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INTEGRATED OCEAN MANAGEMENT IN THE MEDITERRANEAN Overview and good practices to foster the Ecosystem Approach

Federico Fabbri, Tecla Maggioni, Anastasia Charitou, Fabio Carella, Folco Soffietti, Delphine Thibaud, Joan Gonzalvo, Simone Panigada, Elena Politi,
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► **To cite this version:**

Federico Fabbri, Tecla Maggioni, Anastasia Charitou, Fabio Carella, Folco Soffietti, et al.. INTEGRATED OCEAN MANAGEMENT IN THE MEDITERRANEAN Overview and good practices to foster the Ecosystem Approach. 2022. hal-03906410

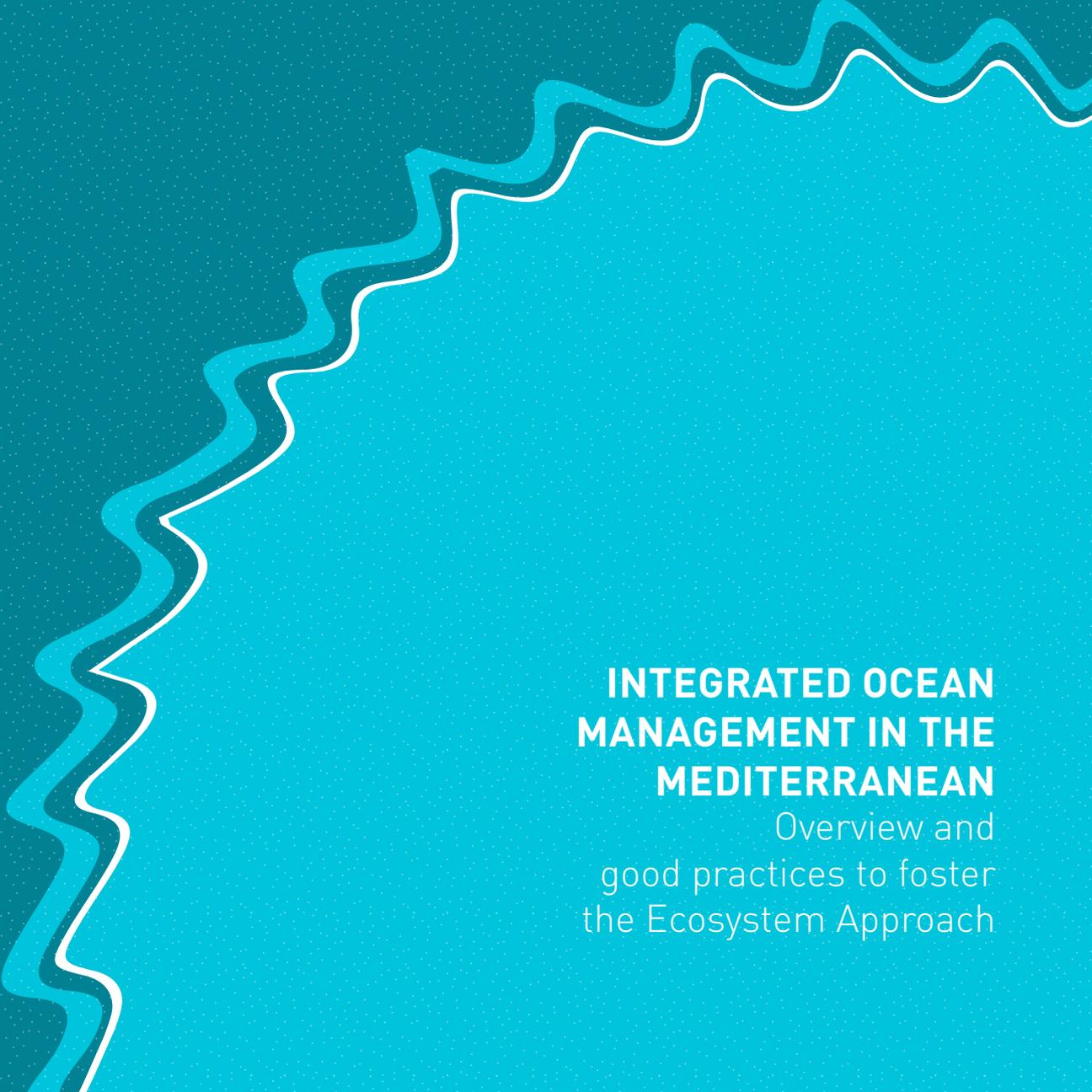
HAL Id: hal-03906410

<https://hal.science/hal-03906410>

Submitted on 19 Dec 2022

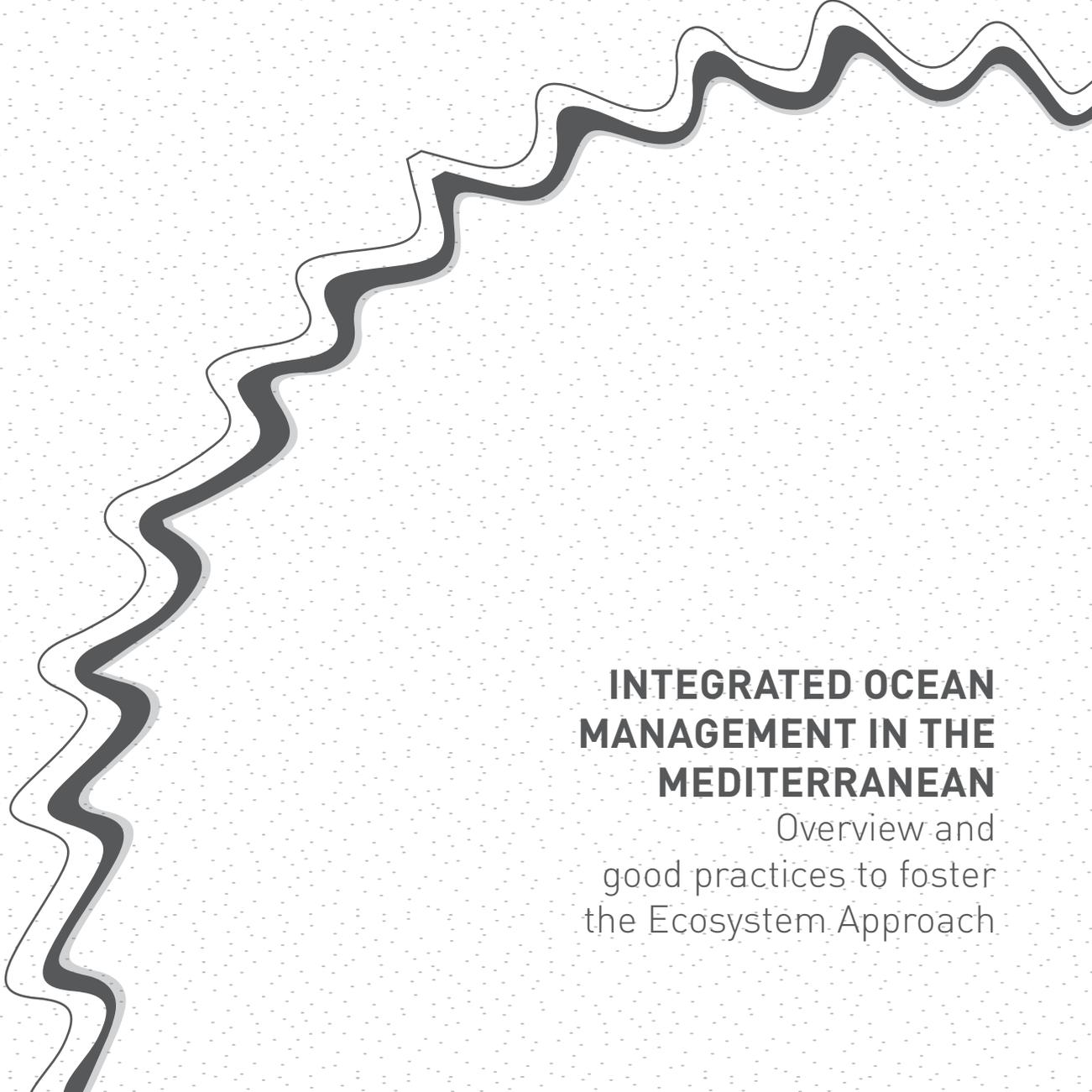
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For bibliographic purposes, this document should be cited as follows:
F. Fabbri, T. Maggioni, A. Charitou, F. Carella, F. Soffietti, D. Thibault, S. Panigada, E. Politi, D. Katsada, J. Gonzalvo, A. Mazaris, G. Pozoukidou, M. Papageorgiou, J. Sánchez, A. Dalmau, F. Musco (2021) Integrated Ocean Management in the Mediterranean. Overview and good practices to foster the ecosystem approach. EU Project Grant No.: 2018-1-IT02- KA203-048520. MARINE Education and COmmunication network on the Mediterranean (MARINE_ECOMED). IUAV. 126 pp. [English]. DOI: 10.5281/zenodo.7413462



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1 FOREWORD

FOREWORD

The Mediterranean Sea, yet occupying just a small portion of the global ocean, hosts approximately 7% of the marine biodiversity and it is considered a hotspot for economic development.

In the Mediterranean, there is a complex socio-economic framework including a diversified pool of maritime activities that depend on and interact with the coastal and marine ecosystems.

The use of ecosystem services and resources by society plays a fundamental role in the Mediterranean economy and the livelihood of coastal populations. In this context, Integrated Ocean Management (IOM) is recognized to be crucial to sustainable development in the Mediterranean and more in general, worldwide. Managing our common ocean with an Integrated Approach has been front and centre of many initiatives at the global level.

In 2010, Contracting Parties to the Convention on Biological Diversity adopted the so-called 'Aichi targets' to achieve global biodiversity conservation. Target 11 specifically provides that "by 2020, at least 17 percent of terrestrial and inland water, and 10 percent 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"¹.

In September 2021, members of the International Union for Conservation of Nature met in France for the World Conservation Congress and approved a much-anticipated motion to support the target of effectively and equitably conserving and protecting at least 30% of land and ocean by 2030, known as 30x30. This motion calls on all components of IUCN to support the conservation target, with a focus on sites of particular importance for biodiversity, in well-connected systems of protected areas and other effective area-based conservation measures (OECMs) by 2030, in the post-2020 global biodiversity framework.

In 2015, an area-based ocean conservation target was included amongst the UN Sustainable Development Goals, recognizing the pivotal role of IOM. Sustainable Development Goal 14 Life Below Water reasserted the need to "conserve and sustainably use the oceans, seas and marine resources for sustainable development". Specifically, Target 14.5 states: "by 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information which will be measured by 'coverage of protected

areas in relation to marine areas”².

The increasing need for a holistic, ecosystem-based, and knowledge-based overarching approach that ensures the sustainability and resilience of marine ecosystems has reached the top of the international agenda thanks to the UN Decade of Ocean Science for Sustainable Development 2021-2030.

This initiative (hereafter, the ‘Ocean Decade’) was proclaimed by the United Nations General Assembly in December 2017, and it seeks a revolution in the way we do ocean science. Boosting the generation of qualitative and quantitative ocean knowledge, it is aimed at informing the development of solutions to achieve the 2030 Agenda for Sustainable Development, with a focus on SDG 14. This initiative envisages a mobilization of the scientific community, governments, private sectors, and civil society around a common research and technological innovation agenda.

The Ocean Decade vision is captured in the motto “the Science we need for the ocean we want”, providing a “once in a lifetime” opportunity for nations to work together to create the global ocean science needed to support sustainable development and management of our shared ocean.

In doing so, the Ocean Decade shall transition us from the ‘ocean we have’ to the ‘ocean we want’, that

is clean, healthy, safe, resilient, productive, predicted, accessible, inspirational and engaging.

In parallel, a transformative change in the way society values the ocean is envisaged. To do so, the Ocean Literacy approach will be a key tool to incite behavior change, towards having by 2030 a society that is fully aware of the importance of the ocean for our life.

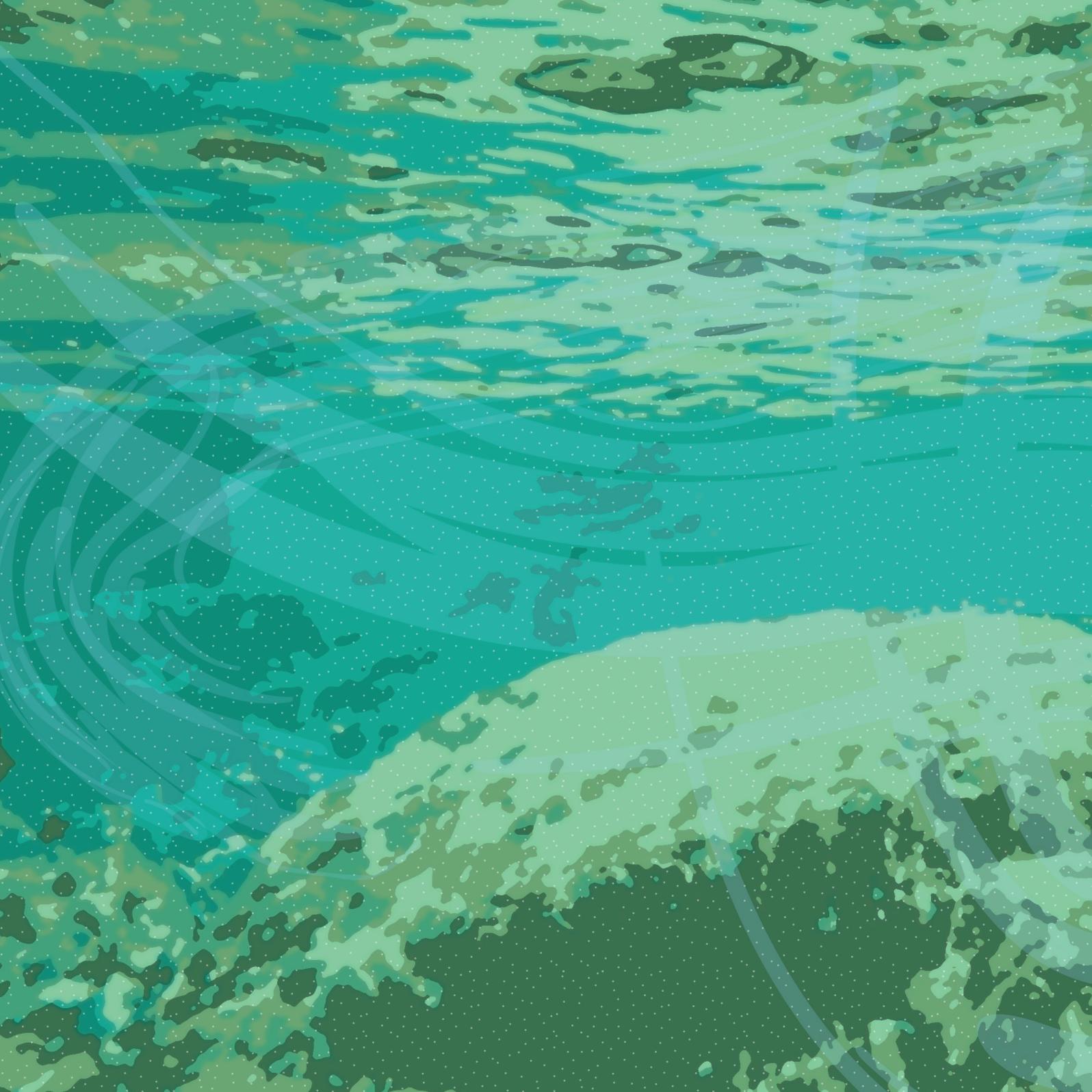
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This publication was built in the context of the MARINE_ECOMED Erasmus + European Project through the collaboration of experts from different Mediterranean regions. This Handbook is intended to provide an overview of the IOM topic, its development in the Mediterranean and it includes a description of some of the most representative projects in the form of replicable good practices. By gathering an inclusive look at the challenges and achievements of IOM in the Mediterranean context, the Handbook is meant to support its understanding and implementation in the future. The knowledge provided seeks to boost the replication and adaptation of IOM, despite the different geographical contexts in which it will be planned and established.

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² SDG 14 <https://sdgs.un.org/goals/goal14>



2 ABOUT THIS HANDBOOK

ABOUT THIS HANDBOOK

2.1 What is the purpose of this Handbook?

This Handbook aims to provide an overview of the Integrated Ocean Management (IOM) topic and its state of implementation in the Mediterranean, through an ecosystem approach and targeted communication strategies.

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To complement the knowledge and understanding of IOM, a series of good practices relevant to the subject are presented.

Several case studies have been collected from research and environmental conservation organizations, to provide a comprehensive overview of different approaches that can be adapted and replicated in different geographical contexts.

2.2 Who should be interested in this Handbook?

This Handbook is addressed primarily to experts, early-career professionals, and students involved in ocean management-related fields.

It is thought both as a source of replicable good practices and successful case studies for experts, as well as an educational tool for early-career practitioners and students in the multidisciplinary subject of IOM.

2.3 How was this Handbook developed?

This Handbook was developed in the context of the MARINE_ECOMED Project supported by the Erasmus + European Programme over a three years duration, from late 2018 until the end of 2021. The MARINE_ECOMED Project was framed to enhance research and cooperation within the Mediterranean region in the field of sustainable management of marine and coastal areas, through the development of innovative communication and education strategies.

The project has been implemented by a strategic partnership of academic institutions and Non-Governmental Organizations (NGOs), coordinated by the University Iuav of Venice (Fig.1).

The present Handbook integrates the professional experiences, knowledge, and approaches from the project partner organizations, that are located in different Mediterranean coastal countries: University Iuav of Venice and Tethys Research Institute from Italy, Environmental Organization iSea and the Aristotle University of Thessaloniki (AUTH) from Greece, SUBMON Environmental Organization from Spain, and the Aix-Marseille University (AMU) from France.

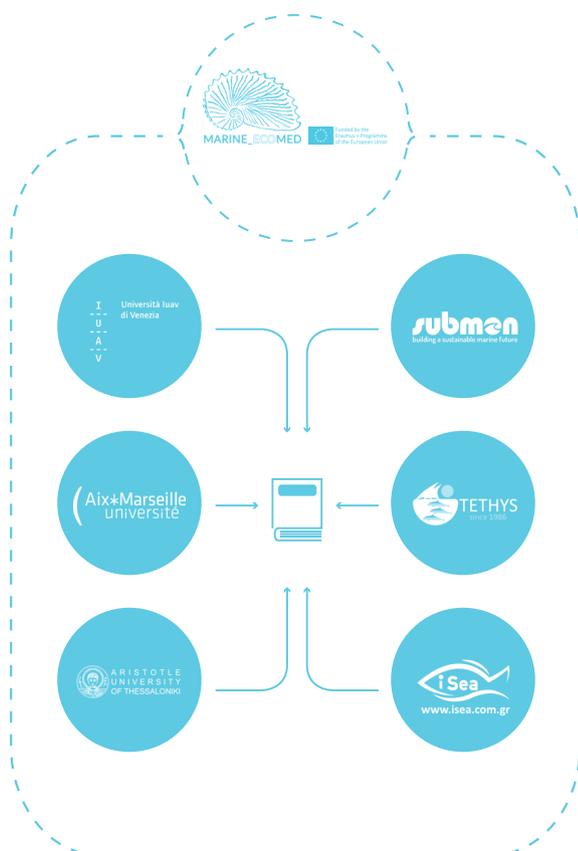


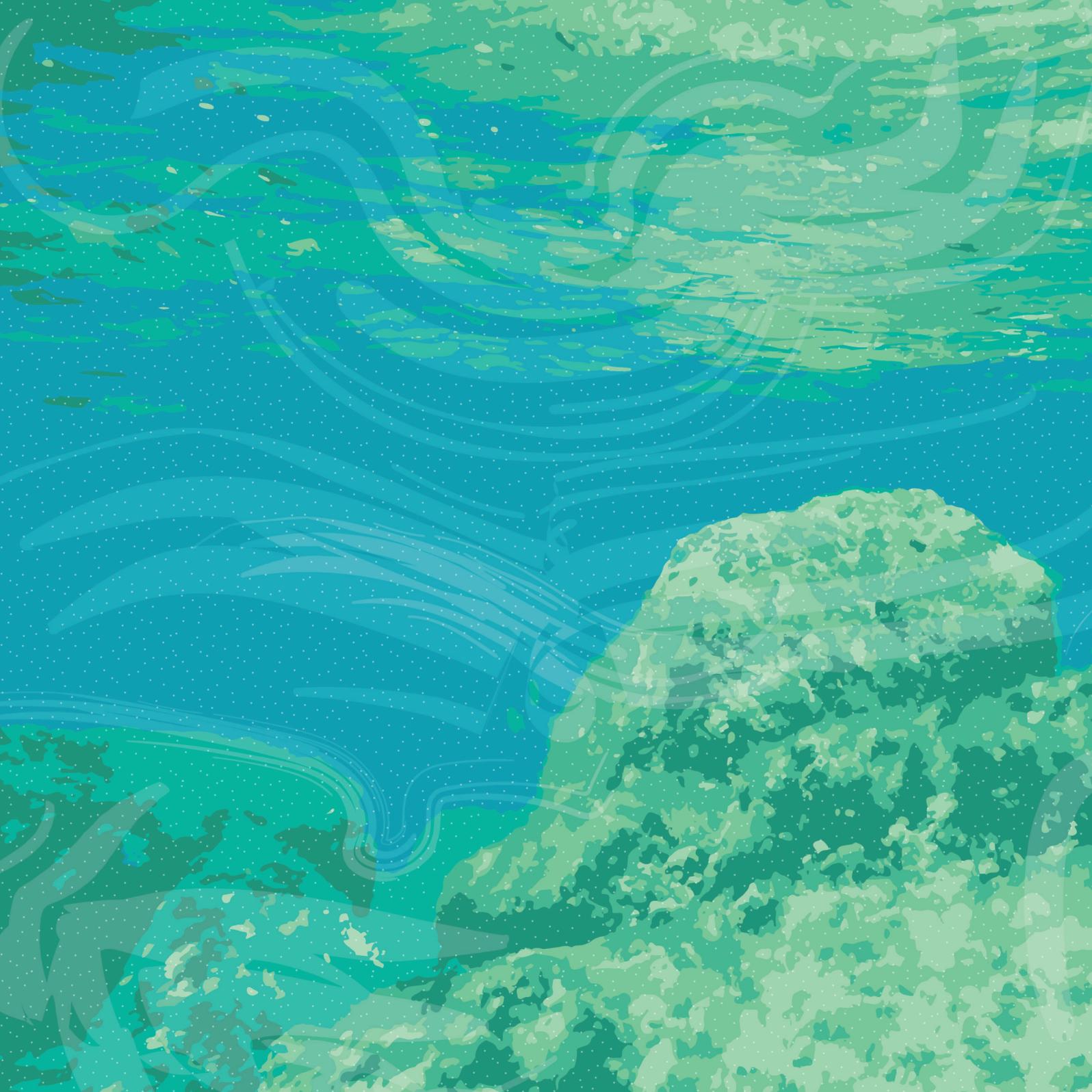
Figure 1. MARINE_ECOMED Project strategic partnership involved in the creation of this handbook

2.4 How is this Handbook organized?

This Handbook is organized into three main parts. The first part provides a general introduction to the topic of IOM, the ecosystem approach, and communication strategies to support IOM. Here the definition of tools and strategies for IOM is included. In the second part an overview of the Mediterranean Basin from a natural and socio-economic point perspective is provided, followed by a summary on the state of implementation of IOM in the Mediterranean. In the third part, a number of selected good practices, on the application of the ecosystem approach and communication strategies to support IOM, are described.

2.5 How to use this Handbook

This Handbook can be used in three different ways: 1) as a reference document including most relevant terms and definitions related to the ecosystem approach and communication strategies to support IOM; 2) as a source of summarized information on the state of the art of IOM in the Mediterranean basin; 3) as a source of good practices that can be consulted individually.



3 KEY CONCEPTS OF INTEGRATED OCEAN MANAGEMENT

KEY CONCEPTS OF INTEGRATED OCEAN MANAGEMENT

The following section provides the definitions of the main topics that are the focus of this Handbook. Furthermore, main related approaches and terminology are also presented.

18 3.1 What is the Integrated Ocean Management

Integrated Ocean Management (IOM) has been defined as “a holistic, ecosystem-based and knowledge-based approach that aims to ensure the sustainability and resilience of marine ecosystems while integrating and balancing different ocean uses to optimize the overall ocean economy.”¹

In a scenario of an increasing trend of human pressures on the marine environment, IOM in the Mediterranean is fundamental to allow the sustainable development of maritime activities, while preserving the natural environment and cultural heritage on which they depend. Its achievement represents a common goal and challenge for all Mediterranean countries and it should be accomplished across borders and extensively across the entire Mediterranean basin. Indeed, marine natural resources and activities are highly dynamic in space and time and their distribution commonly overcomes political borders, therefore

the coordination between neighboring countries and regions is imperative to ensure their effective and sustainable management.

To achieve IOM both the implementation of the Ecosystem Approach and effective communication strategies are required.

The Ecosystem Approach is considered crucial to attaining, at the same time, the sustainable management and conservation of the natural environment and its resources. On the other hand, effective communication strategies play a key role to foster sustainable exploitation of the Mediterranean values and resources. The enhanced knowledge and awareness of the marine environment and the use of marine space and resources will support a wider understanding of its complexity and related issues by our society, including non-specialist public and policy makers, and ultimately foster its sustainable management.

3.2 Main approaches and terminology relevant to IOM

Ecosystem Approach (EA) was at first defined and adopted at the fifth Conference of the Parties to the Convention of Biological Diversity in 2000 (COP 6). Its adoption seeks to develop an approach to ensure

integrated management of land, water, and living resources that could promote their conservation and sustainable use in an equitable way. For this Handbook it is adopted the definition issued in 2003 by the Regional Seas Conventions of OSPAR & HELCOM (2003), which specifically refers to the marine context and define the EA as: “the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity”².

It is worth noting that the term “Ecosystem-Based Approach (EBA)” is also used, as within the terminology adopted within the European legal framework, with equivalent meaning to “Ecosystem Approach (EA)”.

Marine Spatial Planning (MSP) is a public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social objectives that have been specified through a political process³. MSP is not an end in itself but a practical way to

create and establish a more rational use of marine space and the interactions among its uses, to balance demands for development with the need to protect the environment, and to deliver social and economic outcomes in an open and planned way⁴.

Land-Sea Interactions (LSI) are interactions in which land-based natural phenomena or human activities have an influence or an impact on the marine environment, resources and activities and interactions in which marine natural phenomena or human activities have an influence or an impact on the terrestrial environment, resources and activities⁵.

Blue Economy is the sustainable use of ocean resources for economic growth, improved livelihoods and jobs while preserving the health of ocean ecosystems⁶. Blue Economy encompasses all sectoral and cross-sectoral economic activities based on or related to the seas and coasts

Integrated Coastal Zone Management (ICZM) is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation.

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ICZM uses the informed participation and cooperation of all stakeholders to assess the societal goals in a given coastal area, and to take actions towards meeting these objectives. ICZM seeks, over the long-term, to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics. 'Integrated' in ICZM refers to the integration of objectives and also to the integration of the many instruments needed to meet these objectives. It means integration of all relevant policy areas, sectors, and levels of administration. It means integration of the terrestrial and marine components of the target territory, in both time and space⁷.

Marine Protected Area (MPA) A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values⁸. Designed to conserve marine life, MPAs are a globally recognized tool for managing and enhancing the marine ecosystems and to promote a sustainable use of marine resources. They help protect important habitats and representative samples of marine life and can

assist in restoring the productivity of the oceans and avoid further degradation. MPAs can play a vital role in providing ecosystem services, by protecting important, unique, and productive areas from human impacts.

Important Marine Mammal Areas (IMMAs) IMMAs, are "discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation", and are an initiative of the Joint IUCN Species Survival Committee/World Commission on Protected Areas (SSC/WCPA) Task Force on Marine Mammal Protected Areas (the "Task Force"). Identification is achieved through the application of IMMA criteria covering key biological and ecological considerations for marine mammal species. These criteria were created through an expert process with additional public consultation with the wider marine mammal science and conservation community. The Convention on Migratory Species, with Resolution 12.13 adopted at COP12 in Manila in October 2017, acknowledged the IMMA process, and *inter alia* requested Parties and invited Range States to identify specific areas where the identification of IMMAs could be beneficial.

Other Effective area-based Conservation Measure (OECM) A geographically defined area other than a Protected Area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the in situ conservation of biodiversity, with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values⁹.

Communication strategies play a key role in supporting the implementation of IOM. Effective communication is crucial to many aspects of IOM, namely: the stakeholder engagement process, the involvement of policymakers, the awareness on environmental and social issues, the collection of scientific information, as well as to gather consensus on science-based information.

The communication strategies for IOM include any approach aimed to communicate science-based information related to this specific multidisciplinary topic. An overall definition, adapted from the definition of “science communication” by Burns et al. (2003)¹⁰ is provided here: “Communication strategies for IOM include a variety of practices that transmit ideas, methods, knowledge, and research on the subject to non-expert audiences in an accessible, understandable, engaging or useful way.

Communication strategies audiences may not require any prior interest or educational background in the topic of IOM.

There is no limit to how to communicate or who to communicate IOM subject to. It is a burgeoning field with a multidisciplinary nature that may take from a wide range of communication disciplines and styles. Communication strategies for IOM include academic study of communicating scientific related topics to different publics that draws on a wide range of disciplines in the social sciences, humanities, and sciences. This includes research, critiques, and debates on models of communication practiced by science communicators”.

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Education is the process of facilitating learning or the acquisition of knowledge, skills, values, beliefs and habits, with the use of different methods and in the context of different setting, defined as the “discipline that is concerned with methods of teaching and learning in schools or school-like environments as opposed to various non formal and informal means of socialization”¹¹.

Education by definition is divided into two main types: Formal Education and Non-formal Education.

Formal Education refers to Education that is institutionalized, intentional and planned through public organizations and recognized private bodies and, in their totality, make up the formal education system of a country. Formal education programmes are thus recognized as such by the relevant national educational authorities or equivalent, e.g. any other institution in cooperation with the national or sub-national educational authorities. Formal education consists mostly of initial education. Vocational education, special needs education and some parts of adult education are often recognized as being part of the formal education system¹².

Non-formal education which corresponds to Education that is institutionalized, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an

addition, alternative and/or a complement to formal education within the process of the lifelong learning of individuals. It is often provided to guarantee the right of access to education for all. It caters for people of all ages, but does not necessarily apply a continuous pathway-structure; it may be short in duration and/or low intensity, and it is typically provided in the form of short courses, workshops or seminars. Non-formal education mostly leads to qualifications that are not recognized as formal qualifications by the relevant national educational authorities or to no qualifications at all. Non-formal education can cover programmes contributing to adult and youth literacy and education for out-of-school children, as well as programmes on life skills, work skills, and social or cultural development¹³.

Citizen science is the practice of involving citizens in scientific research by providing important information that contributes to the increase of scientific knowledge¹⁴. Citizen Science projects are related to many different areas and scientific disciplines, namely Biodiversity, Physics, Medicine, Ecology, Biology and other fields and their success depends on several aspects. Thus, there are key principles and guidelines to promote good practices in Citizen Science. UNESCO points that “at its most inclusive

and most innovative, citizen science involves citizen volunteers as partners in the entire scientific process, including determining research themes, questions, methodologies, and means of disseminating results¹⁵. Environmental related citizen science projects in particular, have the potential to 1) provide massive data spatio-temporally that can contribute to the rapid and science-based decision-making for the management of natural resources, 2) enhance environmental awareness and the environmental literacy of the participants, through the continuous information they receive and the relationship they develop with the natural environment, 3) provide information that will be used for the creation of problem-solving strategies¹⁶.

Ocean Literacy (OL) has been defined as “understanding of the ocean’s influence on people and their influence on the ocean”¹⁷. Ocean Literacy is not only about increasing awareness of the state of the ocean, it is also about providing tools to transform ocean knowledge into action. Ocean knowledge should serve as the engine to drive a change in the human behaviours to achieve ocean sustainability. Many people are not fully aware of the intrinsic connection to the ocean, or there is a misconception

that the ocean only affects those that are living near the coastal areas. Ocean Literacy is intended as a tool to counteract this lack of awareness, and to promote the use of ocean knowledge in day-to-day actions, with the final aim of supporting informed decisions. Ocean Literacy started as a movement in the United States at the beginning of 2000 when a group of scientists and educators realized there was very little ocean knowledge in school curricula. They developed an Ocean Literacy framework that is made of 7 essential principles, and they created some tools that could be used by educators in formal and non-formal education to encourage ocean science inclusion in the classroom.

The seven essential principles of OL states:

Principle 1: The Earth has one big ocean with many features

Principle 2: The ocean and life in the ocean shape the features of Earth.

Principle 3: The ocean is a major influence on weather and climate.

Principle 4: The ocean made the Earth habitable.

Principle 5: The ocean supports a great diversity of life and ecosystems.

Principle 6: The ocean and humans are inextricably interconnected.

Principle 7: The ocean is largely unexplored. In 2015, Unesco started to work on Ocean Literacy, and in the Ocean Conference held in 2017 Ocean Literacy was brought to the stage for the first time in the international agenda. Since its initial formulation, the Ocean Literacy concept has evolved, and from being only used in school it is now contemplated as an educational approach for the whole society, from citizens, to the private sectors to the policy makers. In the framework of the Ocean Decade, Ocean Literacy is intended as a key approach to reach the objectives set, and to tackle the challenges identified.

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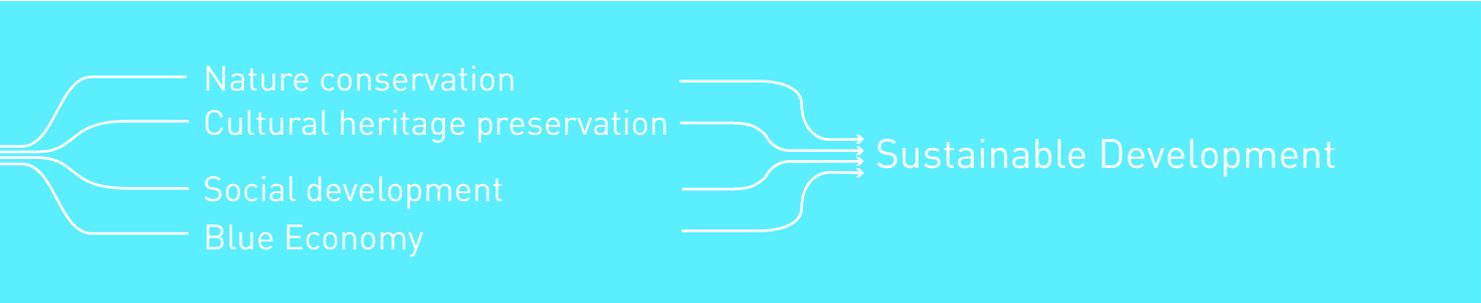
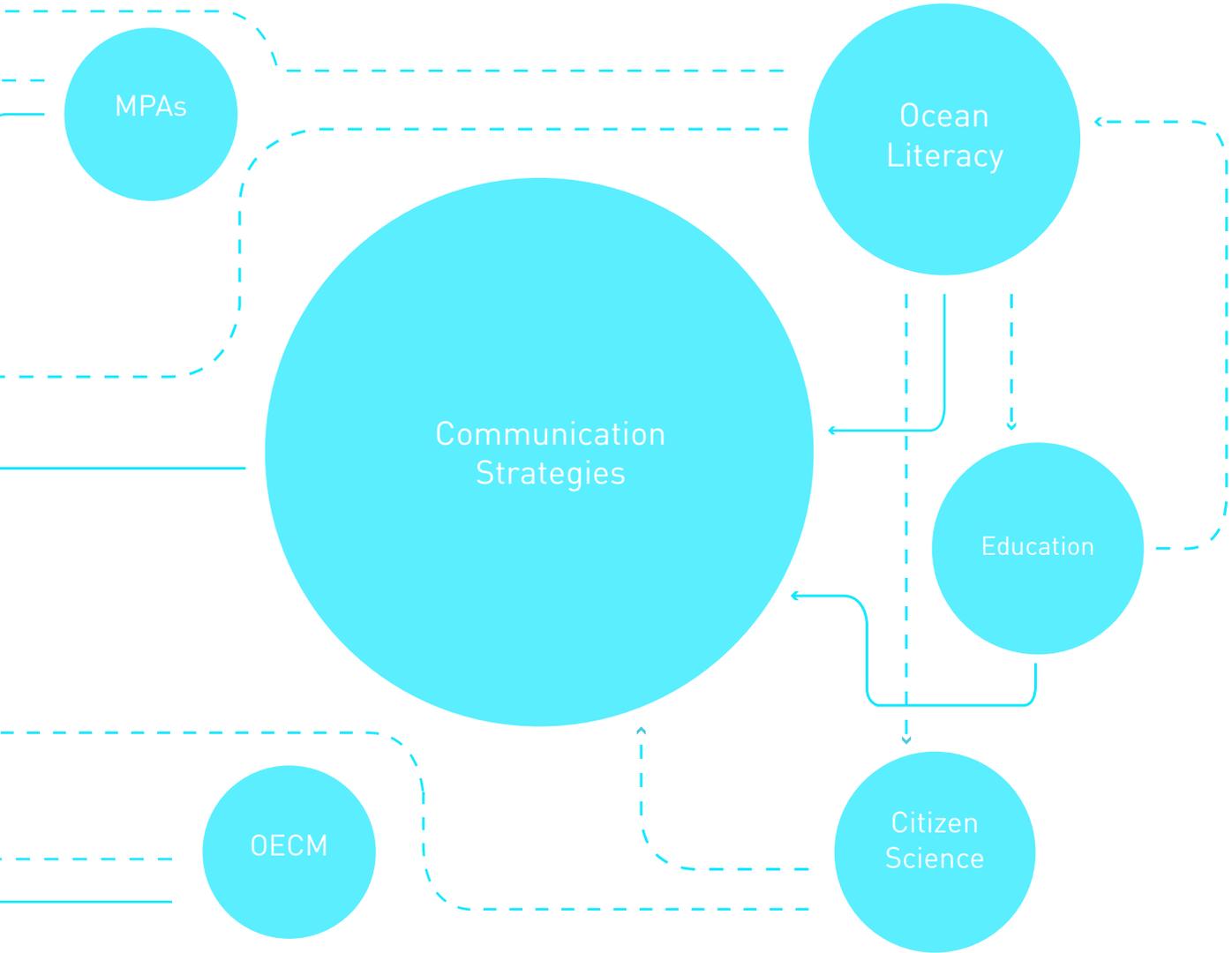
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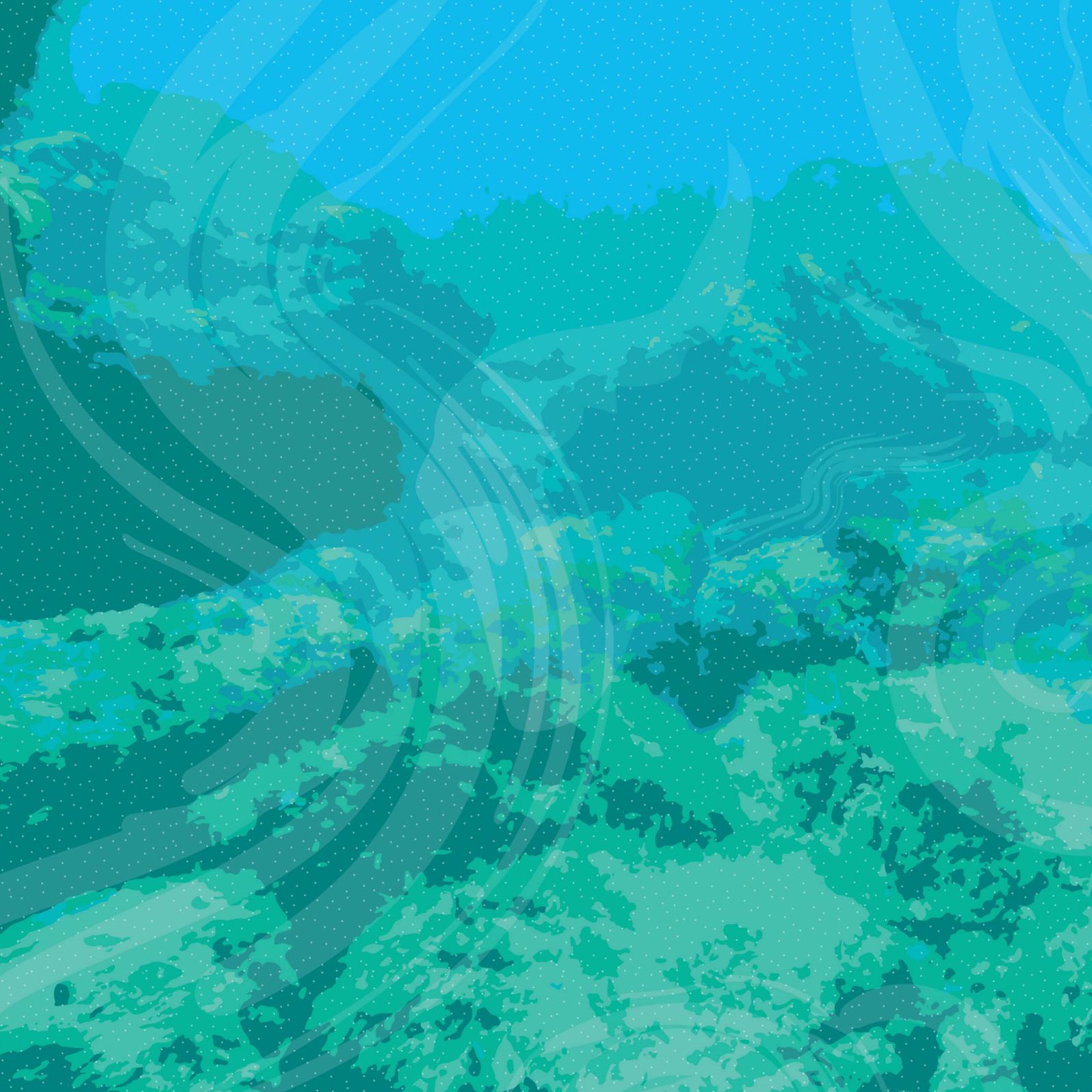
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4 SHORT OVERVIEW OF THE MEDITERRANEAN SEA

SHORT OVERVIEW OF THE MEDITERRANEAN BASIN

4.1 Geography

30 The Mediterranean Sea (Fig.2) is the largest semi-enclosed sea, covering an area of approximately 2,500,000 km². The length of its coastline is about 46,000 km long and includes the shore of 21 countries from Europe, Africa and Asia. It is connected to the Atlantic Ocean via the Strait of Gibraltar, to the Black Sea through the Bosphorus Strait, and to the Red Sea by the artificial waterway of the Suez Canal. The Mediterranean Sea is classified as a temperate sea, its mean depth is 1,370 m and its deepest point is the Calypso Deep located in the Hellenic trench (Greece) at -5,267 m.

The Mediterranean Sea name originates from Latin, meaning “middle of the land”, because of its position between Europe, North Africa, and the Middle East. It mainly consists of narrow continental terraces and includes more than 3,000 islands. Mediterranean coastlines are mostly rimmed by mountain ranges, coastal plains and deltaic zones of large rivers. Being a semi-enclosed sea, it is characterized by high salinities, evaporation rate, temperatures and densities, but rather low nutrient concentrations and limited tides. The Mediterranean coastline “hosts” major cities and areas. Approximately one third of the Mediterranean population is concentrated along its coastal regions¹.

4.2 Natural heritage

The Mediterranean Sea encloses a very unique natural value. It is included among the 36 main Biodiversity Hotspots and the 64 Large Marine Ecosystems of the world², indeed its specific climate together with the fact that it is a semi-enclosed basin have created the right conditions for the establishment of rich biodiversity, including several endemic species in its waters and along its coastline. While its surface corresponds to less than 1% of the world’s oceans it contains approximately 7.5% of the world’s marine fauna and 18% of its marine flora³. It includes 17,000 marine species of which more than 20% are endemic^{4,5}. The Mediterranean comprises several ecosystems with a high ecological value representative of its marine and coastal environment, namely: seagrass meadows, coralligenous beds, seamounts, lagoons, estuaries, wetlands, sandy and rocky shores. Among the marine ecosystems, seagrass meadows composed of *Posidonia oceanica* (Fig.3), a species endemic of the Mediterranean, are widely distributed through most of its coast. *Posidonia oceanica* is considered an ecosystem engineer, and it provides many different ecological functions: meadows serve as nursery areas, providing shelter for many different vertebrate and invertebrate species, they regenerate and fix the sediment, counteracting coastal erosion,

Figure 2. Satellite image of the Mediterranean basin



32 produce oxygen and maintain the water clear. In view of climate change, *Posidonia oceanica* meadows, annoverated among the Blue Carbon ecosystems, would serve as a key habitat due to their ability to fix carbon dioxide (CO₂) and store organic carbon in their canopy. Some Mediterranean species are a focus for conservation due to their key role in the ecosystem and their vulnerability to anthropogenic threats. Among the most representative are found: 41 shark species⁶, 23 cetacean species⁷, 3 sea turtle species⁸, and one seal species (the monk seal, *Monachus monachus*)⁹.

4.3 Cultural heritage

The Mediterranean region is home to some of the oldest human settlements in the world due to its unique cultural heritage and cultural landscapes. The long history of human settlements on the Mediterranean coasts and waters is witnessed by the presence of an uncountable number of archeological findings and sites both on the coast landward and at sea, among which 191 Unesco World Heritage Sites are counted. The first human settlements on the Mediterranean

Figure 3. *Posidonia oceanica* meadows. Source: SUBMON



shores are dated back to around 1,3 million years¹⁰. The Mediterranean played a historical role as a hub of human development, trade, and exchange among different cultures and it is considered the main area of development of Western Civilization. This has forged, over thousands of years, strong bonds among the people of the region and given added meaning to the sense of belonging to the Mediterranean. Despite their diversity, the regional identity of the Mediterranean countries has been strengthened by centuries of commerce and communication. Many maritime traditions are maintained and practiced in present days. Among these, traditional fishing still plays a very significant cultural, social, and economic role for the coastal territories of the entire basin. The Mediterranean diet which is strongly connected with the traditional consumption of seafood was included in 2010 in the UNESCO List of the Intangible Cultural Heritage of Humanity¹¹.

4.4 Socio-economic context

The Mediterranean basin is a highly complex multi-national context, indeed it includes the coastlines and jurisdictional waters of twenty-one riparian countries from three continents (Fig.4).

Over 150 million people live in coastal areas¹² and depend on the use of marine space and resources. On the Mediterranean shores, a considerable number of big cities are found in which 70% of the riparian countries' population live¹³.

Thanks to its unique combination of mild climate, rich history, culture and unique natural resources and proximity to major trade hotspots, the Mediterranean is the world's leading tourism destination in terms of both international and domestic tourism. In addition to the resident population, its coasts are visited by an additional number of over 300 million tourists per year¹⁴ (about one-quarter of the entire global tourism) of which 26 million are part of cruise tourism^{15,16}.

The Mediterranean encloses the trade routes of its riparian countries with the rest of the world. It is one of the main hubs for marine transport worldwide, including over 600 ports and terminals, several of which are listed among the 100 world top ports¹⁷. Intra-Mediterranean maritime trade flows account for 25% of global traffic¹⁸ and the total revenues of maritime transport amount to more than 70 billion Euros in the Mediterranean Sea, equivalent to 5% of the total revenues worldwide¹⁹.

Fisheries and aquaculture are essential drivers for the blue economy in the Mediterranean. They provide essential coastal livelihoods as well as

Figure 4. Geopolitical overview of the Mediterranean Sea.



often substantial access to food, as part of the “Mediterranean diet”. The professional fisheries sector plays a fundamental role in the economy of Mediterranean countries providing around 250,000 jobs of which more than half are in the Small-scale artisanal fisheries²⁰. Recreational fishing in the Mediterranean is estimated to account for more than 10% of the total fish catch and it has a strong impact on the economy of the region²¹. Aquaculture production has quadrupled in the last 20 years with an actual product that exceeds 2 million tonnes per year, accounting for more than 50% of today’s total fishery output at the Mediterranean scale and providing 120,000 direct jobs²². Dredging of sand is also common in shallow areas of the Mediterranean Sea bottom²³ as well as oil and gas exploration and extraction from offshore areas in particular in the Eastern Mediterranean Sea, and in the Adriatic Sea²⁴. Regardless of its relatively early stage compared to other global oceans, marine renewable energy offers interesting development potentials for the Mediterranean. Two technologies seem to be the most promising for the region: offshore wind and waves. Further seabed mining is expected to be developed in the coming years to supply the increasing demand for minerals from the ocean floor²⁵.

4.5 Ecological status

The marine and coastal ecosystems of the Mediterranean have undergone a considerable change over the last century. Intense and poorly regulated exploitation of its marine and coastal resources has caused the worsening of the ecological status of its waters, bottoms and coasts, with negative consequences on its biodiversity and the ecosystem (Fig.5). This trend has led to a consistent loss of the services provided by the ecosystem to society. Several pressures are generated by human activities on the coast and at sea while in parallel climate change is weakening the resilience of Mediterranean ecosystems, making them more vulnerable to anthropogenic stressors. Industrial fishing has severely reduced the population of several fish species and at the moment 78% of assessed fish stocks are exploited besides the sustainable level. Fisheries and in particular bottom trawlers play a substantial role in the ongoing biodiversity crisis, indeed the amount of discards is estimated at around 230,000 tonnes of marine species per year (around 18 % of total catch considering all types of fisheries and over 40% for bottom trawlers)²⁶. Furthermore, maritime tourism is adding a burden to coastal and marine environments, and pressures are mainly related to the construction and use of tourism

infrastructures and unregulated recreational activities. Underwater noise from marine traffic and other activities is also intense²⁷.

In the Mediterranean, organic pollution, from coastal activities (e.g. agriculture and farming), waste from urban agglomerations, and the input of marine litter (mainly plastic) are particularly intense. The presence of a large and growing number of non-indigenous species (over 900) is also altering the ecosystem and threatening Mediterranean biodiversity²⁸. Looking to the near future, there is great concern from the scientific community on the potential effects of the sea bed mining activities that might be developed, in particular in the deep sea, where they can drastically affect the ecosystem²⁹.

The interaction of all these stress factors, acting simultaneously on the marine ecosystem can influence the ability of species and habitats to respond to individual pressures, and can sometimes compromise the entire balance. A complex suite of interacting factors could limit the identification of conservation priorities, implementation of mitigation strategies, and accomplishment of effective restoration plans for marine habitats. To tackle this context, ocean management can not focus on individual stressors and disturbances resulting from human activities but must take into consideration the consequences of their combined action.

Figure 5. Degraded *Posidonia oceanica* meadow due to the effects of human activities (i.e. dredging). Source: SUBMON



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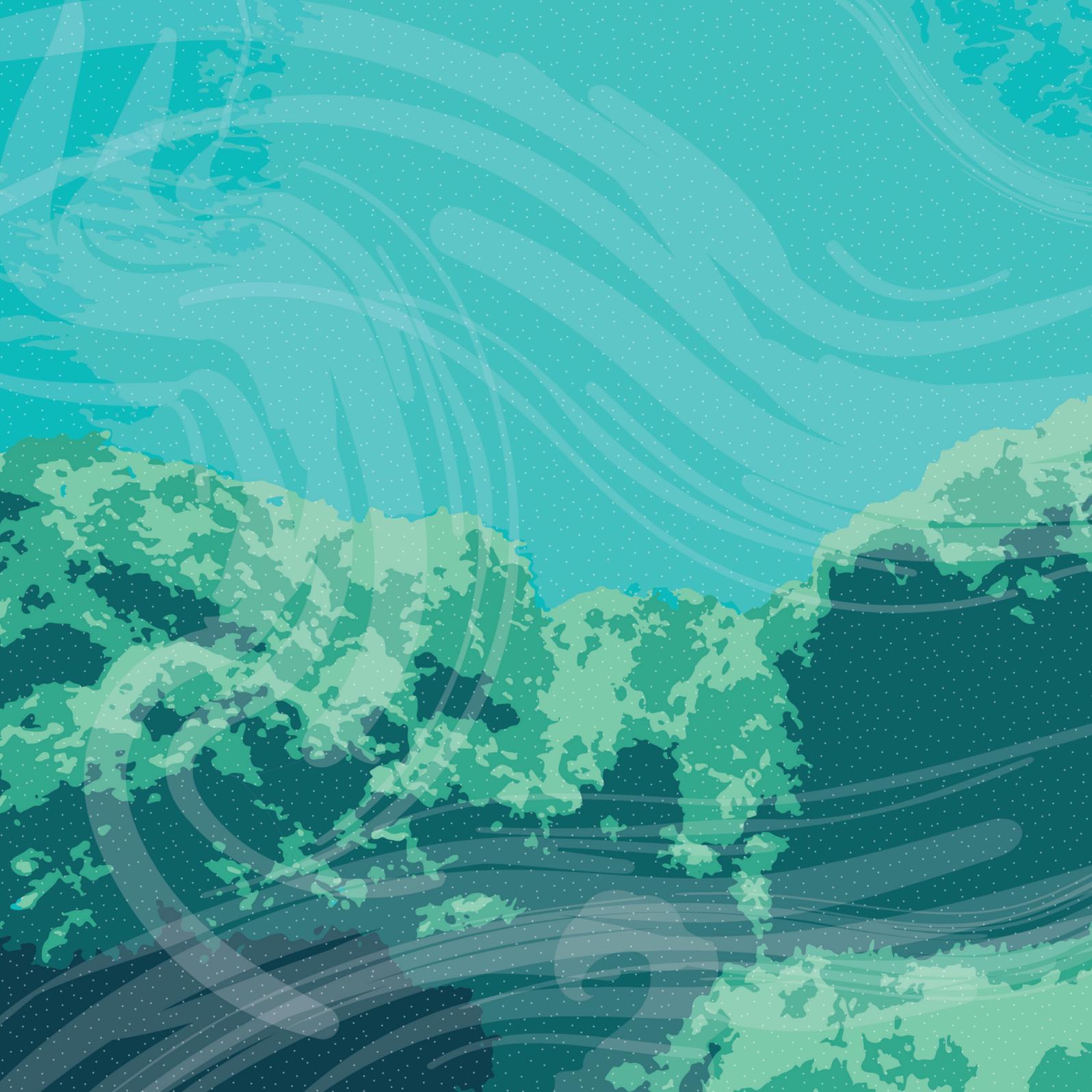
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5 INTEGRATED OCEAN MANAGEMENT IN THE MEDITERRANEAN

INTEGRATED OCEAN MANAGEMENT IN THE MEDITERRANEAN

5.1 The coordinative framework

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The Mediterranean space and resources are managed at the upper level, through a few institutions and programmes that coordinate a complex framework of organizations operating at the international, national, and regional levels. These main coordinative institutions set common guidelines and goals to achieve IOM, fostering the ecosystem approach.

The Mediterranean Action Plan (MAP)—Barcelona Convention System is the main pan Mediterranean international programme established for the protection of the Mediterranean Sea and its ecosystem. Through this multilateral environmental agreement the United Nations Environmental Programme (UNEP), 21 Mediterranean countries, and the European Union, have developed a common institutional, legal, and implementing framework to foster sustainability in the Mediterranean.

The MedPAN association coordinates the network of Mediterranean marine protected areas (MPAs). The International Maritime Organization (IMO) is responsible for the sustainable management of marine traffic and the General Fisheries Commission for the Mediterranean (GFCM) of FAO regulates the management of the fishery.

5.2 The coastal and marine policies of the European Union

The European Union defined several policies to enhance, sustainable and transboundary management of the European seas and coasts (including the Mediterranean) and develop the blue economy among European countries.

[The Marine Strategy Framework Directive](#) is the European legal act established specifically for the protection of the marine environment through the achievement of the Good Environmental Status (GES) of European waters.

[The Water Framework Directive](#) aims at the management of river basins and concerns the control of the input of nutrients and chemicals into the fresh and marine water.

[The common Fishery Policy \(CFP\)](#) was adopted to manage the European fishing fleets sustainably and conserving fish stocks.

[The Recommendation on Integrated Coastal Zone Management \(ICZM\)](#) was defined to set the path towards cross-border ICZM among European countries.

[The Maritime Spatial Planning Directive \(MSPD\)](#) was established to develop maritime spatial planning in European countries with the goal to support

the Blue Economy through an ecosystem-based approach while taking into account LSI. [The Habitat and Birds Directive](#) are the two key directives established to support nature conservation, ensuring that the species and habitat types they protect are maintained, or restored, to a favourable conservation status throughout their natural range within the EU. Together they set the provisions necessary for the establishment of protected sites of the Natura 2000 Network. [The Integrated Maritime Policy \(IMP\)](#) seeks to provide a coherent approach to maritime issues, with increased coordination between different policy areas, mainly concerning Blue Growth, marine data and knowledge, maritime spatial planning, integrated maritime surveillance, and sea basin strategies.

5.3 Integrated Coastal Zone Management (ICZM)

The process of implementing ICZM in the Mediterranean has been developed through several projects at local, regional, national and international level over the last decades. The main milestone toward the development of ICZM in the Mediterranean is the adoption of the Protocol

on Integrated Coastal Zone Management within the framework of the Barcelona Convention. The Mediterranean ICZM Protocol was adopted in 2008 and entered into force in 2011, to allow Mediterranean countries to achieve enhanced management of their coastal zones and adaptation to coastal environmental challenges. Being adopted within the framework of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, this new Protocol brings a joint commitment for an integrated approach to coastal management and the many different interests in both land and marine components of the coast.

The main principles of the Mediterranean ICZM Protocol take into account governance, cross-sectoral approaches to policy and management, and stakeholders consultation. To achieve this it demands good communication among different levels of governance and the application of adaptive management tools able to be effective at local level (2009/89/EC).

Another main driver of ICZM implementation in the Mediterranean is the Recommendation on ICZM adopted by the European Parliament and Council in 2002 (2002/413/EC). The Recommendations

include a list of principles defining the main pillars of ICZM and the main steps that European member states should follow to implement ICZM on their coasts. A number of initiatives have been developed by different member states to follow the Recommendations¹.

5.4 Maritime Spatial Planning (MSP)

The establishment of MSP in the Mediterranean basin is still at its initial stage. An international legal framework is being developed to foster and harmonize the implementation of MSP among Mediterranean riparian countries. On the other hand, most MSP plans at a local scale have been developed in the form of pilot projects which are not legally enforced.

In this context, the MSP-MED project was launched at the beginning of 2020, with the overall objective to favour the MSP process in the Mediterranean Sea, by supporting the establishment of coherent and coordinated plans across the Mediterranean marine regions and between the Member States, in line with the MSP European Directive objectives. The MSP-MED project is aimed at capitalising on

the results of other EU-funded projects on MSP in the region, either recently carried out or still ongoing, and also promotes the active participation of both EU and non-EU Mediterranean countries, in a pan-Mediterranean approach. The MSP-MED project addresses specific issues regarding the national MSP implementation, tailored to the actual needs of each member state, and at the same time implements activities at basin scale, enhancing cooperation and knowledge sharing, finally ensuring coherence among the member state's plans. The project will support the definition of the different national MSP objectives through specific tasks, supporting the roadmaps towards the plans' adoption of the participating Member States. Also, it facilitates, through already existing collaboration and communication channels, the consultation processes of plans with bordering member states and third countries in the Mediterranean. As far as now, the MSP Competent Authorities of France, Greece, Italy, Malta, Slovenia, Spain, participate directly or endorse relevant national institutions for participating in the project and are involved in its development.

Another worth mentioning project is the MSP Global, a joint initiative by the Intergovernmental

Oceanographic Commission of UNESCO (IOC-UNESCO) and the European Commission's Directorate-General for Maritime Affairs and Fisheries (DG MARE) to develop new international guidelines on Maritime Spatial Planning². Over three years, the MSP global initiative contributes to improving cross-border and transboundary cooperation where it already exists and promoting MSP processes in areas where it is yet to be put in place, with the objective to triple the marine area benefiting from MSP effectively implemented by 2030.

Within MSP Global, a pilot project in the West Mediterranean is being implemented in Algeria, France, Italy, Malta, Morocco, Spain and Tunisia, while other member countries of the Union for the Mediterranean in the Western Mediterranean can also participate in training activities³. Building on previous experiences in the region to promote good MSP practices, activities are adapted to meet both regional and national priorities and needs in the context of the Western Mediterranean. More specifically, they are designed under Goal 3 of the "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions" on the Initiative for the

sustainable development of the blue economy in the western Mediterranean (COM(2017)183), which aims at better governance of the region. The West Mediterranean pilot project fosters dialogue and cooperation between EU and non-EU countries to enable the development of a sustainable blue economy in the region. Following a regional and integrated approach, the pilot project supports the development of the preplanning phase of a regional transboundary MSP. It also aims at strengthening institutional capacities and formulating regional recommendations in line with the WestMED Initiative towards the overarching goal of adopting a roadmap on transboundary MSP and a sustainable blue economy for the region.

At a critical juncture in Europe, where countries are required to develop maritime spatial plans by 2021 in line with Article 15 of the MSP Directive, an ongoing process is leading MS to a decisive advancement in the field. However, it is important to mention that MSP initiatives result in quite unbalanced situations between the two shores of the Mediterranean, being the northern area more effectively implemented than the southern coast.

At the time of this publication all European Member Countries in the Mediterranean have finalised the transposition of the MSP EU Directive into national

legislation and identified the competent MSP national authorities⁴.

Furthermore, coordination mechanisms exist or are being created to improve cross-sector integration within MSP, and EU countries are busy developing other MSP-related activities, such as data collection

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and structuring, elaboration of guidelines, development of MSP methodologies to cite some. Ramieri et al. report that some initial actions have also been taken in some non-EU countries, such as Israel with a strategic plan (Israel Marine Plan) or regional actions to support MSP (e.g. the design and testing of a methodology for marine vulnerability assessment based on EcAp in Boka Kotorska Bay, Montenegro).

The European Commission has supported several initiatives to take a step further in the development of MSP in the basin, notably, cross-border projects have received co-funding by the European Maritime and Fisheries and Aquaculture Fund.

Some of these projects have also involved non-EU Countries. Among the long list of MSP Projects present in the European MSP Platform⁵ it is necessary to mention: MEDTRENDS, SHAPE, ADRIPLAN, SUPREME, THAL-CHOR, SIMWESTMED, COEXIST, and POCTEFEXALBORÁN. These projects have paved the road to MSP implementation

providing tools and best practices issued from pilot projects and case studies.

5.5 Marine Protected Areas (MPAs) and Other Effective Conservation Measures (OECMs)

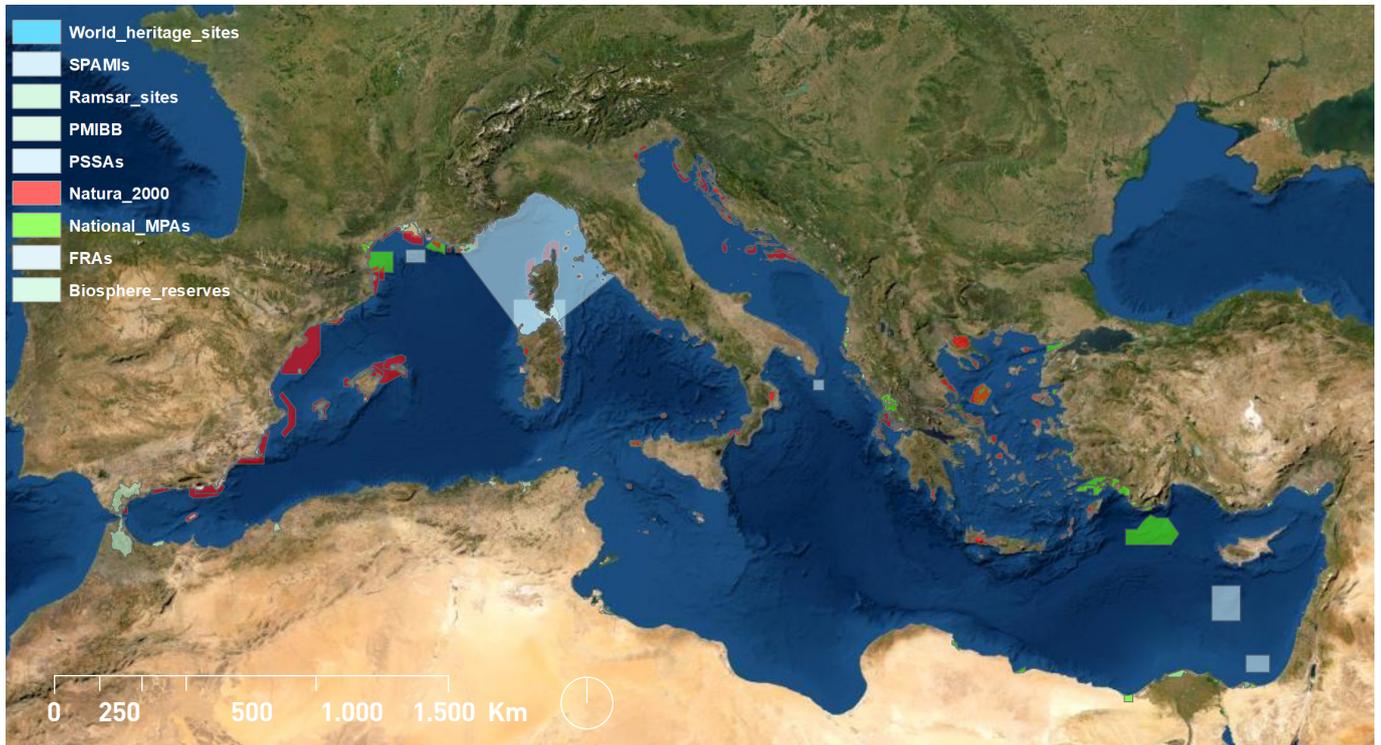
The Mediterranean includes a network of 1215 MPAs and OECMs (Fig.6) which cover a total of 171,362 km², corresponding to 6.81% of the surface of the entire basin of which only the 0.04% is managed under strict protection (i.e. no-go, no-take or no-fishing zones).

MPAs and OECMs are mostly coastal and European; indeed over 72.77% of the surface covered is located in the Western Mediterranean while 90.05% of the total surface is in European waters.

However 9.79% of European waters are protected as part of the Natura 2000 at sea network, which includes 882 sites⁶, many of which have no management plan, nor restrictive measures established for their management.

There are 46 different types of MPAs and OECMs in the Mediterranean with highly variable levels of protection. Main categories include: **National designated MPAs**. Are MPAs impleted

Figure 6. MPAs and OECMs in the Mediterranean¹⁸



within the jurisdictional waters of a country which are established through national legislation.

46 **Natura 2000 sites** is the largest coordinated network of natural protected areas in the world. It includes core breeding and resting sites for rare and threatened species, and some rare natural habitat types which are listed under two European Directives, namely the Birds Directive and the Habitats Directive⁷.

Fisheries Restricted Areas (FRA) are geographically defined areas in which some specific fishing activities are temporarily or permanently banned or restricted in order to improve the exploitation patterns and conservation of specific stocks as well as of habitats and deep-sea ecosystems⁸.

Particularly Sensitive Sea Area (PSSA) is an area that needs special protection through action by International Maritime Organization because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities⁹.

Pelagos Sanctuary is a marine area of 87,500 sq.

km, subject to an international agreement between Italy, Monaco and France for the protection of marine mammals which live in it¹⁰.

Ramsar sites are wetland sites designated as Wetlands of International Importance, according to Ramsar International Convention on Wetlands¹¹.

World heritage sites are landmarks or areas with legal protection by the World Heritage Convention¹² administered by the United Nations Educational, Scientific and Cultural Organization (UNESCO), for having cultural, historical, scientific or other forms of significance; The selected sites must be “cultural and natural heritage around the world, considered to be of outstanding value to humanity”¹³.

Biosphere reserves are ‘learning places for sustainable development’ under diverse ecological, social and economic contexts, where solutions reconciling the conservation of biodiversity with its sustainable use are promoted¹⁴.

Specially Protected Areas of Mediterranean Importance (SPAMIs) are marine protected and coastal areas of importance for conserving the components of biological diversity in the

Mediterranean, listed according to the provisions of the Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol)¹⁵, under the auspices of the Barcelona Convention.

Parc Marin International des Bouches de Bonifacio (PMIBB), established by the European Grouping of Territorial Cooperation, is the international maritime park linking Corsica and Sardinia and constituting a natural heritage area under the legal responsibility of the two states and two regions¹⁶.

Areas of high ecological value (HEV) are natural habitats, which are of outstanding significance or critical importance due to their high biological, ecological, social or cultural values at a national, regional or global level¹⁷.

Apart from MPAs and OECMs a number of areas with high ecological value and no specific management tools in place are found (fig. 6). They include the following types:

Ecologically and Biologically significant Areas (EBSAs), special areas in the ocean that serve important purposes to support the healthy functioning of oceans and the many services that it

provides¹⁹.

Critical Cetacean Habitats (CCH), potential manageable area where attention has to be drawn/focused because there exists a threat for cetaceans²⁰.

Important Bird Areas (IBAs), sites of international significance for the conservation of the world's birds and other biodiversity, also providing essential benefits to people, like food, materials, water, climate regulation, flood protection and opportunities for recreation²¹.

Important Marine Mammals Areas (IMMAs), discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation²².

5.6 Blue Economy

Among the initiatives in the basin the WestMED, Blue Economy initiative²⁴ has been triggered by the Union for the Mediterranean with the support of the European Commission to help achieve a safer and more secure maritime space, create a smarter

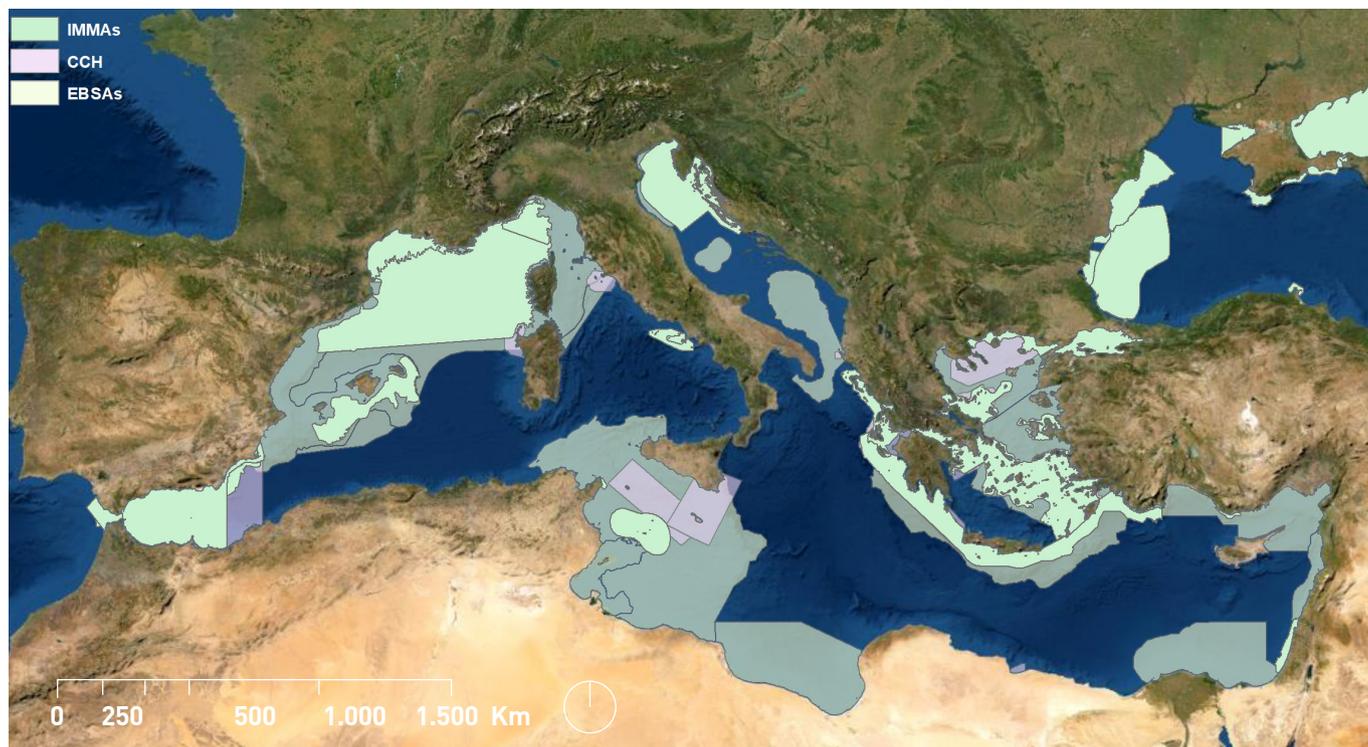


Figure 7. Areas of high ecological importance in the Mediterranean²³

and more resilient Blue Economy and improve the maritime governance for the western Mediterranean. It was launched in 2017 and counted five EU Member States (France, Italy, Portugal, Spain, and Malta), and five Southern coastal countries (Algeria, Libya, Mauritania, Morocco, and Tunisia) brought together by six main priorities agreed upon an assigned roadmap, namely:

- Maritime safety and the fight against marine pollution
- Maritime cluster development
- Skills development and circulation
- Sustainable consumption and production
- Biodiversity and marine habitat conservation and restoration
- Development of coastal communities and sustainable fisheries and aquaculture

In parallel, another initiative called “BLUEMED, Research and Innovation for blue jobs and growth in the Mediterranean Area” was launched in 2018²⁵. The project aimed at “advancing a shared vision for a more healthy, productive, resilient, better known and valued Mediterranean Sea, promoting the citizens’ social well-being and prosperity, now and for future generations, and boosting economic growth and

jobs”. BLUEMED wished to promote an innovative and multi-disciplinary research that would generate the knowledge needed to increase ecosystems resilience; provide new tools to mitigate the impacts from global climate change and the multiple environmental stressors in the Mediterranean Sea, and to protect and/or restore vulnerable marine ecosystems. Great support was given to the implementation of EU Policies and Directives related to marine and maritime issues in the region. It also fostered data monitoring (e.g. marine litter) and EU citizens’ awareness and literacy on the importance of a sustainable Mediterranean Sea.

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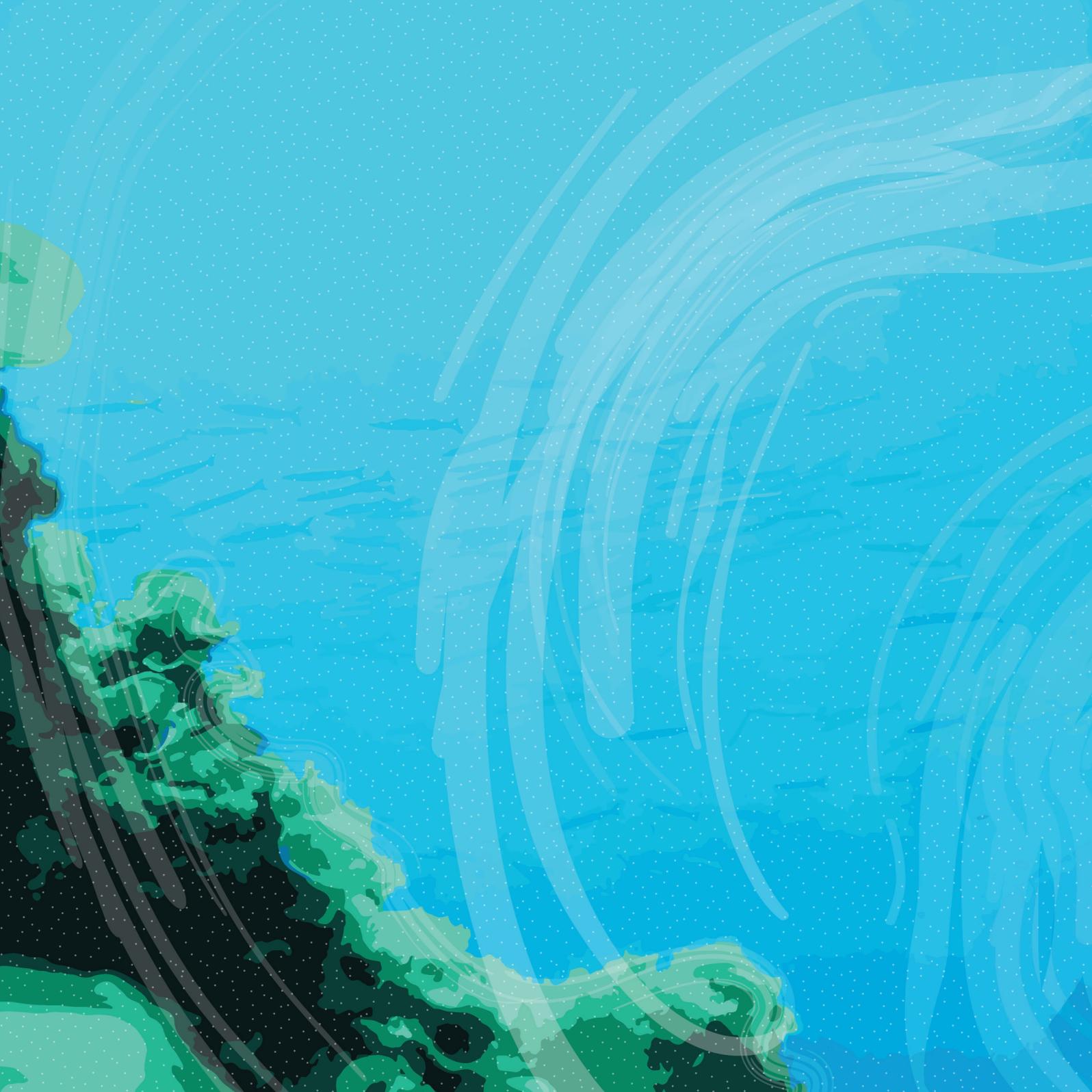
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6 COLLECTION OF GOOD PRACTICES

6.1

PLANNING AND MANAGEMENT OF THE GULF OF VENICE, ITALY

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6.1 Planning and management of the Gulf of Venice, Italy

Introduction

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The Gulf of Venice is found on the North-Western Adriatic and includes some emblematic singularities of great ecological, cultural and socio-economic value such as the Venice lagoon and the Po River Delta. Several human activities are developed on its coasts and waters. Among these fishing, tourism, marine transport and fossil fuel extraction are the most representative. Through the present work an overview is provided on the Gulf of Venice natural and socio-economic setting, its governance framework and the existing management challenges for the area. Finally, the planning and management framework in place is described with specific attention to its integration into the national maritime spatial plan which has recently been defined by Italy.

Natural context

The Gulf of Venice (Fig.8) is characterized by shallow sandy and muddy bottoms, while the coastal area landscape is typically composed of sandy beaches. Geographically located in the Northeastern part of the Adriatic, one of the most productive seas of the Mediterranean basin, the Gulf of Venice's coastal and

marine area includes hotspots of great ecological value. The most representative ecosystems include estuaries, lagoons, salt marshes, seagrass meadows, coralligenous beds, and dunal systems.

Among the most emblematic sites on the coast, are found the Venice Lagoon and the Po River Delta. They represent two coastal environments typical of the Mediterranean that include a large variety of habitats and a rich biodiversity. Concerning the offshore marine area, the coralligenous beds locally known as "Tegnue" are considered having a great ecological importance due to their role as nursery habitats with a key role for the regeneration of species commercially relevant within the fish market (Fig.9).

Socio-economic context

The Gulf of Venice traditions and economy are highly connected with the marine resources and the use of the marine space. The area includes one of the main industrial and touristic ports (the Venice Port) in Italy. Further it is a hotspot for national and international tourism, in particular due to the presence of the City of Venice, one of the most touristic coastal cities of the world. Indeed, cruise passengers amounts to over 1 million every year (Port Venice). Marine traffic in the region is intense and it is particularly dense through the traffic routes that connect towards the Venice port.

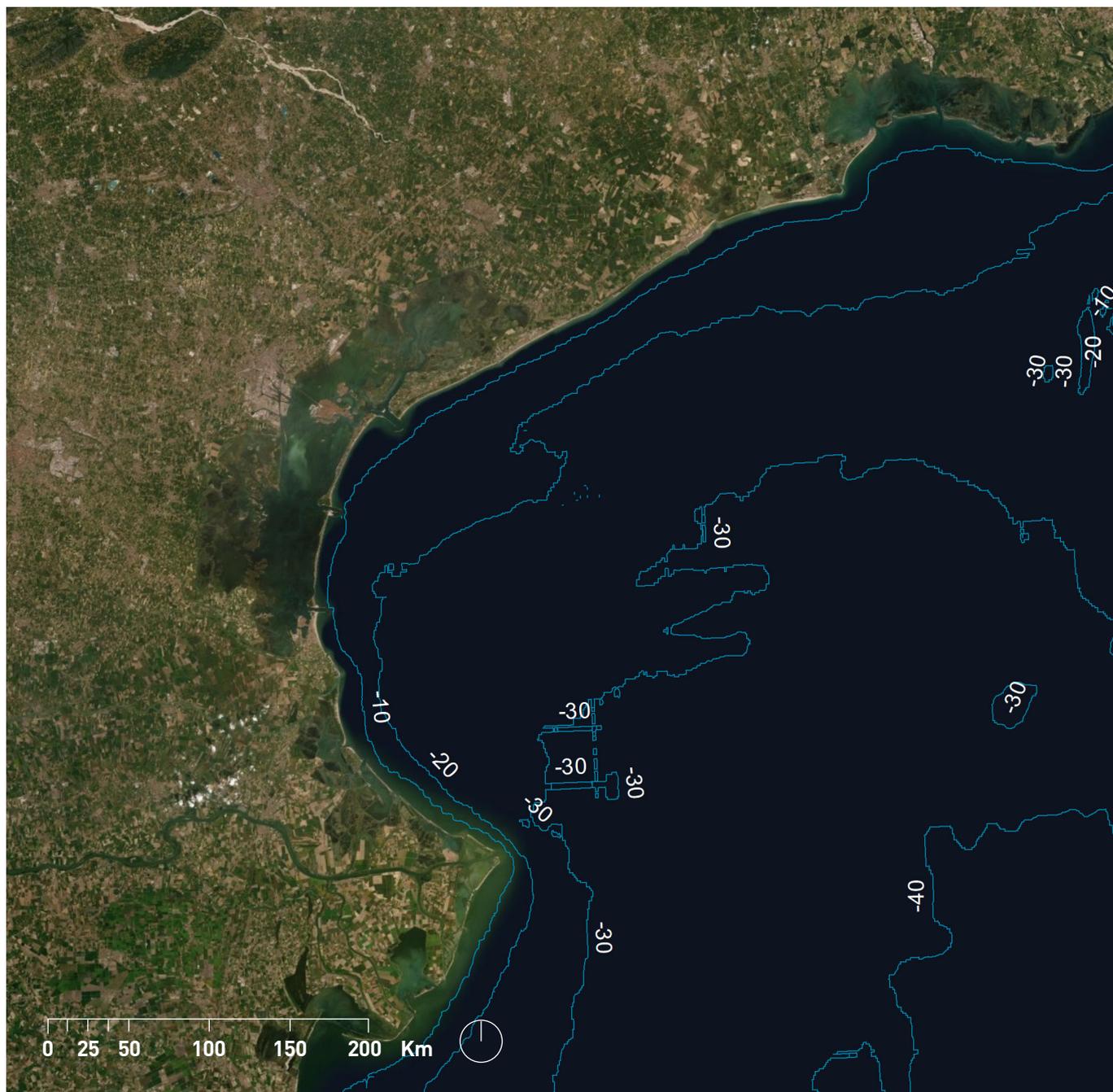


Figure 8. The Gulf of Venice and its bathymetry

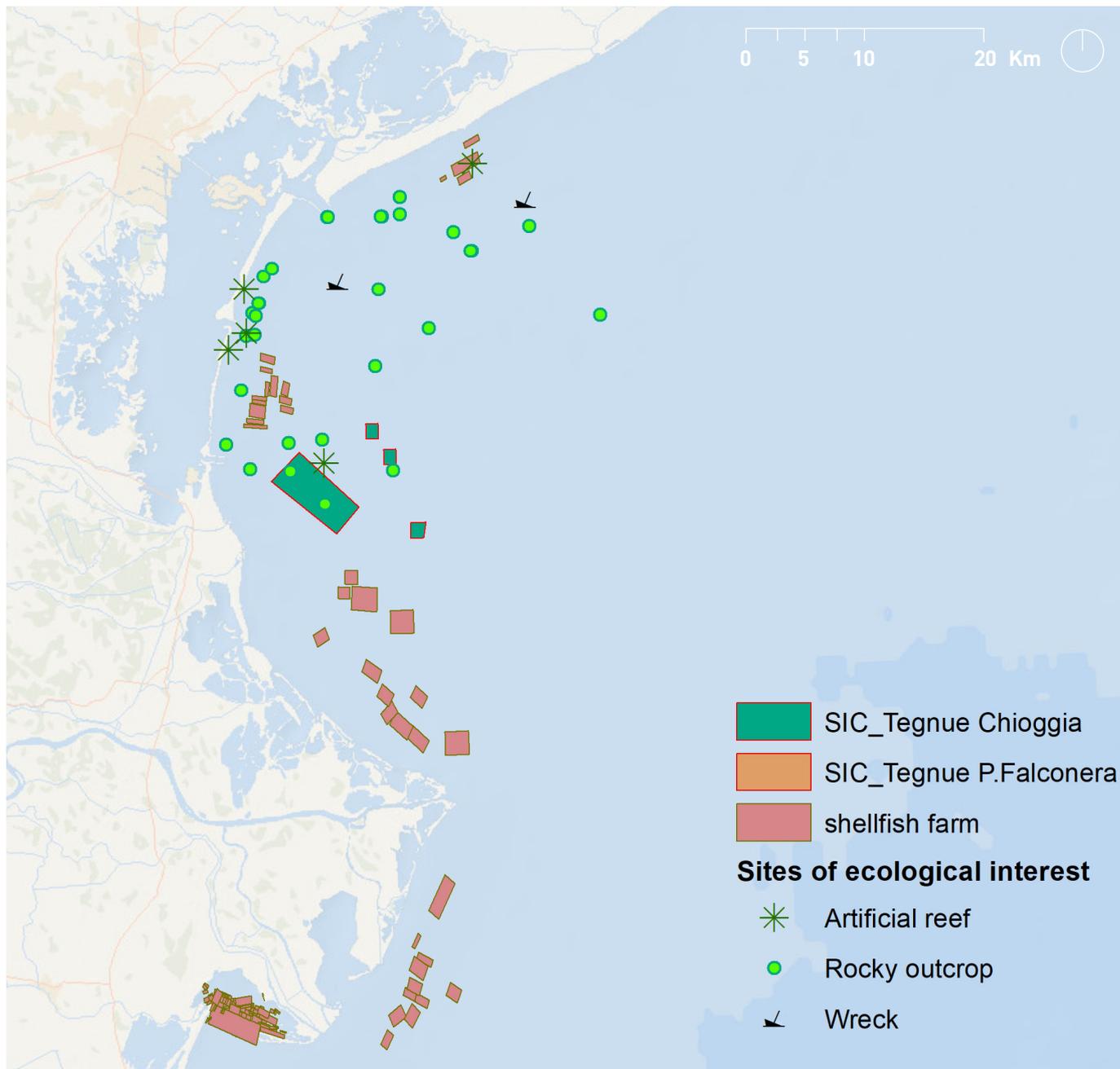


Figure 9. Sites of ecological interest, including marine areas declared as Sites of Communitarian Importance (SCI) that are part of the Natura 2000 Network and zones specific for aquaculture in the Gulf of Venice.

Specific offshore areas for mooring of large commercial boats have also been designated. In the territorial waters and near the offshore areas have been adopted separation schemes for maritime traffic, Rule 10 of the International Regulations for Preventing Collisions at Sea, better known as Colreg, which allow to regularize, channel and monitor the traffic of ships leaving and entering the ports and the related coastal traffic zones (InshoreTraffic Zone), suitable both for navigation of pleasure boats, and anchorage and for merchant ships. The fishing sector is very developed: the fishing fleet of the Region is composed by more than 500 boats of which around half are from the Chioggia port, the main fishing port of Italy. The highest fishing effort is registered both in the area facing the mouth of the port up to the territorial waters and in the southern part, close to the Po Delta.

In the same area the aquaculture activity is strongly present, in particular in relation to the production of shellfish which is farmed extensively on dedicated areas of the shallow coastal waters.

Three nautical miles from the coastline there are also three biological protection zones that are protected sea areas established to safeguard and repopulate fish resources. Non-living resources are also extracted in the area, in particular sand for beach nourishment and fossil fuel (i.e. gas) from offshore reserves.

Governance framework

The Gulf of Venice, hierarchically subordinated to the Italian government, has the responsibility to ensure the integrated development of its economic activities and the protection of coastal and marine ecosystems. It is also responsible for the coastal and marine areas ascribed within the Natura 2000 network. The Port Authority of the Northern Adriatic Sea (Autorità di Sistema Portuale del Mare Adriatico Settentrionale), is responsible for the administration of the main ports and related facilities. The coast guard is the main authority responsible for the monitoring of marine traffic. Concerning the maritime spatial planning of the area, while the Gulf of Venice is addressed with responsibility to design its marine spatial plan within its waters, the Italian Ministry of Transport is the national authority responsible to approve it.

Management challenges

The maritime sector represents for Veneto one of the essential elements for regional economic development, but at the same time also a fundamental feature of its landscape and cultural identity. The complex production configuration makes the region a main maritime hub, and for this reason it is a priority to develop policies for the nautical efficiency of its ports, with particular reference to the management of the seabed. Further priorities are to ensure the monitoring of the marine

routes, to relaunch the commercial functions of the terminals in close connection to the railway and road network, to resolve the issue of the accessibility of cruise traffic. The latter is closely connected with the sustainable development of tourism on the cities of the coast and its beaches. Tourism represents a main economic revenue on the coast and there is great potential for its future sustainable development in synergy with the culture of the sea (such as fishing tourism, eco-tourism, eco-friendly coastal navigation and underwater tourism). In this perspective, the maintenance of the quality of the coastal landscape remains relevant, with particular attention to the land-sea interface, both for tourism purposes but also for integrated management, ensuring continuity of planning and consequent management of the activities. This aspect is strictly connected to the development and experimentation of policies to increase the resilience of the coastal strip to climate change, but also guaranteeing fishermen and fish farmers the maintenance of an adequate income for professional consolidation and the development of their activities, favoring their generational change by reconciling the needs for the protection of marine flora and fauna. Spatializing the available data of the maritime activities present in the Venetian waters, it is evident how many of these insist in the same spaces, thus creating numerous

conflicts between different interests and putting both environmental and social safety at risk.

Planning and management framework in place

Historically the planning and management of the area has been made with a sector specific approach (Fig.10). Sectoral planning has been developed separately for nature conservation, marine traffic, aquaculture and extraction of fossil fuel. Among the 11 areas included in the Natura 2000 network, 4 of them are managed by a specific entity responsible for nature protection, in line with a site specific management plan. The mooring areas were defined by the Port Authority and are monitored by the service of the Coast Guard. The ministry of energy has issued the permits for fossil fuel exploration and extraction in specific areas previously defined. Finally, the ministry of Agriculture has approved the concessions for aquaculture in specific delimited areas. Within the framework of the MSP Directive implementation, the Gulf of Venice has designed a maritime spatial plan following the national guidelines, through a transboundary approach in regard to the neighboring regions and the ecosystems and human activities found in their waters. The plan has been submitted to the European commission and it is expected to be implemented by the year 2022.

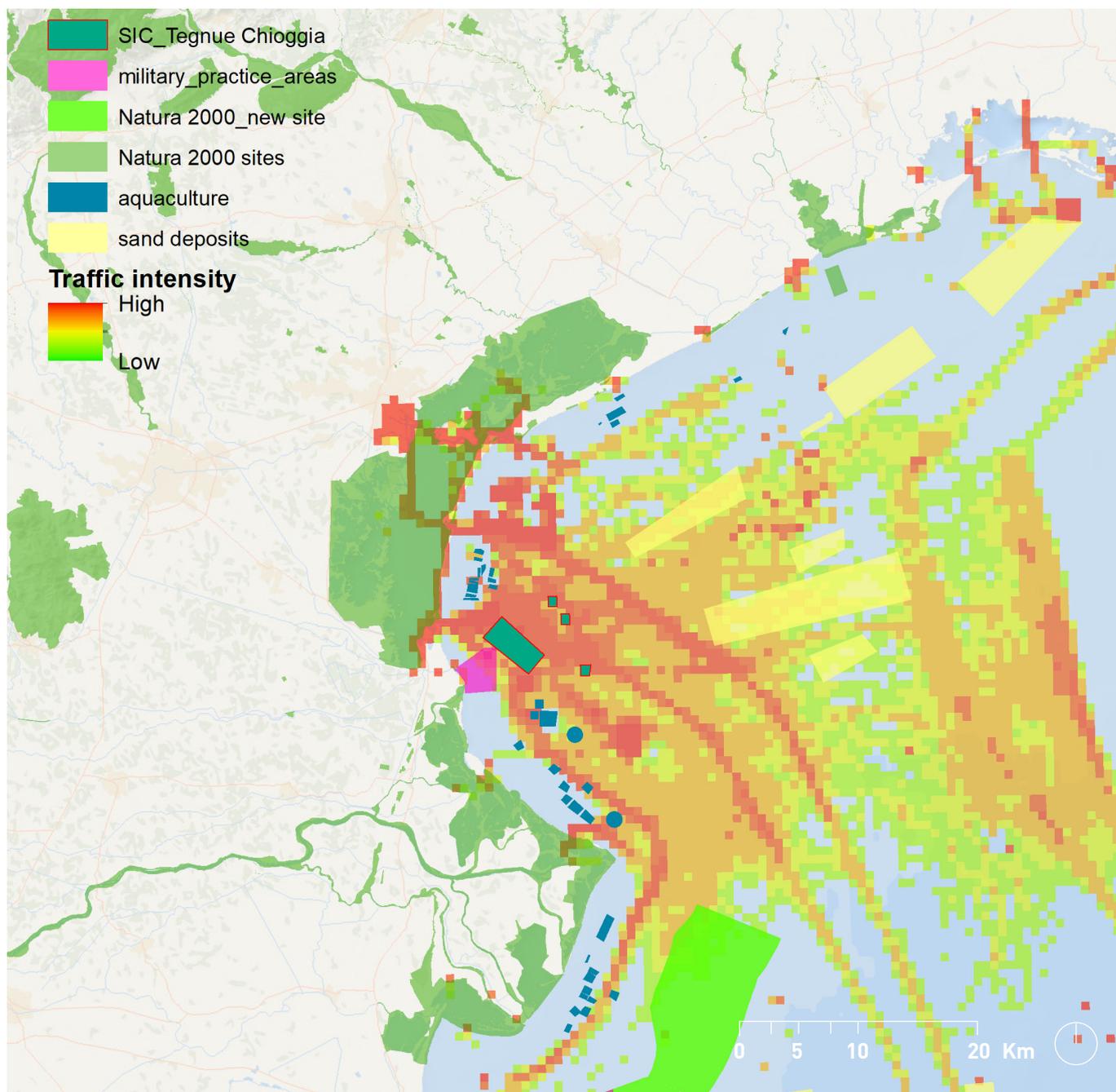


Figure 10. Distribution of the main human uses and activities in the Gulf of Venice





6.2

**PLANNING AND MANAGEMENT
OF THE PARK NATIONAL
DES CALANQUES, FRANCE**

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6.2 Planning and management of the Park National des Calanques, France

Introduction

64 France's marine heritage is one of the most important in the world, representing the second-largest maritime space worldwide. To protect this heritage, France is pursuing a proactive policy of creating and managing Marine Protected Areas in all of its waters. During the last IUCN congress (International Union for the Conservation of Nature: the world largest conservation organization), Emmanuelle Macron, the French President, announced an extension of highly protected areas in the Mediterranean Sea, which currently only cover 0.2% of the waters, to 5% by 2027 and 10% in 2030. In line with the work carried out by the Marine Protected Areas Agency from 2006 to 2016, the policy of creating and managing marine protected areas is now implemented by the French Agency for Biodiversity, a public institution under the supervision of the Ministry in charge of the Environment. 546 Marine Protected Areas have been created in metropolitan France and overseas, including 9 marine national parks. These parks aim to protect marine ecosystems and enable the sustainable development of maritime activities. Marine Protected Areas are organized into connected

networks and must be effectively managed to keep the oceans healthy and ensure their resilience, i.e. their ability to regain their functions after a disturbance.

Natural context

The Calanques are made of a specific geological formation consisting of limestone rocks, forming deep and narrow coves, with 26 Calanques within the Marseille-Cassis area. The entire domain covers 5,000 hectares, 25 kilometers of coastline between Marseille and Cassis, and 145 km of marked trails. Out of 900 plant species that have been cataloged, 38 are protected and 43 recognised as noteworthy. This rich biodiversity (Fig.11) is linked to the large numbers of landscape and habitats (i.e. cliffs, screes, limestones, Lapiaz, seashore, forests, scrubs, wind-exposed areas, no shade areas). Vegetation contains evergreen broad-leaved and aciformed trees (i.e. Holm oaks, arbutuses, olive trees, laurels, carob trees, pine trees, junipers, cypresses), as well as shrubs (rock roses, mastic trees, myrtle, and rosemary), several being halotolerant withstanding drought and sea spray.

The area is home to hundreds of animals with ~100 being protected species, including birds, bats, and reptiles. Nesting, or potentially nesting, birds are

commonly observed with 67 species protected, such as Bonelli's Eagle. Seabirds include the Yellow-legged gull, Cory's Shearwaters, European Shags, and Cormorants. Thirteen species of bats, such as the European Free-Tailed bat (the largest bats in Europe); a great diversity of reptiles (i.e. ocellated lizard, European Leaf-toed gecko), as well as the Mediterranean Tree frog, and the bush cricket, the largest cricket in Europe, are very common. The Calanques displays also a variety of seascapes (14 habitats) often considered rare and fragile (*Posidonia oceanica* seagrass meadows, *lithophyllum* corridors, infralittoral reefs, coralligenous reefs, soft seabeds, rocky areas, and sea caves and underwater canyons). The marine biome of the Calanques hosts a high biodiversity of flora and fauna often described as an underwater garden. In the sea grass meadows, several fish species (i.e. sars, wrasses) and invertebrates (seastars, urchins, nudibranchs). Over the coralligenous area, and rocky ecosystem, large number of benthic and pelagic fish forming large shoals are often observed. Colonies of red corals and yellow gorgonians are also reported. Dusky groupers have been more often reported within the past few years, as well as different species of cetaceans. In total, 140 terrestrial animal and plant protected species and 60 marine heritage species are reported.

Figure 11. Some of the seascapes and marine biodiversity found in the Calanques of Marseille (@Sandrine Ruitton)



Socio-economic context

The National Park of Calanque (NPC) is located along the French Mediterranean coast in the South of France and extends over 520 km² from Marseille to La Ciotat in the East (Fig.12). The NPC is the tenth French National Park. It was created on April 18, 2012 and bears the specificity of being both terrestrial (85 km²) and marine (435 km²), including a large peri-urban area around the 2nd largest city of France. The NPC shelters several marine habitats listed in the European Habitat Directive (92/43/EC) and includes the Natura 2000 SAC "Calanques et îles marseillaises - Cap Canaille et massif du Grand Caunet" (FR9301602).

Within the marine core area, protection is stricter and human activities are regulated to ensure the efficient conservation of fauna, flora, natural environment, and landscape. The marine core area extends 10 nautical miles from the coast and includes seven No-Take Zones, accounting for almost 11% of its surface (46.5 km²). The "adjacent marine area", which is the part of the park territory where activities are not subjected to specific regulations (although they must be referenced in terms of sustainable development), extends over a marine surface of 977 km². The heart of the park is the most protected part through a specific regulation.

The coastal zone of Marseille is a perfect illustration of the complex interactions between ecological and socio-economic aspects and has been since Antiquity. Located on the northwestern Mediterranean seafront of France, its coastline has been highly impacted by anthropic activities (Fig.13). Artisanal fishing activities (in decline) are using mainly fishing nets and longlines, while recreational fishermen are using angling, trolling, jig fishing and spearfishing.

The intensive urbanization led to the artificialization of the coastline and the discharges from the city in particular the runoff of urban wastewater (1.8 million inhabitants) and occasionally bypass sewage water after a severe thunderstorm were increased. Other industrial activities include industrial plants close to the shore which are sources of pollution both for marine and terrestrial ecosystems. The commercial and industrial Port of Marseille-Fos records ~10,000 ship calls, handles ~80 million metric tons of goods and over 3 million passengers per year, leisure boating is also significant in the use of the shore. Along the shore and within the NPC large local and visiting populations (>2 million visitors per year), diving and other recreational activities are adding pressures on the ecosystems, both terrestrial and marine.

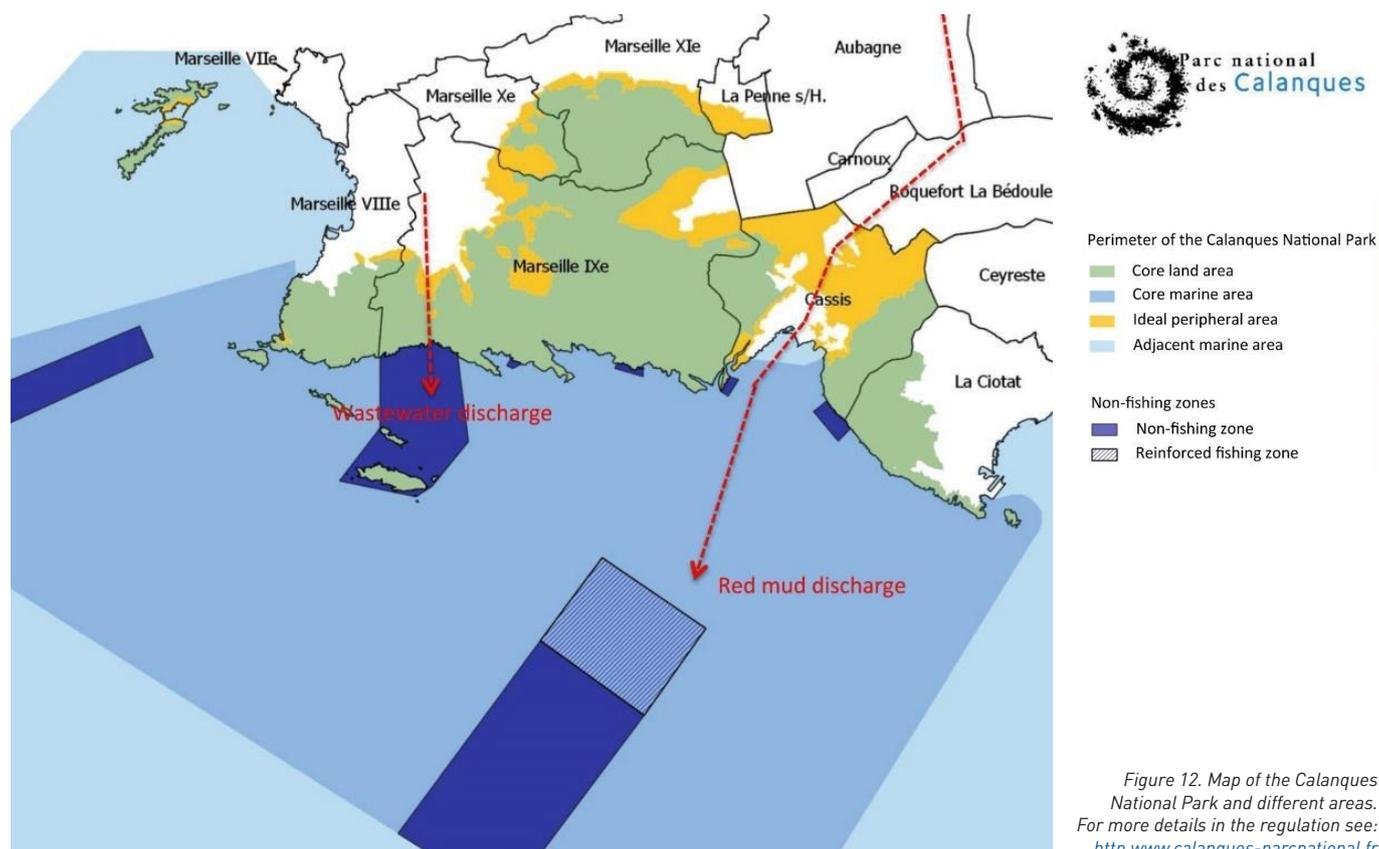


Figure 12. Map of the Calanques National Park and different areas. For more details in the regulation see: <http://www.calanques-parcnational.fr>

Governance framework

68 The governance of the Calanques National Park consists of the Board of Directors, a decision-making and impulse body, as well as the Scientific Council and the Economic, Social and Cultural Council. The Scientific Council defines, in conjunction with the Director of the National Park, the main axes and orientations of the multiannual research programs carried out by the public institution. Dedicated to sustainable development, and not only to the protection of the environment, the charter forms a common economic, social, cultural, and ecological project. The CESC assists the Board of Directors and the Director in matters of contractual policy, monitoring the implementation of the charter and

animation of local life.

The charter thus includes three distinct parts: the heart, the optimal area of membership and the adjacent maritime area. Marseille, Cassis and La Penne-sur-Huveaune voluntarily promote the sustainable development of the park. They thus constitute the optimal area of the National Park's membership area, which was endorsed by the prefectural Decree of September 19, 2012. The adjacent maritime area also expresses sustainable development guidelines, except that municipalities do not have to adhere to them.

Management challenges

The context of the Marseille coastal area is

Figure 13. Some of the anthropic pressures reported in the CNP @Sandrine Ruitton



representative of a big city which has been developed at the expense of the environment, and which must now initiate management measures to reconcile its economic activities, the well-being of the population and the need to implement sustainable development for the future. Conservation efforts have been put in place but are coming with and heartfelt objections from fishers, boaters, cyclists, and pedestrians. Outside of the no-take zones, fish assemblages are quite poor, characterized by low biomass, predominantly small individuals and some species that have become rare. The professional fisheries are mainly artisanal fishing (small-scale fishing) using passive and selective fishing gear. Trawling, which has been a common practice in the past, has been gradually abandoned due to regulations. Currently, except for poaching, trawling is no longer practiced. The recreational fishing activities are intense in the area, with a large panel of fishing gear (angling, trolling, jig fishing, spearfishing). The bad state of the fish assemblages jeopardizes the future of artisanal fishing. Besides, in recent years the number of artisanal fishermen has been decreasing regularly.

Planning and management framework in place

Management and conservation of the marine environment includes a good understanding of

scope and intensity of human activities, which is a prerequisite for linking ecological status and anthropogenic pressures. Current planning and management framework are conducted within the scope of the DCE, DCSMM and Natura 2000 networks. Social actors' contribution to public environmental protection policies has been also established through the environmental effort. This effort will impact differently the different users of this Protected Area, making its management more challenging as restrictions on access (i.e. boating, access to the calanques by sea), regulations (deployment of ecologic buoys for anchoring, number of visitors limited) or banning of certain practices (cycling in certain sectors) have already been implemented, starting in 2021.

6.3

PLANNING AND MANAGEMENT OF MARINE AND COASTAL AREAS OF THERMAIKOS GULF, GREECE

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6.3 Planning and Management of Marine and Coastal Areas of Thermaikos Gulf, Greece

Introduction

Study area (Fig.14): Thermaikos Gulf (central); including the Metropolitan Area of Thessaloniki and the Thermaikos Gulf Protected Areas Management Authority.

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The Thermaic Gulf, hosted in the northern Aegean Sea, is a closed, relatively shallow gulf of a major environmental, economic, and societal value. The second largest city in Greece, Thessaloniki, is hosted at the northeastern tip of the Gulf, with all the metropolitan area and relevant activities being expanded along a large portion of the coastal zone of the inner part of the Gulf. A number of large rivers and several streams are flowing into the Gulf. As these riparian systems transfer materials from distant sources, increased nutrient loads often lead to the degradation of the sensitive ecosystems of Thermaikos Gulf. Similarly, the Gulf receives a large amount of nutrient pollution originating from point sources distributed across the watershed and often close to the metropolitan area. The key objective of the work was to develop a comprehensive, multidimensional framework that consists of a set of methodological tools, databases, policy

recommendations, and background information, towards improving our planning capacity. In this work we made an effort to advance and integrate our understanding of natural and anthropogenic processes and their effects upon key aspects related to a sustainable growth, at different scales, by applying recent methodological advances to new and existing data. We further assessed and modeled the socio-economic driving forces (e.g. EU policies, large scale economic and demographic trends, etc) and the resulting environmental pressures (e.g. habitat loss) affecting biodiversity under present and projected future conditions across the coastal and marine areas of Thermaikos Gulf.

Natural context

The Thermaikos Gulf is characterized by an even bed with low declivities and depths ranging from 2 to 200 m, at its southern side. It receives fresh water from three great rivers (Axios, Loudias, Aliakmon), which are estimated to jointly drain a region of about 3,500,000 hectares, where the accumulation of sediment from the three rivers has shaped the bed as well as the morphology of the western and northern coastline. There, the heterogeneous mosaic of the coastal sites of the Gulf, a number of rivers, lagoons, salt marshes, and fertile fields provide

Figure 14. The spatial pattern of the main land uses and protected areas. Source: Corine Land Cover/Copernicus



habitats for numerous species. This is also the case for the marine part of the Gulf, which hosts among others, extended meadows of *Posidonia oceanica*, an endemic habitat type for the Mediterranean which is considered as of conservation priority for the European Union.

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Socio-economic context

Thessaloniki is the second largest city in Greece with more than 1,1 million inhabitants, representing approximately 1/10 of the country's population (2011 Census Count). It is located in the Southern part of Europe and the Northern part of Greece, very close to the National and European borders. According to the National Spatial Planning Framework, along with Athens it is a metropolis – pole of national magnitude. Thessaloniki is the seat of the Region of Central Macedonia and has more than half of the region's population.

Thessaloniki is a transport node. It is connected to the two major motorways of the country, PATHE and Egnatia Motorway, and is a node of all major national rail lines. The rail station is located right in the outer part of the historic city center. Rail lines cross part of the western neighborhoods and the west suburbs. The Thessaloniki Airport Makedonia (classified as international) is located between the compact part of

the city and the southern suburban neighborhoods. The Thessaloniki Port is the second largest port in the country and serves mostly commercial transport. It is located within the compact part of the city, next to the historic center, and is served by rail lines for commercial purposes.

In terms of the economic activities and the way Gross Domestic Product is distributed among the three main economic sectors; the Primary sector accounts for 1,7%, the Secondary for 16,1% and the Tertiary for 82,3%.

The fishing sector in the area is well developed while the areas support more than 80% of the national mussel culture production. At the NW part of the gulf, extensive rice fields cover almost 70% of the national rice production. It should also be noted that, in the western part of the Gulf, the second largest salt production unit in Greece is located, with saltpans occupying approximately 400 hectares and yield annually more than 25,000 tons of salt.

Governance framework

The coastal and marine habitats at the NW part of the Gulf are enclosed within the Natura2000 network and further protected under the Ramsar International Convention on wetlands. The first Joint Ministerial Decree of the Hellenic state was



Figure 15. The three main urban zones of the County of Thessaloniki
Source: Thessaloniki Master Plan

published in 1998, on the protection and preservation of the region in the Delta of the rivers Axios, Loudias, Aliakmon and at Alykes Kitrous, while the National Park was established in 2009 (JMD 12966/2009). In 2018, following the addition of new protected sites, the former Axios Delta Management Authority was renamed to Thermaikos Gulf Protected Areas Management Authority. Based on the national legislation, the basic objectives of the authority, as a legal entity of private law acting for the public benefit and overseen by the Ministry of Environment and Energy, are: to manage the protected area and preserve its flora and fauna, to promote eco-tourism and sustainable development, to inform and raise the awareness of the local community and visitors alike. The protected area belongs to the Region of Central Macedonia and more specifically, it expands into areas of the regional units of Thessaloniki, Kilkis, Pella, Imathia and Pieria. At a municipal level, it extends over the municipalities of Delta, Chalkidona, Oraiokastro, Paionia, Pella, Alexandria, Pydna – Kolindros and Katerini.

In terms of the urban environment, the Official Master Plan of Thessaloniki defines three main urban zones which cover part of the Country of Thessaloniki (Fig.15). These -planning- zones are: the urban agglomeration that consists of dense urban

tissue, high buildings (up to 10 stories) and mixed land use; the Inner suburban which is a less dense area with big box development (shopping malls, research centers etc); the outer suburban with a mix of agricultural uses, pastures, and sparse residential development.

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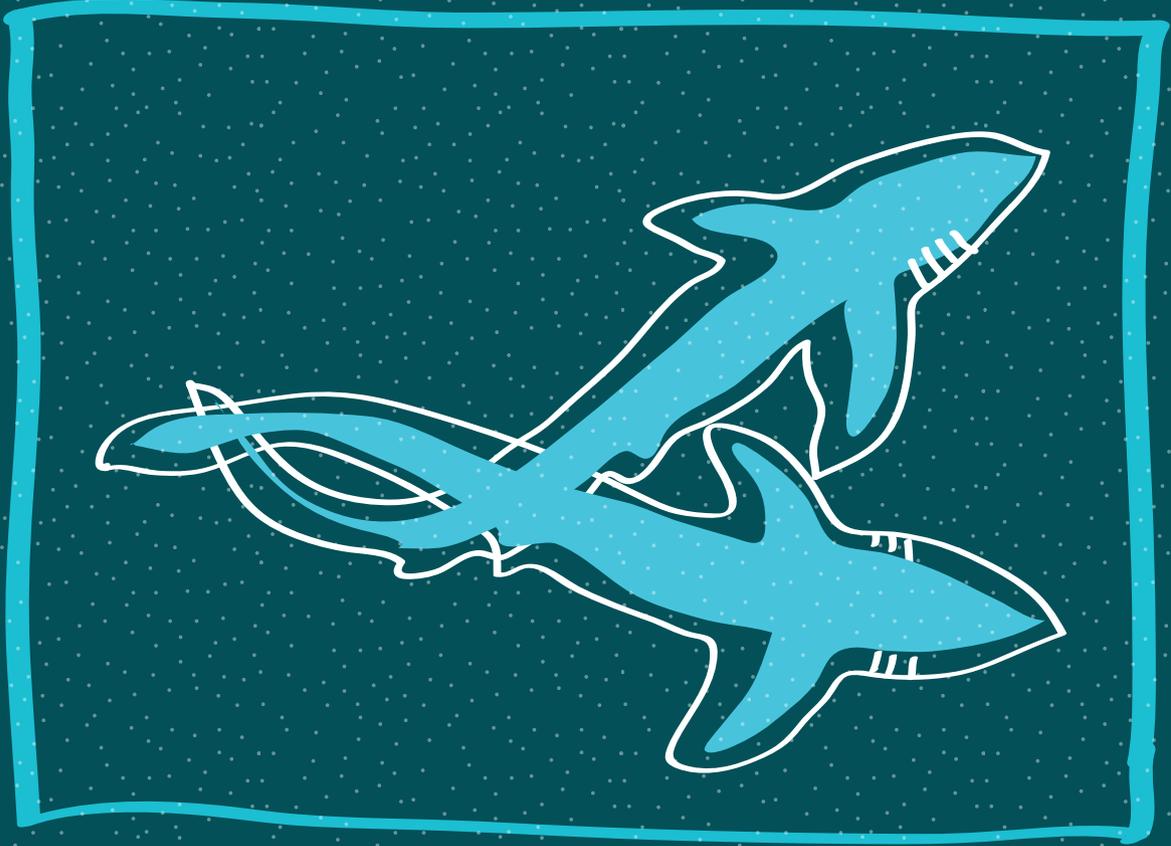
Management challenges

The key challenge in terms of marine spatial planning in the study area arises from the fact that Thermaikos Gulf is a marine area under protection status (Axios Delta National Park), which is put under great pressure because of the existence of the international port and the Metropolis of Thessaloniki. Given the nature of the study area, it is highly important that Thermaikos Marine Spatial Plan, fully considers the Ecosystem Approach, as well as the Land-Sea Interactions while planning for such a heterogeneous and complex area and attention needs to be given to land-sea interaction. As the study area encloses several important Natura 2000 sites and many species and habitats of conservation interest, measures concerning these sites should be carefully addressed and incorporated in the Marine Spatial Plan. Against this background, the general objective of this project is to provide the most appropriate assessment tools and policy instruments to foster

our capacity for a balanced development and the conservation of the ecosystems services across spatial and temporal scales, and to disseminate them to a wide range of users.

Planning and management framework in place

Planning and management of the area is realized through a series of spatial plans at the strategic level that are sectoral based, like tourism, aquaculture, energy etc. Region wide plan also known as the Regional Framework for Spatial Planning and Sustainable Development of Central Macedonia is setting the strategic framework for planning and development in the area. Furthermore, the area is regulated at a local level by the corresponding spatial plans at the municipal administrative level. These plans define the spatial organization and development of urban functions, land uses, building regulations, and any other measure, conditions, or restrictions required for the integrated spatial development and organization of an area at the municipal level. In addition, due to the complexity of the urban environment and the metropolitan role of the city of Thessaloniki a Master Plan for the metropolitan area is institutionalized.





6.4
MEDITERRANEAN
ELASMOBRANCHS CITIZEN
OBSERVATIONS (M.E.C.O.
PROJECT): CITIZEN-SCIENCE TO
RECONSTRUCT THE CHECKLIST OF
CHONDRICHTHYANS IN CYPRUS
(EASTERN MEDITERRANEAN SEA)
ANASTASIA CHARITOU, DIMITRA KATSADA
ISEA, ENVIRONMENTAL ORGANISATION
FOR THE PRESERVATION OF THE AQUATIC
ECOSYSTEMS, GREECE

6.4 Mediterranean Elasmobranchs Citizen Observations (M.E.C.O. project): Citizen-Science to Reconstruct the Checklist of Chondrichthyans in Cyprus (Eastern Mediterranean Sea)

Introduction the project

80 Chondrichthyans (sharks, skates, rays, sawfish, and chimeras) are apex predators influencing the trophic web through a top-down process and providing stability to the marine structures. Thus their depletion affects the remaining biota significantly. Targeted fisheries and bycatch are the most important threats they face, making them heavily overfished worldwide. Particularly in the Mediterranean Sea, which was considered a hotspot, chondrichthyan species now face the threat of extinction and population decline. In contrast to their ecological value, research on chondrichthyans is deficient in several areas worldwide. In the Mediterranean, the limited financial resources, the difficulties in species identification and their low population densities are the main reasons why many of the chondrichthyan species are still listed as “Data Deficient” according to the Red List of the International Union for the Conservation of Nature (IUCN). In response to these long-lasting knowledge gaps, the Citizen

Science project “Mediterranean Elasmobranch Citizen Observations” (M.E.C.O. project) was launched, which uses social media to create a regional database of elasmobranch observations (Fig.16).

Citizen Science projects are grounded in the active involvement of citizens in scientific research. More specifically, citizens contribute to the increase of scientific knowledge by providing important information and data to researchers. Advances in social media and mobile-phone applications have strengthened citizen science, rendering the sharing of information even more effective. Citizen Science projects related to biodiversity and the natural environment have the potential to provide massive data spatiotemporally that can contribute to the rapid and science-based decision-making for the management of natural resources, as well as to provide information that will be used for the creation of problem-solving strategies. In addition, citizen science enhances environmental awareness and the environmental literacy of the participants through the continuous information citizens receive and the relationship they develop with the natural environment. The aim of the M.E.C.O project is to collate

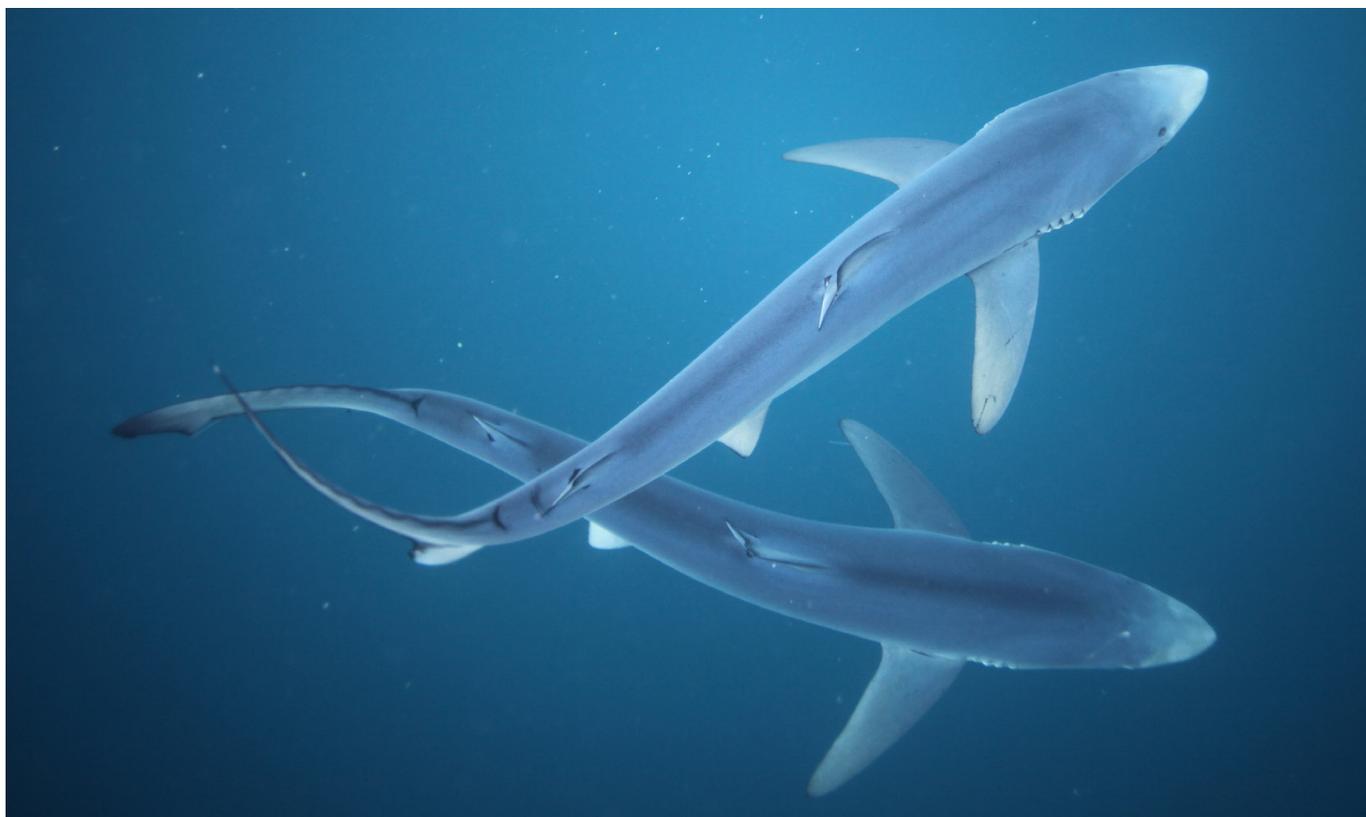


Figure 16. Blue shark (*Prionace glauca*). Critically Endangered shark species in the Mediterranean, according to the IUCN (International Union for Conservation of Nature) Red List of Threatened Species. Photo Credit: Alessandro De Maddalena.

- knowledge on chondrichthyan occurrence, seasonality, and distribution using citizen science and social media. From its beginning, in 2014, the project gradually expanded operation to nineteen countries. In MECO, participants report their sightings with photographic evidence (Fig.17).
- 82 Scientific experts request further information, when needed, such as date, location, specimen length and weight, number of individuals observed, and depth of the observation (if applicable). The experts then check pictures for authenticity and identify all original pictures to the lowest possible taxonomic level. Whenever possible, experts also record data such as maturity, gestation, and sex. Finally, there is also a two-way dialogue between citizen participants and scientific experts to retrieve historical records based on old pictures and social media posts.

Target audience

Being a Citizen Science project, M.E.C.O. participants, both scientists and non-scientists, are connected and share information. The stakeholders that mainly report their observations are the ones regularly interacting with the ocean i.e. divers, snorkelers, fishers and sailors. As result, more than 27,000 Citizen Scientist are involved in the project throughout



Figure 17. A *Gymnura Altavela* record reported from a citizen scientist through social media. Photo Credit: Kos Divers.

the Mediterranean. Taking the effectiveness of M.E.C.O. project into consideration, in combination with the need to update the knowledge about chondrichthyans living in Cypriot waters, M.E.C.O. was one of the tools used in order to revise the previous chondrichthyan checklist for Cyprus. To achieve this goal, all the records regarding the Cypriot waters, coming from the M.E.C.O. database, were reviewed. According to the results, recreational fishers are the ones consisting the vast majority of stakeholders involved in the project, followed by scuba divers, snorkelers and professional fishers, from which 117 chondrichthyans of at least 23 different species were reported in M.E.C.O. project.

Media and communication strategy adopted

The results of M.E.C.O. project, as a Citizen Science project in general, is based on well boosted social networks. The project's main tool of data reporting are twelve relevant Facebook groups (www.facebook.com/pg/). The data referring to the Greek and Cypriot seas are reported to the corresponding Facebook group: [Sharks and rays in Greece and Cyprus](#) (Fig.18). Apart from the procedure followed in order to obtain validated data, there is also the need of disseminating the results of the project, as well as of expanding the network of the participant citizen scientists. One step

towards this goal, is including the project as part of global crowdsourcing and citizen science platforms, like iNaturalist or facilitating public participation and data analysis through the “recruitment” of other tools, like the SEAlly mobile application. The results of the project with important scientific input are published in peer reviewed magazines or presented in relevant conferences. In order to inform, not only the already involved citizen scientists, but also the broader public and targeted stakeholder groups, the M.E.C.O. project sets the baseline for designing and implementing awareness raising campaigns. In particular, through “Sharks and rays in Greece and Cyprus” became obvious that there is a lack of

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Καρχαρίες και Σαλάχια σε Ελλάδα και Κύπρο / Sharks and Rays in Gr and Cy

Figure 18. Sharks and rays in Greece and Cyprus facebook group.

knowledge among both the general public, but also among the fisheries stakeholders, including Port authorities, auction markets, Fisheries authorities, professional and recreational fishers. As a result, part of the project “[Alliance for Survival](#)” aims to empower them regarding the legislation regulating the protection of sharks and rays in Greek waters, to train them on identifying vulnerable shark and ray species (Fig.19) and safely release them when incidentally caught and guide the consumers on how they can contribute to the imposition of the legal framework. Furthermore, the project and all its data collection tools, also works as a communication channel with the public involved in order to distribute useful information and materials created based on their interest and needs on different topics, like Conservation Status and the Protection Measures for Sharks species in different areas.

Results achieved

The way that M.E.C.O. project and the valuable collaboration it develops between researchers and non-scientists crucially promotes marine conservation can be interpreted by the updated checklist of chondrichthyans in Cyprus. Based on the projects results, it now includes 15 more species, three of which were first recorded in the area through citizen science. It is also important to note that up to 13%

of the species reported from recreational fishers through M.E.C.O. project was Data Deficient, so the evaluation of their status was not able. In addition, particular characteristics of the observations, like pregnant specimens, different observations of the same specimens and size of specimens in different areas and seasons led to further conclusions for next conservation steps, like nursing and spawning grounds of the area, fidelity sites by species and possible migration routes. Apart from being a crucial source of data regarding the species itself, 8 illegal activities were traced through M.E.C.O. project which led to legal procedures. M.E.C.O. project and its contribution to the updated Cypriot Chondrichthyan list, confirms the importance of citizen science approaches to promote science based policy decisions.

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Figure 19. S(A) Aggregation of *Mobula mobular* observed in 2020 in Cyprus. Photo credit: Marios Chisophorout. (B) A *Carcharhinus plumbeus* juvenile caught and released by a recreational fisher in 2018 in Cyprus. (C) A *Squatina aculeate* individual caught by a recreational fisher in 2020 in Cyprus. Photo credit: Stelios Kotzikas. (D) A female *Glaucostegus cemiculus* caught and released by a recreational fisher in 2010 in Cyprus. Photo Credit: Pamos Stavrou (E) A possible record of *Dasyatis marmorata* reported by Marine and Environmental Research Lab in 2020 from Cavo Greco, Cyprus. Photo Credit: Demetris Kleitou (F) A *Taeniurops grabatus* individual reported from a photo record that dates back in 1977 from Cyprus. Photo Credit: George Karamanos.

6.5

**TRAINING OF DIVING INSTRUCTORS FOR THE CONSERVATION OF
MARINE HABITATS AND COASTAL SPECIES OF INTEREST TO FISHERY**

TECLA MAGGIONI, JORDI SÁNCHEZ, ANDREU DALMAU

SUBMON, AWARENESS, STUDY AND CONSERVATION OF THE MARINE ENVIRONMENT; SPAIN





6.5 Training of diving instructors for the conservation of marine habitats and coastal species of interest to fishery

Summary

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The diving tourism industry is a driving sector for the economy of Catalunya. Diving activities attract approximately 250.000 national and international tourists each year. Direct income to diving centers is about 25 million € and the total income from the economic activities that revolve around diving tourism - including accommodation, food, transportation - reaches up to 100 million € (Triadó et al., 2014). Diving spots along the Costa Brava are studded with extended coralligenous hard bottoms and submerged caves, Maërl beds and *Posidonia oceanica* meadows that host great marine biodiversity and hold great attraction. If on the one hand diving tourism brings benefits to the local communities, on the other, it poses a relevant threat to the marine environment. Benthic habitats and slow-growing species are known to be very fragile, and unintentional hits, disturbance, and trampling could cause their degradation and loss. SUBMON has been involved in public awareness activities and training, targeting all the diving centers of the Costa Brava, to introduce a model for sustainable tourism that includes the

delivering of an eco-briefing before diving sessions, coupled with the active role of eco-instructors. Such measures are proven to be successful in limiting the impacts of diving on the marine environment, with the final aim of maintaining the long-term viability of the tourism industry in the area.

Introduction

Scuba diving has been considered a potential ecotourism activity: it gets visitors close to the natural resources, it may offer financial support to expedite marine subsistence and can support the local economy, and it possibly promotes the engagement of society toward marine conservation. This premise can be quite controversial, given the extensive impacts that diving tourism has on underwater communities (Di Franco et al., 2009, Luna et al., 2009, Betti et al., 2019). Until recently, diving in protected areas was generally considered a non-destructive activity (Milazzo et al., 2002), but new evidence of intentional or accidental behaviors of divers that cause great impacts are well documented (Di Franco et al., 2009, Luna et al., 2009; Betti et al., 2019). SCUBA diving is not immune to some side-effects, the most evident of whom are easily detectable, in the Mediterranean Sea, in the hard substrate communities formed by sessile erected, calcified organisms, particularly

within the coralligenous habitat (Ballestreros, 2006, Linares et al., 2010). Those negative effects are derived from the physical contacts by fins, body, hands, or diving equipment with the bottom as well as when divers kick, hold, stand on or kneel on the seafloor (Luna et al., 2009). The physical and biological characteristics of the bottoms reflect the susceptibility of benthic communities to impacts, and therefore, the number of visitors that can be accommodated at them (Lloret et al., 2006).

In Catalonia, the diving tourism industry is a driving sector for the tourism economy, attracting approximately 250.000 national and international tourists each year and bringing a total income of 25 million € to the diving centers located along the coast. On average, the total income of diving tourism and related facilities and business – including accommodation, food, transport – is about 100 million € in the Catalan region (Triadó et al., 2014). Costa Brava, located north of Barcelona is a coastal belt of approximately 216 km, and alone attracts approximately 140.000 divers/year. The most visited diving spot of Costa Brava is the Medes Islands archipelago, located in the municipality of l'Estartit, designated as a Marine Protected Area and included in the territory of the Montgrí- Illes Medes-Baix Ter

Natural Park. Currently, 12 certified diving centers operate in the Medes Islands, and data from the l'Estartit Tourist Office showed that diving activity has an economic impact of almost 10 million euros/year on the small tourist destination of l'Estartit-Medes Islands, directly employing around 7% of the total registered inhabitants of the territory. In this area, approximately 75.000 dives are registered each year, during the summer season.

The shores of the Costa Brava are a hotspot of marine biodiversity (Fig.20). The wild, rugged profile of the coastline conceals hidden caves and secluded coves, that host coralligenous, a hard substratum of biogenic origin that is mainly produced by the accumulation of calcareous encrusting algae (such as *Lithophyllum*, *Mesophyllum*, and *Peyssonnelia*) growing in dim light conditions (Ballesteros, 2006). Coralligenous assemblages can be found between 25 up to 200 meters depth and are one of the preferred diving spots for tourists due to the great diversity of organisms. In terms of biodiversity, the coralligenous reef formations are considered as the second benthic habitat in the Mediterranean Sea after the *Posidonia oceanica* meadows (Boudouresque, 2004). Divers are astonished by the high number of species belonging to taxonomic groups as diverse as

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sponges (*Crambe crambe*), gorgonians (*Paramuricea clavata*, *Eunicella singularis*), corals (*Corallium rubrum*), molluscs, bryozoans (*Myriapora truncata*, *Pentapora fascialis*), tunicates, crustaceans, or fishes (*Epinephelus marginatus*). Being one of the habitats most frequented by scuba divers, they are also most vulnerable to impact and degradation especially because of the slow-growing nature of species. The second habitat of interest for the Costa Brava region is the Maërl bed, characterized by coralline red algae, also known as rhodoliths, which grow approximately 1 mm/year. Rhodoliths have a purple-pink color and form reef-like carpets in the infralittoral zone until 120-150 meters depth. In terms of ecological functions, they play a major role in biogeochemical cycles as significant carbon and nitrogen sinks (Foster et al., 2013). Such habitat is quite threatened by trawling, climate change, and eutrophication, and unregulated diving activities could pose a further burden (Salomidi et al., 2014). Another habitat that provides valuable ecosystem services is the Posidonia meadows that serve as a nursery for many species, providing shelter, food, and protection. Given the high biodiversity hosted, this habitat can be an attractive pole for recreational SCUBA diving activities. SUBMON carried out a study in the Medes

Islands (Sánchez et al., 2010) to monitor divers' behavior underwater in relation to the underwater communities visited (Fig.21). A total of 166 divers were followed, of which 88 (53% of the total) made contact with the substrate or marine species. Specifically, these 88 divers hit the bottom an average of 7 times per 10 minutes of diving, with these contacts being mainly made with the fins (46.96% of the total) and hands (29.89% of the total). These contacts may have an impact on some fragile species, and may even lead to their uprooting or breakage, or raise sediment, which may



affect filter-feeding species. The long-term viability of the diving tourism industry of Costa Brava strictly depends on how the marine habitats are managed: to maintain the activity of diving as a tourist attraction, it must be compatible with the conservation of the habitat and species. The diving activity is often carried out in a protected area, that is designated specifically to maintain or restore the biological communities found, and any harm related to diving should be limited.

Moreover, it is precisely the conservation of the natural heritage of the area that will ensure its

attractiveness for the thousands of divers who visit it. The degradation of coralligenous reefs, Maërl beds, and *Posidonia oceanica* meadows would reduce the value of the underwater environment and would lead to a decreased scuba divers' satisfaction as well as a drop in the rate of return visits, thus resulting in a dramatic loss in terms of monetary income. Given the strict relation between divers' behavior and the health of the marine ecosystem, it is crucial to put efforts in spreading awareness to achieve a full understanding of what are the threats posed on the marine environment by diving, coupled with the

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Figure 20. From left to right: Coralligenous assemblages, Maërl beds and *Posidonia oceanica* meadows



Figure 21. Group of divers in the Medes Islands MPA



dissemination of good practices to reduce impacts on benthic ecosystems.

The project: goals, actions, process and target audience

- 92 In 2018, SUBMON carried out the project “Training of diving instructors for the conservation of marine habitats and coastal species of interest to fishery”, with the support of Generalitat de Catalunya, Grup d’Acció Local Pesquera of Costa Brava (from now on GALP), Association of Diving Centers in Costa Brava and co-financed by the European Maritime and Fisheries Fund. The main objective of the project was to maintain the long-term viability of the tourism industry in the Costa Brava, by developing communication and awareness activities addressing the diving centers located along the coast. SUBMON organized free training courses for diving instructors to foster a model of sustainable diving, which includes the eco-briefing and introduces the role of the eco-guides. The course focuses particularly on diving instructors and guides because these are the people who work in direct contact with the marine environment and the divers that visit it. For this reason, they should play an active role in preventing possible impacts of diving activities and

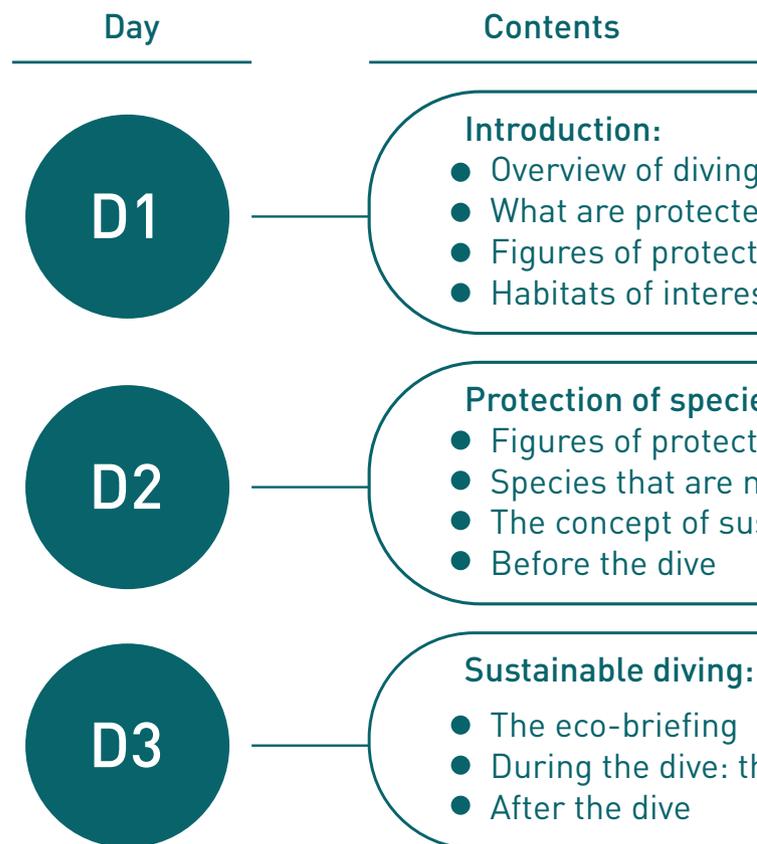


Table 1. Topics covered during the course

... tourism in Catalunya and Costa Brava
... d areas
... ion for marine habitats
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... es and sustainable diving:
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... sustainable diving

... he role of the eco-instructor

should be active players in the conservation of the marine resources their activities depend on.

The training had as main objectives:

- Spread awareness on the marine habitats and species of fishing interest of the Costa Brava
- Boost good practices for diving activities
- Train diving instructors and guides to limit impacts related to diving activities

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The table on the left (Table 1) summarizes the topics covered during the three days course:

The concept of sustainable diving could be defined, in a simple way, as the practice of this activity in a form that does not impact the marine environment or the species that inhabit it. In this sense, it encompasses all the actions involved in this activity. The proposed model for sustainable diving is characterized by three elements, distributed in time over the diving session:

- **Before the dive:** an eco-briefing should always be delivered by the instructors to the group of divers and it should cover not only technical aspects of the dive but also environmental features of the area that will be visited. The explanation should include the natural value of the area, biological and ecological information on the type of seabed and habitat visited,

notions on the impacts of diving on fragile marine habitats and species. It would also be important to define some concrete signal to be able to indicate the presence of sensitive communities underwater. The eco-briefing should also include some good practices to limit the impacts such as: control the buoyancy, avoid contacts produced by any part of the body or scuba gear, limit the interactions with flora and fauna. The main objective of eco-briefing is to encourage a change in the behavior and attitude of the divers. The success of many diving centers depends not only on the diving experience but also on the role and attitude of the guides. Therefore, they must be able to summarize the speech and explain the concepts in a clear, catchy, and even playful way, without losing the importance and significance of the message. Thus, to capture the interest of divers, the message and contents must be clear and be presented in a way that motivates the audience to contribute to the prevention, protection, and conservation of the marine environment.

- **During the dive:** the role of the guide could significantly influence the behavior of divers and it is acknowledged that during guided dives, the number of interactions with the bottom decreases (Sánchez et al., 2010). For this reason, all dives should be guided,

with a proper ratio between guide/number of divers. The eco-guides should stand as a role model for the group of divers and his role should go beyond simply guiding the clients. The eco-guides should have an active role in monitoring and rectifying misbehaviors to limit impacts. During the training, conflict resolution strategies were explained to support eco-guides in the process of rectifying harmful behaviors of clients while diving.

- **After the dive,** it is time to discuss different aspects that can help to add value to the diving activity. Clients may have questions about species and habitats, and the guide should always be available for answering and giving further information. If anything unexpected was observed during the dive (e.g. mortality events or occurrence of invasive species), the guide should encourage divers to report it, acting as sentinels. In this way, a successful collaboration between divers and the scientific community could be established through citizen science activities and the collection of data. Once the dive is over, the eco-guides should remind customers of the importance of good diving practices. It is important to highlight that the conservation of the marine environment, in general, depends on our actions. If a diving company wishes to offer environmentally

responsible services, it is essential that its working procedures and systems are geared towards sustainable management. The training program also covered aspects to improve the sustainability of diving centers facilities (eg. management of waste, carbon footprint reduction), boat operations and anchoring (eg. protocols for accidental oil spill, management of bilge water, eco-friendly anti-fouling paints, cetacean approach regulations, eco-anchoring etc.).

Media and communication strategy

The training program was open both to diving centers affiliated to the Association of Diving Centers in Costa Brava as well as to centers that have their headquarters in a municipality that is part of the GALP. A database was created comprising 71 diving centers that respond to one of the two requirements and are officially recognized by the Generalitat de Catalunya.

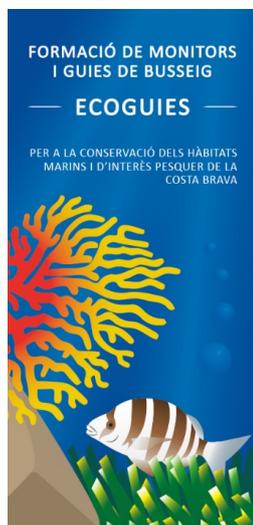
A first communication document was shared by email with the diving centers, together with a presentation of the main objectives and contents of the project. Once defined the schedule for the training program, a call for enrollment was opened and shared among interested parties.

To disseminate the call, SUBMON designed some leaflets (Fig.22) explaining basic concepts about sustainable diving and highlighting the imperative need to introduce a transformative change in how diving activities are carried out to ensure the long-term viability of diving tourism. Other communication actions included a press release at the beginning of the project and an advertising teaser on the official website of the Association of Diving Centers in Costa Brava.

Project achievements:

The training program was held in 9 towns on the Costa Brava (Blanes, Cadaqués, L'Escala, L'Estartit, Palamós, Port de la Selva, Roses, Tossa and Vall-llobrega) the course was repeated 13 times and 201 diving instructors and guides actively participated. A printed manual, with the theory and the good practices, was provided to all participants after the completion of the course.

This project offered a unified and homogeneous training program to the diving centers of the Costa Brava, which are working together in the same area. The contents of the training were adapted specifically to the coastal and protected areas where the diving centers are operating, offering the opportunity to learn more about the natural value.



QUÈ ÉS UNA IMMERSIÓ ECOGUIADA?



És aquella on el guia no només mira endavant, i ensenya i interpreta allò que veiem, si no que mira enrere i comprova que els capbussadors que l'acompanyen tenen el comportament adequat

És una immersió en la que s'adverteix prèviament de les zones més fràgils que es visitaran i s'explica com no pertorbar-les

El guia aprofita per detectar i comunicar qualsevol signe de deteriorament per evitar nous impactes

Una immersió ecoguiada és una immersió sostenible



PER QUÈ CAL PARTICIPAR?



- Perquè som i ens sentim responsables del comportament dels capbussadors que acompanyem al mar
- Perquè els nostres clients valoren el compromís mediambiental
- Perquè les normatives que afecten la immersió a les zones protegides contemplen ja aquest paper proactiu
- Perquè volem deixar a les noves generacions un fons marí millor que el que vàrem trobar
- Perquè podrem segellar i identificar les immersions que fem amb aquests criteris, generant un valor afegit

Figure 22. Leaflet of the training program

Diving centers operating in the Medes Islands MPA had the opportunity to get trained in compliance with the new Master Plan adopted in 2017 that requires the delivery of the eco-briefing prior to each diving session. The eco-briefing and the eco-guides are now adopted as conservation measures in the MPA, to preserve the marine habitats and reduce the impacts of the diving tourism industry. As it concerns Medes Islands MPA, SUBMON carried out a scientific study in the summer 2021 to monitor the divers and assess if the efforts put in the awareness and education projects are improving how divers and instructors behave underwater.

Indirectly, this course highlighted the importance of considering diving activities under the umbrella of



eco-tourism opportunities, to get visitors close to the marine environment and encouraging them to be active player in the conservation of marine habitat of fishing interest.

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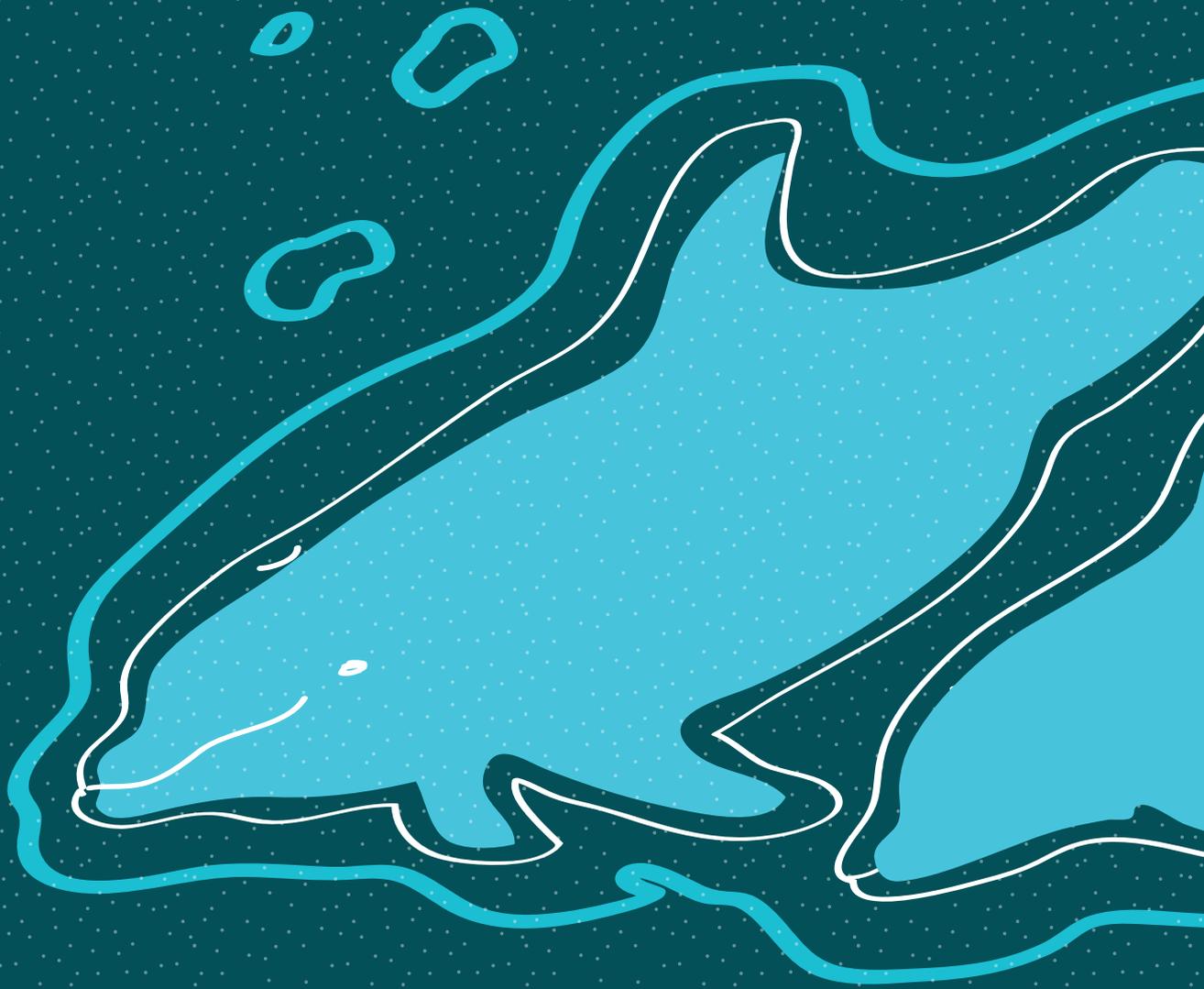
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6.6

**ENHANCING THE PROTECTION OF THE CRITICALLY
ENDANGERED COMMON BOTTLENOSE DOLPHIN IN
THE GULF OF AMBRACIA, GREECE**

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6.6 Enhancing the protection of the Critically Endangered Common bottlenose dolphin in the Gulf of Ambracia, Greece

Summary

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The common bottlenose dolphin (*Tursiops truncatus*), hereafter bottlenose dolphin, in the Gulf Ambracia, Western Greece (Fig.23), constitutes a geographically distinct and genetically differentiated unit, with little demographic exchange with the Ionian Sea. Further, these dolphins are exposed to high levels of pollution, mostly derived from local agriculture (i.e., pesticides). Bottlenose dolphins occur in the Gulf in high densities (mean: 0.37 animals km⁻²), one of the highest observed densities in the Mediterranean for this species (Bearzi et al. 2008, Gonzalvo et al. 2016). Photo-identification-based population estimates over a 10-year period (2006-2015) were between 127 and 174 individuals, with Coefficients of Variations (CV) averaging about 10%. The estimated trend in population size over those ten years indicated a decline of 1.6% per year but was not significant, as there is insufficient power in the data to detect a decline of this magnitude over ten years (Gonzalvo et al. 2016). While local density of dolphins is among the highest recorded anywhere in the Mediterranean Sea, this is not indicative of favourable conservation

status or pristine habitat. On the contrary, the viability of bottlenose dolphins in the Gulf of Ambracia may be at risk due to their likely reproductive isolation, small population size and small extent of occurrence, as well as to the increasing acute anthropogenic impacts in their semi-enclosed shallow habitat.

Background info

In 2001, the Tethys Research Institute started a study in the Gulf of Ambracia, western Greece, where bottlenose dolphins are the only cetacean species encountered.

Ongoing research showed that roughly 150 dolphins inhabit the Gulf. These dolphins are members of a highly 'resident' community, displaying unique behaviour and ecology. A few individuals photo-identified in the Gulf of Ambracia were subsequently observed in the Inner Ionian Sea archipelago and in the Gulf of Corinth, but no immigration into the Gulf was recorded so far.

Research carried out by Tethys is documenting how the local dolphin community interacts with its environment and how human activities may influence its conservation status.

The Gulf - which is part of a larger National Park - is also inhabited by loggerhead sea turtles and has a rich bird fauna including rare species. The Gulf's

biodiversity, however, is threatened by high and increasing eutrophication and pollution.

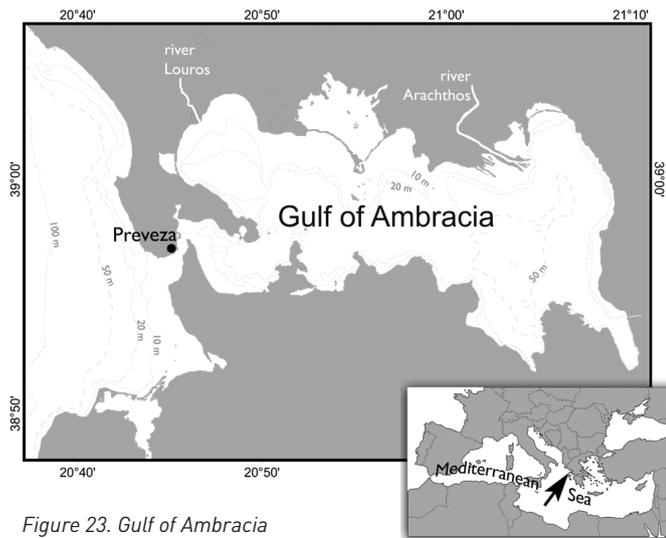


Figure 23. Gulf of Ambracia

The Gulf of Ambracia

The Gulf of Ambracia is a semi-closed embayment of 405 km² connected with the open Ionian Sea only through the narrow (minimum width of 370m) and shallow (maximum depth point of 20 m) 3 km-long Preveza Channel. The average depth of the Gulf is

about 30 m (maximum depth 60 m) and its bottom is covered mainly by mud and sand (Ferentinos et al., 2010). Moreover, it is the final receptor of freshwater and nutrient loads from the surrounding catchment area and its water quality is influenced by the runoff of two rivers (Louros and Arachthos), located on the northern shore (Kountoura & Zacharias, 2013), which form a complex ecosystem consisting of a double delta with its marshes and lagoons. In addition to intensive fish farming, the Gulf is also affected by agriculture, livestock farming and discharges of domestic sewage from coastal towns and villages (Bearzi et al., 2008; Ferentinos et al., 2010; Gonzalvo et al., 2014). Local commercial fisheries include only small-scale fisheries working mainly with set nets (i.e., trammel and gill nets), consisting of a fleet of 300 fishing boats (Gonzalvo et al., 2014).

The Gulf of Ambracia is a Natura 2000 site (code GR2110001 <https://natura2000.eea.europa.eu/Natura2000/SDF.aspx?site=GR2110001>) and it is also part of the network of Ramsar Sites. In 2006, it was confirmed as a Site of Community Importance (SCI) and in 2011 it was designated as a Special Area for Conservation (SAC) according to Law 3937/29-3-11 (OJ 60 A). In 2008, it was designated as a 'National Park' in accordance with Greek national legislation (11989/08 KYA). Nevertheless, despite being protected

by national, European, and international legislation, the Gulf has undergone severe changes resulting in the degradation of the entire ecosystem. In the past decades, the deeper layers of the water column have become seasonally hypoxic/anoxic, with the western side seasonally hypoxic and the eastern side seasonally anoxic (Kountoura & Zacharias, 2013). The Gulf of Ambracia was declared in 2017 as an Important Marine Mammal Area (IMMA) by the IUCN Joint Species Survival Committee/World Commission on Protected Areas (SSC/WCPA) Marine Mammal Protected Areas Task Force.

The bottlenose dolphin population in the Gulf of Ambracia

Bottlenose dolphins occur in the Gulf in high densities (mean: 0.37 animals km⁻²), one of the highest observed densities in the Mediterranean for this species (Bearzi et al. 2008, Gonzalvo et al. 2016). Photo-ID-based population estimates over a 10-year period (2006-2015) were between 127 and 174, with Coefficients of Variations (CV) ranging between 5.4-16.7%. The estimated trend in population size over those ten years indicated a decline of 1.6% per year but was not significant, as there is insufficient power in the data to detect a decline of this magnitude over ten years (Gonzalvo et al. 2016).

The Gulf of Ambracia subpopulation of bottlenose dolphins is genetically differentiated from the surrounding Mediterranean subpopulations, and the observed genetic diversity suggests that the Gulf of Ambracia subpopulation is highly isolated (Gonzalvo et al. 2016, Curry 1997, Natoli et al. 2005, Viaud-Martinez et al. 2008).

Threats

The main threat to the survival of the bottlenose dolphin subpopulation in the Gulf of Ambracia is the increasingly degraded condition of the Gulf's water quality. As the final receptor of freshwater and nutrient loads from surrounding areas through runoff and the contribution from rivers Louros and Arachthos (Kountoura and Zacharias 2013), the Gulf's water is affected by agriculture, livestock and discharges of domestic sewage from coastal towns



and villages (Bearzi et al. 2008, Ferentinos et al. 2010, Gonzalvo et al. 2015). In addition, considering that fish farm waste could cause a 1% increase in nutrient concentrations in the Mediterranean (Karakassis et al. 2005), the intensive fish farming operations in the Gulf can be expected to contribute significantly to nutrient load.

With respect to toxicological status, the organochlorine levels found in Ambracian bottlenose dolphins were similar to those reported by Fossi et al. (2003) for the same species in the neighbouring waters of the Ionian Sea as far as HCB and PCBs were concerned; however, DDTs levels were four times higher in the Gulf than in neighbouring waters, indicating the existence of a real toxicological problem for these dolphins (Gonzalvo et al. 2016). Lipid content in the bottlenose dolphins' subcutaneous blubber (represented by extracted

organic matter, EOM%), indicative of health condition, resulted in 28.6% (n=14); a value much lower than what was reported for bottlenose dolphins from other areas (the Sea of Cortez (n=11; 43.5%), the Strait of Gibraltar (N=3; 48.9%), the Strait of Sicily (n=4; 60.8%), and a single specimen from the Ionian Sea with 74%, but similar to EOM% from specimens in the Croatian Adriatic Sea (n=14; 24.5%) (L. Marsili, unpublished data; Marsili et al. 1996). A mean value as low as that detected in the Gulf of Ambracia is indication of a generalized poor health condition (Gonzalvo et al. 2016).

About one in three bottlenose dolphins in the Gulf of Ambracia was found to be suffering from some kind of skin condition (Gonzalvo et al. 2015). Numerous cumulative factors may be influencing the epidermal integrity and immune response of the skin of Ambracian dolphins or cause them physiological stress, thereby rendering this highly resident community more prone to natural infections or to impact by anthropogenic activities.

Concerning fisheries interactions, in the Gulf of Ambracia, purse-seine and trawl fishing have been prohibited by law since 1953 and 1966, respectively (No A81 Royal Decree 23.3/8-4-53 and No 8 Royal Decree 917/66). Local commercial fisheries are limited to about 300 small-scale artisanal



vessels, working mainly with trammel and gill nets (Gonzalvo et al. 2014). Fishermen working in the Gulf unanimously report predation and damage to their nets by bottlenose dolphins; nevertheless, they describe dolphins as 'special' animals, defining them as intelligent and beautiful. Accordingly, the occurrence of intentional killing of dolphins by fishermen as a form of retaliation or culling was never reported in recent years; however, about half of the fishermen community has declared to be aware of occasional dolphin incidental captures (Gonzalvo et al. 2014).

Human disturbance is also a potential threat to bottlenose dolphins in the Gulf of Ambracia, considering the development of dolphin-watching activities in the Gulf in recent years by operators who have not been applying consistently the ACCOBAMS Guidelines of respectful whale-watching operations (J. Gonzalvo, unpublished).

Communication and awareness

In April 2021 a brand-new Ionian Dolphin Project (IDP) website was officially released <https://www.ioniandolphinproject.org>, after the first IDP website was produced in 2012. In addition to provide education material such as basic information on marine mammal species present in Greek waters

(Fig.24), as well as guidelines for boaters and sea users on how to behave when coming across cetaceans and monk seals, this website offers a digital platform to report marine mammal sightings (i.e., citizen science programme) through a very user-friendly interface.

Nowadays, the use of digital cameras, cell phones and other devices capable of easily recording several minutes of video, or to capture high quality digital images is widespread among boaters. Using the on-line sighting form videos and images can be sent to us to facilitate additional information and to allow us to confirm the identification of the species reported. It also includes essential information about the cetacean species found in the Greek seas and identification tips.

The number of charter boats and flotilla sailing holiday companies operating around the Ionian



Islands has steadily increased during the last decade. Together they pose a fleet of several hundred boats, regularly navigating the waters between the islands of Zakynthos and Corfu. The resulting regular activity of this large fleet not only offers a huge potential for the recording of opportunistic marine mammal sightings but also calls for the design of adequate education and awareness initiatives addressed to boat users. This increase in boat traffic and the potential disturbance it generates may pose a threat to marine mammal populations by causing unnecessary stress by disrupting their natural behaviours. Such threats can be minimised by applying a basic code of conduct when coming across a group of cetaceans or monk seals.



Figure 24. Cetacean identification guide

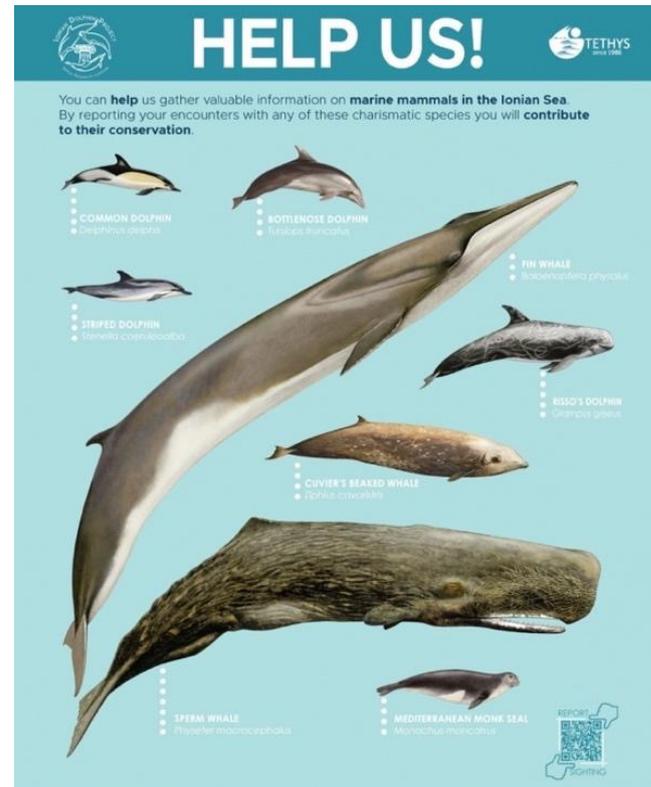
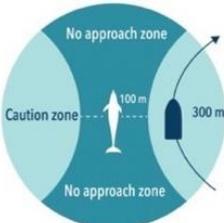


Figure 25. Code of conduct guidelines

LET'S BE SMART
SUPPORT MARINE MAMMAL CONSERVATION



While today's abundance of monk seals, whales and dolphins is likely only a fragment of what it was a century ago, important populations still live and reproduce in the Ionian Sea. Human disturbance to marine mammals causes them unnecessary stress. By applying the following very basic codes of conduct you will be contributing to their conservation.




S	Stay back 100 metres from cetaceans	S	Stay back 30 metres from seals
M	Move away cautiously if the animals show signs of disturbance (sudden change in behaviour)	M	Move away cautiously if the animals show signs of disturbance (sudden change in behaviour)
A	Always put your engine in neutral when cetaceans are near.	A	Avoid making noise in the presence of a seal on land and if at sea put your engine in neutral
R	Refrain from feeding, touching, or swimming with wild dolphins or whales	R	Refrain from feeding, touching, or swimming with monk seals, and KEEP PETS AT A DISTANCE, as they might be carriers of dangerous diseases to the seal
T	Teach others to be CETACEAN SMART	T	Teach others to be MONK SEAL SMART

PROJECT BY  www.ioniandolphinproject.org

WITH SUPPORT FROM  

Mini posters with marine mammal species and species guides and code of conduct guidelines (Fig.25) when encountering marine mammals made available for download at the IDP website <https://www.ioniandolphinproject.org/download/>

Key outcomes

- Until 2016 the Gulf of Ambracia Natura 2000 Area was exclusively including the marshes and lagoons of the northern side of the Gulf, which were also included in the Ramsar Site EU network because of their importance as nesting sites for seabirds. In December 2016, the the Gulf of Ambracia Natura 2000 site GR2110001 was significantly expanded to cover the totality of the waters of the Gulf as a result of the evidence provided by Tethys Research Institute on its importance as a key area for the conservation of bottlenose dolphins.

- The Gulf of Ambracia was declared in 2017 as an Important Marine Mammal Area (IMMA) by the IUCN Joint Species Survival Committee/World Commission on Protected Areas (SSC/WCPA) Marine Mammal Protected Areas Task Force¹. (Fig.26)

IMMA Area size: 401 km²

Qualifying species: common bottlenose dolphin

(*Tursiops truncatus*)

IMMA selection criteria: A (species or population vulnerability), B1 (aggregations), C1 (reproductive areas), D1 (distinctiveness).

PDF made available for download at <https://www.marinemammalhabitat.org/portfolio-item/gulf-of-ambracia/>

- In September 2020 an assessment of the *Tursiops truncatus* Gulf of Ambracia subpopulation was submitted to the IUCN Red List authority proposing it as CRITICALLY ENDANGERED (CR) because of undergoing an inferred continuing decline caused

by the deteriorating quality of the Gulf's waters and have fewer than 250 mature individuals within a single subpopulation (C2a(ii)). This assessment was ratified by the IUCN in September 2021 and at the moment of producing this document is in press.

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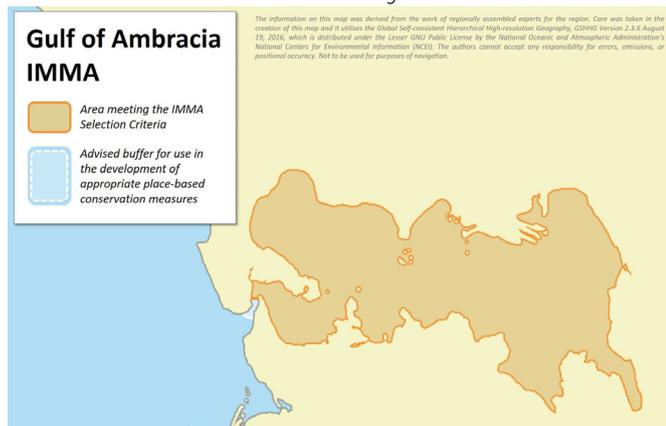
¹ *Important Marine Mammal Areas (IMMAs) are defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation. They are identified in order to prioritise their consideration for conservation measures by governments, intergovernmental organisations, conservation groups, and the general public.*

IMMAs are identified through an expert-led process involving the collation and assessment of evidence against a set of selection criteria. This process, lasting approximately 12 months, aims to engage a wide range of representatives within the marine mammal science and conservation communities where much of the evidence necessary to assess IMMAs is held. Experts are selected based on their region-specific knowledge, experience and skills relevant to the task of weighing evidence and applying the IMMA selection criteria. Potential sources of information are actively sought in a process engaging with experts and other holders of evidence on a region-by-region basis.

A five-stage process with the help and support of the Task Force is used to identify, review, and accept or reject IMMA nominations, as follows:

Stage 1 – Nomination of 'preliminary Area of Interest'. Any expert or interested party may propose a pAoI following a simple template, accompanied by supporting evidence. Each pAoI, along with existing marine mammal place-based conservation areas (e.g., MPAs,

Figure 26. Gulf of Ambracia IMMA



EBSAs, KBAs, etc.) is then presented and evaluated at regional expert workshops. The supply information about pAols is included in a regional Inventory of Knowledge (IoK) using a standardised Data Appraisal Form (DAF).

Stage 2 - Development of 'candidate IMMAs' – It is a multi-step process guided by the Task Force during regional workshops publicly announced with 'calls for information' 4-6 months in advance.

Participants use their regional knowledge to develop cIMMA, based on their review of pAol submitted in advance or generated during the workshop itself. cIMMAs are submitted to the Task Force on an agreed IMMA Review Template to (a) identify proposed boundaries, (b) provide a thorough rationale based on one or more of the IMMA criteria (<https://www.marinemammalhabitat.org/immas/imma-criteria/>), (c) summarise and provide access to the full supporting evidence and (d) identify any existing conservation measures within the areas proposed.

Stage 3 - Final review and IMMA Status Qualification - The Task Force, in consultation with the IUCN [e.g. through the Chairs of the relevant specialist groups], nominates an independent Review Panel, chaired by Randall R. Reeves, charged with assessing the scientific robustness of the proposals and satisfaction of the criteria.

Stage 4 and 5 - Reporting, communication, final review and IMMA Status Qualification - Confirmed IMMAs and their associated documentation are made publicly available by the Task Force on its website via a searchable and downloadable database, and a dedicated online IMMA e-Atlas. Areas that are not accepted as full IMMAs by the Task Force because they do not present convincing evidence that they satisfy the criteria remain as either cIMMAs or Areas of Interest (AoI).

Read more on the Marine Mammal Protected Areas Task Force website www.marinemammalhabitat.org

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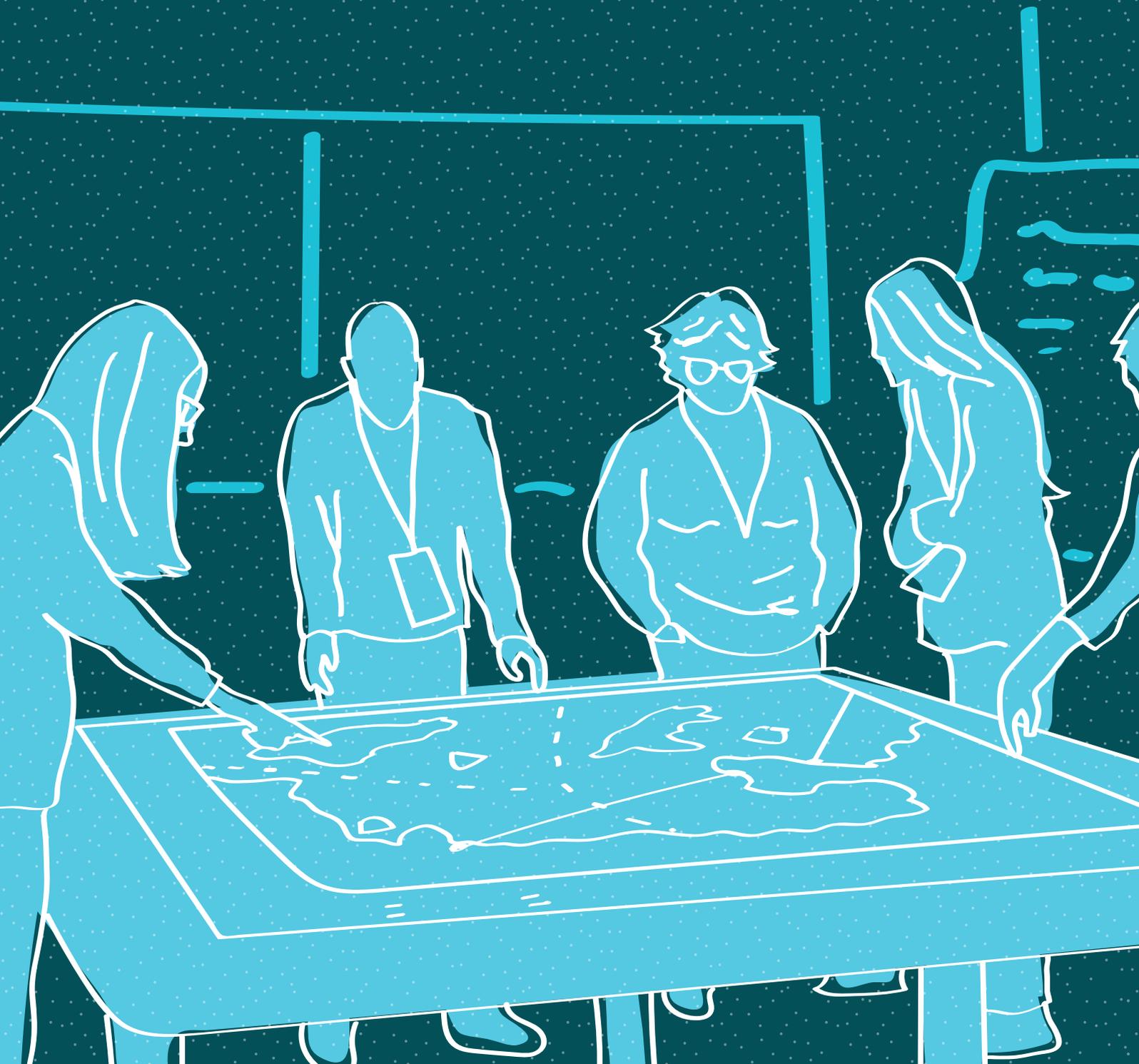
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6.7

A DIDACTIC PATHWAY TO
UNDERSTAND PLANNING AND
MANAGEMENT OF MARINE AND
COASTAL AREAS

FEDERICO FABBRI
UNIVERSITY IUAV OF VENICE



6.7 A didactic pathway to understand planning and management of marine and coastal areas

Introduction

112 The Intensive Study Program (ISP) on planning and management of marine and coastal areas was created in the context of the MARINE_ECOMED project developed through the Erasmus + Programme of the European Union. It was conceived as a didactic pathway to connect students from different backgrounds through an innovative course on the multidisciplinary subject of planning and management of marine and coastal areas. Specific focus was devoted to the Mediterranean Sea through the overview of experiences of planning and management of marine and coastal areas, case studies, and good practices localized on its coasts and waters.

The ISP has been conducted for three editions (from 2019 to 2021) and it was organized through 2 Long Distance Learning (LDL) modules and a 2-week long workshop.

Students get trained by the experts of the project partner institutions (University of Venice, Aix-Marseille University, Aristotle University of Thessaloniki, iSea Environmental Organization, SUBMON Association, Tethys Research Institute)

and participate together in the course. Collaboration between participants was enhanced to promote knowledge exchange and networking. Participation in the workshop was supported through the award of Erasmus + grants available for students of the project partner universities in order to entirely cover their mobility expenses. Subscriptions of students from institutions external to the partnership were also considered.

Contents

The entire ISP was designed to provide participants with:

- fundamental knowledge to understand how terrestrial planning deeply influences marine and coastal areas and vice-versa;
- understanding on the main aspects of marine and coastal planning and management and the main challenges and potential solutions for its effective implementation;
- knowledge of the main aspects and strategies adopted in citizens science and how these can support the implementation of spatial planning and management;
- detailed insight on good practices in the context of planning and management of marine and coastal areas through interactive classes delivered by the

experts of the project partner institutions;

Learning outcomes

The learning outcomes were developed based on the Dublin Descriptors¹ as follow:

- **Knowledge and understanding:** Acquire knowledge on main relevant aspects of coastal and marine planning and management and the main challenges and potential solutions for its effective implementation; acquire an overview of citizens science and communication strategies and approaches and their relevance to support spatial planning and management;
- **Applied knowledge and understanding:** Depict the key steps typical of a coastal-marine planning and management process and apply it to a specific geographical context;
- **Making judgements:** Select the best tools and approaches for the development of a coastal-marine planning and management project concerning site-specific conditions of different scenarios/case studies;
- **Communication skills:** Communicate effectively with other students and teachers from different backgrounds; communicate their working results to specialist and non-specialist audiences; be able to work in teams around common problems;

- **Learning skills:** Describe main tools and methods available to effectively approach planning and management of coastal-marine systems; acquire an overall knowledge of marine-coastal planning and management adequate to orient their future study, research, and work within the framework of this multidisciplinary field.

Teaching methodology

The entire course was developed through three complementary modules: two Long Distance Learning (LDL) online modules and a two weeks workshop. The two LDL modules provided the background knowledge to prepare for the workshop. An online platform (Canvas Learning Management System) was used to support the implementation of an innovative, interactive learning approach. The platform was made available for teachers and for students from different backgrounds and institutions to provide them with a virtual space to interact. In particular, through the online forum, they were enabled to share experiences and discuss the course aspects and topics. Anonymous questionnaires were submitted to the students to provide feedback to teachers on the different aspects of the course and collect their opinions and qualitative evaluation of the course.

More in detail the three main modules of the course were organized as follow:

114 The LDL 1 was based on Open Education Resources (OERs) made available by the project partners from the 3 academic institutions (Aix-Marseille University, Aristotle University of Thessaloniki, and University Iuav of Venice) and shared through the project web platform. This module focused on: the terrestrial-marine continuum; the planning process (key steps: visioning, problem scoping, analysis, elaboration of planning measures and implementation program); monitoring and planning implementation evaluation;

The LDL 2 was based on Open Education Resources (OERs) made available by the project partners from the 3 non-academic institutions (iSea Environmental Organization, SUBMON Association, Tethys Research Institute) and shared through the project web platform. This module focused on: survey strategies to support monitoring and planning implementation evaluation; stakeholder engagement strategies; communication and public awareness strategies; To capitalize the knowledge acquired from the LDL modules, each student was asked to undertake an individual problem-based exercise related to the subject of innovative strategies for planning,

engagement, and communication to support the sustainable management of marine and coastal areas. During both LDL modules interactive tutoring and examination were delivered through the project web platform.

The workshop was delivered in presence, with all the students from the different universities involved and the experts from the different organizations of the MARINE_ECOMED partnership as lecturers. Each edition of the workshop was hosted in one of the partner universities: the first by Aix-Marseille University, the second by Aristotle University of Thessaloniki, and the third by University Iuav of Venice.

Students with different backgrounds worked in groups on a real case study on the local marine and coastal area of the workshop site (Fig.27, 28). Through the workshop participants got the opportunity to apply the knowledge acquired during the two previous LDL modules and to benefit from frontal classes taught by the experts involved in the program, who shared their professional experiences and provided support to students in the development of their work.

The workshop aimed to provide participants with a clear understanding of planning and management strategies, available communication strategies,

and related challenges, enhancing them to work on existing issues on a real case, with real data, in a real political and administrative context, with real stakeholders and workers. Participants of different nationalities, backgrounds (planning and oceanography), skills (e.g. GIS, graphic tools) work in groups to simulate real-life multidisciplinary teamwork. Research and campaign experiences selected by the partnership members were presented to students by the experts involved in the mobility program. The case studies selected were located in the coastal-marine geographical context of the hosting university. Students were provided with data and information on the case study to support the development of their work. A field trip was organized on the coastal area adopted as a case study to foster understanding of main specificities and challenges to the planning and management of the case study local context. The workshop was also an occasion to foster students' understanding of ecosystem services by involving them in a role-playing simulation, the Marine Ecosystem Services Game. To allow students to get a better understanding of real dynamics in planning and management, their work was presented at a public event organized within the project framework (one for every edition) where local experts and stakeholders were invited to give very important

feedback to workshop results. The evaluation of the students was based on the active participation in the workshop (30%), problem-based activities consisting in the oral presentation of a potential strategy developed for the "marine planning, management, and communication" of the case study (30%), writing of a report on a potential strategy developed for the "marine planning, management, and communication" of the case study (40%). At the end of the workshop a joint certificate was issued to participants by the three universities involved.

115

Figure 27. Field excursions during the second edition of the workshop in Thessaloniki



116

Results achieved

A total of 63 students from 8 different European and non-European countries participated over the three editions of the ISP. Most of the students participating in the course come from master courses in the subjects of Oceanography, Territorial Planning, Ecology, Biological Sciences, Architecture and Visual Arts. Students from Undergraduate (Bachelor) and Ph.D. courses were also involved. The average feedback from the questionnaire submitted to students was positive and specific observations collected in it allowed to adapt and improve several aspects of the course over the three years of its implementation.

The teachers involved amounted to a total of 25 from the partner organizations and other local experts invited during the workshop to share their experience and knowledge about the case studies in which the workshop was focused each time.

A total of 13 planning proposals were realized by students for the coastal and marine areas in which each case study was focused. The planning proposals were presented by the students through an oral presentation and a poster session during the public event organized at the end of each workshop. At each public event, approximately 40 participants were present including local stakeholders that provided

feedback to students' work. The mobility grants assigned to students amounted to a total of 33 over the three editions of the ISP.

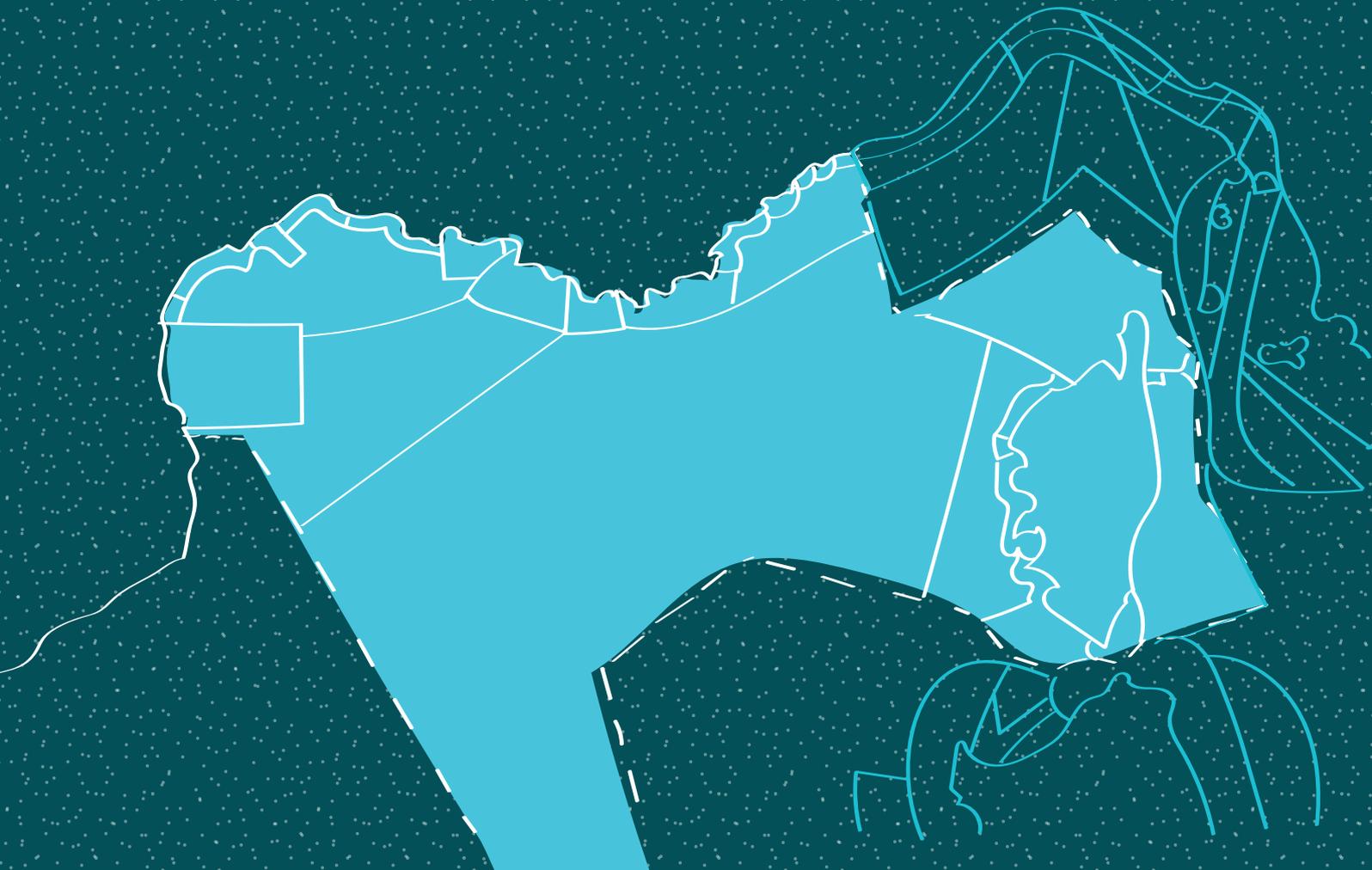


Figure 28. Field excursions during the first edition of the workshop in Marseille

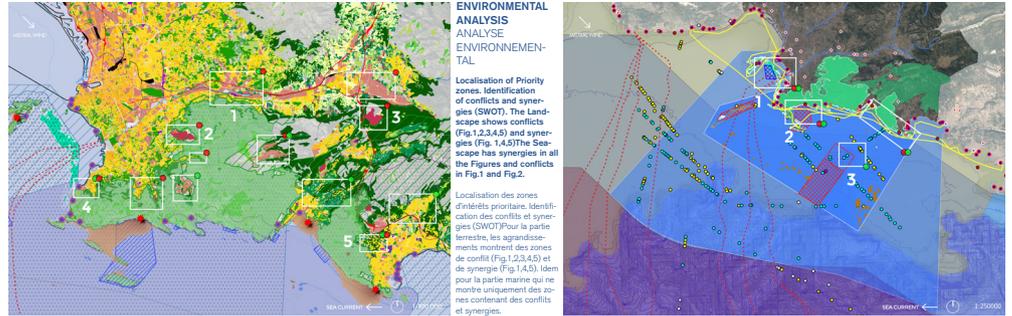
References

¹ Bologna Follow-Up Group (2005) *Framework for Qualifications of the European Higher Education Area*. Copenhagen, p. 9.

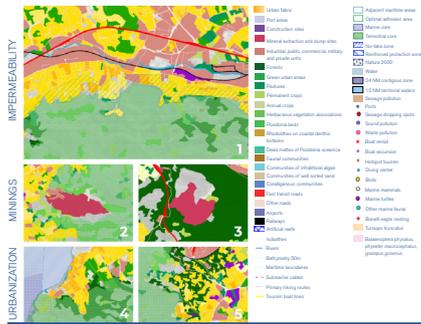
6.7.1
DIDACTIC OUTCOMES



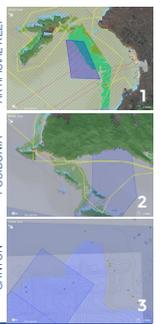
AN ENVIRONMENT-ORIENTED PLAN OF THE CALANQUES PARK UN PROJET ENVIRONNEMENTAL POUR LE PARC DES CALANQUES



LANDSCAPE | PARTIE TERRESTRE



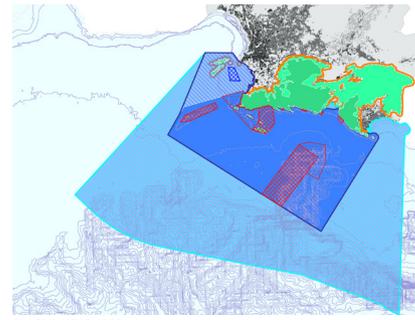
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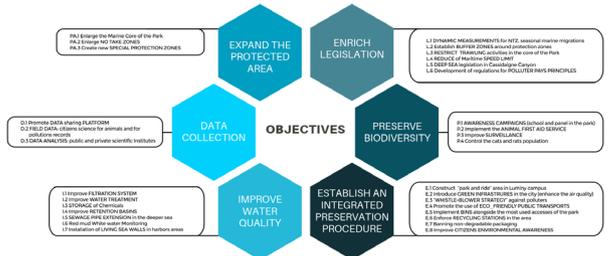
GOALS BUTS

Preserve the Calanques Park and **enlarge** the boundaries of the protected area, **improve** the environmental status in order to make the Calanques Park a **prototype preservation area**.

Préserver le Parc des Calanques, **agrandir** les zones protégées et **améliorer** le statut écologique au sein du Parc dans l'optique d'en faire un modèle en tant que **zone de préservation**.



PROPOSAL PROPOSITION
Addition of the Frioul Islands and the artificial reef into the core of the MPA and creation of the buffer zone along the lanpark.
Ajout des îles du Frioul et des récifs artificiels au sein de la zone marine protégée et création d'une zone tampon aux limites terrestres du parc.

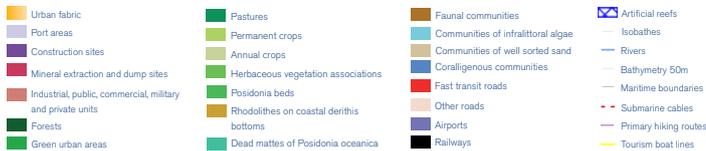
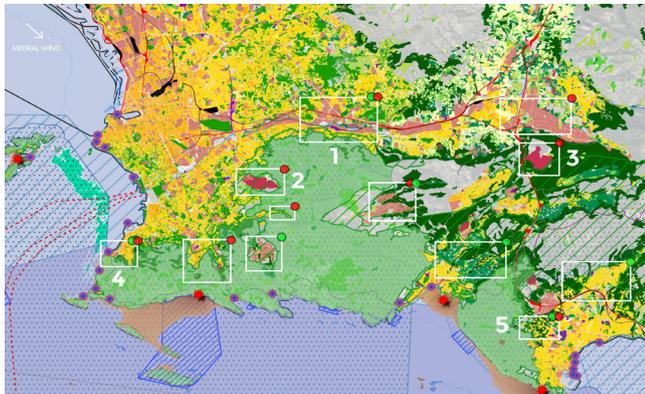


Objectives	Year 1	Year 2	Year 3	Year 4	Year 5
Enrich Legislation	Progress bar				
Establish an Integrated Preservation Procedure	Progress bar				
Data Collection	Progress bar				
Expand the Protected Area	Progress bar				
Preserve Biodiversity	Progress bar				
Improve Water Quality	Progress bar				

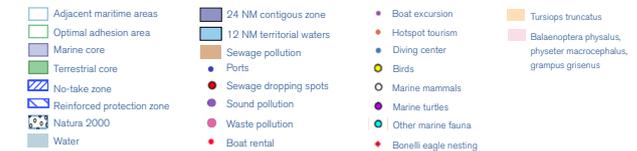
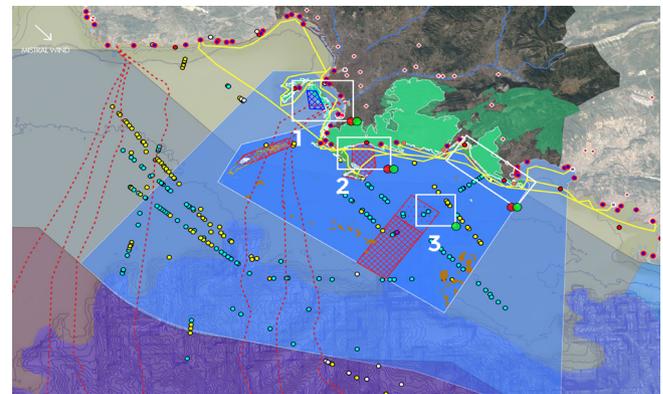
6.7.1 Didactic outcome

The MARINE_ECOMED workshop was organized over three editions as part of the Intensive Study Programme in Planning and Management of Marine and Coastal Areas described at Section 6.7. Each edition focused on a local case study and was organized in different Mediterranean cities, namely: Marseille in June 2019, Thessaloniki in September 2021 and Venice (Italy) in November 2021.

Environmental terrestrial analysis

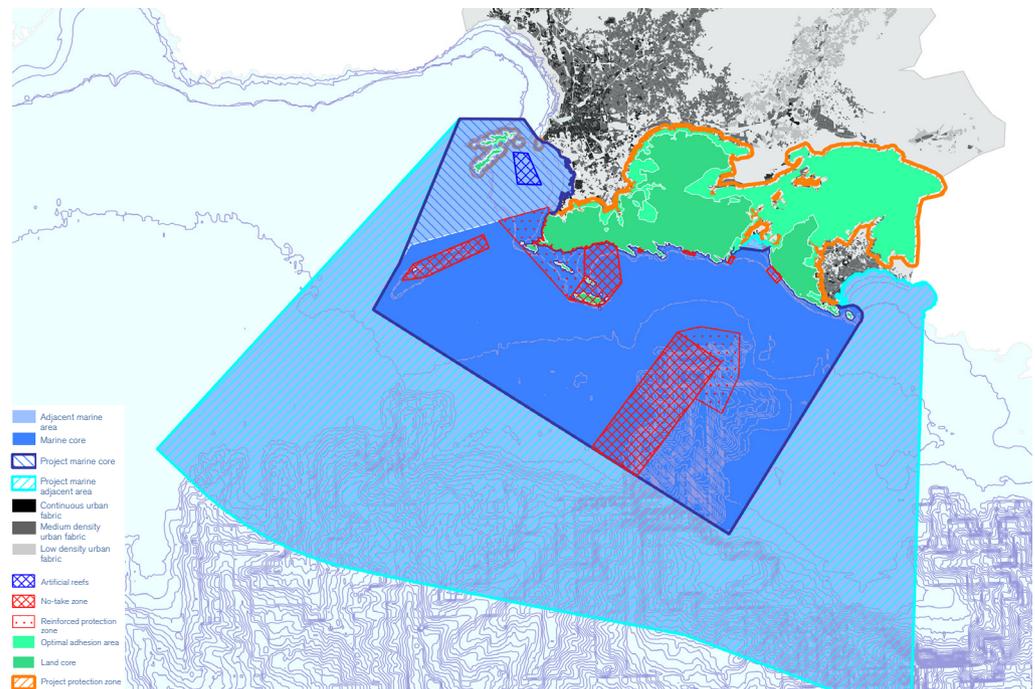


Environmental marine analysis



Calanques National Parc

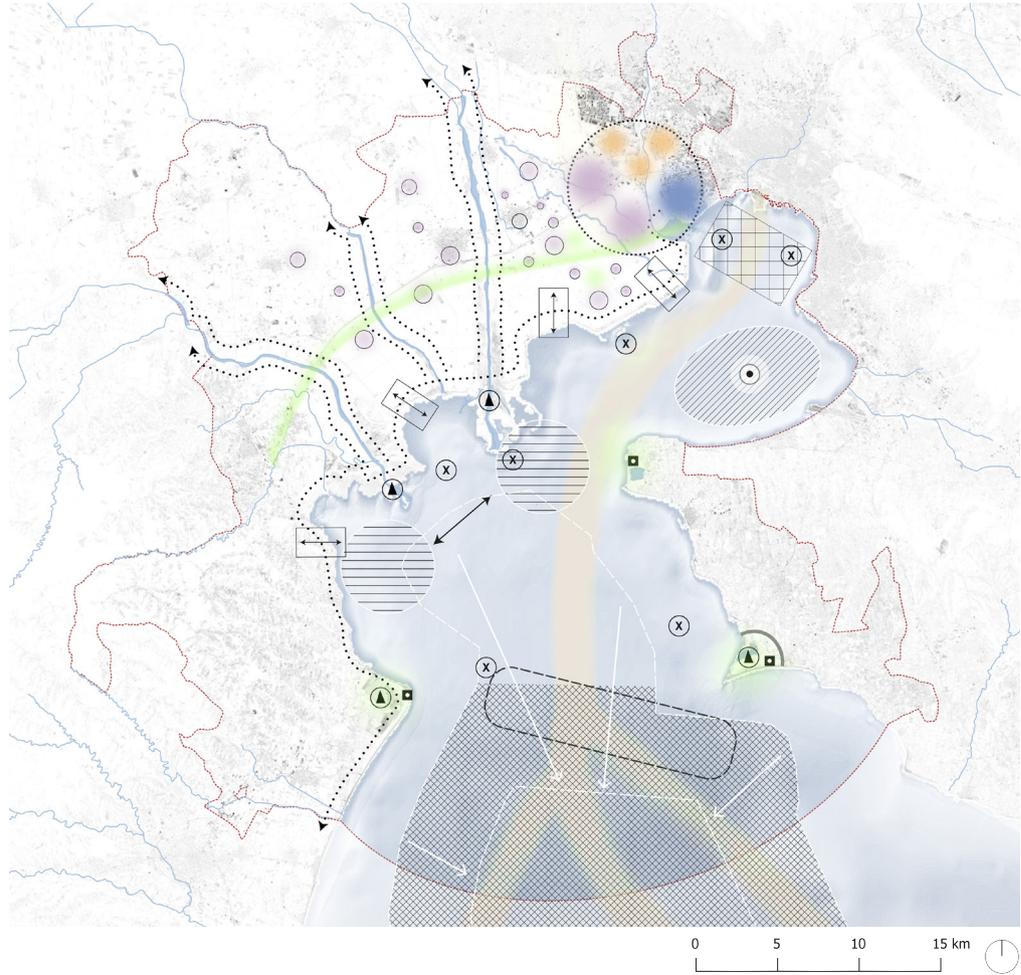
Student's final outputs from the first edition of the Workshop, held at Aix-Marseille University. A full spatial planning proposal, focused on environmental conservation aspects for the marine and coastal area of the Calanques National Parc, was designed. The main planning phases, including the spatial analysis outputs and the spatial management plan proposal, are described and illustrated.



Planning proposal

PLANNING PROPOSAL FOR THE THERMAIKOS GULF MARITIME SPATIAL PLAN

FISHERY, TRASPORATION, TOURISM, INDUSTRY, ENERGY, ENVIRONMENT



LEGEND

territorial informations

- study area
- waterbodies

aquaculture / fishery

- land-sea interaction
- nitrate and phosphates
- monitoring of illegal fishing zone
- pollution management buffer green zone
- fishing traffic attention zone
- habitat rehabilitation zone

industry / energy

- industry / energy management zone
- industry / energy action sites
- attention area
- energy sectors transition
- sustainable industries strategies
- port management actions

environment

- environmental quality monitoring station point
- environmental management actions
- environmental protection strategies

transports

- fore port
- corridors for marine traffic

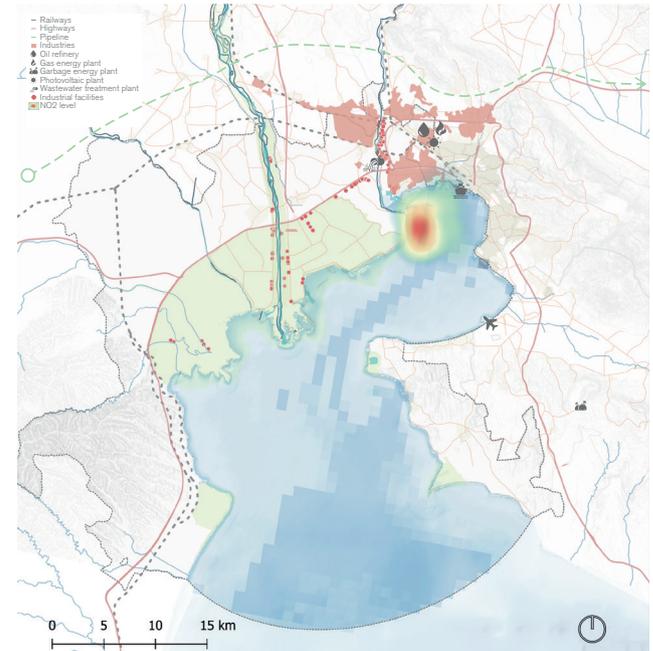
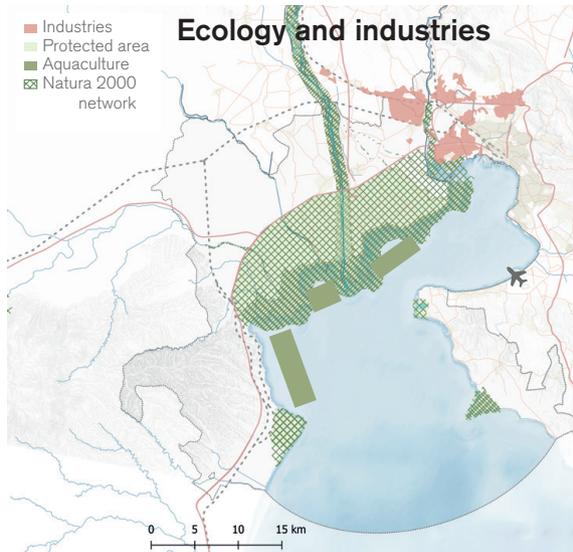
tourism

- touristic management actions

Thermaikos Gulf

Student's final outputs from the 2nd edition of the Workshop, held at Aristotle University of Thessaloniki. A full spatial planning proposal aiming at the sustainable development of the marine and coastal area of the Thermaikos Gulf was designed. This included specific measures to tackle

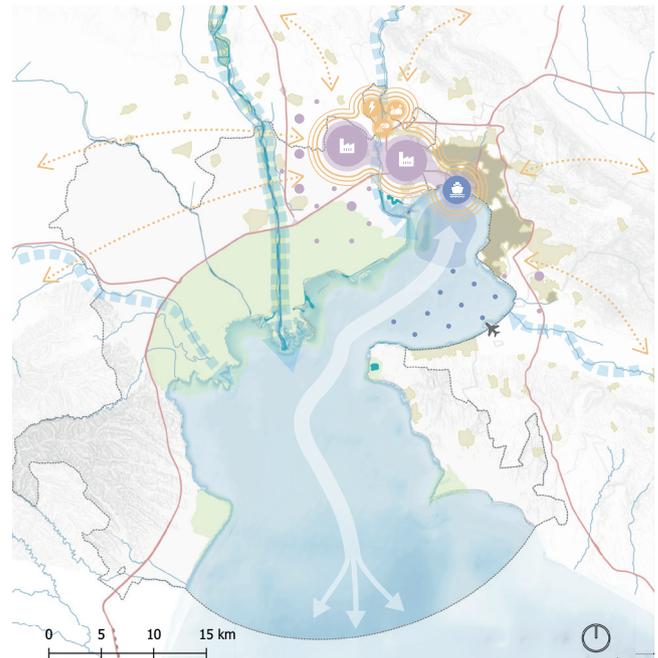
Spatial overlap of existing uses



Conceptual strategy

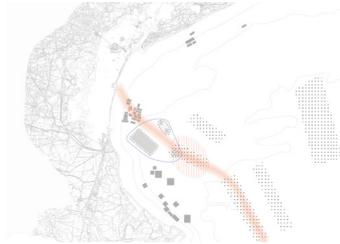


some of the main issues in the area, namely: organic pollution from land-based activities, potential conflicts between marine traffic and other activities (e.g. fishery), anthropogenic pressures on coastal marine ecosystems. Speed limit areas for shipping, areas of temporal restriction for aquaculture and fishery as well as the allocation of spots for environmental monitoring, were suggested.



PLANNING PROPOSAL FISHERIES & AQUACULTURE

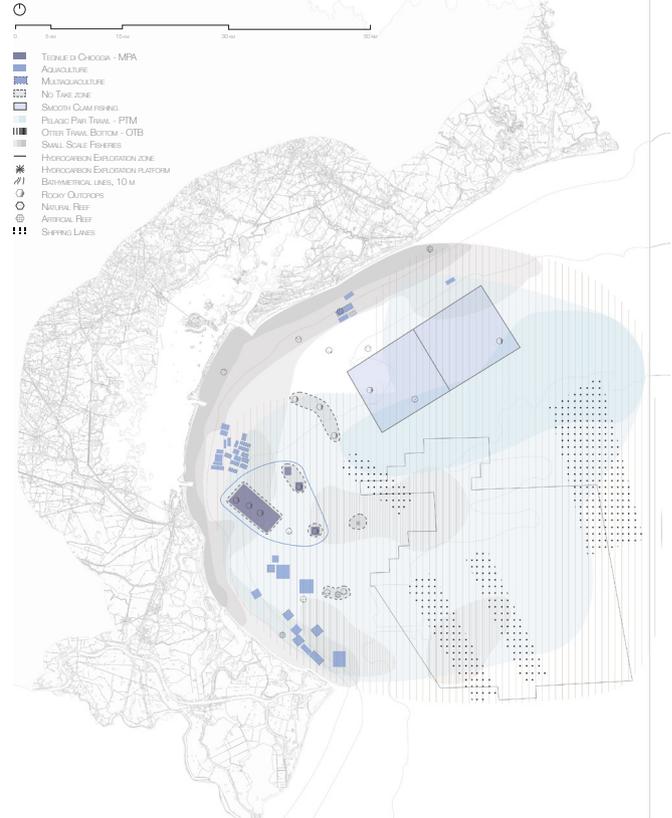
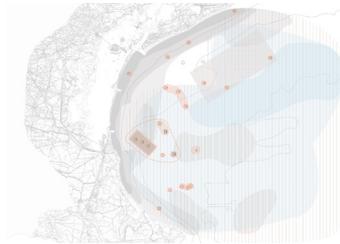
SPIRAL MEASURE DIVERSION OF SHIPPING ROUTES



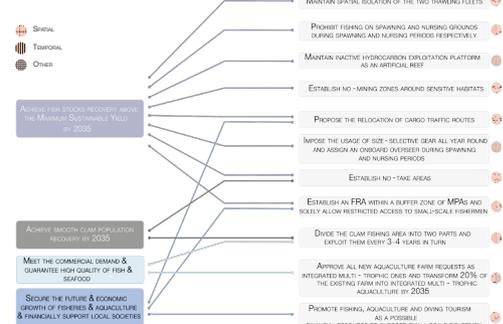
SPIRAL MEASURE ESTABLISHMENT OF NO-MINING AREA



SPIRAL MEASURE ESTABLISHMENT OF NO-TIME AND FISHERIES RESTRICTED AREAS



OBJECTIVES & MEASURES

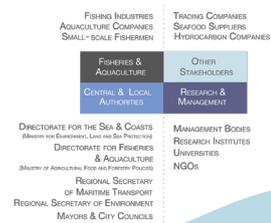


GOAL

ENSURE SUSTAINABILITY OF FISHERIES INDUSTRY AND AQUACULTURE IN CONJUNCTION WITH OTHER USES IN THE FRAMEWORK OF BLUE GROWTH



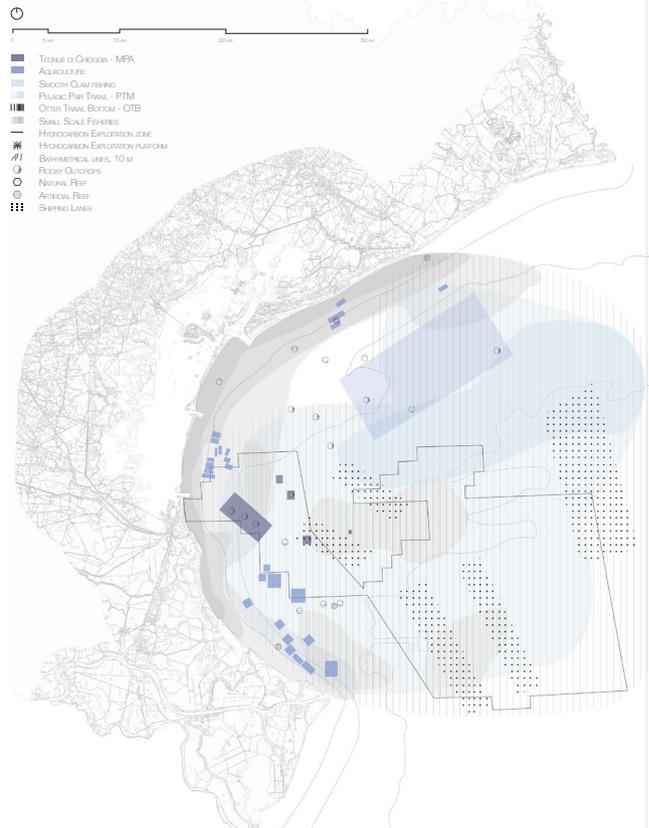
STAKEHOLDERS



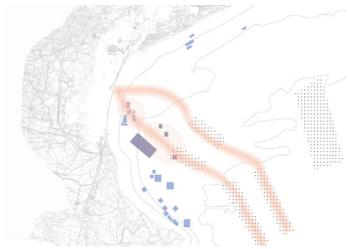
Gulf of Venice

Student's final outputs from the 3rd edition of the Workshop, held at University Iuav of Venice. The study area was the Gulf of Venice marine and coastal space, in the Northern Adriatic Sea. Specific management measures were defined to tackle main issues in the area, such as negative interactions

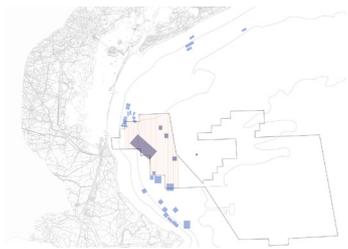
ANALYSING NORTH ADRIATIC SEA FISHERIES & AQUACULTURE



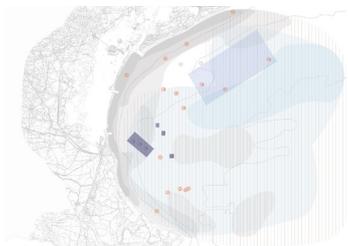
SPATIAL CONFLICT OVERLAP OF SHIPPING ROUTES VS MPA&AQUACULTURE



SPATIAL CONFLICT OVERLAP OF MPA&AQUACULTURE VS HYDROCARBON EXPLOITATION ZONE

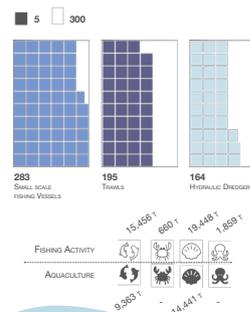


SPATIAL CONFLICT FISHING ZONES VS REEFS



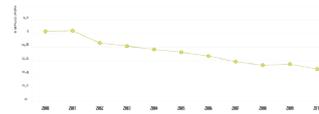
of aquaculture and conservation with marine traffic and hydrocarbon extraction, and between fishery and nature conservation. Changes in the spatial distribution of marine traffic routes, hydrocarbon extraction areas were suggested as well as restrictions to fishing activities in areas with high ecological relevance (i.e. reefs).

FISHERIES & AQUACULTURE DATA

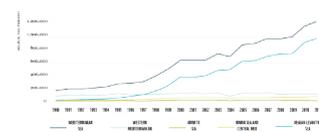


FUTURE TRENDS

TOTAL FISHING DAY TRENDS FOR THE NORTHERN AND CENTRAL ADRIATIC TRAWLER FLEET



MARINE AND BRACKISH AQUACULTURE PRODUCTION IN THE MEDITERRANEAN



SYNERGIES & CONFLICTS

