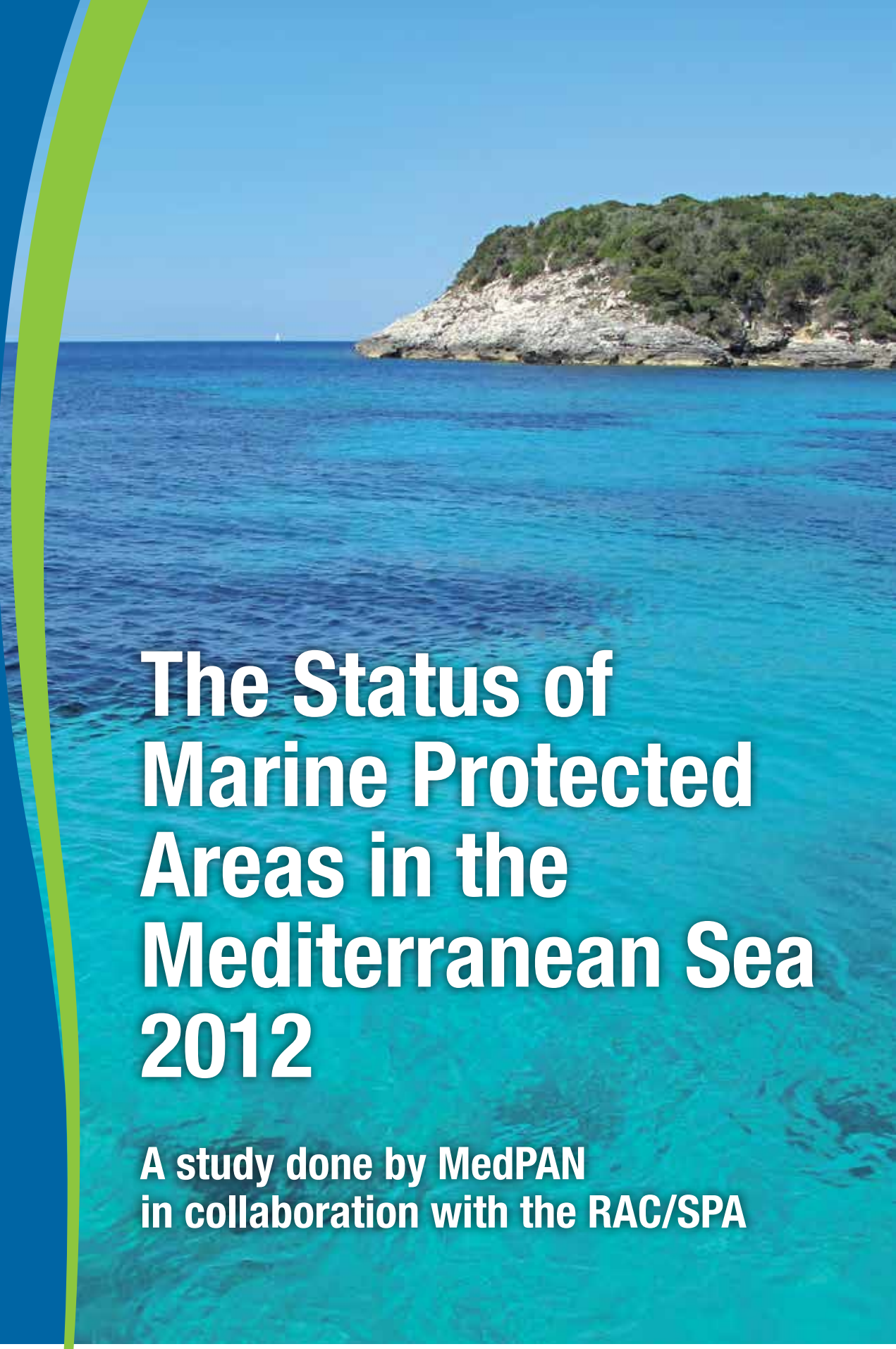
MedPAN COLLECTION



The Status of Marine Protected Areas in the Mediterranean Sea 2012

A study done by MedPAN in collaboration with the RAC/SPA

MedPAN

UNEP MAP RAC/SPA

ACCOBAMS

Agence des aires marines protégées

Conservatoire du littoral

GFCM CGPM

IUCN

WWF

The designation of geographical entities in this book, and the presentation of the material, do not imply the expression of any opinion whatsoever on the part of the MedPAN, RAC/SPA or other partner organisations concerning the legal status of any country, territory, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.
The views expressed in this publication do not necessarily reflect those of MedPAN, RAC/SPA or their partners.

Printed by: MedPAN and RAC/SPA

Coordination: MedPAN and RAC/SPA

Copyright: © 2012 - MedPAN & RAC/SPA

Reproduction of this publication for educational or other non-commercial purposes is authorized without prior permission from the copyright holder provided the source is fully acknowledged. Reproduction of this publication for resale or other commercial purposes is prohibited without prior written permission of the copyright holder.

Citation: Gabrié C., Lagabrielle E., Bissery C., Crochelet E., Meola B., Webster C., Claudet J., Chassanite A., Marinesque S., Robert P., Goutx M., Quod C. 2012. The Status of Marine Protected Areas in the Mediterranean Sea. MedPAN & RAC/SPA. Ed: MedPAN Collection. 256 pp.

ISBN no.: 979-10-92093-06-3 9791092093063

English translation: Kate Anderson

Layout: Marie-Laure Tomasi / Studio PIKNETART.COM

Cover Photo: Bonifacio Strait Nature Reserve, France © AMICLA-C. Amico / WWF-Canon

Available from: MedPAN, 46 rue St Suffren, 13006 Marseille, France. Tel. : + 33 4 91 58 09 62. Website: www.medpan.org

MedPAN COLLECTION

The Status of Marine Protected Areas in the Mediterranean Sea

Date: 2012

Authors: Catherine Gabrié, Erwann Lagabrielle, Claire Bissery, Estelle Crochelet, Bruno Meola, Chloë Webster, Joachim Claudet, Aurore Chassanite, Sophie Marinesque, Philippe Robert, Madeleine Goutx, Caroline Quod.

Erwann Lagabrielle: coordination of Chapter 4 and spatial analyses for Chapters 3 & 4
Estelle Crochelet: study of connectivity (Chapter 4)
Bruno Meola and Chloë Webster - MedPAN Secretariat: supervision, coordination and revision of the report
Caroline Quod: mapping of benthic sediments (Chapter 4)
Claire Bissery: analysis of MPA management efficiency and statistics (Chapter 5)
Joachim Claudet, Aurore Chassanite and Sophie Marinesque: study of the multidisciplinary monitoring programmes (Chapter 6 and associated recommendations)
Catherine Gabrié: overall coordination and report writing, in particular of the summary and recommendations

With support from: ACCOBAMS, French Marine Protected Areas Agency, Conservatoire du Littoral, GFCM, French GEF, MAVA Foundation, Prince Albert II of Monaco Foundation, PACA Region, IUCN Med, WWF Mediterranean Programme Office and WWF France

Publication lead

MedPAN

Since 1990, the MedPAN network has brought together the managers of Mediterranean Marine Protected Areas (MPAs) and has supported them in their management activities. A legally independent structure since 2008, MedPAN aims to promote the establishment, the operation and sustainability of the network of MPAs. Currently, the MedPAN association has 9 founding members, 31 members (MPA managers), 24 partners (activities related to MPA management) in 18 Mediterranean countries.

> www.medpan.org

RAC/SPA

The Regional Activity Centre for Specially Protected Areas (RAC/SPA) was established in Tunis in 1985 by decision of the Contracting Parties to the Barcelona Convention, which entrusted it with responsibility for assessing the situation of natural heritage and assisting the Mediterranean countries to implement the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol), which came into force in 1999.

> www.rac-spa.org/fr

Technical partners

ACCOBAMS

The ACCOBAMS (Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contigous Atlantic Area) is a cooperative tool for the conservation of marine biodiversity in the Mediterranean and Black Seas.Its purpose is to reduce threats to cetaceans in Mediterranean and Black Sea waters and improve our knowledge of these animals.

> *www.accobams.net*

Agence des Aires Marines Protégées

The French Agence des Aires Marines Protégées is a public establishment of an administrative nature created by the law of 14 April 2006 and placed under the governance of the Ministry of Ecology, Sustainable Development, Transport, and Housing. It's dedicated to the protection of the marine environment. The main assignments of the Agence des Aires Marines Protégées are supporting public policies for the creation and management of marine protected areas in the entirety of French maritime waters, running the MPA network, technical and financial support of natural marine parks, reinforcing French potential in international negotiations concerning the sea.

> *www.aires-marines.com*

Conservatoire du Littoral

Drawing on its experience as a public body committed to the perennial protection of natural areas, seascapes and lake shores in mainland France and overseas, the Conservatoire du Littoral has been involved since the early 1990s in a number of international actions for global coastal conservation, especially in countries in the Mediterranean basin. Since 2006, the Conservatoire has been coordinating the PIM Initiative programme whose aim is to promote and assist in the management of small Mediterranean islands. This programme is dedicated to protecting these micro-territories through the implementation of concrete actions in the field, including through the promotion of exchanges and the sharing of knowledge and expertise among managers and experts from across the Mediterranean basin.

> *www.conservatoire-du-littoral.fr*
> *www.initiative-pim.org*

GFCM

The Agreement for the establishment of the General Fisheries Commission for the Mediterranean (GFCM), under the provisions of Article XIV of the FAO constitution, was approved by the FAO Conference in 1949 and entered into force in 1952. Consisting of 23 Member countries along with the European Union, the GFCM's objectives are to promote the development, conservation, rational management and best utilization of living marine resources, as well as the sustainable development of aquaculture in the Mediterranean, Black Sea and connecting waters.

> *www.gfcm.org*

Technical Partners

IUCN Centre for Mediterranean Cooperation

The IUCN Centre for Mediterranean Cooperation was inaugurated in 2000. The goal of the IUCN Centre for Mediterranean Cooperation is "to influence, encourage and assist Mediterranean societies in achieving both the conservation and sustainable use of natural resources, and sustainable development." The aim of the IUCN Mediterranean Marine Programme is to implement a coherent network of marine protected areas that ecologically and socially represents the Mediterranean Sea and its people.

> *www.iucnmed.org*

WWF

WWF's mission is to stop the degradation of our planet's natural environment, and build a future in which humans live in harmony with nature. Through its Mediterranean Initiative, WWF has been actively involved in promoting the establishment and effective management of marine protected areas in the Mediterranean for many years.

The MedPAN South Project is a collaborative project, led by WWF Mediterranean, aimed at improving the management effectiveness of Marine Protected Areas (MPAs) in the south and east of the Mediterranean and supporting the creation of new ones.

The MedPAN North project is also a European collaborative project operating under the leadership of WWF-France. It brings together 12 key actors from 6 European countries bordering the Mediterranean. The aim of the MedPAN North project is to improve MPA management effectiveness, including in the marine Natura 2000 sites and to contribute to the establishment of a network of MPAs, as part of the international commitments, and particularly the European commitments in this area.

> *www.medpannorth.org*
> *www.wwf.fr*
> *http://mediterranean.panda.org*
> *http://www.panda.org/msp*

Financial contributors

FGEF – French Global Environment Facility

The FGEF's objective is to support the protection of the global environment in developing countries, since its creation by the French government in 1994.

> *www.ffem.fr*

MAVA Fondation

Dr Luc Hoffmann established MAVA in 1994 as an expression of his long personal commitment to conservation.

> *http://fr.mava-foundation.org*

Prince Albert II of Monaco Foundation

In June 2006, HSH Prince Albert II of Monaco decided to establish his Foundation to address our planet's alarming environmental situation. The Prince Albert II of Monaco Foundation is dedicated to the protection of the environment and the promotion of sustainable development on a global scale.

> *www.fpa2.com*

Région PACA (Provence-Alpes-Côte d'Azur)

The Provence-Alpes-Côte d'Azur Region is a French local territory that supports MedPAN network activities for several years.

> *www.regionpaca.fr*

Med Programme

The MED programme is a European initiative for transnational cooperation. It supports the MedPAN North Project (MNP).

> *www.programmemed.eu*

Acknowledgements

The preparation of this document was made possible thanks to the contribution of a number of people:

The MedPAN association and RAC/SPA technical teams.

All the managers of MPAs and experts who took the time to fill in the survey.

Peer reviewers, for providing careful feedback on the various chapters of the report, the people who gave their support for data collection and shared their knowledge, experts of the MedPAN Scientific Committee for providing dedicated advice on the scientific aspects of the report, and members of the Steering Committee who backed the process at every step of this lengthy project.

Reviewers:

Tundi Agardy,
José Amengual,
Lobna Ben Nakhla,
Purificació Canals,
Sandra Cariou,
Daniel Cebrian,
Souha El Asmi,
Amandine Eynaudi,
Marina Gomei,
Paolo Guidetti,
Alain Jeudy de Grissac,
Atef Limam,
Amy Milam,
Giuseppe Notarbartolo di Sciara,
Atef Ouerghi,
Catherine Piante,
Chedly Rais,
François Simard,
Laurent Sourbès.

The people who gave us support with the data collection and shared their knowledge, in particular:

Abdennadi Abarkach	*Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification*	Morocco
Judith Ahufinger Breto	*Generalitat de Catalunya*	Spain
Camille Albouy	*Laboratoire Ecosym*	France
Jesús Enrique Argente García	*Comunitat Valenciana*	Spain
Pierre Boissery	French Water Agency of the *Rhône-Méditerranée et Corse*	France
Marta Coll	Institute of Marine Sciences (ICM, CSIC)	Spain
Christopher Cousin	Malta Environment and Planning Authority	Malta
Nabigha Dakik	Tyre Coast Nature Reserve	Lebanon
Elodie Damier	*Agence des Aires Marines Protégées (AAMP)*	France
Fabricio D'Ortenzio	*Laboratoire d'Océanographie de Villefranche (LOV)*	France
Xavier Durrieu de Madron	*Centre de Formation et de Recherche sur les Environnements Méditerranéens (CEFREM), Université de Perpignan*	France
Jean-Marc Fromentin	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Hisham Ghmati	Marine Biology Research Center	Libya
Jean-Pierre Giraud	UNEP-MAP Blue Plan	
Marina Gomei	WWF Mediterranean Programme Office	Italy

Samir Grimes	*Ecole Nationale Supérieure des Sciences de la Mer et de l'Aménagement du Littoral (ENSSMAL)*	Algeria
Harun Güçlüsoy	General Directorate of Natural Assets Protection	Turkey
Saba Guellouz	*Agence de Protection et d'Aménagement du Littoral (APAL)*	Tunisia
Brian Mac Sharry	European Topic Centre on Biological Diversity (ETC-BD)	Europe
Pilar Marín	Oceana	
Capucine Melon-Duval	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Fatmir Memaj	University of Tirana	Albania
David Mouillot	*Laboratoire Ecosym* –University of Montpellier 2	France
François Poisson	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Jacques Populus	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Elvana Ramaj	Ministry of Environment, Forest and Water Administration	Albania
Silvia Revenga Martínez de Pazos	*Ministerio de Agricultura, Alimentación y Medio Ambiente*	Spain
Jacques Sacchi	Independant Consultant	France
Laurent Sourbès	National Park of Zakynthos	Greece
Daniel Springer	*Ministarstvo Zaštite Okoliša i Prirode* (Ministry of Environment and Nature Protection)	Croatia
Juan Luis Suárez de Vivero	*Universidad de Sevilla*	Spain
Marc Taquet	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Corine Tomasino	*Institut Français de Recherche pour l'Exploitation de la Mer (Ifremer)*	France
Fabio Vallarola	AdriaPAN	Italy
Gilad Weil	Israel Nature and Parks Authority	Israel
Maurizio Würtz	University of Genova	Italy
Ruthy Yahel	Israel Nature and Parks Authority	Israel

The members of MedPAN's Scientific Committee:

Tundi Agardy	Earthlink – UNEP-MAP Consultant	USA
Enric Ballesteros Sagarra	*Centro de Estudios Avanzados de Blanes* (CEAB) - Spanish National Research Council (CSIC)	Spain
Joachim Claudet	Chairman of MedPAN Scientific Committee. *Centre National de la Recherche Scientifique* (CNRS), EPHE, CRIOBE	France
Moustapha Fouda	Egyptian Environmental Affairs Agency (EEAA), Chairman of Nature Conservation Sector	Egypt

Samir Grimes	Benthic Ecosystems Laboratory, Institute of Marine Sciences and Coastal Management, ISMAL National Consultant for *Commissariat National du Littoral* (CNL)	Algeria
Harun Güçlüsoy	Institute of Marine Science and Technology, University of Dokuz Eylul - UNDP Programme in MPAs in Turkey	Turkey
Paolo Guidetti	*Laboratoire Ecosytèmes Côtiers Marins et Réponses aux Stress* (ECOMERS/EA 4228) University of Nice - Sophia Antipolis Previously Marine Zoology and Biology Laboratory, DiSTeBA, University of Salento (Lecce)	Italy
Drosos Koutsoubas	Professor of marine biology, Marine Science Department, Environment, University of Egee Chairman of Zakynthos Marine National Park	Greece
Giuseppe Notarbartolo di Sciara	IUCN Regional Coordinator (WCPA) – Chairman of Tethys, MOm - ACCOBAMS, RAC/SPA, UNEP Consultant	Italy
Chedly Rais	Okianos –ACCOBAMS, Blue Plan, GFCM, RAC/SPA Consultant	Tunisia

The organisations which are members of this project's steering committee:

Regional stakeholders :

ACCOBAMS
European Environment Agency (EEA)
MedPAN Organisation
Regional Activity Centre for Specially Protected Areas (RAC/SPA)
General Fisheries Commission for the Mediterranean (GFCM)
Eurosite (European network of sites for nature conservation)
MAVA Foundation
Total Foundation
MedWet/*Tour du Valat*
UNEP/MAP/Blue Plan
IUCN Centre for Mediterranean Cooperation
UNEP-World Conservation Monitoring Centre
WWF Mediterranean

National stakeholders :

Agence des aires marines protégées	France
Agence de Protection et d'Aménagement du Littoral (APAL)	Tunisia
Atelier Technique des Espaces Naturels (ATEN)	France
Conservatoire du Littoral (CdL) - *Initiative pour les Petites Iles de Méditerranée* (PIM)	France
DEPANA - *Lliga per a la Defensa del Patrimoni Natural*	Spain
Direction Générale des Forêts (DGF)	Algeria
Prince Albert II of Monaco Foundation	Monaco
French Global Environmental Facility (FGEF)	France
Ministère de l'Aménagement du Territoire, de l'Environnement (MATE)	Algeria
Ministerio de Agricultura, Alimentación y Medio Ambiente (Ministry of Agriculture, Fisheries and Food)	Spain
Ministarstvo Zaštite Okoliša i Prirode (Ministry of Environment and Nature Protection)	Croatia
National Park of Port-Cros	France
National Park of Zakynthos	Greece
Region of Provence-Alpes-Côte d'Azur (PACA)	France
City of Marseilles	France
WWF France	France
WWF Italy – Miramare MPA	Italy

Lastovo Islands Nature Reserve, Croatia © AMICLA-C. Amico / WWF-Canon

Foreword

Credit: RAC/SPA

ABDERRAHMEN GANNOUN

Director of the Regional Activity Centre for Specially Protected Areas (UNEP/MAP-RAC/SPA, Tunis)

The marine and coastal protected areas have been designed and developed as a tool for conservation and sustainable management of the coastal and marine environment, to preserve ecosystems, habitats and protected or endangered species as well as natural resources. Protected areas are established to deal with the perils and pressures caused by human activities on the Mediterranean fauna, flora and habitats and to prevent further deterioration of its biodiversity.

The Mediterranean is one of the richest biodiverse seas in the world,it is a jewel that must be preserved for the well-being of present and future generations. Since 1982, the Mediterranean countries have recognised its value and the need to preserve this mutual space so they adopted the Protocol on Specially Protected Areas in the Mediterranean (SPA Protocol) within the Mediterranean Action Plan (MAP) framework and in addition to the Barcelona Convention.

At a time when the loss of biodiversity is a global issue, especially because of the current uncertainties posed by climate change, the importance of protected areas for the conservation of biodiversity is clear.

On a Mediterranean level, since 1995 the Parties to the Barcelona Convention have been committed to a collective approach and adopted a new Protocol: «the protocol concerning Specially Protected Areas and Biological Diversity (SPA / BD Protocol) which is the main Mediterranean instrument for implementing the 1992 Convention on Biological Diversity (CBD) on sustainable management of its coastal and marine biodiversity.

In order to facilitate the implementation of the SPA/BD Protocol, RAC/SPA devised a Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean Region (SAP BIO) which was adopted in 2003 by the contracting Parties. The main objective of the SAP BIO is to create the appropriate framework for the implementation of the SPA/BD Protocol by the contracting Parties, international and national organisations, NGOs, major donors and other actors involved with protecting and managing the Mediterranean natural environment. This framework specifies the principles and concrete measures and actions to be coordinated at the national, transboundary and regional level for the conservation of the Mediterranean marine and coastal biodiversity within the perspective of sustainable natural resources utilization.

The Contracting Parties to the CBD agreed in 2004 to take action in addressing the under-representation of marine ecosystems in the global network of protected areas.In this context, they adopted the 2012 marine protected areas objective which calls on countries to implement by 2012 a global network of national and regional protected areas which is comprehensive, representative and effectively managed. To this end, a regional work programme on the Mediterranean's marine and coastal protected areas, including on the high seas was adopted in 2009 in Marrakech. The implementation of this programme is the responsibility of the Contracting Parties national authorities. Partner organisations which participated in its elaboration give the Mediterranean countries, at their request, technical and possible financial assistance to undertake this work programme. The first step in the implementation of this work programme is to make an assessment of the representativity and effectiveness of the current network of Marine and Coastal Protected Areas in the Mediterranean.

This assessment of the status of the network of marine protected areas in the Mediterranean, in this pivotal year of 2012, leaves no doubt as to the global failure and particularly our region in achieving the 2004 objectives of the Convention on Biological Diversity.

Faced with this fact, the Action Plan for the Mediterranean, in particular through the RAC/SPA's thematic regional centre for the promotion of protected areas, is preparing to roll up its sleeves and give new life to this cause during the forthcoming period leading up to the next deadline in 2020.

This clearly can be achieved both through enhancing the coverage and quality, the representativity and, if applicable, the connectivity of marine protected areas, thus contributing to the development a representative system of protected areas and a coherent ecological network which integrates all the Mediterranean's biomes, eco-regions, or key ecosystems.

Several other challenges to rise to are improved management efficiency and reinforcing national capacities over the next decade by joining forces with every international organisation which fights for the cause of marine biodiversity in this region.

Let us identify the problems and be realistic in dealing with them. Let us prepare for these challenges and move forward by addressing them with the support and backing of all the States bordering the Mediterranean!

Credit: MedPan

PURIFICACIO CANALS

Chairman of MedPAN
The network of Marine Protected Areas in the Mediterranean

Since 2008, progress has been made in marine conservation in the Mediterranean. Policymakers at all levels have shown that they are firmly committed to creating new MPAs and giving support to existing sites. New laws and international agreements have also been approved to that effect.

However, there is still much to be done to achieve effective management in all the existing Marine Protected Areas in the Mediterranean and for the current network to be representative of the Mediterranean's marine biodiversity. One must be assiduous and adopt concrete measures to reinforce the MPAs management and governance capacity, ensure their financial sustainability, enforce regulations and controls in these sites and build up exchanges of experience.

This will only be possible if the riparian countries, scientists, European and Mediterranean institutions, field managers, non-governmental organisations, financial partners and the private sector renew and strengthen their commitment and that new links are established between all these stakeholders in order to obtain a common vision. Thus, each stakeholder's needs must be taken into account, the obstacles they face must be overcome and finally a mutual understanding and coordination between all these stakeholders will be the key to success.

MedPAN, the network of Marine Protected Areas managers, will have an important role in facilitating this dialogue and establishing a link between all the stakeholders.

Thus MedPAN, with its partners, is launching the Mediterranean Forum of MPAs in November 2012. This unique event, a first in the Mediterranean, will bring together all the stakeholders involved in the marine environment; a unique platform to learn from everyone's experiences and to establish a collective work programme to develop the network of MPAs in the Mediterranean over the next 10 years and thereafter.

MedPAN has also determined its action strategy in the years to come, highlighting its role in disseminating and improving knowledge on MPAs, creating interactivity between managers and other local stakeholders, promoting best practices and innovations in the field and steering political decisions on a European, Mediterranean and International level to favour MPAs. The network, with its partners, will also contribute to evaluating the MPAs situation in 2016.

In the current context of economic crisis and political upheaval, the preservation of the Mediterranean Sea's natural, cultural and social heritage will only be possible if all the riparian countries and stakeholders are mobilised, committed and follow a common vision to reinforce the network of marine protected areas for the benefit of the Mediterranean society, especially those living in fragile and vulnerable ecosystems.

Marine Protected Areas are everyone's business!

DAN LAFFOLEY

Marine Vice Chair,
IUCN's World Commission on Protected Areas

Credit: James Duncan Davidson TED

There is little doubt now that MPAs are the best tool we have to protect, maintain and restore marine wildlife and habitats. Science continues to show us that properly established and managed MPAs bring benefits that other spatial management approaches simply cannot deliver. There can be equally little doubt though that despite such benefits, progress in applying them by countries is lagging far behind that expected and needed to counter the state of ocean health.

Studies such as this 2012 Status Report are a welcome insight into the results of many good things that are being achieved by many agencies and individuals in many countries around the Mediterranean. It provides that essential stock take on progress. It delivers a firm basis from which countries can work together to plan further significant steps towards putting in place fully representative and well managed MPA networks. If progress is slow though and yet benefits are high, what can be done to help accelerate the growth in MPA networks? Through this foreword I would like to share some thoughts with you, as you reflect on progress so far in the Mediterranean and the challenges that lie ahead in the coming years.

There are many actions that could be taken to speed up implementation but these often related to improving communications. Improving how we communicate and share information, as a community, as well as with the public, needs to be a stronger priority supported by better tools and activities. This is if we are to become more effective in our actions and have more supportive and understanding audiences for our work. We have made this issue a priority for IUCN and its World Commission on Protected Areas. Our intent is that by investing at the global scale we can provide new opportunities for everyone to communicate and engage with ocean protection – the ethos of 'do once and use many times'.

Three areas stand out for special mention. The first developed with Google is the provision of a 3D digital ocean for Google Earth. This provides the platform to showcase how we are currently protecting the ocean. It also gives visibility to areas that should be protected – those ocean hope spots needing action! Perhaps more significantly it gives everyone a whole new set of free tools and opportunities to explain your work to over one billion users worldwide who have now downloaded this digital ocean. Greater visibility provides greater opportunities than ever before to build effective communication with local communities and the wider public.

Alongside this recent innovation are other exciting developments that already enable us to share data on existing MPAs. The web platform underpinning MPAs on Google Earth (protect planet ocean), as well as the revitalised platform for outreach more generally on protected areas for the World Database of Protected Areas (protected planet), are major advances to enabling anyone anywhere to contribute to build a better map of ocean protection. By going to these websites you can input site data or update the information about your sites from your own computer. Better site data means better analyses used to inform the CBD and other global conventions and agreements. This is significant because unless we find easy cheap ways of working effectively together to better share information about existing sites we will not produce complete maps or as compelling cases as we need to drive counties forward to protect more of the ocean. More protection will give our seas the breathing space they need to recover and restore lost resilience.

Finally the most recent innovations involves seeing how new technology can make our ocean protection efforts much more available and visible to the public. It is amazing to think in 2012 that unlike almost most all other sectors the MPA community has not taken the opportunity to connect with the public through their phones and tablet devices. In recent months we have been exploring ways to do this and on World Ocean Day 2012 we released our first MPApp with UNESCO. By typing 'marine world heritage' into the iPhone App store you can connect with a touch of your finger to all our marine World Heritage sites.

Clearly these developments are just a part of the new opportunities we need to better communicate MPA progress. They are though a small subset of actions needed to accelerate progress with implementing MPAs at local, regional and global scales. Nevertheless by innovating in this way we hope to inspire others to look beyond the usual and to find new ways to pick up the pace with ocean protection.

GIUSEPPE NOTARBARTOLO DI SCIARA

Regional Coordinator, Mediterranean & Black Sea Region
IUCN's World Commission on Protected Areas - Marine

Credit: Giuseppe Notarbartolo di Sciara

The status of MPAs in the Mediterranean is currently undergoing a significant evolutionary process, and therefore the publication of the "2012 Mediterranean MPA Status Report" is timely because it allows a comparison with the condition described in the 2008 report by IUCN, WWF and MedPAN, in collaboration with RAC/SPA. What has happened during the four years separating the two reports? I think that the situation can be described as a combination of lights and shades.

First, the good news. The Mediterranean has many more MPAs now than it did back then. With a total count of 161 areas established by national governments as well as 9 of international status only and a total protected surface of almost 19 000 km^2 (Pelagos Sanctuary and Natura 2000 at sea sites excluded), compared to the 94 areas and a surface of less than 10 000 km^2 in 2008, the increase is impressive.

Once 55 more MPAs which are currently in the pipeline, and the 507 declared Natura2000 marine sites (25 243 km^2), will be added to the existing, with a total of well over 700 MPAs, the Mediterranean will look smart compared to most of the world's marine regions. This will be only about 2% of the region's total surface and therefore still a far cry from the 2020 CBD target of 10%, however it is mostly the rate of growth in the 2008-2012 period which bodes well for the coming of age of the Mediterranean MPA system.

Considering the "not-so good" news, however, will clarify why rejoicing excessively about the growth of MPAs in the Mediterranean would be inappropriate at this time. The regional MPA system still suffers severely from geographical and ecological unbalance, and from crippling management ineffectiveness. Geographical issues are dramatic, and although some timid progress was made during the quadrennium along the southern coastlines, this is still not enough to smoothen the difference with the North, and too much of the southern shores – which include some of the last remaining Mediterranean coastal wilderness – still remain unprotected. The existing set of MPAs lacks in coherence, connectivity and representativity, and too little progress was made so far in attributing the deserved attention to the Mediterranean open seas and deep seas; even the protection afforded by the region's only high seas MPA – the Pelagos Sanctuary – remains basically nominal. Thus the current Mediterranean MPAs, still far from being a network, can only be considered a piecemeal assemblage of protected locations, weakly connected one to another. Finally, many of these protected areas are afflicted by grossly inefficient – when not downright inexistent – management, and therefore remain paper parks; i.e., totally irrelevant as far as conservation is concerned.

To summarize, some progress was made but not quite as much as would be desirable, and which one can be proud of. Why is that? I think that answering this question is the key of the door to MPA advance in the Mediterranean.

I am convinced that problem is neither technical nor scientific. True, there is still huge room, and always will there be, for science and technology to make progress. However we now know enough, and have enough data, for laying the bases for a decent, ecologically representative and well connected network of MPAs in the Mediterranean. The real problem resides instead in what I would call the "lack of implementation syndrome", whereby the responsibility for the failure of establishing a working MPA network in the Mediterranean is shared among a diversity of players: the conservation practitioners who have not given the deserved importance to systematic planning; the decision-makers, who have failed to honour their commitments with appropriate actions; and civil society at large, which evidently still does not perceive with sufficient clarity the societal costs deriving from the degradation of the marine environment, and the benefits of conserving it. While MedPAN and RAC/SPA are right to continue to sharpen the tools that will enable to reach our marine conservation objectives, it is fundamentally important that the appropriate attention be given, at the same time, to the hand that will use such tools. Only then, I am sure, the path will be open to achieving an effective and functional network on MPAs in the Mediterranean.

List of Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Areas
CBD	Convention on Biological Diversity
CFP	Common Fisheries Policy
COP	Conference of the Parties
DB	Database
EBSA	Ecologically or Biological Significant Areas
EC	European Commission
EEZ	Exclusive Economic Zone
EU	European Union
FAO	United Nations Food and Agriculture Organisation
GFCM	General Fisheries Commission in the Mediterranean
GCPA	Global Commission for Protected Areas
GIS	Geographical Information System
IBA	Important Bird Areas
IUCN	International Union for the Conservation of Nature
ICZM	Integrated Coastal Zone Management
MAP	Mediterranean Action Plan
MedPAN	The network of managers of Marine Protected Areas in the Mediterranean
MPA	Marine Protected Area
MPD	Maritime Public Domain
n.m.	nautical mile
NA	No answer in the questionnaire
MAP	Mediterranean Action Plan
NOAA	National Oceanic and Atmospheric Administration
RAC/SPA	Regional Activity Centre / Special Protected Areas
RAC/PAP	Regional Activity Centre / Priority Actions Programme
SAP BIO	Strategic Action Programme for the Protection of Biological Diversity in the Mediterranean Region
SCI	Sites of Community Importance
SEPA	Special Environmental Protection Areas
SPA	Special Protected Area
SPAMI	Special Protected Area of Mediterranean Importance
SSC	Species Survival Commission

SCZ	Special Conservation Zone
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WDPA	World Database on Protected Areass
WSSD	World Summit on Sustainable Development
WWF	World Wide Fund for Nature

In the tables and diagrams, the names of the countries* are designated as follows, in accordance with ISO 3166-1:

ALB : Albania	**GRC : Greece**	**MCO : Monaco**
BIH : Bosnia-Herzegovina	**HRV : Croatia**	**MLT : Malta**
CYP : Cyprus	**ISR : Israel**	**MNE : Montenegro**
DZA : Algeria	**ITA : Italy**	**SVN : Slovenia**
EGY : Egypt	**LBN : Lebanon**	**SYR : Syria**
ESP : Spain	**LBY : Libya**	**TUN : Tunisia**
FRA : France	**MAR : Morocco**	**TUR : Turkey**

*The Gaza Strip and the Palestinian territories were not taken into account in the analysis as they are not contracting parties to the Barcelona Convention and do not as yet have MPAs. The Gibraltar territory has not been included in the analysis as it is not a party to the Barcelona Convention.

Table of Contents

Publication lead 4
Technical partners 5
Financial contributors 7
Acknowledgements 8
Foreword 12
List of Acronyms 16
Table of Contents 18
List of Figures 21
List of Tables 25

EXECUTIVE SUMMARY 28

CHAPTER 1 - OBJECTIVES AND CONTEXT 33
Introduction 34
The study's objectives 35
The study's context 38
The Mediterranean Sea 38
A remarkable biodiversity, a priority eco-region 38
A closed sea with unique oceanographic features 39
A sea under threat 40
The MPAs in the Mediterranean 41
Legal and institutional framework 41
The MPAs 43
Gap analysis and conservation planning studies in the Mediterranean 44
Initiatives undertaken by international organisations to help Mediterranean countries develop MPAs and improve their management 54
MEDPAN INTERREG programme : creation of the MedPAN Organisation 54
The MedPartnership: MedPAN South Project and MedMPAnet Project 54
The MedPAN North Project 55
The PIM initiative: Mediterranean Small Islands Initiative 55
IUCN-Med marine programme 55

CHAPTER 2 - DATA AND MAPAMED, THE MEDITERRANEAN MPA DATABASE 57
Data sources on mpas and the mapamed database 58
MPA identification and management data collection questionnaire 58
Identification of Mediterranean MPAs 58
MPA Data collection 59
MAPAMED, the MPA database's access and interface 61
Scope of the study, geographical and scale considerations 63

CHAPTER 3 - MPAS CHARACTERICTICS AND LEVEL OF PROTECTION 67
Mediterranean MPA system 69
Number and surface area of MPAs in 2011 - Evolution since 2008 69
The different MPA designations 72
MPAs with a national designation 72
The Natura 2000 at sea sites 73
IUCN categories 74
The international designations 76
Overlap between different MPA designations 77
Distribution of MPAs 78
Distribution of MPAs in the entire basin region 78

Distribution of MPAs per ecoregion 78
Distribution of MPAs per country 79
Size of MPAs 80
Age of MPAs 80
Percentages of protection, according to the CBD 10% target 81
On the Mediterranean scale 81
Within the 12 nautical mile zone 81
Beyond the 12 nautical mile zone 81

CHAPTER 4 - REPRESENTATIVITY AND CONNECTIVITY 85
Representativity of the MPA network 86
Methodology 86
Representativity of the eco-regions 87
Representativity of habitats 89
Benthic zone: representativity of benthic marine habitats 89
Pelagic zone: representativity of epipelagic bioregions 96
Representativity of some threatened species 99
Marine Mammals 99
Turtles 102
Fish 104
Birds 107
Species and habitats present in MPAs based on the questionnaire 109
The reported habitats in the MPAs 109
The species reported in the MPAs 109
Assessing population connectivity 111

CHAPTER 5 - MANAGEMENT, USES AND PRESSURES 119
Evaluation of the management effort 120
Method 120
Parameters used 120
Data processing methods 120
Remarks on the quality of the data supplied 120
Comparisons with 2008 120
Key features of the MPA sample group analized 121
Management capacity and effectiveness 121
Type of governance 121
Existence of a management plan 122
Presence of prohibited resources extraction areas 123
Existence of MPA baseline information 124
Existence of regular monitoring and ad hoc studies implemented in the MPA 124
Perception of the global evolution of fishery resources 125
Staff assigned to the MPA 125
Surveillance effort 127
Existing infrastructure and equipment 127
Awareness raising tools 128
Funding 128
MPA management typologies 130
Key features of uses and pressures on the MPAs in the Mediterranean 132
The uses in MPAs 132
An identification of the major pressures affecting the MPAs in the Mediterranean 134

CHAPTER 6 - AN INVENTORY OF MULTIDISCIPLINARY MONITORING PROGRAMMES 137
An inventory of multidisciplinary monitoring programmes carried out in Mediterranean MPAs 138

CHAPTER 7 - SUMMARY AND RECOMMENDATIONS..... 145
Summary 146
Mediterranean MPAs, now better known, are localised and recorded in the new MAPAMED database 146
The CBD target of 10% protection of Mediterranean waters has not yet been achieved 148
There is still an imbalance in the geographical distribution of MPAs between the southern, eastern and northern shores of the Mediterranean and MPAs are still mainly coastal 150
Representativity is highly variable depending on the species and habitats..... 150
Eco-regions 150
Habitats 150
Species..... 151
Ecological coherence is weak 152
MPA management must become more effective 154
Recommendations 157
1. Development of the MPA network to reach the 10% CBD target of the surface coverage of the Mediterranean 157
2. Strengthen the effectiveness of protection measures, of management and of the assessment of MPAs 160
3. Promote the development of tools to evaluate the network on a regional scale 163
4. Ensure a stronger management of threats to MPAs 164
5. Reinforce recognition and prominence of Mediterranean MPAs on an international level 165

APPENDICES..... 167
Appendix 1 - CBD Criteria on MPA networks..... 168
Appendix 2 - Database on Marine Protected Areas in the Mediterranean 169
Appendix 3 - IUCN categories for MPAs (Dudley, 2008)..... 187
Appendix 4 - List of MPAs with a national designation 189
Appendix 5 - List of MPAs with an international designation..... 197
Appendix 6 - Distribution of MPAs (aside Natura 2000) 199
Appendix 7 - MPA national designation, and grouping for the purpose of the analysis..... 201
Appendix 8 - Data analysis method 203
Appendix 9 - Representativity of the MPA network through different elements of the marine ecosystem 206
Appendix 10 - Distribution of benthic habitats..... 210
Appendix 11 - Source of variables integrated in the bio-regionalisation 213
Appendix 12 - Average value of the biophysical variables for epipelagic bioregions Level I and II 214
Appendix 13 - Average value of the biophysical variables for epipelagic bioregions level III 217
Appendix 14 - table of overlapping MPA statuses 218
Appendix 15 - Habitats and species managers declared present in their MPA 220
Appendix 16 - Connectivity 229
Appendix 17 - Key features of the MPAs in the sample group..... 233
Appendix 18 - Important areas proposed to reinforce the network of MPAs 238

BIBLIOGRAPHY..... 245

List of Figures

Figure 1: The Mediterranean Sea 38
Figure 2: The 12 priority conservation areas identified by the RAC/SPA (UNEP//MAP/RAC/SPA, 2010c): 45
Figure 3: Ecologically or Biologically Significant Areas (EBSAs) identified by the RAC/SPA (UNEP/MAP/RAC/SPA, 2010d), adopted by the CBD: 45
Figure 4: Important Sea Landscape Areas (ISLAs) (Franzosini *et al.,* 2001) 47
Figure 5: The 13 «key» areas to protect (WWF, 2000) 47
Figure 6: The 33 marine reserves proposed by Greenpeace (2004) 48
Figure 7: Crucial habitats for cetaceans, monk seals, seabirds, turtles, sharks and bluefin tuna (according to Hoyt and Notarbartolo di Sciara, 2008) 48
Figure 8: Key marine and coastal biodiversity areas of the Mediterranean Basin hotspot, identified by the CEPF (CEPF, 2010)
Mauve line: hotspot limits, according to the CEPF 49
Figure 9: New MPAs proposed for whales and dolphins in the Mediterranean and Black Seas by ACCOBAMS (Notarbartolo di Sciara et al. 2010) 49
Figure 10: Map of the Mediterranean Sea including the priority sites for protection: 50
Figure 11: The CIESM Peace Parks 50
Figure 12: Biodiversity hot-spot for the Mediterranean's marine vertebrates, of conservation interest (Coll *et al.,* 2010), based on the distribution of 110 critically endangered, endangered, vulnerable or near threatened species. The colours expresses its occurrence (blue: low; red: high) 51
Figure 13: Distribution of areas where biodiversity and pressures overlap (Coll *et al.,* 2011). Overlap index between species diversity and threats: (a) ≥ 25% (b) ≥ 50% (c) ≥ 75%) 51
Figure 14: Distribution gradient for Mediterranean fish, total species richness (A), endemic species richness (B), IUCN status species richness (C), the phylogenetic diversity (D) and functional diversity (E) (Mouillot *et al.,* 2011) 52
Figure 15: (A - on the left) Important zones in the Alboran Sea (IUCN - Robles, 2010): in red, MPAs and Sites of Community Importance. In blue, new priority areas for marine conservation. (B - on the right) EBSA in the Adriatic Sea (Notarbartolo di Sciara and Agardy, 2009) 53
Figure 16: Division of the Mediterranean by Oceana as part of Oceana MedNet 53
Figure 17: The 100 sites selected for the Oceana MedNet network 53
Figure 18: MAPAMED interface 61
Figure 19: The ecoregions according to Nortarbartolo di Sciara and Agardy (UNEP-MAP-RAC/SPA, 2010) ... 63
Figure 20: The Mediterranean countries in the study 65
Figure 21: Spatial distribution of all the MPAs (spatial information available for 154 out of 170 MPAs and for the 507 Natura 2000 Sites)* 68
Figure 22 : Distribution of the MPAs being planned 69
Figure 23: Spatial distribution of MPAs with a management structure (spatial data available for 154 of 170 MPAs; without Pelagos)4 70
Figure 24: Regulated fisheries areas declared by GFCM: bottom trawling exclusion zone (in blue) and Fisheries Restricted Areas (in orange) 71
Figure 25: Cumulative number of MPAs created in the Mediterranean between 1960 and 2012. 71
Figure 26: Spatial distribution of all the 170 MPAs (spatial information available for 154 out of the 170 MPAs) 72
Figure 27: Number of MPAs per group and per country (aside MPAs with an international designation; 2 out of 161 MPAs with no status information) 72
Figure 28: The surface area of MPAs with a national designation by group per country 73
Figure 29: Spatial distribution of the Natura 2000 sites 73
Figure 30: Distribution of Natura 2000 sites at sea per country. 74
Figure 31: Distribution of the different IUCN categories identified or those attributed for the purpose of

this study 75
Figure 32: Number of MPAs by IUCN category per country 76
Figure 33: : Spatial distribution of MPAs with an international status (spatial data missing for 1 SPAMI) 77
Figure 34: Spatial overlapping of MPA designations (number of overlapping designations) 77
Figure 35: Distribution of MPAs per region (percentage) 78
Figure 36: Number of MPAs per ecoregion. N.B. The colours refer to those used for the ecoregion map 78
Figure 37: Distribution of MPAs by surface area and per country 79
Figure 38: Distribution of MPAs per country. 79
Figure 40: Number of MPAs created between 1960 and 2012 in the Mediterranean 80
Figure 39: The number of MPAs per size group 80
Figure 41: Proportion (%) of the area of the 12 n.m. zone (8.22%) and the area beyond the 12 n.m. zone (2.7%) covered by MPAs 81
Figure 42: Number of records in the OBIS database describing the biota in the Mediterranean (note the non-linear scale) 87
Figure 43: Representation of ecoregions within the MPA network (without the Pelagos Sanctuary).The colour code used in the graph matches the ecoregions represented in the map 88
Figure 44: Map of benthic sedimentary habitats drawn up by merging the GEBCO bathymetric map 90
Figure 45: Representation of the different benthic zones within the network of MPAs (aside the Pelagos Sanctuary) 91
Figure 46: Representation of benthic sedimentary habitats within the network of MPAs (aside the Pelagos Sanctuary), for MPAs of all designations and for MPAs with a management structure only 91
Figure 47: Mediterranean unique deep sea biocenosis (WWF/IUCN, 2004)- (circles=corals – squares=cold seeps) 92
Figure 48: Interface portal access to EUSeaMAP data on broadscale modelled benthic habitats in the Western Basin (http://jncc.defra.gov.uk/page-5760) 93
Figure 49: Map of coralligenous habitats and seagrass meadows, according to Cameron *et al.*, 2011. 94
Figure 50: Representation of coralligenous habitats and *Cymodocea* and *Posidonia* meadows in the network of MPAs (excluding Pelagos Sanctuary) 94
Figure 51: Map of remarkable deep sea geomorphologic components (canyons: Harris & Whiteway, 2011 – submarine banks: UNEP-MAP-RAC/SPA, 2010c – seamounts and knolls: Yesson *et al.*, 2011) 95
Figure 52: Representation of the remarkable deep sea geomorphologic components identified within the network of MPAs (excluding Pelagos) 96
Figure 53: Map of epipelagic bioregions in level I, II and III 97
Figure 54: Representation of level III bioregions within the MPA network, for MPAs of all designations and for MPAs with a management structure only (excluding Pelagos). 98
Figure 55: Distribution range of seven subpopulations of cetacean species (based on Notarbartolo di Sciara and Birkun, 2010). 101
Figure 56: Distribution range of the Mediterranean monk seal (*Monachus monachus*) (completed from Johnson *et al.*, 2006) 101
Figure 57: Representation of the distribution range of eight species of marine mammals in the network of MPAs (including Pelagos) 102
Figure 58: Representation of the distribution range of five species of turtles in the network of MPAs (aside Pelagos sanctuary) 102
Figure 59: Distribution range of five species of turtle present in the Mediterranean and nesting sites for *Caretta caretta* and *Chelonia mydas*, noting these two last species are the most regular in the Mediterranean Sea 103
Figure 60: Representation of the nesting sites of *Caretta caretta* and *Chelonia mydas* within the network of MPAs (aside Pelagos) 103
Figure 61: Spawning grounds of female bluefin tuna (*Thunnus thynnus*). Map based on Fromentin and

Powers (2005) 104
Figure 62: Map of the distribution of the 16 selected fish species (Albouy *et al.*, in press) 106
Figure 63: Representation of the potential distribution of the 16 selected fish species within the network of Mediterranean MPAs (without the Pelagos sanctuary) 107
Figure 64: Distribution range at sea of four Mediterranean bird species which are a conservation priority 108
Figure 65: Representation of the area of distribution of four seabird species in the MPA network 108
Figure 64bis. Priority areas for the conservation of seabirds (UNEP-MAP-RAC/SPA, 2010a) 108
Figure 66: Rate of MPAs which declared the existence of each target habitat 109
Figure 67: Rate of MPAs who declared the existence of each target species 110
Fig. 68. Results of the estimated proximity between MPAs in IUCN categories II and IV (determined by a Euclidean distance) 114
Fig. 69. Percentage of the 113 MPAs in IUCN categories II and IV located less than 25 km, between 25 km and 50 km, between 50 km and 150 km and beyond 150 km in distance from its nearest neighbour . 114
Fig. 70. General surface current circulation data in the Mediterranean Sea (according to Millot and Taupier-Letage, 2005) 115
Figure 71: (on the left) Distribution of MPAs across the region 121
Figure 72: (on the right) Distribution (in percentage) of the surface area of MPAs across the ecoregions .. 121
Figure 73: Percentage of MPAs with a management plan 122
Figure 74: Number of MPAs, by region, which have/don't have a strict nature reserve zone 123
Figure 75: Spatial distribution of MPAs with a strict nature reserve zone and/or a no-take zone 124
Figure 76: Types of regular monitoring and ad hoc studies carried out in MPAs on species, key ecosystem functions, fishing (commercial resources, catches…), tourism & other socio-economic activities, pollutants and physic-chemical conditions 124
Figure 77: Importance (%) of the various monitoring operators in the MPAs, all monitoring types combined 125
Figure 78: MPA Staff. On the left the type of staff: permanent, temporary or seasonal. On the right total number of staff (permanent, temporary or seasonal) in relation to the MPA belonging to an EU country or not 126
Figure 79: Tools available in MPAs for education and awareness raising 128
Figure 80: The MPAs infrastructure and equipment. 128
Figure 81: Average annual budget for the last 5 years. 129
Figure 82: Average operating budget per country 130
Figure 83: MPAs source of funding (8 MPAs – 10% with no information on their source of funding) 130
Figure 84: MPA groupings in the management typology. 131
Figure 86: Number of diving boats bringing divers into the MPA 133
Figure 85: Average annual number of visitors (all uses) over the last 5 years 133
Figure 87: Number of boats doing a commercial fishing activity in the MPA 133
Figure 88: Number of leisure boat berths in the MPA 134
Figure 90: Number of mooring systems in the MPA 134
Figure 91: Key pressures on habitats and species, as reported by the managers 134
Figure 89: Number of leisure boat berths in the nearest two ports to the MPA's boundaries 134
Figure 92: The intensity of illegal activities in MPAs 135
Figure 93: A breakdown of the programmes by type of study for the A, B, C et D objective categories (n=100) 139
Figure 94: The involvement of Mediterranean countries in national programmes 139

List of Tables

Table 1: Description of the 10 Ecologically or Biologically Significant Areas (EBSAs) identified by the RAC/SPA (UNEP/MAP/RAC/SPA, 2010d) and the Pelagos Sanctuary 46
Table 2: Vulnerable sites in open seas (UNEP/MAP/RAC/SPA, 2010b 50
Table 3 : Comparison of figures between the 2008 study and the current 2012 study 59
Table 4: List of MPAs basic attributes adapted from the WDPA « Core Attributes « (UNEP-WCMC, 2010) 60
Table 5: A comparison of the various classifications of the Mediterranean (UNEP-MAP-RAC/SPA, 2010d) ... 63
Table 6: Countries considered in this study (in bold: member countries of the EU) 64
Table 7: MPAs inventoried in MAPAMED 70
Table 8: Number and marine surface area of Natura 2000 sites per country. 73
Table 9: Number of MPAs per IUCN category and marine surface area 76
Table 10: Overlap between Natura 2000 sites at sea and MPAs with a national designation 77
Table 11: Distribution of MPAs per ecoregion 78
Table 12: MPAs age groups per region. (no information about the year of creation for 1 MPA). 80
Table 13: The Mediterranean's percentage of protection under the various designations. Detailed figures (no decimal) 82
Table 14: Percentage of protection per country in the 12 nautical mile zone. (ND: no data available) 83
Table 15: Description of the level I epipelagic bioregions characteristics 97
Table 16: Species of cetaceans considered in the study. EN: endangered - VU: vulnerable - DD: Data deficient - LC: Least Concern. The common dolphin Delphinus delphis ought to be integrated to future analysis. 100
Table 17: List of the selected species, their trophic level and their IUCN status 105
Table 18. Species of birds considered in the study. 107
Table 19. Species in the SPA/BDB Protocol Appendix: the differences found in the 2010 (Rais, 2010) and this studies' results 110
Table 20: Age of the management plan in the MPA sample group and year of revision for those which have been revised 123
Table 21: Number of MPAs, by country, which have a strict nature reserve zone, and total surface area of these zones (when available) 123
Table 22: Percentage of MPAs undertaking different types of monitoring or ad hoc studies/surveys 125
Table 23: Number of MPAs per group type and per category of staff number 126
Table 24: Number of MPAs per size group and per categories of hours of surveillance 127
Table 25: Number of MPAs per group type (above) and per surface area (below) for each operating budget class 129
Table 26: Number of MPAs that have or don't have a business plan for each MPA group type (response rate 89%) 130
Table 27: Number of collaborations per Mediterranean country within the regional and sub-regional programmes 140
Table 28: Figures about Mediterranean MPAs (rounded to the nearest hundred) 149

THE 2012 FORUM of Marine Protected Areas in the Mediterranean

MARINE PROTECTED AREAS: **Everyone's Business.**

Boosting the Marine Protected Areas network for the benefit of the Mediterranean society

Marine and Coastal Protected Area of Cap Negro-Cap Serrat, Tunisia © M.Mabari - MedPAN

OBJECTIVES OF THE CBD:

"At least 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes."

Managers, decision-makers, scientists, civil society and private sector met at the 2012 Forum of Marine Protected Areas in the Mediterranean, to make an assessment of Marine Protected Areas. On this basis, participants established a strategic roadmap to achieve, by 2020, the international target of the Convention on Biological Diversity related to improving the status of biodiversity.

Jijel market, National Park of Taza, Algeria © M.Mabari / WWF Mediterranean

Executive summary

The Mediterranean is considered to be one of the world priority ecoregion and is one of the major marine and coastal biodiversity hotspot. Although it represents less than 1% of the global ocean surface, it hosts almost 20% of global marine biodiversity and has a high level of endemism with up to nearly 50% for some groups. It is an important breeding area for several key pelagic species, and some of these are threatened. There is intense urbanisation, tourism, shipping traffic, overfishing, pollution and global changes which weigh heavily on this environment.

RAC/SPA and MedPAN are working alongside their partners (IUCN, WWF, local NGOs, research organisations, ...) to establish an ecological network of MPAs to protect at least 10% of the marine and coastal waters which is representative of the Mediterranean's diversity and made up of ecologically interconnected and well managed MPAs, in accordance with the latest guidelines from the Convention on Biological Diversity and the Barcelona Convention.

The aim of this study is to evaluate in 2012 the progress that has been made, since the first inventory done in 2008, on the Mediterranean system of MPAs in view of the above mentioned objectives: does the network cover 10% of the Mediterranean, is it representative of the Mediterranean's diversity, are MPAs well-connected and well managed?

An increasing number of studies led in recent years, particularly impelled by the RAC/SPA have identified important gaps in protecting key habitats and species which highlights the urgent need to protect certain critical areas (Greenpeace, 2006; Notarbartolo di Sciara, 2008, 2010, UNEP-MAP/RAC/SPA, 2010d, 2011; UNEP-MAP/RAC/SPA, 2009a; UNEP, 2012; Coll et al., 2010, 2011; Mouillot et al., 2011; CEPF, 2010; de Juan et al., 2010; Oceana Mednet, 2011; IUCN MedRAS, 2012; de Juan et al., 2012; Fenberg et al., 2012...).

This study has used the last, most recent (MAPAMED, 2011-2012) inventory made on MPAs and a survey questionnaire sent to managers, both conducted jointly by MedPAN and RAC/SPA. The main results of this study are summarised below.

MAIN CONCLUSIONS

1. The information on Mediterranean MPAs is now more accurate, they have been geo-located and their data recorded in the MAPAMED database.

The inventory made on Mediterranean MPAs has helped to identify and geo-locate 677 MPAs (about 7% of the total number of MPAs in the world). All data collected during this study has been incorporated into the MAPAMED database, developed for the occasion, which is a major breakthrough for the assessment of the network. Among these MPAs, 161 have a national designation, 9 just an international designation and 507 are Natura 2000 sites at sea. Among existing MPAs, 40 have one or several international designations, including 32 Specially Protected Areas of Mediterranean Importance (SPAMI). There are 5 Biosphere Reserves and only 2 marine World Heritage sites which is exceptionally low for such a unique sea which is so naturally rich and culturally diverse. In addition, 55 MPAs are being planned.

2. The target of 10% protection is far from being achieved

These MPAs cover a total surface area of almost 114 600 km², namely about 4.6% of the Mediterranean; and 1.1% if we exclude the Pelagos Sanctuary (87 500 km²) which alone accounts for 3.5%.

Less than 0.1% of the Mediterranean's total surface area is covered by a strict protection and/or no take zone.

Since 2008, 23 MPAs have been established in 10 countries amounting to an additional area of 6 754 km² which represents close to a 7% increase of the protected surface area in 5 years in comparison to the 2008 protected surface area of 97 410 km², or 4% of the Mediterranean.

These figures do not take into account the 5 fisheries restriction areas created by the GFCM (17 677 km² – or 0.7% of the Mediterranean).

3. There is still a disproportionate geographical distribution in MPAs between the southern, eastern and northern shores of the Mediterranean and MPAs are still mainly on the coast

The geographic imbalance, already mentioned in 2008, is still important in 2012, even if it is lower: 96% of MPAs are located in the northern basin (83% without Natura 2000). But several southern and eastern countries (Algeria, Morocco, Tunisia, Libya, Israel, Lebanon) have many on-going projects, which would partly rebalance the system. Italy, France and Spain have more than half of the total number of MPAs of national status, and Greece and Italy have 67% of the Natura 2000 sites at sea.

MPAs are mainly coastal with 86% of the MPAs surface area in the 12 nautical mile zone[1], without Pelagos sanctuary. This area, where legal instruments exist, has an 8.5% protection from MPAs with a strong contribution from the Pelagos Sanctuary (6.1%). Two countries protect their 12 nautical mile zone by over 10%: Monaco and France, with Pelagos (and France only when not counting Pelagos). The area beyond 12 n.m. which represents 74% of the Mediterranean's surface area has a protection of less than 3%, with Pelagos contributing to three quarters of this area.

1. Some countries have a 6 n.m. territorial waters limit. However, it was decided to set a consistent distance of 12 n.m. for all countries for the purpose of this study and to overcome the judicial problems of this enclosed sea.

4. Representativity of ecological sub-regions, habitats and species is very variable

Just a quick look at the spatial distribution of Mediterranean MPAs tells us that the network is not yet coherent: MPAs are in most part located in the coastal zones (aside Pelagos), and long stretches of the Southern and Eastern coastal areas are devoid of MPAs. Still, the number of MPAs that can be counted in the Western basin (plusher ecologically), as well as in the North-eastern part, is far from insignificant.

The MPA network is currently not representative of all the Mediterranean sub-regions (or ecoregions). The ''Algerian-Provencal Basin" and ''Tyrrhenian Sea" are the best protected ecoregions (13%) with Pelagos contributing to over 80%. The 6 other ecoregions are covered by less than 3% of MPAs. The Tunisian plateau/Gulf of Sirte, and the Levantine, Ionian and Adriatic Seas are markedly under-represented.

The lack of homogenous data on benthic habitats at the scale of the whole of the Mediterranean Sea led to developing the appropriate layers for the purpose of the study; this was undertaken by intersecting the existing Mediterranean bathymetric map and the sediment one, then digitalising the result.

The analysis shows that the infralitoral zone which comprises several of the remarkable Mediterranean habitats, is better represented than other zones within the system of MPAs (10% without Pelagos and 13% with, yet only 4% when taking into account just MPAs which have a management structure, Pelagos left aside). For this zone, rocky substrate dominated habitats appear best represented (16% for all MPAs aside Pelagos and 7% for MPAs with a management structure).

Trends are similar for the circalitoral zone of which 3.9% is covered by MPAs (7% with Pelagos), or 2.3% when taking into account just MPAs which have a management structure (Pelagos excluded); for this zone, the rocky substrate which supports *coralligenous* assemblages is best represented (6.5% by all MPAs – 3.5% by MPAs with a management structure).

The large scale distribution of coralligenous, as well as *Posidonia* and *Cymodocea spp*. meadows is so far only reasonably homogenously mapped for the western basin of the Mediterranean Sea (west of the Sicily straight), where they are fairly well covered by MPAs, namely *Posidonia* meadows which are represented at 50% in the system of western MPAs, on the basis of current knowledge (19% when taking into account just MPAs which have a management structure). 12% of coralligenous and 8% of *Cymodocea spp.* meadows habitats are represented within the system of MPAs (aside Pelagos) – or 5% and 1% respectively within MPAs which have no management structure. These habitats are those most often reported by managers as present in their MPA (respectively 69%, 52% and 19%); all other iconic habitats are reported in less than 35% of all MPAs.

In contrast, the system of MPAs is weak in representing deep sea benthic habitats, the bathyal zone (resp. 0.6 and 4% without and with Pelagos) and the abyssal zone (resp. 0 and 2% without and with Pelagos) in particular. Deep sea biocenosis that are unique to the Mediterranean, such as cold seeps, brine pools and cold- water corals are not protected. Managers reported deep sea corals as present by in only 10% of MPAs, for example.

Aside deep-sea canyons, several of which are located in the Pelagos sanctuary (represented at 13% within the system of MPAs including Pelagos), and seamounts (7% with Pelagos), other remarkable geomorphological features such as submarine knolls and banks) are only weakly represented.

The study presents a bioregionalisation of the pelagic zone. The thereby identified epipelagic bioregions, which indicate differences in oceanic water masses, are represented to various degrees within the network of MPAs. Offshore bioregions are by far the least protected, mostly when they are located in oligotrophic waters (nutrient poor) of Eastern Mediterranean. Only 2 pelagic bioregions reach the 10% protection target (the Gulf of Lion and the Aegean Sea).

Among the iconic species considered in this study, only one of the seven species of cetaceans studied[2], namely the fin whale sees its range covered by over 10% by MPAs. The range of the other 6 species has a lower representation in the MPA network, spanning between 3% and 8%. But these species are highly mobile and priority protection areas have been identified by ACCOBAMS. The potential range of the monk seal, classified as Critically Endangered (CR), with fewer than 250-300 individuals left only, has very little protection (less than 2%). Only a restricted number of turtle nesting sites are known and the few that exist are mainly located in the North-East of the basin; 29% of known *Caretta caretta* nesting sites, and 18.7% of *Chelonia mydas* are currently covered within the system of MPAs (excluding Pelagos; and 26% and 19% respectively by MPAs which have a management structure). Birds are represented within MPAs on levels varying from 13% (for the *Puffinus maritanicus*) to 8%. As for the distribution range of the16 species of fish considered in the study, 6% on averaged is covered within the system of MPAs, reaching 10% of the range for *Sarpa salpa*. The range of *E. marginatus* is covered at 7% (all MPAs considered or 3.5% when looking at only MPAs with a management structure), yet noting that 70% of managers reported the species present in their MPA.

Species most frequently reported by MPA managers as present within their site are the giant mussel *(Pinna nobilis)*, *Posidonia oceanica,* the bottlenose dolphin *(Tursiops truncatus)*, the loggerhead turtle *(Caretta caretta)* and the grouper *(Epinephelus marginatus)*. Several MPAs indicate a relatively large presence of species considered to be very rare (date mussels: 60% of MPAs; monk seal: 10% of MPAs or the great white shark - 6%), which requires further investigation.

5. The adequacy and viability of sites is very variable

There is a very diverse range of sizes for the marine part of MPAs, the smallest covers 0.003 km² (National Park Akhziv in Israel) and the largest (excluding the Pelagos marine Sanctuary - 87 500 km²) covers about 4 000 km² (Gulf of Lion Marine Park in France). But 66% of MPAs are no bigger than 50 km².

Over half (61%) of MPAs are over 10 years old, which is considered the minimum age for a MPA to reach a certain maturity and 35% are over 20 years old, which provides a unique opportunity to fathom management effectiveness.

6. The ecological coherence is better in the western basin, but still low on a Mediterranean scale

The visual analysis on the distribution of MPAs shows that the northern part of the basin has a good number of MPAs, especially with the network of Natura 2000 sites, and one could therefore consider that this part of the network is relatively coherent, but most of the Natura 2000 sites do not yet have a management structure. The proximity study between MPAs for the entire basin (Euclidean distance) shows that 60% are located less than 25 km from their nearest neighbour.

Experimental fish larvae dispersal scenarios (using the iconic Mediterranean species (E. marginatus) and passive particles drifting with currents were modelled. These models (using only IUCN category II & IV MPAs) seem to indicate a low rate of connectivity and that the western part of the Mediterranean is

2. Fin whale *(Balaenoptera physalus)*, common pilot whale *(Globicephala melas)*, Risso's dolphin (*Grampus griseus)*, sperm whale *(Physeter macrocephalus)*, striped dolphin *(Stenella coeruleoalba)*, bottlenose dolphin *(Tursiops truncatus*), and Cuvier's beaked whale *(Ziphius cavirostris).*

better connected than the eastern part, where MPA density is lower. These results would however need to be compared to other studies that use different methodologies and at different scales.

7. MPA management is still insufficient

The management's effectiveness was measured through several parameters taken from the responses of 80 MPAs who responded to a survey which was sent to managers. Whilst some progress has been made since the 2008 study, the level of management in Mediterranean MPAs still remains weak on several points: 75% of Natura 2000 sites have no identified manager that is fully appointed as yet and over half of the MPAs in the sample group still do not have a management plan. However, as a management plan defines clear conservation objectives and strategies, it is a strong indicator of good management, if implemented. Yet, there is hope for a significant improvement in these figures, particularly in the Southern and Eastern countries, as 22% of MPAs mentioned that they were preparing their management plan at the time of the survey. Nearly three quarters of MPAs with management plans have already evaluated them and an analysis on these evaluations should already be able give an idea of the management's effectiveness.

However, there is progress on ecological baselines and regular monitoring of parameters and indicators in the MPA, with 70% and 80% of MPAs respectively indicating that they implement them (against 39% in 2008).

In general, the human resources assigned to management is substantial, 84% of MPAs reported having permanent staff, usually supplemented by seasonal and temporary staff which is relatively high, even if it is difficult to know what kind of staff they are (in administrative offices or technical staff actually in the field, managing the MPA).

Surveillance, as well as applying infraction penalties for breaches in regulations is recognised as essential for the marine protected areas to be effective. In the sample group analysed, it is difficult to come to a conclusion on the level of surveillance in MPAs, known to be low in the Mediterranean. Only a quarter of the MPAs reported having sworn staff, but most of them rely on other partners for surveillance (coast guards, marine police, armed forces). The reality and effectiveness of this surveillance is difficult to measure. The number of surveillance hours varies widely, with an average of 8 hours of surveillance per day in MPAs in the North-West, 9 hours per day on average for MPAs in the North-East and 1.5 hours per day on average for MPAs in the South.

Financial resources are essential for good management, but few MPAs provided information on their budgets; among the MPAs who did respond, the North-West (Spain, France, Croatia, Greece or Italy) are to date the only ones with a sufficient budget to ensure an effective management. 36% of MPAs autofinance, which is still too little to ensure the sustainability of MPAs with no other resources and the private sector's commitment is low (8 MPAs reported benefitting from it).

Thus, the study shows that not all the Mediterranean MPAs have the same capacity or even management resources: training, equipment, governance, ... The MPAs with the most resources are located in the North-West and those in the South often have less, but the geographic distribution of those with management needs is not so clear-cut. The needs assessment for capacity building has already been done on MedPAN's initiative (conducted by WWF MedPO); the needs assessment for equipment and financial resources should be the subject of a more detailed analysis, on a case by case basis with managers.

Recreational and fishing activities (artisanal and recreational) are the usages that are considered to exert the most pressure on MPAs

RECOMMENDATIONS

Based on the above results the recommendations are the following:

1. Reinforce the development of the MPA network in order to achieve the 10% target of the Mediterranean's surface area

- Extend the boundaries of existing MPAs
- Create new coastal MPAs of all sizes according to their management objectives
- Create large MPAs in open seas, knowing that the sea beyond the 12 nm zone, which covers 74% of the Mediterranean, is protected by less than 3%
- Integrate other areas of usage restrictions which will contribute positively to biodiversity conservation, such as fisheries restricted areas

Representativity and ecological coherence need to be reinforced, namely in areas where major gaps are identified, and this working on different levels:

- by supporting the establishment of the 55 MPAs being planned, especially in countries that have less MPAs
- prioritise actions in the many sites already identified as essential for the protection of biodiversity
- reinforce research on habitats critical to species' life cycle, and that are essential to protect in order to sustain viable populations of species
- demonstrate the economic and social value of MPAs
- increase the number of no-take zones

The emphasis is on the need to continue supporting the development of think tanks on MPAs (including SPAMIs and Natura 2000) in open seas and in transboundary areas, by contributing to international work on these topics and creating an *ad hoc* regional committee.

2. Reinforce the effectiveness of protection, management and evaluation measures in MPAs

- Improve governance of MPAs and implement appropriate management structures, close to the field, with well-trained teams, with a particular emphasis on the Natura 2000 sites needs in this area
- Ensure that all MPAs have a management plan which is regularly revised in order to adapt management decisions: support the completion of management plans in progress (18 MPAs) and promote

developing these plans in the 24 MPAs who still have none

- Develop a strategy for reinforcing strict nature reserve zones/ wilderness areas and other no take zones
- Reinforce human resources and managers capacities: deliver training and promote exchanges
- Reinforce equipment and human resources for surveillance and better enforcement of regulations as well as a better communication with stakeholders on the MPA's rules
- Reinforce awareness raising and education for current and future users of the marine environment (inside and outside MPAs), taking into account the use of new technologies which are now available
- Reinforce the capacity to ensure the financial sustainability of MPAs: in particular to encourage the development of business plans and to strengthen partnerships with the private sector
- Support regional initiatives and strategies aimed at creating sustainable financial instruments which enable a large scale support for the network

3. Reinforce the resources and tools to ensure an evaluation of the management's effectiveness

- on an MPA scale (management plan objectives)
- on a national level (public policy objectives)
- on a regional scale (Barcelona Convention's objectives)
- finally on an international scale (CBD and other conventions' objectives)

In order to do this, it is necessary to reinforce long-term monitoring programmes, scientific programmes, as well as regional programmes of participatory science and harmonise certain protocols and indicators on a regional level. It is also essential to maintain the systematic recording of data taken on a regional scale and communicating results.

4. Promote the development of network's evaluation tools on a regional level

One must start working with partners on:

- Reviewing and rationalising the labels of MPAs with a national designation and the IUCN categories for better transparency, particularly internationally, and
- Continue developing and improving the MAPAMED database so that it becomes the region's baseline and supplies international databases.

5. Ensure a better management of threats to MPAs

Given the pressures and the various threats which the MPAs face one would recommend the need to consider creating MPAs within a broader ecosystem-based and integrated management. Developing spatial marine planning across the Mediterranean would promote a more sustainable management of usages and conflicts, as well as limit pressures and threats.

6. Enhance the Mediterranean MPAs international recognition

The following key protection actions are among the priorities that should be supported:

- The registration of SPAMIs
- The registration of sites with UNESCO World Heritage
- The protection of areas heavily impacted by fishing with GFCM
- The registration of the 9 sites which currently just have an international status with an MPA national status

The report in figures

MPAs in the world in 2012 (Spalding *et al.*, in press)

- A total of 10 280 MPAs are listed internationally
- They cover around 8.3 million km²
- 2.3% of the oceans total surface
- 28 countries and territories (out of 193) have over 10% of their waters covered by MPAs (12 more countries than in 2010)
- 111 countries and territories (58% of all countries) have less than 1%

MPAs in the Mediterranean in 2012

- The Mediterranean Sea covers 0.8% of the global oceans' surface
- A total of 677 MPAs are listed, including 507 Natura 2000 at sea sites, namely about 6.6% of the world's total
- They cover about 114 600 km² (27 100km² without the large Pelagos Sanctuary for Mediterranean marine mammals), namely 1.38% of the global protected surface area
- 4.56% of the Mediterranean Sea has a legal protection status (national, international and Natura 2000 at sea) and 1.08% if the Pelagos Sanctuary is excluded.
- Less than 0.1% in a strict protection zone (integral reserve) or a no-take zone.
- Two out of 21 countries have over 10% of their waters protected by MPAs (none without Pelagos)
- 96% of MPAs are in the northern part of the basin (83% without Natura 2000)
- 53% of MPAs (without Natura 2000) are centered in Italy, Spain and France
- 67% of Natura 2000 sites are located between Greece and Italy, but in terms of surface area France holds 47%
- 6.1% of the 12 nautical mile zone is under a protected status (8.5% with Pelagos)
- 0.1% of the open sea is under a protected status (2.7% with Pelagos)
- 60% of MPAs are less than 25 km from their nearest neighbour

Mediterranean MPAs management effectiveness (sample group of 80 MPAs)

- 42% of all the Mediterranean MPAs have a management structure (95% of MPAs with a national designation and 25% of Natura 2000 sites)
- 56% of the MPAs in the sample group have no management plan, but there has been a significant improvement, particularly in the Southern and Eastern countries since 2008
- 80% of the MPAs surveyed do regular monitoring in their MPA, an improvement since 2008 (39%) and with a good participation from the management structure's teams alongside the scientists (30%)
- 84% of MPAs have permanent staff
- 25% of MPAs have sworn staff, but MPAs are often helped by other partners for their surveillance
- 40% of managers reported observing illegal activities in their MPA
- 30% of MPAs are equipped with more than 2 boats

We also note that there is:

- A good participation from local stakeholders in the planning and management of MPAs (in 60% of MPAs)
- The MPA is taken into proper consideration in public planning policies (in 91% of MPAs)
- A good collaboration between Mediterranean MPAs (in 50% of MPAs)

Calanques
National Park, France
© GIP des Calanques

CHAPTER 1

Objectives and context

Introduction

Scandola Natural Reserve, France © Scandola Natural Reserve

The Contracting Parties of the Convention on Biological Diversity (CBD) set in 2004 the objective of establishing, by 2012, comprehensive, ecologically representative and efficiently managed national and regional protected areas systems.

In 2010, the CBD's Parties adopted the Strategic Plan for Biological Diversity 2011-2020, including Target 11 which states that «by 2020, at least 17% of terrestrial and inland water and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes» (see Appendix 1: CBD criteria on MPA networks).

The Specially Protected Areas and Biological Diversity Protocol in the Mediterranean (SPA/BD Protocol) and the Strategic Action Plan for the Conservation of Biological Diversity in the Mediterranean (SAP BIO) are the main tools which the contracting parties to the Barcelona Convention can use to implement the Convention on Biological Diversity (see diagram below).

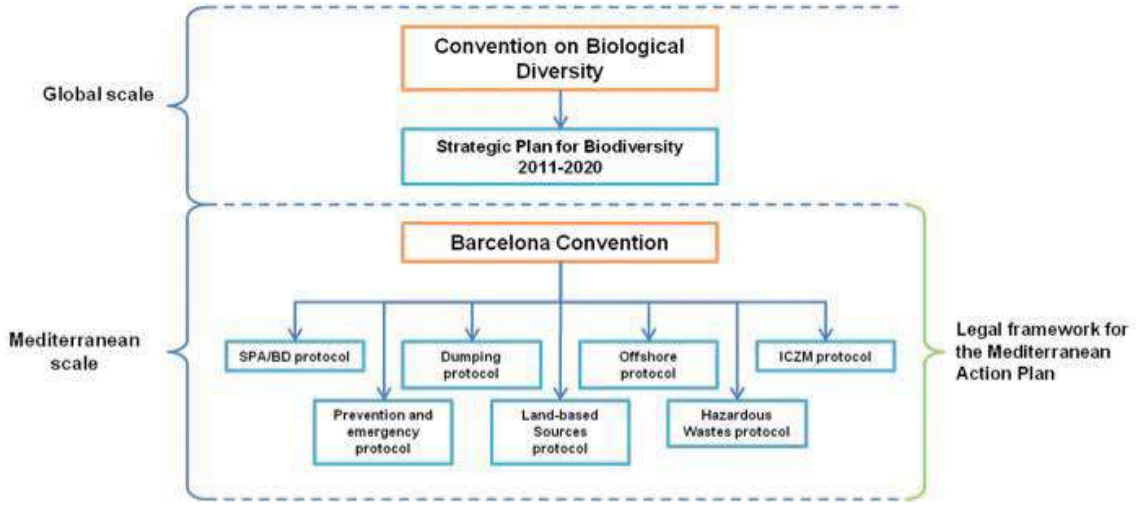
Under the SPA/BD Protocol, Mediterranean countries contribute to the objective of establishing a far-reaching and coherent Mediterranean network of marine and coastal protected areas by implementing the Regional Work Programme for marine and coastal protected areas in the Mediterranean, as well as in open sea, which was adopted by the Contracting Parties to the Barcelona Convention in 2009.

The Regional Activity Centre for Specially Protected Areas (RAC/SPA) was established in Tunis in 1985 on the decision of the Contracting Parties to the Barcelona Convention. It was given the responsibility of assessing the natural heritage situation and assisting Mediterranean countries in implementing the Specially Protected Areas Protocol (SPA protocol of 1982), which was later replaced by the Protocol concerning Specially Protected Areas and Biological Diversity (SPA/BD protocol of 1995 which came into force in 1999), through the following actions:

- The implementation of scientific and technical research programmes as defined by the SPA/BD Protocol with these research programmes having the priority of being relevant to Specially Protected Areas of Mediterranean Importance (SPAMI) and species listed in Appendices II and III of the SPA / BD Protocol;
- The elaboration of management plans for protected areas and species, (ex. MedMPA and MedMPAnet Projects...);
- The development of cooperation programmes in order to coordinate the creation, conservation and management of specially protected areas, as well as the selection, management and conservation of protected species.

Since 1990, the MedPAN Network (the network of managers of Marine Protected Areas in the Mediterranean) is dedicated to unifying the managers of Marine Protected Areas (MPAs) in the Mediterranean and to give them support in their management activities. By the end of 2008, MedPAN became an Association under the 1901 law (French legal system) and aims to promote the creation, sustainability and operation of a Mediterranean network of marine protected areas. The MedPAN Association now has 9 founding members, 40 members (MPA managers) and 24 partners (activities linked to the management of MPAs) from 18 different Mediterranean countries (see diagram below).

Les instruments réglementaires internationaux et régionaux



Key dates for the MedPAN network

1990	1996	2001	2005-2007	2007	2008	2009	Since 2010
Launch of the MedPAN network	Temporary cessation of network activities	Operational responsibility of the network delegated by Port-Cros NP to WWF France	INTERREG IIIC MedPAN project with 23 partners	1st Mediterranean MPA Conference (Porquerolles – France)	Creation of the MedPAN organisation	Permanent secretariat of the organisation based in Hyères (France)	Implementation of the organisation's activities

The study's objectives

In order to identify how the MPA network in the Mediterranean meets the CBD's objectives IUCN and WWF France launched in 2007, with the RAC/SPA's support, a study to create a starting point for the network in order to then assess the progress of its development and its relevance to the CBD's objectives. The main conclusions of this 2008 study are as follows (see box for details on the findings):

- the CBD's target of an effective conservation of at least 10% of each ecological region in the world by 2010 has not been not reached in the Mediterranean, the coverage rate is about 4% with Pelagos but only 0.4% without Pelagos;
- the MPA system in the Mediterranean is neither coherent nor representative;
- MPA management is not effective when compared to the analyzed criteria in the study.

The RAC/SPA study (UNEP-MAP-RAC/SPA, 2010) confirmed these results and in particular:

- The protected areas names and typologies are very diverse and are closely linked to the national legislative and regulatory context. Countries have the ability to create many types of protected areas under their legislative framework.
- The SPAs are unevenly distributed in the Mediterranean basin.
- If one only looks at areas with a marine part, the size of the protected area is 128 700 km ^{2} or 5.1% of the total surface area of the Mediterranean. This confirms that the CBD objective to protect 10% of the coastal and marine area by 2010 is still far from being achieved.

The objective of this current study is to do a new inventory in 2012 of the MPA system in the Mediterranean, thus 3 to 4 years later, in order to assess the progress made on the CBD's objectives since 2008. The questions which arise are:

1. **What is the current level of protection in the Mediterranean basin and what progress has been made since 2008?**
2. **Is the network representative, comprehensive and coherent?**
3. **Is the network effectively and efficiently managed?**
4. **What are the main uses in MPAs and which pressures are the MPAs affected by?**

Thus, four parts make up this study:

- An analysis of the MPA network's characteristics: numbers, area, geographical distribution, protection status, ..., of all the listed Mediterranean MPAs which make up the network and the height of protection on different levels (the Mediterranean Sea, sub-regions, national level);
- An analysis of the network's representativity on different levels and its connectivity, taking into account all the MPAs;
- An analysis of the management of MPAs, based on the answers of a cross-section of MPA managers who responded to the survey;
- An analysis of the uses and pressures in the MPAs who answered the survey.

The results must show the progress made in protection since 2008 in order to identify the gaps in the MPA network and the efforts to be undertaken to complete the network and to ensure that the MPAs are more efficiently managed.

In parallel to this work, a study on an "inventory of the multidisciplinary monitoring programmes which are relevant to Mediterranean MPAs" was made at the request of the MedPAN network's partners. This study is the subject of a separate document Chassanite *et al.,* 2012, but the main results are given in this report. This study aimed:

- To record the multidisciplinary monitoring programmes done in MPAs on a regional level, sub-regional level or national level. A multidisciplinary database has been developed, to facilitate the use of this information. The aim is to eventually integrate this database into the MAPAMED one;
- To draw up a detailed inventory of the monitoring done in the Mediterranean from the information gathered. And in particular to highlight:
  - The current best practices through certain programmes which can be used as examples of success («success stories»);
  - The geographical areas where little information exists;
  - The subjects and themes that are underrepresented in the study of the effects of MPAs; the gaps in terms of monitoring and / or indicators used and success criteria used.

Bonifacio Strait Nature Reserve, France © AMICLA-C. Amico / WWF-Canon

The main conclusions of the 2008 report on the status of MPAs [1]

1. The CBD's target of 10% protection of the global eco-regions will probably not be achieved in the Mediterranean (by 2012)

The marine protected areas in the Mediterranean cover 97 410 km², which is about 4% of the Mediterranean. Apart from the Pelagos Sanctuary (87 500 km²), there is only an area of 9910 km² which is protected by coastal MPAs, that is 0.4% of the total surface area of the Mediterranean Sea. The integral reserves' cumulative surface area is 202 km², or 0.01% of the total surface area of the Mediterranean.

2. The current Mediterranean MPA system is not representative or coherent

All the MPAs are located in coastal waters under national jurisdiction, except the Pelagos Sanctuary which is the only MPA today located on the High Seas in the Mediterranean. MPAs are found mainly on the northern shores of the Mediterranean, with the exception of a few sites in Algeria, Morocco, Tunisia, Israel, Lebanon and Syria. The results reveal disparities in the distribution of MPAs which highlights the fact that some of the Mediterranean's major marine habitats and biomes are not taken into account and that protected sites are maybe too far apart to ensure the exchange of most marine organisms' larvae in the protected areas network.

3. There needs to be a more effective management of the Mediterranean MPAs

The results showed that there is still inadequate management in about half of the MPAs in this region. Some of the reasons behind this are the lack of management plans, information on natural resources, enforcement of rules and surveillance, human and financial resources, facilities and equipment like boats, visitor centres and diving equipment. In addition, the ecological and socio-economical monitoring is not common practice in the Mediterranean. More specifically, MPA management must progress to the North-East and South of the Mediterranean.

These sites results revealed significant challenges and needs for capacity management. Some MPA have an insufficient number of personnel or equipment, indicating a low capacity and potential for management. However, the northern Mediterranean MPAs are very heterogeneous. Many of them have excellent management and can be considered as benchmarks for MPAs, whilst others can be defined as «paper parks». The results of this study confirm the trends observed in the North western Mediterranean MPAs and those in other parts of the world which have been extensively studied, namely that the level of success and continuity over time depends on the size and capacity of the management teams, and their ability to work in appropriate conditions.

4. The perceived state of the habitats and species within MPAs

The data on the status of habitats and species which are protected and under management shows that the ecological information requested has not been readily available in many MPAs. However, many managers observed negative trends in some of the major habitats like the seagrass beds and coral communities, and vital areas such as the spawning aggregation and feeding sites. The only significant population development has been found in the dusky grouper, *Epinephelus marginatus* and the brown meager, *Sciaena umbra*. Whereas, the Mediterranean lobster *Palinurus elephas* and red coral, *Corallium rubrum* have decreased significantly according to managers.

5. Local, regional and global pressures threatening the Mediterranean MPAs

The Mediterranean MPAs are affected by multiple anthropogenic threats from adjacent or close by land and marine areas which may influence their effectiveness. More than half of the MPAs are affected by anchorage, invasive plants, over fishing, noise pollution, solid waste, the degassing of oil and diesel or oil spills, changes in plants composition or animals due to climate change as well as urbanization or artificial constructions. The MPAs also face the threat of introduced and invasive species. The invasive algae *Caulerpa racemosa* and *Asparagopsis armata* are the most frequently mentioned by the Mediterranean MPAs.

[1] *Citation: Ameer Abdulla, Marina Gomei, Elodie Maison, and Catherine Piante (2008) Status of Marine Protected Areas* in the Mediterranean Sea . IUCN, Malaga and WWF, France. 152 p

Coralligenous assemblage, Croatia © A. Rosetti / Sunce

The study's context

THE MEDITERRANEAN SEA

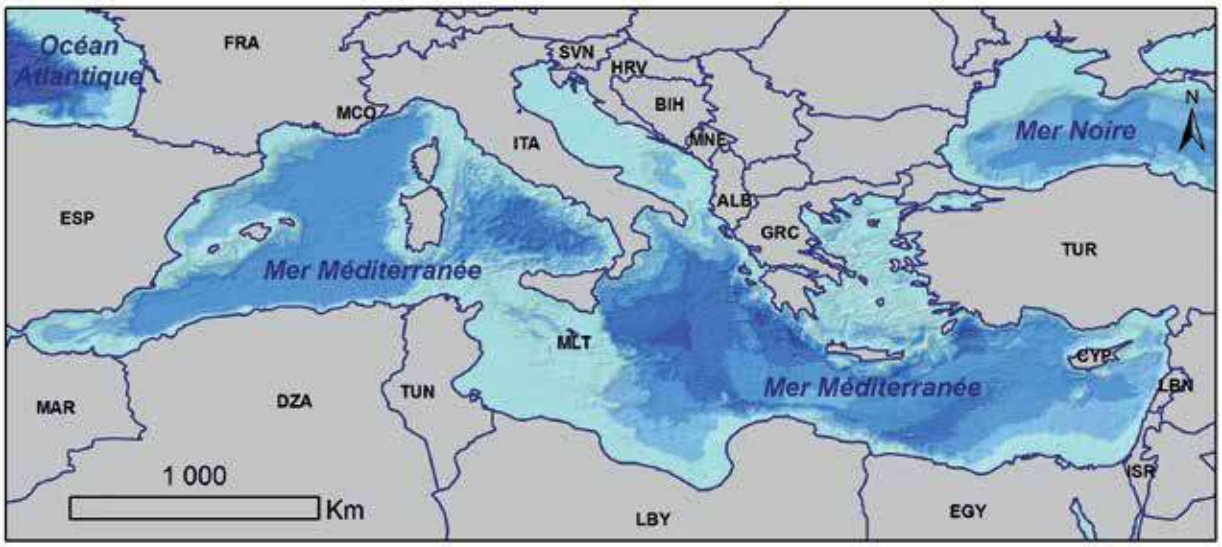


Figure 1: The Mediterranean Sea

A remarkable biodiversity, a priority eco-region

The Mediterranean [1] (see Fig. 1) is one of the priority eco-regions in the world. It represents only 0.82% of the ocean surface, but with nearly 17 000 known marine species today it is home to 4-18% of the global marine biodiversity, according to the taxonomic groups examined (Coll *et al.*, 2010 Bianchi & Morri, 2000), and has an important endemism of 10 to 48% depending on the groups (in Coll *et al.*, 2010). The spatial patterns have shown a general decline of biodiversity from the Northwest to the southeast with some exceptions, and given the limited knowledge on the biodiversity along the southern and eastern shores (Coll *et al.*, 2010).

This remarkable diversity is the result of its geological history: the opening / closing of the Straits of Gibraltar with consecutive drying / reflooding in the basin, warming and ice age cycles, mixed flows from the Atlantic Ocean and the Red Sea via the Gulf of Suez .

The Mediterranean provides vital areas for the reproduction of pelagic species (see box «Remarkable biodiversity of the Mediterranean»): the Atlantic bluefin tuna's main spawning areas, the great white shark's unique breeding areas and sea turtles, such as the green and loggerhead turtles, nesting areas along its eastern coast. These high oceanic productivity areas host a particularly rich marine mammal fauna and the eastern part of the basin is one of the last shelters for the threatened Mediterranean monk seal. The shallow coastal waters are home to key species and sensitive ecosystems such as seagrass beds and coralligenous assemblages, whilst the deep waters host a unique and fragile fauna. Many of these species are rare and / or threatened and are globally or regionally classified by IUCN as threatened or endangered.

This natural heritage has profoundly influenced the development of populations, transforming this basin into a rich and heterogeneous mosaic of cultures.

1. A large part of this chapter (see paragraphs on biodiversity, pressures, legal framework and MPAs) is taken from the 2008 report, amended, supplemented and updated

Remarkable biodiversity of the Mediterranean

- The Mediterranean is home to the Atlantic bluefin tuna's main spawning grounds, *Thunnus thynnus*, which are found in the Balearic Islands, Tyrrhenian Sea, Levantine Sea and southern Turkey (Medina *et al.*, 2007 Fromentin and Powers, 2005);
- Around 2-3 000 **sea turtles**, *Caretta caretta*, and 350 green turtles, *Chelonia mydas*, nest annually in the Mediterranean (Broderick *et al.,* 2002). The coasts of Turkey, Greece, Cyprus and Libya are the most important nesting areas for the *C. caretta*, with a few sites in the western Mediterranean; whereas the *C. mydas* lays almost exclusively in the eastern Mediterranean mainly in Turkey and Cyprus (Margaritoulis, 2003, Canbolat, 2004, Casale *et al.,* 2010);
- The **great white shark**, *Carcharodon carcharias*, a species listed in the Barcelona and Berne Conventions and classified as Endangered Species in the Mediterranean by the IUCN's Commission for the Survival of Species, has unique breeding areas in the Strait of Sicily (Tudela, 2004, Abdulla, 2004);
- Protective measures have enabled the survival of specific species which were close to extinction like the **Audouin's seagull**, *Larus audouinii*, which is endemic to the Mediterranean region and breeds in the western Mediterranean coastal locations / islands of Spain, Corsica and Sardinia (UNEP/MAP/RAC/SPA, 2004);
- The oceanographic characteristics of the Corso-Ligurian-Provençal basin means that this is a highly productive area which hosts a particularly rich **cetaceans** fauna, including the largest part of the fin whale population (3 500 individuals), *Balaenoptera physalus* in the Mediterranean (Notarbartolo di Sciara *et al.,* 2003);
- The eastern part of the Mediterranean especially the Aegean Sea is home to most of the small and largely fragmented population of the Mediterranean **monk seal**, *Monachus monachus* (UNEP/MAP/RAC/SPA, 2006, Dendrinos et *al.,* 2007). This mammal species is classified as critically endangered (the most endangered) on the IUCN World Red List. In the Mediterranean, there were only about 600 individuals in remote areas (Cebrian, 1998, Gucu *et al.,* 2004, Dendrinos *et al.,* 2007) and today it is estimated that there are about 300 left;
- **Seagrass meadows** are the top biodiversity hotspot of the Mediterranean; many invertebrates and vertebrates live, feed, breed and shelter in their leaves and rhizomes (Gambi *et al.,* 2006). These are also key species for providing oxygen, nutrients and protection to the coast (Duffy, 2006). Three seagrass species are found in shallow waters: *Posidonia oceanica* which is endemic to the Mediterranean, *Cymodocea nodosa* and *Zostera spp*.;
- One of the most beautiful and productive ecosystems in the Mediterranean is the *coralline assemblage*. It consists of hard corals and can be dated from 600 to 7 000 years BP (Sartoretto *et al.,* 1996). This biocenosis is extremely diverse and heterogeneous and is made up of a large number of algae, sponges, gorgonians, corals, bryozoans and tunicates species, and it hosts communities of crustaceans, molluscs or fish of all ages who live in this complex structure (UNEP/MAP/RAC/SPA, 2008a, 2009c).
- The **vermetid platforms** are the most important biogenic structures affecting the complex spatial mediolittoral Mediterranean areas; they host a diverse community (Molinier and Picard, 1953). These biogenic reefs consist of sessile gastropods, the *Dendropoma petraeum* and *Vermetus triquetrus* vermetids who are endemic to the Mediterranean and are mainly found in the eastern part of the basin (Antonioli *et al.,* 1999).

A closed sea with unique oceanographic features

The Mediterranean is a semi-closed sea and has unique oceanographic conditions. One of its characteristics is that its bodies of water have a relatively short occupancy (~ 70 years) compared to other oceans (200-1000 years). The intense evaporation due to its thin cloud cover and lots of sunshine exceeds precipitation and river runoff. This water deficit is compensated by the inflow of Atlantic water through the Straits of Gibraltar. The warmer and fresher Atlantic water entering the Mediterranean Sea originates from the thermohaline circulation which does a counter-clockwise circuit along the continental slopes through both western and eastern Mediterranean basins (see Millot and Taupier-Letage, 2005).

Intense episodes of cold and dry northerly winds in winter cause dense water formation in the North-western Mediterranean, the Adriatic and the Aegean Seas, increasing the density of the Atlantic water, which sinks to intermediate or deep levels forming Levantine Intermediate Water or Mediterranean Deep Waters. This winter and deep water formation phenomenon are the two cooling forces of the Mediterranean's waters and maintain the thermohaline circulation. A possible scenario for the Mediterranean's evolution, as a result of global warming, is a weaker convection and an increase of the water column's average temperature (Dijkostra and Meijer, 2009).

The Mediterranean Sea is one of the most oligotrophic regions in the world's oceans due to a limited supply of nutrients to the surface waters, especially inorganic phosphorus (Krom *et al.*, 1991; Thingstad and Rassoulzadegan, 1995). Nutrient distribution is characterized by a decreasing trend in nutrient concentrations from the oligotrophic western basin to the ultra-oligotrophic eastern basin (Moutin and Raimbault, 2002). Anomalous values in nutrient ratios which characterize the Mediterranean, are essentially explained by tthe excess of nitrogen over phosphorus in all nutrient sources arriving to the basin via atmospheric deposits (Markaki *et al.*, 2009) and river discharge (Ludwig *et al.*, 2009; Krom *et al.*, 2010). Moreover, the fixation of atmospheric nitrogen was found to be negligible in the East compared to the western Mediterranean. In the eastern Mediterranean, this high imbalance in the nutrient supply fosters an inefficient trophic transfer through a microbial food chain via copepods up to commercially important fish species (Thingstad *et al.,* 2005).

Recently, the biogeography of the Mediterranean Sea and the seasonal cycle of the surface biomass were

characterized in different areas of the basin by analyzing ten years of SeaWiFS satellite surface chlorophyll a (Chl-a) concentrations data (D'Ortenzio and Ribera d'Alcala, 2009). In this study, it is clearly shown that the North West Mediterranean and East Mediterranean basins have a different trophic regime, under the influence of physical, chemical and biological asymmetric forcing factors. In the North-western Mediterranean, primary producers are able to efficiently exploit available nutrients, leading to classical spring blooming. In several regions of the western Mediterranean (the Balearic front, the Liguro-Provencal current, and partially the Alboran Sea, the South Adriatic gyre, and the North-western Ionian), the regime is intermittently blooming showing increases of biomass in both late winter and beginning of Autumn. In the remaining regions, East and South of the Mediterranean, representing 60% of the Mediterranean Sea, a non-blooming regime prevails with biomass increasing very slowly over a background low productivity pattern (D'Ortenzio and Ribera d'Alcala).

Fertilization of deep habitats occurs through the sinking of fresh organic matter from productive areas of the surface to the seabed. In the offshore waters, particulate organic matter fluxes occur throughout the year and provides a little, but almost continuous energy to meso- and bathypelagic organisms. In contrast, dissolved organic matter fluxes are important, but occur only during the winter cooling and deep-water formation. This could play a very important and often underestimated role in carbon export in the Mediterranean Sea.

In the Gulf of Lion, the coastal waters winter cooling by the continental winds and the increase in density compared to the offshore waters leads to «cascading» water, rich in organic matter, along the continental slope and particularly in the canyons in the Gulf 's southwestern end (Lacaze-Duthiers and Cap de Creus). This is an annual recurring process with a high interannual variability. Intense events of dense coastal downwelling reaching the deep basin are observed on a decanal scale (1990, 2000, 2010) (Béthoux *et al.,* 2002; Durrieu de Madron *et al.,* 2005; Canals *et al.,* 2006; Heussner *et al.* 2006; Hermann *et al.,* 2008).

One can thus observe benthic communities living at the head of the Lacaze Duthiers and Cape Reus canyons which shelter exceptional colonies of deep-sea cold corals.

A sea under threat

Over decades human pressure has intensified. The population living in coastal areas now stands at 460 million people (approximately 7% of the world population) of which 150 million live on the coast itself; in addition millions of tourists annually visit the Mediterranean coast: in 2007, the Mediterranean countries welcomed 275 million international tourists, about 30% of the world's population UNEP/MAP/Plan Bleu, 2009.

Anthropogenic pressures and threats are particularly linked to the loss and destruction of habitats, resource exploitation, pollution, climate change, eutrophication and invasive marine species (Coll *et al.,* 2010).

Physical loss of Mediterranean characteristic habitats is one of the most visible consequences of human pressure. Urbanization, the increasing number of tourist infrastructures and other economic activities have led to drastic alterations of coastal areas in recent decades by replacing natural areas with artificial developments; this is particularly an issue in the Mediterranean's northern coast. 50% of the Mediterranean coastline is predicted to be transformed into one huge metropolis causing an irreversible change to the coastal environment and associated ecological processes (UNEP/MAP/Plan Bleu, 2009). The abundance and distribution of seagrasses has declined significantly due to bottom trawling, coastal development and pollution. The density of the most common species, *Posidonia oceanica*, has declined by 50% compared to its original distributions (Airoldi and Beck, 2007). Fragile ecosystems, like the coralligenous communities are strongly affected by global warming, pollution, trawling and sometimes diving (UNEP/MAP/RAC/SPA, 2010a). The underwater canyons, the cold-seep waters, deep coral reefs, seamounts and brine lakes are threatened by uncontrolled trawling (Cartes *et al.,* 2004).

Pollution is one of the most important problems in this semi-enclosed sea with a limited water circulation. Dangerous substances discharged by 21 Mediterranean countries can circulate for years (IUCN, 2008). Evidence of pollution caused by industrial and agricultural waste, heavy metals and persistent organic or solid waste is present on all the marine organisms' trophic levels. The Mediterranean Sea accommodates 20 to 25% of global maritime oil traffic in an area representing 0.8% of the global sea surface. It is estimated that 250 000 tons of oil/per year are regularly discharged into the sea during shipping activity, accidents and by common spills (European Environment Agency, 2006). The effect of these hydrocarbons is detectable over the short and long term and its impact goes from genetic modification to instant poisoning of marine organisms (Galil, 2006).

During the last century, **fishing effort** has increased rapidly in the Mediterranean whereby this formerly traditional activity has been practically transformed into an industrial one today, which is unsustainable for the natural resources (Goñi *et al.,* 2000). Most of the commercial fish stocks are overexploited in the Mediterranean (FAO, 2006). «Since the 1980s, the fishing output has declined in the Mediterranean and Black Seas: it has fallen from 1.950 million tons in 1986 to 1.450 million tons in 2005 (Eurostat figures). Therefore today, the size of the catches is 25% smaller than 20 years ago, except for the bluefin tuna. This fall in the catches' size which is not due to a lower fishing activity, reflects an alarming decline in certain stocks. The pressure is particularly felt among swordfish, hake, whiting, mullet, all the Sparidae (breams, dentex, *Pagellus*, sargo…), anchovy, sardines, deepwater rose shrimp and red shrimp species which scientists do not hesitate in describing as being «overfished», to only mention stocks that have been evaluated ... As for bluefin tuna, its level of exploitation has become difficult to assess because the pressure from illegal overfishing has assumed alarming proportions «(European Commission, 2008).

Illegal and destructive fishing has caused a serious decline in typical Mediterranean species, such as the red coral *Corallium rubrum* (antangelo, 1993, UNEP/MAP/RAC/SPA, 2007) or the date mussels *Lithophaga lithophaga* (Fanelli *et al.,* 1994). Fishing's negative effects goes beyond the target species: some trawling equip-

ment destroys habitats, the use of long lines and driftnets has a significant impact due to their bycatches of turtles, sharks and cetaceans (Tudela, 2004, Tudela *et al.,* 2005) and bird species endemic to the Mediterranean, as well as wintering species (UNEP/MAP/RAC/SPA, 2010a). 60% of the Mediterranean's cetaceans and 40% of the shark and ray species are threatened with extinction (Reeves and Notarbartolo di Sciara 2006, Cavanagh and Gibson, 2007). Several studies coordinated by ACCOBAMS show that cetaceans in particular suffer increasing pressure from chemical pollution, but also noise pollution, causing major disruptions to their biosonar. Collisions and bycatch also contribute to weakening these populations. Finally, it is estimated that the loss of top predators in the Mediterranean (such as monk seals, sharks, tuna, swordfish and groupers) has had a direct cascading effect on the trophic food network, changing the ecology in a number of Mediterranean areas (Sala, 2004).

Climate change, by a warming and acidification of seawater, rising water levels and an alteration of sea and air currents also has an impact and this is only going to escalate. In the Mediterranean Sea, one observes a constant increase in the sea surface temperature (SST) which has been recorded since the 80s (Bethoux *et al.*, 1998, 1990, Lelieveld, 2002) and is also occurring in deep waters (Diaz-Almela *et al.,* 2007). These climate changes have different ecological consequences (UNEP/MAP/RAC/SPA, 2009). One being species composition - and thus, ultimately ecosystems – which can change in space and time as the distribution of warmer water species spreads and the cold water species reduces (Occhipinti Ambrogi and Savini, 2003). One observed an unusual mass mortality in the red coral *C. rubrum* in the North-Western Mediterranean which was also attributed to a severe thermal anomaly (Garrabou *et al.* 2001). In addition, the increase in CO2 could reduce the ocean's pH (ocean acidification) and carbonate ion concentrations (Bates *et al.,* 2008). This process is predicted to affect marine organisms such as cold water corals, calcareous algae, sea urchins and plankton which depend on calcium or aragonite to build their shells and skeletons which, in turn, provide essential habitat for fish and a source of food for important predators from a higher trophic level (Orr *et al.*, 2005, Hall-Spencer *et al.,* 2008).

The introduction of non-native species appears to be one of the most important ecological and economic threats to the Mediterranean. These introduced species' main vectors into the Mediterranean are through the Suez Canal (allowing a migration of Red Sea species), hull fouling, ballast water from shipping and aquaculture (Flagella and Abdulla, 2005). Just 10 years ago, 99 fish, 63 crustaceans, 137 molluscs and 9 macrophytes, all foreign to the Mediterranean were identified (CIESM 2002a, 2002b, 2004, Boudouresque and Verlaque 2002). The latest studies give a figure of about 1 000 alien species and an introduction rate of 10 new species per year (Zenetos et al., 2009, Zenetos, 2010).

The warming of the waters also facilitates the geographic spread of these non-native species. The impact of these introductions can be ecological, economic and social and is visible in many Mediterranean areas where these species have now become invasive species and/or compete with native species (CIESM, 2002c).

Notable examples are the invasion of two green algae species of the *Caulerpa* genus which compete or dominate seagrass species (Galil, 2007), or an increase in jellyfish and algae which has an impact on fishing activities, aquaculture and tourism (Galil, 2000, Streftaris and Zenetos, 2006).

THE MPAS IN THE MEDITERRANEAN

Legal and institutional framework

The designation and management of MPAs in the Mediterranean is governed by a range of international, regional and national instruments (see box «Legal framework and instruments for MPAs in the Mediterranean»). The main two are the Convention on Biological Diversity (CBD) on an international level, and the Barcelona Convention on a regional level. In addition, the Northern European Mediterranean countries all have directives, policies, and other European instruments which include the Marine Strategy Framework Directive, Natura 2000 and the Common Fisheries Policy which is currently under reform. One must also highlight the progress being made in national legislation.

All these instruments are presented in the 2008 MPA status report (link: www.iucn.org/about/union/secretariat/offices/iucnmed/resources/publications/index.cfm?uNewsID=1962), but the main changes to note since 2008 are the following (not in chronological order and presented according to their relevance to MPAs)

The CBD's recent commitments

In 2010, the Nagoya conference adopted a protocol which validated an operational «2011-2020 Biological Diversity Strategic Plan», with 20 quantified sub-objectives known as the «Aichi targets». These 20 objectives include two key objectives: one on fishing and the other on protected areas:

- By 2020, to manage / operate all exploited aquatic stocks (fish, invertebrates, aquatic plants) in a sustainable way by applying an ecosystem based approach in order to avoid overfishing.
- By 2020, create a network of protected areas covering at least «17% of the land area and 10% of coastal and marine areas, constituting an ecologically representative and well connected network of protected areas which are effectively conserved and equitably managed.»

The Barcelona Convention

In February 2012, the signatories met to validate the "Paris Declaration" for the Mediterranean which reinforces the tenets of the Nagoya commitments and, in particular, that of the ecosystem-based approach, combating climate change, making greater efforts to reduce pollution, reinforcing the network of MPAs with the 10% objective in the Mediterranean by 2020 and actions to be taken in ecologically or biologically significant marine areas (EBSAs). This meeting has also acted on the need to reinforce changes in economic practices by "setting up a "blue" economy for the Mediterranean, deriving from the "green" economy and applied to seas, based on the Mediterranean Strategy of sustainable develop-

ment as a framework for action".

The "Paris Declaration" also reaffirms the commitments made in relation to ICZM Protocol adopted in 2008, following its ratification by six of the Contracting Parties and which came into force in 2011. The process of implementation is reflected in a roadmap which was developed in 2012 and coordinated by the RAC/PAP. The ICZM Protocol has been added to the Convention's Protocols, specifically for SPA and biological diversity, and completes the intervention areas by requiring the protection of specific coastal ecosystems, islands and coastal landscapes (art.10,11.12).

The Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean

The SPA/BD Protocol is the main Mediterranean instrument for implementing the 1992 Convention on Biological Diversity, for the sustainable management of coastal and marine biodiversity.

The Barcelona Convention's Plenipotentiary Conference adopted this Protocol in 1995.

The Protocol gives three key elements to ensure the preservation of the Mediterranean's biological diversity:

- The creation, protection and management of Specially Protected Areas (SPA);
- To draw up a list of Specially Protected Areas of Mediterranean Importance (SPAMI) and
- The protection and conservation of species.

To achieve these objectives, the following aspects are developed:

- Conservation of marine and coastal type ecosystems, representative of the Mediterranean;
- The protection of endangered habitats or those essential for the survival, breeding and restoration of threatened or endemic species;
- The protection of scientific, aesthetic, cultural or educational sites;
- The development and adoption of management plans;
- Continuous surveillance (monitoring) of all factors for the integrity, function and balance of these ecosystems, habitats and sites;
- The conservation of species which are threatened with extinction, endangered or to be managed;
- The sustainable use of biological resources.

The Marine Strategy Framework Directive and the European Union's Natura 2000 instrument

The Directive N° 2008/56/CE of 17th June 2008 is aimed at protecting and restoring ecosystems based on establishing a good ecological status (indicators as support) and the viability of economic activities. It emphasizes the MPAs central role, referring to them as marine protected zones (MPZs) in its introduction, in Article 13.4 (particularly on the notion of network / N2000) and is an obligation for the member countries to have results by 2014. Its transposition into national law is underway with a programme launch planned for late 2013.

The network of MPZs in the Directive also clearly fits into the Natura 2000 initiative (SPAs and SACs sites - and other MPAs, these can be given other labels when created according to the judicial instrument used) which emphasises the possibility of overlapping designations and an extension to the designation already established. The Natura 2000 network ensues from the Habitats (1992) and Bird (1979) Directives which is to form a group of sites to be protected and whose process to identify sites at sea ends in 2012, giving a total of 507 Natura 2000 at sea sites for the Mediterranean front. Each member State has to implement the network on their national territory. In 2011, the main observation made on the progress of the implementation of the Natura 2000 network's management plans was the slow nature of this process which is mainly due to a lack of consultation on how to operate the programmes and funding. Thus, it is the issue of funding which is currently under discussion in order to adopt a more strategic approach from 2014.

The Common Fisheries Policy reform

The Common Fisheries Policy (CFP) is to ensure the sustainability of living aquatic resources and environmental protection. This is the European Union's instrument to manage fisheries and aquaculture. Among other things, it aims to restore fish stocks using fishing reserves as one of its tools. Since 1983, reforms are submitted around every 10 years. From 2009 to 2010, consultations were held on the Green Paper in order to identify the CFP's structural problems.

In July 2011, a proposal for a Regulation of the Fisheries Committee was submitted to Parliament and the EU Council. The content of the reform bill is anticipated to enter into force on 1st January 2014, with certain points on the differentiated regimes being better suited to the Mediterranean climate.

In 2006, three deep sea areas of ecological importance have been identified as sites of ecological interest. The GFCM Agreement on Fisheries Restricted Areas (FRA) protects:

- A deep water coral reef off Capo Santa Maria di Leuca, Italy, in the Ionian Sea, home to the rare white coral, Lophelia pertusa,
- An area of cold seeps offshore the Nile Delta,
- The Eratosthenes Seamount South of Cyprus, which hosts rare species of coral.

In 2009, a fourth zone of Fisheries Restricted Areas - area of the Gulf of Lion - was established at the 33rd annual session of the GFCM in Tunis to protect concentrations of spawning fish in deep water sensitive habitats.

Deep-sea sites of particular ecological interest identified by the GFCM cover 17 677 km², that is to say 0.70% of the total area of the Mediterranean.

This resolution has marked an important step towards the emergence of the GFCM as an effective authority for fisheries management and protection of the marine environment and ecosystems in the International waters of the Mediterranean.»

Rio+20

The 5th Summit of the Earth organised by the United Nations (June 2012 in Rio de Janeiro, Brazil) reaffirmed the importance of adopting conservation measures in specific areas, including the creation of marine protected areas which comply with international law and are based on the best scientific data available to conserve the bio-

logical diversity and ensure a sustainable use of its components. The commitment was made to protect and regenerate the health, productivity and resilience of the oceans and marine ecosystems and maintain their biodiversity by applying an ecosystem based approach and a precautionary approach to the management of activities affecting the marine environment, in accordance with international law. Thus, emphasising the importance of the conservation and sustainable use of oceans, seas and their resources to ensure sustainable development.

The commitments made apply also to capacity building in developing countries, especially in strengthening their national capacities to protect and sustainably manage fisheries resources; to give support to a notification and systematic global assessment mechanism on the marine environment's state, including the socio-economic aspects and the decision was also taken to prepare an international instrument under the United Nations Convention framework on the Law of the Sea for the areas that are outside national jurisdictions.

The Union for the Mediterranean

The Union for the Mediterranean (UfM) was founded in July 2008. It is an intergovernmental organisation with a regional focus whose purpose is mainly to give a new impetus to the Barcelona process, a partnership between Europe and the bordering Mediterranean countries. Also known as the «Barcelona Process: Union for the Mediterranean» it has 44 members, all countries bordering the Mediterranean and EU Member States.

The organisation's aim revolves around energy and the environment - especially the cleanup of the Mediterranean's pollution - and the shipping lanes. Although, the UfM has not put forward projects or programmes linked to MPAs, the UfM's partner countries must promote the need to establish MPAs and to protect biodiversity even in areas that are not under their national jurisdiction. The UfM is exploring ways to interact in this way.

Developments on a national level

Several countries have taken steps to improve their legislation and strategies to favour MPAs. Among them are the following:

- Tunisia : 2009 - a new law for Coastal and Marine Protected Areas (CMPA)
- Turkey : 2009-2013 – a national approach for a network of MPAs (UNDP/GEF)
- Spain : 2010 – a new law to protect the marine environment (especially on MPAs)
- Morocco : 2010 – a new law for MPAs
- Algeria : 2011 – a new law for MPAs
- France : 2012 – the launch of the MPA Agency (created in 2006) strategy for MPAs

Legal Framework and instruments for MPAs in the Mediterranean

Global instruments and initiatives

World Summits
United Nations Convention on the Law of the Sea (UNCLOS - Montego Bay, 1982)
Convention on Biological Diversity (CBD - Rio de Janeiro, 1992)
Convention on Wetlands of international importance, in particular as habitats for aquatic birds (Ramsar, 1971)
Convention concerning the Protection of the World Cultural anda Natural Heritage (UNESCO - World Heritage Convention - Paris, 1972)
UNESCO Convention on the Protection of the Underwater Cultural Heritage (2001)
Biosphere reserves (sites recognized under UNESCO's Man and the Biosphere Programme)

European Union legislation and initiatives

Convention on the Conservation of European Wildlife anda Natural Habitats (Bern, 1979)
Emerald Network
Habitats and Birds Directives (1992 & 1979 respectively)
Water Framework Directive (2000)
Common Fisheries Policy (CFP - updating in process)
Marine Strategy Framework Directive (MSFD - updating in process)

Mediterranean regional tools and initiatives

Mediterranean Action Plan (UNEP - 1975) and Barcelona Convention (1976)
Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS - 1996)
General Fisheries Commission for the Mediterranean (GFCM - 1949)

The MPAs

The international definitions for MPAs have varied over time. In this report, the definition used is the latest one provided by the IUCN (Dudley, 2008):

«a protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values».

This definition clearly differentiates the sites aimed at conservation from those mainly used for mining; an example would be the fisheries management areas. However, we cannot distinguish the terrestrial areas from the marine ones.

A study jointly undertaken by MedPAN and RAC/SPA and validated by MedPAN's scientific committee has led to adapt this definition: therefore a marine protected area is considered to be «any clearly defined geographical marine area - including sub-tidal, inter-tidal and supratidal or lagoon / coastal lake area which is continuously or temporarily connected to the sea, together with its overlying water - recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values « (Claudet *et al.*, 2011) .

Marine Protected Areas (MPAs) are recognized as the most effective management and conservation tool to manage the unprecedented alteration to marine ecosystems and mitigate its effects as well as using other complementary tools (pollution control, resource management by regulating the access, equipment or authorized periods for example). These are now being increasingly recognized as a fisheries management tool.

MPAs are a shelter for endangered species, prevent the deterioration of habitats and allow the development of natural biological communities. If they are effective, eggs and larvae can be exported, adults and juveniles can re-colonise adjacent areas, replenish fish stocks or restore degraded environments. Protected areas are more resilient and able to withstand stress. Marine reserves or no-take zones, in particular, have proven to be effective with significant increases in density, biomass, size and species richness (Fenberg et al, 2012).

In the Mediterranean, as well as worldwide (Dudley, 2008), the type of protection applied in MPAs is variable and reflects the cultural and political differences between countries. Historically and in the Mediterranean, the areas' classification was mainly motivated by the presence of flagship species and unique characteristics or opportunities rather than a comprehensive ecological approach (Francour *et al.*, 2001 Fraschetti *et al.*, 2002, 2005).

Beyond the traditional planning approach of MPAs as single, independent entities, the CBD now recognises the need to develop a connected ecological network of MPAs to protect the biodiversity of a whole eco-region and its ecosystem services.

A definition of a coherent network of MPAs is "a set of individual MPAs operating cooperatively and in synergy on various spatial scales and with a range of protection levels, to achieve more effectively and completely the environmental objectives than individual sites could alone. The network will also provide social and economic benefits, however these will only be felt once it is fully developed, thus after a long period of time, and as ecosystems recover." (IUCN-WCPA, 2007).

The main criteria for creating a coherent network are: representativity, effectiveness, connectivity, replication and that the MPAs have an appropriate size and structure (see Appendix 1 for a more detailed description of these criteria).

As in the 2008 report, we refer to the network of MPAs according to these criteria, otherwise we refer to a system of MPAs as a term to describe «the grouping of individual MPAs or networks in a multi-institutional framework which is subject to strategic planning and managed coherently « (Notarbartolo di Sciara, 2005)

GAP ANALYSIS AND CONSERVATION PLANNING STUDIES IN THE MEDITERRANEAN

Numerous studies have been done on the representativity of the network of MPAs in the Mediterranean, gap analyses and conservation planning in recent years, impelled by the RAC/SPA (2009, 2010d, 2010e).

In 2010, the UNEP (UNEP-MAP-RAC/SPA, 2010) with the Barcelona Convention Parties' support did a study to propose SPAMIs in open seas using a previous EBSA identification work and basing themselves on the Hoyt and Notarbartolo (2008) study. The elements considered in this study were crucial habitats for cetaceans, monk seals, seabirds, turtles, sharks and the bluefin tuna. Criteria for the identification of the Mediterranean EBSA were proposed using adapted CBD criteria (uniqueness, rarity,...); on this basis, 86 sites were identified and grouped in 12 priority conservation areas (see Fig. 2) and in 10 EBSA (see Fig. 3 and table 1).

At the 16th meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA 16, April 30-May 5, 2012, Montreal), 10 Mediterranean EBSA were presented. These areas are now part of the CBD repository and were submitted to the Contracting Parties for approval at the Conference of Parties in October 2012.

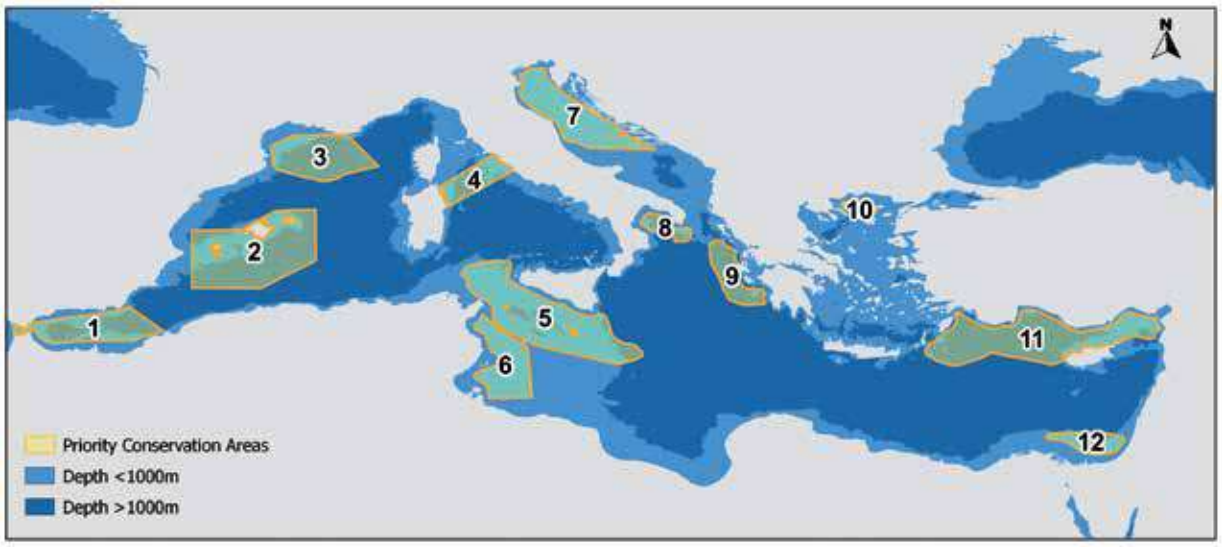


Figure 2: The 12 priority conservation areas identified by the RAC/SPA (UNEP//MAP/RAC/SPA, 2010c):

1. Alboran Sea; 2. Balearic Islands area; 3. Gulf of Lion area; 4. Tyrrhenian Sea; 5. Northern Strait of Sicily (including Adventure bank and surrounding banks); 6. Southern Strait of Sicily; 7. Northern and central Adriatic Sea; 8. Cape Santa Maria di Leuca; 9. North-east region of Ionian Sea; 10. Thracian Sea; 11. North-east Levantine Sea and Rhodes Gyre; 12. Nile Delta region

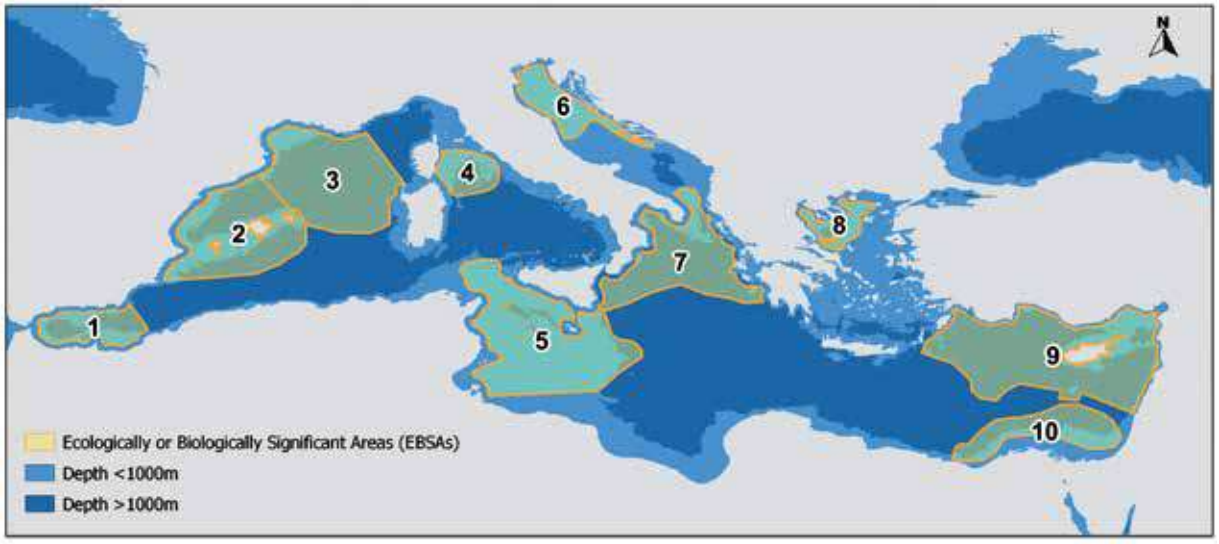


Figure 3: Ecologically or Biologically Significant Areas (EBSAs) identified by the RAC/SPA (UNEP/MAP/RAC/SPA, 2010d), adopted by the CBD:

1. Alboran Sea; 2. Balearic Islands area; 3. Gulf of Lion area; 4. Tyrrhenian Sea; 5. Tunisian Plateau; 6. Adriatic Sea; 7. Ionian Sea; 8. Aegean Sea; 9. Levantine Sea; 10. Nile Delta region

Golf of Sirte © R. Dupuy de la Grandrive22

LIST OF POTENTIAL PROPOSED EBSAs IN THE MEDITERRANEAN		
N°	Ecologically or Biologically Significant Areas	Ecological Value Criteria
A	**Alborán Sea .** The seamounts in this portion of the Alborán Sea support a wide array of marine biodiversity, and the site contains sea bird and cetacean critical habitat. The southwestern portion of the Alborán Sea is highly productive and is also a transit corridor for bird, mammal and fish species travelling between the eastern Atlantic and Mediterranean Sea	Biological diversity Biological productivity Importance for life history Importance for threatened species Vulnerability Uniqueness
B	**Balearic Islands area**. This area of the Western Mediterranean contains seamounts and provides critical spawning habitats for bluefin tuna and critical sea bird and cetacean habitats as well.	Importance for life history Importance for threatened species Vulnerability Uniqueness
C	**Gulf of Lions area .** This highly productive shelf region of the greater Gulf of Lions also contains deep sea canyons that have a high biodiversity significance. The area also shares important cetacean habitats with the contiguous Pelagos Sanctuary, and is probably inhabited by the same cetacean populations that occur in the Sanctuary. It thus represents the natural continuation westward, involving waters off France and Spain, of cetacean conservation measures foreseen in the Pelagos Sanctuary. It is also an important sea bird area.	Biological productivity Importance for life history Importance for threatened species Vulnerability Uniqueness
D	***Pelagos Sanctuary.*** *It is an important productive area, with upwelling phenomenon and diverse key preys for different cetacean species, which manifest in the area with high abundance. It is the most important known ground for fin whales.*	*Biological productivity* *Importance for life history* *Importance for threatened species*
E	**Tyrrhenian Sea.** This area is highly productive, supporting sea bird, marine mammal and shark species.	Biological productivity Importance for life history Importance for threatened species Vulnerability Uniqueness
F	**Tunisian Plateau.** This portion of the south-central Mediterranean contains critical sea bird and cetacean habitats, deep sea corals, seamounts, and highly productive, very shallow offshore banks. The Tunisian Plateau region of the Sicily Strait supports a high productivity and nursery areas for several shark species as well as critical sea bird habitats.	Uniqueness Biological productivity Vulnerability Importance for life history Importance for threatened species
G	**Adriatic Sea.** This portion of the Adriatic has a high natural productivity that supports an extensive food web, including sea birds, loggerhead sea turtles and several shark species. Considering the high level of degradation of the North-western Adriatic Sea, establishing a protected area in this site would require significant marine restoration effort.	Biological productivity Importance for life history Importance for threatened species
H	**Ionian Sea.** This area includes cetacean critical habitats and important nursery areas for several shark species. In addition to supporting a broad array of Mediterranean diversity, this northern extent of the Ionian has significant deep sea coral habitats.	Fragility Naturalness Importance for life history Importance for threatened species
I	**Aegean Sea.** This portion of the Aegean Sea is highly productive and includes key habitats for sea birds, the Mediterranean monk seal and other marine mammals, as well as deep sea coral habitats. This area encompasses the Greek National Marine Park of Alonissos and the Northern Sporades.	Biological productivity Importance for life history Importance for threatened species Uniqueness
J	**Levantine Sea.** This area encompasses important bluefin tuna spawning grounds as well as key marine mammal habitats. This area is the most productive in eastern Mediterranean pelagic waters and is likely to provide critical habitats for both fishery species and marine mammals. In addition, the Eratosthenes Seamount has been identified by the GFCM as a critical fisheries habitat and represents high productivity of pelagic and deepwater species, and rich and diverse benthic fauna.	Importance for life history Importance for threatened species Biological productivity Uniqueness Biological diversity Vulnerability
K	**Nile Delta Region.** This southern portion of the Levantine Sea includes recently discovered cold seeps, as well as important sea turtle - and possibly cetacean - habitats.	Uniqueness Importance for threatened species Importance for life history

Table 1: Description of the 10 Ecologically or Biologically Significant Areas (EBSAs) identified by the RAC/SPA (UNEP/MAP/RAC/SPA, 2010d) and the Pelagos Sanctuary

Figure 4: Important Sea Landscape Areas (ISLAs) (Franzosini *et al.*, 2001)

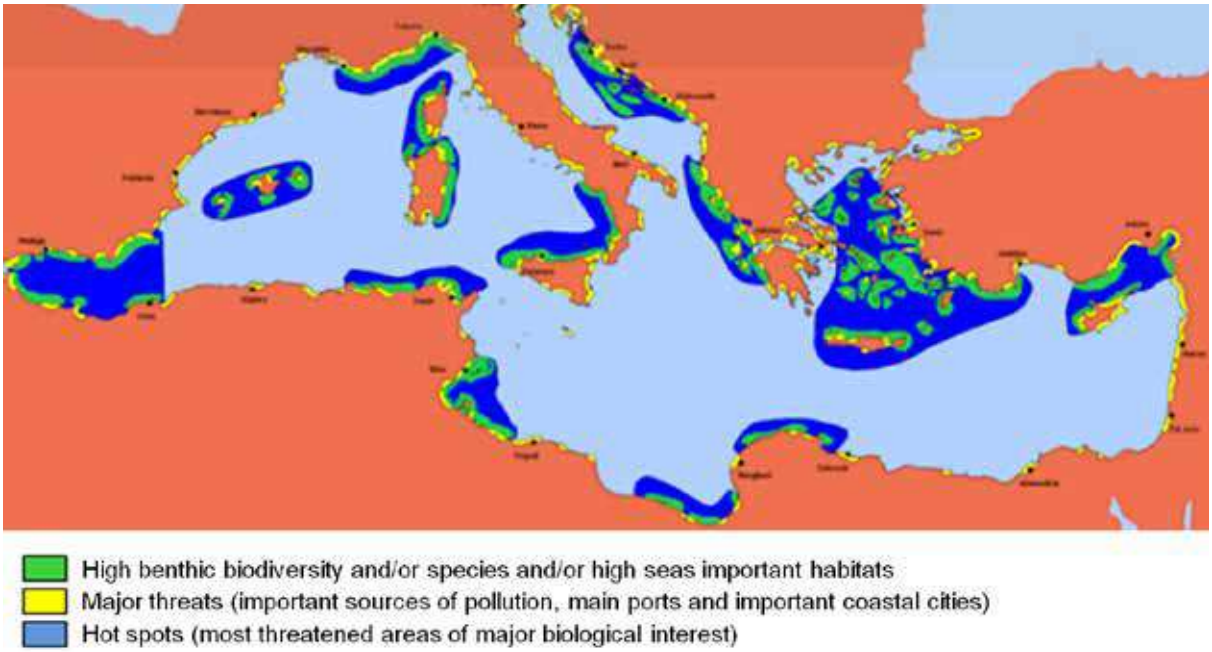


Figure 5: The 13 «key» areas to protect (WWF, 2000)

Numerous other studies which focus more on the open sea give a good overview of the shortcomings of the current system of MPAs and the sites to be protected, which could help to make the system more comprehensive, representative and coherent. We feel it is important to summarise chronologically these studies in this report (see also the Oceana MedNet report).

In 2001, based on an analysis of the complex bathymetric sea bed between 0 and 200 meters in depth, (Franzosini *et al.*, 2001), WWF identified 1921 «ISLAs» (Important Sea Landscape Areas - see Fig. 4) characterized by a steep slope and an important bathymetric variability therefore normally containing a remarkable diversity; these ISLAs represent 6.8% of the coastal sea; 40% of MPAs existing at that time which corresponded to ISLAs. On this basis, the WWF identified 13 key areas for protection (see Fig. 5). This study pointed out that in large areas of the Mediterranean there are gaps on knowledge and a need for biodiversity proxies.

In 2004, Greenpeace, in their «Marine Reserves for the Mediterranean Sea» pointed out the lack of protection in open seas and did identification study for a regional network of marine reserves. This study was based on an analysis of biological diversity and physical oceanographic data linked with a study by experts . The study enabled to determine the most important ecological areas and to select those that could be incorporated to form a regional representative network, ensuring that at least 40% of each type of habitat is included. The prin-

The 13 key areas to protect (WWF, 2000)

1. Alboran Sea (Spain, Morocco, Algeria)
2. Balearic Islands (Spain)
3. Liguro-Provençal coast (France, Italy, Monaco)
4. Corso-Sardinian coast (France, Italy)
5. Southern Tyrrhenian coast (Italy)
6. Dalmatian coast (Croatia)
7. Eastern Ionian coast and islands (Albania, Greece)
8. Aegean Sea and Anatolia coast (Greece, Turkey)
9. Cilician coast (Turkey) and Cyprus Island coast
10. Cyrenaica (Libya)
11. Gulf of Sidra (Libya)
12. Gulf of Gabes (Tunisia)
13. Algero-Tunisian coast (Algeria, Tunisia)

ciples adopted by Greenpeace are the following:

- The network must cover an appropriate part of the marine areas.
- Each type of habitat must be protected and not just rare, unique or still intact sites. Common habitats must not be overlookedas they are often degraded and yet essential for marine species.
- The protected area of each habitat type must include an appropriate part of this habitat, as well as numerous sites.

Following the above principles, Greenpeace proposed 33 open sea marine reserves (see box and Figure 3) covering a large part of the Mediterranean.

In 2008, a study by Hoyt and other contributors established the distribution of crucial habitats for six groups of large marine predators (cetaceans, monk seals, seabirds, turtles, sharks and bluefin tuna) in the Mediterranean, and identified areas where they concentrate, and where MPAs could be established to help their conservation. 15 areas were identified for protection (see Fig. 7).

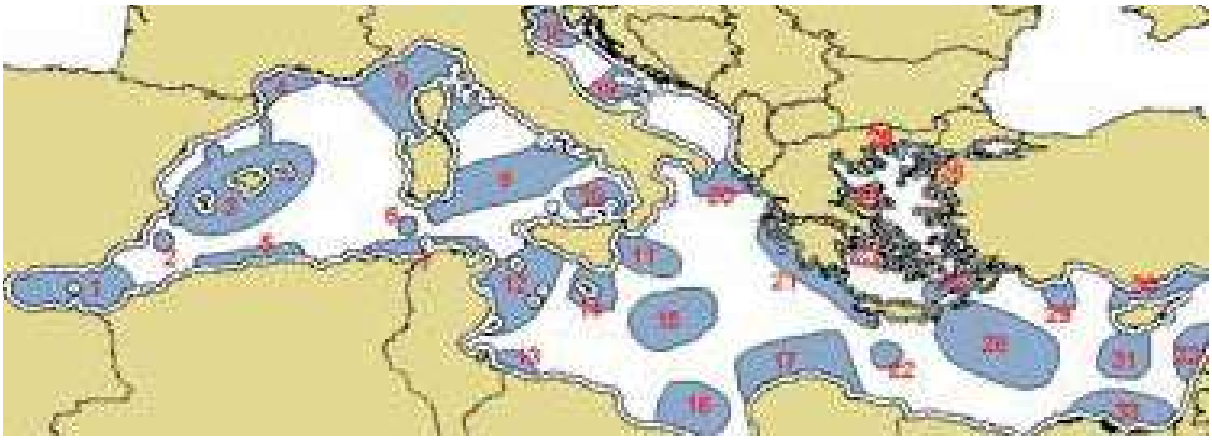


Figure 6: The 33 marine reserves proposed by Greenpeace (2004)

The 33 marine reserves proposed by Greenpeace (2004)

1. Alboran basin
2 et 6 : Seamounts
3. : Balearic Islands
4. Gulf of Lion
5. Algerian Coast
6. Seamounts (see 2)
7. Carthaginian Coast
8. Ligurian Sea
9. Central Tyrrhenian Sea
10/11. Strait of Messina (North and South)
12. Strait of Sicily
13. Tuniso-Libyan coast
14. Malta Escarpment
15. Medina seamounts
16. Gulf of Sidra
17. Cyrenaican Point
18. Northern Adriatic
19. Pomo/Jabuca Trench
20. Heel of Italy
21. Hellenic Trench
22. Olimpi
23. Gulf of Saronikos
24. Sporades
25. Thracian Sea
26. North-East Aegean Sea
27. Between Crete and Turkey.
28. Central Levantine Basin
29. Anaximandre seamounts
30. Strait of Cyprus
31. Eratosthene seamounts
32. Phoenician Coast
33. Nile Deltta

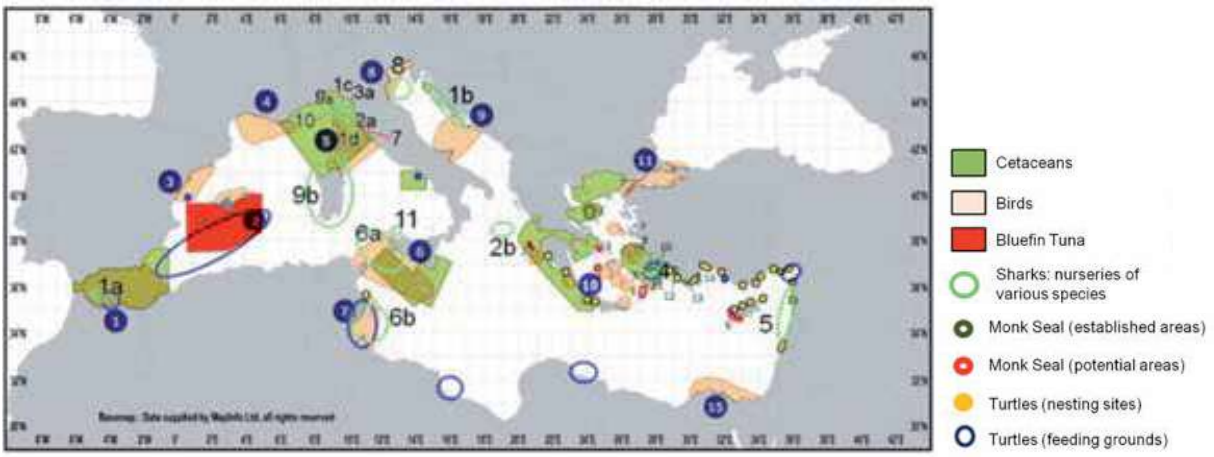


Figure 7: Crucial habitats for cetaceans, monk seals, seabirds, turtles, sharks and bluefin tuna (according to Hoyt and Notarbartolo di Sciara, 2008)

In 2010, the CEPF (Critical Ecosystem Partnership Fund), as part of its Mediterranean Basin Ecosystem Profile strategy, selected several sites (see Fig. 8), based on the WWF proposals (Franzosini et al., 2001)

Figure 8: Key marine and coastal biodiversity areas of the Mediterranean Basin hotspot, identified by the CEPF (CEPF, 2010)
Mauve line: hotspot limits, according to the CEPF

ACCOBAMS in turn, based on the Hoyt and Notarbartolo studies, identified key areas for marine mammals and proposed several large areas to be declared as MPAs (see Fig. 9)

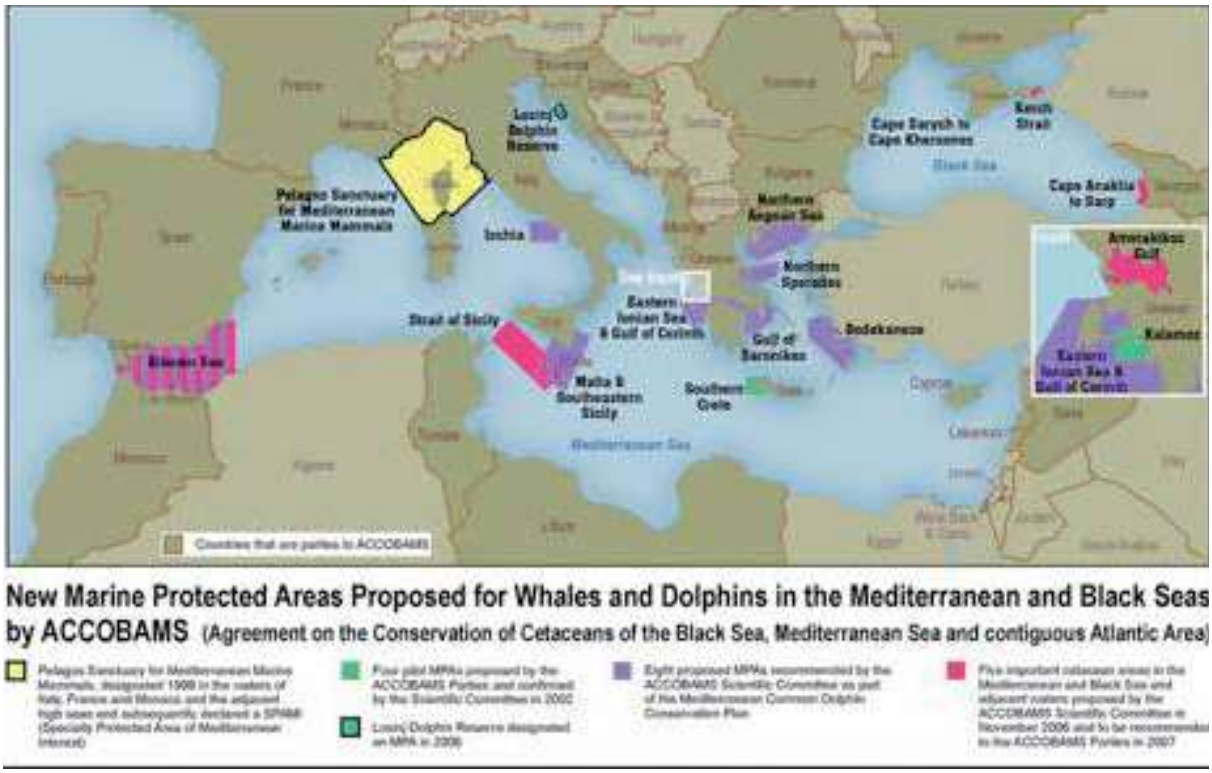


Figure 9: New MPAs proposed for whales and dolphins in the Mediterranean and Black Seas by ACCOBAMS (Notarbartolo di Sciara et al. 2010)

In 2010, the RAC/SPA (UNEP/MAP/RAC/SPA, 2010b) published a study on the protection of vulnerable habitats impacted of fishing in open seas. They identified 14 vulnerable sites, in line with other studies on SPAMIs (see Fig. 10 and Table 2).

				SURFACE
Demersal	Crucial habitats for fish	Adventure and Malta benches	Thracian Sea	7023
		Samothraki et Strymonikos benches	Aegean Sea	116
		Gulf of Lion slope		8087
		Jabuka trench	Central Adriatic	5481
	Sensitive habitats	Cap de Santa Maria di Leuca	Central Adriatic	2183
		The Nile hydrocarbon seeps	Eastern Mediterranean	4374
		Eratosthene seamounts	Eastern Mediterranean	10295
		Alboran Sea seamounts	Western Mediterranean	3626
Pelagic	Crucial habitats for fish	South of the Balearic Islands	Western Mediterranean	84348
		Northern Levantine Sea	Eastern Mediterranean	29992
	Sensitive habitats	Straits of Gibraltar and the Alboran Sea	Western Mediterranean	9000
			Central Mediterranean	97679

Table 2: Vulnerable sites in open seas (UNEP/MAP/RAC/SPA, 2010b

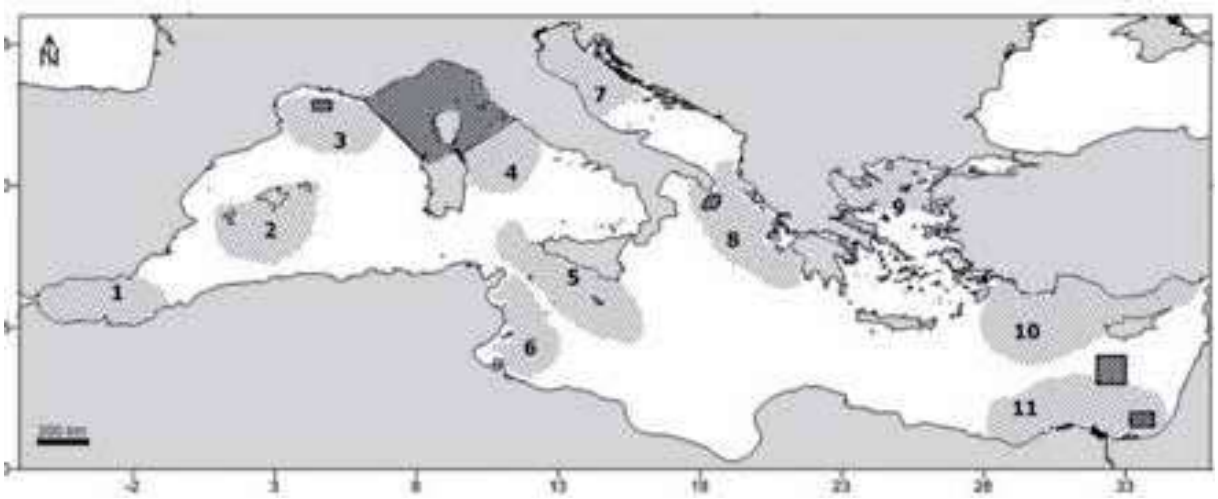


Figure 10: Map of the Mediterranean Sea including the priority sites for protection:

1, Alboran Sea; 2, South of Balearic Islands; 3, Gulf of Lions slope; 4, central Tyrrhenian Sea; 5, Sicily strait; 6, Tunisian plateau; 7, north-central Adriatic Sea; 8, north-central Ionic Sea; 9, north Aegean Sea; 10, north Levantine Sea; 11, Nile hydrothermal area (after Coll *et al.*, 2010; de Juan and Lleonart, 2010; Abdulla *et al.*, 2008; UNEP-MAP RAC/SPA, 2010; IUCN, 2010). The existing GFCM FRAs and the Pelagos sanctuary of cetaceans are delimited by the blackslash polygons

In addition to these studies, the CIESM proposed the creation of Marine Peace Parks (CIESM, 2011 - see Fig. 11):

Middle Atlantic, Pelagian Sea, Herodotus, Eratosthenes, Northern Levantine Sea, Southern Aegean, Southern Adriatic, Northern Ionian Sea

Figure 11: The CIESM Peace Parks

In 2010, Coll in a paper on biodiversity and the Mediterranean's global pressures (Coll *et al.*, 2010), identifed the Mediterranean's hotspots and highlighted the ecological importance of most of the western Mediterranean's plateau (and, in particular, the Straits of Gibraltar and the adjacent Alboran Sea), the western parts of the African coast, the Adriatic and Aegean Seas, which host high concentrations of endangered, threatened or vulnerable species. The Levantine Basin with the invasive species having a severe impact is also at risk (see Fig. 12).

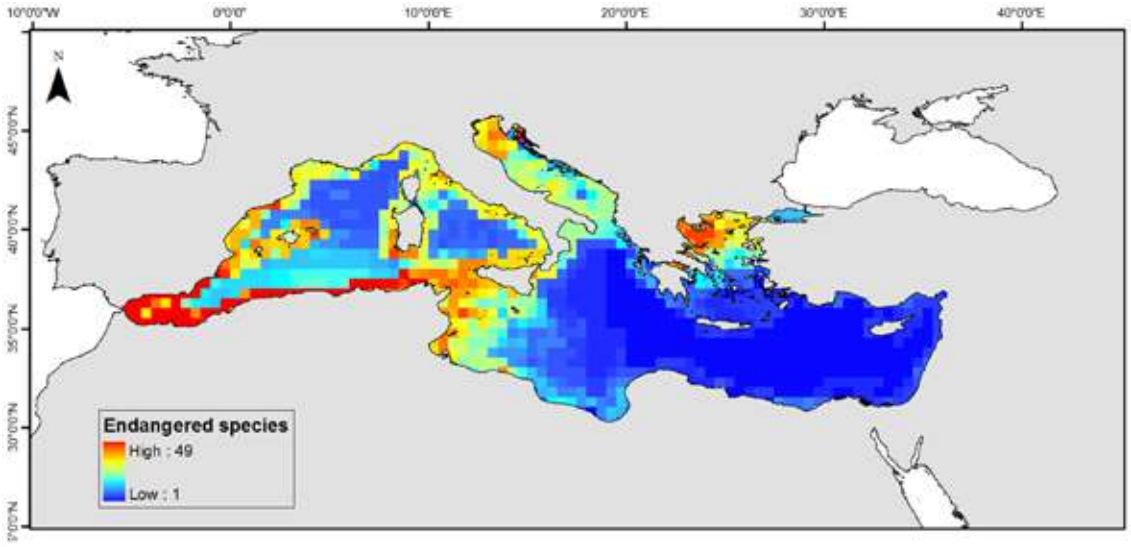


Figure 12: Biodiversity hot-spot for the Mediterranean's marine vertebrates, of conservation interest (Coll *et al.*, 2010), based on the distribution of 110 critically endangered, endangered, vulnerable or near threatened species. The colours expresses its occurrence (blue: low; red: high)

In Coll's further study in 2011, which complements and reinforces the previous (Coll *et al.*, 2011) the distribution of invertebrates, fish, marine mammals, turtles and seabirds was used, and crossed it with the distribution of the pressures. Coll shows that the areas of high marine biodiversity are mainly located along the central and northern Mediterranean coasts and the main areas of seriously threatened biodiversity (hot-spot - overlap 0l50%*) are concentrated in the coastal areas of Spain, Gulf of Lion, North-East of the Ligurian sea, the Adriatic and Aegean Seas, South-eastern Turkey, the surrounding areas of the Nile Delta and in the North-west coast of Africa. The hot-spots (overlap 75%) are limited to six coastal regions of the Mediterranean Sea (East coast of Spain, the South of France, North coast of Tunisia, in northern part of the Adriatic Sea, Ionian Sea and the coastal areas of the West, Northeast and Southeast of the Aegean Sea). This study notes that less than 2% of the priority conservation areas are currently covered by MPAs, this falls to less than 0.2% if we exclude the Pelagos Sanctuary (see Fig. 13).

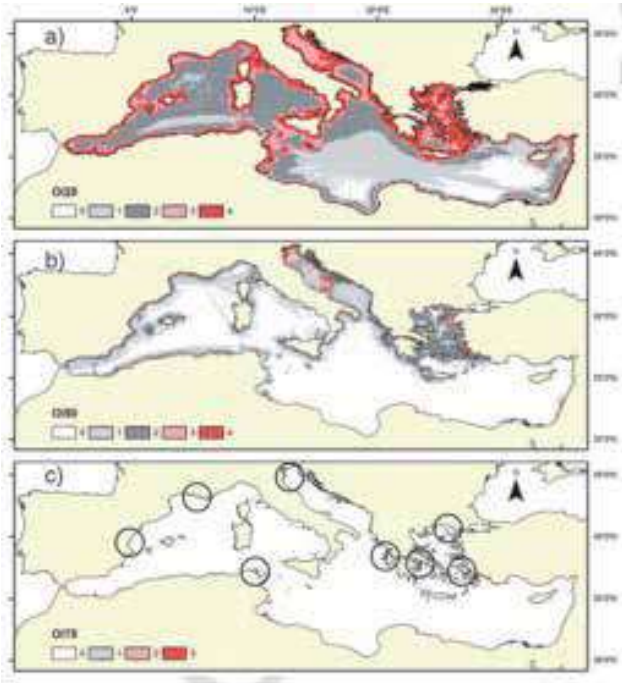
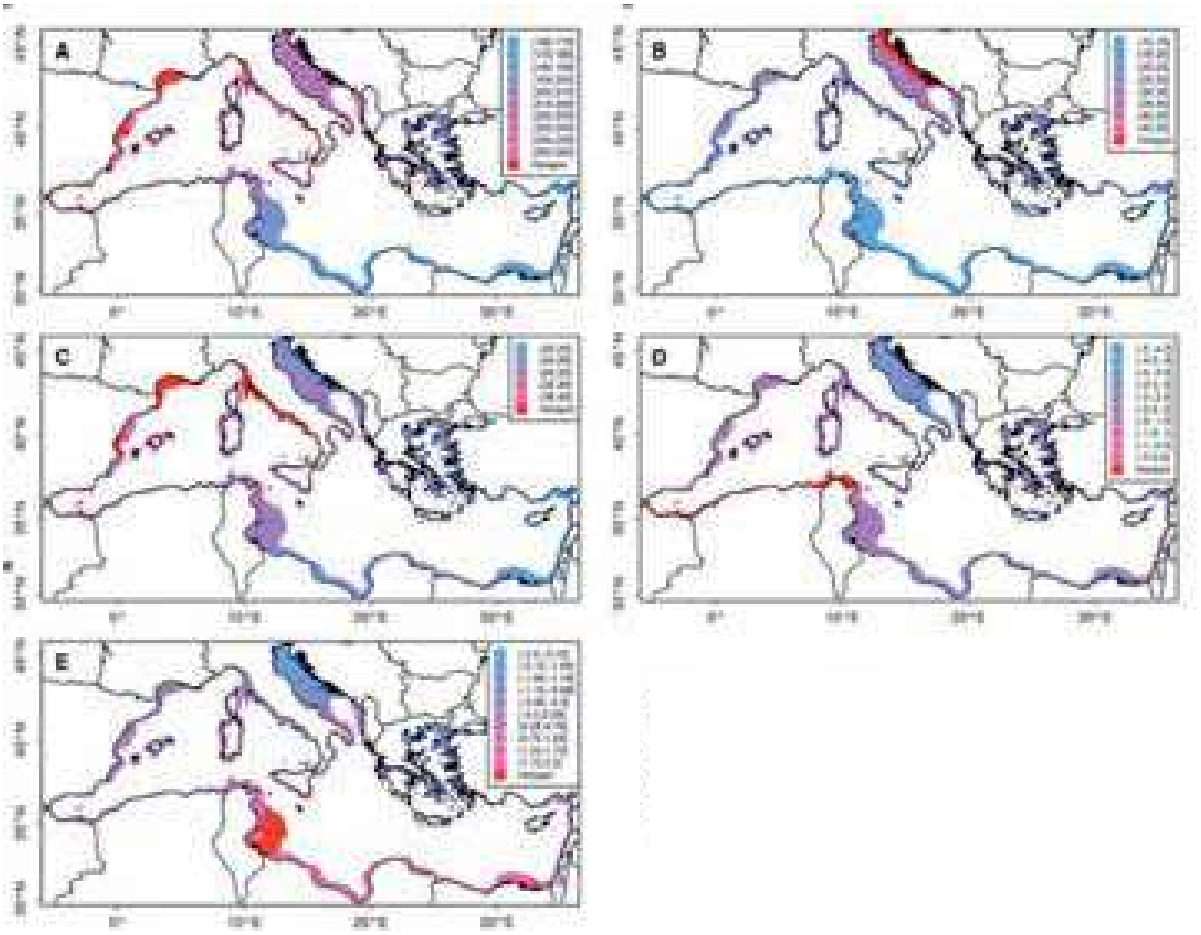


Figure 13: Distribution of areas where biodiversity and pressures overlap (Coll *et al.*, 2011). Overlap index between species diversity and threats: (a) ≥ 25% (b) ≥ 50% (c) ≥ 75%)

* Overlap between biodiversity zones and pressure zones

In 2011, another collective study (Mouillot *et al.,* 2011 - see Fig. 14) on the "Protected and threatened components of fish biodiversity in the Mediterranean Sea" used a biodiversity multi-parameters approach, based on the total specific richness of coastal fish assemblages, the richness of endemic and endangered species as well as the functional and phylogenetic diversity. The study shows that these various diversity components are spatially heterogeneous. It also shows that the Mediterranean MPAs cover many diversity spots, but they do not cover the functional and phylogenetic diversity hot spots which are mainly located in the Gulf of Gabes and along the eastern coast of North Africa where MPAs are sparse (but fishing pressure is low).



A: Total species richness, B: Endemic species richness, C: IUCN species richness, D: Phylogenetic diversity, E: Functional diversity

Figure 14: Distribution gradient for Mediterranean fish, total species richness (A), endemic species richness (B), IUCN status species richness (C), the phylogenetic diversity (D) and functional diversity (E) (Mouillot *et al.,* 2011)

The latest study to date (2011) was done by the Oceana association. After having presented all the previous proposals, as we do here, it says that unlike the previously mentioned initiatives, its study offers a network of specific sites rather than conserving large priority areas; Oceana MedNet aims primarily to protect «underwater elevations» which are biodiversity concentration points, but also a series of oceanographic formations (like vortices) or geological (eg. mud volcanoes) according to the CBD requirements. It suggests dividing the Mediterranean into 31 sections (see Fig. 16).

The in depth analysis of each zone has led, on the basis of various criteria, to the selection of 159 sites, grouped into 100 zones covering 207 100 km² or 8.2% of total area of the Mediterranean (see Fig. 17). The ecological significance of each site is given in detail in their report.

Finally, the IUCN Med-RAS project aims to define a representative and coherent network of managed marine protected areas in the Mediterranean. This network should cover both species, ecosystems, habitats, geological and hydrological features and cultural sites and take into account existing and future threats linked to natural or human activities (http://www .IUCNmed.org / medras /). his project focuses currently on the Alboran Sea (Robles, 2010 - see Fig. 15a) and the coast of Libya. A study has also been done in the Adriatic Sea (Notarbartolo di Sciara *et al.,* 2009 - see Fig. 15b) and the Aegean Sea (Öztürk, 2009).

The present study therefore complements these previous studies from the last inventory made on Mediterranean MPAs.

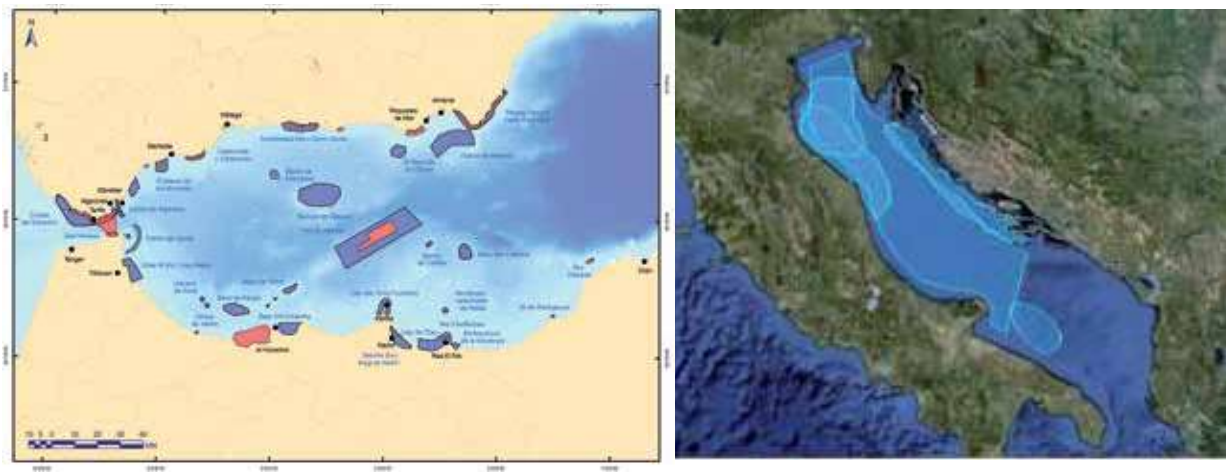


Figure 15: (A - on the left) Important zones in the Alboran Sea (IUCN - Robles, 2010): in red, MPAs and Sites of Community Importance. In blue, new priority areas for marine conservation. (B - on the right) EBSA in the Adriatic Sea (Notarbartolo di Sciara and Agardy, 2009)

Figure 16: Division of the Mediterranean by Oceana as part of Oceana MedNet

Figure 17: The 100 sites selected for the Oceana MedNet network

INITIATIVES UNDERTAKEN BY INTERNATIONAL ORGANISATIONS TO HELP MEDITERRANEAN COUNTRIES DEVELOP MPAS AND IMPROVE THEIR MANAGEMENT

MEDPAN INTERREG programme : creation of the MedPAN Organisation

Further to a feasibility study carried out in 2003, MedPAN activities started again with a three-year project (2005 – 2007) financed by the INTERREG IIIC South zone Initiative. The Network was fully dedicated to Marine Protected Areas.

The project brought together 23 partners from 11 countries around the shores of the Mediterranean, including 14 European partners from France, Italy, Greece, Spain, Malta, Slovenia and 9 non-European partners from Morocco, Tunisia, Algeria, Croatia and Turkey. Additional funding from the IUCN allowed participants from Lebanon, Libya and Egypt to be associated to the project. Together, they managed more than 20 marine protected areas and worked on the functional and regulatory supervision of several new sites.

The project helped organize several workshops each year on management issues common to all marine protected areas, such as management planning, management of fisheries and tourism, habitat management or financing of marine protected areas.

It also funded the studies and the production of methodological tools and communication tools to assist managers in their daily work and to establish the first global database of marine protected areas in the Mediterranean.

During the 5th Steering Committee of the INTERREG project, the partners expressed their will to see MedPAN activities being carried on after the end of the INTERREG IIIC project. A feasibility study was then carried out in August 2007 to provide an institutional framework to the MedPAN Network.

Together, the Network of Marine Protected Areas' Managers in the Mediterranean - MedPAN, Port-Cros National Park and WWF-France – coordinator of the Network – organized from 24th to 27th October 2007, on Porquerolles Island (France), the 1st Conference of the Marine Protected Areas Network in the Mediterranean, in close partnership with the RAC/SPA and the IUCN-Med. A statement was drawn up by the participants during this conference.

At the end of 2008, under the technical coordination of WWF-France and with the support of 9 founding members, a legally independent structure was created under French Law with an international governance.

In 2009, a 2010-2012 action strategy was developed. At the end of 2009, the Executive Secretariat of the Organisation was established in Hyeres (France) and the first General Assembly was organized. In 2012, the Organisation brings together more than 60 members and partners.

A 2013-2017 strategy is currently under development for the MedPAN network.

www.medpan.org

The MedPartnership: MedPAN South Project and MedMPAnet Project

The GEF "Large Marine Ecosystem Partnership" programme includes 4 components of which one relates to the "Conservation of Biological Diversity: implementation of the Strategic Action Plan and related National Action Plans". This component specifically addresses the decline of biodiversity and fisheries in the Mediterranean ***www.themedpartnership.org***

Component 3.1 is implemented through two complementary projects, the MedMPAnet project led by the RAC/SPA and the MedPAN South project led by WWF MedPO and through an economic assessment of the benefits of marine protected areas led by Blue Plan.

The MedMPAnet Project led by the Regional Activity Center for Specially Protected Areas (RAC/SPA) includes 12 countries of the Southern and Eastern Mediterranean: Albania, Algeria, Croatia, Egypt, Lebanon, Libya, Montenegro, Morocco, Syria, Tunisia and Turkey. It is a 60-month project during which a set of activities will be implemented around 4 main categories:

- Pilot projects on the identification and planning of new MPAs and proposals for financial sustainability mechanisms in Albania, Croatia, Libya, Tunisia and Montenegro;
- Establishment of priority activities to create MPAs, identification of stakeholders and potential partnerships required and characterization of marine sites suitable to become MPAs;
- Experience-sharing and capacity-building to improve the management of new/existing MPAs in the Eastern and Southern part of the Mediterranean;
- Communication on the project outcomes and achievements, and public awareness-raising.

medmpanet.rac-spa.org

The MedPAN South Project, led by WWF Mediterranean, also targets the same 12 countries and is currently being deployed with:

- Pilot projects aimed at strengthening MPA management efficiency in 5 countries, Algeria, Croatia, Libya, Tunisia and Turkey,
- and a regional capacity-building programme in support of the MedPAN Network. As part of this capacity-building programme, regional training workshops are organized each year during which the MPA managers of each country identify fields of interest and accordingly develop specific projects to be implemented in their country after the training.

www.panda.org/msp

The Blue Plan also implements a study which aims at evaluating economic impacts of MPAs on territorial socioeconomic development. The evaluation makes the connection between the costs and benefits from MPAs, on a mid-term scale, in order to highlight the impact of areas and biodiversity conservation on development process. Several pilot areas are identified with the support of other partners of the Component 3.1.

The MedPAN North Project

The MedPAN North Project was approved at the end of April 2010 by the European Union Programme Med funding line. It is led by WWF France in partnership with MedPAN, and gathers 12 partners from 6 European Mediterranean countries (Spain, Greece, France, Italy, Malta, and Slovenia). It is a three-year project (2010-2013) aimed at improving MPA management efficiency in these countries (including Marine Natura 2000 sites) through 5 components: innovative aspects of MPA management, sustainable fisheries management in the MPAs, sustainable tourism management in the MPAs, information, communication and capitalization, project management.

www.medpannorth.org

The PIM initiative: Mediterranean Small Islands Initiative

The Mediterranean Small Islands Initiative - for the promotion and assistance in the management of the small islands of the Mediterranean Sea - coordinated by the French Coastal Protection Agency, contributes to the protection of these microcosms by setting-up practical measures for conservation management, and by facilitating the exchange of information and experience between the site managers and experts from across the Mediterranean Basin.

The Mediterranean Small Islands Initiative is based on the exchange and sharing of knowledge. Its aim is to set-up an effective and practical management structure for microcosms, achieved through scientific and technical missions in the field, with the ultimate objective of developing resource protection projects.

The initiative intends to operate over the long-term rather than getting into a project logic. Indeed, although the initiative aims at facilitating interactions among managers, scientists and experts in natural resources and biodiversity conservation, its main objective is to set up programmes of field research, to experiment and to innovate. Here, priority is given to concrete, simple and pragmatic proposals.

Rangers, technicians, scientists, naturalists, representatives of organisations and administrations will meet together for a common purpose: to promote the protection of the small islands of the Mediterranean Sea and set up effective schemes that will have a real impact on their endemic ecosystems and the local populations.

www.initiative-pim.org

IUCN-Med marine programme

The Marine Programme of the IUCN Centre for Mediterranean Cooperation (IUCN-Med) is involved in a number of pragmatic initiatives to preserve and restore the biological integrity of the Mediterranean Sea, as well as to foster the sustainable development of the region.

www.IUCNmed.org

Identifying Priority Representative Areas and Species in the Mediterranean Sea to Conserve: Med-RAS (2009-2010)

The Med-RAS project is a joint initiative between the IUCN Mediterranean Marine and Species Programmes. The aim of Med-RAS is to identify priority habitats and species to be managed and protected in the Mediterranean Sea. This is achieved by defining a science-based standardized methodology to identify and map important ecological and biodiversity areas for establishing a coherent and representative network of Mediterranean Marine Protected Areas.

www.IUCNmed.org/medras

Continuation of Med-RAS project: Nereus project (2011-2014):

www.iucn.org/fr/propos/union/secretariat/bureaux/iucnmed/projets_IUCN_med/?9106/NEREUS

Scientific monitoring in the Special Environmental Protection Area of Kaş-Kekova, Turkey © WWF Turkey

CHAPTER 2

Data and MAPAMED, the Mediterranean MPA database

Data sources on MPAs and the MAPAMED database

An important inventory work on Mediterranean MPAs was undertaken by MedPAN and RAC/SPA, also collecting a full array of data. The data resulting from this work was used to create the MAPAMED database which was developed in 2011-2012. This online database stems from the need to have an ever evolving tool to collect and organize all this Mediterranean MPAs data and then make it available for everyone to use and search in MAPAMED's main objectives are:

- to enable an analysis and assessment of the status and trends of the Mediterranean network of MPAs according to international targets
- to promote access to data on Mediterranean MPAs (and updating)
- to identify ecological and management issues on a supra-MPA level.

MPA IDENTIFICATION AND MANAGEMENT DATA COLLECTION QUESTIONNAIRE

Identification of Mediterranean MPAs

The MPAs included in MAPAMED were selected based on a MedPAN/RAC/SPA study (Claudet *et al.,* 2011) which identified the sites to be considered as MPAs and their selection criteria (see Box "Definitions and Criteria for the MAPAMED MPA selection"). The MedPAN association's Scientific Committee was consulted on the content of this study which was then validated by the MAPAMED database's steering committee.

Definitions and Criteria for the MAPAMED MPA selection

MAPAMED's MPAs:

The criteria for the inclusion of MPAs in MAPAMED are based on the IUCN definition of a MPA (Dudley, 2008) and adapted by Claudet *et al.* (2011). The MPAs considered are:

«Any clearly defined geographical marine area - including sub-tidal, inter-tidal and supratidal or lagoon / coastal lake area which is continuously or temporarily connected to the sea, together with its overlying water - recognized, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values»

The MPAs selection criteria for MAPAMED are based on:

- The nature of the site
- The site's compliance to the definition of a protected area and the definition of a marine protected area
- The MPAs objectives (IUCN category)
- Type of protection
- Other criteria (management, temporal dimension, vertical zoning ...)

The criteria defined for MAPAMED are wider than those in the 2008 study and include in particular:

- The supratidal level (includes nesting beaches for marine turtles)
- The lagoons/coastal lakes which are temporarily or permanently connected to the sea
- Sites without a legal protection framework

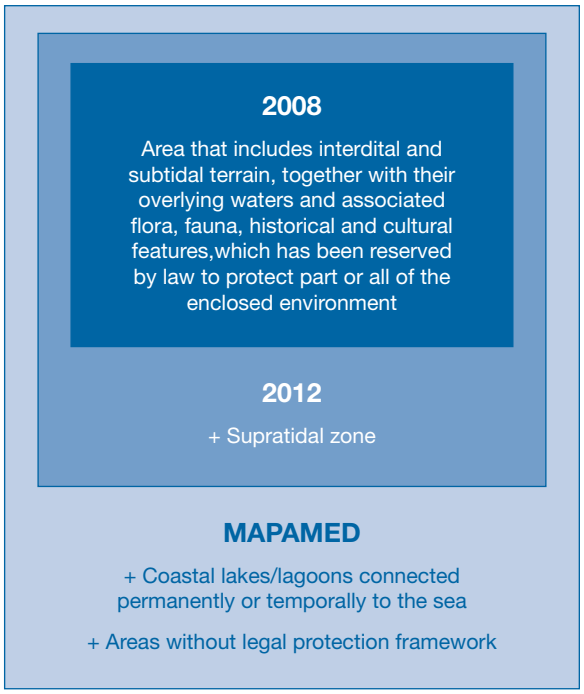
The selection criteria for the 2012 MPA study:

Although all the sites which meet these new criteria are intended to be eventually incorporated into the database and an extensive inventory being in progress, it was decided to exclude the following from this study's analysis:

- The lagoons/coastal lakes which are temporarily or permanently connected to
- Sites with no legal basis.

A total of 161 MPAs with a national designation were identified. This figure does not include lagoons/coastal lakes which are temporarily or permanently connected to the sea, even if they have a strong ecological link with the sea. For time reasons, they could not be comprehensively identified (see Box ''Comparison of figures between the 2008 study and the current 2012 study''). However, the coastal protected areas which include sea turtles nesting beaches have been taken into account.

The Natura 2000 sites at sea were taken from the «European Environment Agency Natura 2000 database, using their field "habitatCode" (version End 2010). This field corresponds to general habitat classes, and its values are numbered N01 (sea, sea inlets) to N27 (agricultural habitats, general). Only Mediterranean sites with a marine component (N01) were retained. Thus, the marine surface area of the Natura 2000 sites selected was calculated by intersecting the perimeter of these sites with the Global Self-consistent, Hierarchical, High-resolution Shoreline provided by the NOAA's online NGDC (National Geophysical Data Center) ((rimmer.ngdc.noaa.gov).



Comparison of figures between the 2008 study and the current 2012 study:			
	2008	2012	
		MPA with national designation	Natura 2000
Number of MPAs identified	94	161	507
Number of MPAs where the questionnaire was sent	85	148*	14**
Number of MPAs for which the questionnaire was completed and analyzed (response rate)	62 (72.9%)	71 (48,0%)	9 (64,3%)

Table 3 : Comparison of figures between the 2008 study and the current 2012 study

***: Difficult to assess because sometimes a) Several contacts for one MPA, or b) Only one contact for several MPAs.**
****: The difficulty of identifying a management structure for the Natura 2000 sites explains the low proportion of Natura 2000 sites contacted to complete the questionnaire**

MPA Data collection

The inventory made on MPAs allowed us to gather two sets of data which was used to characterize them:

- spatial data associated to so-called «basic» attributes,
- so-called «specific» attributes.

The MPAs spatial inventory and basic attributes

Spatial data collected corresponded to polygon (s), or failing that, to point (s) (geographic coordinates) representing the perimeter (or location) of the MPA. For time reasons, it was not possible to collect spatial data on MPA zoning. «Basic» attributes were collected at the same time giving general information on the MPAs (name, designation, total area ...) to establish their identity card. These basic attributes, shown in Table 4, are based on the UNEP-WCMC (2010) data standards in order to facilitate sharing the protected areas data on an international scale.

Ain El Ghazella, Libya © F. Maamouri - WWF Mediterranean

Champ	Name	Definition
NAME	Name	The official name of the protected area provided in Latin characters.
ORIG_NAME	Original Name	The original name of the protected area in any character set supported by UTF 8.
COUNTRY	Country	Country where the protected area is located, as given by its ISO 3166-1 alpha-3 code.
DESIG	Designation	The type of protected area as legally/officially established or recognised (e.g. national park, biosphere reserve). If one site has several designation, please create one record for each designation.
DESIG_ENG	Designation in English	The protected area's label as defined officially and legally in the country, translated into English if possible.
DESIG_TYPE	Type of designation	Please enter "National" if you provide data for a national site and "International" if you provide data for an internationally recognized protected area (Biosphere Reserve, Ramsar, SPAMI ...).
IUCNCAT	IUCN Category	For this field, please indicate the IUCN category in which the protected area falls (Ia, Ib, II, III, IV, V or VI). International Protected Areas, please indicate "Not applicable".
MARINE	Nature of site	For this field, please indicate if the protected area is: • Strictly marine, • Partly marine, • Coastal (without marine part).
REP_M_AREA	Reported marine area	Official marine surface area of site in km².
REP_AREA	Reported area	Official surface area of site in km².
STATUS	Status	Current legal or official standing of the site (e.g. proposed, designated).
STATUS_YR	Status Year	Year in which this status was established.

Table 4: List of MPAs basic attributes adapted from the WDPA « Core Attributes « (UNEP-WCMC, 2010)

This spatial data was used for the following studies: the MPA network's general characteristics, the level of protection of legally established MPAs, the representativity and connectivity of the network.

An initial collection of spatial data and their basic attributes was carried out in order to compare and merge existing data from major international databases such as WDPA (World Database of Protected Areas) or the CDDA (European database - Common Database on Designated Areas) as well as national databases. This collected information was then sent to the National Focal Points for Specially Protected Areas (SPA) and MedPAN's national contacts to be verified, updated, corrected and possibly completed.

However, for certain MPAs there was no international or national data available. So it was collected directly from the relevant MPA managers. A lot of information was also collected through:

- grey literature,
- websites,
- laws and other legal texts,
- international organisations reports,
- maps,
- the MPAs communication tools (flyers, brochures ...).

The information on the processing of geographic data, namely the tools (ARCGIS 10, Marine Geospatial Ecology Tools) and projections (Lambert Azimuthal Equivalent Area) used, the coastline and the spatial units of reference adopted in the case of an overlapping between MPAs are specified in Appendix 8.

The managers survey and specific attributes

The specific attributes supplement the basic ones with more detailed information on the MPAs, especially on the following points:

- MPA's general characteristics,
- Governance,
- Objectives and Management Plan,
- Personnel, equipment and budget,
- Uses and pressures,
- Regulation,
- Studies and monitoring,
- Habitats and species[1],
- Education and awareness raising.

1. Habitats : Habitats: based on the Interpretation Manual of marine habitat types to select sites to be included in national inventories of natural sites of interest for conservation «(UNEP-MAP-RAC/SPA, 2007) Species: based on the list of species annexes II and III of ASP/DB Protocol.

The management analysis was based on this information which was collected from an online questionnaire of 70 questions (also available in a Word version) inspired from the one used to produce the first inventory in 2008 on MPAs in the Mediterranean. This survey questionnaire was sent directly to MPA managers where possible and is presented in Appendix 2. In the absence of a management organisation, the authority in charge of the MPA or scientists working there were asked to fill it in (for certain MPAs in Israel, Turkey and Slovenia for example). Thus, 187 people were contacted during 2011 and early 2012, covering 162 MPAs (including 14 Natura 2000 sites at sea). A total of 109 questionnaires were completed from the 162 sites. However, only 80 out of the 109 completed questionnaires could be used for this study's analyses.

Indeed, some questionnaires had to be set aside for future analyses as they still need to be completed. For example, the MPAs in Turkey and Israel only filled in one questionnaire for several MPAs because their network approach is centralized and also their network of MPAs management is being developed. As this approach does not adequately reflect the current reality of individual MPAs and could induce a bias in the analysis, their answers have been kept for further studies and once additional information is given. The same decision was taken regarding Libyan MPAs: indeed, the responses are still incomplete both because of the fact that Libyan MPAs have been designated recently and have no established management structure yet, and because of the events that shook this country at the time of data collection.

MAPAMED, THE MPA DATABASE'S ACCESS AND INTERFACE

All of this data has been incorporated into the MAPAMED database. This online database allows all users to view the Mediterranean network of MPAs through a map interface and access detailed information for each referenced MPA.

One can research the database either by navigating directly in the map interface or through an advanced search panel that allows to combine several criteria (country, designation, type of site ...). The search results can be displayed as a map or as a list (see Box "MAPAMED – Database Interface").

Access to the database is available for MPA managers so that they can update directly the information on their MPA.

The box below shows the proposed MAPAMED interface for users.

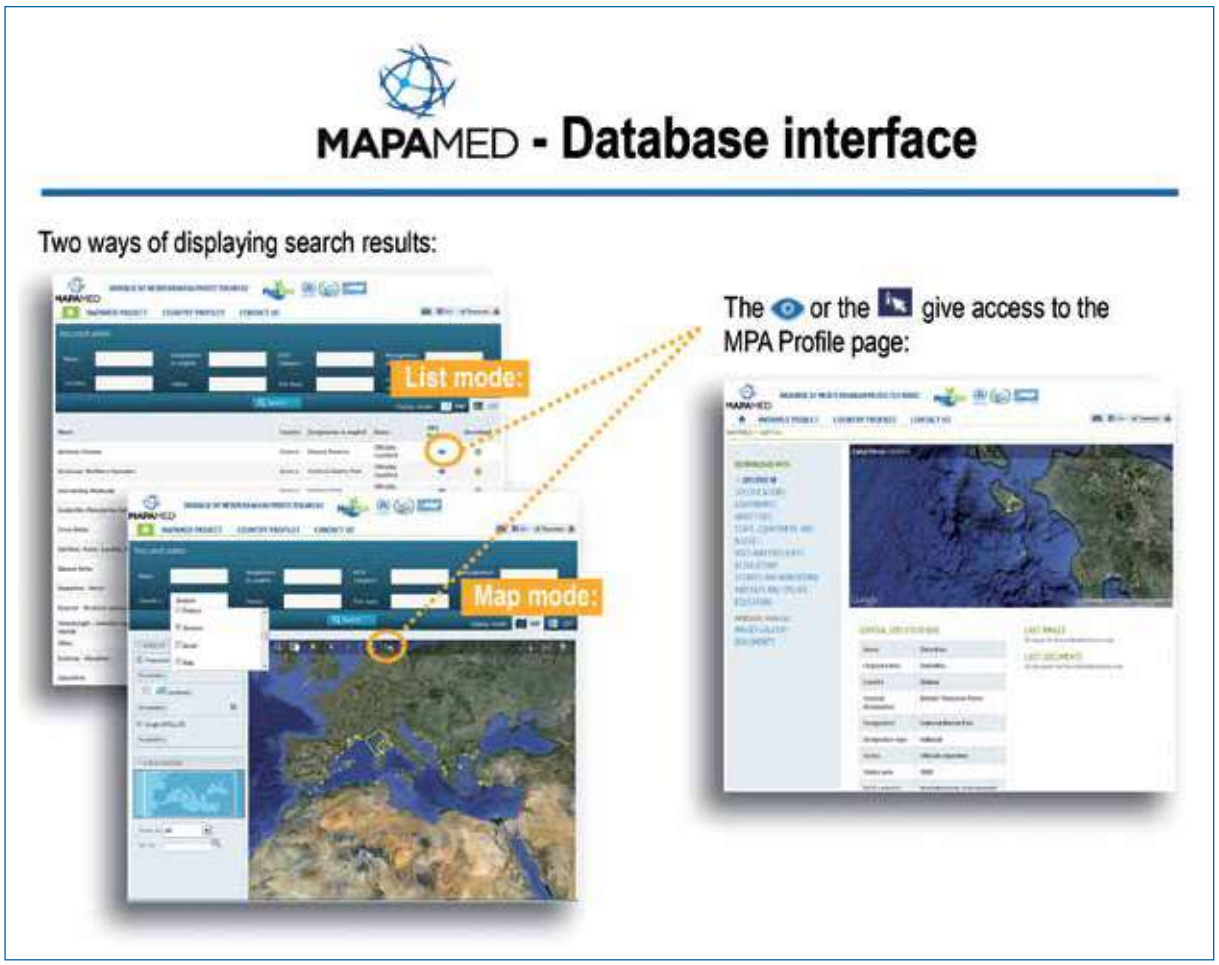


Figure 18: MAPAMED interface

Considerations regarding MPA designations

There is a wide range of Mediterranean designations referring to MPAs. No less than 26 different designations were identified. Among the most common are the following:

- Marine Protected Area,
- Nature Reserve
- National Park,
- Marine Reserve,
- Nature Park.

Some of these designations are country specific: Special Environmental Protection Areas, SEPAs in Turkey, Maritime Public Domaine (MPD) is attributed to the Coastal Protection Agency in France, or specific to an administrative subdivision (Pla d'Espais d'Interès Natural in Catalonia).

These international designations are in addition to these 26 designations (which often overlap)[2]:

- SPAMIs
- Biosphere Reserves
- World Heritage Sites
- Ramsar sites
- Natura 2000 sites (EU only)

Such a variety of designations reflects a lack of standardization on a national and regional level, especially as from one country to another, depending on the language used,the same designation does not necessarily correspond to the same level of protection.

The IUCN designations aims to rationalize the different designation and MPA statuses, but our doubts on the IUCN classification of the inventoried MPAs led us to develop analyses on both the IUCN categories and the national designations. As there were so many different designations, it was essential to improve the legibility by classifying the MPAs into four broad groups, according to their designation. This is therefore not a new MPA categorization, but only a rational grouping of the 26 different MPA designations for the purposes of this analysis. The grouping is as follows:

- The group A «Park « type includes the following labels: Marine Protected Area; Marine National Park or National Marine Park; Marine Park; National park; Natural Marine Park; Natural Park; Nature park; Underwater Park; Protected Ecological Park
- The group B « Reserve» type, with a stricter protection includes: Marine Nature Reserve; Marine (/coastal) Reserve; Special Reserve; Nature Reserve; Regional Nature Reserve; National Hunting Refuge; Biotope Protection Order; Nature Protectorate
- The group C « Landscape Park» type includes: Landscape park; Natural Landscape; Natural Monument
- The group D includes country specific labels:
  - D1: the Spanish "Pla d'Espais d'Interès Natural" (Plan for Areas of Natural Interest) and
  - D2: the MPD (maritime public domain) of Conservatoire du Littoral (Coastal Protection Agency).

IUCN categories

The IUCN's (Dudley, 2008) proposed classification system of protected areas allows to compare the protected areas through a universal reference system, according to their conservation and management objectives (categories I to VI – see Appendix 3). It was essential to categorize and group MPAs for the analysis, therefore, if the IUCN category was not stated by the manager, we assigned an IUCN category according to each MPA management's objectives set forth in their creation decree or in the sample group's responses to the survey. We did not assign an IUCN category to the Natura 2000 sites (probably class VI). This more or less arbitrary designation which was made for the purposes of this study should be reviewed with the managers and the relevant authorities by using the latest IUCN guidelines aimed specifically at MPAs (Day *et al.*, 2012).

2. Let us also include, the areas which are important for bird conservation (IBA), although these do not have a protected statute.

Scope of the study, geographical and scale considerations

All the analyses were made on three scales: the overall Mediterranean scale, the ecological eco-region scale in order to ensure that each is well represented in the network, and on a country scale[3]. Several bio-regionalisation works Pérès, 1972; Spalding *et al.,* 2007) have already been done to specify the ecoregions of the Mediterranean (ecological regions with homogeneous oceanographic and biological characteristics). In this work, we have used the Notarbartolo di Sciara and Agardy (2010) eco-regions, through their work on the Mediterranean EBSA which was more relevant, especially as they identify the East Sardinian and North Sicilian areas which have different ecological characteristics to the rest of the North West Mediterranean basin (depths, currents, habitats) (UNEP-MAC-RAC/SPA, 2010d) (Tsee Table 5 and Fig 19).

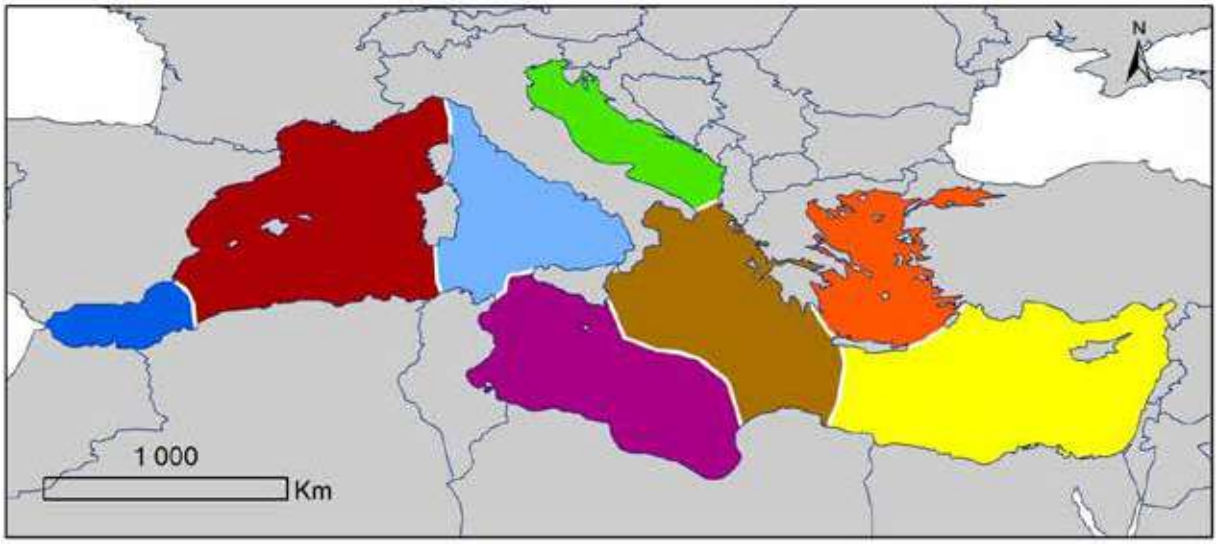


Figure 19: The ecoregions according to Nortarbartolo di Sciara and Agardy (UNEP-MAP-RAC/SPA, 2010)

Ecoregions

- Adriatic Sea
- Aegean Sea
- Alboran Sea
- Algerian-Provencal basin
- Ionian Sea
- Levantine Sea
- Tunisian Plateau/Gulfe of Sirte
- Tyrrhenian Sea

Spalding *et al.* (2007)	Marine Strategy Directive	Notarbartolo and Agardy (2010)
1. Alborán Sea	1. Western Mediterranean Sea	1. Alborán Sea
2. Western Mediterranean Sea		2. Algerian-Provencal Basin
		3. Tyrrhenian Sea
3. Adriatic Sea	2. Adriatic Sea	4. Adriatic Sea
4. Ionian Sea	3. Ionian Sea and Central Mediterranean Sea	5. Ionian Sea
5. Tunisian Plateau – Gulf of Sidra		6. Tunisian Plateau – Gulf of Sidra
6. Aegean Sea	4. Aegean – Levantine Sea	7. Aegean Sea
7. Levantine Sea		8. Levantine Sea

Table 5: A comparison of the various classifications of the Mediterranean (UNEP-MAP-RAC/SPA, 2010d)

3. Gibraltar and Gaza, who are not contracting parties to the Barcelona Convention, have not been taken into account for this study.

The scope of the study covers all the Mediterranean countries who are contracting parties to the Barcelona Convention, namely 21 countries. These countries were grouped according to the Mediterranean's major regions, like in 2008, i.e. the north-west, North-West, North-East and South regions; the latter includes the countries on the eastern shore of the basin and the African shores (see Table 6 and Fig. 2).

This report also refers to countries which are members of the European Union (EU), especially for the Natura 2000 sites at sea. Seven countries in the region are members of the European Union (see in bold in Table 6 and Fig. 20) and five are in the process of joining (europa.eu/about-eu/countries/index_en.htm).

Regions	Country	Abbreviation (ISO 3166-1 alpha 3 code)
North-West	France	FRA
	Italy	ITA
	Malta	MLT
	Monaco	MCO
	Spain	ESP
North-East	Albania	ALB
	Bosnia-Herzegovina	BIH
	Croatia	HRV
	Cyprus	CYP
	Greece	GRC
	Montenegro	MNE
	Slovenia	SVN
South	Algeria	DZA
	Egypt	EGY
	Israel	ISR
	Lebanon	LBN
	Libya	LBY
	Morocco	MAR
	Syria	SYR
	Tunisia	TUN
	Turkey	TUR

Table 6: Countries considered in this study (in bold: member countries of the EU)

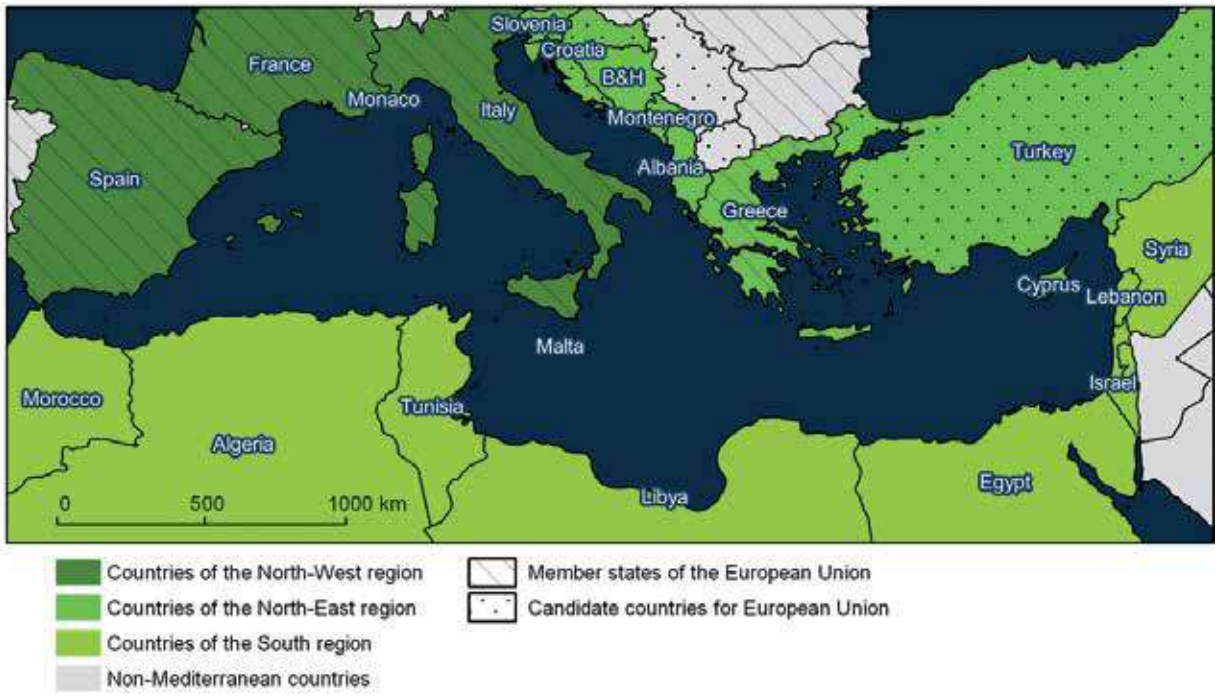


Figure 20: The Mediterranean countries in the study

Brijuni National Park, Croatia © Brijuni National Park

Torre Guaceto Marine Protected Area, Italy © TGMPA

CHAPTER 3

MPAs characterictics and level of protection

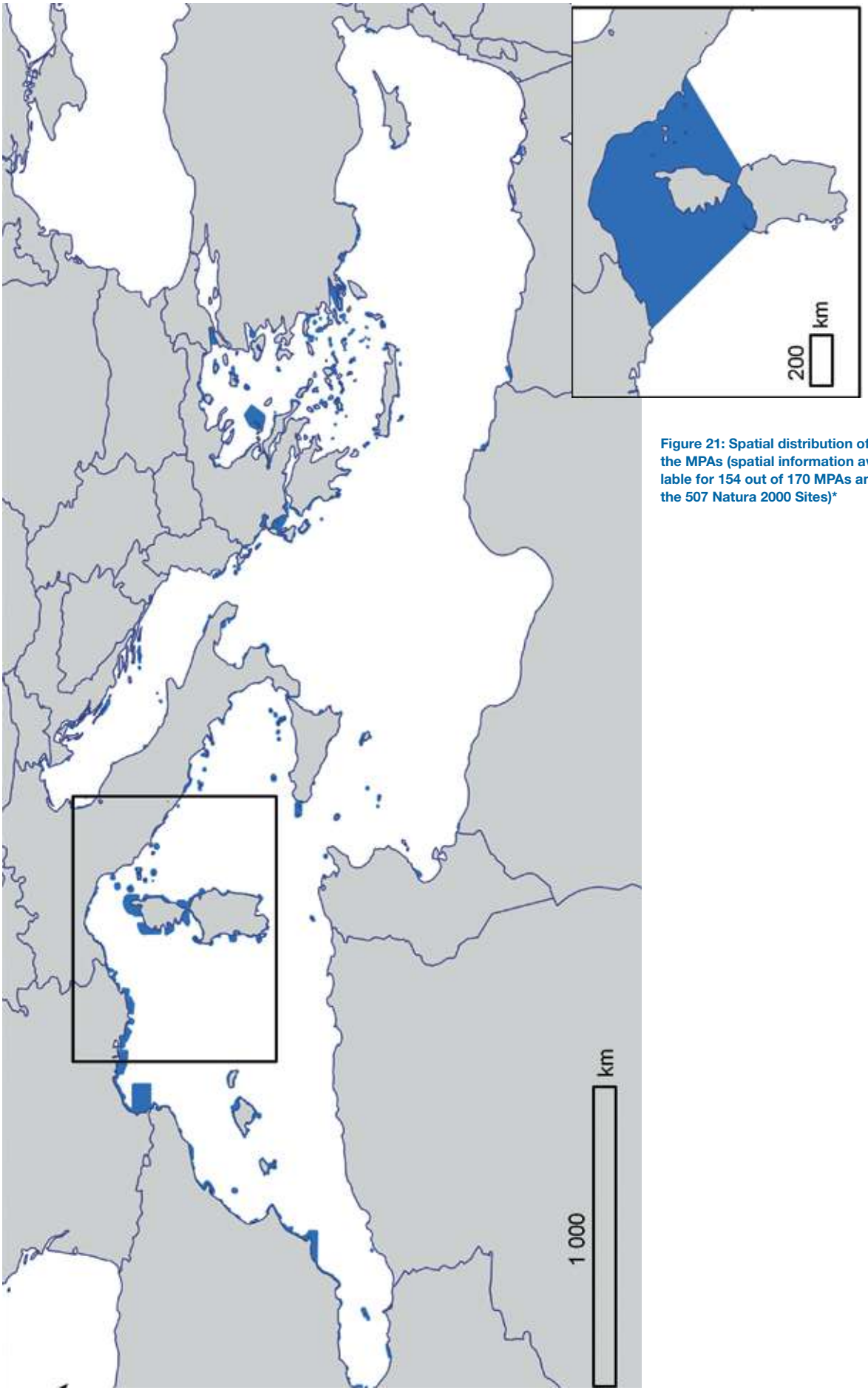


Figure 21: Spatial distribution of all the MPAs (spatial information available for 154 out of 170 MPAs and for the 507 Natura 2000 Sites)*

*. In order to make the MPA contours more visible they have been thickened

Characteristics of the Mediterranean MPA system

NUMBER AND SURFACE AREA OF MPAS IN 2011 - EVOLUTION SINCE 2008

The inventory made on MPAs has identified a total of 677 MPAs (See Fig. 21 – only MPAs for which we have a polygon are indicated) - and Appendices 4 and 5, including:

- 161 MPAs designated under a legal national designation; 31 of which also have an international designation (SPAMI, Biosphere Reserve),
- 9 MPAs which just have an international designation and no national designation, thus making a total of 170 MPAs.
- there are in addition 507 Natura 2000 sites at sea.
- Also, an additional 55 MPAs which are being planned were identified, 4 of which are extensions of existing coastal protected areas (see Fig. 22).

677 MPAs were inventoried in the Mediterranean

161 MPAs with a legal national status - they also often have an international designation

9 MPAs with just an international designation (no national designation)

507 Natura 2000 sites at sea

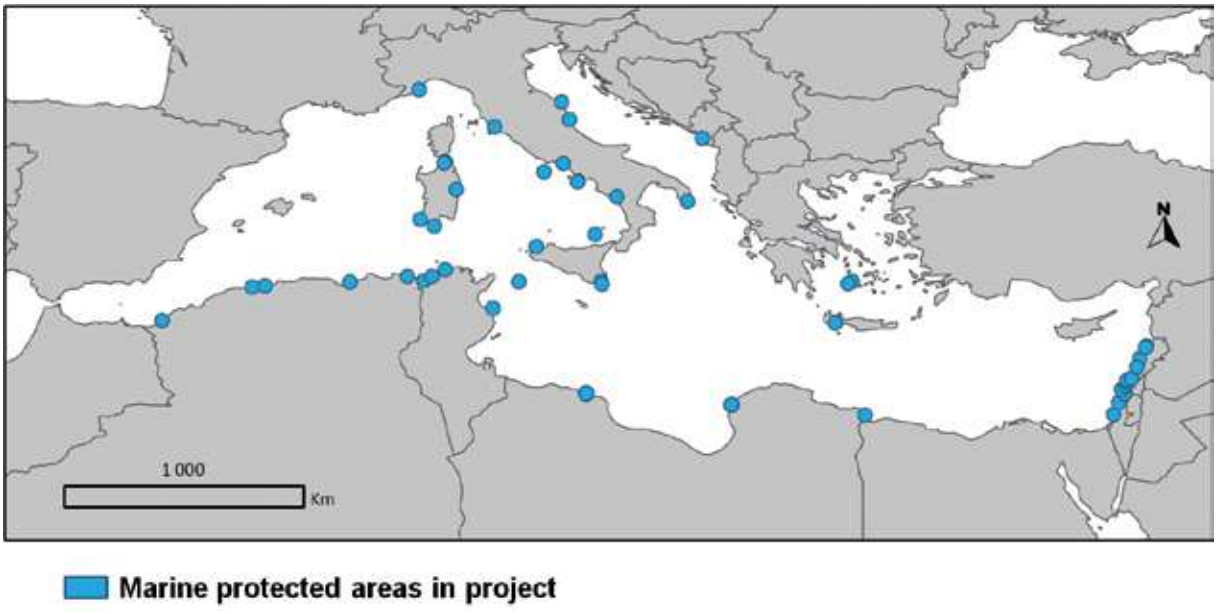


Figure 22 : Distribution of the MPAs being planned

The 170 MPAs identified cover a total marine surface area of 106 465 km² (the declared surface area is the one taken into consideration, unless otherwise indicated[2]); which includes 87 500 km² of the Pelagos Sanctuary, namely 18 965 km² without Pelagos[3]. The total known surface area for the MPAs being planned (14 out of 55) comes to 1 126 km² (surface areas known at the time of this report's analysis), thus an estimated provisional overall total of 107 591 km² to date.

73 MPAs (43%) are strictly marine areas, 89 (52%) are partly marine (MPAs with both terrestrial and marine areas).

The total surface area of the 507 Natura 2000 sites at sea (European designation applicable to EU member states only) comes to 31 417 km² (this goes down to 25 243 km² if we take into account the overlap of Habitats Directive with Birds Directive sites). There is an overlap of 17 142 km² between Natura 2000 sites and other MPA designations, including Pelagos. Given this considerable overlap, only 8 101 km² is actually added to the area covered by the 170 MPAs.

This study has not made an inventory of all **the fisheries reserves** with a national designation as it is focusing on sites whose primary objective is the protection and conservation of biodiversity. Note however that an inventory on Fisheries reserves is currently being completed by the General Fisheries Commission for the Mediterranean (CFCM) and will be integrated in the near future to analyses on the protection and management of the marine environment.

On an international level, 4 Fisheries Restricted Areas in open seas have been designated by GFCM and cover 17 677 km² (see Fig. 24).

- The slope of the Gulf of Lion : 2 017 km²
- Lophelia reef off Capo Santa Maria di Leuca: 976 km²
- The Eratosthenes seamount : 10 306 km²
- The Nile Delta's cold seeps: 4 377 km²

Moreover, the GFCM decided in 2005 to prohibit bottom trawling under 1000 m depth in the Mediterranean, due to biological issues at such depths (sperm whale's prey species, deep benthic or pelagic fish) (see Fig. 24). This exclusion zone covers an area of 1 455 411 km², or about 58% of the Mediterranean Sea's surface area.

	MPAs with national designation	MPAs with just an international designation	Natura 2000 Sites at sea	MPAs being planned
Number	161	9	507	55
Marine Surface area (km²)	18 467	87 998 (including Pelagos sanctuary: 87 500 km²)	25 243 (including overlaps with Natura 2000 sites)	1 126 (for an ocean surface of 14 km²)

Table 7: MPAs inventoried in MAPAMED

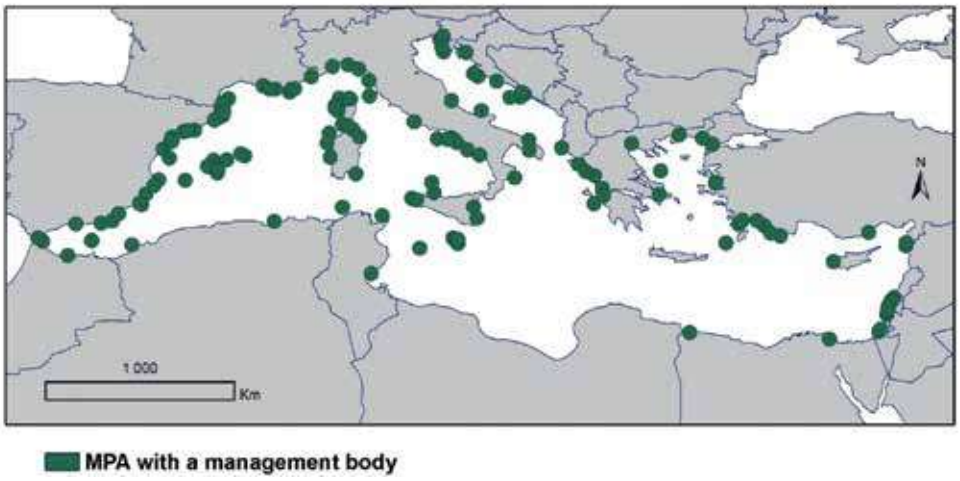


Figure 23: Spatial distribution of MPAs with a management structure (spatial data available for 154 of 170 MPAs; without Pelagos)4

2. The figures presented in this section are taken either from MPA polygons in the spatial inventory or from the area reported by the managers in the survey. The latter method does not allow to take into account the overlap between MPAs when calculating the surface areas; in addition, due to the lack of geographical data for certain MPAs we correlated both methods. Overall, the results differed little between the two methods, except for certain countries due to the lack of availability of geographical data. The results from these two assessment methods are provided in Appendices 4 and 5. The reported surface area is the one taken into consideration, unless otherwise indicated.
3. Knowing that 8 MPAs (5%) did not indicate a marine surface area: 1 Libya, 1 Montenegro, 1 Syria, 5 Turkey.
4. No identified management structure in the following MPAs: Isole dello Stagnone di Marsala (Italy) ; the Libyan MPAs (Ain Al-Ghazalah Gulf, El Kouf, Farwa lagoon) ; in Montenegro (Kotorsko Risanski Zaliv), in Syria (Fanar Ibn Hani, Om Al Toyour, Ras El Bassit)

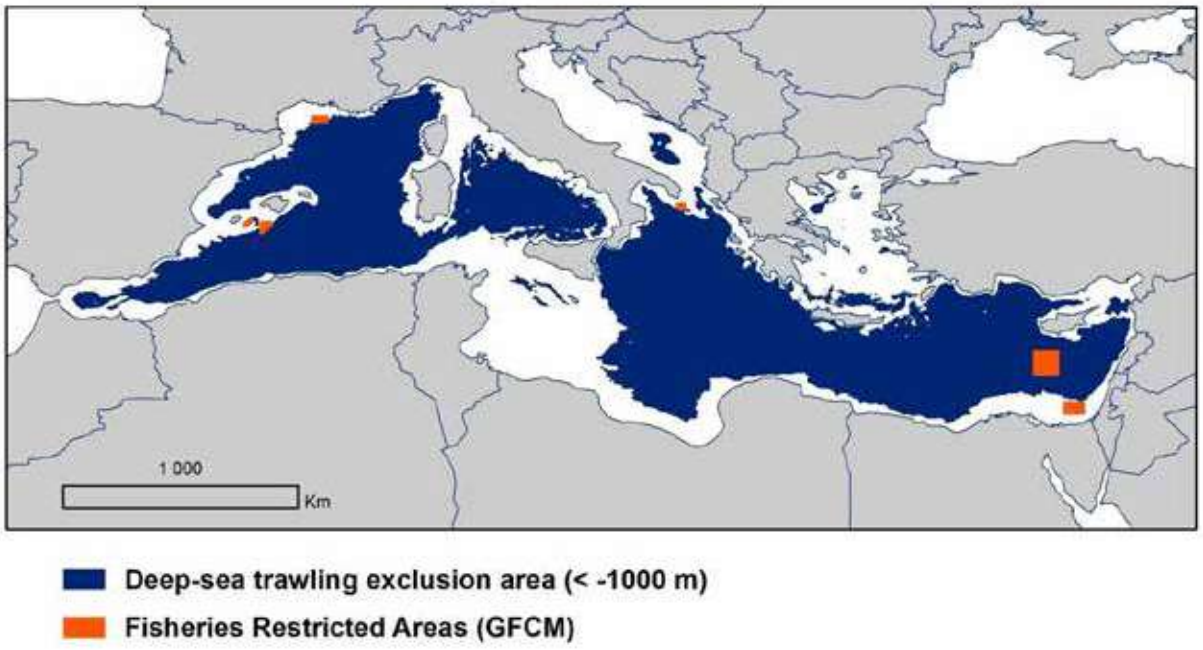


Figure 24: Regulated fisheries areas declared by GFCM: bottom trawling exclusion zone (in blue) and Fisheries Restricted Areas (in orange)

The evolution since 2008

Since 2008, 23 MPAs have been created in 10 countries: 6 in Greece, 4 in Italy, 2 in Libya, 3 in France, 3 in Malta, 1 in Albania, 1 in Israel, 1 in Egypt, 1 in Spain and 1 in Turkey, which represents an additional known surface area of 6 754 km² (which represents a 6.9% surface increase in 5 years when compared to the surface considered in 2008 (97 410 km²).

The new MPAs created in the Mediterranean since 2008:

Albania: Karaburuni-Sazani (2010)
Egypt: Sallum Bay (2010)
France: Gulf of Lion Marine Park (2011), Calanques National Park (2012), Port d'Alon (2009)

Greece: Acheron Estuary Nature Reserve (2009) ; Amvrakikos wetlands Park (2008), Kotychi - Strofylia (2009); Anatolikis Makedonias kai Thrakis (2008) ; Lagoon Gallikos, Axios, Loudias, Aliakmon, Kitrous, Kalohori (2009) ; Kalama Delta (2009
Italy: Secche della Meloria (2009) and de Torre del Cerrano (2009) ; Costa degli Infreschi e della Masseta (2009) ; Santa Maria di Castellabate (2009) MPAs
Israel: Shiqmona Nature Reserve (2008)
Libya: Ain Al-Ghazalah (2011), Farwa Lagoon (2011)
Malta: Ghar Lapsi and Filfla (2010); Mgarr ix-Xini (2010), Northeast Malta (2010)
Spain: El Montgrí Natural Park, Medes i el Baix Ter Islands (2010)
Turkey: Saros Korfezi (2010)

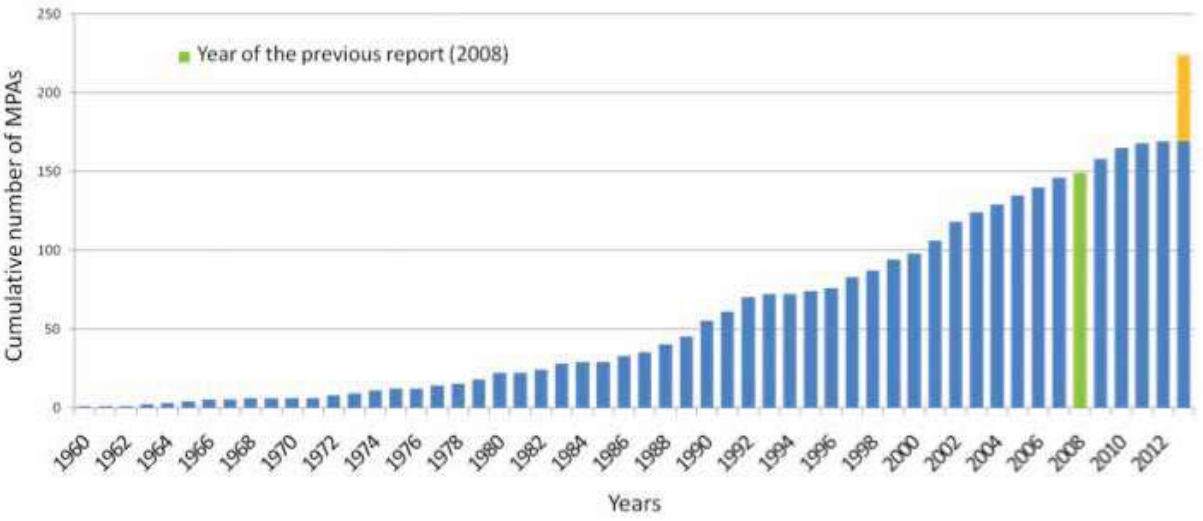


Figure 25: Cumulative number of MPAs created in the Mediterranean between 1960 and 2012.

The MPAs being planned have been added in yellow in 2012; the green column highlights 2008, the year of the previous MPA status report (11 MPAs - 6% with no information on the date of creation)

THE DIFFERENT MPA DESIGNATIONS

MPAs with a national designation

The MPAs are distributed among different status categories. For the purpose of the present analysis, a repartition per group was undertaken resulting as follows (see Fig. 26, 27 and 28)[5]:

- 56% belong to Group A (« Park « type);
- 30% to Group B (« Reserve « type);
- 4% to Group C (« Landscape park « type);
- 9% to Group D (special designations) - 6% for Spanish sites and 3% for the French Conservatoire du Littoral's sites with marine areas;
- 1% not assigned to a group due to lack of information.

Several MPAs have a national as well as an international status.

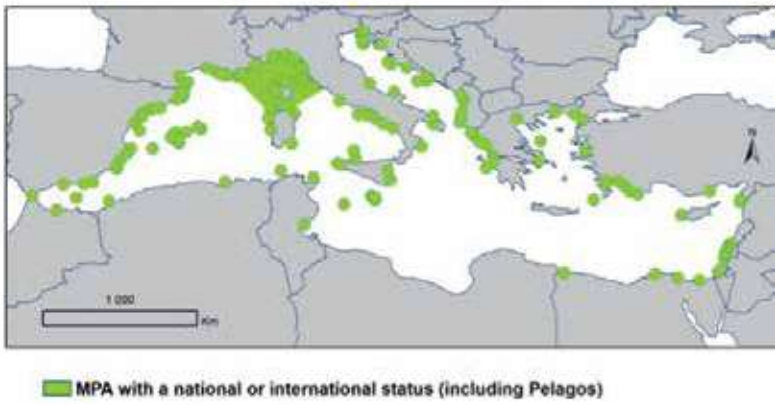


Figure 26: Spatial distribution of all the 170 MPAs (spatial information available for 154 out of the 170 MPAs)

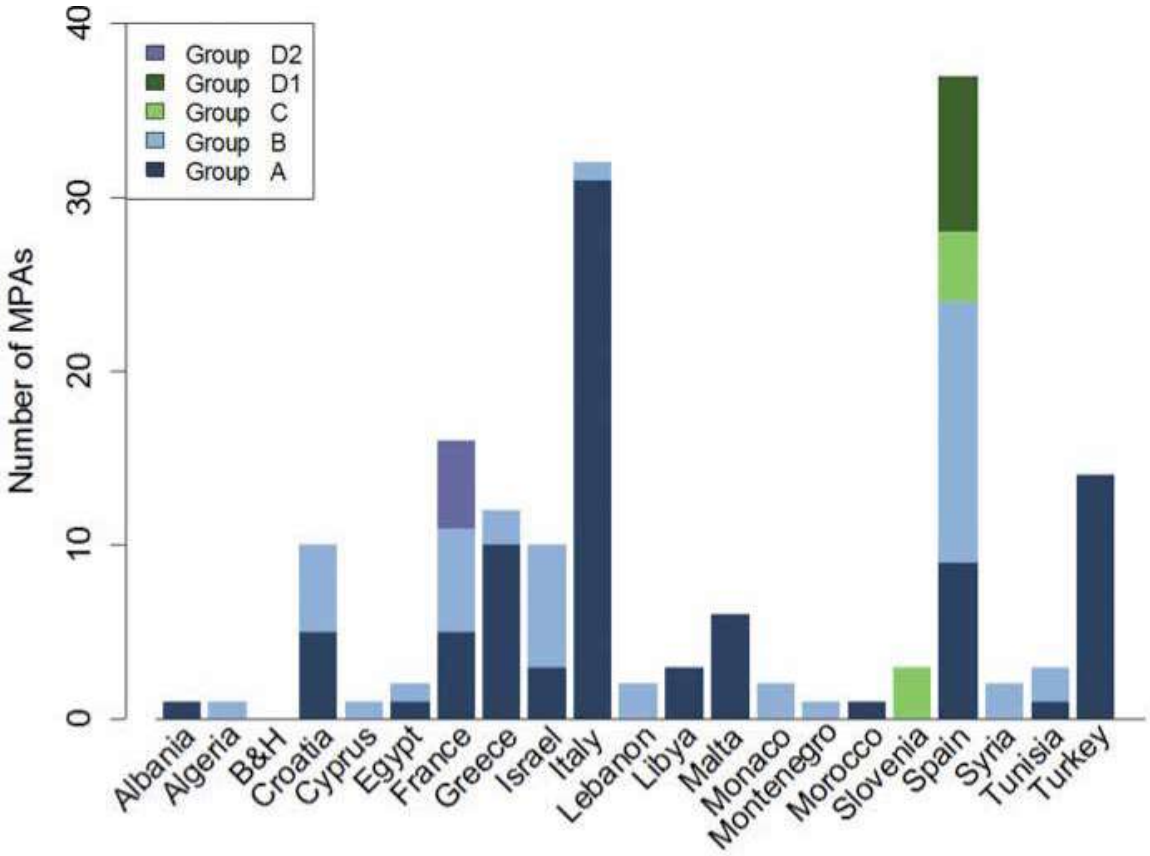


Figure 27: Number of MPAs per group and per country (aside MPAs with an international designation; 2 out of 161 MPAs with no status information)

5. For the status groups, see Methodology section.

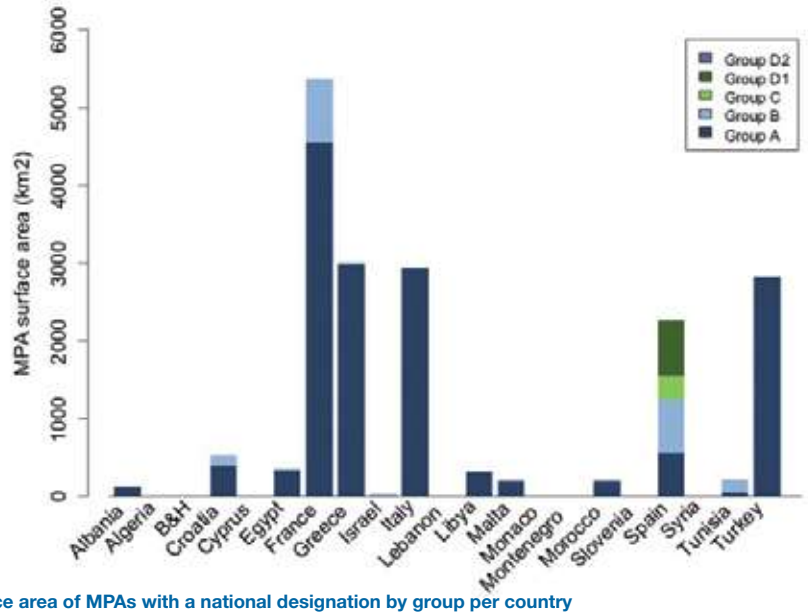


Figure 28: The surface area of MPAs with a national designation by group per country

(13 out of 161 MPAs with no information on marine surface area and/or designation)

The Natura 2000 at sea sites

The 507 Natura 2000 sites[6] at sea cover a total marine surface area of 31 417 km², but if we take into account the overlap between Natura 2000 sites, the marine surface area covered by Natura 2000 is 25 243 km² (see Fig. 29). Greece and Italy have a particularly high number of sites (67% of all the sites for just these 2 countries – see Table 8 and Fig. 3). A number of Natura 2000 sites have been declared in MPAs which already have a national or international designation. Thus, there are many designations which overlap.

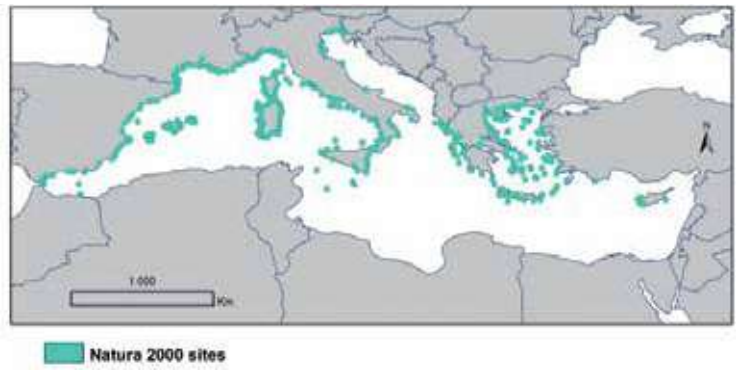


Figure 29: Spatial distribution of the Natura 2000 sites

Country	Number of Natura 2000 sites	Total marine surface area (km²)	No. of sites with no information on marine surface area
Cyprus	7	193.58	0
France	58	14,776.14	2
Greece	152	7,154.84	4
Italy	188	4,138.11	10
Malta	2	7.89	1
Slovenia	4	1.51	1
Spain	96	5,145.1	0
TOTAL	507	31,417.17	18

Table 8: Number and marine surface area of Natura 2000 sites per country.

The surface areas shown in this table are a simple sum of marine surfaces and do not take into account the overlap between Natura 2000 sites, hence the difference with the surface of 25 243 km² stated in the text.

6. 18 Natura 2000 sites with no information on marine area

Among the 507 Natura 2000 sites at sea:

- at least 9 sites have a management structure;
- 58 sites have a management structure which supervises at least part of the Natura 2000 site because it overlaps with an existing MPA;
- 58 are automatically managed as they are included in an MPA which already has a management structure,

It was impossible to determine the presence of a management structure for the other sites. Thus, from this information it seems that at least 125 Natura 2000 sites (24.6%) have a management structure, at least for a part of its surface area.

IUCN categories

The MPA IUCN categories declared by managers or completed for the purpose of this study, namely 161 MPAs (See section «Methodology» and Appendix 8) refer to the categories II, III, IV, V, VI. No MPA in Category I has been declared at this stage, although it is likely that there are some considering that a number of strict nature reserves have been reported in some MPAs. The most represented categories are IV (Habitat / Species Management Area) and II (National Park); there are few MPAs under category VI (Protected area with sustainable use of natural resources), but they are much larger (ssee Fig. 31 and 32; Table 9).

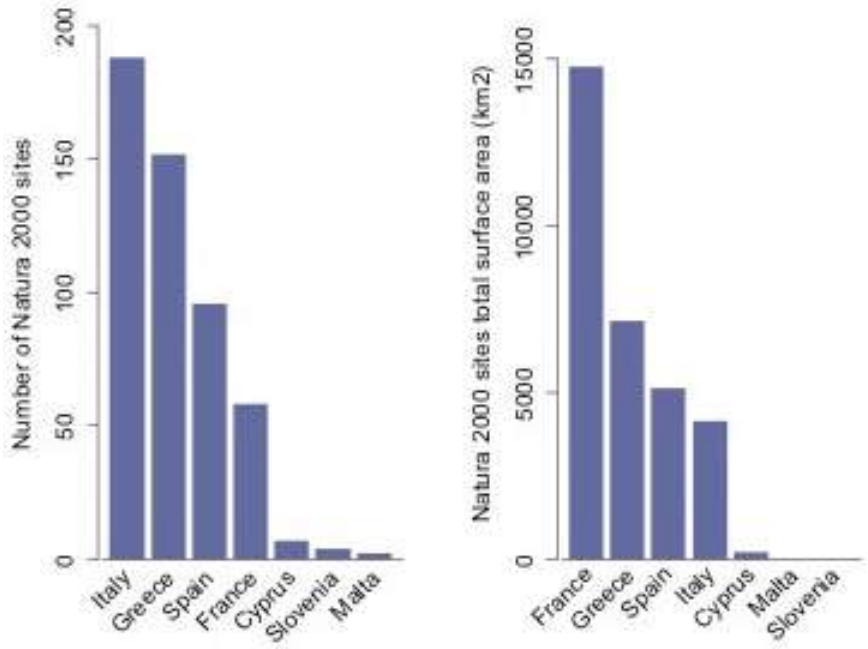
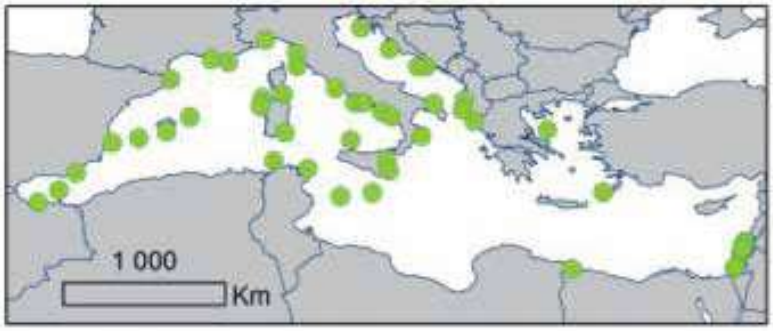


Figure 30: Distribution of Natura 2000 sites at sea per country.

On the left by number of sites, on the right per total surface area[7] (18 MPAs - 4% with no information on the marine surface area)

The coast in Northern Syria © R. Dupuy de la Grandrive

7. Cumulative number which does not take into account possible overlaps between sites



a. IUCN category II

b. IUCN category III

c. IUCN category IV

d. IUCN category V

e. IUCN category VI

Figure 31: Distribution of the different IUCN categories identified or those attributed for the purpose of this study

IUCN Categories	Number of MPAs	%	Marine surface area (km²)	%
I	0	0.00	0.00	0.00
II	55	34.16	5,775.72	31.28
III	3	1.86	1.40	0.01
IV	69	42.86	6,363.53	34.46
V	20	12.42	907.40	4.91
VI	14	8.70	5,419.17	29.34
Total	161	100	18,467.22	100.00

Table 9: Number of MPAs per IUCN category and marine surface area

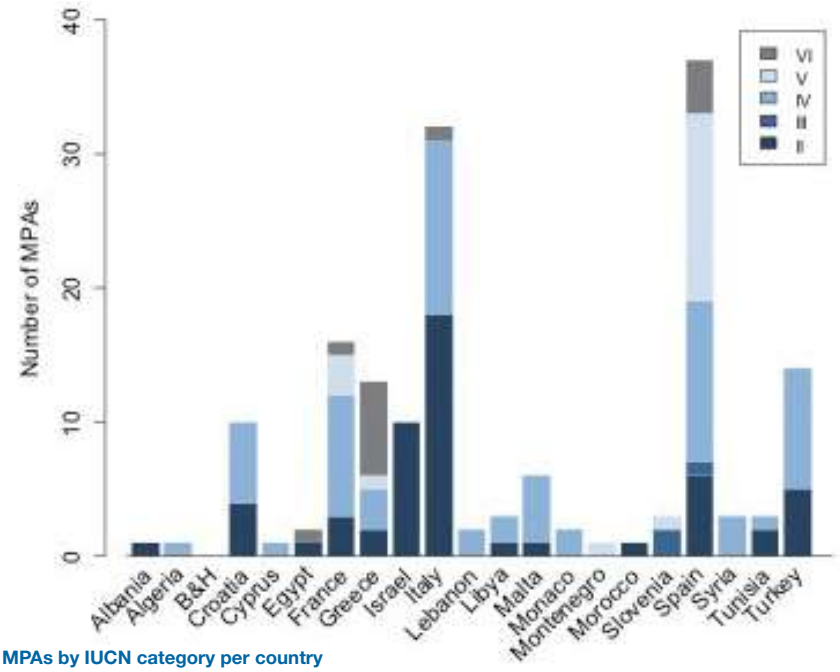


Figure 32: Number of MPAs by IUCN category per country

The international designations

Forty MPAs have an international designation (apart from Natura 2000) - (see Fig. 33 and Appendix 5):

- 32 SPAMIs
- 5 Biosphere Reserves
- 2 world heritage sites
- 1 sanctuary for marine mammals

Some sites even hold several international designations. For example, the Zembra Zembretta archipelago in Tunisia is both a SPAMI and a biosphere reserve.

The SPAMIs cover a total marine surface area of 90 718 km ², with the Pelagos Sanctuary on its own covering an area of 87 500 km ², or 3 220 km ² without Pelagos. Fifteen SPAMI are strictly marine. 2 sites among the SPAMIs are also a Biosphere reserve and 1 is also a Ramsar site. There are a number of coastal Ramsar sites, but only 2 marine Ramsar sites have been identified to date, the Cap des trois fourches in Morocco and Kneiss Islands in Tunisia which is also a SPAMI.

Among all these sites, 9 just have an international designation (with no associated national designation):

- Banc des Kabyles (SPAMI), included in the Taza National Park's future marine area.
- Cap des trois fourches (Ramsar)
- Fondos marinos del levante almeriense (SPAMI), which essentially corresponds to the Natura 2000 site under the same name.
- Golfe de Porto (world heritage) which includes the Scandola nature reserve
- Islas Medas (SPAMI) which is under the El Montgri Nature Park, Medes i el Baix Ter Islands
- Mar Menor y Costa Oriental in the Murcia Region (SPAMI) which includes the Cabo de Palos Marine Reserve – Islas Hormigas
- Intercontinental Biosphere Reserve of the Mediterranean, which partially overlaps the El Estrecho Nature Park
- Pelagos Sanctuary for the conservation of marine mammals in the Mediterranean, which is also a SPAMI
- Fango Valley (Biosphere Reserve)

Two of these 9 sites are transboundary:

- Pelagos Sanctuary which is between France, Italy and Monaco,
- Intercontinental Biosphere Reserve of the Mediterranean which is between Spain and Morocco.

a. World heritage UNESCO sites

b. Biosphere reserves

c. SPAMI, including the Pelagos sanctuary

Figure 33: : Spatial distribution of MPAs with an international status (spatial data missing for 1 SPAMI)

Another transboundary site is underway between France and Italy which is the International Marine Park of the Strait of Bonifacio for which the Parties signed an agreement in 2011. This future International Marine Park will include the Strait of Bonifacio and Tre Padule of Suartone nature reserves which are managed by the Corsican Environment Office, lands acquired by the Conservatoire du Littoral (French Coastal Protection Agency) and on the Sardinian side the Maddalena Archipelago National Park.

Overlap between different MPA designations

In the Mediterranean, there are a large number of different national and international designations. One can sometimes count up to 4 different overlapping designations (see Fig. 34). This is partly explained by the fact that international statuses are often attributed to sites which already have a national designation. In addition, a large number of Natura 2000 sites have partially overlapping areas with MPAs which have a national designation (see Table 10).

From the spatial data, it was possible to assess the overlap between the different Mediterranean designations (see Appendix 14).

Number of Natura 2000 sites by overlapping type	Type of overlap
387	Separate from 161 MPAs (no overlap)
48	Included in one of 161 MPAs (the Natura 2000 site's perimeter is within the MPA)
5	Encompass one of 161 MPAs (the Natura 2000 site's perimeter is bigger and surrounds one of the 161 MPAs)
11	Total overlap (the geographical perimeters of the two labels are identical)
56	Partial overlap (the two sites partially overlap)
507	**TOTAL number of Natura 2000 sites at sea recorded in MAPAMED**

Table 10: Overlap between Natura 2000 sites at sea and MPAs with a national designation

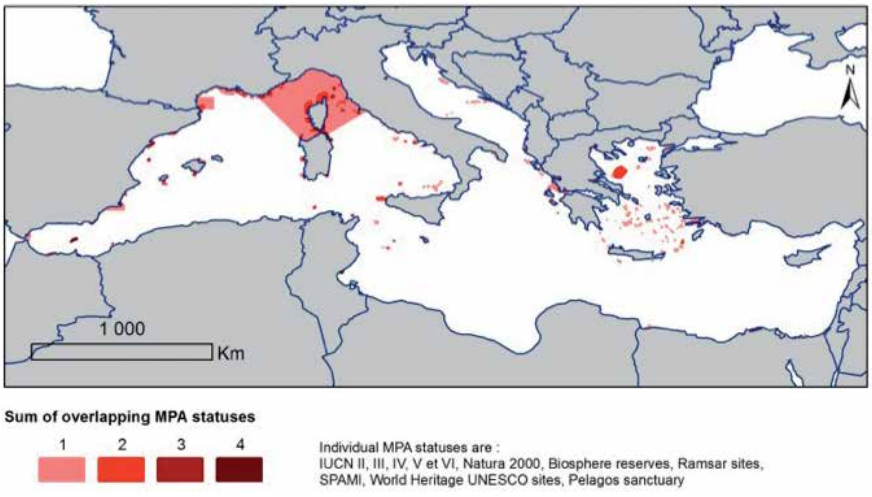


Figure 34: Spatial overlapping of MPA designations (number of overlapping designations)

DISTRIBUTION OF MPAs

The MPAs are very unevenly distributed across the Mediterranean's regions and countries. The Natura 2000 sites at sea are all located in the northern part of the basin; the imbalance is particularly seen in the North Basin region which has 96% of all the MPAs in the Mediterranean. In the following section, we have mainly taken into account the distribution of MPAs with a national and international designation, excluding the Natura 2000 sites. Also, we have not taken into consideration the two transboundary MPAs (Pelagos, between France, Italy and Monaco, and the Intercontinental Biosphere Reserve of the Mediterranean between Spain and Morocco)

Distribution of MPAs in the entire basin region

Most of the MPAs in the Mediterranean (111 MPAs – 66%) are located in the North-West region, followed by the North-East region (98 MPAs - 58); 84% of MPAs are thus located in the northern part of the basin. The Southern region has the least MPAs (27 – 16%). See Fig.35

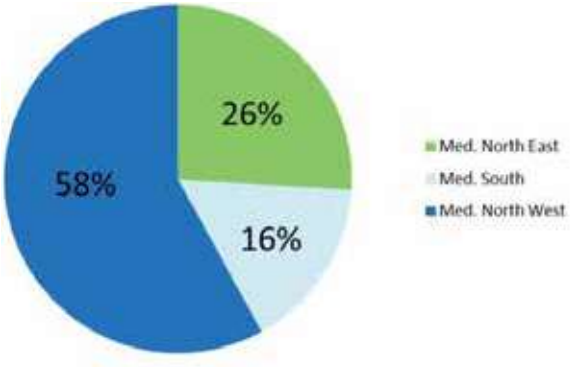


Figure 35: Distribution of MPAs per region (percentage)

Distribution of MPAs per ecoregion

38.3% of the number of Mediterranean MPAs is concentrated in the Algerian-Provençal Basin's ecoregion (Spatial Analysis Method).In contrast, the following ecoregions are only represented by a dozen of MPAs: Tunisian Plateau - Gulf of Sirte, the Ionian Sea, the Alboran Sea, and the Aegean Sea.The MPAs being planned continue the trend of the eastern Mediterranean ecoregions being under-represented in the system of MPAs (see Fig. 36 and Table 11).

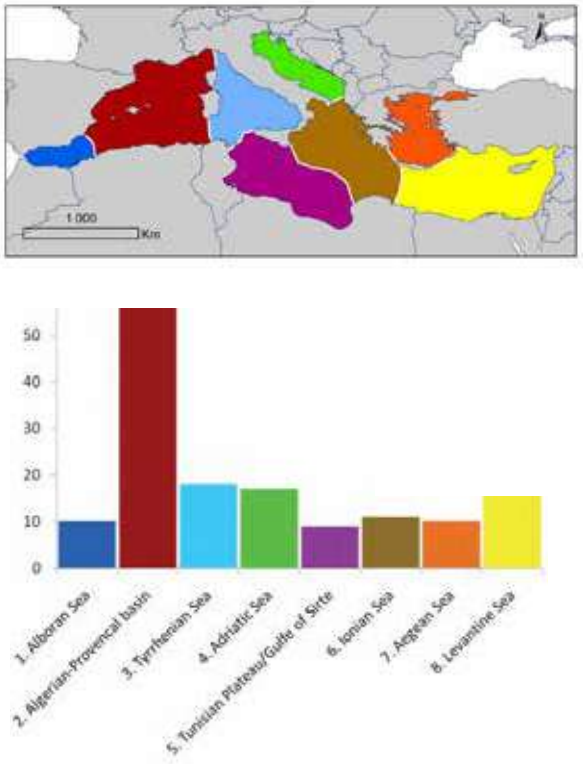


Figure 36: Number of MPAs per ecoregion. N.B. The colours refer to those used for the ecoregion map

	Number of MPAs	By% of total number	% ecoregion surface (without Pelagos)	% ecoregion surface (with Pelagos)	% Surface/ MPA per ecoregion (without Pelagos)	% Surface/ MPA per ecoregion (with Pelagos)	Number of MPAs being planned
1. Alboran Sea	10	6.49%	1.05%	1.05%	4.89%	0.86%	
2. Algerian-Provençal Basin	59	38.31%	1.42%	12.55%	39.32%	60.94%	4
3. Tyrrhenian Sea	18	11.69%	0.91%	12.51%	12.75%	30.66%	1
4. Adriatic Sea	17	11.04%	0.42%	0.42%	3.05%	0.54%	
5. Tunisian Plateau – Gulf of Sidra	9	5.84%	0.13%	0.13%	2.95%	0.52%	2
6. Ionian Sea	11	7.14%	0.28%	0.28%	6.22%	1.09%	
7. Aegean Sea	10	6.49%	2.35%	2.35%	24.57%	4.31%	
8. Levantine Sea	20	12,99%	0.21%	0.21%	6.25%	1.10%	7

Table 11: Distribution of MPAs per ecoregion

(Table established from spatial data available for 154 out of the 170 existing MPAs and for 14 of 55 MPAs being planned)

Distribution of MPAs per country

The distribution per country is also very uneven (see Fig. 37 and 38)- Italy, France and Spain have together 54% of the total number of MPAs; followed by Turkey, Greece, Croatia, Israel and Malta, which each represent between 3 and 9% of the total while other countries each have less than 2% of the total. Algeria, Lebanon, Israel and Italy also have a significant number of MPAs planned, some of which are already at a well advanced stage. There are 113 EU MPAs and 55 non-EU.

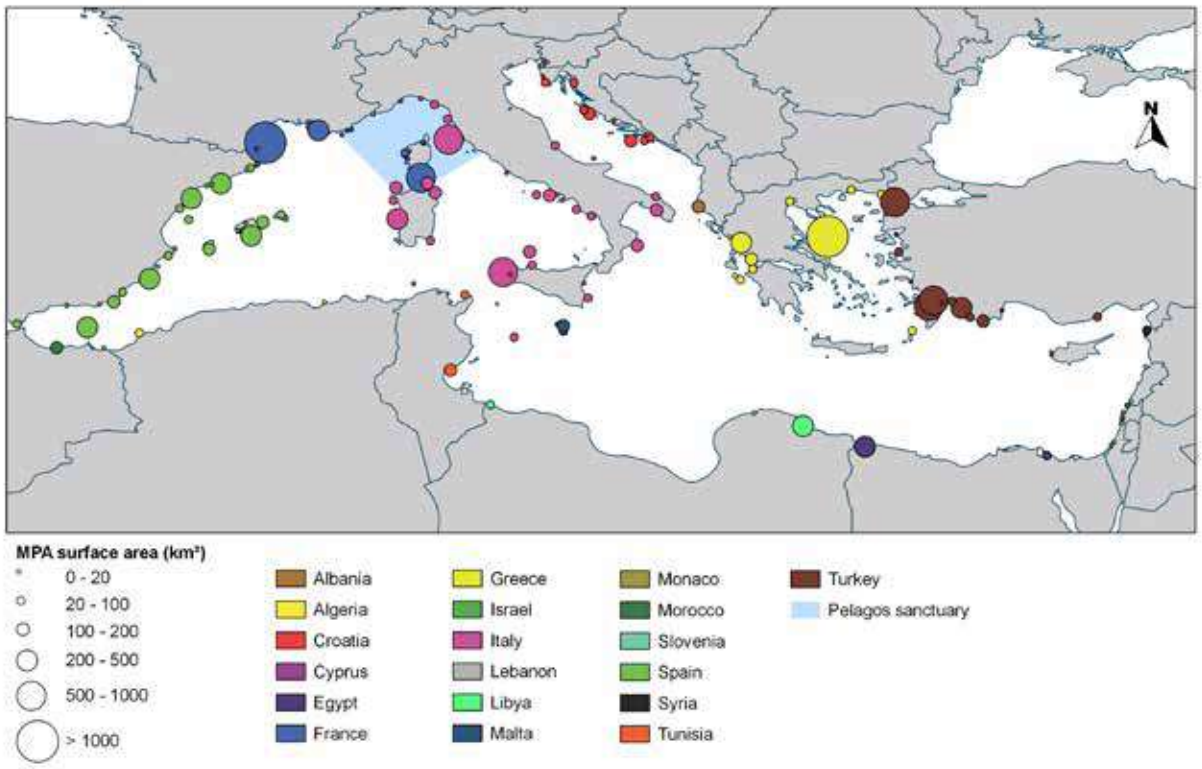


Figure 37: Distribution of MPAs by surface area and per country

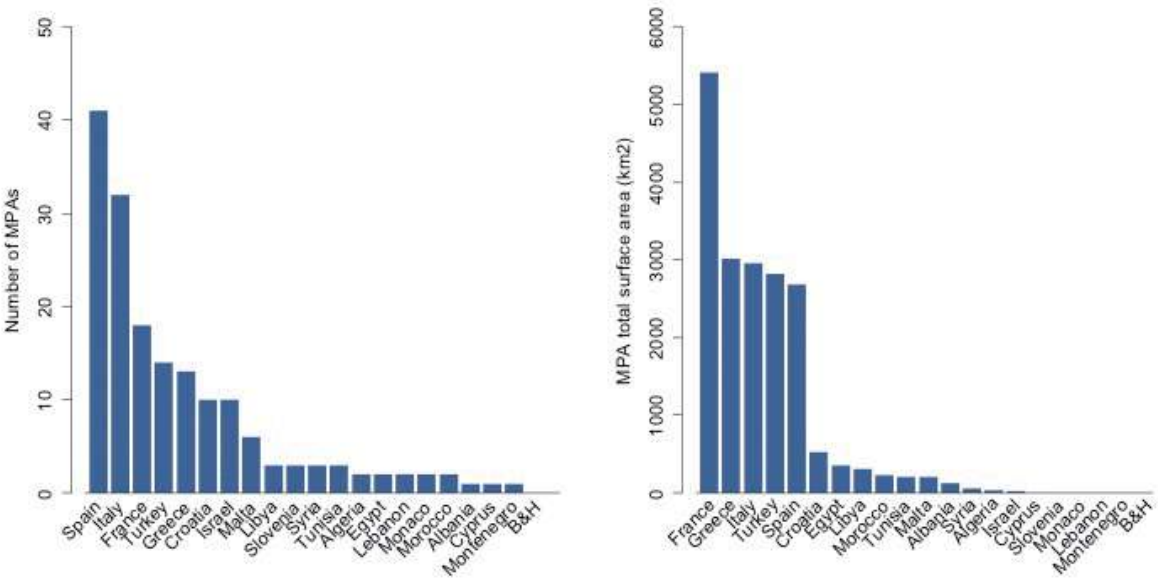


Figure 38: Distribution of MPAs per country.

On the left the number of MPAs per country, on the right total surface area of MPAs per country (without Pelagos and for the surface areas available; 13 MPAs – 8% with no information on marine surface area)

SIZE OF MPAs

The question of the optimal size of MPAs («several small or one large») has still not been decided by scientists and depends on the MPA's objectives (habitat, benthic species, pelagic species protection ...), breeding strategies for species that we are trying to protect, the network's organisation (closeness of MPAs to one another)...The work of Empafish has shown, for example, for commercial fish species, that increasing the size of no-take zones leads to an increase in the density of these species within the reserve compared to surrounding areas (Empafish final report). The size range of the MPAs marine area is very wide and goes from the smallest which covers 0.003 km² (Akhziv National Park in Israel) to the largest MPA (excluding the Pelagos marine sanctuary – 87 500 km²) which covers over 4 000 km² (the Gulf of Lions Marine Nature Park in France). Between these two extremes, the MPAs surface areas are relatively equal in distribution (between 20 and 25 MPAs per size group) when it comes to extreme size groups. The 11-25 km² size group has the largest number of MPAs.

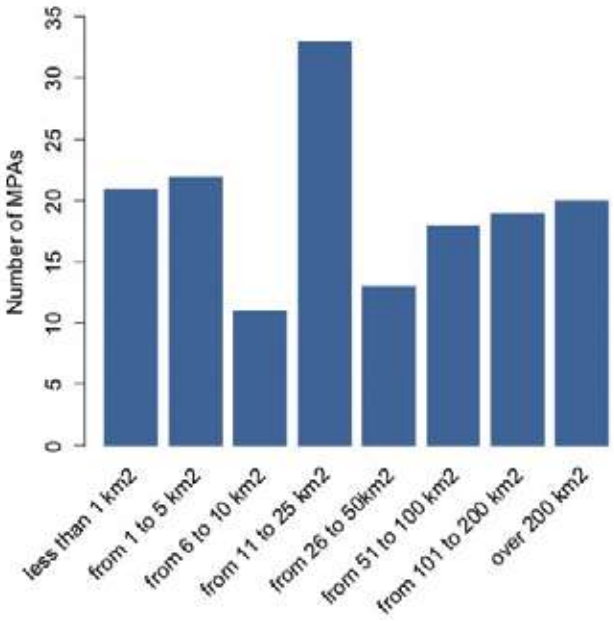


Figure 39: The number of MPAs per size group

(13 MPAs – 8% with no information on the marine surface area)

AGE OF MPAs

The first MPAs were created in the 60s (Mjet in 1960 and Port Cros in 1963). One hundred and five (105) MPAs or 61% are more than 10 years old which is considered to be the minimum age for an MPA to reach a certain maturity and even 35% are over 20 years old.

In general, the MPAs in the South are younger. One notices peak years for their creation like in the 90s for example and in 2002, and then in 2009-2010 (see Fig. 40 and Table 12).

	<5yrs old	5-10yrs old	10-20yrs old	>20yrs old	Total
North-West	11	26	32	29	98
North-East	8	4	5	26	43
South	4	9	7	6	26
					167

Table 12: MPAs age groups per region. (no information about the year of creation for 1 MPA).

N.B.: transboundary MPAs (Pelagos Sanctuary and Intercontinental Biosphere Reserve of the Mediterranean) are not taken into account in this table

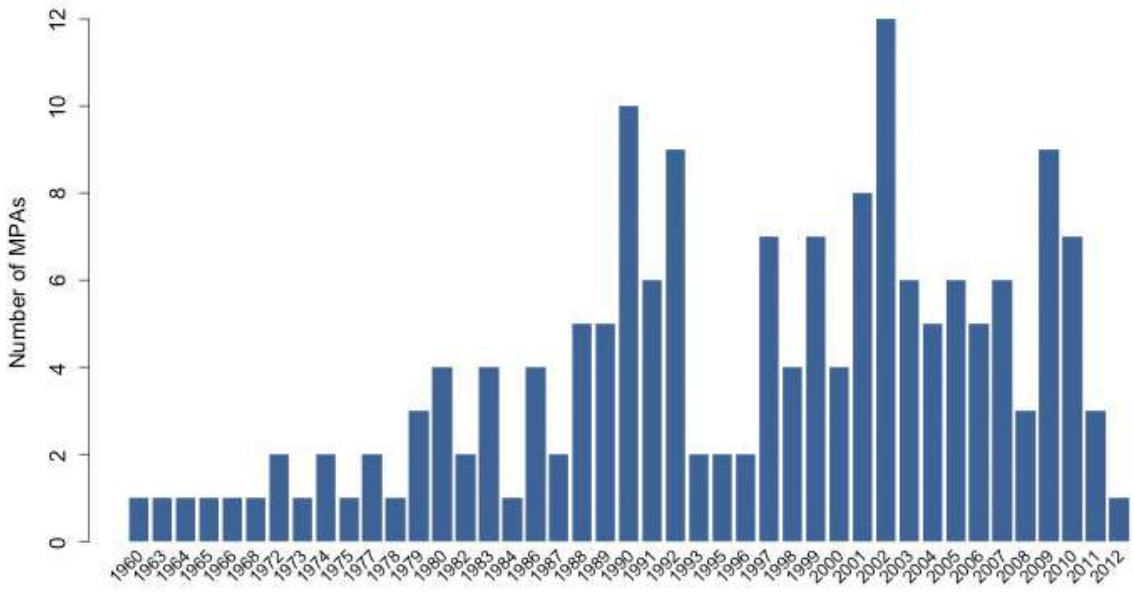


Figure 40: Number of MPAs created between 1960 and 2012 in the Mediterranean

(11 MPAs- 6% with no information on their creation date)

Percentages of protection, according to the CBD 10% target

114 600 km² surface area under a protection status:

- 4.56% of the Mediterranean
- 8.22% in the 12 nautical mile zone
- 2.7% beyond the 12 nautical mile zone

ON THE MEDITERRANEAN SCALE

If we take into account all the MPAs in the Mediterranean - MPAs with a legal national and/or international designation, including Pelagos and Natura 2000 - 4.56% of the Mediterranean is under a protected status, and 1.08% excluding Pelagos.

Recognising the fact that most of the Natura 2000 sites are not really protected (with the exception of a few sites), and if we just take MPAs under national and international jurisdiction, this percentage is 4.24% with Pelagos and 0.75% without Pelagos.

In 2008, for the record, the report indicated a protected total surface area (excluding Natura 2000 which had not been taken into account at the time) of 97 410 km², or a 0.4% protection of the Mediterranean (excluding Pelagos).

We do not know the total surface area of no take zones (strict nature areas and where fishing is prohibited) because this is only known for some of the MPAs surveyed (namely 46% of Mediterranean MPAs with a national designation - see management section). This strict protection area covers 0.02% of the Mediterranean; the RAC/SPA (2010) indicates 0.4% of strict protection for all the MPAs.

WITHIN THE 12 NAUTICAL MILE ZONE

While some countries (Turkey and Greece for example) have a 6 mile territorial sea limit, it was decided for the purposes of this study and to circumvent the jurisdiction problems of this enclosed sea, to take 12 nautical miles for all the countries. The analysis of the geographical distribution of MPAs (using a Spatial Analysis Method) shows that 8.22% of the 12 nautical mile zone is protected in the Mediterranean, with a strong contribution from the Pelagos Sanctuary (6.1%).

The 12 nautical mile zone includes more than 50 000 km² with depths of less than 1000 meters (i.e. bottom trawling exclusion zone).

In France, 11.43% of the 12 mile zone is covered by MPAs (array of different levels of protection), Turkey 7.09%, Malta 4.66%, Spain 4.45%; all the other countries have less than 2% covered by MPAs.

BEYOND THE 12 NAUTICAL MILE ZONE

The area beyond 12 nautical miles which represents 74% of the Mediterranean surface is very poorly represented in the MPA network: only 2.7% of which 2.6% is Pelagos, the rest (0.1%) is only represented by the Gulf of Lion Marine Nature Park (see Appendix X).

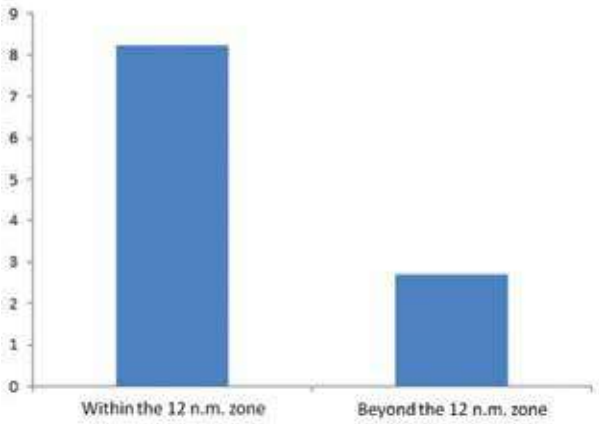


Figure 41: Proportion (%) of the area of the 12 n.m. zone (8.22%) and the area beyond the 12 n.m. zone (2.7%) covered by MPAs

Port-Cros National Park © C. GERARDIN

The Mediterranean's percentages of protection under the various designations

MPAs	Total Number	Without Pelagos		With Pelagos	
		Marine surface area (km²)	% Mediterranean	Marine surface area (km²)	% Mediterranean
MPAs with national status	*161*	*18 467*	*0.73*	*18 467*	*0.73*
MPAs with just international status	*9*	*498*	*0.02*	*87 998*	*3.50*
Total MPAs	**170**	**18 965**	**0.75**	**106 465**	**4.24**
Natura 2000 at sea (with overlapping sites)	*507*	*25 243*	*1.00*	*25 243*	*1.00*
*Natura 2000 at sea (without an overlap with other MPAs) **	*122*	*8 101*	*0.32*	*8 101*	*0.32*
Total MPAs + Natura 2000	**677**	**27 066**	**1.08**	**114 566**	**4.56**
GFCM Regulated fishing zones (open sea)	*4*	*17 677*	*0.70*	*17 677*	*0.70*
Total MPAs + Natura 2000 + Regulated fishing zones (GFCM)	**681**	**44 743**	**1.78**	**132 243**	**5.26**
Possible scenarios for the Mediterranean's cover including MPAs being planned where a surface is pre-determined					
MPAs being planned	*55*	*1 126*	*0.04*	*1 126*	*0.04*
Estimated Total (MPA + Natura 2000 + Planned)	**732**	**28 193**	**1.12**	**115 693**	**4.60**
Estimated TOTAL (MPA + Natura 2000 + Regulated fishing zones + Planned MPAs)	**736**	**45 869**	**1.83**	**133 369**	**5.31**

Table 13: The Mediterranean's percentage of protection under the various designations. Detailed figures (no decimal)

**When counting only once the same surface areas covered by both the EU Habitats Directive and the EU Birds Directive, the total marine surface cover of Natura 200 sites adds up to 25 243 km² (about 1% of the Mediterranean Sea). Some surface areas within these 25 243 km² also overlap with MPAs of other statutes, and when this overlap is only counted once, the true net additional surface area brought by the Natura 2000 system adds up to 8 101 km².*

Percentage of protection by country in the 12 nautical mile zone

Country	A: Surface of MPAs within the 12 n.m. zone (in km²)	B: Surface area of the 12 n.m. zone (in km²)	A/B: % of MPA surface within 12 n.m. zone / 12 n.m. zone surface area
Albania	125.4	5 998.7	2.09%
Algeria	19.1	26 748.7	0.07%
Bosnia-Herzegovina	0	12.9	0.00%
Cyprus	2	15 376.9	0.01%
Croatia	494	31 057.7	1.59%
Egypt	429	24 451.2	1.75%
Spain	2 416	54 271.7	4.45%
France	2 809	24 568.1	11.43%
Greece	3 078	18 8641.4	1.63%
International Pelagos (aside existing MPAs)	37 557	37 557	100.00%
Israel	27	4 886.2	0.55%
Italy	2 898	140 764.1	2.06%
Lebanon	0	4 783.5	0.00%
Libya	ND	39 116.7	ND
Morocco	268	8 881.9	3.02%
Monaco	0.2	77.4	0.26%
Malta	187	4 009.8	4.66%
Montenegro	ND	2 363.1	ND
Slovenia	0.9	186.4	0.48%
Syria	62	3 896.9	1.59%
Tunisia	267	3 0454.2	0.88%
Turkey	2622	3 6969.4	7.09%
Total	**53 261.6**	**647 853**	**8.22%**

Table 14: Percentage of protection per country in the 12 nautical mile zone. (ND: no data available)

Milos island, Greece © Cinthia

CHAPTER 4

Representativity and connectivity

Representativity of the MPA network

According to the CBD, a network of MPAs is representative «when it consists of areas representing the different biogeographical subdivisions of the world's oceans and regional seas, reasonably reflecting the full range of ecosystems, including the biotic diversity and habitats of these marine ecosystems».

Within the framework of the Barcelona Convention, the objective is to ensure that the diversity of ecosystems, habitats, communities of species and ecological processes of the whole of the Mediterranean is well represented and protected in MPAs (UNEP-MAP-RAC/SPA, 2009c). Assessments on the status of MPA networks, similar to this one, have already been undertaken, particularly within the OSPAR Convention (2010) framework.

In recent years, an increasing number of studies have been carried out in the Mediterranean to evaluate the representativity of the MPA system and they identified major gaps in terms of protecting key habitats and species (Greenpeace, 2006; Notarbartolo di Sciara, 2008, 2010; UNEP/RAC/SPA 2010; Coll *et al.,* 2010, 2011; Mouillot *et al.*, 2011; CEPF, 2010; de Juan *et al.*, 2010; Oceana Mednet, 2011; IUCN MedRAS, 2012). This current study is thus complementary and only new because it is based on the most recent inventory made on marine protected areas in the Mediterranean. It also brings new condensed information on benthic and pelagic habitats, as well as on issues of connectivity.

This current study contributes to assessing, across the whole Mediterranean MPA system and based on MPAs which are registered in MAPAMED, the representativity of:

- (1) ecological sub-regions of the Mediterranean
- (2) habitats, using RAC/SPA habitats
- (3) the most iconic, endemic or rare specie

METHODOLOGY

To measure correctly this representativity (see box "Measuring representativity") it was essential to have the digitised distribution of each component considered across the whole of the Mediterranean. However, it soon became apparent that there is incomplete distribution data across the basin and that the accuracy of the datasets is very heterogeneous. Overall, data is very discrepant and even though there are many sectors including many MPAs where information is fairly accurate, there are however large geographic areas with none, especially in the eastern Mediterranean. Figure 40 shows the contrast between the western and northern Mediterranean which are rich in data and the Eastern Mediterranean with much less.

The first step consisted in identifying the elements (ecoregion, habitats and species) for which the relevant homogeneous and fairly complete data was available at the scale of the Mediterranean in order to obtain the digitized geographical layers of the component's distribution. When data was missing or incomplete, complementary sources of data were identified. Distribution maps were thereafter digitized from existing publications. Geographic "proxies" were identified and used to generate or refine the spatial distribution of some of the biodiversity elements.

The first, longest part of this work was thus linked to identifying and collecting the array of data needed to create the distribution of a given element (species or habitat) across the whole Mediterranean or build these layers. The method was then to cross the MPAs layer with each considered habitat or species layer to assess the representativity of the system of MPAs for each of these biodiversity elements. The method is explained in more detail in the Appendix 8.

Information on the habitats and species taken into account will be explained in more depth in each of the following paragraphs.

The representativity analyses were initially made on all 661 MPAs for which the polygon (or outer limits) were available (154 sites with national and international designation, 507 Natura 2000 sites), and then with the 278 MPAs for which a management structure has been identified (153/161 MPAs with a national designation and 125/507 for Natura 2000 sites) which can be considered better protected than the other sites. For the latter, the analyses were performed without the Pelagos sanctuary unless when including it was relevant, namely for the study on the representation of marine mammals' distribution areas.

It has not been possible to complete this work by just taking into account marine areas which are actually effectively protected as this information is not currently available for all the recorded MPAs. Therefore, one must understand that throughout this section the results refer to: 1. the representation of elements of biodiversity that are present in a marine area with a legal protection status, whether this area is effectively protected or not in practice, as is the case with many Natura 2000 sites without a management structure yet in place; and 2. the representation of these biodiversity elements in MPAs that have a management structure.

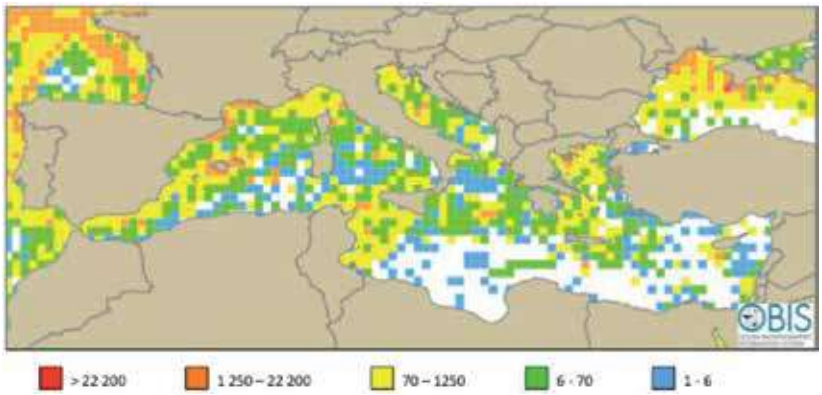


Figure 42: Number of records in the OBIS database describing the biota in the Mediterranean (note the non-linear scale)

REPRESENTATIVITY OF THE ECO-REGIONS

The different ecoregions identified by the RAC/SPA (UNEP/MAP/RAC/SPA, 2010d) are fairly homogeneous sub-regions of the Mediterranean in terms of their geomorphologic and biogeographic diversity. It is important that these ecoregions are all represented in the network of marine protected areas as they embody different areas of diversity.

The analysis shows that:

- When taking into account all MPAs (including the Pelagos Sanctuary), the Tyrrhenian Sea and Algerian-Provencal basin are represented at a level of 12.5% and 12.6% respectively within the system, Pelagos contributing about 80% to the representation of these two ecoregions;
- When taking into account all the MPAs aside Pelagos, the Algerian-Provencal basin, the Aegean Sea and the Alboran Sea ecoregions are the best represented with each having just over 3% of their surface covered within an MPA;
- When taking into account the system of MPAs which have a management structure, ecoregion representation ranges from 0.1% (Tunisian Plateau - Gulf of Sidra) to 2.4% (Aegean Sea).

Therefore, the Tunisian Plateau/Gulf of Sidra, the Levantine Sea, the Ionian Sea and the Adriatic Sea are very poorly represented.

Measuring representativity

Representativity is a measure of the level of coverage of biodiversity components (species, habitats, ecological and evolving processes) by MPAs in a given region. Namely a ratio between the surface (or the number of occurrences) of a protected component and the total area of distribution of this component (or the total number of occurrences) on the scale in question (region).

A system of protected areas can be qualified as «representative» when the system contains a small part (e.g. 10%) of each biodiversity component considered. So one considers the «representation» of a biodiversity component within a system of protected areas. Thus, a habitat is «well-represented» when the percentage of its distribution range located in a protected area is higher than the set representation target (for example, a target of 10%).

The analysis enables to estimate that X% of a specific biodiversity component is present in a marine area with protected status, but however it is not possible to determine the quality and effectiveness of its protection because this information is currently not known comprehensively at the scale of the Mediterranean.

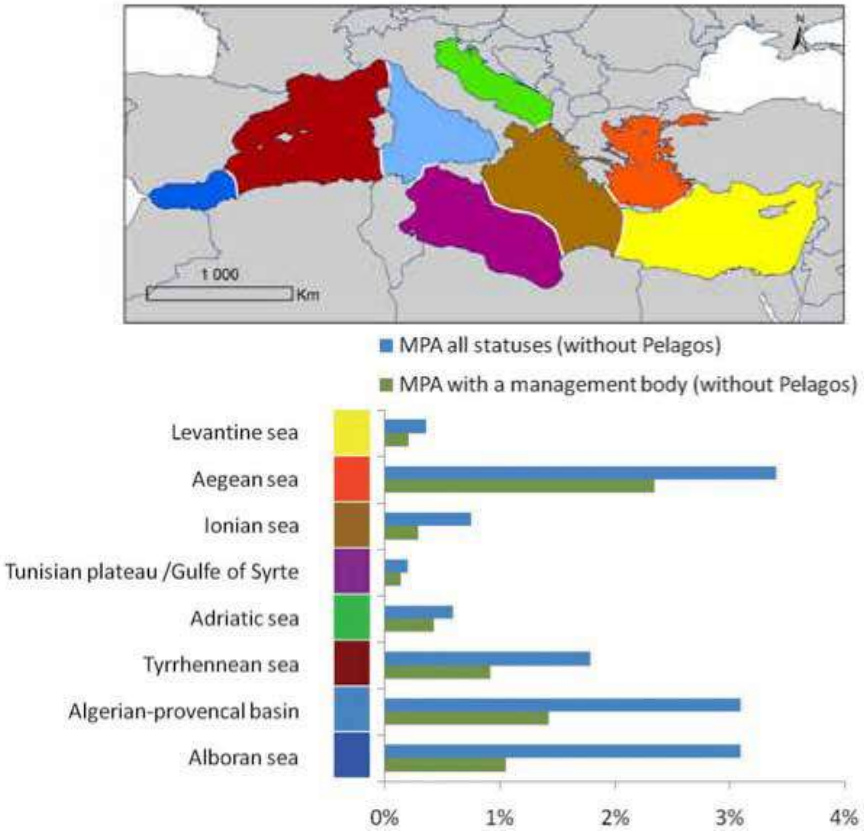
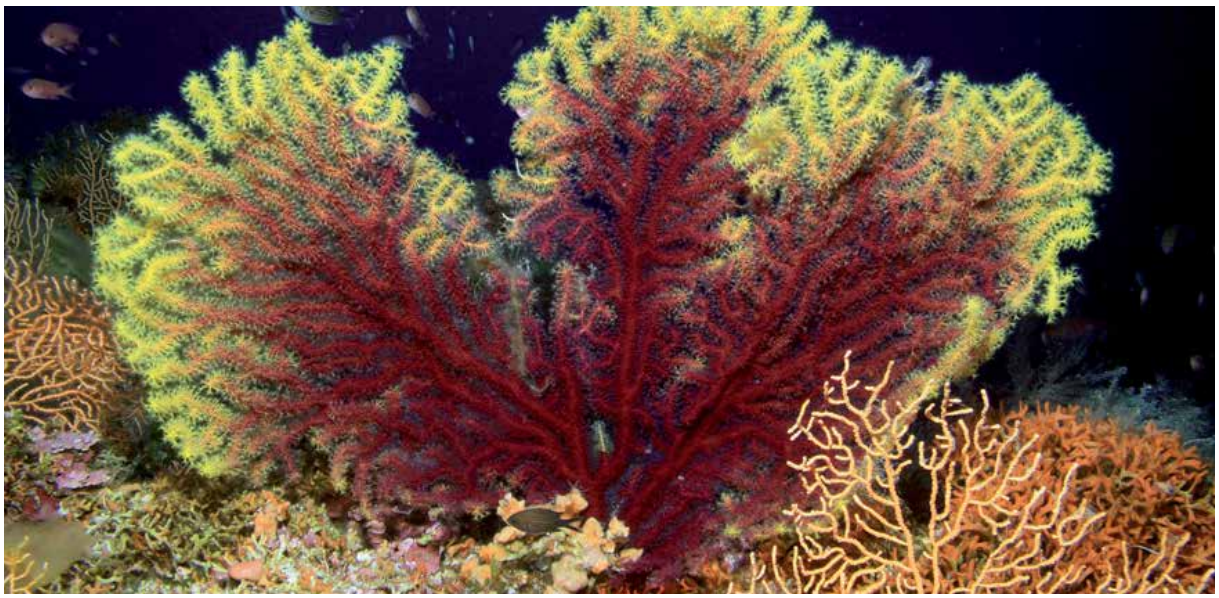


Figure 43: Representation of ecoregions within the MPA network (without the Pelagos Sanctuary).The colour code used in the graph matches the ecoregions represented in the map

Underwater realm of the Taza National Park, Algeria © M. Foulquié



Gorgonacea © A. Rosetti / Sunce

REPRESENTATIVITY OF HABITATS

Benthic zone: representativity of benthic marine habitats

The ”zoning” of benthic communities in the Mediterranean

In the Mediterranean, different communities of marine species (biocenosis) thrive in habitats (biotopes) which are distributed following a vertical zoning, or by «tiers», according to the depth. In this work we have taken into account:

- the infralittoral zone between depths of zero and 30-40m,
- the circalittoral zone between depths of 35 and 200m,
- the bathyal zone between depths of 200 and 2 700 (or 2 000 to 3 000m depending on authors) and
- the abyssal zone and beyond.

A zone is a «vertical space of the marine benthic domain where the ecological conditions, ”which are set in relation to the sea level, are practically constant or fluctuate regularly between the two critical levels which indicate the boundaries of the stage”. These zones each have characteristic populations and their boundaries are revealed by a change in these populations near the critical levels which mark the boundary conditions of the zone concerned.

Within these different zones, communities are distributed according to the nature of the substrate (hard substrate, sand, muds, sandy muds, sands with more or less mud,...). Thus, the habitat typology put forward for the Mediterranean uses the reference base (1) tiering and zoning (2) the grain size of the substrate. Based on this approach, scientists have identified nearly 200 different habitats in the Mediterranean (see list of habitats validated by RAC/SPA in Appendix 2).

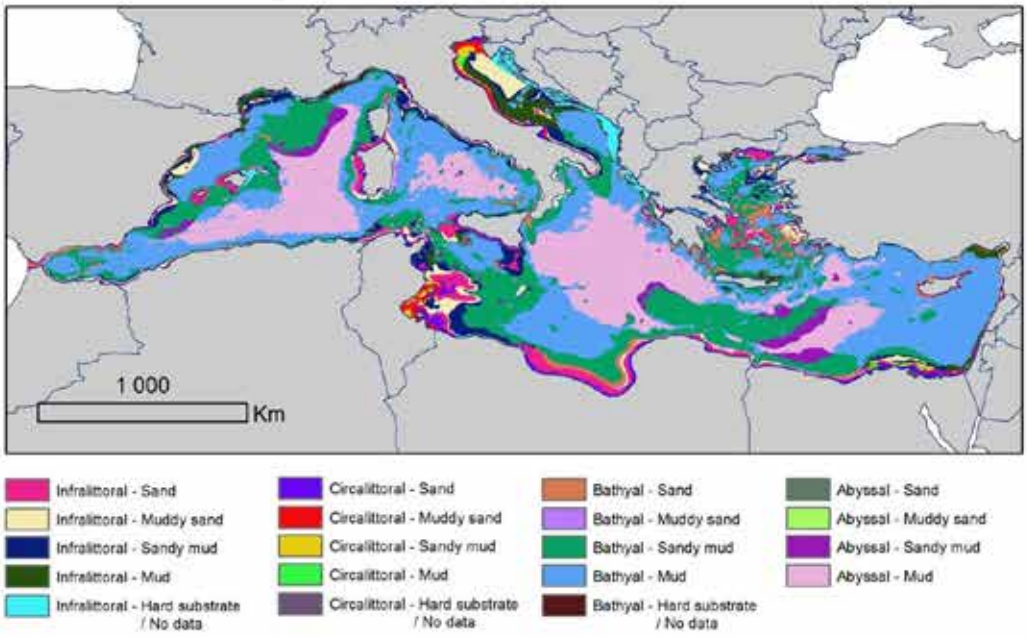
As knowledge on the distribution of these benthic habitats is fractional, we worked on components where we had data available on their large scale distribution or where available information was sufficient enough to generate distribution data at the larger Mediterranean scale.

In order to assess their representation within the system of MPAs, the following benthic habitats were therefore mapped:

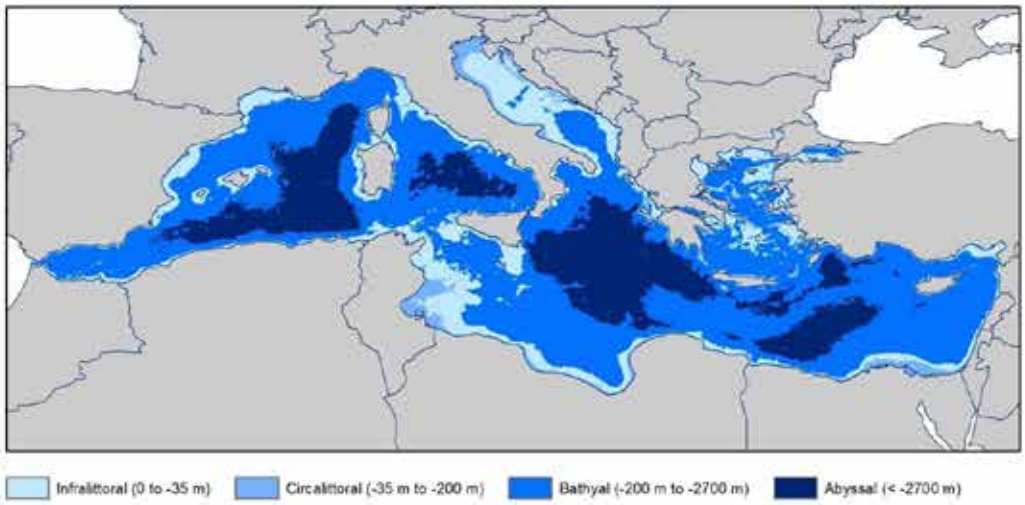
- The bentho-sedimentary habitats (biotopes) across the whole basin, based on a distribution map that we drew up using the GEBCO bathymetric map (General Bathymetric Chart of the Oceans) and the IBCM (International Bathymetric Chart of the Mediterranean) map unconsolidated bottom surface sediments in the Mediterranean Sea.
- The remarkable habitats identified as a priority across the western part of the Mediterranean basin, where a homogeneous layer was developed within the EUSeaMAP programme: the *Posidonia* and *Cymodocea* seagrass meadows (representative of the infralittoral zone) and the coralligenous (cricalittoral).
- the remarkable geomorphological components for which we had layers of information across the whole basin thanks to work carried out by RAC/SPA Harris and Whiteway (2011) and Yesson *et al.* (2011): the deep sea canyons, seamounts, submarine knolls and submarine banks.

Another study was led in parallel to characterise epipelagic habitats.

a. Benthic sedimentary habitats



b. Benthic levels



c. Sedimentary substrates

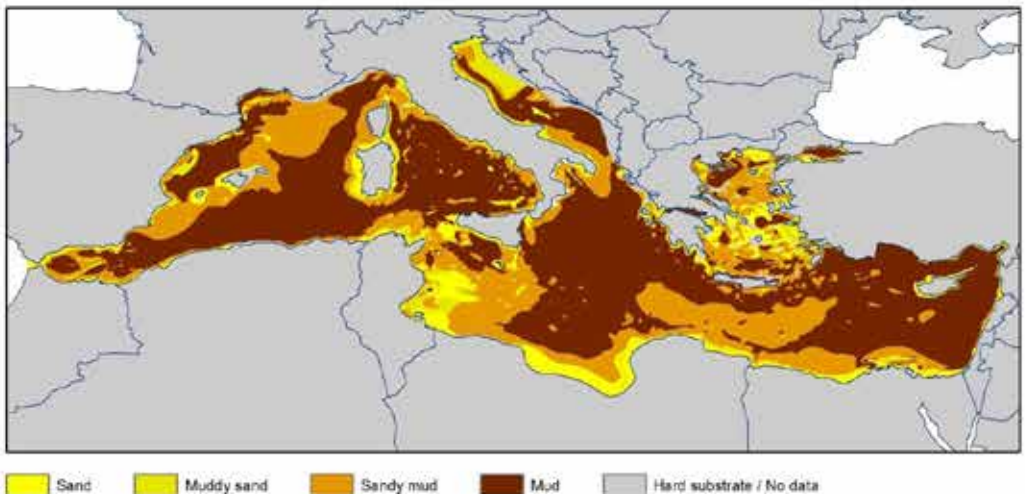


Figure 44: Map of benthic sedimentary habitats drawn up by merging the GEBCO bathymetric map

(General Bathymetric Chart of the Oceans – zone limits, Emig and Geistdoerfer, 2004) and the map of unconsolidated bottom surface sediments in the Mediterranean Sea from the IBCM (International Bathymetric Chart of the Mediterranean)

Representativity of benthic habitats on the Mediterranean scale

In view of a lack of homogeneous layers in benthic habitats across the whole of the Mediterranean, we built them. The benthic habitats were characterised by using the bathymetric map and the non-consolidated sediments map of the Mediterranean Sea which has been digitised. The 19 categories of benthic sedimentary habitats considered in this work are taken from intersecting the zones (infralittoral, circalittoral, bathyal and abyssal) (Emig, 1997; Emig and Geistdoerfer, 2004) and the sediment classes (a sedimentary typology simplified into five classes: sand, muddy sand, sandy mud and mud). A final category ("unspecified" – no information) corresponds to predominantly rocky substrates (see Fig. 44). The spatial resolution for the geographic layer is 1km (30 arc seconds).

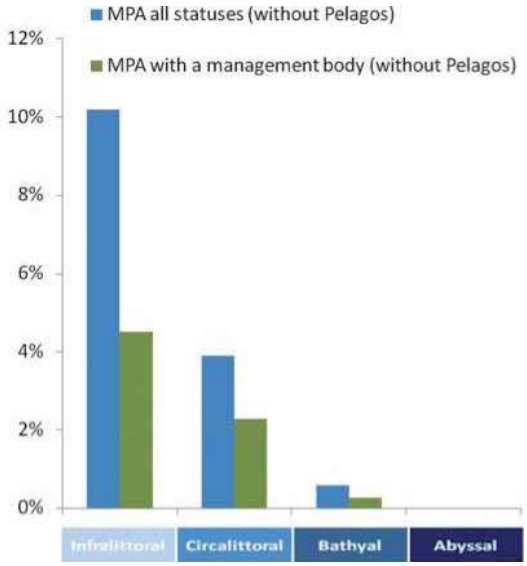


Figure 45: Representation of the different benthic zones within the network of MPAs (aside the Pelagos Sanctuary)

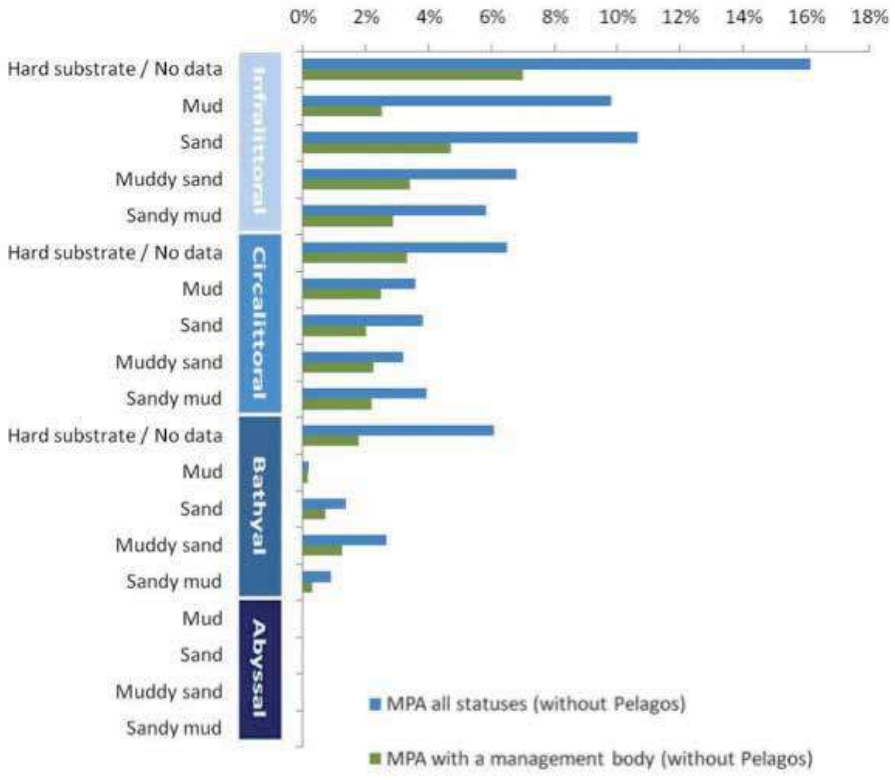


Figure 46: Representation of benthic sedimentary habitats within the network of MPAs (aside the Pelagos Sanctuary), for MPAs of all designations and for MPAs with a management structure only

Not surprisingly, the representativity analysis shows that the **infralittoral zone** is the one best covered by MPAs under legal protection with 10.2% of its surface included in MPAs (of all designations aside Pelagos) or a 4.5% cover if we take into account only MPAs with a management structure (see Fig. 45).

The detailed analysis on the representativity (see Fig.46) shows that mainly rocky substrate habitats (which corresponds to the "no information" label) have the best cover from MPAs, with 16.1% included in MPAs of all designations (aside Pelagos) and 7% in MPAs with a management structure. Among the sedimentary zones, sandy and muddy substrates are the best represented. This infralittoral zone supports remarkable biocenosis such as *Posidonia oceanica* as well as coastal euryhaline and eurythermal biocenosis, associations with *Cymodocea* and *Zostera* on fine sand or slightly muddy substrates, or associations with *Cystoseira*, facies with Vermetids or *Mytilus* on hard substrate.

The trend is akin for the **circalittoral zone**, 3.9% of which is represented in MPAs (or 2.3% when considering only MPAs with a management structure). Likewise in this zone, the rocky substrate habitat which supports coralligenous assemblages and facies with *Corallium rubrum* is the best represented (6.5% within all MPAs; 3.5% in MPAs with a management structure).

Less than 1% of the **bathyal zone**, where stretch deep sea corals biocenosis, is represented within MPAs while the abyssal zone is not represented within the system of MPAs except by the Pelagos sanctuary which covers 2%.

The system of MPAs is therefore only weakly representative of deep-sea benthic habitats. In particular, some unique Mediterranean deep sea biocenosis, such as cold seeps, brine pools and cold-water corals (see Fig. 47) are not covered by existing MPAs, despite the existing 4 Fisheries Restricted Areas (Gulf of Lion slope; Lophelia reefs off Capo Santa Maria di Leuca; Eratosthenes Seamount; Cold seeps of the Nile Delta) and the bottom trawling exclusion zone at depths inferior to – 1 000m.

Representativity of the coralligenous and seagrass habitats in the western basin

Seagrass meadows make up the wealth of the Mediterranean's coastal waters due to the surface area they cover (20 to 50% of the seabed in depths of between 0 and 50m) and particularly for their role in maintaining the coastal balance on a biological level and related economic activities (Boudouresque *et al.*, 2006). *Posidonia oceanica* is present in most of the Mediterranean. In the West it disappears just before the Straits of Gibraltar, near Calaburros in the North and Melilla in the South (Conde Poyales, 1989). In the East, it is not present on the Egyptian coasts (Eastern Nile Delta), Palestine, Israel and Lebanon (Por, 1978).

Coralligenous assemblages are found in depths of between 30 to 100m (Ballesteros, 2006) in different formations (Sartoretto and Baucour, 2011): coralligenous rock wall, coralligenous sedimentary bottoms, or coralligenous underlying seaweed bed... Along the French coast, the bioconstructions may reach between hundreds or even thousands of years old (Sartoretto *et al.*, 1996). After the *Posidonia* meadows, the coralligenous is the next biodiversity hub in coastal areas with nearly 1 700 invertebrate species, 315 algae species and 110 fish species (Sartoretto and Baucour, 2011). From a functional point of view, they provide shelter for many species which hold an important heritage or commercial value. The coralligenous are also recruitment and nutrition areas. They are also good for crustacean fishing (lobsters, spider crabs) and fish (Sparidae, bonito, yellowtail ...) (Sartoretto and Baucour, 2011).

Distribution data on coralligenous habitats and *Posidonia oceanica* and *Cymodocea* spp. meadows was taken from the benthic habitat mapping work within the EUSeaMAP project which covered the western Mediterranean, West of the Strait of Sicily (Cameron *et al.*, 2011).

This mapping effort (see Fig. 48) is currently the only available homogenous data on these habitats on a scale of 1:250 000 (although some more precise data exists at a finer scale for some areas such as the French façade for example; Hamdi *et al.*, 2010). The coralligenous habi-

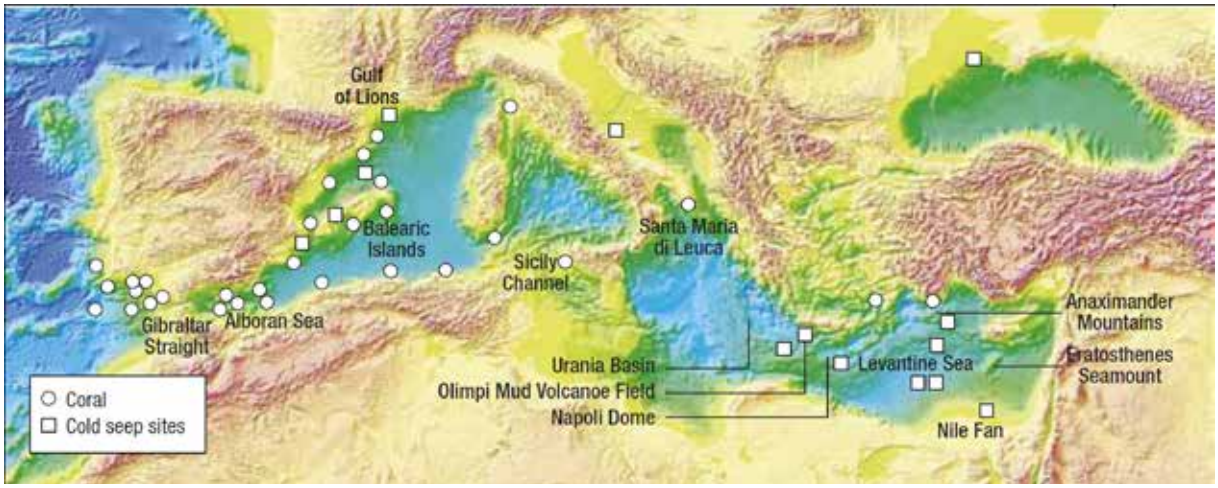
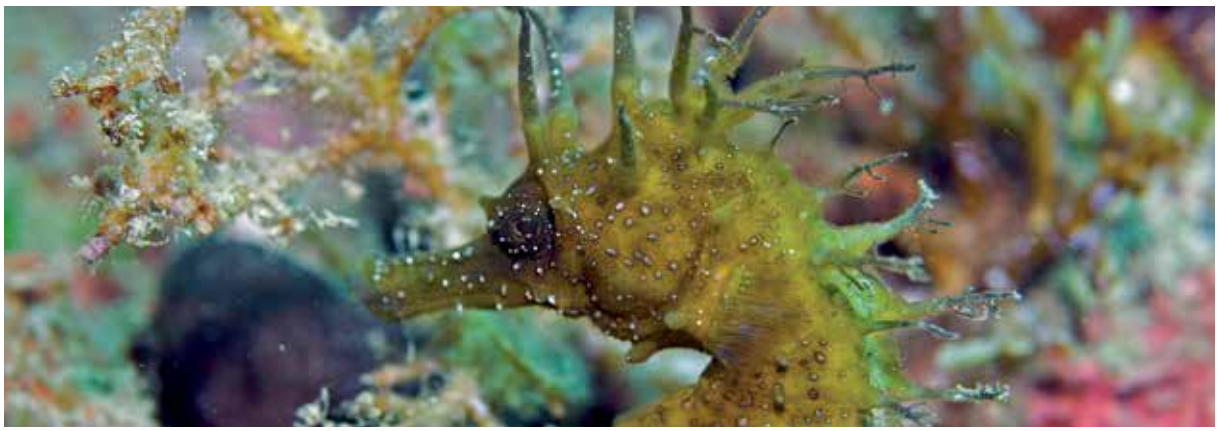


Figure 47: Mediterranean unique deep sea biocenosis (WWF/IUCN, 2004)- (circles=corals – squares=cold seeps)



Hippocampus guttulatus © T. Makovec

tats field validation data, mainly taken from surveys done in Spain, are 89% consistent with data. An assessment of the EUSeaMAP mapping quality done by Isaeus *et al.*, 2011 shows a lower match (about 20%) between modelled habitats and field data from fragmented habitats which consist of small areas (for example, confusion between rocky and coralligenous habitats along the Italian coastline). Other sources of data are too discrepant in quality (depending on the countries which supplied the data) to do a comparative analysis on a Mediterranean scale - including data referred to in the UNEP-MAP-RAC/SPA (2010c) publication. This is why these analyses were only conducted on the scale of the Western Mediterranean (Fig. 49).

Coralligenous habitats and *Cymodocea* and *Posidonia* meadows, whose distribution is taken from modelled data (Cameron *et al.*, 2011), are represented to varying degrees within all the MPAs in the Western basin (see Fig. 50):

- *Posidonia* meadows are fairly well represented: 49.7% within the system of MPAs (aside Pelagos sanctuary) and 19.1% within MPAs that have a management structure;
- coralligenous habitats are represented at a level of 11.6% in all MPAs (aside Pelagos sanctuary) and 4.9% in MPAs that have a management structure;
- *Cymodocea spp*. meadows are the least represented, with 7.8% covered by MPAs of all types (aside Pelagos sanctuary) and 1.1% by MPAs that have a management structure.

It should be emphasised that these figures are only for the Western part of the Mediterranean (to the West of Sicily Channel). There seems to be an urgent need to collect data on the distribution of these habitats in the southern and eastern Mediterranean sub-regions.

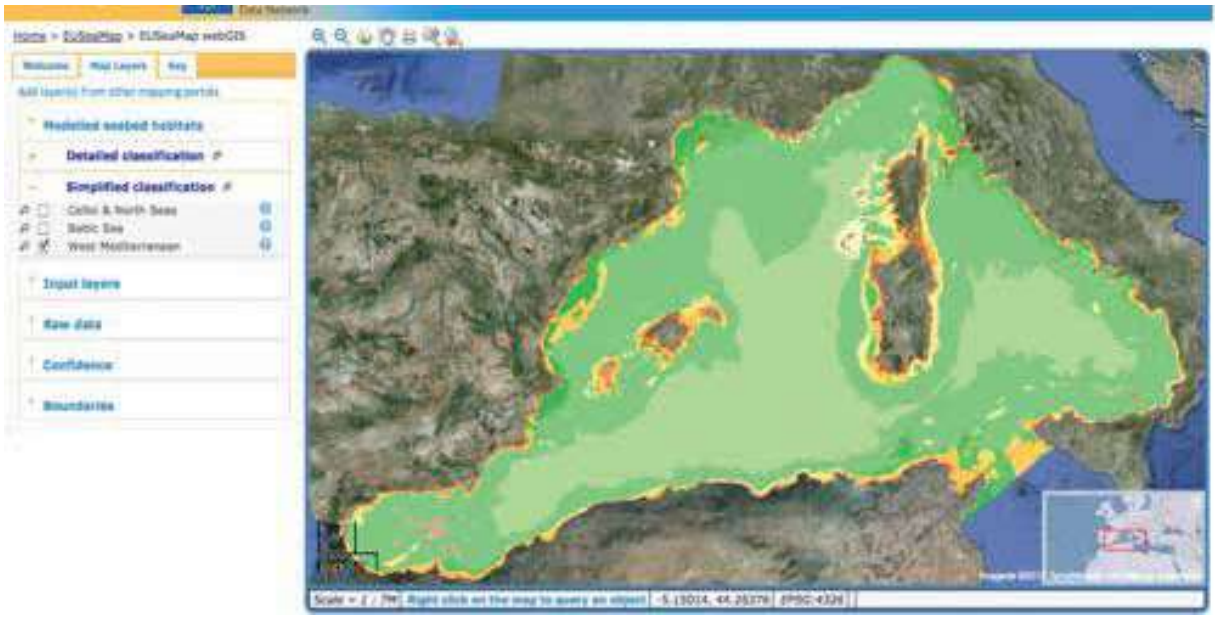


Figure 48: Interface portal access to EUSeaMAP data on broadscale modelled benthic habitats in the Western Basin (http://jncc.defra.gov.uk/page-5760)

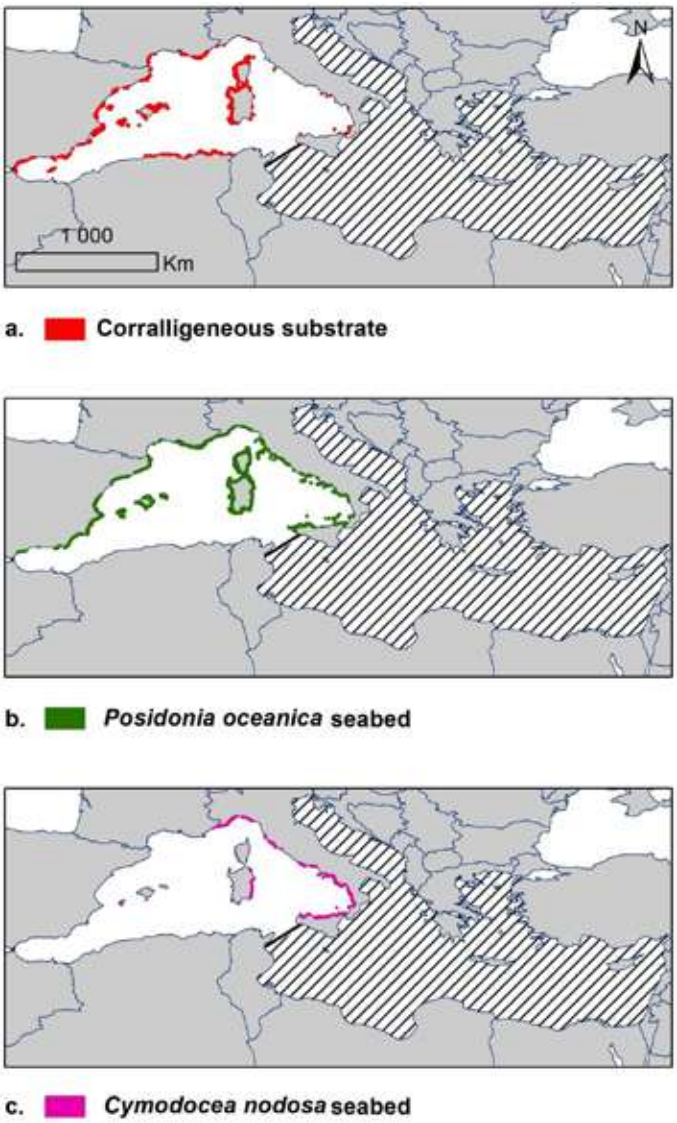


Figure 49: Map of coralligenous habitats and seagrass meadows, according to Cameron *et al.*, 2011.

The lines delimiting coralligenous and seagrass meadows areas have been thickened in order to make these habitats more visible. The striped area indicates a lack of distribution data

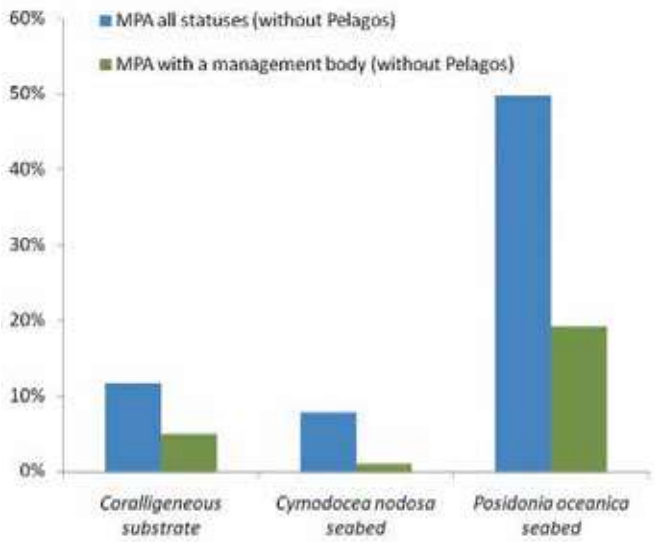


Figure 50: Representation of coralligenous habitats and *Cymodocea* and *Posidonia* meadows in the network of MPAs (excluding Pelagos Sanctuary)

Representativity of some of remarkable deep sea geomorphologic features

Several studies (WWF/IUCN, 2004; Danovaro, 2010; Würtz, 2010; UNEP-RAC/SPA, 2010d) have been carried out focusing on open sea and deep-sea habitats, highlighting their importance in terms of biodiversity.

A seamount is a mountain that rises from the sea bed without its summit reaching the ocean surface. Submarine knolls resemble seamounts yet are smaller in size, the latter rise to over 1 000m above the ocean floor (Yesson *et al.*, 2011). Deep sea banks are like shelves that are located above the ocean floor. These different geomorphologic components host an important faunal biodiversity and a higher degree of endemism.

A deep-sea canyon is a narrow deep sea valley (reaching depths of 1 000m compared to surrounding areas) with steep edges that cut into the continental shelf. Canyons play an essential role of conveyance between continents and oceans, canyon heads are important habitats as they host a concentration of marine mammals. They are currently in the limelight and several studies are being led for their protection: studies in the Spanish Cabrera area, the French MPA agency's studies on canyons along the entire French coastline, IUCN studies. The latest IUCN publication on the subject (Würtz, 2012) indicates there are 518 large canyons in the Mediterranean, of 3 types: (i) shelf-incising canyons connected to a major river system, (ii) shelf-incising canyons, and (iii) blind canyons incised onto the continental slope. These canyons were identified based on the general canyon mapping established by Harris and Whiteway (2011) which totals 756 canyons in the Mediterranean. Results of this study on the presence and morphological characteristics of canyons in the world show the Mediterranean to be a globally different region. Canyons are closer to one another (14.9 km), more dentric (12.9 limbs per 100 000 km^2), of a shorter length (mean length of 26.5 km), among the steepest (mean slope of 6.5°) and of a smaller depth range (mean depth: 1 613 m). The Gulf of Lion is one of the areas of the world oceans with the higher canyon density per 100 km.

The spatial distribution data on the 756 deep-sea canyons was taken from the work associated to the publication of Harris and Whiteway (2011). Data on submarine banks was taken from UNEP-MAP-RAC/SPA (2010c) database. The distribution data for 88 seamounts and 401 submarine knolls was taken from data available online from the Yesson *et al.* (2011) publication (see Fig 51).

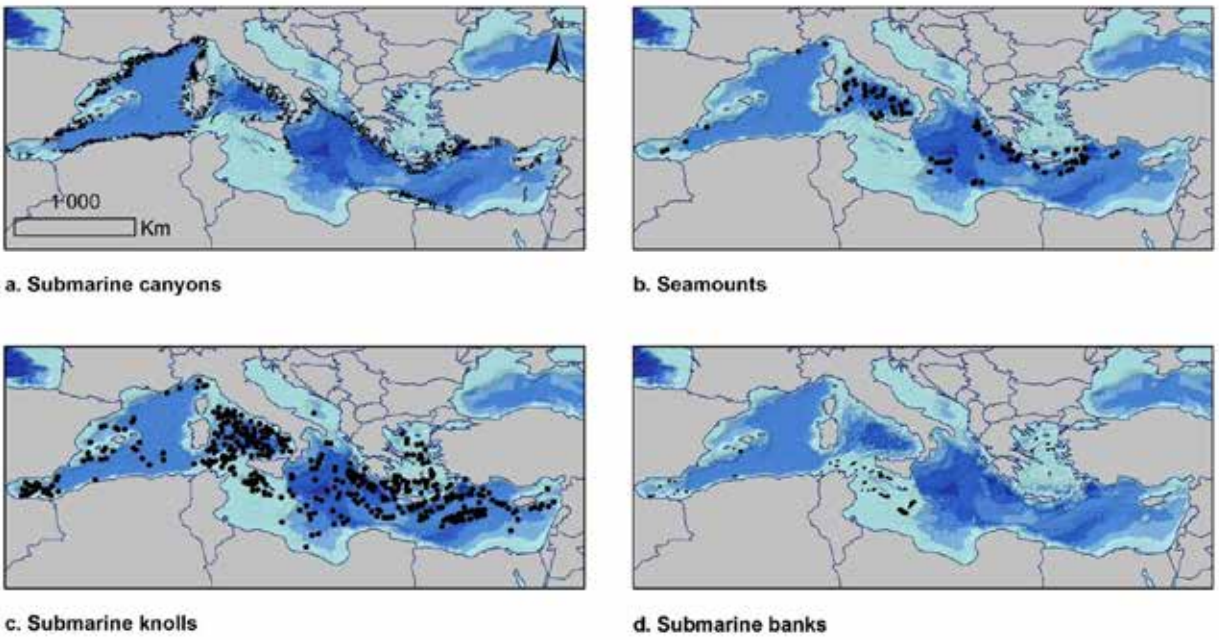


Figure 51: Map of remarkable deep sea geomorphologic components (canyons: Harris & Whiteway, 2011 – submarine banks: UNEP-MAP-RAC/SPA, 2010c – seamounts and knolls: Yesson *et al.*, 2011)

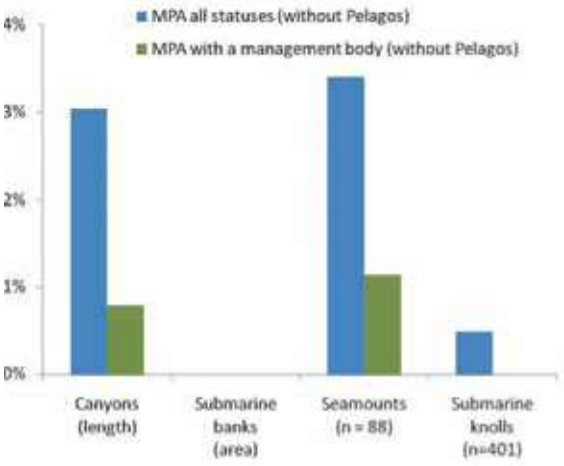


Figure 52: Representation of the remarkable deep sea geomorphologic components identified within the network of MPAs (excluding Pelagos)

The representation of these remarkable deep sea features within the network of MPAs shows that (see Fig. 52):

- Canyons are represented at 3.05% and 12.7 respectively without and with Pelagos
- Seamounts are represented at 3.4% and 6.8%, respectively without and with Pelagos
- Submarine knolls are covered at 0.5% and 2.2%, respectively without and with Pelagos
- Submarine banks are covered at 1.3% when including Pelagos (and 0% without Pelagos)

Sabella (Spirographis) spallanzanii © M. Moghaddam

Pelagic zone: representativity of epipelagic bioregions

It is essential to identify and map the state of the biophysical ocean masses in order to establish a conservation planning policy for coastal and deep sea ecosystems and to implement a system of MPAs which is representative of this epipelagic bioregional diversity. To support this approach, bioregionalisation aims to identify biogeographic regions within a vast marine area (the Mediterranean in this case). These regions are biologically significant and different from one another based on a set of physical and biological variables from data collection campaigns at sea or more broadly from satellite time series images. Many conservation planning projects for marine biodiversity have used this type of approach, including in Australia (Lyne and Hayes, 2005), New Zealand (Snelder *et al.*, 2006) and in the Southern Ocean (Grant *et al.*, 2006).

The variables selected for the Mediterranean's bioregionalisation (see Appendix 11) were depth, temperature, salinity, pH, dissolved oxygen, turbidity, chlorophyll-a concentration, the frequency of temperature fronts and chlorophyll-a and frequency of mesoscale ocean gyres. For each of these variables, different parameters were measured using time series (average, minimum, maximum range, extent of distribution). These parameters were chosen as they are non-repetitive indicators of the average state of the ocean surface and of the temporal variation of this state. This choice of variables was done based on expertise developed in the past, namely in southern Africa and the western Indian Ocean with the ASCLME (Agulhas and Somali Current Large Marine Ecosystem) and BCLME projects (Benguela Current Large Marine Ecosystem). These variables were then organised statistically (K-means method) (Hartigan and Wong, 1979) in order to identify similar clusters representing the bioregions.

In this analysis, 37 epipelagic[1] bioregions were identified (see Fig. 53, Table 15 and Appendices 12 & 13). These 37 epipelagic bioregions (level III in the classification tree) have been grouped at a lower level of similarity into 16 bioregions in level II and 5 bioregions in level I.

The representativity analysis shows that epipelagic bioregions, aside a few exceptions are poorly represented in the network of MPAs (see Fig. 54 and Appendix 9). Thus, most of the 37 bioregions in Level III have less than 3% of their surface covered within the system of MPAs (and even less than 1% for the majority).

Some of the bioregions are better represented within the system of MPAs, such as II-6-12 (Alboran Sea – with a little over 6%) or II-9-11, but only 2 bioregions (in level III) reach the target of 10% protection (see Fig. 54). These bioregions are III-8-17 (which corresponds to the Gulf of Lion - 12.6%) and IV-10-3 (in the Aegean Sea which reaches 31.5%). If we consider Pelagos, these figures go up ten-fold for 4 bioregions (III-5-19; III-5-36; III-7-15 and III-9-11).

Data describing the representation of the 37 bioregions in level III is provided in Appendix 2. The analysis conducted on this data suggests that the overall protection effort needs to focus on the Mediterranean's deep sea areas, whilst taking into account the epipelagic bioregions diversity.

1. «The epipelagic zone comprises the section of the water column from the ocean surface to the maximum depth where light penetrates enough to prompt photosynthesis. Theoretically, it stretches down to a depth at which the residual light intensity is 1% of the surface light. Remote sensing data used for bioregionalisation analysis only allow for the surface of the epipelagic zone to be assessed.»

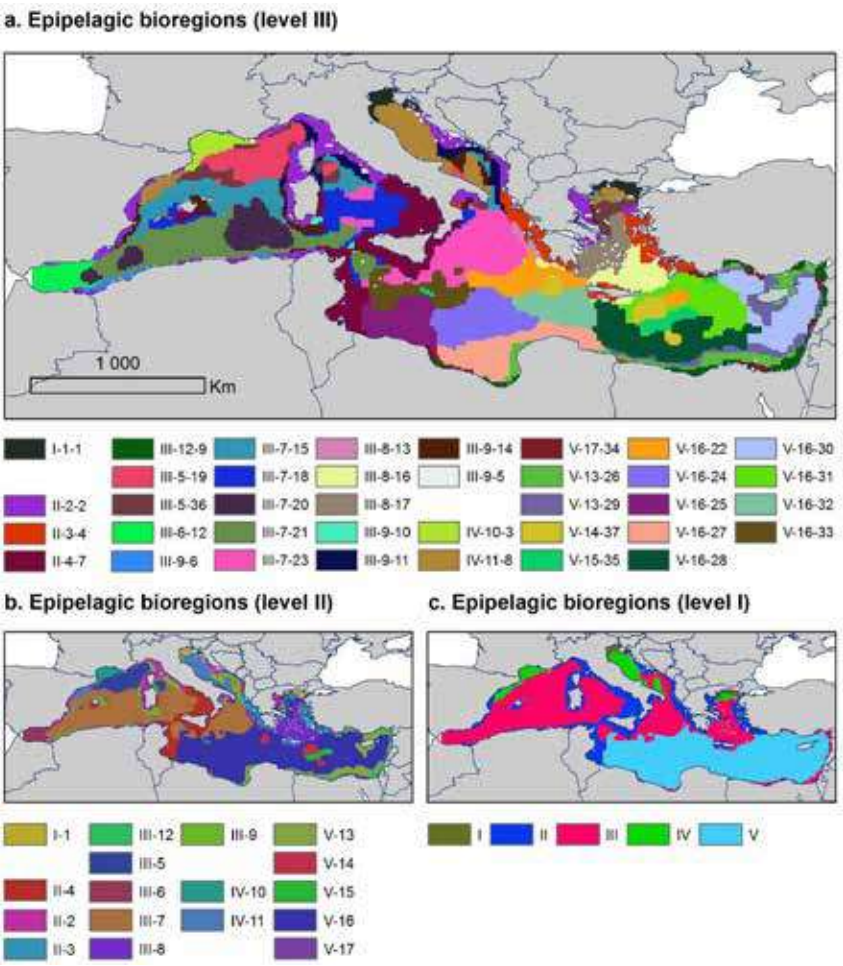


Figure 53: Map of epipelagic bioregions in level I, II and III

Level I Bioregion	Spatial distribution	Main characteristics
I		Very shallow, low surface temperature with high inter-seasonal variation, very high chlorophyll-a concentration with high inter-seasonal variation, very high water turbidity, low salinity, absence of oceanic gyres
II		Shallow, average sea surface temperature, high salinity, absence of oceanic gyres
III		Important depth, average sea surface temperature, frequent temperature fronts, low chlorophyll concentration, frequent local oceanic gyres
IV		Average depth, low sea surface temperature, average chlorophyll concentration, frequent temperature fronts, rather low salinity, absence of oceanic gyres
V		High average temperature, low chlorophyll concentration, frequent temperature fronts, rather high salinity, very low turbidity, frequent local oceanic gyres

Table 15: Description of the level I epipelagic bioregions characteristics

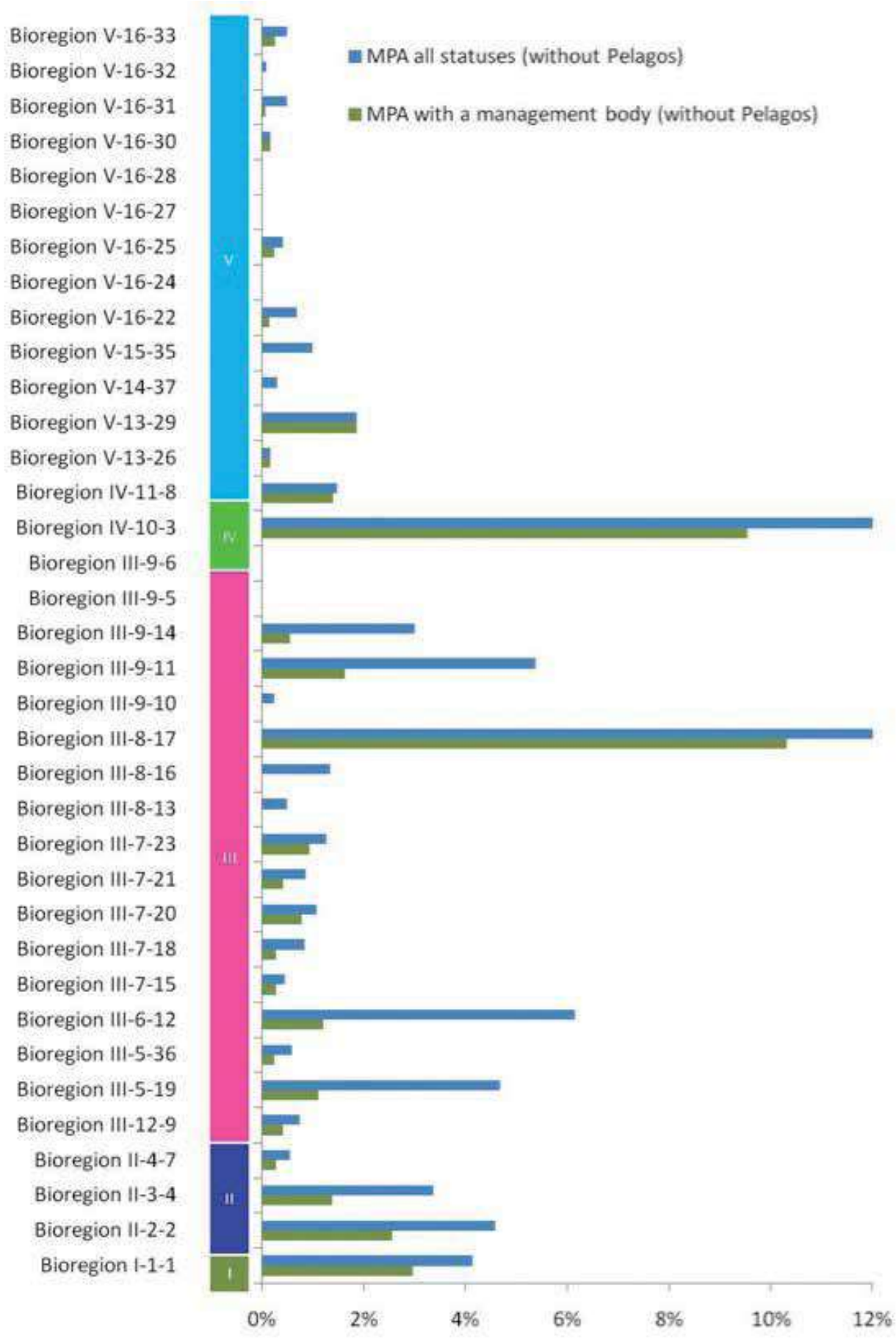


Figure 54: Representation of level III bioregions within the MPA network, for MPAs of all designations and for MPAs with a management structure only (excluding Pelagos).

The number corresponding to the 5 level I bioregions are shown on the graph with their associated colours

Monachus monachus © NMPANS

REPRESENTATIVITY OF SOME THREATENED SPECIES

The endangered species list in annex II of the Protocol concerning Specially Protected Areas and Biological Diversity of the Barcelona Convention (SPA/BD Protocol - UNEP/MAP, RAC/SPA) gives a total of 132 endangered species. Among these are some benthic species, therefore ancillary to one of the habitats described previously; the others are migratory or highly mobile, including fish and other species such as marine mammals and turtles. In this study, we have concentrated our efforts on the most iconic and/or endangered species in the Mediterranean for which we have information; these include marine mammals (8 species), birds (4 species), turtles (5 species) and fish (16 species).

It is important to protect the habitats that are essential to the life cycle (nesting grounds, breeding areas, nurseries, migration zone...) of species that migrate over large areas, particularly pelagic species such as marine mammals and sea turtles. Currently, these essential areas are largely unknown and when they are, our knowledge is limited, so we used the species' range when it was known. An important amount of work still needs to be done to map the habitats linked to the life cycle of these species and the interaction between these habitats, the species and human activities (including MPAs in their role as a tool for regulating the activities).

"We based our work on a number of studies led by the RAC/SPA, IUCN, by ACCOBAMS on marine mammals, by Johnson *et al.* (2006) on the monk seal, by Carbonera and Requena (2011) on birds and the UMR 5119 ECOSYM laboratory (University of Montpellier II – France) on fish. In addition, an assessment on the distribution of critical habitats for six groups of marine predators (cetaceans, monk seals, seabirds, turtles, sharks and bluefin tuna) was presented at the IUCN World Conservation Congress in Barcelona (Hoyt and Notarbartolo di Sciara, 2008) to help identify their concentration areas, where MPAs could be established to give support to their conservation.

Also to be highlighted is the work of Coll *et al.*. They evaluated the network of MPAs in the Mediterranean in terms of its pressures and specific diversity. Finally, Giakoumi *et al.* (2012) suggest future research lines and measures in the field of conservation planning in the Mediterranean. This study contributes to the Giakoumi *et al.* (2012) article's third objective by using a habitat and species spatial information synthesis, even if this data is still incomplete and imprecise".

Marine Mammals

All the Mediterranean's marine mammals are listed in Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity of the Barcelona Convention (UNEP/MAP, RAC/SPA, 1995) and, for the cetaceans, protected under the ACCOBAMS («Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic Area»). The IUCN and ACCOBAMS jointly conducted studies on the conservation status of 10 species of cetaceans in the Mediterranean. The results show that 60% of these species are threatened (Critically Endangered, Endangered and Vulnerable) and 40% are «Data Deficient» (Reeves and Notarbartolo di Sciara, 2006).

Twenty-one out of the 83 cetacean species listed in the

world have been identified in the Mediterranean, half of which are just passing through and come from Atlantic populations (Reeves and Notarbartolo di Sciara, 2006; Notarbartolo di Sciara *et al.*, 2010).

In this report, the geographic distribution mapping of 7 species of cetaceans was undertaken based on a data synthesis done by Notarbartolo di Sciara and Birkun (2010) for ACCOBAMS following previous work by Hoyt and Notarbartolo di Sciara (2008). The species taken into account are specified in Table 16 and Fig. 55.

To complete the data on cetaceans, the distribution range of another marine mammal, namely the Mediterranean monk seal (*Monachus monachus*) was mapped based on information taken from Johnson *et al.* (2006). With only about 250-300 individuals known to be left, the IUCN status for this species is CR (Critically endangered). The highest concentrations, with regular observations, are located along the coast of Turkey and Greece; they are very rarely still observed in Morocco, Algeria and Libya.

The target of 10% representation within the network of MPAs which have a management structure (including Pelagos) is only reached for one species of cetacean, the Fin whale. For the six others, the representation of their distribution range within the network of MPAs spans from 2.7% to 7.9% when considering all MPAs, and from 2.7% to 7.3% when considering MPAs with a management structure, including Pelagos (see Fig. 57).

These results will require further analysis in the near future based on finer knowledge of the distribution of these species.

Less than 2% of the monk seal distribution range at sea is included within a MPA (with a management structure) and 3.7% if all MPAs are considered (see Fig. 56 & 57). The survival of this species is threatened on the short term and in addition to MPAs, integrated management measures for human pressures are necessary on the coasts where the monk seals are present. It is also necessary to gain more precise data on the localisation of coastal terrestrial sites this species uses.

Marine Mammals of the Mediterranean

Ten cetacean species are regularly encountered in the Mediterranean: the striped dolphin (*Stenella coeruleoalba*), the short-beaked common dolphin (*Delphinus delphis*), the bottlenose dolphin (*Tursiops truncatus*), Risso's dolphin (*Grampus griseus*), long-finned pilot whales (*Globicephala melas*), harbour porpoise (*Phocoena phocoena*), killer whale (*Orcinus orca*), the Cuvier's beaked whale (*Ziphius cavirostris*), the common sperm whale (*Physeter macrocephalus*) and fin whales (*Balaenoptera physalus*).

Four other species have also been identified in the basin and are considered occasional: the minke whale (*Balaenoptera acutorostrata*), the humpback whale (*Megaptera novaeangliae*), the false killer whale (*Pseudorca crassidens*) and the rough-toothed dolphin (*Steno bredanensis*) which resides in the eastern basin, but not in the western Mediterranean.

Species	Occurrence	IUCN status (Mediterranean subpopulations)
Fin whale *(Balaenoptera physalus)*	Found in all oceans, including the Mediterranean	VU
Long-finned pilot *whale(Globicephala melas)*	One of the two pilot whale species	DD
Risso's dolphin *(Grampus griseus)*	Common in the Mediterranean	DD
Sperm whale *(Physeter macrocephalus)*	Found in almost all the seas, including the Mediterranean Sea	EN
Striped dolphin *(Stenella coeruleoalba)*	Abundant dolphin species found in all seas and oceans	VU
Bottlenose dolphin *(Tursiops truncatus)*	Found in all seas and oceans	VU
Cuvier's beaked whale *(Ziphius cavirostris)*	Frequent in the Mediterranean	DD

Table 16: Species of cetaceans considered in the study. EN: endangered - VU: vulnerable - DD: Data deficient - LC: Least Concern. The common dolphin Delphinus delphis ought to be integrated to future analysis.

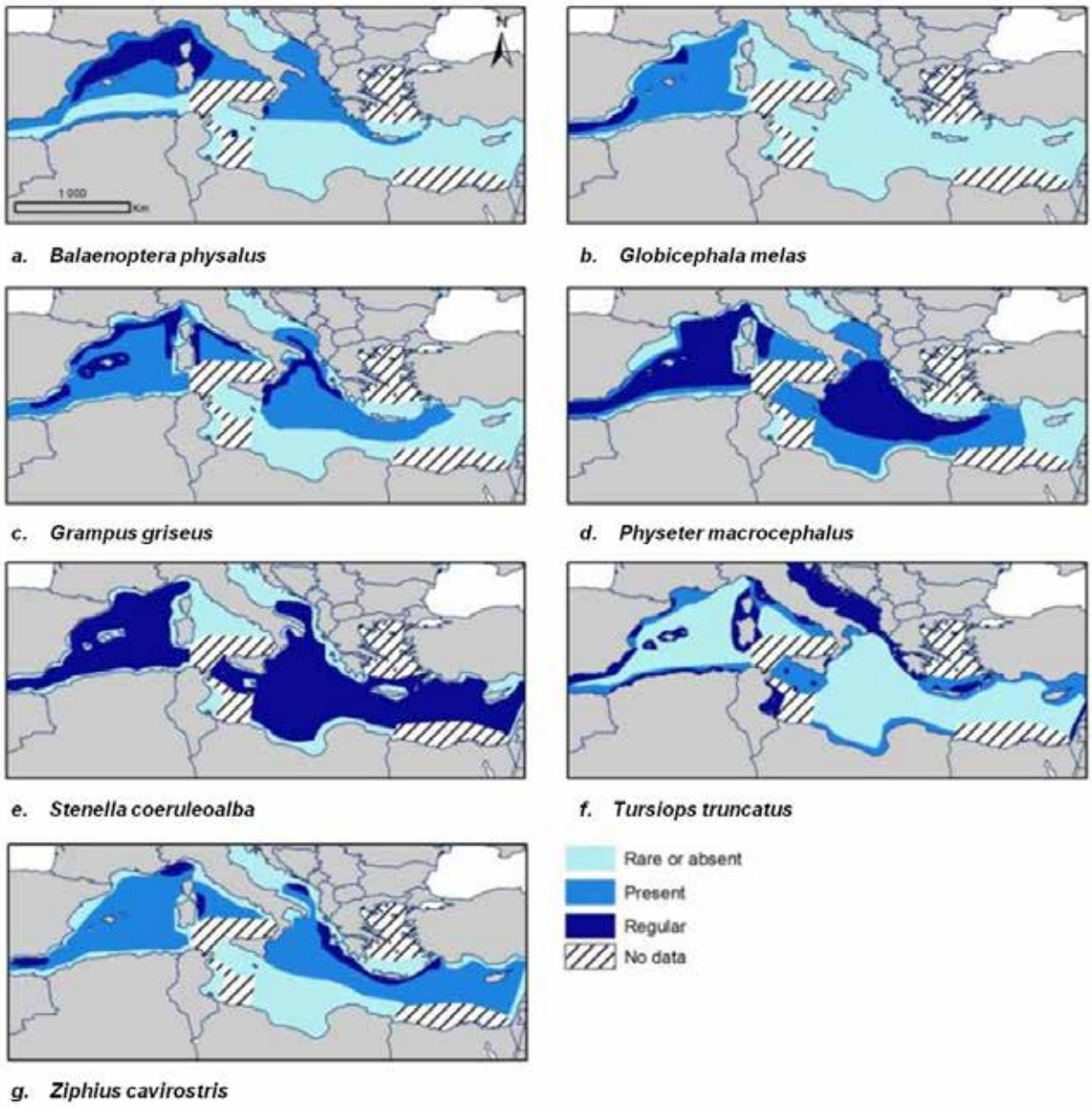


Figure 55: Distribution range of seven subpopulations of cetacean species (based on Notarbartolo di Sciara and Birkun, 2010). Only areas matching the categories 'Present' and 'Regularly Present' were taken into account in the reprensentativity analysis

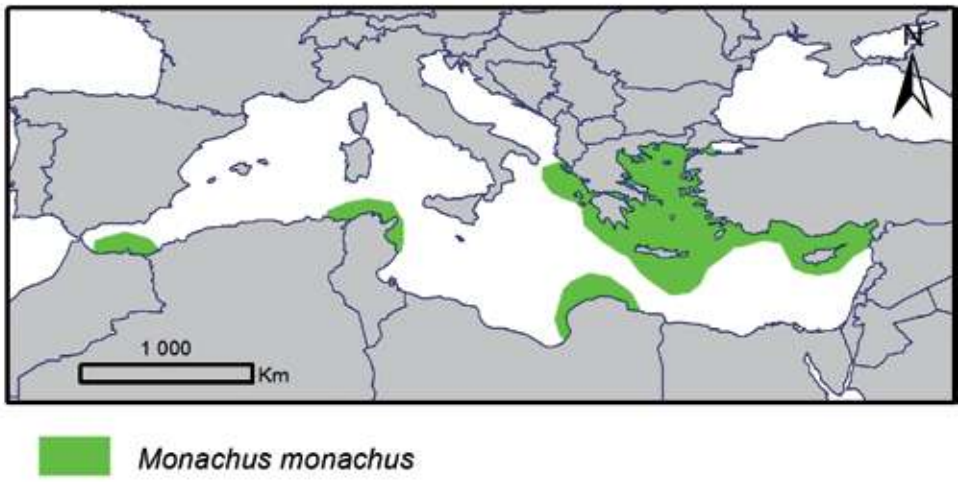


Figure 56: Distribution range of the Mediterranean monk seal (*Monachus monachus*) (completed from Johnson *et al.*, 2006)

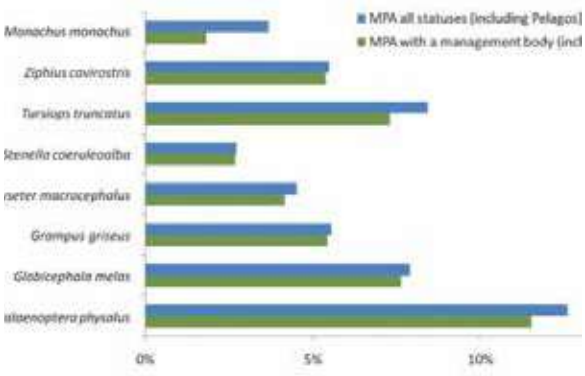


Figure 57: Representation of the distribution range of eight species of marine mammals in the network of MPAs (including Pelagos)

Turtles

Three sea turtle species, listed in Annex II of the Protocol «Specially Protected Areas and Biological Diversity» of the Barcelona Convention are present in the Mediterranean (Casale *et al.*, 2010; UNEP/MAP, RAC/SPA, 2010d): The loggerhead turtle (*Caretta caretta*), still abundant but now mainly confined to the eastern basin of the Mediterranean and whose last reported nesting sites are located in Greece, Turkey, Cyprus, Libya and Israel; the Green turtle (*Chelonia mydas*) which is becoming rarer and whose last nesting sites were observed in Cyprus, Turkey, Egypt and Libya; and the Leatherback turtle (*Dermochelys coriacea*) which does not nest in the Mediterranean and as such should be analysed on a different front in future representatiivty studies. The Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) are more infrequent.

The mapping of the spatial distribution of 5 turtle species present in the Mediterranean was obtained using geographic information extracted from the SWOT database (State of the World's Sea Turtles) OBIS-SEAMAP (Halpin *et al.*, 2009). The distribution data used by SWOT is taken from Eckert *et al.* (2009), Mortimer (2007), Mortimer and Donnelly (2007), Nichols (2007), Seminoff (2004, 2007), Tiwari (2007), Wibbels (2007), Witt *et al.* (2007), Hirth (1997), Marquez (1990), Dodd (1988), Witzell (1983). The *Caretta caretta* nesting sites (n = 31) and those of the *Chelonia mydas* (n = 16) were identified from the Casale *et al.* (2010) list. The geographic coordinates of these sites were taken from the SWOT database or Google Earth website. The protection status of these "terrestrial" sites was estimated by looking at the nearest MPA in a 5 km radius around the nesting sites (see Fig. 59).

None of the turtle species distribution range is protected at over 10% in MPAs of all statuses (see Fig. 58).

Besides, 29% of *Caretta caretta* and 18.7% of *Chelonia mydas* known nesting sites are currently represented within the system of MPAs (and respectively 25.8% and 18.7% when taking into account only MPAs with a management structure, excluding Pelagos) - see Fig. 60. However, known nesting sites are tremendously limited and these species are threatened in the Mediterranean.

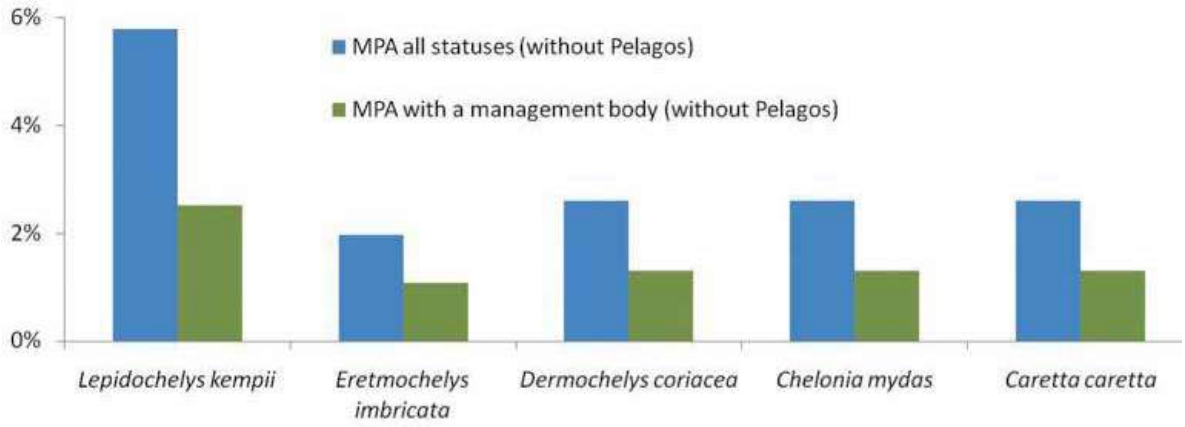


Figure 58: Representation of the distribution range of five species of turtles in the network of MPAs (aside Pelagos sanctuary)

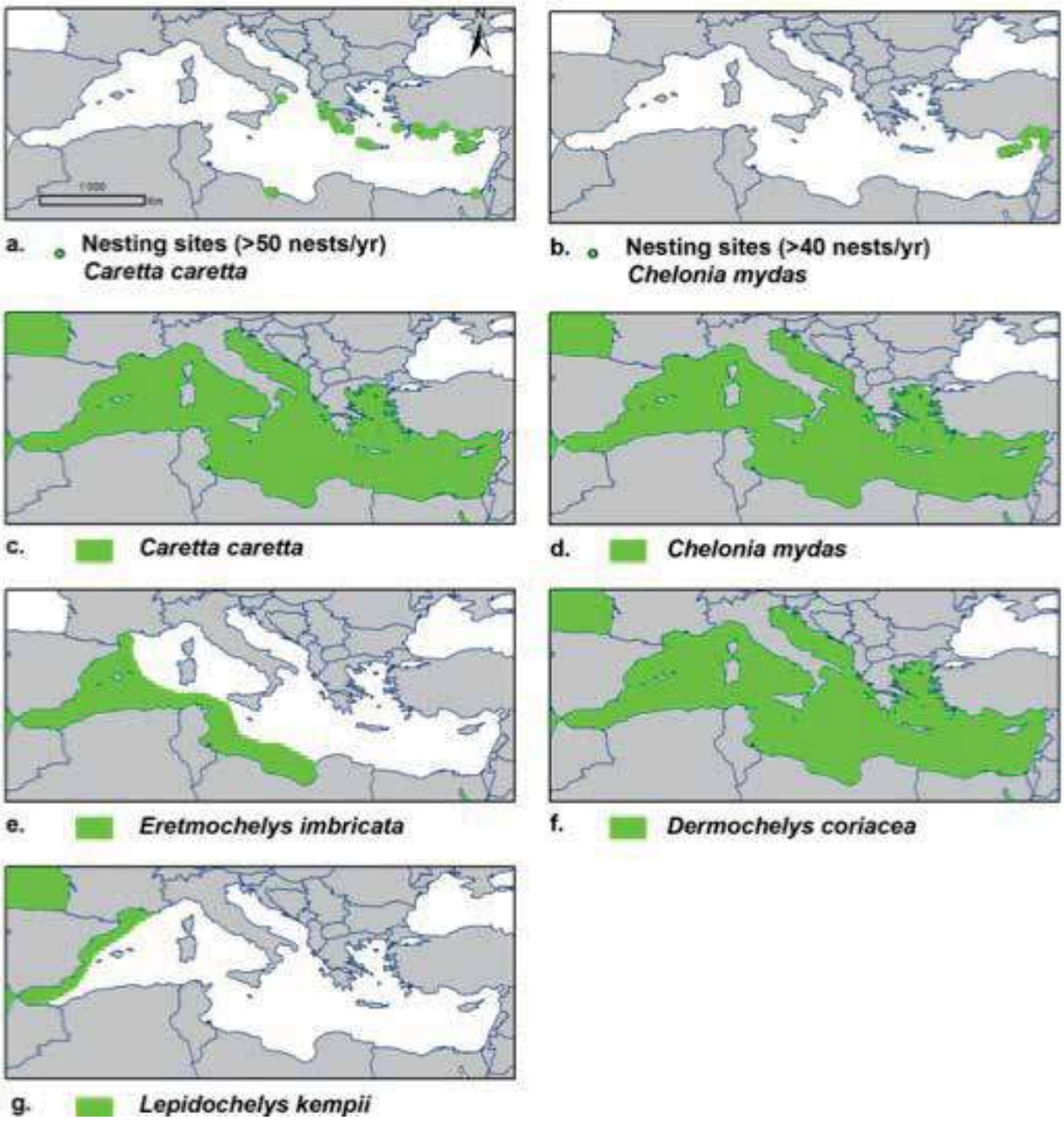


Figure 59: Distribution range of five species of turtle present in the Mediterranean and nesting sites for *Caretta caretta* and *Chelonia mydas*, noting these two last species are the most regular in the Mediterranean Sea

n.b. Although three of the species occur throughout the Mediterranean basin, this does not mean that they are abondant, as their conservation status indicate

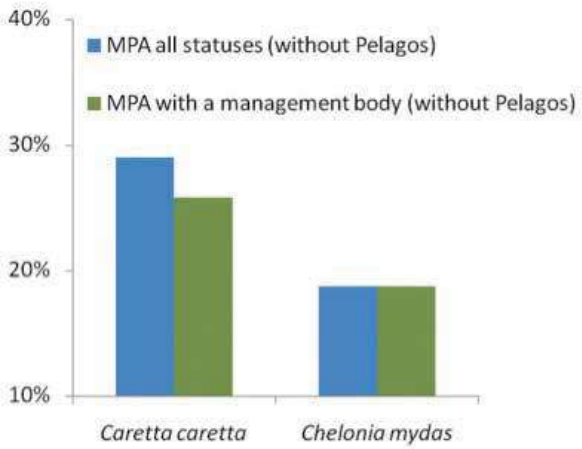


Figure 60: Representation of the nesting sites of *Caretta caretta* and *Chelonia mydas* within the network of MPAs (aside Pelagos)

Fish

The Mediterranean has a varied cartilaginous fish fauna with among 80 species (approximately 7% of the Chondrichthyes total), including 45 shark species (17 families), 34 batoids species (9 families) and a kind of chimera species (Cavanagh and Gibson, 2007). This fauna includes charismatic breeding populations such as the great white shark (*Carcharodon carcharias*) and populations of the basking shark (*Cetorhinus maximus*), which are listed in Annex II of the SPA/BD Protocol of the Barcelona Convention.

A recent IUCN assessment determined that 42% of the Mediterranean's chondrichthyan species are considered threatened, 18% is critically endangered, 11% is endangered and 13% vulnerable (Cavanagh and Gibson, 2007).

Ferretti *et al.* (2008) estimate that the hammerhead shark (*Sphyrna spp*.), blue shark (*Prionace glauca*), shortfin mako shark (*Isurus oxyrinchus*), porbeagle shark (*Lamna nasus*) and the common thresher shark (*Alopias vulpinus*) populations have declined from 96 to 99.99% compared to their initial population.

In the last two decades, many commercial fish stocks have declined in the Mediterranean Sea while in the same period fishing effort as a non-professional activity has increased (Morales-Nin *et al.*, 2005). This is the case for the emblematic Bluefin tuna (*Thunnus thynnus*) – see Fig. 61.

As a result, the sustainability of the Mediterranean's artisanal fisheries is declining and even threatened (Gomez *et al.*, 2006). This situation is exacerbated by the added pressure of recreational fisheries activities (Albouy *et al.*, 2010).

On the International scene, a number of MPAs have been put in place to reduce these negative impacts within the framework of an ecosystem-based approach to manage the sea and coast (Lubchenco *et al.*, 2003). Until now well designed, managed and enforced MPAs have demonstrated to produce positive effects on fish populations inside and close to boundaries (Gaines *et al.,* 2011). On the contrary, the expected positive effect on Mediterranean fish stocks has not yet demonstrated to have a role in limiting or halting this declining trend (Gomez *et al.,* 2006). This can be partly attributed to the fact that: 1) MPAs and especially no-take zones (NTZs) cover a negligible extent compared to fished areas; 2) a non negligible fraction of MPAs are just paper parks.

It is worth nothing, anyway, that recent studies provided suggestive evidence that working MPAs can be effective sources of eggs and larvae replenishing surrounding fished areas locate at tens to hundreds kilometers from MPAs (Di Franco *et al.,* 2012).

For this report, we assessed the representativity of 16 species of fish which are found in the Mediterranean (Table 17). These species represent different trophic levels. Distribution data was collected by the UMR 5119 Ecosym laboratory (Albouy *et al.*, in press) and then digitized into GIS layers, based on existing maps as well as information on potential habitat for the species considered (temperature and depth criteria in particular). Albouy *et al.* (in press) offer a comprehensive representativity analysis of MPAs for over 600 Mediterranean fish species. We took information layers on the 16 selected species which we then crossed with the latest GIS layer of Mediterranean MPAs provided by MedPAN and RAC/SPA in 2012 (see Fig. 62).

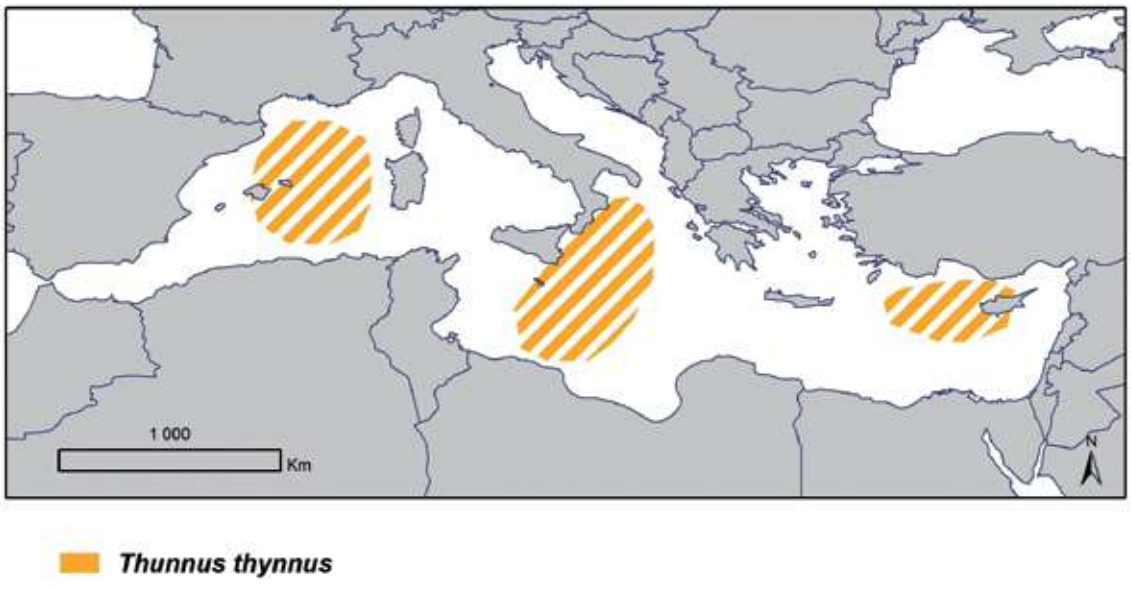


Figure 61: Spawning grounds of female bluefin tuna (*Thunnus thynnus*). Map based on Fromentin and Powers (2005)

Trophic Level	Species	Bibliography	IUCN status
Piscivorous	*Dentex dentex*	Morales-Nin and Moranta, 1997	NE
	Phycis phycis	Papaconstantinou and Caragitsou 1989	NE
	Sphyraena sphyraena	De Sylva, 1990	NE
	Epinephelus marginatus	Heemstra and Randal, 1993	EN
Opportunist piscivorous fish	*Pagrus pagrus*	Papaconstantinou and Caragitsou 1989	EN
	Scorpaena scrofa	Bell and Harmelin-Vivien, 1983	NE
Fish: Benthic invertebrate feeders (I)	*Pagellus erythrinus*	Rosecchi,1983	NE
	Sciaena umbra	Derbal and Kara, 2007	NE
Macroplanktivorous fish	*Serranus cabrilla*	Bell and Harmelin-Vivien, 1983	NE
Fish: Small pelagic feeders	*Merluccius merluccius*	Le Loc'h, 2004	NE
	Zeus faber	Bell and Harmelin-Vivien, 1983	NE
Fish: Mollusc feeders	*Coris julis*	Bell and Harmelin- Vivien, 1983	LC
	Diplodus vulgaris	Sala and Ballesteros, 1997	NE
Zooplanktivorous fish	*Engraulis encrasicolus*	Tudela and Palomera, 1997	NE
	Sardina pilchardus	Moreno and Castro, 1995	NE
Fish : Benthic invertebrate feeders (II)	*Mullus surmuletus*	Pinnegar and Polunin, 2000	NE
	Symphodus tinca	Khoury, 1987	LC
Herbivorous	*Sarpa salpa*	Bauchot and Hureau, 1990	NE

Table 17: List of the selected species, their trophic level and their IUCN status

(Albouy *et al.*, 2010); EN(endangered); NT (near threatened); VU (vulnerable); LC (least concern); NA (not assessed)

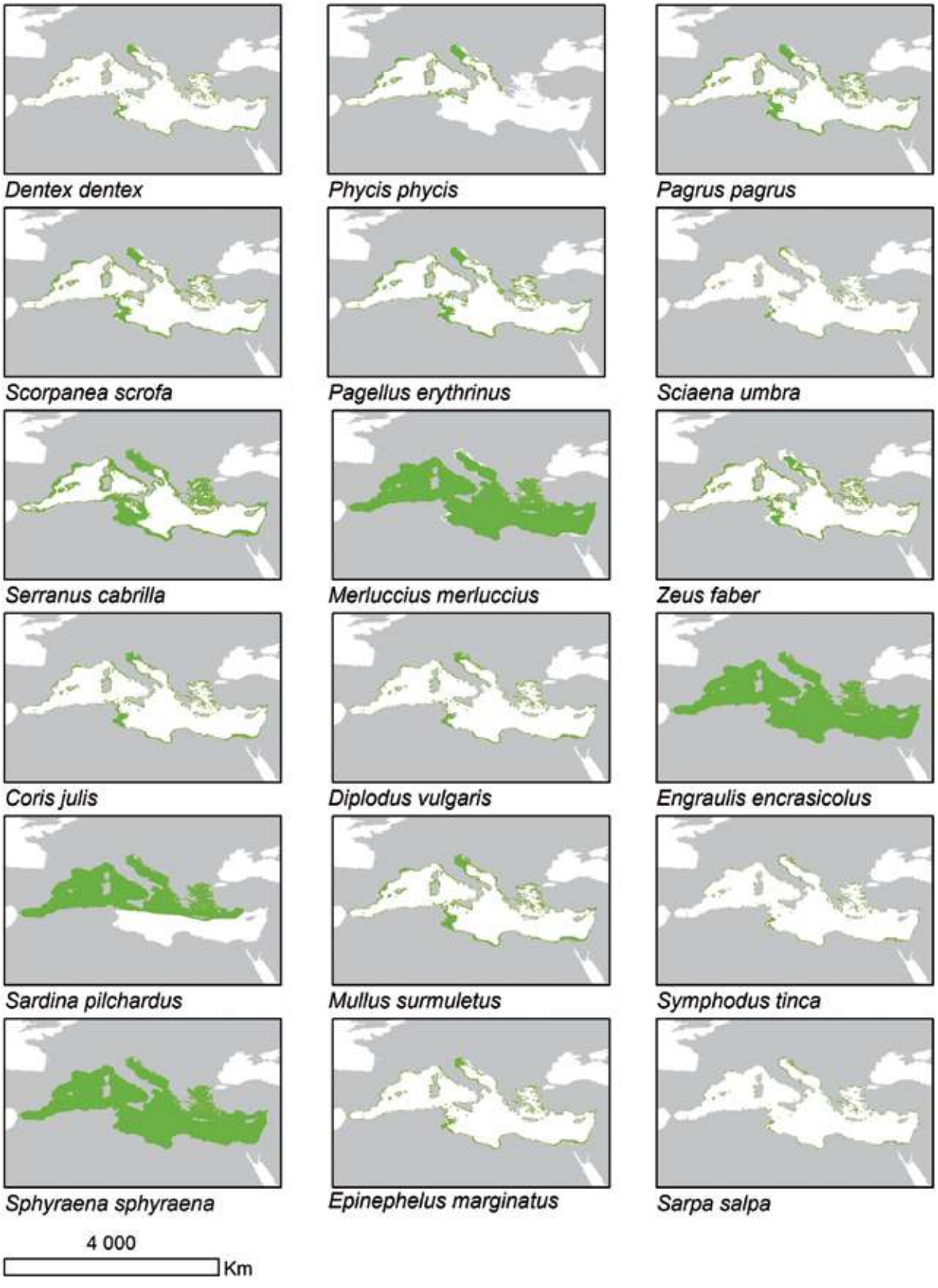


Figure 62: Map of the distribution of the 16 selected fish species (Albouy *et al.*, in press)

In general, less than 5.7% of the potential distribution area of the 16 species considered appears to be covered by the full MPA system (see Fig. 63). However, results from this analysis show some discrepancies with field reality. As such, the measure of representativity in the case of fish is merely an indicator to assess the surface area covered by MPAs which could eventually give support to reinforcing fisheries restrictions.

In the future, it will be necessary to fine tune this analysis, both in the choice of species (for example integrating Diplodus sargus sargus), and their significance in relation to given MPAs, considering their specific trophic level.

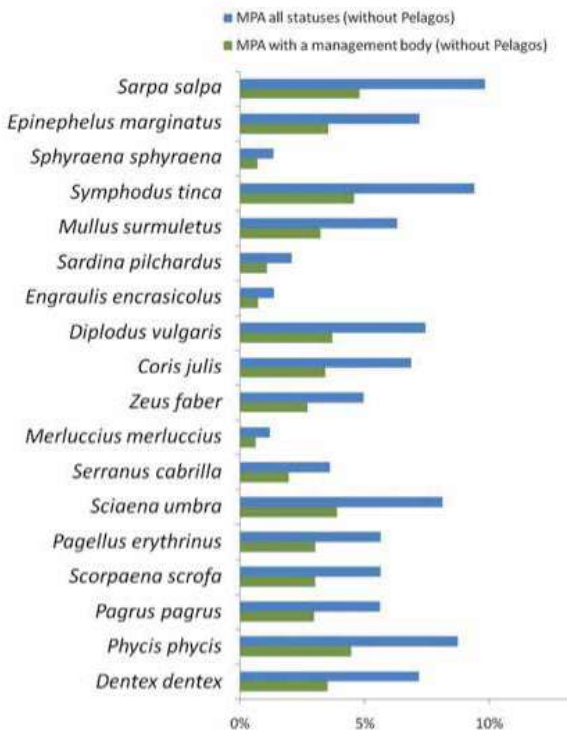


Figure 63: Representation of the potential distribution of the 16 selected fish species within the network of Mediterranean MPAs (without the Pelagos sanctuary)

Birds

There is poor diversity in the Mediterranean's seabirds (15 species) and their population densities are low according to an oligotrophic ecosystem (Coll *et al.*, 2010.) Ten of the Mediterranean's species are gulls and terns (Charadriiformes) four are shearwaters and petrels (Procellariiformes) and one species is a cormorant (Pelecaniformes). Three out of the 15 species are endemic (Aguilar *et al.*, 1993; Yesou and Sultana, 2000; Minguez *et al.*, 2003).

Data on the distribution of bird species at sea comes from the work done by Carbonera and Requena (2011) and UNEP-MAP-RAC/SPA (2010c). These authors selected and mapped the distribution of 4 of the bird species among those which are a conservation priority (see Table 18):

Species	Occurrence	IUCN species status
The Scopoli's or Cory's Shearwater (Calonectris diomedea)	nests in temperate latitudes, on the islands or rocky coasts of the Mediterranean and the East Atlantic. Between September and March, the Mediterranean populations leave the Mediterranean to join the Atlantic populations	LC
The Balearic Shearwater (Puffinus mauretanicus)	nests only in the Balearic Islands (less than 10 000 individuals)	CR
The Levantine or Yelkouan shearwater (Puffinus yelkouan)	nests from the South of France and East of Tunisia all the way to Turkey and Bulgaria. Outside of nesting periods, it is found throughout the Mediterranean and in the Black Sea (between 14 000 and 50 000 individuals)	VU
The Audouin's Gull (Larus audouinii)	only found in the Mediterranean and to a lesser extent along the Moroccan coast (less than 20 000 individuals). The main colonies can be found in the Ebro delta	NT

Table 18. Species of birds considered in the study.

EN (Endangered) - VU (Vulnerable) - NT (Near Threatened) - LC (Least Concern) - DD (Data Deficient)

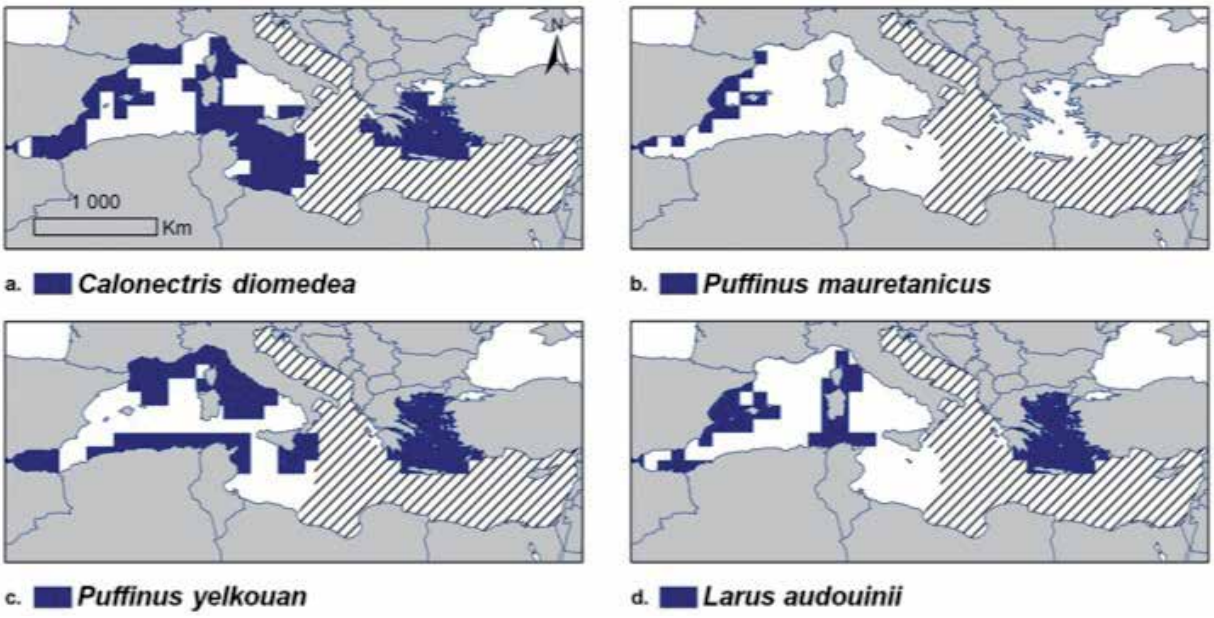


Figure 64: Distribution range at sea of four Mediterranean bird species which are a conservation priority

(Carboneras and Requena, 2011). The striped areas indicate absence of data on distribution

The mapping of this species was undertaken with a 1 degree resolution (latitude and longitude) – namely squares of about 100x100 km (Carbonera and Requena, 2011 – see Fig. 64). The map's coverage is only for the western Mediterranean, Greece and Maltese waters. Data on distribution is too fragmented outside these cited zones to be able to map the whole of the Mediterranean.

The range of distribution at sea of the four species considered is represented weakly in the network of existing MPAs (excluding Pelagos sanctuary – see Fig. 65): of about 8% for *Puffinus mauretanica* and about 1.8% for the other 3 species (considering all MPAs without Pelagos, but respectively 13% and 8% when including Pelagos). A very small portion of their distribution range is covered in MPAs that have a strict protection zone. It has to be underlined, nevertheless, that the current analysis only focuses on Mediterranean's sub-regions which tends to lead to an overestimation of the representativity of the network for the species involved. Besides, the priority areas for the conservation of birds have been identified by the RAC/SPA (UNEP-MAP- RAC/SPA, 2010a – see Fig. 64bis).

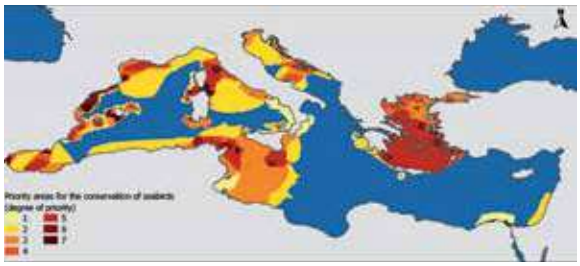


Figure 64bis. Priority areas for the conservation of seabirds (UNEP-MAP-RAC/SPA, 2010a)

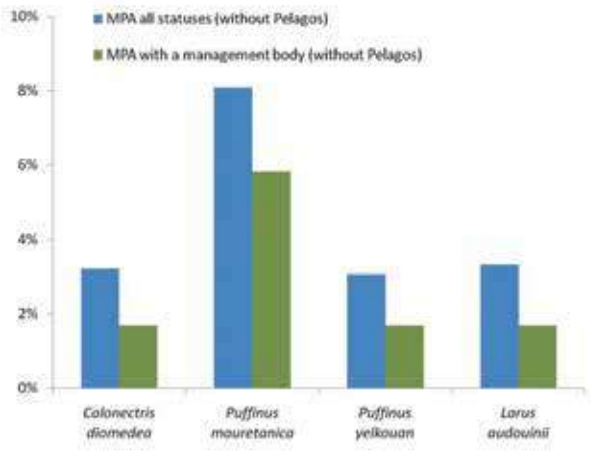


Figure 65: Representation of the area of distribution of four seabird species in the MPA network

SPECIES AND HABITATS PRESENT IN MPAS BASED ON THE QUESTIONNAIRE

The reported habitats in the MPAs

Fifty-two MPA managers have started to fill in the «habitats» section in MAPAMED (response rate 65%). This section is based on the RAC/SPA reference list of marine habitats types has 189 habitats. However, there is still a lot of missing information (many MPAs declared only a few habitats, so the data set is very incomplete).

For the benefit of the analysis, a selection of 16 target habitats (see Fig. 66) likely to be known by the MPAs and are of major biological significance was undertaken (all the detailed answers on the 189 habitats are in appendix).

The most frequently mentioned habitats (Posidonia meadows and coralligenous assemblages) are well known and are targeted the most in MPA conservation objectives. Among the MPAs in the sample group who answered the question on habitats, the *Posidonia* meadows are mentioned in 69% of the MPAs (not reported in Lebanon, Morocco - Al Hoceima and Slovenia) and the coralligenous assemblages in 52% of MPAs (not reported in Greece, Lebanon, Malta and Morocco). Apart from these two habitats, other iconic habitats were mentioned in less than 35% of MPAs. Less than 10% of MPAs mentioned deep-sea corals, most of the MPAs being primarily coastal. No MPA mentioned the presence of the abyssal zone.

The species reported in the MPAs

The «species» section in MAPAMED was answered by 58 MPAs (72.5% answer rate). Out of the 146 species in the survey, we have used here the 31 most iconic species in the Mediterranean; these are indicators of the ecological status or economic importance (Robert, pers. com.). All the detailed answers on the list of 146 species in the survey are in Appendix 15.

The giant mussel (*Pinna nobilis*), Posidonia (*Posidonia oceanica*), bottlenose dolphin (*Tursiops truncatus*), loggerhead turtle (*Caretta caretta*) and grouper (*Epinephelus marginatus*) are all well-known species in the Mediterranean which each manager has included as a priority in their conservation objectives. These are the ones which are most frequently mentioned by MPA managers (see Fig. 67).

Some results deserve further investigation including several species whose representation percentages are quite high and are deemed very rare. One notices the strong presence of lithophagous molluscs (*Lithophaga lithophaga* in nearly 60% of MPAs) mentioned by managers, regarded to be in danger of extinction, as well as the Common dolphin *Delphinus delphis* (in 25% of MPAs) also classified as rare, which makes one wonder if there was not some confusion between the species, so obviously needy of further research. The presence of the great white shark (*Carcharodon carcharias*) in 5 to 6% of MPAs is also surprising as this species is very rare.

The bluefin tuna (*Thunnus thynnus*) is present in over 35% of MPAs. No doubt they have just been seen in passing, but the interesting point about this information would be to know the rate of their presence or the periods (to compare breeding, feeding and migration sites); the same for the swordfish (*Xiphias gladius*).

Based on the questionnaires' answers, the monk seal (*Monachus monachus*) appears in more than 10% of MPAs in the Mediterranean which seems surprising since it is regarded as very rare today. Further information is required: isolated presence of erratic males, individuals or permanent or temporary population, linked to the life cycle or season.

In general, it would be interesting to know whether the species considered in the analysis reside permanently in the MPA or if they use the MPA as key habitats (feeding, breeding, nursery, rest area, mandatory migration zone).

These results should also be analysed in the light of the observation effort done in the MPA; thus is the loggerhead turtle (*Caretta caretta*) mentioned more often than the grouper (*Epinephelus marginatus*); or even the common dolphin (*Delphinus delphis*) which is often men-

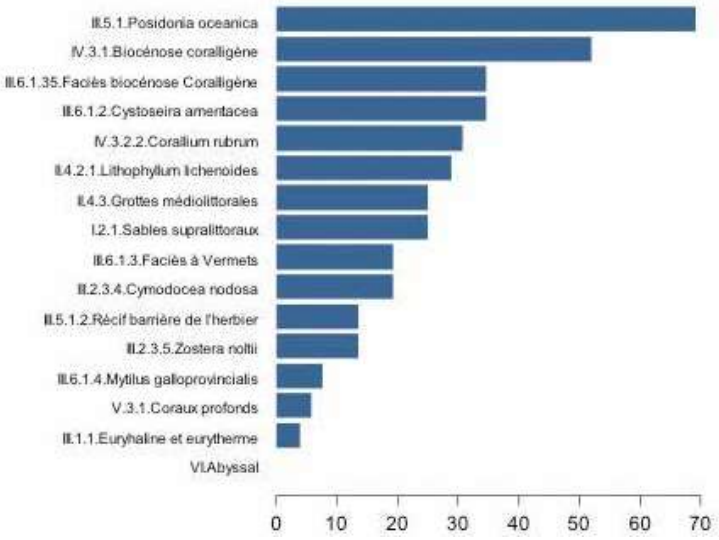


Figure 66: Rate of MPAs which declared the existence of each target habitat

(calculated from the 52 MPAs in the sample group which indicated the existence of at least one habitat)

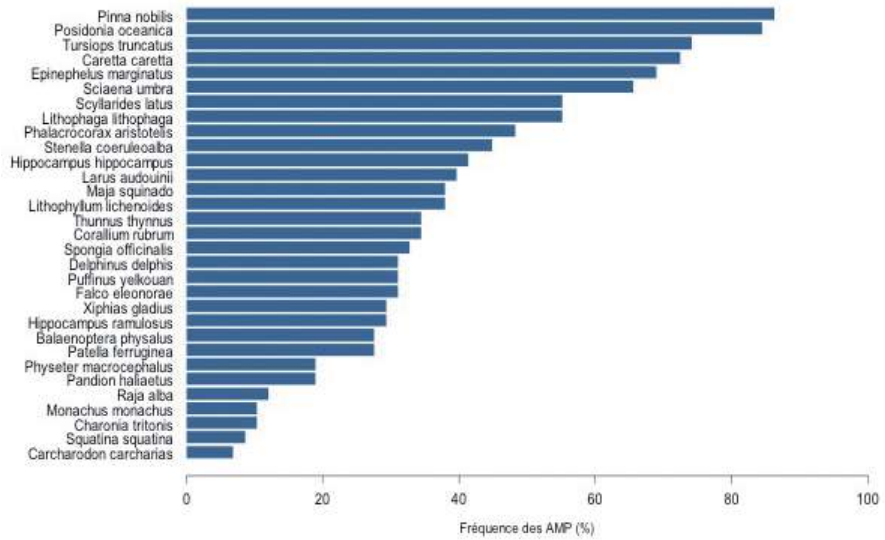


Figure 67: Rate of MPAs who declared the existence of each target species

(calculated from the 58 MPAs in the sample group which reported on species)

tioned in the answers, while it is rather rare. One should organise training sessions for managers and contributors on how to fill in the questionnaires to avoid the highly probable confusion between species of dolphins. Undoubtedly, professional fishermen should also be involved in this survey in order to confirm the presence of many species.

In 2009, a work done by RAC/SPA (Rais, in UNEP-MAP-RAC/SPA, 2009a) indicated that 80% of the species listed in the annexes of the SPA/BD Protocol were covered by MPAs, this is based on information available in the RAC/SPA database. In this study, 90% of species are listed as present in at least one MPA and only 14 species are not mentioned. Thus, among the species reported as absent in the C. Rais's work, the Raja alba is mentioned as present in 16 MPAs, *Caulerpa ollivieri* is present in Port-Cros, *Balaenoptera acutorostrata* in Portofino and the Gulf of Lion, *Orcinus orca* in the Gulf of Lion, etc. The other species, which are not reported in any of Mediterranean MPAs are shown in the table below (Table 19).

	Not mentioned in 2010 (Rais, 2010)	Not mentioned in 2010 but mentioned in 2012	Not mentioned in 2012 but mentioned in 2010
Algues/ Phanérogames	*Caulerpa ollivieri ; Cystoseira dedoides ;*	*Ptilophera mediterranea*	
Porifaires	*Ircinia pipetta*		
Cnidaires	*Errina aspera*		
Mollusques	*Gibbula nivosa ; Ranella olearia*		
Crustaceans	*Scyllarides pigmaeus*	*Pachylasma giganteum*	
Reptiles	*Trionyx triunguis*		*Lepidochelys kempii*
Birds	*Pelecznus onocrotalus ; Sterna bengalensis*		
Mammals	*Balaenoptera acutorostrata; Balaenoptera borealis ; Megaptera novaeangliae ; Orcinus orca*	*Eubalaena glaciali ; Mesoplodon densirostris Phocoena phocoena ; Pseudorca crassidens ; Steno bredanensis*	*Kogia simus*
Fish	*Alosa alosa ; Aphanius iberus ; Huso huso ; Pomatoschistus canestrinii; Raja alba ; Valencia hispanica*	*Lampetra fluviatilis ; Lethenteron zanandreai Pomatoschistus tortonesei*	*Acipenser naccarii ; Valencia letourneuxi*

Table 19. Species in the SPA/BDB Protocol Appendix: the differences found in the 2010 (Rais, 2010) and this studies' results

Assessing population connectivity

Along with representativity, connectivity is one of the key components guiding the establishment of representative networks of MPAs (see Box: CBD components to establishing networks of MPAs).

Connectivity is thus considered an important factor within the principles of ”ecological coherence” when planning for conservation. However, the concept of ”ecological coherence”, as defined in the EC Habitat Directive, and used both by OSPAR and HELCOM in assessing the regional seas networks of MPAs, is more policy based than scientifically based (Ardron, 2008).

This means that conservation planning for ecologically coherent networks of MPAs should incorporate the full array of empirical research, including on ecological integrity, ecological resilience, metacommunities and ecosystem health. Specifically for ”connectivity”, it also means that policy definitions used in a design-led process shouldn’t be confused with the quantification of connectivity (Catchpole, 2012).

While the design process for ecologically coherent networks of MPAs intends to meet conservation goals, the quantification of connectivity is a quantitative evaluation of how species move through a landscape. Although there are obvious synergies, and despite the growing use of spatially explicit connectivity metrics in attempting to underpin the design of ecological networks in many countries, one needs to beware the shortcomings: the presence of an ecological network does not necessarily mean that ecological coherence has been achieved (Catchpole, 2012).

While the notion of assessing connectivity stems from the terrestrial realm - looking at species movements throughout a given landscape and aiming at preserving corridors of nature to ensure the survival of species - connectivity within the ocean realm gets intricate due to the many more parameters we are yet to get to grips with. Furthermore, our understanding of connectivity also varies depending on which ecosystem is in focus and one could argue, for example, that knowledge is more advanced concerning connectivity within tropical coral reefs than for other ecosystems. Finally, it is important to specify which connectivity we are addressing when discussing MPAs and what can help decision makers determine the development of network of MPAs.

The field of connectivity looks at different kinds of connections, yet for MPAs we are specifically concerned with the concept of the connection that exists between populations of species that are harboured within a number of MPAs, and also the underlying mechanism whereby propagules (e.g. eggs and larvae) can migrate from an MPA to its outside with currents and active ocean movements. So we are specifically discussing population connectivity in this chapter.

CBD components to establishing networks of MPAs:

Appendix III of the CBD Decision - IX/20: recommendations as adopted at COP 9 lists EBSAs, Representativity, Connectivity, Replicated ecological features and Adequate and viable sites as the 5 components to establish networks of MPAs.

Specifically, it states that: ‘’Connectivity in the design of a network allows for linkages whereby protected sites benefit from larval and/or species exchanges, and functional linkages from other network sites. In a connected network individual sites benefit one another.”

Currents; gyres; physical bottlenecks; migration routes; species dispersal; detritus; functional linkages. Isolated sites, such as isolated seamount communities, may also be included

Assessing marine population connectivity quantitatively (i.e. rates of exchange among subpopulations of marine organisms) can be undertaken in a variety of ways and over different geographical scales. It is key here to underscore that concurrently using several methods (i.e. interdisciplinary framework) targeting the same species/scale will likely sharpen the validity of results, due to the complex nature of connectivity in the marine ecosystem. Methods and technologies include, for instance, molecular, genetic, microchemistry, modeling, tracers and ‘smart’ drifters.

Definition : Population connectivity is the exchange of individuals among geographically separated sub-populations that comprise a metapopulation.

And further to rates of connectivity, it will be the successful recruitment of species that move from one area to another that will bear all its importance for conservation. Several researchers have worked on this particular aspect.

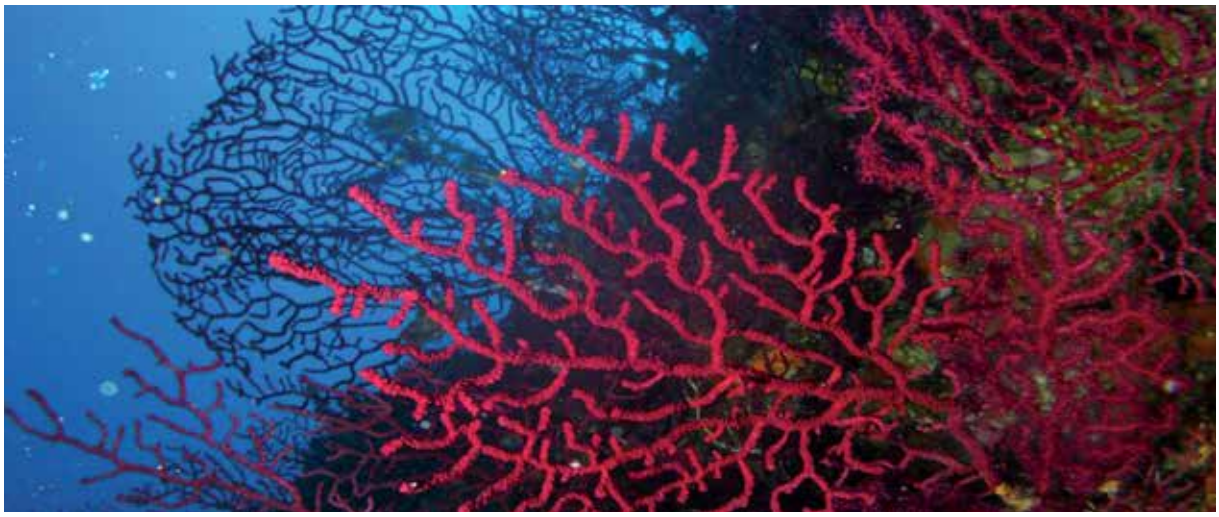
In the Mediterranean, a limited number of population connectivity studies have been undertaken in relation to MPAs, mostly at the level of coastal MPAs within a single country, and several look at the settlement and recruitment of species. Another couple of larger scale initiatives (and up to basin-wide) are also currently underway. However, when considering the following studies, it is of paramount importance to recognise that they represent the teasing kick-off to the much vaster field of research on population connectivity. Data on species biomass and on parameters governing their dispersal is so scant at the level of the Mediterranean that a network of MPAs at such a dimension cannot be designed on the mere findings relating to a handful of species or to using proxies, or extrapolating from local scale results even when using a combination of several methods.

In the Balearic Islands (Spain), Basterretxea *et al.* (2012) focused on assessing connectivity, mainly with regards to the 4 MPAs South-West of Mallorca. Using a model with data on currents, coastal fish larval dispersal and particle-tracking, they also introduced local data on seasonal wind patterns (wind stochasticity) to determine if this factor might be determinant in successful recruitment, aside coastal morphology. Results suggested that at the local scale, wind regime does indeed play a seasonal role in ensuring larval supply to coastal zones, thus highlighting some of the functions the local MPAs may have.

Still in the Mediterranean, Di Franco *et al.* (2012a) used otolith chemistry in the white sea bream D. sargus sargus to look at dispersal patterns in the Adriatic Sea (around Torre Guaceto MPA) which came out to be different depending on the life stage: larvae were estimated to move from spawning areas up to at least hundreds of km (to a max of ~200 km) to metamorphose and settle in coastal habitats, while after the settlement small fish were found to move up to tens of km from settlement sites (to a max of ~30 km) to recruit to the adult population. The advantage of this method is to look at connectivity while considering the different life-stages of a fish species. Although the study shows that larval dispersal occurs over an at least 200 km spread, the post-settlement dispersal analysis seems to bear added significance for the role of MPAs / network of MPAs, with results indicating that a 1/3rd of recruits settled in the same site, while about 20% moved to between 6-8 km away, another 20% to up to a 20 km distance and 10% about 30 km away from their settlement site. However, were this type of analysis be conducted in other locations, rocky-reef patchiness and sea-water chemistry would have to be born in mind as they would likely affect the results. Also to be considered is the ability to identify the actual geographic location of the spawning origins which requires possibly the use of other techniques such as genetic analysis and artificial tagging.

Further to this work and in order to fine-tune analyses of the usefulness of MPAs as linked to connectivity, Di Franco *et al.* (2012b) conducted further research in and around Torre Guaceto MPA, Italy) on the dispersal of fish propagules of D. sargus sargus. They looked at spatial distribution patterns of adults and settlers, and used simulated dispersal trajectories (Langrangian model application) and travel distance in addition to genetic patterns. The results confirm previous indications (Guidetti, 2006) on the role of Torre Guaceto MPA in protecting adult *D. sargus sargus*, and possibly favoring an enhanced propagules' production, thus acting as the most significant spawning source over a 200 km spread in the South West Adriatic Sea. These findings carry obvious implications for the development of a network of MPAs in that part of the Mediterranean Sea, at least where the conservation objectives of future MPAs involve fisheries.

In parallel, similar work was undertaken in the new Natural Marine Park of the Gulf of Lion (France, Western Mediterranean). In order to assess where best to establish no-take zones in the area (and determine size effectiveness), and whether the existing Carry-le-Rouet (CR), and Cerbère-Banyuls (CB) protected sites play a positive role in dispersal, Guizien *et al.* (2012) developed a methodology using larval dispersal simulations (langrangian) and population dynamics traits for sedentary species with a planktonic larval stage (which can be applicable to some invertebrates). They also quantified offspring spillover from no-take reserves to adjacent fished areas. Aside bringing out salient factors that contradict previously undertaken work on dispersal and connectivity, thus re-affirming the site specific parameters that need to be introduced as stochastics to models, they conclude on a number of findings which should be most useful to the Gulf of Lion region. First, they point out that CR and CB's



© A. Rosetti / Sunce

conservation objectives do not serve to ensure larval dispersal for the studied larvae forms. Rather, these sites have targeted the protection of key habitats. However, the small radius of these no-take reserves may compromise their efficiency in ensuring the survival of species through habitat preservation. Then, findings point out that these two sites may not be located in optimal sites and a protection effect of CB has only been demonstrated for Epinephelus marginatus (Lenfant *et al.,* 2003) and some commercial fish species. The paper makes some recommendations on extensions, new areas which could serve to protect sources of dispersal, and spacing of no-take reserves for the Gulf du Lion, while adopting a reasonable conservation stance that takes into account the human and economic perspectives.

Another couple of studies which ought to be pointed to have been conducted by López-Sanz *et al.* (2009, 2011) in the MPA of the Medes Islands where by sampling several fish species (including *Epinephelus marginatus*), they show the habitat, spawning location of adults and the role of the MPA appear to determine the stability of the larval distribution patters in time. Further, they empirically confirm larvae export from this MPA. The researchers also underline the importance of small-scale approaches to better understand dynamics of connectivity.

Finally, Guidetti *et al.,* (in press) discuss the importance of spatially planning conservation while better integrating MPAs that are coastal with those that are pelagic, highlighting that the connections between the two types are more functionally/biologically linked than previously considered in planning, as much as are use- and management- linked. Taking the example of the Pelagos Sanctuary (North West Mediterranean) and the array of MPAs that exist in the vicinity and/or embedded therein, they underscore that planning effective networks of MPAs should consider more readily the role of dispersal patterns for the spatial scales of connectivity among populations.

In other parts of the world, particular attention can be brought to efforts in progress in the Caribbean, including by another network of MPAs (CAMPAM). The recent work of Correll *et al.,* (2012) in the Baltic Sea provided for HELCOM concerning connectivity while looking at larval depth distribution, vertical migration and MPA functionality is another area worth some attention. Many initiatives around The United States of America (Hawaii in particular), Australia or Papua New Guinea can also be of much interest in the context of the Mediterranean, even if more specific to tropical environments. Also of use to the discipline of connectivity is the work on alien and invasive species. Despite there being many reasons for the spread of alien species, one key factor can be currents; these can indicate how specific species spread when analysing reported sightings over time. Bodilis *et al.* (2011) provide such an example with the case of Fistularia Commersonii.

Continuing debates on the efficacy of MPAs have triggered the need for models that allow capturing marine population dynamics. Theoretical studies suggest that population connectivity plays a fundamental role in local and metapopulation dynamics, community structure, genetic diversity, and the overall resilience of populations to human exploitation. While ocean modeling can be of valuable use (Treml *et al.,* 2008), it is to be clearly stated that, however, modeling efforts have been hindered by the paucity of empirical data on population connectivity. While progress is obvious with older life stages, connectivity as a function of larval dispersal remains unresolved for most marine populations and this lack of knowledge, namely on the spatial context, remains a primary obstacle to any comprehensive understanding of the population dynamics of marine organisms. As such, and particularly for fisheries, evaluating the design and potential benefits of novel management strategies keeps on being hampered (Cowen *et al.,* 2002; 2007).

For the purpose of this report, a demonstration of what can be achieved with using models for assessing connectivity in the context of Mediterranean MPAs was undertaken (Crochelet, in press). This work is currently being peer reviewed and we present a preview of its content in Appendix 16. First, the experiment looked at proximity and the Box "Proximity of MPAs" presents this first part of experimental work. While this gives an idea at the scale of the Mediterranean basin, one has to be cautioned into drawing conclusions, as pointed by Claudet *et al.,* (2008). Indeed, when undertaking a Mediterranean wide study of the effect of MPAs, the researchers found no evidence of the effect of distance between reserves. Rather, they stress that other factors (larval dispersal, species and disturbance dynamics and habitat discontinuities) are likely to play the prominent role. As such, these should be considered when looking designing networks of MPAs, or when assessing MPA network effectiveness.

Proximity Study

Ecological coherence can be assessed by the estimation of the Euclidean distance between MPAs. The regional seas conventions HELCOM (Baltic Sea BALANCE-HELCOM, 2006) and OSPAR (NE Atlantic; OSPAR, 2007) respectively recommend a distance of 25 and 50 km between MPAs. Other studies, on population genetics, suggest a mean dispersal distance for fish that lies between 25 and 150 km (Palumbi, 2003; Hogan, 2011).

In the Mediterranean, the average distance between MPAs (between the nearest two) is 26.6 km (SD = 56.26 km) - Minimum to maximum distances between 2 MPAs: min = 0.09, max = 3 631.5 km). Figure 68 shows the proximity between MPAs using buffers of 25, 50 and 150 km. Out of the 113 MPAs (of IUCN categories II and IV, Figure 69), 59.9% of MPAs are less than 25 km apart (between the nearest two), 6.9% are between 25 km and 50 km apart, and 9.5% are 50 km to 150 km apart, while 2.6% are distant by over 150 km from one another (with a maximum distance between the nearest two of 498.6 km).

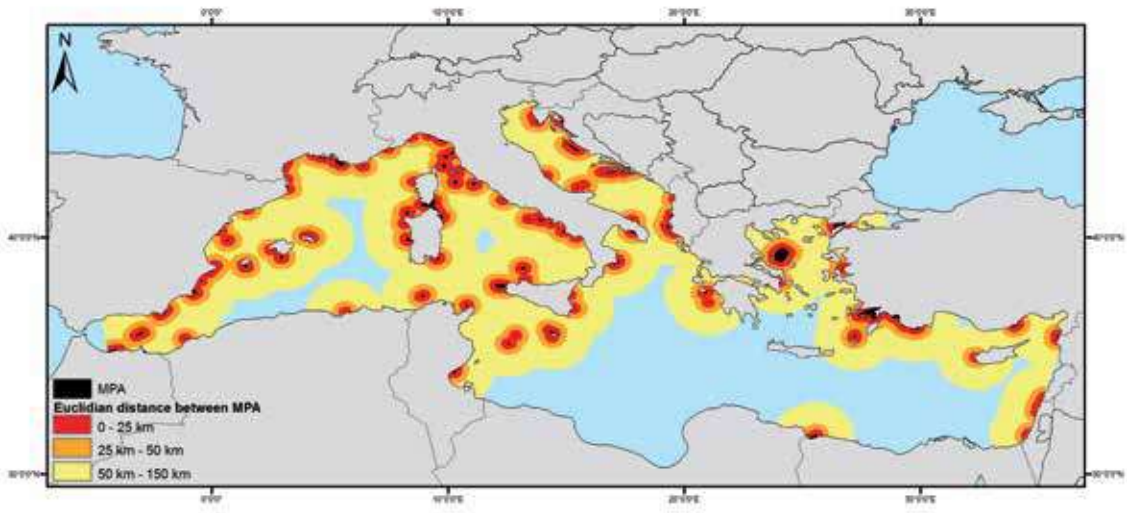


Fig. 68. Results of the estimated proximity between MPAs in IUCN categories II and IV (determined by a Euclidean distance)

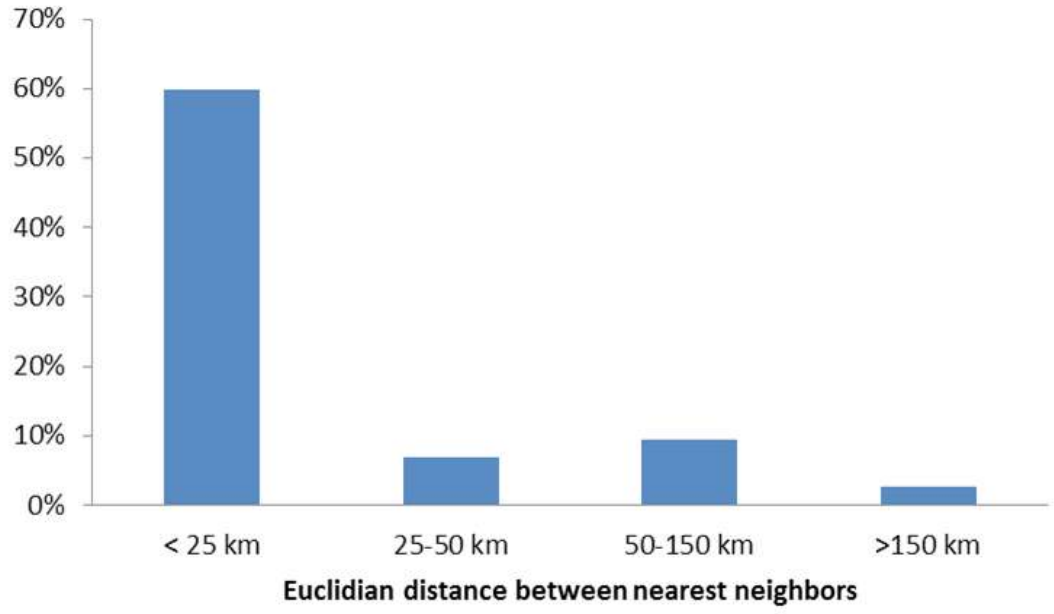


Fig. 69. Percentage of the 113 MPAs in IUCN categories II and IV located less than 25 km, between 25 km and 50 km, between 50 km and 150 km and beyond 150 km in distance from its nearest neighbour

Second, the experiment looked at rates of connectivity using fish larval dispersal, and finally, using drifting propagules – using data on Mediterranean surface currents (see Fig. 70). Throughout looking at this experiment, it is important to keep in mind that dispersal varies between taxonomic groups and that such models should therefore be run with different additional species, as well as coupled with other methods and over different scales in future research initiatives… As such, a single model cannot provide all rightful answers nor be translated for decision making about the effectiveness of networks of MPAs in the reality.

Recognising that the understanding of population connectivity is also key in efforts to develop spatial management methods for marine-capture fisheries, including the design of networks on marine reserves (Sala *et al.,* 2002), the limitations still pertinent to this field are highlighted in the box entitled "Limitations".

In 2002, a key workshop was held to discuss population connectivity in marine systems (Cowen *et al.,* 2002). At the time, it drew recommendations many of which could still apply today and some of which are highlighted above. One to underscore, due to the limitations of each of the techniques currently in use to measure connectivity, is the broadly interdisciplinary nature of the research required to address population connectivity. Another is the need to cross-check not just between disciplines, but also between scales. Further to this workshop, the Oceanography Society published a special Issue on Marine Population Connectivity (Oceanography, 2007) in which some of the key aspects are further analysed. Jones *et al.* (2007) look specifically at population connectivity and conservation of Marine Biodiversity while Fogarty *et al.* (2007) focus on population connectivity and Spatial Management of Marine Fisheries. As for Werner *et al.* (2007), it is the field of modeling which is under scrutiny, identifying an array of necessary developments for future studies of population connectivity. Finally, attention can be drawn to the work of Leis et al. (2011) who review what could work best in estimating connectivity in marine fish populations.

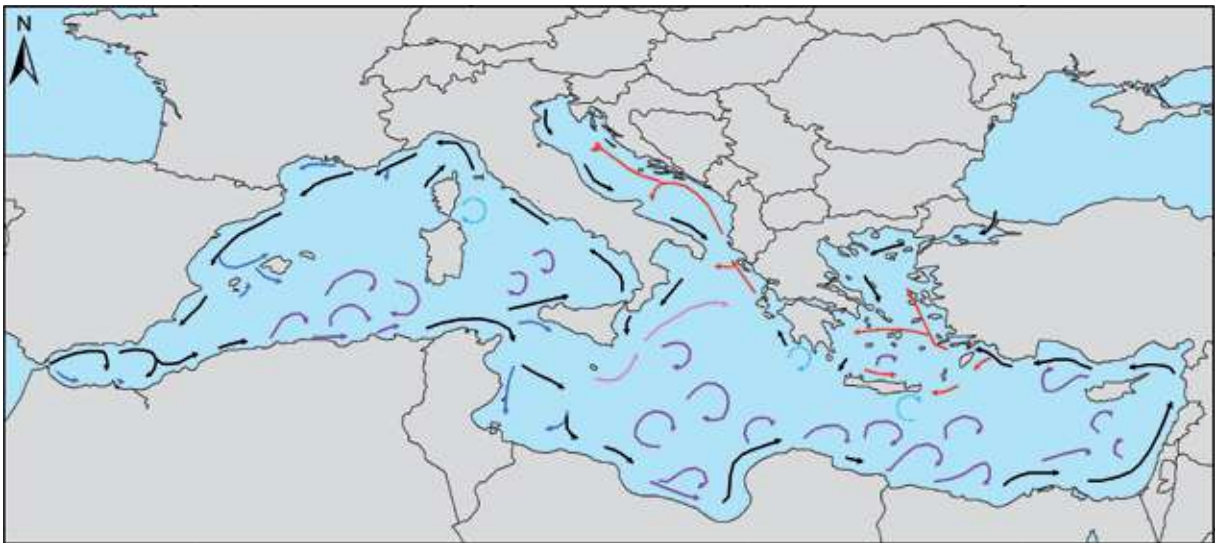


Fig. 70. General surface current circulation data in the Mediterranean Sea (according to Millot and Taupier-Letage, 2005)

Limitations

- There is a big lack of data regarding knowledge of species and their dispersal patterns. As a result, there is often the need to use proxy when wanting to obtain a regional overview, for example, but this type of data provides only a very general idea.

- The relationship between larval fish patterns and environmental factors (depth, habitat type, temperature and salinity) needs to be taken into account at a small spatial scale, in a given area.

- There is also an important need to assess connectivity at multiple species/phylum levels for results to bear significance for an ecologically/ecosystem based MPA design or network of MPA design. Indeed, results for a single given species cannot provide conclusions for other species which are likely to play a key role in the ecosystem balance.

- Modeling larval dispersal can be tricky as many factors can affect their trajectories. Indeed, larvae have the capacity to swim, orientate, migrate vertically etc… Traditionally, it had been assumed that fish larvae had poor swimming abilities and drifted passively with currents (Roberts, 1997); however, subsequent studies demonstrated that behavioural capabilities (swimming, orientation and sensory abilities) can influence, if not control, dispersal trajectories, as can fish 'personality' – e.g. boldness, sociability or aggressiveness. (Leis, 2007).

- Marine currents and long pelagic larval stages for most organisms create a high potential for long-distance dispersal, despite relatively sedentary adult phases. However, recent evidence (gained through tagging studies, otolith chemistry and population genetics) shows short-distance larval dispersal and sharp genetic breaks in species thought to have potentially high dispersal (Di Franco *et. al.*, 2012). Dispersal at sea, therefore, may actually be surprisingly lower than expected: 10 to 100 km for invertebrates and 50 to 200 km for fish (see Palumbi, 2004, for a review). As such, using models can skew results; the reason is that models work considering large scale current patterns, while small scale oceanographic structures and coastal currents are not taken into account, yet play a crucial role (Guidetti, pers. Comm.).

- Estimating dispersal distances of early stages thus remains one of the greatest challenges in marine ecology (Halpern *et al.*, 2003). Otolith chemistry provides a potential opportunity to investigate dispersal patterns at a number of life history stages.

- Very few data are available that are derived from direct observations of early stage dispersal distances (Palumbi, 2004). Direct measurements of dispersal are needed to better understand connectivity in a network of MPAs. MPAs are intended to serve community and ecosystem functions, and these functions involve species with many different dispersal patterns, most of which are unknown. Determining the optimal spacing of MPAs within a network requires knowledge about how far larvae, juveniles and adults regularly disperse or move, which could allow decisions about how close MPAs need to be to be effectively connected (in Di Franco *et al.*, 2012).

- Models can show a rate of Connectivity but the habitat may not be there for successful settlement and/or recruitment.

- About how to set a no-take zone size and location, a large scale approach can give some indication for detecting best locations for protection implementation at the regional scale, but should be complemented by local dispersal studies accounting for more detailed hydrodynamics features, species motility behavior and species interactions (Guizien *et al.*, 2006).

Posidonia of Cap d'Agde Marine Protected Area, France © R. Dupuy de la Grandrive

CHAPTER 5

Management, uses and pressures

Evaluation of the management effort

Other than criteria for representativity and ecological coherence, the CBD calls for MPAs to be well-managed and in an equitable way. The management analysis is based on answers to the questionnaire (see methodology section) which doesn't allow to measure the "efficiency" / "performance" of management but rather the «effectiveness» of the management (see box "Effectiveness versus performance").

METHOD

Parameters used

To measure the management's effectiveness, the following parameters from the questionnaire were used:

- Existence or absence of a management plan
- Existence of baseline studies for the MPA
- Implementation of regular monitoring programmes or occasional studies within the MPA
- Type of governance (participation of stakeholders)
- Presence of no-take zones
- Perception of the global evolution of fishery resources
- Personnel assigned to the MPA (sworn staff, staff training)
- Importance of the surveillance effort
- Existing infrastructure and equipment
- Awareness raising tools developed by the MPA
- Financing of the MPA and the existence of a business plan

Data processing methods

A mainly explorative method was used with an analysis of the percentages from the different responses to the questions and graphical presentation. This is an essential first step to understand the data and identify the sources of variability. Correlation tests, regression and variance analyses were made on many interrelated variables to assess the links between the variables (e.g. link between operational budget and personnel or with the MPA's surface area; link between the personnel and the MPA's surface area...). Only the significant variables amongst all these links are presented in this report.

Multivariable analyses and classification typologies were also made on the survey's data (see method in Appendix 8).

All analyses were made using the R software (R Development Core Team, 2011).

Effectiveness versus performance

To measure the efficiency of management and the performance of an MPA is complex and can only be obtained in the light of the management objectives which have been determine; this requires the implementation of a set of indicators linked to the MPA's objectives and the interpretative framework of these indicators. Therefore, the responses in the questionnaire cannot measure the management's efficiency, but as in 2008, it is rather the current management's capacity and effort or «effectiveness» which we are trying to measure.

Remarks on the quality of the data supplied

To obtain quality, complete and validated data, a person responsible for data collection and its validation must help each manager with the sensitive and complex issues. This approach can enhance the performance and reliability of the whole data processing chain. This was possible for certain cases, but not always due to lack of time.

Another crucial point in processing surveys lies in the design and wording of the questionnaire. Indeed, some questions in the current questionnaire are very difficult to process statistically due to their wording .

On the other hand, the official lists of habitats and species were very long and complex in the questionnaire and some answers were incomplete if non-existant.

Therefore, a major step forward has been taken in creating this MAPAMED database and this is only the first step, so it will be essential to supplement the missing information and continue working with the managers to validate the existing data in order to develop a solid and reliable database which can be used over the long term.

Comparisons with 2008

The 2012 questionnaire was changed from the 2008 one. Although most of the management themes in the 2008 questionnaire were included, altered wording in the questions and different MPA selection criteria between 2008 and 2012 makes a comparison difficult.

KEY FEATURES OF THE MPA SAMPLE GROUP ANALIZED

Out of a total of 170 Mediterranean MPAs with a national designation currently listed in MAPAMED and the 507 Natura 2000 sites at sea, 278 sites have a management structure 153 MPAs and 125 Natura 2000 among them responded to the questionnaire sent by MedPAN; 80 out of these 109 MPAs, including 9 Natura 2000 sites, namely 36% were selected for the study on management effectiveness, as their answers corresponded to the questionnaire and the results could be used significantly.

In terms of the sample group's representativity, we note that:

- The MPAs of the sample group represent 12% of the total number of MPAs registered in MAPAMED, and 29% of MPAs for which a management structure has been identified (46% of MPAs with a national designation and 7% of Natura 2000 sites that have a management structure identified);
- The MPAs who answered represent a protected surface area of 10,957 km², about 40% of the Mediterranean MPAs total area, without Pelagos (and 0.43% of the Mediterranean's surface area) ;
- 75% (n = 60) of them are located in the North-West region;
- 79% (n = 63) are in the European Union;
- Almost 50% are located in the Algerian-Provencal basin (see Fig. 71 and 72).

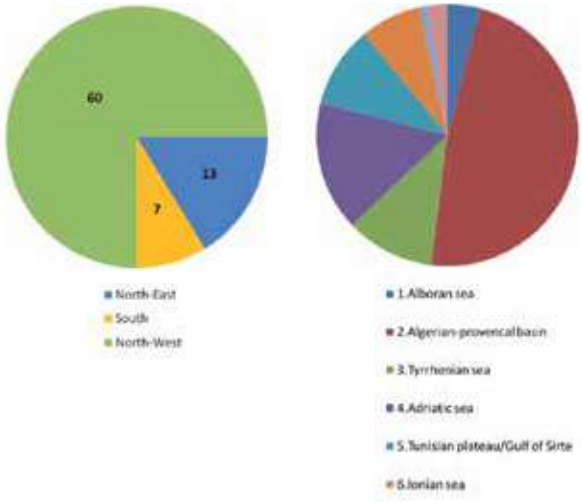


Figure 71: (on the left) Distribution of MPAs across the region

Figure 72: (on the right) Distribution (in percentage) of the surface area of MPAs across the ecoregions

This MPA sample group is not truly representative as there is an uneven distribution, especially within the basin, but it can give some idea of the means deployed by an MPA for its management and more particularly a manager who can answer a survey at the time of the study

The detailed characteristics of the MPA sample group used for the study are given in the appendix (see the main features in the box below, details in Appendix 17, and the list of MPAs in Appendix 4).

The characteristics of the MPA sample group selected for the study

Please note, the groups A to D used for the study mentioned below have been established on the basis of MPA designations and their management objectives (see Chapter 2).

- 45 MPAs (56%) are in Group A (park type), 15 (19%) are in Group B (nature reserve type), 9 (11%) are Natura 2000 sites, 8 (10%) are in Group D (country-specific designations) and 3 (4%) are in Group C (landscape type);
- the age of MPAs surveyed which is important to measure its effectiveness is quite varied: 27 MPAs (34%) are over 20 years old, 21 MPAs (26%) were between 10 and 20 years old, 21 MPAs (26%) are more recent, between 5 and 10 years old and 10 MPAs are very recent (12%) less than 5 years old; this low representation of MPAs under 5 years can be explained by the fact that all MPAs being planned or those who gave fragmented information in the survey were withdrawn from the study;
- The MPAs are divided, in a relatively homogeneous way, into different size groups: the group 5 to 30 km² is the largest (27 MPAs - 34%);
- One of the main objectives of most of the MPAs in the study (91%) is the conservation of biodiversity, followed by the issues on sustainable tourism and fishing activities, habitat conservation and education and awareness-raising.

MANAGEMENT CAPACITY AND EFFECTIVENESS

Type of governance

The questions on governance focused on the MPA's type of governance, as defined in the IUCN «Guidelines for the application of management categories for protected areas» (Dudley, 2008), namely the government - national, regional or local - in shared governance (co-management), private governance or governance by local communities, they were also on the management structure, the presence of a Scientific Committee and the participation of local stakeholders in the planning and management of MPAs. Questions on the inclusion of the MPA in policy planning and collaborative management with other Mediterranean MPAs were also asked.

In terms of type of governance (response rate 93%), most MPAs (76%) are under the government whether at a local, regional or national level. A few MPAs reported shared governance in co-management or joint collaboration (9 MPAs - 11%) or by local communities (3 MPAs - 4%). One MPA has private governance managed by an NGO (Miramare in Italy). However, it seems that this question was not always well understood with confusion between the term «type of governance» and «management structure».

Most of the MPAs in the survey have a decentralised **management structure** at a local or regional level (37 MPAs - 46%), whilst 36% (29 MPAs) are directly managed by the State. Some MPAs have a combined management (6 MPAs - 7.5%) or are managed by an NGO (4 MPAs - 5.5%). 2 MPAs said they had no management

(Debeli rtic and Cape Madona in Slovenia). (response rate 97.5%).

Over half of the MPAs in the study lack a scientific committee (42 MPAs - 52%) 32 MPAs (40%) have one (8% no responses), even if several call upon teams of scientists (universities, for example) to give them support when needed.

The participation of local stakeholders in the planning and management of MPAs is relatively high (51 MPAs, 64%). 11 MPAs (14%) believe that this is insufficient, and for 14 MPAs (17%) there is no participation (5% no responses), besides, 36 MPAs (45%) have one or more charters for users (14% no responses).

The MPA is taken into account in policy planning in 91% of MPAs (n = 73); in 13 of these MPAs (16%) they are partially taking into account (6% no responses). Half of the MPAs (41 - 51%) reported developing joint management activities with other Mediterranean MPAs (response rate 95%). Among the MPAs who have a good collaboration there are many Spanish, Italian, Greek, French or Croatian MPAs (many of them members of the MedPAN network), but also Algerian and Lebanese MPAs.

Existence of a management plan

Most managers answered this question (response rate 96%).

Out of the 80 MPAs in the sample group, 35 (44%) have a management plan, 18 (22%) have a management plan in progress and 24 MPAs (30%) do not have one (see Fig. 73). Therefore in total, 66% of MPAs already have or are in the process of developing their management plan.

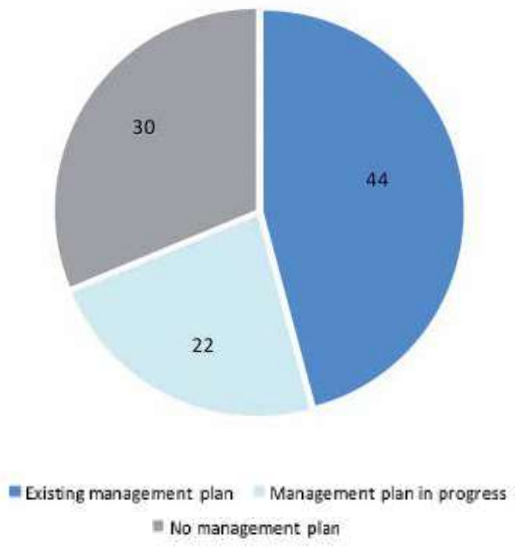


Figure 73: Percentage of MPAs with a management plan

(3 MPAs - 4% had no information on a management plan).

In the Southern Mediterranean region, 4 MPAs out of 7 have a management plan (67%) ; the 3 MPAs without a management plan include a very recent MPA in Libya, 1 MPA in Algeria which however has an outlined management plan proposal only partially implemented due to lack of funding on the ground and a long-standing MPA in Tunisia.

Most of the North-eastern Mediterranean MPAs are currently developing their management plans (9 MPAs out of 13 - 69%). Amongst these, 7 long-standing MPAs from the North-eastern Mediterranean (5 Croatian MPAs, 1 Turkish and 1 Slovenian) had no plan in 2008 and are now in the process of developing one.

In contrast, 30% of MPAs in the North-West region still do not have a management plan (Spain with a majority of group D sites and Natura 2000 sites, Monaco and Malta with 2 MPAs out of the 3 without a management plan - but they are very recent MPAs designated in 2010 - and Italy).

One also observes that there are also differences between EU MPAs (49% have a management plan) and non-EU ones (only 23% have one).

Even if the results cannot be fully comparable with 2008 due to a different sample group selection process, the percentages of MPAs with and without management plan don't seem to have changed much. In 2008, the results showed that 26 managers (42%) had a management plan and 13 managers (21%) had a management plan in progress. However, whilst the report noted a lack of management plans mainly in the Eastern countries of the Mediterranean basin, in 2012 69% of the North-eastern MPA managers reported being in the process of developing their management plans. Out of the 9 MPAs between 2008 and 2012 with a management plan being developed in 2008, 5 now have an operational plan (Italy, France, and Morocco).

Concerning the status, 57% of MPAs in group A (park type) and 47% of MPAs in group B (reserve type) have a management plan, whilst the Spanish or French Conservatoire du Littoral grouped in type D MPAs often do not have one (83% - n = 5 MPAs) and MPAs in group C (landscape type) neither (2 MPAs - 67%).

Most of the management plans, for the 35 MPAs which have one, have been in force for over 5 years, and a large number of them (81%) have been recently revised 67% of management plans have already undergone an assessment (response rate 86%) which is an important step forward compared to 2008 where the report states «only 14 MPAs (23%) have managers which are planning to conduct studies to evaluate their management's effectiveness.» (see Table 20)

If the existence of a management plan is not directly linked to the budget, the latter is however essential for its implementation; analyses do not show a direct link between the budgets of the MPA and the existence of a management plan.

Age of management plan					
Age of management plan	1 to 5 year	5 to 10 years	10 to 15 years	Over 15 years	NA
Number of MPAs	6	13	10	5	1

Revision year	2004	2005	2006	2007	2008	2010	2011	2012
Number of MPAs	1	1	1	1	4	4	12	3

Table 20: Age of the management plan in the MPA sample group and year of revision for those which have been revised

Presence of prohibited resources extraction areas

Out of the 80 MPAs in the study, 51 MPAs (64%) have one or several areas in which all extractive activities are prohibited (strict nature reserves and/or no-take zones or NTZ), totalling a surface area of 492 km² (see Fig. 74 and 75 and Table 21)[1].

- Nearly half (n = 37) of the MPAs surveyed have a strict nature reserve zone (that is 46% and 10% no responses). We note that the MPAs in the South nearly always have a strict nature reserve zone (86% of MPAs; n=7), whereas this is true for 50% for MPAs in the North-West (n=54) and for 31% of MPAs in the North-East (n=11).
- In total, strict nature reserve zones cover 303 km² that is 3% of the total area of MPAs surveyed and 0.012% of the Mediterranean surface area[2]. The surface areas of these strict nature reserve zones are often low, half cover less than 3 km², the largest covers 110 km² (Zembra Zembretta Archipelago in Tunisia). Only the MPAs with A or B type groups have strict nature reserve zones.
- Moreover, 14 MPAs in the study have NTZ areas where all extractive activities (hunting, recreational fishing, commercial fishing) are prohibited, covering an area of 207 km², or 2% of the surface areas of MPAs surveyed and 0.01% of the Mediterranean.
- In addition to the total exclusion zones for extractive activities, MPAs have regulated areas (although we do not know if there is a strict regulation or not). The surface area for these zones is 3 390 km² for the 41 MPAs concerned, that is 31% of the surface area of MPAs surveyed and 0.14% of the basin's surface area.

If one adds up all the extractive activity zones which are either regulated or prohibited, we reach 36% of the surface area of the MPAs surveyed.

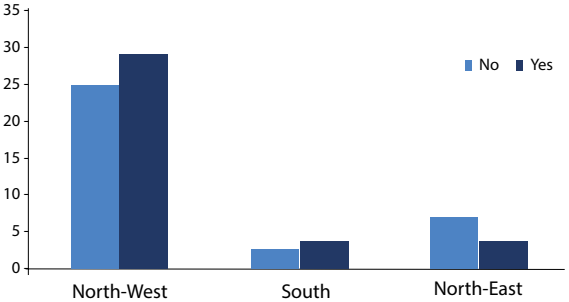


Figure 74: Number of MPAs, by region, which have/don't have a strict nature reserve zone

(n = 72 MPAs)

Presence of a strict nature reserve zone	No	Yes	Total surface (km²)
Albania	1	0	0
Algeria	0	1	4.85
Croatia	2	2	13.32
Spain	11	7	25.42
France	6	5	3.44
Greece	1	1	8
Italy	2	17	60.03
Lebanon	2	0	0
Libya	1	0	0
Malta	4	0	0
Morocco	0	1	23.3
Monaco	2	0	0
Slovenia	3	0	0
Tunisia	0	2	140
Turkey	0	1	25
TOTAL	35	37	303.36

Table 21: Number of MPAs, by country, which have a strict nature reserve zone, and total surface area of these zones (when available)

1. No take zone (NTZ): a zone where all extractive activities (fishing, collecting etc ...) is prohibited; Strict nature reserve zone: a zone where all activity is prohibited
2. Surface areas reported by the managers.

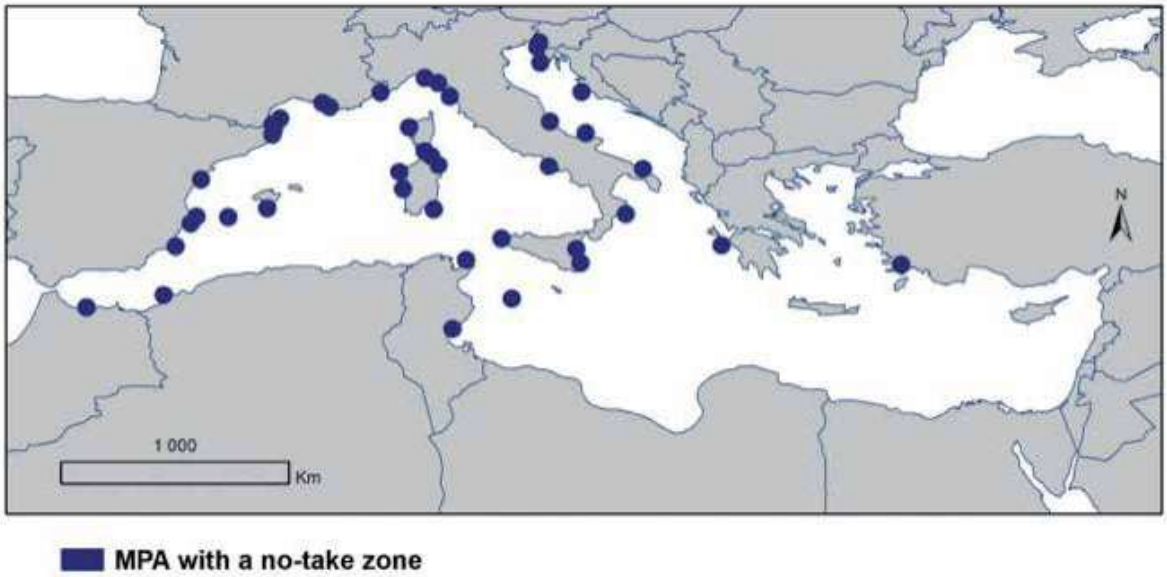


Figure 75: Spatial distribution of MPAs with a strict nature reserve zone and/or a no-take zone

(when spatial information is available) 51% of sample n=80

Existence of MPA baseline information

The questions focused on the existence of ecological and socio-economic baseline information (complete or partial).

Ecological baseline information (initial inventory - 20% no responses): 70% of MPAs (56 MPAs) in the study have ecological baseline information (full or partial), the latter being regarded as complete by 42 of the MPAs, 10% (8 MPAs) do not have one. One can note that these baseline inventories exist mainly in MPAs belonging to Group B (reserve type).

Socio-economic baseline information (response rate 77%): 56% (45 MPAs) have socio-economic baseline information (partial or complete). Amongst these MPAs, 36% (29 MPAs) declared having a complete one. 21% of the MPAs said they did not have one.

Existence of regular monitoring and ad hoc studies implemented in the MPA

The question asked was on the existence of regular monitoring and ad hoc studies carried out in the MPA. This topic was also the subject of a specific study undertaken by MedPAN («An inventory on the multidisciplinary monitoring programmes done in Mediterranean MPAs» Chassanite *et al.,* 2012).

The vast majority of MPAs surveyed (80%) ensures regular monitoring and three-quarters carry out ad hoc studies (76%) on species or particular functions of the ecosystem (e.g. shelter, wintering, feeding, reproduction ...), on the physico-chemical conditions of the environment (temperature, salinity ...) and pollutants, on the uses like fishing activities (fisheries, catches ...), tourism (the only type of monitoring done by the three group-D MPAs in the study) or the other socio-economic activities (see Fig. 76).

Even if comparisons are difficult, these figures show a net increase in monitoring efforts in the MPAs compared to 2008 where the report stated in the section on Monitoring and Evaluation of Management Plan that *"the monitoring of habitats and species does not seem to be common practice in the Mediterranean. Among the managers who responded to the questionnaire, only 24 (39%) mentioned that there are regular monitoring programmes which give support to their MPA's management objectives and only 14 MPAs (that is 23%) where the managers plan to do studies to evaluate their management effectiveness. Almost half of the managers in the current study (48.4% or 30 MPAs) reported that socio-economic analysis was carried out in and around their MPA."*

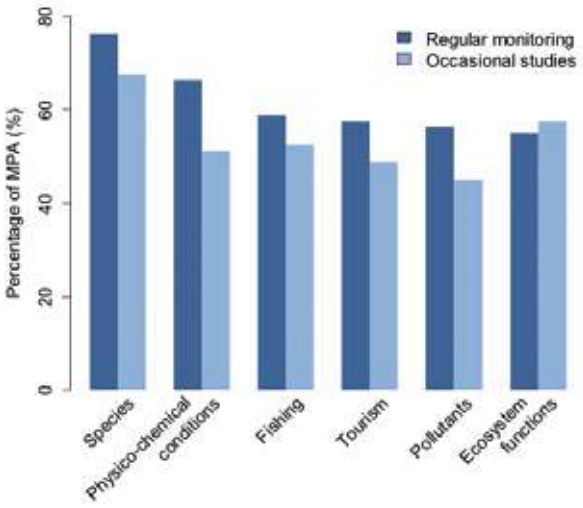


Figure 76: Types of regular monitoring and ad hoc studies carried out in MPAs on species, key ecosystem functions, fishing (commercial resources, catches…), tourism & other socio-economic activities, pollutants and physic-chemical conditions

(12 MPAs - 15% with no information on regular monitoring, 19 MPAs - 24% for ad hoc studies)

Number of types of monitoring or studies	Regular monitoring	Ad hoc studies
The 6 types	28	25
From 3 to 6 types	45	35
Between 1 and 2	8	16
No monitoring or studies	20	24

Table 22: Percentage of MPAs undertaking different types of monitoring or ad hoc studies/surveys

A variable number of types of monitoring are developed by MPAs out of the six types listed above: 22 MPA managers (28%) reported doing the 6 types of regular monitoring. 36 MPAs (45%) declared doing between 3 and 5 types of regular monitoring, 6 MPAs (8%) between 1 and 2 types and 16 MPAs (20%) said they do no regular monitoring. The MPAs in the North-East do proportionately less monitoring; an average of 3 types of monitoring in the North-East, 4 in the South and 5 in the North-West. The fishing monitoring is done more frequently in the European Union MPAs (EU: 76% / Non-EU: 47%).

Most managers therefore ensure regular monitoring in their MPA; when there is no budget, the MPAs in the sample group only do a little monitoring and these are mainly focused on species and tourism (and other socio-economic activities).

The people in charge of monitoring

One question was about the various monitoring operators (response rate 84%). Several operators can intervene on the same type of monitoring in a MPA (scientists, MPA personnel, NGOs, consulting services, ...). Overall, on all the different types of monitoring, scientists are involved in 39% of cases; the MPA personnel are involved in 29% of monitoring, the consultants in 17%, other operators in 12%, the NGOs in only 5% of cases (see Fig. 77).

63% of species monitoring is done completely or partly by the MPA personnel, 48% of ecosystem functions, 53% of fishing, 70% of tourism, 18% of pollutants, 25% of physico-chemical conditions. (See Appendix 17 for details on the various operators performing each type of monitoring). Therefore, the personnel play a significant part in monitoring, alongside the scientists, especially on the following topics: species, tourism, ecosystem functions and fishing activities.

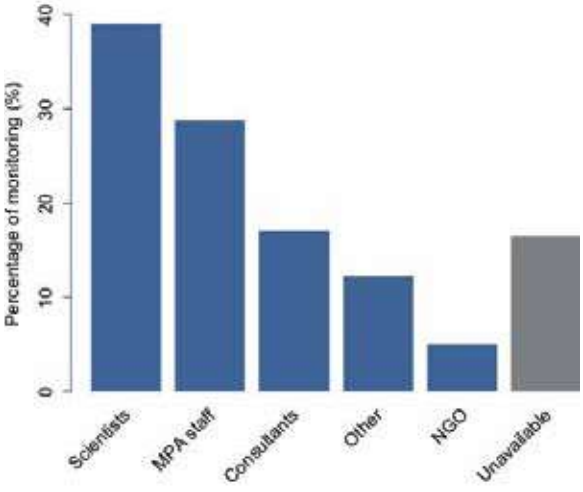


Figure 77: Importance (%) of the various monitoring operators in the MPAs, all monitoring types combined

(12 MPAs - 15% with no information on regular monitoring)

Except for monitoring on tourism which is based on easily applicable protocols, the monitoring done on the environment, fishing and the physico-chemical quality of the water is done by scientists collaborating with the MPA (local universities, students and research teams who frequently use the MPA as a field of study). The personnel usually take part in these monitoring, but under the supervision of specialists who also provide its interpretation.

Perception of the global evolution of fishery resources

The perception of the global evolution of fishery resources yields consistent results over the three trends: fishery resources show an increase in 15 MPAs (19%), they are stable in 14 MPAs (18%), and have declined in 14 MPAs (18%), with the knowledge that less than half of the MPAs responded (46% no responses) and that the question could be explored in greater depth in the future.

Staff assigned to the MPA

Among the MPAs who responded to this question (namely 73% of MPAs), 84% of them have permanent staff and 63% employ temporary or seasonal staff (70% have permanent and temporary staff). But from this question it is difficult to tell if this is administrative staff (those in charge of the MPA in the ministries and not necessarily in the field), technical staff, or both (see Fig. 78 and Table 23).

The total number of staff in MPAs ranges from 0 to 95 people, with an average of 53% for permanent staff, 19% temporary, and 28% seasonal. As was already mentioned in 2008, many MPAs are also terrestrial and so it is difficult to know whether the people are employed for marine activities or mainly for land management activities (many forest rangers were mentioned). Thus, the actual number of staff dedicated to marine management activities may be less.

Five MPAs reported having no staff at all (neither permanent, temporary or seasonal – MPAs in Libya, Monaco and 1 MPA in Slovenia) and 5 MPAs have no permanent staff, but they have temporary or seasonal staff (from 1 to 12 people) who occasionally remedy this situation (Slovenia, Croatia, Greece, Italy).

43 MPAs (54%) have between 1 and 10 permanent staff members and 9 MPAs have over 10 permanent staff and even up to 79:

- the MPAs in Croatia (Kornati, Telascica, Mljet and Bri-

juni): up to over 30 permanent staff;

- the Magdalena Archipelago in Italy (20 permanent staff;
- the Straits of Bonifacio (31 permanent and up to 300 seasonal staff) and Port-Cros (79 permanent staff) in France;
- Costes del Garaf (33) and Cabrera (35) in Spain;
- in Algeria, El Kala and Taza whose marine part is being planned (40 and 53 permanent staff respectively).

The majority of MPAs in the North-West region (79%) have between 1 to 10 permanent staff; 31% of MPAs in the Nort-East have over 10 permanent staff. The trends in seasonal and temporary staff are essentially the same. Italy, Greece and Croatia, for example, use a lot of temporary staff to reinforce the permanent teams. If one combines all these staff categories, there are significant differences in the distribution of these staff categories between EU and non-EU countries (chi-sq test, p-value<0.001), with a higher proportion of MPAs in EU countries having over 10 people. In non-EU countries, the MPAs have either no staff or a high number of staff.

The highest number of staff is found in MPAs in groups A and B; the other status types, including Natura 2000 sites, have few staff.

Some MPAs are well staffed in comparison to their surface area (knowing that many also have a terrestrial part and it would be beneficial to determine in the future the number of actual staff dedicated to the marine environment): For example: the Miramare MPA in Italy (24 staff declared for a marine area of 0.3 km² - including 3 temporary and 12 seasonal staff), Port-Cros in France (95 staff in all for 13 km² - including 10 temporary and 6 seasonal staff) or Mjet in Croatia (65 staff in all for 24 km²); others have much less: 12 staff for a marine area of nearly 5000 km² in the Gulf du Lion (France), 5 staff for 800 km² at Gokova in Turkey, or even in the French Natura 2000 sites like the Posidonia of the Côte Palavasienne, Corniche Varoise, Baie and Cap d'Antibes - Iles de Lerins, with 1 to 3 staff for marine areas of 100-200 km².

Out of the 55 MPAs who responded, 42 MPAs (76%) provide training for their staff. 32 do less than 5 hours/month/permanent staff, 5 do in average between 5 and 10 hours/month/permanent staff, and 5 between 10 and 20 hours.. 2 MPAs train their temporary and / or seasonal staff, 12 do not provide training (25 no responses). Whilst training needs are rather important for MPAs in the South and East, we note that it is the EU countries which provide the most training.

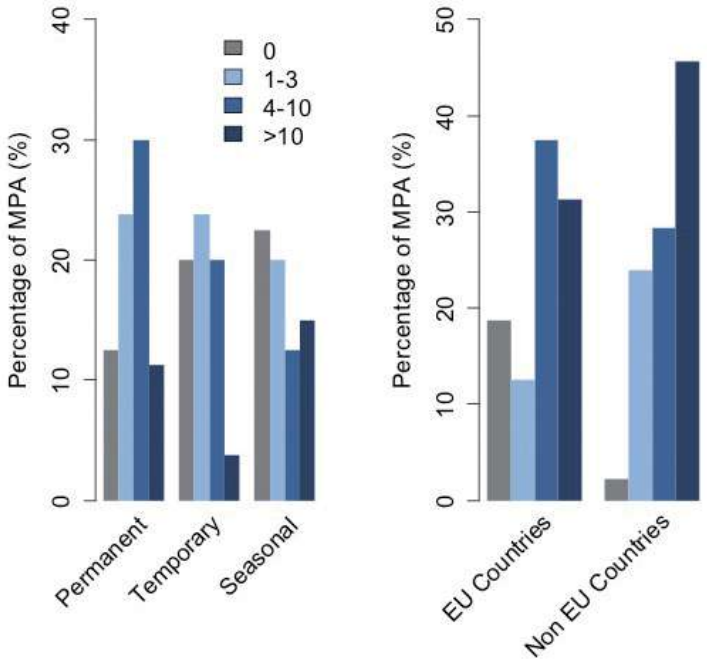


Figure 78: MPA Staff. On the left the type of staff: permanent, temporary or seasonal. On the right total number of staff (permanent, temporary or seasonal) in relation to the MPA belonging to an EU country or not

(18 MPAs – 23% with no information on permanent staff, 26 – 33% on temporary staff, 24 – 30% on seasonal staff and 18 – 23% on total number of staff)

Number of staff	Natura 2000	Group A (Park type)	Group B (Nature Reserve type)	Group C (Landscape type)	Group D (Country specific)
0	0	1	2	1	0
01-03	3	7	1	1	1
04-10	1	9	8	1	0
>10	0	21	4	0	1
Total	**4**	**38**	**15**	**3**	**2**

Table 23: Number of MPAs per group type and per category of staff number

Capacity Building Strategy to Enhance the Management of MPAs

WWF, MedPAN and RAC/SPA jointly developed with their partners* a Capacity Building Strategy to Enhance the Management of MPAs in the Mediterranean Sea.

They spearheaded a study to assess the needs and priorities across the region, both on a MPA and national level. Through a series of questionnaires, interviews, and workshops, they collected information which represents the baseline for building a regional, integrated and feasible capacity building programme.

*IUCN-Med, Conservatoire du Littoral, ACCOBAMS, Blue Plan, EUROPARC, French MPA Agency/ATEN, General Directorate for Natural Assets Protection in Turkey, UNDP Turkey, UNEP/MAP, NOAA

Surveillance effort

Surveillance is one of the key parameters for assessing the management's effectiveness. Along with the follow up on offenses/infringements this is one of the essential elements for the MPA to apply the correct regulations set out by relevant legal texts and the management plan. However, less than half of the managers answered the questions on surveillance (43% no responses). The questions focused on equipment (boats and surveillance vehicles; the existence of signs of demarcation in the MPA - see paragraph on equipment), on the sworn staff or those in charge of surveillance and on the average number of hours of surveillance per month for the current year. This information is important and needs to be developed further in MAPAMED with data on the number of offenses, and how these offenses are taken into account and dealt with (judgment, sentences etc...).

A quarter of the MPAs who answered have their own sworn staff: 14 MPAs (23%) in the North-West region, 5 MPAs (29%) in the southern region, 4 MPAs (31%) in the North East region. A number of MPAs who reported not having any sworn staff (57 MPAs) are nevertheless monitored either by coastguards, marine police or maritime affairs (Algeria, Morocco, many MPAs in Italy, France, Monaco, Tunisia, Slovenia) or by the armed forces (MPAs in Malta, Lebanon), the police or the gendarmerie (Croatia, Lebanon); in some cases, managers mentioned surveillance being done by forest rangers (Albania, several Spanish MPAs).

The total monthly number of hours of surveillance is extremely variable, from 0 to 1 540 hours (for 42% of the MPAs who responded). On average the monthly surveillance declared was 242 hours for the MPAs in the North-West (an average of 8 hours per day), 281 hours for MPAs in the North-East (9 hours per day on average) and 44 hours for MPAs in the South (1.5 hrs /day on average). There are on average more hours of actual effective monthly surveillance by total staff in the MPAs in EU countries (22 hrs) compared to MPAs in non-EU countries (6 hrs). One MPAs indicated 0 hours of surveillance.

Surveillance data is highly variable, but there is a positive and low correlation with the MPA's surface area (correlation coefficient, r = 0.61), with several exceptions, such as very small MPAs who have high surveillance and vice versa. For example, Portofino in Italy reported 289 hours of surveillance per month per km^2 for a marine area of 3.46 km^2; Miramare in Italy reported 43 hours of surveillance per month per km^2 for a marine area of 0.3 km^2. Two Croatian MPAs (Mljet and Brijuni) each being about 25 km^2 respectively reported doing 16 and 27 hours of surveillance per month per km^2. Similarly, there is a positive trend between surveillance and budget (correlation coefficient, r = 0.72), but this data is very variable and many MPAs did not answer (42%).

Note that approximately 40% of MPAs reported an average to important level of illegal activities in their MPA (see paragraph on pressures).

Existing infrastructure and equipment

The questions focused on the existence of offices for the management structure's staff, the number of boats and vehicles used for surveillance or research, diving equipment and the MPA's GIS equipment.

Almost three-quarters (71%) of the MPAs reported having offices for the management structure's staff[3]. It would be advisable to consolidate MAPAMED in the future by making this question more specific in order to identify if the offices are in the field or located at a distance from the field (see Fig. 80).

Few MPAs are equipped with buoys or other indication of demarcation to identify restricted areas: 34% have land and sea demarcation signs, 11% have ones only at sea and 35% have none (89% responded). In 2008, 45% of managers had stressed the fact that their MPAs did not have buoys or visible demarcation signs at sea.

Overall, MPAs are well equipped in boats[4]: out of the 60 MPAs in the sample group who answered this question, 17%» do not have any (in 2008 this was 27%), 35% of MPAs have 1 or 2 boats and nearly 30% reported

Number of surveillance hours per staff, compared to the MPA's surface area	<50 hours	50-250 hours	>250 hours
<5 km^2	4	1	1
5-30 km^2	2	9	2
30-100 km^2	4	1	2
100-200 km^2	0	1	1
>200 km^2	0	2	1

Table 24: Number of MPAs per size group and per categories of hours of surveillance

3. But the questionnaire does not show if the offices are in proximity, allowing a closer management of the MPA, or rather offices in town. For example, the local management team and park rangers from the Habibas Islands MPA are on land in Oran (the CNL Oran headquarters).

having more than 2 boats and even 10 or 11 boats for the Straits of Bonifacio, Port-Cros or Isole Egadi. This boat equipment rate has increased since 2008[4]. More detailed information on the type of boat could be acquired in the future in order to find out what kind of surveillance is carried out at sea (coastal, offshore, etc ...).

Over three-quarters of the MPAs have GIS equipment which is a significant improvement from 2008, and a little over 40% of MPAs are equipped in diving equipment, but equally the same have none. This is proportionately less than in 2008.

In general, the MPAs in the South and to a lesser extent those in the North-East are less well equipped than in the North-West.

Awareness raising tools

The questions focused on the tools and awareness raising actions and environmental education developed by the MPA and on the existence of a communication plan.

The communication tools developed are mainly paper based tools (brochures, posters ...). The number of MPAs with a website is significant (over 60%). A little over 30% of MPAs have an interpretation centre, showing some evolution since 2008 (see Fig. 79).

35 MPAs (44%) have a communication plan or it is in progress (24 yes and 11 in progress; response rate 95%).

70% of the MPAs have educational and environmental awareness actions for the public (response rate 80%).

Very few MPAs to date have an observatory[5] type information system. It seems that this question was not clearly understood and it would be advisable to make this a more detailed question in the future.

Funding

The section on funding is essential. The questions focused on the average annual operating budget and investment over the last 5 years, the funding

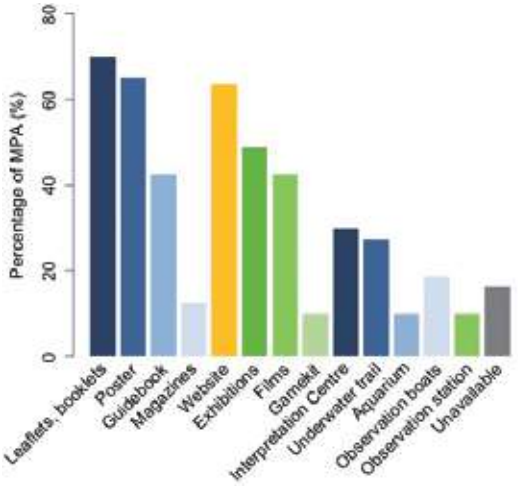


Figure 79: Tools available in MPAs for education and awareness raising

(1 MPAs – 1% with no information).

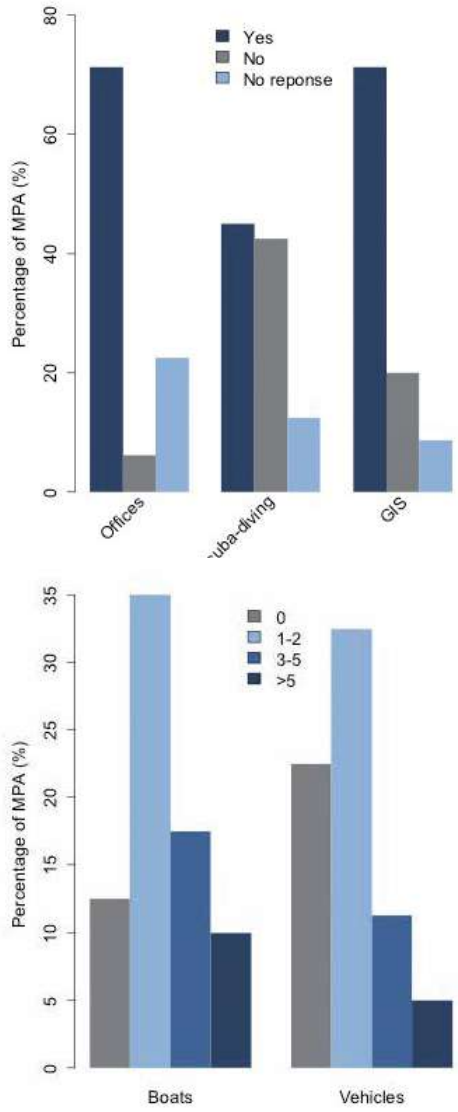


Figure 80: The MPAs infrastructure and equipment.

Above left the existence of offices for management structure's staff, diving equipment and a geographic information system (GIS) (18 MPAs - 23% with no information on the presence of offices, 10 MPAs - 13% for diving equipment, 7 MPAs - 9% for GIS). Below total number of boats and vehicles used for surveillance (20 MPAs - 25% with no information on the number of boats, 23 MPAs - 29% for number of vehicles)

sources (government, NGOs and international donors, private sector and auto-financing) and the existence of a business plan.

Half of the MPAs answered this question. Though two long standing MPAs said that they do not have a budget or management, whereas certain MPAs do not have a budget directly allocated by the authorities or the government, but receive external support (projects from various donors, for example).

MPAs global operating budgets (applying to both marine and terrestrial parts) range from € 0 to € 6 345 000, with a median of € 287 000 and investment budgets from € 0 to € 974 440, with a median of € 100 000 (see Table 25 and Fig. 81). The operating budgets for MPAs in EU countries are higher than for other countries (in average

4. The 2008 study showed that the management variables which held the greatest weight were related to staff (seasonal, permanent staff and surveillance) and the fleet of boats (surveillance and total number of boats).
5. By observatory we mean a base used to improve and provide knowledge on biodiversity. Generally, these are databases of observational data. In some cases, these databases are used only by experts (in the case of the Port-Cros observatory on biodiversity and coastal marine uses), but in other cases they are available to amateurs, in a participatory scientific spirit.

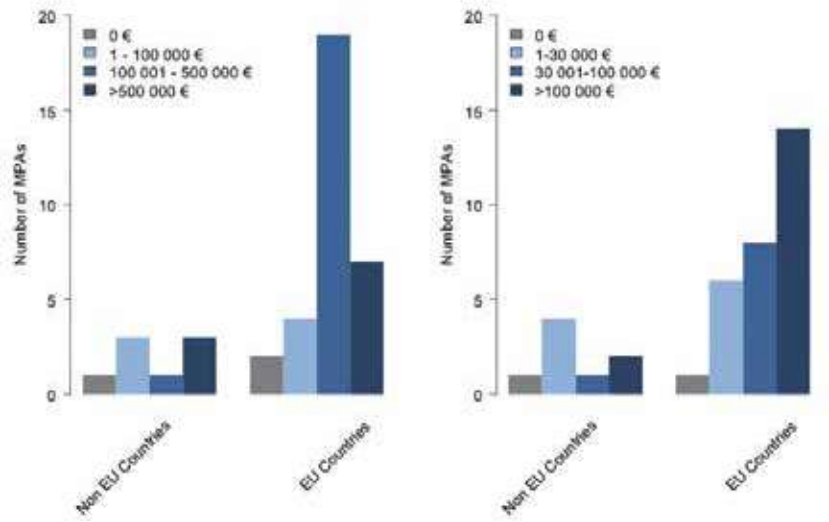


Figure 81: Average annual budget for the last 5 years.

On the left the operating budget, on the right the investment budget (40 MPAs – 50% with no information on operating budget, 43 MPAs – 54% for investment budget)

€ 682 845 for an EU country and € 453 125 for a non-EU country, see Fig. 82).

Both budgets are higher in MPAs of Group A. There is a strong positive correlation between the number of permanent staff and the operating budget (correlation coefficient, r = 0.93) which is logical.

However, there is little correlation between the annual operating budget over the last 5 years and the MPA's surface area. Very small MPAs (less than 5 km²) have large budgets; 4 MPAs have a budget between 100 000 and 200 000 €/km², 7 with between 20 000 and 100 000€/km², 8 between 10 000 and 20 000 €/km², 15 MPAs between 1 and 10 000 €/km².

Funding comes primarily from governments (89% of MPAs - including MPAs who did not give their budgets); only 12 MPAs have funding from NGOs and international donors (see Fig. 83).

Self-financing is present in 36% of MPAs (29 MPAs; including Lebanon, Slovenia, Croatia, Turkey, Greece, France, Italy, Spain) which is still too low to ensure the sustainability of an MPA which has no other resources, this is especially the case in some countries in the South or the North-East (8 no responses).

The private sector's commitment is still very low (only 8 MPAs benefit from it- Croatia, France, Greece, Spain, Italy, Slovenia, Lebanon).

Over 70% of the MPAs have no business plan. 16 MPAs declared having a business plan (20%) and 6 MPAs (8%) are currently developing one (89% responded). When we compare if they belong to an EU country or not, 33% of the MPAs which are from non-EU countries have a business plan, 20% for MPAs in EU countries.

The 2008 report noted that 25 MPAs (40% of the MPAs surveyed) had a business plan, which is more than in 2012.

Category of operating budget (Euros)	Natura 2000	Group A	Group B	Group C	Group D
0	0	1	2	0	0
1 - 100 000	1	2	0	4	0
100 001 - 500 000	0	14	1	4	1
>500 000	0	7	0	2	1
Operating budget in relation to surface area	**<5 km²**	**From 5 to 30 km²**	**From 30 to 100 km²**	**From 100 to 200 km²**	**>200 km²**
0 €	2	0	0	1	0
1-100 000 €	2	2	0	1	1
100 001-500 000 €	4	8	4	2	2
>500 000 €	0	4	2	2	2

Table 25: Number of MPAs per group type (above) and per surface area (below) for each operating budget class

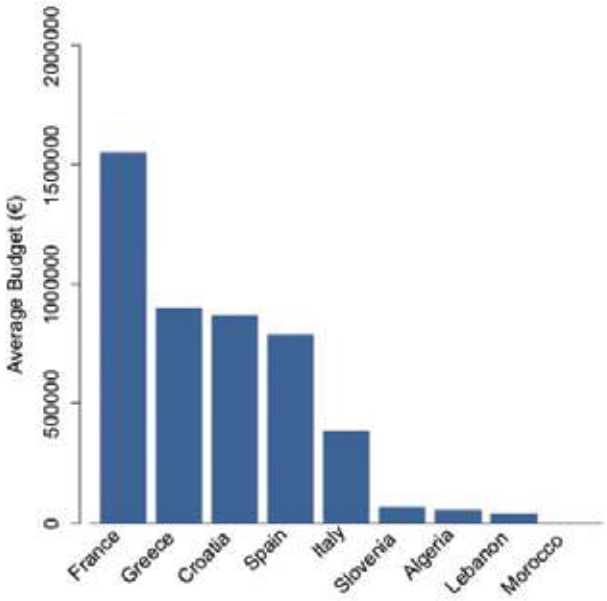


Figure 82: Average operating budget per country

(Euros – an average taken from the total number of MPAs per country who responded; 40 MPAs – 50% with no information on operating budget)

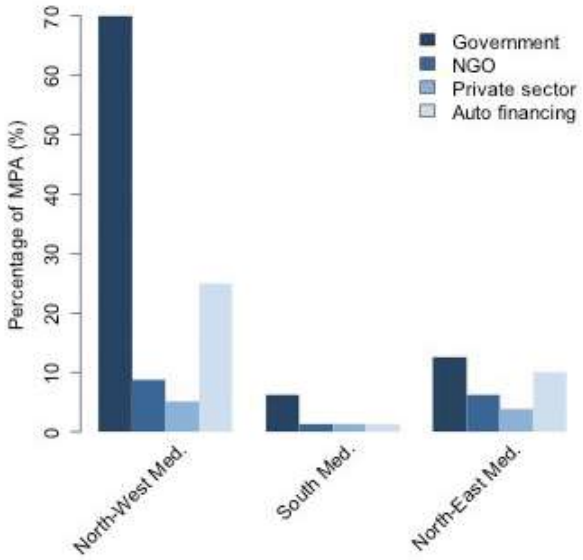


Figure 83: MPAs source of funding (8 MPAs – 10% with no information on their source of funding)

Existence of a business plan	Natura 2000	Group A	Group B	Group C	Group D
Yes	0	10	1	5	0
In progress	0	6	0	0	0
No	8	23	2	10	6

Table 26: Number of MPAs that have or don't have a business plan for each MPA group type (response rate 89%)

Eco-guard in Taza National Park, Algeria © M.Mabari / WWF Mediterranean

MPA management typologies

In order to find a general trend in MPA management, a multivariate analysis and classification was done on a number of the most significant parameters taken from the managers' responses to the questionnaire (see box "variables used").

Variables used:

Management Plan, budget per MPA's km², charter for users, scientific body, the presence of ecological baseline information, local stakeholders recognition and participation to the planning and management of the MPA, the presence of a strict nature reserve zone, total number of staff; number of hours of surveillance to the MPAs surface area, number of days of training per year and per permanent staff, demarcation signs in the MPA, number of surveillance boats, number of mooring buoys, diving equipment.

Methodology: MCA and classification (AHC) on the coordinates of the MCA (ade4 and Cluster packages).

MCA: Multiple Correspondence Analysis,

AHC: Agglomerative Hierarchical Clustering.

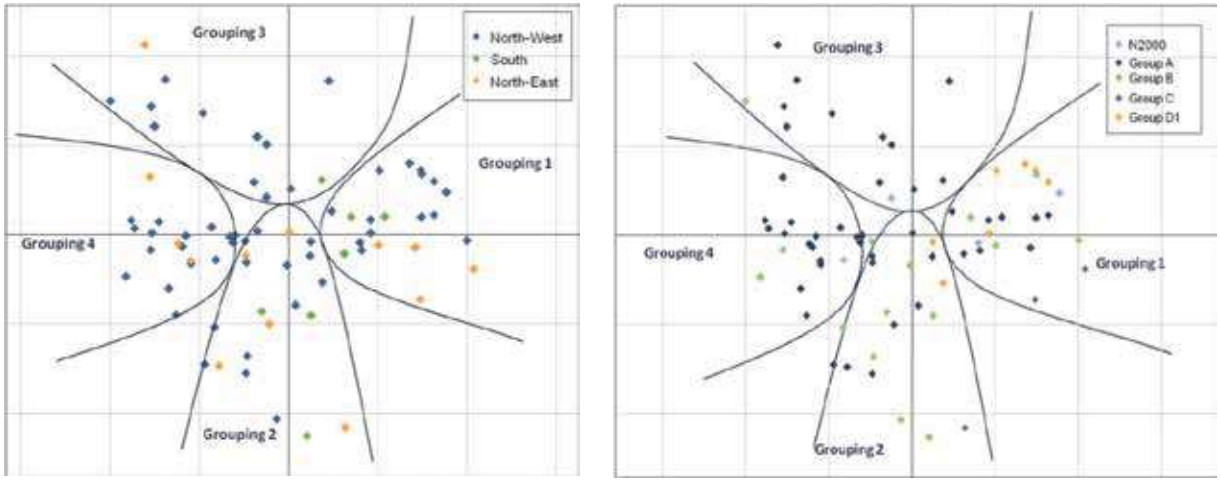


Figure 84: MPA groupings in the management typology.

On the left according to their geopolitical region, on the right according to their MPA group (A to D1 groups)

The analysis identified four main MPA groupings (see Fig. 84):

The first grouping set consists of MPAs with very little current management capacity or who only answered a few questions on management tools.

In this grouping of 27 MPAs (34% from the sample group), 3 MPAs are in South of the Mediterranean, 4 in the North-East and 20 in the North-West. Most of the MPAs in the North-West Mediterranean are Spanish (11 MPAs out of 20) and whose questionnaires still need to be completed.

Most of these MPAs have no management plan, few of them have a Scientific Committee; they have no charter for users. There is little information available on their budgets. Human resources for surveillance are very low when these are given (4 MPAs declared having no staff whether permanent, temporary or seasonal) and the staff are insufficiently trained. These MPAs are poorly equipped, 6 of them said they had no boats for surveillance or diving equipment and no mooring buoys for boats anchoring at their site. Most of them lack strict nature reserve zones and demarcation signs.

This grouping set includes MPAs where data was not received or is incomplete and MPAs being developed, whose management is progressing or their geographical and statutory situation allows them a certain management effectiveness through partnerships or educational or leisure activities. For example, the small marine reserve of Larvotto in Monaco, which is in a privileged location in the heart of a resort whose human pressures are mainly linked to swimming. The Palavasienne Coast has a Natura 2000 status and has objectives which are essentially on awareness and a progressive involvement of all its users, like many of these areas under the Habitats Directive. MPAs in this grouping set often receive State resources to help reinforce surveillance.

The second grouping set of MPAs has surveillance resources, but some management tools and equipment are insufficient.

In this grouping set of 25 MPAs (31% of the sample group), 3 MPAs are in the South of the Mediterranean, 5 in the North-East and 17 in the North-West. A majority of the MPAs in the North-West are from Italy and Spain (7 from each of these two countries).

This is a relatively heterogeneous grouping which declared having human resources in all the MPAs, usually 4 to 10 staff. The staff are trained and boats are available for surveillance, most have 1 to 2 boats per MPA. These MPAs budgets are variable, but a significant number have a budget exceeding 5 000 €/km². Many have a management plan in progress (44%), scientific advice is not always available (48% none) as are charters for users (52% none). Most have no strict nature reserve zones or MPA demarcation signs (44% with no neither strict nature reserve zones nor demarcation signs). A large number of MPAs in this grouping have no mooring buoys to receive boats.

Often these MPAs show a trend towards significant human pressure, leading them to prioritise on a monitoring policy which is quite well established, but where developing other management measures would be necessary. These are often some of the oldest like Mljet (the first one in the Mediterranean) or Scandola whose coastal scenery and reputation attracts a large number of visitors, driving the managers to put in place important and strict surveillance measures. The Miramare Marine Reserve and Côte bleue Marine Park, for example, have clear conservation objectives, but one is oriented towards education and the other was initially for the conservation of fish stocks. Surveillance is implemented by a relatively versatile team.

The third grouping set consists of MPAs who have management resources, but little for surveillance.

In this group of 13 MPAs (16% of the sample group), 1 MPA is in the South of the Mediterranean, one in the North-East and 11 in the North-West. Most of the ones in the North-West are in France and Italy (5 and 4 MPAs respectively).

This grouping set is also quite heterogeneous. There is a varying number of staff in all the MPAs, but overall they provide only a few hours of surveillance: 0-3 hours per month per person. The number of staff training days is very variable.

For management tools, these MPAs generally have a management plan (61% have one), ecological baselines, charters for users and local stakeholders are taken into account in the planning and management of MPAs. An important number of them have management tools with mooring systems in every MPA, demarcation signs and most have a strict nature reserve zone. Unlike the previous group, one observes in these MPAs a fairly comprehensive management system, but they need to reinforce their control and surveillance strategies. These are also among the oldest like Port-Cros, Cap de Creus, Cabrera and Kornati, are classified into Group A («National Park» type) and all receive resources enabling good management, although continuously prone to improvements, and whose governance closely binds all the users.

The fourth grouping set of MPAs has management resources for staff and equipment and they also have governance.

In this grouping set of 15 MPAs (19% of the sample group), 3 MPAs are in the North-East of the Mediterranean and 12 in the North-West. Most of the MPAs in the North-West are in Italy (7 MPAs).

Most have management plans in place or in progress (3 MPAs) and complete ecological baselines as well as a scientific advisory committee, charters for users and local stakeholders are taken into account in the planning and management of the MPAs. Their budgets are variable, but often exceed 500 €/km^2. These MPAs have reported an important number of staff with the majority having more than 10 staff per MPA. Surveillance is important with 3 to over 6 hours of effective surveillance per month per person. Most have diving equipment available. They have strict nature reserve zones with demarcation signs on land and at sea (signs, marks and buoys).

This grouping highlights MPAs which have a fairly comprehensive management system with a good balance between surveillance and governance involving all the local stakeholders. For example, the Zakynthos, Cerberus-Banyuls, Capo Rizzuto, Montgri-Medes parks or reserves are a good example of MPAs which meet the full range of technical, legal, scientific and human measures available for a governance, with relevant all-round objectives on knowledge, conservation, awareness raising and sustainable tourism (but this does not mean that they do not encounter challenges on certain levels).

The 2008 survey showed the dominant effect of staff and boats. If we compare the total staff, boat equipment and budget, the results are highly variable with several MPAs being well equipped with a large number of staff and a high budget ; some MPAs are well equipped and have staff, but their budget is lower and the other MPAs have smaller financial and human resources and less equipment.

One can see that although MPAs in the South often have fewer resources, the geographical distribution of needs in terms of capacity building is not as clear-cut. Therefore, the assessment of the capacity building needs in terms of financial resources and equipment must be dealt with in a more detailed analysis with the managers themselves.

The MPA's typology on their management parameters shows us that not all the Mediterranean MPAs have the same capacity or the same management resources and that the support required must be tailored to their needs: training, equipment, reinforcing governance,.... Several MPAs have little management resources while others have the necessary tools to ensure both surveillance and the management of their protected area. Between these two extremes are two other groupings which require different support priorities.

KEY FEATURES OF USES AND PRESSURES ON THE MPAs IN THE MEDITERRANEAN

The uses in MPAs

This analysis on the uses has taken into account the questionnaire's parameters, namely:

- Average annual number of visitors over the past 5 years;
- Number of commercial fishing boats operating in the MPA;
- Number of diving boats bringing divers into the MPA;
- Number of leisure boat berths in a port in the MPA;
- Number of leisure boat berths in the nearest two ports to the MPA's boundaries;
- Number of mooring buoys in the MPA.

These parameters were used to categorise the MPAs through their uses, but also to measure some of the root sources of threats.

Visitor numbers are highly variable (see Fig. 85): over 100 000 visitors/per year for 26% of the MPAs, between 10 000 and 100 000/per year for 20% of the MPAs and less than 10 000 visitors per year for 12% of the MPAs. There are more tourists in the northern part of the Mediterranean and the MPAs' visitor numbers are at a maximum there; none of the MPAs in the South receive more than 100 000 visitors/per year. Some very small MPAs may receive more than 100 000 visitors/per year (Portofino-Italy, Strunjan-Slovenia) and larger MPAs only a few tourists (Amvrakikos Wetlands in Greece, for example). Guidelines for analysing tourism in MPAs are currently under development by the MedPAN North Project.

Diving is an important activity in half of the MPAs who answered, with 10% of them having over 25 boats operating in the MPA and up to nearly 50 in the Straits of Bonifacio, 40 in Mar Menor y Costa Oriental in the Murcia region and in Port-Cros. Eight MPAs (10%) have no diving activity (see Fig. 86).

Professional fishing activity is regulated or prohibited in most MPAs (it is permitted within the full perimeter of only 4 MPAs among those who answered the question). This activity is also variable, but is much more pronounced in the South. Out of the 50 MPAs (63%) who answered this question, 12 MPAs (15%) indicate the presence of over 50 fishing boats working in their MPA, and up to 200 to 300 fishing boats in Al Hoceima (Morocco - 196 km^2), Karaburun-Sazani (126 km^2), the Ebro Delta (7 km^2) or the Calanques in France (435 km^2); 22 MPAs (27%) have 11 to 50 boats doing fishing activity and 8 MPAs (10%) have less than 10 boats (see Fig. 87).

On the **number of leisure boats berths in the MPA**, 47 MPAs (59%) did not answer; 15% (12 MPAs) declared not having a port for leisure boats in their MPA. The other MPAs (45%) have a very variable number of berths from 2 to 9 000 berths (Gulf of Lion) 11 MPAs have from 1 000 to 5 000 berths and 29 MPAs have 1 to 1 000 berths. This is similar for the number of leisure boat berths in the nearest two ports to the MPA's boundaries, 53 MPAs did not answer, the Blue Coast has around 12 000 berths nearby, 13 MPAs between 1 000 and 5 000 berths, 35 MPAs between 1 and 100 berths (see Fig. 88 and 89).

Mooring systems are used to limit the impact of the number of diving boats and yachts in the MPA. 29% (n=23 MPA) of the MPAs have no mooring system (30% no responses), including MPAs in the South (6 MPAs) and of the East (7 MPAs). It is difficult to compare this information with the number of diving boats or berths in the MPA; several MPAs with an important diving activity, for example, have no mooring system at all (see Fig. 90).

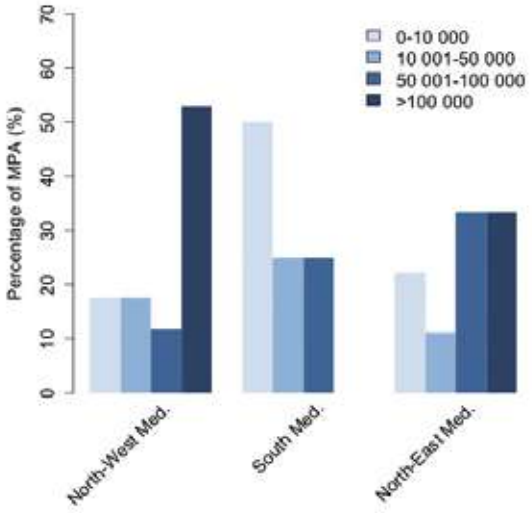


Figure 85: Average annual number of visitors (all uses) over the last 5 years

(33 MPAs - 41% with no information on the number of visitors)

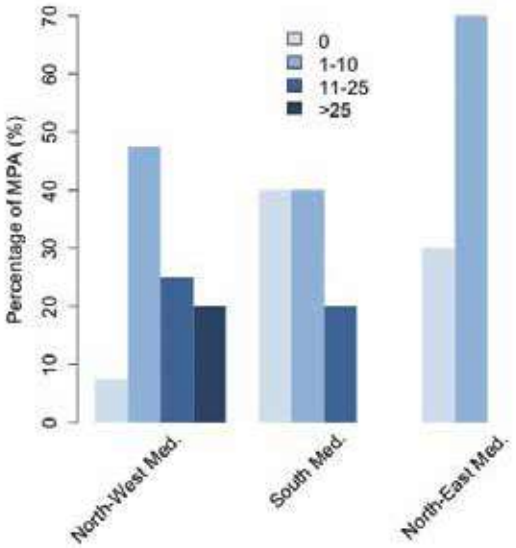


Figure 86: Number of diving boats bringing divers into the MPA

(25 MPAs - 31% with no information on the number of diving boats)

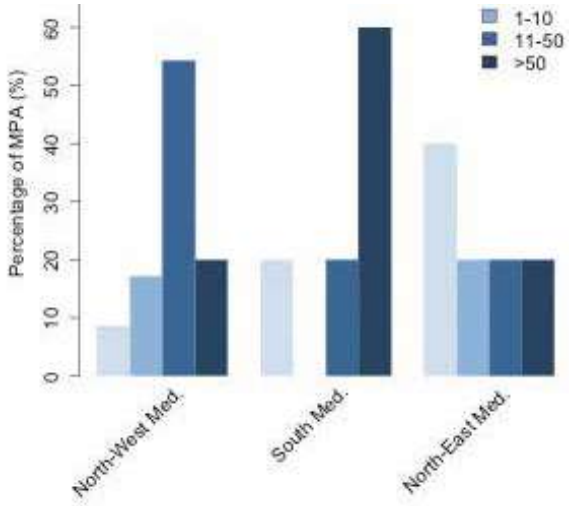


Figure 87: Number of boats doing a commercial fishing activity in the MPA

(30 MPAs – 38% with no information on the number of commercial fishing boats)

Artisanal fishermen in Tunisia © M.Mabari / MedPAN

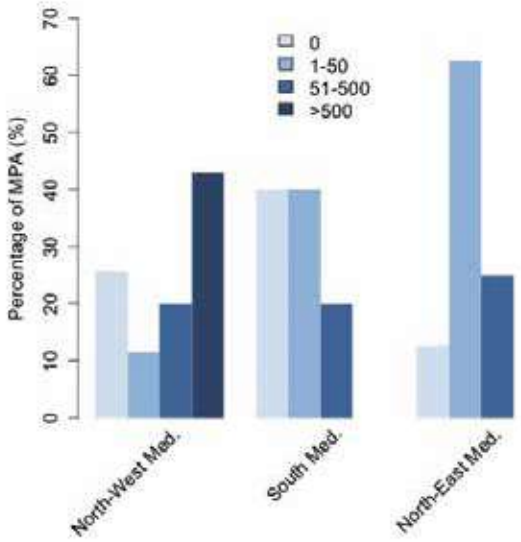


Figure 88: Number of leisure boat berths in the MPA

(32 MPAs – 40% with no information on the number of berths in a port in the MPA)

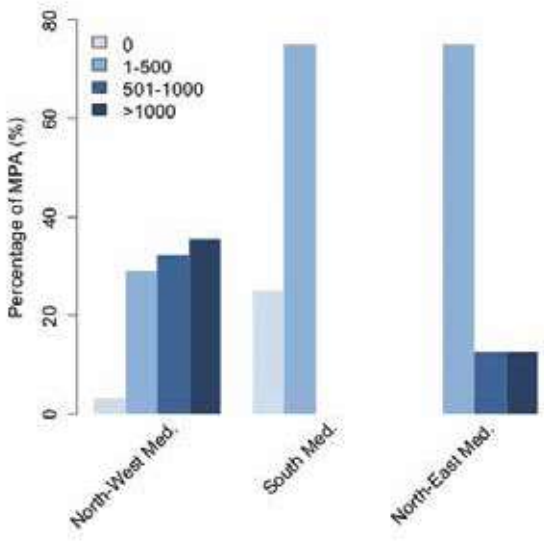


Figure 89: Number of leisure boat berths in the nearest two ports to the MPA's boundaries

(37 MPAs – 46% with no information on the number of berths in a port outside the MPA)

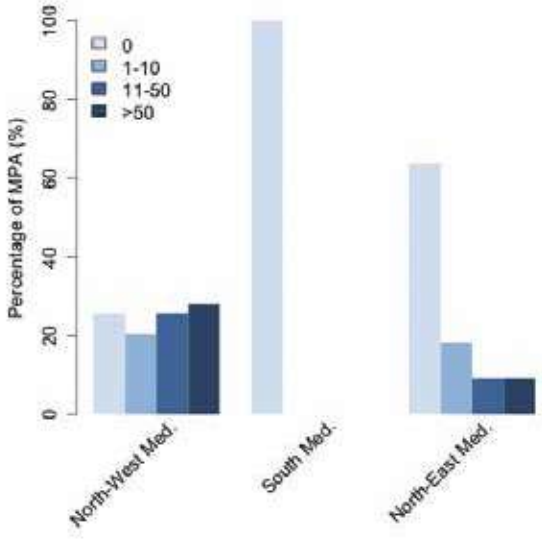


Figure 90: Number of mooring systems in the MPA

(24 MPAs – 30% with no information on the number of mooring systems)

An identification of the major pressures affecting the MPAs in the Mediterranean

The study on pressures was carried out from an analysis on the questionnaire's answers to the importance (from «none» to «high») of typical major pressures put on habitats and species in the MPAs, namely:

- Industrial fishing
- Artisanal fishing
- Recreational fishing
- Extraction of oil or gas at sea
- Shipping transport (military transport, ferries, cargo ships ...)
- Port activities
- Recreational activities other than fishing
- Urban Pollution

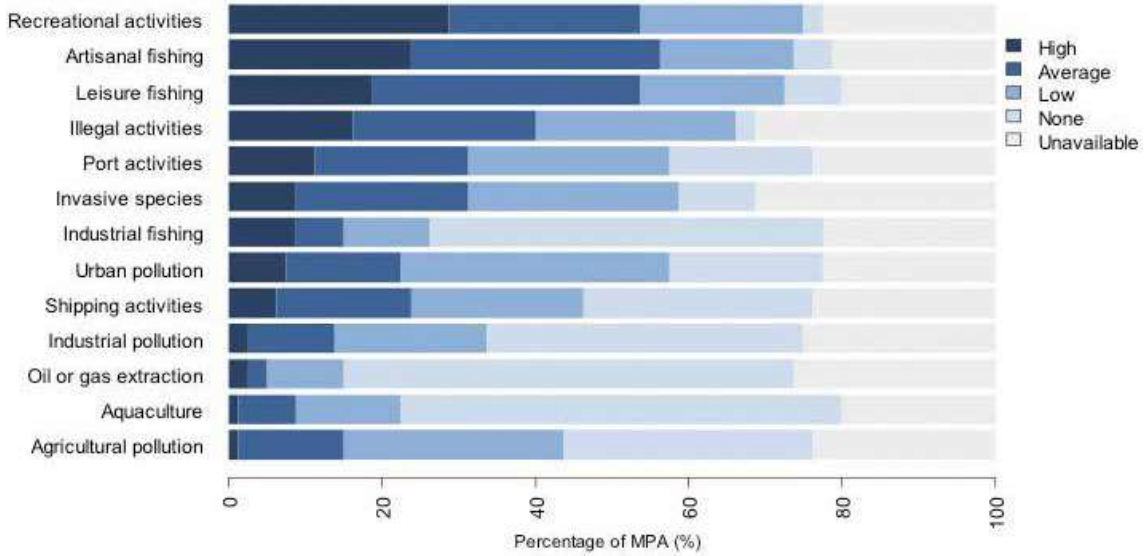


Figure 91: Key pressures on habitats and species, as reported by the managers

('Unanswered' includes 'No response' and 'Unspecified response')

- Agricultural Pollution
- Industrial Pollution
- Aquaculture
- Invasive Species
- Illegal activities

According to the questionnaire's answers, the uses which put the most pressure on the MPAs are recreational activities and fishing (artisanal and recreational). Fishing puts significant pressure on the MPAs in the southern countries (see Fig. 91).

These are followed by port activities and invasive species which were reported by 25% of the MPAs. Pollution, shipping transport and industrial fishing affect less than 20% of the MPAs.

Illegal activities are being carried out in every Mediterranean region and nearly 40% of the MPAs indicate it being on an important or average degree, with varying intensity in different regions (see Fig. 92). The southern region is most prone to illegal activities, followed by the North-West. One must remember that in 2008 the report indicated that, in general, most managers regarded illegal activities to be a low pressure.

Risk prevention plans can be developed on an MPA level to define and try to overcome these threats. Half of the MPA managers (40 MPAs) surveyed do not have a risk prevention plan. 22% (18 MPAs) have this type of plan

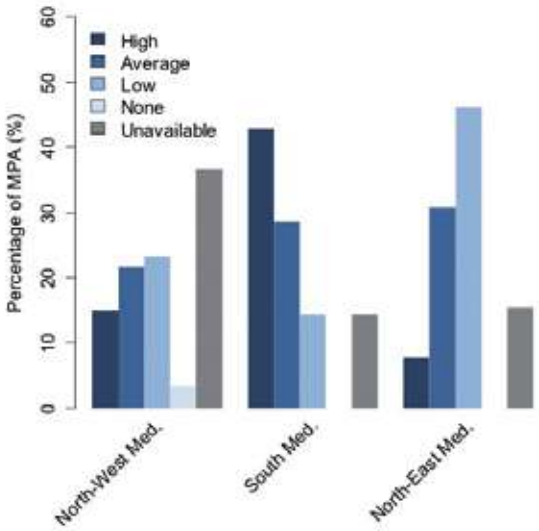


Figure 92: The intensity of illegal activities in MPAs

(Unanswered includes No response and Unspecified response)

Patella ferruginea monitoring, Zembra Archipelago National Park, Tunisia © APAL

The coast in the Torre del Cerrano Marine Protected Area, Italy © Torre del Cerrano MPA

CHAPTER 6

An inventory of multidisciplinary monitoring programmes

An inventory of multidisciplinary monitoring programmes carried out in Mediterranean MPAs

In order to establish a detailed inventory of the monitoring done in the Mediterranean (Chassanite *et al.,* 2012) we identified the multidisciplinary monitoring programmes done on a regional level in the MPAs (i.e. for the whole of the Mediterranean), sub-regional (i.e. representing a subset of the Mediterranean basin) or national (i.e. only one of the Mediterranean countries). A multidisciplinary database has been developed to facilitate the use of the information collected. It includes the following tables: "Programmes", "Scientific Literature", "Grey Literature".

One hundred monitoring programmes in all were identified. Some have been completed (e.g. EMPAFISH, AMPAMED) or are in progress (e.g. COCONET, PEGASO). These programmes may vary from one another according to the problems they address, the objectives that have been set and particularly from which angle the MPAs are covered. They have therefore been classified into four distinct categories reflecting this diversity (see box «Categories of objectives for MPA monitoring programmes»). The relevance of these programmes to the evaluation of the MPAs decreases from category A to D.

Categories of objectives for MPA monitoring programmes

- **A:** Objective category gathering programmes which assess MPAs as tools for conservation and sustainable management of the marine and coastal ecosystems (e.g. MPAs effectiveness in relation to the targets set by their respective management plans) [13 programmes] ;
- **B:** Objective category consisting of the monitoring programmes which go beyond the strict MPA framework, but incorporating their role or their potential benefits (e.g. monitoring of coastal tourism or fishing after an MPA has been set up, monitoring of the establishment of an integrated coastal zone management strategy in an area including one or more MPAs) [3 programmes] ;
- **C:** Objective category consisting of the monitoring programmes using the MPAs as a «laboratory» for research (e.g. monitoring carried out in MPAs to observe a given phenomenon or process, but not taking into account the effect of the MPA on the subject of study and therefore not designed to evaluate the MPA) [19 programmes] ;
- **D:** Objective category consisting of the monitoring programmes done as part of the conservation actions or spatial management of coastal areas (e.g. determining the zoning, identifying relevant future MPAs sites) [65 programmes].

Even within a given category, the programmes may vary from one another depending on the subject concerned. They have therefore been classified into six distinct types reflecting this diversity (see box "Types of monitoring studies for MPAs").

Types of monitoring studies for MPAs

- **Ecological:** Type of studies covering programmes focusing on the biological and/or ecological processes, excluding ecological networks [41 programmes] ;
- **Governance:** Type of studies covering programmes to study or improve governance and/or management of MPAs [8 programmes] ;
- **Oceanographic:** Type of studies covering programmes aimed at studying physical, chemical and/or geological oceanographic processes [2 programmes] ;
- **Ecological networks:** Type of studies covering programmes focusing on the MPAs ecological networks (sensu Grorud-Colvert *et al.,* 2011) [1 program] ;
- **Socio-economic:** Type of studies covering programmes focusing on the ecosystem's goods and services, the socio-economic benefits of MPAs and/or social component to the success of establishing MPAs [5 programmes] ;
- **Integrated:** Type of studies covering programmes where at least two of the disciplinary fields listed above are represented [43 programmes].

Out of the 43 Integrated programmes, 41 (namely 95%) have a Governance type component, 40 (93%) an Ecological type component, 37% a Fishery type component, 33% a Socio-economic type component and 5% an Oceanographic type component. The objective categories are not evenly distributed across the six types of study programmes (see Fig. 93).

The monitoring programmes are mainly (63%) done on a national level. A little over a quarter of the programmes (26 programmes) are sub-regional and 10% of them are done on a regional level. Eight out of the 100 monitoring programmes also include non-Mediterranean countries.

The Mediterranean countries with the highest number of collaborations within the regional and sub-regional programmes are France with Spain (23 collaborations),

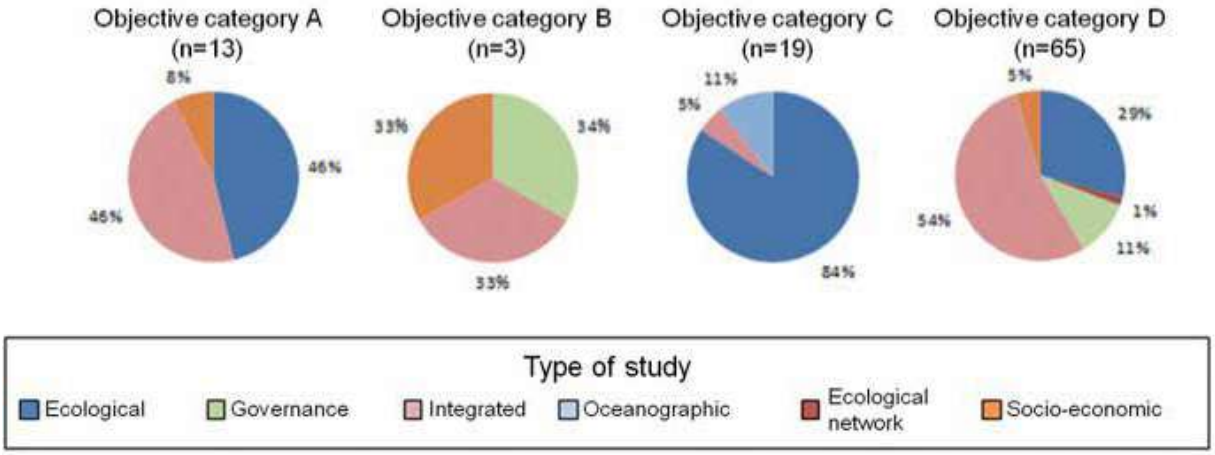


Figure 93: A breakdown of the programmes by type of study for the A, B, C et D objective categories (n=100)

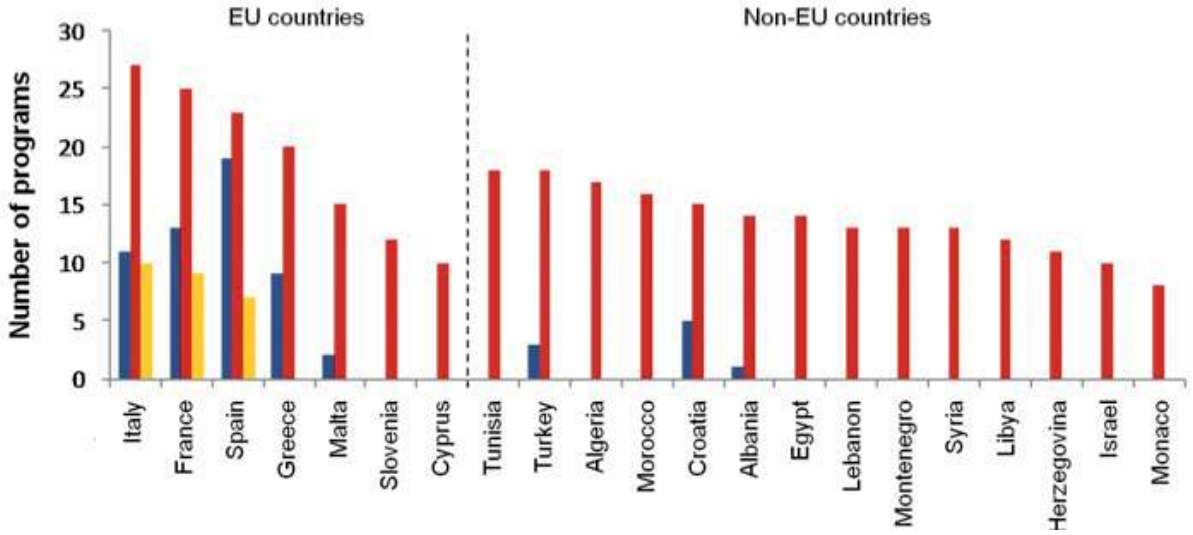


Figure 94: The involvement of Mediterranean countries in national programmes

(n=64) ( ), in collaborative programmes (regional and sub-regional; n=36) ( ) and the number of times a country's organisation is the leader of a collaborative programme ( )

France with Italy (21 collaborations), Italy with Greece (20 collaborations) and Spain with Italy (19 collaborations) (see Table 27). These four Mediterranean countries are all in the European Union. Among the non-EU Mediterranean countries, the most frequent collaborations are Algeria with Tunisia and Tunisia with Turkey (17 collaborations) and Algeria with Turkey, Morocco with Tunisia (16 collaborations). The Non-EU countries which have had the most collaborations with EU countries are Tunisia (13 collaborations with Spain, France and Italy respectively), Turkey (13 collaborations with Greece and Italy and 12 with Spain and France respectively) and Algeria (12 collaborations with Spain, France and Italy respectively). We note that that on average the EU Mediterranean countries collaborate more amongst themselves than with non-EU Mediterranean countries, and vice versa.

Despite the fact that many countries participate in regional monitoring programmes (90% of Mediterranean countries are included in 70% of regional programmes) it is only the French and Italian organisations which are leaders of these programmes (only Spanish, Italian or French organisations are leaders of sub-regional programmes) (see Fig. 94). Three regional programmes are under the supervision of international organisations. On average, the regional and sub-regional programmes include 16 and 12 different partners respectively.

Information on the types of funding sources was obtained for 93 out of the 100 programmes. The European Union is the main contributor by number of programmes (50% of regional programmes, 65% of sub-regional programmes, 57% of national programmes). Public funds from EU countries are next, funding a third of the programmes. National Public funds from non-EU Mediterranean countries fund only 4% of the monitoring programmes and they are all national ones. Regardless of the geographical location, NGOs only finance or co-finance objective category D programmes (6% of the total number of programmes in this category).

	Albania	Algeria	Bosnia & Herzegovina	Croatia	Cyprus	Egypt	France	Greece	Israel
Albania		11	11	13	7	11	8	10	8
Algeria	11		10	13	9	13	12	11	8
Bosnia & Herzegovina	11	10		11	7	10	7	8	7
Croatia	13	13	11		7	12	10	11	8
Cyprus	7	9	7	7		8	9	9	8
Egypt	11	13	10	12	8		9	10	8
France	8	12	7	10	9	9		15	10
Greece	10	11	8	11	9	10	15		9
Israel	8	8	7	8	8	8	10	9	
Italy	10	12	8	11	10	10	21	20	9
Lebanon	11	13	10	12	8	13	9	9	8
Libya	11	12	10	11	7	11	7	7	7
Malta	8	10	7	9	10	9	13	12	9
Monaco	7	8	7	7	7	7	8	8	7
Montenegro	13	11	11	13	7	11	8	9	8
Morocco	12	15	10	14	9	13	12	11	9
Slovenia	9	10	9	10	8	9	10	11	8
Spain	9	12	7	10	9	9	23	15	9
Syria	10	13	10	11	9	12	9	8	8
Tunisia	12	17	10	14	9	13	13	12	10
Turkey	12	16	10	14	9	14	12	13	9

Table 27: Number of collaborations per Mediterranean country within the regional and sub-regional programmes

(n=36), between EU countries (■), between non-EU countries (■) and between EU and non-EU countries (■)

Italy	Lebanon	Libya	Malta	Monaco	Montenegro	Morocco	Slovenia	Spain	Syria	Tunisia	Turkey
10	11	11	8	7	13	12	9	9	10	12	12
12	13	12	10	8	11	15	10	12	13	17	16
8	10	10	7	7	11	10	9	7	10	10	10
11	12	11	9	7	13	14	10	10	11	14	14
10	8	7	10	7	7	9	8	9	9	9	9
10	13	11	9	7	11	13	9	9	12	13	14
21	9	7	13	8	8	12	10	23	9	13	12
20	9	7	12	8	9	11	11	15	8	12	13
9	8	7	9	7	8	9	8	9	8	10	9
	9	7	15	8	9	12	11	19	9	13	13
9		11	8	7	11	13	9	9	12	13	13
7	11		7	7	11	11	8	7	11	12	12
15	8	7		7	8	11	10	13	9	11	11
8	7	7	7		7	7	7	8	7	8	8
9	11	11	8	7		12	9	8	11	12	12
12	13	11	11	7	12		10	12	13	16	15
11	9	8	10	7	9	10		10	9	10	10
19	9	7	13	8	8	12	10		9	13	12
9	12	11	9	7	11	13	9	9		13	12
13	13	12	11	8	12	16	10	13	13		17
13	13	12	11	8	12	15	10	12	12	17	

A few examples of these monitoring programmes:

BIOMEX

ASSESSMENT OF BIOMASS EXPORT FROM MARINE PROTECTED AREAS AND ITS IMPACTS ON FISHERIES IN THE WESTERN MEDITERRANEAN SEA

Objective category: A
Type of study: Ecological
Time Period: 2003-2005
Scale: Sub- regional (France, Spain)

Objectives: To implement and develop methods to assess the export of fish biomass from MPAs to surrounding areas. In this programme the MPAs were used as marine ecosystem management tools to ensure sustainable fisheries. This study was conducted in six MPAs.

Results: The results of the BIOMEX programme have brought evidence of biomass export from MPAs to fished areas in the Western Mediterranean, for adults as well as for eggs and larvae of some species or groups of species depending on the MPA. However, this exportation would benefit local fisheries only at a small spatial scale, from tens to hundreds of meters, even if fishes are able to migrate longer distances. The small spatial scale (100 to 1000m) on which fish biomass gradients from the MPAs studied were revealed was probably related to the high fishing pressure existing in the Western Mediterranean outside the MPAs and, where relevant, to habitat discontinuities. Even if fish biomass export from MPAs varies greatly in space and intensity according to fish species, and is restricted to a small distance from MPA border, it is likely to have positive effects on adjacent fisheries.The recommendations from BIOMEX are: (1) develop a regular monitoring of exploited populations as an integral part of the management activities; (2) establish and maintain research to improve knowledge on the ecology of these species (especially their movements); (3) integrate the scientific study's results and the opinions of users in the decision-making process, (4) designing MPAs as a tool for fisheries management; (5) produce detailed habitat maps of the protected areas and associated fisheries areas.

Summary: One observed benefits to local fisheries yields (i.e. limited to hundreds of meters around the heart of the MPAs) for certain species or groups of species. This programme has shown that reserves (i.e. strict nature reserve zones or no-take zones) are essential in using MPAs as a fisheries management tool through fish biomass export.

EMPAFISH

EUROPEAN MARINE PROTECTED AREAS AS TOOLS FOR FISHERIES MANAGEMENT AND CONSERVATION

Objective category: A
Type of study: Integrated
Time Period: 2005-2008
Scale : Sub- regional (France, Spain, Italy, Malta)

Objectives: An investigation on the potential of different regimes of MPAs in Europe as measures to protect species, habitats and ecosystems, and as a tool for fisheries management. The development of quantitative methods for assessing the effects of MPAs. To provide the European Union with a set of integrated measures and policy proposals for the implementation of marine protected areas as fisheries and ecosystems management tools. A study conducted in 16 MPAs.

Results : The major findings were: (1) the size and age of the reserve (i.e. strict nature reserve zone or no-take zone) matters: by increasing the size of wilderness areas the density of commercial species increases within these areas compared to outside, while increasing the buffer zone has the opposite effect; (2) the ecological, fisheries and socio-economic benefits vary depending on the reserves' design, the activities within it, its environmental characteristics and protected species; (3) the export of biomass can be seen within the first five years of full protection; (4) MPAs have a positive economic impact on non-extractive uses (diving) and some extractive uses (some types of fishing). The recommendations arising from this programme are: (1) the use of MPAs for fisheries management and conservation means that they must provide protection for a wide range of species with different biological traits and ecology; (2) The monitoring programme's conception must include a characterisation of biotic assemblages in order to obtain a better representation of the samples by depth strata and assemblage type; (3) it is essential to enhance the dialogue between scientists, managers and users of the environment to reduce perception disparities between these groups on the benefit of the protection of the environment on fisheries.

Summary: The pooling of existing data has highlighted the hypothesis raised by models, but never demonstrated experimentally. The benefits of MPAs, whether ecological fisheries or economic are linked to the MPAs design at the time of protection and the presence of no-take zones. The MPAs in the Mediterranean can be regarded as being a regional network (or ad hoc) of MPAs, but not an ecological network.

AMPAMED

THE ROLE OF MARINE PROTECTED AREAS IN THE SUSTAINABLE MANAGEMENT OF ECONOMIC ACTIVITIES, SUCH AS ARTISANAL FISHING AND TOURISM, HARMONIZED WITH THE CULTURAL IDENTITY OF THE WESTERN MEDITERRANEAN AREAS

Objective category: A
Type of study: Socio-economical
Time Period: 2006-2008
Scale : Sub- regional (France, Spain, Italy)

Objectives: Using three western Mediterranean MPAs (Corsica, Sardinia, Murcia area) to identify criteria which can lead to sustainable management of traditional activities.

Results: The results obtained are different from one MPA to another. Bonifacio was good for both diving and sailing. Cabo de Palos is primarily devoted to commercial fisheries although diving activities are increasing. While Sinis-Mal di Ventre is traditionally oriented to fishing rather than tourism activities. The social and geographical factors as well as management could play an important role in these differences. The additional value of this project is the recommended sustainable development strategies: (1) increase knowledge through research (2) improve public management actions through innovative experimental solutions (3) implement awareness raising campaigns aimed at socio-economic stakeholders and the general public.

Summary: This programme is the only socio-economical one and in objective category A, which means that its purpose is to assess the direct socio-economic benefits of MPAs. Similar assessments are now increasingly included in multidisciplinary regional programmes.

PEGASO

PEOPLE FOR ECOSYSTEM-BASED GOVERNANCE IN ASSESSING SUSTAINABLE DEVELOPMENT OF OCEANS AND COASTS

Objective category: B
Type of study: Integrated
Time Period: 2010-2014
Scale: Sub- regional (Spain, France, Greece, Italy, Morocco, Turkey, Croatia, Algeria, Tunisia, Lebanon, Égypt)

Objectives: PEGASO's main objective is to build on existing capacities and develop new joint approaches to support integrated policies for the coastal, marine and maritime areas in the Mediterranean and Black Sea basins, in a consistent and relevant way in order to implement the Mediterranean's ICZM protocol.

Results : Programme in progress.

Summary: Programme in progress.

COCONET

COAST TO COAST NETWORKS OF MARINE PROTECTED AREAS (FROM THE SHORE TO THE HIGH AND DEEP SEA), COUPLED WITH SEA-BASED WIND ENERGY POTENTIAL

Objective category: A
Type of study: Integrated
Time Period: 2012- 2016
Scale: Regional (Italy, Greece, France, Spain, Tunisia, Israel, Turkey, Morocco, Croatia, Albania, Malta, Montenegro)

Objectives: The project aims to identify groups of marine protected areas (MPAs) that are potentially interconnected in the Mediterranean and Black Seas, by putting themselves on a local scale (one MPA), a regional scale (networks of MPAs) and on basin-wide scale (the network of MPA networks). The identification of connections between physical and biological processes will highlight those which direct biodiversity's pattern of distribution. This project will improve the environmental management policies effectiveness, to determine whether existing MPAs are effective in sustaining ecological networks and suggest how to design better protection systems based on an efficient exchange/communication between protected areas. Up to now the emphasis was on the coastal zone, but this will be expanded to offshore and deep sea habitat areas by including them in the networks of MPAs. This project will also identify areas where offshore wind farms (OWF) could be established, avoiding sensitive habitats but acting as springboards (links) within MPAs. Socio-economical studies will integrate base knowledge in environmental management concerning both environmental protection (MPA) and the production of clean energy (OFW). The project must generate the necessary guidelines for the design, management and surveillance of a network of MPAs, and draw up a detailed atlas of the Mediterranean and Black Sea winds. In addition, it must promote the establishment of a permanent network of qualified researchers (e.g. with «summer courses») whose expertise could also, in the future, be used by their country and the European Union.

Results: Programme in progress.

Summary: Programme in progress. Given that this programme has just started, only case study results are currently available.

Los Acantilados de Maro-Cerro Gordo Natural Park, Spain © R. Dupuy de la Grandrive

CHAPTER 7

Summary and recommendations

Summary

In 2010, the CBD's Parties adopted the Strategic Plan for Biological Diversity 2011-2020 which states that «by 2020, at least 10% 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, and integrated into the wider landscape and seascapes».

The purpose of this study, as specified under these terms of reference was to "assess in 2012, compared with the 2008 1st appraisal, the progress of the Mediterranean's system of MPAs vis-à-vis the Convention on Biological Diversity's objectives which is to establish by 2012 representative networks of MPAs, which are comprehensive and managed effectively". In the Mediterranean, the main instrument for implementing the CBD is the Barcelona Convention Protocol concerning Specially Protected Areas and Biological Diversity (SPA/BD).

The objective of this 2012 study, as specified in the terms of reference, is to assess the progress of the Mediterranean MPA system made since 2008, year of the 1st status report with regard to the objectives of the CBD to establish by 2012 comprehensive, effectively managed and ecologically representative MPA networks

Thus, this study has focused on analysing the system of MPAs in the Mediterranean in terms of some of the CBD's objectives: the level of protection of marine areas in view of 10% target, the representativity, connectivity between MPAs, and management effectiveness.

The analysis of the spatial coverage of the Mediterranean basin by MPAs, and of the representativity and connectivity is based on an inventory of the Mediterranean MPAs which was done by MedPAN and RAC/SPA in 2011-2012, on their geographical location and their spatial area, whilst the study on the management's effectiveness is based on the MPA managers' responses to a survey.

The definition of an ecological network according to OSPAR (North-East Atlantic Convention) and HELCOM (Baltic Sea Convention) (OSPAR, 2010)

OSPAR and HELCOM agreed that an ecologically coherent network of MPAs must:

- interact with and supports the wider environment;
- maintain the processes, functions, and structures of the intended protected features across their natural range; and
- function synergistically as a whole, such that the individual protected sites benefit from each other to achieve the two objectives above.

The world's MPAs in 2012 (Spalding *et al.*, in press)

- A total of 10 280 MPAs are listed internationally.
- They cover around 8.3 million km^2.
- 2.3% of the oceans' total surface.
- 28 countries and territories (out of 193) have over 10% of their waters covered by MPAS (12 more countries than in 2010).
- 111 countries and territories (58% of all countries) have less than 1%.

The Mediterranean's MPAs in 2012

- The Mediterranean Sea covers 0.8% of the global oceans' surface.
- Inventoried MPAs amount to 677 sites, namely 6.6% of the world's total.
- They cover around 114 600 km^2 (27 100 km^2 without the large Pelagos Sanctuary), namely 1,38% of the global protected surface area.
- 4.56% of the Mediterranean Sea has a legal protection status (national, international and Natura 2000 at sea) and 1.08% if the Pelagos Sanctuary is excluded.
- There is less than 1% in a strict nature reserve zone or a no take zone.
- 2 out of 21 countries have over 10% of their waters protected by MPAs, and only 1 without Pelagos.

MEDITERRANEAN MPAS, NOW BETTER KNOWN, ARE LOCALISED AND RECORDED IN THE NEW MAPAMED DATABASE

The inventory identified 677 MPAs to be considered for the geographical analysis, while 80 were considered for the management analysis (62 MPAs were studied in 2008). All the data collected has been integrated into the MAPAMED database (a joint initiative between MedPAN and RAC/SPA).

A major step forward was taken with the creation of the MAPAMED database, compared to the 2008 study. However, this is only the first step which still requires a

Fishing boats, Greece © R. Desbief

significant effort to complete the missing information and further validation of existing data to provide a solid database to do comparable periodic evaluations in the years to come.

Among the 677 MPAs in MAPAMED, which represent 6.6% of the total number of MPAs in the world (knowing that the Mediterranean Sea covers 0.8% of the global oceans' surface– see box "The Mediterranean MPAs in 2012"):

- 161 have a national designation, 31 of which also have an international status (if not several), not including Natura 2000 sites at sea;
- 9 just have an international status;
- 507 are Natura 2000 sites at sea (strictly or partially marine), a designation applicable to EU member countries and which they have an obligation to implement;
- In addition to these 677 MPAs, 55 MPAs are being planned.

The 170 identified MPAs of national and/or international status cover a total surface area of 106 500 km² and of 19 000 km² without the Pelagos Sanctuary (which alone covers 87 500 km²). The 507 Natura 2000 sites at sea, which have a unique European status, cover 25 200km². But several of these sites overlap with each other and other MPAs, therefore the Natura 2000 sites at sea system actually covers 8 100 km², this can be added to the surface area covered by the 170 MPAs with other designations.

Progress made since 2008

Since the study published in 2008 (for which data was collected in 2007), 23 MPAs have been established in 10 countries adding an area of about 6 754 km², which represents an increase of 6.9% to the protected surface area in 5 years compared to the 2008 protected surface area (97 410 km²); but it is difficult to make a comparison because the 2012 study adopted a wider criteria for site selection than the 2008 one. Progress can be reported in several countries on the southern and eastern shores of the Mediterranean (with 6 new MPAs and 24 being planned), and in the North-West region (17 new MPAs and 31 being planned).

Forty MPAs have one, or even several international designations, including 32 which are SPAMIs. There are only 2 World Heritage Sites which is exceptionally low for such a unique sea which is so naturally rich and culturally diverse, and 5 Biosphere Reserves.

Regarding designations (which have been classified into groups for the purposes of the study), MPAs of ''Park" or ''Reserve" group types seem to be the more common (56% and 30% respectively when looking at national designations). As for the IUCN categories, there are currently no MPAs listed as IUCN Category I, even if strict nature reserve zones have been designated within some MPAs. Category IV (Habitats / Species Management Area) and II (National Park) are the most represented in numbers (77%) and surface area (66%); fewer MPAs are in Category VI (Protected area with sustainable use of natural resources), but these are generally larger in size (nearly 30% of the Natura 2000 surface area).

With 26 different types of designations, the Mediterranean MPAs array of designations is extremely variable; concepts and words do not have the same value everywhere and the labeling of ''marine protected area" is still too often used as a status, while it is primarily a generic term. Ex: National Park can be a highly regulated area and close to a reserve (USA), or otherwise quite open to human activities without strong leadership, as it is the case for some national parks in the Mediterranean. Some countries have also other terminologies difficult to integrate into existing categories («Oasi blue» in Italy, Marine Park and the Blue Coast artificial reef sites in France). There is a need to homogenise labelling, based on a further analysis between type of MPA, IUCN categories, objectives and regulation of the MPA with support from the World Commission on Protected Areas.

Moreover, these IUCN categories need to be reviewed in view of the new specific marine area guidelines (Day *et al.*, 2012). Indeed, as the choice of one or other of these categories is not always easy for managers/relevant authorities and sometimes an inadequate label is assigned; the Categories II and IV are often confused and several MPAs are assigned Category IV or even II when their objectives are multipurpose and so more likely to be under Category VI. This global lack of coherence in assigning categories was pointed out at the recent IUCN World Conservation Congress (Jeju, 2012): «This is how among the MPAs which have been categorised, about half have an incorrect one because the MPA's label (e.g. National Park, Sanctuary, etc…) was used to determine the category and not the management objectives» (IUCN website, 2012).

THE CBD TARGET OF 10% PROTECTION OF MEDITERRANEAN WATERS HAS NOT YET BEEN ACHIEVED

The total number of Mediterranean MPAs and their surface area is today more accurate as they are now georeferenced, but information on their actual protection level is still limited and many documents consider that a lot of them are "paper MPAs" without any actual management structure (42% in particular have no management structure, mainly the Natura 2000 sites at sea who don't have an identified manager).

As such, it is the area covered by the MPA which is taken into account here rather than actual protected surface area.

In 2012, globally 2.3% of the oceans are protected (Spalding *et al*., in press).

In 2012, the Mediterranean Sea's[1] 2.5 million km² is covered by (see Table 28):

- 4.56% of MPAs from all designations and 1.08% when excluding the Pelagos Sanctuary (87 500 km²), which alone represents 3.48%;
- 4.24% (0.75% without the Pelagos Sanctuary), if we only count the MPAs with a national and/or international status, not including the Natura 2000 sites at sea (which represent 0.32%)[2];
- 5.26% including the 4 Fisheries Restricted Areas in open seas created by the GFCM (17 677 km²; 1.78% excluding the Pelagos Sanctuary);
- Finally, the bottom trawling exclusion zone, which includes the benthic zones at less than 1000m deep (GFCM regulation adopted by European legislation in 2006) covers 58% of the Mediterranean Sea or 1 455 411 km² in spatial projection.

With regards to the issue of ''full protection", integral reserves (strict nature reserves/wilderness areas) or no take zones, we do not have comprehensive information on the total coverage for all MPAs. The 2008 report states that «the Mediterranean's percentage of protected strict nature reserves/wilderness area (0.01%) is well below an already weak global figure of 0.2%». In this study, this information is only available for 71 MPAs of the sample group, namely 40% of the MPAs with a national and international status. Out of these 71 MPAs, 500 km², that is 0.02% of the Mediterranean, is in no take zones and/or integral reserve areas, but as we only have information on less than 50% of all the MPAs, this figure is probably underestimated.

Therefore, depending on the status taken into consideration, the surface areas with a protection status or management are between 4.24 and 5.26% with Pelagos Sanctuary and between 0.75 and 1.78% without the Pelagos Sanctuary; the Mediterranean has not yet reached the recommended 10% target set by the Convention on Biological Diversity. Although the accuracy of this percentage can be improved, the results show that less than 1% of the total surface area is in full protection (integral) and/or in a non-extractive zone (no-take zone).

1. The surface area taken into account for this report is 2 513 270 km²
2. in 2008, even if it is difficult to compare accurately, the figures were 3.88% and 0.4% respectively – without Natura 2000 sites – thus a difference of 0.38%, knowing that MPAs considered in 2012 differed to some extent;

NB: reference surface area taken for the Mediterranean: 2 513 270 km²	Total number	Without Pelagos		With Pelagos	
		Marine surface area (km²)	% Mediterranean*	Marine surface area (km²)	% Mediterranean*
MPAs with national designation	161	18 500	0.73	18 500	0.73
MPAs with just international designation	9	500	0.02	88 000	3.50
Total MPAs	170	19 000	0.75	114 600	4.24
Natura 2000 at sea* (without an overlap with other MPAs)	507	8 100*	0.32	8 100*	0.32
Total MPAs + Natura 2000	**677**	**27 100**	**1.08**	**114 600**	**4.56**
GFCM Fisheries Restriction Areas (open sea)	4	17 700	0.70	17 700	0.70
Total MPAs + Natura 2000 + Fisheries Restriction Areas (GFCM)	**681**	**44 800**	**1.78**	**132 300**	**5.26**

Possible scenarios for the Mediterranean's cover including MPAs being planned where a surface is pre-determined

MPAs being planned	55	1 100	0.04	1 100	0.04
Estimated Total (MPA + Natura 2000 + Planned)	732	28 200	1.12	115 700	4.60
Estimated TOTAL (MPA + Natura 2000 + Regulated fishing zones + Planned MPAs)	736	45 900	1.83	133 400	5.31

Table 28: Figures about Mediterranean MPAs (rounded to the nearest hundred)

** When counting only once the same surface areas covered by both the EU Habitats Directive and the EU Birds Directive, the total marine surface cover of Natura 2000 sites adds up to 25 243 km² (about 1% of the Mediterranean Sea). Some surface areas within these 25 243 km² also overlap with MPAs of other designations, and when this overlap is only counted once, the true net additional surface area brought by the Natura 2000 system adds up to 8 101 km².*

Port-Cros National Park, France © H. Bergère

THERE IS STILL AN IMBALANCE IN THE GEOGRAPHICAL DISTRIBUTION OF MPAS BETWEEN THE SOUTHERN, EASTERN AND NORTHERN SHORES OF THE MEDITERRANEAN AND MPAS ARE STILL MAINLY COASTAL

The distribution and the surface area of identified MPAs are quite uneven across the Mediterranean. This imbalance was already mentioned in 2008 and this is still the case in 2012, even if it tends to lessen:

- 84% of MPAs are located in the northern part of the Mediterranean (North-West and North-East) with 66% in the European Union member countries, highlighting the lack of MPAs on the southern and eastern shores. Yet, progress has been made in these areas since the 2008 study and several countries in the South and East indicate that they have some being planned: Algeria (6 MPAs planned), Israel (8 MPAs planned), Lebanon (4 MPAs planned), and Libya (3 MPAs planned), and Tunisia (3 MPAs planned);
- This regional disparity is more pronounced if one considers Natura 2000 sites at sea in the EU member countries, because then 96% of the Mediterranean MPAs are in the North of the basin;
- Italy, France and Spain hold 52.8% of the total MPAs with a national designation;
- Greece and Italy have 67% of all Natura 2000 sites at sea and France 47% of the total surface area.

The 12 nautical mile zone[3] (territorial waters), under national legal jurisdiction, has an 8.5% protection, with the Pelagos Sanctuary contributing a large area (6.1%). Only two countries protect their 12 nautical mile zone by 10%: Monaco (the Pelagos Sanctuary covering its waters) and France, largely due to the French part of Pelagos and the Gulf of Lion Natural Marine Park.

The open sea area, usually beyond the 12 nautical miles, represents 74% of the Mediterranean's surface area has a 2.7% protection, 2.6% of which is Pelagos. One must note, however, that there are many initiatives for creating MPAs in the open sea (including the SPAMI projects proposed by the RAC/SPA in the Gulf of Lion, the Alboran and Adriatic Seas, etc…).

- 96% of MPAs are in the northern basin (83% not including Natura 2000)
- 53% of MPAs (not including Natura 2000) are located in Italy, Spain and France
- 67% of Natura 2000 sites are located in Greece and Italy, but in terms of surface area, France holds 47%
- 6.1% of the 12 nautical mile zone is under a protected status (8.5% with Pelagos)
- 0.1% of the open sea is under a protected status (2.7% with Pelagos)
- 60% of MPAs are less than 25 km from their nearest neighbour

REPRESENTATIVITY IS HIGHLY VARIABLE DEPENDING ON THE SPECIES AND HABITATS

The CBD recommends that a network of protected areas is representative of the diversity found in habitats, species communities, species, and of regional ecological processes.

Coherence of the network

A glance at the map of spatial distribution of Mediterranean MPAs is enough to see that the network is not coherent, since MPAs are all distributed in the coastal zone (only Pelagos extends offshore), and large portions of the South-eastern coast of the Mediterranean have no MPAs. However, in the western basin, the richest, and the North East, the number of MPAs is not negligible. Beyond this visual and pragmatic approach adopted by OSPAR (OSPAR, 2010), this work has attempted to provide more precise answers on the representativity and connectivity.

Eco-regions

Located in the western part of the Mediterranean, offshore France, Spain and Italy, the ecoregions of the Algerian-Provencal Basin and Tyrrhenian Sea appear best protected(13%, all MPAs, including Pelagos). However, the Pelagos sanctuary contributes 90% or more to representing these two ecoregions. Without Pelagos, the Algerian-Provencal Basin, the Aegean Sea and the Alboran Sea are the best represented (around 3%). The Mediterranean MPA network is not representative of all the ecoregions (the Tunisian Plateau / Gulf of Sirte and the Levantine, Ionian and Adriatic Seas are particularly under-represented).

Habitats

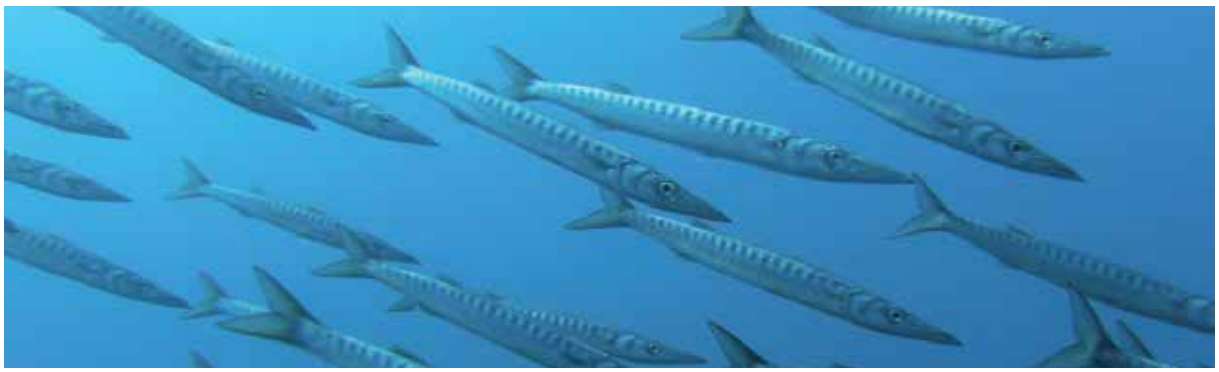
The Benthic zone

The RAC/SPA reference list of marine habitats types has 189 habitats which are distributed in the Mediterranean following a vertical zoning, or by "layers" according to the depth and nature of the substrate. There is little knowledge on these habitats' distribution except for a few and then this knowledge is not homogeneous across the basin.

In order to carry out a representative approach to these habitats, we drew up a homogeneous map of the major biotopes on a Mediterranean level by crossing layers from the bathymetric map and the size and nature of the sediment (sand, muds, etc.).

On this basis, the analysis of the representativity per benthic layers shows that between depths of 0 to 200m, the infralittoral domain (10%) and to a lesser extent the circalittoral domain (4%) are the most protected (respectively 4.5 and 2.3% in MPAs with a management structure. The Bathyal and abyssal zones are not well represented within the system (less than 1% for the former, and nearly not at all for the latter).

3. Some countries have a 6 n.m. territorial waters limit (Turkey and Greece for example). It was decided for the purposes of this study and to circumvent the jurisdiction problems of this enclosed sea to take 12 nautical miles for all the countries.



Shpyraena spyraena © Cinthia

The network is thus not representative of deep sea benthic habitats which harbour unique Mediterranean biocenosis, such as cold seeps, brine pools, cold-water corals and are not subject to strict protection. Only the 4 fisheries restriction zones and the bottom trawling exclusion zone (deeper to 1000m) represent forms of management. Sandy and muddy substrates in the infralittoral zone are represented at about 10% (for all MPAs).

A more detailed analysis shows that:

- The coastal habitats with a mainly rocky substrate have the best protection. Thus, mainly rocky substrate infralittoral habitats have 18% of their surface in MPAs (of all statuses) and over 7% of their surface in MPAs with a management structure.
- The distribution of coralligenous habitats and Posidonia oceanica and Cymodocea spp. meadows is only known relatively homogeneously in the western basin of the Mediterranean (west of the Strait of Sicily) as they were mapped within the EUSeaMAP project (noting that this was done on a large scale so clearly approximate). Based on this, we can consider that 12%, 50% and 8% respectively of the surface area of these habitats is covered by a MPA in the western part of the basin (5%, 19% and 1% respectively by MPAs with a management structure). It can thus be considered that at least for this part of the Mediterranean, Posidonia oceanica meadows are adequately represented.

Considering some remarkable deep-sea geomorphological elements:

- The 756 deep-sea canyons identified to date have close to a 13% representation within the network of MPAs, most of them are in the Pelagos Sanctuary.
- The 88 seamounts, 401 submarine knolls and sea banks are weakly represented (less than 3%).

The pelagic zone

The epipelagic bioregions as indicators of the different oceanic water masses were identified by using a number of oceanographic variables (37 bioregions of level III clustered in 16 bioregions of level II and in 5 bioregions of level I). Their representation within the network of MPAs is varied. Most bioregions are weakly represented aside from for the Gulf of Lion (about 12%), the Alboran Sea (6%) and the bioregion of the Aegean Sea in particular (31.5%). Open sea bioregions have practically no protection, especially those located in the oligotrophic waters of the eastern Mediterranean.

In the survey, MPA managers were asked to list between 3 and 5 habitats the most important for their management objectives (see box «Most important habitats for management objectives»), and specify, among a list of 189 habitats, the ones that are significant in their MPA. The habitats most often cited by managers - *Posidonia* meadows and *Coralligenous* - are the best known and most targeted by MPAs in their conservation objectives. Then come caves and infralittoral rocks with photophilic algae. The *Posidonia* meadows are reported in 69% of the MPAs in the sample group (not reported in Lebanon, Morocco - and Slovenia) and 52% of MPAs for coralligenous (not reported in Greece, Lebanon, Libya, Malta, Morocco). All other iconic habitats are only reported in less than 35% of MPAs. Less than 10% of MPAs mention deep-sea corals, considering that MPAs in the Mediterranean are mainly coastal. No MPA mentions the presence of the abyssal floor.

The most important habitats for the MPAs management objectives

Fifty-one MPAs responded and there was a wide range among the 3 to 5 habitats listed by managers as the most important in their MPA for their management objectives: the most frequently mentioned were the Posidonia meadows (82% of responses), coralligenous (49% of responses), caves and the monk seal habitats (22%), infralittoral rocks with photophilic algae (18%) and Cystoseira forests and/or belts (18%).

Others which were more rarely mentioned were: maerl facies (6 MPAs), Cymodocea meadows (3 MPAs), Puffin habitats (3 MPAs), vermetid habitats (4 MPAs), Amphioxus habitat (Gulf of Lion), and even more rarely canyons (Gulf of Lion), facies with large Bryozoa (Negre Cape / Serrat Cape) or even turtle habitats (Kuriat).

Species

Other than fisheries management and regulation on fishing gear, the protection of species is essentially carried out by protecting the vital habitats for their life cycle: breeding areas (fish spawning areas, turtle and seabirds nesting sites...), nursery areas (shallow waters close to the beach...), feeding areas (meadows for turtles, upwelling zones and fronts rich in zooplankton ...), migratory areas.... But this information is not readily available and in any case not homogeneous across the Mediterranean. Thus, in this study we have considered the species distribution area only where homogeneous information exists.

The monk seal (Monachus monachus), with only about 250-300 individuals known to be left in the Mediterranean out of 600, most being located in Greece, Turkey, the Aegean Sea and in the south-western basin (Morocco, Algeria…) is classified as critically endangered by the IUCN. Several MPAs mentioned the existence of caves, the species preferred habitat (Galite, Habibas Islands, Zembra - Zembretta, Al-Hoceima, Mgarr ix-Xini, Brijuni, El Montgrí, Medes i el Baix Ter Islands, Telascica, Isole Tremiti, Isole Pelagie), but their distribution is not known homogeneously. Less than 2% of the monk seal's potential distribution range which is still little known is included within a MPA with a management structure; this is a concern for the survival of this species on the short term.

Three sea turtle species, the Loggerhead turtle (*Caretta caretta*), the Green turtle (*Chelonia mydas*) and the Leatherback turtle (*Dermochelys coriacea*) are present in Mediterranean waters: only the first two nest in the Mediterranean, and mainly in the eastern basin. Nesting sites are much reduced nowadays and protected respectively at 29% and 19% by the current system of MPAs. *Eretmochelys imbricatra* and *Lepidochelys kempii* are much more sporadically spotted.

The MPAs representativity for birds was assessed using for 4 priority species for conservation: the Cory's shearwater (*Calonectris diomedea*), the Balearic shearwater (*Puffinus mauretanicus*), Yelkouan shearwater (*Puffinus yelkouan*) and Audouin's gull (L*aurus audouinii*). The mapping of this species was only for the western Mediterranean, Greece and Maltese waters. Data on distribution is too fragmented outside these cited zones. The four species considered are represented between 8% (*P. mauretanicus*) and less than 4% for the other species (6% and less than 2% for respectively in MPAs with a management structure). However, the distribution range for 3 out of the 4 species is covered by less than 1% by MPAs with a strict protection zone. One must underline that the current analysis only focuses on Mediterranean's sub-regions which tends to lead to an overestimation of the representativity of the network for the species involved.

The distribution of the 16 species of fish in the different trophic zones was analysed for its representativity which reaches an average of 6% and a maximum of just under 10% (less than 3% on average for MPAs with a management structure). *Epinephelus marginatus* is represented at 7.2% in all MPAs and 3.5% in MPAs with a management structure - although 70% of managers stated that the species occured in their MPA.

In the managers' survey (80 MPAs in sample group), the species most frequently mentioned are the noble pen shell (*Pinna nobilis*), neptune grass (*Posidonia oceanica*), the bottlenose dolphin (*Tursiops truncatus*), the loggerhead turtle (*Caretta caretta*) and the dusky grouper (*Epinephelus marginatus*). A number of responses indicated the presence of species considered rare, which would need a further more detailed investigation to see if this is due to a real protective effect or the occasional sightings of individuals; hus 60% of MPAs indicated the presence of date mussels, 10% reported the presence of monk seal and 6% the great white shark, which seems particularly high and will require further enquiry.

In 2009, a RAC/SPA study (Rais, 2009) indicated that 80% of the species listed in the annexes of the SPA/BD Protocol were covered by MPAs, according to the information then available in their databases. In the present study, 90% of species are listed as occuring in at least one MPA and only 14 species are not mentioned.

Many Priority Conservation Areas identified already

An increasing number of studies in recent years have identified the main gaps in the protection of key habitats and species which highlights the urgent need to protect critical areas (Franzosini *et al.,* 2001; Greenpeace, 2006; Notarbartolo di Sciara, 2008, 2010; UNEP/MAP/RAC/SPA, 2010 ; Coll *et al.,* 2010, 2011; Mouillot *et al.,* 2011; CEPF, 2010; de Juan *et al.,* 2012; Oceana Mednet, 2011; IUCN MedRAS, 2012...). These studies select the location of sites where MPAs should be established or existing zones expanded in coastal or open sea or even recommend perimeters of «mobile» MPAs. Even if the lack of knowledge remains important for most of the eastern and southern regions in the Mediterranean, it is not the identification of areas for protection which is lacking, but the will and the means to ensure the creation and effective management of these identified sites.

Adequate and viable sites: one of the CBD criteria is adequate and viable sites whosesize, shape and protection is sufficient to ensure the viability and ecological integrity of the characteristic or attribute for which they were selected. In the Mediterranean, there is a wide variety of sizes in the marine part of the MPA, the smallest covers 0.003 km ² (Akhziv National Park in Israel) and the largest (aside the 87 500 km² Pelagos sanctuary) covers about 4 000 km² (the Gulf of Lion Marine Nature Park in France). But 66% of MPAs cover less than 50 km².

With regards to the age of MPAs 61% is older than 10 years which is considered a minimum for a given MPA to access some sort of maturity; and 35% is even older than 20 years.

ECOLOGICAL COHERENCE IS WEAK

The CBD recommends a coherent network where MPAs are well connected. The ecological coherence of a network of MPAs, beyond the notion of representativity, is therefore closely linked to the level of connectivity between MPAs enabling the exchange of larvae or organic matter. The connectivity depends on the species targeted for protection: it is not the same for a species that moves over large areas such as turtles, marine mammals or pelagic fish, as it is for benthic species which remain on the sea floor, in a small radius. It is based on their biology (reproduction methods, larval dispersal,...). There is little knowledge on the connectivity of metapopulation species over large areas for most species in Europe or the world (Fenberg *et al.,* 2012).

The visual analysis on the distribution of MPA shows that the northern part of the basin has a good number of MPAs, particularly with the network of Natura 2000 sites, and one could therefore consider that this part of the network is relatively coherent, although most of the Natura 2000 sites do not have a management structure.

An outlook on population connectivity in the Mediterra-

nean was provided considering the few currently existing studies carried out on this subject. This area of research is new in the region and it appears necessary to intersect a number of different techniques used to measure population connectivity (at different trophic levels) and to intersect the different scales at which it is measured (local level, level of the basin).

In the framework of this report, an experience was carried out using one of the techniques to measure connectivity: models (research study currently under peer review). Models allow a simulation of several scenarios to obtain a glimpse of the situation. They also allow to put forth information that can support field work, steer the planning and adaptation of the management of MPAs, and guide the creation of future MPAs based on their ecological role.

This connectivity analysis was first approached using a proximity study between MPAs (the Euclidean distance). This showed that out of the 113 MPAs considered (IUCN II & IV), 60% of MPAs are less than 25 kms apart (from their nearest neighbour) which is the maximum recommended distance by the HELCOM convention (Baltic Sea BALANCE-HELCOM, 2006); 7% are between 25 and 50 kms apart which is recommended under the OSPAR convention (NE Atlantic; OSPAR, 2007), 9.5% are from 50 to 150 kms apart and 3% are over 150 kms apart. Thus, most of the MPAs are relatively close together, but because of a complex currents system, in terms of connectivity the distance is not the only important factor.

This analysis was then elaborated using fish larvae dispersal model scenarios (Epinephelus marginatus, iconic species in the Mediterranean Sea) and passive particles drifting with the currents - over 30 days.

The dispersal analyses results enables to assess the larval dispersal dynamics across the Mediterranean, in relation to MPAs, in terms of distance, connectivity rate and direction of the larvae flow (consistent with genetic analysis of fish populations (Palumbi, 2003; Hogan, 2011).

Results from runing the model suggest, only for the elements considered, that:

- the rate of connectivity is generally low (6% between MPAs on average);
- the western part of the Mediterranean basin appears better connected than the eastern part where the system is less dense;
- the average connection distance for *E. marginatus* between MPAs would be 180km;
- the average connection distance for drifting passive particules would stretch between 184 and 209km.

The simulations also suggest:

- a direction tendancy of the larval movement along coasts (eg. from the Adriatic Sea towards the Gulf of Lion for Italian MPAs);
- the existence of more or less strong connection between neighbour countries (whether sharing a frontier or not).

Larval dispersal modeling can only be supplemented and validated when associating field data (genetic and/or chemical). These experiment results will also need to be compared to conclusions of similar research work, such as those from the project FISHCONNECT*.

**» Predicting fish connectivity among Marine Protected Areas under climate change scenarios: management implications and interplay with fisheries « (in press).*

© Sunce

MPA MANAGEMENT MUST BECOME MORE EFFECTIVE

An online survey, consisting of 70 questions, was sent to MPA managers. Eighty MPAs (12% of the total number of MPAs but 29% of MPAs with a management structure [4]) were selected and form the MPA sample group on which the management effort assessment was made. Some limitations regarding the analysis of the survey are presented in the box «Analysis limitations and reservations on conclusions».

The conservation of biodiversity (91% of MPAs), of key habitats (49%) and key species (26%) remain the main objectives for all the MPAs in the study.

Other than their conservation role, MPAs, when they have no-take areas of sufficient size, are increasingly recognised as a tool for fisheries management, with a higher biomass which is denser and richer in species within reserves rather than outside (see EMPAFISH and BIOMEX project results, Fenberg *et al.,* 2012 Seytre *et al.,* 2008 and 2009): 45% of the sample group indicated that MPA fisheries management is one of their MPA's 4 priorities.

Sustainable management objectives linked to the issues on sustainable tourism and fishing are more often targets set by the MPAs in the northern basin whilst objectives targeting education and raising awareness are more frequently cited for the MPAs in the South.

The management effectiveness - as whether it is in place via a management plan - was measured using several parameters from the questionnaire (see box «The parameters used for evaluating management effectiveness).

While some progress has been made since the 2008 study, the level of management of Mediterranean MPAs remains low on different levels; In particular: The part of all MPAs that have a **management structure** is of only 42%; Most Natura 2000 sites don't seem to have one (75%), whereas 95% of MPAs of national designations have one.

Across the panel of 80 surveyed MPAs, over half (56%) still don't have a **management plan**. Yet, without a management plan that defines clear objectives and conservation strategies, management fails to be effective. However, a significant improvement in these figures is expected as 22% of MPAs, among those without a management plan, reported being in the process of developing their management plan (Slovenia, Monaco, Spain, Malta ...). If these management plans are quickly developed, nearly 70% of respondents from the 80 MPAs surveyed in the network would then have a management plan.

If the proportion of MPAs with a management plan has not evolved much since 2008 (44% with a management plan and 22% in the process of developing one, compared with 42% and 21% respectively in 2008), it is to be reminded that the number of MPAs considered in the 2012 study is higher and that globally, important efforts have been made in southern and eastern countries.67% of MPAs who have a management plan have already evaluated it. The assessment of these evaluations should already give an idea of the management effectiveness and of the benefits brought by MPAs of the network (see box "Concrete results of the EMPAFISH programme for decision makers and managers'").

Most of the MPAs (76%) **are governed** by the government whether at a local, regional or national level, with only 11% having shared governance in co-management or joint collaboration[5].

The participation of **local stakeholders** in the management is often the best guarantor of compliance on the ground. Only three MPAs reported being directly managed by local communities, but almost 65% of MPAs declared that local stakeholders were involved in the planning and management, and nearly half of the MPAs have developed a charter of good conduct with users (fishermen, divers ...), which is a significant contribution to the involvement of users in MPA management even if the charters are not statutorily binding (some exceptions).

Analysis limitations and reservations on conclusions

To better understand certain limitations in the analysis of the responses to the survey several aspects require attention:

First, the MPA sample group who responded to the survey is not very representative of the diversity of the Mediterranean MPAs: it represents 29% of MPAs who have a management structure (46% of MPAs with national designation and 7% of Natura 2000 sites), and 40% of the total surface covered by MPAs in the Mediterranean, with a distribution bias towards the northern basin (75% are located in the North-West, 66% belong to EU member countries, and nearly 50% are located in the Algerian-Provençal basin).

Second, some managers did not answer all the questions in the survey. The future work to be undertaken is to clarify the questionnaire, give support to the managers who responded and collect the missing information which is so important as more than 62% of the Mediterranean MPAs surveyed are over 10 years old (36% of MPAs are even over 20 years old), which is a unique case of «old» MPAs which have already reached the stage of maturity (FFEM, 2010), thus an MPA sample group which could give a good picture of the effectiveness and efficiency of management in the region.

Also, it should be noted that the wording of some questions sometimes led to different interpretations from the managers surveyed.

Nonetheless, having obtained answers to the questionnaire is a strong indication that MPAs had a management structure in place at the time of the study.

The conclusions and summary presented below should be considered in view of the limitations described above.

4. In this paragraph, all percentages refer to the number of responses to the considered question

5. In the «collaborative» management, decision-making and responsibility is assigned to an organisation, but it is required by law or by political decision to inform or consult other stakeholders. Participation in collaborative management can be enhanced by giving bodies which are composed of various stakeholders the responsibility of developing technical proposals for the regulation and management of the protected area, which will then be subject to the final approval of the decision-making body. In «joint» management, various stakeholders sit on a management structure that has the authority and responsibility for decision-making. Decisions may or may not require a consensus.

Mediterranean MPAs management effectiveness

- 42% of all the Mediterranean MPAs have a management structure (95% of MPAs with a national status and 25% of Natura 2000 sites)
- 56% of the MPAs in the sample group have no management plan, but there has been a significant improvement, particularly in the Southern and Eastern countries since 2008
- 80% of the MPAs surveyed do regular monitoring in their MPA, an improvement since 2008 (39%) and with a good participation from the management structure's teams (30%) alongside scientists
- 84% of MPAs have permanent staff
- 25% of MPAs have sworn staff, but MPAs are often helped by other partners for their surveillance
- 40% of managers reported observing illegal activities in their MPA
- 30% of MPAs have more than 2 boats

We also note that there is :

- A good participation from local stakeholders in the planning and management of MPAs (in 60% of MPAs)
- the MPA is taken into proper consideration in public development policies (in 91% of MPAs)
- A collaboration between Mediterranean MPAs (in 50% of MPAs)

As for the involvement of scientists in management, half of the MPAs have no **scientific committee**. This doesn't necessarily mean that no scientific expertise is present, but information on this is so far not known.

MPAs are strongly taken into account in policy local planning (91% of MPAs).

Half of the **MPAs have a good cooperation with other Mediterranean MPAs**, indicating that the human network for exchanging experiences (particularly MedPAN) works quite well.

The ability to rely on an **ecological baseline** ((to be able to measure changes in habitats, species populations or MPA functionnalities) or socio-economic status (MPA visitor numbers, MPA-induced benefits for the population ...) and ensuring **regular monitoring** of parameters and corresponding indicators is essential to give support to management decisions and adapt them regularly. Many MPAs have indicated a baseline on habitats and species (70% of MPAs) even if it is not always complete, and a socio-economic baseline (56% - against 48% in 2008), with respect to regular monitoring this is provided in 80% of MPAs surveyed (against 39% in 2008) and three-quarters of them also provide specific studies on different relevant MPA topics. Even if it is difficult to compare with the 2008 study, it seems that there is still a marked improvement in this area. The managers and their teams are involved in about 30% of monitoring alongside scientists.

Parameters used for evaluating management effectiveness

- Presence of a management plan
- Presence of an ecological baseline for the MPA
- Regular monitoring and occasional studies
- Type of governance (participation of local stakeholders)
- Presence of no-take zones
- Manager's perception of the global evolution of fish resources
- Staff (sworn staff – training)
- Surveillance effort
- Presence of infrastructure and equipment
- Presence of MPA specific public awareness tools
- Importance of financial means of the MPA and presence of a business plan

We do not have detailed information on the perception of the evolution of species and habitats from the MPA managers (unlike in 2008), only their perception of the overall development of fishery resources was given by managers and it shows no particular overall trend, an equal number of MPAs indicating stability, a rise or fall.

On **human resources management**, 84% of MPAs reported having permanent staff, the most often supplemented by seasonal and temporary staff, which is quite important even if it is difficult to know what kind of staff they are (in administrative offices or technical staff actually assigned to MPA management in the field). Ten MPAs (12%) however indicated having no full-time/permanent staff (including five with no staff at all). There are many differences between MPAs in staff resources allocated to each MPA when compared to their marine surface area.

Surveillance together with implementing infractions' penalties, are recognized critical elements to ensure the good management of MPAs. Within the sample surveyed, it is difficult to conclude on the level of surveillance in MPAs, known to be low in the Mediterranean. If only a quarter of the MPAs reported having sworn-in personnel, most of them rely on partners for surveillance such as coast guards, marine police, armed forces or the police. The reality and effectiveness of this surveillance are difficult to measure in the light of the questions and answers. Few MPAs (43%) indicated the number of hours of surveillance, and for those who responded it varies widely with an average of 8 hours per day of surveillance in MPAs in the North-West, 9 hours per day on average for MPAs in the North-East and 1.5 hours per day on average for MPAs in the South. The presence of illegal activities in the MPAs ranks fourth in the list of pressures and was reported by 40% of MPAs, which would justify increased surveillance.

The results on **equipment** of the MPA sample group surveyed show that MPAs are fairly well equipped in

Concrete results from the EMPAFISH programme for decision makers and managers

- Increasing the size of wilderness area increases the density of commercial species within them compared to outside, while increasing the buffer zone has the opposite effect;
- The ecological and fisheries benefits and socio-economic conditions vary depending on the « design « of reserves, current activities and environmental characteristics of protected species;
- The export of biomass can appear within the first five years of full protection;
- MPAs have a positive economic impact on non-extractive uses (diving) and some extractive uses (some types of fishing).

boats (surveillance and research), with only 12% indicating none and 30% having more than 2 boats. They are quite well equipped in GIS equipment too (more than 3/4 of the MPAs), this is a significant improvement on 2008. In contrast, signs of demarcation at sea showing the boundaries of the MPAs are rare (11% of MPAs), as well as diving equipment, thus MPAs are generally poorly equipped.

Financial resources are essential for good management, but very few MPAs gave information on their operating or investment budgets and among those who responded their budgets differ vastly with 7 MPAs whose operating budget is between 20 000 and 100 000 €/km², 8 between 10 000 and 20 000 €/km², and 15 MPAs between 1 and 10 000 €/km². According to the survey results, MPAs in the North-West (France, Spain, Croatia, Greece or Italy) appear to be the only ones to date with a sufficient budget to ensure a priori effective management.

Funding is mainly from government[6] (89% of MPAs); few MPAs get funding from NGOs and international donors, while 36% of MPAs are self-financed, which is still too little to ensure the sustainability of MPAs who have no other resources, including some countries in the South or the North-East. The commitment of the private sector is currently low (only 8 MPAs mentioned it).

The typology of multi-parameter management criteria indicates that all Mediterranean MPAs do not have the same capacity or the same management tools and these will need to be tailored to each MPA: training, equipment, building governance... If the MPAs with the best resources are located in the North-East and if those in the South often have fewer resources, the geographical distribution of management needs is not so clear-cut. The needs assessment for capacity building in financial and material resources should be done in a more detailed analysis, case by case, with managers. Assessing the needs for a capacity building strategy has already been extensively analysed in 2012 by a joint initiative with WWF Mediterrnean, MedPAN and RAC/SPA (Di Carlo *et al.*, 2012).

Based on the surveyed MPAs, leisure and fishing activities (both artisanal and leisure fishing) represent **the usages that exert the most pressure on MPAs**. For information, the MedPAN North Project study resulted in leisure fishing and invasive species (ranking 6th out of 13 activities in the present survey) being seen as exerting the most pressure on MPAs. While the questionnaire allowed indicating the direct causes for pressure on MPAs, it didn't allow identifying the root causes for these pressures for each country. However, studies such as by the Blue Plan and the MAP transboundary diagnosis focus on these at the Mediterranean scale.

The importance of research programmes, at different scales, to help advance the objectives of protection of the marine environment is well known. A detailed inventory of monitoring programs for the Mediterranean MPAs was thus undertaken (initiative aimed at supporting actions of the MedPAN network - Chassanite et al., 2012), leading to the creation of a multidisciplinary database. The latter is organized as follows:

- by subject area (type of study: environmental, governance, oceanographic, network-based, socio-economic and integrated (ie treating several of these areas);
- according to categories of objectives based on their relevance to MPAs (from direct MPA assessment, through using MPA sites to conduct research directly linked to the activities or that fit within a larger spatial planning approach);
- according to the geographical scale.

A total of 100 monitoring programs were identified (recently closed or ongoing). More than half of these are conducted on a national level (63%), although many sub-regional and regional collaborations are manifest. The majority of programs are of the 'Integrated' type, followed by the 'Ecological' and then 'Fishery' types. This underscores the need to increase efforts, namely but not only, in the socio-economic field. The results also show spatial and financial disparities, and as such the need to address these shortages, such as increasing research work undertaken by non EU countries (or national research bodies in countries outside the EU).

Aplysina sp. © UNDP Turkey

6. This could be due to a problem with the question of the source of funding, leading to a bias in the results: the EU funding is redistributed in the majority of cases by the state or region that contributes to a percentage ranging from 50% to 20% depending on the case. Thus Europe would be a stronger contributor to several EU countries (L. Sourbès, pers. comm.)

Recommendations

During these past 20 years, progress has been made in terms of marine conservation in the Mediterranean. MPAs have been developed to better protect habitats and species and to manage natural resources or activities that threaten them. States have shown political will in this sense and international, European and Mediterranean laws and agreements have been put in place to protect biodiversity and ecosystems and to establish MPAs. MPA managers, governments, scientists and the private sector are more aware of the benefits of MPAs, the impact of various anthropogenic pressures and loss of biodiversity.

This report nonetheless shows that the objectives of protection and effective management of the marine environment have not yet been achieved in the Mediterranean.

Reaching the quantitative objectives of surface cover, from 4.6% in 2012 to 10% in 2020, will prove difficult if the coastal areas are the only ones targeted. Hence, developing MPAs in the Open Sea has to be envisaged, which has currently become the subject of everyone's attention. Besides the area percentages to achieve, some questions remain unanswered on the representativity of species, habitats and ecological processes of the Mediterranean within the network of MPAs, of the ecological coherence of such a network and on the management effectiveness of MPAs; these have become key issues worldwide and for the Mediterranean. Indeed, weak management persists as a hindrance to many MPAs. The level of protection in a given MPA and/or of its zonation is a dimension which also adds to the issues of management. As strict nature reserves and other no-take zones have proven their efficiency - and the larger they are the more effective - there is a strong need to enlarge and increase their numbers. The exact surface they cover is currently unknown, yet it is no doubt lower than 0.1% of the Mediterranean and this is way too low.

The recommendations which follow have been advocated for the most part in previous reports (IUCN/WWF 2008 Report but also several other reports impulsed by the RAC/SPA, ACCOBAMS, OCEANA and scientific publications...). However, most of these recommendations have not yet been implemented many years later. As such, other than the recommendations of developing the network and reinforcing management, it is also essential to identify the levers to put in place in order to respond effectively to these recurring recommendations.

Following on from the present work, the main lines of recommendations are the following:

1. **Develop the MPA network in view of achieving 10% or more of the surface of the Mediterranean**
2. **Strengthen the effectiveness of protection measures, the management and assessment of MPAs**
3. **Promote the development of tools to evaluate the network on a regional scale**
4. **Ensure a stronger management of threats to MPAs**
5. **Reinforce recognition and prominence of Mediterranean MPAs on an international level**

Adopting a medium term vision to 2020, these recommendations are advocated:

- At different scales (local, national, ecoregional, regional and international)
- In different key domains (legal, scientific, management, economics/business, …)
- And consider cross-cutting means and actions (financial resources, human and equipment capacity building, sectorial integration, monitoring and evaluation, public awareness and education, …)

1. DEVELOPMENT OF THE MPA NETWORK TO REACH THE 10% CBD TARGET OF THE SURFACE COVERAGE OF THE MEDITERRANEAN

Reaffirmed by the Parties at the latest meeting of the Parties to the Barcelona Convention in February 2012, the Aichi Target (CBD) is to achieve 10% protection in the Mediterranean by 2020.

We need 150 000 km² of MPAs to achieve this objective, namely more than the current existing area. So we have 7 years to create more MPAs than were created in 50 years, and/or MPAs with large enough surfaces to reach this objective.

Action must focus on areas which currently fail to be representative and where connectivity is the lowest; this

7. If creating large MPAs in the open sea would be one of the solutions, the creation of coastal MPAs and extension of existing MPAs must not be overlooked. Several scientific discussions are ongoing and emphasise the importance of small coastal MPAs versus large MPAs in the open sea (see: MPA news, vol 13, nº 2, September-October 2011 – and results of the ongoing GRAMP project on the governance of large MPAs supported by the French Ministry of Ecology and Sustainable Development).

must be undertaken at 4 levels[7]:

- Extend the boundaries of existing MPAs
- Create new coastal MPAs of all sizes based on their management objectives
- Establish large MPAs in open seas with knowledge that the sea beyond the 12 nm line covers currently 74% of the Mediterranean and is protected by less than 3%
- Incorporate other types of restricted usages zones which will contribute positively to preserving biodiversity. But these protected or managed areas, such as fisheries reserves or other tools to manage commercial resources (yet still linked to biodiversity), need to be considered carefully with the network's partners and be fully inventoried.

Action must make use of the full array of available legal tools, and of those that are being developed:

- Using juridical instruments on a national level (including local authorities)
- Using the regional and international juridical instruments (CBD, Barcelona Convention, United Nations Convention on the Law of the Sea) and the various European tools (various Directives and Protocols, Integrated Maritime Policy, Common Fisheries Policy, etc.)

Action must benefit from the environmental rationale as much as the socio-economic and business rationale when taking steps aiming at protecting better the marine environment.

Demonstrate the economic and social value of MPAs to empower decision makers

The economic assessment allows identifying and quantifying ecosystem goods and services, showing the positive economic impacts in most cases. As such, it provides decision makers and socio-economic actors with economics based arguments.

Recent studies conducted in other parts of the world, such as Empafish in the Mediterranean, show that the economic and social benefits of MPAs as well as a return on investment is almost always positive. This must be brought to policy makers' attention so they impulse the creation of MPAs. The Blue Plan's current work on the issue of economic evaluation of MPAs will help to develop specific arguments for the Mediterranean.

Recommendations specific to an action plan on different spatial and time scales

Support countries to create national MPAs on sites which they have already identified. We saw that 55 MPAs are being planned (see box ''MPAs in project"); the priority should be given to sites that:

- Support ecological coherence (reproduction, resting and feeding grounds of iconic and threatened species: monk seals, turtles, groupers, …)
- Play a key role for commercial species resources
- Are located in the Adriatic and the eastern basin where the network of MPAs is not dense enough, and thus compromising representativity of its richness, ecosystem functions, and connectivity

MPAs in project

Algeria	6	Israel	8	Malta	2
Greece	3	Italy	23	Montenegro	1
France/Italy	1	Lebanon	4	Tunisia	3
France	1	Libya	3		

Several projects underway are already tackling the above:

- The MedPAN South Project (MSP) led by the WWF Mediterranean Programme Office which works in Algeria, Croatia, Libya, Tunisia and Turkey
- The MedMPANet project of the RAC/SPA which aims at developing a Mediterranean Network of Marine and Coastal Protected Areas through the creation and management of MPAs in Albania, Algeria, Bosnia & Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Syria,Tunisia and Turkey
- The IUCN initiative «carried out in Libya and in the Alboran Sea.

Prioritise intervention on potential known sites. We already have enough information on priority sites to protect the Mediterranean in order to initiate a work of reinforcing the network; a hundred important sites are already known. It is thus a matter of defining priority actions within these sites, depending on:

- the environmental emergency (rare, endangered or threatened species or habitats), and
- the feasibility and political possibilities.

The identification of Mediterranean hot spots by a number of authors and organisations, including the RAC/SPA (2010) which takes into account risks to heritage species and species exploited in open waters including areas beyond national jurisdiction, reveals the ecological significance of a number of sites which show a high concentration of endangered, threatened and vulnerable species.

Protecting these must be supported:

- Most plateaus in the western Mediterranean and particularly the Strait of Gibraltar
- The Alboran Sea
- The North African coast
- The Gulf of Gabes
- The northern Adriatic
- The Aegean Sea

Identify sites of ecological and biological importance in the least known sectors of the Mediterranean and in countries which have the fewest MPAs (South and East basin).

- Using the RAC/SPA guidelines to support contracting Parties to the Barcelona Convention to establish network of MPAs that are ecologically representative and coherent
- Reinforcing environmental knowledge and mapping in

these areas and in open sea strategic areas, which are still little known today. In particular:

- Continue research allowing to identify and localise priority habitats, namely those essential to the life cycle of rare, threatened and over-exploited species: spawning areas, feeding grounds, migratory passages, rest areas, ...
- Undertake a more detailed analysis of coastal currents which is necessary to understand better the connectivity; it is becoming better known, but requires more work on various types of species in order to have good network coherence.
- Continue work that has been initiated through the RAC/SPA SAP/BIO.

Recommendations specific to reinforcing the creation of MPAs in waters outside national jurisdiction

Speed up and support the development of thinking on MPAs in open sea (in particular SPAMIs and Natura 2000 sites) and in transnational areas in terms of creation as much as of adequate governance.

The RAC/SPA and IUCN have already analysed the issues around jurisdiction and governance of waters outside national jurisdictions in the Mediterranean, namely for SPAMIs. Based on this, work should now focus on:

- Putting into place the mechanisms that will allow concrete advances
- Contributing to international initiatives to elaborate the appropriate instruments within the framework of the UNCLOS, ensuring the specificities of the Mediterranean are taken into account

The creation of MPAs outside areas of national jurisdiction is increasingly at the heart of current debates, but it raises a question on adapted juridical instruments and international governance. The lack of conventions, which would specify protection rules and allow enforcement/compliance by every country and not only by those which have already endorsed a sub-regional agreement, remains a major obstacle. Located in the open sea outside territorial waters, the creation of these MPAs will require considerable cooperation between countries.

- An ad hoc regional committee could develop concrete proposals to contribute to efforts within UNCLOS and the Barcelona Convention, among others, and which strive in that direction

Today States and international organisations are committed to addressing this issue (see box "Towards a consideration of conservation and management issues in areas beyond national jurisdiction"), knowing that the 'think-tank' of the United Nations Special Informal working group on these issues relate primarily on how to improve the implementation of the existing legal framework, placing greater emphasis on the responsibility of the Flag State (Bissuel, 2012).

Specific recommendations to reinforce the representativity and ecological coherence of the weakest zones

The network must be supplemented by the creation of new MPAs or by extending existing ones, targeting unique, rare or threatened habitats and species or habitats which have key functions for some species and are whose representation is now insufficient both on the coast and in the open sea, taking into account local, regional and international concerns.

Towards a consideration for conservation and management issues in areas beyond national jurisdiction

At the Rio +20 conference, Heads of State and Governments stated (paragraph 162): «Building on the work of the ad hoc working group and before the end of the sixty-ninth session of the General Assembly we commit to address, on an urgent basis, the issue of the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction, including by taking a decision on the development of an international instrument under the United Nations Convention on the Law of the Sea.»

The IUCN at the 11th Conference of Parties to the Convention on Biological Diversity (Hyderadad, 8-19 October 2012) invited «the UN Working Group on biodiversity beyond national jurisdiction to explore mechanisms to encourage States and competent intergovernmental organisations to respond to the information on areas beyond national jurisdiction contained in the EBSA summary reports and to report back on actions taken».

In terms of ecoregions efforts to reinforce representativity should focus on Tunisian Plateau/Gulf of Sirte, and also Levantine, Ionian and Adriatic Seas.

In terms of habitats and species, efforts should focus on:

- all priority biocenosis, especially rarest and ecologically most important coastal zone formations such as Posidonia and Cymodocea meadows, vermitid platforms, coralligenous biocenosis, Cystoseira... but also on more common environments;
- the circalittoral zone which is currently under-represented;
- bathyal and abyssal zones, and on the main sites of ecological importance, particularly rich, such as canyons, seamounts, deep sea coral reefs, hydrothermal vents which have been partially identified, even if further research is needed in these remote areas.

In terms of species, the priority should be to identify and to protect the habitats of the currently most threatened Mediterranean species: red coral *(Corallium rubrum)*, noble pen shell *(Pinna nobilis)* and ribbed Mediterranean limpet *(Patella ferruginea)* and prioritise the most endangered species like the monk seal (*Monachus monachus*) the bluefin tuna (*Thunnus thynnus*) and sea turtles (*Caretta caretta* and *Chelonia mydas)*, and thus help countries who host important habitats for these species to strengthen their system of MPAs and their management (e.g. Greece, Turkey, Cyprus, Libya, Israel, Egypt, Morocco and Algeria).

Reinforcing the system of MPAs must also take into account the issue of connectivity, while adopting a precautionary approach as there is still little knowledge on this complex subject. According to the modelling scenarios used for this report, the current-based connectivity seems higher in the western part of the basin, perhaps due in part to a more important density of MPAs in this

area compared to the eastern basin (where it is possible that the relatively small number of MPAs means a lower connectivity). In view of the lack of sufficient data on connectivity, reinforcing the system of MPAs must take into account the results of field studies as well as modelling ones. One must develop the concept of an MPA network in the western part and also build up the potential offshoots by creating new protected areas.

2. STRENGTHEN THE EFFECTIVENESS OF PROTECTION MEASURES, OF MANAGEMENT AND OF THE ASSESSMENT OF MPAS

This objective is manifold and for which details are given beneath:

- Improve the governance of MPAs and put in place adapted management structures in the field with well trained staff
- Ensure that MPAs have a management plan which is regularly reviewed in order to adapt management decisions
- Develop a strategy to strengthen strict nature reserves and other no-take zones
- Reinforce human, material/equipment and financial resources for a more effective and efficient management of MPAs, namely for the ones currently the most needy, and in particular to reinforce surveillance
- Develop ways for more regular monitoring, particularly to evaluate the management effectiveness of MPAs and adapt it gradually to the challenges facing a given MPA, but also to report on the evolution of the regional network of MPAs
- Increase the financial resources to ensure a long-lasting management in Mediterranean MPAs

These actions are aimed at existing MPAs, but will also apply to MPAs that are created in the future. These recommendations are for both a national level (appropriate ministries) and local level (competent authorities and land managers).

Improve the governance of MPAs and put in place adapted management structures in the field with well trained staff

- In terms of governance, it is essential to have an active management structure, acting directly in the field; managers are too often working in offices, far from the field.
- The effort should focus in priority» on the 8 MPAs with a national designation which do not have a declared manager as yet, but the task is huge for the Natura 2000 sites as 75% have no manager; this is even more the case for some countries acceding, candidate and potential to entering the EU as they are currently working on the definition of their national network of sites which could eventually become Natura 2000 sites (Croatia, Turkey ...).
- Shared governance, such as co-management should be encouraged. Very few MPAs in our sample group reported shared governance by co-management or joint collaborative, which often allows a greater ownership and acceptance of the rules. This must be strengthened where possible and required: local authorities (municipality, region ...) which are closer to the territories and can take an active role in the management of the MPA; sharing the responsibilities with the civil society and particularly with the most implicated stakeholders, including most involved actors such as fishermen, and the private sector.
- When there is an appropriate opportunity a consultation and participation policy must be implemented at the initial creation steps of the MPA and then involves stakeholders in the assessment and management phase of MPAs.
- To improve effective implementation of management plans, stronger support from the central authorities attached to marine protection could at times accelerate processes, in particular where inter-sectoral consultations and administrative procedures are concerned.

Ensure that MPAs have a management plan which is regularly reviewed in order to adapt management decisions

The existence of a management plan is one of the major criteria for qualifying as an MPA. This means in fact that a thorough reflection has taken place, with clearly defined objectives, resources, a calendar of implementation and indicators of achievement and impact.

- Support needs to be given to MPAs to develop management plans. Support to follow this direction can be brought by providing existing management plans as an example and developing a standard management plan (based on an improved classification by type of the MPAs in the network), imposing a basic reflection and adaptable to each MPA. Associated with training for agents, help can then be offered to build the plan in MPAs where there are none.
- In the short term, support must be given in priority, and based on the Report survey questionnaire, to the 18 MPAs that are currently finalising their management plan and to the 24 MPAs of the sample who are lacking one today.
- These management plans must be assessed and revised regularly to be iterative and adapted to the shifting situation in the field.
- Management plans must be implemented by both the administrative and in the field teams (balance) by adopting an equally ‘’top-down” and ‘’bottom-up” approach especially for the enforcement of regulations (compliance to rules by sea users) and surveillance.

Develop a strategy to strengthen strict nature reserves and other no-take zones

A specific study must be carried out in order to establish a strategy to strengthen no-take zones.

Increase human resources and build on the managers capacity: train and promote exchanges

Besides the ecological coherence, reinforcing the human network of managers and the network’s management coherence is essential: training levels, sharing of experiences, joint research programmes on priority species and habitats, raising awareness ac-

tions across the Mediterranean, reflect on new directions and management measures, especially focusing on awareness raising or scientific monitoring.... This capacity building must be based on a regional strategy. It must be undertaken based on the needs assessment, often on a case by case basis (see Box "Training needs for MPA managers'").

- A training programme for staff - permanent ones take priority - should be implemented as many MPAs are being created and among the existing ones an evolution in functions and management tools, research and awareness raising requires the teams to adapt. This capacity building must take two complementary routes, 'formal' training and particularly exchanges of experience in the field.
- Staff exchanges between MPAs, MPA twinning or exchange visits with fishermen representatives have already been successful and should be multiplied. A North-South exchange programme needs to be given particular support (e.g. twinning).

Following in this direction, the WWF, MedPAN and RAC/SPA have jointly developed a strategy to build the managers capacity, meeting the management needs of MPAs in the Mediterranean (Di Carlo *et al.*, 2012) on a regional, national and local level and proposing integrated and achievable training mechanisms in collaboration with regional and national stakeholders.

The strategy for building the MPAs capacity identified targets (national institutional teams and MPA managers, MPAs field technicians, NGOs working with MPAs) and several training topics (see Box "Training needs for MPA managers"). Training will take place on a regional, sub-regional, national and local level.

- It is also important to identify, rank and prioritise the problems which agents are facing and their tasks, to ensure their actions are prioritised and more effective.

Reinforce surveillance and the means of enforcing better the regulations

The best way to ensure the effectiveness of good management is to ensure that the rules are known and applied properly.

- The legal framework for MPAs and the competent authorities must define the procedures and means of a good dissemination of rules and regulations relevant to a specific MPA (sometimes, the process needs to be developed by several Ministries – e.g. environment, fisheries, defense…)
- Sea users must be informed of the MPA rules through clear and adapted communication measures; new technologies can be used to help these campaigns
- Signs of demarcation at sea should also be developed on all MPAs and support given to providing adequate mooring systems where required.

Surveillance plays an essential role, just as the means to monitor infractions.

- The number of sworn MPA agents need be increased and/or partnerships with other services (police, ...) must be multiplied to provide semi-permanent and all-
- season surveillance on activities in the MPA. These surveillance partners must be informed of the MPA issues and specifically trained. Also training on legal services that teach making infraction statements in MPAs could be considered in order to expedite the proceedings. To these purposes, the allocation of the necessary funds mus be supported
- The reality and effectiveness of surveillance at sea should be regularly evaluate

Training needs for MPA managers (Di Carlo *et al.*, 2012)

- Management of species or habitats (seagrass meadows, sea turtles, seabirds, cetaceans, invasive species),
- Stakeholder participation, conflict resolution,
- Basic marine biodiversity and ecology,
- Enforcing MPA rules,
- Monitoring systems, biological and socio-economic indicators,
- Visitor management (and usages): diving, water sports,
- Auto-financing and business plans,
- Management of local fishing,
- Marine spatial planning and MPA zoning,
- Sustainable tourism and the tourist industry,
- MPA management planning,
- Basic administration and maintenance of a MPA,
- Regional and network conventions,
- Environment education and communication,
- Legal/institutional framework of MPAs,
- GIS, collection and management of data,
- Natura 2000 at sea.

Reinforce awareness raising and educational actions

For current and future users of the marine environment (in and outside MPAs), also using the new technologies available.

Reinforce the resources to ensure the financial sustainability of MPAs

It is essential to find financial resources needed for management. The share of auto-financing in the MPAs in the sample group studied is too low to ensure the sustainability of MPAs with no other resources.

- It is therefore important and a priority for MPAs with the least resources, to explore possible ways of funding; the cost-benefit analysis of the MPA enables to evaluate the economic benefits from the different industries (fisheries, tourism) linked to its presence, the financial potential linked to key ecosystem services and to allow, if necessary, to adjust the potential rights of use
- One of the first things to consider is thus also to give support to MPAs in developing their business plan by developing methodological guides and organising training workshops on the subject
- In general, the private sector's share in financing MPAs should be strengthened, especially as it enjoys the benefits of the MPA. Support to MPAs in developing partnerships with the private sector ought to be encouraged

However, it is not always easy for MPAs to finance themselves, especially when tourism is not very developed. In

this case regional solidarity comes into play. The setting up of a regional trust fund, like the Mesoamerican funds MAR Fund[8] for example must be studied, as well as any other means of innovative financing. The development of a regional strategy for the financing of Mediterranean MPAs was launched in 2012 by MedPAN.

- Support must be given to regional initiatives and strategies aimed at creating sustainable financial instruments which gives support on the network's scale

Reinforce the development of regular and long-term biological and socio-economic monitoring programmes, in particular those aimed at assessing the effectiveness of MPA management and of MPA network efficacy

The business plan should help to balance the annual operating costs of the MPA (the «jobs» investments, renewals and ongoing operation) with annual revenues in order to fund them («resources»). It must establish a forecast for the next 5 years to assist the manager to ask the right questions and identify actions to raise funds to balance the accounts (FFEM, 2010).

The assessment of the network's management effectiveness needs to be done on several scales:

- on a MPA scale (management plan objectives)
- on a national scale (public policy objectives)
- on a regional scale (Barcelona Convention's objectives)
- and finally on an international scale (CBD and other conventions' objectives)

Regular and long-term monitoring of biological, socio-economic and governance parameters must inform dashboards and other reporting tools across all these different scales.

Reinforce the regular biological and socio-economic monitoring programmes

• A specific study was carried out on monitoring programmes by MedPAN (Chassanite *et al.,* 2012) which highlighted that it is important to assess MPAs as tools for conservation and sustainable management of coastal and marine ecosystems (e.g. MPAs effectiveness in relation to the objectives set by their respective management plans) as they can allow to make an inventory of MPAs performance in meeting their goals.

• Efforts should also be focused on monitoring programmes beyond the MPA itself, integrating their role or their potential benefits (e.g. monitoring coastal tourism or fishing activities after the implementation of a MPA, monitoring the implementation of an integrated management strategy of coastal zones in an area including one or more MPAs). And finally the development of monitoring programmes that use MPAs as a research "laboratory".

• Similarly, attention must be paid to monitoring programmes carried out within the framework of conservation actions or spatial management of coastal areas (e.g. determining zoning, identifying relevant sites for future MPAs). They can in fact bring key elements to evaluate implemented actions for the development of MPAs in the Mediterranean or improving their management. Several quality monitoring was done during these programmes and these examples of "best practices" are potentially transferable to other MPAs, particularly by transferring developed tools (protocols, guidelines for managers, etc.).

• The 20% of MPAs who declared not doing regular monitoring must be assisted to implement them.

Develop ways to assess the management effectiveness of the MPA network

• In order to develop a regional vision of the effectiveness of protection and social and economic benefits provided by the network of MPAs, a standardisation of certain monitoring protocols and common indicators on key species and habitat on a regional level, and on some socio-economic or governance parameters must also be proposed on the network's level.

• Capitalising on proven evaluation projects must be used to transfer the experiences of the Mediterranean MPAs who participated and to disseminate it to the required MPAs: such as METT - www.conservationgateway.org.ExternalLinks/Pages/mett-management-effective.aspx - or the PAMPA project on Indicators of MPA Performance for managing coastal ecosystems, resources and their usages (wwz.ifremer.fr/pampa).

• As far as possible, the results of these monitoring programmes must be compiled and made available on a national level, then centralised in a regional database. Interoperability between this regional database and other databases, especially international ones, must be ensured so that they can easily share data (about MPAs in their role as an observatory for issues such as climate change or invasive species).

Work by IUCN Med/WWF Italy is in progress to follow this direction within the MedPAN North European project which is developing common indicators across the MedPAN network to assess the MPAs management effectiveness. The French MPA agency, for example, has also developed a MPA "dashboard", while the PAMPA research project has also developed a number of common indicators for evaluating the management effectiveness and a homogeneous dashboard for some Mediterranean MPAs (French part).

The network has the chance of having MPAs of all ages (from 50 years of existence to MPAs created in 2011-2012), which is a unique phenomenon to study the MPAs effectiveness. A scientific monitoring protocol could use certain MPAs of different ages as a benchmark and group the same habitats or species by MPAs age.

Involve all the stakeholders in monitoring

These assessments should be made by scientists, field staff and other stakeholders

- Field workers must be trained in the field on simple scientific monitoring protocols by scientific teams already in charge of research and monitoring work and able to operate the monitoring data. This will allow

8. MAR Fund is a regional initiative backed by FFEM. It is created from four national environmental funds established in 2002 as a financial mechanism to conserve resources and natural processes in the Mesoamerica region (www.marfund.org) (FFEM, 2010).

these agents to become more implicated, a better 'ownership' of MPAs and a better investment on their part to increase the effectiveness of their daily management to which they are associated. Objectives/result protocols need to be defined with criteria and indicators for a simple and verifiable management using standard methods.

- For other stakeholders, because the task is huge and everyone can contribute; partnerships with professional fishermen for sea monitoring, developing participatory science actions by involving networks of volunteer observers (divers, fishermen, tourists, ...) similar to those currently done on land or in reefs (see Reef Check) should be considered on a regional level (particularly using new communication and information technologies).

• Socio-economic assessments should be enhanced, Even though there is a lot said about biological monitoring, socio-economic monitoring is equally crucial for assessing the management effectiveness and economic impacts on the local stakeholders, but it is not often done. Quick assessment methods such as the SOCMON[8] (Bunce *et al.*, 2008) method could be adapted to the Mediterranean; the ongoing work within the Blue Plan could also lead to common indicators for socio-economic evaluations of MPAs.

• One must also increase the presence of scientific committees (why not set up a regional scientific committee "task force" – which could help MPAs when required) to assist MPAs and facilitate this type of monitoring by developing partnerships between the MPA manager and research organisations which are implicated in the MPA (the laboratory role of a MPA).

Communicate the monitoring results of large-scale research programmes

Whatever the objective category (see Chapter 6) or type of study programmes, a considerable effort needs to be made to:

- Communicate, first, on the nature of the programmes, and second,
- Communicate on the meaning results can have in terms of enhancing management.

Often, major scientific advances are made with potentially strong implications in terms of management, but these results are usually only communicated to the scientific community through relevant literature and therefore do not reach the stakeholders who are the managers and decision makers.

- Special attention should also be paid to raising the awareness of the general public. Very few programmes develop their actions to achieve this.

3. PROMOTE THE DEVELOPMENT OF TOOLS TO EVALUATE THE NETWORK ON A REGIONAL SCALE

Rationalise the MPA status labels and IUCN categories

As there are 26 different labels for the MPAs in the Mediterranean on one hand, and on the other hand IUCN categories which give homogenous types to MPAs according to their management objectives, the latter which are often wrongly applied, the fact is the MPA designations need to be rationalised. It is important, as already stressed in the 2008 report, to work on understanding how to apply the IUCN guidelines and thus better categorise the MPAs in relation to their main objectives, resources and management methods and regulations, in order to obtain similar elements for each country and for comparative assessments.

A global review and rationalisation of labels for MPAs with a national designation and the IUCN categories needs to be undertaken, especially in view of the recent guidelines for applying marine protected areas management categories (Day et *al.,* 2012).

Continue developing and improving the MAPAMED database

The MAPAMED database is an important step. It must become the benchmark for MPAs in the Mediterranean and it is in the position of becoming the regional source of data for the IUCN World Commission on Protected Areas.

In order to do this and because the issue is important, it is recommended to:

- To continue the work in progress, first a lot of information still needs to be validated and completed on the MPAs already registered.
- Continue the data collection work and updating over the long term (MedPAN / RAC/SPA); with human resources dedicated to this task, working closely with managers and national authorities (experience has shown that working at a distance is possible, but very long and less efficient).
- Also, based on lessons learned from 2008 and 2012, the questionnaire must be simplified and refined in order to evaluate better the management effectiveness, while remaining similar for the next inventory of MPAs in the Mediterranean (2015/16). It will need to include a clearer view of the no-take zones number of staff assigned to the field, the effective monitoring effort.
- Then, based on the criteria for the MPAs considered in

9. A simple socio-economic monitoring method used worldwide, adapted to different regions (Bunce *et al.,* 2000)

MAPAMED, there is useful data to be added:

- national fisheries reserves (a GFCM and national authorities partnership)
- wetlands connected to the sea (MedWet, MWO/ Tour du Valat partnership)
- military sites, specifying the criteria for their integration

Finally for more routine work which will enhance MAPAMED, it will be necessary to:

- Improve local skills and resources for managers in order to update information on protected areas in real time (GIS and attributed data) in MAPAMED; integrate monitoring data or links to monitoring in other databases (habitats, species, management and others)
- Develop ways to supply MAPAMED from official national sources
- Promote interoperability between MAPAMED and other regional and international databases (IUCN, RAC/SPA, UNEP) to update MAPAMED on the one hand and to automatically and regularly supply regional and international databases enabling harmonised reporting at all these levels

Marine spatial planning

"Spatial planning is a public process that aims to ensure the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives as specified in public policies. It is based on an ecosystem-based and territorial, integrated, adaptive, strategic and participatory approach" (UNESCO-Intergovernmental Oceanographic Commission)

4. ENSURE A STRONGER MANAGEMENT OF THREATS TO MPAS

Shipping traffic, increasing number of oil projects, discharges of pollutants, overfishing etc. make the network of MPAs vulnerable. The protection of the marine environment is useless if the pollution inputs and degradation are not controlled. Specific questions on the usages, such as interactions between fishing (commercial and recreational) and the MPAs must also be better managed. To these questions, one must also consider root causes of the identified pressure sources.

- Without addressing these issues in this report, the idea of an integrated approach on a national and regional level across the Mediterranean basin, based on marine spatial planning (see box «Marine spatial planning») would be of interest in this semi-enclosed sea. The management of sustainable usages and of related conflicts would as such be improved.
- On a policy framework level, this means working on cross-sectoral integration.
- MPAs would benefit from being better integrated in regional frameworks and policies, especially on a large «watersheds» scale.
- The integration of MPAs in national and regional policies addressing economic development using integrated coastal zone management and spatial planning tools should be reinforced.
- The principles of Green Economy in adapting development policies should be taken in - therefore taking into account the role MPAs play in this domain.

5. REINFORCE RECOGNITION AND PROMINENCE OF MEDITERRANEAN MPAS ON AN INTERNATIONAL LEVEL

• Harmonizing the categorisation of Mediterranean MPAs with the IUCN designations must proceed to present a clearer image of the status of protection of the Mediterranean Sea at the International level.

• Efforts to improve international recognition of Mediterranean MPAs needs to advance. The number of SPAMIs is not negligible, even if they are mainly coastal, but the other international marine environment designations/ labels are rather limited and. The opportunity to promote such projects is during major international meetings (Meetings of the Parties to the Conventions, IMPAC III in October 2013 ...). The actions to be taken could include the following:

- With the support of the SPA focal points of in the Mediterranean and based on various gap analyses, identify the priorities for national and international SPAMIs by encouraging and assisting the States concerned with their creation. A strong support of this approach by the IUCN and other conventions and intergovernmental structures would have the advantage of raising the States awareness of the urgency of the situation.
- Register the 9 sites which are now just classified internationally (SPAMI, biosphere reserves) into MPAs with a national designation as well, to reinforce their protection.
- Increase the international registration of unique sites; particularly increasing the number of sites to the UNESCO World Heritage, which is significantly low in this region; working with UNESCO, which is currently revising its marine strategy could begin.
- On the basis of current knowledge, start a process with the GFCM and other national and international organisations concerned, particularly on fishing, for the protection of areas heavily impacted by fishing.
- Enhancing the prominence of socio-economic services and cultural value of the Mediterranean Sea based on the already successful worldwide popularity of its features.

Key milestones by 2020

2013

Implementation of the new Common Fisheries Policy
MSFD: Establishment of environmental targets
IMPAC 3: 3rd International Marine Protected Areas Congress
MAP: 11th meeting of National Focal Points for Specially Protected Areas

2014

CBD: 12th Conference of Parties (COP 12)
MFSD: Implementation of monitoring programmes "for the ongoing assessment of the environmental status of their marine waters " by Member States

2015

WFD:

- Member states reporting on the achievements of the objectives set
- Establishment for each basin of a new management plan and a new 6-year programme of measures

2016

MFSD: Entry into operation of programmes of measures "designed to achieve or maintain good environmental status".

2020

CBD: Conservation of at least 10% of coastal and marine areas

MFSD: Marine Framework Strategy Directive • CFP: Common Fisheries Policy • WFD: Water Framework Directive • CBD: Convention on Biological Diversity • IMPAC: International Marine Protected Areas Congress • MAP: Mediterranean Action Programme

Kornati National Park, Croatia © M. Mabari / MedPAN

Appendices

Appendix 1 - CBD Criteria on MPA networks

Required network properties and components	Definition	Applicable site specific considerations (inter-alia)
Ecologically and biologically significant areas	Ecologically and biologically significant areas are geographically or oceanographically discrete areas that provide important services to one or more species/populations of an ecosystem or to the ecosystem as a whole, compared to other surrounding areas or areas of similar ecological characteristics, or otherwise meet the criteria as identified in annex I to decision IX/20.	• Uniqueness or rarity • Special importance for life history stages of species • Importance for threatened, endangered or declining species and/or habitats • Vulnerability, fragility, sensitivity or slow recovery • Biological productivity • Biological diversity • Naturalness
Representativity	Representativity is captured in a network when it consists of areas representing the different biogeographical subdivisions of the global oceans and regional seas that reasonably reflect the full range of ecosystems, including the biotic and habitat diversity of those marine ecosystems.	A full range of examples across a biogeographic habitat, or community classification; relative health of species and communities; relative intactness of habitat(s); naturalness.
Connectivity	Connectivity in the design of a network allows for linkages whereby protected sites benefit from larval and/or species exchanges, and functional linkages from other network sites. In a connected network individual sites benefit one another.	Currents; gyres; physical bottlenecks; migration routes; species dispersal; detritus; functional linkages. Isolated sites, such as isolated seamount communities, may also be included.
Replication	Replication of ecological features means that more than one site shall contain examples of a given feature in the given biogeographic area. The term "features" means "species, habitats and ecological processes" that naturally occur in the given biogeographic area.	Accounting for uncertainty, natural variation and the possibility of catastrophic events. Features that exhibit less natural variation or are precisely defined may require less replication than features that are inherently highly variable or are only very generally defined.
Adequate and viable sites	Adequate and viable sites indicate that all sites within a network should have size and protection sufficient to ensure the ecological viability and integrity of the feature(s) for which they were selected.	Adequacy and viability will depend on size; shape; buffers; persistence of features; threats; surrounding environment (context); physical constraints; scale of features/processes; spillover/ compactness.

Appendix 2 - Database on Marine Protected Areas in the Mediterranean

MPA MANAGEMENT DATA COLLECTION QUESTIONNAIRE

Please answer all the questions. In some cases you can choose «no answer» from the list of choices.

Important: Please note that unless otherwise stated, all information will be available online in the MAPAMED database.

Identity

Your name (confidential):	
Your first name (confidential):	
Your e-mail (confidential):	
Date:	

General characteristics

Name of the MPA			
Name of the MPA in your national language			
Email (confidential)T:			
Country (multiple choice):	☐ Albania ☐ Algeria ☐ Bosnia and Herzegovina ☐ Cyprus ☐ Croatia ☐ Egypt ☐ Spain ☐ France	☐ Greece ☐ Israel ☐ Italy ☐ Lebanon ☐ Libya ☐ Malta ☐ Morocco ☐ Monaco	☐ Montenegro ☐ Slovenia ☐ Syria ☐ Tunisia ☐ Turkey ☐ Area beyond national jurisdiction

Governance

Governance type	Choose
Management authority	
Scientific body	Choose
Is the MPA taken into account in local land planning policies? (confidential)	Choose
Stakeholders recognition and participation to the MPA planning and management actions (confidential):	Choose
Development of joint activities with other Mediterranean MPAs	Choose
Additional details:	

Objectives and management plan

MPA primary objectives (maximum 4 values):

- [] Biodiversity conservation
- [] Target species conservation
- [] Target habitat conservation
- [] Maintain key ecological functions related to ecosystems'services
- [] Sustainable management of tourism
- [] Sustainable management of fisheries
- [] Sustainable management of other socio-economic activities
- [] Conflict resolution
- [] Knowledge increase (knowledge of elements of the natural environment, species and uses)
- [] Promotion of cultural and historical heritage
- [] Education and awareness-raising

Other, please specify:

Management plan	Choose
Year of implementation of the first management plan:	
Year in which the management plan has been last revised:	
Monitoring and evaluation of management plan	Choose
Additional details:	

Staff, equipment and budget

Average number of permanent staff per year over the last 5 years	
Average number of short-term staff per year over the last 5 years	
Average number of seasonal staff per year over the last 5 years	
Average number of training days for MPA staff per year over the last 5 years	
Offices available for management authority staff:	Choose
Total number of boats used for surveillance or research within the MPA	
Total number of motorized vehicles used for coastal surveillance of the MPA:	
Scuba-diving equipment	Choose
Does the MPA benefit from a Geographic Information System (GIS)?	Choose
Average annual operating budget of last 5 years (in euros) (confidential)	
Average annual investment budget of last 5 years(in euros) (confidential)	

Sources of funding (confidential):

[] Governments (local, regional or national)
[] International donors and NGOs
[] Private sector
[] Autofinancing (entry taxes, taxes on leisure activities…)

Other, please specify:

Existence of a business plan:	Choose

Additional details:

Uses and pressures

Average number of visitors per year over the last 5 years (all uses taken into account)	
Number of professional fishing boats currently fishing within the MPA (confidential)	
Number of dive boats that take divers into the MPA	
Number of currently available harbour berths for leisure boats	
Number of currently available berths for leisure boats in the 2 closest ports to your MPA	
Number of mooring buoys in the MPA	

Main pressures on habitats and species:	None	Low	Medium	High	Not reported
Industrial fishing	☐	☐	☐	☐	☐
Artisanal fishing	☐	☐	☐	☐	☐
Leisure fishing	☐	☐	☐	☐	☐
Oil or gas extraction at sea	☐	☐	☐	☐	☐
Shipping activities (military transport, ferries, cargo ships…)	☐	☐	☐	☐	☐
Port activities	☐	☐	☐	☐	☐
Recreational activities other than fishing	☐	☐	☐	☐	☐
Urban pollution	☐	☐	☐	☐	☐
Agricultural pollution	☐	☐	☐	☐	☐
Industrial pollution	☐	☐	☐	☐	☐
Aquaculture	☐	☐	☐	☐	☐
Invasive species (please list which ones in additional details section)	☐	☐	☐	☐	☐
Illegal activities (please describe in the additional details section)	☐	☐	☐	☐	☐
Other, please specify:	☐	☐	☐	☐	☐
Existing risk prevention plan:	Choose				
Additional details:					

Regulations

Is the MPA zoned for different uses?	Choose
Number of MPA zones - help	
Does the MPA have a marine zone of Strict Nature Reserve? - help	Choose
Total Strict Nature Reserve surface area	Choose

ZONE 1: the most highly protected marine zone after the marine zone of Strict Nature Reserve

ZONE 1: Name of this zone	
ZONE 1: Total area of this zone	
ZONE 1: Existing regulations in this zone?	
Hiking, walking	Choose
Swimming	Choose
Scuba-diving	Choose
Spear-fishing	Choose
Recreational fishing	Choose
Professional fishing (specify gear type)	Choose
Navigation, sailing	Choose
Mooring, anchoring	Choose
Water sports (kayak, motor yachting, jet-skiing, wind-surf, kite-surf)	Choose
Scientific research	Choose

ZONE 2: the most highly protected marine zone after zone 1

ZONE 2: Name of this zone	
ZONE 2: Total area of this zone	
ZONE 2: Existing regulations in this zone?	
Hiking, walking	Choose
Swimming	Choose
Scuba-diving	Choose
Spear-fishing	Choose
Recreational fishing	Choose
Professional fishing (specify gear type)	Choose
Navigation, sailing	Choose
Mooring, anchoring	Choose
Water sports (kayak, motor yachting, jet-skiing, wind-surf, kite-surf)	Choose
Scientific research	Choose

ZONE 3: the most highly protected marine zone after zone 2

ZONE 3: Name of this zone	
ZONE 3: Total area of this zone	
ZONE 3: Existing regulations in this zone?	
Hiking, walking	Choose
Swimming	Choose
Scuba-diving	Choose
Spear-fishing	Choose
Recreational fishing	Choose
Professional fishing (specify gear type)	Choose
Navigation, sailing	Choose
Mooring, anchoring	Choose
Water sports (kayak, motor yachting, jet-skiing, wind-surf, kite-surf)	Choose
Scientific research	Choose

Who is in charge of the enforcement of the regulations?

- ☐ MPA staff legally registered to perform the duties of a police officer
- ☐ Other (e.g. public services…), please specify

Average number of hours of surveillance per month (over the current year)	
MPA demarcation signs (e.g. buoys...)	Choose
Existence and distribution of one or more charter(s) for users	Choose

Additional details:

Studies and monitoring

Ecological reference conditions for the site (baseline data) - help	Choose
Socio-economic reference conditions for the site:	Choose

Regular monitoring programs undertaken in the MPA	MPA staff	Scientists	Consulting services	NGO	Other	Not available	No answer
Species	☐	☐	☐	☐	☐	☐	☐
Ecosystem functionalities (e.g. shelter, nursery, spawning ground...)	☐	☐	☐	☐	☐	☐	☐
Fisheries (e.g. resources, catches...)	☐	☐	☐	☐	☐	☐	☐
Tourism and other socio-economic activities	☐	☐	☐	☐	☐	☐	☐
Pollutants (any type)	☐	☐	☐	☐	☐	☐	☐
Physicochemical conditions of the environment (e.g. temperature, salinity…)	☐	☐	☐	☐	☐	☐	☐

Etudes ponctuelles mises en œuvre dans l'AMP	MPA staff	Scientists	Consulting services	NGO	Other	Not available	No answer
Species	☐	☐	☐	☐	☐	☐	☐
Ecosystem functionalities (e.g. shelter, nursery, spawning ground...)	☐	☐	☐	☐	☐	☐	☐
Fisheries (e.g. resources, catches...)	☐	☐	☐	☐	☐	☐	☐
Tourism and other socio-economic activities	☐	☐	☐	☐	☐	☐	☐
Pollutants (any type)	☐	☐	☐	☐	☐	☐	☐
Physicochemical conditions of the environment (e.g. temperature, salinity…)	☐	☐	☐	☐	☐	☐	☐

Perception of the global evolution of fisheries resources by the MPA manager:	Choose
Additional details:	Choose

Habitats and species

List between 3 and 5 habitats the most important for your MPA management objectives:

Significant habitats in the MPA (Optional but please give it a go)	
I. SUPRALITTORAL	
I. 1. MUDS	☐
I. 1. 1. Biocenosis of beaches with slowly-drying wracks under glassworts	☐
I. 2. SANDS	☐
I. 2. 1. Biocenosis of supralittoral sands	☐
I. 2. 1. 1. Facies of sands without vegetation, with scattered debris	☐
I. 2. 1. 2. Facies of depressions with residual humidity	☐
I. 2. 1. 3. Facies of quickly-drying wracks	☐
I. 2. 1. 4. Facies of tre truncks which have been washed ashore	☐
I. 2. 1. 5. Facies of phanerogams which have been washed ashore (upper part)	☐
I. 3. STONES AND PEBBLES	☐
I. 3. 1. Biocenosis of slowly drying wracks	☐
I. 4. HARD BEDS AND ROCKS	☐
I. 4. 1. Biocenosis of supralittoral rock	☐
I.4.1.1. Association with *Entophysalis deusta and Verrucaria amphibia*	☐
I.4.1.2. Pools with variable salinity (mediolittoral enclave)	☐
II. MEDIOLITTORAL	☐
II. 1. MUDS, SANDY MUDS AND SANDS	☐
II. 1. 1. Biocenosis of muddy sands and muds	☐
II. 1. 1. 1. Association with halophytes	☐
II. 1. 1. 2. Facies of saltworks	☐
II. 2. SANDS	☐
II. 2. 1. Biocenosis of mediolittoral sands	☐
II. 2. 1. 1. Facies with *Ophelia bicornis*	☐
II. 3. STONES AND PEBBLES	☐
II. 3. 1. Biocenosis of mediolittoral coarse detritic bottoms	☐
II. 3. 1. 1. Facies of banks of dead leaves of *Posidonia oceanica* and other phanerogams	☐
II. 4. HARD BEDS AND ROCKS	☐
II. 4. 1. Biocenosis of the upper mediolittoral rock	☐
II. 4. 1. 1. Association with *Bangia atropurpurea*	☐
II. 4. 1. 2. Association with *Porphyra leucosticta*	☐

II. 4. 1. 3. Association with *Nemalion helminthoiof and Rissoella verruculosa*	
II. 4. 1. 4. Association with *Lithophyllum papillosum and Polysiphonia* spp.	
II. 4. 2. Biocenosis of the lower mediolittoral rock	
II. 4. 2. 1. Association with *Lithophyllum lichenoides* (= Entablure with L. tortuosum)	
II. 4. 2. 2. Association with *Lithophyllum byssoides*	
II. 4. 2. 3. Association with *Tenarea undulosa*	
II. 4. 2. 4. Association with *Ceramium ciliatum* and *Corallina elongata*	
II. 4. 2. 5. Facies with *Pollicipes cornucopiae*	
II. 4. 2. 6. Association with *Enteromorpha compressa*	
II. 4. 2. 7. Association with *Fucus virsoides*	
II. 4. 2. 8. Neogoniolithon brassica-florida concretion	
II. 4. 2. 9. Association with *Gelidium* spp	
II. 4. 2. 10. Pools and lagons sometimes associated with vermetids (infralittoral enclave)	
II. 4. 3. Mediolittoral caves	
II. 4. 3. 1. Association with *Phymatolithon lenormandii* and *Hildenbrandia rubra*	
III. INFRALITTORAL	
III. 1. SANDY MUDS, SANDS, GRAVELS AND ROCKS IN EURYHALINE AND EURYTHERMAL ENVIRONMENT	
III. 1. 1. Euryhaline and eurythermal biocenosis	
III. 1. 1. 1. Association with *Ruppia cirrhosa* and/or *Ruppia maritima*	
III. 1. 1. 2. Facies with *Ficopomatus enigmaticus*	
III. 1. 1. 3. Association with *Potamogeton pectinatus*	
III. 1. 1. 4. Association with *Zostera noltii* in euryhaline and eurythermal environment	
III. 1. 1. 5. Association with *Zostera marina* in euryhaline and eurythermal environment	
III. 1. 1. 6. Association with *Gracilaria* spp.	
III. 1. 1. 7. Association with *Chaetomorpha linum* and *Valonia aegagropila*	
III. 1. 1. 8. Association with *Halopithys incurva*	
III. 1. 1. 9. Association with *Ulva laetevirens* and *Enteromorpha linza*	
III. 1. 1. 10. Association with *Cystoseira barbata*	
III. 1. 1. 11. Association with *Lamprothamnium papulosum*	
III. 1. 1. 12. Association with *Cladophora echinus* and *Rytiphloea tinctoria*	

III. 2. FINE SANDS WITH MORE OR LESS MUD	
III. 2. 1. Biocenosis of fine sands in very shallow waters	
III. 2. 1. 1. Facies with *Lentidium mediterraneum*	
III. 2. 2. Biocenosis of well sorted fine sands	
III. 2. 2. 1. Association with *Cymodocea nodosa* on well sorted fine sands	
III. 2. 2. 2. Association with *Halophila stipulacea*	
III. 2. 3. Biocenosis of superficial muddy sands in sheltered waters	
III. 2. 3. 1. Facies with *Callianassa tyrrhena and Kellia corbuloides*	
III. 2. 3. 2. Facies with fresh water resurgences with *Cerastoderma glaucum,* and *Cyathura carinata*	
III. 2. 3. 3. Facies with *Loripes lacteus* and *Tapes* spp.	
III. 2. 3. 4. Association with *Cymodocea nodosa* on superficial muddy sands in sheltered waters	
III. 2. 3. 5. Association with *Zostera noltii* on superficial muddy sands in sheltered waters	
III. 2. 3. 6. Association with *Caulerpa prolifera* on superficial muddy sands in sheltered waters	
III. 2. 3. 7. Facies of hydrothermal oozes with *Cyclope neritea* and nematodes	
III. 3. COARSE SANDS WITH MORE OR LESS MUD	
III. 3. 1. Biocenosis of coarse sands and fine gravels mixed by the waves	
III. 3. 1. 1. Association with rhodolithes	
III. 3. 2. Biocenosis of coarse sands and fine gravels under the influence of bottom currents (also found in the Circalittoral)	
III. 3. 2. 1. Maërl facies (= Association with *Lithothamnion corallioides* and *Phymatolithon calcareum*) (can also be found as facies of the biocenosis of coastal detritic)	
III. 3. 2. 2. Association with rhodolithes	
III. 4. STONES AND PEBBLES	
III. 4. 1. Biocenosis of infralittoral pebbles	
III. 4. 1. 1. Facies with *Gouania wildenowi*	
III. 5. POSIDONIA OCEANICA MEADOWS	
III. 5. 1. *Posidonia oceanica* meadows (= Association with *Posidonia oceanica*)	
III. 5. 1. 1. Ecomorphosis of stripped meadows	
III. 5. 1. 2. Ecomorphosis of « barrier reef « meadows	
III. 5. 1. 3. Facies of dead « mattes « of *Posidonia oceanica* without much epiflora	
III. 5. 1. 4. Association with *Caulerpa prolifera*	
III. 6. HARD BEDS AND ROCKS	
III. 6. 1. Biocenosis of infralittoral algae :	

III. 6. 1. 1. Overgrazed facies with encrusting algae and sea urchins	▯
III. 6. 1. 2. Association with *Cystoseira amentacea* (var. *amentacea*, var. *stricta*, var. *spicata*)	▯
III. 6. 1. 3. Facies with Vermetids	▯
III. 6. 1. 4. Facies with *Mytilus galloprovincialis*	▯
III. 6. 1. 5. Association with *Corallina elongata* and *Herposiphonia secunda*	▯
III. 6. 1. 6. Association with *Corallina officinalis*	▯
III. 6. 1. 7. Association with *Codium vermilara* and *Rhodymenia ardissonei*	▯
III. 6. 1. 8. Association with *Dasycladus vermicularis*	▯
III. 6. 1. 9. Association with *Alsidium helminthochorton*	▯
III. 6. 1. 10. Association with *Cystoseira tamariscifolia* and *Saccorhiza polyschides*	▯
III. 6. 1. 11. Association with *Gelidium spinosum* v. *hystrix*	▯
III. 6. 1. 12. Association with *Lobophora variegata*	▯
III. 6. 1. 13. Association with *Ceramium rubrum*	▯
III. 6. 1. 14. Facies with *Cladocora caespitosa*	▯
III. 6. 1. 15. Association with *Cystoseira brachycarpa*	▯
III. 6. 1. 16. Association with *Cystoseira crinita*	▯
III. 6. 1. 17. Association with *Cystoseira crinitophylla*	▯
III. 6. 1. 18. Association with *Cystoseira sauvageauana*	▯
III. 6. 1. 19. Association with *Cystoseira spinosa*	▯
III. 6. 1. 20. Association with *Sargassum vulgare*	▯
III. 6. 1. 21. Association with *Dictyopteris polypodioides*	▯
III. 6. 1. 22. Association with *Calpomenia sinuosa*	▯
III. 6. 1. 23. Association with *Stypocaulon scoparium* (=Halopteris scoparia)	▯
III. 6. 1. 24. Association with *Trichosolen myura* and *Liagora farinosa*	▯
III. 6. 1. 25. Association with *Cystoseira compressa*	▯
III. 6. 1. 26. Association with *Pterocladiella capillacea* and *Ulva laetevirens*	▯
III. 6. 1. 27. Facies with large hydrozoa	▯
III. 6. 1. 28. Association with *Pterothamnion crispum* and *Compsothamnion thuyoides*	▯
III. 6. 1. 29. Association with *Schottera nicaeensis*	▯
III. 6. 1. 30. Association with *Rhodymenia ardissonei* and *Rhodophyllis divaricata*	▯
III. 6. 1. 31. Facies with *Astroides calycularis*	▯
III. 6. 1. 32. Association with *Flabellia petiolata* and *Peyssonnelia squamaria*	▯
III. 6. 1. 33. Association with *Halymenia floresia* and *Halarachnion ligulatum*	▯
III. 6. 1. 34. Association with *Peyssonnelia rubra* and *Peyssonnelia* spp.	▯

III. 6. 1. 35. Facies and association of *Coralligenous biocenosis* (in enclave)	
IV. CIRCALITTORAL	
IV. 1. MUDS	
IV. 1. 1. Biocenosis of coastal terrigenous muds	
IV. 1. 1. 1. Facies of soft muds with *Turritella tricarinata communis*	
IV. 1. 1. 2. Facies of sticky muds with *Virgularia mirabilis* and *Pennatula phosphorea*	
IV. 1. 1. 3. Facies of sticky muds with *Alcyonium palmatum* and *Stichopus regalis*	
IV. 2. SANDS	
IV. 2. 1. Biocenosis of the muddy detritic bottom	
IV. 2. 1. 1. Facies with *Ophiothrix quinquemaculata*	
IV. 2. 2 Biocenosis the coastal detritic bottom	
IV. 2. 2. 1. Association with rhodolithes	
IV. 2. 2. 2. Maerl facies (*Lithothamnion corallioides* and *Phymatholithon calcareum*)	
IV. 2. 2. 3. Association with *Peyssonnelia rosa-marina*	
IV. 2. 2. 4. Association with *Arthrocladia villosa*	
IV. 2. 2. 5. Association with *Osmundaria volubilis*	
IV. 2. 2. 6. Association with *Kallymenia patens*	
IV. 2. 2. 7. Association with *Laminaria rodriguezii on detritic*	
IV. 2. 2. 8. Facies with *Ophiura texturata*	
IV. 2. 2. 9. Facies with Synascidies	
V. 2. 2. 10. Facies with large Bryozoa	
IV. 2. 3. Biocenosis of shelf-edge detritic bottom	
IV. 2. 3. 1. Facies with *Neolampas rostellata*	
IV. 2. 3. 2. Facies with *Leptometra phalangium*	
IV. 2. 4. Biocenosis of coarse sands and fine gravels under the influence of bottom currents (biocenosis found in areas under specific hydrodynamic conditions – straits ; also found in the Infralittoral)	
IV. 3. HARD BEDS AND ROCKS	
IV. 3. 1. Coralligenous biocenosis	
IV. 3. 1. 1. Association with *Cystoseira zosteroides*	
IV. 3. 1. 2. Association with *Cystoseira usneoides*	
IV. 3. 1. 3. Association with *Cystoseira dubia*	
IV. 3. 1. 4. Association with *Cystoseira corniculata*	
IV. 3. 1. 5. Association with *Sargassum* spp (indigènes).	
IV. 3. 1. 6. Association with *Mesophyllum lichenoides*	

IV. 3. 1. 7. Association with *Lithophyllum frondosum* and *Halimeda tuna*	
IV. 3. 1. 8. Association with *Laminaria ochroleuca*	
IV. 3. 1. 9. Association with *Rodriguezella strafforelli*	
IV. 3. 1. 10. Facies with *Eunicella cavolinii*	
IV. 3. 1. 11. Facies with *Eunicella singularis*	
IV. 3. 1. 12. Facies with *Lophogorgia sarmentosa*	
IV. 3. 1. 13. Facies with *Paramuricea clavata*	
IV. 3. 1. 14. Facies with *Parazoanthus axinellae*	
IV. 3. 1. 15. Coralligenous plateforms	
IV.3. 2. Semi-dark caves (also in enclave in upper stages)	
IV. 3. 2. 1. Facies with *Parazoanthus axinellae*	
IV. 3. 2. 2. Facies with *Corallium rubrum*	
IV. 3. 2. 3. Facies with *Leptosammia pruvoti*	
IV. 3. 3. Biocenosis of shelf-edge rock	
V. BATHYAL	
V. 1. MUDS	
V. 1. 1. Biocenosis of bathyal muds	
V. 1. 1. 1. Facies of sandy muds with *Thenea muricata*	
V. 1. 1. 2. Facies of fluid muds with *Brissopsis lyrifera*	
V. 1. 1. 3. Facies soft muds with *Funiculina quadrangularis* and *Apporhais seressianus*	
V. 1. 1. 4. Facies of compact muds with *Isidella elongata*	
V. 1. 1. 5. Facies with *Pheronema grayi*	
V. 2. SANDS	
V. 2. 1. Biocenosis of bathyal detritic sands with *Grypheus vitreus*	
V. 3. HARD BEDS AND ROCKS	
V. 3. 1. Biocenosis of deep sea corals	
V. 3. 2. Caves and ducts in total darkness (in enclave in the upper stages)	
VI. ABYSSAL	
VI. 1. MUDS	
VI. 1. 1. Biocenosis of abyssal muds	

Significant species in the MPA (optional but please give it a go)	
Magnoliophyta	
Posidonia oceanica	☐
Zostera marina	☐
Zostera noltii	☐
Chlorophyta	☐
Caulerpa ollivieri	☐
Phaeophyta	
Cystoseira amentacea (inclus var. stricta et var. spicata)	☐
Cystoseira mediterranea	☐
Cystoseira sedoides	☐
Cystoseira spinosa (inclus C. adriatica)	☐
Cystoseira zosteroides	☐
Laminaria rodriguezii	☐
Rhodophyta	
Goniolithon byssoides	☐
Lithophyllum lichenoides	☐
Ptilophora mediterranea	☐
Schimmelmannia schousboei	☐
Porifera	
Aplysina sp. plur.	☐
Asbestopluma hypogea	☐
Axinella cannabina	☐
Axinella polypoides	☐
Geodia cydonium	☐
Ircinia foetida	☐
Ircinia pipetta	☐
Petrobiona massiliana	☐
Tethya sp. plur.	☐
Hippospongia communis	☐
Spongia agaricina	☐
Spongia officinalis	☐
Spongia zimocca	☐
Cnidaria	
Astroides calycularis	☐
Errina aspera	☐

Gerardia savaglia	▯
Antipathes sp. plur.	▯
Corallium rubrum	▯
Echinodermata	▯
Asterina pancerii	▯
Centrostephanus longispinus	▯
Ophidiaster ophidianus	▯
Paracentrotus lividus	▯
Bryozoa	
Hornera lichenoides	▯
Mollusca	
Charonia lampas (= Ch. rubicunda = Ch. nodifera)	▯
Charonia tritonis (= Ch. seguenziae)	▯
Dendropoma petraeum	▯
Erosaria spurca	▯
Gibbula nivosa	▯
Lithophaga lithophaga	▯
Luria lurida (= Cypraea lurida)	▯
Mitra zonata	▯
Patella ferruginea	▯
Patella nigra	▯
Pholas dactylus	▯
Pinna nobilis	▯
Pinna rudis (= P. pernula)	▯
Ranella olearia (= Argobuccinum olearium = A. giganteum)	▯
Schilderia achatidea	▯
Tonna galea	▯
Zonaria pyrum	▯
Crustacea	
Ocypode cursor	▯
Pachylasma giganteum	▯
Homarus gammarus	▯
Maja squinado	▯
Palinurus elephas	▯
Scyllarides latus	▯

Scyllarus arctus	
Scyllarus pigmaeus	
Pisces	
Acipenser naccarii	
Acipenser sturio	
Aphanius fasciatus	
Aphanius iberus	
Carcharodon carcharias	
Cetorhinus maximus	
Hippocampus hippocampus	
Hippocampus ramulosus	
Huso huso	
Lethenteron zanandreai	
Mobula mobular	
Pomatoschistus canestrinii	
Pomatoschistus tortonesei	
Valencia hispanica	
Valencia letourneuxi	
Alosa alosa	
Alosa fallax	
Anguilla anguilla	
Epinephelus marginatus	
Isurus oxyrinchus	
Lamna nasus	
Lampetra fluviatilis	
Petromyzon marinus	
Prionace glauca	
Raja alba	
Sciaena umbra	
Squatina squatina	
Thunnus thynnus	
Umbrina cirrosa	
Xiphias gladius	
Reptiles	
Caretta caretta	

Chelonia mydas	
Dermochelys coriacea	
Eretmochelys imbricata	
Lepidochelys kempii	
Trionyx triuguis	
Aves	
Calonectris diomedea	
Falco eleonorae	
Hydrobates pelagicus	
Larus audouinii	
Numenius tenuirostris	
Pandion haliaetus	
Pelecanus crispus	
Pelecanus onocrotalus	
Phalacrocorax aristotelis	
Phalacrocorax pygmaeus	
Phoenicopterus ruber	
Puffinus yelkouan	
Sterna albifrons	
Sterna bengalensis	
Sterna sandvicensis	
Mammalia	
Balaenoptera acutorostrata	
Balaenoptera borealis	
Balaenoptera physalus	
Delphinus delphis	
Eubalaena glacialis	
Globicephala melas	
Grampus griseus	
Kogia simus	
Megaptera novaeangliae	
Mesoplodon densirostris	
Monachus monachus	
Orcinus orca	
Phocoena phocoena	

Physeter macrocephalus (= P. catodon)	☐
Pseudorca crassidens	☐
Stenella coeruleoalba	☐
Steno bredanensis	☐
Tursiops truncatus	☐
Ziphius cavirostris	☐

Education and awareness-raising

Environmental education and awareness-raising tools:

☐ Website
☐ Leaflets, booklets
☐ Magazines
☐ Guides, handbooks
☐ Posters, notice board
☐ Films
☐ Exhibitions/slide shows
☐ Interpretation centre
☐ Observation station
☐ Underwater trails
☐ Game kit
☐ Aquarium
☐ Observation boats (tourism)
☐ Information not available
☐ No answer

Other, please specify:

Environmental education and awareness-raising actions:	Choose
Existence of a communication plan:	Choose

Additionnal details about environmental education and awareness-raising actions:

Appendix 3 - IUCN categories for MPAs (Dudley, 2008)

http://data.iucn.org/dbtw-wpd/edocs/PAG-019.pdf?utm_campaign=1111376001&utm_content=1016726692106&utm_medium=email&utm_source=Emailvision

Category	Objectives	Comments
Category Ia : Strict Nature Reserve	To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed when subjected to all but very light human impact.	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological/geomorphical features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.
Category Ib : Wilderness areas	To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas.	Category Ib are protected areas which are usually large unmodified or slightly modified areas, retaining their natural character and influence without permanent or significant human habitation, which are protected and managed so as to preserve their natural condition.
Category II : National Park	To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.	Category II protected areas are large natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities.
Category III : Monument ot natural feature	To protect specific outstanding natural features and their associated biodiversity and habitats.	Category III protected areas are set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove. They are generally quite small protected areas and often have high visitor value.
Category IV : Habitat/Species Management area	To maintain, conserve and restore species and habitats.	Category IV protected areas aim to protect particular species or habitats and management reflects this priority. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats, but this is not a requirement of the category.

Category V : Protected Landscape/ Seascape	To protect and sustain important landscapes/ seascapes and the associated nature conservation and other values created by interactions with humans through traditional management practices	A protected area where the interaction of people and nature over time has produced an area of distinct charcter with significant, ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.
Category VI : Protected area with sustainable use of natural resources	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial.	Category VI protected areas conserve ecosystems and habitats together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area.

In 2012, the IUCN released a new document for assigning management categories to protected areas («Guidelines for Marine Areas»). This document states: «Spatial areas which may incidentally appear to deliver nature conservation, but do not have stated nature conservation objectives should not automatically be classified as MPAs, as defined by the IUCN. These areas include:

• Fishery management areas with no wider stated conservation aims;

• Community areas which managed primarily for the sustainable extraction of marine products (e.g. corals, fish, shells, etc.).

• Marine and coastal management systems managed primarily for tourism, which also include areas of conservation interest;

• Wind farms and oil platforms that incidentally help to build up biodiversity around underwater structures and by excluding fishing and other vessels;

• Marine and coastal areas set aside for other purposes, but which also have conservation benefit: military training areas or their buffer zones (e.g. exclusion zones); disaster mitigation (e.g. coastal defences that also harbour significant biodiversity); communications cable or pipeline areas; shipping lanes etc.. ;

• Large areas (e.g. regions, provinces, countries) where certain species are protected by law across the entire region.

Any of the above management approaches could be classified as an MPA if instead they had a primary stated aim and are managed to deliver nature conservation.»

Appendix 4 - List of MPAs with a national designation

Country	Name	Label	IUCN Category*	Marine Surface area (km²)	Total Surface area (km²)	Year of current status implemen-tation	Completed Question-naire and analysed
ALB	Karaburun-Sazani island	National Marine Park	II	125.7	125.7	2010	Yes
CYP	Lara Toxeftra	Marine/Coastal Reserve	IV	5.5	6.5	1989	No
DZA	Iles Habibas	Marine Nature Reserve	IV	26.8	27.2	2003	Yes
EGY	Ashtum El-Gamel	Nature Protectorate	VI	30	180	1988	No
EGY	Sallum gulf	Marine Protected Area	II	326.91	380	2010	No
ESP	Acantilados de Maro Cerro Gordo	Natural Landscape	V	14.2	18.16	1989	No
ESP	Aiguamolls de l'Alt Empordà	Plan for Areas of Natural Interest	V	58.64	108.97	1992	Yes
ESP	Archipielago de Cabrera	National Park	II	87.72	100.87	1991	Yes
ESP	Arrecife Barrera de Posidonia	Natural Monument	III	1.08	1.08	2001	No
ESP	Bahia de Palma	Marine Reserve	IV	23.94	23.94	1982	No
ESP	Cabo de Gata Nijar	Natural Park	II	120.32	495.12	1987	No
ESP	Cabo de Palos - Islas Hormigas	Marine Reserve	IV	19.31	19.31	1995	Yes
ESP	Cabo de San Antonio	Marine Nature Reserve	IV	9.68	9.68	2002	Yes
ESP	Cap de Creus	Natural Park	VI	30.87	139.22	1998	Yes
ESP	Cap de Santes Creus	Plan for Areas of Natural Interest	V	3.5438	4.43	1992	Yes
ESP	Castell - Cap Roig	Plan for Areas of Natural Interest	V	7.9768	12.29	2003	Yes
ESP	Costes del Garraf	Plan for Areas of Natural Interest	V	264.74	264.74	1992	Yes
ESP	Delta de l'Ebre	Natural Park	V	6.96	78.18	1983	No
ESP	Delta de l'Ebre	Plan for Areas of Natural Interest	V	356.47	483.85	1992	Yes

***as reported by the manager in the survey or given for the purposes of this study.**

ESP	El Estrecho	Natural Park	V	93.88	189.19	2003	No
ESP	El Montgrí, les Illes Medes i el Baix Ter	Natural Park	II	20.38	81.92	2010	Yes
ESP	Freus d'Eivissa i Formentera	Marine Reserve	IV	136.17	136.17	2001	No
ESP	Illa de Tabarca	Marine Nature Reserve	IV	17.47	17.54	1986	No
ESP	Illa del Toro	Marine Reserve	IV	1.36	1.36	2004	No
ESP	Illes Columbretes	Marine Nature Reserve	IV	54.81	55	1990	No
ESP	Illes Malgrats	Marine Reserve	IV	0.889	0.889	2004	No
ESP	Irta	Marine Nature Reserve	IV	24.45	24.49	2002	Yes
ESP	Isla de Alboran	Natural Landscape	VI	263.7	263.7	2003	No
ESP	Islas Chafarinas	National Hunting Refude	IV	3.1	3.6	1982	Yes
ESP	Llevant de Mallorca - Cala Ratjada	Marine Reserve	VI	113.6	113.6	2007	No
ESP	Masia Blanca	Marine Reserve	IV	4.57	4.57	1999	No
ESP	Massís de les Cadiretes	Plan for Areas of Natural Interest	V	21.02	98.68	1992	Yes
ESP	Migjorn de Mallorca	Marine Reserve	VI	223.32	223.32	2002	No
ESP	Muntanyes de Begur	Plan for Areas of Natural Interest	V	12.29	23.31	1992	Yes
ESP	Norte de Menorca	Marine Reserve	IV	51.19	51.19	1999	No
ESP	Pinya de Rosa	Plan for Areas of Natural Interest	V	0.148	0.9887	2006	Yes
ESP	S'Albufera des Grau	Natural Park	II	17.43	52.31	2005	No
ESP	Serra de Tramuntana	Natural Landscape	V	11.2	630.84	2007	No
ESP	Serra Gelada	Natural Park	II	49.79	56.55	2005	Yes
ESP	Ses Negres	Marine Reserve	V		0.8	1993	No
ESP	Ses Salines d'Eivissa i Formentera	Nature Park	II	136.1	153.96	2001	Yes
ESP	Tamarit - Punta de la Mora	Plan for Areas of Natural Interest	V	3.0254	4.23	1992	Yes
FRA	Agriate	Land acquired by Littoral and Lakeside Conservatory	IV	0.45	0.45	1979	No
FRA	Calanques	National Park	II	435	518	2012	Yes
FRA	Cap Taillat	Land acquired by Littoral and Lakeside Conservatory	V	0.64	1.43	1987	No

FRA	Capo Rosso - Baie de l'Ancisa	Land acquired by Littoral and Lakeside Conservatory	IV	0.27	0.76	1980	No
FRA	Cerbere-Banyuls	Marine Nature Reserve	IV	6.5	6.5	1974	Yes
FRA	Cote Bleue	Marine Park	IV	98.73	98.73	1983	Yes
FRA	Domaine du Rayol	Land acquired by Littoral and Lakeside Conservatory	V	0.14	0.14	1989	No
FRA	Formation récifale de Saint Florent	Biotope Protection Order	IV	0.08	0.08	1998	No
FRA	Frioul Islands	Marine Park	II	8	9.52	2002	No
FRA	Grotte marine de Temuli/ Sagone (Coggia)	Biotope Protection Order	IV	0.01	0.01	2000	No
FRA	Gulf of Lion	Natural Marine Park	VI	4009.49	4009.49	2011	Yes
FRA	Iles Bruzzi et Ilot aux Moines	Biotope Protection Order	IV	11.53	11.77	1997	No
FRA	Port d'Alon	Land acquired by Littoral and Lakeside Conservatory	V	1	1	2009	No
FRA	Port-Cros	National Park	II	12.88	19.88	1963	Yes
FRA	Scandola	Nature Reserve	IV	6.5	15.69	1975	Yes
FRA	Strait of Bonifacio	Nature Reserve	IV	782.94	794.6	1999	Yes
GRC	Acheron Estuary	Nature Reserve	VI	5.6	23.26	2009	No
GRC	Alonissos-Northern Sporades	National Marine Park	II	2070	2300	1992	No
GRC	Amvrakikos Wetlands	National Park	VI	403.49	1808.62	2008	Yes
GRC	Anatolikis Makedonias kai Thrakis	National Park	V	50.03	929.47	2008	No
GRC	Evros Delta	National Park	VI	35.7	128.96	1977	No
GRC	Gallikos, Axios, Loudias, Aliakmonas, saltmarsh Kitrous, Kalohori lagoon	National Park	VI	84.55	337.79	2009	No
GRC	Kalama Delta	Nature Reserve	VI	20.71	88.56	2009	No
GRC	Karla - Mavrovouniou	NA	NA	NA	NA	NA	No
GRC	Karpathos - Sarias	Protected Ecological Park	II	53	154	2002	No
GRC	Kotychi - Strofylia wetland	National Park	VI	21.12	160.61	2009	No

GRC	Messolonghi - Aetoliko lagoons, estuaries of Acheloos and Evinos and Echinades islands	National Park	VI	175.25	334.71	2006	No
GRC	Schinias - Marathon	National Park	IV	4.35	13.84	2000	No
GRC	Zakynthos	National Marine Park	IV	86.95	104.33	1990	Yes
HRV	Brijuni	National Park	II	26.46	33.97	1983	Yes
HRV	Kornati	National Park	II	165.63	215.67	1980	Yes
HRV	Lastovo archipelago	Nature park	II	143.18	195.83	2006	Yes
HRV	Lim bay	Special reserve	IV	4.29	4.29	1979	No
HRV	Maloston bay	Special reserve	IV	66.77	173	1983	No
HRV	Mljet	National park	II	24.39	52.91	1960	Yes
HRV	Neretva delta - southeastern part	Special reserve	IV	4.58	4.99	1974	No
HRV	Pantana	Special reserve	IV	0.1	0.44	2001	No
HRV	Prvic	Special reserve	IV	44.82	57.57	1972	Yes
HRV	Telascica	Nature park	IV	44.67	70.01	1988	Yes
ISR	Akhziv	National park	II	0.003	0.075	1968	No
ISR	Hof Dor and Ma'Agan Michael Islands	Nature reserve	II	0.021	0.021	1964	No
ISR	Rosh Hanikra - Akhziv	Marine Protected Area	II	11.155	11.155	2005	No
ISR	Rosh Hanikra islands	Nature reserve	II	0.311	0.311	1965	No
ISR	Shiqma	Nature reserve	II	1.028	1.028	2005	No
ISR	Shiqmona	Nature reserve	II	1.67	1.677	2008	No
ISR	Yam Dor Habonim	Nature Reserve	II	5.192	5.192	2002	No
ISR	Yam Dor Habonim	Marine Protected Area	NA	NA	NA	2005	No
ISR	Yam Evtah	Nature reserve	II	1.342	1.342	2003	No
ISR	Yam Gador	Nature reserve	II	0.844	0.844	2004	No
ITA	Arcipelago della Maddalena	National Park	II	143.02	201.52	1991	Yes
ITA	Arcipelago Toscano	National Park	II	565.98	730.08	1996	No
ITA	Baia	Underwater Park	VI	1.77	1.77	2002	Yes
ITA	Capo Caccia - Isola Piana	Marine Protected Area	II	26.31	26.31	2002	Yes
ITA	Capo Carbonara	Marine Protected Area	II	85.98	85.98	1999	Yes
ITA	Capo Gallo - Isola delle Femmine	Marine Protected Area	IV	21.73	21.73	2002	No

ITA	Capo Rizzuto	Marine Protected Area	II	147.21	147.21	1991	Yes
ITA	Cinque Terre	Marine Protected Area	IV	45.54	45.54	1997	Yes
ITA	Costa degli Infreschi e della Masseta	Marine Protected Area	II	23.32	23.32	2009	No
ITA	Gaiola	Underwater Park	IV	0.42	0.42	2002	No
ITA	Isola dell'Asinara	Marine Protected Area	II	107.32	107.32	2002	No
ITA	Isola di Bergeggi	Marine Protected Area	II	2.03	2.03	2007	No
ITA	Isola di Ustica	Marine Protected Area	II	159.51	159.51	1986	No
ITA	Isole Ciclopi	Marine Protected Area	II	6.23	6.23	1989	Yes
ITA	Isole dello Stagnone di Marsala	Regional Nature Reserve	IV	12.4	20.45	1984	No
ITA	Isole di Ventotene e santo Stefano	Marine Protected Area	II	27.99	27.99	1997	No
ITA	Isole Egadi	Marine Protected Area	IV	539.92	539.92	1991	Yes
ITA	Isole Pelagie	Marine Protected Area	II	41.36	41.36	2002	Yes
ITA	Isole Tremiti	Marine Protected Area	IV	14.66	14.66	1989	Yes
ITA	Miramare	Marine Protected Area	IV	0.3	0.3	1986	Yes
ITA	Penisola del Sinis - Isola Mal di Ventre	Marine Protected Area	IV	267.03	267.03	1997	Yes
ITA	Plemmirio	Marine Protected Area	II	24.29	24.29	2004	Yes
ITA	Porto Cesareo	Marine Protected Area	IV	166.54	166.54	1997	No
ITA	Portofino	Marine Protected Area	IV	3.46	3.46	1998	Yes
ITA	Punta Campanella	Marine Protected Area	IV	15.39	15.39	1997	No
ITA	Regno di Nettuno	Marine Protected Area	II	112.56	112.56	2007	No
ITA	Santa Maria di Castellabate	Marine Protected Area	II	70.94	70.94	2009	No
ITA	Secche della Meloria	Marine Protected Area	II	93.72	93.72	2009	Yes
ITA	Secche di Tor Paterno	Marine Protected Area	II	13.87	13.87	2000	Yes
ITA	Tavolara - Punta Coda Cavallo	Marine Protected Area	IV	153.57	153.57	1997	Yes
ITA	Torre del Cerrano	Marine Protected Area	IV	34.3	34.3	2009	Yes
ITA	Torre Guaceto	Marine Protected Area	II	22.27	22.27	1991	Yes

LBN	Palm Islands	Nature Reserve	IV	NA	5	1992	Yes
LBN	Tyre Coast	Nature Reserve	IV	0.22	3.8	1998	Yes
LBY	Ain Al-Ghazalah Gulf	Marine Protected Area	IV	260.74	292.78	2011	No
LBY	El Kouf	National Park	II	NA	320	NA	No
LBY	Farwa lagoon	Marine Protected Area	IV	46.5	55.91	2011	Yes
MAR	Al-Hoceima	National Park	II	196	484.6	2004	Yes
MCO	Larvotto	Underwater reserve	IV	0.5	0.5	1978	Yes
MCO	Tombant des Spélugues	Marine reserve	IV	0.01	0.01	1986	Yes
MLT	Filfla, il-Bahar Madwar	Special Area of Conservation of International Importance	II	13.07	13.07	1990	No
MLT	Marine Area in the limits of Dwejra	Special Area of Conservation of International Importance	IV	2.29	2.29	2007	Yes
MLT	Marine Area in the limits of Ghar Lapsi and Filfla	Special Area of Conservation of International Importance	IV	24.51	24.51	2010	Yes
MLT	Marine Area in the limits of Mgarr ix-Xini	Special Area of Conservation of International Importance	IV	0.31	0.31	2010	Yes
MLT	Marine Area in the Northeast Malta	Special Area of Conservation of International Importance	IV	155.19	155.19	2010	Yes
MLT	Marine Between Rdum Majjiesa u Ras ir-Raheb	Special Area of Conservation of International Importance	IV	8.49	8.49	2007	Yes
MNE	Kotorsko Risanski Zaliv	Nature Reserve	V	NA	120	1979	No
SVN	Cape Madona	Natural Monument	III	0.12	0.12	1990	Yes
SVN	Debeli rtic	Natural Monument	III	0.2	0.3	1991	Yes
SVN	Strunjan	Landscape Park	V	1.5	4.29	1990	Yes
SYR	Fanar Ibn Hani	NA	IV	NA	NA	2000	No
SYR	Om Al Toyour	Nature Reserve	IV	8.35	11.27	1999	No
SYR	Ras El Bassit	Nature Reserve	IV	53.82	62.91	1999	No
TUN	Iles Kneiss	Nature Reserve	IV	160	339.73	1993	Yes
TUN	La Galite archipelago	Marine reserve	II	NA	NA	1980	No
TUN	Zembra and Zembretta archipelago	National Park	II	48.28	52.77	1973	Yes
TUR	Ayvalik Islands	Nature Park	II	NA	179.5	1995	No
TUR	Datca-Bozburun	Special Environmental Protection Area (SEPA)	IV	736.63	1443.9	1990	No

TUR	Dilek Yarimadisi	National Park	II	NA	276.75	1966	No
TUR	Fethiye-Gocek	Special Environmental Protection Area (SEPA)	IV	340.11	805.37	1988	No
TUR	Foca	Special Environmental Protection Area (SEPA)	IV	51.78	71.44	1990	No
TUR	Gallipoli	National Park	II	NA	330	1980	No
TUR	Gokova	Special Environmental Protection Area (SEPA)	IV	820.23	1097.78	1988	Yes
TUR	Goksu Delta	Special Environmental Protection Area (SEPA)	IV	80.78	228.5	1990	No
TUR	Kas-Kekova	Special Environmental Protection Area (SEPA)	IV	165.91	257.83	1990	No
TUR	Koycegiz-Dalyan	Special Environmental Protection Area (SEPA)	IV	40.84	461.46	1988	No
TUR	Marmaris	National Park	II	NA	333.5	1996	No
TUR	Olimpos-Beydaglari (Olympos Bey Mountain)	National Park	II	NA	344.25	1972	No
TUR	Patara	Special Environmental Protection Area (SEPA)	IV	49.94	197.1	1990	No
TUR	Saros Korfezi	Special Environmental Protection Area (SEPA)	IV	538.34	730.2	2010	No

List of Natura 2000 sites where questionnaires were completed and analysed:

Country	Name	Label	Marine surface area (km²)	Total surface area (km²)	Year of current status implementation
ESP	Costes del Maresme	Natura 2000 - SCI	29,08	29,064	2006
ESP	Costes del Tarragonès	Natura 2000 - SCI	8,77	11,107	1997
ESP	Grapissar de la Masia Blanca	Natura 2000 - SCI	4,12	4,4058	2006
ESP	Litoral del Baix Empordà	Natura 2000 - SPA & SCI	17,09	33,321	2005
ESP	Litoral meridional tarragoní	Natura 2000 - SCI	45,32	49,038	2006
FRA	Baie et Cap d'Antibes – Iles de Lérins	Natura 2000 - SCI	132,19	136,27	2003
FRA	Corniche Varoise	Natura 2000 - SCI	284,89	290,61	2003
FRA	Posidonies de la Côte Palavasienne	Natura 2000 - SCI	107,89	108,3	2001
FRA	Posidonies du Cap d'Agde	Natura 2000 - SCI	22,95	23,17	2002

Appendix 5 - List of MPAs with an international designation

MPA	Country	World Heritage	SPAMI	Biosphere Reserve	Ramsar
Caps de Girolata et de Porto, Scandola Nature Reserve,	France	■			
Calanches de Piana	Spain	■			
Iles Habibas	Algeria		■		
Banc des Kabyles Marine Reserve			■		
Falaises de Maro Cerro Gordo	Spain		■		
Cabrera archipelago National Park			■		
Cabo de Gata-Nijar Nature Park			■	■	
Cap de Creus Nature Park			■		
Le fond marin du Levant d'Almérie			■		
Iles Columbretes			■		
Iles Medes			■		
Iles d'Alboran			■		
Mar Menor and the Eastern Mediterranean coast in the Murcia Region			■		
Port-Cros National Park	France		■		
Straits of Bonifacio Nature Reserve			■		
Côte Bleue Marine Park			■		
Embiez - Six Fours archipelago			■		
Pelagos Sanctuary	France, Italy, Monaco		■		
Capo Caccia - Isola Piana	Italy		■		
Miramare			■		
Plemmirio			■		
Portofino			■		
Punta Campanella			■		
Tavolara - Punta Coda Cavallo			■		
Torre Guaceto			■		
Porto Cesareo			■		
Capo Carbonara			■		
Penisola del Sinis - Isola di Mal di Ventre			■		

Côte de Tyre Nature Reserve	Lebanon				
Iles des Palmiers Nature Reserve					
Al-Hoceima National Park	Morocco				
Iles Kneiss	Tunisia				
Galite archipelago					
Zembra and Zembretta National Park					
Intercontinental Biosphere Reserve of the Mediterranean	Spain				
Camargue	France				
Vallée du Fango					
Cap des Trois Fourches	Morocco				
TOTAL		2	32	5	2

Appendix 6 - Distribution of MPAs (aside Natura 2000)

Reference surfaces used for the Mediterranean (to calculate percentages):

- Total surface area: 2 513 270 km²
- Surface area within 12 nautical miles: 647 853 km²
- Surface area beyond 12 nautical miles: 1 865 417 km²

	Declared Method (not taking into account overlapping designations)				Spatial Analysis Method From the MPAs geographical information (taking into account the MPAs which overlap)		
Country	Number of MPAs	MPA Surface area (in km²)	% MPA surface/ Medi-terranean surface	% MPA surface/ Medi-terranean surface	Number of MPAs with spatial data	Marine Surface area (in km²)	% MPA surface/ Medi-terranean surface
Albania	1	125,70	0,0050	0,1181	1	125,4	0,0050
Algeria	2	32,80	0,0013	0,0308	2	19,1	0,0008
Cyprus	1	5,50	0,0002	0,0052	1	2	0,0001
Croatia	10	524,89	0,0209	0,4930	10	493	0,0196
Egypt	2	356,91	0,0142	0,3352	2	429,3	0,0171
Spain	41	2683,91	0,1068	2,5209	40	2416,1	0,0961
France	18	5412,69	0,2154	5,0840	17	5365,6	0,2135
Greece	13	3010,75	0,1198	2,8279	12	3077,8	0,1225
International Pelagos	1	87500,00	3,4815	82,1864	1	87305	3,4738
Israel	10	21,57	0,0009	0,0203	9	27,1	0,0011
Italy	32	2950,94	0,1174	2,7717	32	2898	0,1153
Lebanon	2	0,22	0,0000	0,0002	1	0,2	0,0000
Libya	3	307,24	0,0122	0,2886	0	NA	NA
Morocco	2	231,00	0,0092	0,2170	1	268,3	0,0107
Monaco	2	0,51	0,0000	0,0005	2	0,2	0,0000
Malta	6	203,86	0,0081	0,1915	6	186,7	0,0074
Montenegro	1	NA	NA	NA	0	NA	NA
Slovenia	3	1,82	0,0001	0,0017	3	0,9	0,0000
Syria	3	62,17	0,0025	0,0584	2	62,2	0,0025
Tunisia	3	208,28	0,0083	0,1956	3	267,1	0,0106
Turkey	14	2824,56	0,1124	2,6530	9	2721,9	0,1083
Total	170	106 465	4,24	100,00	154	105 666	4,20

Spatial Analysis Method From the MPAs geographical information (taking into account the MPAs which overlap)						
% MPA surface/ Medi-terranean surface	MPA Surface within 12 miles (in km²)	% MPA Surface within 12 miles / Mediterranean surface within 12 miles	% MPA Surface within 12 miles/ Mediterranean surface within 12 miles (55 035 km²	MPA Surface beyond 12 miles (in km²)	% MPA Surface beyond 12 miles / Mediterranean surface beyond 12 miles	% MPA Surface beyond 12 miles / Mediterranean surface beyond 12 miles (50 532 km²)
0,1187	125,4	0,0194	0,2279	0	0,0	0,0
0,0181	19,1	0,0029	0,0347	0	0,0	0,0
0,0019	2	0,0003	0,0036	0	0,0	0,0
0,4666	493	0,0761	0,8958	0	0,0	0,0
0,4063	429,3	0,0663	0,7801	0	0,0	0,0
2,2865	2416,1	0,3729	4,3901	0	0,0	0,0
5,0779	2808,6	0,4335	5,1033	2 557	5,1	0,1
2,9128	3077,8	0,4751	5,5925	0	0,0	0,0
82,6236	39331	6,0710	71,4656	47 974	94,9	2,6
0,0256	27,1	0,0042	0,0492	0	0,0	0,0
2,7426	2898	0,4473	5,2657	0	0,0	0,0
0,0002	0,2	0,0000	0,0004	0	0,0	0,0
NA	NA	NA	NA	NA	NA	NA
0,2539	268,3	0,0414	0,4875	0	0,0	0,0
0,0002	0,2	0,0000	0,0004	0	0,0	0,0
0,1767	186,7	0,0288	0,3392	0	0,0	0,0
NA	NA	NA	NA	NA	NA	NA
0,0009	0,9	0,0001	0,0016	0	0,0	0,0
0,0589	62,2	0,0096	0,1130	0	0,0	0,0
0,2528	267,1	0,0412	0,4853	0	0,0	0,0
2,5759	2621,9	0,4047	4,7641	0	0,0	0,0
100	55 035	8,5	100	50531	100	2,7

Appendix 7 - MPA national designation, and grouping for the purpose of the analysis

Assigned Group	National Label[1]	IUCN Category reported by the managers or assigned for this study (see Appendix 5)	Number of MPAs	Country
Group A ("Park" type)	Marine Park	II, IV	2	France (2)
	Marine Protected Area	II, IV	32	Egypt (1)
				Israel (2)
				Italy (27)
				Libya (2)
	National Marine Park	II, IV	3	Albania (1)
				Greece (2)
	National Park	II, IV, V, VI	23	Croatia (3)
				Spain (1)
				France (2)
				Greece (7)
				Israel (1)
				Italy (2)
				Libya (1)
				Morocco (1)
				Tunisia (1)
				Turkey (4)
	Natural Marine Park	VI	1	France (1)
	Natural Park	II, IV, V	7	Spain (7)
	Nature Park	II, IV	4	Croatia (2)
				Spain (1)
				Turkey (1)
	Protected Ecological Park	II	1	Greece (1)
	Special Area of Conservation of International Importance	II, IV	6	Malta (6)
	Special Environmental Protection Area (SEPA)	IV	9	Turkey (9)
	Underwater Park	IV, VI	2	Italy (2)

Group B (“Reserve“ type)	Biotope Protection Order	IV	3	France (3)
	Marine Nature Reserve	IV	6	Algeria (1)
				Spain (4)
				France (1)
	Marine Reserve	II, IV, V, VI	12	Spain (10)
				Monaco (1)
				Tunisie (1)
	Marine/Coastal Reserve	IV	1	Cyprus (1)
	National Hunting Refuge	IV	1	Spain (1)
	Nature Protectorate	VI	1	Egypt (1)
	Nature Reserve	II, IV, V, VI	17	France (2)
				Greece (2)
				Israel (7)
				Lebanon (2)
				Montenegro (1)
				Syria (2)
				Tunisia (1)
	Regional Nature Reserve	IV	1	Italy (1)
	Special Reserve	IV	5	Croatia (5)
	Underwater reserve	IV	1	Monaco (1)
Group A (“Landscape Park“ type)	Landscape Park	V	1	Slovenia (1)
	Natural Landscape	V, VI	3	Spain (3)
	Natural Monument	III	3	Spain (1)
				Slovenia (2)
Group D1	Plan for Areas of Natural Interest	V	9	Spain (9)
Group D2	Land acquired by Littoral and Lakeside Conservatory	IV, V	5	France (5)
			159	

1. Two MPAs with no information on their national label: Fanar Ibn Hani (Syria) and Karla – Mavrovouniou (Greece).

Appendix 8 - Data analysis method

1. List of MPAs for which the IUCN category was assigned for the purposes of this study (note that this exercise could stand as a proposal that could be discussed with the managers and competent authorities).

Country	Name	Assigned IUCN Category	Label
Algeria	Iles Habibas	IV	Marine Nature Reserve
Croatia	Brijuni	II	National Park
Croatia	Kornati	II	National Park
Croatia	Lastovo archipelago	II	Nature Park
Croatia	Lim bay	IV	Special reserve
Croatia	Maloston bay	IV	Special reserve
Croatia	Mljet	II	National Park
Croatia	Neretva delta - southeastern part	IV	Special reserve
Croatia	Pantana	IV	Special reserve
Croatia	Prvic	IV	Special reserve
Croatia	Telascica	IV	Nature Park
Egypt	Sallum gulf	II	Marine Protected Area
Spain	Acantilados de Maro Cerro Gordo	V	Natural Landscape
Spain	Arrecife Barrera de Posidonia	III	Natural Monument
Spain	Cabo de Palos - Islas Hormigas	IV	Marine Reserve
Spain	Cabo de San Antonio	IV	Marine Nature Reserve
Spain	Costes del Garraf	V	Plan for Areas of Natural Interest
Spain	Delta de l'Ebre	V	Plan for Areas of Natural Interest
Spain	El Montgrí, les Illes Medes i el Baix Ter	II	Natural Park
Spain	Irta	IV	Marine Nature Reserve
Spain	Isla de Alboran	VI	Natural Landscape
Spain	Llevant de Mallorca - Cala Ratjada	VI	Marine Reserve
Spain	Massís de les Cadiretes	V	Plan for Areas of Natural Interest
Spain	Migjorn de Mallorca	VI	Marine Reserve
Spain	S'Albufera des Grau	II	Natural Park
Spain	Serra de Tramuntana	V	Natural Landscape
Spain	Serra Gelada	II	Natural Park
Spain	Ses Salines d'Eivissa i Formentera	II	Nature Park
France	Cap Taillat	V	Land acquired by Littoral and Lakeside Conservatory

France	Domaine du Rayol	V	Land acquired by Littoral and Lakeside Conservatory
France	Frioul Islands	II	Marine Park
France	Gulf of Lion	VI	Natural Marine Park
France	Port d'Alon	V	Land acquired by Littoral and Lakeside Conservatory
Greece	Karla - Mavrovouniou	IV	NA
Greece	Karpathos - Sarias	II	Protected Ecological Park
Israel	Hof Dor and Ma'Agan Michael Islands	II	Nature Reserve
Israel	Rosh Hanikra islands	II	Nature Reserve
Italy	Baia	VI	Underwater Park
Italy	Capo Carbonara	II	Marine Protected Area
Italy	Costa degli Infreschi e della Masseta	II	Marine Protected Area
Italy	Gaiola	IV	Underwater Park
Italy	Isola dell'Asinara	II	Marine Protected Area
Italy	Isola di Bergeggi	II	Marine Protected Area
Italy	Isola di Ustica	II	Marine Protected Area
Italy	Regno di Nettuno	II	Marine Protected Area
Italy	Santa Maria di Castellabate	II	Marine Protected Area
Italy	Secche della Meloria	II	Marine Protected Area
Italy	Secche di Tor Paterno	II	Marine Protected Area
Italy	Torre del Cerrano	IV	Marine Protected Area
Italy	Torre Guaceto	II	Marine Protected Area
Lebanon	Tyre Coast	IV	Nature Reserve
Libya	Ain Al-Ghazalah Gulf	IV	Marine Protected Area
Libya	El Kouf	II	National Park
Libya	Farwa lagoon	IV	Marine Protected Area
Malta	Filfla, il-Bahar Madwar	II	Special Area of Conservation of International Importance
Malta	Marine Area in the limits of Dwejra	IV	Special Area of Conservation of International Importance
Malta	Marine Area in the limits of Ghar Lapsi and Filfla	IV	Special Area of Conservation of International Importance
Malta	Marine Area in the limits of Mgarr ix-Xini	IV	Special Area of Conservation of International Importance
Malta	Marine Area in the Northeast Malta	IV	Special Area of Conservation of International Importance
Malta	Marine Between Rdum Majjiesa u Ras ir-Raheb	IV	Special Area of Conservation of International Importance
Syria	Fanar Ibn Hani	IV	NA
Syria	Om Al Toyour	IV	Nature Reserve
Syria	Ras El Bassit	IV	Nature Reserve
Tunisia	Iles Kneiss	IV	Nature Reserve
Tunisia	La Galite archipelago	II	Nature Reserve
Turkey	Ayvalik Islands	II	Nature Park

2. Analysis of geographic information and method for assessing representativity

Representativity was assessed at the level of the Mediterranean, for benthic habitats (19 habitat categories), epipelagic habitats (37 categories), seagrass meadows (2 categories), coralligenous habitats, some remarkable underwater features (canyons, banks, hills and seamounts) and most emblematic, endemic or rare species of the Mediterranean, including marine mammals (8 species), birds (4 species), turtles (4 species) and fish (16 species).

The first part of the work consisted in collecting spatial data about Mediterranean MPAs. We had the outer limits of 662 MPAs of which 507 Natura 2000 sites. We used the following MPA categories: MPA all designations (national and international ones), with and without Pelagos, MPA with a management structure, with and without Pelagos. These MPA spatial data were collected and fed into the Geographic Information System ARCGIS 10. This commercial software is widely used and has various «toolbox» aimed at the management of vector and raster data, with specialised functions in the field of conservation planning (including Marine Geospatial Ecology Tools).

The second part consisted in creating a geographical grid composed of spatial units of reference for assessing the representativity of MPAs.

Projection

The spatial projection used is Lambert Azimuthal Equivalent Area in the Geodetic European Terrestrial Reference System 1989 (ETRS89). This projection is recommended by the European INSPIRE directive on Infrastructure for Spatial Information in Europe (http://inspire.jrc.ec.europa.eu/) and is an equivalent i.e. it matches the surfaces. It is easily transformable into the World Geodetic System 1984 which is the system used by GPS.

Coastline

In order to keep only the marine part of the protected areas the MPAs boundaries were intersected with the full resolution (to the decameter) global reference shoreline data which is made available online by NOAA/NGDC (National Oceanographic and Atmospheric Administration, National Geophysical Data Center).

Reference spatial units

For the purpose of this analysis, the MPAs limits were intersected at every point in order to identify the different protection statuses which can sometimes overlap. This was done by using the «union» function in ArcGIS. Then, in order to achieve an accurate assessment of the MPAs representativity, we intersected these limits with a 1 125 degrees (about 120 km) square mesh vector grid. This mesh was selected because of the lower spatial resolution information used for the analysis, namely radar altimetry data. Then the fragmentary polygons of less than 1 hectare made in the intersection operations were merged with fragments that share the longest common border This grid could be used as a reference for future work on conservation planning.

The third part of the work has focused on collecting and formatting all the information on the spatial distribution of each habitat or species concerned at the Mediterranean level. It was necessary to digitize some GIS layers from articles or reports to have a spatially explicit information on the distribution of species in particular. Overall, data on the Mediterranean scale are very disparate and large geographical areas are poorly documented, especially the eastern Mediterranean.

The fourth step was to evaluate, for each geographical grid cell, the amount of habitat and species, expressed in area and linear units, and in occurrence. This tabulating operation enabled to generate a matrix where each row is a cell of the geographic grid and each column provides information about the protected status of the cell (protected or not), the MPA category, the area of the mesh and the quantity (in km^2, in km or in occurrence) of each habitat or species concerned. The intermediate grid which was used for tabulating had a spatial resolution of 100 m, which was the size of the smallest elements of the reference geographic mesh.

In parallel, an analysis of the questionnaire responses regarding the habitats present in the MPA was carried out. However, given the length and level of detail proposed in the list of habitats, few managers have been able to respond within the allotted time and the statistical results of these elements, which constitute a first baseline drafted, are to be checked and completed, following the publication of this report. At most, they give an idea of species and habitats in MPAs who responded and those who were not mentioned by any respondents MPA.

3. MPA typology

A MPA typology was suggested based on the general data collected from all the MPAs (170 MPAs without Pelagos). This Mediterranean MPAs general characteristics typology aims to try to categorise the MPAs into larger groups in order to have a simplified view of the MPA network.

Two other typologies are also available in the management assessment section. Both these typologies are done on a sample group of MPAs (80) who responded to the survey and they focus on MPA management and the pressures on MPAs.

The variables included in each typology were selected for their relevance and also to balance the number of MPAs in each category. In fact, if a variable is only represented by a few MPAs (e.g. IUCN Category III: only 3 MPAs out of 170) this can create an imbalanced analysis and just focuses on special cases which are easily analysable without a typology.

The methodology used is a combination of a multiple correspondence analysis (MCA) and agglomerative hierarchical clustering (AHC) on the coordinates of the MCA. The R software was used to do these analyses using ade4 and Cluster (R Development Core Team, 2011; Dray *et al.,* 2007; Maechler *et al.,* 2011).

Appendix 9 - Representativity of the MPA network through different elements of the marine ecosystem

	MPA all designations		MPA with a management authority		Area (1000 km²)	Length (km)	Number of occur-rences
	Without Pelagos	Including Pelagos	Without Pelagos	Including Pelagos			
Ecoregions							
Alboran sea	3,09%	3,09%	1,05%	1,05%	84344	-	-
Algerian-provencal basin	3,09%	13,39%	1,42%	12,55%	502972	-	-
Tyrrhennean sea	1,78%	12,92%	0,91%	12,51%	253929	-	-
Adriatic sea	0,59%	0,59%	0,42%	0,42%	131432	-	-
Tunisian plateau /Gulfe of Sidra	0,19%	0,19%	0,13%	0,13%	402046	-	-
Ionian sea	0,75%	0,75%	0,28%	0,28%	398356	-	-
Aegean sea	3,40%	3,40%	2,35%	2,35%	190254	-	-
Levantine sea	0,36%	0,36%	0,21%	0,21%	548003	-	-
Benthic biocenosis et key geomorphological features							
Canyons	3,05%	12,68%	0,80%	12,00%	-	18478	-
Submarine banks	0,00%	1,29%	0,00%	1,29%	7479	-	-
Seamounts	3,41%	6,82%	1,14%	5,68%	-	-	88
Submarine knolls	0,50%	2,24%	0,00%	2,00%	-	-	401
Coralligeneous substrate	11,60%	18,40%	4,91%	14,28%	1441	-	-
Cymodocea nodosa seabed	7,81%	28,44%	1,06%	23,55%	310	-	-
Posidonia oceanica seabed	49,68%	60,81%	19,14%	43,33%	4798	-	-
Bentho-sedimentary habitats							
Infralittoral	10,18%	12,58%	4,50%	7,71%	122871	-	-
Circalittoral	3,89%	7,19%	2,29%	6,06%	399033	-	-
Bathyal	0,57%	4,25%	0,26%	4,13%	1416808	-	-
Abyssal	0,00%	2,05%	0,00%	2,05%	574493	-	-
Infralittoral - Hard substrate / No data	16,11%	18,56%	6,98%	11,22%	22860	-	-
Infralittoral - Mud	9,79%	9,79%	2,50%	2,50%	5842	-	-
Infralittoral - Sand	10,64%	13,36%	4,69%	7,54%	51683	-	-
Infralittoral - Muddy sand	6,77%	9,62%	3,38%	7,52%	29596	-	-

Infralittoral - Sandy mud	5,81%	6,90%	2,85%	5,00%	12890	-	-
Circalittoral - Hard substrate / No data	6,48%	9,33%	3,29%	7,11%	35069	-	-
Circalittoral - Mud	3,57%	3,80%	2,48%	2,72%	55286	-	-
Circalittoral - Sand	3,81%	5,46%	2,01%	4,03%	101229	-	-
Circalittoral - Muddy sand	3,19%	6,91%	2,23%	6,38%	96905	-	-
Circalittoral - Sandy mud	3,91%	10,05%	2,19%	8,96%	110544	-	-
Bathyal - Hard substrate / No data	6,08%	40,08%	1,77%	38,89%	11396	-	-
Bathyal - Mud	0,17%	3,84%	0,16%	3,82%	800592	-	-
Bathyal - Sand	1,34%	1,73%	0,70%	1,13%	44844	-	-
Bathyal - Muddy sand	2,66%	6,36%	1,24%	5,60%	22481	-	-
Bathyal - Sandy mud	0,89%	4,24%	0,30%	4,04%	537495	-	-
Abyssal - Mud	0,00%	1,54%	0,00%	1,54%	518421	-	-
Abyssal - Sand	0,00%	0,00%	0,00%	0,00%	177	-	-
Abyssal - Muddy sand	0,00%	0,00%	0,00%	0,00%	9	-	-
Abyssal - Sandy mud	0,00%	6,77%	0,00%	6,77%	55886	-	-
Epipelagic bioregions							
Bioregion I-1-1	4,15%	4,15%	2,96%	2,96%	20243	-	-
Bioregion II-2-2	4,58%	12,73%	2,56%	12,34%	197519	-	-
Bioregion II-3-4	3,38%	3,38%	1,38%	1,38%	97100	-	-
Bioregion II-4-7	0,55%	2,80%	0,28%	2,53%	187754	-	-
Bioregion III-12-9	0,75%	0,75%	0,43%	0,43%	143785	-	-
Bioregion III-5-19	4,69%	70,01%	1,12%	68,53%	46961	-	-
Bioregion III-5-36	0,60%	18,50%	0,25%	18,17%	30544	-	-
Bioregion III-6-12	6,15%	6,15%	1,20%	1,20%	36884	-	-
Bioregion III-7-15	0,45%	18,99%	0,28%	18,86%	74829	-	-
Bioregion III-7-18	0,84%	1,59%	0,29%	1,03%	56169	-	-
Bioregion III-7-20	1,08%	1,08%	0,78%	0,78%	53900	-	-
Bioregion III-7-21	0,85%	0,85%	0,43%	0,43%	124995	-	-
Bioregion III-7-23	1,27%	1,27%	0,93%	0,93%	79918	-	-
Bioregion III-8-13	0,51%	0,51%	0,00%	0,00%	5928	-	-
Bioregion III-8-16	1,34%	1,34%	0,01%	0,01%	34253	-	-
Bioregion III-8-17	12,61%	12,61%	10,31%	10,31%	15390	-	-
Bioregion III-9-10	0,25%	0,25%	0,00%	0,00%	2062	-	-
Bioregion III-9-11	5,38%	49,36%	1,63%	49,36%	16111	-	-
Bioregion III-9-14	3,00%	12,50%	0,55%	12,28%	23501	-	-
Bioregion III-9-5	0,00%	0,00%	0,00%	0,00%	1014	-	-
Bioregion III-9-6	0,00%	0,00%	0,00%	0,00%	43393	-	-
Bioregion IV-10-3	31,50%	31,50%	9,55%	9,55%	7684	-	-
Bioregion IV-11-8	1,48%	1,48%	1,41%	1,41%	74234	-	-
Bioregion V-13-26	0,17%	0,17%	0,17%	0,17%	93301	-	-

Bioregion V-13-29	1,87%	1,87%	1,87%	1,87%	42335	-	-
Bioregion V-14-37	0,31%	0,31%	0,00%	0,00%	20048	-	-
Bioregion V-15-35	1,00%	1,00%	0,00%	0,00%	11156	-	-
Bioregion V-16-22	0,69%	0,69%	0,15%	0,15%	46606	-	-
Bioregion V-16-24	0,00%	0,00%	0,00%	0,00%	72475	-	-
Bioregion V-16-25	0,43%	0,43%	0,25%	0,25%	87660	-	-
Bioregion V-16-27	0,00%	0,00%	0,00%	0,00%	102692	-	-
Bioregion V-16-28	0,00%	0,00%	0,00%	0,00%	88212	-	-
Bioregion V-16-30	0,18%	0,18%	0,17%	0,17%	65194	-	-
Bioregion V-16-31	0,50%	0,50%	0,08%	0,08%	58837	-	-
Bioregion V-16-32	0,09%	0,09%	0,00%	0,00%	43951	-	-
Bioregion V-16-33	0,51%	0,51%	0,26%	0,26%	31053	-	-
Bioregion V-17-34	0,99%	0,99%	0,93%	0,93%	43676	-	-
Bird species (at-sea distribution: Western Mediterrannean, Aegean sea and Malta surroundings)							
Calonectris diomedea	3,22%	8,37%	1,70%	7,33%	828068	-	-
Puffinus mauretanica	8,10%	8,10%	5,83%	5,83%	103928	-	-
Puffinus yelkouan	3,07%	12,57%	1,71%	11,78%	738395	-	-
Larus audouinii	3,33%	10,12%	1,71%	9,15%	499388	-	-
Marine mammals species (at-sea distribution)							
Balaenoptera physalus	2,98%	12,59%	1,27%	11,52%	834039	-	-
Globicephalus melas	0,54%	7,88%	0,28%	7,63%	459321	-	-
Grampeus griseus	0,47%	5,54%	0,26%	5,41%	1057046	-	-
Physeter macrocephalus	1,28%	4,51%	0,76%	4,15%	1449543	-	-
Stenella coeruleoalba	0,29%	2,71%	0,22%	2,67%	1443034	-	-
Tursiops truncatus	3,38%	8,43%	1,65%	7,29%	809730	-	-
Zyphius cavirostris	0,58%	5,48%	0,12%	5,37%	1155835	-	-
Monachus monachus	3,21%	3,66%	1,34%	1,80%	567477	-	-
Turtle species (at-sea distribution)							
Lepidochelys kempii	5,80%	9,29%	2,52%	6,49%	143991	-	-
Eretmochelys imbricata	1,97%	2,79%	1,09%	2,00%	676722	-	-
Dermochelys coriacea	2,60%	5,04%	1,31%	4,17%	2481368	-	-
Chelonia mydas	2,60%	5,04%	1,31%	4,17%	2481368	-	-
Caretta caretta	2,60%	5,04%	1,31%	4,17%	2481368	-	-
Turtle species (nesting sites)							
Chelonia mydas (> 40 nest per year)	18,75%	18,75%	18,75%	18,75%	-	-	16
Caretta caretta(> 50 nests per year)	29,03%	29,03%	25,81%	25,81%	-	-	31
Fish species (potential distribution area)							
Dentex dentex	7,18%	10,69%	3,49%	7,88%	236003	-	-
Phycis phycis	8,73%	15,62%	4,44%	12,64%	200068	-	-
Pagrus pagrus	5,61%	9,03%	2,95%	7,03%	417626	-	-
Scorpaena scofra	5,63%	9,07%	3,00%	7,11%	406960	-	-

Pagellus erythrinus	5,63%	9,07%	3,00%	7,11%	406962	-	-
Sciaena umbra	8,11%	11,26%	3,88%	7,91%	164737	-	-
Serranus cabrilla	3,60%	6,99%	1,94%	5,83%	863243	-	-
Merluccius merluccius	1,18%	4,41%	0,62%	4,05%	2436455	-	-
Zeus faber	4,95%	8,69%	2,71%	7,14%	444828	-	-
Coris julis	6,86%	10,35%	3,42%	7,68%	310810	-	-
Diplodus vulgaris	7,42%	10,68%	3,69%	7,78%	262174	-	-
Engraulis encrasicolus	1,35%	4,53%	0,70%	4,09%	2499855	-	-
Sardina pilchardus	2,06%	7,30%	1,07%	6,64%	1515737	-	-
Mullus surmuletus	6,30%	9,50%	3,23%	7,15%	379359	-	-
Symphodus tinca	9,39%	11,82%	4,56%	7,83%	140462	-	-
Sphyraena sphyraena	1,32%	4,50%	0,69%	4,07%	2494750	-	-
Epinephelus marginatus	7,19%	10,63%	3,52%	7,83%	241468	-	-
Sarpa salpa	9,81%	12,02%	4,77%	7,83%	120632	-	-

Appendix 10 - Distribution of benthic habitats

	II	III	IV	IV	V	VI
	Mediolittoral	**Infralittoral**	**Circalittoral (coastal)**	**Circalittoral (in open sea)**	**Bathyal**	**Abyssal**
Limits used		0-35m	35m-edge of the continental shelf (around 180-200m)		Upper horizon 200 to 400-500 Intermediate horizon from 400 to 1200-1400, Lower horizon from 1400 to 2700m	2700-3500
Populus upper limit			Intersection of the bottom with level 1% of surface light	Intersection of the bottom with level 0.01% of surface light	Shelf edge defined by bathymetric break (average depth)	Foot of the slope defined by bathymetric break
Polpulus lower limit			Intersection of the bottom with level 0.01% of surface light	Shelf edge defined by bathymetric break (average depth)	Foot of the slope defined by bathymetric break (if average depth)	
Bionomie des sunstrats meubles (d'après Peres)		Euryhaline and eurythermal biocenosis (muds)	Biocenosis of coastal terrigenous muds		Biocenosis of upper bathyal muds (hypothetical)	
		Biocenosis of fine sands in very shallow waters			Biocenosis of bathyal muds	
		Biocenosis of superficial muddy sands in sheltered waters	Biocenosis of the muddy detritic bottom		Biocenosis detritic bottom (offshore)	
		Biocenosis of coarse sands and fine gravels mixed by the waves	Biocenosis of coastal detritic bottom		Biocenosis of bathyal detritic sands - SDB (between 100 and 150-300m)	
		Biocenosis of coarse sands and fine gravels under the influence of bottom currents	Biocenosis of coarse sands and fine gravels under the influence of bottom currents			

		Biocenosis of infralittoral pebbles				
		Biocenosis of meadows at *Posidonia oceanica*				
Muds			IV.1.1. Biocenosis of coastal terrigenous muds		V.1.1. Biocenosis of bathyal muds	VI.1.1. Biocenosis of abyssal muds
			IV.1.1.1. Facies of soft muds with *Turritella tricarinata communis*		V.1.1.2. Facies of fluid muds with *Brissopsis lyrifera*	
			IV.1.1.2. Facies of sticky muds with *Virgularia mirabilis* and *Pennatula phosphorea*		V.1.1.3. Facies soft muds with *Funiculina quadrangularis* and *Apporhais seressianus*	
			IV.1.1.3. Facies of sticky muds with A*lcyonium palmatum* and *Stichopus regalis*		V.1.1.4. Facies of compact muds with I*sidella elongata*	
Sandy muds					V.1.1.1. Facies of sandy muds with *Thenea muricata*	
Fine sands with more or less mud		III.2. FINE SANDS WITH MORE OR LESS MUD				
		III.2.3. Biocenosis of superficial muddy sands in sheltered waters				
		III.2.3.4. Association with *Cymodocea nodosa* on superficial muddy sands in sheltered waters.				
		III.2.3.5. Association with *Zostera noltii* on superficial muddy sands in sheltered waters.				
Sands		III.2.1. Biocenosis of fine sands in very shallow waters			V.2.1. Biocenosis of bathyal detritic sands with *Grypheus vitreus*	
		III. 2. 2. Biocenosis of well sorted fine sands				

Coarse sands		III.3. COARSE SANDS WITH MORE OR LESS MUD	IV.2.4. Biocenosis of coarse sands and fine gravels under the influence of bottom currents			
		III.3.1. Biocenosis of coarse sands and fine gravels mixed by the waves.				
		III.3.2. Biocenosis of coarse sands and fine gravels under the influence of bottom currents				
Muddy detric			IV.2.1. Biocenosis of the muddy detritic bottom			
Detric			IV.2.2 Biocenosis the coastal detritic bottom	IV.2.3. Biocenosis of shelf-edge detritic bottom (90-250m)		
Stones and pebbles		III.4. STONES AND PEBBLES				
Posidonia		III.5.1. *Posidonia oceanica* meadows				
Cymodocea		*Cymodocea meadows*				
Hard beds		III.6. HARD BEDS AND ROCKS	IV.3. HARD BEDS AND ROCKS			
		III.6.1 Biocenosis of infralittoral algae	IV.3.1. Coralligenous biocenosis			
	Trottoir à *lithopyllum lichenoides**	III.6.1.2. Association with *Cystoseira amentacea* (var. *amentacea*, var. *stricta*, var. *spicata*)	IV.3.2. Semi-dark caves (also in enclave in upper stages)		V.3.1. Biocenosis of deep sea corals between 200 and 1200)	
	Formation de grès et trottoirs à vermets des côtes sud (Algérie)	III.6.1.3. Facies with Vermetids	IV.3.2.2. Facies with *Corallium rubrum*			
	Grottes médiolittorales	III.6.1.4. Facies with *Mytilus galloprovincialis*	IV.3.3. Biocenosis of shelf-edge rock			
		III.6.1.35. Facies and association of Coralligenous biocenosis (in enclave)				

Appendix 11 - Source of variables integrated in the bio-regionalisation

Variable	Parameter	Unit	Opération	Data	Reference
Depth	Value	(m)			
Sea surface temperature	Average	(°C)	Average 2003-2011 Climatology 8 days	Aqua-MODIS	-
Sea surface temperature	maximum	(°C)	Maximum 2003-2011 Climatology 8 days	Aqua-MODIS	-
Sea surface temperature	Minimum	(°C)	Minimum 2003-2011 Climatology 8 days	Aqua-MODIS	-
Sea surface temperature	Range	(°C)	Range 2003-2011 Climatology 8 days	Aqua-MODIS	-
Sea surface temperature	Frequency of fronts	(%)	Frequency of fronts 2003-2011 8 days	Aqua-MODIS	-
Chlorophyll a concentration	Average	(mg m-3)	Average 2003-2011 Climatology 8 days	Aqua-MODIS	-
Chlorophyll a concentration	maximum	(mg m-3)	Maximum 2003-2011 Climatology 8 days	Aqua-MODIS	-
Chlorophyll a concentration	Minimum	(mg m-3)	Minimum 2003-2011 Climatology 8 days	Aqua-MODIS	-
Chlorophyll a concentration	Range	(mg m-3)	Range 2003-2011 Climatology 8 days	Aqua-MODIS	-
Chlorophyll a concentration	Frequency of fronts	(%)	Frequency of fronts 2003-2011 8 days	Aqua-MODIS	-
Diffuse attenuation coefficient	Average	(m-1)	Average (2002-2009) Monthly climatology	Aqua-MODIS	Tyberghein *et al.* (2012)
Diffuse attenuation coefficient	Minimum	(m-1)	Average (2002-2009) Monthly climatology	Aqua-MODIS	Tyberghein *et al.* (2012)
Diffuse attenuation coefficient	Maximum	(m-1)	Average (2002-2009) Monthly climatology	Aqua-MODIS	Tyberghein *et al.* (2012)
Salinity	Average	(PSS)	DIVA interpolation of in-situ measurements	WOD 2009	Boyer *et al.* (2009)
pH	Average		DIVA interpolation of in-situ measurements	WOD 2009	Boyer *et al.* (2009)
Dissolved Oxygen	Average	ml/l	DIVA interpolation of in-situ measurements	WOD 2009	Boyer *et al.* (2009)
Gyres	Frequency	(%)	Frequency of detected gyres on AVISO Delayed Time Mean Sea Level Anomalies 1992-2011 8 days	AVISO	-

Appendix 12 - Average value of the biophysical variables for epipelagic bioregions Level I and II

Bioregion Level I	Bioregion Level II	Area (km²)	Depth (m)	SST moy. (°C)	SST max (°C)	SST min (°C)	SST range (°C)	SST front (%)	CHLO moy. (mg m-3)
I	-	25506	-72	17,55	26,07	9,78	16,29	2,21	1,95
I	1	25506	-72	17,55	26,07	9,78	16,29	2,21	1,95
II		357854	-559	19,73	26,10	14,35	11,75	3,16	0,45
II	2	133807	-362	19,01	25,67	13,46	12,21	2,88	0,45
II	3	69310	-671	19,95	25,63	15,24	10,40	2,56	0,23
II	4	154737	-642	20,24	26,98	14,36	12,63	4,04	0,67
III	-	1007825	-1354	19,46	25,75	14,40	11,35	5,17	0,26
III	5	129532	-1912	18,09	24,47	13,07	11,40	6,29	0,31
III	6	38161	-751	18,68	23,74	15,03	8,71	5,37	0,51
III	7	594478	-2243	19,59	26,27	14,20	12,07	5,58	0,20
III	8	113895	-1218	19,82	25,58	15,16	10,42	5,18	0,15
III	9	91773	-668	19,19	25,68	14,01	11,67	4,82	0,25
III	12	39986	-230	22,50	28,54	17,03	11,50	2,36	0,62
IV	-	116316	-436	17,70	24,31	12,35	11,95	4,90	0,57
IV	10	27849	-579	16,99	22,65	12,37	10,28	5,19	0,59
IV	11	88467	-292	18,42	25,96	12,34	13,62	4,60	0,55
V	-	983462	-1813	21,39	27,35	16,23	11,12	5,63	0,22
V	17	19616	-870	22,33	28,67	16,75	11,93	3,32	1,50
V	13	115371	-782	22,14	27,93	16,98	10,95	4,78	0,15
V	14	33620	-3018	20,80	26,41	15,98	10,44	6,07	0,11
V	15	24174	-2500	21,01	26,61	16,24	10,37	7,26	0,11
V	16	790681	-1937	21,23	27,27	16,04	11,23	5,85	0,11

CHLO max (mg m-3)	CHLO min (mg m-3)	CHLO range (mg m-3)	CHLO front (%)	DA moy. (m-1)	DA min (m-1)	DA max (m-1)	Salinity avg. (PSS)	pH moy.	Gyres (%)
3,67	1,06	2,60	0,98	0,13	0,17	5,60	35,08	8,32	0,00
3,67	1,06	2,60	0,98	0,13	0,17	5,60	35,08	8,32	0,00
0,81	0,22	0,59	1,63	0,05	0,07	5,24	38,04	8,22	0,00
0,84	0,22	0,62	1,40	0,06	0,09	5,37	37,77	8,23	0,00
0,39	0,13	0,26	1,30	0,04	0,05	5,19	38,81	8,21	0,00
1,20	0,32	0,88	2,19	0,06	0,09	5,15	37,55	8,23	0,00
0,49	0,14	0,35	4,39	0,05	0,07	5,27	37,89	8,21	0,45
0,75	0,15	0,60	8,01	0,06	0,09	5,36	38,08	8,24	0,03
0,99	0,26	0,73	3,24	0,07	0,10	5,47	36,61	8,21	0,48
0,38	0,10	0,28	5,92	0,04	0,06	5,27	37,59	8,21	1,39
0,22	0,09	0,13	3,73	0,04	0,04	5,23	38,89	8,19	0,01
0,44	0,13	0,32	2,58	0,05	0,07	5,29	37,55	8,22	0,04
1,03	0,36	0,67	1,73	0,06	0,08	4,92	39,06	8,17	0,00
1,02	0,28	0,73	3,43	0,07	0,10	5,44	37,45	8,27	0,00
1,11	0,28	0,83	3,20	0,08	0,11	5,41	37,54	8,26	0,00
0,92	0,29	0,63	3,66	0,07	0,09	5,47	37,35	8,27	0,00
0,36	0,12	0,23	5,82	0,04	0,05	4,99	38,81	8,17	1,71
2,36	0,84	1,51	5,32	0,09	0,11	4,95	39,02	8,16	0,03
0,25	0,08	0,17	2,64	0,04	0,05	4,93	39,13	8,15	0,13
0,20	0,07	0,13	6,69	0,03	0,04	5,08	39,06	8,16	13,24
0,18	0,07	0,12	8,97	0,03	0,04	5,07	39,06	8,15	2,20
0,20	0,07	0,13	6,13	0,03	0,04	4,99	38,67	8,17	0,92

Appendix 13 - Average value of the bioregions level III

Bioregion Level I	Bioregion Level II	Bioregion Level III	Bioregion (code)	Area (km²)	Depth (m)	SST moy. (°C)	SST max (°C)	SST min (°C)	SST range (°C)
I	1	1	I-1-1	25506	-72	17,55	26,07	9,78	16,29
II	2	2	II-2-2	133807	-362	19,01	25,67	13,46	12,21
II	3	4	II-3-4	69310	-671	19,95	25,63	15,24	10,40
II	4	7	II-4-7	154737	-642	20,24	26,98	14,36	12,63
III	12	9	III-12-9	39986	-230	22,50	28,54	17,03	11,50
III	5	19	III-5-19	77238	-2376	17,83	23,97	12,88	11,10
III	5	36	III-5-36	52294	-1448	18,36	24,97	13,27	11,70
III	6	12	III-6-12	38161	-751	18,68	23,74	15,03	8,71
III	7	15	III-7-15	113125	-1855	19,13	25,96	13,59	12,37
III	7	18	III-7-18	91801	-2038	19,67	26,69	13,91	12,78
III	7	20	III-7-20	81430	-2701	19,47	25,90	14,44	11,46
III	7	21	III-7-21	158713	-1960	19,49	25,94	14,45	11,49
III	7	23	III-7-23	149409	-2664	20,20	26,86	14,62	12,24
III	8	13	III-8-13	7993	-2216	20,18	26,26	15,12	11,14
III	8	16	III-8-16	56560	-985	19,97	25,31	15,67	9,64
III	8	17	III-8-17	49342	-454	19,30	25,18	14,69	10,49
III	9	10	III-9-10	2728	-678	19,31	26,04	13,86	12,18
III	9	11	III-9-11	37046	-724	18,90	25,49	13,60	11,89
III	9	14	III-9-14	40825	-871	19,13	25,93	13,73	12,20
III	9	5	III-9-5	1014	-711	19,30	25,87	13,85	12,02
III	9	6	III-9-6	10160	-354	19,34	25,09	15,00	10,09
IV	10	3	IV-10-3	27849	-579	16,99	22,65	12,37	10,28
IV	11	8	IV-11-8	88467	-292	18,42	25,96	12,34	13,62
V	13	26	V-13-26	58876	-346	22,11	27,87	16,97	10,91
V	13	29	V-13-29	56495	-1218	22,17	27,99	17,00	10,99
V	14	37	V-14-37	33620	-3018	20,80	26,41	15,98	10,44
V	15	35	V-15-35	24174	-2500	21,01	26,61	16,24	10,37
V	16	22	V-16-22	68995	-3187	20,47	26,73	15,19	11,54
V	16	24	V-16-24	105614	-2522	21,38	27,71	16,00	11,71
V	16	25	V-16-25	75385	-320	21,49	27,90	16,02	11,88
V	16	27	V-16-27	99621	-1046	21,60	27,43	16,56	10,87
V	16	28	V-16-28	130788	-2437	21,51	26,85	16,75	10,10
V	16	30	V-16-30	94457	-1791	22,22	28,32	16,89	11,43
V	16	31	V-16-31	87238	-2509	21,02	27,01	16,05	10,96
V	16	32	V-16-32	63583	-2516	20,55	26,25	15,61	10,64
V	16	33	V-16-33	65000	-1103	20,79	27,20	15,28	11,92
V	17	34	V-17-34	19616	-870	22,33	28,67	16,75	11,93

biophysical variables for epipelagic

SST front (%)	CHLO moy. (mg m-3)	CHLO max (mg m-3)	CHLO min (mg m-3)	CHLO range (mg m-3)	CHLO front (%)	DA moy. (m-1)	DA min (m-1)	DA max (m-1)	Salinity avg. (PSS)	pH moy.	Gyres (%)
2,21	1,95	3,67	1,06	2,60	0,98	0,13	0,17	5,60	35,08	8,32	0,00
2,88	0,45	0,84	0,22	0,62	1,40	0,06	0,09	5,37	37,77	8,23	0,00
2,56	0,23	0,39	0,13	0,26	1,30	0,04	0,05	5,19	38,81	8,21	0,00
4,04	0,67	1,20	0,32	0,88	2,19	0,06	0,09	5,15	37,55	8,23	0,00
2,36	0,62	1,03	0,36	0,67	1,73	0,06	0,08	4,92	39,06	8,17	0,00
5,72	0,34	0,89	0,15	0,74	7,70	0,06	0,11	5,34	38,20	8,24	0,00
6,85	0,28	0,60	0,14	0,46	8,32	0,05	0,08	5,37	37,96	8,24	0,05
5,37	0,51	0,99	0,26	0,73	3,24	0,07	0,10	5,47	36,61	8,21	0,48
5,96	0,22	0,45	0,11	0,34	5,50	0,05	0,07	5,34	37,73	8,24	0,42
5,07	0,18	0,32	0,09	0,23	5,21	0,04	0,06	5,21	37,77	8,23	0,05
5,50	0,22	0,43	0,10	0,33	6,15	0,05	0,07	5,36	37,21	8,19	5,12
5,72	0,23	0,43	0,11	0,32	6,27	0,05	0,07	5,26	37,09	8,20	0,87
5,63	0,15	0,24	0,09	0,15	6,48	0,04	0,05	5,17	38,14	8,22	0,47
4,24	0,13	0,19	0,09	0,10	3,64	0,04	0,04	5,20	38,66	8,22	0,01
5,61	0,14	0,21	0,08	0,12	3,12	0,04	0,04	5,18	39,12	8,17	0,02
5,69	0,17	0,26	0,10	0,15	4,42	0,04	0,05	5,31	38,90	8,19	0,00
5,35	0,20	0,38	0,09	0,29	3,14	0,04	0,06	5,21	37,71	8,21	0,00
5,64	0,23	0,38	0,13	0,25	2,96	0,05	0,06	5,33	38,09	8,25	0,04
4,61	0,23	0,40	0,12	0,27	4,08	0,05	0,07	5,31	37,82	8,23	0,04
5,00	0,22	0,34	0,12	0,22	0,00	0,05	0,06	5,35	37,41	8,26	0,00
3,50	0,37	0,71	0,15	0,56	2,72	0,06	0,09	5,27	36,70	8,14	0,13
5,19	0,59	1,11	0,28	0,83	3,20	0,08	0,11	5,41	37,54	8,26	0,00
4,60	0,55	0,92	0,29	0,63	3,66	0,07	0,09	5,47	37,35	8,27	0,00
4,43	0,20	0,33	0,10	0,22	1,50	0,04	0,05	4,92	39,06	8,15	0,02
5,12	0,11	0,18	0,06	0,12	3,77	0,03	0,04	4,95	39,20	8,15	0,23
6,07	0,11	0,20	0,07	0,13	6,69	0,03	0,04	5,08	39,06	8,16	13,24
7,26	0,11	0,18	0,07	0,12	8,97	0,03	0,04	5,07	39,06	8,15	2,20
5,35	0,12	0,21	0,07	0,14	5,98	0,03	0,04	5,10	38,75	8,19	0,94
5,81	0,10	0,18	0,06	0,12	6,66	0,03	0,04	4,94	38,45	8,18	2,66
5,22	0,13	0,23	0,07	0,16	5,94	0,03	0,05	5,06	37,93	8,21	0,13
5,25	0,10	0,18	0,06	0,12	4,76	0,03	0,04	4,80	38,61	8,16	0,55
5,77	0,09	0,15	0,06	0,10	5,44	0,03	0,04	5,00	39,11	8,15	1,85
5,86	0,11	0,19	0,06	0,12	6,08	0,03	0,04	4,94	39,24	8,15	0,55
6,77	0,12	0,22	0,07	0,15	6,44	0,03	0,04	5,05	39,20	8,14	0,35
6,12	0,11	0,17	0,07	0,11	6,46	0,03	0,04	4,92	38,85	8,17	0,81
6,49	0,14	0,25	0,08	0,17	7,45	0,04	0,05	5,09	37,86	8,21	0,40
3,32	1,50	2,36	0,84	1,51	5,32	0,09	0,11	4,95	39,02	8,16	0,03

Appendix 14 - table of overlapping MPA statuses

Table 1

Overlap between the MPAs statuses in km^2 (Table reads by row and column). The Pelagos Sanctuary is included in the SPAMI category. The table was done from spatial information available for 154 of the 170 MPAs and the 507 Natura 2000 sites.

	IUCN II	IUCN III	IUCN IV	IUCN V	IUCN VI	SPAMIs incl. Pelagos	UNESCO Sites	Biosphere Reserve	Ramsar Sites	Natura 2000
IUCN II	6202	0	17	0	264	1764	0	158	0	4103
IUCN III	0	1	0	0	0	0	0	0	0	1
IUCN IV	17	0	5994	0	6	1550	5	50	154	2211
IUCN V	0	0	0	934	0	13	0	87	0	777
IUCN VI	264	0	6	0	6086	31	0	0	462	1397
SPAMIs incl Pelagos	1764	0	1550	13	31	89184	29	169	154	8224
UNESCO Sites	0	0	5	0	0	29	29	0	0	29
Biosphere Reserve	158	0	50	87	0	169	0	808	0	400
Ramsar Sites	0	0	154	0	462	154	0	0	616	0
Natura 2000	4103	1	2211	777	1397	8224	29	400	0	25243

Table 2

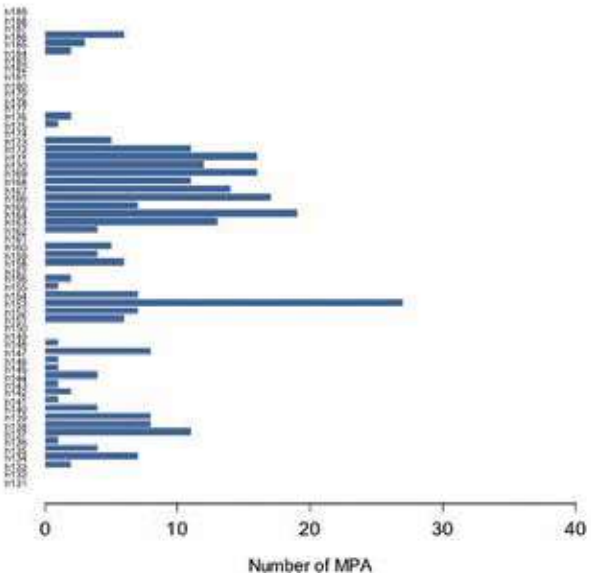
Overlap between MPAs by% (table reads by row only). For example, this table shows that MPAs in IUCN category II are also by 66.16% Natura 2000 sites. The Pelagos Sanctuary is included in the SPAMI category. The ones in yellow indicate values close to 0%, while the dark red ones indicate values close to 100%.

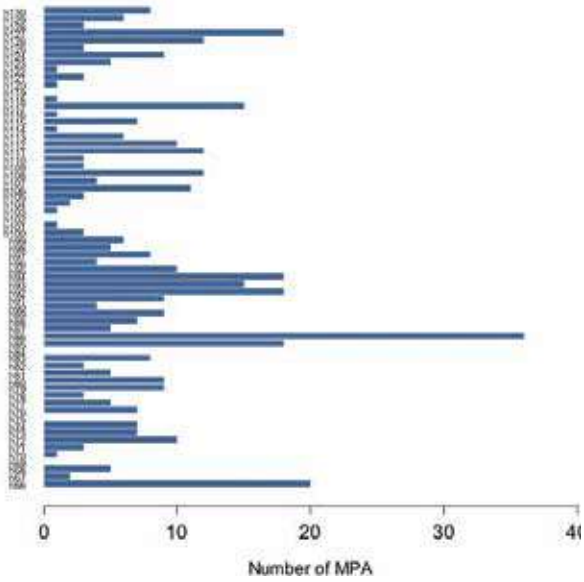
	IUCN II	IUCN III	IUCN IV	IUCN V	IUCN VI	SPAMIs incl. Pelagos	UNESCO Sites	Biosphere Reserve	Ramsar Sites	Natura 2000
Protected Surface (all statutes)	5,34%	0,00%	5,16%	0,80%	5,24%	76,73%	0,02%	0,69%	0,53%	21,72%
IUCN II		0,00%	0,27%	0,00%	4,25%	28,44%	0,00%	2,55%	0,00%	66,16%
IUCN III	0,00%		0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	81,12%
IUCN IV	0,28%	0,00%		0,00%	0,10%	25,86%	0,08%	0,83%	2,57%	36,89%
IUCN V	0,00%	0,00%	0,00%		0,00%	1,38%	0,00%	9,34%	0,00%	83,16%
IUCN VI	4,34%	0,00%	0,10%	0,00%		0,52%	0,00%	0,00%	7,59%	22,95%
SPAMIs incl Pelagos	1,98%	0,00%	1,74%	0,01%	0,04%		0,03%	0,19%	0,17%	9,22%
UNESCO Sites	0,00%	0,00%	16,68%	0,00%	0,00%	100,00%		0,00%	0,00%	100,00%
Biosphere Reserve	19,57%	0,00%	6,15%	10,80%	0,00%	20,92%	0,00%		0,00%	49,58%
Ramsar Sites	0,00%	0,00%	25,01%	0,00%	74,99%	25,01%	0,00%	0,00%		0,00%
Natura 2000	16,26%	0,00%	8,76%	3,08%	5,53%	32,58%	0,11%	1,59%	0,00%	

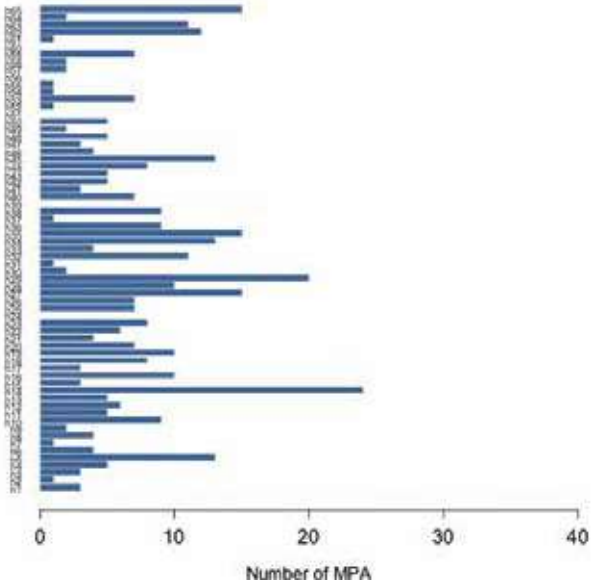
Appendix 15 - Habitats and species managers declared present in their MPA

Habitats:

Number of MPAs where a habitat was declared by the managers as being present in their MPA (sample group of 80 MPAs who answered the questionnaire) – please find the code information below.







Code information

Column	Name
h1	I. SUPRALITTORAL
h2	I. 1. MUDS
h3	I. 1. 1. Biocenosis of beaches with slowly-drying wracks under glassworts
h4	I. 2. SANDS
h5	I. 2. 1. Biocenosis of supralittoral sands
h6	I. 2. 1. 1. Facies of sands without vegetation, with scattered debris
h7	I. 2. 1. 2. Facies of depressions with residual humidity
h8	I. 2. 1. 3. Facies of quickly-drying wracks
h9	I. 2. 1. 4. Facies of tre truncks which have been washed ashore
h10	I. 2. 1. 5. Facies of phanerogams which have been washed ashore (upper part)
h11	I. 3. STONES AND PEBBLES
h12	I. 3. 1. Biocenosis of slowly drying wracks
h13	I. 4. HARD BEDS AND ROCKS
h14	I. 4. 1. Biocenosis of supralittoral rock
h15	I.4.1.1. Association with *Entophysalis deusta* and *Verrucaria amphibia*
h16	I.4.1.2. Pools with variable salinity (mediolittoral enclave)
h17	II. MEDIOLITTORAL
h18	II. 1. MUDS, SANDY MUDS AND SANDS
h19	II. 1. 1. Biocenosis of muddy sands and muds
h20	II. 1. 1. 1. Association with halophytes
h21	II. 1. 1. 2. Facies of saltworks
h22	II. 2. SANDS
h23	II. 2. 1. Biocenosis of mediolittoral sands
h24	II. 2. 1. 1. Facies with *Ophelia bicornis*
h25	II. 3. STONES AND PEBBLES
h26	II. 3. 1. Biocenosis of mediolittoral coarse detritic bottoms
h27	II. 3. 1. 1. Facies of banks of dead leaves of *Posidonia oceanica* and other phanerogams
h28	II. 4. HARD BEDS AND ROCKS
h29	II. 4. 1. Biocenosis of the upper mediolittoral rock
h30	II. 4. 1. 1. Association with *Bangia atropurpurea*
h31	II. 4. 1. 2. Association with *Porphyra leucosticta*
h32	II. 4. 1. 3. Association with *Nemalion helminthoiof* and *Rissoella verruculosa*
h33	II. 4. 1. 4. Association with *Lithophyllum papillosum* and *Polysiphonia* spp.
h34	II. 4. 2. Biocenosis of the lower mediolittoral rock
h35	II. 4. 2. 1. Association with *Lithophyllum lichenoides* (= Entablure with *L. tortuosum*)
h36	II. 4. 2. 2. Association with *Lithophyllum byssoides*
h37	II. 4. 2. 3. Association with *Tenarea undulosa*
h38	II. 4. 2. 4. Association with *Ceramium ciliatum* and *Corallina elongata*.
h39	II. 4. 2. 5. Facies with *Pollicipes cornucopiae*

h40	II. 4. 2. 6. Association with *Enteromorpha compressa*
h41	II. 4. 2. 7. Association with *Fucus virsoides*
h42	II. 4. 2. 8. *Neogoniolithon brassica-florida* concretion
h43	II. 4. 2. 9. Association with *Gelidium* spp
h44	II. 4. 2. 10. Pools and lagons sometimes associated with vermetids (infralittoral enclave)
h45	II. 4. 3. Mediolittoral caves
h46	II. 4. 3. 1. Association with *Phymatolithon lenormandii and Hildenbrandia rubra*
h47	III. INFRALITTORAL
h48	III. 1. SANDY MUDS, SANDS, GRAVELS AND ROCKS IN EURYHALINE AND EURYTHERMAL ENVIRONMENT
h49	III. 1. 1. Euryhaline and eurythermal biocenosis
h50	III. 1. 1. 1. Association with *Ruppia cirrhosa* and/or *Ruppia maritima*
h51	III. 1. 1. 2. Facies with *Ficopomatus enigmaticus*
h52	III. 1. 1. 3. Association with *Potamogeton pectinatus*
h53	III. 1. 1. 4. Association with *Zostera noltii* in euryhaline and eurythermal environment
h54	III. 1. 1. 5. Association with *Zostera marina* in euryhaline and eurythermal environment
h55	III. 1. 1. 6. Association with *Gracilaria* spp.
h56	III. 1. 1. 7. Association with *Chaetomorpha linum* and *Valonia aegagropila*
h57	III. 1. 1. 8. Association with *Halopithys incurva*
h58	III. 1. 1. 9. Association with *Ulva laetevirens* and *Enteromorpha linza*
h59	III. 1. 1. 10. Association with *Cystoseira barbata*
h60	III. 1. 1. 11. Association with *Lamprothamnium papulosum*
h61	III. 1. 1. 12. Association with *Cladophora echinus* and *Rytiphloea tinctoria*
h62	III. 2. FINE SANDS WITH MORE OR LESS MUD
h63	III. 2. 1. Biocenosis of fine sands in very shallow waters
h64	III. 2. 1. 1. Facies with *Lentidium mediterraneum*
h65	III. 2. 2. Biocenosis of well sorted fine sands
h66	III. 2. 2. 1. Association with *Cymodocea nodosa* on well sorted fine sands
h67	III. 2. 2. 2. Association with *Halophila stipulacea*
h68	III. 2. 3. Biocenosis of superficial muddy sands in sheltered waters
h69	III. 2. 3. 1. Facies with *Callianassa tyrrhena* and *Kellia corbuloides*
h70	III. 2. 3. 2. Facies with fresh water resurgences with *Cerastoderma glaucum*, and *Cyathura carinata*
h71	III. 2. 3. 3. Facies with *Loripes lacteus* and *Tapes* spp.
h72	III. 2. 3. 4. Association with *Cymodocea nodosa* on superficial muddy sands in sheltered waters
h73	III. 2. 3. 5. Association with *Zostera noltii* on superficial muddy sands in sheltered waters
h74	III. 2. 3. 6. Association with *Caulerpa prolifera* on superficial muddy sands in sheltered waters
h75	III. 2. 3. 7. Facies of hydrothermal oozes with *Cyclope neritea* and nematodes
h76	III. 3. COARSE SANDS WITH MORE OR LESS MUD
h77	III. 3. 1. Biocenosis of coarse sands and fine gravels mixed by the waves
h78	III. 3. 1. 1. Association with rhodolithes
h79	III. 3. 2. Biocenosis of coarse sands and fine gravels under the influence of bottom currents (also found in the Circalittoral)
h80	III. 3. 2. 1. Maërl facies (= Association with *Lithothamnion corallioides* and *Phymatolithon calcareum*) (can also be found as facies of the biocenosis of coastal detritic)

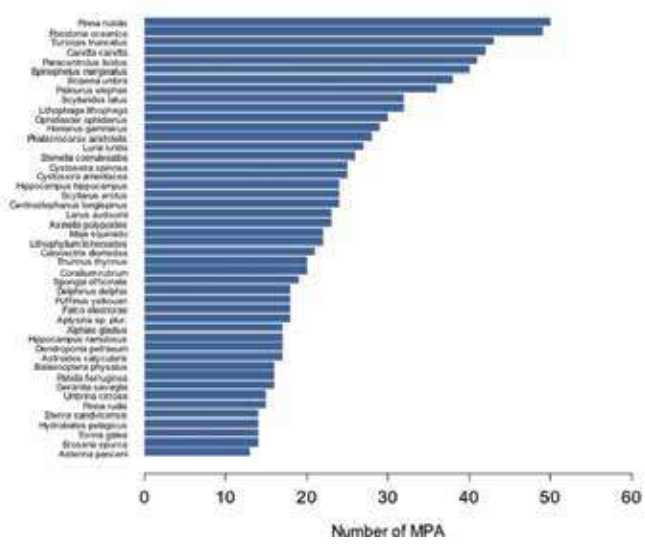
h81	III. 3. 2. 2. Association with rhodolithes
h82	III. 4. STONES AND PEBBLES
h83	III. 4. 1. Biocenosis of infralittoral pebbles
h84	III. 4. 1. 1. Facies with *Gouania wildenowi*
h85	III. 5. POSIDONIA OCEANICA MEADOWS
h86	III. 5. 1. *Posidonia oceanica* meadows (= Association with *Posidonia oceanica*)
h87	III. 5. 1. 1. Ecomorphosis of stripped meadows
h88	III. 5. 1. 2. Ecomorphosis of « barrier reef « meadows
h89	III. 5. 1. 3. Facies of dead « mattes « of *Posidonia oceanica* without much epiflora
h90	III. 5. 1. 4. Association with *Caulerpa prolifera*.
h91	III. 6. HARD BEDS AND ROCKS
h92	III. 6. 1. Biocenosis of infralittoral algae :
h93	III. 6. 1. 1. Overgrazed facies with encrusting algae and sea urchins
h94	III. 6. 1. 2. Association with *Cystoseira amentacea* (var. *amentacea*, var. *stricta*, var. *spicata*)
h95	III. 6. 1. 3. Facies with Vermetids
h96	III. 6. 1. 4. Facies with *Mytilus galloprovincialis*
h97	III. 6. 1. 5. Association with *Corallina elongata* and *Herposiphonia secunda*
h98	III. 6. 1. 6. Association with *Corallina officinalis*
h99	III. 6. 1. 7. Association with *Codium vermilara* and *Rhodymenia ardissonei*
h100	III. 6. 1. 8. Association with *Dasycladus vermicularis*
h101	III. 6. 1. 9. Association with *Alsidium helminthochorton*
h102	III. 6. 1. 10. Association with *Cystoseira tamariscifolia* and *Saccorhiza polyschides*
h103	III. 6. 1. 11. Association with *Gelidium spinosum* v. *hystrix*
h104	III. 6. 1. 12. Association with *Lobophora variegata*
h105	III. 6. 1. 13. Association with *Ceramium rubrum*
h106	III. 6. 1. 14. Facies with *Cladocora caespitosa*
h107	III. 6. 1. 15. Association with *Cystoseira brachycarpa*
h108	III. 6. 1. 16. Association with *Cystoseira crinita*
h109	III. 6. 1. 17. Association with *Cystoseira crinitophylla*
h110	III. 6. 1. 18. Association with *Cystoseira sauvageauana*
h111	III. 6. 1. 19. Association with *Cystoseira spinosa*
h112	III. 6. 1. 20. Association with *Sargassum vulgare*
h113	III. 6. 1. 21. Association with *Dictyopteris polypodioides*
h114	III. 6. 1. 22. Association with *Calpomenia sinuosa*
h115	III. 6. 1. 23. Association with *Stypocaulon scoparium* (=*Halopteris scoparia*)
h116	III. 6. 1. 24. Association with *Trichosolen myura* and *Liagora farinosa*
h117	III. 6. 1. 25. Association with *Cystoseira compressa*
h118	III. 6. 1. 26. Association with *Pterocladiella capillacea* and *Ulva laetevirens*
h119	III. 6. 1. 27. Facies with large hydrozoa
h120	III. 6. 1. 28. Association with *Pterothamnion crispum* and *Compsothamnion thuyoides*
h121	III. 6. 1. 29. Association with *Schottera nicaeensis*
h122	III. 6. 1. 30. Association with *Rhodymenia ardissonei and Rhodophyllis divaricata*

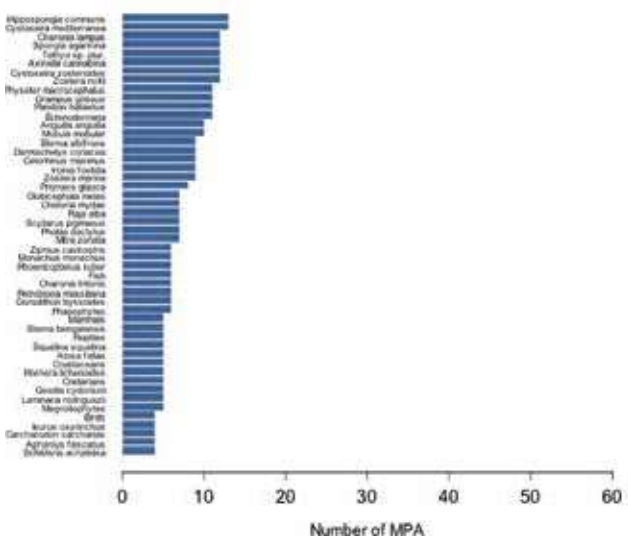
h123	III. 6. 1. 31. Facies with *Astroides calycularis*
h124	III. 6. 1. 32. Association with *Flabellia petiolata* and *Peyssonnelia squamaria*
h125	III. 6. 1. 33. Association with *Halymenia floresia* and *Halarachnion ligulatum*
h126	III. 6. 1. 34. Association with *Peyssonnelia rubra* and *Peyssonnelia* spp.
h127	III. 6. 1. 35. Facies and association of Coralligenous biocenosis (in enclave)
h128	IV. CIRCALITTORAL
h129	IV. 1. MUDS
h130	IV. 1. 1. Biocenosis of coastal terrigenous muds
h131	IV. 1. 1. 1. Facies of soft muds with *Turritella tricarinata communis*
h132	IV. 1. 1. 2. Facies of sticky muds with *Virgularia mirabilis* and *Pennatula phosphorea*
h133	IV. 1. 1. 3. Facies of sticky muds with *Alcyonium palmatum* and *Stichopus regalis*
h134	IV. 2. SANDS
h135	IV. 2. 1. Biocenosis of the muddy detritic bottom
h136	IV. 2. 1. 1. Facies with *Ophiothrix quinquemaculata*
h137	IV. 2. 2 Biocenosis the coastal detritic bottom
h138	IV. 2. 2. 1. Association with rhodolithes
h139	IV. 2. 2. 2. Maerl facies (*Lithothamnion corallioides* and *Phymatholithon calcareum*)
h140	IV. 2. 2. 3. Association with *Peyssonnelia rosa-marina*
h141	IV. 2. 2. 4. Association with *Arthrocladia villosa*
h142	IV. 2. 2. 5. Association with *Osmundaria volubilis*
h143	IV. 2. 2. 6. Association with *Kallymenia patens*
h144	IV. 2. 2. 7. Association with *Laminaria rodriguezii* on detritic
h145	IV. 2. 2. 8. Facies with *Ophiura texturata*
h146	IV. 2. 2. 9. Facies with Synascidies
h147	V. 2. 2. 10. Facies with large Bryozoa
h148	IV. 2. 3. Biocenosis of shelf-edge detritic bottom
h149	IV. 2. 3. 1. Facies with *Neolampas rostellata*
h150	IV. 2. 3. 2. Facies with *Leptometra phalangium*
h151	IV. 2. 4. Biocenosis of coarse sands and fine gravels under the influence of bottom currents (biocenosis found in areas under specific hydrodynamic conditions – straits , also found in the Infralittoral)
h152	IV. 3. HARD BEDS AND ROCKS
h153	IV. 3. 1. Coralligenous biocenosis
h154	IV. 3. 1. 1. Association with *Cystoseira zosteroides*
h155	IV. 3. 1. 2. Association with *Cystoseira usneoides*
h156	IV. 3. 1. 3. Association with *Cystoseira dubia*
h157	IV. 3. 1. 4. Association with *Cystoseira corniculata*
h158	IV. 3. 1. 5. Association with *Sargassum* spp (indigènes).
h159	IV. 3. 1. 6. Association with *Mesophyllum lichenoides*
h160	IV. 3. 1. 7. Association with *Lithophyllum frondosum* and *Halimeda tuna*
h161	IV. 3. 1. 8. Association with Laminaria ochroleuca
h162	IV. 3. 1. 9. Association with *Rodriguezella strafforelli*
h163	IV. 3. 1. 10. Facies with *Eunicella cavolinii*

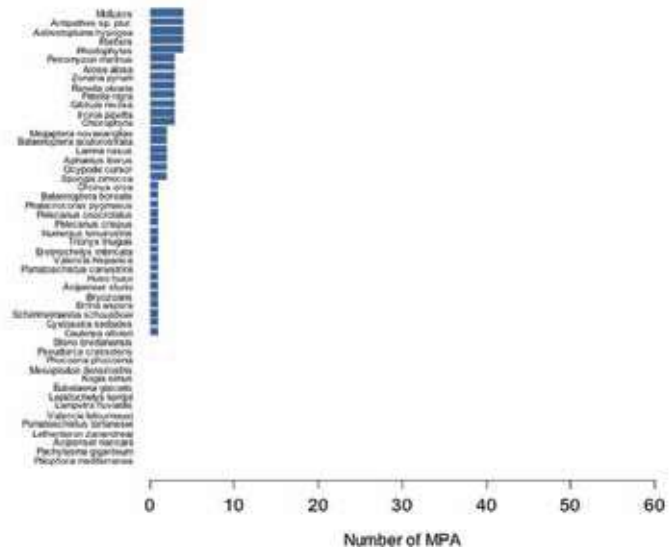
h164	IV. 3. 1. 11. Facies with *Eunicella singularis*
h165	IV. 3. 1. 12. Facies with *Lophogorgia sarmentosa*
h166	IV. 3. 1. 13. Facies with *Paramuricea clavata*
h167	IV. 3. 1. 14. Facies with *Parazoanthus axinellae*
h168	IV. 3. 1. 15. Coralligenous plateforms
h169	IV.3. 2. Semi-dark caves (also in enclave in upper stages)
h170	IV. 3. 2. 1. Facies with *Parazoanthus axinellae*
h171	IV. 3. 2. 2. Facies with *Corallium rubrum*
h172	IV. 3. 2. 3. Facies with *Leptosammia pruvoti*
h173	IV. 3. 3. Biocenosis of shelf-edge rock
h174	V. BATHYAL
h175	V. 1. MUDS
h176	V. 1. 1. Biocenosis of bathyal muds
h177	V. 1. 1. 1. Facies of sandy muds with *Thenea muricata*
h178	V. 1. 1. 2. Facies of fluid muds with *Brissopsis lyrifera*
h179	V. 1. 1. 3. Facies soft muds with *Funiculina quadrangularis* and *Apporhais seressianus*
h180	V. 1. 1. 4. Facies of compact muds with *Isidella elongata*
h181	V. 1. 1. 5. Facies with *Pheronema grayi*
h182	V. 2. SANDS
h183	V. 2. 1. Biocenosis of bathyal detritic sands with *Grypheus vitreus*
h184	V. 3. HARD BEDS AND ROCKS
h185	V. 3. 1. Biocenosis of deep sea corals
h186	V. 3. 2. Caves and ducts in total darkness (in enclave in the upper stages)
h187	VI. ABYSSAL
h188	VI. 1. MUDS
h189	VI. 1. 1. Biocenosis of abyssal muds

Species:

Number of MPAs where the species was declared by managers as being present in their MPA (sample group of 80 MPAs who answered the questionnaire







The regarded most representative species in the Mediterranean declared by managers in their MPA (in grey = pelagic species)

Citically endangered species (CR)
Endangered species (EN)
Vulnerable species (VU)
Near threatened (NT)

	Species or group of species		IUCN Status	Number of MPAs where the species is declared present
Phanerogams	*Posidonia oceanica*	Posidonia	-	60
	Zostera	Zostera	-	17
	Cystoseira	Cystoseira	-	35
Algae	*Lithophyllum lichenoides*	Exposed and rocky shores	-	22
Sponges	*Spongia officinalis*	Sponges	-	28
Coral	*Corallium rubrum*	Deep Coralligenous/Red coral)	-	18
Molluscs	*Charonia tritonis*	Triton's trumpet	-	14
	Lithophaga lithophaga	Date mussel	-	48
	Patella ferruginea	Patella (giant limpet)	-	25
	Pinna nobilis	Pinna (giant mussel)	-	69
Crustaceans	*Maja squinado*	Crustaceans - spider	-	22
	Scyllarides latus	Crustaceans – slipper lobster	-	40
Fish	*Hippocampus hippocampus*	Short-snouted Hippocampus à nez court	NT	31
	Hippocampus ramulosus (cf guttulatus)	Long-snouted Hippocampus	NT	16
	Merluccius merluccius	Hake		
	Opeatogenys gracili	Pigmy clingfish		
	Epinephelus marginatus	Dusky Grouper		59
	Sciaena umbra	Brown Meager		47
	Umbrina cirrosa	Shi Drum		
	Pomatoschistus microps	Common Gobie		
	Pomatoschistus minutus	Sandy Gobie		
	Pomatoschistus tortonesei	Tortonese's Gobie		
	Labrus viridis	Green Wrasse		
	Dentex dentex	Common Dentex		
	Thunnus thynnus	Bluefin Tuna		22
	Xiphias gladius	Swordfish	NT	26
	Syngnathus taenionotus	Darkflank Pipefish		

Sharks, rays et chimeras	*Carcharodon carcharias*	Great white shark		5
	Cetorhinus maximus	Basking shark		
	Mobula mobular	Giant Devil Ray		
	Squalus acanthias	Spiny Dogfish		
	Squatina squatina	Angel Shark		6
	Squatina oculata	Smoothback Angel Shark		
	Rostroraja alba	White Skate		16
	Leucoraja melitensis	Maltese Ray		
Marine mammals	*Delphinus delphis*	Short-beaked Common Dolphin		27
	Monachus monachus	Monk Seal		14
	Physeter macrocephalus	Sperm Whale		10
	Stenella coeruleoalba	Striped Dolphin or Blue White Dolphin		34
	Tursiops truncatus	Bottlenose Dolphin		61
Turtles	*Caretta caretta*	Loggerhead Turtle		60
Birds	*Falco eleonorae*	Eleonora's Falcon		19
	Larus audouinii	Audouin's Gull		33
	Pandion haliaetus	Osprey		21
	Phalacrocorax aristotelis	Common Shag		39
	Puffinus yelkouan	Yelkouan Shearwater		18

Appendix 16 - Connectivity

This appendix provides a preview of the work currently under review which was carried out to show how modelling could support understanding population connectivity in the context of MPAs. This work was undertaken by Crochelet, E. *(in press.).*

Ecological coherence within the network of MPAs depends partly upon the level of connectivity between MPAs allowing the flow of larvae and organic matter. The distance of these exchanges depends on the species characteristics (sessile, mobile, migratory species) and their biology (reproductive mode, larval dispersal, …). To date, few studies have been carried out on connectivity in the Mediterranean (Planes, 2005; López-Sanz *et al.,* 2009; Basterretxea *et al.,* 2012; Di Franco *et al.,* 2012) and most of these have focused on the western basin and the Adriatic. These research studies are based on local measurements (biomass, genetic or otolith chemistry).

Analysis of the connectivity between sites is complex; in this study, a three-tiered approach was used. First, a proximity analysis between MPAs was carried out (the results are presented in Chapter 4). Then a larval dispersal simulation was run using an iconic species of the Mediterranean, the Grouper *Epinephelus marginatus*. Finally, focus was set on simulating the dispersion of a drifting particle released in currents over a 30 day period. The MPAs used in this analysis are those classified in IUCN II and/or IV categories (of which there are 113) due to their protection status for marine wildlife.

Methodology: the hydrodynamic connectivity model

The modeling of larval and particles connectivity in the Mediterranean Sea was carried out using the "Coral Reef Connectivity Simulation" tool developed by Treml *et al.* (2008) and which is part of the "Marine Geospatial Ecology Tools" software (Roberts *et al.,* 2010).

In this section we will take the example of the dusky grouper's larval dispersal. This method also applies to the particle disperal study.

The MGET tool simulates larval dispersal by an Eulerian advection-diffusion in two dimensions. Thus, the larvae leave their 'natal' site at t0 and move passively

via advection (currents) and diffusion (turbulence) during the simulation process. Model outputs have a temporal series of images representing the concentrations of larvae at time t and a matrix of connectivity between the source and sink sites.

For the implementation of this simulation, we prepared all the necessary products to initialise the "landsea mask" tool and the map of the source / sink sites. We determined the geographic extent of the study area using the data from GSHHS database (Global Self-consistent, Hierarchical, High-resolution Shoreline Database, ftp://ftp.soest.hawaii.edu/pwessel/gshhs/, Wessel & Smith, 1996).

We then defined the source / sink sites: a site every 30 km along the Mediterranean

coastline (Figure 1). This data is shown in the World Mercator system, datum WGS 84 with a 14 km resolution. The next step was to integrate the geostrophic currents

speed data in the simulation. They are available on the AVISO website (Archiving, Validation and Interpretation of Satellite Oceanographic data) and can be downloaded

via the toolbox MGET by using the OPeNDAP protocol (Open-source Project for a Network Data Access Protocol). We used the daily products from "Med DTUpd Merged MADT" with a 1/8 ° resolution.

Finally, the tool was configured to simulate larval dispersal of the *Epinephelus marginatus* species whose larval lifespan was set to 30 days for this simulation. The release date of larvae (t0) is the first day of each month during the breeding period (from June to September) and over 6 years (2005-2010). One must also note down the initial amount of larvae (N0) in the nesting sites, as well as the diffusivity coefficient. We kept the default values which were 10 000 larvae per km^2 and $25m^2.s\text{-}1$ respectively. The "current number" parameter must also be defined so that the time step calculation is less than or equal to 0.25.

An average of the connectivity matrices recovered at the output of the model for each month was taken to obtain a connectivity matrix. This gives the exchanges between all the designated source and sink sites along the Mediterranean coastline. These sites were then separated into 'MPA sites' and 'outside MPA sites' (or coastal). To do this we selected the sites within the perimeter of each MPA.

DISPERSAL STUDY

The connectivity analysis between MPAs was assessed using the dispersal model described in the methodology, applied at first to an iconic Mediterranean fish species. Hence, the dusky grouper was chosen to illustrate a scenario of connectivity in the Mediterranean basin (see Box ''The Dusky Grouper, *Epinephelus marginatus*, larval dispersal modelling"). Simulations were run for six years (2005-2010), over the breeding period intervals of the species (from June to September).

A better knowledge of fish larval transport is fundamental for understanding connectivity between distant populations which can be separated by tens to hundreds of kilometres. Dispersal is favoured by species which have a larval pelagic stage in their life cycle. Indeed, the eggs are not attached to the substrate but released into the open water.

Various techniques are used to assess patterns of larval dispersal and fish population connectivity across the marine environment, including genetics (Shulman, 1998; Planes, 2002), chemical tagging (Jones *et al.,* 1999; Swearer *et al.,* 1999), stable isotopes (Peterson *et al.,* 1985; Schwarcz et al., 1998; Blamart *et al.,* 2002), otolith chemistry (Fowler *et al.,* 1995; Campana *et al.,* 1997) and otolith shape analysis (Smith 1992; Torres *et al.,* 2000). Given the limited feasibility of the above mentioned methods across large regions, numerical transport models have been developed to infer pattern of larval dispersal (Schultz and Cowen, 1994; Roberts, 1997; Cowen *et al.,* 2000; Treml *et al.,* 2008; Mora *et al.,* 2011). These models are increasingly being used worldwide for the design of MPAs (Planes *et al.,* 2009), fisheries management (Gaines *et al.,* 2010) and disaster management (oil leaks, tsunamis, cyclones) (Allison *et al.,* 2003).

Currents are an important connectivity parameter. General surface circulation in the Mediterranean Sea is rather complex. Surface currents follow intricate paths (see Fig. 2) which fluctuate according to the meteorological conditions and seasons. They also display temporal variability from day to season. They can form gyres (eddies) of a few hundred kilometers, lasting from several months to several years (Millot and Taupier-Letage, 2005), but also circulation patterns that are impredictable and/or intermittent (Astraldi *et al.,* 1995; Artegiani *et al.,* 1997).

The second stage of the analysis consisted in processing a connectivity scenario for a passive particle drifting with the currents over a 30 day period, such as with organic matter. Simulations were produced over a year, from November 2009 to October 2010. The connectivity matrices resulting from the simulation runs were averaged to obtain one averaged connectivity matrix over a full year (see Box ''Current connectivity modelling for passive particles").

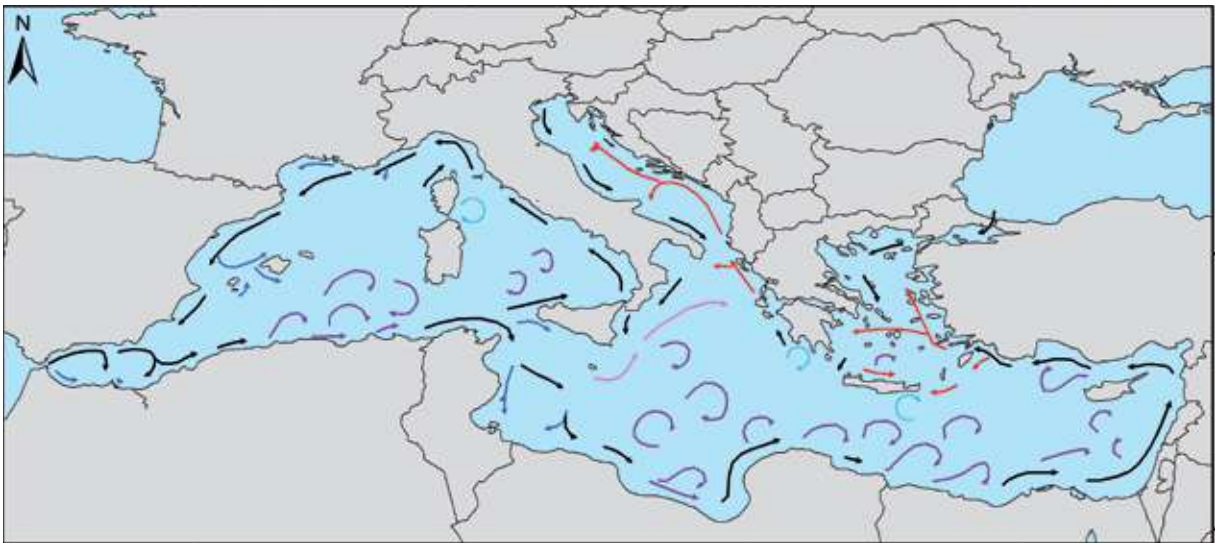


Fig. 2. General surface circulation in the Mediterranean Sea (according to Millot and Taupier-Letage, 2005)

Results of the dusky grouper, Epinephelus marginatus, larval dispersal modelling

The aim of this analysis is to understand the dispersal possibilities of fish larvae, using the dusky grouper (*Epinephelus marginatus*) as an example in the Mediterranean Sea. A connectivity model was run (Treml *et al.,* 2008) under the «Marine Geospatial Ecology Tools» (Roberts *et al.,* 2010). This model takes in currents' data provided by satellite imagery and the specific pelagic larval duration.

The Dusky Grouper Epinephelus marginatus (Pisces, Serranidae), which occurs widely, is regarded as an iconic species of the Mediterranean Sea. It lives near the sea bed in rocky and rugged areas down to a depth of 50 m., along the Mediterranean coastline (Heemstra and Randall, 1993). Adults are sedentary and territorial (Lembo *et al.,* 1999, Pastor *et al.,* 2009). Reproduction takes place during the summer months (Zabala *et al.,* 1997; Planes, 2005; Hereu *et al.,* 2006; Reñones *et al.,* 2010). Its pelagic larval duration is on average 30 days in the natural environment (Macpherson and Raventos, 2006).

Connectivity matrices produced for each month over the reproduction period (from June to September) are averaged from 2005 to 2010. We thus obtained one averaged connectivity matrix over the study period. The latter is illustrated in Fig. 3, showing «connections» between pairs of sites. Values are classified by quartiles, from the highest to the lowest connectivity. The first quartile (a) corresponds to «strong flow» connections while the bottom quartile corresponds to «weak flow» connections.

As mentioned previously, we focused only on the 113 MPAs classified with IUCN categories II and/or IV because they have a protection status for marine wildlife.

Figure 3 shows the resulting connections between MPAs for the simulation run of *E. marginatus* during its breeding period. The connectivity level is 6.8% between pairs of sites (ratio between 'manifest' connections and potential connections). The average connection distance between two MPAs is 179.86 km (SD = 127 km, min = 14 km, max = 760.6 km). Two distinct areas stand out: the western basin with more inter-connections than the eastern part of the Mediterranean. Thus, connections occur between MPAs in Spain, France, Italy, Malta, Tunisia, Algeria and Morocco. This area might be connected, over several generations, to MPAs in the Adriatic Sea via Sicily and then Malta. In the eastern part, there are exchanges between MPAs of Cyprus and Turkey and between MPAs of Syria, Lebanon, Israel and Turkey. Exchanges between the MPAs in the Aegean Sea (Greece, Turkey) appear to be nonexistent. MPAs in Egypt and Tunisia seem to be isolated. The separation into two zones in the Mediterranean Sea reflects the lower MPA network developed in the Eastern basin.

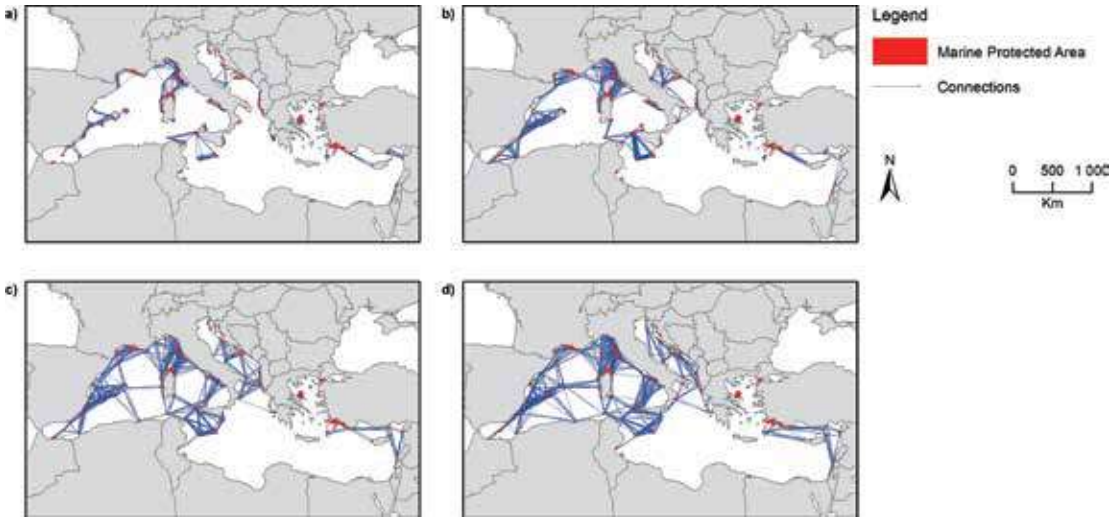


Fig. 3. Connections between MPAs for the simulation run of *E. marginatus* during its breeding period. The connectivity rate is classified by quartiles based on connection flow: a) very strong flow, b) strong flow c) weak flow) very weak flow

Results of the hydrodynamic connectivity modelling of passive particles

Hydrodynamic connectivity analysis of passive particles is focused on connections between MPAs (see Fig. 4), from MPAs towards the coast (including MPA), and from the coast (including MPA) to MPAs. As mentioned previously we only focused on MPAs classified under IUCN categories II and/or IV (there are 113) because they have a protection status for marine wildlife.

Figure 4 shows the connections between MPAs resulting from the simulations, with a connectivity level of 6.33% between pairs of sites (ratio between realised connections and potential connections). The average connection distance between two MPAs is 183.8 km (SD = 131.7 km, min = 14 km, max = 706.8 km). Two distinct areas stand out: the western basin with more inter-connections than the eastern part of the Mediterranean.

Thus, connections occur between MPAs in Spain, France, Italy, Malta, Tunisia, Algeria and Morocco. This area appears to be connected to MPAs in the Adriatic Sea. The exchanges go from the MPAs in the Adriatic Sea to the North West Mediterranean via Sicily and then Malta. Exchanges between MPAs in the Aegean Sea are not manifest. Finally, exchanges between MPAs of the eastern Mediterranean occur, except with the Egyptian ones which seem to be isolated.

The above mentioned split of the Mediterranean sea into two distinct zones would appear to stem from the simple fact that the system of MPAs is less developed in the eastern basin than the one in the western basin.

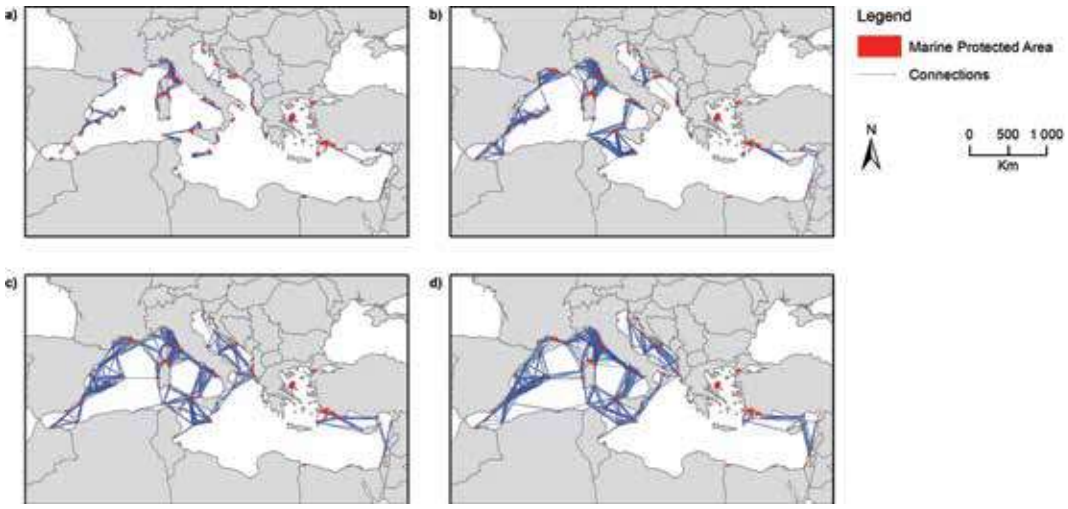


Fig. 4. Connections between MPAs. The connectivity rate is classified by quartiles based on connection flow: a) very strong flow, b) strong flow c) weak flow) very weak flow

The connectivity analysis was then conducted to simulate the passive particles connectivity rates between pairs of sites in three different configurations:

- From MPAs to the coast
- From coast to MPAs
- From coast to coast

Sites comprise, as mentioned previously, the 113 MPAs selected according to their IUCN ascribed status and the source / sink sites (set at every 30 km along the Mediterranean coastline).

Although the results show a rather low connectivity rate, they provide a general indication of country to country flow and of the usefulness of MPAs which, following cross-checking with other methodologies used for assessing population connectivity, could be most useful in the future design of networks of MPAs in the Mediterranean.

Appendix 17 - Key features of the MPAs in the sample group

Reminder: Out of a total of 170 existing Mediterranean MPAs currently listed in MAPAMED and the 507 Natura 2000 sites at sea, 221 sites have a management structure (154 MPAs and 67 Natura 2000 sites) among these 93 responded to the questionnaire sent by MedPAN and RAC/SPA; 80 MPAs, including 9 Natura 2000 sites, namely 36% were selected for the study on the management effort, their answers corresponded to the questionnaire and the results can be used significantly.

Below are the elements used for the MPAs characterisation.

THE MPAs MAIN OBJECTIVES

In the questionnaire 11 types of objectives were proposed which cover the usual scope of objectives assigned to MPAs and can be grouped into the following objectives: conservation, sustainable management of activities related to the sea, reinforcing knowledge, highlight cultural and/or historical heritage, education and awareness raising. Four maximum answers were possible and corresponded to the MPAs main objectives with no order of priority.

Geopolitical Region	Number of MPAs in sample group	Country	Number of MPAs	Surface Area
North East	13	Albania	1	126
		Croatia	6	449
		Greece	2	490
		Slovenia	3	1.8
		Turkey	1	820
North West	*60*	Spain	23	864
		France	11	5 900
		Italy	19	1 665
		Malta	5	191
		Monaco	2	0.5
South	*7*	Algeria	1	27
		Lebanon	2	0.2
		Libya	1	18
		Morocco	1	196
		Tunisia	2	208

Conservation	Conservation of biodiversity Conservation of key species Conservation of key habitats Maintaining the ecological functions in connection with the services provided by ecosystems
Sustainable management of activities	Sustainable management of fishing Sustainable management of tourism Sustainable management of other socio-economic activities Conflict resolution
Reinforcing knowledge	
Highlight cultural and / or historical heritage	
Education and awareness raising	

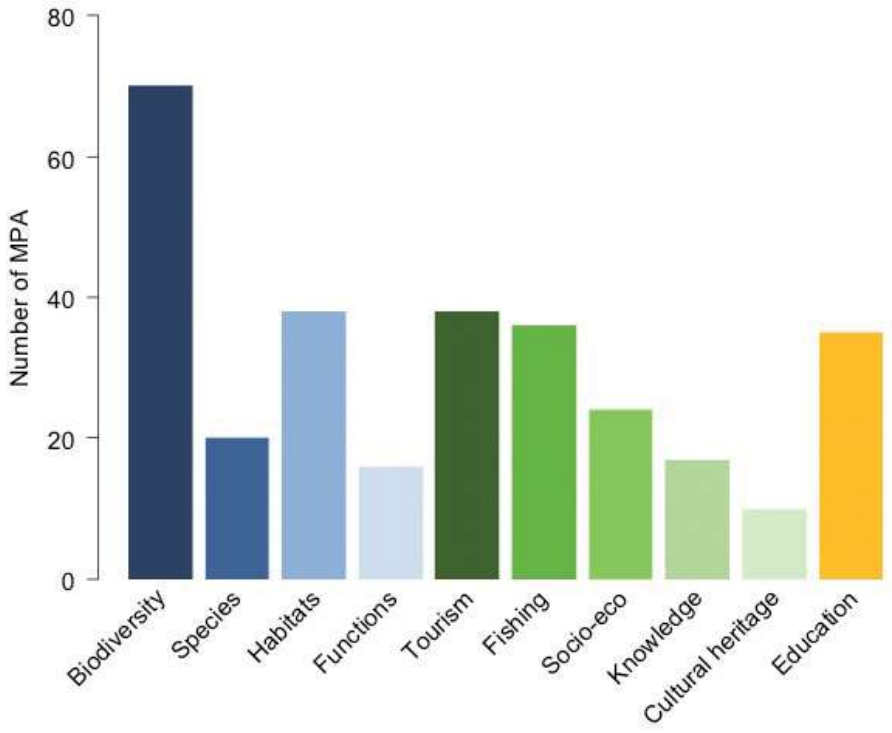


Figure 4: The MPAs main objectives (maximum of 4 answers per MPA; 3 MPAs – 4% - with no information on their main objectives)

Most of the MPAs in the study indicate that the conservation of biodiversity is one of their four main objectives (91% of MPAs who responded to this question). This was followed by the protection of habitats (49%), tourism management (46%), and education (46%). Fishery management came next (45%) as well as the protection of species (26%); the other objectives were only mentioned by less than 20% of MPAs. All the MPAs have at least conservation as an objective (conservation of biodiversity, key habitats or species). Proportionally, MPAs from the North-West and the East mentioned more frequently objectives focusing on sustainability (tourism, fishing and other socio-economic activities). Education and awareness raising objectives are a bigger priority for the MPAs in the South.

STATUS OF MPAs

According to our grouping, the 80 selected MPAs are divided into:

- 45 MPAs in Group A (National Park type)
- 15 MPAs in Goup B (Nature Reserves type)
- 9 Natura 2000 sites (Natura 2000)
- 3 MPAs in Group C (Landscape Park type)
- 8 MPAs in Group D (designations specific to a country)

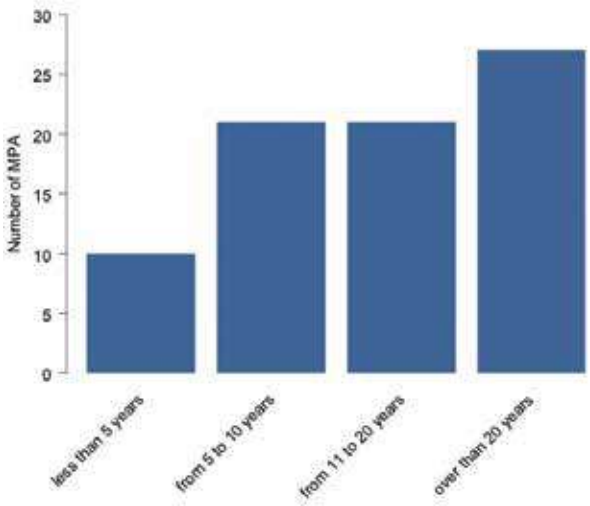
Among these are 18 MPAs which also have a SPAMI international designation and one is a Biosphere Reserve.

Distribution of MPA types (groups) per country

Country	Group A	Group B	Natura 2000	Group C	Group D
Albania	1	0	0	0	0
Algeria	0	1	0	0	0
Croatia	5	1	0	0	0
Spain	6	4	5	0	8
France	4	3	4	0	0
Greece	2	0	0	0	0
Italy	18	1	0	0	0
Lebanon	0	2	0	0	0
Libya	1	0	0	0	0
Malta	5	0	0	0	0
Morocco	1	0	0	0	0
Monaco	0	2	0	0	0
Slovenia	0	0	0	3	0
Tunisia	1	1	0	0	0
Turkey	1	0	0	0	0

AGE OF MPAs

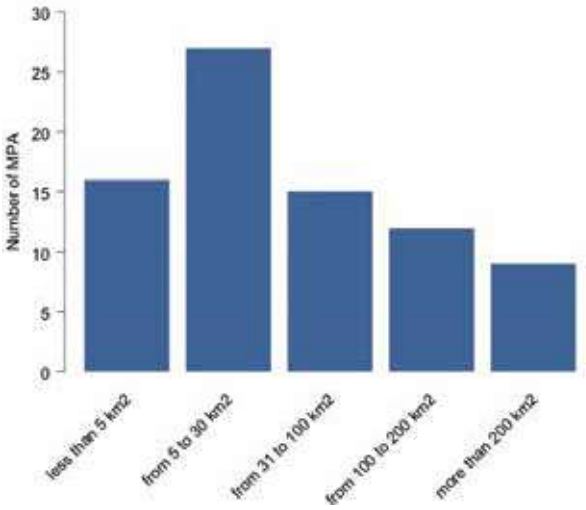
There is a diverse range of ages among the MPAs surveyed; the sample group includes 34% of MPAs which are over 20 years old (n= 27 MPAs), 26% of MPAs between 10 and 20 years old (n= 21 MPAs), then more recent MPAs of 5 to 10 years old (21 MPAs - 26%) and finally MPAs of less than 5 years old (10 MPAs - 12%). A lot of the recent MPAs or those being planned could not be taken into account in this study as they do not necessarily have a team or all the information to respond to the survey



Age of MPA	Less than 5yrs old	5 to 10yrs old	11 to 20 yrs old	Over 20 yrs old
North-West	8	18	18	16
South	0	2	3	1
North-East	2	1	0	10
Total	**10**	**21**	**21**	**27**

SIZE OF MPAs

The surface area of the MPAs is divided into relatively homogeneous size groups - the group of 5-30 km² is the largest (27 MPAs - 34%). In the South there are no MPAs over 200 km², but there are a proportionally larger number of MPAs of 100 to 200 km² compared to the other two regions. In the northeast the MPA surface areas are fairly homogeneous. In the northwest most of them are in the 5 to 30 km² size group.



The distribution of size groups per country

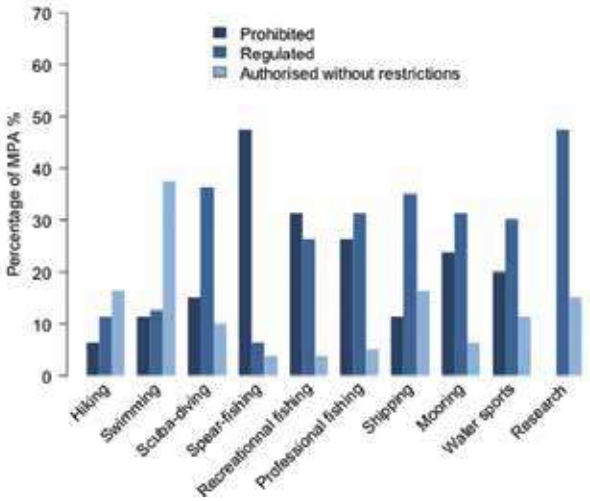
Marine Surface area (km²)	Less than 5	From 5 to 30	From 30 to 100	From 100 to 200	Over 200
North-West	12	23	11	7	7
South	1	2	1	2	0
North-East	3	2	3	3	2
Total	16	27	15	12	9

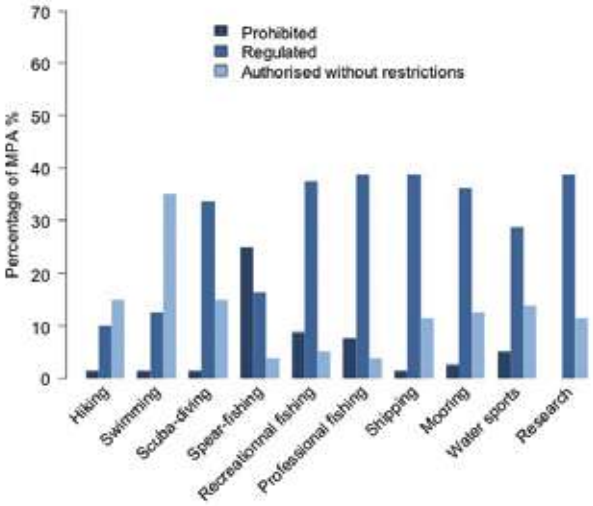
Marine Surface (km²)	Less than 5	From 5 to 30	From 30 to 100	From 100 to 200	Over 200
Albania	0	0	0	1	0
Algeria	0	1	0	0	0
Croatia	0	2	2	2	0
Spain	5	11	5	1	1
France	0	4	1	2	4
Greece	0	0	1	0	1
Italy	3	6	5	3	2
Lebanon	1	0	0	0	0
Libya	0	1	0	0	0
Malta	2	2	0	1	0
Morocco	0	0	0	1	0
Monaco	2	0	0	0	0
Slovenia	3	0	0	0	0
Tunisia	0	0	1	1	0
Turkey	0	0	0	0	1

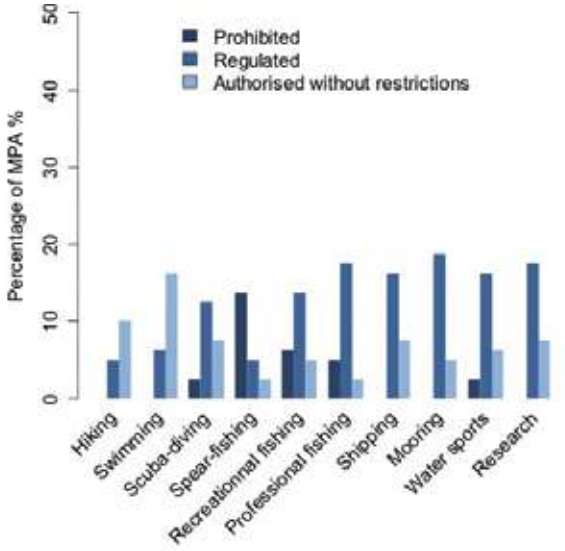
MPA ZONING AND SEA USES IN THE DIFFERENT ZONES

In addition to the strict nature reserve and no-fishing zones (see corresponding chapter) 38 MPAs have zoning with one or more areas where activities are prohibited or regulated[1].

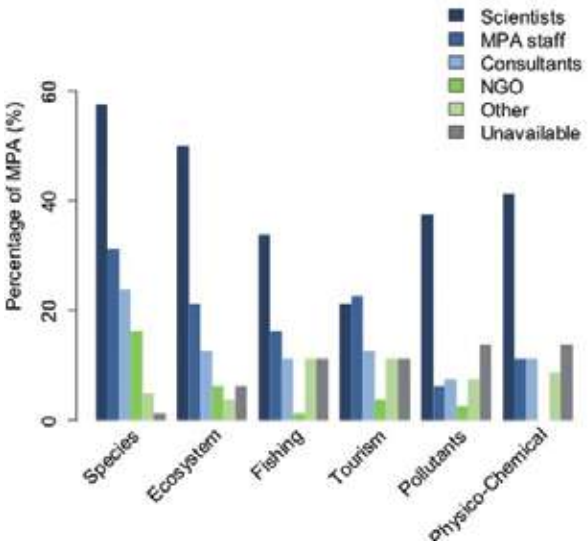
Zone 1: most protected marine zone after the strict nature reserve zone
Zone 2: most protected marine zone after zone 1
Zone 3: most protected marine zone after zone 2

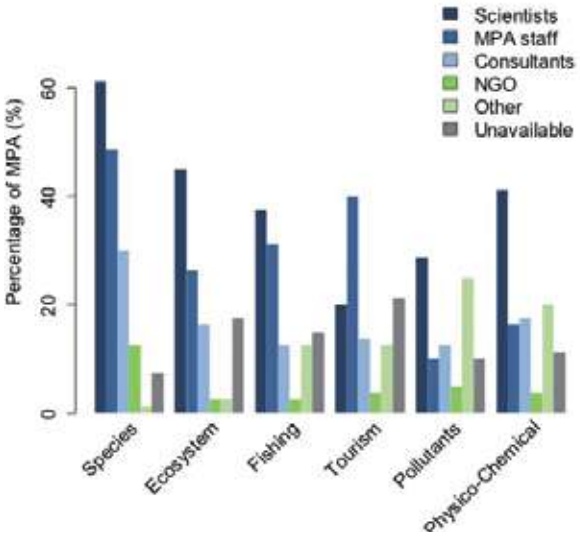






REGULAR MONITORING OPERATORS AND AD HOC STUDIES DONE IN THE MPA





1. Hiking/Walking; Swimming; Diving; Spear fishing; Recreational Fishing; Commercial Fishing; Shipping, Sailing; Mooring, Anchorage; Water sports (kayak, jet ski ...); Scientific Research.

Appendix 18 - Important areas proposed to reinforce the network of MPAs

Marine Reserves proposed by Greenpeace (2004)		SPAMIs proposed by UNEP (RAC/SPA, 2010)		De Juan and Lleonart Sensitive sites	
1. Alboran Basin	Atlantic / Mediterranean exchange zone Upwelling area migration route for many species of fish, whales, dolphins and turtles spawning area for pilchards and anchovies important for a number of marine mammals species seamounts and coral depth	1. Alboran Sea	The south-western part of the Alboran Sea is highly productive and is also a transit corridor for birds, mammals and fish which travel between the Atlantic and the Mediterranean Sea. The seamounts in this part of the Alboran Sea are the basis of an extensive marine biodiversity and this site includes a critical habitat for cetaceans and seabirds.	Straits of Gibraltar and the Alboran Sea	The Alboran Sea is a migratory route for many species of tuna, whales, dolphins and turtles, including the internationally protected loggerhead turtle (*Caretta caretta*). Among resident species, the short-beaked common dolphin (*Delphis delphis*) merits particular attention, as this population remains the healthiest, after a dramatic decline of the species in most of its Mediterranean range. The anticlyclonic gyres in this area and the Almeria-Oran front create conditions of high productivity, which are the optimal conditions for large pelagic fish
				Seamounts in the Alboran Sea	There is an area with relatively high density of seamounts located in the Alboran Sea between the European and the African continents. Seamounts are scattered through the whole area, and it also harbours submarine canyons containing deep-water corals
2 et 6 : Seamounts	breeding and feeding place for species which live in shallow waters				
3. Balearic Islands	Important spawning area for tuna and swordfish Spawning area for pilchards, round sardines and anchovies. important area for sperm whales Presence of great white shark	2. South of Balearic Islands	Seamounts and spawning habitats essential for bluefin tuna; crucial habitats for seabirds and cetaceans.	South of Balearic Islands	The waters surrounding the Balearic Islands are an important spawning area for bluefin tuna (*T. thynnus*). Moreover, this is an important area for sperm whales (*Physeter macrocephalus*) and white shark (*Carcharodon carcharias*)

4. Gulf of Lion	Important for spawning pilchards, anchovies, round sardines and shrimp important area for sperm whales cold seeps and coral depth	3. Continental shelf and slope of the Gulf of Lion	This region includes highly productive deep water canyons that have a significant importance for biodiversity. This area also shares important cetacean habitat with the adjacent Pelagos Sanctuary and is probably inhabited by the same cetacean populations as in the sanctuary. It therefore represents a natural continuation of cetacean conservation measures under the Pelagos Sanctuary westward to the French and Spainish waters. It is also an important area for seabirds.	Slope of the Gulf of Lion	This area is a spawning ground for several important commercial species in the northwestern Mediterranean (i.e. hake, *M. merluccius,* monkfish, *Lophius* spp. blue and red shrimp, *A. antennatus*). It also harbours numerous canyons with cold seeps and deep sea corals which constitute a refuge for many species but increases its vulnerability to exploitation
5. Algerian Coast	spawning area for anchovy important area for sperm whales deep corals				
6. Seamounts (see 2)					
7. Carthaginian Coast	important area for sperm whales spawning area for anchovy. Presence of pilchards, round sardines, blue whiting, red shrimp dolphins nesting and migration routes for turtles				
8. Ligurian Sea	area of high biological productivity important feeding area for marine mammals (13 species), including the fin whale seamounts and deep corals	4. Central Tyrrhenian Sea	This part of the Tyrrhenian Sea, adjacent to the PELAGOS Sanctuary is highly productive, supporting species of seabirds, marine mammals and sharks.		
9. Central Tyrrhenian Sea	important area for several species of cetaceans including sperm whales, fin whales and common dolphins anchovy breeding area important area for pelagic fish such as blue whiting and round sardine tuna migratory route important area for seabirds concentration of seamounts, including Mount Vavilov				

10/11. Strait of Messina (North and South)	extensive system of upwelling migration route for pelagic fish, whales and dolphins many seamounts, including Mount Marsili, one of the largest volcanic structures of the Mediterranean important area for sperm whales and fin whales				
		5. Ionian Sea	Santa Maria di Leuca: important diversity and crucial habitat for deep-sea corals. Northeast of the Ionian Sea: crucial habitats for cetaceans and important nursery for different species of sharks.	Cold coral reefs off Santa Maria di Leuca	A massive concentration of deep-water corals dominated by living colonies of *Lophelia pertusa* and *Madrepora oculata* that harbour high biodiversity were discovered by Italian scientists off the coast of Santa Maria di Leuca (Ionian Sea) at depths between 425 m and 1110 m. Young of the year of many commercial species have been detected in the area , and the white coral reefs function as nurseries and centres of spreading forthe associated fauna.
12. Stait of Sicily	junction between the eastern and western basin of the Mediterranean highly productive area important area for sperm whales and fin whales, as well as the great white shark seamounts and deep-sea corals turtles nesting beaches Posidonia meadows sponge fields	6. Tunisian plateau	Northern Strait of Sicily (including the Adventure and Malta benches) This part of south-central Mediterranean contains crucial habitats for birds	Stait of Sicily	This area is delimited by the Tunisian and Sicilian coasts and joins the West and East Mediterranean basins, being an important migratory route for large pelagicspecies. It is a highly productive area and represents a biodiversity hotspot within the Mediterranean. Moreover, it is a spawning area for the white shark (*C. carcharias*) and bluefin tuna(*T. thynnus*), as Italian surveys [70] have found bluefin tuna larvae being mainly concentrated all around Sicily.
				Adventure and Malta benches	The Strait of Sicily harbours the Adventure Bank and the Malta Bank between 100 and 200 m. A permanent cyclonic gyre and the Ionian front create productive conditions in the area; moreover, the topography of the slope in this area is complex with many canyons and steep slopes. These banks are a spawning ground and nursery area for many demersal species of commercial interest: hake (*M. merluccius*) rose shrimp (*Parapenaeus longirostris*) and red mullet (*Mullus barbatus*) . Recently scientists identified two sub-areas on the eastern sides of the two banks where young of the year are concentrated
13 Tunisian-Libyan Coast			Southern Strait of Sicily: highly productive areas and rearing for several shark species and crucial habitats for seabirds.		

14. Malta Escarpement	one of the major Mediterranean's biodiversity areas important area for young anchovies important for common dolphins probable breeding place for great white sharks large area containing deep water habitats as well as the backbone of Medina (Malta) and some seamounts, including the Archimede and Epicharmus mounts.				
15. Medina seamounts	large area containing deep water habitats as well as the backbone of Medina (Malta) and some seamounts, including the Archimede and Epicharmus mounts.				
16. Gulf of Sidra	Important feeding place for bluefin tuna Posidonia meadows turtle nesting area				
17. Cyrenacian Point	Posidonia meadows turtle nesting area seamounts (including Mount Herodotus) cold seeps				
18. Northern Adriatic	important breeding area for pilchards and anchovies dolphins wide variety of fish species including tuna, swordfish and sharks Posidonia meadow	7. North and Central Adriatic	This part of the Adriatic has a high natural productivity that protects an extensive food chain including seabirds, loggerhead turtles and different species of sharks. High level of degradation in the north western Adriatic Sea	Adriatic Sea Jabuka Pit or Fosa di Pomo	This area is a depression in the centre of the Adriatic and it is an important nursery area for demersal species (i.e. hake, *M. merluccius*, and Norway lobster, N*ephrops norvegicus*) that are mainly exploited by bottom trawling (Italian and Croatian). Spawning of hake in this area occurs throughout the year with two peaks in winter and summer. The earliest spawning occurs in winter in deeper waters, down to 200 m, the greatest depths found in the central Adriatic Sea, whereas spawning in summer occurs in shallower waters
19. Pomo/Jabuca Pit	Important breeding ground for hake, anchovies of crucial importance for many fish populations in the Adriatic cold seeps				

20. Heel of Italy	Important deep-sea coral reefs, including rare white coral Lophelia.				
21. Hellenic Trench	Important area for sperm whales and Cuvier's beaked whales characteristic elements of the deep including the Calypso pit, the deepest of the Mediterranean seamounts and cold seeps nesting beaches for turtles				
22. Olimpi	Important characteristic elements of the deep, including mud volcanoes, cold seeps and hyper-saline pockets. Important microbial communities				
23. Gulf of Saronikos	Important area for common dolphins, nursery place for hake (Merluccius merluccius),				
24. Sporades	Important area for monk seals common dolphins				
25. Thracian Sea	important nursery place for many species, including hake, common bouquet (prawn) and anchovy. last zone in the Mediterranean for harbor porpoise monk seals common dolphins	8. Aegean Sea Thracian Sea	Highly productive area and key habitats for seabirds, the Mediterranean monk seal and other marine mammals, and deep-sea coral habitats. A corresponding EBSA covers the Alonissos Greek National Marine Park and Northern Sporades.	Aegean Sea: Samothraki plateau and Gulf of Strymonikos	This site is a disjoint area covering two shelves known as Strymonikos gulf and Samothraki plateau in the Thracian Sea (north Aegean Sea) outside Greek jurisdictional waters. The area around 180 m depth is an important nursery habitat for many demersal species. It is also one of the most productive areas for hake *(M. merluccius*) in Greece, harbouring high densities of juveniles
26. Nord-east Aegean Sea	last zone in the Mediterranean for harbor porpoise important area for common dolphins				
27. Between Crete and Turkey.	seamounts important area for common dolphins beaches were sea turtles lay eggs.				
28. Central Levantine Basin	many seamounts and cold seeps breeding ground for swordfish				
29. Anaximandre Mounts	Anaximander Mounts: seamounts, mud volcanoes and methane seeps cold. sea turtles nesting beaches				

30. Strait of Cyprus	breeding ground for bluefin tuna (*Thunnus thynnus*), frigate tuna (Auxis rochei) and Atlantic black skipjack (Euthynnus alletteratus). Caretta and Chelonia nesting beaches	9. Levantine Sea North-eastern Levantine Sea and Rhode gyre	spawning area of bluefin tuna and major marine mammals habitat. Most productive pelagic waters zone of the eastern Mediterranean which can provide crucial habitat for fish and marine mammals.	Nord de la Mer Levantine	Contrary to what was, until recently believed, bluefin tuna (*T. thynnus*) also spawn in the Eastern Mediterranean. Bluefin tuna larvae, as well as albacore (*T. alalunga*), have been found south of the Anatolian peninsula, therefore being the principal area for tuna spawning in the Eastern Mediterranean. This area maintains a sedentary population of these species and it should become a sanctuary with the prohibition of tuna fisheries.
31. Eratosthene Mount	800m above the sea floor and below the level of the sea with rare coral species as Caryophyllia calver and Desmophyllum cristagalli marine mammals such as sperm whales, fin whales, bottlenose dolphin and striped dolphin large concentration of nesting beaches for turtles			Mont Eratosthène	This massive seamount is located south of Cyprus and north of the Nile delta, rising up from the seafloor to 800 m below sea level. It harbours rare coral species, such as *Caryophyllia calveri* and *Desmophyllum cristagalli* . This unique ecosystem is probably the most pristine environment found in the Mediterranean.
32. Phoenician Coast	important migratory route for tuna breeding place for turtles (Caretta and (Chelonia mydas), breeding ground for sharks. Presence of threatened shark species such as shark (Carcharias taurus), the gulper shark (Centrophorus granulosus) and angel shark (Squatina squatina). Hydrothermal vents and associated communities				
33. Nile Delta	Submarine canyons and associated cold seeps Important feeding place for a variety of fish, including tuna.	Nile Delta region	recently discovered cold seeps crucial habitats for sea turtles and probably cetaceans	Nile cold seeps	This area harbours a region with high concentration of cold hydrocarbon seeps in the south eastern Mediterranean, in front of the Nile delta: between 300 and 800 m off the continental slope, which are highly diverse and fragile sites

Parc national des Kornati, Croatie © M. Mabari / MedPAN

Bibliography

Abdulla A., 2004. Status and Conservation of Sharks in the Mediterranean Sea. IUCN Technical Paper, 7p.

Abdulla A., M. Gomei, D. Hyrenbach, G. Notarbartolo di Sciara and T. Agardy, 2008. Challenges facing a network of representative marine protected areas in the Mediterranean: prioritizing the protection of underrepresented habitats International Council for the Exploration of the Sea. ICES Journal of Marine Science 66: 22-28

Abdulla A., M. Gomei, E. Maison and C. Piante, 2008. Status of Marine Protected Areas in the Mediterranean Sea. IUCN Malaga and WWF France, 152p.

Aguilar A., X. Monbailliu and A. Paterson, 1993. Status and conservation of seabirds: Proceedings of the 2nd Pan- Mediterranean Seabird Symposium. Calvià, Mallorca, 1989. S.E.O., Madrid, 386p.

Airoldi L. and M.W. Beck, 2007. Loss, status and trends for coastal marine habitats of Europe. Oceanogr. Mar. Biol. Annu. Rev. 45: 345-405

Albouy C., D. Mouillot, D. Rocklin, J.M. Culioli and F. Le Loc'h, 2010. Simulation of the combined effects of artisanal and recreational fisheries on a Mediterranean MPA ecosystem using a trophic model. Mar. Ecol. Prog. Ser. 412: 207-221

Allison G.W., S.D. Gaines, J. Lubchenco and H.P. Possingham, 2003. Ensuring persistence of marine reserves: Catastrophes require adopting an insurance factor. Ecol. Appl. 13, S8-S24

Antonioli F., R. Chemello, S. Impronta and S. Riggio, 1999. *Dendropoma* lower intertidal reef formations and their paleoclimatological significance, NW Sicily. Marine Geology 161: 155-170

Ardron J.A., 2008. The challenge of assessing whether the OSPAR network of marine protected areas is ecologically coherent. Hydrobiologia 606: 45-53

Artegiani A., D. Bregant, E. Paschini, N. Pinardi, F. Raicich and A. Russo,1997. The Adriatic Sea general circulation. Part II: Baroclinic Circulation Structure. Journal of Physical Oceanography 27: 1515-1532

Astraldi M., C.N. Bianchi, G.P. Gasparini and C. Morri, 1995. Climatic fluctuations, current variability and marine species distribution: a case study in the Ligurian Sea (north-west Mediterranean). Oceanol. Acta. 18 (2): 139-149

Badalamenti F., A.A. Ramos, E. Voultsiadou, J.L. Sanchez Lizaso, G. D'Anna, C. Pipitone, J. Mas, J.A. Ruiz Fernandez, D. Whitmarsh and S. Riggio, 2000. Cultural and socio-economic impacts of Mediterranean marine protected areas. Environmental Conservation 27(2):110-125

Ballesteros E., 2006. Mediterranean coralligenous assemblages: a synthesis of present knowledge. Oceanography and Marine Biology - An Annual Review 44: 123-195

Bas C., 2009. The Mediterranean, a synoptic overview. Science 5(1): 25-39

Basterretxea G., A. Jordi, I. Catalán and A. Sabatés, 2012. Model-based assessment of local-scale fish larval connectivity in a network of marine protected areas (MPAs). Fisheries oceanography 21: 291-306

Bates B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, 2008. Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210p.

Becker N. and Y. Choresh, 2006. Economic Aspects of Marine Protected Areas (MPAs). Ed: UNEP-MAP RAC\SPA, Tunis, 131p.

Béthoux J.P., B. Gentili, J. Raunet and D. Tailliez, 1990. Warming trend in the western Mediterranean deep water. Nature 347: 660-662

Béthoux J.P., P. Morin, C. Chaumery, O. Connan, B. Gentili and D. Ruiz-Pino, 1998. Nutrients in the Mediterranean Sea, mass balance and statistical analysis of concentrations with respect to environmental change. Mar. Chem. 63: 155-169

Béthoux J.P., X. Durrieu de Madron, F. Nyffeler and D. Taillez, 2002. Deep water in the western Mediterranean: peculiar 1999 and 2000 characteristics, shelf formation hypothesis, variability since 1970 and geochemical inferences. Journal of Marine Systems, 33-34: 117-131

Bianchi C.N. and C. Morri, 2000. Marine biodiversity of the Mediterranean Sea: Situation, problems and prospects for future research. Mar. Pollut. Bull. 40: 367-376

Bissuel J.L., 2012. Faut-il réviser Montego Bay ? Marine et Océans 237: 22-25

Blamart D., K. Escoubeyrou, A. Juillet-Leclerc, R. Ouahdi and R. Lecomte-Finiger, 2002. Stable isotope compositions (O-C) of reef fish otoliths from the Taiaro lagoon (Tuamotu, French Polynesia): isotopic and biologic implications. C. R. Biol. 325: 99-106

Bodilis P., H. Arceo and P. Francour, 2011. Further evidence of the establishment of *Fistularia commersonii* (Osteichthyes: Fistulariidae) in the north-western Mediterranean Sea. Marine Biodiversity Records. Marine Biological Association of the United Kingdom, 4 (18): 1-4

Boudouresque C.F., G. Bernard, P. Bonhomme, E. Charbonnel, G. Diviacco, A. Meinesz, G. Pergent, C. Pergent-Martini, S. Ruitton and L. Tunesi, 2006. Protection and conservation of *Posidonia oceanica* meadows. RAMOGE pub., 202p.

Boudouresque C.F. and M. Verlaque, 2002. Biological pollution in the Mediterranean: invasive versus introduced macrophytes. Marine Pollution Bulletin 44: 32-38

Broderick A.C., F. Glen, B.J. Godley and G.C. Hays, 2002. Estimating the number of green and loggerhead turtles nesting annually in the Mediterranean. Oryx 36(3): 227-235

Bunce L., P. Townsley, R. Pomeroy and R. Pollnac, 2000. Socioeconomic manual for coral reef management. Global Coral Reef Monitoring Network, Australian Inst. Marine Science, Townsville, Australia, 251p.

Cameron A. and N. Askew (eds.), 2011. EUSeaMap - Preparatory Action for development and assessment of a European broad-scale seabed habitat map final report, 227p. Available at: http://jncc.gov.uk/euseamap

Campana S.E., S.R. Thorrold, C.M. Jones, D. Gunther, M. Tubrett, H. Longerich, S. Jackson, N.M. Halden, J.M. Kalish, P. Piccoli, H. De Pontual, H. Troadec, J. Panfili, D.H. Secor, K.P. Severin, S.H. Sie, R. Thresher,

W.J. Teesdale and J.L. Campbell, 1997. Comparison of accuracy, precision and sensitivity in elemental assays of fish otoliths using the electron microprobe, proton-induced X-ray emission, and laser ablation inductively coupled plasma mass spectrometry. Canadian Journal of Fisheries and Aquatic Sciences, 54: 2068-2079

Canals M., P. Puig, X. Durrieu de Madron, S. Heussner, A. Palanques and J. Fabres, 2006. Flushing submarine canyons. Nature, 444: 354-357

Carboneras C., 2008. Marine birds. In: Hoyt, E. and G. Notarbartolo di Sciara. Workshop: Species information for managing marine protected areas: improving access and integration. Proceedings of the IUCN World Congress, Barcelona 5-14 October 2008

Carboneras C. and S. Requena, 2011. Seabird distribution in the Mediterranean sea: Western Mediterranean, Greek and Maltese waters. In: European Union, 2011. Contribution to the preparation of a Plan of Action for Seabirds Final Report, 45-60

Cartes J.E., F. Maynou, F. Sarda, J.B. Company, D. Lloris and S. Tudela, 2004. The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts. In: The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Malaga and WWF, Rome, 9-38

Casale P. and D. Margaritoulis (Eds.), 2010. Sea turtles in the Mediterranean: Distribution, threats and conservation priorities. Gland, Switzerland : IUCN, 294p.

Catchpole R.D.J., 2012. Ecological Coherence Definitions in Policy and Practice Final Report. Contract Report to Scottish Natural Heritage. Aspen International, 28p.

Cavanagh R.D. and C. Gibson, 2007. Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea. IUCN, Gland, Switzerland and Malaga, Spain, 42p.

Cebrian D., 1998. La foca monje (*Monachus monachus* Hermann 1779) en el Mediterranean Oriental (Grecia y Croacia). Publ. Univ. Complutense de Madrid

CEPF, 2010. Ecosystem Profile Mediterranean basin biodiversity hotspot. 251p.

Chassanite A., S. Marinesque and J. Claudet, 2012. Etats des lieux des programmes de suivis multidisciplinaires visant les AMP de Méditerranée. MedPAN , 95p.

CIESM, 2002a. Atlas of Exotic Species in the Mediterranean - Vol. 1. Fishes by D. Golani, L. Orsi-Relini, E. Massuti and J.P. Quignard, 256p.

CIESM, 2002b. Atlas of Exotic Species in the Mediterranean - Vol. 2. Crustaceans by B. Galil, C. Froglia and P. Noel, 192p.

CIESM, 2002c. Alien marine organisms introduced by ships in the Mediterranean and Black seas. CIESM Workshop Monographs n°20, 136p.

CIESM, 2004. Atlas of Exotic Species in the Mediterranean - Vol. 3. Molluscs by A. Zenetos, S. Gofas, G. Russo and J. Templado, 376p.

CIESM, 2010. Marine Peace Parks in the Mediterranean - A CIESM proposal. CIESM Workshop Monographs n°41, 128p.

Claudet J., G. Notarbartolo di Sciara and C. Rais, 2011. Critères d'identification des sites de la base de données MAPAMED. Commissioned by MedPAN and RAC/SPA, 6p. + appendix

Claudet J., C.W. Osenberg, L. Benedetti-Cecchi, P. Domenici, J.A. García-Charton, Á. Pérez-Ruzafa, F. Badalamenti, J. Bayle-Sempere, A. Brito, F. Bulleri, J.M. Culioli, M. Dimech, J.M. Falcón, I. Guala, M. Milazzo, J. Sánchez-Meca, P.J. Somerfield, B. Stobart, F. Vandeperre, C. Valle and S. Planes, 2008. Marine reserves: size and age do matter. Ecology Letters 11(5): 481-489

Coll M., C. Piroddi, J. Steenbeek, K. Kaschner, F. Ben Rais Lasram, J. Aguzzi, E. Ballesteros, C.N. Bianchi, J. Corbera, T. Dailianis, *et al.*, 2010. The biodiversity of the Mediterranean Sea: Estimates, patterns, and threats. PLoS ONE 5(8), e11842. doi:10.1371/journal.pone.0011842

Coll M., C. Piroddi, C. Albouy, F. Ben Rais Lasram, W.W.L. Cheung, V. Christensen, V.S. Karpouzi, F. Guilhaumon, D. Mouillot, M. Paleczny, M. Lourdes Palomares, J. Steenbeek, P. Trujillo, R. Watson and D. Pauly, 2012. The Mediterranean under siege: spatial overlap between marine biodiversity, cumulative threats and marine reserves. Glob. Ecol. Biogeogr. 21: 465–481

Conde Poyales F., 1989. Ficogeografia del mar de Alboran en el contexto del Mediterraneo occidental. An.Jard. bot. Madrid 46(1): 21-26

Corell H., P.O. Moksnes, A. Engqvist, K. Döös and P.R. Jonsson. 2012. Depth distribution of larvae critically affects their dispersal and the efficiency of marine protected areas. Mar. Ecol. Prog. Ser. 467: 29-46

Cowen R.K., G.G. Gawarkiewicz, J. Pineda, S.R. Thorrold and F.E. Werner, 2002. Report of a Workshop to Develop Science Recommendations for the National Science Foundation - November 4-6, 2002 - Durango, Colorado. 23p.

Cowen R.K., G.G. Gawarkiewicz, J. Pineda, S.R. Thorrold and F.E. Werner, 2007. Population connectivity in marine systems: an overview. Oceanography 20(3): 14-21

Cowen R.K., K.M. Lwiza, S. Sponaugle, C.B. Limouzy-Paris and D.B. Olson, 2000. Connectivity of marine populations: open or closed? Science. 287: 857-859

Crochelet, E. *In press*.

Danovaro R., J.B. Company, C. Corinaldesi, G. D'Onghia, B. Galil, *et al.*, 2010. Deep-Sea Biodiversity in the Mediterranean Sea: The Known, the Unknown, and the Unknowable. PLoS ONE 5(8): e11832. doi:10.1371/journal.pone.0011832

Day J., N. Dudley, M. Hockings, G. Holmes, D. Laffoley, S. Stolton and S. Wells, 2012. Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas. Gland, Switzerland: IUCN, 36p.

De Juan S. and J. Lleonart, 2010. A conceptual framework for the protection of vulnerable habitats impac-

ted by fishing activities in the Mediterranean high seas. Ocean & Coastal Management 53: 717-723

De Juan S., J. Moranta, H. Hinz, C. Barbera, C. Ojeda-Martinez, D. Oro,F. Ordines, E. Olafsson, M. Demestre, E. Massuti and J. Lleonart, 2012. A regional network of sustainable managed areas as the way forward for the implementation of an Ecosystem-Based Fisheries Management in the Mediterranean. Ocean & Coastal Management 65: 51-58

Di Carlo G., A. Lopez and F. Staub, 2012. Capacity building strategy to enhance the management of MPAs in the Mediterranean Sea. Commissioned by WWF MedPO /MedPAN / UNEP-MAP-RAC/SPA, 19p. + appendix

Di Franco A., B.M. Gillanders, G. De Benedetto, A. Pennetta, G.A. De Leo and P. Guidetti, 2012a. Dispersal patterns of coastal fish: Implications for designing networks of Marine Protected Areas. Plos One, 7(2)

Di Franco A., G. Coppini, J.M. Pujolar, G.A. De Leo, M. Gatto, V. Lyubartsev, P. Melia, L. Zane and P. Guidetti, 2012b. Assessing Dispersal Patterns of Fish Propagules from an Effective Mediterranean Marine Protected Area. PLoS ONE 7(12): e52108.

D'Ortenzio F. and M. Ribera d'Alcala, 2009. On the trophic regimes of the Mediterranean Sea: a satellite analysis. Biogeosciences 6: 1-10

Dodd C.K., 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service biological report 88(14), 110 p.

Dudley N., 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN, x + 86p.

Durrieu de Madron X., V. Zervakis, A. Theocharis and D. Georgopoulos, 2005. Comments to "Cascades of dense water around the world ocean". Progress in Oceanography, 64 (1): 83-90

Eckert K.L., B.P. Wallace, J.G. Frazier, S.A. Eckert and P.C.H. Pritchard, 2009. Synopsis of the Biological Data on the Leatherback Sea Turtle, *Dermochelys coriacea* (Vandelli, 1761). US Fish and Wildlife Service PO no. 20181-0-0169, Jacksonville, FL, 214p.

Emig C.C., 1997. Bathyal zones on the Mediterranean continental slope: An attempt. Publicaciones Especiales del Instituto Espanol de Oceanografia, 23: 23-33

Emig C.C. and P. Geistdoerfer, 2004. The Mediterranean deep-sea fauna: historical evolution, bathymetric variations and geographical changes. Carnets de Géologie / Notebooks on Geology, 2004 (1)

European Commission, 2008. Fisheries and aquaculture in Europe. Special issue : The Mediterranean. Managing Mediterranean fisheries n° 39, 12p.

European Environment Agency, 2006. Report No.4 - Priority issues in the Mediterranean environment. EEA/UNEP, Copenhagen

Fanelli G., S. Piraino, G. Belmonte, S. Geraci and F. Boero, 1994. Human predation along Apulian rocky coast (SE Italy): desertification caused by *Lithophaga lithophaga* (*Mollusca*) fisheries. Marine Ecology Progress Series 110: 1-8

FAO General Fisheries Commission for the Mediterranean, 2006. Report of the ninth session of the Scientific Advisory Committee. Rome, Italy 24-27 October 2006

FAO Fisheries Report No. 814. Rome, FAO, 106p.

Flagella M.M. and A. Abdulla, 2005. Ship ballast water as a main vector of marine introductions in the Mediterranean. WMU Journal of Maritime Affairs 4(1): 97-106

Fenberg P.B., J.E. Caselle, J. Claudet, M. Clemence, S.D. Gaines, J.A. Garcia-Charton, E.J. Goncalves, K. Grorud- Colvert, P. Guidetti, S.R. Jenkins, P.J.S. Jones, S.E. Lester, R. McAllen, E. Moland, S. Planes and T. Sorensen, 2012. The science of European marine reserves: Status, efficacy, and future needs, Marine Policy 36: 1012–1021, doi:10.1016/j.marpol.2012.02.021

Fogarty M.J. and L.W. Botsford, 2007. Population connectivity and spatial management of marine fisheries. Oceanography 20(3): 112-123

Fowler A.J., S.E. Campana, C.M. Jones and S.R. Thorrold, 1995. Experimental assessment of the effect of temperature and salinity on elemental composition of otoliths using laser ablation ICPMS. Can. J. Fish. Aquat. Sci. 52: 1431-1441

Francour P., J.G. Harmelin, D. Pollard and S. Sartoretto, 2001. A review of marine protected areas in the northwestern Mediterranean region: siting, usage, zonation and management. Aquatic Conservation: Marine and Freshwater Ecosystems 11: 155-188

Franzosini C., R. Odorico, M. Spoto, M. Tempesta, P. Guglielmi, M.A. Tlili and S. Ciriaco, 2001. A GIS approach for marine conservation areas in the Mediterranean ecoregion. Paper CM 2001/Y06, Theme Session on Sustainable Development of Natural Resources of Coastal Zone. ICES 2001 Annual Science Conference, 26–29 September 2001, Oslo, 12 p.

Fraschetti S., A. Terlizzi, F. Micheli, L. Benedetti-Cecchi and F. Boero, 2002. Marine Protected Areas in the Mediterranean Sea: objectives, effectiveness and monitoring. Marine Ecology 23(1): 190-200

Fraschetti S., A. Terlizzi, S. Bussotti, G. Guarnirei, P. D'Ambrosio and F. Boero, 2005. Conservation of Mediterranean seascapes: analysis of existing protection schemes. Marine Environmental Research 59(4): 309-332

French Global Environment Facility (FGEF), 2010. Marine Protected Areas - Review of FGEF's cofinanced project experiences. Assessment carried out by C. Gabrié, T. Clément, J.R. Mercier and H. You. Study coordinated by J. Calas

Fromentin J.M. and J.E. Powers, 2005. Atlantic bluefin tuna: population dynamics, ecology, fisheries and management. Fish and Fisheries 6: 281-306

Gaines S.D., C. White, M.H. Carr and S.R. Palumbi, 2010. Designing marine reserve networks for both conservation and fisheries management. PNAS, 107(43): 18286-18293

Galil S.B., 2000. A sea under siege - Alien species in the Mediterranean. Biological Invasions 2: 177-186

Galil S.B., 2006. Shipwrecked – Shipping impacts on the biota of the Mediterranean Sea. The Ecology of Transportation: Managing Mobility for the Environment 10: 39-69

Galil S.B., 2007. Loss or gain? Invasive aliens and biodiversity in the Mediterranean Sea. Marine Pollution Bulletin 55: 314-322

Gambi M.C., J.A. Borg, M.C. Buia, G. Di Carlo, C. Pergent-Martini, G. Pergent and G. Procaccini (Eds.), 2006. Proceedings of the Mediterranean Seagrass Workshop, 29 May – 4 June 2006, Marsascala, Malta, Biologia Marina Mediterranea 13(4): 293p.

Garrabou J., T. Perez, S. Sartoretto and J.G. Harmelin, 2001. Mass mortality event in red coral *Corallium rubrum* populations in the Provence region (France, NW Mediterranean). Marine Ecology Progress Series 217: 263-272

Giakoumi S., T. Mazor, S. Fraschetti, S. Kark, M. Portman, M. Coll, J. Steenbeek and H. Possingham, 2012. Advancing marine conservation planning in the Mediterranean Sea. J Reviews in Fish Biology and Fisheries 22: 943-949

Gómez S., J. Lloret, M. Demestre and V. Riera, 2006. The decline of the artisanal fisheries in Mediterranean coastal areas: the case of Cap de Creus. Coast. Manag. 34: 217-232

Goñi R., N.V.C. Polunin and S. Plane, 2000. The Mediterranean: marine protected areas and the recovery of a large marine ecosystem. Environmental Conservation 27: 95-97

Grant, S., A. Constable, B. Raymond and S. Doust, 2006. Bioregionalisation of the Southern Ocean: Report of Experts Workshop, Hobart. WWF-Australia and ACE-CRC, 44p.

Greenpeace, 2004. Réserves marines en Méditerranée. 52p.

Grorud-Colvert K., J. Claudet, M. Carr, J. Caselle, J. Day, A. Friedlander, S. Lester, T. Lison de Loma, B. Tissot and D. Malone, 2011. The assessment of marine reserve networks: Guidelines for ecological evaluation. In Claudet J., editor. Marine Protected Areas - A Multidisciplinary Approach. Cambridge University Press, Cambridge, UK, 293-321

Gucu A.C., G. Gucu and H. Orek, 2004. Habitat use and preliminary demographic evaluation of the critically endangered Mediterranean monk seal (*Monachus monachus*) in the Cilician Basin (Eastern Mediterranean. Biological Conservation 116: 417-431

Guidetti P., 2006. Marine reserves re-establish lost predatory interactions and cause community-wide changes in rocky reefs. Ecological Application 16: 963-976

Guidetti P., G. Notarbartolo Di Sciara and T. Agardy, in press. Integrating pelagic and coastal MPAs into large-scale ecosystem-wide management. Aquatic Conservation: Marine and Freshwater ecosystems. Aquatic Conserv.: Mar. Freshw. Ecosyst. 4p.

Guizien K., M. Belharet, P. Marsaleix and J. M. Guarini, 2012. Using larval dispersal simulations for marine protected area design: Application to the Gulf of Lions (northwest Mediterranean). Limnol. Oceanogr. 57(4): 1099-1112

Hall-Spencer J.M., R. Rodolfo-Metalpa, S. Martin, E. Ransome, M. Fine, S.M. Turner, S.J. Rowley, D. Tedesco and M.C. Buia, 2008. Volcanic carbon dioxide vents show ecosystem effects of ocean acidification. Nature 454: 46-47

Halpern B.S. and R.R. Warner, 2003. Matching marine reserve design to reserve objectives. Proceedings of Royal Society of London B 270: 1871-1878

Hamdi A., M. Vasquez and J. Populus, 2010. Cartographie des habitats physiques Eunis – Côtes de France. Rapport IFREMER/AAMP, 110p.

Harmelin J.G., 2000. Mediterranean marine protected areas: some prominent traits and promising trends. Environmental Conservation 27: 104-105

Hartigan J.A. and M.A. Wong, 1979. A K-means clustering algorithm. Applied Statistics 28: 100-108

Heemstra P.C. and J.E. Randall, 1993. FAO species catalogue, vol. 16. Groupers of the world (Family *Serranidae,* subfamily *Epinephelinae*). An annotated and illustrated catalogue of the grouper, rockcod, hind, coral grouper and lyretail species known to date, FAO Fish. Synop. n°125, vol. 16, 382p.

Hereu B., D. Diaz, J. Pasqual, M. Zabala and E. Sala, 2006. Temporal patterns of spawning of the dusky grouper *Epinephelus marginatus* in relation to environmental factors. Mar. Ecol. Prog. Ser. 325: 187-194

Hermann M., C. Estournel, M. Deque, P. Marsaleix, F. Sevault and S. Somot, 2008. Dense water formation in the Gulf of Lions : Impact of atmospheric interannual variability and climate change. Continental Shelf Research 28 (15): 2092-2112

Heussner S., X. Durrieu de Madron, A. Calafat, M. Canals, J. Carbonne, N. Delsaut, G. Saragoni, 2006. Spatial and temporal variability of downward particle fluxes on a continental slope: lessons from an 8-yr experiment in the Gulf of Lions (NW Mediterranean). Marine Geology 234: 63-92

Hogan J.D., R.J. Thiessen, P.F. Sale and D.D. Heath, 2011. Local retention, dispersal and fluctuating connectivity among populations of a coral reef fish. Oecologia 168: 61-71

Hoyt E. and G. Notarbartolo di Sciara, 2008. Distribution and overlap of critical habitats of Mediterranean top marine predators. Workshop: "Species information for designing and managing marine protected areas: improving access and integration", World Conservation Congress, Barcelona, 6 October 2008

IUCN, 2010. Towards a better Governance of the Mediterranean. IUCN Gland, Switzerland and Malaga, Spain

Jones G.P., M.J. Millcich, M.J. Erosile and C. Lunow, 1999. Self-recruitment in a coral fish population. Nature 402: 802-804

Jones, G.P., M. Srinivasan and G.R. Almany, 2007. Population connectivity and conservation of marine biodi-

versity. Oceanography 20(3): 100-111

Krom M.D., S. Brenner, N. Kress and L.I. Gordon, 1991. Phosphorus Limitation of Primary Productivity in the E.Mediterranean Sea. Limnol. and Oceanogr. 36: 424-432

Krom M.D., K.C. Emeis and P. Van Campellen, 2010. Why is the Eastern Mediterranean phosphorus limited? Prog. Oceanogr. 85: 236-244

Leis J.M., 2007. Behaviour as input for modelling dispersal of fish larvae: behaviour, biogeography, hydrodynamics, ontogeny, physiology and phylogeny meet hydrography. Mar. Ecol. Prog. Ser. 347: 185-193

Leis J.M., L. Van Herwerden and H.M. Patterson, 2011. In Ed. J.D.M. Gordon. Chapter 5. Estimating connectivity in marine fish populations - What works best? Oceanography and Marine Biology. An Annual Review, Vol. 4

Lelieveld J., H. Berresheim, S. Borrmann, P.J. Crutzen, F.J. Dentener, H. Fischer, J. Feichter, P.J. Flatau, J. Heland, R. Holzinger, R. Korrmann, M.G. Lawrence, Z. Levin, K.M Markowicz, N. Mihalopoulos, A. Minikin, V. Ramanathan, M. De Reus, G.J. Roelofs, H.A. Scheeren, J. Sciare, H. Schlager, M. Schultz, P. Siegmund, B. Steil, E.G. Stephanou, P. Stier, M. Traub, C. Warneke, J. Williams and H. Ziereis, 2002. Global air pollution crossroads over the Mediterranean. Science 298(5594): 794-799

Lembo G., I.A. Fleming, F. Okland, P. Carbonara and M.T. Spedicato, 1999. Site fidelity of the dusky grouper *Epinephelus marginatus* (Lowe, 1834) studied by acoustic telemetry. Marine Life 9(2): 37-43

Lenfant P., P. Louisi and M.L. Licari, 2003. Inventory of dusky groupers (*Epinephelus marginatus*) in the marine reserve of Cerbere-Banyuls (France, North-Western Mediterranean Sea) after 17 years of protection. Cybium 27: 27-36

Lester S.E., McAllen R., Moland E., Planes S., Sorensen T., 2012, The science of European marine reserves: Status, efficacy, and future needs, Marine Policy, 36, 1012–1021, doi:10.1016/j.marpol.2012.02.021

López Ornat A. (Editor). 2006. Guidelines for the Establishment and Management of Mediterranean Marine and Coastal Protected Areas. MedMPA project. Ed: UNEP-MAP-RAC\SPA,Tunis

López-Sanz A., N. Vert, M. Zabala and A. Sabates, 2009. Small-scale distribution of fish larvae around the Medes Islands marine protected area (NW Mediterranean). J. Plankton Res. 31: 763-775

López-Sanz, À., V. Stelzenmüller, F. Maynou and A. Sabatés, 2011. The influence of environmental characteristics on fish larvae spatial patterns related to a marine protected area: The Medes islands (NW Mediterranean), 521-533. In Estuarine, Coastal and Shelf Science 92 (4)

López-Sanz, À., N. Vert, M. Zabala and A. Sabatés, 2009. Small-scale distribution of fish larvae around the Medes Islands marine protected area (NW Mediterranean), 763-775. In Journal of Plankton Research 31 (7)

Lubchenco J., S.R. Palumbi, S.D. Gaines and S. Andelman, 2003. Plugging a hole in the ocean: the emerging science of marine reserves. Ecol Appl 13: 3-7

Ludwig W., A.F. Bouwman, E. Dumont and F. Lespinas, 2009. Water and nutrient fluxes from major Mediterranean and Black Sea rivers: past and future trends and their implications for the basin scale budgets. Global Biogeochem. 24, GB0A13

Lyne V. and D. Hayes, 2005. Pelagic regionalisation: National bioregionalisation Integration Project. Australian Government National Oceans Office and CSIRO Marine Research

Macpherson E. and N. Raventos, 2006. Relationship between pelagic larval duration and geographic distribution of Mediterranean littoral fishes. Marine Ecology Progress Series 327: 257-265

Markaki Z., M.D. Loye-Pilot, K. Violaki, L. Benyahya and N. Mihalopolos, 2010. Variability of atmospheric deposition of dissolved nitrogen and phosphorus in the Mediterranean and possible link to the anomalous seawater N/P ratio. Mar. Chem. 120: 187-194

Marquez R., 1990. Sea turtles of the world. FAO Fish. Synop. Vol. 11, n°125

Medina A., F.J. Abascal, L. Aragon, G. Mourente, G. Aranda, T. Galaz, A. Belmonte, J.M. de la Serna and S. Garcia, 2007. Influence of sampling gear in assessment of reproductive parameters for bluefin tuna in the western Mediterranean. Marine Ecology Progress Series 337: 221-230

Meijer P.T. and H.A. Dijkostra, 2009. The response of Mediterranean thermohaline circulation to climate change: a minima model. Clim. Past 5: 713-720

Millot C. and I. Taupier-Letage, 2005. Circulation in the Mediterranean Sea. In: Saliot, A. (Ed.), The Handbook of Environmental Chemistry 5 (K). Springer-Verlag, Heidelberg, 29-66

Minguez E., D. Oro, E. de Juana and A. Martinez-Abrain, 2003. Mediterranean sea birds and their conservation. Scientia Marina 67 (Suppl.2): 1-148

Molinier R. and J. Picard, 1953. Notes biologiques à propos d'un voyage d'étude sur les côtes de Sicile. Annales de l'Institut Océanographique 28(4): 163-188

Mora, C., E.A. Treml, J. Roberts, K. Crosby, D. Roy and D.P. Tittensor, 2012. High connectivity among habitats precludes the relationship between dispersal and range size in tropical reef fishes. Ecography. Ecography 35: 89-96

Morales-Nin B., J. Moranta, C. Garcia, M.P. Tugores, A.M. Grau, F. Riera and M. Cerda, 2005. The recreational fishery off Majorca Island (western Mediterranean): some implications for coastal resource management. ICES J Mar Sci 62: 727-739

Mortimer J.A., 2007. Hawksbill sea turtle (*Eretmochelys imbricata*) 5-year review: summary and evaluation. National Marine Fisheries Service and US Fish and Wildlife Service, 93 p.

Mortimer J.A. and M. Donnelly, 2007. IUCN Red List Status Assessment: hawksbill turtle (*Eretmochelys imbricata*)

Mouillot D., C. Albouy, F. Guilhaumon, F. Ben Rais Las-

ram, M. Coll, V. Devictor, C.N. Meynard, D. Pauly, J.A. Tomasini, M. Troussellier, L. Velez, R. Watson, E.J.P. Douzery and N. Mouquet, 2011. Protected and Threatened Components of Fish Biodiversity in the Mediterranean. SeaCurrent Biology 21: 1044-1050

Moutin T. and P. Raimbault, 2002. Primary production, carbon export and nutrients availability in western and eastern Mediterranean Sea in early summer 1996 (MINOS cruise). J. Mar. Syst. 33: 273-288

Nichols W.J., 2007. Loggerhead sea turtle (*Caretta caretta*) 5-year review: summary and evaluation. National Marine Fisheries Service and US Fish and Wildlife Service, 65p.

Notarbartolo di Sciara G., 2005. Scoping Meeting to support Mediterranean States to meet the 2012 WSSD target on networks of Mediterranean MPAs. Report of the Meeting, Livorno, 6-8 December 2004. IUCN - World Commission on Protected Areas, 13p.

Notarbartolo di Sciara G., 2010. Methods for the identification of EBSAs in the Adriatic Sea. 3rd International workshop on Biodiversity in the Adriactic : towards a representative network of MPAs in the Adriatic. Piran, Slovenia, Octobre 2010, 13 p.

Nortarbartolo di Sciara G., A.Jr. Birkun, 2010. Conserving Whales, Dolphins and Porpoises in the Mediterranean and Black Seas: an ACCOBAMS Status Report, 2010. ACCOBAMS, Monaco, 212 p.

Notarbartolo di Sciara G., M. Zanardelli, M. Jahoda, S. Panigada and S. Airoldi, 2003. The fin whale *Balaenoptera physalus* (L.1758) in the Mediterranean Sea. Mammal Review 33(2): 105-150

Oceana, 2011. Oceana MedNet : MPA Network Proposal for the Mediterranean Sea. 102p.

Oceanography. 2007. Special Issue on Marine Population Connectivity. 20 (3)

Orr J.C., V.J. Fabry, O. Aumont, L. Bopp, S.C. Doney, R.A. Feely, A. Gnanadesikan, N. Gruber, A. Ishida, F. Joos, R.M. Key, K. Lindsay, E. Maier-Reimer, R. Matear, P. Monfray, A. Mouchet, R.G. Najjar, G.K. Plattner, K.B. Rodgers, C.L. Sabine, J.L. Sarmiento, R. Schlitzer, R.D. Slater, I.J. Totterdell, M.F. Weirig, Y. Yamanaka and A. Yool, 2005. Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature 437(7059): 681-686

OSPAR, 2007a. Guidance for the design of the OSPAR Network of Marine Protected Areas: a self-assessment checklist. OSPAR Reference number: 2007-6

OSPAR, 2007b. Background Document to Support the Assessment of Whether the OSPAR Network of Marine Protected Areas is Ecologically Coherent. OSPAR Biodiversity Series: 320p.

OSPAR, 2010. 2010 Status Report on the OSPAR Network of Marine Protected Areas. 61p.

Ozturk B., 2009. Marine protected areas in the high seas of the Aegean and Eastern Mediterranean Seas, some proposals . J. Black Sea/Mediterranean Environment, Vol. 15: 69-82

Palumbi S.R., 2003. Population genetics, demographic connectivity and the design of Marine Reserves. Ecological Applications, 13 (1): S146-S158

Palumbi S.R., 2004. Marine reserves and ocean neighborhoods: The Spatial Scale of Marine Populations and Their Management. Annual Review of Environment and Resources 29: 31-68

Pascal N., 2012. Réserve Naturelle de Saint Martin: Valeur Economique. Rapport technique – IFRECOR Guadeloupe (MEEDTL-MOM) APNSP/MOM 2010, Novembre 2011, 139p.

Pastor J. and P. Francour, 2010. Occurrence and distribution range of *Parablennius pilicornis* (*Actinopterygii*: Perciformes: *Blenniidae*) along the French Mediterranean coast. Acta Ichthyol. Piscat. 40 (2): 179-185

Pastor, J., M. Verdoit-Jarraya, P. Astruch, N. Dalias, J.S. Nelva Pasqua, G. Saragoni and P. Lenfant, 2009. Acoustic telemetry survey of the dusky grouper (*Epinephelus marginatus*) in the Marine Reserve of Cerbère- Banyuls: informations on the territoriality of this emblematic species. Comptes Rendus Biologies. 332: 732-740

Pérès J.M., 1972. Clefs pour l'océanographie. Paris : Seghers

Peterson B.J., R.W. Howarth and R.H. Garritt, 1985. Multiple stable isotopes used to trace the flow of organic matter in estuarine food webs. Science 227: 1361-1363

Piekäinen H., 2006. BALANCE/HELCOM Workshop on ecologically coherent network of MPAs in the Baltic Sea and the North East Atlantic. Minutes of the meeting. Helsinki, Finland, 25-27 October 2006, 15p.

Pipitone C., 2012. Spatial approach to fisheries management in the Mediterranean region. Transversal workshop on spatial based approach to fishery management. Rome, Février 2012, 7p.

Planes S., 2005 (project coordinator). Final report BIOMEX (Assessment of biomass export from marine protected areas and its impacts on fisheries in the Western Mediterranean Sea) Project – UE – QLRT-2001-0891. BIOMEX Perpignan. Available at: http://biomex.univ-perp.fr/MEDIATEK/FinalReportBIOMEX.pdf

Planes S., G.P. Jones and S.R. Thorrold, 2009. Larval dispersal connects fish populations in a network of marine protected areas. PNAS 106(14): 5693-5697

Por F.D., 1978. Lessepsian migrations. The influx of Red Sea biota into the Mediterranean by way of the Suez canal. Springer Verlag publ., Berlin, x + 1-228

Rais C., 2010. Representativity and coherence of MPA network : concepts and applicability to the Mediterranean Sea. 3rd International workshop on Biodiversity in the Adriactic : towards a representative network of MPAs in the Adriatic. Piran, Slovenia, Octobre 2010, 14p.

R Development Core Team, 2011. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/

Reeves R. and G. Notarbartolo di Sciara, 2006. The status and distribution of cetaceans in the Black Sea and Mediterranean Sea. IUCN Centre for Mediterranean Cooperation, Malaga, Spain, 137p.

Reñones O., A. Grau, X. Mas, F. Riera and F. Saborido-Rey, 2010. Reproductive pattern of an exploited dusky grouper *Epinephelus marginatus* (Lowe 1834) (Pisces: *Serranidae*) population in the western Mediterranean. Sci. Mar. 74(3): 523-537

Roberts C.M., 1997. Connectivity and management of Caribbean coral reefs. Science 278: 1454-1457

Roberts J.J., B.D. Best, D.C. Dunn, E.A. Treml and P.N. Halpin, 2010. Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207

Robles R., 2010. Conservacion y desarrollo sostenible del mar de Alboran / Conservation et développement durable de la mer d'Alborán. Gland, Suiza y Malaga, Espana: IUCN

Sala E., O. Abuto-Oropeza, G. Paredes, I. Parra, J.C. Barrera and P.K.Dayton, 2002. A general model for designing networks of Marine reserves, Science, 295,1991-1993

Sala E., 2004. The past and present topology and structure of Mediterranaen subtidal rocky-shore food webs. Ecosystems 7: 333-340

Santangelo G., M. Abbiati, F. Giannini and F. Cicogna, 1993. Red coral fishing trends in the Western Mediterranean Sea. Scientia Marina 57: 139-143

Sartoretto S., 1996. Vitesse de croissance et bioérosion des concrétionnements « coralligènes « de Méditerranée nord-occidentale. Rapport avec les variations Holocènes du niveau marin. Thèse Doctorat d'Ecologie, Université d'Aix-Marseille II, 194p.

Sartoretto S. and C. Baucour, 2011. Habitats particuliers du circalittoral : le coralligène de la sous-région marine Méditerranée occidentale DCSMM/EI/MO. Ministère de l'Ecologie, du Développement Durable, des Transports et du Logement, Ref. DCSMM/EI/EE/MO/2.2.5.c/2011, 11p.

Sartoretto S., M. Verlaque and J. Laborel, 1996. Age of settlement and accumulation rate of submarine "coralligene" (-10 to -60 m) of the northwestern Mediterranean Sea; relation to Holocene rise in sea level. Marine Geology 130: 317-331

Schultz E.T. and R.K. Cowen, 1994. Recruitment of coral reef fishes to Bermuda: local retention or long distance dispersal. Mar. Ecol. Progr. Ser. 109: 15-28

Schwarcz H.P., Y. Gao, S. Campana, D. Browne, M. Knyf and U. Brand, 1998. Stable carbon isotope variations in otoliths of Atlantic cod (*Gadus morhua*). Can. J. Fish. Aquat. Sci. 55: 1798-1806

Seminoff J.A. (assessor), 2004. Global Status Assessment: Green turtle (*Chelonia mydas*). Marine Turtle Specialist Group Species Survival Commission, Red List Programme: 71

Seminoff J.A., 2007. Green sea turtle (*Chelonia mydas*) 5-year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland 102p.

Seytre, C. and P. Francour, 2008. Is the Cape Roux marine protected area (Saint-Raphael, Mediterranean Sea) an efficient tool to sustain artisanal fisheries ? First indications from visual censuses and trammel net sampling. Aquatic Living Resources, 21(3): 297-305

Seytre, C., and P. Francour. 2009. The Cap Roux MPA (Saint-Raphael, French Mediterranean): changes in fish assemblages within four years of protection. ICES Journal of Marine Science 66: 180-187

Smith M.K., 1992. Regional differences in otolith morphology of the deep slope red snapper *Etelis carbunculus.* Can. J. Fish. Aquat. Sci. 49: 795-804

Snelder T.H., J.R. Leathwick, K.L. Dey, A.A Rowden, M.A. Weatherhead, G.G. Fenwick, M.P. Francis, R.M. Gorman, J.M. Grieve, M.G. Hadfield, J.E. Hewitt, K.M. Richardson, M.J. Uddstrom and J.R. Zeldis, 2006. Development of an ecologic marine classification in the New Zealand region. Journal of Environmental Management 39(1): 12-29

Spalding M.D., H.E. Fox, G.R. Allen, N. Davidson, Z.A. Ferdana, M. Finlayson, B.S. Halpern, M.A. Jorge, A. Lombana, S.A. Lourie, K.D. Martin, E. McManus, J. Molnar, C.A. Recchia and J. Robertson, 2007. Marine ecoregions of the world: a bioregionalization of coastal and shelf areas. Bioscience 57(7): 573-583

Spalding M. D., I. Meliane, A. Milam, C. Fitzgerald and L.Z. Hale, in press. Protecting Marine Spaces: global targets and changing approaches: Ocean Yearbook, v. 27

Streftaris N. and A. Zenetos, 2006. Alien marine species in the Mediterranean - the 100 'worst invasives' and their impact. Mediterranean Marine Science 7(1): 87-118

Swearer S.E., J.E. Caselle, D.W. Lea and R.R. Warner, 1999. Larval retention and recruitment in an island population of a coral-reef fish. Nature 402: 799-802

SWOT Report, 2005. The State of the World's Sea Turtles, Vol. 1, 37p.

SWOT Report, 2006. The State of the World's Sea Turtles, Vol. 2, 49p.

SWOT Report, 2007. The State of the World's Sea Turtles, Vol. 3, 43p.

SWOT Report, 2010. The State of the World's Sea Turtles, Vol. 5, 56p.

Thingstad T.F. and F. Rassoulzadegan, 1995. Nutrient limitations, microbial food webs, and biological pumps: Suggested interactions in a P-limited Mediterranean. Mar. Ecol. Prog. Ser. 117: 299-306

Thingstad T.F., M.D. Krom, R.F.C. Mantoura, C.A.F. Flaten, S. Groom, B. Herut, N. Kress, C.S. Law, A. Pasternak, P. Pitta, S. Psarra, F. Rassoulzadegan, T. Tanaka, A. Tselepides, P. Wassmann, E.M.S. Woodward, C.W. Riser, C. Zodiatis and T. Zohary, 2005. Nature of phosphorus limitation in the ultraoligotrophic eastern Mediterranean. Science 309: 1068-1071

Tiwari M., 2007. Leatherback sea turtle (*Dermochelys coriacea*) 5-year review: summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, 79p.

Torres G.J., A. Lombarte and B. Morales-Nin, 2000. Saggital otolith size and shape variability to identify geographical intraspecific differences in three species of

genus *Merluccius*. J. Mar. Biol. Ass. UK. 80: 333-342

Treml E.A., P.N. Halpin, D.L. Urban and L.F. Pratson, 2008. Modeling population connectivity by ocean currents, a graph-theoretic approach for marine conservation. Landscape Ecology. 23 Supp. 1: 19-36

Tudela S., 2004. Ecosystem effects of fishing in the Mediterranean: an analysis of the major threats of fishing gear and practices to biodiversity and marine habitats. Studies and Reviews. General Fisheries Commission for the Mediterranean. No. 74, Rome, FAO

Tyberghein L., H. Verbruggen, K. Pauly, C. Troupin, F. Mineur, O. De Clerck, 2012. Bio-ORACLE: a global environmental dataset for marine species distribution modeling. Glob. Ecol. Biogeogr. 21(2): 272-281

UNEP, 2012. Synthesis report on the work carried out regarding EBSAs identification in the Mediterranean. UNEP/CBD/SBSTTA/16/INF/8

UNEP-MAP-Plan Bleu, 2009. State of the Environment and Development in the Mediterranean. UNEP-MAP-Plan Bleu, Athens, 204p.

UNEP-MAP-RAC/SPA, 1995. Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

UNEP-MAP-RAC/SPA, 2004. Manual to support implementation of species-related commitments. RAC/SPA, Tunis, 2004

UNEP-MAP-RAC/SPA, 2007. Handbook for interpreting types of marine habitat for the selection of sites to be included in the national inventories of natural sites of conservation interest. By G. Pergent, D. Bellan-Santini, G. Bellan, G. Bitar and J.G. Harmelin, CAR/ASP publ., Tunis, 217p.

UNEP-MAP-RAC/SPA, 2008a. Action plan for the conservation of the coralligenous and other calcareous bio-concretions in the Mediterranean Sea. Ed. RAC/SPA, Tunis, 21p.

UNEP-MAP-RAC/SPA, 2008b. Impact of climate change on biodiversity in the Mediterranean Sea. By T. Perez, .RAC/SPA Edit., Tunis, 62p.

UNEP-MAP-RAC/SPA, 2009. Synthesis of National Overviews on Vulnerability and Impacts of Climate Change on Marine and Coastal Biological Diversity in the Mediterranean Region. By A. Pavasovic, D. Cebrian, A. Limam, S. Ben Haj and J.A. Garcia Charton, Ed. RAC/SPA, Tunis, 76p.

UNEP-MAP-RAC/SPA, 2009a. Regional synthesis on the representativity of Mediterranean Marine Protected Areas. By C. Rais, Ed. CAR/ASP, Tunis, 40p.

UNEP-MAP-RAC/SPA, 2009b. Proceedings of the 1st Mediterranean symposium on the conservation of the coralligenous and other calcareous bio-concretions (Tabarka, 15-16 January 2009). By C. Pergent-Martini and M. Brichet edits., RAC/SPA publ., Tunis, 273p.

UNEP-MAP-RAC/SPA, 2009d. Regional working programme for the coastal and marine protected areas in the Mediterranean including the high seas. 40p.

UNEP-MAP-RAC/SPA, 2010a. Overview of scientific findings and criteria relevant to identifying SPAMIs in the Mediterranean open seas, including the deep sea. By G. Notarbartolo di Sciara and T. Agardy, Ed. RAC/SPA, Tunis, 71p.

UNEP-MAP-RAC/SPA, 2010b. Specially Protected Areas in the Mediterranean, Assessment and Perspectives. By S. Ben Haj, L. Ben Nakhla, A. Ouerghi and C. Rais, Ed. CAR/ASP, Tunis, 36p.

UNEP-MAP-RAC/SPA, 2010c. Report presenting a georeferenced compilation on bird important areas in the Mediterranean open seas. By S. Requena and C. Carboneras, Ed. RAC/SPA, Tunis, 39p.

UNEP-MAP-RAC/SPA, 2010d. Impact of climate change on marine and coastal biodiversity in the Mediterranean Sea: Current state of knowledge. By S. Ben Haj and A. Limam, RAC/SPA Edit., Tunis, 28p.

UNEP-MAP-RAC/SPA 2010e. The Mediterranean Sea Biodiversity: state of the ecosystems, pressures, impacts and future priorities. By H. Bazairi, S. Ben Haj, F. Boero, D. Cebrian, S. De Juan, A. Limam, J. Lleonart, G. Torchia and C. Rais, Ed. RAC/SPA, Tunis, 100p.

UNEP-MAP-RAC/SPA, 2010f. Technical report on the geographical information system developed for Mediterranean open seas. By S. Requena, Ed. RAC/SPA, Tunis, 50p.

UNEP-MAP-RAC/SPA, 2010g. Fisheries conservation and vulnerable ecosystems in the Mediterranean open seas, including the deep seas. By S. De Juan and J. Lleonart, Ed. RAC/SPA, Tunis, 103p.

UNEP-MAP-RAC/SPA, 2011. Guidelines for the Establishment and Management of Marine Protected Areas for Cetaceans. By G. Notarbartolo di Sciara, Ed. ACCOBAMS-RAC/SPA, Tunis, 36p.

UNEP-WCMC, 2010. Data standards for the World Database on Protected Areas. UNEP-WCMC, 9p.

Werner F.E., R.K. Cowen and C.B. Paris, 2007. Coupled biological and physical models: Present capabilities and necessary developments for future studies of population connectivity. Oceanography 20(3): 54-69

Wessel P., W.H.F. Smith, 1996. A Global Selfconsistent, Hierarchical, High-resolution Shoreline Database. J. Geophys. Res. 101: 8741-8743

Wibbels T., 2007. Kemp's ridley sea turtle (Lepidochelys kempii) five-year review: summary and evaluation. National Marine Fisheries Service and U.S. Fish and Wildlife Service, 50p.

WIDECAST, 2009. Basic biology of the green turtle. WIDECAST network. Online at http://www.widecast.org/Biology/Green.html

Johnson W.M., A.A. Karamanlidis, P. Dendrinos, P. Fernandez de Larrinoa, M. Gazo, L. Mariano Gonzalez, H. Guclusoy, R. Pires and M. Schnellmann, 2006. Monk Seal Fact Files. Biology, Behaviour, Status and Conservation of the Mediterranean monk seal, Monachus monachus. The Monachus Guardian, www.monachus-guardian.org

Witzell W.N., 1983. Synopsis of biological data on the hawksbill turtle, Eretmochelys imbricata (Linnaeus, 1766). FAO Fish. Synop. n°137, 78p.

Witt M.J., R. Penrose and B.J. Godley, 2007. Spatio-temporal patterns of juvenile marine turtle occurrence in waters of the European continental shelf. Marine Biology 151: 873-885

Würtz M., 2010. Mediterranean Pelagic Habitat: Oceanographic and Biological Processes, An Overview. Gland, Switzerland and Malaga, Spain: IUCN

WWF, 2000. 13 key Mediterranean marine areas in need of protection. The Mediterranean Marine Gap Analysis. WWF

WWF/IUCN, 2004. The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Malaga and WWF, Rome.

- Part I. Cartes J.E., F. Maynou, F. Sarda, J.B. Company, D. Lloris and S. Tudela, 2004. The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts. In: The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Malaga and WWF, Rome, 9-38
- Part II. Tudela S., F. Simard, J. Skinner and P. Guglielmi, 2004. The Mediterranean deep-sea ecosystems: a proposal for their conservation. In: The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Malaga and WWF, Rome, 39-47

Yesou P and J. Sultana, 2000. Monitoring and conservation of birds, mammals and sea turtles of the Mediterranean and Black Seas: Proceedings of the 5th MEDMARAVIS Pan-Mediterranean Seabird Symposium, Gozo, Malta, october 1998. Environmental Protection Dpt, Malta, 320p.

Yesson C., M.R. Clark, M. Taylor and A.D. Rogers, 2011. The global distribution of seamounts based on 30 arc second bathymetry data. Deep Sea Research Part I: Oceanographic Research Papers, 58(4): 442-453

Zabala M., A. Garcia Rubies, P. Louisy and E. Sala, 1997. Spawning behaviour of the Mediterranean dusky grouper Epinephelus marginatus (Lowe, 1834) (Piscea, Serranidae) in the Medes Islands Marine Reserve (NW Mediterranean, Spain). Scientia Marina 61(1): 65-77

Zenetos A., 2010. Trend in aliens species in the Mediterranean. An answer to Galil, 2009 “Taking stock: inventory of alien species in the Mediterranean Sea”. Biol Invasions (2010) 12: 3379-3381

Zenetos et al. 2009. Marine Biological Invasions. In UNEP-MAP-Plan Bleu: State of the Environment and Development in the Mediterranean 155-161

Artisanal fishermen in Jijel Harbor, Algeria © M.Mabari / WWF Mediterranean

The MedPAN collection

The MedPAN collection is a series of publications designed to provide Marine Protected Areas (MPA) managers and other stakeholders in the Mediterranean, guidance, practical and useful information, experience feedback or overviews on key MPA management issues.

The MedPAN collection is fully adapted to the Mediterranean context. It gathers publications developed by different key players in the Mediterranean MPA community under a unified look and feel.

The MedPAN collection is an initiative of the MedPAN organisation and several partners, including RAC/SPA, WWF, IUCN Mediterranean, ACCOBAMS, the French MPA Agency and the Conservatoire du Littoral. It is edited by MedPAN, the network of MPA managers in the Mediterranean.

Date : 09/2013 - Version : 1.0

MedPAN

The network of Marine Protected Areas Managers in The Mediterranean

www.medpan.org