9 highlights that:

- **Where Aichi target is reached, MPA coverage is in any case increasing**
- **The MPA biological zone coverages that are still far from attainment of the Aichi target are increasing at slower rates**
- **The rate of coverage increase observed in the circalittoral ICME and bathyal Bay of Biscay and the Iberian Coast is higher.**

Table 3.10 reports the MPA percentage coverage of the revised broad habitats while Table 3.11 illustrates the representativity of the target achievement (*sensu* ETC/ICM, 2017, i.e. twenty percent target coverage achievement and 60% for Posidonia) and the rate of coverage increase observed during the four year period (end 2012–2016). Percent increase trends are considered with the same conceptual approach as explained for Table 3.9.

**Table 3.10 Percentage coverage of the revised broad habitats within each MPA assessment region (NP = Revised broad habitat is not present in the region/sub-region)**

| MPA assessment area regions and sub-regions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Bs | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 29.4 | 48.2 | 59.8 | 36.2 | 29.1 | NP | NP | 18.5 | 26.1 | 26.3 | 5.0 | 12.7 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP |
| **North-East Atlantic Ocean** | 47.9 | 61.0 | 72.9 | 47.9 | 54.0 | NP | 88.4 | 28.0 | 22.1 | 19.9 | 14.6 | 27.5 | 27.3 | 20.6 | 20.8 | 11.7 | 24.9 | 0.0 | 0.0 | 0.8 | 0.1 | 0.6 |
| Celtic Sea | 38.3 | 55.1 | 69.3 | 0.0 | 60.5 | NP | NP | 27.7 | 16.6 | 10.9 | 13.7 | 28.3 | 67.6 | 22.2 | 25.1 | 18.2 | 34.5 | 3.7 | NP | 17.6 | 0.2 | 1.1 |
| Greater North Sea incl. Kattegat and English Channel | 45.7 | 65.3 | 78.9 | 57.0 | 56.9 | NP | NP | 41.9 | 30.7 | 24.6 | 12.1 | 21.2 | NP | NP | 0.0 | 0.0 | 39.6 | NP | NP | NP | NP | NP |
| Bay of Biscay and the Iberian Coast | 53.4 | 48.3 | 45.9 | 62.5 | 41.5 | NP | NP | 23.9 | 33.9 | 18.5 | 20.9 | 35.0 | 36.6 | 11.8 | 17.4 | 16.1 | 33.0 | 0.2 | NP | 0.7 | 0.8 | NP |
| Macaronesia | 68.8 | 67.9 | 72.4 | 89.3 | 19.2 | NP | 88.4 | 50.4 | 29.8 | 78.8 | 60.7 | 7.1 | 9.9 | 0.3 | 19.6 | 5.1 | 11.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| **Mediterranean** | 48.8 | 49.7 | 16.1 | NP | 24.4 | 66.2 | 11.8 | 33.7 | 54.7 | 23.0 | 19.6 | 25.5 | 13.7 | 59.1 | 32.6 | 8.4 | 4.8 | NP | 48.8 | 42.8 | 4.9 | NP |
| Western Mediterranean | 70.9 | 62.2 | 0.0 | NP | 77.9 | 67.2 | 30.4 | 40.7 | 62.2 | 49.8 | 49.2 | 34.8 | 21.3 | 87.9 | 40.7 | 15.8 | 0.9 | NP | 48.8 | 42.8 | 5.2 | NP |
| Ionian Sea and Central Mediterranean Sea | 35.9 | 1.2 | 30.2 | NP | 0.1 | 53.1 | 0.0 | 18.9 | 28.1 | 4.9 | 4.0 | 27.1 | 3.2 | 3.5 | 11.5 | 0.9 | 4.8 | NP | NP | NP | 0.0 | NP |
| Adriatic Sea | 25.2 | 57.1 | 27.1 | NP | 61.2 | 68.3 | 2.0 | 29.1 | 34.9 | 6.8 | 2.3 | 11.8 | NP | NP | 7.8 | 0.0 | NP | NP | NP | NP | NP | NP |
| Aegean-Levantine Sea | 2.5 | 5.0 | 10.3 | NP | 1.0 | 76.4 | NP | 1.1 | 3.3 | 4.5 | 3.6 | 3.2 | 0.0 | 0.0 | 20.2 | 0.7 | 3.2 | NP | NP | NP | NP | NP |
| **Black Sea** | 77.4 | 81.6 | 78.8 | 34.8 | 68.8 | NP | NP | 93.7 | 40.9 | 24.2 | 27.7 | 9.6 | NP | NP | NP | 0.2 | NP | NP | NP | NP | 0.0 | 0.0 |
| **Total** | 42.5 | 54.3 | 53.4 | 39.1 | 31.6 | 66.2 | 15.9 | 27.2 | 23.1 | 20.8 | 13.9 | 16.0 | 24.0 | 23.6 | 24.1 | 9.4 | 23.0 | 0.0 | 48.8 | 6.7 | 0.9 | 0.6 |

**Note**: Habitat legend: I, C, B and A= infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx =rock, coarse, sand, mud mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds

**Table 3.11 Twenty percent target coverage achievement (60% for Posidonia) of each revised broad habitat by MPAs network in each MPA assessment region (green/red) and percentage of coverage variation with respect to 2012 coverage (>4% increase ☺; increase between 0 and 4 % 😐; no trend increase observed, ☹).**

| MPA assessment area regions and sub-regions | Ir | Ic | Is | Im | Imx | Pos | Cym | Cr | Cc | Cs | Cm | Cmx | Br | Bc | Bs | Bm | Bmx | Ar | Ac | As | Am | Amx |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Baltic Sea** | 😐 | 😐 | 😐 | 😐 | 😐 | ▪ | ▪ | 😐 | ☺ | 😐 | 😐 | ☺ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ |
| **North-East Atlantic Ocean** | ☺ | ☺ | 😐 | ☹ | ☺ | ▪ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☹ | ☹ | 😐 | ☹ | ☹ |
| Celtic Sea | ☹ | ☺ | 😐 | ☹ | ☺ | ▪ | ▪ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | 😐 | ▪ | ☹ | 😐 | ☹ |
| Greater North Sea incl. Kattegat and English Channel | ☹ | 😐 | 😐 | ☹ | ☹ | ▪ | ▪ | ☹ | ☺ | ☺ | ☺ | ☺ | ▪ | ▪ | ☹ | ☹ | ☹ | ▪ | ▪ | ▪ | ▪ | ▪ |
| Bay of Biscay and the Iberian Coast | ☺ | ☺ | ☺ | ☺ | ☺ | ▪ | ▪ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☹ | ▪ | 😐 | 😐 | ▪ |
| Macaronesia | ☺ | ☺ | ☺ | ☺ | 😐 | ▪ | ☺ | ☺ | ☺ | ☺ | ☺ | ☹ | ☺ | ☹ | ☺ | 😐 | ☺ | ☹ | ☹ | 😐 | ☹ | ☹ |
| **Mediterranean** | ☺ | ☺ | ☹ | ▪ | ☺ | 😐 | ☹ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | 😐 | 😐 | 😐 | ☺ | ▪ | 😐 | 😐 | 😐 | ▪ |
| Western Mediterranean | ☺ | ☺ | ☹ | ▪ | 😐 | ☺ | 😐 | ☺ | ☺ | ☺ | ☺ | ☹ | ☺ | 😐 | ☺ | 😐 | ☹ | ▪ | 😐 | 😐 | 😐 | ▪ |
| Ionian Sea and Central Mediterranean Sea | 😐 | ☹ | 😐 | ▪ | ☹ | 😐 | ☹ | ☺ | 😐 | 😐 | 😐 | ☺ | 😐 | ☹ | ☺ | 😐 | ☺ | ▪ | ▪ | ▪ | ☹ | ▪ |
| Adriatic Sea | ☺ | ☺ | ☺ | ▪ | ☺ | 😐 | 😐 | 😐 | ☺ | ☺ | 😐 | ☺ | ▪ | ▪ | 😐 | ☹ | ▪ | ▪ | ▪ | ▪ | ▪ | ▪ |
| Aegean-Levantine Sea | 😐 | ☹ | ☹ | ▪ | ☹ | ☹ | ▪ | ☹ | ☹ | ☹ | 😐 | ☹ | ☹ | ☹ | ☹ | 😐 | 😐 | ▪ | ▪ | ▪ | ▪ | ▪ |
| **Black Sea** | ☺ | ☺ | ☹ | ☹ | 😐 | ▪ | ▪ | ☺ | ☺ | ☺ | ☺ | ☺ | ▪ | ▪ | ▪ | 😐 | ▪ | ▪ | ▪ | ▪ | ☹ | ☹ |
| Total | ☺ | ☺ | ☹ | ☹ | 😐 | 😐 | ☹ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | ☺ | 😐 | ☺ | ☹ | 😐 | 😐 | ☹ | ☹ |

**Note**: Habitat legend: I, C, B and A= infralittoral, circalittoral, bathyal, abyssal; r,c,s,m,mx =rock, coarse, sand, mud mixed sediments; Pos, Cy = *Posidonia oceanica* meadows, *Cymodocea nodosa* beds

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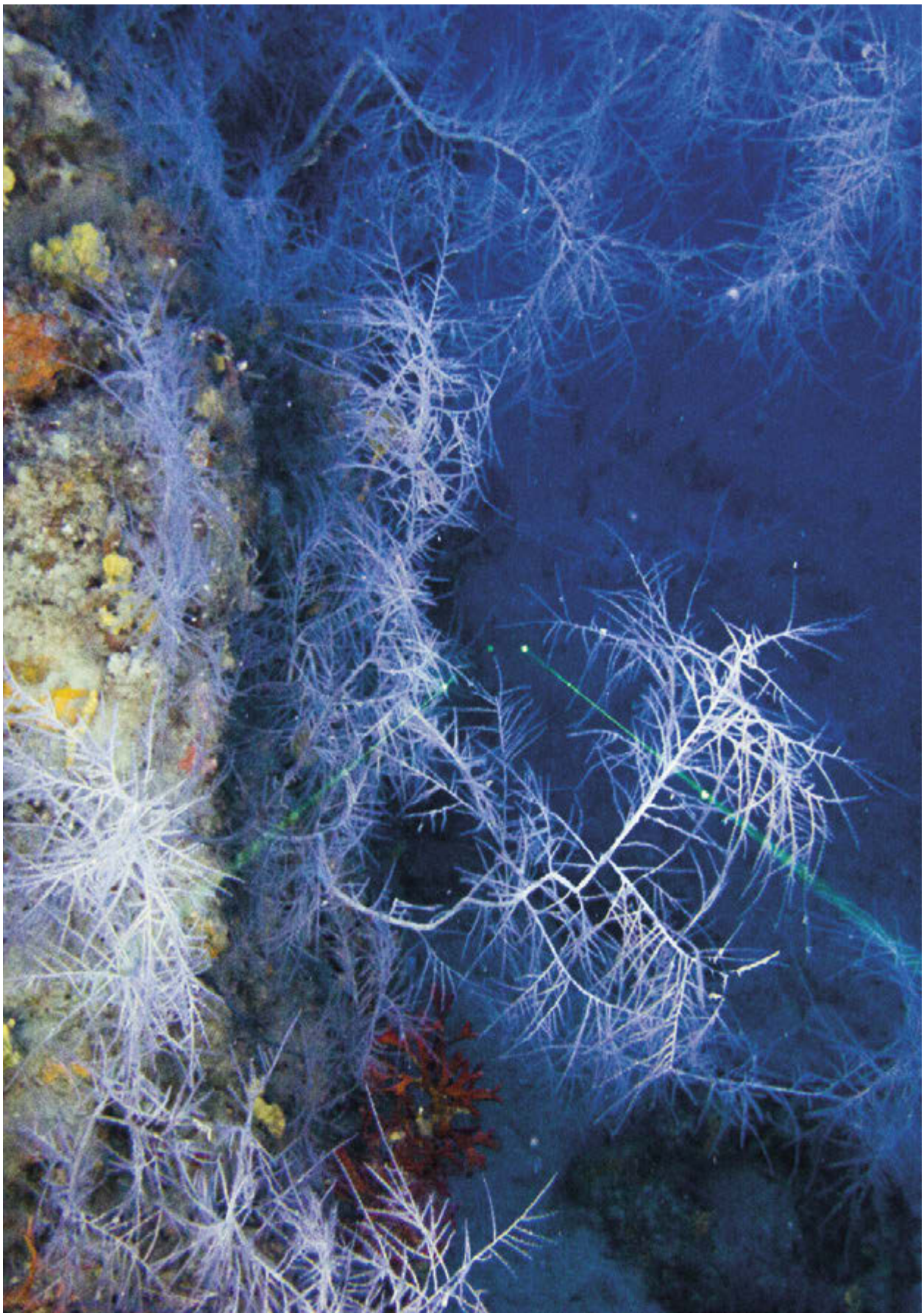
RAMOGE

# CAMPAGNE
# D'EXPLORATION
# DES ZONES PROFONDES

CAMPAGNA D'ESPLORAZIONE
DELLE ZONE PROFONDE

Photo de couverture :
*Dendrophyllia cornigera*
(Bordighera)

# Exploration des zones profondes
## Esplorazione delle zone profonde



Corail noir roches profondes / Corallo nero rocce profonde (-59 m / Monaco)

# Préface
## Prefazione

La surveillance du milieu marin et la protection de sa biodiversité, objectifs premiers de l'Accord RAMOGE qui unit la France, l'Italie et la Principauté de Monaco depuis 40 ans, ont pris une importance croissante en méditerranée alors que la dégradation des milieux naturels est devenue une préoccupation majeure pour la société et la communauté scientifique.

Les écosystèmes nord méditerranéens ont en particulier été identifiés comme étant écologiquement ou biologiquement d'un grand intérêt.

L'Accord RAMOGE, correspond à l'espace maritime de la Région Provence-Alpes-Côte d'Azur, de la Principauté de Monaco et de la Région Ligurie, il permet la mise en œuvre d'une coopération multidisciplinaire et notamment scientifique, par une mutualisation des moyens des Etats, un partage d'expériences et le lancement d'opérations conjointes.

C'est dans ce cadre, que RAMOGE a effectué en 2014 un premier travail d'identification sur des zones d'intérêt écologique et révélé l'importance des têtes de canyons et des affleurements rocheux profonds en tant qu'habitats clés. Sur cette base, une campagne d'exploration scientifique a été menée du 16 au 23 août 2015, par des membres du Groupe de travail « Gestion Intégrée des Zones Côtières » de l'Accord, sur les canyons et zones profondes de Bordighera, d'Arma di Taggia, de Monaco, du Dramont et de la Nioulargue.
Les résultats de cette campagne, présentés dans les pages qui suivent, démontrent combien une approche plurielle en termes d'acteurs, de moyens et d'hommes peut faire avancer la science, la connaissance et les solutions pour atteindre les objectifs de préservation des milieux marins côtiers et pourtant méconnus.

Ainsi, sur une distance de près de 21 kilomètres, l'Agence française des aires marines protégées, l'Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), la Direction de l'Environnement et le Centre scientifique de Monaco ont, avec la mise à disposition du navire scientifique de l'ISPRA, exploré des zones comprises entre 50 et 400 mètres de profondeur afin d'établir un état des lieux des habitats, des espèces protégées et commerciales, des écosystèmes et des pressions anthropiques.

Forts de ces conclusions, l'intérêt de préserver ces zones nous apparaît dès lors évident alors que presque 122 espèces, dont certaines emblématiques, comme le corail noir (*Antipathella subpinnata*) et le corail blanc (*Madrepora oculata*) ont pu être identifiées et que les impacts liés aux activités de plaisance (mouillage) et de pêche ont été mis en évidence jusque dans ces profondeurs.

**Elisabeth Lanteri-Minet**
Présidente de la Commission RAMOGE

Il monitoraggio dell'ambiente marino e la tutela della biodiversità sono obiettivi primari dell'Accordo RAMOGE, che da 40 anni unisce Francia, Italia e Principato di Monaco. Questi obiettivi hanno assunto sempre più importanza a livello mediterraneo, in un momento in cui il degrado degli ambienti naturali è diventato motivo di grave preoccupazione per la società e la comunità scientifica.

Gli ecosistemi della parte settentrionale del Mediterraneo sono considerati di grande interesse a livello ecologico e biologico.

L'Accordo RAMOGE, che comprende le zone marittime della regione Provenza-Alpi-Costa Azzurra, del Principato di Monaco e della Regione Liguria, promuove una cooperazione multidisciplinare in ambito scientifico, mediante la messa in comune delle risorse degli Stati, la condivisione di esperienze e l'organizzazione di operazioni congiunte.

In tale contesto RAMOGE nel 2014 ha condotto una prima attività per individuare le zone di interesse ecologico e dimostrare l'importanza che le testate dei canyon e gli affioramenti rocciosi profondi rivestono quali habitat chiave. Su questa base, il gruppo di lavoro "Gestione integrata delle zone costiere" dell'Accordo Ramoge, dal 16 al 23 agosto 2015, ha condotto una campagna di esplorazione scientifica sui canyon e sulle zone profonde di Bordighera, di Arma di Taggia, di Monaco, del Dramont e della Nioulargue.

I risultati di questa campagna presentati nelle seguenti pagine dimostrano che un approccio congiunto a livello di attori, di risorse e di uomini può dare un forte contributo alla scienza, alla conoscenza e alle soluzioni per raggiungere gli obiettivi di conservazione degli ambienti marini costieri che, ancora oggi, rimangono sconosciuti.

Su una distanza di quasi 21 km, l'Agenzia francese delle Aree Marine Protette, il Centro scientifico e la Direzione dell'Ambiente di Monaco, e l'Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) hanno esplorato, con la nave scientifica dell'ISPRA, alcune zone comprese tra i 50 e i 400 metri di profondità per valutare la situazione degli habitat, delle specie protette e commerciali, degli ecosistemi e delle pressioni antropiche.

L'interesse di preservare queste zone ci sembra pertanto evidente in virtù del fatto che è stato possibile identificare la presenza di circa 122 specie, di cui alcune emblematiche come il corallo nero (*Antipathella subpinnata*) e il corallo bianco (*Madrepora oculata*), e di rilevare che gli impatti legati alle attività di diporto (ancoraggio) e alla pesca sono presenti anche a queste profondità.

**Elisabeth Lanteri –Minet**
Presidente della Comissione RAMOGE

# 1 Accord RAMOGE
## L'Accordo RAMOGE


L'Accord RAMOGE, créé en 1976, sous l'initiative du Prince RAINIER III est un instrument de coopération entre trois pays, la France, Monaco et l'Italie. Postérieur de quelques mois à la Convention pour la protection du milieu marin et du littoral de la Méditerranée, l'Accord RAMOGE s'est inscrit dès l'origine dans une approche sous-régionale à vocation pilote.

L'Accord RAMOGE rend possible la coopération scientifique, technique, opérationnelle, juridique et administrative entre ces trois États. Ils arrêtent ensemble les actions à conduire pour la gestion intégrée du littoral et la sensibilisation du public au respect de l'environnement.

A ce titre RAMOGE a une mission de recommandation de bonnes pratiques auprès des collectivités locales, d'information auprès des utilisateurs et gestionnaires de la mer (plaisanciers, pêcheurs, élus, administrations) et de sensibilisation du grand public, en visant directement les usagers de la mer via des campagnes de communication ou en

L'Accordo RAMOGE, istituito nel 1976 per iniziativa del Principe RANIERI III, è uno strumento di cooperazione tra tre paesi firmatari: Francia, Monaco e Italia. Siglato alcuni mesi dopo la Convenzione per la protezione dell'ambiente marino e della regione costiera del Mediterraneo, sin dai suoi esordi l'Accordo RAMOGE si è connotato come un'iniziativa pilota a scala sub-regionale.

L'Accordo RAMOGE permette la cooperazione scientifica, tecnica, operativa, giuridica e amministrativa tra questi tre Stati che, insieme, decidono quali azioni intraprendere per la gestione integrata del litorale e la sensibilizzazione del pubblico al rispetto dell'ambiente.

In tale contesto RAMOGE opera per proporre raccomandazioni di buone pratiche agli enti locali, fornire informazioni ai gestori e utenti del mare (diportisti, pescatori, politici, amministrazioni) e promuovere la sensibilizzazione del grande pubblico, rivolgendosi direttamente agli utenti del mare mediante campagne di comunicazione o coinvolgendoli nelle attività


associant ceux-ci aux travaux des groupes de travail (campagnes de surveillance, aide au recensement des espèces, de sensibilisation aux déchets…).

De plus, RAMOGE a un volet opérationnel en matière de lutte antipollution, avec son Plan RAMOGEPOL, signé en 2003 puis amendé, traite les actions de prévention et de lutte contre les pollutions marines. Il vise notamment à la connaissance croisée des organisations nationales, l'amélioration de la fluidité de circulation de l'information et l'amélioration de la coopération et de la coordination des moyens de prévention et de lutte contre les pollutions.

dei gruppi di lavoro (campagne di monitoraggio, supporto al censimento delle specie, attività di sensibilizzazione sulla problematica dei rifiuti, ecc.).

Inoltre, RAMOGE opera attivamente nel campo della lotta contro l'inquinamento, con il suo Piano RAMOGEPOL, firmato nel 2003 e successivamente emendato, fornisce un quadro operativo alle azioni di prevenzione e di lotta agli inquinamenti marini. Nello specifico promuove l'interazione tra le organizzazioni nazionali esistenti, una maggiore fluidità nel flusso di informazioni e un miglioramento nella cooperazione e nel coordinamento dei mezzi di prevenzione e di lotta antinquinamento.

# 2

# Importance des zones profondes

## Importanza delle zone profonde

Dans le millénaire actuel, caractérisé par une avancée notable des connaissances dans de multiples secteurs, le milieu marin est le domaine pour lequel les informations disponibles sont parmi les plus lacunaires, et cette carence de connaissance est particulièrement marquée en ce qui concerne les zones profondes.

La notion de mer profonde est communément associée à des environnements océaniques situés dans des régions éloignées, alors qu'elles peuvent être très proches de nos côtes, comme c'est le cas dans la zone marine couverte par la zone de l'Accord RAMOGE. Le profil très escarpé du littoral caractéristique de la mer Ligure, et en particulier le long de la Riviera ligurienne (Région Ligure, Italie) et de la région Provence-Alpes-Côte d'Azur (PACA, France), fait que l'on retrouve de très grandes profondeurs à seulement quelques centaines de mètres de la côte.

Ces profondeurs sont des zones de grand intérêt, à la fois écologique, scientifique, et éducatif. Elles se situent au-delà d'un plateau continental très étroit et entaillé par de fréquentes incisions profondes le plus souvent perpendiculaires à la côte; il s'agit des canyons sous-marins.

Dans ces environnements se rencontrent des phénomènes particuliers. Les échanges entre les masses d'eaux du plateau continental et celles des zones profondes impliquent le transport de sels nutritifs, qui favorise la présence d'habitats benthiques extrêmement riches et diversifiés. Ces habitats sont caractérisés par la richesse d'espèces qui vivent sur le fond comme les coraux d'eau froide, les gorgones et les éponges ainsi que d'autres espèces qui vivent dans la colonne d'eau comme de nombreuses espèces de poissons, de cétacés, et en surface, d'oiseaux marins.

Le milieu marin méditerranéen du bassin nord occidental est fréquemment exploré jusqu'à 50 mètres de profondeur grâce à la plongée en scaphandre. Il l'est également, au-delà de 1000 mètres, nécessitant le recours à des navires océanographiques dotés d'équipements sophistiqués.

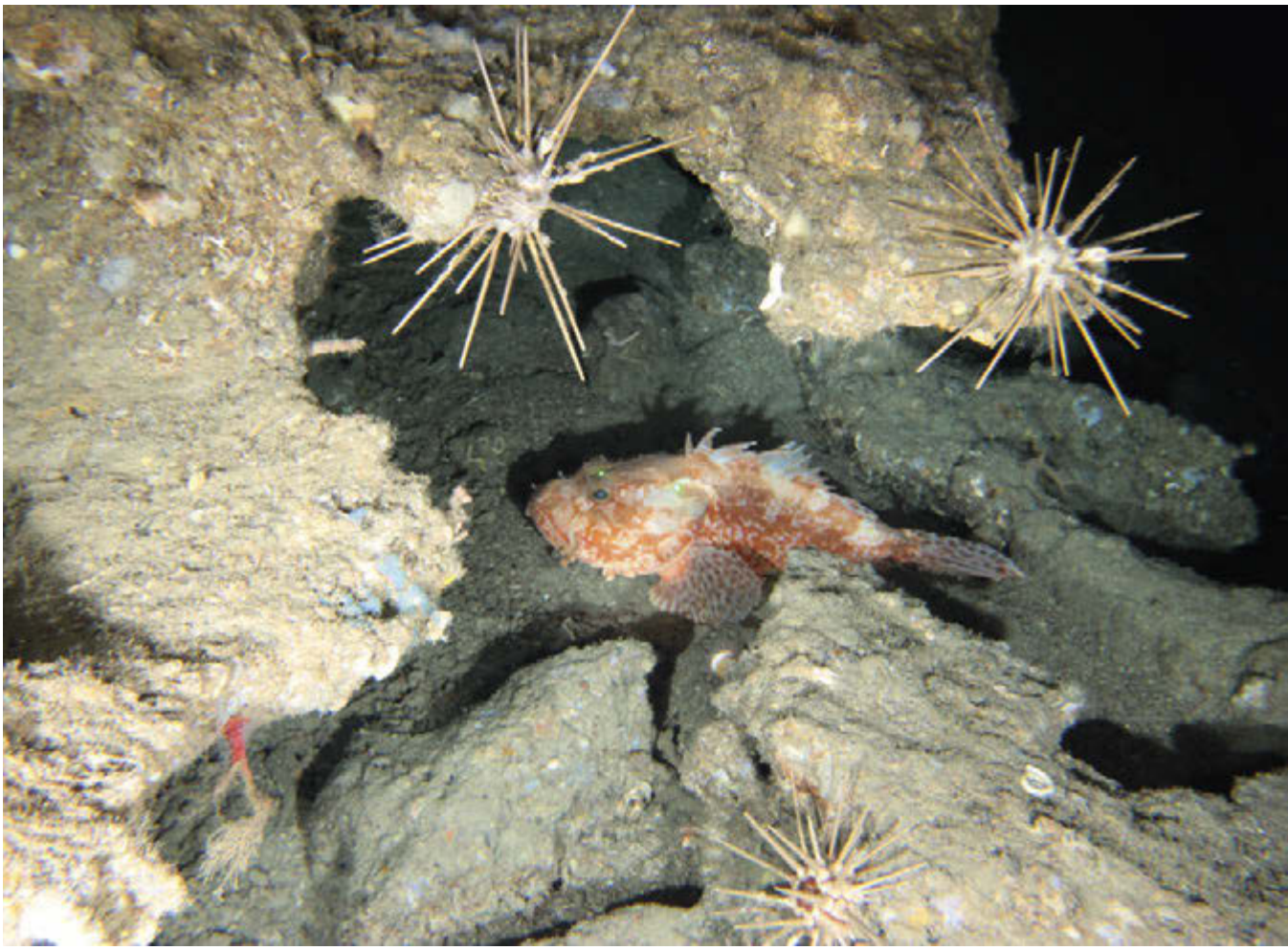
In questo millennio, caratterizzato dal notevole avanzamento delle conoscenze in molteplici campi, l'ambiente marino costituisce una realtà per la quale le informazioni a disposizione sono tra le più limitate, e questa carenza conoscitiva è particolarmente marcata per gli ambienti profondi.

Parlando di mare profondo, si è portati a pensare ad ambienti oceanici siti in regioni remote, mentre in realtà gli ambienti profondi possono essere molto vicini alle nostre coste, proprio come accade nelle acque marine afferenti alla zona RAMOGE. La particolare conformazione dei fondali che caratterizzano il Mar Ligure, molto ripidi soprattutto in corrispondenza della riviera ligure di ponente e della regione Provenza-Alpi-Costa Azzurra (regione PACA, Francia), fa sì che già a poche centinaia di metri dalla costa le profondità marine possano spingersi a valori particolarmente elevati.

Questi fondali costituiscono ambienti di elevatissimo interesse a livello ecologico, scientifico, e educativo: si trovano al di là di una piattaforma continentale molto stretta e solcata da profonde incisure di frequente quasi perpendicolari alla costa: sono i canyon sottomarini.

In questi ambienti si verificano fenomeni particolari. Gli scambi tra le masse d'acqua presenti sulla piattaforma continentale e quelle profonde, che implicano il trasporto di sali nutritivi, favoriscono la presenza di habitat bentonici estremamente ricchi e diversificati. Questi habitat sono caratterizzati dalla ricchezza di specie che vivono sul fondo, come coralli profondi, gorgonie e spugne, e di altre che frequentano la colonna d'acqua come, numerose specie di pesci, di cetacei e, in superficie, di uccelli marini.

L'ambiente marino mediterraneo del bacino nord occidentale è stato studiato adeguatamente sino alla profondità di 50 metri mediante immersioni subacquee con autorespiratore ad aria. Quest'ambiente è stato esplorato anche oltre i 1000 metri di profondità, anche se in modo meno esaustivo, con l'impiego di navi oceanografiche e di strumentazioni importanti.



*Scorpaena elongata* et cidaridae
*Scorpaena elongata* e Cidaridi
(-157 m Nioularge)

La zone intermédiaire, comprise entre 50 et 1000 mètres de profondeur, moins étudiée, est par conséquent la moins bien connue, même si depuis une dizaine d'années plusieurs campagnes océanographiques ont permis d'appréhender la richesse de ces secteurs qui constituent de réels points de concentration de la biodiversité marine (« hot spots »).
Pour ces raisons, au cours des dernières années, les principales organisations internationales œuvrant pour la protection du milieu marin, tels que la Convention sur la Diversité Biologique (CDB), la Convention de Barcelone, ou l'Union Internationale pour la Conservation de la Nature (UICN) ont mis en évidence l'importance d'acquérir de nouvelles connaissances sur ces habitats profonds. Le recueil de ces données doit permettre de rassembler les informations scientifiques sur leurs spécificités et leur vulnérabilité, informations sur la base desquelles il sera possible de proposer des mesures de gestion des activités humaines, nécessaires à la préservation de ces milieux particuliers.

La zona compresa tra i 50 e i 1000 m di profondità, meno studiata, rimane quindi quella meno conosciuta, anche se negli ultimi dieci anni diverse campagne oceanografiche hanno consentito di prendere coscienza della ricchezza dei fondali presenti in questo intervallo di profondità, che costituiscono veri e propri punti di concentrazione della biodiversità marina (hot spot).
Proprio per questi motivi negli ultimi anni i principali accordi internazionali per la protezione della biodiversità marina, come la Convenzione sulla Diversità Biologica (CBD) o la Convenzione di Barcellona per la protezione dell'ambiente marino e delle regioni costiere del Mediterraneo, oltre ad alcune organizzazioni internazionali come l'Unione Internazionale per la Conservazione della Natura (IUCN), hanno evidenziato l'importanza di acquisire nuove conoscenze su questi habitat profondi. Da qui l'esigenza di acquisire informazioni scientifiche sulle loro specificità e vulnerabilità, con cui sarà possibile mettere a punto misure di gestione delle attività antropiche necessarie alla salvaguardia di questi ambienti particolari.

# 3 Campagne RAMOGE
## Campagna RAMOGE

## Présentation

En 2014 à Malaga en Espagne, lors d'un atelier spécifique à la Méditerranée organisé dans la cadre de la CDB, deux aires marines écologiquement ou biologiquement significatives dans la partie nord de la Méditerranée occidentale ont été identifiées (ecologically or biologically significant marine areas– EBSA), l'une pour les écosystèmes pélagiques et l'autre pour les écosystèmes benthiques (UNEP / CBD, 2014).

A partir de cette évaluation générale et dans le cadre des activités de l'Accord RAMOGE, un premier travail d'identification sur des zones d'intérêt écologique a été présenté lors du symposium sur les habitats clés de Méditerranée organisé par le Centre d'Activités Régional pour les Aires Spécialement Protégées (CAR/ASP) de Méditerranée à Portoroz en Slovenie. Grace à la collaboration entre les Etats au sein de la zone RAMOGE et en appliquant les critères proposés par la CDB, 35 zones d'intérêts pour les eaux ligures (Italie) ont pu être identifiées, 6 pour Monaco et 25 pour la région Provence-Alpes Côte d'Azur (France). Les zones identifiées concernent surtout des têtes de canyons et des affleurements rocheux profonds.

RAMOGE a réalisé en 2015, une première campagne d'exploration des zones profondes, comprises entre 50 et 400 mètres de profondeur afin d'établir un état des lieux concernant les habitats, les espèces protégées et commerciales, les écosystèmes et les pressions anthropiques.

Sur la base de ces critères, six zones d'intérêt écologique ont été retenues pour la conduite des activités de la campagne, deux par Etat membre (Figure 1): Italie - canyons d'Arma di Taggia et de Bordighera ; Monaco - Canyon et roches profondes du Larvotto; France - banc de la Nioulargue et canyon du Dramont.

Certaines zones se situent dans un espace maritime géré (aires marines protégées, sites Natura 2000). La campagne a aussi permis d'apporter les éléments de connaissances nécessaires à la constitution d'un état des lieux

## Presentazione

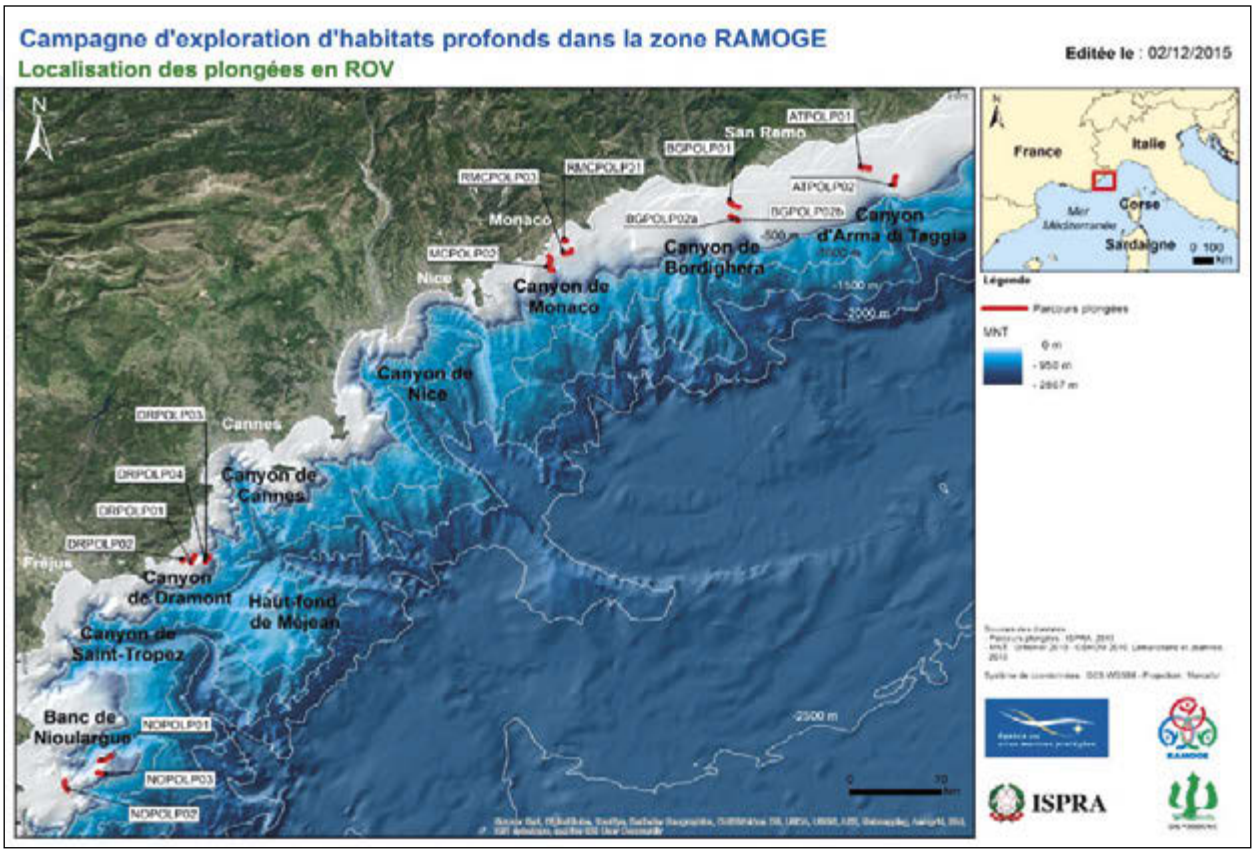
Nel 2014 a Malaga, in Spagna, in occasione di un workshop specifico per il Mediterraneo organizzato nel quadro della CBD, la parte nord del bacino occidentale del Mediterraneo è stata identificata per la presenza di due aree marine ecologicamente o biologicamente significative (Ecologically or Biologically Significant marine areas – EBSA), una per gli ecosistemi pelagici e l'altra per gli ecosistemi bentonici (UNEP / CBD, 2014).

Partendo da questa valutazione generale e nel quadro dell'Accordo RAMOGE, in occasione del simposio sugli habitat chiave del Mediterraneo organizzato dal Centro di Attività Regionale per le Aree Specialmente Protette (RAC/SPA), tenutosi in Slovenia a Portorose, è stato presentato un primo lavoro di identificazione di maggior dettaglio delle zone di interesse ecologico (Coppo et al., 2014). Detto contributo, elaborato nell'ambito della collaborazione transfrontaliera RAMOGE, applicando i criteri proposti dalla CBD, ha permesso di individuare 35 zone di interesse per le acque liguri (Italia), 6 per Monaco e 25 per la regione ProvenzaAlpi-Costa Azzurra (Francia) (Figura 1). Molte delle zone individuate sono costituite da testate di canyon sottomarini e da affioramenti rocciosi profondi.

Nel 2015 RAMOGE ha organizzato una prima campagna di esplorazione delle zone profonde, comprese in un intervallo di profondità tra i 50 e i 400 m, per avere una visione d'insieme sugli habitat, le specie protette e di interesse commerciale, gli ecosistemi e le pressioni antropiche.

Sulla base di questi criteri sono state selezionate sei zone di interesse ecologico dove condurre le attività della campagna, due per ogni Stato membro (Figura 2): Italia - canyon di Arma di Taggia e di Bordighera; Monaco - canyon e rocce del Larvotto; Francia - banco di Nioulargue e canyon del Dramont.

La maggior parte di queste zone si trova in uno spazio marittimo già oggetto di misure di gestione (aree marine protette, siti Natura 2000). La campagna ha altresì consentito di




Localisation des zones explorées
Localisazione delle zone esplorate

environnemental, préalable indispensable à l'établissement de document cadre de gestion locale.
Dans cette volonté de coopération internationale, plusieurs structures se sont mobilisées dans la préparation et la réalisation de cette campagne. Il s'agit pour l'Italie de l'Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), pour Monaco de la Direction de l'Environnement, la Direction des Affaires Maritimes et du Centre Scientifique de Monaco, pour la France de l'Agence française des aires marines protégées (AFAMP) et du GIS Posidonie.

Cette campagne océanographique d'exploration RAMOGE s'est déroulée du 16 au 23 août 2015, de Cogolin (France) à San Remo (Italie), en utilisant les moyens nautiques et scientifiques de l'ISPRA. Les explorations ont été menées grâce au navire de 23 mètres « R/V ASTREA » qui a embarqué pour l'occasion un ROV[1] (Remotely Operated Véhicule), « Polluce III » permettant des explorations jusqu'à 500 mètres de profondeur. L'utilisation préalable du sonar multifaisceaux a permis l'acquisition une topographie des fonds par une image acoustique afin d'orienter au mieux les explorations.

acquisire elementi conoscitivi necessari alla realizzazione di una mappatura ambientale, presupposto indispensabile alla predisposizione di un documento quadro di gestione locale.
A riprova della volontà di promuovere una cooperazione internazionale, numerose strutture si sono mobilitate per preparare e realizzare questa campagna: per l'Italia l'Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), per Monaco la Direzione dell'Ambiente e il Centro Scientifico, per la Francia l'Agenzia delle aree marine protette (AAMP) e il GIS Posidonie.

La campagna oceanografica di esplorazione RAMOGE si è svolta dal 16 al 23 agosto 2015 da Cogolin (Francia) a Sanremo (Italia), utilizzando i mezzi e le strumentazioni scientifiche dell'ISPRA. Le esplorazioni sono state condotte con la R/V ASTREA, una nave da ricerca di circa 23 m di lunghezza.
La R/V ASTREA è equipaggiata con un sonar multibeam, che consente di ottenere la batimetria e l'immagine acustica dei fondali sino a circa 500 m di profondità; le immagini raccolte hanno permesso di ottimizzare le esplorazioni condotte tramite ROV[1] (Remotely Operated Vehicle). L'esplorazione e la raccolta di immagini e filmati sono state effettuate con

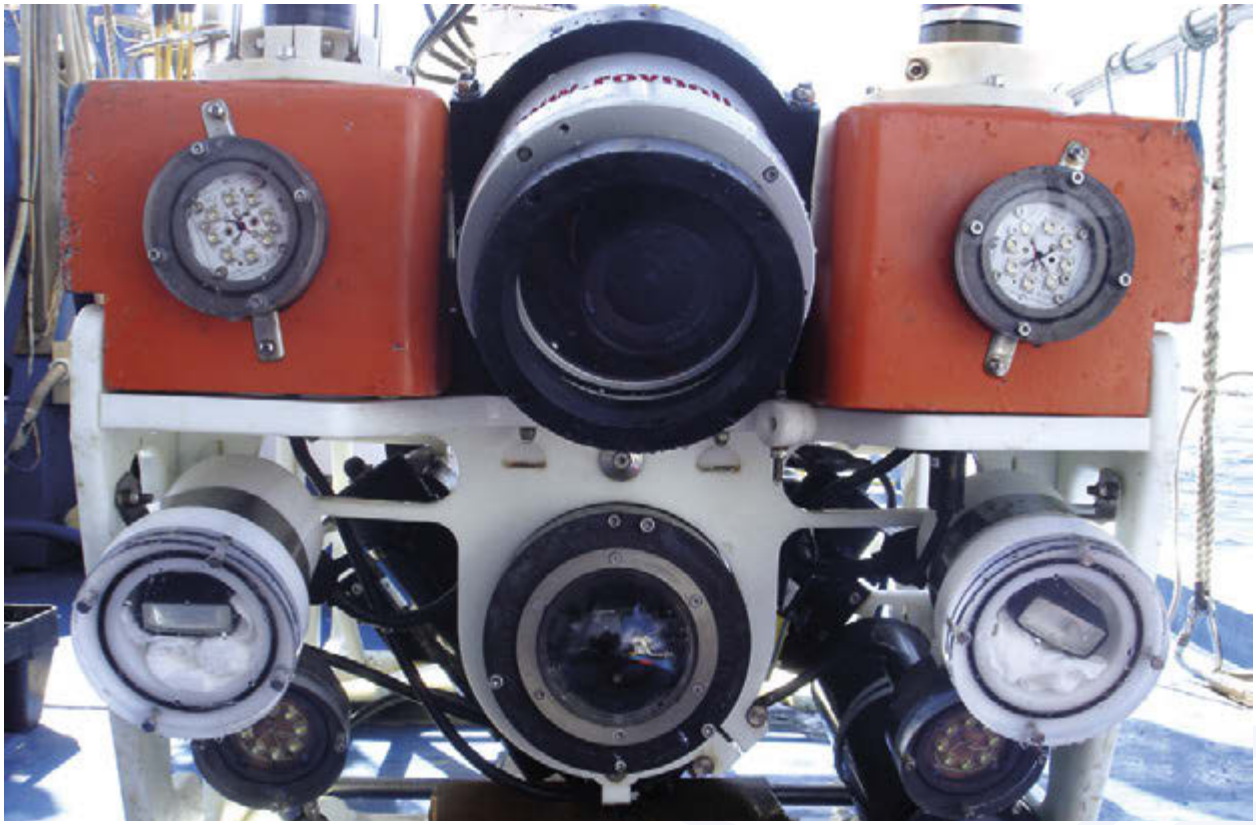
NOTE

[1] Le ROV Pollux III est un engin sous-marin filoguidé, utilisé pour l'exploration et la prise de vues, il est équipé de 2 caméras vidéo et d'un appareil photo.

[1] Il ROV Polluce III è un'apparecchiatura subacquea filoguidata utilizzata per l'esplorazione e le riprese, dotata di due videocamere e di una macchina fotografica.

## CAMPAGNE À LA MER DU NAVIRE R/V ASTREA DU 16 AU 23 AOÛT 2015
## CAMPAGNA OCEANOGRAFICA DELLA R/V ASTREA DAL 16 AL 23 AGOSTO 2015

| | | |
|---|---|---|
| 16/08/15 | Canyon d'Arma di Taggia (Italie) | Prospection sonar (Prospezione sonar) |
| 17/08/15 | Canyon de Bordighera (Italie) | Prospection au sonar (Prospezione sonar)<br>Transit sur Monaco (Spostamento su Monaco) |
| 18/08/15 | Canyon de Monaco | Prospection sonar (Prospezione sonar)<br>+ ROV |
| 19/08/15 | Roches profondes du Larvotto (Monaco)<br>Affioramenti rocciosi profondi del Larvotto | Prospection sonar (Prospezione sonar)<br>+ ROV<br>+ Transit Cogolin (Spostamento su Cogolin) |
| 20/08/15 | Banc (Banco) de la Nioulargue (France) | Exploration sonar (Prospezione sonar)<br>+ ROV |
| 21/08/15 | Canyon du Dramont (France) | Exploration sonar (Prospezione sonar)<br>+ ROV |
| 22/08/15 | Canyon d'Arma di Taggia (Italie) | Transit San Rémo (Spostamento su Cogolin)<br>+ ROV |
| 23/08/15 | Canyon de Bordighera (Italie) | ROV |



Mise à l'eau du ROV /
Immersione del ROV

Les outils de saisie d'informations durant les explorations étant différents d'une équipe à l'autre , il a été nécessaire de réaliser un travail de standardisation des données. Les échanges amorcés sur le post-traitement entre les équipes italienne, monégasque et française ont permis d'apprécier leur complémentarité et de partager les outils de traitement et de discuter les résultats.
A l'instar des campagnes océanographiques d'exploration des têtes de canyons en Méditerranée française MedSeaCan & CorSeaCan (2008-2010) diligentées par l'Agence des aires marines protégées, le travail d'homogénéisation des données et d'identification d'espèces a été confié au GIS Posidonie.

Les résultats sont présentés dans ce document et de manière plus détaillée et chronologique dans un document interactif qui peut être consulté sur le site internet de l'Accord RAMOGE.
http://www.ramoge.org/fr/storymap.aspx

il ROV filoguidato "Polluce III", dotato di una telecamera HD Sony, una macchina fotografica e una telecamera di navigazione.

Poiché gli strumenti di acquisizione dei dati nel corso delle esplorazioni sono diverse nei tre Paesi, è stato necessario un lavoro di standardizzazione delle osservazioni. La collaborazione registrata nel post-trattamento dei dati tra i team italiano, monegasco e francese ha permesso di apprezzare la complementarietà e di condividere gli strumenti di trattamento dei dati e di discutere i risultati. Il lavoro di standardizzazione e di identificazione di base delle specie è stato affidato al GIS Posidonie, vista l'esperienza acquisita da questa struttura con le campagne oceanografiche di esplorazione delle testate di canyon nel Mediterraneo francese MedSeaCan & CorSeaCan (2008-2010), organizzate dall'Agenzia francese delle aree marine protette .

La campagna ha portato alla produzione di diversi elaborati, tra i quali un rapporto di missione, i cui risultati preliminari sono presentati nelle pagine seguenti, un documento interattivo che può essere consultato sul sito internet dell'Accordo RAMOGE.
http://www.ramoge.org/it/storymap.aspx

Astrea (Monaco)

NOTES

[2] L'étage circalittoral est un milieu dans lequel la lumière est insuffisante pour permettre la vie d'algues photophiles et de phanérogames, comme la *Posidonia oceanica*, et où les algues sciaphiles, surtout les rouges, sont capable de créer un habitat particulier comme le coralligène. La limite supérieure et inférieure de l'étage circalittoral varie en fonction de la turbidité de l'eau, mais, dans l'ouest de la Méditerranée, l'étage circalittoral correspond souvent à des profondeurs comprises entre 40 et 180 m de profondeur. La partie la plus profonde de cet étage, où dominent les espèces animales en raison de l'insuffisance de lumière qui ne permet pas la vie des algues multicellulaires, est appelée circalittoral profond.

[3] Vase bathyale : L'étage bathyal se situe immédiatement après l'étage circalittoral et descend jusqu'à 2000-2500m de profondeur. Lorsque le fond est vaseux entre 180 et 2000 m, on parle de vases bathyales.

## Résultats par site

Sur les trois pays, plus de 21 kilomètres ont été parcourus entre 52 et 462 mètres de profondeur explorant des secteurs situés entre 0,5 km (canyon de Monaco) et environ 10 km de la côte (extrémité est du banc de la Nioulargue) :

- des roches profondes du plateau continental (banc de la Nioulargue et les roches profondes du Larvotto)
- ainsi que des têtes de canyon dans leur partie supérieure (canyons du Dramont, de Monaco, de Bordighera et d'Arma di Taggia).

Majoritairement, ces sites sont dominés par les espèces de l'étage circalittoral[2] et circalittoral profond. Des secteurs de roches et des zones de vases bathyales[3] ont également été prospectés dans les canyons. Cent vingt-deux espèces ont ainsi été observées et identifiées.

Le banc de la Nioulargue et les roches du Larvotto offrent des paysages très différents (cf graphique p.14). Le banc de la Nioulargue est constitué d'une avancée rocheuse couverte d'un riche détritique et parsemé d'affleurements rocheux colonisés par des gorgones, des coraux noirs et quelques éponges. Les roches du Larvotto émergent d'un milieu meuble, vaseux ou sablo-vaseux. Elles constituent des oasis de vie pour les

## Risultati per sito

Nei tre paesi sono stati percorsi in immersione oltre 21 km tra 52 e 462 m di profondità, esplorando dei settori situati tra 0,5 km (canyon di Monaco) e all'incirca 10 km dalla costa (estremità Est del banco di Niuoulargue):

- le rocce profonde della piattaforma continentale (banco di Nioulargue e le rocce profonde del Larvotto)
- le testate dei canyon nella loro parte superiore (canyon del Dramont, di Monaco, di Bordighera e di Arma di Taggia).

I siti esplorati sono risultati principalmente dominati da specie del piano circalitorale[2] e del circalitorale profondo, benché nei canyon siano stati studiati anche settori di roccia e di fango batiale[3]. Nel complesso sono state osservate e identificate centoventidue specie.

Il banco di Nioulargue e le rocce del Larvotto sono caratterizzati da paesaggi molto differenti (cf grafico p.14). Il banco di Nioulargue è costituito da una balza rocciosa coperta da un ricco detritico punteggiato da affioramenti rocciosi colonizzati da gorgonie, coralli neri e qualche spugna. Le rocce del Larvotto, affioranti da un ambiente di fondo mobile (fangoso o sabbio-fangoso), rappresentano oasi di vita per le specie sessili dominate dalle spugne con un'importante presenza di coralli neri e gorgonie.

San Remo / Sanremo

espèces sessiles, dominées par le groupe des éponges (cf graphique p.14), de coraux noirs et de gorgones.

Dans les secteurs rocheux les moins profonds des canyons du Dramont et de Bordighera, des paysages comparables ont été observés (cf graphique p.14) avec des gorgones telles que *Paramuricea clavata* (gorgone pourpre) et *Eunicella cavolini* (gorgone orange) principalement, mais également *Eunicella verrucosa* (gorgone blanche verruqueuse), en particulier dans le canyon de Bordighera et sur les roches du Larvotto.

Le corail jaune *(Dendrophyllia cornigera)* a été observé sur tous les sites mais il est particulièrement présent dans le canyon de Bordighera avec parfois une telle densité qu'il faudrait le considérer comme un facies.

Au banc de la Nioulargue, la découverte de deux colonies de corail profond *Madrepora oculata* (corail zig-zag) pourrait indiquer la présence d'un peuplement de ces coraux d'eau froide, dans des milieux encore plus pofonds.

En ce qui concerne les pressions anthropiques visibles on observe notamment celles liées aux engins de pêche perdus (canyon de Bordighera, banc de la Nioulargue) et celles dues aux ancrages répétés (roches profondes du Larvotto).

Nei settori rocciosi meno profondi dei canyon del Dramont e di Bordighera sono stati osservati paesaggi simili (cf grafico p.14), caratterizzati dalle gorgonie *Paramuricea clavata* (gorgonia rossa) ed *Eunicella cavolini* (gorgonia gialla), ma anche da *Eunicella verrucosa* (gorgonia verrucosa) soprattutto nel canyon di Bordighera e sulle rocce del Larvotto.

Il corallo giallo (*Dendrophyllia cornigera*) è stato osservato in tutti i siti ma è particolarmente presente nel canyon di Bordighera, con una densità per sito tale da considerarlo in grado di caratterizzare una facies.

Sul banco di Nioulargue la scoperta inattesa di due colonie di corallo profondo *Madrepora oculata*, dalle dimensioni abbastanza importanti, potrebbe indicare la presenza di questi coralli freddi negli ambienti ancora più profondi.

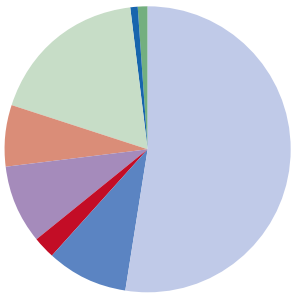
Gli impatti antropici visibili sono principalmente costituiti da attrezzi da pesca persi (canyon di Bordighera, banco di Nioulargue) e da ripetuti ancoraggi (rocce profonde del Larvotto).

NOTES

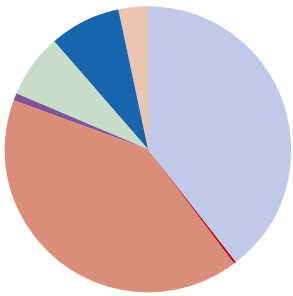
[2] Piano circalitorale: è l'ambiente dove la luce è insufficiente per permettere la vita delle alghe fotofile e delle fanerogame marine, come *Posidonia oceanica,* e dove le alghe sciafile, soprattutto quelle rosse, sono in grado di creare un habitat particolare come il coralligeno. Il limite superiore e inferiore del piano circalitorale varia in funzione della torbidità dell'acqua ma, nel Mediterraneo occidentale, spesso corrisponde a fondali compresi tra 40 e 180 m di profondità. La parte più profonda di questo piano dove sono dominanti le specie animali, a causa della luce insufficiente per permettere la vita di alghe pluricellulari, è chiamata circalitorale profondo.

[3] Fango batiale: il piano batiale si trova subito dopo il piano circalitorale e scende fino a 2000-2500 m di profondità. Quando il fondale tra 180 e 2000 m è fangoso, si parla di fanghi batiali.

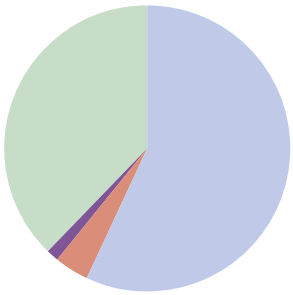
## NOMBRE D'OBSERVATIONS PAR FACIÈS[4]
## NUMERO DI OSSERVAZIONI PER FACIES[4]



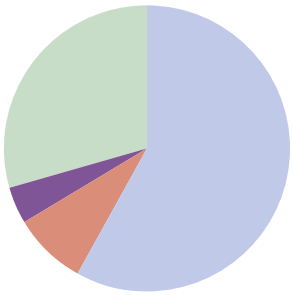
Banc de la Nioulargue



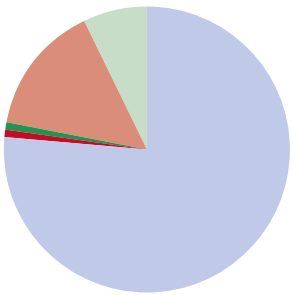
Roches profondes de Monaco



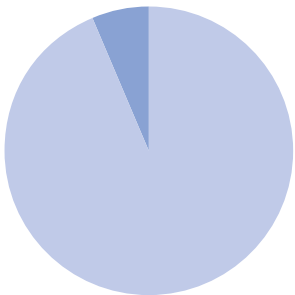
Canyon du Dramont



Canyon di Bordighera



Canyon de Monaco



Canyon Arma di Taggia

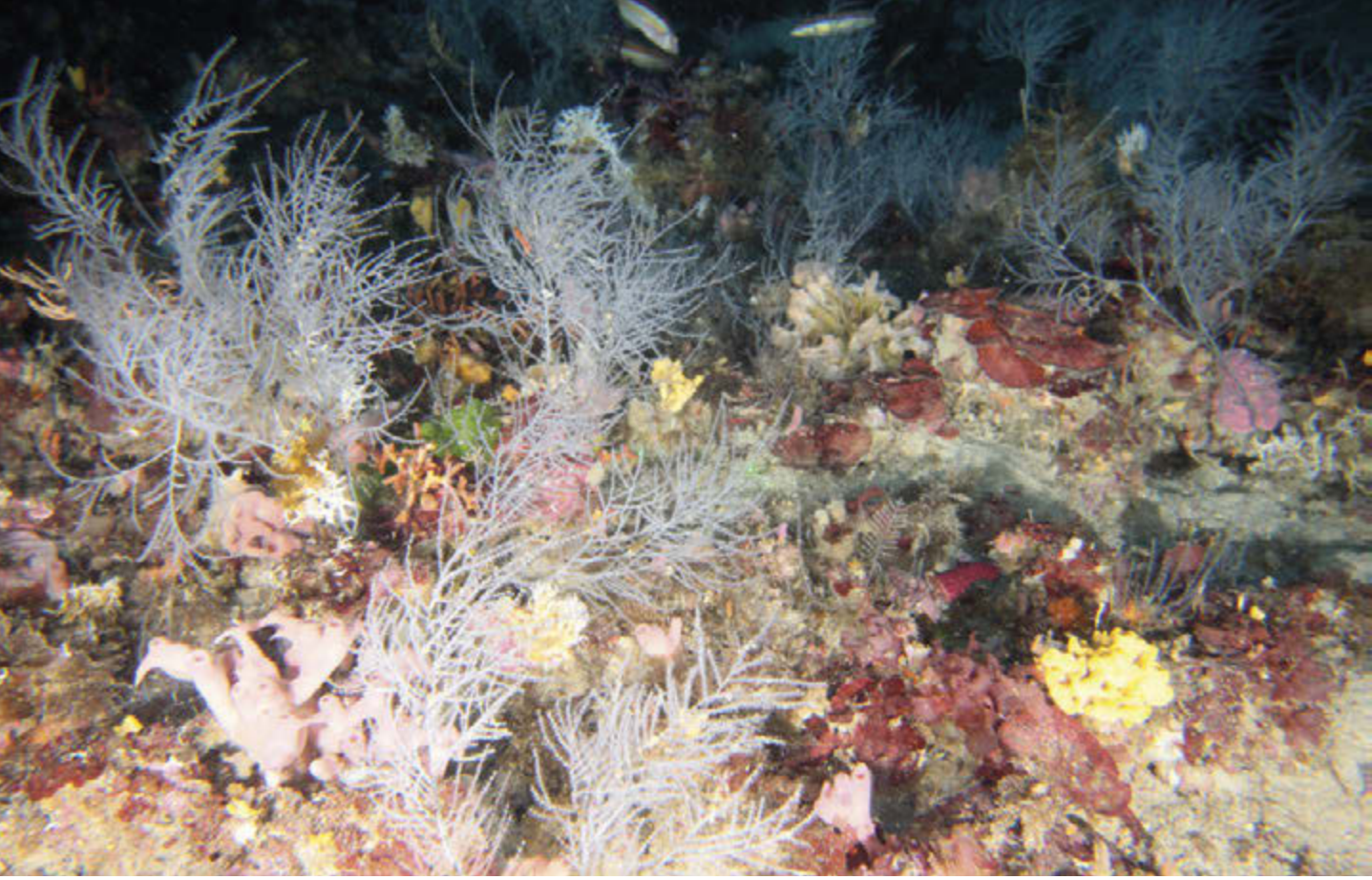
NOTES

[4] Ici le terme faciès est utilisé pour décrire un paysage dominé par une espèce ou un groupe d'espèces.

[4] Facies : Il termine facies è utilizzato per descrivere un paesaggio dominato da una specie o da un gruppo di specie.

- Pas de faciès particulier
  Non ci sono facies particolari
- Faciès à grands invertébrés fixés
  facies a grandi invertebrati fissi
- Faciès à éponges / facies a spugne
- Débris de coraux profonds
  frammenti di coralli profondi
- Débris coquilliers / frammenti di conchiglie
- Banc d'huîtres / banco d'ostriche
- Faciès à rhodolites / facies a rodoliti
- Faciès à pennatulaires / facies a pennatulari
- Faciès à polychètes / facies a polycheti
- Faciès à *Callogorgia verticillata*
  facies *Callogorgia verticillata*
- Faciès à *Funiculina quadrangularis*
  facies a *Funiculina quandrangularis*
- Faciès à *Leptometra phalangium*
  facies a *Leptometra Phalangium*

# Les sites - I siti



Corail noir,
fonds à rhodophytes
et algues calcaires
Corallo nero, fondale
a rodofite ed alghe calcaree

**Le Banc de la Nioulargue** forme une sorte d'arête qui domine la rive droite du canyon de Pampelonne et se trouve à l'extrémité de la rive gauche du canyon des Stoechades. Il se trouve dans le site Natura 2000 « Corniche varoise ».
Exploré lors de précédentes campagnes, les nouveaux secteurs inventoriés confirment une importante richesse d'espèces et d'habitats. Les trois plongées effectuées entre 4 et 10 km de la côte ont montré un fond sablo-vaseux ou détritique côtier avec la présence régulière de roches sur lesquelles les espèces sessiles se développent assez densément. Le détritique[5] côtier autour des roches est parfois extrêmement riche et contient une diversité d'espèces remarquables. Par ailleurs les gorgones et coraux noirs qui se développent sur les roches sont de petite taille et en bon état de conservation. La présence de deux colonies de corail blanc *Madrepora oculata* à 280 m, à l'extrémité est du banc a été une découverte inattendue. Les gorgones et coraux noirs qui se développent sur les roches sont en bon état de conservation, mais correspondent à de petites colonies.

L'observation de deux poissons-lunes *(Mola mola)* dont encore un vivant, pris au piège d'hameçons de palangres perdues, témoigne de la non sélectivité des palangres et des dégats qu'elles peuvent causer même lorsqu'elles sont abandonnées.

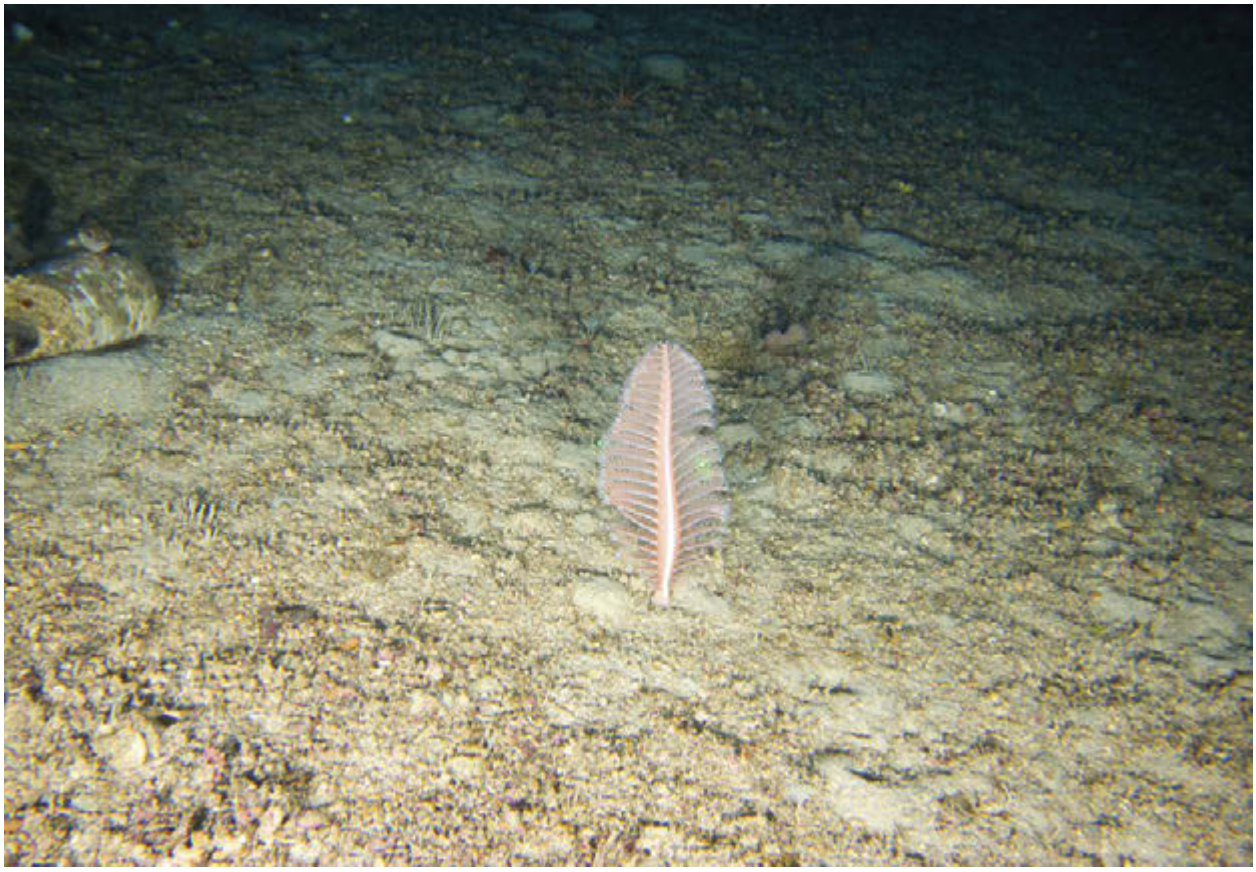
**Il Banco di Nioulargue** forma una sorta di spigolo che domina la riva destra del canyon di Pampelonne e si trova all'estremità sinistra del canyon delle Stoechades. È posizionato all'interno del sito Natura 2000 "Corniche varoise".
Già esplorato in occasione di campagne precedenti, i nuovi settori studiati confermano l'importante ricchezza di specie e habitat. Le tre immersioni condotte tra 4 e 10 km dalla costa hanno rivelato un fondo sabbiofangoso o detritico[5] costiero con la presenza regolare di rocce, sulle quali le specie sessili formano popolamenti piuttosto densi. A volte il detritico costiero intorno alle rocce è estremamente ricco, e caratterizzato da una notevole diversità specifica. La presenza di due colonie di corallo bianco *Madrepora oculata* alla profondità di 280 m, all'estremità orientale del banco, è stata una importante scoperta. Le gorgonie e i coralli neri insediati sulle rocce sono in buono stato di conservazione ma sono rappresentati da colonie di dimensioni ridotte.

L'osservazione di due pesci luna *(Mola mola)* di cui uno ancora vivo, presi dagli ami di un palamito perso, è indice della non selettività di questo attrezzo da pesca e mostra i danni che esso può causare anche quando viene abbandonato.

NOTES

[5] Le détritique côtier est un amas de particules minérales issues de l'altération de roches préexistantes, constitué de petits éléments généralement biogènes (provenant d'espèces vivantes). Il peut être très riche en petites espèces vivantes comme des bryozoaires, des éponges, des hydraires, ou des vers.

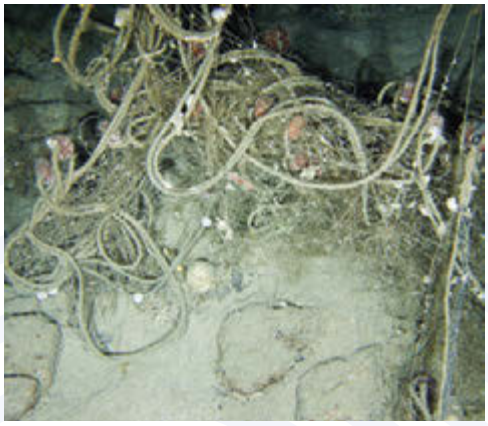
[5] Il detritico costiero è un fondo mobile caratterizzato da particelle minerali derivanti dall'alterazione di rocce preesistenti e costituito di piccoli elementi generalmente biogeni (provenienti da specie viventi). Può essere ricchissimo di piccole specie viventi quali briozoi, spugne, idroidi o vermi.



*Pennatula rubras*
(-78 m)

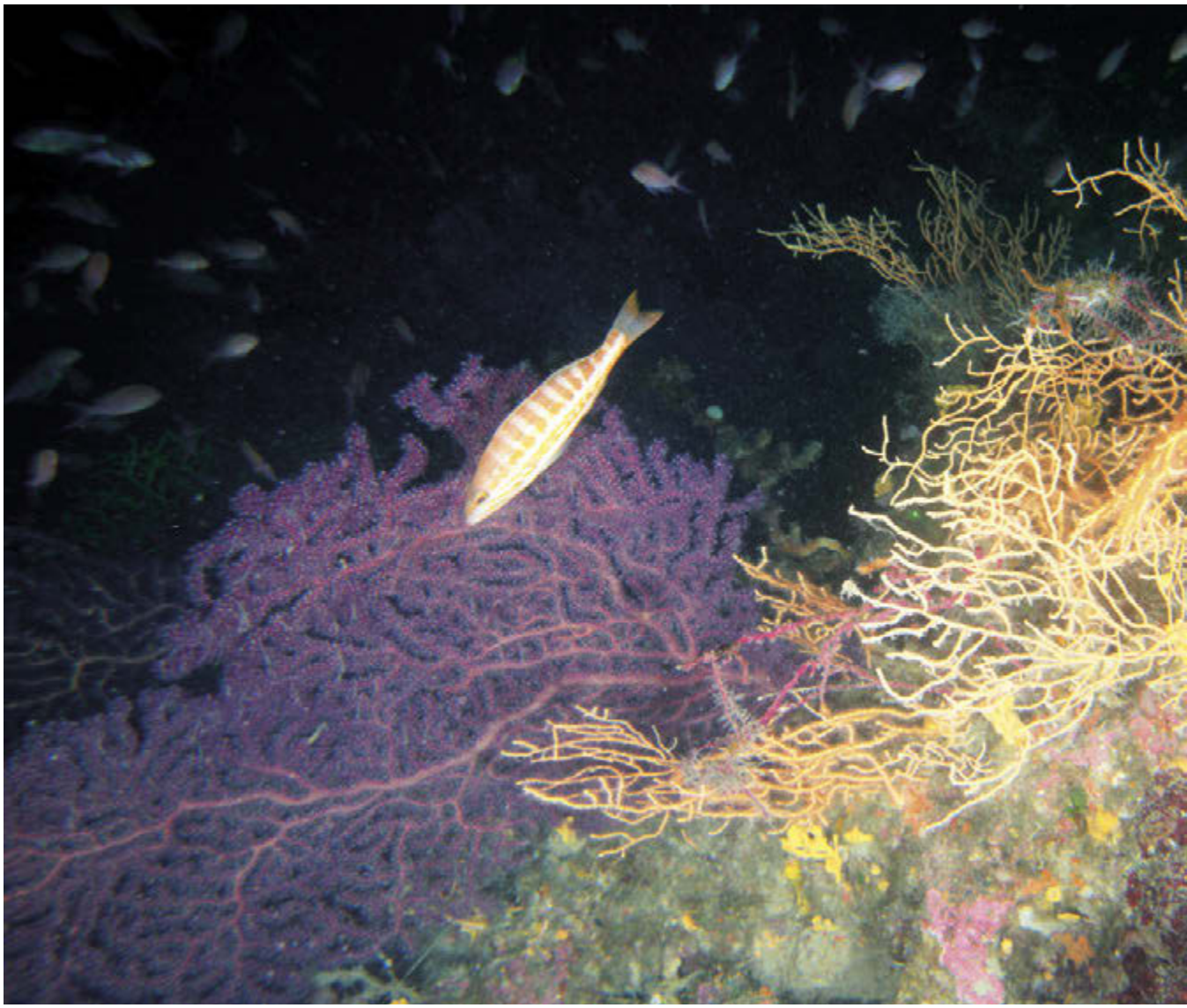
*Madrepora oculata / corail blanc /* Corallo bianco
(-277 m)

Crabes de l'espèce Paromola cuvieri sur les restes d'un poisson-lune
Granchi della specie Paromola cuvieri sui resti di un *Mola mola*
(-260 m)



*Anthias anthias* et gorgones
*Anthias anthias* e gorgonie

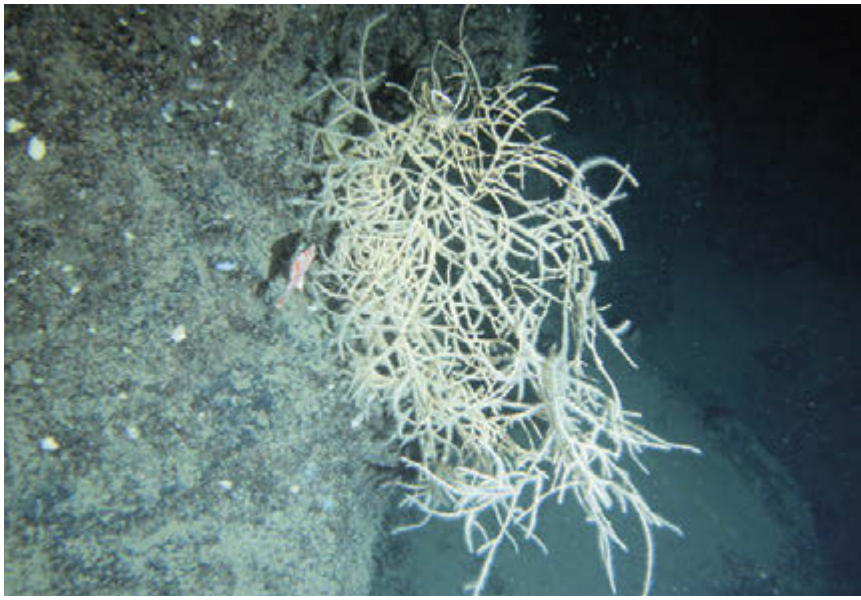
Amoncellement de filets perdus
Ammasso di reti perse



*Serranus cabrilla* et gorgones
*Serannus cabrilla* e gorgonie

**Le canyon du Dramont** est inclus (pour la partie explorée) dans le site Natura 2000 « Estérel ». La tête de canyon du Dramont est très proche de la côte. Quatre plongées ont été effectuées de 1 et 4 km de la côte, sur la rive droite du canyon entre 54 et 370 mètres de profondeur. Proche de la côte, la densité en gorgones sur les roches est forte et la présence de colonies de corail rouge *(Corallium rubrum)* en bon état de conservation est importante. En sortie de canyon, les gorgones sont plus petites et trapues, cette morphologie particulière pouvant être due à un fort hydrodynamisme. Ce canyon montre des communautés d'anthozoaires en très bon état de conservation. Malgré la proximité de la côte, on note peu d'engins de pêche perdus.

**Il canyon del Dramont** è incluso (per quanto riguarda la parte esplorata) nel sito Natura 2000 "Esterel". La testata del canyon del Dramont è molto vicina alla costa. Quattro percorsi sono stati effettuati tra 1 e 4 km dalla costa sulla riva destra del Canyon del Dramont. Sul versante destro sono state effettuate quattro immersioni tra 54 e 370 m di profondità. Vicino alla costa, la densità di gorgonie sulle rocce è elevata e si registra un'importante presenza di corallo rosso *(Corallium rubrum)* in buono stato di conservazione. All'uscita del canyon le gorgonie sono più piccole e tozze, probabilmente a causa del forte idrodinamismo. Questo canyon ospita comunità di antozoi in ottimo stato di conservazione, anche se sono state studiate soprattutto le comunità del circalitorale profondo. Nonostante la vicinanza alla costa, si osservano pochissimi attrezzi da pesca persi.

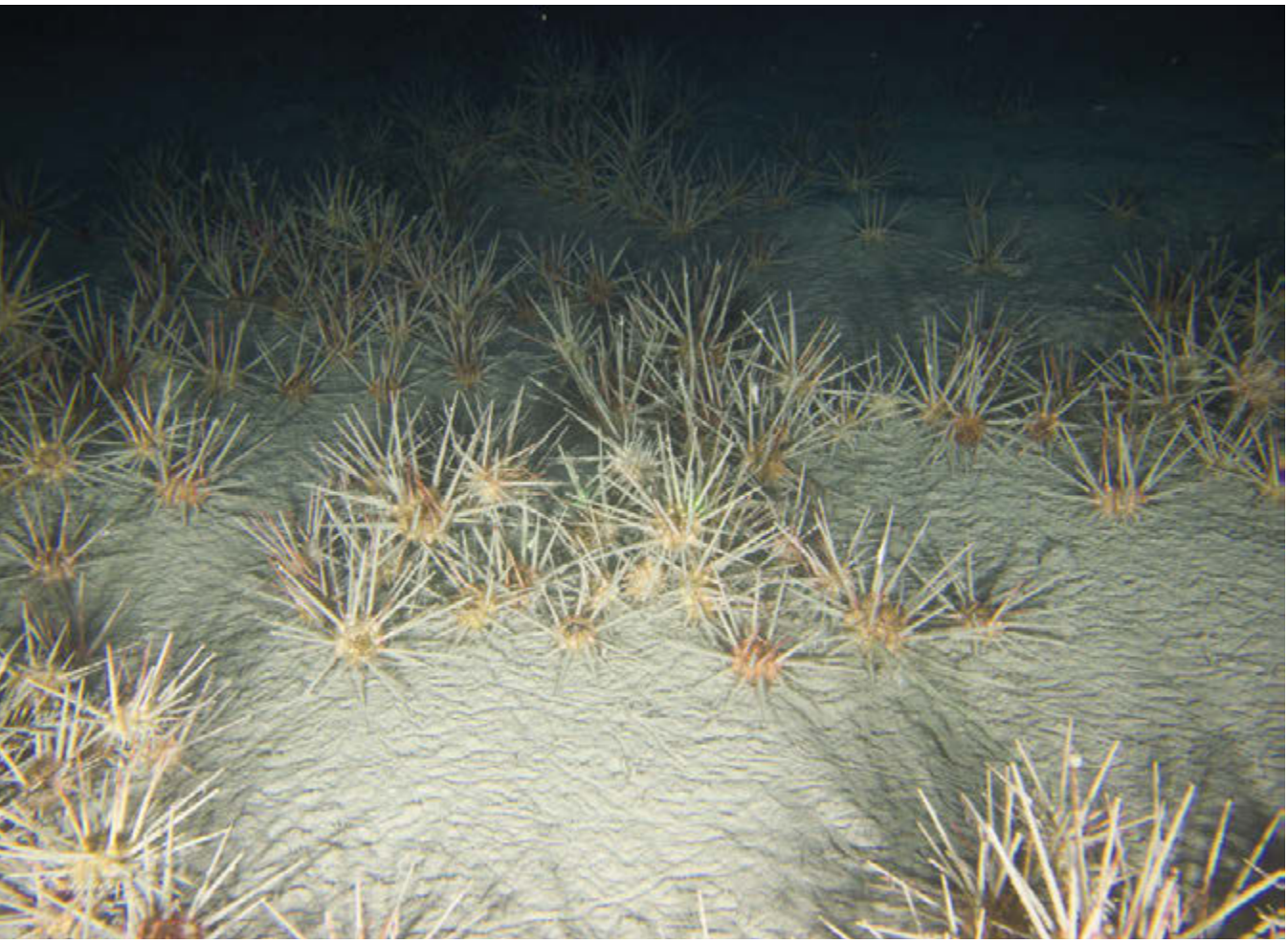


*Eunicella cavolini*

*Eledone cirrhosa*
(-222 m)

Corail noir
Corallo nero

*Dendrophyllia cornigera*
(-308 m)

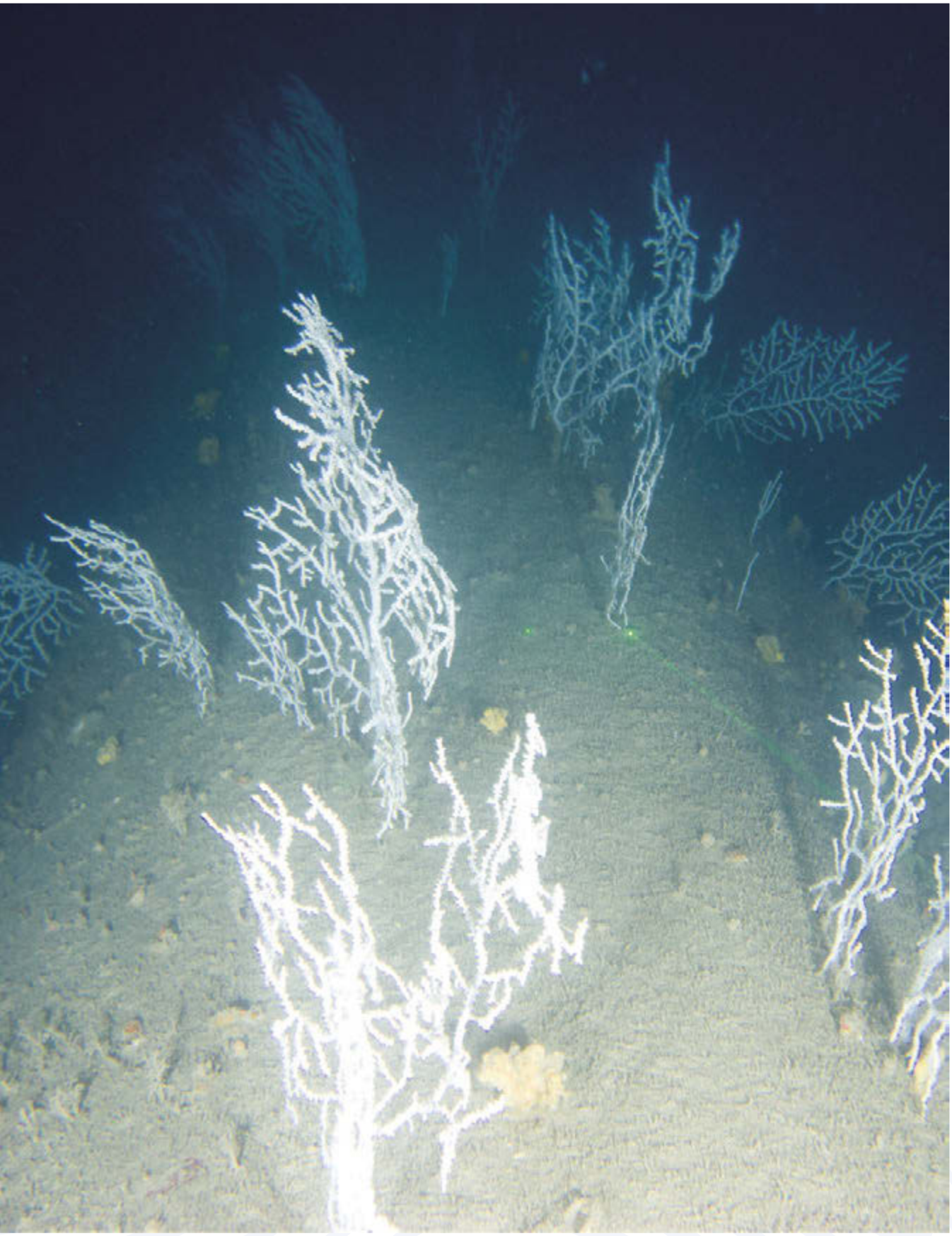


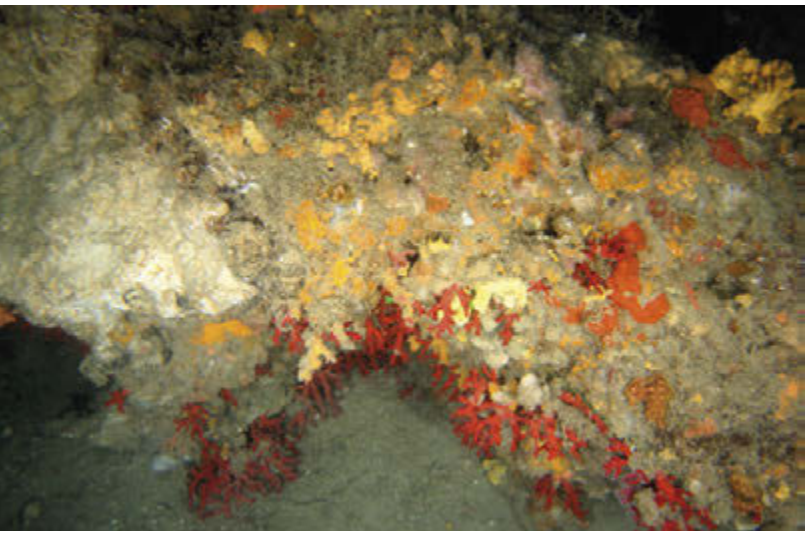
Rassemblement de Cidaridae
Raggruppammento di Cidaridi
(-93 m)

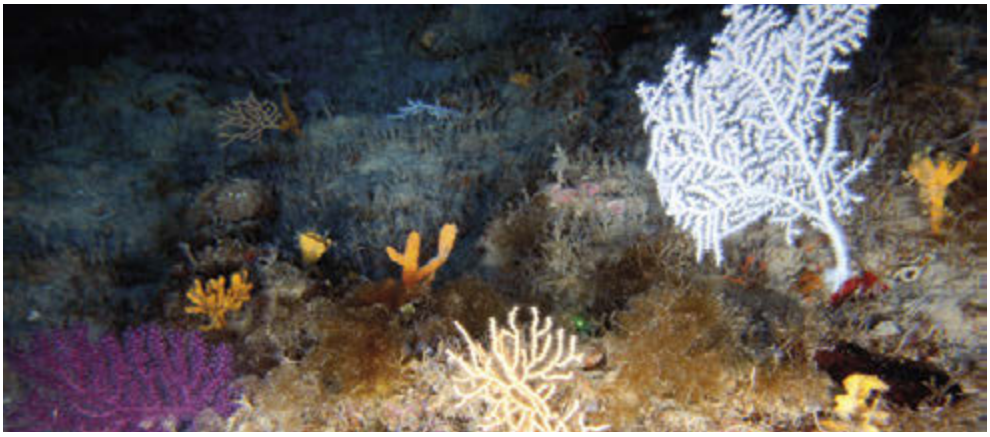
*Enicella verrucosa* sur canalisation
*Enicella verrucosa* su una condotta
(-78 m)

**Le canyon de Monaco** à une distance de la côte comprise entre 500 m et 2 km, a montré lors de l'unique exploration de rive droite, des fonds plutôt envasés. On note la présence d'un support solide correspondant à la canalisation des eaux usées provenant de la station d'épuration de Monaco. Sur ce support, fixé sur un fond sablo-vaseux, se développent de très nombreuses colonies de gorgones blanches verruqueuses *(Eunicella verrucosa)* ainsi que quelques colonies de *Leptogorgia sermentosa* accompagnées de petites éponges jaunes *(Axinella spp.)*. Cette tête de canyon peu explorée présente des alcyonaires et pennatulaires sur les parties meubles et quelques petites roches faiblement colonisées. Ces zones, dans lesquelles n'a été décelé qu'un faible impact mécanique, sont particulièrement intéressantes, car elles constituent un état écologique de référence d'un site n'ayant pas été altéré par des activités de pêche au chalut. En dehors de la canalisation, les impacts anthropiques visibles sont matérialisés par des corps morts et quelques gravats.

**Il canyon di Monaco,** tra 0,5 e 2 km dalla costa, ha mostrato, in occasione dell'unica esplorazione condotta sul versante destro, fondali piuttosto infangati. La condotta dello scarico dell'impianto di depurazione di Monaco costituisce un supporto solido in un contesto sabbiofangoso sul quale si sviluppano colonie molto numerose di gorgonie verrucose *(Eunicella verrucosa)*, così come alcune colonie di *Leptogorgia sarmentosa*, accompagnate da piccole spugne erette gialle *(Axinella spp.)*. Questa testata di canyon poco esplorata presenta alcionari e pennatulari sui fondi mobili, e piccole rocce poco colonizzate. Queste zone, che presentano un impatto meccanico molto limitato, sono quindi molto importanti quali siti di riferimento per caratterizzare le condizioni ecologiche degli ambienti che esse ospitano, generalmente alterati dalle attività di pesca a strascico. Il fondale, oltre alla condotta dello scarico dell'impianto di depurazione presenta, come ulteriori impatti antropici visibili, alcuni corpi morti e dei detriti.







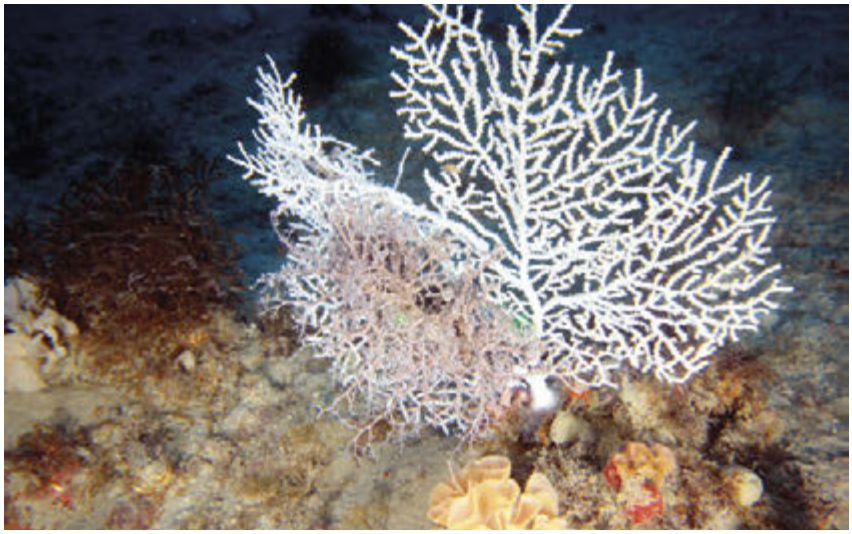
Corail rouge
Corallo rosso
(-65 m)

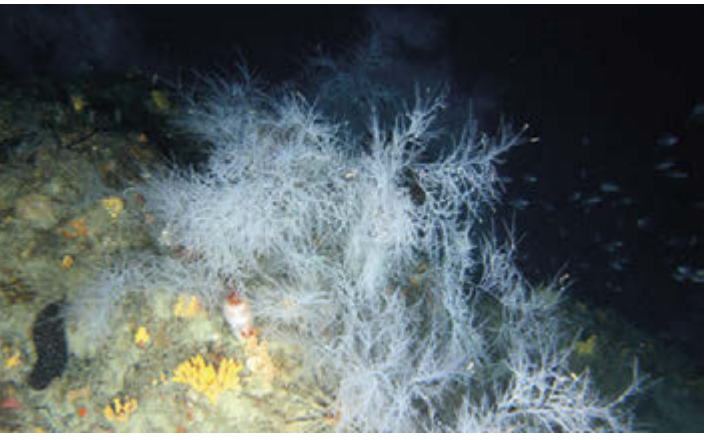
Corail noir
Corallo nero

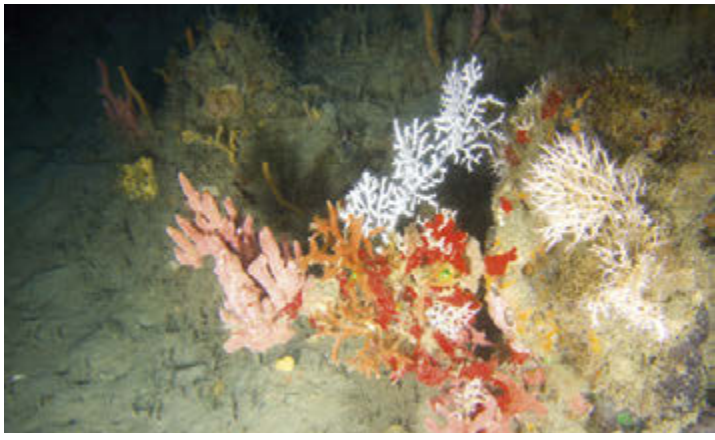
Gorgones
Gorgonie

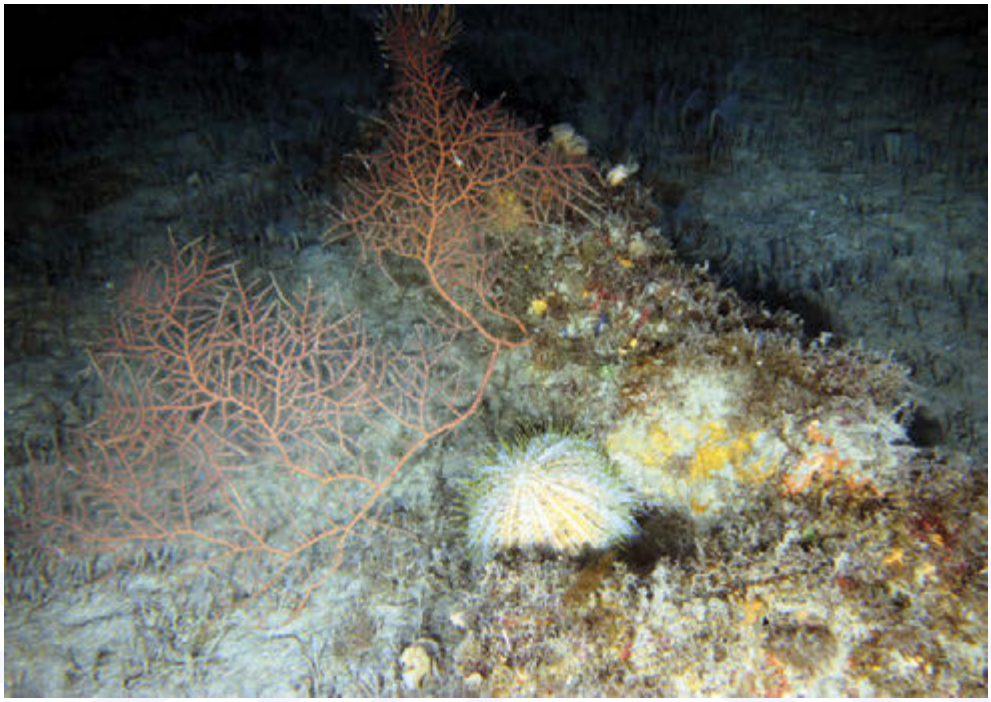
**Les roches profondes du Larvotto** se situent entre 1 et 2 km au large, face à la réserve marine du Larvotto. Elles ont été explorées lors de deux plongées et se présentent sous forme de gros blocs de roche souvent très colonisés et fréquentés par des espèces mobiles dans un contexte vaseux. Ces roches recèlent une richesse importante aussi bien en gorgones qu'en éponges. Les espèces sont en bon état de conservation en dehors des secteurs qui ont subi des dégâts mécaniques liés aux ancrages. Les assemblages de grands invertébrés observés ici sont assez originaux par l'importante présence de grandes éponges cornées parmi lesquelles des « éponges de toilette » *(Spongia spp)* et en particulier de nombreuses éponges « oreille d'éléphant » *(Spongia lamella)*. Ce secteur constitue une zone de mouillage très fréquentée par la grande plaisance. Les nombreux sillons creusés témoignent de l'impact et de l'activité du mouillage. La faune fixée est directement impactée par les ancrages répétés, mis en évidence par le retournement de blocs rocheux, exposant par exemple des colonies de corail rouge à l'envasement.

**Le rocce profonde del Larvotto** si trovano tra 1 e 2 km dalla costa, di fronte alla riserva del Larvotto. Sono state esplorate con due immersioni ROV e si presentano come grossi blocchi di roccia, spesso molto colonizzati e frequentati da specie mobili, in un contesto fangoso. Queste rocce ospitano un'importante ricchezza sia di gorgonie che di spugne. Le specie sono in buono stato di conservazione fuori dai settori che hanno subito l'impatto degli ancoraggi. Qui è stato possibile osservare l'importante presenza di grandi spugne cornee, come la spugna da bagno *(Spongia spp.)* e, numerose spugne "orecchia di elefante" *(Spongia lamella)*. L'area rappresenta una zona di ancoraggio molto importante per la grande nautica da diporto. I numerosi solchi d'ancora osservati testimoniano proprio l'impatto dell'attività di ancoraggio. La fauna fissa subisce i danni causati dai ripetuti ancoraggi come evidenziato dalla rotazione di blocchi rocciosi che, ad esempio, espongono le colonie di corallo rosso alla sedimentazione.







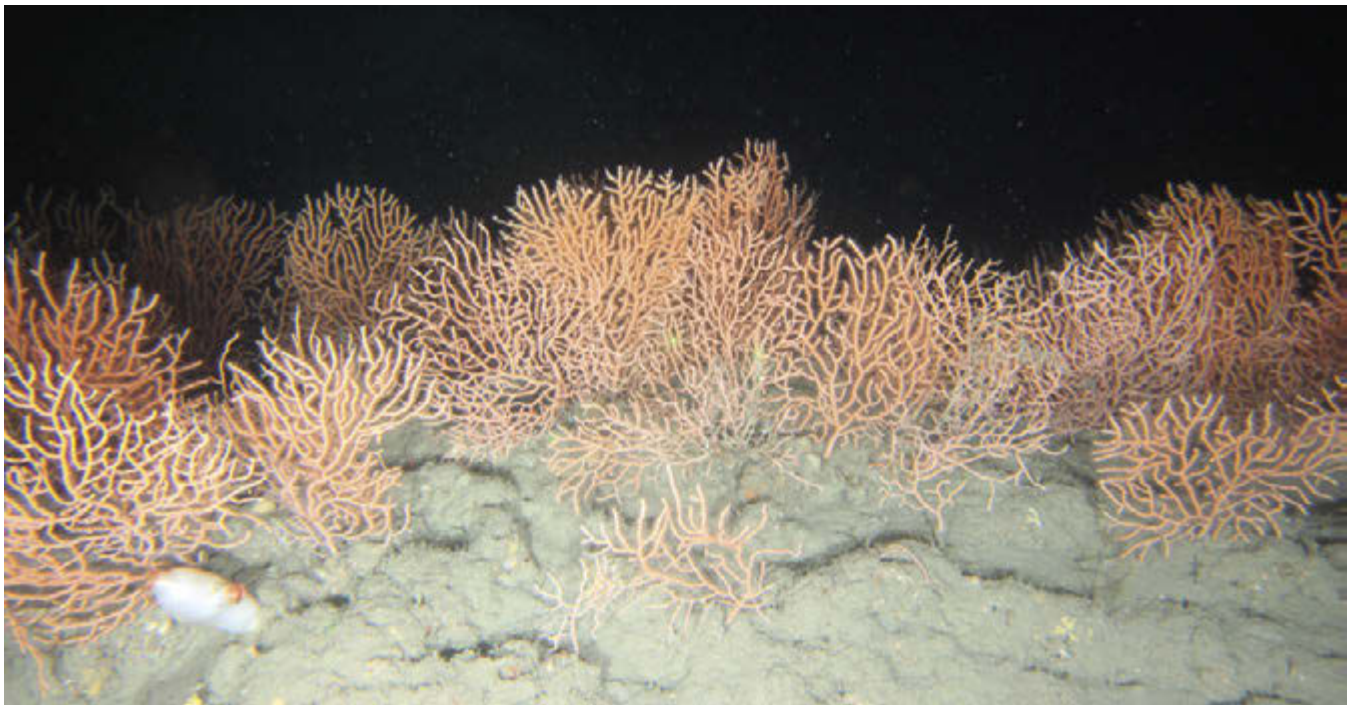


Gorgonocephalus mediterraneus sur *Eunicella verrucosa*

Corail noir
Corallo nero

Assemblage éponges, bryozoaires et gorgones
Aggrupammento di spugne, briozoo e gorgonie

*Echinus melo* et gorgones
*Echinus melo* e gorgonie



*Eunicella cavolini*
Gorgones oranges
Gorgonie gialle
(-100 m)

*(Lophius piscatorius)*
Lotte de mer
Rana pescatrice
(-243 m)

**Le canyon de Bordighera** est proche de la côte, entre 1 et 4 km, a été exploré par deux plongées. En tête de canyon et sur le plateau continental, sont présentes de manière particulièrement dense des communautés de gorgonaires, d'antipathaires et par endroits de coraux jaunes. Les colonies sont grandes et en bon état de conservation. La présence d'un substrat rocheux colonisé en profondeur attire de nombreuses espèces mobiles.
Les nombreux engins de pêche perdus, observés dans ce secteur et dans le canyon d'Arma di Taggia, sont autant de pièges mortels pour les espèces qui s'y trouvent.

**Il canyon di Bordighera** è vicino alla costa ed è stato esplorato con due immersioni effettuate tra 1 e 4 km dalla costa. Sulla testata del canyon e sulla piattaforma continentale sono presenti, con densi insediamenti, comunità di gorgonari, di antipatari e, in alcuni siti, di coralli gialli. Le colonie sono grandi e in buono stato di conservazione. In profondità la presenza di substrato roccioso attira varie specie mobili. Numerosi attrezzi da pesca persi che si trovano in questo settore e nel canyon di Arma di Taggia costituiscono trappole mortali.

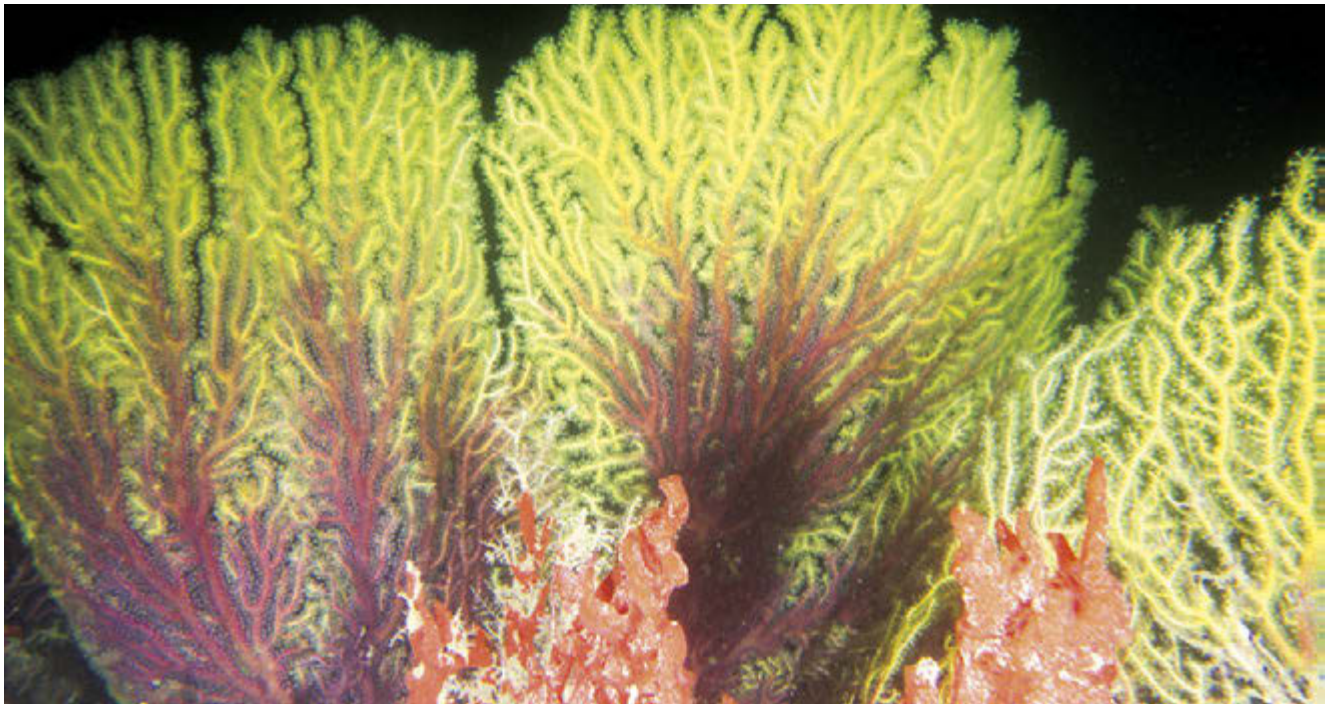
*Hoplostetus mediterraneus*
(-415 m)

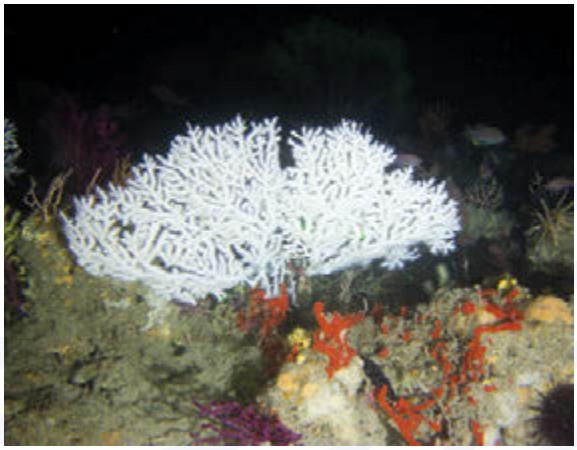
*Palinurus elephas*
et *Dendrophyllia cornigera*
(-176 m)

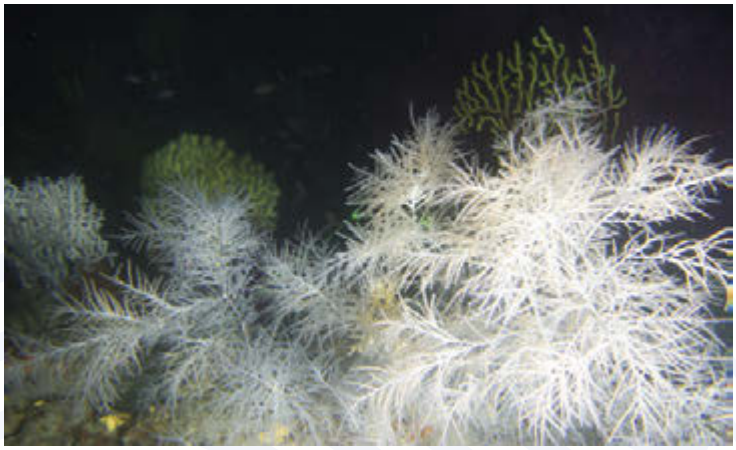
*Paramuncaea clavata*

*Eunicella verrucosa*

*Antipatella subpinnata*



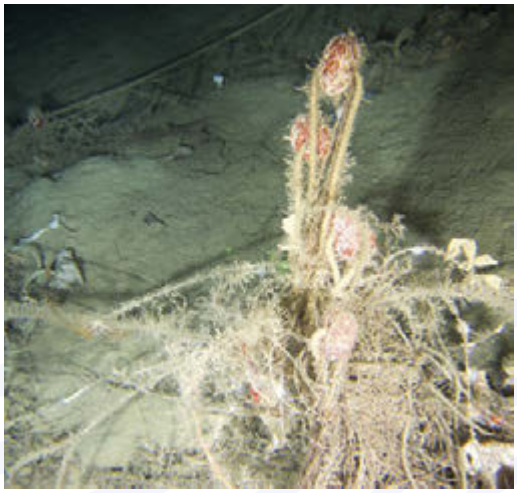




Faciès à leptometra
*Facies* a leptometra
(-190 m)

**Le canyon d'Arma di Taggia** est, du moins dans la tête du canyon explorée, essentiellement constitué de vase. Deux plongées ont eu lieu entre 4 et 8 km de la côte sur la rive droite la plus pentue. Ces zones se caractérisent par des fonds vaseux ou sablo-vaseux. Des débris de végétaux ainsi que des débris de Posidonie ont été observés, signalant la présence d'herbier de Posidonie sur l'étroit plateau continental. La biodiversité est faible mais plusieurs observations intéressantes ont été faites tel un faciès à crinoïdes *(Leptometra phalangium)*, une raie *(Raja clavata)* et deux Saint-Pierre *(Zeus faber)*. La présence de macro-déchets sur la vase rappelle la proximité de centres urbains, notamment celui de San Remo.

**Il canyon di Arma di Taggia** è essenzialmente costituito da fango, almeno per quanto riguarda la parte della testata del canyon esplorata. Sul versante destro, il più ripido, sono state condotte due immersioni tra 4 e 8 km dalla costa. Le indagini hanno permesso di rilevare la presenza di fondali fangosi o sabbiofangosi. Sono stati osservati detriti vegetali così come resti di Posidonia, che segnalano l'esistenza di una prateria di Posidonia sulla soprastante, stretta, piattaforma continentale. Benché la biodiversità sia risultata, scarsa è stato possibile fare diverse osservazioni interessanti come una facies a crinoidi *(Leptometra phalangium)*, una razza *(Raja clavata)* e due pesci San Pietro *(Zeus faber)*. La presenza di macrorifiuti sui fondali fangosi ricorda la vicinanza di centri urbani, tra cui il più importante è la città di Sanremo.



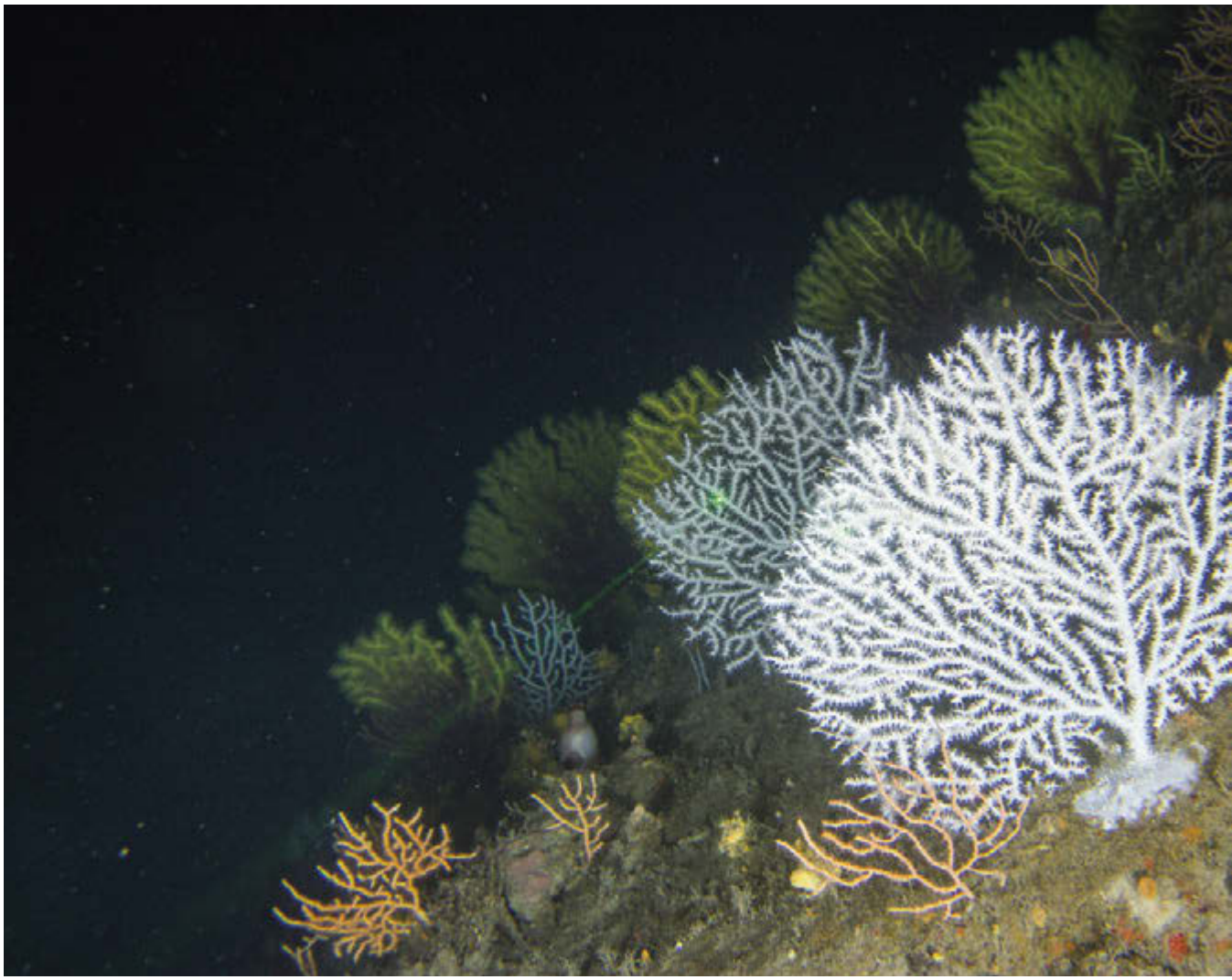
*Raja clavata*
*(Raie - Razza)*

*Zeus faber*
*(Saint-Pierre - Pesce San Pietro)*

*Galeus melastonus*
*(Pristiure à bouche noire - Boccanera)*
(-362 m)

Amoncellement de filets perdus
Ammasso di reti perse

Exemple de déchets trouvés sur les fonds
Esempio di rifiuto



*Eunicella verrucosa*

# Ecologie des milieux profonds

## > Focus sur les cnidaires

Les activités de collecte de données menées dans les eaux françaises, monégasques et italiennes ont été réalisées le long de transects assez variés tant au niveau de leur profondeur que sur le plan géomorphologique (fonds vaseux détritique, blocs rocheux, petits affleurements rocheux et falaises). Ceci a permis d'observer des espèces de cnidaires présentes dans des environnements extrêmement différents.

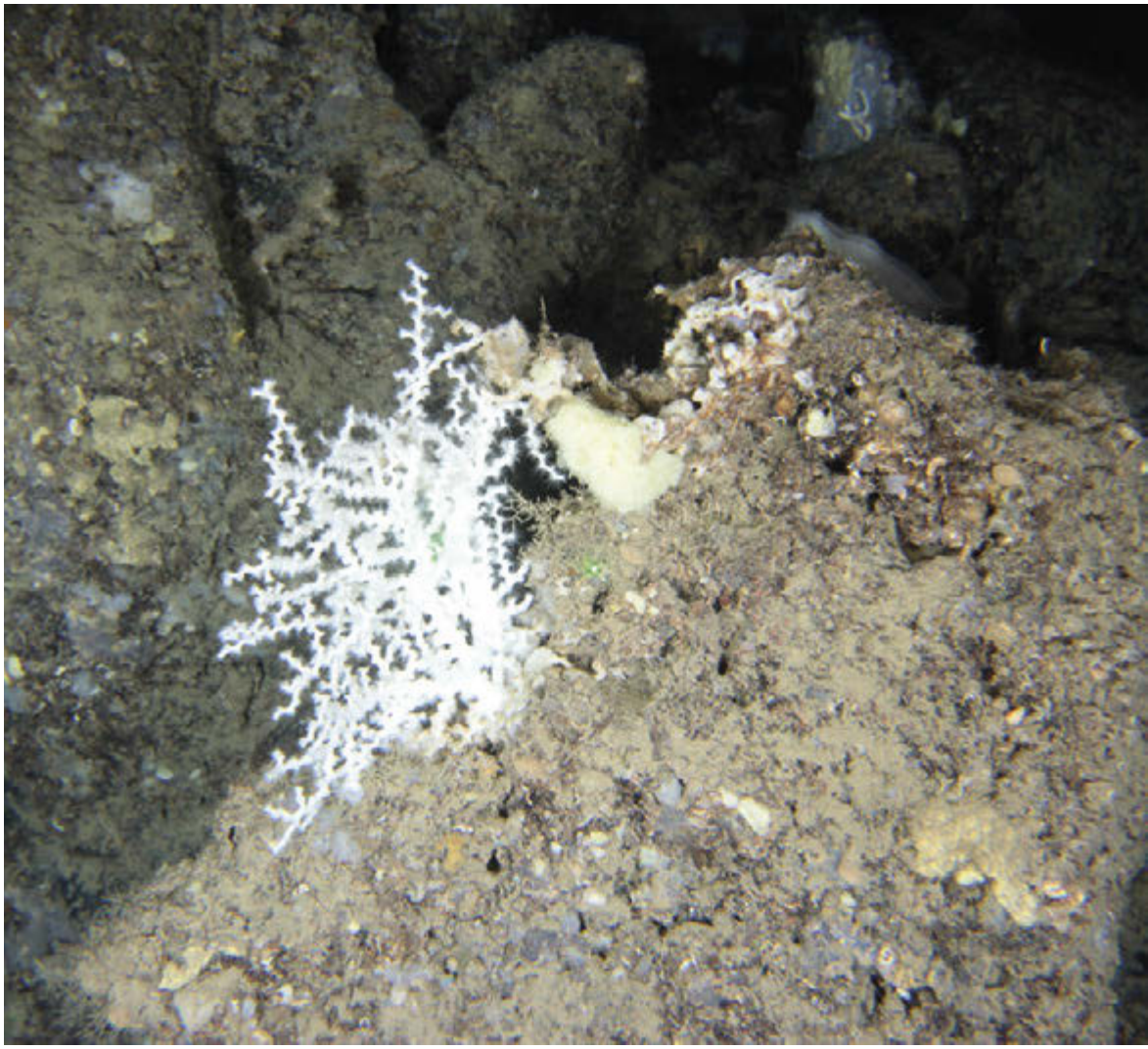
Au total, 27 espèces de Cnidaires ont été identifiés dont trois espèces de méduses (*Paraphyllina* sp., *Pelagia Noctiluca* et *Solmaris* sp.). Soixante dix neuf pourcent des espèces sont sessiles et la plupart d'entre elles sont

# Ecologia degli ambienti profondi

## > Focus sugli cnidari

Le attività di raccolta dati svolte nelle acque francesi, monegasche e italiane sono state realizzate lungo transetti abbastanza diversi per profondità e geomorfologia (fondali fangosi detritici, blocchi rocciosi, piccoli affioramenti rocciosi e falesie). Ciò ha permesso di osservare specie di cnidari presenti in ambienti estremamente diversi.

Nel complesso sono state riconosciute 27 specie di cui tre meduse (*Paraphyllina* sp., *Pelagia noctiluca* e *Solmaris* sp.). Il settantanove percento delle specie presenti sono sessili di cui la maggioranza strutturanti, ovvero in grado di formare grandi colonie arborescenti.



*Madrepora oculata*
(Nioulargue)

structurantes, capables de former de grandes colonies arborescentes. Les espèces les plus fréquemment observées sont : *Eunicella verrucosa, Paramuricea clavata, Dendrophyllia cornigera.*

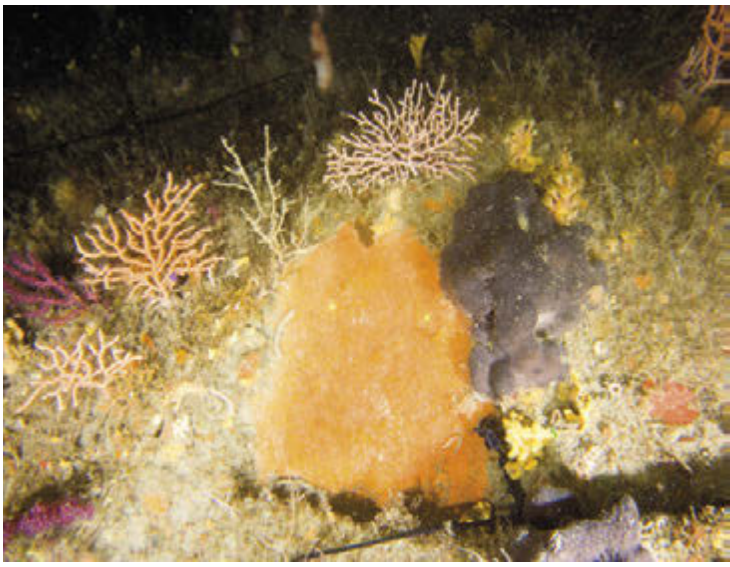
*Eunicella cavolinii* et *Dendrophyllia cornigera* ont été observés avec des faciès très répandus, la première à Monaco et en Italie et la seconde seulement dans les eaux italiennes.

Les observations importantes de cette campagne sont la découverte de *Madrepora oculata* dans le secteur français du banc de la Nioulargue, à -280 mètres, le faciès à *Dendrophyllia cornigera* trouvé sur les fonds vaseux du canyon de Bordighera et l'abondance de colonies de corail rouge *(Corallium rubrum)* sur les fonds rocheux de Monaco.

Queste specie sono perlopiù osservate su fondi duri. Le specie più frequenti sono state *Eunicella verrucosa, Paramuricea clavata e Dendrophyllia cornigera.*

*Eunicella cavolinii* e *Dendrophyllia cornigera* sono state osservate con facies molto estese, la prima sia a Monaco che in Italia mentre la seconda solo in acque italiane.

Le osservazioni importanti di questa campagna hanno riguardato la scoperta di *Madrepora oculata* nel settore francese del banco di Nioulargue, a 280 m di profondità, la facies a *D. cornigera* osservata sui fondali fangosi del canyon di Bordighera e la ricchezza delle colonie di corallo rosso *(Corallium rubrum)* sui fondali rocciosi di Monaco.



*Spongia lamella*
(-64 m / Monaco)

*Spongia officinalis*
(-67 m)

*Poecillasatra compressa*
(-218 m / Nioulargue)

## > Focus sur les éponges

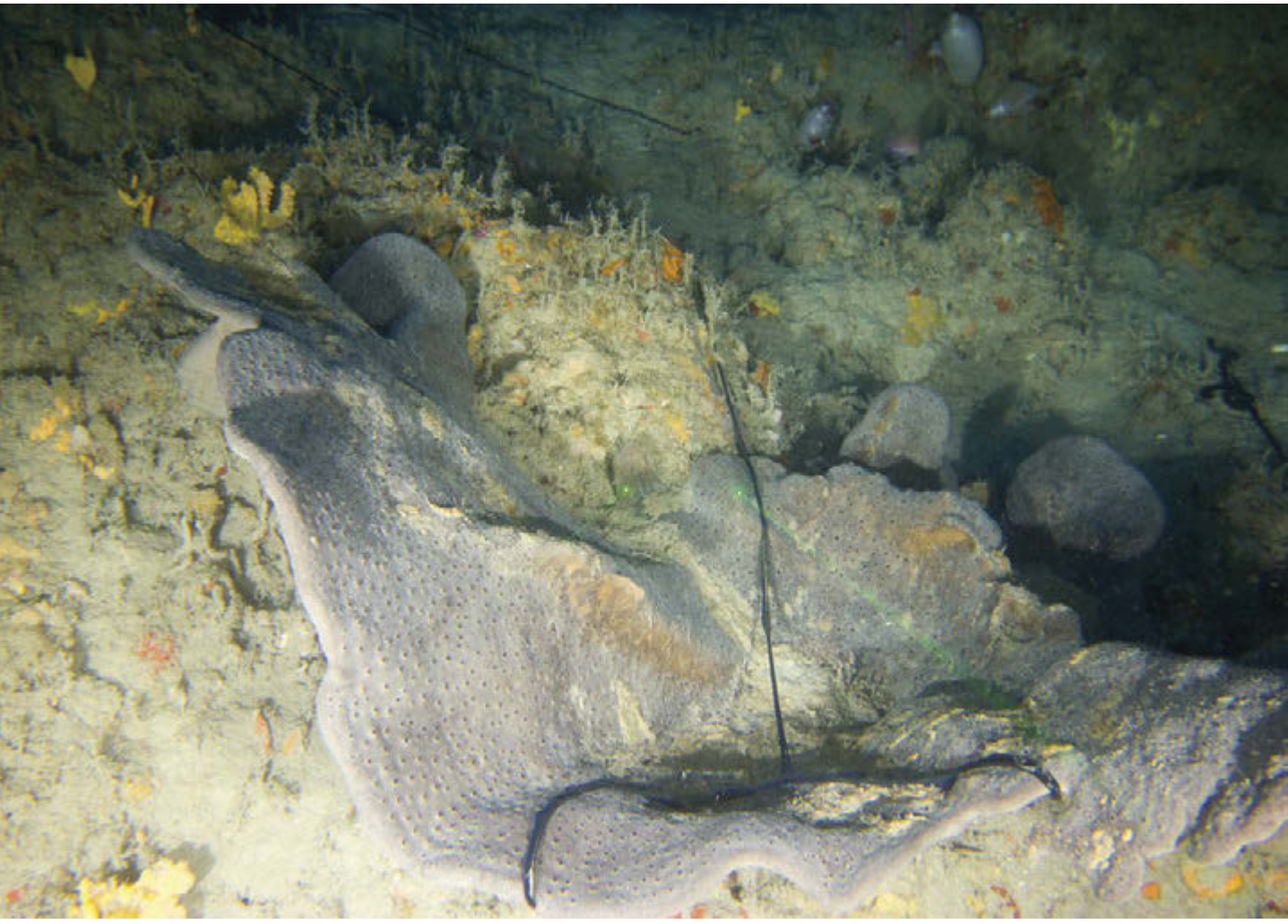
Les éponges (spongiaires) sont un embranchement d'espèces essentiellement sessiles qui dominent sur les fonds rocheux du circalittoral profond et du bathyal. Les éponges peuvent également être présentes sur des fonds vaseux ou sablo-vaseux mais avec moins de diversité. Dans la zone étudiée, les éponges sont très présentes sur les sites rocheux comme les roches profondes du Larvotto, celles du banc de la Nioulargue ainsi que dans les canyons du Dramont et de Bordighera, mais également sur le détritique biogène côtier du banc de la Nioulargue. Les secteurs vaseux comme le canyon de Monaco et celui d'Arma di Taggia ne présentent pas d'éponges de substrat meuble sur les parties explorées.

Il est très difficile d'identifier les éponges uniquement sur la base des photos, en particulier à ces profondeurs où elles sont encore assez mal connues. Certaines ont

## > Focus sulle spugne

Le spugne (poriferi) sono specie sessili raramente libere spesso dominanti sui fondali rocciosi del circalitorale profondo e del batiale. Le spugne possono anche essere presenti su fondali fangosi o sabbio-fangosi, sebbene con minore diversità specifica. Nella zona studiata le spugne sono molto diffuse nei siti rocciosi quali le rocce del Larvotto, quelli del banco di Nioulargue e nei canyon del Dramont e di Bordighera, ma anche sul detritico biogenico costiero del banco di Nioulargue. I settori fangosi, come il canyon di Monaco e quello di Arma di Taggia, non presentano spugne di substrato mobile nelle parti esplorate.

È molto difficile identificare le spugne solo sulla base di immagini, soprattutto a queste profondità, dove sono ancora poco conosciute. Alcune presentano forme caratteristiche e sono più facilmente identificabili, altre invece possono assumere forme diverse, senza avere caratteristiche morfologiche particolari.



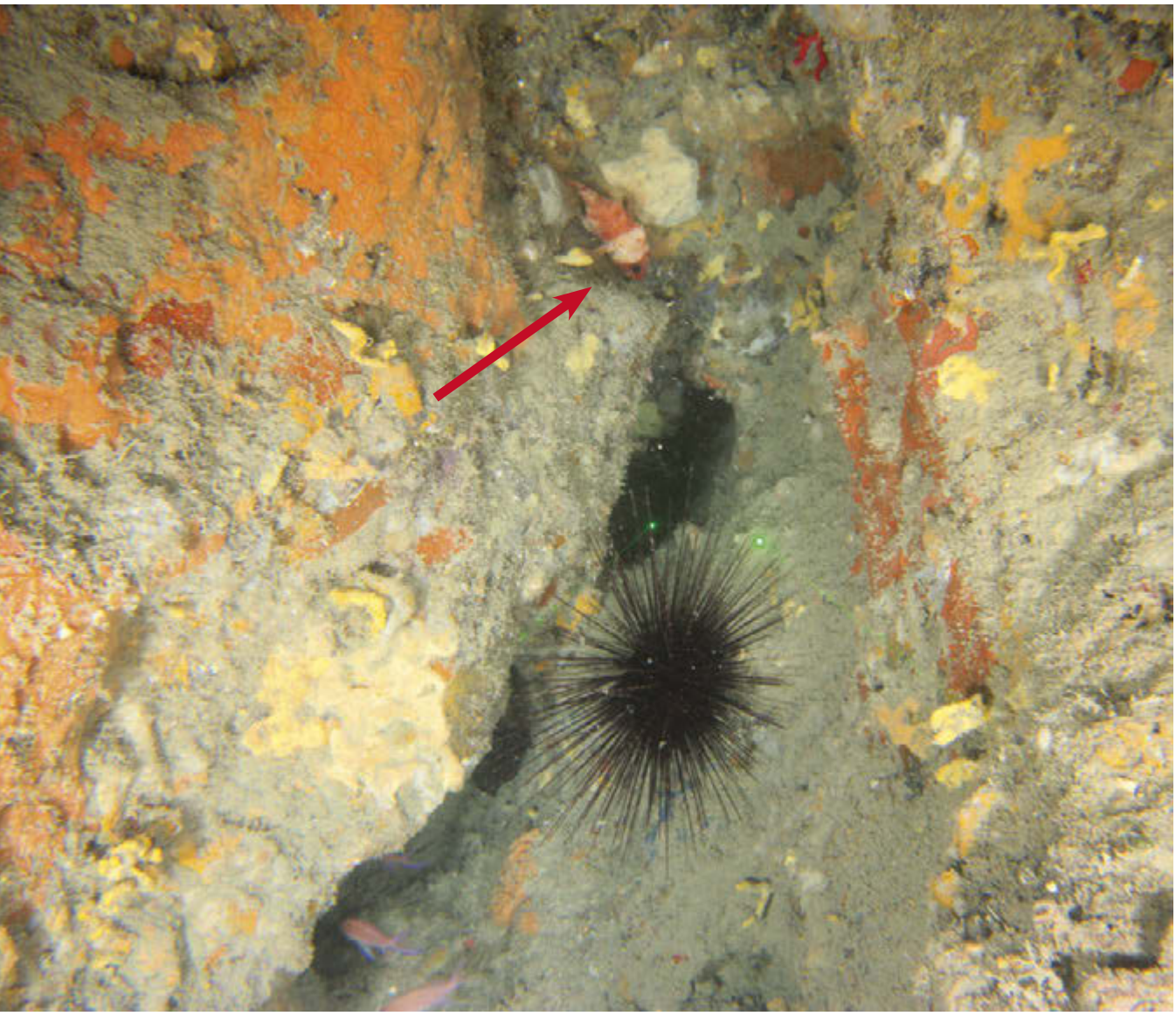
*Spongia lamella*
(-64 m / Monaco)

des formes caractéristiques et peuvent être plus facilement identifiées mais d'autres peuvent prendre des formes diverses, sans caractéristique morphologique particulière. Quand des prélèvements ont été effectués et associés à des images, il est alors parfois possible d'effectuer des identifications. Les éponges ont été observées entre 52 et 437 m de profondeur et 58 espèces (au niveau du genre ou de l'espèce) ont été identifiées. C'est sur les roches profondes du Larvotto qu'ont été observées de nombreuses éponges, grâce à leur grande taille, principalement des éponges du genre *Spongia*. Les roches et le détritique du banc de la Nioulargue recèlent vraisemblablement une diversité plus importante d'éponges, mais plus discrètes.

Parmi les spongiaires les plus fréquemment observées lors de la campagne, il y a l'éponge orange *Crella* sp., les cornées dont les éponges commerciales *Spongia lamella* et *Spongia officinalis*, mais aussi *Haliclona mediterranea*, *Axinella polypoides* et *Poecillasatra compressa*.

Quando sono stati effettuati prelievi associati a immagini, talvolta è stato possibile effettuare delle identificazioni. Le spugne sono state osservate tra i 52 e i 437 m di profondità, e ne sono state identificate 58 specie (a livello di genere o specie). Il maggior numero di spugne è stato registrato sulle rocce profonde del Larvotto grazie alle loro grandi dimensioni, essenzialmente del genere *Spongia*. Le rocce e il detritico del banco di Nioulargue sembrano ospitarne una maggiore diversità, benché qui le spugne siano meno visibili.

Tra i poriferi osservati con maggiore frequenza durante la campagna si segnalano la spugna *Crella* sp., le spugne cornee tra cui le quelle commerciali *Spongia lamella* e *Spongia officinalis*, ma anche *Haliclona mediterranea*, *Axinella polypoides* e *Poecillasatra compressa*.



*Scorpaenodes arenai* et *Centrostephanus longispinus* (-63 m / Monaco)

## > Focus sur les poissons

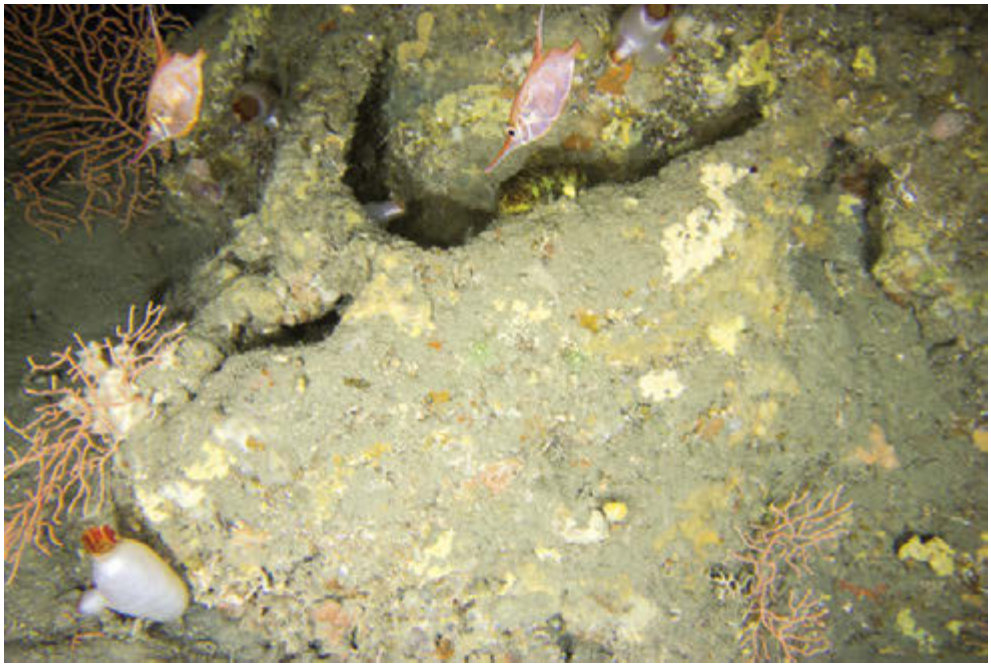
L'exploration entre 52 et 462 mètres de profondeur a permis d'identifier d'avantage d'espèces pelagiques que d'espèces profondes. L'analyse des images recueillies a permis de reconnaître 40 espèces de poissons, dont trois espèces de poissons cartilagineux.

L'espèce la plus observée (29% des observations de poisson) est le barbier *(Anthias anthias)*, qui a été trouvé entre -53 et -210 mètres (canyon de Bordighera), la seconde espèce la plus fréquemment observés (12%) est le sébaste-chèvre *(Helicolenus dactylopterus)*, suivie par le serran chèvre *(Serranus cabrilla)* (10%) et par le sanglier *(Capros aper)* (5%).

## > Focus sui pesci

L'esplorazione condotta dai 52 metri ai 462 metri di profondità ha permesso l'osservazione sia di specie relativamente superficiali che di specie profonde. L'analisi delle immagini raccolte ha consentito di identificare 40 specie di pesci, tre delle quali di pesci cartilaginei.

La specie maggiormente osservata (29% delle osservazioni) è la castagnola rossa *(Anthias anthias)*, trovata a partire da 53 fino a 210 metri di profondità (canyon di Bordighera); la seconda specie più comunemente osservata (12%) è lo scorfano di fondale *(Helicolenus dactylopterus)*, a seguire la perchia *(Serranus cabrilla)* con il 10% e il pesce tamburo *(Capros aper)* con il 5%.



*Coelorinchus caelorhincus*
(-322 m / Dramont)

*Macroamphosus scolopax*
*Bécasse des mers*
*Pesce trombetta*
*(-103 m)*

On note deux observations très intéressantes dans le secteur de Monaco : une rascasse de Messine *(Scorpaenodes arenai)*, rarement observée aussi au nord de la Méditerranée occidentale, ce qui permet d'étendre son aire de répartition. On a aussi observé un groupe de sérioles *(Seriola dumerili)* à des profondeurs d'environ 320 mètres.

Dans les parties les plus profondes des canyons, plusieurs espèces rares ont été observées, comme les petits poissons lanterne de la famille Myctophidae, quelques spécimens de poisson-dragon *(Stomias boa)*, l'hoplostète Poisson-montre *(Hoplostethus mediterraneus)*, le merlan argenté *(Gadiculus argenteus)* et le grenadier raton *(Coelorinchus caelorhincus)*.

Si segnalano due osservazioni molto interessanti nel settore di Monaco: un esemplare di scorpenode mediterraneo *(Scorpaenodes arenai)*, il cui rinvenimento consente di estendere l'area di distribuzione di questa specie molto elusiva anche alla parte nord del Mediterraneo occidentale, e un gruppo di ricciole *(Seriola dumerili)* alla profondità di ben 320 metri.

Nelle parti più profonde dei canyon sono presenti numerose specie poco comuni, come i piccoli pesci lanterna della famiglia dei Myctophidae, alcuni esemplari di drago di mare *(Stomias boa)*, il pesce specchio *(Hoplostethus mediterraneus)*, il pesce fico *(Gadiculus argenteus)* e il celorinco *(Coelorinchus caelorhincus)*.

# Pressions

## > Macro-Déchets

Pneus concrezionati
pneumatici concrezionati

Les stratégies générales pour chercher la présence de déchets sur les fonds marins sont semblables à celles utilisées pour évaluer l'abondance et le type d'espèces benthiques.

Si les quantités permettent de définir l'abondance et l'importance des apports, la typologie des déchets permet de préciser les sources les plus importantes.

Les quelques études effectuées en Méditerranée montrent une distribution extrêmement variable et une concentration de déchets dans les canyons sous-marins. Elles permettent de conclure que les canyons sous-marins agissent comme un dispositif d'accumulation des déchets. Des densités élevées sur le fond sont également observées dans des zones accidentées, comme autour des rochers et des épaves ainsi que dans les dépressions. Dans certains sites, les courants locaux emportent les déchets loin de la côte pour les concentrer dans des zones de forte sédimentation.

En général, l'analyse de la densité de déchets collectés sur les fonds marins de Méditerranée révèle l'importance du plastique, trouvés dans 98% des chaluts et représentant la majorité des objets sur les fonds. Ce pourcentage élevé de plastique n'est pas corrélé à la profondeur. Ce schéma est quelque peu différent lorsque l'on considère les pentes rocheuses où les pertes d'engins de pêche représentent une partie importante de déchets dans la partie supérieure des canyons, ce qui diminue artificiellement le pourcentage de matières plastiques. Une analyse des données provenant d'enquêtes menées par différents laboratoires européens entre 1999 et 2011 (Pham et al., 2014) a montré que dans les canyons, le plastique était l'élément prédominant (50%), suivi par les engins de pêche (25%). Sur les pentes, les engins de pêche (59%), par le plastique (31%) sont les principaux déchets récupérés.

# Pressioni

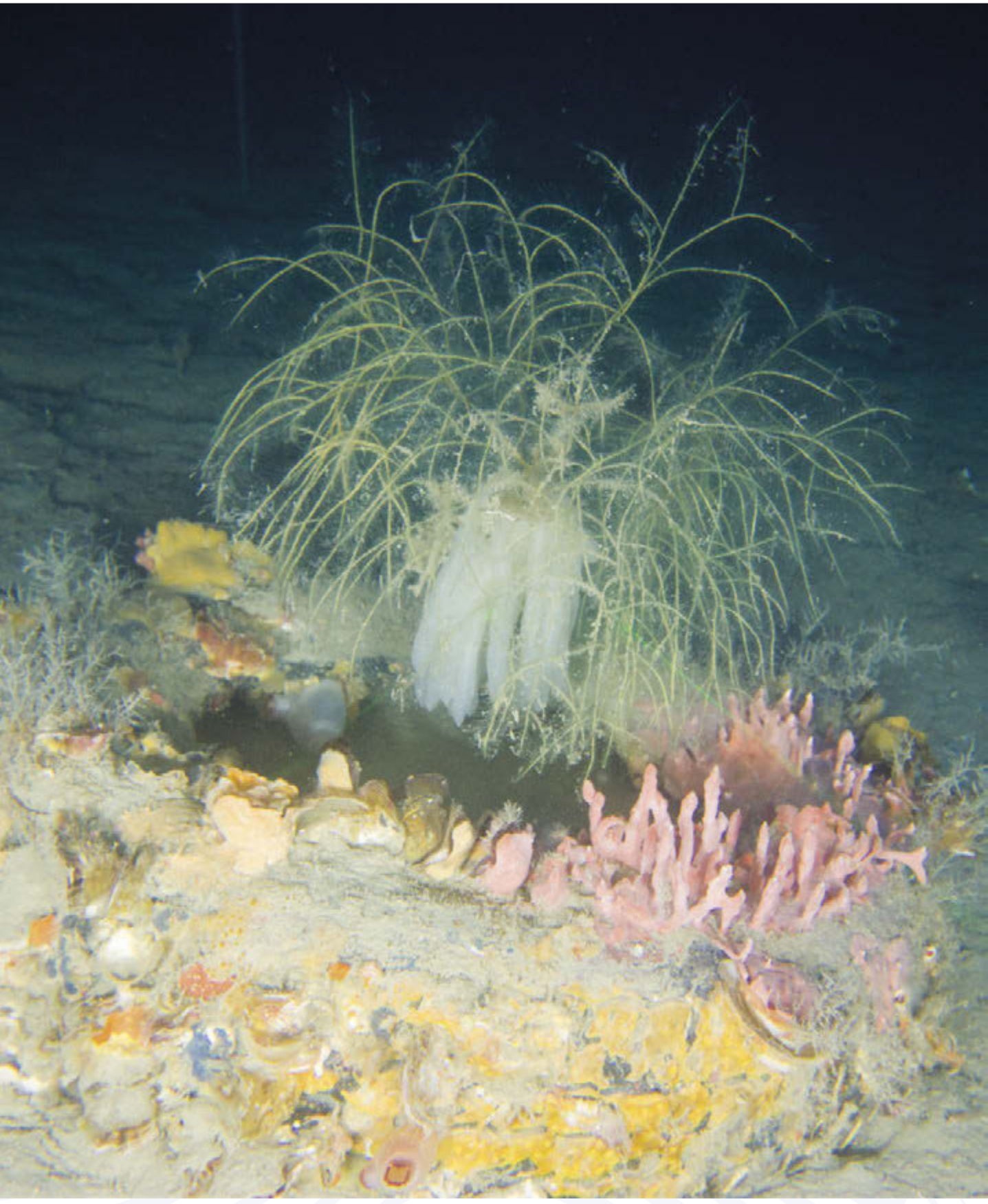
## > Macrorifiuti

Le strategie generalmente usate per cercare la presenza di rifiuti sui fondali marini sono simili a quelle utilizzate per valutare l'abbondanza e il tipo di specie bentoniche.

Se le quantità permettono di definire l'abbondanza e l'importanza degli apporti, la tipologia dei rifiuti permette di precisarne le fonti più importanti.

Alcuni studi condotti in Mediterraneo mostrano una distribuzione estremamente variabile e una concentrazione di rifiuti nei canyon sottomarini. Essi permettono di concludere che i canyon sottomarini agiscono come un dispositivo di concentrazione dei rifiuti verso le zone più profonde. Densità elevate sul fondale sono state osservate anche in zone particolari, come intorno a rocce e relitti, e nelle depressioni. In determinati siti, i movimenti d'acqua locali trasportano i rifiuti lontano dalla costa per accumularli in zone a forte sedimentazione.

In generale, l'analisi della densità dei rifiuti raccolti sui fondali marini del Mediterraneo rivela l'importanza della plastica, trovata nel 98% delle strascicate e che costituisce la maggioranza degli oggetti presenti sui fondali. Questa percentuale elevata di plastica non è correlata alla profondità. La situazione è leggermente diversa se si considerano le pareti rocciose, dove le perdite di attrezzi da pesca costituiscono una componente importante dei rifiuti nella parte superiore dei canyon, diminuendo artificialmente la percentuale di materie plastiche. Un'analisi dei dati provenienti da indagini condotte da diversi laboratori europei tra il 1999 e il 2011 ha mostrato che nei canyon l'elemento predominante dei rifiuti è stata la plastica (50%), seguita dagli attrezzi da pesca (25%). Sui pendii, gli elementi dominanti tra i rifiuti rinvenuti sono stati gli attrezzi da pesca (59%), seguiti dalla plastica (31%).



La zone RAMOGE est un cas particulier, en raison de son plateau continental réduit et d'un environnement profond qui peuvent être influencés par la présence de canyons très côtiers. La répartition géographique des déchets de plastique est fortement impactée par l'hydrodynamisme (courant ligure), la géomorphologie et les facteurs humains. Cette zone est caractérisée par une grande variété d'activités humaines, telles que la pêche, le développement urbain et le tourisme. Dans le cadre de l'étude, les plus fortes densités ont été observées dans les canyons de Bordighera (3,12 déchets/100m) et sur les roches du Larvotto (1,51 déchets/100m). Le plastique représente une fraction faible sur l'ensemble des sites; de 0 à 22% (Arma di Taggia). Son absence est notable sur les zones de pêche (cf graphique p.37).

Les déchets issus de la pêche, y compris les filets fantômes, prévalent dans les zones de pêche commerciale et peuvent constituer une proportion élevée de la quantité totale de déchets. Dans le cas de l'étude RAMOGE, les pourcentages sont importants dans les canyons et zones de la Nioulargue (89% de déchets issus de la pêche), canyon du Dramont (88%) et particulièrement dans le canyon de Bordighera (90%, 2,86 déchets/100 mètres). La zone de Monaco est particulièrement affectée par les déchets et objets caractéristiques des activités de plaisance et navigation (corps morts et ancres – 12%) avec des pourcentages représentant respectivement 16 et 20 % sur les roches et le canyon de Monaco (cf graphique p.37).

Dans le cas des travaux effectués lors de la campagne RAMOGE, la typologie observée est caractéristique des pentes de canyons. Elle ne met pas en évidence l'importance des plastiques, largement confinés en général sur les zones de pente faible et de sédimentation. Cette typologie est caractéristique et résulte des activités de plaisance (Monaco) mais surtout de l'intensité des activités de pêche et de leur impact chronique sur les pentes des trois canyons (Banc de la Nioulargue, canyon du Dramont, canyon de Bordighera).

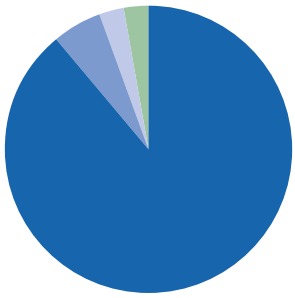
La zona RAMOGE è un caso particolare per via della piattaforma continentale ridotta e di un ambiente profondo che possono essere influenzati dalla presenza di canyon molto costieri. La distribuzione geografica dei rifiuti di plastica è fortemente influenzata dall'idrodinamismo (corrente ligure), dalla geomorfologia e dai fattori umani. Questa zona è caratterizzata da una forte molteplicità di attività antropiche come la pesca, lo sviluppo urbano e il turismo. Nell'ambito dello studio, le maggiori densità sono state osservate nei canyon di Bordighera (3,12 rifiuti/100 m) e sulle rocce del Larvotto (1,51 rifiuti/100 m). La plastica rappresenta una frazione ridotta considerando l'insieme dei siti: da 0 al 22% (Arma di Taggia). È da rilevare la sua assenza nelle zone di pesca (cf grafico p.37).

I rifiuti originati dalla pesca, reti fantasma comprese, prevalgono nelle zone di pesca commerciale e possono costituire una percentuale elevata della quantità totale di rifiuti. Nel caso dello studio RAMOGE, le percentuali sono importanti nei canyon e nelle zone di Nioulargue (89% dei rifiuti provengono dalla pesca), nel canyon del Dramont (88%) e in particolare nel canyon di Bordighera (90%, 2,86 rifiuti/100 m). La zona di Monaco è particolarmente interessata dai rifiuti e dagli oggetti caratteristici delle attività legate alla nautica da diporto e alla navigazione (corpi morti e ancore – 12%), con percentuali rispettivamente del 16 e 20% sulle rocce e nel canyon di Monaco (cf grafico p.37).

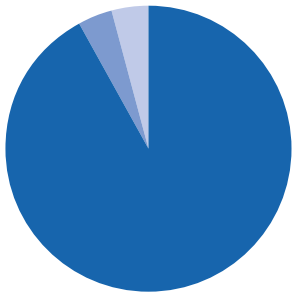
Nel caso delle attività condotte durante la campagna RAMOGE, la tipologia osservata è caratteristica dei pendii sommersi e dei canyon. Non si evidenzia l'importanza delle plastiche, perlopiù confinate alle zone di minore pendenza e di sedimentazione. Questa tipologia è caratteristica ed è legata alle attività della nautica da diporto (Monaco) e, soprattutto, all'intensità delle attività di pesca e al loro impatto sui pendii di 3 canyon (Il banco di Nioulargue, canyon del Dramont, canyon di Bordighera).

**OBSERVATIONS DE DÉCHETS PAR TYPE ET PAR SITES DURANT LA CAMPAGNE RAMOGE 2015**
(n= nombre d'observations de déchets/site)

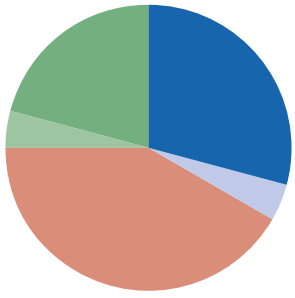
**OSSERVAZIONI DI RIFIUTI PER TIPOLOGIA E PER SITO DURANTE LA CAMPAGNA RAMOGE 2015**
(n= numero d'osservazioni di rifiuti /sito)



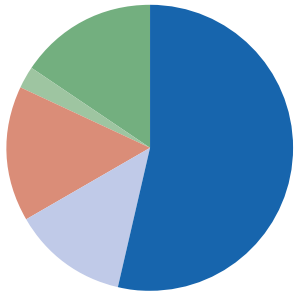
Banc de la Nioulargue n=36



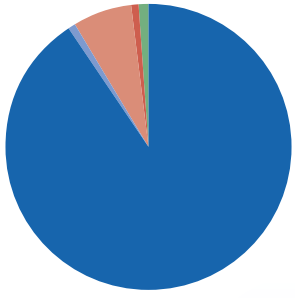
Canyon du Dramont n=25



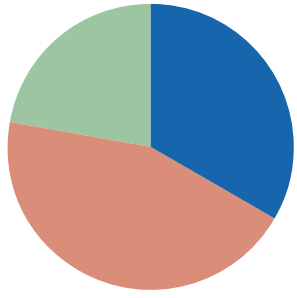
Canyon de Monaco n=24



Roches profondes de Monaco n=39

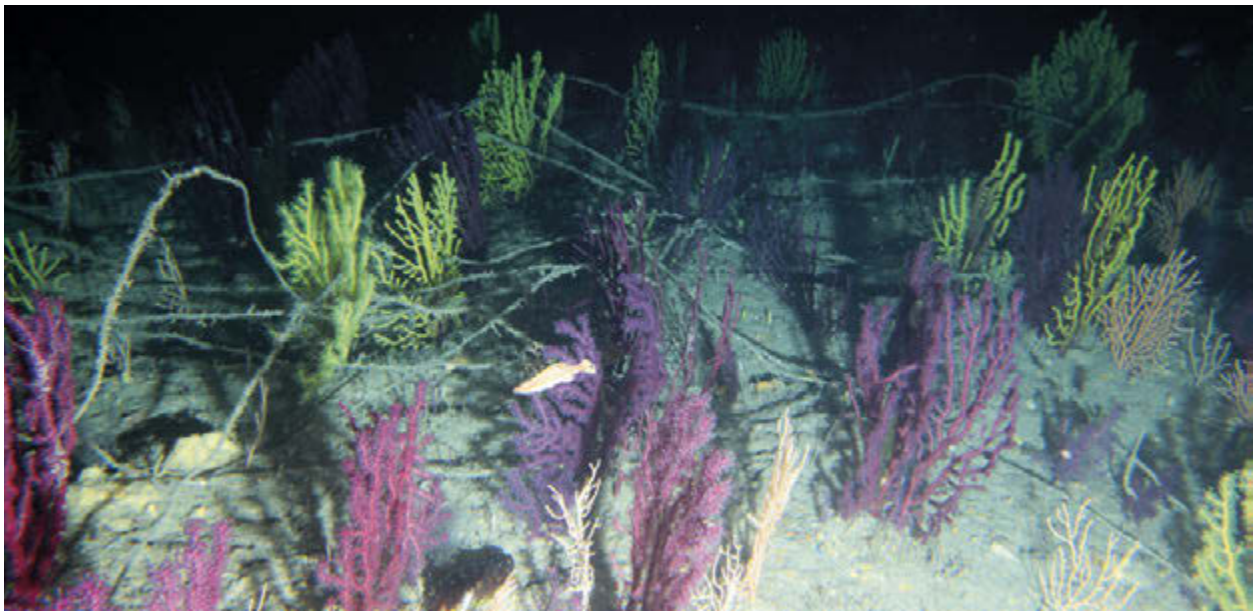


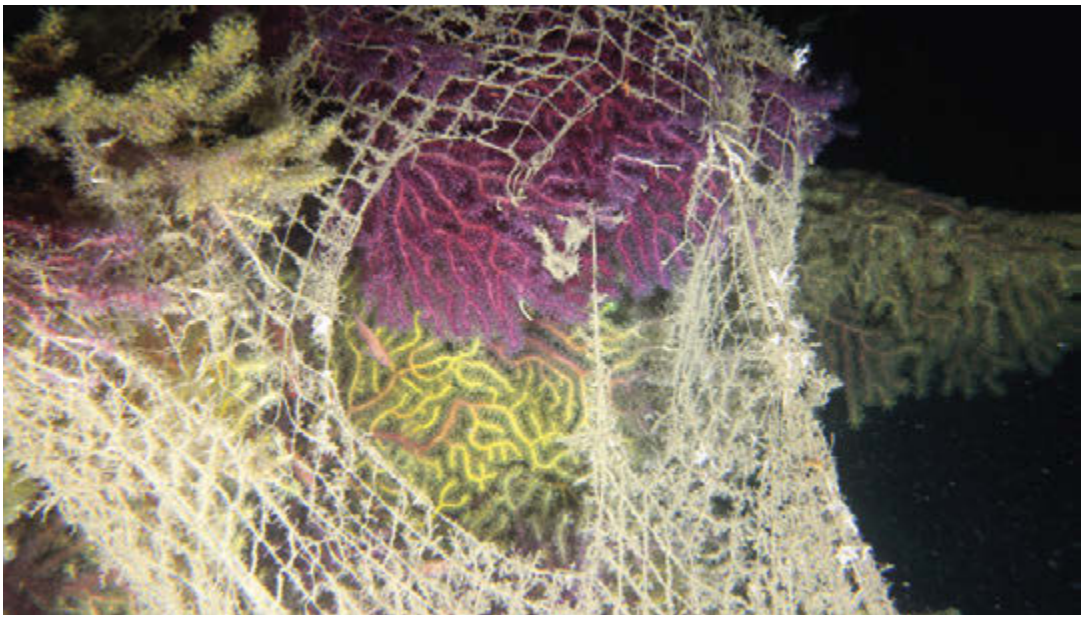
Canyon di Bordighera n=118



Canyon Arma di Taggia n=18

- Engins de pêche / Attrezzi da pesca
- Objets type porcelaine/céramique
  Oggetti di tipo porcelana/ceramica
- Objets de verre / Oggetti di vetro
- Objets divers / oggetti diversi
- Objets metalliques / Oggetti metallici
- Plastiques / Plastiche
- Corps morts et ancres
  Corpi morti e ancore





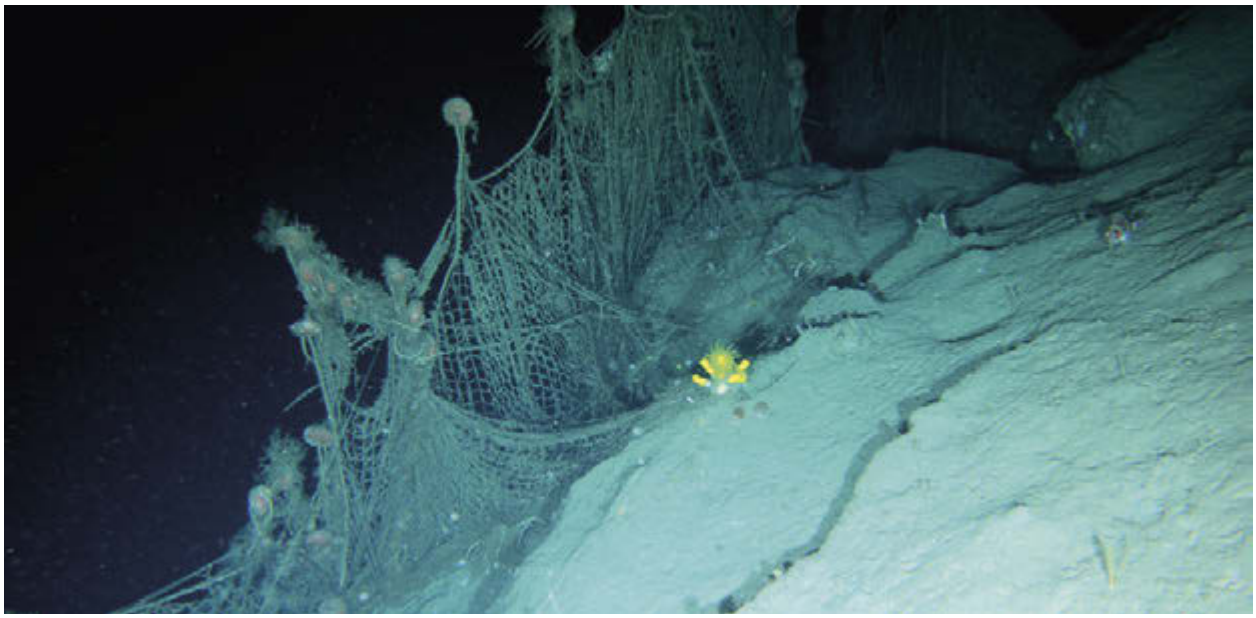
Images 1 et 2 :
Filets de pêche dans *Paramucea clavata*
Attrezzi da pesca persi in presenza *Paramucea clavata*
(-75 m / Bordighera)

## > Pêche

Les engins de pêche (filets et palangres) représentent près 75% des observations de déchets. Les densités (nombre de déchets/100m) sont particulièrement forte le long de la côte ligure notamment dans le canyon de Bordighera. En effet la présence de plusieurs espèces de poissons commercialement exploitées, implique une forte pression de pêche professionnelle et récréative et explique la forte abondance d'engins perdus. En revanche, en France ce type d'impact est moindre, contenu de l'éloignement à la côte du banc de la Nioulargue et d'une pression de pêche plus faible.

## > Pesca

Gli attrezzi da pesca, quali reti e palamiti, rappresentano circa il 75% delle osservazioni effettuate. Le densità registrate (numero di rifiuti/100 m) sono particolarmente elevate lungo la costa ligure, in particolare nel canyon di Bordighera. In effetti, la presenza di numerose specie ittiche commercialmente rilevanti determina una forte pressione di pesca professionale e ricreativa e, di conseguenza, la grande abbondanza di attrezzi persi. Al contrario, in Francia questo tipo d'impatto è minore, grazie alla lontananza del banco di Nioulargue ed a una pressione di pesca probabilmente inferiore.



Les engins de pêche abandonnés, en plus de pêcher encore des espèces pendant un certain temps, s'accrochent entre les rochers, les gorgones ou les coraux. Ils brisent des branches et exercent une action abrasive continue, ce qui rend ces organismes vulnérables à l'établissement d'organismes parasites. Puis les filets, alourdis par des concrétions organiques, recouvrent le fond, et étouffent les peuplements benthiques.
La pression de pêche induit des impacts négatifs sur ces peuplements particulièrement vulnérables. Ces impacts déterminent un appauvrissement des ressources marines diminuant à leur tour, la productivité de la pêche artisanale.

Oltre al continuo prelievo di specie, gli attrezzi da pesca abbandonati si impigliano tra le rocce, le gorgonie e i coralli. Rompono le ramificazioni ed esercitano una continua azione abrasiva, rendendo questi organismi vulnerabili all'insediamento di parassiti. Le reti, appesantite dalle concrezioni organiche, ricoprono il fondale soffocando le comunità bentoniche.
La pressione di pesca comporta impatti negativi su questi popolamenti profondi estremamente vulnerabili, che determinano un impoverimento delle risorse marine riducendo, a loro volta, la produttività della pesca artigianale.

*Mola mola* piégé par une palangre perdue
*Mola mola* intrappolato da un palamito perso
(-260m / Nioulargue)

Filets de pêche perdus et *Dendrophyllia cornigera*
Reti di pesca perse e *Dendrophyllia cornigera*
(Bordighera)

# 4 Mise en perspective
## Prospettive future

### Conservation des zones profondes d'intérêt écologique

La zone RAMOGE fait partie d'une très large zone de la Méditerranée reconnue comme écologiquement et biologiquement importante par la Convention de la Diversité biologique (CDB) ainsi classifiée comme « ZIEB » (Zone d'Intérêt écologique et biologique). Les accords internationaux et les directives européennes poussent les pays à s'approprier les enjeux écologiques des zones profondes.

En 2010, lors de la 10ème Conférence des Parties de la CDB à Nagoya, les pays signataires dont l'Italie, la Principauté de Monaco et la France se sont engagés à protéger au moins 10% des zones marines et côtières d'ici à 2020.

Les moyens permettant la prise en compte et donc la conservation de ces zones profondes

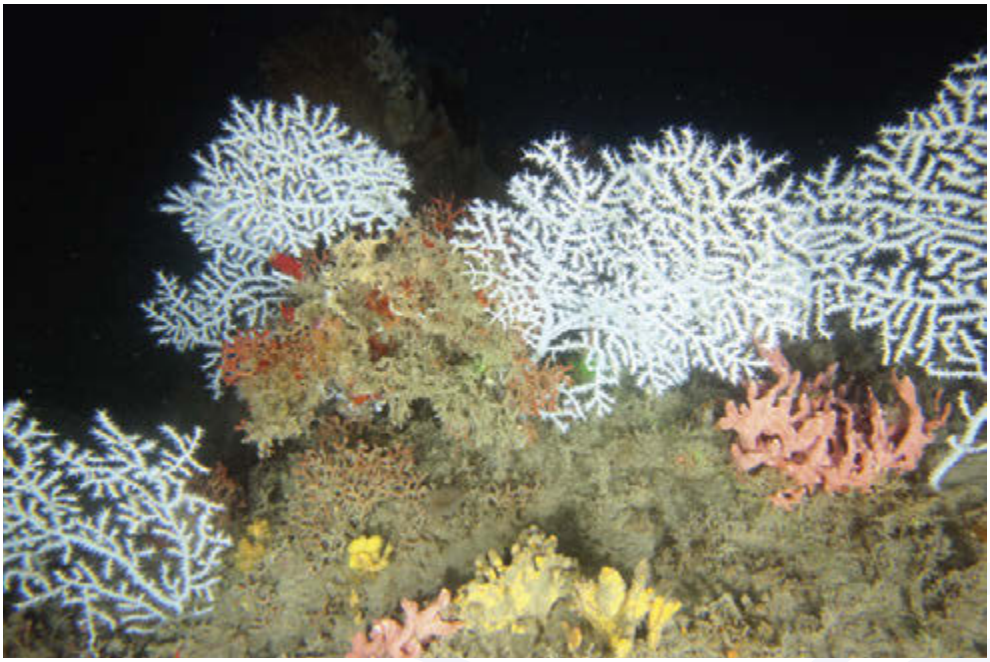
### Conservazione delle zone profonde d'interesse ecologico

La zona RAMOGE rientra in una più vasta area del Mediterraneo nord occidentale considerata ecologicamente e biologicamente importante dalla Convenzione della Diversità Biologica (CDB) e, pertanto, classificata come EBSA (Zona significativa dal punto di vista ecologico e biologico). Gli accordi internazionali e le direttive europee spingono i paesi a far fronte alle sfide ecologiche delle zone profonde.

Nel 2010, alla 10ª Conferenza delle Parti della CDB tenutasi a Nagoya, i paesi firmatari tra cui l'Italia, il Principato di Monaco e la Francia si sono impegnati a proteggere almeno il 10% delle zone marine e costiere entro il 2020.

Gli strumenti che permettono di studiare e quindi conservare le zone profonde sono quelli

Gorgones et éponges
Gorgonie e spugne
(Monaco)



sont classiques ; ils relèvent de la connaissance et de la concertation. On entend régulièrement de la part des scientifiques : « on ne protège bien seulement que ce que l'on connait bien ». La connaissance est une base essentielle pour comprendre le fonctionnement de ces écosystèmes profonds et appréhender les facteurs influençant leur conservation.

La campagne RAMOGE répond ainsi à l'objectif d'amélioration des connaissances sur ces milieux permettant d'en préciser les enjeux écologiques.

La concertation est, quant à elle, le maillon important, structurant plusieurs étapes clés auprès des acteurs et des décideurs. En France comme en Italie, certaines zones profondes d'intérêt écologique ont les caractéristiques pour intégrer le réseau Natura 2000 qui est un outil pour la conservation des habitats d'intérêt communautaire.

Les outils qui permettent de protéger ces zones vont de la sensibilisation du citoyen, à des mesures contractuelles entre plusieurs parties jusqu'à des mesures règlementaires. La connaissance des aspects écologiques et socio-économiques permet de cibler au mieux la vocation de ces espaces.

più classici, ovvero la conoscenza e la concertazione. I ricercatori sono soliti affermare "si protegge bene solo quello che si conosce bene". La conoscenza è un aspetto fondamentale per capire il funzionamento di questi ecosistemi profondi e comprendere i fattori che ne influenzano la conservazione.

La campagna RAMOGE, pertanto, si pone l'obiettivo di migliorare le conoscenze di questi ambienti permettendo di precisarne le problematiche ecologiche.

Dal canto suo, la concertazione è un elemento essenziale che caratterizza i momenti chiave da condividere con attori e decisori. In Francia e in Italia alcune zone profonde di interesse ecologico hanno tutte le caratteristiche per integrare la rete Natura 2000, che è uno strumento per la conservazione degli habitat di interesse comunitario.

Gli strumenti che consentono di tutelare queste zone spaziano dalla sensibilizzazione, alle misure contrattuali tra le parti in causa, sino alla definizione di misure di regolamentazione. La conoscenza degli aspetti ecologici e socioeconomici consente di definire al meglio la vocazione di questi spazi.

## Un exemple d'outil de gestion

Les Aires Marines Protégées (AMP) sont un élément clé pour la préservation de la biodiversité et pour augmenter la résilience des écosystèmes face aux pressions, exercées par les activités humaines, mais également pour faire face aux changements climatiques.

Ces espaces de gestion constituent des outils efficaces pour la conservation de la biodiversité marine et pour faire face aux menaces complexes qui pèsent sur les écosystèmes marins. Les AMP sont des espaces privilégiées pour concilier le développement des activités maritimes (tourisme, pêche professionnelle et de loisir, plaisance, etc.) avec la conservation de ces milieux profonds.

## Un esempio di strumento di gestione

Le aree marine protette (AMP) sono considerate un elemento chiave per la salvaguardia della biodiversità, per aumentare la resilienza degli ecosistemi alle pressioni esercitate dalle attività antropiche e per far fronte ai cambiamenti climatici.

Questi spazi di gestione rappresentano strumenti efficaci per la conservazione della biodiversità marina e per affrontare le complesse minacce che gravano sugli ecosistemi marini. Le AMP sono inoltre spazi privilegiati per conciliare lo sviluppo delle attività marittime (turismo, pesca professionale e ricreativa, diporto, ecc.) e la conservazione di questi ambienti profondi.


Astrea (Monaco)

*Gorgonocephalus mediterraneus* sur / su *Paramucea clavata* (Monaco)

# Surveillance des milieux profonds

La connaissance obtenue sur des écosystèmes profonds méditerranéens à partir de la campagne d'exploration des zones profondes menées à l'été 2015 illustre la riche collaboration entre les équipes scientifiques des trois pays. Une meilleure connaissance partagée des écosystèmes constitue le cadre nécessaire à une surveillance efficace pour la préservation des milieux.

La surveillance de l'état de santé de ces milieux profonds est fondamentale pour évaluer les effets des activités humaines et constitue, ainsi, un élément essentiel de la gestion adaptative, à savoir la possibilité d'ajuster, d'affiner des mesures de gestion des activités humaines afin d'optimiser leur efficacité de préservation.

La Convention de Barcelone, instrument juridique et opérationnel du Plan d'action des Nations Unies pour la protection de la Méditerranée, mène, dans le même esprit une initiative EcAp[6] destinée à faciliter l'application de l'approche écosystémique pour la gestion des activités humaines qui peuvent affecter le milieu marin et le littoral méditerranéen. Dans ce domaine en effet, une étude est en cours pour établir un système intégré de surveillance, un programme d'évaluation de l'état de Méditerranée et de ses cotes avec des critères d'évaluation liés (projet IMAP[7]) .

# Monitoraggio degli ambienti profondi

Le conoscenze acquisite sugli ecosistemi profondi del Mediterraneo grazie alla campagna di esplorazione delle zone profonde condotta nell'estate 2015 dà prova della grande collaborazione tra i team scientifici dei tre paesi. Una maggiore condivisione delle conoscenze sugli ecosistemi rappresenta un presupposto indispensabile per un monitoraggio efficace volto alla conservazione di questi ambienti.

Il monitoraggio dello stato di salute di questi ambienti profondi è essenziale per valutare gli effetti delle attività antropiche e, pertanto, rappresenta un elemento essenziale della gestione adattativa, ovvero della possibilità di adeguare e perfezionare le misure di gestione delle attività antropiche per ottimizzarne l'efficacia in materia di tutela.

Nella stessa direzione si sta muovendo la Convenzione di Barcellona, ovvero lo strumento giuridico e operativo del Piano d'Azione delle Nazioni Unite per la salvaguardia del Mediterraneo, con l'iniziativa EcAp , volta a favorire l'applicazione dell'approccio ecosistemico alla gestione delle attività antropiche che possono influenzare lo stato dell'ambiente marino e costiero del Mediterraneo. Anche in quest'ambito, infatti, è in corso uno studio per predisporre un sistema di monitoraggio integrato, un programma di valutazione del Mar Mediterraneo e delle sue coste, e i criteri di valutazione correlati (progetto IMAP ).

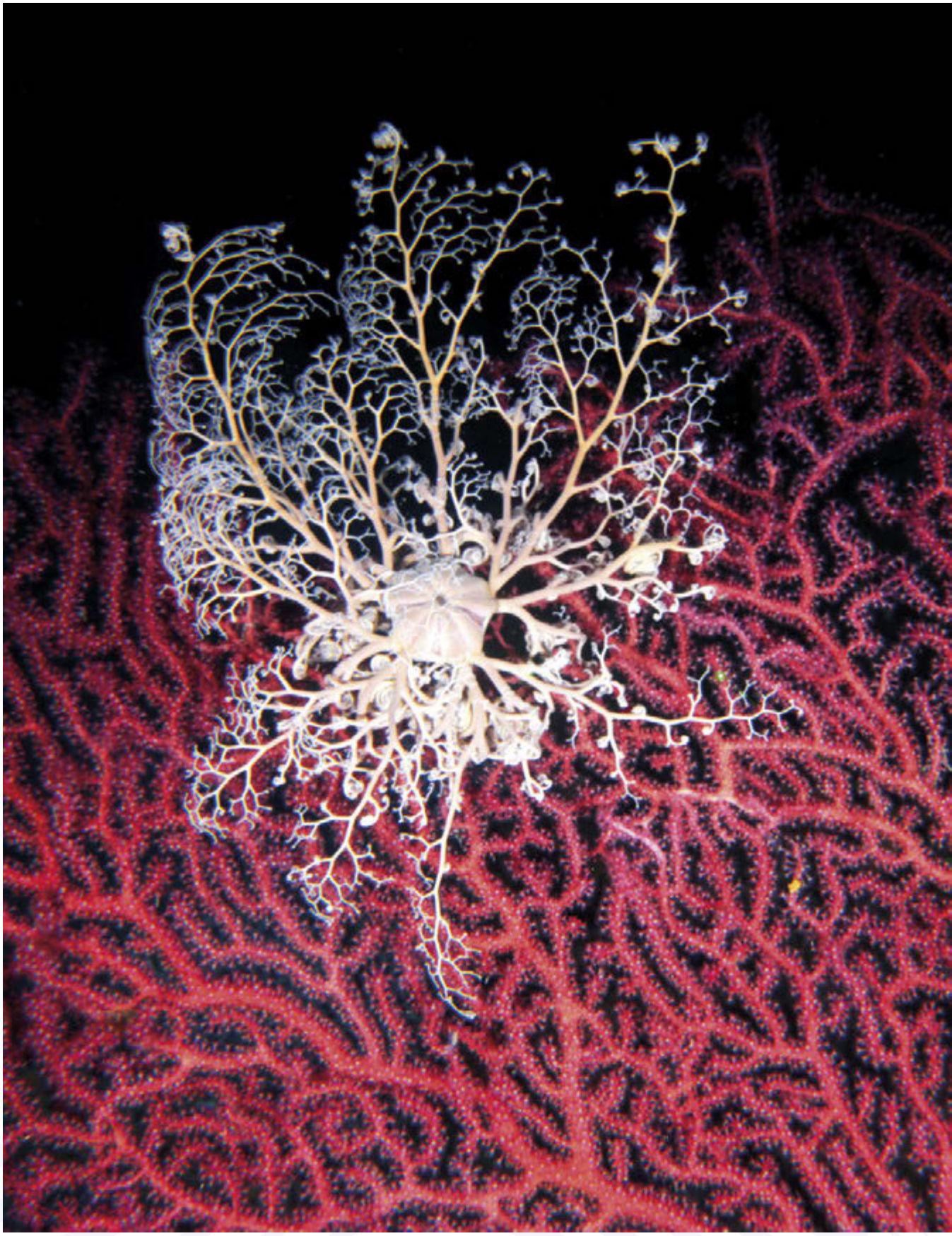
NOTES

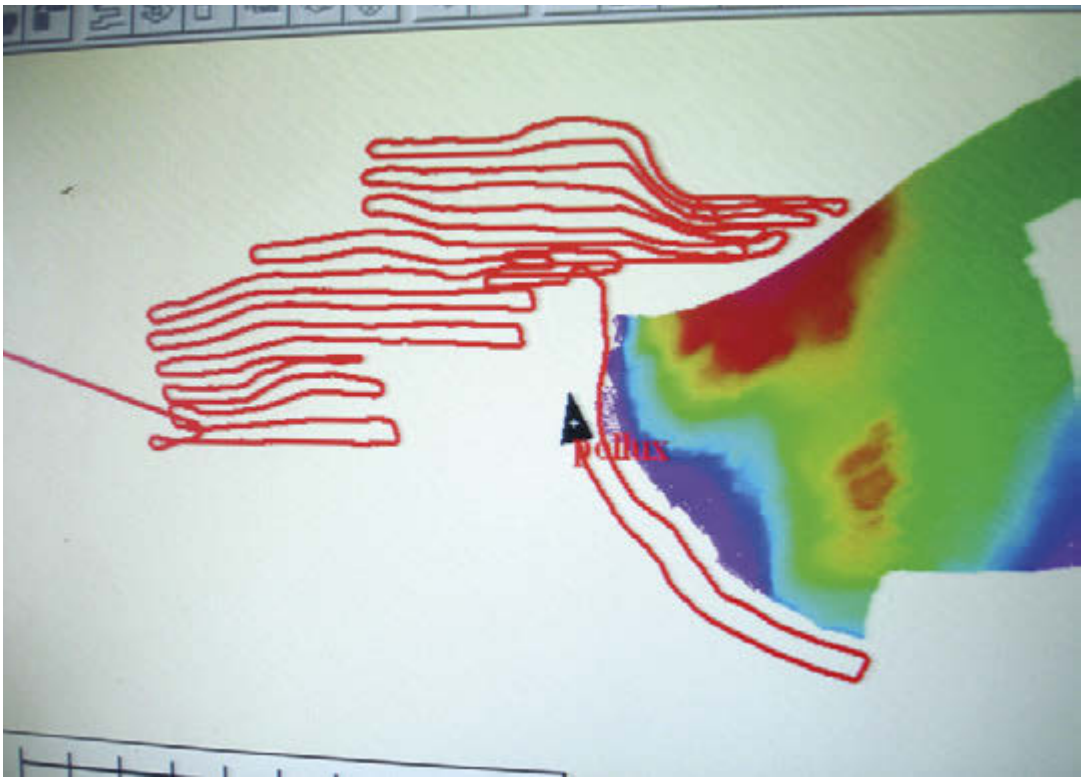
[6] Le projet EcAp ou Ecosystem Approach/ Approche Ecosystémique.

[6] EcaP o "Ecosystem Approach"

[7] Programme intégré de surveillance et d'évaluation (IMAP) développé par le PNUE/ PAM dans le cadre d'EcAp

[7] Programma integrato di Monitoragio e di valutazione (IMAP) sviluppato da UNEP/ MAP nel quadro di EcAp






Acquisition sonar multifaisceaux
Acquisizione multibeam

## Inter calibrations des méthodes de suivi

L'expérience RAMOGE, avec la collaboration des composantes scientifiques des trois pays signataires de l'Accord, se propose d'être un exemple de collaboration internationale pour la définition des activités standardisées d'étude et de surveillance des habitats profonds.

La campagne a été préparée en amont par les trois équipes dans l'objectif d'apprécier les outils utilisés par chaque pays. Les moyens logistiques sont souvent similaires : navire océanographique équipé d'un ROV, de matériels de prise de vues ou encore d'un sonar multifaisceaux. Le sonar multifaisceaux est généralement utilisé avant l'immersion du ROV pour caractériser finement la topographie de la zone d'exploration. Pour l'utilisation du ROV, la méthode retenue a été celle du transect verticale, généralement le long des parois les plus pentues pour les têtes de canyons.

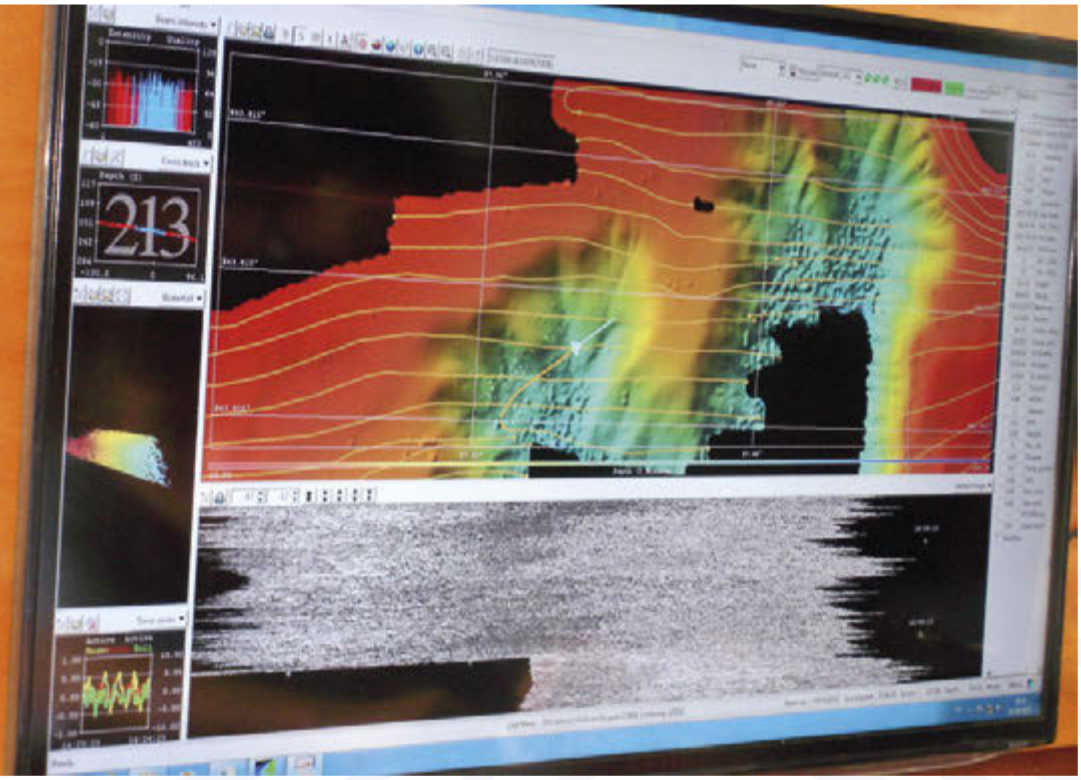
Les échanges entre les équipages, à bord du navire ont été riches et ont révélé l'importance de travailler ensemble. Il est clair que les trois pays partagent, à des intensités différentes les mêmes enjeux environnementaux.

## Intercalibrazione dei metodi di monitoraggio

L'esperienza condotta da RAMOGE con la collaborazione delle componenti scientifiche dei tre paesi firmatari dell'Accordo si propone come un esempio di collaborazione internazionale per definire attività standardizzate di studio e monitoraggio degli habitat profondi.

La campagna è stata preparata in anticipo dai tre team con l'obiettivo di valutare gli strumenti utilizzati dai singoli paesi. La strumentazione logistica è spesso simile: nave oceanografica dotata di ROV, materiali per la raccolta di immagini e filmati e sonar multibeam. Quest'ultimo è solitamente utilizzato prima di immergere il ROV per caratterizzare nel dettaglio la zona oggetto di esplorazione. Per quanto riguarda l'utilizzo del ROV si è fatto ricorso al metodo del transetto verticale, generalmente lungo le pareti più ripide delle testate di canyon.

La condivisione delle osservazioni a bordo ha evidenziato ancora di più l'importanza di lavorare insieme: i tre paesi condividono le stesse sfide ambientali e le pressioni rilevate sono le stesse, anche se di diversa intensità.




Ecrans d'observation Astrea
Schermi di osservazione Astrea

Acquisition sonar multifaisceaux
Acquisizione multibeam

# 5 Conclusion
## Conclusione

La campagne d'exploration menée par RAMOGE dans les zones profondes semble modeste au regard des six secteurs inventoriés, mais le manque de connaissance étant encore très important sur ces milieux, toutes initiatives et observations sont des apports très significatifs, tant sur le plan de la connaissance de la biodiversité que sur les pressions exercées par les activités anthropiques.

Ainsi la campagne a permis notamment dans une première analyse :

- de découvrir la présence de coraux blanc *(Madrepora occulata)* sur le banc de la Nioulargue complétant ainsi l'état des lieux du site Natura 2000 « Corniche varoise » ;
- de souligner l'exubérance de la zone du canyon du Dramont dans les profondeurs de 50 m à 150 m;
- d'observer une rascasse de Messine *(Scorpaenodes arenai)* encore jamais observée en Méditerranée à cette latitude aussi septentrionale;
- d'identifier un secteur peu impacté et relativement riche à proximité du port Hercule à Monaco ;
- de faire l'observation d'anthipathaires (Corail noir) à Monaco alors qu'ils n'avaient jamais été aperçus à une si faible profondeur;
- de révéler la richesse globale du canyon de Bordhiguera et de son attrait pour la pêche;
- de confirmer le rôle des canyons, même vaseux, pour le maintien des ressources halieutiques au niveau d'Arma di Taggia ;

Bien évidemment les observations ont également mis en évidence des impacts importants sur les espèces et peuplements benthiques. Les engins de pêche perdus constituent la pression la plus visible. Une stratégie visant à réduire cette pression serait intéressante à partager, notamment entre la France et l'Italie. La perte d'un engin de pêche est une « double punition », pour le milieu marin et pour le pêcheur.

Limitandosi alla caratterizzazione di sei settori, la campagna di esplorazione RAMOGE sembra modesta, ma poiché per questi ambienti esistono ancora grandi lacune conoscitive, ogni iniziativa e ogni osservazione condotta può contribuire in modo significativo all'incremento della conoscenza sia della biodiversità che delle pressioni esercitate dalle attività antropiche.

Nello specifico, ad una prima analisi, la campagna ha permesso di:

- scoprire la presenza di coralli bianchi *(Madrepora oculata)* sul banco di Nioulargue, completando lo studio conoscitivo del sito Natura 2000 "Corniche varoise";
- evidenziare la ricchezza che caratterizza la zona compresa tra i 50 e i 150 m di profondità del canyon del Dramont;
- osservare un esemplare di scorpenode mediterraneo *(Scorpaenodes arenai)* nel punto più settentrionale mai registrato in Mediterraneo;
- individuare una zona di riferimento priva di impatti meccanici della pesca per i fondi mobili nelle acque del Principato di Monaco, vicine al porto;
- osservare a Monaco degli antipatari (corallo nero) mai segnalati a profondità così ridotte;
- dimostrare la ricchezza del canyon di Bordighera e la sua importanza per la pesca;
- confermare il ruolo dei canyon, anche se fangosi, per il mantenimento delle risorse ittiche nel settore di Arma di Taggia.

Ovviamente le osservazioni hanno anche evidenziato la presenza di impatti importanti sulle specie e sui popolamenti bentonici. Gli attrezzi da pesca persi costituiscono la pressione più visibile. Sarebbe interessante condividere una strategia volta a ridurre questo tipo di pressione, soprattutto tra Francia e Italia, poiché la perdita di un attrezzo da pesca rappresenta una "doppia punizione": non solo per l'ambiente marino ma anche per il pescatore.

Au-delà de ces observations c'est un mécanisme de coopération transfrontalière qui s'est affirmé par cette campagne, où le cadre de l'Accord RAMOGE apporte sa légitimité.

Les perspectives de travaux sur les zones profondes dans le prolongement de cette coopération scientifique, comme l'identification de solutions communes seront d'autant plus efficaces pour conserver ces zones de grand intérêt écologique. La proximité des canyons avec la côte au niveau de la zone RAMOGE facilite ces travaux, qui sont d'autant plus pertinents, que ce littoral attractif est sous une pression très forte.

Il est important que les pays transfrontaliers coopèrent d'une manière coordonnée pour mener des études permettant de recueillir des données cohérentes entre eux, fondamentales pour composer une base de connaissances communes, indispensables pour établir des solutions communes de gestion, et ainsi les rendre plus efficaces.

Les travaux de RAMOGE peuvent ainsi servir d'exemple à l'échelle du bassin méditerranéen et les résultats de cette campagne scientifique, espérons-le, inciteront à de nouvelles initiatives et à d'autres coopérations.

Oltre alle osservazioni sopra riportate, questa campagna costituisce un esempio concreto di cooperazione transfrontaliera, meccanismo al quale l'Accordo RAMOGE conferisce specifica legittimità.

Le prospettive di lavoro sulle zone profonde a seguito di questa cooperazione scientifica, così come la definizione di soluzioni comuni, costituiranno elementi molto efficaci per favorire la tutela di queste zone di grande interesse ecologico. Nella zona RAMOGE, la vicinanza dei canyon alla costa facilita queste attività, che rivestono ancora più interesse poiché il litorale è soggetto a fortissime pressioni.

È importante che i paesi transfrontalieri cooperino per condurre attività di studio in maniera coordinata, in modo da acquisire dati coerenti tra di loro, fondamentali per comporre un quadro conoscitivo comune, indispensabile a sua volta per definire soluzioni gestionali comuni e, pertanto, più efficaci.

Le attività di RAMOGE possono quindi servire da esempio a scala di bacino Mediterraneo ed i risultati della campagna, come auspichiamo, potranno promuovere nuove iniziative di cooperazione.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Nous remercions Laura Amighetti pour la traduction.

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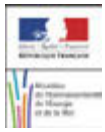


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Toutes le photos du ROV (sous-marines) ont été prises par Simonepietro CANESE
Tutte le foto del ROV (sottomarine) sono state scattate da Simonepietro CANESE


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