Mapping of MPAs and their associated fishing activities in the Mediterranean and Black Seas

(MAPAFISH–MED)

CINEA/EMFAF/2021/3.1.2/01/SC02

Implementing FWC EASME/2020/OP/0021

Final Report

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ACRONYMS

Term	Description
AIS	Automatic Identification System
BACI	Before-After-Control-Impact
BBHT	Benthic Broad Habitat Types
BGR	Bulgaria
CFP	Common Fisheries Policy
CFR	Common Fleet Register
CDDA	Common Database on Designated Areas
CI	Control-Impact
CINEA	European Climate, Infrastructure and Environment Executive Agency
COP	Conference of the Parties
CPUE	Catch Per Unit Effort
CYP	Cyprus
DAS	Days At Sea
DCF	Data Collection Framework
DG MARE	Directorate-General for Maritime Affairs and Fisheries
DRB	Boat Dredges
EC	European Commission
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EMFF	European Maritime and Fisheries Fund
EMODNET	European Marine Observation and Data Network
ERS	Electronic Reporting Systems
ESP	Spain
EU	European Union
EU MAP	European Union Multiannual Programme
FDI	Fisheries Dependent Information
FIX	Traps
FRA	France
FPA	Fully Protected Area
FPN	Stationary uncovered pound nets
FPO	Pots and Traps

GAM	Generalized Additive Models
GEN	Gillnets and entangling nets
GFCM	General Fisheries Commission for the Mediterranean
GNC	Encircling gillnets
GNS	Set gillnets
GRC	Greece
GTN	Combined gillnets-trammel nets
GTR	Trammel nets
HMD	Mechanised dredges
HRV	Croatia
ITA	Italy
IUCN	International Union for Conservation of Nature
LA	Without purse lines (lampara)
LLD	Drifting longlines
LLS	Set longlines
LPUE	Landings Per Unit of Effort
LSF	Large Scale Fishers
KI	Key Informant
MAPAMED	MArine Protected Areas in the MEDiterranean
MLT	Malta
MMSI	Maritime Mobile Service Identity
MoEW	Ministry of Environment and Water
MPA	Marine Protected Area
MS	Member States
MSFD	Marine Strategy Framework Directive
MSPD	Maritime Spatial Planning Directive
N2K	Natura2000
NECCA	Management Unit of the Central Aegean Protected Areas- Natural Environment and Climate Change Agency
NGO	Non-Governmental Organisation
NK	Gear not known or not specified
NTZ	No Take Zone
OECM	Other Effective area-based Conservation Measure
OTB	Bottom otter trawling
OTM	Midwater otter trawling
PPA	Partially Protected Area

PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PS	Purse seining
PTB	Pair Trawls
PTM	Midwater pair trawls
RAC/SPA	Regional Activity Centre for Specially Protected Areas
RCG	Regional Coordination Group
ROM	Romania
SAC	Special Areas of Conservation
SB	Beach Seines
SCI	Sites of Community Importance
SDG	Sustainable Development Goals
SPA	Special Protected Area
SPAMI	Specially Protected Areas of Mediterranean Importance under the Barcelona Convention
SSF	Small Scale Fishers
SV	Boat or Vessel Seines
SVN	Slovenia
SX	Seine nets
TB	Bottom trawls
TBB	Beam trawls
TX	Other trawls
UA	Unprotected Area
UNEP	United Nations Environment Program
VIF	Variance Inflation Factor
VME	Vulnerable marine ecosystem
VMS	Vessel Management System
WDPA	World Database on Protected Areas
WoS	Web of Science
WWF	World Wide Fund for Nature
30x30	EU Biodiversity Strategy goal: protecting 30% of EU land and sea by 2030

ABSTRACT

Marine protected areas (MPAs) have been established to manage and enhance marine ecosystems, fisheries, and wider human activities. They represent a core element of the European Union (EU) Biodiversity Strategy which aims to legally protect and effectively manage 30% of the EU marine waters by 2030. Yet despite this ambitious target there remains a lack of clarity on how well protected the EU's waters currently are - particularly in the Mediterranean and Black Sea region and what role MPAs play for fisheries. This study provides an up-to-date overview of MPAs in the region, improving the scientific knowledge base used to characterise the existing MPAs; providing the most comprehensive insights into the fishing activities present within MPAs and their surrounding areas to date; and increasing our understanding of the response of fishing activities to MPA implementation. Findings from this study show that we are falling short of the 30x30 conservation targets and that a higher level of protection is needed to guarantee conservation success. Fishing effort inside the MPAs was found to be generally lower than outside the MPAs, but that high efforts from towed gears was observed in the MPAs under the Natura2000 sites of community importance. Vessel management system and automatic identification system data revealed that large-scale fishers show an effort concentration in areas relatively close to fully protected area boundaries suggesting a tendency to fish the line. In addition, results from participatory mapping revealed MPAs had displaced small-scale fishers. Stakeholders' perceptions indicated that the importance of MPAs for conservation purposes was recognised, yet their ecological potential and their management were not delivering what was expected or needed to garner support. The present study provides actionable elements that can inform future actions in the Mediterranean and Black Sea region both in terms of (i) research, by highlighting the need for improved data collection and data availability on small scale fisheries operations and catches, and on MPA zoning, management and governance features, and (ii) management, by highlighting elements such as level of protection and engagement that should be strengthened, as they are key in determining successful fisheries management within and around MPAs.

EXECUTIVE SUMMARY

Marine protected areas (MPAs) have been established to address many of the anthropogenic threats facing our seas. They are often strongly promoted from a biodiversity conservation angle but receive less attention as a tool to manage and support fisheries. There is a strong commitment by the European Union (EU) to deliver ambitious targets for MPAs as set in the EU Biodiversity Strategy for 2030, however the current protection status and contribution MPAs can make to fisheries management remains relatively unknown.

The objectives of this study were to improve the available baseline scientific knowledge **to characterise the existing MPAs in the EU Mediterranean and Black Sea** (Chapter 1); the **fishing activities present within MPAs and their surrounding areas** (Chapter 2); and our understanding of the **response of fishing activities to MPA implementation** (Chapter 3). To achieve these objectives, this study combined a large-scale assessment by collecting information on a wide number of MPAs and related fishing activities; and a case study approach focusing on a set of selected MPAs in which in-depth information has been analysed.

This study characterised **949 MPAs** (using MArine Protected Areas in the MEDiterranean (MAPAMED), European Environment Agency (EEA) and World Database on Protected Areas (WDPA) databases) **in the EU Mediterranean and Black Sea (Chapter 1).** In total, **77% of investigated MPAs were found to be Natura 2000 designated sites**. The large number of Natura 2000 designated sites highlights the success of this initiative and the extensive network these sites have created throughout the region. However, we found **44% of the Natura 2000 sites overlap national designated types, questioning the added value the combination these two designations provide**.

We administered questionnaires to MPA managers of the 949 MPAs and received responses for 162 MPAs. We classified **around 44% of the MPAs investigated as being implemented/actively managed.** In terms of protection level, most MPAs were classified as incompatible with the conservation of nature, or minimally or lightly protected (57% of the MPAs or zones, respectively), while 43% were highly or fully protected. MPAs that are not fully or highly protected need to better regulate fishing and other activities that are not compatible with their conservation objectives.

Around **two-thirds (63%) of the 162 MPAs investigated reported having a management plan**. For the majority (92%) of these MPAs with a management plan, conservation objectives were defined. One fourth (22%) indicated there were also clear fisheries management objectives. **In 33% of the MPAs some sort of restrictions on small scale fisheries are in place**. Clear objectives, goals and the use of adaptive management are acknowledged as important elements to ensure MPA effectiveness.

However, based on the replies provided by the respondents, we revealed, in some cases, there to be a lack of clarity about what constitutes a management plan. **A management plan should specify clear goals and identify the steps and resources needed to achieve those goals. It should be used to guide the day-to-day activities in the MPA and be reviewed and adjusted accordingly to ensure that the MPAs' conservation and other ecological and socio-economic**

objectives are met. Without a management plan we essentially have paper parks that are not operational and may fail to meet their potential to conserve and restore biodiversity and fish stocks.

The answers to the questionnaire indicate that **only a limited proportion** of MPAs in the Mediterranean and Black Sea **have the sufficient level of protection to accrue ecological benefits** and that MPA managers (through their answers to the questionnaire) reported **around a third of the MPAs (29%) have investigated or found evidence of significant ecological recovery**.

Results from an extensive literature review and responses to the questionnaire highlight **the scarcity of baseline and/or monitoring data in MPAs (present for 16% of the MPAs investigated), especially for what concerns the socio-economic dimension and their governance.** Managers should be encouraged to dedicate an adequate share of the MPA annual budget to monitoring activities.

We also found, through the literature review, that in about half of the MPAs investigated, monitoring is not based on a robust sampling design. **Most data come from snapshot studies that cover only one year and fail to consider seasonal variations**. This does not pertain to a long-term strategy supporting monitoring requirements that would be much more beneficial to MPAs and their need for adaptive management.

The lack of any zoning information in the aforementioned databases at national, European or International level is a major drawback and one that we suggest is rectified as it is crucial to our understanding of the socio-economic and ecological benefits that can be yielded from MPAs through different levels of protection whilst accounting for the different human uses allowed. The development or strengthening of existing databases (e.g., EEA, MAPAMED, WDPA) that compile all relevant information concerning governance, management, and georeferenced zoning is thus urgently needed.

Via a second extensive literature review (**Chapter 2**) we revealed the **large knowledge gap on fishing activities in relation to MPAs** in the Mediterranean and Black Sea. Our review also underlined a lack of available information about fishing footprint within and around MPAs in the region and evidence of its impact on the underlying habitats.

The analysis of Data Collection Framework (DCF) and automatic identification system (AIS) data found that **fishing effort inside MPAs was generally lower than outside** the MPAs, with a ratio of around 1:3 to 1:4, according to the data source. In addition, the fishing intensity (fishing effort per surface area) depends largely on MPA designation type with **higher fishing activity inside Natura 2000 sites of community importance** ('Regional-SCI'), while 'National' designated MPAs hosted very low fishing activity.

Our findings also revealed that **towed gears** that directly impact the seabed are making significant catches inside MPAs (**~20% of total catches** across all designation types). Based on AIS data and on the available habitat mapping from the European Marine Observation and Data NETwork (EMODnet), a **non-negligible effort by towed gears in direct contact with seafloor was potentially exerted over sensitive seabed habitats with biogenic reefs within MPAs**. However, the

accuracy of habitat mapping and the numerous derogations in place at Member State level, are not allowing for a full assessment of the true extent of fishing activity over these sensitive habitats.

Investigation of certain iconic and sensitive species (groupers, lobsters, chondrichthyans) suggested that fishery dependent abundance (landings per unit of effort) was higher inside the MPAs. For the groupers/lobsters group the overall abundance inside the MPAs was 70% higher, while for the chondrichthyans assemblage, overall abundances were similar. This pattern suggests that MPAs deliver a benefit to these populations, and that fishing operations inside MPAs might remove a non-negligible amount of their biomass.

Overall, the **datasets gathered, and the information extracted in this study provide for the first time a comprehensive picture of the fishing activities exerted in EU MPAs of the Mediterranean and Black Sea** and can be seen as a valuable contribution to improve guidance towards MPA and fisheries management.

Through the analysis of VMS and AIS data (**Chapter 3**) carried out in five case study MPAs throughout the region (Banyuls - France, Egadi and Torre Guaceto - Italy, Gyaros - Greece, and Ropotamo - Bulgaria) to assess the fishing footprint within and surrounding MPAs, we found that **large-scale fishers show an effort concentration in areas relatively close (within 15 km) to fully protected area** boundaries, suggesting there is a **tendency to 'fish the line.'**

We administered a survey to small-scale fishers (i.e., here identified as those not using towed gear and with a vessel length smaller than 12 m), large-scale fishers and key informants in the five case study sites. The participatory mapping exercise within the survey for small-scale fishers revealed that **small-scale fishers had been displaced** from previously used fishing grounds and fishing activity had moved to partially protected areas and unprotected areas, mostly along the coastline.

Results from the survey revealed that although **stakeholders perceived the importance of MPAs for conservation purposes**, their perceptions of the MPAs suggest that **fishers did not feel properly engaged in decision-making and participatory processes, and that MPAs ecological potential and management were not delivering what was expected or needed to garner support**.

Finally, we developed a **conceptual model** with the aim to illustrate the outcomes that MPAs with different levels of protection will have over the ecosystem and fisheries. Findings revealed that **MPAs with the highest levels of protection, although incurring the greatest costs initially, deliver the greatest benefits over the long term**. The conceptual model could be used as a tool to engage stakeholders in participatory processes.

We provide specific recommendations and lessons learnt in each chapter, and a final chapter (**Chapter 4**) is dedicated to **general recommendations** that takes them one step further providing a standalone integrative approach that connects all the chapters and provides nine overarching recommendations listed below, that stem from the findings of this study. The recommendations could be **implemented to foster the beneficial role of MPAs as a fisheries management tool, while supporting their role for biodiversity conservation**.

The main recommendations made from this study are to:

- **Increase the level of protection of existing MPAs.** Scientific evidence shows that the greater the level of protection, the greater the benefits, for both nature and people. Activities that are incompatible with conservation should be phased out in MPAs and MPA legislation tightened to ensure that future potentially impactful activities are prevented from being developed.
- **Ensure important biodiversity and habitat features and ecosystem processes are well represented in the network of MPAs.** Purposefully designed and coordinated MPA networks should be established and strengthened to improve the resilience of the region's marine ecosystems.
- **Use MPAs to curb local threats to nature and people and to foster transformations towards sustainability.** While one tenth of European waters should be exempt from extractive activities to meet the 10% strict protection target, it is also important that the remaining 20% of MPAs adequately curb local threats to ensure they can still be effective for nature and people. Again, MPA legislation should be tightened to ensure that it accounts for potential future threats not only present-day threats.
- **Ensure all MPAs have management plans with clear conservation objectives and regular evaluation and adaptation.** Management plans are vital to deliver significant socio-ecological benefits. The use of a management plan, that acts as a daily guide laying out the MPAs goals and objectives and exact steps needed to achieve these, allows for management actions and resources to be better used and prioritised.
- **Make information and data on MPA level of protection, management and monitoring open and FAIR (findable, accessible, interoperable and reproducible).** It is recommended that a specific investment is made to reinforce an exhaustive and homogeneous data collection of marine data at EU scale within a single, easily accessible platform. Without such a database it remains challenging to understand the status of conservation in the region.
- **Establish long term monitoring and evaluation programs.** Evidence-based feedback through continuous and iterative monitoring, evaluation and reporting is crucial for achieving the objectives of any adaptive management framework. Without monitoring and evaluation programs in place we cannot know if our management actions are working. It is also essential for accountability purposes that MPAs can provide evidence of a MPAs effectiveness to the relevant audiences.
- **Improve mechanisms for public participation in MPA planning and management.** Efforts must be made to ensure public participation in MPA planning and management that it is transparent, 'informed' and effective with meaningful public input. There should also be greater promotion of co-decision making, co-management and community stewardship.
- **Ensure stakeholders understand the need for strict protection and the timing of its benefits and are associated to strict protection prioritisation.** Stakeholders should be involved at all stages of the design, implementation and ongoing management phases of marine spatial planning to help reduce conflicts among users and increase buy-in.

- **Develop climate-smart MPAs.** The impacts of climate change are hard to ignore calling for urgent steps to be taken to establish strategies in which MPAs begin to manage for change. Future conservation efforts should also include climate-change refugia (areas where climate change impacts are minimal), and account for the predicted trajectory of human expansion into the ocean and efforts should be made to support small-scale fishers adapt to more challenging conditions.

In conclusion this report provides an up-to-date picture of MPAs and associated fishing activities in the EU Mediterranean and Black Sea. It includes lessons learnt and recommendations that will help foster the integration of fisheries in MPA management and can be used to improve the role of MPAs as an effective tool for reconciling conservation and fisheries outcomes.

GENERAL INTRODUCTION

There exists no single environment on the planet that is unaffected by anthropogenic activities. Yet, it is healthy environments that are needed to ensure mankind's survival. Protected areas have existed for over 150 years in the terrestrial world (with Yellowstone being the first to be protected in 1872), and in some form in the marine world for the last century. However, it was not until the first World Congress on National Parks in 1962 that the global movement towards protecting the terrestrial and crucially the marine world began. We are still a long way off meeting all the targets ([1]) that have been set in previous years and the need to protect or restore marine biodiversity, habitats and fish stocks is increasingly urgent and has led to increasing calls for the establishment of marine protected areas (MPAs).

MPAs are geographically distinct zones for which conservation objectives are set (Reker et al., 2015) (see Box 0.1). MPAs vary enormously in their design and objectives. Some MPAs are single zones and others are made up of multiple distinct zones that vary in their level of protection in terms of what activities are permitted or not. They are often strongly promoted from a biodiversity conservation angle but receive less attention as a tool to restore and protect fisheries. The European Union (EU) Biodiversity Strategy for 2030 ([2]) promotes a larger and well-connected EU-wide network of protected areas with effective fisheries–management measures to contribute to the sustainable use of seas and oceans. MPAs represent a core element of the EU Biodiversity Strategy and in the wider context of the European Green Deal. Key commitments by 2030 include to legally protect and effectively manage at least 30% of the EU's marine waters surface area, with at least one third of that area (10% of EU's marine waters) under strict protection, known as the 30x30 goal.

With the move towards an ecosystem approach in the management of seas and oceans, it is necessary to look at the full range of tools for fisheries management. MPAs can be a useful component within the fisheries management toolbox. In the EU Mediterranean and Black Seas, there has been some progress in the last decade to protect their waters, with 15% of the EU Mediterranean and 14% of the EU Black Sea now being covered by some regime of protected areas (Aminian-Biquet et al., 2024). However, the levels of protection are highly heterogeneous with a third and a fourth of each sea, respectively, being incompatible with the conservation of nature (Aminian-Biquet et al., 2024). The situation is even worse when considering the whole Mediterranean: 6.01% of the Mediterranean is 'protected' but in 95% of this 'protected' area, regulations are no stronger inside than outside the MPAs (Claudet et al., 2020).

([1]) For example the Aichi Biodiversity Targets set at the tenth meeting of the Conference of the Parties (COP), in October 2010, in Nagoya; the Sustainable Development Goals (SDGs) created at the United Nations Conference on Sustainable Development in Rio de Janeiro in 2012, which were subsequently adopted by all UN Member States in 2015; the EU Biodiversity strategy for 2020 from 2011 and the EU Biodiversity Strategy for 2030 which was adopted in 2020; The Kunming-Montreal Global Biodiversity Framework adopted during the fifteenth meeting of the Conference of the Parties (COP 15).

([2]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, EU Biodiversity Strategy for 2030 Bringing nature back into our lives (COM/2020/380) https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0380.

There has also been progress through the General Fisheries Commission for the Mediterranean (GFCM) establishment of 10 Fisheries Restricted Areas (FRAs) ([3]) covering 1,760000 km^2 of sea habitats in the region (FAO, 2020) and the adoption of the Regional Seas Conventions (Barcelona Convention and the Bucharest Convention) which engage neighbouring countries for the conservation of their common marine environments and supports Member States contracting parties in the implementation of the Marine Strategy Framework Directive (MSFD) through their regional monitoring and assessment programmes (Reker et al., 2015). All of which encompass a huge variety of conservation designations and objectives. In their 2019 report, the World Wide Fund for Nature (WWF) and Sky Ocean, attempted to better understand how well protected Europe's seas are and what all the different terms applied to protection mean in terms of protection status (WWF and Sky Oceans, 2019). They found only 1.8% of the European Union (EU) marine area is covered by MPAs with management plans and a much smaller percentage can be considered effectively managed highlighting the status of protection is a far cry from the 30x30 goal. This figure complements Claudet et al., (2020) reporting that 72% of the protected areas in the Mediterranean (not only EU) lack regulations that can reduce human impacts on biodiversity.

Box 0-1 What is an MPA?

A number of different definitions of marine protected areas (MPAs) have been proposed globally. Three of the most relevant for our context are the ones by the International Union for Conservation of Nature (IUCN) that defines an MPA as '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 values'* (Dudley, 2009); the European Commission (EC) that describes MPAs as *'geographically defined marine areas whose primary and clearly stated objective is nature conservation, and are regulated and managed through legal or other effective means to achieve this objective'* (European Commission, 2015); and the European Environment Agency (EEA, 2015) that describes MPAs as *'geographically distinct zones for which conservation objectives can be set. They are often established in an attempt to strike a balance between ecological constraints and economic activity, so that the seas may continue to allow for goods and services to be delivered.'*

Yet, many diverse definitions of MPAs exist and the concept is applied diversely, and with different terms/names for similar policies globally and among Member States e.g., no-take zones, fully protected areas (FPAs) ([4]), partially protected areas (PPAs), marine parks, biosphere reserves, marine reserves to name a few. The aim of MPAs is rarely exclusive and is often related to biodiversity conservation and / or fisheries management (e.g., gear-exclusion MPAs, conservation of sensitive and essential fish habitats).

([3]) FRAs are fisheries restricted areas which are geographically defined areas in which some specific fishing activities are temporarily or permanently banned or restricted to improve the exploitation patterns and conservation of specific stocks as well as of habitats and deep-sea ecosystems. These areas although serving as a useful tool for fisheries management are not classified as MPAs and their objective is not to conserve biodiversity. For this reason, FRAs were not considered relevant for this study.

([4]) FPAs are no-take zones where all extractive activities, such as fishing or harvesting of resources, are prohibited. PPAs are zones where some human activities, such as small-scale fisheries and other potentially sustainable activities are generally allowed but strictly regulated.

In this context, this study attempts to give answers to some big questions helping us understand how MPAs are and can work in the context of fisheries. What is the status of protection in the EU Mediterranean and Black Sea? What baseline data exists? How are the MPAs being managed and are they making use of management plans to guide their daily activities? Do these plans consider fisheries? Do the conservation objectives align with fisheries? In so doing, we aim to provide the knowledge to support fisheries and MPA managers, policy makers and other stakeholders involved in the foreseen expansion of marine protection via MPAs in EU waters.

The EU currently has a comprehensive policy framework in place for an expansion in protection: the Common Fisheries Policy (CFP), the Habitats and Birds Directives, the Maritime Spatial Planning Directive (MSPD) and the Marine Strategy Framework Directive (MSFD). With their ecosystem-based approach to management, the CFP and the MSFD offer an opportunity to support MPAs to deliver their full potential by taking broader ecosystem considerations – including both ecological (e.g., all species and habitats) and human dimensions – with a goal to achieve ecological and social sustainability. Under the CFP Basic Regulation (Article 8) ([5]), there is an effort to establish protected areas thanks to their biological sensitivity, including fish stock recovery areas, to contribute to the conservation of living aquatic resources and marine ecosystems. Under the Mediterranean Regulation (Articles 5 and 7) ([6]), a central measure is the establishment of fishing protected areas to protect nurseries, spawning grounds, and the marine ecosystem.

Protected areas can result in increased density, biomass, body size and species richness, for certain fish and crustacean species, compared to areas without protection (Edgar et al., 2014). In addition, provided that MPAs are well designed and managed, density-dependent processes ([7]) can then allow organisms to migrate to areas adjacent to the protected area through spillover (Di Lorenzo et al., 2020, 2016; Van Hoey et al., 2024). In the long term, this can potentially lead to positive socio-economic effects (e.g., increase in revenues, opportunities for sustainable tourism) in nearby areas that can benefit different stakeholders including fishers, providing higher yields for fisheries in the form of increased size, biomass or abundance (Di Franco et al., 2016; Hattam et al., 2014; Kerwath et al., 2013; Sala et al., 2013). However, not all MPAs are able to deliver ecological and/or socio-economic benefits, with this happening only when a set of conditions ("key features/enabling features") are met. Available evidence globally suggests that MPAs that are properly designed (in terms of location, size etc), funded, enforced, organised and managed, can provide a series of ecological benefits within their borders (namely the 'reserve effect') (Di Franco et al., 2018; Edgar et al., 2014; Giakoumi et al., 2017; Scianna et al., 2019).

([5]) Regulation (EU) No 1380/2013 of the European Parliament and of the Council of 11 December 2013 on the Common Fisheries Policy, amending Council Regulations (EC) No 1954/2003 and (EC) No 1224/2009 and repealing Council Regulations (EC) No 2371/2002 and (EC) No 639/2004 and Council Decision 2004/585/EC.

([6]) Council Regulation (EC) No 1967/2006 of 21 December 2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EEC) No 2847/93 and repealing Regulation (EC) No 1626/94.

([7]) Density dependent processes refer to ecological processes that can be triggered when certain density thresholds are reached). Density-dependent movements may occur due to space limitation and territorial interactions and can trigger individual to move to other areas.

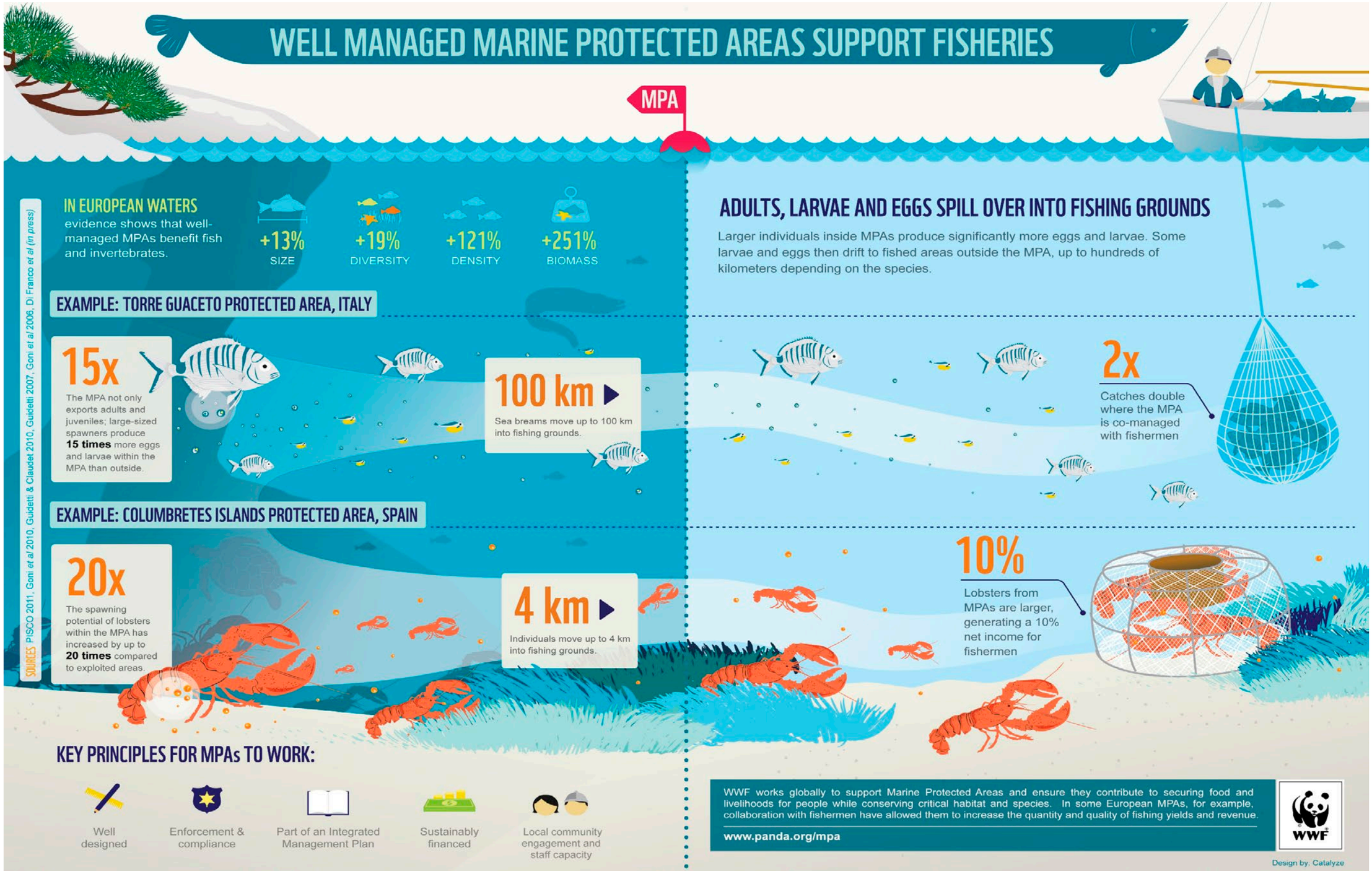

Figure 0-1 Infographic illustrating the potential benefits of MPAs for fisheries. @ WWF

That said, the establishment of an MPA may incur significant costs that must be acknowledged and accommodated for. They directly curtail or regulate human activities and behaviours, which can affect nearby communities, leading to temporary or even permanent losses and to local opposition (Weigel et al., 2014). For example, they can reduce the area that can be fished, depending on the MPAs conservation objectives. This in turn can potentially increase the impact on species and habitats in the surrounding areas. After the establishment of MPAs, a common effect is a change to fishing activities, either through an overall reduction in fishing or the redistribution (reallocation) of fishing activities to the surrounding areas due to loss of fishing grounds (Horta e Costa et al., 2013; Vaughan, 2017). Consequently, the decreased fishing mortality within MPAs may be balanced by the increased fishing mortality outside the protected areas (Belharet et al., 2020; Halpern et al., 2004; Sève et al., 2023). The possible intensification of fishing in the surrounding areas could also have negative effects, for instance on sensitive habitats or non-target species. As such it is necessary to better understand the ecological and socio-economic effects of this spatial reallocation.

While there is growing interest in studying the progress of ocean protection and subsequent benefits, there is a need for an overview of the current state of play of MPAs and associated fishing activities in the Mediterranean and Black Sea EU waters. Before this study began the available evidence indicated that only a small proportion of the existing MPAs in EU waters are being effectively managed and monitored (Giakoumi et al., 2017; Gianni et al., 2022; Mazaris et al., 2017) and only a few have no-take areas in their design. To understand how MPAs already do and can increasingly contribute towards fisheries and their management it is necessary to have a more up to date and comprehensive overview of the current state of play and identify those MPAs which have certain key features, defined conservation objectives, baseline fisheries data, and management plans in place. The same is true for fishing activities. Knowledge on fishing activities within and around MPAs is limited by the scarce and disparate data available, yet it is essential that we have a more comprehensive understanding of the role MPAs play both in and for fisheries.

OBJECTIVES AND OUTLINE

As MPA planning and implementation progresses in the field of marine biodiversity conservation, fisheries aspects are not yet fully understood and thus not always considered appropriately. The overall purpose of this study aimed at providing and improving, for the EU Mediterranean and Black Sea, the scientific knowledge to characterise (i) the existing MPAs; (ii) the fishing activities present within MPAs and their surrounding areas; and to understand (iii) the response of the fishing activities to MPA implementation.

To achieve these objectives, this study combines a large-scale assessment collecting information on many MPAs and related fishing activities throughout the Mediterranean and Black Sea; and a case study approach focusing on a set of selected MPAs in which in-depth information has been gathered and analysed.

The information gathered and presented in this report ultimately aims at incorporating existing work and compiling actionable elements needed to support the

design of appropriate fisheries-management measures in existing MPAs and their surrounding areas, with the aim to contribute to the long-term sustainability of biological resources in the region, thus reconciling fisheries and biodiversity conservation.

This report is divided into four main chapters: the first provides a characterisation of the existing MPAs in the EU Mediterranean and Black Sea, characterising their governance and management status, and mapping their key features potentially driving effective fisheries management, and provides a thorough and up to date picture of the status of protection in the region (**Chapter 1)**. Based on the identification of the different MPAs in the previous chapter, a detailed analysis was made on the fishing activities that take place within them and in their surrounding areas in terms of effort and landings and paying attention to the habitat type over which fishing activities were recorded (**Chapter 2)**. Through case studies, the potential spatial redistribution of fishing activities was explored in response to MPA implementation and perceptions of relevant stakeholders are presented related to fisheries within the selected MPAs and their surroundings areas (**Chapter 3**). To guide future fisheries and MPA management, a conceptual understanding of the potential effects of MPAs on the redistribution of fishing activities is also provided. Finally, lessons learnt, and recommendations derived from the previous chapters are summarised in the last section (**Chapter 4)**, while a selection of annexes offers additional information on key elements and data sources.

1. STATUS OF MPAS FOR FISHERIES

Key highlights

- Despite the efforts made by the European Union and Member States in gazetting many MPAs, findings suggest that we are falling short of the 30x30 conservation targets and that a higher level of protection is needed to guarantee conservation success.
- Around 44% of the MPAs investigated in the EU Mediterranean and Black Sea were classified as being implemented/actively managed. In terms of protection, most MPAs were classified as incompatible with the conservation of nature, or minimally or lightly protected (57% of the MPAs or zones), while 43% were highly or fully protected. MPAs that are not fully or highly protected need to better regulate fishing and other activities that are not compatible with their conservation objectives.
- Around two-thirds (63%) of the MPAs investigated reported having a management plan. For the majority of these MPAs with a management plan (92%) conservation objectives are defined. One fourth (22%) indicated there were clear fisheries management objectives. In 33% of the MPAs some sort of restrictions on small scale fisheries are in place.
- Findings highlight the scarcity of baseline and/or monitoring data in MPAs (present for 16% of the MPAs investigated), especially for what concerns the socio-economic dimension and their governance. Managers should be encouraged to dedicate an adequate share of the MPA annual budget to monitoring activities.
- The lack of any zoning information in databases at national, European or International level is a major drawback. The development or strengthening of existing databases (e.g., EEA, MAPAMED, WDPA) that compile all relevant information concerning governance, management, and georeferenced zoning is needed.

1.1 Introduction and objectives

Each year in the Mediterranean and Black Seas new MPAs are being designated as countries attempt to fulfil the requirements to achieve EU and global conservation goals. Many of these MPAs are implemented using different labels and designations, such as, Natura 2000 sites (Special Areas of Conservation (SAC) and Sites of Community Importance (SCI)), marine reserves, national parks, etc. (see Annex 6.1) and to increase the complexity, many of these designations overlap. The EU Biodiversity Strategy for 2030 (European Commission, 2020) and the more recent Kunming-Montreal Global Biodiversity Framework, adopted in December 2022 (Stephens, 2023) have set ambitious targets to conserve and manage coastal and marine areas. In response various nations have set the "30x30" conservation goal in their national biodiversity strategies and action plans which will involve creating new MPAs or expanding existing ones. However, knowledge on the MPAs that already exist has significant gaps which means we do not know how well protected the two seas really are, how well they are being executed and particularly what these MPA designations mean for fisheries.

We know that protection, and its benefits, do not begin to accrue until an MPA is implemented with activated regulations or actively managed with ongoing monitoring and adaptive management (Grorud-Colvert et al., 2021). Evidence suggests that only a small proportion of the existing MPAs in EU waters are under effective management with monitoring and evaluation plans in use, and even fewer contain no-take areas (Claudet et al., 2020; Roessger et al., 2022). To better move forward with plans to expand protection it is essential that the current situation is better understood. There is also a risk that this approach will strengthen stakeholders' feelings of opposition towards conservation initiatives as MPAs will continue to create dashed expectations and fail to deliver ecological and social benefits. The key questions that we aimed to address through this chapter are - where are we in terms of the stage of establishment with the current MPAs? What is their level of protection? And are they being effectively monitored? To answer these questions this study set the following objectives to:

- Map and characterise the existing EU MPAs in the Mediterranean and Black Seas, describing their main features, paying attention to the types of protection (e.g., fully protected (no-take), partially protected (multi-use areas)); types of management (e.g., local consortium, public administration); legal status; and a set of other relevant features that previous research has identified as key in determining MPAs' effectiveness, (e.g., presence of a fully protected area, enforcement level, MPA age, size, level of stakeholder engagement in decision making, presence of a fishers' representative in the MPA board, presence of activities promoting sustainable fishing, etc.) (Di Franco et al., 2016; Giakoumi et al., 2017);
- Better understand the status of existing MPAs by identifying MPAs with or without a management plan, assessing their stage of establishment and level of protection and assigning MPAs to one of the four stages and levels of protection outlined in the MPA Guide (Grorud-Colvert et al., 2021) (Box 1.1 What is the MPA Guide?);
- Collect information related to MPA assessment and monitoring in the Mediterranean and Black Seas helping to bring together fisheries management and biodiversity conservation, that will help ensure that management measures can be actively adapted if needed, to meet the MPA conservation objectives.

Box 1-2 What is the MPA Guide?

- The MPA- Guide is a science-based, policy- relevant framework created in 2021 by Grorud-Colvert, et al.
- It was designed to facilitate the categorization, evaluation, and planning of MPAs, adding a complementary tool to the well-known IUCN Protected Area Categories for management objectives and governance types (Dudley, 2009).
- The guide consists of four elements that define types of MPAs and activities, conditions for success, and likely outcomes.
- First, the four *stages of establishment* of an MPA are: (i) Proposed/Committed, by a governing or other organising body; (ii) Designated, by law or other authoritative rulemaking; (iii) Implemented, with activated regulations; and (iv) Actively Managed, with ongoing monitoring and adaptive management.
- Second, the four *levels of protection* from abatable activities within an MPA (or MPA zone), based on allowed activities, are (i) Fully Protected—no impact from extractive or destructive activities; (ii) Highly Protected— minimal impact; (iii) Lightly Protected—moderate impact; and (iv) Minimally Protected—high total impact, although still an MPA by IUCN criteria.
- Third, to succeed, an MPA should be established and sustained through the *enabling conditions* for effective and equitable MPA planning, design, governance, and management.
- Fourth, the *likely outcomes* of an MPA depend directly on stage, level, and conditions to succeed.
- The MPA Guide is a useful tool as it enables smart planning, design, and evaluation of new or existing MPAs by informing decisions about scientific, societal, and policy priorities and facilitates evaluating progress on international conservation targets.
- It is interesting as it focuses on quality, not just quantity, of MPAs.
- It points to implemented/actively managed MPAs that are fully or highly protected areas as having the greatest likelihood of achieving biodiverse and healthy ecosystems.

1.2 What we did

To meet the objectives, we:

- collated existing information from various databases to compile a **list of MPAs** in the EU Mediterranean and Black Seas.
- designed and sent an **online questionnaire** to all identified MPA managers and national/regional authorities for their completion.
- assigned MPAs that responded to the questionnaire to a **stage of establishment** and **level of protection** following the MPA Guide.
- performed a comprehensive **scientific and grey literature review** to identify evidence about monitoring and assessment activities in MPAs.

1.2.1 Process followed to compile the list of MPAs

The list of MPAs was initially compiled using the MAPAMED ([8]) database for the Mediterranean area and the World Database on Protected Areas (WDPA) for the Black Sea, filtering by country (EU only) and keeping only areas with a marine part (see Annex 6.2 for details of the data sets used). The lists were combined and then updated using the European Environment Agency (EEA) database to include MPAs that were not available on MAPAMED, leaving us with a total number of 1300 MPAs (refined to 1261 to avoid redundancy). This initial list was then sent to relevant national authorities of each Member State asking them to check and refine the list if needed (see Annex 6.3). In the rare cases that the national authorities were not available to confirm the list (2 Member States out of 10), we used official national databases to cross check which MPAs to include.

Following this initial cross check exclusion criteria were applied refining the list further to ensure all MPAs considered had a relevant designation in the context of the study (i.e., MPAs that can regulate and/or have an effect on marine fisheries). The full list of exclusion criteria can be found in Annex 6.4. The criteria include sites with a marine area that covered less than 5% of the total protected area, sites that concerned mainly wetlands such as Ramsar sites, or other designation types such as vulnerable marine ecosystems or essential fish habitats that are not considered as MPAs. Following the rigorous examination and exclusion process **a total of 949 MPAs** were retained (see Figure 1-1). This subset includes 73% of the total MPAs reviewed, whilst retaining a fair proportion (39.7%) of the total marine surface area covered by EU Mediterranean and Black Sea MPAs. These 949 MPAs were used in this study for further examination. A full list of the MPAs is provided in Annex 6.5 and a summary per Member States in Table 1-1.

([8]) **MAPAMED** (**MA**rine **P**rotected **A**reas in the **MED**iterranean) is a cartographic database of key information on Mediterranean marine protected areas, potential 'other effective area-based conservation measures (OECMs), and more broadly on sites of interest for marine conservation. It is developed and administered jointly by UNEP/MAP-SPA/RAC and the MedPAN Association.

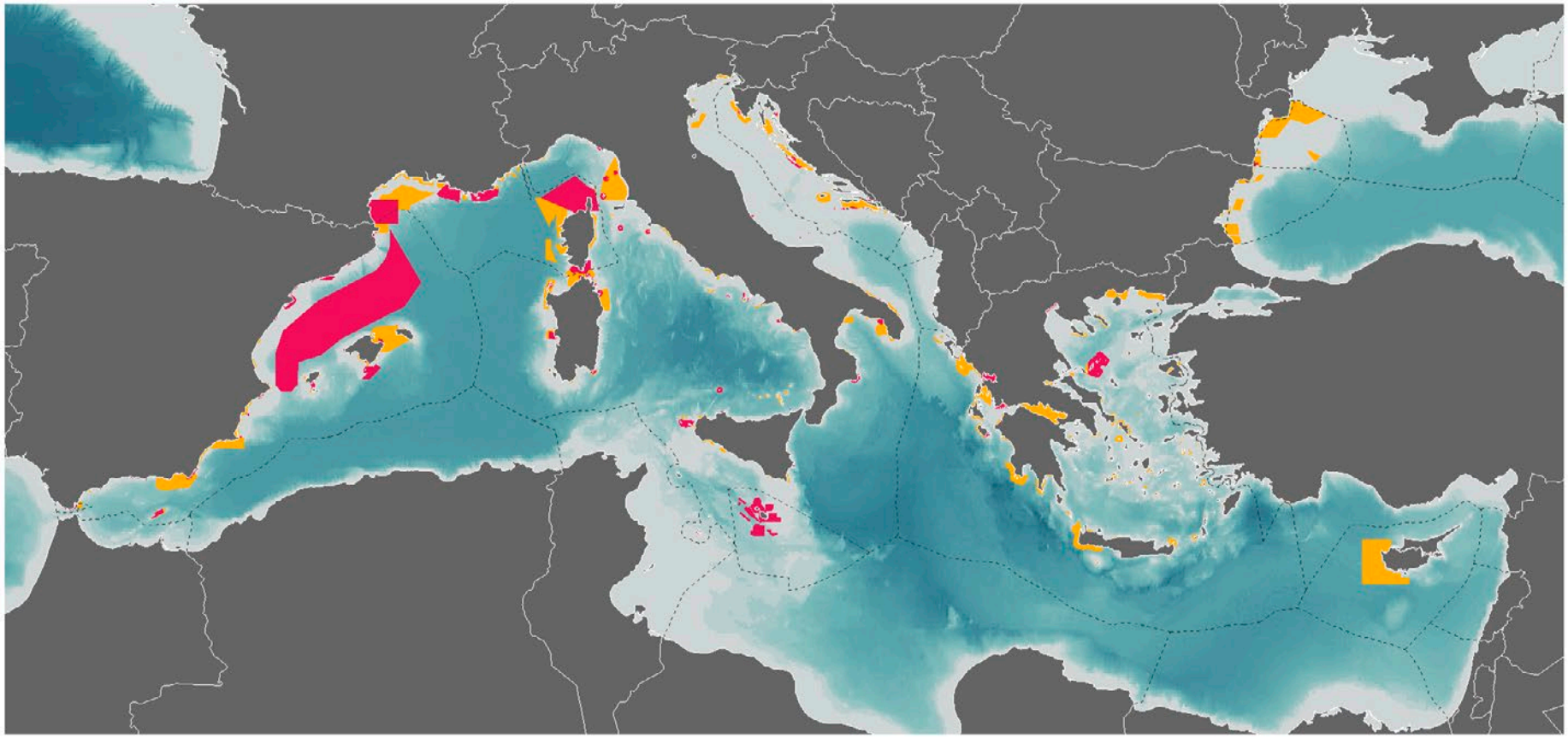

Figure 1-1 Spatial representation of the 949 marine protected areas (MPAs) kept for further analysis for the MAPAFISH-MED study. Yellow indicates the regional Natura 2000 sites and red the nationally designated sites in the EU Mediterranean and Black Sea

Table 1-1 Overview of the retained MPAs per Member State ('Relevant') identified and considered for this study. % Number = percentage of retained (relevant) MPAs, compared to total number of MPAs; % Area = percentage of the marine MPA surface area under study, compared to all MPAs.

Member State	Natura 2000		Nationally Designated		TOTAL			
	All	Relevant	All	Relevant	All	Relevant	%Number	%Area
Bulgaria	25	16	2	2	27	18	66,7	81,7
Croatia	240	213	24	18	264	231	87,5	56,7
Cyprus	11	7	11	11	22	18	81,8	44,9
France	76	44	26	22	102	66	64,7	25,1
Greece	193	112	47	42	240	154	64,2	73,6
Italia	294	219	49	42	343	261	76,1	30,4
Malta	11	10	26	18	37	28	75,7	70,4
Romania	12	9	2	1	14	10	71,4	34,5
Slovenia	13	4	7	4	20	8	40,0	52,0
Spain	170	94	61	61	231	155	67,1	46,2
TOTAL	**1045**	**728**	**255**	**221**	**1300**	**949**	**73,0**	**39,7**

A final database was created using two primary sources of information. All the general information on each MPA was obtained using the WDPA that uses the EEA database (both CDDA and Natura 2000 datasets) as the main sources of information (see Annex 6.2). This information was cross checked with the MAPAMED database. A scrutinous examination of these data sources was performed as we found them to contain some differences e.g., in some cases where a protected area was composed of a marine and terrestrial area, the size of the marine area was found to differ between the two databases. In other cases, the name indicated for certain MPAs was found to differ, and some errors were spotted for some MPAs where the WDPA_ID used was incorrect (Annex 6.6).

Finally, to account for overlap a procedure described in Annex 6.7 was followed. The issue of overlap also had relevance for the analysis carried out in Chapter 2. **After merging fully overlapping MPA designations, we consider 878 out of the list of 949 MPA designations to be a more realistic number of unique sites.**

1.2.2 Questionnaire for MPA managers

An online questionnaire was designed and developed to gather key information for each MPA, as the available online databases are limited in terms of the information they provide. The questionnaire was divided into different sections covering different aspects such as general MPA information (e.g., size, year of establishment), MPA governance and management, monitoring, fishing activities inside the MPA, and other activities (Annex 6.8). The questionnaire was translated into all the relevant languages (Spanish, French, Italian, Croatian, Greek, Bulgarian, Romanian, while English was used for Malta and Slovenia). A link to the online questionnaire was sent using a registered electronic mailing service to all identified MPA managers/practitioners and relevant national/regional authorities. The process of identifying individuals to target used a mixed approach of internet searches, pre-existing contacts, study partner knowledge and personal contacts/networks and snowballing techniques. Registered follow up emails were sent to everyone identified to encourage participation. Responses to the questionnaire were collected between September 2022 to July 2023.

1.2.3 Process to assign MPAs to a stage of establishment/protection level

Respondents' answers to the questionnaire were examined triangulating answers from the different sections of the questionnaire. Respondents were also asked directly to self-assess the stage of establishment and level of protection of the MPAs they were responding for.

Processes were developed using expert knowledge and the MPA Guide, as it offers a conceptual framework and general instructions on how to categorise MPAs to a stage of establishment and into levels of protection. The approach applied here can be modified on a case-by-case basis to take into consideration the wide range of management, regulatory, monitoring, and other possible site specific factors (size of the MPA, location, species, other features) that may be present in an MPA. More details can be found in Annexes 6.9 and 6.10.

1.2.3.1 Stage of establishment

In general, establishing an MPA occurs as a series of steps by governing or other authorities based on their local and national context. The MPA Guide indicates how these steps can be referred to and create different STAGES of establishment. The four STAGES are (see Annex 6.9 and box 1-1 for more details):

1. **Proposed or committed** by a governing or other organising body;
2. **Designated** by law or other authoritative rulemaking;
3. **Implemented**, with activated changes in management; and
4. **Actively managed**, with ongoing monitoring and adaptive management.

The assessment of the stage of establishment of each MPA was performed in two steps. The first considered the respondents' self-assessment of the stage of establishment. A clear definition of each stage was provided to the respondents to

help ensure a standardised and unbiased assessment. In the second step we used the extended guidance provided in the MPA Guide (Grorud-Colvert et al., 2021), which included identifying whether MPAs had a management plan and if it was used to guide daily activities. We operationalised it using a similar protocol used by Sullivan-Stack et al., (2022) and evaluated the stage of establishment combining the different answers to the questionnaire (Box 1.2). The two answers (self-assessment vs Consortia assessment using the MPA Guide) of the stage of establishment must be seen as concomitant, with neither being considered as more accurate or superseding the importance of the other.

We also attempted to get information regarding the existence of management plans from the databases used in this study (e.g., WDPA, EEA, MAPAMED). However, what is considered a management plan in these databases is not clearly specified and we found that, the management plan indicated could refer to a legal act that gazettes the MPA or a link to the management authority's website (specially the case for the WDPA database). If we look more generally, MAPAMED and WDPA databases reported no information about management plans for 78% and 71% of the MPAs, respectively. In this present study, and as indicated in our questionnaire, we defined a management plan as a formal planning tool with which MPA managers identify the goals, the exact steps and resources needed to achieve those goals, and continually evaluate how well the process is working. In this study we view the official regulation as a different type of document.

Box 1-3 Steps taken to assign MPAs to a stage of establishment

Figure 1-2. outlines the procedure designed (using the MPA guide) and followed to assign each MPA to a stage of establishment.

The first step was to identify how the MPAs were reported in the databases (e.g., WDPA, EEA, MAPAMED). We:

- Retrieved WDPA_ID and an official designation reported on European databases.
- If the MPA was not officially designated/reported, it was considered to have reached the "proposed" stage unless the MPA was recognised/listed by the national authority and was therefore considered to have reached a stage of establishment beyond the proposed stage.

The second step involved analysing the responses to questions on management plans.

- If respondents reported an approved and partially or fully implemented management plan, the MPAs were considered to be (at least) "implemented" (i.e., they could also be assessed as actively managed depending on the other answers).
- Some MPAs where no indication of an implemented management plan was reported, were classified as "implemented" as there was a reported presence of clear rules and regulations, an acceptable enforcement level, adaptive management and for some a clear monitoring system.
- To move up to the actively managed stage, the MPA had to indicate the presence of monitoring in the MPA, and adaptive management.
- The level of enforcement and the capacity of the staff to enforce the rules was also considered.
- Responses to questions on MPA objectives and whether conservation and fisheries measures were included within the management plan were also examined.

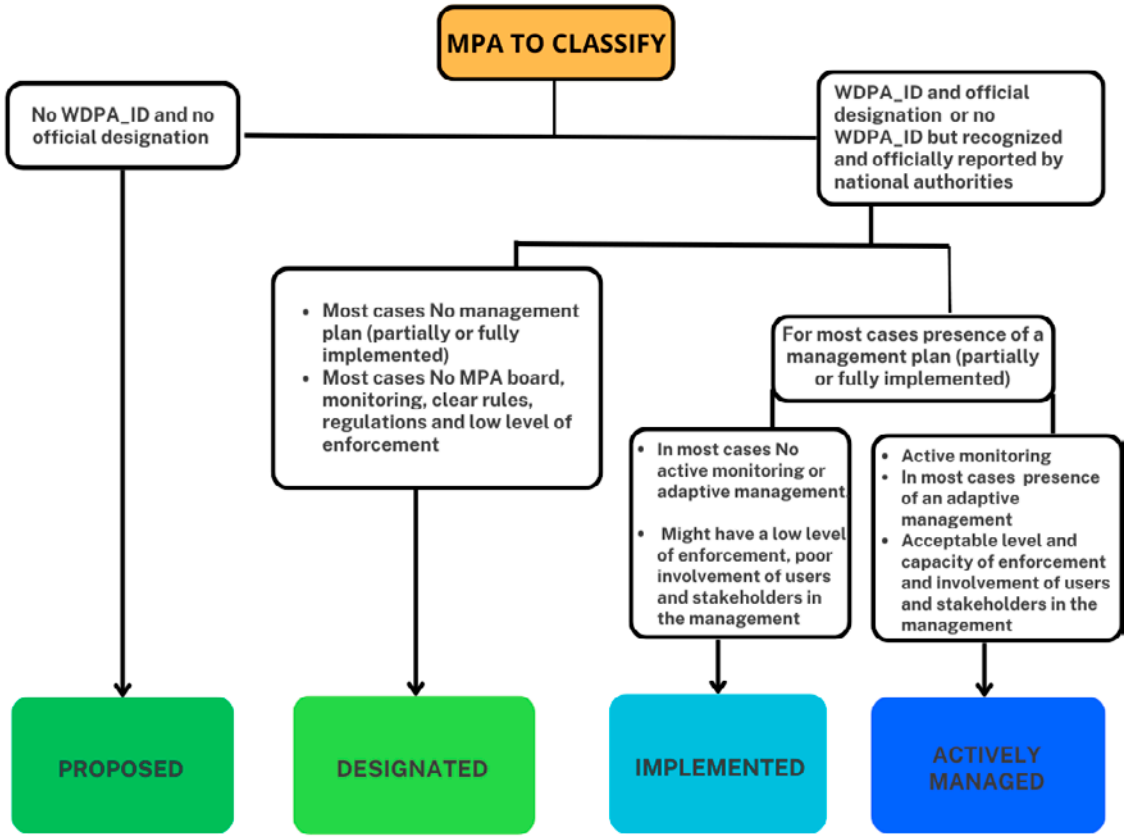

Figure 1-2 General guidance developed within the study and based on the MPA Guide to assess the stage of establishment from respondents' answers to a series of questions.

1.2.3.2 Level of protection

The level of protection refers to how well protected an MPA (or MPA zone) is from abatable extractive and destructive activities (Grorud-Colvert et al., 2021). This is important because MPA outcomes depend on the level of protection (Edgar et al., 2014; Grorud-Colvert et al., 2021). The level of protection is based on allowed activities:

- **Fully protected** – no extractive or destructive activities;
- **Highly protected** – minimal extractive or destructive activities;
- **Lightly protected** – moderate extractive or destructive activities;
- **Minimally protected** – activities with high total impact; and
- **Incompatible** – where activities allowed are incompatible with nature conservation.

As above to assess the MPAs/zones level of protection, respondents were asked for a self-assessment and responses to other questions on fishing and other activities were combined and examined (Box 1.3 provides a description of the process followed). Multiple-zone MPAs were assessed at the zone level in opposition to single-zone MPAs that were assessed at the MPA level given that they have one zone with

one set of restrictions. We received responses for 162 MPAs, of which 110 MPAs reported having a single zone and 52 MPAs having multiple zones giving an overall total of 293 zones to analyse, corresponding to 265 levels of protection. Meaning some of these 293 zones had the same level of protection (i.e., regulations).

Box 1-4 Steps taken to assign MPAs a level of protection

To assess and establish the level of protection of the investigated MPAs, the following steps were taken:

- Responses to questions on fishing gears permitted were examined.
    - Fishing gears impact was assigned a rating following the MPA Expanded Guidance for Levels of Protection (Grorud-Colvert et al., 2021).
    - The total number of fishing gears allowed were summed to classify the MPA zones. This classification was not only based on the level of impact of each fishing gear, but also accounted for the quantity of fishing gears allowed, as some zones for instance allow few but highly destructive fishing gears.
    - A first classification of the fishing activity within the MPA was obtained. In cases where the gear could vary in impact level depending on the scale of operation the responses were compared with answers to questions on vessel size to give a better indication of the scale of the fishing activities permitted.
- Other activities were then classified within the MPA/zone based on their impact. We did not have a full picture of the impact (i.e., intensity, duration) of each activity, as this information is generally not reported and not available even to MPA managers, so we decided to establish two potential scenarios (optimistic and pessimistic):
    - **Scenario 1**: was considered as the "optimistic" one. We took the highest scores for each activity (the ones with the least impact), to assign a level of protection. The activity with the lowest score (within the highest scores), is the one that leads the classification. For example, for one MPA, the activity "anchoring" had the answer "allowed everywhere". Looking at Annex 6.10, we can see that this impact can be considered as "highly" or "lightly", while the rest of the activities in the MPA had a response where the final impact was "fully". In this case, the highest scores for the activities are, "fully" for all except, "highly" for anchoring. So, for this scenario, we take the "highly" score from the anchoring activity, as it is the leading one, and assign it to the whole MPA.
    - **Scenario 2**: was considered as the "pessimistic" one. In this scenario, we kept the lowest scores for each activity (the ones with the highest impact), to assign a level of protection. Taking the example mentioned above, in this case, we will still have a "highly" impact for all the activities, except for anchoring, which would be "lightly", as it is the lowest score given to this activity. In this scenario, the final level of protection would be "lightly" for the whole MPA.
- These two scenarios (optimistic and pessimistic) were applied to both the analysis of the fishing activity, the other activities, and to the overall assessment (the combination of fishing and other activities) of each MPA/zone.
- Based on the answers of the respondents to the questionnaire regarding the activities present in the MPA/zone, we were able to assign each activity an impact colour code from red to dark green corresponding to one of the 4 levels of protection, plus the Incompatible with conservation level (grey).

- The result of the assessment related to the fishing activities was compared with the assessment of the other activities, retaining the "worst case scenario rating" (e.g., if the fishing assessment gave a yellow impact and the other activities assessment a green, we assigned the MPA to yellow).

An example of the classification of an MPA into its level of protection is provided in Figure 1-3.

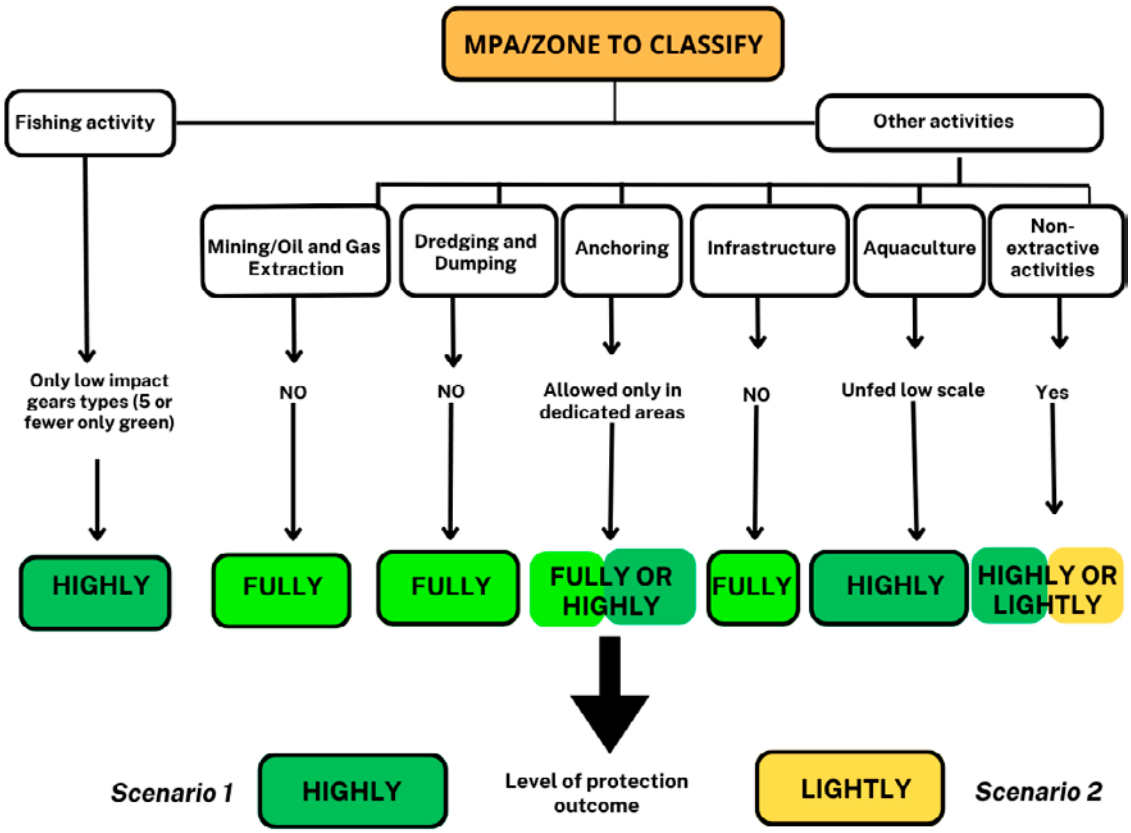

Figure 1-3 Example of the procedure followed to assess the level of protection of an MPA/zone applying the general guidance from the MPA Guide to respondents' answers to a series of questions related to the impacts of the activities allowed within the MPA/zone.

1.2.4 Process followed to assess MPA monitoring and planning

To identify evidence and assess monitoring and planning activities in MPAs, we performed a comprehensive scientific and grey literature review. To perform this literature review, we followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). The PRISMA flow diagram and results for both the scientific and grey literature review are summarised in Figure 1-4.

We performed a search on the Web of Science to find scientific literature published in English using the following combination of keywords present in the title and/or abstract and/or keywords of the publications:

"protected area" or "national park*" or "marine reserve*" or "Natura" and "marine" and "monitoring" or "assessment" or "baseline" and "country". The search was done for each country separately, and the keyword "country" was substituted with "Italy", "Greece", "France" etc. We also performed two additional searches that instead of a country, used the keywords: "Mediterranean" and "Black Sea".*

National biodiversity assessments commonly use non-English literature (Amano et al., 2023), thus we performed a search on Google Scholar using the string:

"protected area" or "national park" or "marine reserve" or "Natura" and "marine" and "monitoring" or "assessment" or "baseline" and (for example) "Italy" and "Italian".

Translated into the official language of each country. Consortium partners went through the first 50 results that Google Scholar generated and identified documents/reports that are related to the study by reading their (executive) summary or abstract. Fifty has been estimated as a good trade-off between sampling effort and information potentially gathered considering that technical reports and PhD theses that are potentially retrieved through this search are usually very long and time consuming to be assessed (Haddaway et al., 2015).

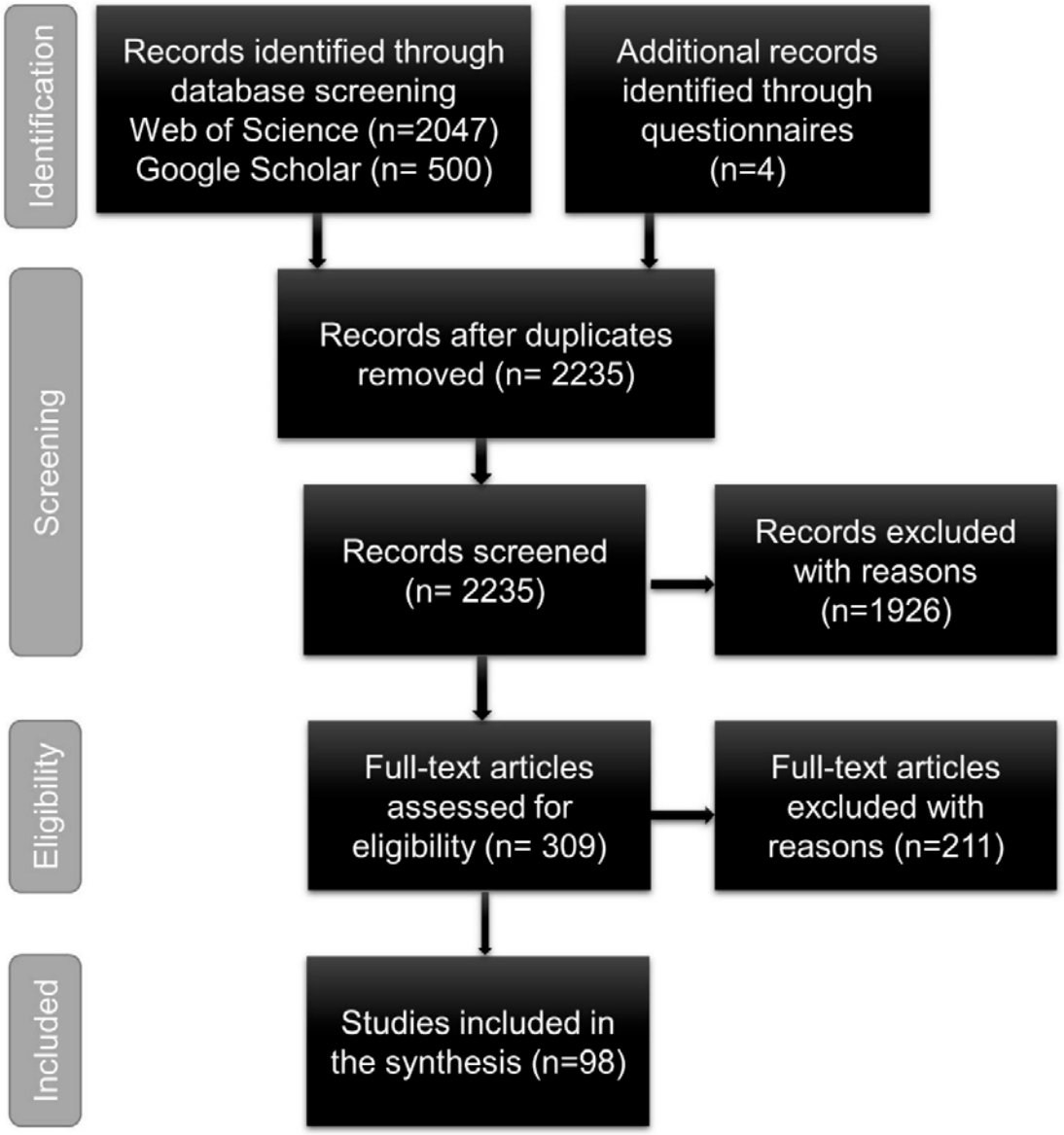

Figure 1-4 PRISMA flow chart presenting the articles/documents retained and excluded at each review step. Data for scientific and grey literature are integrated.

We retrieved 2047 scientific articles overall (all searches combined), 500 grey literature papers/documents, and 4 additional documents identified through the questionnaires administered to MPA managers. Some of the articles/documents were duplicated items considering that multiple searches (e.g. "country"-based and "sea"-based, i.e., "Mediterranean" and "Black Sea") could, in some cases, generate the same papers. After removing duplicates, we retained 2235 papers and documents which were screened going through the abstract to decide whether to include or exclude the paper - retaining only papers that were relevant to the topic, i.e., baseline studies and/or monitoring studies using ecological, social, economic, governance variables related to conservation and/or fisheries within MPAs. Papers were excluded for one or more of the following reasons: the paper did not include a protected area; the protected area was not marine; the MPA(s) were not in the Mediterranean or the Black Sea (e.g., French MPAs in the Atlantic Ocean) or in these seas but not in the EU (e.g., MPAs in Tunisia); the paper did not report relevant variables (e.g.,

monitoring of plastic debris). The entire text of the 309 papers and documents retained following the abstract screening were assessed in full.

After reviewing the documents in their entirety, we retained **a total of 98 articles and documents** (i.e., 74 scientific articles and 24 grey literature documents) that were pertinent to our topic and extracted relevant information for one or multiple MPAs (Annex 6.11). The information collected included: the name and zone of the MPAs included in the study, who conducted the study (e.g., research institutes, MPA authorities, NGOs), whether it was a baseline study, whether it was ecological and/or social and/or economic and/or governance monitoring, the variables investigated, the sampling year(s) and season(s), the sampling methods and unit area, the type of sampling design, the number of sampling sites and replicates within the sites, and whether the data collected is publicly available, and if so, where are they stored.

1.3 Results

1.3.1 What do we know about MPAs in the Mediterranean and Black Sea?

1.3.1.1 Results of databases search and data collation

Overall, in the list of 949 MPA designation, 408 MPA designations (43%) were found to overlap to some degree. This considers overlap of Natura 2000 sites overlapping national designations and national designations overlapping other national designations. More specifically, we found 318 cases where Natura 2000 sites overlapped with national designations, covering 21225 km^2, and 90 cases where national designations overlapped with other national designations, covering 5053 km^2. We considered two or more MPAs as fully overlapping when they have ≥90% of their areas in common. We found 82 MPA designations (9%) that fully overlapped, as such we must consider these as "labels" but not necessarily as a set of unique MPAs. After merging fully overlapping MPA designations, we consider 878 out of the list of 949 MPA designations to be a more realistic number of unique sites. The vast majority of MPAs (727: 77%) are under a Natura 2000 designation (considered as a regional designation). The remaining MPAs (222: 23%) are national types of designation.

1.3.1.2 Results from the questionnaire

A general overview of responses to the questionnaire revealed the **governance approaches** applied in the 123-157 MPAs that provided information to this section ([9]) is generally top down with 88% indicating that the governance of the MPA is ensured by a public administration (at either the local, regional, or national level), with little stakeholder involvement (36%). Only 14 MPAs (11%) indicated that a **fishers' representative** was part of the MPA board and had some decision-making power. More than one third of MPAs (38%) reported that there was no interaction

([9]) It should be noted that not all respondents provided an answer to each question asked in the questionnaire, meaning response rates per question varied.

between fishers and the MPA management body**,** while **62% (97) reported some form of interaction** between fishers and MPA management body (informal, unidirectional, bidirectional, proactive (Figure 1-5).

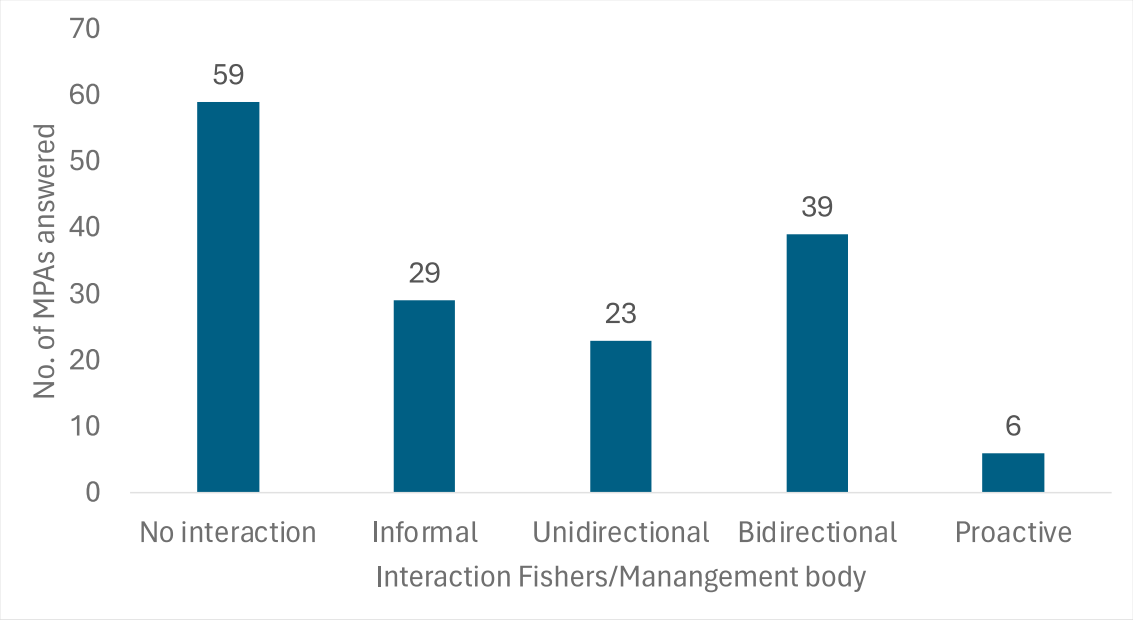

Figure 1-5 Reported interaction between fishers and the MPA management body

Regarding the **level of enforcement** within the MPA (i.e., extent of surveillance effort and compliance to regulations that restrict fishing, both through overt policing and through community support for regulations) as well as the **capacity of the MPA staff** to enforce the MPA rules/regulations, we found that 34% of respondents declared a high level of enforcement, 38% medium and 28% low. Yet, 33% reported that the MPA staff had a lack of skills/resources/legal power to enforce MPA legislation and regulations (e.g., lack of skills, no patrol budget) and 34% reported having no capacity.

As no database exists at the national, European or International level that provides zoning information for MPAs, where possible, **zoning information** was retrieved by analysing the responses to the questionnaire. A total of 208 MPAs were investigated, with 158 coming from answers received via the questionnaire and 50 French MPAs that were assessed by examining the documentation available (management plan, legal act). A total of 44 MPAs (21%) were found to be multi-zone MPAs (i.e., MPAs with zones that have different levels of protection and thus accommodate for different levels of human-use activities and MPAs that have one level of protection separated into multiple areas). The Natura 2000 sites are mostly composed of one zone, with only 8% (11/139) of Natura 2000 MPAs analysed found to have multi-zones. Conversely, almost half 48% (33/69) of nationally designated MPAs analysed have several zones. At this stage the zones were categorised in protection levels between FPAs (where all extractive activities, such as fishing or harvesting of resources, are prohibited) and PPAs (where some human activities, such as small-scale fisheries and other potentially sustainable activities are generally allowed but strictly regulated). We summed the zones (single zone MPAs + multi-zones MPAs) to give us a total number of 265 protection levels. Of these, we found that 21% (56) were FPAs and 79% (209) were PPAs. From the 158 MPAs assessed from the questionnaire, 29% (46) MPAs had at least one FPA. A total of 38 MPAs out of the 44 multi-zone areas

assessed (86%) are multiple-use areas where at least one FPA and one PPA is present. Six MPAs out of 44 (14%) were composed of multi-zone areas that are considered PPAs.

In total, 63% (101/160) of the EU MPAs of the Mediterranean and Black Sea that responded to the questionnaire reported they had a **management plan** (this corresponds to 67% of the total surface of the 160 MPAs considered when the very large Spanish MPA ([10]) that accounts for about two thirds of the overall investigated surface is removed, or 23% when this very large MPA is kept). Forty-six percent (73/160) reported having a management plan that is either partially or fully implemented. On the other hand, 37% (59/160) declared there to be no management plan and 17% (28/160) declared a management plan exists but is not implemented. Further, 7% of MPAs (11/160) declared they have a management plan that is approved and partially implemented and 39% of MPAs (62/160) have an approved and fully implemented management plan. Finally, 45% of the Natura 2000 sites (SCIs (34% (14)) and SACs (52% (33))) and 21% (12) Nationally designated MPAs declared having no management plan (Figure 1-6).

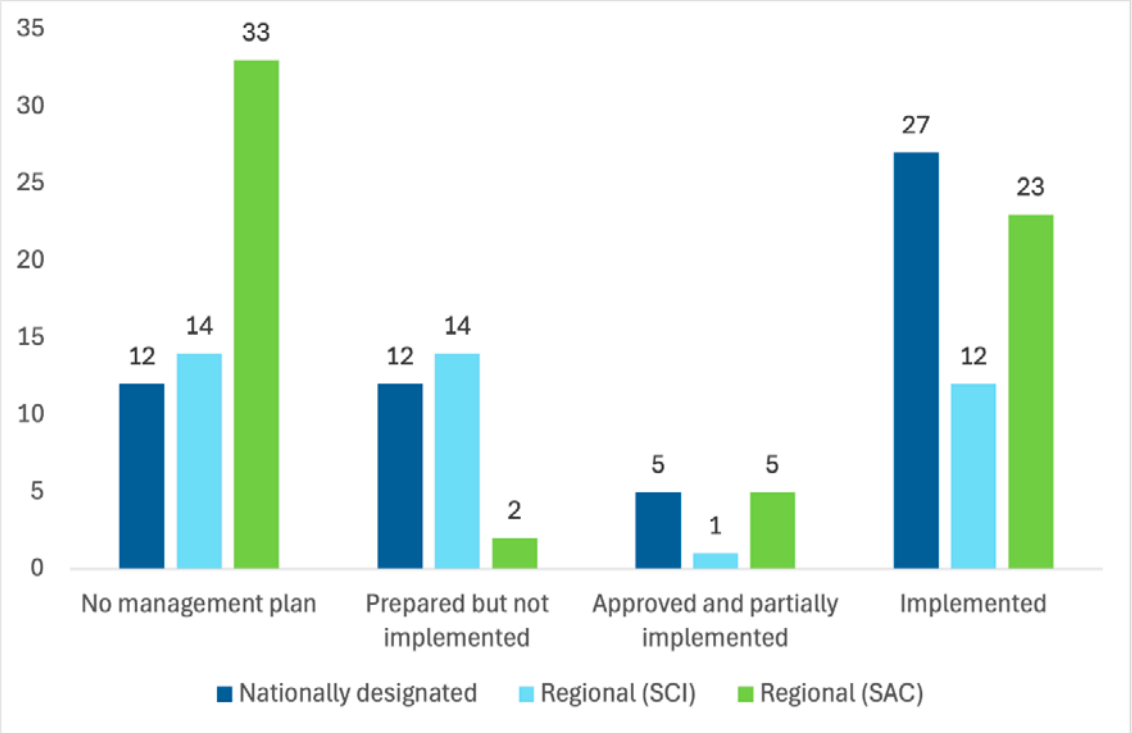

Figure 1-6 Status of management plan implementation in Nationally and Regionally (N2000 sites, with a breakdown in SCI and SAC) MPAs in Mediterranean and Black Sea.

Regarding the contents of the management plan 92% (72 out of the 78 who responded to this question) indicated that it contained clearly stated **conservation objectives** and 22% (17) indicated there were also clear fisheries management objectives. Seventy MPAs (out of 121 that replied to the question on adaptive MPA management) declared the management plan was adaptive (58%) and 51 said it was not (42%).

([10]) Corredor de migración de cetáceos del Mediterráneo (WDPA ID: 555596226).

Regarding **fisheries management**, we received responses for 97 MPAs indicating that 5% of those MPAs were preparing a specific small-scale fisheries plan, 4% of those MPAs had a specific plan dedicated to small-scale fisheries and 14% indicated that the MPA small-scale fisheries plan was part of a broader official plan for small-scale fisheries. In total 33% respondents (14/42) indicated that the existing small-scale fisheries plans contain quantitative goals. Half of the respondents indicated that there were fisheries management objectives (51% (18/35) and 49% (17/35) declared they were not present.

Regarding whether the MPA delivered **ecological benefits**, we received responses for 64 MPAs, 27% (17) indicated no and 73% (47) indicated yes. Regarding evidence of **fish spillover and/or larval export** from within and/or around the MPA, we received answers for 42 MPAs, 33% (14) indicated they had evidence and 67% (28) said not. Regarding a **potential increase in the CPUE** (catch per unit of effort) within and/or around the MPA after its implementation 24% (8/33) indicated yes. MPAs were indicated to be providing an increase to fishers' incomes for 18% of the respondents (4/18).

1.3.2 What do we know about MPAs conservation status?

The following results stem from responses to the questionnaire.

1.3.2.1 Stage of establishment

We received 162 answers to the question "what is the stage of establishment of your MPA?", with 108 (67%) indicating stages preceding "Implemented" (i.e., the threshold where biodiversity conservation and other socio-ecological benefits start to accrue (Grorud-Colvert et al., 2021)). Fifty-five responses concerned national designated MPAs, and 107 were Natura 2000 sites (with 43 SCIs and 64 SACs). Figure 1-7 provides a graphical representation of the reported stages of establishment across the Mediterranean and the Black Sea.

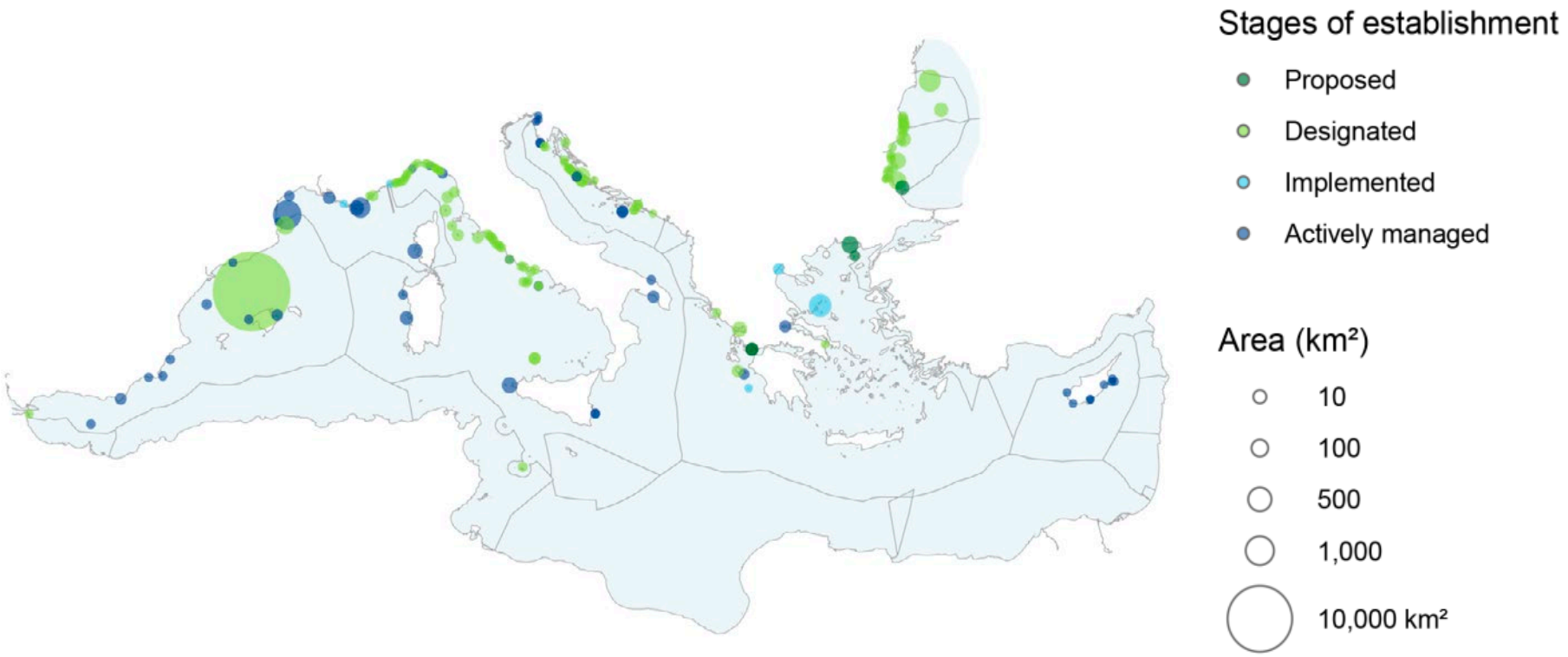

Figure 1-7 Spatial representation of the self-assessed stage of establishment of MPAs in the Mediterranean and the Black Sea (n = 162). **([11])**

([11]) Source: EEZ borders Flanders Marine Institute (2023). Created using: Wickham ggplot 2 (2016), R Core team (2021), and Pebesma and Bivand (2023).

For what concerns the stage of establishment by designation type, we found that 91% of Natura 2000 sites indicated the stage of establishment to be "proposed" or "designated". For national designation sites, 76% indicated the stage of establishment to be "implemented" or "actively managed".

By looking at the mean age of the MPA status per stage of establishment, the Proposed and Designated MPAs were found to be "younger" than the other stages with a mean age of 15 and 13 years, respectively. The Implemented and Actively managed MPAs had a respective mean age of 22 and 21 years.

Following the first step to assess the stage of establishment (extracted directly from the respondents' direct answer; self-assessment), the second step of the assessment was performed by the scientific Consortium using the answers to relevant questions included in the questionnaire. This led to a change in status for 33 MPAs. Figure 1-8 below illustrates these changes. As with the self-assessment this second step confirmed that the majority of MPAs investigated had not reached the stages of establishment that can potentially accrue ecological benefits. More national designated sites had reached the "Implemented"/ "Actively managed" stages whereas most Natura 2000 sites (SACs and SCIs) were between the "Proposed" and "Designated" stages.

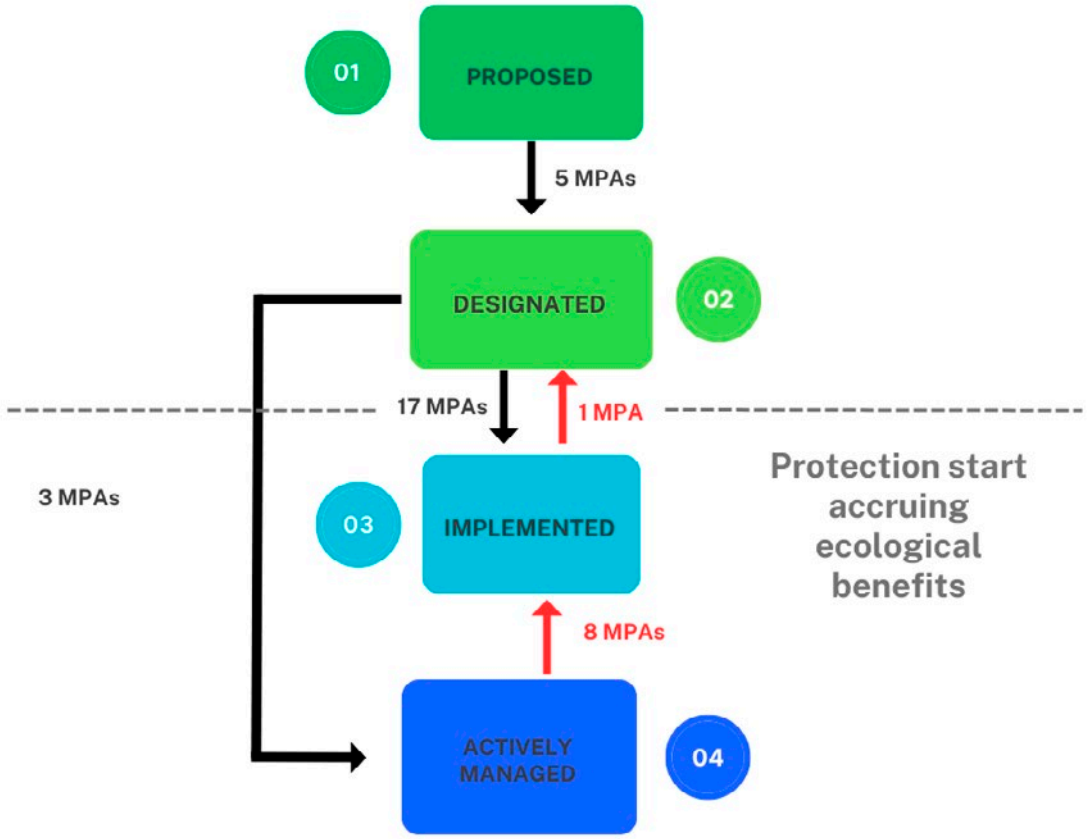

Figure 1-8 Category changes between respondent assessment and our assessment of the stages of establishment. Black arrows indicate the number of MPAs that have been "moved forward" (to a more advanced stage of establishment), while red arrows indicate number of MPAs that have been "moved backward" (to a less advanced stage of establishment)

1.3.2.2 Level of protection

Around one third (35%; 39/110) of single zone MPAs were assessed to be either fully or highly protected considering scenario 1 ("optimistic") and 7% (8/110) considering scenario 2 ("pessimistic"). In scenario 1, 28% (30) of the single-zone MPAs were assessed to be incompatible with the conservation of nature and 37% to be lightly and minimally protected. Considering scenario 2, 40% (44) of the single zone MPAs were assessed to be incompatible with the conservation of nature and 56% to be lightly and minimally protected. Considering multiple zone MPAs, we found that using scenario 1, 47% (87) of the zones were assessed to be fully or highly protected, while when considering scenario 2 these two levels of protection correspond to 24% (44) of the zones assessed. For scenario 1, 11% (12) of the zones were assessed to be incompatible with the conservation of nature and 20% (36) when considering scenario 2.

The MPAs/Zones assessed to be incompatible with the conservation of nature fell into this category due to the reported presence of certain fishing gears consisting of fishing vessels >12 m combined with beam trawling and seining (43/51), dredging (7/51) or by the reported presence of mineral oil, gas prospecting or exploitation (1/51).

Note from this point forward all MPAs were analysed at the zone level (n=293 zones) and considering only scenario 1 (optimistic) from the consortia's assessment of protection level.

Considering designation type, our assessment revealed that in the 158 zones of national designated sites, 24% (n=38) fell into the incompatible and minimally protected categories, and for the 135 zones of Natura 2000 sites, 47% (n=63) fell in these two categories. In national designated sites and Natura 2000 sites, 47% (n=75) and 35% (n=47) of the zones respectively, were identified as highly and fully protected (Figure 1-9).

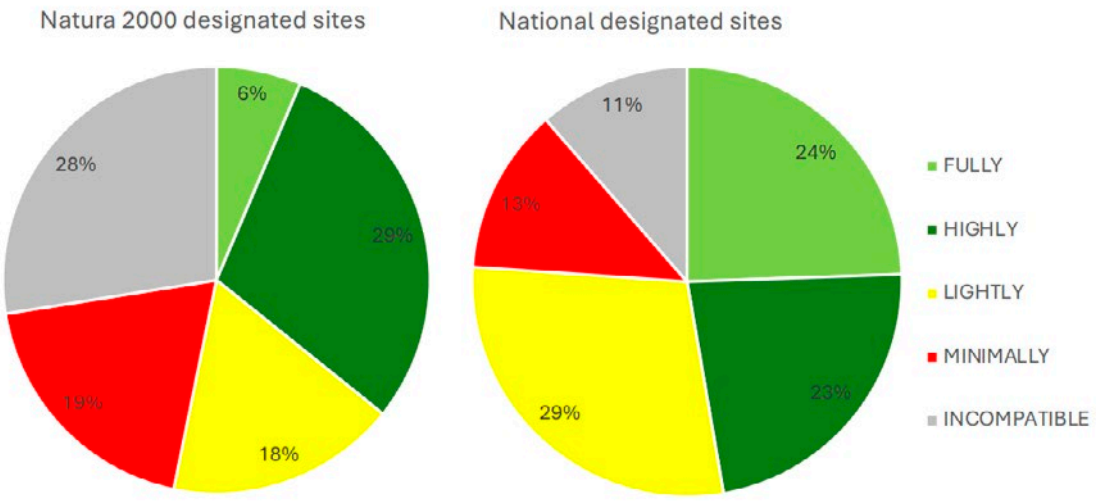

Figure 1-9 Levels of Protection of the assessed MPAs divided by their designation type: Regional Natura 2000 sites (left) and National designated sites (right).

Our assessment of the zones under the different levels of protection was then compared with the respondents answer to the questionnaire regarding their perception of the level of protection of each zone in the MPA they were replying for. From the 67 fully protected zones indicated by the respondents, only 39% (26) matched with our assessment of fully protected zones.

In their self-assessment respondents indicated 64 highly protected zones, and from those, 38% (24) matched with our assessment. Of the 75 zones that respondents declared to be lightly protected 28% (21) matched our assessment. Of the 44 zones self-assessed as minimally protected 36% (16) matched our assessment.

1.3.2.3 The relationship between Stage of Establishment and Level of Protection

We investigated the relationship between the stage of establishment and level of protection of the MPAs. We found that 67% (35 out of 52) fully protected zones are actively managed, followed by 30% (22/74) highly, 51% (37/72) lightly and 50% (22/44) minimally protected. We found there to be a relatively low proportion of fully and highly protected zones that are at the implemented stage (8 % and 14%, respectively) (Table 1-2).

Table 1-2 Stage of establishment of the assessed MPAs/zones and their associated level of protection. Results are presented in percentages of the total number of zones of a given level of protection.

	FULLY	HIGHLY	LIGHTLY	MINIMALLY	INCOMPATIBLE
Actively managed	67%	30%	51%	50%	22%
Implemented	8%	14%	15%	2%	8%
Designated	21%	57%	33%	48%	65%
Proposed	4%	0%	0%	0%	6%
Total number of zones	**52**	**74**	**72**	**44**	**51**

Focusing on national designated zones, 87% are actively managed. Only in the category Incompatible with conservation, some MPAs/zones (a very low percentage) have been classified at the Proposed stage. All the others (Fully, Highly, Lightly and Minimally protected) were classified at more advanced stages of implementation. Actively managed zones were found to be the dominant stage of establishment category for all the protection level categories in national designated MPAs: highly (48%), lightly (65%) minimally (90%) and incompatible (48%) (Table 1-3).

Table 1-3 Stage of establishment of the assessed national designated MPAs/zones and their associated level of protection. Results are presented in percentages of the total number of zones of a given level of protection.

National designated sites	Actively managed	Implemented	Designated	Proposed	Total number of zones
Fully	87%	0%	13%	0%	30
Highly	48%	17%	36%	0%	42
Lightly	65%	21%	15%	0%	44
Minimally	90%	5%	5%	0%	21
Incompatible	48%	19%	29%	5%	21

Considering the regional designated zones (in Natura 2000 sites), we found the "designated" stage of establishment to be dominant for almost all the levels of protection categories: highly (84%), lightly (68%), minimally (87%) and incompatible (90%). The fully protected level had a higher number of zones classified as actively managed (41%) compared to the other levels of protection (Table 1-4).

Table 1-4 Stage of establishment of the assessed regionally designated zones and their associated level of protection. Results are presented in percentages of the total number of zones of a given level of protection, for scenario 1.

Regional Natura 2000 sites	Actively managed	Implemented	Designated	Proposed	Total number of zones
Fully	41%	18%	32%	9%	22
Highly	6%	9%	84%	0%	32
Lightly	18%	14%	68%	0%	28
Minimally	13%	0%	87%	0%	23
Incompatible	3%	0%	90%	7%	30

1.3.2.4 Enforcement, Staff Capacity and Level of Protection

Out of 293 zones, we received answers related to 247 zones for enforcement and 256 for staff capacity ([12]).

Fully protected zones were declared by respondents to be moderately and highly enforced (30% and 57%, respectively). Highly protected zones were found to have an equally high and medium level of enforcement (27 answers each) representing a total of 54 out of 70 (77%), while lightly protected zones were moderately enforced (61%; 39 out of 64). For minimally protected zones, the level of enforcement was reported to be medium or low (84%; 31 out of 37). Zones assessed to be incompatible with conservation were found to be either moderately (50%; 15 out of 30) enforced or to have low enforcement (43%; 13 out of 30) (Figure 1-10). Overall, MPAs reporting higher levels of enforcement were found to have a corresponding higher level of protection.

([12]) For the following two analyses: enforcement and staff capacity vs level of protection, the answers provided by the respondent in the questionnaire were at the level of MPAs, not zones. However, to be able to compare these categories with the level of protection assessment presented in this report, in the case of multiple-zones MPAs, the assessment of the respondent for both the enforcement level and the staff capacities applies to all the zones, which explains why there is the same amount of data for the enforcement, staff capacity and levels of protection.

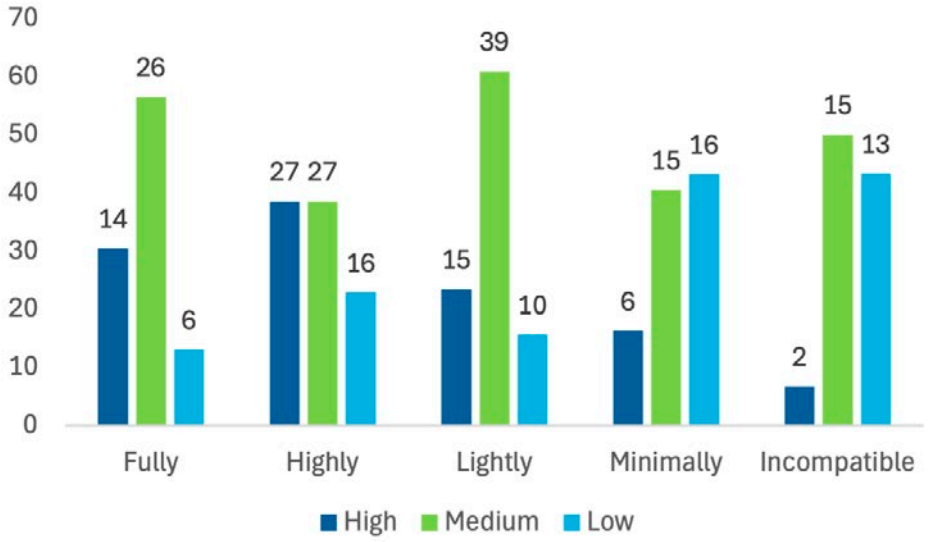

Figure 1-10 Levels of protection of the assessed MPAs/zones and their respective level of enforcement. Values over bars indicate the absolute number of zones per category. Results are presented in percentages.

For highly protected zones, respondents reported to have no effective staff capacity in most cases (52%: 37/71). The lowest staff capacities (not effective and major deficiencies) were found to match with zones we had classified as incompatible (47%:15/32 and 44%: 14/32, respectively) (Figure 1-11). Overall, no/low staff capacity was the common pattern revealed across all protection levels, but the capacity increased with higher protection levels.

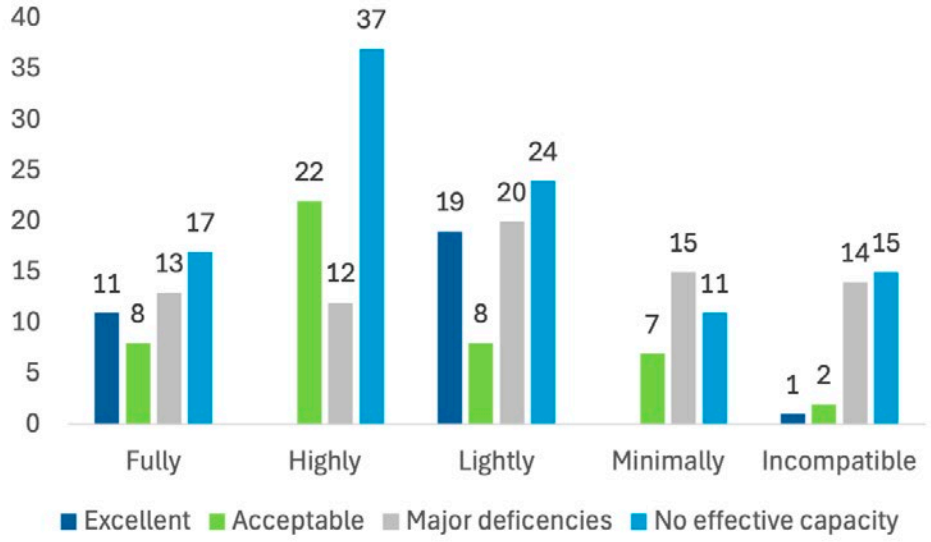

Figure 1-11 Levels of protection of the assessed MPAs/zones and their respective staff capacity to enforce the rules. Values over bars indicate the absolute number of zones per category. Results are presented in percentages.

1.3.2.5 Fisheries and biodiversity conservation outcomes

We found that 29% (47) out of the 161 MPAs that responded to this question, reported positive ecological benefits. Twenty out of the 52 zones (38%), classified as fully protected, reported positive ecological benefits as did 12 out of the 74 (16%) highly protected zones.

Concerning the spillover effect and larval displacement, 12 fully protected zones and only 1 highly protected zone (8%), reported any evidence of fish spillover and/or larval export from within and around the MPA. Only 8 MPAs (5%) reported increases in CPUE within and/or around the MPA after its implementation, with 6 of them being fully protected, 1 highly and 1 lightly protected.

For what concerns the restrictions and regulations on small-scale fisheries, 96% of the zones classified as fully and highly reported having some sort of restriction on small-scale fisheries, e.g., limiting entry, having gear restrictions, territorial use rights. Moreover, 34% lightly protected MPAs also reported using the aforementioned restrictions, as well as 20% minimally protected MPAs and 59% incompatible ones. In 33% of the MPAs some sort of restrictions on small scale fisheries are in place.

1.3.3 Are MPAs being monitored?

1.3.3.1 Results from the questionnaire

We received 123 responses to the monitoring section of the questionnaire from nine Member States (see Annex 6.5 which provides the full list of MPAs considered in the study and those MPAs that responded to the questionnaire and for which information was found through the literature search). Overall, authorities managing 81 MPAs in

eight Member States (out of the nine) stated that they perform some sort of monitoring. While the overall percentage of MPA designations performing monitoring activities is low, approx. 10% (of the 878 MPAs considered in this analysis; see section 1.3.1 and Annex 6.7 regarding overlapping designations), 65% (of the 123 MPAs that replied to the questionnaire) gave a positive response (i.e., they reported performing some kind of monitoring). Ecological monitoring was reported most frequently with 47% followed by social monitoring (25%). Economic and governance aspects were reported to be the least monitored, with 4% and 10% respectively. Only 20% and 23% of the MPAs reported having baseline ecological and socio-economic data, respectively.

1.3.3.2 Results from the literature review

The peer-reviewed scientific articles (n=74) included baseline and/or monitoring information for 79 MPAs in eight Member States: 44 national designated sites and 35 Natura 2000 sites. The grey literature documents (n=24) included information for another 12 MPAs: 2 national designated sites and 10 Natura 2000 sites. In total, these 91 MPAs correspond to approx. 10% of all Mediterranean and Black Sea MPA unique sites investigated in this study (n=878) (Figure 1-12).

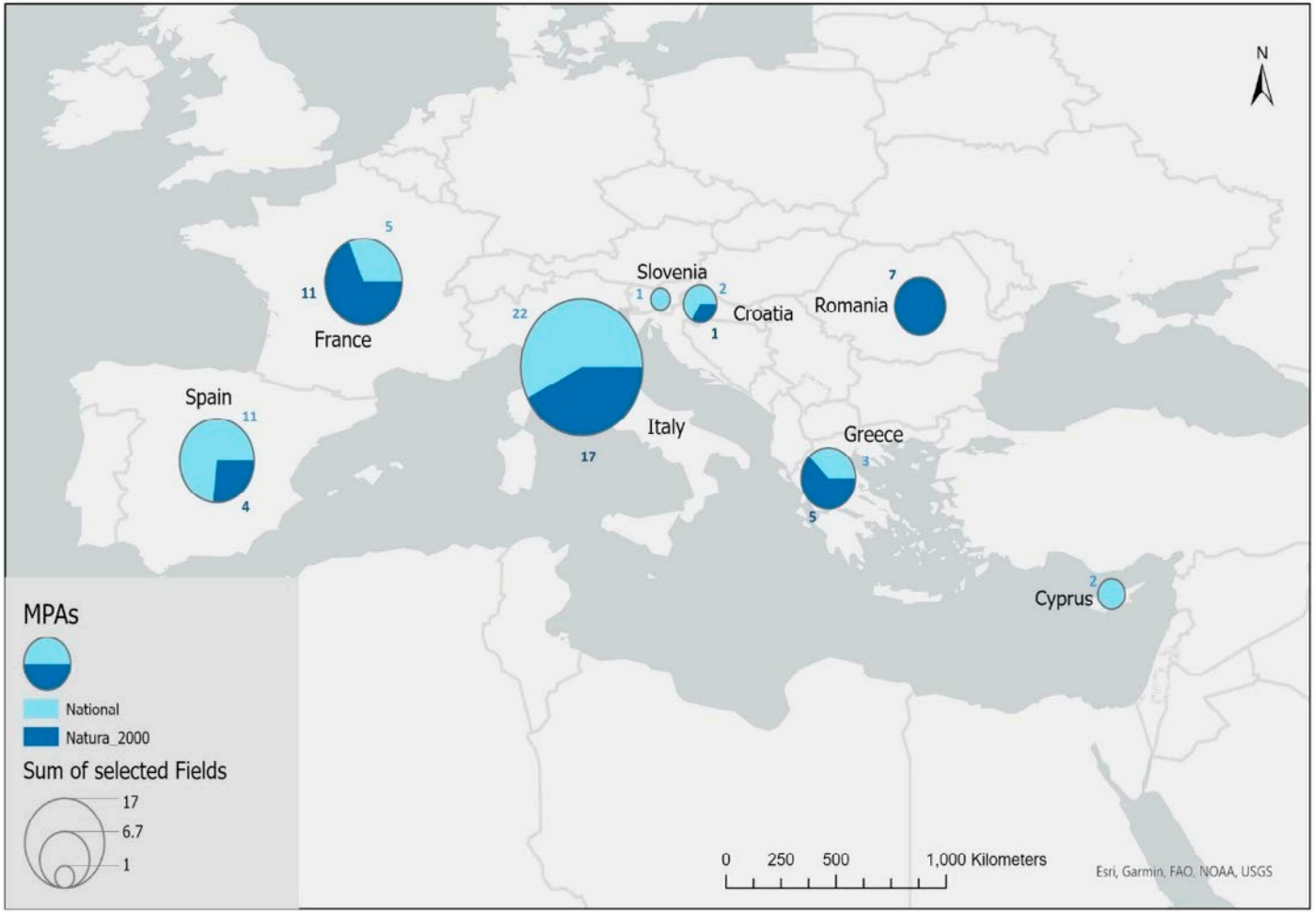

Figure 1-12 Distribution of national designated MPAs (light blue) and Natura 2000 sites (dark blue) for which baseline and/or monitoring data were retrieved in the literature review. The full list of MPAs investigated in the study is provided in Annex 6.5.

Out of the 98 documents/articles, 81% included ecological monitoring data, 15% social monitoring data, 11% economic monitoring data, and 11% governance monitoring data ([13]). In 22% of the studies, it was stated that baseline data were included. About 70% of the studies included data on commercially exploited species, six studies included species (fish and molluscs) harvested only by recreational fishers, and 22% of the studies contained data about a sensitive habitat or species (e.g., *Posidonia oceanica* or coralligenous).

A total of 43 variables were examined/measured in these 98 documents/articles (Annex 6.12) with most studies examining more than one variable. To measure the variables, half the studies used visual census techniques, and one quarter used interviews and questionnaires. It is worth noting that some studies used more than one sampling method. About 70% of the studies including data for ecological monitoring (n=80) did not account for covariates in their analysis. The ones that did, used mostly depth (18%) and habitat type (16%). In the ecological monitoring studies, bony fish (Actinopterygii) were by far the most studied taxonomic group (71%), followed by Mollusca (18%).

Almost half of the ecological studies (49%) did not follow a structured sampling (experimental) design ([14]) and their methods were descriptive. Half of the ecological studies (50%) used a Control-Impact (CI) sampling design whereas only one study (1%) used a Before-After-Control-Impact (BACI) sampling design (Figure 1-13). Most of the studies collected data for one year (61%) and for one season (65%). Only 5% of the studies used long time-series that covered over 10 years.

([13]) It should be noted that the sum is higher than the total number of papers retained as some papers included multiple categories of data.

([14]) Experimental design is an approach to properly design a study to carry out research in a controlled and objective way, so that conclusions can be drawn regarding a hypothesis statement. In the case of our study most of the time the hypothesis was concerning the effects of MPAs on different response variable. To test such a hypothesis different experimental design can be used. Among these we can find Before-After Control-Impact (BACI) design, which monitors impact and control groups both before and after an impact has occurred (e.g., MPA implementation), and Control-Impact (CI), which lacks pre-impact data. For details, please refer to specific literature. Interesting references are Claudet and Guidetti, (2010) and Ahmadia et al., (2015)

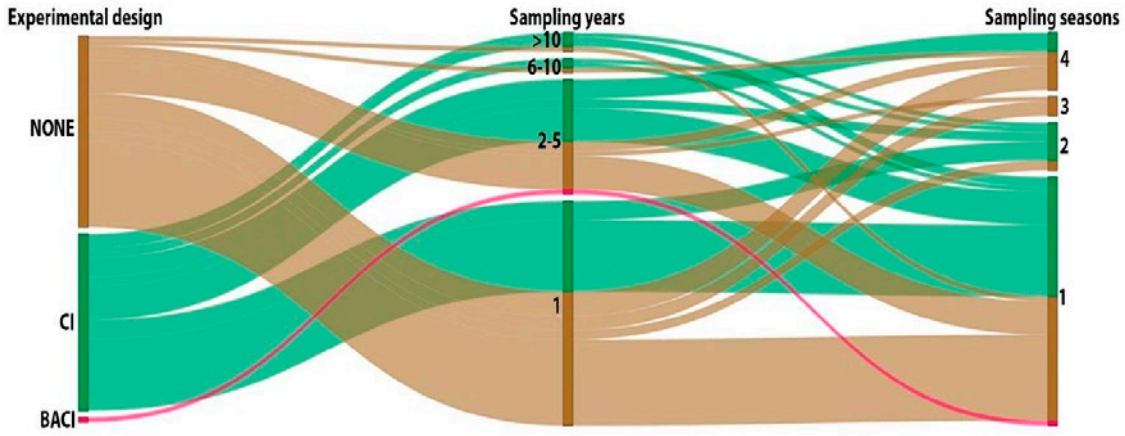

Figure 1-13 Sampling design used, and sampling years and seasons covered in studies with ecological baseline and monitoring data (N =78). CI: Control-Impact; BACI: Before-After- Control-Impact.

The majority of the studies exploring social, economic, and governance aspects of MPAs (70%; n=27) collected information through interviews/questionnaires with stakeholders, mostly fishers but also MPA managers. The most common variables explored by studies focusing on the socio-economic system of MPAs included: CPUE (45%), stakeholder engagement (30%), fisheries revenue/income (18%), human wellbeing (15%), and number of jobs (11%). Like the ecological studies, most socio-economic studies (70%) covered a one-year period. Only two studies (7%) included data that covered a period longer than 10 years.

When combining the list of MPAs that responded to our questionnaire, reporting they perform monitoring of some kind (n=81) with the list of MPAs from the literature review (n=91), and accounting for duplicates (i.e., MPAs that were identified via the literature review and responded to the questionnaire; n=33), we found that **16% of MPAs (139/878) performed monitoring activities**.

1.4 Discussion

1.4.1 Status of MPAs in the Mediterranean and Black Sea

While the MAPAMED, EEA and WDPA databases proved useful resources to compile the list of current MPAs in both regions, we uncovered many discrepancies between the databases (Annex 6.6), **and with the lists provided to us by the relevant officials from each Member State**. This reveals a lack of up-to-date information regarding the status of protection in the Mediterranean and Black Seas and a need for improvement. We also found these databases lack information about key aspects of MPAs, such as management and governance features (e.g., existence of and details of management plans, information on stakeholders' engagement, enforcement, uses allowed) and zoning (Lippi et al., 2024). These factors are pivotal to effectively assess the potential effectiveness of MPAs as ecological and fisheries management tools, going beyond the simple surface

level understanding (Claudet et al., 2020; Gurney et al., 2023). In particular, the lack of any zoning information on the European databases is a major drawback and one that we suggest is rectified as it is crucial to our understanding of the benefits that can be yielded from MPAs through different levels of protection whilst still meeting human needs. The administration of the questionnaire went some way in filling these knowledge gaps and making use of the MPA Guide (Grorud-Colvert et al., 2021) to classify MPAs stage of establishment and level of protection has provided an extra level of insight into the status for a sample of MPAs in the region. The MPA Guide has proven to be effective in this study and in other similar assessments. For example, by Sullivan-Stack et al., (2022) who applied it to US MPAs, combining it with scientific literature and individuals' direct expertise as experts. It was also applied globally to assess the 100 largest MPAs (Pike et al., 2024).

The lack of clarity in protection status is a barrier to the overall effectiveness of the system of MPAs. We established there is a lack of clarity in the current protection status of the region which is exacerbated by the overlap of MPA designations, which reduces the number of unique protected sites (we identified as being relevant to this study) from 949 to 878, when considering fully overlapping MPAs (i.e., >90% overlap). **In the Mediterranean Sea, about 28% of Natura 2000 sites are in areas already protected by nationally designated MPAs, while this proportion being virtually 100% in the Black Sea.** Overlaying MPA designations adds little to the conservation value unless the new designation has stricter regulations (Claudet et al., 2020). There are cases where, with the addition of a new designation, the surface area protected is increased, which can be beneficial (if well considered in terms of what this extension is protecting) and that the new designation provides stricter regulations. This is an important element to consider given the Global Biodiversity's Framework and the EU Biodiversity Strategy 30x30 target which calls for 30% of the earth's land and sea to be conserved through the establishment of protected areas and other area-based conservation measures (Gurney et al., 2023).

While 76% of all protected sites in the EU Mediterranean and Black Sea are Natura 2000 sites - illustrating the success of this initiative and the extensive network these sites have created throughout the region - **44% of the Natura 2000 sites overlap national designated types, questioning the added value the combination of these two designations is providing**. Particularly as marine Natura 2000 sites were found to be rarely well implemented, studied, or monitored with little in terms of management plans (see also Mazaris et al., (2017). The MPA Guide states that to accrue biodiversity conservation and other ecological and social benefits an MPA must have reached the stage "implemented" meaning there must be a management plan with clearly defined management activities and regulations for human uses in place and actively used. Management plans have been shown to be associated with successful outcomes in terms of small-scale fisheries management in Mediterranean MPAs (Di Franco et al., 2016). Here we highlighted that about two-thirds of the MPAs that responded to our questionnaire declared that they have a management plan, with more than one-fourth of these declaring that the management plan is not implemented. This leaves us with less than half of the MPAs, for which we received information for, having a management plan fully or at least partially implemented. This estimate, to the best of our knowledge, is the first specifically for the EU Mediterranean and Black Sea. This figure is in line with the one previously estimated for the Mediterranean Sea, where 53% of the investigated MPAs declared that they have a management plan that was either fully or partially

implemented (MedPAN and SPA/RAC, 2019). The same pattern was revealed in the WWF and Sky Oceans (2019) report which revealed that only 1.8% of the EU marine area is covered by MPAs with management plans, with 11 MS having failed to report any management plans for their MPAs. Their report found that 19 of the 23 marine EU MS have no or hardly any management plans in place for their MPAs (WWF and Sky Oceans, 2019).

In this context, a very large proportion of the MPAs that replied to this question declared that the management plan contained clearly stated conservation objectives, and about half of the MPAs declared the management plan to be adaptive. Clear objectives, goals and the use of adaptive management are acknowledged as important elements to ensure MPA effectiveness (Scianna et al., 2019, 2015; Zentner et al., 2023).

Based on the replies provided by the respondents, we revealed, in some cases, there to be a lack of clarity about what constitutes a management plan. A management plan should specify clear goals and identify the steps and resources needed to achieve those goals. It should be used to guide the day-to-day activities in the MPA and be reviewed and adjusted accordingly to ensure that the MPAs' conservation and other ecological and social objectives are met. Without a management plan we essentially have paper parks that are not operational and may fail to meet their potential to conserve and restore biodiversity and fish stocks.

Similarly to the global figure (Pike et al., 2024), **only a low number of the studied MPAs are implemented (i.e., a large number are only declared or designated)**. Regarding the analysis of the relationship between the stage of establishment and the level of protection; protection will only start to have positive biodiversity outcomes once an MPA is fully implemented. We only found 33% (53) of the MPAs in the Mediterranean and Black Sea that replied to our survey, to be at the "implemented" or "actively managed" stage indicating we are still below a sufficient level of protection in the region, as most of the MPAs fail to reach a stage of establishment that could deliver socio-ecological benefits. Overall, the stage of establishment was more advanced, and level of protection was higher for the national designated MPAs/zones than for the regional ones. The regional Natura 2000 sites were found to have a higher proportion of minimally protected and incompatible with the conservation of nature levels, for which none or very minimal benefits can be expected on the biodiversity conservation of the zone.

We found 75% of the MPAs assessed as fully protected were also assessed to be at least implemented, with most of them being at the actively managed stage of establishment, suggesting that this level of protection, not only being the one with the highest chances of success to deliver social-ecological outcome is the most likely to be implemented and managed. Actively managed MPAs/zones combined with a fully protected area are expected to have the most positive biodiversity outcomes (Sala et al., 2018). For example, an increase in abundance and biomass of organisms, a more balanced population age structure, an increase in species richness, and a better reproduction leading to a faster replenishment of the population and higher export of offspring (Di Lorenzo et al., 2020, 2016; Giakoumi et al., 2017; Harrison et al., 2012; Marshall et al., 2019). Level of protection can also influence endangered species that are likely to recover their populations (especially sessile, sedentary, or low mobility species) (Di Franco

et al., 2009; García-Rubies et al., 2013; Guidetti et al., 2014; Linares et al., 2012). The genetic diversity can also be enhanced by strong protection, allowing the species to be more resilient (Munguía-Vega et al., 2015). The effect of strong protection inside the MPA can also produce effects outside through the process of spillover and recruitment subsidy (i.e., export of eggs and larvae) toward external unprotected areas (Di Franco et al., 2012; Di Lorenzo et al., 2020, 2016; Harrison et al., 2012). This was confirmed by the findings of our study with some fully protected MPAs reporting evidence of spillover and of the 8 MPAs reporting an increase in the CPUE, 6 were fully protected areas, confirming the need for MPAs to reach a certain level of protection and stage of implementation before benefits are accrued. Protection of a zone/MPA can also have positive outcomes on water quality (State of Queensland, 2018) as well as climate resilience/adaptation with a better carbon sequestration, limiting local acidification, and increasing productivity (Duffy et al., 2016; Gaines et al., 2018; Jacquemont et al., 2022). The correlation between fully protected and actively managed MPAs tends to be even stronger for the national designated MPAs where 87% of the fully protected MPAs/zones were also found to be actively managed.

Effective protection can be mitigated by multiple drivers. Poorly designed, managed, and funded MPAs, with low compliance and low staff capacity, will deliver limited or even no benefits (Gill et al., 2017; Scianna et al., 2019). However, a highly protected area could produce better outcomes than those of a fully protected area, if it has stronger enabling conditions, as also suggested by a previous study comparing fish biomass in MPAs with different protection levels and enforcement (Sala et al., 2012). The results presented here that combine the level of protection and level of enforcement show that, generally, the highest levels of protection (fully and highly) are associated with a medium to high level of enforcement. The highest levels of protection are zones where the rules and restrictions are the strictest and so require strong enforcement to ensure they are respected and legitimate. **It is encouraging to see from our results that there is a positive relationship between level of protection and level of enforcement**. In comparison, for the lowest levels of protection, the enforcement was reported as lower. MPAs/zones with a low level of protection tend to have a lower stage of establishment with poor management capacity and few to no rules/regulations in place to protect biodiversity. We found this to be most relevant for Natura 2000 sites that generally have a single zone that requires stricter regulations and more active management. This pattern suggests that the large proportion of MPAs with low levels of protection are probably providing a limited contribution to biodiversity conservation, fish stocks and support for human well-being (as shown in Sala et al., 2012)). On the bright side, this suggests a potential for improvement of the current conditions.

Perceptions of MPA levels of protection can differ from objective measures. It is interesting to note that respondents' self-assessment on the stage of establishment and level of protection showed some differences to the results obtained through the process we applied. For example, many respondents overestimated the level of protection, whereas the combination of answers regarding activities permitted revealed activities that are less compatible or impactful on biodiversity. We acknowledge that we miss the nuanced information regarding the intensity of the activities permitted (with this information generally not available for MPAs except in very few cases, see Zupan et al., (2018) and although we applied both conservative and optimistic scenarios it could be that either we or the respondents' overestimate or underestimate the level of compatibility of some activities. A note of caution should

be taken when considering the differences between respondents' self-assessments of their MPAs status and the Consortia's assessment which made use of a combination of other answers revealed. In both cases, the responses only provide a glimpse of how the MPA is organised and functioning and are also open to the respondents' interpretation of those questions, meaning that although it is hoped the second step gave a more accurate picture, we used data provided by the same individuals. No respondents for example, self-assessed their MPA/zone to be incompatible with nature conservation, however we assigned zones to this category because many high impact fishing gears (e.g., beam trawling, otter twin trawling), which are known to be detrimental to conservation efforts are allowed within certain MPAs, as also revealed in a previous study (Dureuil et al., 2018). A finding that highlights the need to phase out these fishing activities from MPAs, as stated in the EU marine action plan (European Commission, 2023). The need to remove extractive activities that contradict the conservation objectives of MPAs should also be considered to meet the 10% target of strict protection.

Not surprisingly, **the MPAs that were reported as actively managed (with management plans in place) were also reported effective at delivering ecological outcomes**. These findings highlight the great potential of MPAs to support fisheries management, help protect and restore biodiversity and fish stocks when human activities are effectively and consistently limited and are in line with what has been reported in the scientific literature (Di Franco et al., 2016; Edgar et al., 2014; Giakoumi et al., 2017; Gill et al., 2017). These findings emphasise the importance of an active management plan. When effectively managed and implemented MPAs can deliver an array of ecological and socio-economic benefits that support fisheries (Di Franco et al., 2016). It is clear from our analysis that, despite a large number of MPAs having been implemented in the study area and despite a proportion of these MPAs showing features potentially enabling them to deliver socio-ecological benefits, there is still a need to improve the protection in MPAs of the Mediterranean and Black Sea MPAs. It is positive to observe that there are several MPAs reporting positive biodiversity and fishery outcomes, that we can use as an example to learn from and strive towards (e.g., Reserva Marina Cabo de Palos - Islas Hormigas (Spain), the Cote Bleue Marine Park (France) and Torre Guaceto Marine Protected Area (Italy)).

It is worth mentioning that data collected through questionnaires can have some limitations, particularly those administered online, as they rely on the goodwill of those contacted to complete the questionnaire in the first place and secondly that they fully understand the questions and so answer accurately (Bell et al., 2022). In addition, respondents failed to complete all the questions leaving gaps in our understanding and interpretation of the data. The number of responses is however, in line with exercises carried out in other areas (e.g., Batista and Cabral, (2016). In addition, the number of MPAs for which information was gathered is particularly high for the study area considering that a previous assessment published in 2019 by the non-governmental organisation MedPAN (network of Marine Protected Area managers in the Mediterranean) identified 180 management bodies in the EU Mediterranean Sea and collected information for 59 MPAs (MedPAN and SPA/RAC, 2019).

1.4.2 Baseline and monitoring activities

Overall, we observed a scarcity of baseline and monitoring data for most MPAs, including nationally designated sites and especially for Natura 2000 sites in all Member States. This scarcity of data confirms what has been reported in previous efforts to compile data about small-scale fisheries management in Mediterranean MPAs (Di Franco et al., 2016). Based on the combined literature review and the questionnaire, we found **baseline and/or monitoring data for only 16% of the 878 investigated MPAs** (including Natura 2000 sites). Italy was the Member State that presented the largest amount of available data, whereas no data were found in the scientific and grey literature about fisheries aspects for Maltese and Bulgarian MPAs. However, 18 Bulgarian MPAs stated that they do some sort of monitoring but did not indicate specific literature to understand how the monitoring activities are conducted.

Both the literature review and questionnaires demonstrated that **most baseline and monitoring data concern ecological and biological variables, with most of the monitoring efforts focusing on bony fish**. Fewer studies included data related to social, economic, and governance aspects of fisheries within MPAs. This finding is consistent with evidence presented in global studies (e.g., Giakoumi et al., (2018). **We also found that in about half of the MPAs sampling is not based on a robust sampling design, suggesting that the gap previously shown in Claudet and Guidetti (2010) is not yet fully filled**. Most data come from snapshot studies that cover only one year and fail to consider seasonal variations. This finding is perhaps reflective of the tendency for MPAs to rely on short-term projects and project funding to perform monitoring activities which is then dictated by the available funding and/or objective of the research topic. The latter does not pertain to a long-term funding strategy supporting monitoring requirements that would be much more beneficial to MPAs and its management (Bohorquez et al., 2019).

Less than 40% of the marine Natura 2000, both SCIs and SACs, sites declared to have management plans, a figure that is in-line with what has been previously recorded at the EU scale (<40%) (Mazaris et al., 2017). Therefore, a relevant percentage of MPAs under such designations are unlikely to be achieving positive ecological outcomes or to have monitoring programs. The large number of MPA designations that exist only on paper may in fact distort the percentage of implemented MPAs with active regulations that perform monitoring activities. In fact, for the MPAs that responded to the questionnaire 65% of the MPAs are performing some sort of monitoring. We can therefore speculate that the results of the questionnaire reflect the situation of the MPAs that are being more actively managed, including a proportion of effectively managed MPAs. This number differs substantially from the overall picture emerging from the literature review and findings from the process to characterise the MPAs in the Mediterranean and Black Sea. This pattern would stress once again, the importance of management capacities in the context of MPAs (Gill et al., 2017).

Despite our best efforts to produce the most comprehensive literature review possible (with multiple searches, covering both scientific and grey literature, also in local languages), we acknowledge that the literature review we performed may have some gaps, especially when it comes to grey literature as not all information may be made available online. Often, information collected in monitoring surveys is not published or shared but stays "in-house" with the managers and local authorities. In addition,

the information collected by different authorities/organisations (e.g., regional and national authorities) for the same MPAs may not be compiled into a common database. These gaps in the literature review have been partially covered with the questionnaires addressed to MPA authorities and managers.

1.5 Lessons learnt and recommendations

Our study has characterised the MPAs in the EU Mediterranean and Black Sea and represents a reliable picture of their protection status and the status of monitoring activities. It made use of data collation through existing databases, various verification processes, the assessment of scientific and grey literature available online and the administration of questionnaires to MPA managers and MPA authorities. Our investigation highlights that, despite the significant effort made by the EU and MS in gazetting many MPAs, we are lagging in our attempts to meet conservation targets and that the level of protection falls short of what is needed to guarantee conservation success. In this context, a significant proportion of the existing MPAs do not meet the conditions (in terms of stage of establishment, protection level, enforcement, presence of a management plan etc.) needed to deliver significant socio-ecological benefits.

The following lessons learnt, and recommendations could contribute to strengthening the role of MPAs as conservation and fisheries management tools and improve the capacity of MPAs to design and implement effective monitoring programs. In relation to the findings within this chapter that attempted to characterise MPAs in the region, it would be worthwhile to:

- **develop a new database and/or further strengthen existing ones to include all the relevant information concerning governance, management, and georeferenced zoning (including stage of establishment and level of protection)**. These databases could be used to categorise the MPAs in the Mediterranean and Black Sea according to various factors and could provide a site to house monitoring data with standardised protocols ([15]).
- **ensure that all MPAs are actively managed**. Many MPA managers are still considering legal acts to be a management plan. However, MPAs should have a 'good' management plan i.e., a formal planning tool with which MPA managers identify missions, set quantitative goals, identify the exact steps and the resources needed to achieve those goals, and continually evaluate how well the process is working.
- **develop fisheries management measures in all MPAs according to clearly defined conservation objectives and based on the best available scientific advice** (as stated in the EU Biodiversity Strategy). Currently, some fishing activities that have an impact on seabed habitats remain allowed in MPAs whose objectives include seabed protection.

([15]) Some databases, such as MAPAMED, EEA and WDPA, provide the foundations for this, however the current information included is limited and further efforts are required to increase the usefulness of these databases.

- **strengthen the level of MPAs' protection.** For MPAs that are not fully or highly protected **to better/more strictly regulate fishing and other activities (e.g., trawling, dredging and dumping, mining) that are not compatible with their conservation objectives.** Mobile bottom contacting gears should be gradually phased out to decrease damage on the seabed, especially in the most sensitive marine areas, as indicated in the EU marine action plan (European Commission, 2023).
- **ensure that monitoring and assessment is performed regularly in each MPA, that MPAs are provided with needed capacities** (human and financial). An adequate share of the MPA annual budget needs to be dedicated to the implementation of monitoring activities. MS, national agencies and MPA managers could, explore diverse sources of private and public funding including blue carbon and biodiversity offsets (see Bohorquez et al., (2022) to support long-term monitoring activities.
- **ensure the use of standardised metrics** across MPAs and MS, to ensure inter-operable assessments, effectiveness tracking, and/or integrated regional assessments (Claudet and Guidetti, 2010; Grorud-Colvert et al., 2021).
- **foster long-term collaboration between MPA management authorities and researchers/research institutes**, to gather comprehensive, integrated long-term data.
- **engage fishers and other stakeholders in collaborative action research, knowledge co-production and co-management** to build trust, foster stewardship and reinforce the acceptance of MPAs by the local community.
- **collaborate with other MPAs through established networks** such as MedPAN or multilateral agreements (e.g., OSPAR ([16]), COI ([17]), Nairobi Convention[18]) to increase capacity building (e.g. MedPAN regular training programme ([19]) on financing, on cetacean and turtle conservation, and monitoring habitat and species in coastal waters), agree on common metrics for assessing effectiveness (e.g., adaptation of the same sampling methods and data collection of Catch per Unit Effort as developed by researchers in a EU Interreg project ([20]) and then applied in several Italian MPAs such as Bergeggi MPA, Capo Milazzo MPA, Cinque Terre MPA, Isola di Ustica MPA, Isole Pelagie MPA, Portofino AMP, and monitor common threats to marine biodiversity which are transboundary (e.g., plastic pollution (Hatzonikolakis et al., 2022)).
- **use new technologies**, e.g., high-resolution satellite imagery and unmanned aerial and underwater vehicles, that can increase the monitoring capacity of MPAs with the assistance of researchers who have relevant skills (López and

([16]) https://www.ospar.org/convention

([17]) https://www.commissionoceanindien.org

([18]) https://www.nairobiconvention.org

([19]) https://medpan.org/en/formations#

([20]) https://fishmpablue-2.interreg-med.eu/

Mulero-Pázmány, 2019) **and collect data about human pressures** in MPAs that are generally missing (e.g., estimating fishing effort).

- **use artificial intelligence (AI)** such as computer vision and deep learning algorithms that can be employed to automatically identify marine life in images, facilitating more efficient assessment. The use of AI can contribute to the collection and processing of biological, oceanographic, and socioeconomic data but should always be done in consultation with scientists and stakeholders to ensure privacy and property rights (Şeyma, 2023).

The combination of the proposed recommendations, that entail the concomitant effort of multiple stakeholders (including local, national and European policy makers, MPA managers, researchers, fishers, etc.,) could support the MPA as an effective tool to deliver benefits achieving both conservation and fisheries goals.

2. FISHING ACTIVITIES WITHIN AND SURROUNDING MPAS

Key highlights

- An extensive literature review revealed the large knowledge gap when it comes to fishing activities in relation to MPAs in the Mediterranean and Black Sea. The current work aspired to fill the existing gap.
- Fishing effort inside the MPAs was generally lower than outside the MPAs, with a ratio of around 1:3 to 1:4, according to the data source.
- Fishing intensity (fishing effort per surface area) depends largely on MPA designation type; higher activity was observed inside Natura 2000 sites of community importance ('Regional-SCI'), while 'National' designated MPAs hosted low fishing activity.
- A high effort from towed gears was observed in the MPAs of the 'Regional-SCI'. Towed gears were the ones making significant catches inside the MPAs (~20% of total catches across all designation types).
- Based on automatic identification system (AIS) data, a non-negligible effort by towed gears in direct contact with the seafloor was potentially exerted in MPAs over sensitive seabed habitats with biogenic reefs. However, the accuracy of habitat mapping and the numerous derogations in place at MS level, are not allowing for a full assessment.
- Investigation of certain iconic and sensitive species (groupers, lobsters, chondrichthyans) suggested that fishery dependent abundance (landings per unit of effort) was higher inside MPAs.

2.1 Introduction and objective

Marine protected areas (MPAs) are generally acknowledged as an effective tool for biodiversity conservation, while until relatively recently, their potential role as fisheries management tools has been generally neglected. (Hilborn, 2016; Kerwath et al., 2013; Weigel et al., 2014). The European Commission, through a comprehensive set of policy tools such as the Common Fisheries Policy (CFP), the Habitats and Birds Directives, the Maritime Spatial Planning Directive (MSPD) and the Marine Strategy Framework Directive (MSFD) acknowledged the potential role of protected areas in reconciling biodiversity conservation and the sustainable use of marine resources.

MPAs can represent a key component in the fisheries management toolbox to achieve ecological and social sustainability of marine ecosystems (Belharet et al., 2020; Carvalho et al., 2019; Sève et al., 2023; Weigel et al., 2014). However, MPA implementation induces potential displacement of fishing activities from their traditional fishing grounds with a potential set of related implications (e.g., variations in selection of fishing grounds, fishing methods, target species, costs and benefits) (Horta e Costa et al., 2013). As a result, there is a need to assess the real potential of MPAs for both biodiversity conservation and fisheries objectives in the light of the increasing calls for the establishment of MPAs, supported by international strategies and agreements such as the EU Biodiversity Strategy with key commitments by 2030

to legally protect and effectively manage at least 30% of surface area of the EU's marine waters, with at least 10% of that area under strict protection.

The objective for this part of the study was to:

- provide a detailed account of all fishing activities, in the different MPAs and in the surrounding areas beyond their borders in the EU Mediterranean and Black Sea waters;
- associate fishing activities with the MPA designation status, as well as the habitat type over which fishing is potentially exerted.

2.2 What we did

To meet the objectives, we:

- performed a comprehensive **scientific literature review** to gather the current available knowledge on fishing activities within MPAs and surrounding areas;
- collated **data on fishing activities** from various data sources, including from the EU Multiannual Programme (EU MAP) of the Data Collection Framework, the EU Control Regulation (EC 1224/2009; COM 404/2011) and automatic identification system (AIS) data, to investigate the spatial fishing footprint and associated catches;
- collated available **data on seabed characteristics** to acquire habitat categorization over which fishing fleets operate and assess the most frequently impacted habitats.

2.2.1 Scientific literature review

To be both comprehensive and to reduce bias, a systematic approach with careful consideration of the objectives, search terms, inclusion/exclusion criteria, the method for data/knowledge extraction and ultimately how these data and knowledge would be used, was undertaken (Shamseer et al., 2015). The aim of the systematic scientific literature review (see Box 2.1 for details) was to identify studies relevant to fishing within and surrounding MPAs in the EU Mediterranean and Black Sea. The review aspired to assess MPA performance (e.g., are fishery restrictions within MPAs implemented?) and potential displacement of fishing activity over time. However, the scarcity of available studies restricted our ability to investigate the proportion of studies with potential effects of fishing, and the relationship of these effects on a number of indicators with fishery regulations within MPAs.

Box 2-5 Steps taken to perform the literature review on fishing activities

The searches for the literature review were conducted in the widely used database Web of Science (WoS). The following search terms were used and organised into three categories (Country/location, MPA synonyms, fishing terms), all limited to the marine environment:

- Country/location = *all Mediterranean and Black Sea EU countries*
- MPA synonyms = *'MPA' OR 'Protected Area*' OR 'NTZ*' OR 'No Take Zone*' OR 'No-Take-Zone*' OR 'NATURA' OR 'NATURA2000' OR 'Marine reserve*' OR 'refug*e' OR 'Ramsar' OR 'National Park*' OR 'sanctuary' OR 'sanctuaries'*
- Fishing terms = *'exploitation' OR 'fishery' OR 'fisheries' OR 'fishing' OR 'net*' OR 'longline*' OR 'trawler*' OR 'trawling' OR 'Purse seines' OR 'Beach seines' OR 'Boat seines' OR 'Bottom trawls' OR 'Beam trawls' OR 'Towed dredges' OR 'Hand dredges' OR 'Mechanized dredges' OR 'Portable lift nets' OR 'Boat-operated lift nets' OR 'Shore-operated stationary lift nets' OR 'Cast nets' OR 'Covered pots/lantern nets' OR 'Boat-operated falling nets' OR 'Set gillnets' OR 'Drift gillnets' OR 'Encircling gillnets' OR 'Fixed gillnets' OR 'Trammel nets' OR 'pound nets' OR 'Pots' OR 'fyke nets' OR 'stow nets' OR 'Barriers, fences and weirs' OR 'Aerial traps' OR 'handlings and hand-operated pole-and-lines' OR 'Mechanized lines and pole-and-lines' OR 'Longlines' OR 'Set longlines' OR 'Drifting longlines' OR 'Vertical lines' OR 'Trolling lines' OR 'Harpoons' OR 'Electric fishing' OR 'pushnet' OR 'scoopnet' OR 'Drive-in nets' OR 'Diving'*

After compiling the results of the search, the following steps were taken:

- Screening process solely on the abstract
- Data extraction process based on full-text
- Review process realised by two independent reviewers per study

A total of 1626 articles were generated from the database Web of Science (WoS). The articles were screened using the Abstract text by two independent reviewers. Out of the 1626 articles resulting from the search queries, the screening process identified 96 relevant articles which were retained for the data extraction phase. In the extraction phase, readers were requested to go through the full text of the article, after which a further 64 articles were excluded, mainly due to lack of any fishing information. A **total of 32 articles** were retained and data was extracted.

2.2.2 Collation of fisheries data

2.2.2.1 List of Mediterranean and Black Sea MPAs

Numerous (43) designation types were identified at national level (Annex 6.1). The vast majority of MPAs ([21]) were established after 2010, most of them in the Natura 2000 context. The few long-established MPAs belong largely to the 'National' designation type. Assessing displacement or reallocation of fishing activities would require having relevant fisheries datasets prior and after 2010, which is not the case (see following sections on available fisheries data). The 43 designation types were narrowed down to three designation types subdivided into five broad designation categories (see Annex 6.13). The designation types were '**Regional-SCI**' and '**Regional-SAC**' for the Natura 2000 sites protected under the 'Sites of Community Importance (Habitats Directive)' and 'Special Areas of Conservation (Habitats Directive)' respectively (Box 2.2), and the '**National**' for all other nationally assigned designations. The final classification adopted included five broad designation categories (National, Regional-SCI, Regional-SAC, National-Regional-SCI, National-Regional-SAC), as numerous protected sites have multiple overlapping designations (see Annex 6.7).

To account for overlapping MPAs and for the purposes of this chapter, an MPA was defined as a unique geographical area assigned the designations of all WDPA_IDs that overlap its area by ≥90% (Annex 6.7). This resulted in 878 unique geographical areas (or unique sites being under some protection status) from the 949 MPAs. After removing six areas from Cyprus and two from France that had no WDPA_ID assigned to them (and for which no data could be retrieved) we were left with a total of 870 geographical areas for analysis. Hereafter, we will refer to these unique geographical areas as MPAs. The resulting MPAs fall under the five broad designation categories (mentioned above). The final set of five major broad designation categories and the numbers of MPAs by Member State are shown in Table 2-1. The MPAs range in area from 0.0013 km^2 to 46,355 km^2 with the majority (53%) having areas <10km^2. The area distribution is constant across different designations (Figure 2-1). The relation among Member State, area, and designation of the set of 870 MPAs is presented in Figure 2-1.

([21]) The MPAs considered in this chapter are the ones identified in Chapter 1 (see Section 1.2.1). The final list containing 949 MPAs and 878 when taking into account overlap ≥90%.

Table 2-5 MPAs in the EU Mediterranean and Black Sea, considered in the present section of the study, grouped by the five broad designation categories.

Member State	National	National_Regional-SAC	National_Regional-SCI	Regional-SAC	Regional-SCI	Total
BGR		1	1	2	14	**18**
CYP	2			2	5	**9**
ESP	18	32	9	21	45	**125**
FRA	13	20	2	28	3	**66**
GRC	14	26		83	21	**144**
HRV	7	3	13		202	**225**
ITA	25	22	6	173	24	**250**
MLT	6	6		5		**17**
ROM			1		9	**10**
SVN	3	2		1		**6**
Total	**88**	**112**	**32**	**315**	**323**	**870**

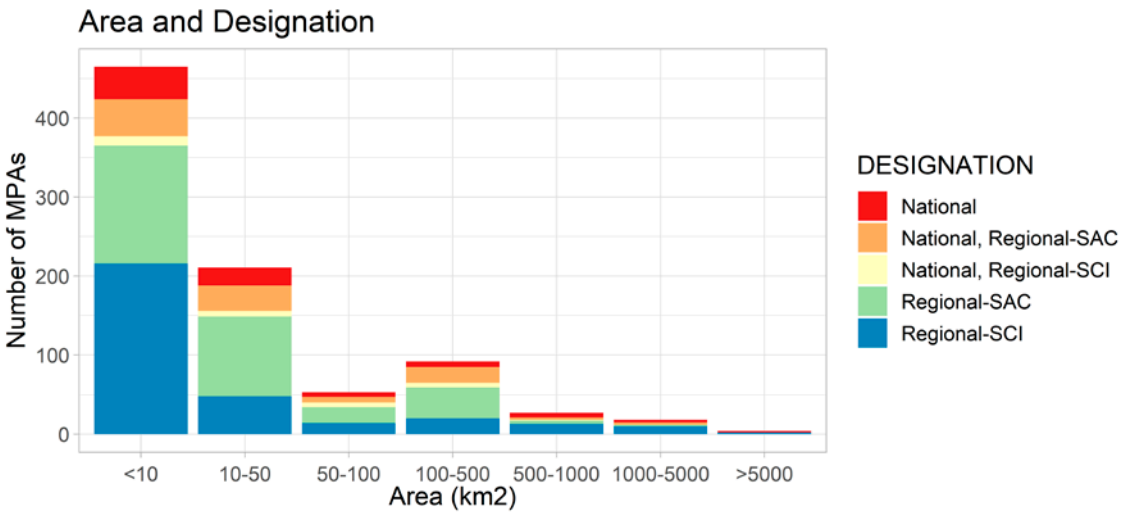

Figure 2-14 Distribution of the surface area of MPAs in the EU Mediterranean and Black Seas per broad designation category.

Box 2-6 Definitions of Natura 2000 SCI and SAC sites

SCI (Site of Community Importance): a site which, in the biogeographical region or regions to which it belongs, contributes significantly to the maintenance or restoration at a favourable conservation status of a natural habitat type in Annex I of Habitats Directive (92/43/EEC) or of a species in Annex II and may also contribute significantly to the coherence of Natura 2000 referred to in Article 3, and/or contributes significantly to the maintenance of biological diversity within the biogeographic region or regions concerned.

SAC (Special Area of Conservation): a site of Community importance designated by the Member States in the framework of Habitats Directive (92/43/EEC), through a statutory, administrative and/or contractual act where the necessary conservation measures are applied for the maintenance or restoration, at a favourable conservation status, of the natural habitats and/or the populations of the species for which the site is designated.

2.2.2.2 Fishery data from the EU Multiannual Programme of the Data Collection Framework

We explored data collected and/or managed and shared under the EU multiannual programme (EU MAP) ([22]) for fisheries data collection. For these data, in collaboration with DG MARE, an official data request was sent out to the national authorities responsible for data collection in the fisheries sector of each Member State of the Mediterranean and Black Sea (Box 2.3).

Box 2-7 EU-MAP ([23]) data requested from Member State

The request focused on assembling data for each MPA and adjacent unprotected areas aggregated by fishing gear and year (2003-2022) concerning:

- fishing effort in days at sea;
- number of fishing vessels;
- landings in kg; and
- discards in kg at species level, separately for the area inside the MPA and the area that covers a radius of 5 km from MPAs' borders (hereinafter called "buffer zone" without any specific reference to the level of protection).

The request was accompanied with R scripts and examples to assist data extraction and analysis of data.

The final number of MPAs used in the analyses was **855** (instead of 870), as no relevant data was available for Slovenia and Cyprus. Furthermore, data availability

([22]) Commission Delegated Decision (EU) 2019/910 of 13 March 2019 establishing the multiannual Union programme for the collection and management of biological, environmental, technical and socioeconomic data in the fisheries and aquaculture sectors [here].

([23]) Part of these data are collected under the Control Regulation and shared under the rules of the EU MAP.

for Romania covered only one year and one fishing gear; any results on this part of the dataset should be considered with caution.

The details of the planning and implementation of sampling activities of each Member State can be traced in the EU Member States Work Plans and Annual Reports ([24]). As a rule, in response to the data request sent, only data concerning vessels above 15m in length registered in the electronic reporting system (ERS) ([25]) were submitted by MS, as these were the most readily available data stored in all MS fisheries databases. The small-scale fisheries fleet is largely under-represented in this dataset. However, Greece, Croatia and Italy submitted data that also covered the small-scale fisheries fleet.

2.2.2.3 Automatic identification system data

Automatic identification system (AIS) allows for real time geo-tracking and identification of equipped vessels. AIS was developed with the intention to avoid collisions at sea and did not intend to support fisheries monitoring. However, AIS data are openly available and cover all marine regions of the Mediterranean and Black Sea (regardless of vessel flag, national waters jurisdiction or economic exclusive zones), thus allowing us to assess the fishing footprint in all MPAs of the Mediterranean and Black Sea. One limitation, as is the case for vessel monitoring system (VMS) data, is that AIS trackers are compulsory only for vessels over 15m of length (EU Control Regulation 1224/2009 Art. 10.2.a). AIS data were downloaded from the Global Fishing Watch web portal (https://globalfishingwatch.org). Data was available for the period 2012-2021. Fishing effort was expressed in hours of fishing and calculated by applying a fishing detection algorithm to determine "apparent fishing activity" based on changes in vessel speed and direction. This estimate may deviate from the true fishing activity.

2.2.3 Collation of seabed habitat data

To acquire habitat categorization over which fishing fleets operate and assess the most frequently impacted habitats by demersal fisheries, MSFD benthic broad habitat types (BBHT) were downloaded from EMODnet ([26]) covering the whole Mediterranean and Black Sea region. Habitat description using the BBHT is defined in Commission Decision 2017/848. EMODnet habitat type dataset is a coarse estimation (250m resolution in coastal areas - much coarser in deeper strata) based on extrapolation of samples from scientific surveys and as such, the true habitat types are unknown, until ground-truthing surveys confirm its accuracy.

2.3 Results

([24]) https://dcf.ec.europa.eu/wps-and-ars_en

([25]) https://oceans-and-fisheries.ec.europa.eu/fisheries/rules/enforcing-rules/inspections-monitoring-and-surveillance_en

([26]) https://emodnet.ec.europa.eu/en/seabed-habitats

To assess if, how and to what extent fishing activities vary within MPAs and their surrounding areas, we focused on analysing datasets by major groups: ***designation type, fishing gear, species assemblage, seabed habitat type***. In this way, we managed to have a broader view on a series of MPAs bearing similar characteristics/features and hypothesise on how and why these features shaped fishing activities. The alternative, to focus on the individual MPAs, does not allow us to draw general patterns but allows us to reason at local level, which was not the goal of this study. However, detailed information at individual MPA level can be hosted through the Regional Database for the Mediterranean and Black Seas (Med & BS RDB-FIS) portal ([27]).

2.3.1 Scientific literature review

The 32 articles contained fishing information about 38 unique case studies ([28]) (i.e., which refer to a given MPA investigated by a particular article), with 3 of the articles presenting information for more than one MPA. The 38 case studies corresponded to 29 distinct MPAs in eight EU Mediterranean Member States (mostly in France, Italy and Spain), with five MPAs investigated in more than one article. One review article referred to 142 MPAs in the Mediterranean Sea, however a lack of fishing information was identified at individual MPA level. Approximately 150 marine species or taxa were reported in the articles. The most frequently appearing species were the white seabream (*Diplodus sargus*), gilt-head bream (*Sparus aurata*), striped red mullet (*Mullus surmuletus*) and salema (S*arpa salpa*). However, only 17 out of 38 case studies contained information on the potential effects of fishing activities.

The impact of fishing (categorised as 'no significant', 'mild' and 'very high') linked to several indicators (e.g., biomass, density, occurrence, catch) was extracted for each study. Figure 2-2 shows the link between the impact of fishing per indicator (impact metric) and the fishery regulation per case study. There seems to be a segregation among MPAs with 'Spatial closures with protection zones' and 'Combined' regulations, with the former being linked to 'Mild' or 'No significant impact', while the latter mostly linked to 'Very high' impact. In particular, 'size', 'abundance' and 'biomass', were assessed as highly impacted by fishing in all or in most cases, while 'occurrence', 'growth', 'CPUE' and 'catch' were mostly 'mildly' impacted.

([27]) https://medbsrdb.eu/

([28]) In this Chapter case studies refer to a given MPA investigated by a particular article. Some articles investigated more than one MPA and in some instances the same MPA was investigated in different articles. The term case study used here is not to be confused with the five MPA case studies investigated in Chapter 3.

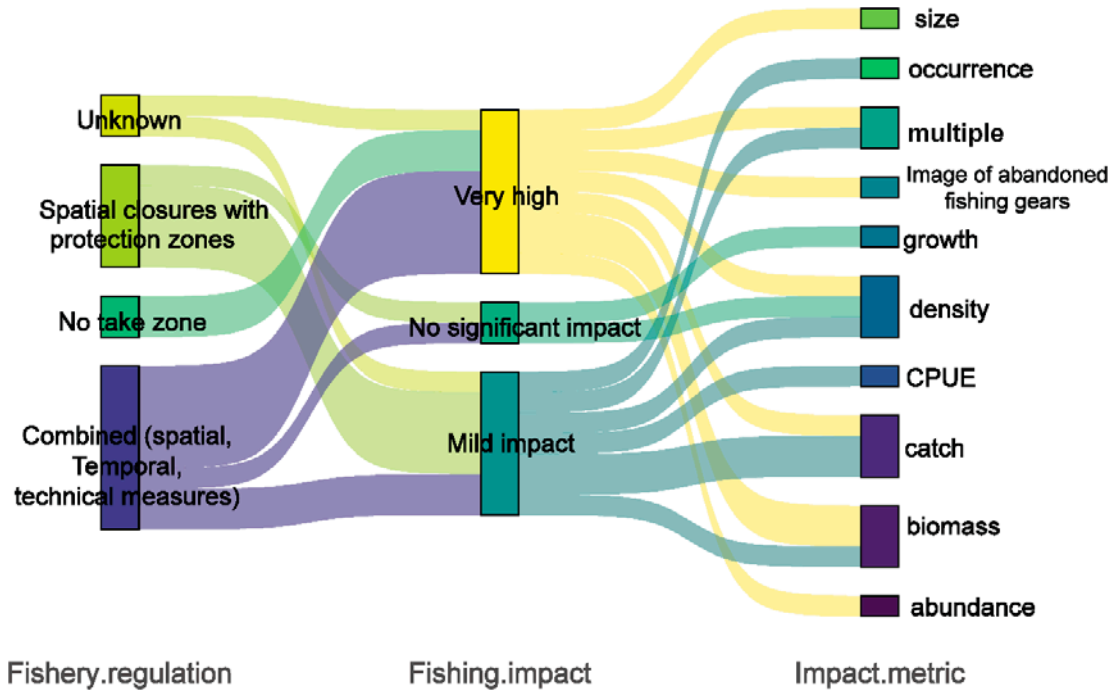

Figure 2-15 Fishery regulation, fishing impact and impact metric relation across case studies.

The results of the **systematic literature review** should be viewed with caution given:

- the **small number of case studies** (17 out of 38) providing information on the potential effects of fishing activities. In the 17 case studies, the impact of fishing refers to each of ten different indicators (impact metrics), hence very **few observations per indicator** are available.
- the complete **lack of data on fishing footprint**.

Nevertheless, some studies provide interesting information regarding catches within MPAs and their surrounding areas, while some others reason on the effectiveness of their regulatory schemes (see Annex 6.14).

2.3.2 Fishery data

Fishing data were reported in 603 out of the 855 MPAs considered containing almost 200,000 fishing days at sea with more than 100,000 tons of catches, and 1650 species.

2.3.2.1 Fishing effort

As a general pattern, **fishing effort inside the MPAs was lower than outside the MPAs** (5km buffer zone) **in the Mediterranean and Black Sea, with a ratio of approximately 1:4**. The total surfaces covered by each area (inside/outside) were

comparable; roughly 141,000 km^2 outside and 136,000 km^2 inside. To acquire compatible results, we calculated the fishing effort per surface area, expressed in Days at sea per km^2 – hereafter called *Fishing intensity.*

'Regional-SCI' designation group of MPAs stood out, as high fishing intensity was observed inside these MPAs, almost comparable to the one outside the MPAs (Figure 2-3). This designation type is the most common, comprising more than 40% of the MPAs under investigation.

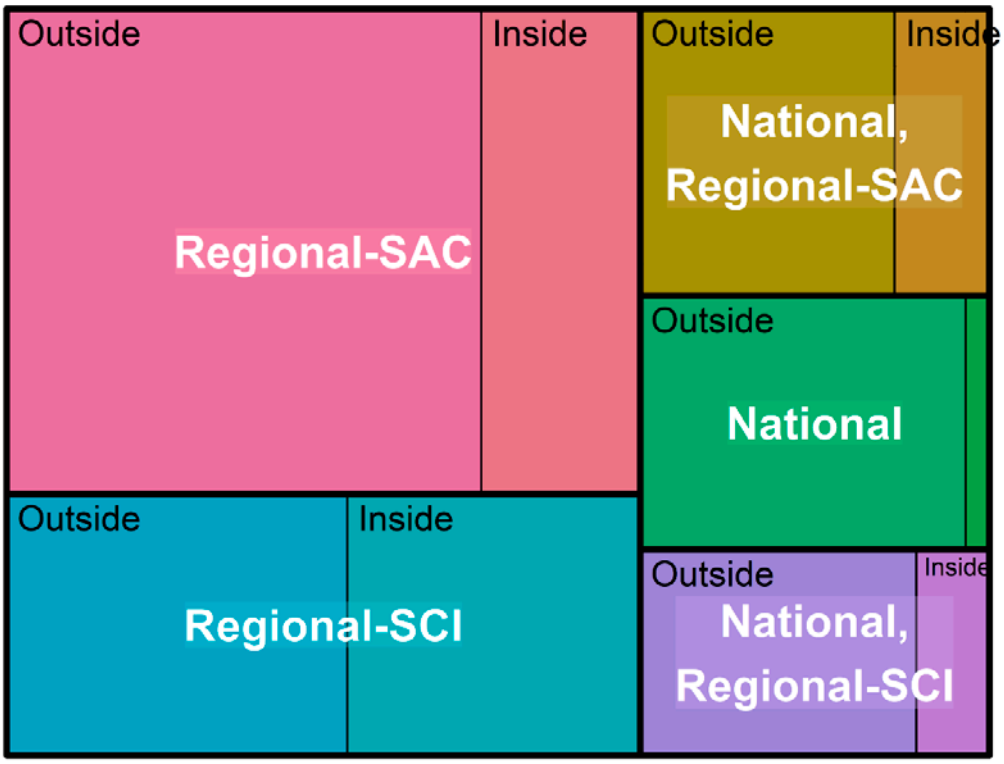

Figure 2-16 Treemap representation of fishing intensity by broad designation type, inside and outside of the MPAs of the Mediterranean and Black Sea (in days at sea per km^2).

Forty-three different fishing gears ([29]) were reported inside and outside the MPAs studied; 10 of them accounted for 90% of the fishing effort, otter bottom trawling (OTB) being the most active. Among the towed gears having a direct impact on the seafloor (OTB, HMD, PTB, TBB, TB, DRB, TX) - bottom trawling (OTB) accounted for 89.9% of the fishing effort (Figure 2-4). For the boat seines (SV/SB) and traps (FPN) more effort was exerted inside the MPAs than outside (Figure 2-5.- see Annex 6.15). This was possibly due to the specific operation of the aforementioned gears, as they are cast in very shallow waters close to the coast where most MPAs exist. A high effort from towed gears in contact with the seafloor was observed within the MPAs belonging to the 'Regional-SCI' designation type; however, this effort was always lower inside the MPA (see Annex 6.16).

([29]) FAO gear type (letters in brackets) is the International Standard Statistical Classification of Fishing Gear (ISSCFG) available here: https://www.fao.org/3/bt986e/bt986e.pdf also see (https://fish-commercial-names.ec.europa.eu/fish-names/fishing-gears_en)

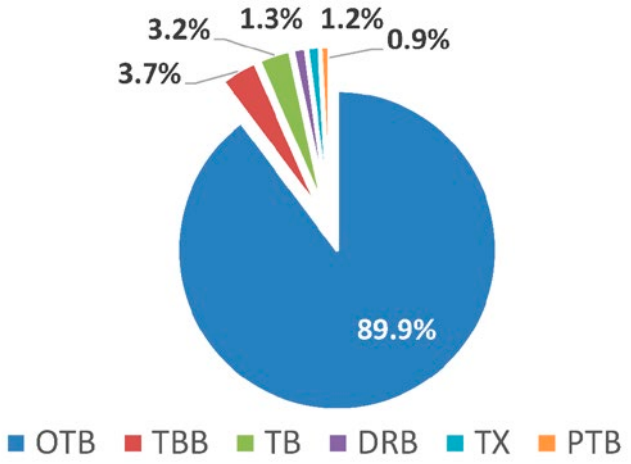

Figure 2-17 Fishing effort share among the towed gears with direct contact to the seabed for the Mediterranean and Black Sea MPAs

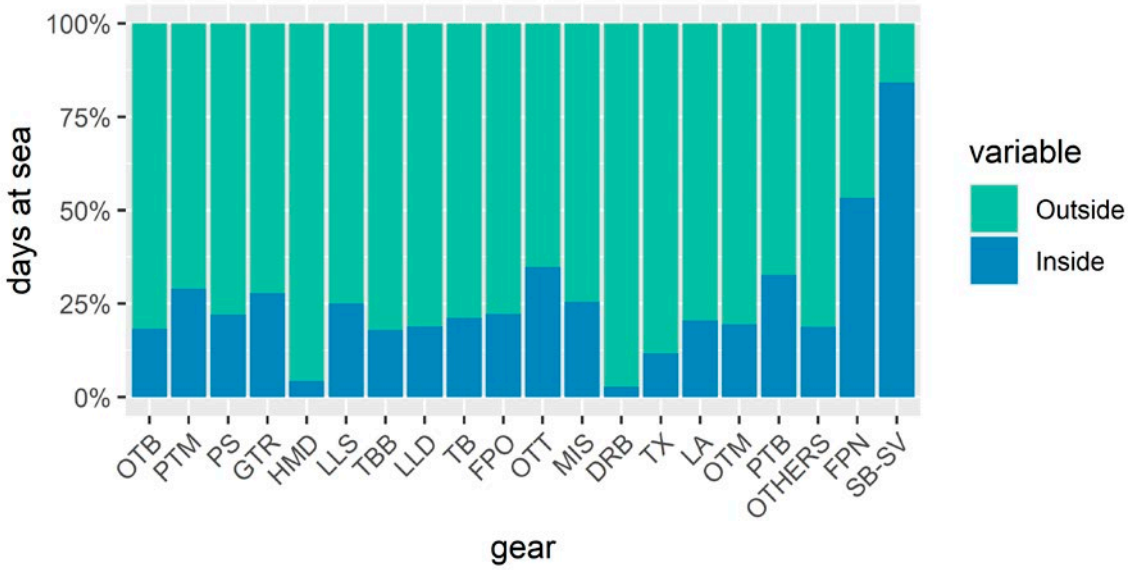

Figure 2-18 Fishing effort shared by fishing gear inside and outside of MPAs by major gear types (OTHERS include numerous gears with very low effort share).

2.3.2.2 Landings

More than 1600 species/taxa were recorded. However, just 20 of them accounted for more than 90% of catches. Their catch share by MPA designation type inside/out of the MPA are given in Annex 6.17. Overall commercial fishery dependent abundance (LPUE - "Landings per unit effort" expressed in kg/DAS - "Days At Sea") was statistically significantly higher inside the MPAs compared to outside unprotected areas, only in the 'Regional-SCI' designation (multifactor ANOVA, F-ratio=7.19, $p<0.05$), which is the group of MPAs experiencing the higher fishing effort inside the MPAs. This effect was more pronounced in Spain, France, Italy and Romania (see Annex 6.18). LPUE per designation category inside and outside MPAs is shown in Figure 2-6.

Towed gears having a direct impact on the seafloor (OTB, HMD, PTB, TBB, TB, DRB, TX) are making significant catches inside the MPAs (~20% of total catches). The highest proportion of catches is occurring in 'Regional-SAC' and 'Regional-SCI' (Figure 2-7).

MPA effect on some sensitive or iconic species (i) Groupers/lobsters combined (*Epinephelus* spp., Palinuridae, Scyllaridae) and (ii) All chondrichthyan species combined was investigated by assessing the level of catches inside and outside the MPAs. For groupers/lobsters the overall abundance inside the MPAs was 70% higher than outside (0.28 kg/DAS inside vs 0.17 kg/DAS outside the MPAs). For the chondrichthyans assemblage, overall abundance was similar, however in four out of five MPA broad designation types and five out of eight Member States, abundance inside the MPA was statistically significantly higher than outside (see Annex 6.19).

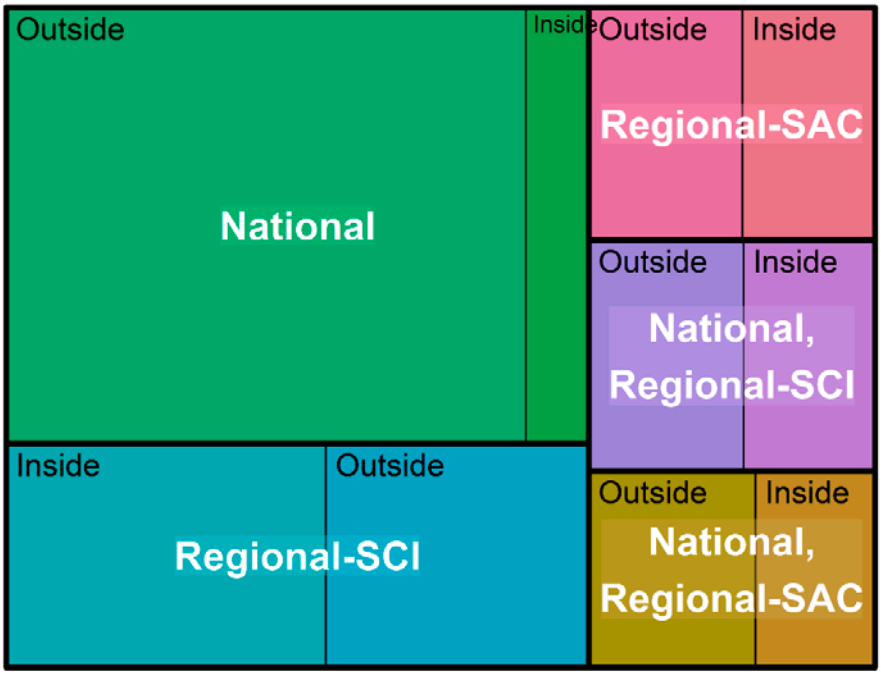

Figure 2-19 Treemap representation of Landings Per Unit of Effort – LPUE (expressed in kg per days at sea per km^2) by broad designation type, inside and outside of the MPAs of the Mediterranean and Black Sea.

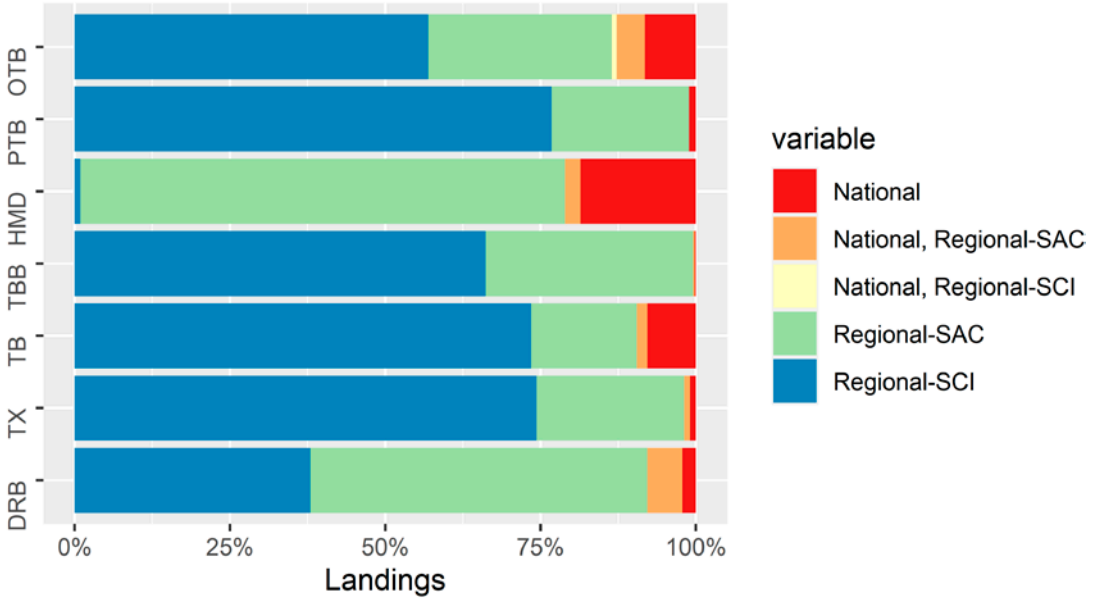

Figure 2-20 Landings share (in %) by Designation type for towed fishing gear in direct contact with seabed, inside the EU Med & BS MPAs.

2.3.3 AIS data

Fishing effort inside the MPAs was, as a rule, lower than outside the MPAs (5 km buffer zone), **with a ratio close to 1:3** - a value comparable to the results from the EU MAP fishery data (Section 2.3.2). Allocation of fishing effort by fishing gear, confirmed that bottom trawling (OTB) was the technique most frequently exerted within and outside the MPAs under investigation (similar to the EU MAP fishery data). It was evident that a high level of effort is exerted by towed gears having a direct impact on the seafloor (OTB, HMD, PTB, TBB, TB, DRB, TX) within certain MPA designations (Regional-SCI, regional-SAC).

Comparing the AIS data with the area covered by the MPAs, we can deduce that a disproportionate fishing activity is exerted in the 'Regional-SCI' and 'Regional-SAC' designations. Although they share 36% and 12% of the total MPA areas respectively, their share of fishing effort is 55% and 20% of the total effort (Figure 2-8).

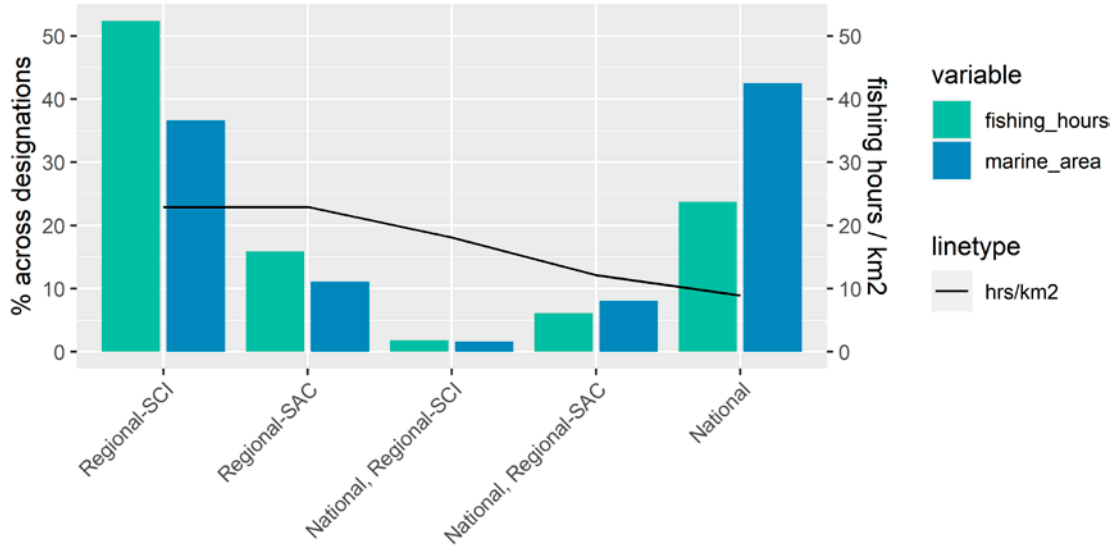

Figure 2-21 Share of AIS Fishing effort (green bars) and marine area (blue bars) by broad designation types inside the Mediterranean and Black Sea MPAs (data in the period 2012-2021). Hours of fishing per km² is indicated in a solid line (scale in secondary axis to the right).

2.3.4 Seabed data

Analysis by *BBHT*, *Designation type and Gear type* allowed more information to be extracted and assessed where fishing fleets operate and to identify the most frequently impacted habitats by demersal fisheries. Around 80% of the MPAs surface had a valid BBHT category, while it was not assigned for the remainder.

In the AIS database the two main gear types operating over seabed and in contact with the seafloor were: 'trawlers' and 'dredge fishing'. Results for this group of towed gears by seabed habitat are presented in Figure 2-9. This effort is estimated at more than 17 hrs/km² in "Regional-SAC/SCI" designation types and is higher than in any other MPA designation type (see Figure 2-8). Focusing on the most sensitive habitats, these being habitats hosting biogenic reefs (e.g., reefs, maerl beds), it was estimated

that a non-negligible 6.4 hrs/km^2 was exerted by towed gears over such habitats (see Annex 6.20).

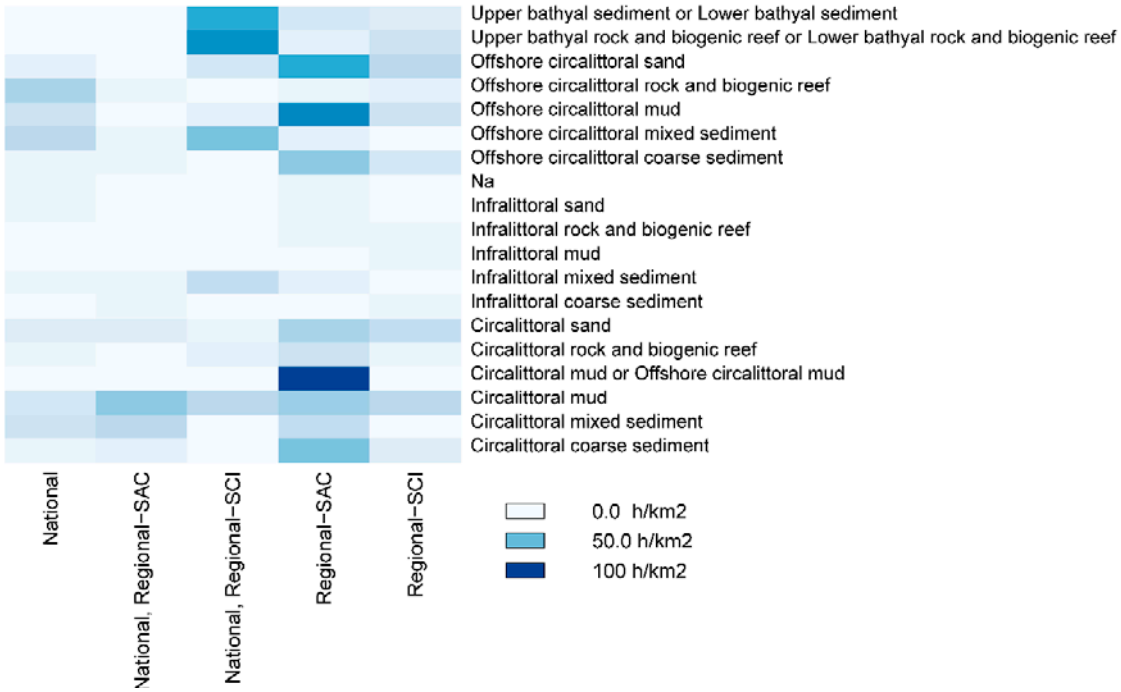

Figure 2-22 Heatmap of AIS derived fishing intensity (fishing hours/km^2 in the period 2012-2021) for towed gears by seabed habitat (BBHT) and broad designation types, inside MPAs of the EU Mediterranean and Black Sea. "Na" stands for Not available seabed type. (colour scale: light blue=low intensity; dark blue=high intensity).

2.4 Discussion

Although fishing is one of the most widespread activities by which humans harvest natural resources, the fishing footprint is poorly understood and is rarely quantified (Kroodsma et al., 2017) and even less is known about fishing activity inside and around MPAs (see Lattanzi et al., 2024) for a recent example trying to fill this gap in the Mediterranean). As such, our findings make a significant contribution to our understanding of the fishing activities inside and around MPAs in the Mediterranean and Black Sea.

Based on the EU MAP fisheries datasets fishing effort inside the MPAs was lower than outside the MPAs. The 'Regional-SCI' designation type of MPAs stood out, as high fishing activity was observed inside these MPAs. It seems that since SCIs are the first step in establishing a Natura 2000 network (to be established later as SACs), they suffer from a general absence of management plans and regulations, as reported in the previous chapter and in line with other examples for the literature (Giakoumi et al., 2024; Gianni et al., 2022), making them susceptible to exploitation of marine resources. The outcomes of the survey conducted within this study targeting the Mediterranean and Black Sea MPAs management authorities, support the previous statement (see Figure 1-6). On the other hand, 'National' designated MPAs seem to enjoy a higher level of protection. The different restrictions implemented between national designated MPAs and Natura 2000 sites, are probably mirrored in the different ecological outcomes recorded for these MPAs, with the well-

managed national designated ones showing higher reserve effect than Natura 2000 sites (Guidetti et al., 2019). Allocation of fishing effort by fishing gear, revealed that otter bottom trawling was the technique most frequently exerted within, and around the MPAs under study. This was an effect of the collected data sources, largely based on the ERS database, including only vessels > 12m. A high effort from towed gears in contact with the seafloor (OTB, HMD, PTB, TBB, TB, DRB, TX) was observed in the MPAs belonging to the 'Regional-SCI' designation type. This supports the finding by (Dureuil et al., 2018) that trawling occurs widely in EU MPAs.

Landings inside the MPAs were at similar levels to those outside the MPAs (5 km buffer zone). Overall, commercial fishery dependent abundance (LPUE - kg landed per day at sea-DAS) was significantly higher inside the MPAs only in the 'Regional-SCI' designation type. The highest level of catches occurred in 'Regional-SAC' and 'Regional-SCI' MPAs, which by definition are either Natura 2000 sites where towing gears are forbidden or limited over certain habitats (such as *Posidonia oceanica* meadows and maerl beds) or are sites that contribute significantly to the coherence of Natura 2000 sites. However, numerous derogations at Member State level are in place, not allowing for a full assessment of the true extent of fishing activity over sensitive protected habitats.

Towed gears, having a direct impact on the seafloor (OTB, HMD, PTB, TBB, TB, DRB, TX) were the ones making significant catches inside the MPAs (~20% of total catches). Nevertheless, these findings are supportive of those of (Eigaard et al., 2017) citing that some of the largest footprints per unit landings were observed in the Mediterranean Sea.

Investigation of certain iconic and sensitive species suggests that fishery dependent abundance (LPUE) was higher inside the MPAs. For the groupers/lobsters group the overall abundance inside the MPAs was 70% higher; while for the chondrichthyans assemblage, overall abundances were similar, however in four out of five MPA designation types, abundance inside the MPA was significantly higher. This pattern is in line with recent evidence from Mediterranean MPAs showing higher catches per unit of effort inside MPAs compared to surrounding unprotected areas for sensitive and vulnerable species (Di Lorenzo et al., 2022). **This suggests, at the same time, that (1) MPAs deliver a benefit to these populations, as higher LPUE may be indicative of higher densities highlighting a reserve effect on the species considered, and (2) that fishing operations inside the MPAs remove a non-negligible amount of biomass of species that have life traits (e.g., growth rate, age at maturity etc.) making them especially vulnerable to fishing and other threats** (Dulvy et al., 2017, 2014).

Our findings add to the limited body of literature analysing the effect of MPAs on fisheries catches (see e.g., Di Lorenzo et al., (2022); Vandeperre et al., (2011)), and on spatial arrangement of fishing effort (see e.g., Dureuil et al., (2018); Horta e Costa et al., (2013)).

Based on **AIS derived datasets**, The 'Regional-SCI' and 'National' designation types of MPAs, showed the higher level of fishing activity inside the MPAs (~75% of total effort). Trawling was the fishing technique most frequently exerted inside and outside of the MPAs under study. A high level of effort by towed gears was exerted over certain MPA designation types (Regional-SAC, Regional-SCI). Occurrence of high-risk fishing inside MPAs both in the EU and UK waters that are designated to protect

habitats within the Natura 2000 MPA network has been previously documented in the literature (Dureuil et al., 2018; Perry et al., 2022).

Higher levels of fishing intensity were observed in the 'Regional-SCI' and 'Regional-SAC' MPAs (>20 hrs/km^2) and the lower ones in the 'National' MPAs (~7 hrs/km^2). Effort by towed gears in direct contact with the seafloor was estimated at more than 6 hrs/km^2 over seabed habitats with biogenic reefs (see Annex 6.20). This is an illuminating finding considering that Thrush and Dayton (2002) confirmed in their extensive review that the extent and intensity of human disturbance (particularly from fishing) to oceanic ecosystems is a significant threat to both structural and functional biodiversity and in many cases, this has virtually eliminated natural systems that might serve as baselines to evaluate these impacts. In this context, our findings, in line with previous literature, may suggest that ecosystems and species inhabiting some of the Natura 2000 sites where towed gears are used could be threatened by these activities.

Finally, a degree of uncertainty in some of the data sources associated with our data sets should be noted:

- Fishery data: as most Member States submitted only data concerning vessels above 15 m of length the small-scale fisheries fleet is largely under-represented in this dataset;
- Seabed data: around 80% of the MPAs surface had a valid MSFD BBHT category. Furthermore, the quality and accuracy of EMODnet datasets in representing the true coverage of seabed habitats adds to the uncertainty around the extent of fishing activities over them.

2.5 Lessons learnt and recommendations

The current work aspired to fill the existing knowledge gap of fishing activities within and surrounding EU MPAs in the Mediterranean and Black Sea. An extensive literature review identified the limited information on fishing activities available for a few MPAs, most of them in the central and western Mediterranean subregions. Our review also underlined a lack of available fishing footprint in the region and evidence of its impact on the underlying habitats.

To this end, we acquired and combined data from multiple sources into a unique relevant geolocated rich datasets; some of them were publicly available (fishing footprint - AIS data; seabed habitats - EMODnet data), while others were made available in a level of detail, extent and resolution that has never been made available before (fishing data - EU MAP effort and catch). This was made possible thanks to the cooperative approach of all involved Member States.

The datasets gathered and the information extracted in this report provide for the first time a comprehensive picture of the fishing activities exerted in EU MPAs of the Mediterranean and Black Sea and can be seen as a valuable contribution to improve guidance towards an effective MPA management. It is hoped that the outcomes and findings presented will prove useful in the implementation of the EU biodiversity strategy and the EU marine action plan.

In relation to the findings of this chapter and the experience gained during this study, it would be worthwhile to:

- **ensure effective monitoring, control, and surveillance of MPAs.** From our findings, fishing effort from towed gears was identified inside some MPA designation types (mainly in Regional-SCI) and potentially over sensitive habitats (e.g., coral reefs and maerl beds) where fishing is regulated (generally forbidden or limited). A highly cited global study on MPA features (Edgar et al., 2014) stresses that regardless of its size, age or protection status, enforcement is a key feature for an effective MPA.
- **increase the accuracy of the mapping of sensitive habitats.** The absence of accurate and detailed mapping of the aforementioned habitats impairs the abilities of authorities to design spatially explicit fisheries regulations and the scientists to assess adequately the potential level of fishing in these sensitive areas. To date a full mapping of all marine benthic habitats in realisation of the EU MSFD (Directive 2008/56/EC) has been completed and is publicly available in Croatia ([30]), while Spain ([31]) has also launched a similar portal.
- **further exploration of data collected under the EU MAP multiannual programme should be encouraged under the data transparency and openness guidelines**. Open access to 'public data' ([32]) is promoted as the international norm for the exchange of scientific data by numerous scientific and political bodies but above all the European Commission (EC, 2011). A recent opinion of the EU STECF ([33]) stresses that: "…*the data collected under DCF calls are funded through public money; survey data, in particular, represent highly valuable information of generic scientific interest and without restrictions linked to commercial confidentiality. STECF fully supports that these scientific resources be made publicly available in the interests of all end-users and be freely used for further analyses provided the source is acknowledged and the obligations are met*."

([30]) https://www.bioportal.hr/content/karta-obalnih-i-pridnenih-morskih-stani%C5%A1ta-jadrana-na-bioportalu

([31]) https://www.miteco.gob.es/es/costas/temas/proteccion-costa/ecocartografias.html

([32]) public data: all the information that public bodies in the European Union produce, collect or pay for. (EC, 2011)

([33]) https://digital.csic.es/bitstream/10261/322418/3/STECF%20PLEN%2021-02.pdf

3. FISHERIES RESPONSE TO MPAS

Key highlights

- This chapter used AIS, VMS and stakeholder surveys (including participatory mapping) data to assess the fishing footprint within and surrounding five case study MPAs, investigated stakeholder perceptions and created a conceptual model to better understand the potential impacts of MPAs on fisheries.
- Analysis of VMS and AIS revealed that large-scale fishers show an effort concentration in areas relatively close (within 15 km) to fully protected area boundaries. This suggests that there is a tendency to 'fish the line'.
- Participatory mapping revealed that small-scale fishers had been displaced from previously used fishing grounds and fishing activity had moved to partially protected areas and unprotected areas mostly along the coastline.
- Stakeholders' perceptions indicated that there was recognition for the importance of MPAs for conservation purposes, yet their ecological potential and their management were not delivering what was expected or needed to garner support.
- The conceptual model revealed that MPAs with the highest levels of protection, although incur the greatest costs initially, deliver the greatest ecological and socio-economic benefits over the long term.

3.1 Introduction and objectives

When properly designed, funded, enforced, organised and managed, MPAs are able to provide a series of ecological benefits within their borders (namely the 'reserve effect') (Di Franco et al., 2018; Edgar et al., 2014; Giakoumi et al., 2017; Gill et al., 2017; Scianna et al., 2019), which can potentially lead to positive socio-economic effects in nearby areas (Di Franco et al., 2016; Hattam et al., 2014; Kerwath et al., 2013; Sala et al., 2013). However, marine environments along with their associated communities are highly complex and as a result MPAs by necessity vary enormously in their form, level of protection and in their effectiveness. Since MPAs have a variety of forms, their potential to deliver benefits (for biodiversity and fisheries) and impacts on different communities and users may vary hugely, providing endless scope for controversy over the fairness of their arrangements (Andradi-Brown et al., 2023). Such controversy is not a trivial feature of MPAs, but a crucial matter for their successful management, since unless MPAs can attract the support of local communities and resource users, they are unlikely to succeed in meeting their ecological objectives (Agardy et al., 2003; Chaigneau and Brown, 2016; Christie, 2004; Hogg et al., 2019).

The creation of an MPA entails that human activities and behaviours are directly curtailed or regulated, which affects nearby communities for example causing displacement and/or short-term economic losses and can lead to local opposition (Bennett and Dearden, 2014; Weigel et al., 2014). The complexities of the relationships between people, including struggles between different actor groups and conflicts between people and their environment, make it absolutely necessary to better understand the potential impacts of MPAs, particularly for resource users and

to examine conservation problems hand-in-hand with societal beliefs, customs, attitudes and practices (Chaigneau and Brown, 2016; Christie, 2004; Hogg et al., 2019; Voyer et al., 2012). Understanding the impacts of MPAs with different levels of protections, patterns of fishing displacement and how fishers perceive and respond to MPAs would improve the capacity to address areas of contention and implement factors that can potentially smooth the MPA planning process.

The objectives for this part of the study were to:

- assess the spatial reallocation (if any) of fishing activities related to MPA implementation in five selected case studies to understand if the MPAs have displaced fishers or altered their fishing footprint;
- collect perceptions data from relevant stakeholders regarding potential effects of MPAs on fisheries within five case study MPAs and their surrounding areas to understand how MPAs are impacting local communities and how level of support can be improved;
- model the effects of MPAs of various protection levels on the ecological (fish biomass) and fisheries (fishery catch) over time to see how different scenarios can impact local communities and be used to better communicate the potential role of MPAs for fisheries management purposes.

3.2 What we did

To meet the objectives, we:

- defined, for each of the five case studies, a **spatial domain** including the MPA and surrounding areas to reasonably include areas potentially affected by MPAs and created a set of grids with a square mesh of 1 km resolution to be used as reference for AIS, VMS and surveys data.
- collated and analysed **AIS and VMS data** for fishing vessels in the five case studies, to infer the number of fishing vessels operating in the areas surrounding the MPAs and the yearly distribution of the relative fishing effort, by metier.
- designed and carried out **stakeholder surveys** with small-scale and large-scale fishers and key informants in each case study site, to gather their perceptions on the impact of the MPAs on their fishing activities and MPA management/governance.
- created a **conceptual model** to describe the potential effect of MPAs on fisheries by adapting and generalising key findings from a pre-existing spatially explicit model, expert opinions, and previously published guides.

3.2.1 Selection of case studies

The case studies (Figure 3-1, Table 3-1 and Annex 6.21) were selected to ensure the different Mediterranean sub-regions and the Black Sea were covered and provided a heterogeneous set of MPA features (e.g., size, year of establishment, designation type). In addition, the case studies were selected based on the availability of MPA managers and fishers that were willing to collaborate in the study.

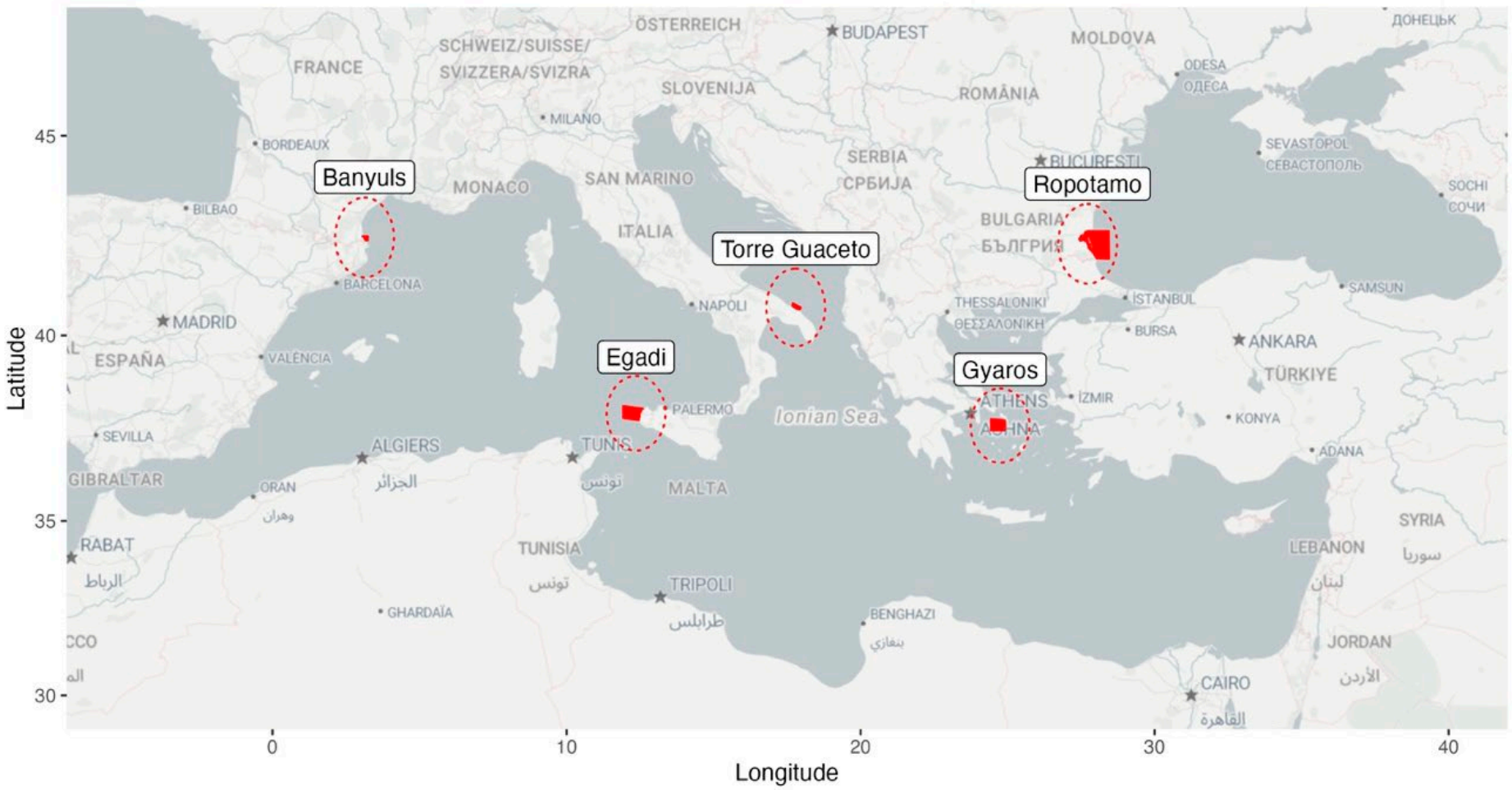

Figure 3-23 Location of case study sites

Table 3-6 Summary of the five case studies investigated.

MPA name	Subregion, Member State	Designation type	Year of designation and reference year in bold	Overall MPA surface area (km2)
Cerbère-Banyuls	Western Med, France	Nationally designated MPA	1974, in **1978** the no-take zone was introduced	6.5
Egadi Islands	Central Med, Italy	Nationally designated MPA, Natura 2000	1991. In **2001** Management consortium in place.	539.9
Gyaros	Eastern Med, Greece	Nationally designated MPA, Natura 2000	2022 as full MPA/No-take zone - **2019** as partial MPA (2015 as wildlife refuge/No-take zone)	250
Ropotamo	Black Sea, Bulgaria	SAC, Natura 2000	Designated as SCI in 2007, extended in 2013, designated as SAC in **2021**	982
Torre Guaceto	Central Med, Italy	Nationally designated MPA	1991. **2001** Management consortium in place.	22.3

*The consortia selected a reference year for each MPA that may or may have not been the same as the year of designation, that reflected the history of the MPA and that in most cases coincided with the onset of regulations in place (e.g., start of effective management). Some of the MPAs have both the national designation and the regional Natura2000 designation.

Cerbère- Banyuls, France

The Cerbère-Banyuls MPA (Figure 3-2) was the first French marine reserve (established in 1974 with the no-take zone added in 1978), located in the Western Mediterranean Sea. It covers 6.5 km^2, of which 0.65 km^2 prohibits all human activities except those associated with scientific research (i.e., a fully-protected zone). The objectives of the MPA are to conserve the local habitats and their specific diversity; to control human activities in a way that they are compatible with conservation of ecosystems; to favour the reserve effect by implementing protection measures outside the MPA; to have an impact on public (education and culture); to constitute an opportunity for scientific research; to procure economic benefits; to participate in maintaining small-scale fisheries.

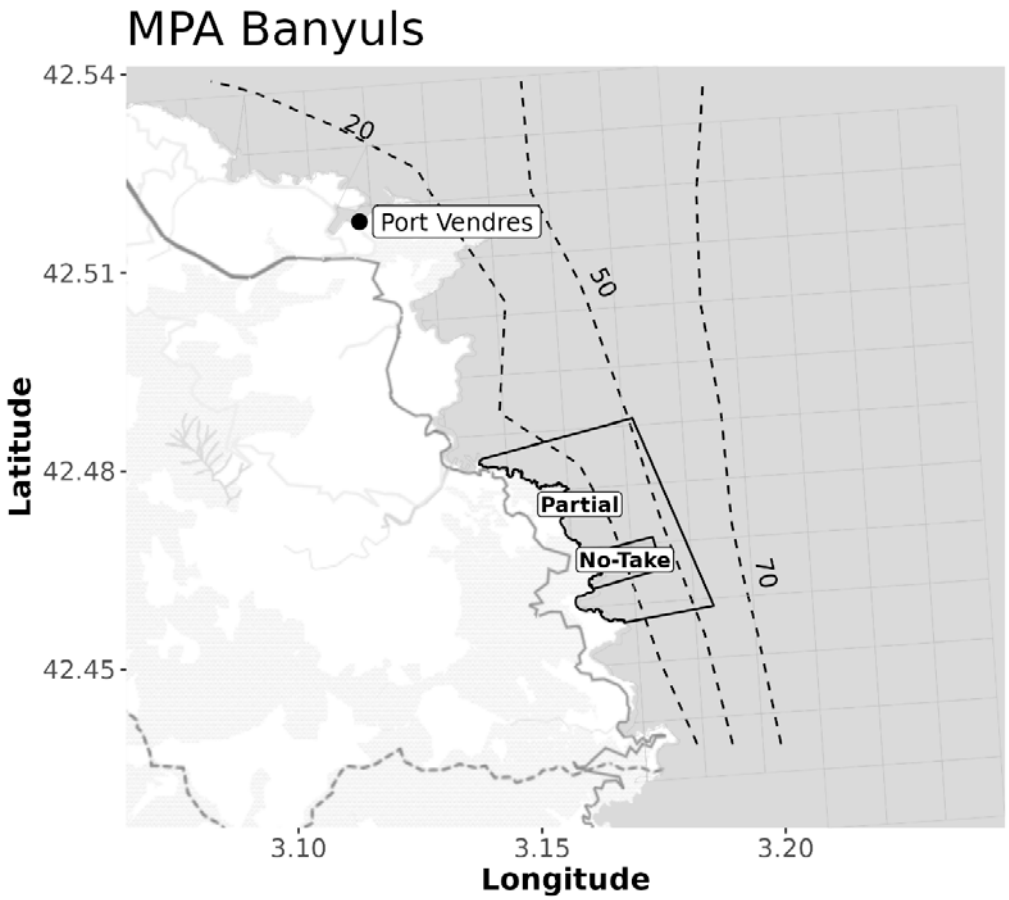

Figure 3-24 Location and zoning of the Cerbère-Banyuls MPA

Egadi Islands, Italy

The Egadi Islands MPA (Figure 3-3) a National MPA established in 1991, covers a total surface area of 540 km^2 (in territorial waters) and is located off the western coast of Sicily which includes the islands of Favignana, Levanzo, Marettimo and the islets of Formica and Maraone. It is listed among the European Natura 2000 Network sites. In 2001 the management authority was put in place and from this year the MPA was recognised to exist. The priority objective of the MPA is maintaining or restoring the main natural features of the marine environment to a favourable conservation status. The 1991 MPA designation decree sets the following aims: (1) protecting the marine environment; (2) protecting the marine biological resources; (3) educating the public about the characteristics of marine habitats; (4) supporting scientific research; (5) increasing the protection of local archaeological sites; (6) promoting the socio-economic development connected to the environmental features of the area.

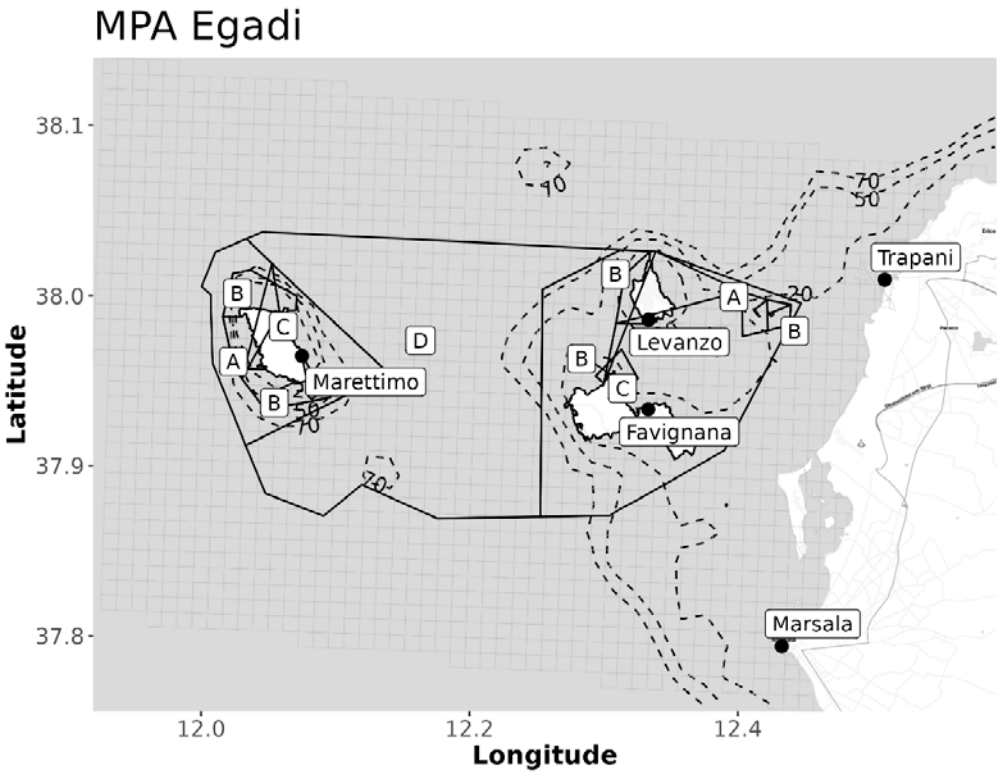

Figure 3-25 Location and zoning of the Egadi Islands MPA

Gyaros, Greece

The Gyaros Island MPA (Figure 3-4), is in Greece. In 2011, Gyaros and the surrounding marine area of three nautical miles from its coastline, was listed among the European Natura 2000 Network sites and was established as a Wildlife Refuge. In 2019 it became an MPA and in 2022 it became a full no-take MPA. The total area protected covers 250km^2. The objective of the MPA is to address the need for further shielding and protection of the fish fauna of the island of Gyaros and the marine environment in general.

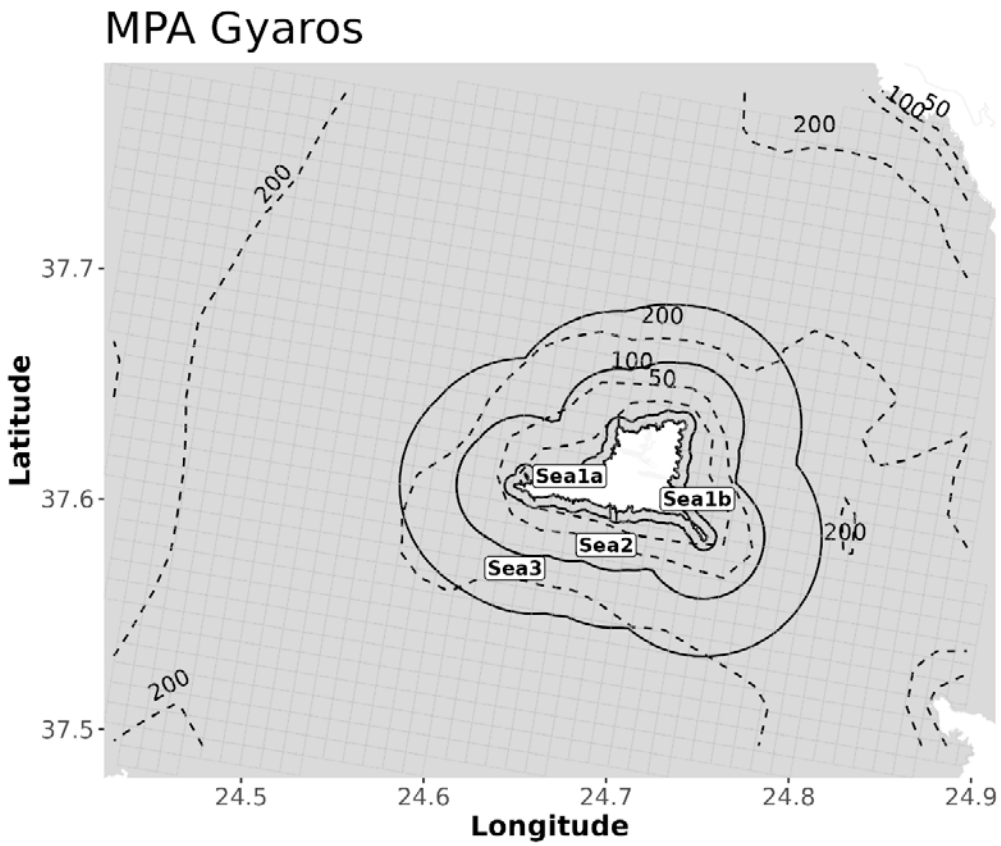

Figure 3-26 Location and zoning of the Gyaros MPA

Ropotamo, Bulgaria

Ropotamo is a Special Area of Conservation (SAC) (Figure 3-5) in Bulgaria, designated in 2021, and belongs to the Natura 2000 network under the European Habitats Directive (92/43/EEC). The MPA covers 982 km^2, of which 89.9% is marine (882 km^2). Ropotamo SAC's objectives are to protect and maintain the specified types of natural habitats, the habitats of the specified species, their populations and distribution within the boundaries of the area to achieve and maintain their favourable conservation status in the Black Sea biogeographical region; if necessary, improving the condition or restoring the types of natural habitats, the habitats of the specified species and their populations.

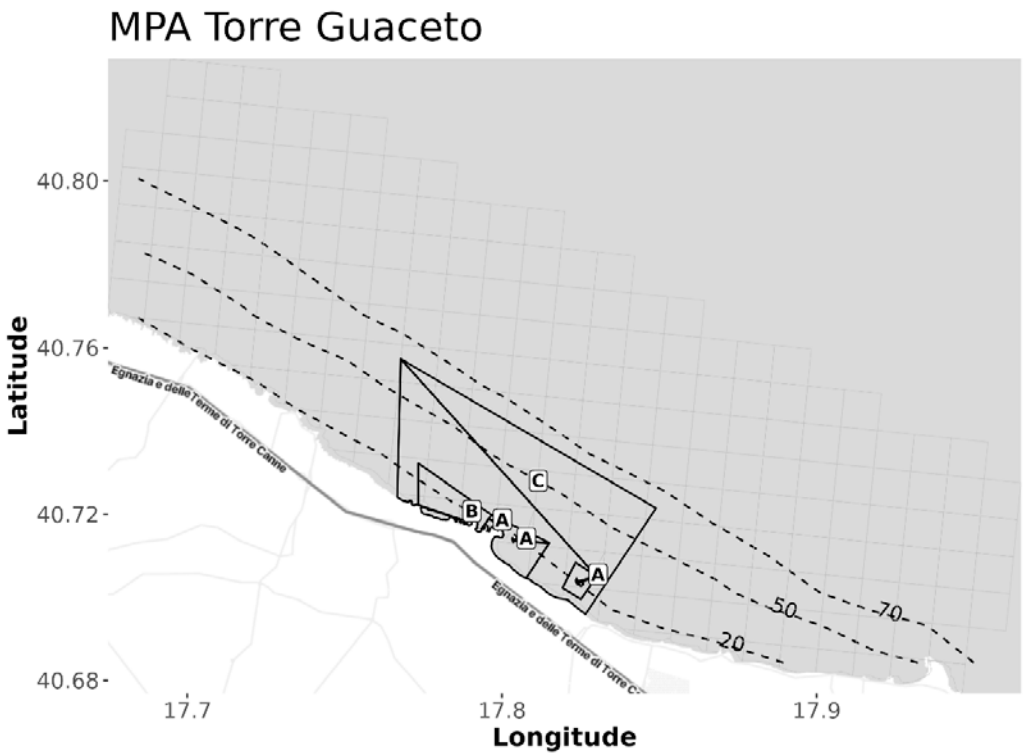

Figure 3-27 Location and zoning of the Ropotamo MPA

Torre Guaceto, Italy

The Torre Guaceto MPA (Figure 3-6) a national MPA designated in 1991, is in the south of Italy on the Adriatic side (north-east of Salento peninsula, Puglia, Italy), and covers 22.3 km^2. The objectives of the MPA were designed to protect the coastal and marine ecosystems and heritage; support studies to improve knowledge about the area to develop appropriate management strategies; disseminate knowledge related to coastal and marine environments; to support sustainable exploitation of fisheries resources; and promote sustainable socio-economic development of the area.

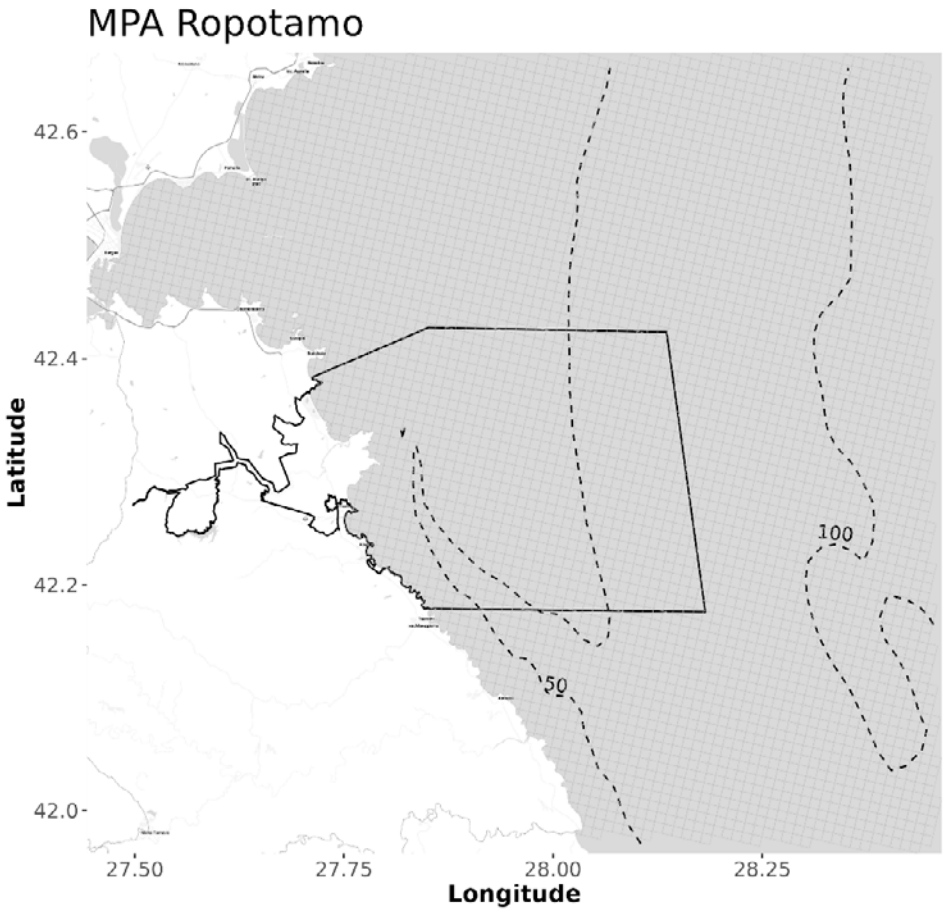

Figure 3-28 Location and zoning of the Torre Guaceto MPA

3.2.2 Definition of the spatial domain

A spatial domain including the MPA and extended to surrounding areas (to reasonably include areas potentially affected by MPAs) was defined for each case study (Figure 3-7). A set of grids with a square mesh of 1 km resolution was also generated to be used as reference for AIS, VMS and small-scale fishers (SSF) surveys. A larger area was defined around each MPA, representing the overall spatial domain of the case study. It is assumed that the effect determined by the MPAs in terms of displacement of fishing effort, if any, is detectable in this spatial domain. The domain has been completely covered by the defined grids, and thus cells in the domain but not in the MPA are defined as unprotected areas (UA).

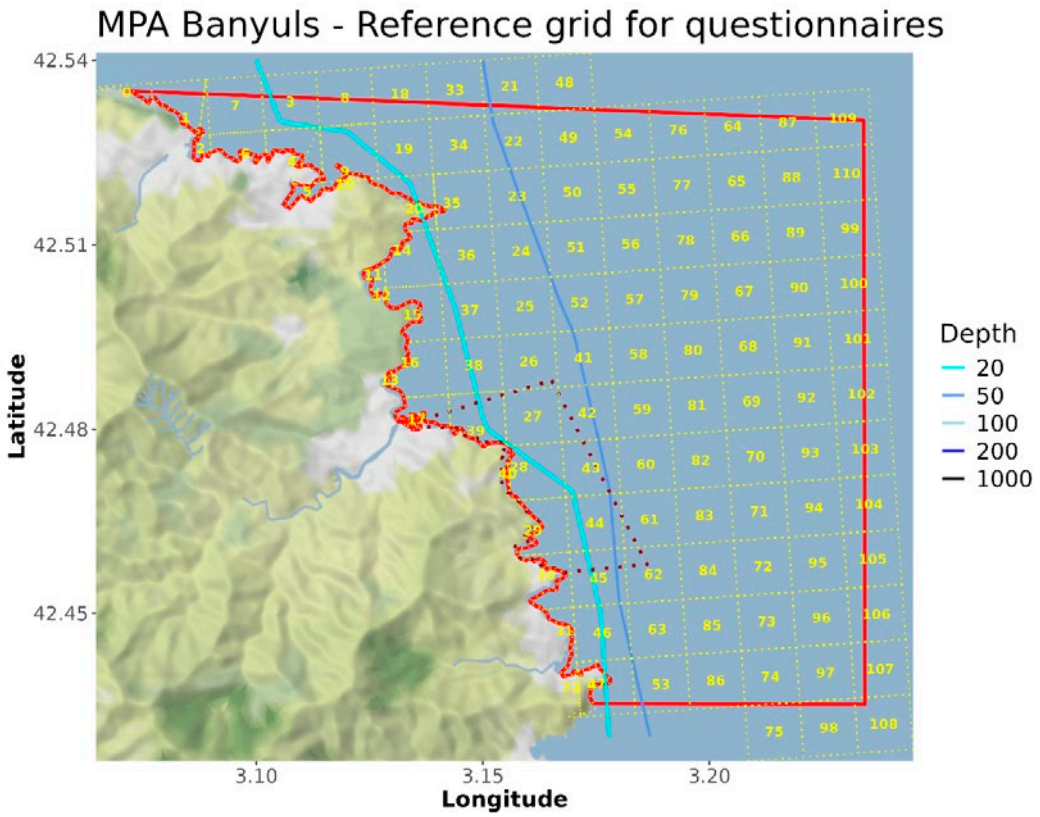

Figure 3-29 The spatial domain including the MPA and the surrounding areas for the Cerbère-Banyuls MPA, as an example. A grid with a square mesh and 1 km resolution was developed. The dashed line represents Cerbère-Banyuls MPA' boundaries, while the solid red line represents the spatial domain's boundaries. In yellow the 1 km^2 cells are reported (each with a unique ID).

3.2.3 Collection and analysis of AIS and VMS data

3.2.3.1 AIS

AIS data for vessels belonging to category 30 (fishing vessels) were purchased from a private provider at 5-minute spatial resolution, for the entire period after the AIS system entered into force (January 2012 – July 2022). AIS data was integrated with the register of fishing units operating in the Mediterranean provided by the FAO General Fisheries Commission of the Mediterranean (GFCM). AIS data was cleaned and processed (gear identification and classification, vessel identity check and review, removal of vessels not engaged in fishing activities) and analysed to classify the fishing units with respect to the fishing gear used, and to classify the pings ([34]) with respect to the different types of activity (steaming, fishing, resting).

([34]) Pings refer to the messages that are transmitted from the AIS hardware that sits on a vessel. The pings, transmitted at regular intervals, include the ship's current coordinates, speed, course and dimensions (along with a few other fields).

An individual review of the activity of vessels in the AIS dataset was carried out by researchers producing, for each unit in the AIS dataset, a series of combined maps representing:

- the spatial distribution of AIS points;
- the distribution of speed values (a critical indicator of the fishing gear used);
- the distribution of sea depth values corresponding to each AIS point;
- the combined distribution of speed and depth, and the distribution of AIS points over the period considered (January 2012 – July 2022).

An example of these combined maps is shown in Figure 3-8.

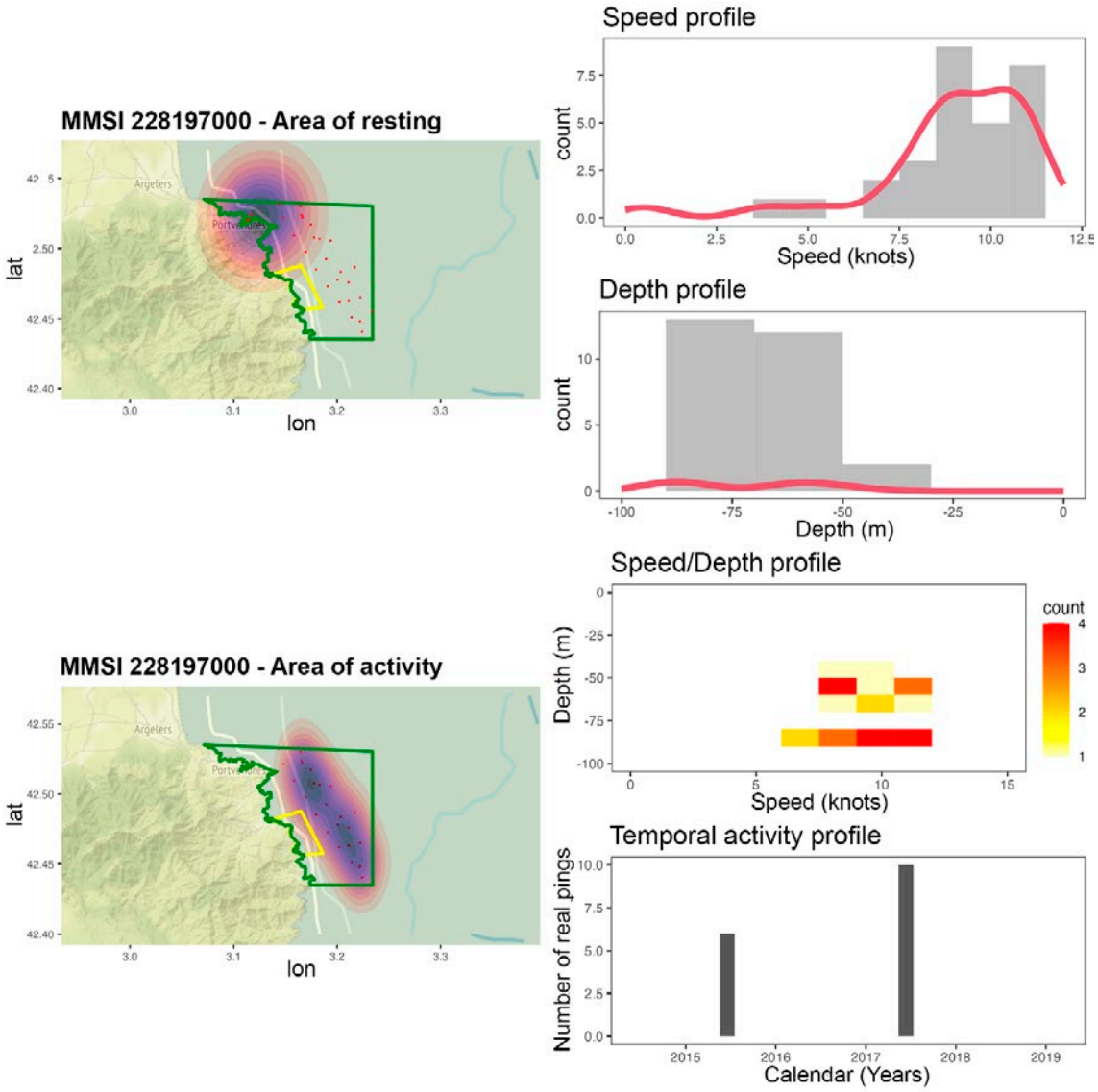

Figure 3-30 Examples of the combined maps from the Cerbère-Banyuls MPA used for the revision/analysis of the gear used from each vessel in the AIS dataset A) Distribution area of AIS pings corresponding to vessel resting; B) Distribution area of AIS pings corresponding to vessel activity; C) Distribution of vessel speed values; D) Distribution of sea depth values corresponding to each AIS ping; E) Combined distribution of vessel speed and sea depth; F) Yearly distribution of AIS pings.

After identifying the gear used by each vessel according to the official classification defined for the Mediterranean and Black Sea, and in particular the Metier level 4 ([35]), the fishing points were isolated using a speed filter and the points corresponding to other activities were discarded. Finally, all the points in the fishery were aggregated on a monthly/annual basis and associated with the cells of the grids with a square mesh and 1 km resolution for each study area (see Figure 3-7). In this way, considering the temporal frequency (5 minutes) of the AIS data, it was possible to quantify the fishing effort in space and time for each gear. All these analyses were

([35]) FAO gear type (letters in brackets) is the International Standard Statistical Classification of Fishing Gear (ISSCFG) available here: https://www.fao.org/3/bt986e/bt986e.pdf also see (https://fish-commercial-names.ec.europa.eu/fish-names/fishing-gears_en)

carried out in the R environment (R Core Team, 2022) using a workflow based on the VMSbase package (Russo et al., 2014).

3.2.3.2 VMS

A specific VMS data request was submitted to the relevant Member States (Bulgaria, France, Greece and Italy) to collect available VMS data for the five MPAs (Box 3.1).

Box 3-8 VMS data requested from Member States

The VMS data for the five MPA case studies and requested from Member States were as follows:

- **TIME SERIES:** years 2012 to 2022; monthly scan.
- **VESSEL ID:** anonymized unique identification number of the vessel, irrespective of any national fishing fleet numbers.
- **LON:** Longitude of the ping in WGS 1984 unprojected.
- **LAT**: Latitude of the ping in WGS 1984 unprojected.
- **DATE and TIME:** any format for date and time.
- **SPEED:** speed over ground of the vessel (SOG), that is the speed of the vessel relative to the surface of the earth.
- **METIER L4:** Fishing gear type.

As is established in the Fisheries Dependent Information (FDI; https://stecf.jrc.ec.europa.eu/dd/fdi), Member States independently processed VMS and logbook data to produce the required information.

Member States directly provided VMS data indicating the fishing gear (Metier level 4) used. This made many of the steps applied to clean the AIS data unnecessary. However, the identity of the vessels was masked by artificially generated codes, rendering it impossible to merge the VMS data with the AIS data to avoid duplication (vessels present in both datasets) and to obtain an enhanced AIS-VMS dataset (Russo et al., 2016). The VMS data and the AIS data were treated and analysed independently and in parallel.

3.2.4 Surveys for stakeholders

Three surveys were designed and tailored to suit the relevant stakeholders to be targeted in the five case study sites: small-scale fishers (SSF), large scale fishers (LSF) and key informants (KIs) (Annex 6.22). Ethics approval was obtained from the University of Palermo's Ethical Committee (approval n. 154/2023). The surveys were translated into Bulgarian, French, Greek, and Italian. Fieldwork was carried out between August and November 2023. A total of 93 SSF, 24 LSF and 19 KI interviews were carried out in the five MPA case studies (Table 3-2). KIs included representatives from the MPA management, coast guard, NGOs, researchers, GFCM, national/regional administrations and fishers unions.

Respondents were mostly targeted through purposive, opportunistic and snowball sampling (Bell et al., 2022; Bryman, 2012) ensuring a significant proportion of each community (i.e., the fishers operating within and/or surrounding each MPA) was interviewed (≥29% of all fishers in each MPA). The surveys included questions on current fishing activity (SSF and LSF surveys), institutional background (KIs), change in fishing activity overtime, perceptions of management and governance and background/demographic information (all).

Table 3-7 Breakdown on survey numbers administered by site and stakeholder category. Estimated number of professional fishers (SSF and LSF) operating in each site is also provided.

MPA	No. SSF Interviewed	Est total no. of SSF	% of SSF interviewed	No. LSF Interviewed	Est total no. LSF	% of LSF interviewed	No. KI Interviewed
Cerbère-Banyuls	10	16	63	0	0	0	3
Egadi	36	101	36	10	24	42	3
Gyaros	14	20	70	0	0	0	4
Torre Guaceto	8	13	62	9	15	60	2
Ropotamo	25	85	29	5	15	33	7
TOTAL	**93**	**235**	**40**	**24**	**54**	**44**	**19**

Data was analysed using descriptive statistics. Small-scale fishers' level of support for the MPAs and level of adaptation to the MPAs were also modelled as a function of a set of independent variables using ordinal logistic regression detailed in the following section (3.2.5.2).

A **participatory mapping** approach was used in the SSF survey to gather spatial information using pre-printed maps of the coastal areas covering each MPA and its surroundings (as done in Grati et al., (2022) and Lattanzi et al., (2024)). Each fisher was asked to provide information about their fishing habits before and after the MPA implementation (or a specific moment, depending on the MPAs' specific history, see Table 3-1 for reference year used), using two separate maps. From a technical point of view, it was possible to distinguish two approaches by which the maps in the surveys were filled in:

- NO MPA/WITH MPA: Fishers have indicated where they fish considering the presence of the MPA and where they would fish if the MPA was not present;
- BEFORE MPA/AFTER MPA: Fishers indicated where they fished before the establishment of the MPA and where they fished after the establishment of the MPA.

The information collected was digitised and analysed as follows:

- The fishing areas marked in the map of each individual questionnaire (which contained, a map dedicated to the situation before/without the establishment of the MPA and one dedicated to the situation after/with the establishment of the MPA) were transformed into digital information using the sequence code (unique identifier) of each cell;

- Since respondents did not indicate an estimate of fishing effort in each cell, the digitised grids were overlaid and the importance of each cell (a proxy for the fishing effort potentially allocated in it) was quantified in terms of the number of interviewees that indicated the presence of effort in that cell.

This produced a pair of maps (pre-MPA and post-MPA, or without MPA and with MPA) for each case study in which the importance of the various cells (fishing grounds) corresponded to the number of surveys. These digital maps were used, like those obtained from the analysis of VMS and AIS data for the large scale fleet, to quantify the fit of the small-scale fisheries fleet in terms of fishing effort distribution. The rationale of this approach is based on a recent application in which data from vessel tracking data and participatory mapping were collected and combined (Lattanzi et al., 2024).

3.2.5 Statistical analyses

3.2.5.1 Statistical analysis of VMS & AIS Data

To assess the potential effect of MPAs on the spatial distribution of fishing effort, a statistical method represented by Generalized Additive Models (GAM) (Hastie and Tibshirani, 2017) was used. The R package "mgcv" was used to apply GAMs (Wood, 2022). The GAM models were applied independently on the datasets obtained from the AIS and VMS data. The total annual amount of fishing effort (hours fishing) allocated, for each gear, in each of the grid cells defined for each study area was related to the following predictors:

- The depth of the cell;
- Its distance from the borders of the nearest FPA within each MPA;
- The fishing gear used;
- The case study;
- The time (year of the time series) and the season

The potential existence of collinearity between the predictors of the GAM models was analysed using the 'vif.gam' function of the package 'mgcv.helper'. The results of the independently fitted GAM models for the AIS and VMS data were analysed and compared. The two models yielded very similar outputs (Annex 6.23).

3.2.5.2 Statistical analysis of SSF survey data

Logistical regression models were used to assess SSFs level of support and adaptation. To perform logistical regression analyses, we removed "no answer" and "don't know" responses. As the model tested several variables against each other, all questions required the same number of responses. As a result, after removing "no answer" and "don't know" we were left with 47 individual SSFs out of 93 to be analysed in the models. Three separate models were run to accommodate for the question theme: (1) perceptions of governance/management; (2) perceived socio-economic impact; and (3) perceived ecological impact.

- Independent variables included in the first analysis on **governance/management** were: (a) perception on whether SSF were treated fairly when the MPA was created; (b) perception about the adequacy of the consultation process when the MPA was created; (c) perception about the adequacy of consultation when decisions are made now about the MPA; (d) perception about how well traditional knowledge is included in the management process; (e) perception about the level of involvement of fishers in decision-making processes.
- In the second analysis on **socio-economic impact**, independent variables included: (a) overall impact of the MPA on the fisher's fishing business; and perceptions of the effects of the MPA on: (b) access to productive fishing areas; (c) the quantity of fish caught; (d) the size of fish caught; (e) fishing business profitability; (f) personal income from fishing; (g) the number of commercial fishers who fish in their areas; and (h) the number of recreational fishers who fish in their areas.
- The final analysis on perceived **ecological impact**, independent variables included: (a) perceptions on the MPAs importance to protect the seabed and marine species; (b) perceptions on the MPAs importance to protect spawning and nursery areas; and (c) perceptions on the MPAs importance to protect fish stocks.

Statistical significance was set at alpha=0.05.

In addition, the information obtained in the participatory mapping exercise during the SSF surveys, after being digitised and represented graphically, was used to test, by means of Syrjala test (Syrjala, 1996), the existence of significant differences in fishing behaviour/displacement between the patterns described for the periods before and after the establishment of the MPA.

3.2.6 Creation of the conceptual model

To construct a conceptual model able to communicate the complex relationship between spatial management and fisheries, we adapted and generalised the key findings from: previous research, a spatially explicit model, expert opinions, and previously published guides (Grorud-Colvert et al., 2021; Horta e Costa et al., 2013; Sève et al., 2023). The previous research investigated the mixed fishery in the Parc Naturel Marin du Golfe du Lion (located in a sub-region of the western Mediterranean Sea) and focused on the white seabream fish *Diplodus sargus* (Linnée, 1758) to represent a generic type of bentho-pelagic species in the north-western Mediterranean that provides a typical and representative demersal coastal species valuable to Mediterranean fisheries (Box 3.2) (Sève et al., 2023).

Box 3-9 Model of *D. sargus* used to inform the conceptual model (Sève et al., 2023)

Using a metapopulation model of *D. sargus* (ISIS-fish population dynamic, Belharet et al., 2020), simulations of a wide range of MPA configurations and levels of protection were built. The effects of every scenario were later compared to understand the ecological (seen as the effect on the fish populations) and socio-economical (seen as the effect on the fisheries activities) outcomes of each. This model was built by joining virtual MPAs built of grid cells of 2 x 2 km with the fish metapopulation model, time dynamics, and then run under simulations with diverse management scenarios. The metapopulation model describes the key biological traits and processes influencing the demographic dynamics of *D. sargus* (reproduction, larval dispersal, recruitment, body growth, sexual maturation, natural mortality, and fishing mortality). The management scenarios are layered with two different underlining contexts, a non-overfished and an overfished one. For the construction of our conceptual model, we focused on the modelled outcomes under an overfished context, as it better relates to the reality that a large proportion of the seas, including the Mediterranean and Black Sea, are currently experiencing (Hilborn et al., 2020; Piroddi et al., 2017). We created an overfishing context by increasing the fishing mortality rate that left 10% of the total unexploited biomass remaining (Worm et al., 2009). The management scenarios in the model included: non-spatial fishery management; implementation of a large MPA; and implementation of a network of MPAs. Then, each management scenario was tested under different levels of protection over a period of 44 years and compared against control simulations where no MPA was implemented. This allowed the effect size associated with each scenario by calculating the log-response ratio *R* of biomass or catch in each area on each year to be obtained in contrast to the control scenario (Sève et al., 2023).

The conceptual model used knowledge both from previous studies that assessed the effects of different levels of protection on ecological and fisheries outcomes (Grorud-Colvert et al., 2021; Jacquemont et al., 2022; Sève et al., 2023; Turnbull et al., 2021; Zupan et al., 2018), on socioeconomic outcomes (Schratzberger et al., 2019), and on wellbeing outcomes (Baker et al., 2023; Ban et al., 2019) (Figure 3-9), and from history in potential fishing displacement from the five case studies described in this study (Section 3.2.1 and Annex 6.21). General patterns of fishing effort displacement from MPAs to unprotected areas (yielded from the data gathered by the participatory mapping exercise), and fishing effort concentration at limited distance from MPAs' boundaries (as highlighted by analyses of VMS and AIS data), and the perceptions on changes to fishing behaviour (as yielded from the surveys) were conceptually integrated in the model. This allowed us to include the concept of concentration of fishing effort into the model and to vary fishing mortality in relation to these patterns.

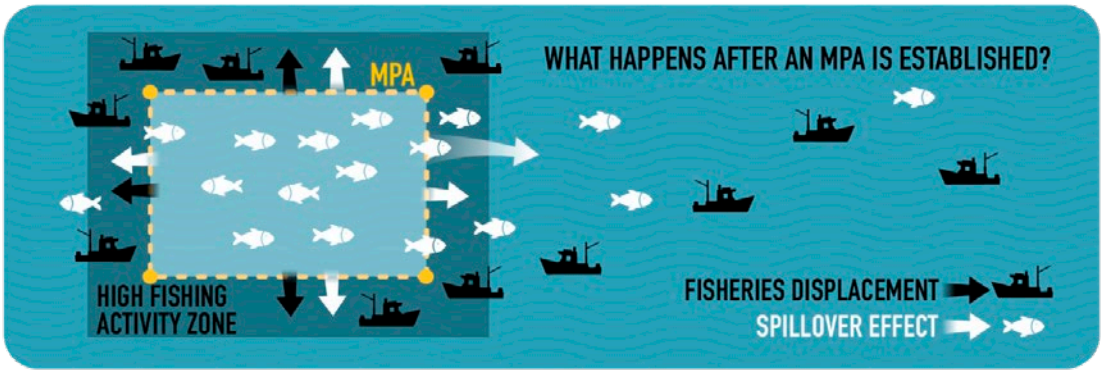

Figure 3-31 Illustration that showcases the potential immediate effect that occurs after the establishment of an MPA. Fishing activities are displaced out of the MPA but concentrate their activity around the polygon of the MPA. On the other hand, the adult (or sub/adults) fish hosted within the MPA boundaries will replenish areas adjacent to the MPA through spillover. Conceptualised from (Sève et al., 2023).

The management scenarios (non-spatial fishery management; implementation of a large MPA; and implementation of a network of MPAs) were joined with previous knowledge into a conceptual model, by simplifying the output data into only: Implementation of an MPA. With a more simplified data matrix, we created heatmaps with the data to obtain accurate colour gradients, equivalent to real data that can illustrate the effects of MPAs under different levels of protection. These outputs were combined with expert knowledge to frame the key messages in the conceptual model and present it in a way that provides a summary of previous efforts to understand the fisheries-MPA interaction complexity. We included the knowledge derived and simplified from the MPA Guide's levels of protection. We did this to create a conceptual map that is based on data, previous publications, and expert knowledge that has the capacity to be understood and adopted by a wide audience.

3.3 Results

3.3.1 Spatial reallocation

3.3.1.1 Large-scale fleet: analysis of VMS and AIS data

When the variation in VMS data over time was analysed (Figure 3-10), it was observed:

- In Cerbère-Banyuls, a progressive decrease in the number of fishing units and (less evident) in the amount of fishing effort;
- In Egadi islands, the number of fishing vessels remained quite stable, but the corresponding amount of fishing effort increased through the inspected time period (2012 to 2019);
- In Gyaros, a substantial stability of the fishing effort, while the number of vessels increased;

- In Ropotamo, with data available from 2019 to 2022, showed an increase through time in the total fishing effort;
- In Torre Guaceto, wide fluctuations were observed for the number of fishing vessels; the total fishing effort peaked in 2016.

The AIS data provided the following information on the case studies (Figure 3-10):

- In Cerbère-Banyuls, an overall decrease in the number of fishing vessels was observed, while the amount of fishing effort remained stable;
- In Egadi islands, the number of fishing vessels increased in the first half of the considered period, and remained stable for the second half. The total amount of fishing effort showed the highest values from 2015 to 2020;
- In Gyaros, the total amount of fishing effort was stable, while the number of fishing vessels reached its maximum in 2017 and decreased afterwards;
- In Ropotamo, the number of fishing vessels and the amount of fishing effort increased from 2012 to 2021;
- In Torre Guaceto, both values increased to reach their highest values in 2017, and decreased afterwards.

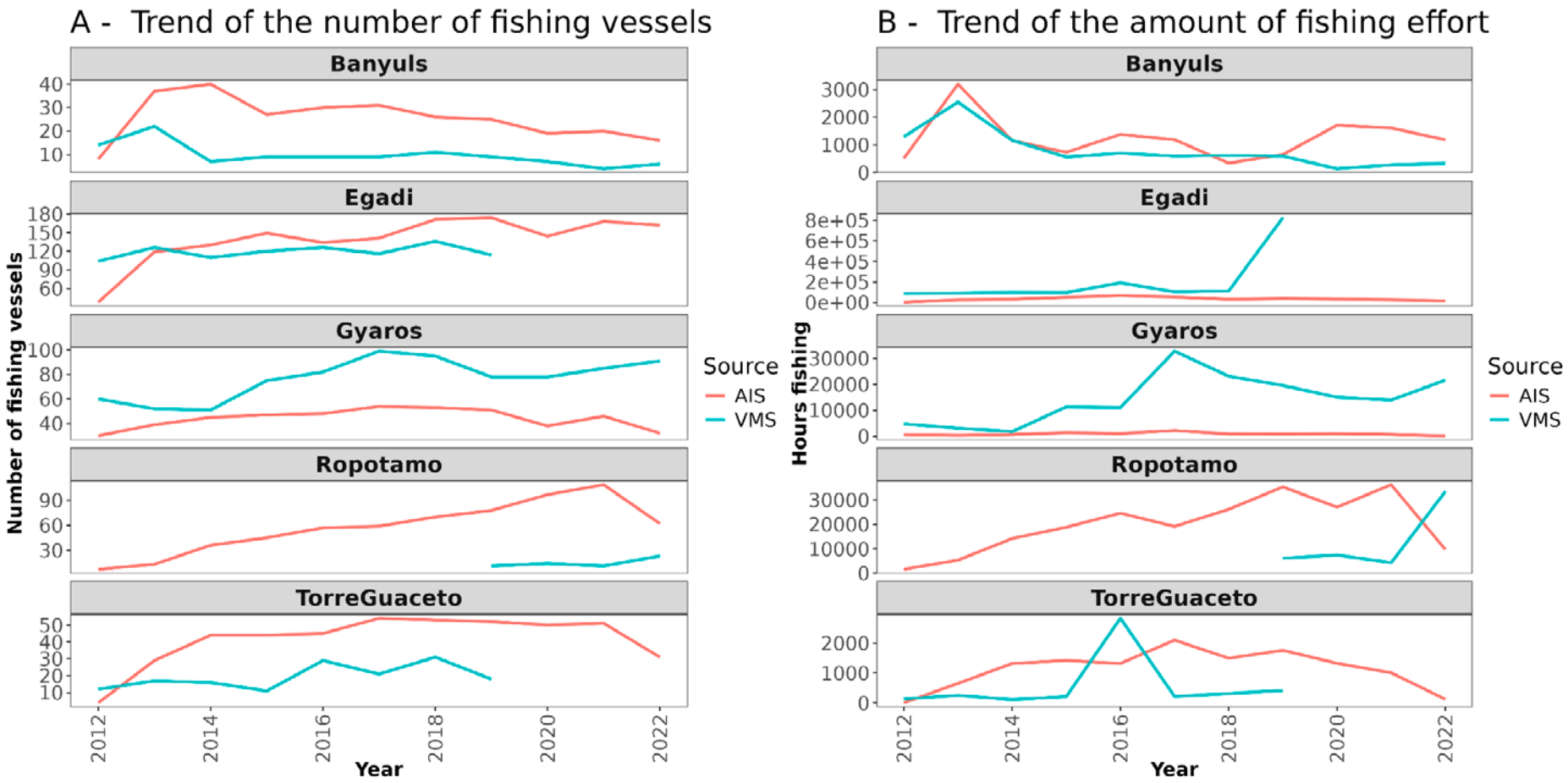

Figure 3-32 Trends of (A) the number of fishing vessels operating in each case study and (B) the corresponding amount of fishing effort, as reconstructed using VMS and AIS data.

The analysis of VMS and AIS data with respect to the fishing gear used, revealed a heterogeneous situation (Figure 3-11). It is important to recall that the analysis of VMS and AIS is related not only to the MPA but also to the surrounding area (where other gears are used).

- Bottom otter trawling (OTB) dominated the effort in Cerbère-Banyuls, Egadi, Gyaros,Torre Guaceto;
- Midwater otter trawling (OTM) dominated the effort in Ropotamo;
- Purse seining (PS) was well represented and important in Cerbère-Banyuls and Egadi islands;
- Set longlines (LLS) were present in the Egadi islands and Gyaros;
- Set gillnets (GNS) were present in the Egadi islands, Gyaros and Ropotamo;
- Cerbère-Banyuls also hosted other gears - Pots and Traps (FPO) Trammel nets (GTR), and Seines (SX).

See Annex 6.24 for maps representing the fishing footprint for each gear in each case study. A selected example is reported in Figure 3-12.

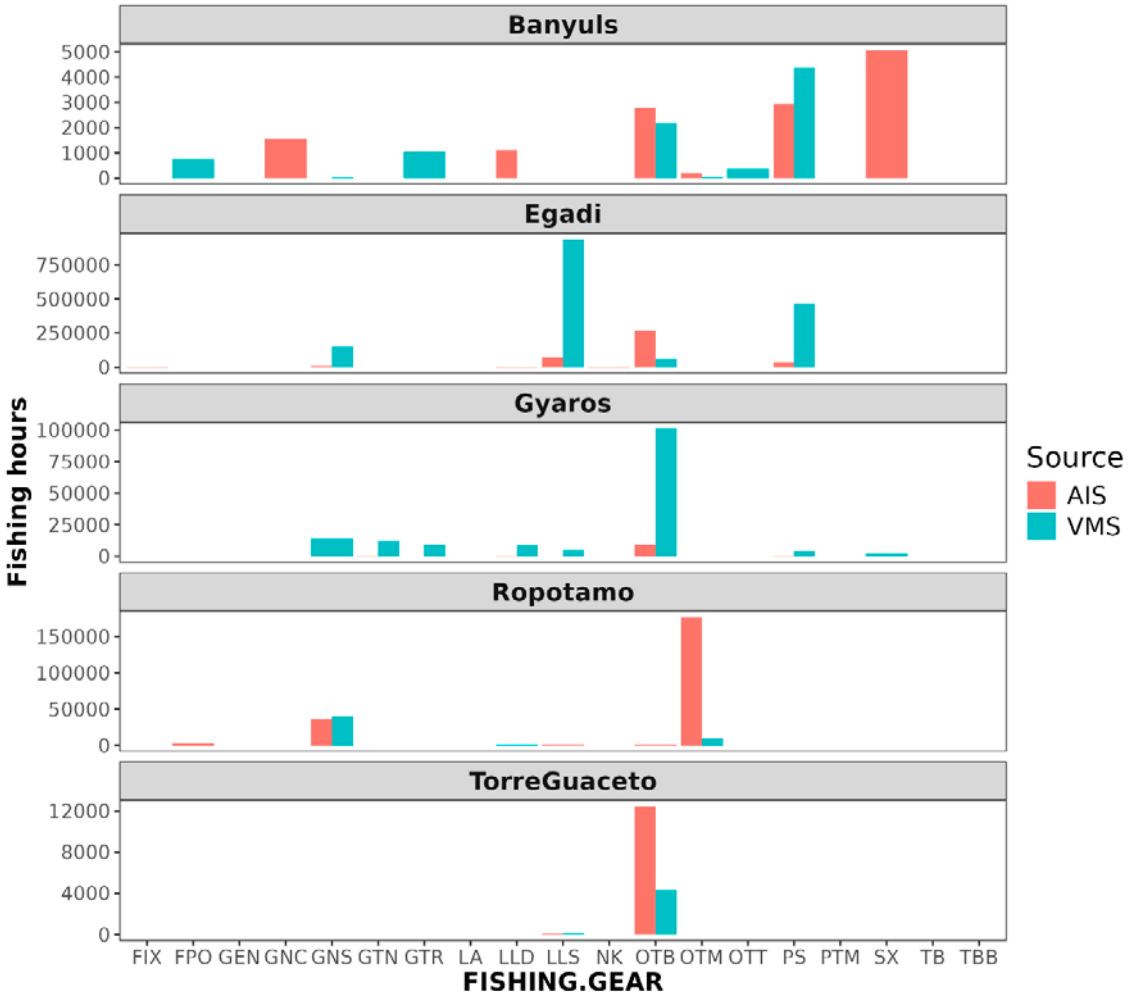

Figure 3-33 Barplots representing the total amount of fishing effort in each case study and by gears (Metier of level 4).

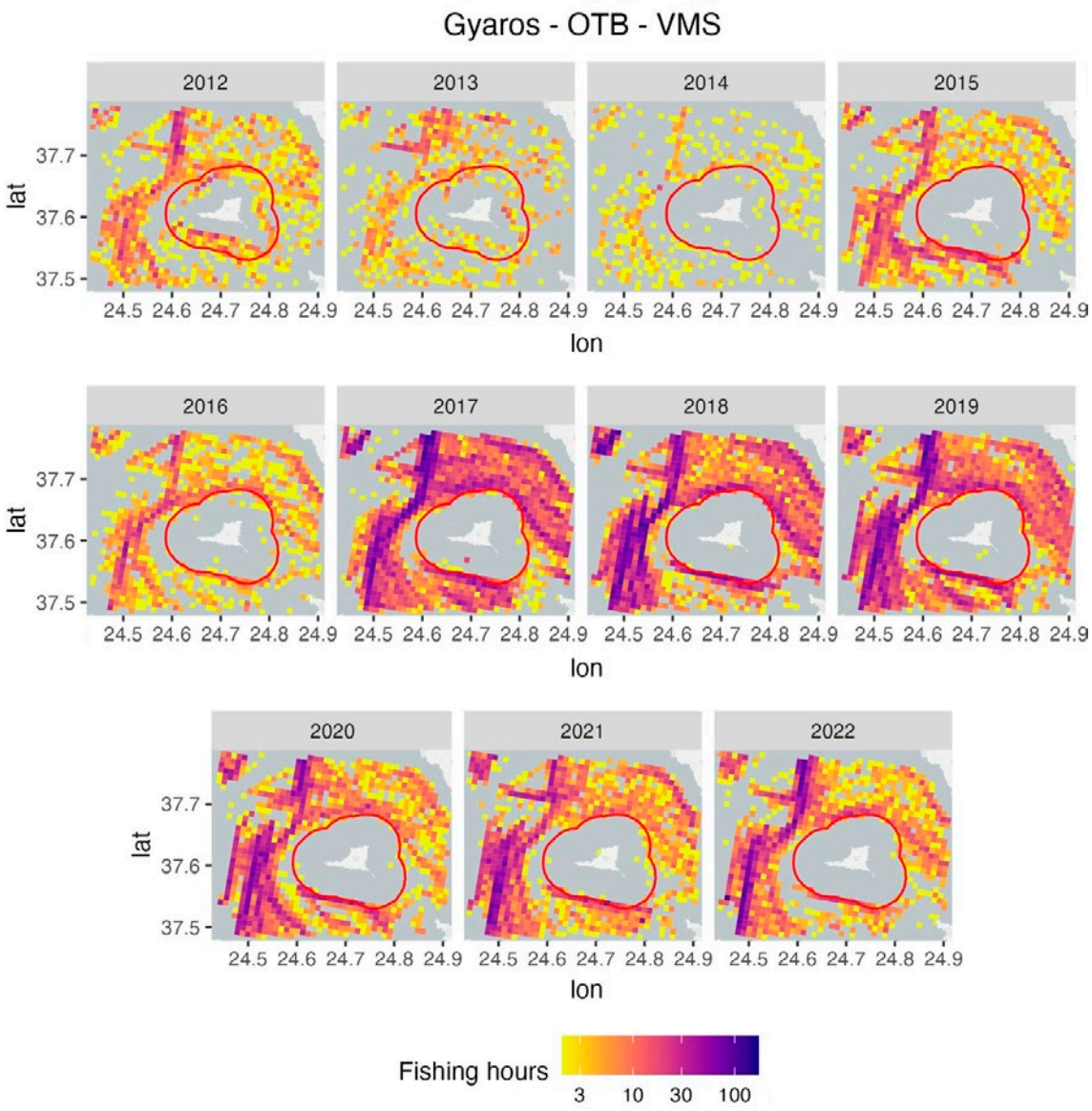

Figure 3-34 Example of map representing large-scale fisheries fishing footprint: Bottom Otter Trawling in Gyaros from 2012 to 2022, as gathered from VMS data.

The average percentage distribution for each gear/area, calculated from VMS and AIS data, was analysed for the different protection levels considered in this analysis:

- Fully-protected areas (FPA);
- Partially-protected areas (PPA);
- Unprotected areas (UA).

With only one exception (Bottom Otter Trawling in the FPA and PPA of Cerbère-Banyuls and Drifting Longlines in the PPA of Cerbère-Banyuls), the analysis of AIS data allowed us to detect that all large-scale fishing effort is located in the UA of each case study. Overall, these exceptions accounted for less than 7% of the total effort in Cerbère-Banyuls. The analysis of VMS data confirmed these results: all the effort of the large-scale fleet was detected in the UA in four out of the five case studies whereas, in Cerbère-Banyuls, there was activity of Pots and Traps and Trammel Nets in the FPA and the same gears, together with Set Gillnets and Purse Seines, were present in the PPA (Figure 3-13 and Figure 3-14).

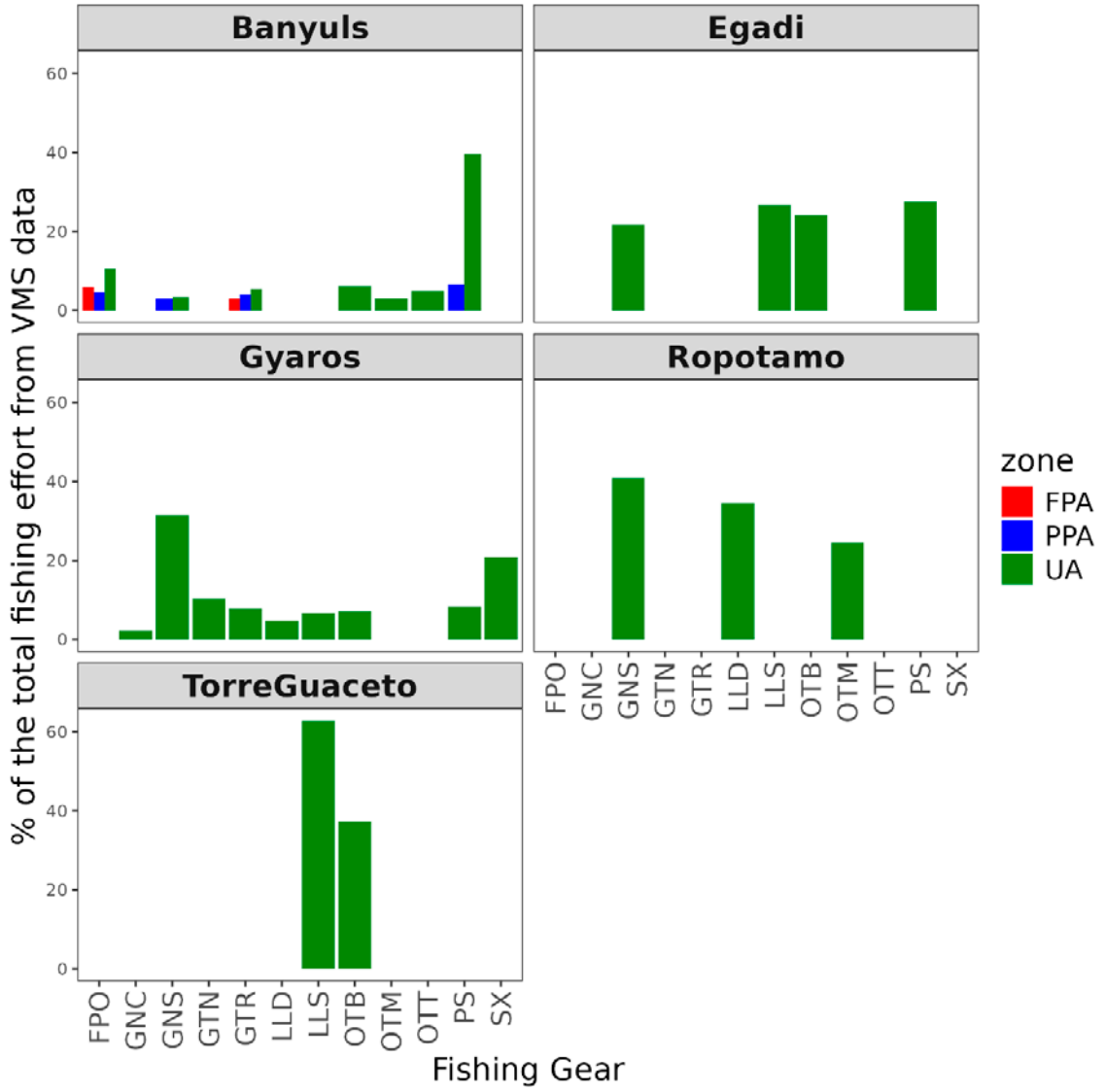

Figure 3-35 Barplots representing the relative amount of fishing effort (hours fishing from VMS data) allocated, for each case study and gear, in the three types of areas. FPA: Fully protected area; PPA: Partially protected area; UA: Unprotected area. The percentages were computed with respect to the total amount of effort in each case study.

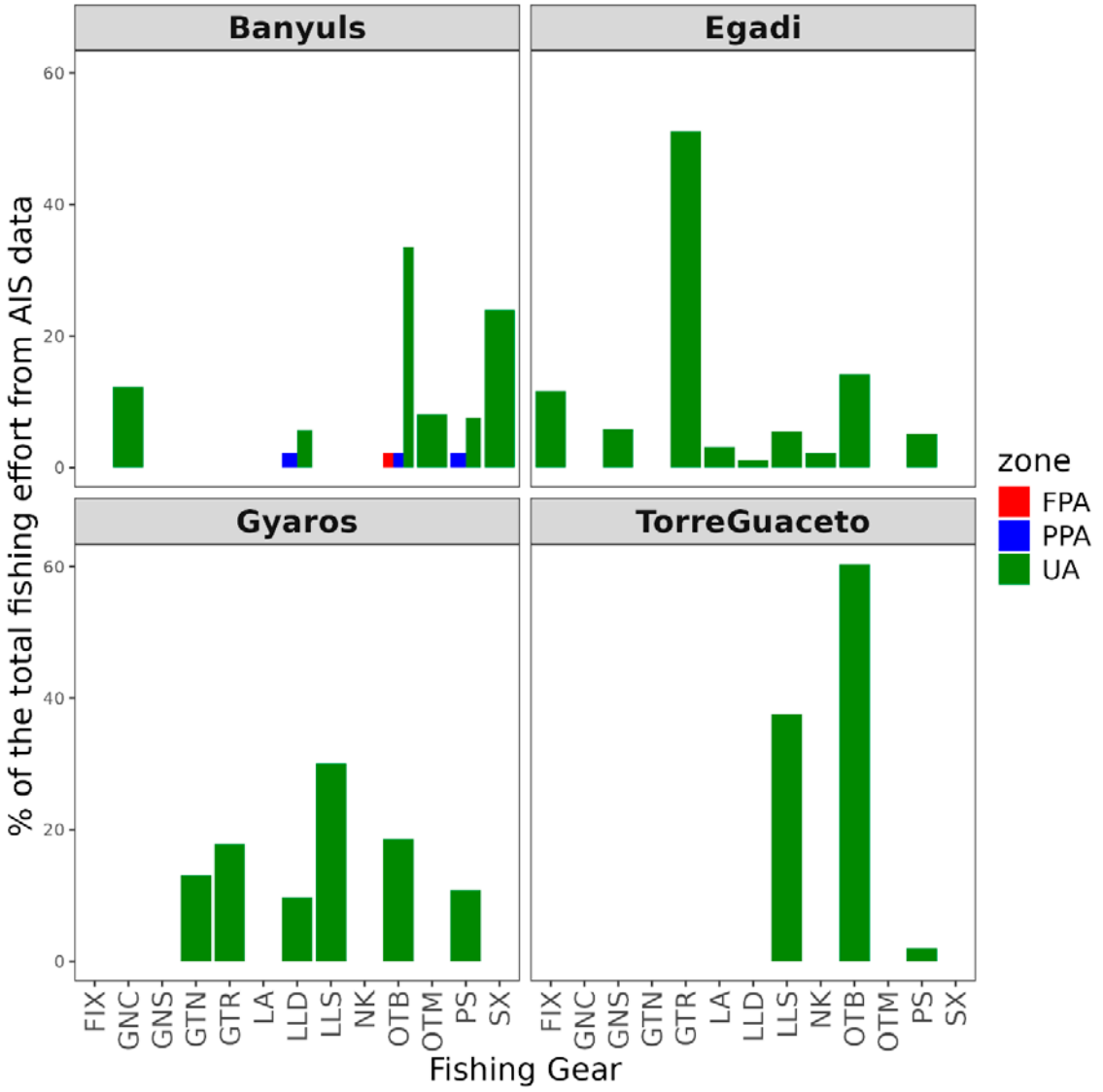

Figure 3-36 Barplots representing the relative amount of fishing effort (hours fishing from AIS data) allocated, for each case study and gear, in the three types of areas. FPA: Fully protected area; PPA: Partially protected area; UA: Unprotected area. The percentages were computed with respect to the total amount of effort in each case study.

The application of the GAMs to the AIS and VMS data yielded the results summarised in Table 3-3, Table 3-4 and Figure 3-15. Both applications yielded satisfactory and largely concordant results. The model based on AIS data although simple in its structure, captured 42% of the overall variance in terms of effort distribution. The model based on VMS data showed a lower performance, but this is largely justified by the small amount of data available. However, both models showed a statistically significant effect of all predictors (Time, Depth and Distance to MPA). Apart from the effect of depth which is different in the two models (this too can be explained by the fact that, essentially, the two models refer to different case studies due to the different coverage of the AIS and VMS systems), the effect of time (Years) and distance from the MPAs is coherent.

The analysis of the variance inflation factor (VIF) allowed, for both AIS- and VMS-based GAM models, excluding the presence of collinearity between the predictors. In

fact, in all cases, the values of the VIF were smaller than 1, which is considered a robust threshold (Sheather, 2009).

The effect of distance from the nearest FPA inside each MPA as captured by its smooth terms ([36])in the two models (Figure 3-15), shows that:

- In the model based on the AIS data (which is, the one with the lowest explained variance and R2 values – see Table 3.3), a positive and progressively decreasing effect is determined by the proximity to the FPA edge. A second peak can be observed at around 16 km from the FPA. This positive effect strongly declined at around 20 km from the FPA edge;
- In the model based on VMS data (the best model in terms of explained variance and R2 – see Table 3.3 & 3.4), the maximum effect on fishing effort occurs about 5-10 km from the FPA edge of each MPA, but it is positive also in the 0-5 km range and it declined rapidly at around 20 km far from the FPA edge;
- In both models the score of the smoothed term for the distance from the FPA edge is positive in the 0-15 km range, indicating a general increase in fishing activity in the PPA and the areas surrounding the FPA;
- The differences between the models can be attributed to the different coverages of AIS and VMS with respect to the case studies.

This result, which is in agreement in the two models, indicates that all direct effects (forced displacement) and indirect effects (potential change in the abundance of the species exploited, including by spillover from the MPA), led to an increase in effort in the areas surrounding the MPA.

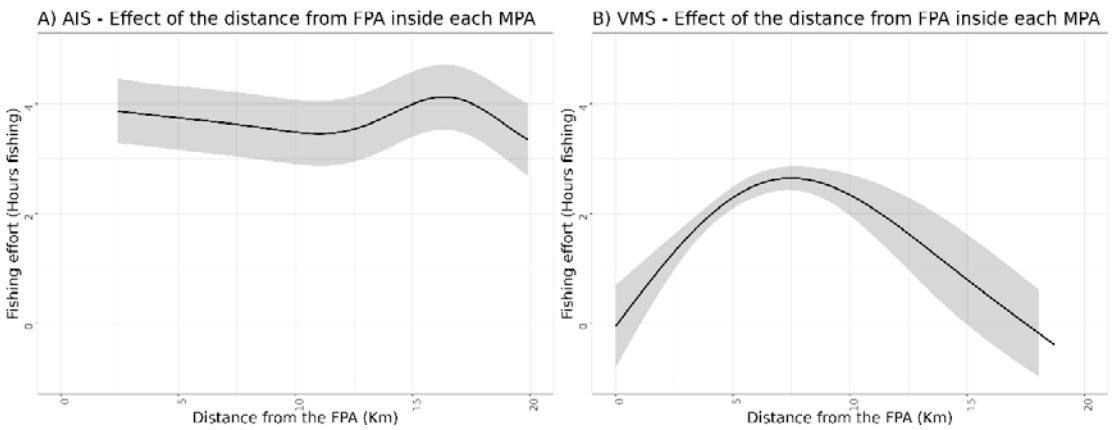

Figure 3-37 Representation of the Smooth term for the distance from the MPA as modelled by the GAM fitted on (A) AIS and (B) VMS data. Confidence intervals are represented in grey

Table 3-8 Main statistics for the GAM model fitted on the AIS and VMS data

AIS Model	
Statistics	Value
Deviance explained	18.2%

([36]) Smooth term refers to the non-linear effects estimated by the model, which allow for more flexible relationships between predictors and the response variable.

AIS Model	
R-sq.(adj)	0.156
Number of records	1322

VMS Model	
Statistics	Value
Deviance explained	31.9%
R-sq.(adj)	0.197
Number of records	2073

Table 3-9 P-values estimated for the smooth predictors of the GAM models

AIS Model	
Smooth term	p-value
s(Year)	<2e-16 ***
s(Depth)	<2e-16 ***
s(Distance from the FPA)	<2e-16 ***
VMS Model	
Smooth term	p-value
s(Year)	<2e-16 ***
s(Depth)	<2e-16 ***
s(Distance from the FPA)	<2e-16 ***

3.3.1.2 SSF: Analysis of survey data

The analysis of the surveys data and maps showed that:

- Only a small number of maps provided clear spatial information on the gear used and target species in addition to the distribution of fishing effort;
- The introduction of MPAs did not substantially affect the gear used or the species targeted.

Figure 3-16 and Figure 3-17 provide the results obtained from the digitisation of the information collected via the surveys. The differences in the distribution of fishing effort for small-scale fisheries, as described by the fishers, are depicted for the periods NO MPA/WITH MPA or BEFORE MPA/AFTER MPA and further emphasised by a map representing the delta between the two moments/conditions. In all cases, clear differences were observed, the statistical significance of which was confirmed by the Syrjala test ($p < 0.01$). The analysis was not run for Ropotamo as the maps were identical in the before and after setting given that the MPA had not yet set its regulations.

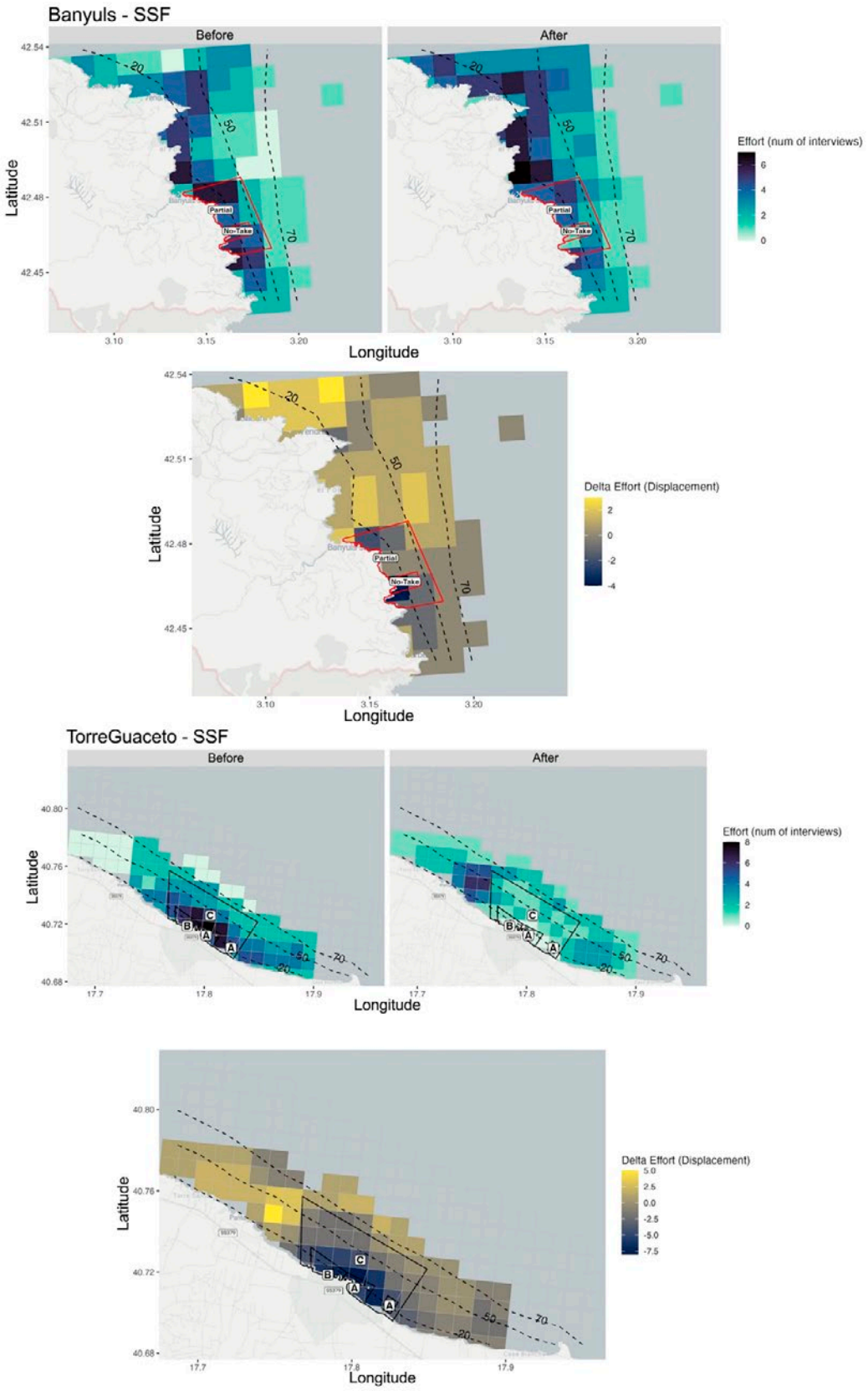

Figure 3-38 Fishing footprint of small-scale fisheries in Egadi and Gyaros before and after the establishment of the MPA (from the digitised surveys). Ropotamo is not shown as the maps were identical in the before and after setting given that the MPA had not yet set its regulations.

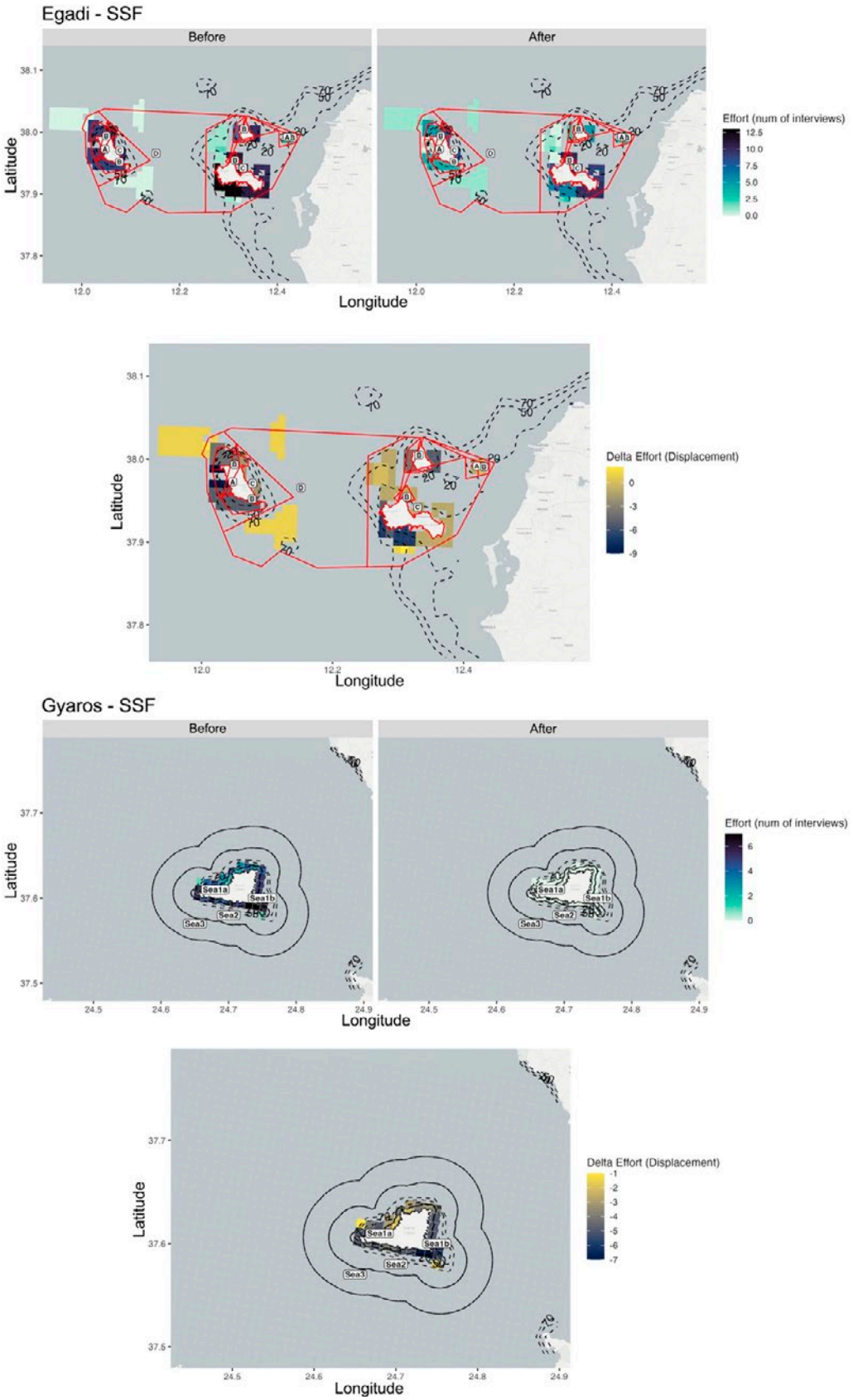

Figure 3-39 Fishing footprint of small-scale fisheries in Banyuls and Torre Guaceto before and after the establishment of the MPA (from the digitised surveys). Ropotamo is not shown as the maps were identical in the before and after setting given that the MPA had not yet set its regulations.

The digitised surveys were used to analyse the distribution small-scale fishing, with reference to the different zones (FPA, PPA, UA) in each case study (Figure 3-18).

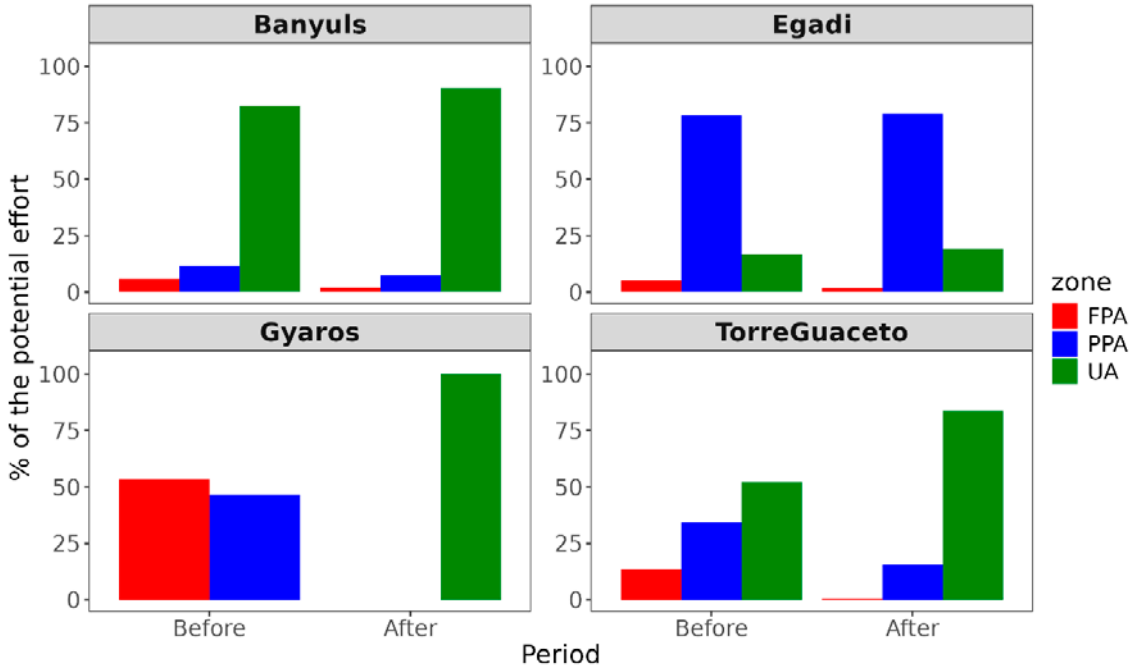

Figure 3-40 Barplot representing the relative proportion of the potential fishing effort (as number of surveys indicating the existence of fishing activity by zone and case study). FPA: Fully protected area; PPA: Partially protected area; UA: Unprotected area. Ropotamo is not shown as the maps were identical in the before and after setting given that the MPA had not yet set its regulations.

In all cases, the effort initially allocated in the FPA disappeared (or at least strongly decreased). An aspect to highlight is that the portion of effort allocated to FPAs after their establishment, which is always less than 5%, is probably an artefact (or at least an overestimation) due to the spatial resolution (1 km) used and the very limited size of FPAs, that does not allow the spatial distribution of fishing effort to be resolved at such a fine scale.

In the case of Cerbère-Banyuls, the effort initially allocated in the FPA and a portion of the effort in the PPA moved to the UA. In the case of the Egadi islands, the effort initially allocated in the FPA became distributed equally in the PPA and UA. The most significant change was found in Gyaros, where all the effort originally located in the FPA and PPA moved to the UA. Finally, in the case of Torre Guaceto, almost all the effort originally located in the FPA and a large part of that located in the PPA moved to the UA. The case study of Ropotamo was not represented because the maps compiled by the fishers for the two periods were identical since the MPA had not yet been fully implemented.

The SSF surveys revealed the fishers (both small and large scale) declared there was no agreement between fishers as to where they fish and that the MPA had not changed this. Two SSFs indicated that where you fish depended on who arrived at the fishing location first and that older fishers usually were given priority. Four LSFs indicated the weather conditions, gears used, and target species are the determining factors. One SSF indicated that the MPA meant there were fewer fishing grounds available for fishers so there was more competition for space. When fishing outside

the MPA, on average SSFs indicated that they fish 6.5nm from the MPA, with distances ranging from 0.05nm to 25nm.

Regarding how the creation of the MPA had changed small-scale fishing activity, the most common response declared by fishers via the SSF survey (answers pooled from all the case study sites) was to reduce their overall fishing activity (45%:35), followed by moving their fishing activity to fishing grounds they had already been using (19%:15) (Figure 3-19). Few fishers reported moving part, or all, of their activities to new fishing grounds (5%:4 and 4%:3, respectively).

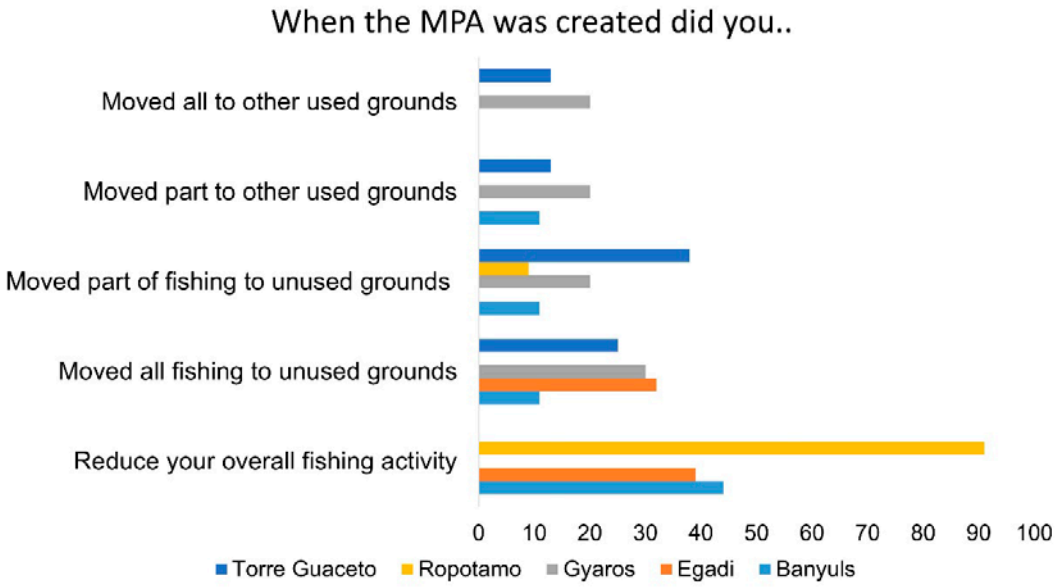

Figure 3-41 SSFs % change in fishing activity in response to the MPA/MPA regulations (n =93)

Survey results revealed the proportion between the number of days in which fishers operate inside the MPA vs outside differed among the five case studies, with one site (Egadi) where the fishers operated more often inside the MPA, one where fishers fished almost the same number of days per week inside and outside the MPA (Ropotamo) and three case studies where fishers operated more often outside the MPA. Table 3-5 describes the average number of days fishing inside and outside.

Table 3-10 Average number of small-scale fishing days inside and outside the MPA.

MPA	Av. Days inside MPA	SE±	Av. Days outside MPA	SE±
Cerbère-Banyuls	1.8	0.76	5.2	0.75
Egadi	4.4	0.39	0.6	0.19
Gyaros	0.35	0.2	6.6	0.2
Ropotamo	2.8	0.14	2.3	0.17
Torre Guaceto	0.5	0.19	6.4	0.18

3.3.2 Fishers' perceptions on the MPA and their fishing activities

3.3.2.1 Fisher profile

All fishers were male ranging in age from 20-60+ years. Most (60%) had a middle school level of formal education. Fishing experience ranged from 10-50+ years. Most (97%) SSFs were boat owners with 1-4 crew members working on the vessels, and 96% of LSFs (with 2-15 crew members per vessel). Fishing was the sole source of household income for 41% of SSFs. Forty-two SSFs (45%) reported that they had at least one immediate family member involved in the fishing industry. Boat length (bow to stern) for SSFs ranged from 5.6-12m and from 6-25.5m ([37]) for LSFs.

3.3.2.2 Attitudes towards the MPA and its impacts on fishers

Respondents were asked to provide their perceptions on a series of statements that explored the effect of the MPA on a number of variables such as access to fishing grounds, quantity of fish caught, levels of competition etc. Figure 3-20 provides an overview of the perceptions collected from SSFs. Data for LSFs and KIs are available in Annex 6.25. Overall, responses from SSF were relatively negative (for example a perceived reduced access to fishing grounds, a perceived increased cost associated with fishing activities, a perceived increased competition with recreational fishers) with one important exception, represented by the effect on economic conditions in terms of income diversification through complementary activities (the income received from other activities is perceived to have increased). Other positive outcomes are associated with the price per kilo of fish caught in the MPA and the reduction in the number of other commercial fishers fishing in the areas that they fish. Some fishers stated that it is not possible to attribute impacts/effects to the MPA. They said they are increasingly seeing evidence of other larger pressures, such as climate change.

([37]) Small-scale coastal fishing' means fishing activities carried out by: (a) marine and inland fishing vessels of an overall length of less than 12 metres and not using towed gear as defined in point (1) of Article 2 of Council Regulation (EC) No 1967/2006; or (b) fishers on foot, including shellfish gatherers (Article 2.2 (14), Regulation (EU) 2021/1139).

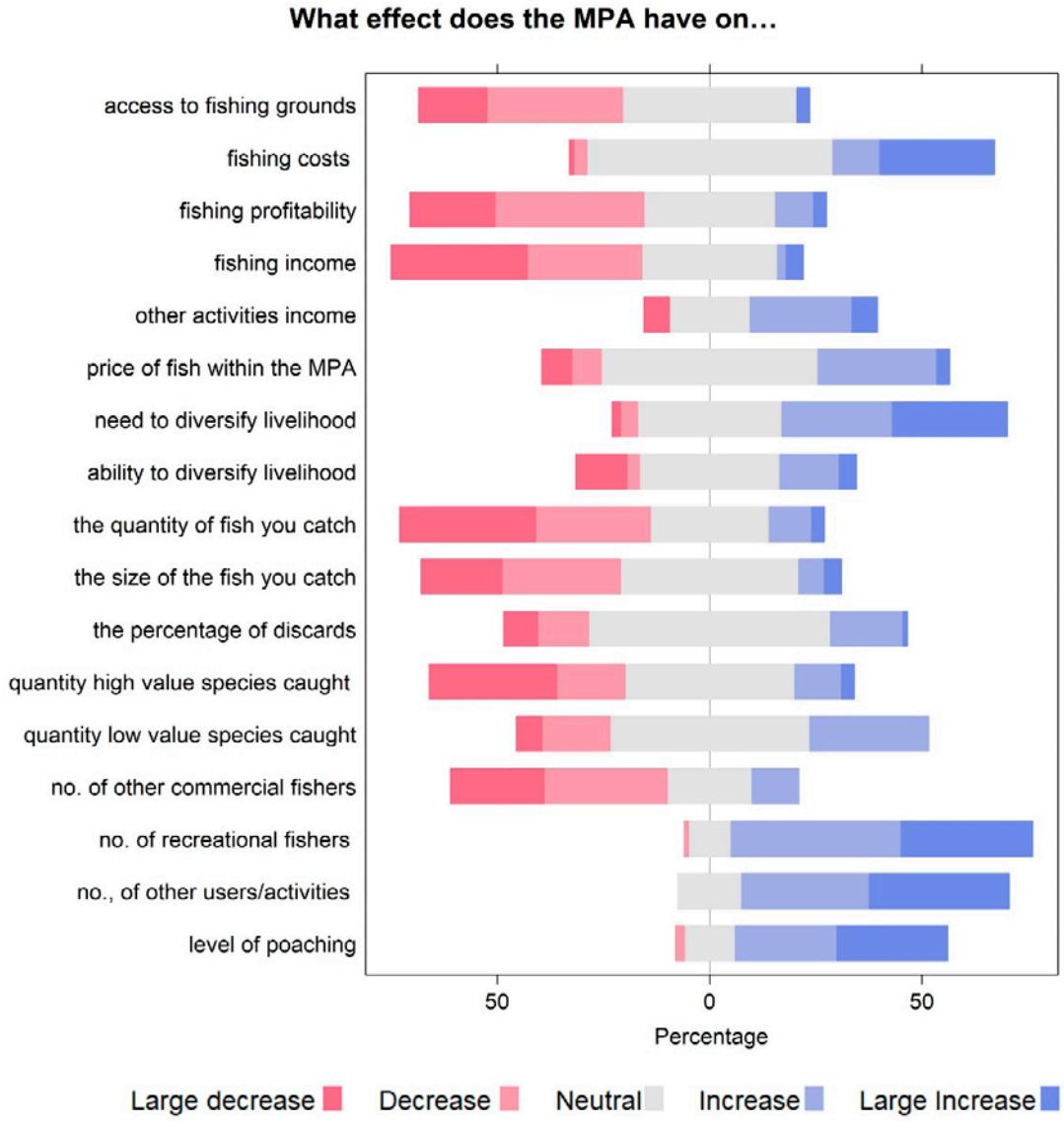

Figure 3-42 SSFs perceived impact of the MPA. Data from the five case studies are pooled (n = 93). No answer and don't know responses have been removed for visualisation purposes.

Most SSFs (38%; 35 out of 93) felt the MPA had a negative effect on their business, with only 13% (12/93) perceiving a positive impact. SSF perceptions were positive regarding the potential of MPAs to provide conservation benefits for the seabed and marine species, fish spawning and nursery areas, fish stocks and minimising incidental catch of vulnerable species. Most SSFs (63%; 59/93) perceived small-scale fishing activities to be compatible with the goal of the MPA to protect marine ecosystems and fish stocks, and 22% (20/93) felt they were incompatible.

Around 38% (9/24) of LSFs reported large-scale fishing activities to be compatible with the MPA, whereas 29% (7/24) and 13% (3/24) stated them to be incompatible and highly incompatible, respectively (Annex 6.25). Fourteen (73%) KIs perceived small-scale fishing activities to be compatible with the MPA objectives and 16% (3/19) incompatible. KIs spoke to the more sustainable nature of small-scale gears which they described as being less destructive. They also indicated that small-scale fishing is more adaptable, and gears and activities can be altered to more easily meet

new restrictions implemented with an MPAs designation. However, several KIs spoke to their concerns about how fishing activity of any kind, particularly when ineffectively managed and/or not limited, can have very negative environmental consequences. In contrast 79% (15/19) of KIs perceived large-scale fisheries to be incompatible with the MPA in questions objectives', stating that large-scale gears are generally more destructive given that many make direct contact with the seabed which has an adverse effect on benthic communities. Four KIs (21%) called for a ban on large scale gears, especially, trawling in MPAs.

3.3.2.3 Attitudes towards management and governance

The perceptions of SSF regarding MPAs governance and management (i.e., treatment of fishers when the MPAs were created, level of consultation, inclusion of fishers' traditional knowledge) were relatively negative (Figure 3-21).

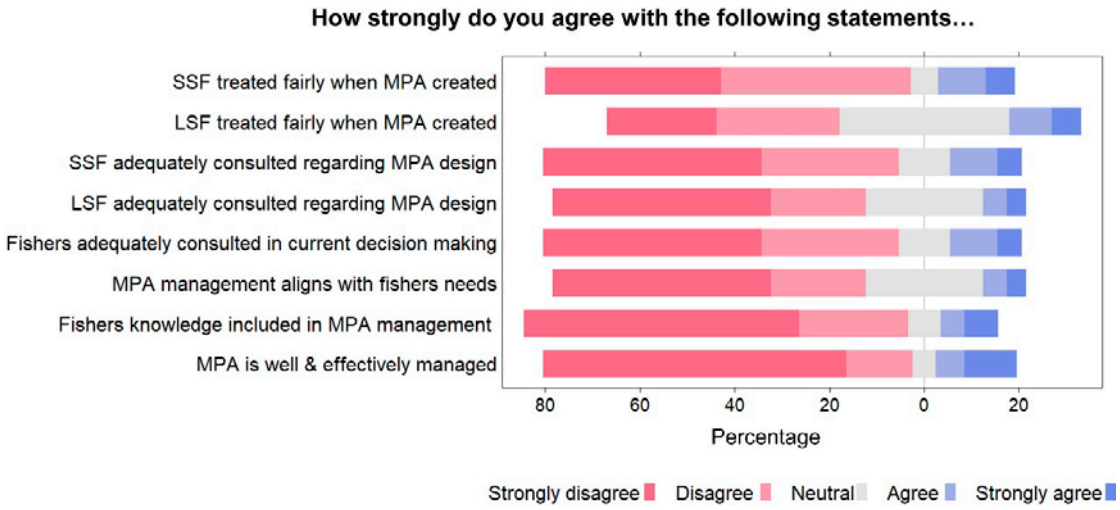

Figure 3-43 Perceptions of small-scale fishers regarding MPAs governance and management. Data from the five case studies are pooled (n = 93). "No answer" and "don't know" responses have been removed for visualisation purposes.

Seventy-six (82%) SSF declared there to be no/low involvement of fishers in MPA decision-making and/or management activities. Seven (8%) SSFs (from Cerbère-Banyuls, Gyaros and Torre Guaceto) stated there to be some/high involvement. Twenty-three (96%) of LSFs stated there to be no/low involvement of large-scale fishers in the decision-making. Nine KIs (53%) also perceived no/low involvement. Only KIs for Cerbère-Banyuls (all 3 interviewed) and both KIs interviewed for Torre Guaceto reported some/a high level of involvement. Six (33%) and 10 (53%) KIs indicated that there should be some/a high involvement of fishers in decision-making processes, respectively. Several KIs spoke to the need for fishers to be involved in decision-making processes to increase the legitimacy and acceptance of management measures.

3.3.2.4 Predicting fishers' support for and adaptation to the MPA

Thirty-four (37%) SSFs felt they had not adapted their fishing business to the MPA, whereas 19% (18/93) felt they had adapted. Eight (33%) LSFs felt they had not

adapted their fishing business well to the MPA, whereas 21% (5/19) felt they had adapted well/very well (see Figure 3-22).

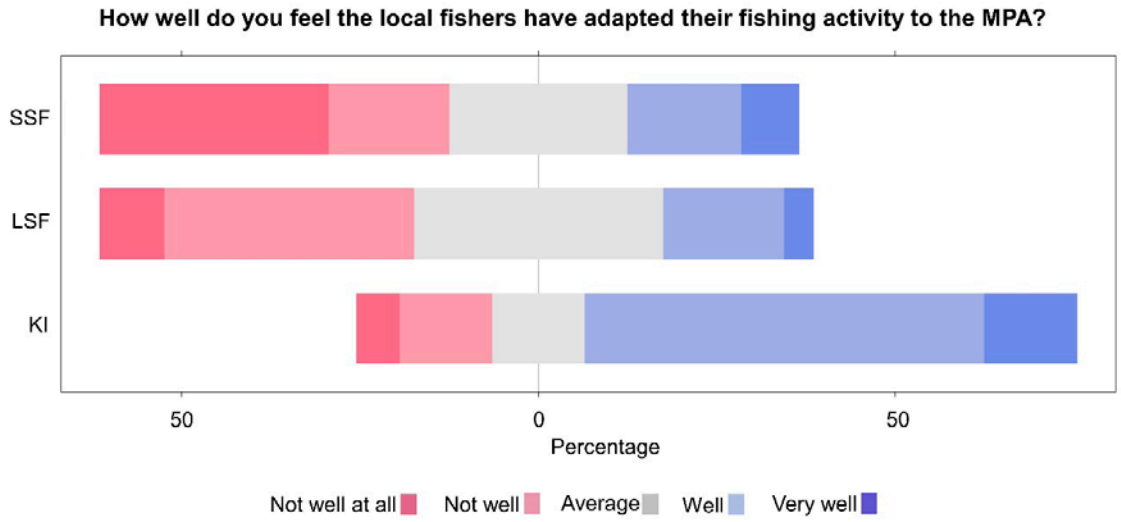

Figure 3-44 Perceived adaptation of their fishing activity to the MPA, per respondent category. KIs were asked to report on how well they thought fishers had adapted. Data from the five case studies are pooled (n = 93 SSF, 24 LSF, 19 KI). "No answer" and "don't know" responses have been removed.

Thirty-nine (42%) of SSFs were supportive of the MPA, in contrast 33% (31/93) were opposed. Seven (30%) LSFs were supportive of the MPA in question and 65% (15/23) were opposed (Figure 3-23).

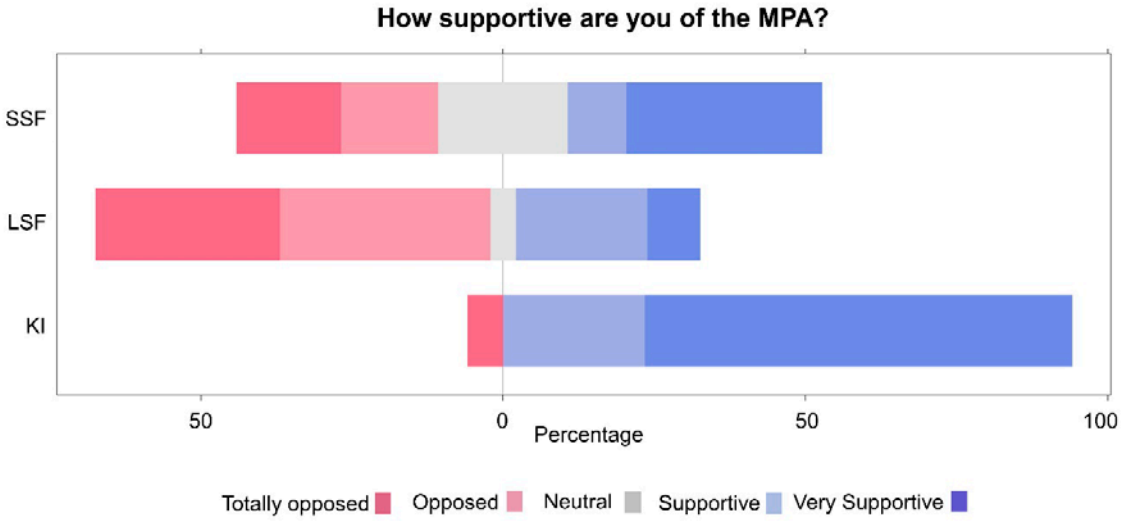

Figure 3-45 Perceived level of support for the MPA, per respondent category. KIs reported on their personal level of support. Data from the five case studies are pooled (n = 93 SSF, 24 LSF, 19 KI) "No answer" and "don't know" responses have been removed for visualisation purposes

SSF' level of support for the MPAs was significantly related to the perception of the overall impact of the MPA on their fishing business (X^2=19.11, p=0.001), the quantity of fish they catch (X^2=5.66, p=0.013), the extent to which they believed they are consulted if decisions are made now about the MPA (X^2=8.38, p= 0.004), and their opinion about the importance of the MPA to protect both the seabed and marine species (X^2=5.20, p =0.022) and spawning/nursery areas (X^2=6.28, p =0.010).

Small scale fishers who believed that the MPA had a negative impact on their fishing business (39%:36) were more likely to oppose the MPA (61%:22 opposed) than fishers who believed the MPA had no impact or a positive impact (35%:33) on their fishing business (12%:4 opposed). Similarly, SSF who believed there to be a low level of consultation when decisions are taken now regarding the MPA and its management (73%:68) were more likely to oppose the MPA (41%:28) than fishers who believed they were adequately consulted now (18%:17) with 12% (2) opposed. SSF who believed that the MPA had a negative impact on the quantity of fish they catch (59%:54) were more likely to oppose the MPA (44%:24 opposed) than fishers who believed the MPA had no impact or a positive impact (41%:38) on the quantity of fish they catch (16%:6 opposed).

The level to which SSF felt they had adapted to the MPAs in question was significantly related to the perception of the overall impact of the MPA on their fishing business (X^2=17.57, p=0.001), the quantity of fish they catch (X^2=4.47, p=0.034) and the profitability of their business (X^2=6.17, p=0.012). Their opinion regarding the income they received from fishing was also found to be important but not statistically significant (X^2=3.46, p=0.06). SSF who believed that the MPA negatively impacted their business (36:39%) were less likely to feel that they had adapted (11%:4 adapted) compared to fishers who believed that the MPA had a positive impact (13%:12) on their business (58%:7 adapted). Small scale fishers who believed that the MPA negatively impacted the quantity of fish they catch (57%:54) were less likely to feel that they had adapted (13%:7 adapted) compared to fishers who believed that the MPA had a positive impact (13%:12) on their business (33%:4 adapted). Similarly, SSFs who believed that the MPA negatively impacted the profitability of their business (56%:52) were less likely to feel that they had adapted (14%:7 adapted) compared to fishers who believed that the MPA had a positive impact (12%:11) on their business (46%:5 adapted).

3.3.3 Conceptual model

Here we present a simplified and conceptual model of the spatial-temporal dynamics associated with the effect of MPAs. The conceptual model has the capacity to serve as an infographic tool that showcases the overall takeaway messages of the interaction between spatial management approaches, the marine ecosystem, and fisheries activities. The model is an intricate infographic with multiple elements that explains the diverse processes that interact and outcomes that stem from the establishment of MPAs with diverse levels of protection (Figure 3-24).

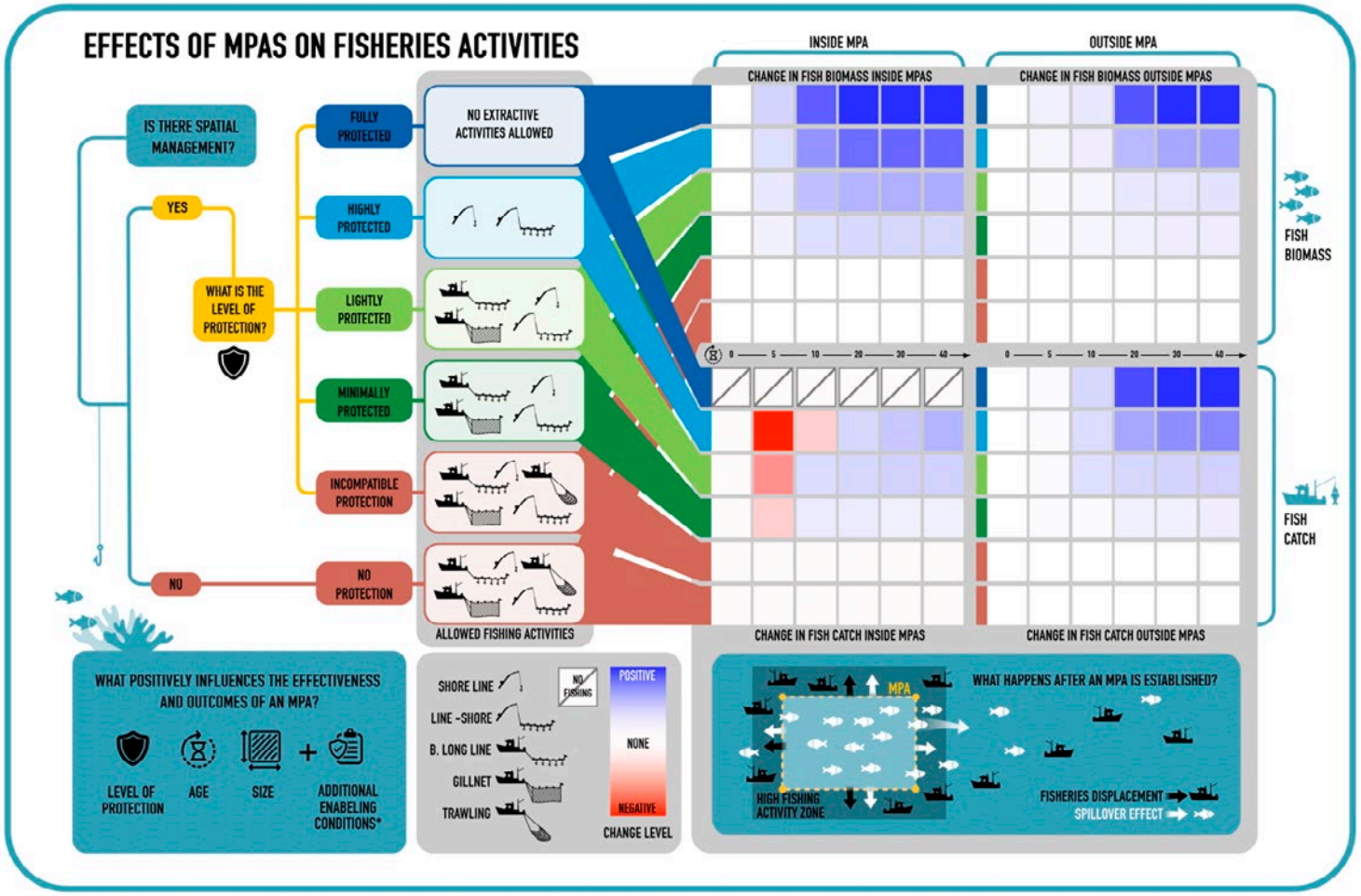

Figure 3-46 Effects of MPAs on fisheries activities, a conceptual model. (*Additional enabling conditions: network effect from other fully protected MPA proximity, co-management of the MPA, compliance, sufficient funding, monitoring and evaluation, support from the communities and support for livelihoods of local communities (Grorud-Colvert et al., 2021)) (See Annex 6.26 for a larger format of the above model

This conceptual model illustrates the outcomes that MPAs with different levels of protection will have over the ecosystem and fisheries. Starting from the left, the framework starts with a decision tree to determine the focal type of spatial management scenario; then, to the choice of the level of protection, as it is an important driver of MPA impacts on biodiversity and fisheries; depending on the level of protection specific fishing activities are allowed or not within the MPA; after determining a level of protection we can then follow the colour coded connectors to a diverse set of heatmaps that showcase the level of change that each management measure will have over time; the heat maps are constructed for: change in fish biomass inside MPAs and outside MPAs, and change in fish catch inside and outside MPAs. In the panel below to the left we can find the factors that will positively influence the effectiveness and the change effect that MPAs will have. These will have an effect over the expected changes by reducing negative changes and increasing the level of positive changes. In the lower central panel, we showcase the different fishing gears iconography and the possible change level gradient in the heatmap: Red signifies a negative change, white signifies no change is occurring, and blue indicates positive change, with the gradient indicating the strength of this effect. In the lower right panel, we incorporated the spatial effect that MPAs will have both on fisheries displacement and over fish spillover.

Inside MPAs, gains in biomass appear after the first 5 years of strong protection and tend to stabilise after 10-20 years. For the lowest level of protection, biomass sees no substantial gain in the long term. Outside MPAs, gains appear after 10 years of protection and stabilise after 30 years. Implementation of any MPA leads to short-term losses in catch (for 5 to 15 years depending on the level of protection) and long-term gains inside the MPA. Whereas, outside of the MPA, protection only leads to long-term gains in catch. Losses in catch inside MPAs are observed right after the implementation of the MPA. These losses are generally higher for stronger levels of protection, and they are also more persistent through time. Outside MPAs, no losses are observed, and gains appear, after around 10 years of protection. Gains appear later and are lower with lower levels of protection. Gains are observed from 10 to 30 years. However, for low levels of protection, losses last longer and are not completely compensated, even after a long period of protection (refer to cases heatmap in Figure 3-24 minimally protected level of protection). However, losses are systematically compensated for in 10-20 years, and gains appear. Generally, gains in catch are observed because MPAs increase the biomass and, thus, more fishes are catchable.

While all scenarios offer short- and long-term gains in biomass, gains in catch appear after 10 years of protection. After the implementation of an MPA, there are no benefits for fisheries, they appear only after year 10, being substantially positive after year 20. The most efficient MPAs for conservation are ones with the strongest level of protection, while the lower losses in catch inside MPAs are observed for lightly and minimally protected areas, at least during the first 10 years. The best compromise scenario could be when MPAs with highly protected status are implemented, but in the long term, fully protected areas will always bring the best outcomes for fish biomass and for catch.

3.4 Discussion

3.4.1 Are MPAs playing a role in fishers' spatial reallocation?

The analyses presented in this study and the results obtained were set up according to the rationale illustrated in Figure 3-25.

The activity of the large-scale fleet was reconstructed using AIS and VMS data, which provided overlapped and complementary information about the fishing footprint of the fleet segments equipped with one of these remote tracking devices, but the temporal coverage is limited to the last 10 years. With reference to the case studies considered, only Gyaros and Ropotamo MPAs were established in the period covered by AIS and VMS.

The activity of the small-scale fleet, and especially the distribution of the fishing effort before and after the establishment of the MPA, was reconstructed using digitised versions of the paper maps in the stakeholder surveys. However, with this approach it is not feasible to obtain reliable quantitative information about the spatial fishing footprint (e.g., fishing hours as for the analysis of AIS and VMS data). Hence, digitised maps were interpreted performing the spatial overlaps of the grids and scoring each cell in terms of concordant surveys.

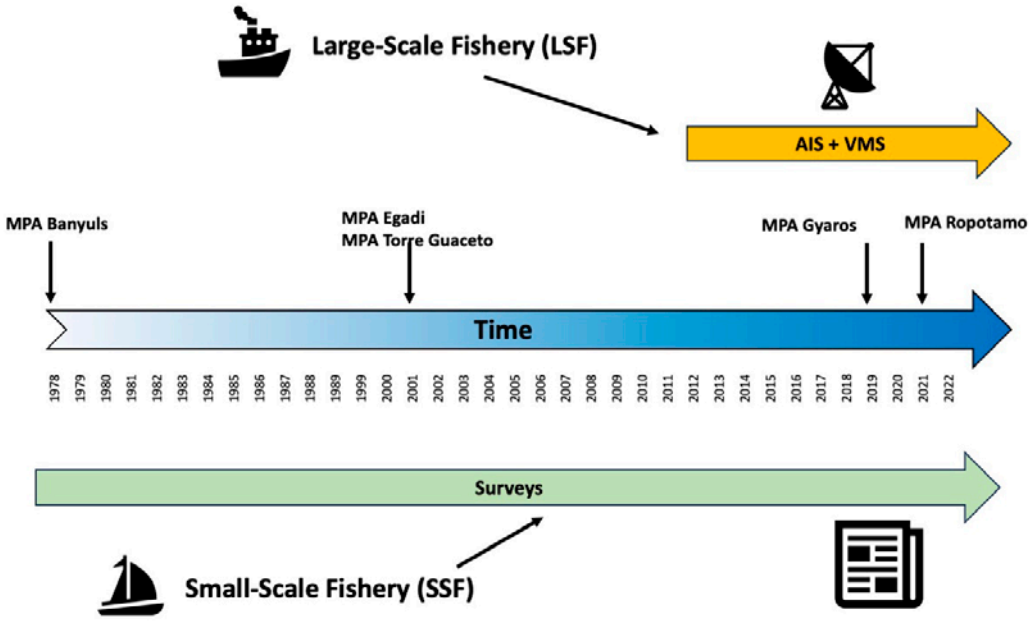

Figure 3-47 Rationale of the analyses presented in this study and coverage of the different data sources with respect to the timeline

This 'flexible' approach nevertheless allowed us to obtain comparable and consistent results, as the same spatial grid was used in all analyses.

The analysis of large-scale fleet behaviour and the results obtained can be summarised as follows:

- **The fishing effort of the large-scale fleet showed fluctuations over the period considered in all case studies** and for all fishing segments. The

demersal trawl (OTB) was the main gear in almost all areas, although the purse seine (PS) was also present in three of the case studies. All other gears contributed much less to the overall effort;

- **AIS and VMS data suggest that fishing effort is essentially non-existent in FPAs and PPAs**, i.e., in practically all MPAs, the activity being in the UA. The only exception detected in this study (represented by a small amount of effort for different gears Cerbère-Banyuls), could be related to the spatial resolution adopted and seems irrelevant);
- On the other hand, statistical analysis of the distribution of fishing effort by GAMs indicated **the existence of a significant effect of the presence of MPAs with both AIS and VMS-based models indicating an increase in fishing effort near the FPA boundary of each MPA**;
- In the VMS model, fishing effort reaches values close to zero at around 15 km from the FPA borders, while in the AIS model this reduction is much more gradual;
- The two models, despite some differences linked to the differential coverage of AIS and VMS, allowed us to detect that **the large-scale fleet avoided the FPA but their effort is actually displaced in the surrounding PPA-UA and especially in the 0-15 km buffer around the FPA**.

These results are consistent with previous findings in the literature. For example, the closure of the 'Cod Box' in the North Sea in 2001, that aimed to protect cod spawning areas to support stock recovery, caused the fleet of large vessels to displace their activity to fishing grounds in the North Sea outside the closed areas, with beam trawling concentrating along the borders of the closed areas and the already closed Plaice Box (Rijnsdorp et al., 2001). In the same way, the MPA designed in the western Baltic for cod protection caused a displacement of effort, which was concentrated around the boundaries of the Bornholm MPA, in line with the distribution of the target stock in fishable areas (Suuronen et al., 2010). A redistribution of effort to areas outside protected areas was seen after the implementation of substantial geographical closures in a North Pacific trawl fishery to safeguard red king crab - three zones were the focus of the effort, one of which was along one of the closures' southern borders (Abbott and Haynie, 2012). The establishment of the Pomo Pit fisheries restricted area (FRA) in the Adriatic Sea also caused the displacement of trawling activity in the surrounding grounds (Elahi et al., 2018). All these experiences support the findings presented in this study: large-scale fisheries, and **trawlers in particular, continued to maintain overall effort by trawling more outside of the FPA, especially near its borders, even though they were largely in compliance with the MPA**.

Research on the redistribution of effort following a simulated closure revealed that the fishing grounds closest to the closed area would experience the largest percentage change in probability of being fished by the fleet, in line with the "fishing the line" scenario (Kellner et al., 2007). Similar displacement of effort has also been predicted by other modelling studies (Hynes et al., 2016; Russo et al., 2019). It is challenging to forecast where fishing effort will be shifted, but if left unchecked, it may have negative effects on the marine ecosystem both in the locations it is moved from and in the areas, it is displaced to, as effort from other gear types grows. This covers effects on habitats and species of conservation significance in the MPA, other MPAs, and the larger maritime environment outside the MPA network. The

environmental benefits that may arise within the MPA must be weighed against the environmental costs that may arise from compensatory increases in fishing activity in other areas (Hiddink et al., 2006) or of other gear types within the MPA to determine the overall success of management for nature conservation. In this way, it seems crucial to anticipate the potential consequences of MPA designation through appropriate spatial models (Bastardie et al., 2014; D'Andrea et al., 2020; Russo et al., 2014).

The analysis of small-scale fleet behaviour and the results obtained can be summarised as follows:

- based on the participatory mapping exercises implemented, **fishers declared a total compliance (net of deviations attributable to the spatial resolution used) with the FPA, within which fishing effort disappears**;
- Therefore, the **establishment of MPAs leads to a statistically significant effect on the small-scale fleet, which undergoes an overall rearrangement of its fishing footprint**;
- In some cases (e.g., Torre Guaceto and Cerbère-Banyuls), the fishing effort initially present in the FPA moves further north or further south, but always along the coast and, therefore, in the same bathymetric range;
- In another case (Egadi islands), the effort previously allocated in the FPA moves to deeper areas previously frequented.

It seems reasonable to conclude that, even in the case of the small-scale fleet, **a high degree of compliance with FPAs can be observed and an important effect of MPAs in determining effort redistribution**. In this case, it is important to highlight that small-scale fleet outputs have been based on maps generated by fishers, and not by automatic tracking systems, with this being the only possible source of information for small scale fishing vessels. Our results are not easily comparable with previous evidence, as information on spatial distribution of small-scale fishing effort is extremely limited, especially in the MPA context. Some relevant exceptions are represented by (Lattanzi et al., 2024), that developed an approach (that inspired our assessment) to map the small-scale and large-scale fleets' effort within and around MPAs producing information about four Italian MPAs; and by (Horta e Costa et al., 2013) that used visual surveys before, during and after the implementation of the management plan in a Portuguese MPA to examine the factors affecting the spatial and temporal distribution of different gears used by the small-scale fisheries fleet. Specifically, (Horta e Costa et al., 2013) showed different patterns depending on the fisheries examined, with preferred habitats of target species driving much of the fishers' choices. We were not able to reach such a detailed level of information, as our investigation was based on a participatory mapping exercise, and it was proved too challenging to gather information for each specific fishery. **Nonetheless, our approach represents to the best of our knowledge the first attempt to assess the effect of MPAs on the small-scale fleet footprint in the EU Mediterranean and Black Sea and provides interesting insight into the redistribution of fishing effort after the displacement from the areas that were included within MPAs.**

Our findings from the small-scale fishers surveys support previous research that suggests that **fishers mostly used previous experience when redistributing**

their fishing activity after the MPA was established, i.e., moving part or all their activity to areas already known to them, rather than searching for new fishing grounds (Abbott and Haynie, 2012). Site fidelity is common with fishers and can be influenced by both economic factors (e.g., cost to reach grounds) and non-economic (e.g., family traditions, inertia) (Bockstael and Opaluch, 1983; Holland and Sutinen, 1999; Salgueiro-Otero et al., 2022). **We also found a high proportion of SSFs had reduced their overall fishing effort, rather than having been 100% displaced.** This potential effect of MPAs in reducing overall fishing effort, together with the overall pattern of ageing and declines in fleets' capacity recorded in the Mediterranean Sea (e.g., Di Cintio et al., (2022)) and the projected increase of MPA coverage to meet international commitments (e.g., Global Biodiversity Framework, EU Biodiversity Strategy) **could be a projection of the expected steep decline in overall fishing effort in coastal areas in the future**.

In most of the MPAs investigated, **the MPAs did not incur major changes to small-scale fishing activity**. There have been some changes to gears permitted in Torre Guaceto, where after a participatory process engaging managers, SSF and researchers it was agreed to use only set nets with relatively a large mesh size, and limiting fishing operations to once a week (Guidetti et al., 2010; Russi, 2020). In Torre Guaceto restrictions also exist regarding temporal access, but the majority of MPAs have ensured that local SSF have been afforded territorial user rights which has been viewed positively by the small-scale sector (Di Franco et al., 2016). Little is known about small-scale fleet site fidelity and the questions regarding how they decided where to fish before and after the MPA was created provided us with little insight. **A better understanding of how and why fishers choose fishing locations and develop attachments to those locations would help predict and understand fishers' response to future management changes and/or other changes (i.e., climate change related) highlighting an important need for future studies.** As highlighted it is necessary to monitor and understand how fishers redistribute their activity because fishing activities commonly concentrate around the boundaries of MPAs after they are implemented (i.e., fishing the line) to take advantage of spillover and potential reserve effect, but, with negative consequences for conservation (Di Lorenzo et al., 2020; Stelzenmüller et al., 2008).

Complementary data sources such as AIS, logbooks and onboard observers are commonly used to investigate the spatial impacts of MPAs or fisheries restrictions on fishers and fishing activities. However, the greatest challenge to understanding the fishing footprint is that the small-scale sector is missing from VMS and AIS data despite the small-scale fisheries sector accounting for more than 83% of fishing vessels operating in the Mediterranean. For the research reported here, small-scale fisheries data were collected directly from a sample of fishers through face-to-face interviews using surveys and participatory mapping. **We acknowledge that spatial data collected through fisher interviews may be less accurate and objective than other methods (e.g., VMS, AIS) and may not capture all the important fishing locations within the study site. Yet, participatory mapping for the small-scale fisheries sector can provide us with a more complete picture of fishing activities within and around MPAs and help us determine what that can mean in terms of MPAs meeting their conservation benefits.** Although a useful tool, participatory mapping has its limitations and alternative methods (such as using voluntary tracking devices) should be sought to strengthen what kind of data can be yielded from the small-scale fisheries sector.

Furthermore, it is often claimed that there are inherent problems with using perception data to assess and monitor different aspects of MPAs, by contrast to conventional scientific indicators which are seen to provide statistical robustness (Hall-Arber et al., 2009). For example, some claim that perceptions of respondents may be distorted by self-interest and different levels of understanding and education on a subject (Hall-Arber et al., 2009). However, (Bennett, 2016) argues that we need to make use of all types of insight and that perceptions are an indispensable form of evidence that is useful at all stages of conservation from planning and implementation to on-going management.

Overall, the use of perceptions to investigate the impact of MPAs on fishers offers interesting insight that supports more traditional approaches that make use of VMS and AIS data to monitor fishing activity and track change. Perception data complements other sources of factual data in evaluating the effectiveness of resource management measures and/or what impacts these measures have on resource users. Our reliance on objective scientific methods has left us with an incomplete picture of the complexity of MPAs and the social and political contexts within which conservation takes place. In this light this part of the study has helped fill a research gap and offers interesting insight.

3.4.2 What is influencing stakeholder perceptions?

Despite SSF positive attitudes towards the necessity of MPAs to provide environmental protection and relatively strong levels of support for the MPAs, there remains a notable amount of opposition towards the MPAs and negative attitudes towards their management and governance. Initial opposition to new MPAs and restrictions are to be expected (Abbott and Haynie, 2012; Hattam et al., 2014; Mangi and Austen, 2008). However, on-going opposition or negative attitudes from commercial fishers towards MPAs can be a problem if it leads to lower levels of compliance with fisheries regulations and zoning or interferes with the development and implementation of future management initiatives in the MPA (Abbott and Haynie, 2012; Pita et al., 2020)

Negative attitudes seem to be mostly concentrated in two large MPAs, Ropotamo and Egadi Islands, that host large numbers of fishers, and where a considerable proportion of the interviews were carried out. The overall patterns of these attitudes, when results are presented for all MPAs pooled, can therefore be driven by the perceptions of the large number of fishers interviewed at Ropotamo and Egadi Islands. For this reason, it is also important to consider the variability recorded among the five case studies.

The results obtained indicate that there are two primary factors underlying fishers' attitudes towards the MPA. **First, was the perception that the MPAs had significant negative effects on their fishing business and the quantity of fish they catch, with most fishers reporting that they had not adapted their fishing activity to the MPA.** This supports the findings of Pita et al. (2020) who found that although awareness of a Portuguese MPA increased over time levels of its acceptance did not. They found that negative perceptions were strongly correlated with declining catch (Pita et al., 2020) which supports the perceptions reported in this study. It also suggests that the fishers interviewed are struggling to adapt to changes (management, environmental, or otherwise) which is exacerbating their

negative feelings towards the MPAs (Marshall and Marshall, 2007). On this note it is important to mention that **many of the fishers from Gyaros and several others elsewhere indicated that it was not possible to disentangle the effects of the MPA from other factors such as climate change (which is beyond the control of the MPA), and even that the impacts of historical overfishing are having a much greater impact on the environment and their fishing activities than MPAs** (Pita et al., 2020, 2021). It must also be noted that these findings might also reflect that some of the MPAs studied are failing to meet their conservation objectives. The results presented in Chapter 1 indicate that only a limited proportion of MPAs in the Mediterranean and Black Sea have the sufficient level of protection to accrue ecological benefits and that MPA managers reported very few MPAs that have investigated or found evidence of significant ecological recovery.

Secondly, **fishers did not feel they were adequately consulted regarding decision-making. Effective engagement of fishers in MPA design and management processes is important for generating and maintaining fishers' support for spatial fishing closures and for the long-term success of MPAs** (Bennett et al., 2020; Charles and Wilson, 2008; Di Franco et al., 2020; Helvey, 2004; Jones et al., 2023) However, we found that in general for the well-established MPAs (Cerbère-Banyuls and Torre Guaceto), the level of support was high, however for Egadi support was low. Both Cerbère-Banyuls and Torre Guaceto were found to involve fishers more readily as a key stakeholder in decision-making processes and that relationships between the MPA and fishing sector were reported by KIs to be positive. In contrast, Egadi has followed a very top-down process, fishers were not involved in the decision-making process when the MPA was created (D'Anna et al., 2016). Although in recent years there has been a marked shift towards more participatory management, trust is complex and takes a significant time to rebuild (Chaigneau and Brown, 2016; Henry and Dietz, 2011; Ostrom, 2009). **Gyaros is considered as a relatively new MPA that employed a co-management approach when designing the MPA, here we found that the level of support is relatively high.** Interestingly, the recent top-down decision to make the MPA a no-take zone does not seem to have impacted the level of support. The SSFs attitudes towards Ropotamo are also unsurprising, the level of support was found to be evenly spread across, opposed, neutral and supportive. Currently Ropotamo MPA is developing its management plan and restrictions. Therefore, opposition could be related to fear of how the MPA will eventually impact their fishing activities and support could reflect the consultation process that is currently underway, or fishers' recognition that fish stocks are dwindling, and action needs to be taken.

3.4.3 How can we manage for changes imposed by MPAs implementation and improve levels of support for MPAs?

Previous research has highlighted that increased measures should be taken to anticipate, reduce and mitigate the impacts of spatial closures such as MPAs or management measures on fishers (Abbott and Haynie, 2012). **A better understanding of the needs and aspirations of fishers is required, and engagement and participatory approaches must be tailored to meet them** (Abbott and Haynie, 2012; Di Franco et al., 2020). Strategies to reduce impacts on fishers should be considered and incorporated at all stages of the planning and implementation processes and in the ongoing management. **More research is needed to better understand the strategies that fishers use to adapt to**

environmental or managerial change and the social and economic factors that allow or constrain their capacity to adapt (Marshall and Marshall, 2007; Pita et al., 2021; Salgueiro-Otero et al., 2022). It is also clear that more **efforts must be made to work closely with fishers to manage for climate change and help fishers find ways to adapt to more challenging and changing conditions** (Fatima et al., 2023; Galappaththi et al., 2021; Ilosvay et al., 2022; Pita et al., 2021), identifying ways for them to make use of existing and strategic social networks that can facilitate adaptive responses (Salgueiro-Otero et al., 2022).

The model (Figure 3-24) offers an additional tool to support decision making, planning, and understanding of the ecological and socio-economic impacts of FPAs and PPAs, highlighting the different outcomes of each level of protection described in the MPA Guide (Grorud-Colvert et al., 2021).

Gains and losses in catch and biomass for each level of protection are dependent on time of protection since establishment (Sève et al., 2023). **The model illustrates that, 10 years after an MPA's implementation, there are conservation benefits inside MPAs, as most of the cases illustrated and the higher the level of protection, the greater the gains in biomass** (Sève et al., 2023). When protection is implemented, fish biomass increases sharply inside MPAs while having no effect in adjacent areas. At the same time, for fully protected and highly protected MPAs we observe an abrupt decline of catch inside MPAs, due to the curb of fishing effort inside the MPA (fishing is totally excluded in fully protected MPAs) and the reallocation of fishing effort from inside the MPAs to adjacent areas (as also illustrated by our analyses on small-scale fisheries footprint via the participatory mapping exercise). While fish biomass takes advantage of the diminution of fishing pressure inside the MPAs, more fishers are in competition for the same number of resources in surrounding areas, causing a decline in fish biomass locally. This information allows us to partially anticipate behavioural adaptations of fishers to design robust management systems (as recommended by Abbott and Haynie, (2012)).

Clearly, the short-term period of decline in fisheries yield is a crucial period for fishers' income. Losses in catch after the implementation of MPAs could be compensated by fisheries management tools or dedicated fishing labels. The latter could be used to guarantee a premium price, supporting fishers' revenues without increasing catches (see Sánchez et al., (2020) for an example, and see Wakamatsu and Wakamatsu, (2017) for a discussion about certifications in small scale fisheries). **The establishment of an MPA leads to the rearrangement of the fisheries footprint. Fisheries will move to occupy unprotected areas around established MPAs to take advantage of adult spillover outside of the limits as seen through the analysis of the VMS, AIS and participatory mapping data**. In cases with lower levels of protection and specific types of fishing gears permitted this could potentially increase in density within the MPA. It is therefore important to mention that in the case of the Mediterranean and Black Seas, as small-scale fisheries constitute 83% of the activity, management needs to acknowledge the reciprocal effects that spatial management and protection could have for the sector.

It should be noted that the data used to inform our conceptual model was modelled considering all MPAs were effectively managed, rules enforced and that no poaching occurred. However, we know that a myriad of non-compliant activities, such as poaching, threaten the effectiveness of MPAs

worldwide (Bergseth et al., 2018; Grorud-Colvert et al., 2021; Iacarella et al., 2021). Moreover, authorised activities can concentrate inside partially protected areas if their management is not regulated (Zupan et al., 2018) and threaten biodiversity. For example, almost 60% of European MPAs authorise trawling and this activity is more concentrated inside than around those MPAs (Dureuil et al., 2018), with this literature supporting our findings described in Chapter 2 showing a considerable amount of fishing effort inside MPAs. In addition, MPAs are currently experiencing effects and consequences of global events such as climate change and ocean acidification, but these are quite complex to include in the evaluations as their effects are usually noticed over the long term (Cinner et al., 2022).

The conceptual model we have created provides a generalised approach to the overall effects that can be expected after the establishment of MPAs, but it is important to consider that every fish species and in diverse regions will experience variant effects, as these will be dependent on factors such as the ecology of the species, the ecosystem, the fisheries system (Claudet et al., 2015). **We suggest that future studies could use this conceptual model and build more details into it and add more substantial information that can keep supporting the understanding of the MPA-fisheries system.**

Stakeholder support for MPAs should be expected to and will vary over time. The initial losses we have seen through our modelling will be felt differently by different individuals, but it is expected that economic loss will result in some pushback against the MPA. Overtime however, 10-30 years (as indicated by our model) fishery spillover benefits may occur and be felt by natural resource users improving their perceptions and increasing their overall support for the MPA (Jones et al., 2023). However, once these benefits have peaked the individual benefits felt by fishers might begin to level out (as confirmed in our model at 30+ years), which again might lead to changes in perceptions and level of support (Jones et al., 2023). These ideas are well reflected in the perceptions of the fishers from the five different case studies investigated, where the age and governance (enabling conditions, particularly level of engagement) of the MPA appeared to have a marked effect on the level of support and how well the MPA is perceived. A finding that is supported by previous research (Bennett et al., 2020; Di Franco et al., 2020; Jones et al., 2023). **It is therefore imperative to make the patterns of gains vs loss clear to resource users and for those wishing to implement MPAs to put greater focus on non-direct benefits related to the existence (fish for the future generations) and the bequest (aesthetic benefits) values of MPAs** (Chaigneau & Brown, 2016).

3.5 Lessons learnt and recommendations

The combination of integrated methodologies used in this chapter has provided insight into the actual, perceived, and theoretical/conceptual impacts of MPAs on fisheries. It has highlighted the different approaches and data sources that can be used to assess fishing footprints within and surrounding MPAs and the way fishing activity can be displaced because of MPA implementation, providing a novel assessment of small-scale fisheries effort reallocation in EU Mediterranean and Black Sea MPAs. MPAs can and do harness such an enormous variety of fisheries restrictions depending on the MPA objectives which ultimately help determine the conservation outcome but can affect local resource users in different ways. We have illustrated how the use of perceptions research can be used to complement the more traditional

research approaches but also as a standalone research tool that can provide us with a more complete picture of the complexity of MPAs and the socio-political context in which conservation is taking place. The conceptual model is a step forward to aid the understanding of the link between protection levels and MPA outcomes for both fish biomass and human well-being through a temporal and spatial dynamic lens (as the effects can be visualised through time, as well as inside and outside of the MPAs).

In relation to the findings within this chapter, investigating the different ways in which fishing communities are and can be affected by MPAs, it would be worthwhile to:

- **monitor more closely fishers' distribution following closure of certain areas.** This would allow us to better understand whether fishing activity becomes concentrated in the MPA boundaries or has unexpected consequences on certain species (Lattanzi et al., 2024). MPAs have become an important tool in the management and protection of marine resources throughout the world. However, as these protection measures have a potential impact on the people using those marine resources, it is essential that we fully understand how and to what degree they impact resource users (Agardy et al., 2003; Chaigneau and Brown, 2016; Christie, 2004; Hogg et al., 2019). Further research to develop new tools, or strengthening the existing ones, to map small-scale fisheries effort is required, and an effort is needed to systematically map small-scale fisheries effort within and around MPAs (Tassetti et al., 2022).
- **consider the voluntary adoption of monitoring systems for small-scale fisheries** (e.g. see Tassetti et al., (2022)). The adoption of these systems could gather extensive, robust and verified spatially explicit data about small-scale fisheries effort distribution. These devices would also help strengthen fisheries management and fishers' position in decision-making processes as reliable data would be available to support their viewpoint. By 2030 it will be mandatory ([38]) for all Member States to ensure positional and catch reporting of all vessels (including vessels under 12m) which should improve data availability.
- **improve opportunities for fishers' participation in management processes.** We should continue finding ways to engage local communities in the design and management of MPAs to ensure we can better understand, monitor, and reduce the impacts on resource users and therefore potentially gain more support for such initiatives from local communities (Abbott and Haynie, 2012; Di Franco et al., 2020). This would help generate a better understanding of the needs and aspirations of fishers and that engagement and participatory approaches are tailored to meet these needs and aspirations (Abbott and Haynie, 2012; Di Franco et al., 2020).
- **work closely with fishers to adapt for climate change and changing conditions**. In collaboration with fishers, we should identify ways to make use of existing and strategic social networks that can facilitate adaptive responses (Salgueiro-Otero et al., 2022).

([38]) Regulation (EU) 2023/2842 of the European Parliament and of the Council of 22 November 2023 amending Council Regulation (EC) No 1224/2009, and amending Council Regulations (EC) No 1967/2006 and (EC) No 1005/2008 and Regulations (EU) 2016/1139, (EU) 2017/2403 and (EU) 2019/473 of the European Parliament and of the Council as regards fisheries control http://data.europa.eu/eli/reg/2023/2842/oj

- **support co-identification and co-construction of MPA conservation objectives.** The conceptual model, developed within this study, could be used as a supporting tool. For instance, this tool could support meetings between stakeholders (e.g., MPA authorities, researchers, resource users, local community members) working towards implementing MPAs where a clear understanding of the potential impacts/outcomes of varying levels of protection is needed (see Guimarães et al., 2023) for a recent example of process to develop shared vision about MPAs goals).
- **improve the process of MPA establishment or modification.** This process should be followed by transparent communication and information where decision makers, stakeholders and users are informed about the potential changes that the area and the fisheries activities could be experiencing under various management scenarios. This could support a socially integrated decision-making process and management. The expected short-term and long-term effects, disadvantages and benefits should be disclosed, followed up and supported by continuous management, and continuous involvement of stakeholders and users (Alexander et al., 2017).

4. GENERAL RECOMMENDATIONS

The work presented has provided a vast improvement to the baseline information available on the status of protection in the Mediterranean and Black Sea and the importance of MPAs in fisheries management and ecosystem conservation. It has highlighted areas in which significant improvements can be made and next steps taken. Each chapter includes specific recommendations and lessons learnt, yet this chapter takes this one step further providing a standalone integrative approach that connects all the chapters and provides nine overarching recommendations that stem from the findings of this study. The recommendations fall within four major pillars and could be implemented to foster the beneficial role of MPAs as a fisheries management tool.

Pillar 1- Improved MPA Status and Planning

To ensure MPAs are effective for both nature and people, we recommend to:

1. Increase the level of protection of existing MPAs

The results from Chapter 1 and previous scientific evidence, show that the greater the level of protection, the greater the benefits, for both nature and people (Grorud-Colvert et al., 2021). Industrial and fisheries activities that are incompatible with the conservation objectives in the protected areas' management plan (e.g., cases of bottom trawling in MPAs that were established to protect vulnerable marine bottom habitat or fisheries activities with high risk for vulnerable species bycatch carried out in protected areas established to protect these same species) need to be phased out in existing MPAs with similar seabed conservation objectives (Dureuil et al., 2018; Perry et al., 2022). Extractive activities should be phased out and/or prevented in areas where scientific advice calls for it, and to contribute to the target of 10% of strict protection. As we highlighted in Chapter 3 the phase out of destructive fishing activities from key biodiversity areas, should not result in displacement of fishing effort in other areas protected or deserving protection, and the impact of management measures should be carefully evaluated. In addition, with the growth of new technologies and need for unforeseen resources and uses of our seas, we strongly recommend that MPA legislation be tightened to prevent the future development of activities within MPAs that may prove to be incompatible with their conservation objectives.

2. Ensure important biodiversity and habitat features and ecosystem processes are well represented in the network of MPAs

Chapter 1 highlights the potential of the Natura 2000 network to improve conservation in the Mediterranean and Black Sea. Networks of MPAs have the potential to protect key biodiversity and habitat features, as well as ecosystem processes (e.g., reproduction through the protection of spawning grounds). They can help ensure the resilience of marine social-ecological systems with long-term in situ biodiversity conservation effectiveness and sustainable fisheries (Bates et al., 2019; Mellin et al., 2016). To better preserve the functioning of marine ecosystems, more effort should be put into designing new and improving existing networks of MPAs, such as the Natura 2000 network (Katsanevakis et al., 2020). Identifying which habitats and species support fundamental ecological functions through space and time is needed. Indeed, Chapter 2 highlights the need to better consider the habitat

type over which fishing activities are permitted that will ensure vulnerable habitats and those that provide key ecosystem functions are better protected.

3. Use MPAs to curb local threats to nature and people and to foster transformations towards sustainability

While one tenth of European waters should be exempt from extractive activities to meet the 10% strict protection target, it is also important that the remaining 20% of MPAs adequately curb local threats to ensure they can still be effective for nature and people and promote the transformation of non-sustainable fishing practices (Ban et al., 2017; Di Franco et al., 2016; Jacquemont et al., 2022). The findings from Chapter 3 highlight that it is key that MPAs are designed accounting for the occurrence and the magnitude of human uses and planning to regulate them to make them ecologically sustainable, economically viable and able to generate socio-economic and cultural benefits to local communities. In the 30x30 framework, 20% of the protected sea will still allow for human uses, including extractive, with this representing an invaluable opportunity to capitalise upon the potential of MPAs to support human wellbeing. As highlighted in Chapter 2 it is therefore imperative to acquire robust and reliable data about fisheries and other current or potential future activities within the currently existing MPAs and entire region in general. Spatially explicit estimates of fishing effort for all the fleet segments (and thus also covering small-scale fisheries that are largely data poor) is needed. In this context it will be key to consider the re-arrangement of the spatial distribution of fishing effort (as seen in Chapter 3), and the related effort displacement and potential socio-ecological consequences (for the ecosystems and also for fishers' communities), due to the gazetting and implementation of MPAs.

Pillar 2- Informed and More Effective Management

To foster adequately, informed and more effective management, we recommend to:

4. Ensure all MPAs have management plans with clear conservation objectives and regular evaluation and adaptation

Management plans are vital to deliver significant socio-ecological benefits (Buhl-Mortensen et al., 2017; Di Franco et al., 2016; Fraschetti et al., 2018), however as we found in this study (Chapter 1) many MPAs particularly Natura 2000 sites have neither a management plan nor conservation measures in place. Many MPAs still consider legal acts to be a management plan yet we strongly recommend that MPAs have a "true" management plan i.e., a formal planning tool with which MPA managers identify goals and objectives and exact steps and resources needed to achieve those goals, that allows them to continually evaluate how well the process is working using a solid system of measurable indicators and regular evaluation and adaptation. Under this context, systematic conservation planning, and prioritisation of management actions gives MPAs a much greater certainty of them achieving their conservation objectives and can support processes to determine priorities and concerns for which plans need adaptive solutions, especially in view of the uncertainties, regime shifts and new challenges imposed by climate change (Katsanevakis et al., 2020).

5. Make information and data on MPA level of protection, management and monitoring open and FAIR (findable, accessible, interoperable and reproducible)

As revealed in Chapter 1 no standardised, open, up-to-date or accurate database exists that contains all the relevant information needed to easily categorise the

management of all the MPAs in the Mediterranean and Black Sea, including georeferenced information on zoning, the management body and monitoring (Lippi et al., 2024). Without such a database it remains challenging to understand the status of conservation in the region. It is recommended that a specific investment is made to reinforce an exhaustive and homogeneous data collection of marine data at EU scale within a single, easily accessible platform (Levin et al., 2014; Vandepitte et al., 2010). This database should also contain information and data about the fisheries activities carried out within each MPA (e.g., number and type of vessels, fishing effort, catches etc.), and could be on existing platform that already share valuable information.

6. Establish long term monitoring and evaluation programs

As marine ecosystems are subject to a complex interplay of processes acting at different spatial and temporal scales and are highly dynamic it is essential that long-term monitoring programs are in place to understand mechanisms underlying ecological changes and to guide an adaptive management of conservation strategies. Evidence-based feedback through continuous and iterative monitoring, evaluation and reporting is crucial for achieving the objectives of any adaptive management framework. Yet, as we have found in this study (Chapter 1, 2 and perceptions of fishers in Chapter 3) there is little available evidence that management measures are implemented and their outcomes monitored, a finding illustrated in previous research (Rilov et al., 2020). We highlighted that a limited proportion of MPAs are carrying out monitoring activities, and data about fishing effort distribution are lacking. There is therefore an inherent need to ensure monitoring and assessment is performed regularly in each MPA (with the time frame depending on the specific indicator/outcome assessed, but with the need to stress the importance of developing time series, such as in Claudet and Guidetti (2010) & García-Rubies et al. (2013), that MPAs have the capacity (human and financial) and that an adequate share of the MPA annual budget is dedicated to the implementation of monitoring activities. This could be reinforced, if national, EU or regional regulations acknowledge the importance of regular monitoring for MPA implementation and adaptive management and make such a commitment mandatory for all MPAs.

Pillar 3- Transparent and Inclusive Conservation

To improve current practices that may compromise the effectiveness of conservation actions, we recommend to:

7. Improve mechanisms for public participation in MPA planning and management

Public participation in decision-making is a fundamental element of environmental governance intended to foster sustainability of policies, promoting economic efficiency, environmental effectiveness, equity, and political legitimacy (Bryson et al., 2012; Eden, 1996; Pita et al., 2012; Yates and Schoeman, 2013). However, the results from this study (Chapter 1 & 3) confirm public participation in decision-making processes is scarce and, in some cases, non-existent. We therefore recommend that efforts must be made to ensure participation and that it is 'informed' and effective with more meaningful public input and more transparency in the MPA designation process and on-going management (D'Anna et al., 2016; Saarman et al., 2013), as

well as greater promotion of co-decision making, co-management and community stewardship (Alexander et al., 2017). We recommend the conceptual model generated by this study (Chapter 3) be used as a tool to engage the public in participatory processes, facilitating discussions on the potential impacts and long-term outcomes, both for the ecosystem and fisheries, of MPAs under varying levels of protection.

8. Ensure stakeholders understand the need for strict protection and the timing of its benefits, and are associated to strict protection prioritisation

Interaction among various actors involved in the use and protection of marine space could be improved (as revealed in Chapters 1 & 3). For instance, collaboration between relevant actors at varying levels, when national/regional strategies such as the need to meet the 30x30 target are being planned, could be fostered. Stakeholder participation can reduce conflicts among users and is a crucial part of planning and designing in marine conservation planning, such as MPA design or extension (Ehler, 2008; Yates, 2018; Yates and Schoeman, 2013). We therefore recommend stakeholder involvement (at all stages of the design, implementation and ongoing management phases of marine spatial planning) (Giakoumi et al., 2018; Pressey and Bottrill, 2009; Smith et al., 2009; Yates, 2018). Several opportunities to engage stakeholders in MPAs exist for example engaging stakeholders (e.g., fishers, diver associations, research institutions) in collaborative action research and knowledge co-production, both better informing decision-making and increasing trust in the data used to make decisions (Claudet and Guidetti, 2010; Di Franco et al., 2020, 2016; Masud et al., 2022; Russi, 2020). This could involve small-scale fishers adopting voluntary monitoring systems to strengthen fisheries management and fishers' position in decision-making processes as reliable data would be available to support their viewpoint (e.g., see Tassetti et al., (2022).

Pillar 4- Account for and Be Responsive to Change

Finally, to account for global change in conservation planning and management, we recommend to:

9. Develop climate-smart MPAs

Climate change can cause mass mortalities, reshuffle biodiversity patterns and drive shifts in species distributions, (Garrabou et al., 2022; Hastings et al., 2020), generating potential fisheries conflict which can strongly affect management efforts (Mendenhall et al., 2020). Through this study (see Chapter 3) we found that fishers were increasingly feeling the pressures of climate change and the impacts of bio-invasions and that it was increasingly difficult for them (as is also the case for experts) to separate out the impacts from various threats and/or from different protection strategies. This ongoing change is placed in the current context of the so-called "blue acceleration" (i.e., the predicted increased use of the ocean by a multitude of, sometimes, competing human uses) (Jouffray et al., 2020), and in the context of multiple-exposure scenarios under co-occurring pressures (Gill et al., 2023). It is therefore recommended that future conservation efforts should include climate-change refugia (areas where climate change impacts are minimal), and account for the predicted trajectory of human expansion into the ocean. Long-term

ecological monitoring inside and outside properly managed MPAs (Recommendation 6) should be promoted as it offers the best chance of distinguishing between local and global stressors, identifying where signals of resilience exist and early detection of invasive species, supporting fast management responses (Giakoumi et al., 2019). We also recommend helping fishers find ways to adapt to more challenging and changing conditions and identifying ways for them to make use of existing and strategic social networks that can facilitate adaptive responses (Salgueiro-Otero et al., 2022)

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6. ANNEXES

6.1 MPA designation types assigned at national level in the EU Mediterranean and Black Sea

DESIGNATION TYPE	BGR	CYP	ESP	FRA	GRC	HRV	ITA	MLT	ROM	SVN
Absolute nature reserve zone in National Park					X					
Biotope Protection Order				X						
Corsican Nature Reserve				X						
Land acquired by Conservatoire du Littoral (national seaside and lakeside conservancy)				X						
Landscape Park										X
Marine Nature Park				X						
Marine Protected Area		X	X				X			
Marine Reserve			X							
Maritime public domain (Coastal Conservancy)				X						
MPA with Artificial Reef with national statute		X								
National Marine Park					X					
National Nature Reserve				X						
National Park			X	X	X	X	X			
National Park - Peripheral zone					X					
Natural Marine Reserve and Natural Protected Marine Areas							X			
Natural Monument			X							
Natural Park			X							
Nature Park						X				
Nature Place			X							
Nature Reserve			X							X
Nature Reserve (Partial)			X							
Nature Reserve (Wildlife)			X							

Nature reserve area					X					
Nature reserve zone in National Marine Park					X					
Nature reserve zone in National Park					X					
Other Protected Natural Regional Areas							X			
Others (National statute)		X			X		X		X	
Protected Natural Areas			X							
Protected Site	X									
Protection Plan			X							
Regional Park			X							
Regional/Provincial Nature Park							X			
Regional/Provincial Nature Reserve							X			
Significant Landscape						X				
Sites of Community Importance (Habitats Directive)	X	X	X	X	X	X	X	X	X	
Special Areas of Conservation - International Importance								X		
Special Areas of Conservation (Habitats Directive)	X	X	X	X	X	X	X			X
Special Protection Areas								X		
Special Reserve						X				
Specially Protected Area										X
State Nature Reserve							X			
Strict Nature Reserve	X									
Wildlife Refugee					X					

6.2 Databases/datasets used to build the MAPAFISH-MED Marine Protected Area list and shapefiles

Description of data layer	Name of the database version	Version date/ download	Source; Link to Source; Obtained from
GENERAL INFORMATION			
MAPAMED dataset 2022 version	MAPAMED_2019_edition_version_2	02/04/2022	https://www.mapamed.org/
WDPA dataset Europe	WDPA_WDOECM_Jun2023 Public_EU_csv	05/06/2023	https://www.protectedplanet.net/region/EU
EEA Natura 2000 areas dataset	Natura 2000 Comma Separated Values Files (ZIP archive)	03/03/2023	https://www.eea.europa.eu/data-and-maps/data/natura-14/natura-2000-tabular-data-12-tables/natura2000-comma-separated-values-files/at_download/file
EEA CDDA areas dataset	CDDA_2022_v01_public_DesignatedArea_csv.zip	03/03/2023	https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-17/cdda/cdda-csv-files/at_download/file
French MPAs dataset	amp.milieumarinfrance	05/06/2023	https://www.amp.milieumarinfrance.fr/accueil-fr/rechercher
Spanish MPAs dataset	C_Extrae_RegionMarinaMed_MyM T	02/10/2022	MITECO (Alonso Leön, Álvaro), Environmental Spanish ministry
OTHER INFORMATION			
Questionnaire MAPAFISH-MED	NA	07/09/2022	https://www.surveymonkey.com/r/MAPAFISH-MED_EN
French MPAs legal acts and management plans (when available)	amp.milieumarinfrance	05/06/2023	https://www.amp.milieumarinfrance.fr/accueil-fr/rechercher
SHAPEFILES			
EEA Natura 2000 areas Shapefiles	Natura2000_end2021_rev1_Shapefile	01/03/2023	https://www.eea.europa.eu/data-and-maps/data/natura-14/natura-2000-spatial-data/natura-2000-shapefile-1
EEA CDDA areas shapefiles	CDDA_2022_v01_public_gpkg	01/03/2023	https://www.eea.europa.eu/data-and-maps/data/nationally-designated-areas-national-cdda-17/cdda/cdda-europeepsg3035-arcgis-geodatabase-file
Mapamed areas shapefiles	MAPAMED_2019_v2_spatial_data_epsg3035.gpkg	02/04/2022	https://www.mapamed.org/

6.3 Table of the corresponding national authorities and national official databases used to check and update the MPA list

The overall number of MPAs, removed or added after checking and removed after applying the various exclusion criteria, are indicated.

Country	Relevant Authority Checked	Use of National Official Database	Overall addition/removal of MPAs after list checked	Overall addition/removal of MPAs after exclusion criteria applied
BGR	Ministry of Environment and Waters (MEOW)	Bulgarian Ministry of Environment and Waters database	2	-9
CYP	Marine Environment sector of the Department of Fishery and Marine Research of Cyprus		6	-4
ESP	Spanish Ministry of Environment.	Official Spanish Ministry database	21	-76
FRA	French National Biodiversity Office (OFB)	Official French Ministry database	-2	-36
GRC	Partially by the Natural Environment & Climate Change Agency (N.E.C.C.A.)		34	-86
HRV	Ministry of Economy and Sustainable Development		-2	-33
ITA	NA	Official Italian Ministry database	-19	-82
MLT	Environment & Resources Authority of Malta		0	-9
ROM	National Agency for Natural Protected Area (ANANMP)		0	-4
SVN	The Institute of the Republic of Slovenia for Nature Conservation		-1	-12

6.4 List of exclusion criteria used to remove some Marine Protected Areas, areas and designations

Given that this study had a focus on fisheries and fisheries management in MPAs, the decision was taken to apply a series of '**exclusion criteria**' that would be used to identify and justify if an MPA/designation/area should be included or excluded from the list of MPAs to be analysed in depth. After applying the exclusion criteria, which are outlined below, a total of **350 MPAs/designations/areas were removed** from the list. These MPAs and areas were deemed irrelevant for the study due to their designation type, low percentage of marine area and other irrelevant characteristics explained below. A total of 16 exclusion criteria were applied to justify the removal of these MPAs as follows:

<5% marine area

All MPAs where 95% or more of the total area was terrestrial were removed from further analysis. Most of these sites are terrestrial protected areas that have a small part that extends onto the shoreline explaining a very low percentage for the marine part. These areas were therefore deemed irrelevant for this study and removed from the list. A total of 55 MPAs were excluded.

Designation not relevant: "UNESCO-MAB Biosphere Reserve"

The "Man and the Biosphere Programme (MAB)" designation aims to establish a scientific basis for enhancing the relationship between people and their environments. These areas are considered out of the scope for this study. Seven MPAs were excluded based on this criterion.

Designation less or not relevant: "Special Protection Area (Birds Directive)"

All Natura 2000 sites (Birds directive) have been removed from the list since these areas have been created to ensure the protection of endangered species of birds and thus less or not relevant for this study which is focused on fisheries. A total of 246 MPAs were excluded based on this criterion.

Designation not relevant: "Ramsar Site, Wetland of International Importance"

All Ramsar sites have been removed from the MPA list. The Ramsar sites are wetlands areas, which are considered irrelevant given the scope of this study. Five MPAs were excluded.

Designation not relevant: "Specially Protected Areas of Mediterranean Importance (Barcelona Convention)"

SPAMI sites (considered an irrelevant designation type for this study) also overlap with other designations and were removed from the list. Eighteen MPAs were removed based on this criterion.

Designation not relevant: "Word Heritage site"

All the sites designated under the World heritage list were removed from the final list. These sites have been granted this designation in recognition of their exceptional

marine values. Given that they overlap with other designations they were not considered as relevant for our study. Two MPAs were excluded based on this criterion.

Designation not relevant: "No Berthing Zone/No Entry Zone except for Fisheries"

This designation is a no berthing zone and has no other regulations, especially regarding fisheries. It accounts for one area in Malta that was removed from further analysis.

Designation not relevant: "International significance Natural Marine Area"

It accounts for one MPA. This part of the Pelagos marine sanctuary was created to protect marine mammals, through the application of a code of conduct for boats to reduce potential disturbance. This area was out of the scope of this study. However, most of this area overlaps with other designations that have been retained.

Designation not relevant: "Protection of Essential Fish Habitat (EFH)"

The Essential Fish Habitat (EFH) designation has been put in place to protect and restore certain areas to maintain productive fisheries and rebuild depleted fish stocks. It is not considered as an MPA and as a result any area found in the databases with this designation was removed from the list. In total 4 MPAs were excluded using this criterion.

Designation not relevant: "UNESCO-Geopark"

The Geopark designation includes geographical areas with internationally significant geological heritage that is used to promote sustainable development. This designation is considered irrelevant. It accounts for one site, which overlapped with another designation type that was kept in the study.

Designation not relevant: "Vulnerable marine ecosystem (VME)"

The vulnerable marine ecosystem (VME) designation was created to manage deep-sea fisheries in areas beyond national jurisdiction (ABNJ). It is not considered as an MPA and as a result the 2 areas found under this designation were removed from the study list.

No marine area (designation: "Natural monument")

These areas are natural monuments and do not present any marine area. For this reason, the three corresponding areas under this designation were removed.

Not relevant (bats) and (bats + butterflies)

These are areas that we identified as being created to protect bats and butterflies only, and therefore out of scope for this study and so excluded from the list. In total 3 MPAs were excluded when applying this criterion.

Not relevant (birds)

This is an area that we have identified as being created to protect birds only and is therefore out of scope of the study and so excluded from the list. One MPA was excluded when applying this criterion.

Cave not relevant for fisheries

It corresponds to a very small cave marine area which represents no interest for the scope of this study and therefore removed. One MPA was excluded when applying this criterion.

Not reported on EEA

One MPA (Neretva Delta) was not reported on the EEA database. The official MPA reported for this area is Ušće Neretve and was kept in the list instead of the Neretva Delta

6.5 List of MPAs identified as relevant for this study

The table lists the 949 MPAs identified as relevant for the study by Member State. The World Database on Protected Areas (WDPA) code which is used to provide an ID to each MPA, the MPA name and designation are included (i.e. Regional corresponds to Natura 2000 sites). The last two columns of the table indicate which MPAs replied to the questionnaire regarding whether they perform some monitoring and which MPAs were found in the literature review on monitoring.

Country	WDPA code	Name	Designation	Questionnaire	Literature
BGR	11561	Kaliakra	National	X	
BGR	1176812	Koketrays	National	X	
BGR	555516432	Plazh Shkorpilovtsi	Regional	X	
BGR	555516434	Galata	Regional	X	
BGR	555516439	Kamchia	Regional	X	
BGR	555516453	Plazh Gradina - Zlatna Ribka	Regional	X	
BGR	555516456	Ezero Durankulak	Regional	X	
BGR	555516591	Kompleks Kaliakra	Regional	X	
BGR	555516592	Aheloy - Ravda - Nessebar	Regional	X	
BGR	555516615	Pomorie	Regional	X	
BGR	555516616	Ezero Shabla - Ezerets	Regional	X	
BGR	555516622	Ropotamo	Regional	X	
BGR	555516623	Emine - Irakli	Regional	X	
BGR	555516624	Strandzha	Regional	X	
BGR	555593018	Aladzha Banka	Regional	X	
BGR	555593019	Emona	Regional	X	
BGR	555593020	Otmanli	Regional	X	
BGR	555721896	Zaliv Chengene Skele	Regional	X	
CYP	555516661	Thalassia Periochi Nisia	Regional		
CYP	555516662	Periochi Polis - Gialia	Regional		
CYP	555516666	Thalassia Periochi Moulia	Regional		
CYP	555516669	Chersonisos Akama	Regional		
CYP	555579959	Kavo Gkreko	Regional	X	
CYP	555596198	Lara-Toxeftra Turtle Reserve	National		
CYP	555596200	Kavo Gkreko	National	X	X
CYP	555721798	Oceanid	Regional		
CYP	555722850	Akrotirio Aspro - Petra Romiou	Regional		
CYP	N/A	Agia Napa	National	X	
CYP	N/A	Amathounta	National	X	
CYP	N/A	Geroskipou	National	X	
CYP	N/A	Kakoskali	National	X	X
CYP	N/A	Larnaca	National	X	
CYP	N/A	Limassol - Dasoudi	National	X	
CYP	N/A	Mpania	National		
CYP	N/A	Paralimni	National	X	
CYP	N/A	Peyia Sea Caves	National		

ESP	15509	Salinas Y Arenales De San Pedro Del Pinatar	National		
ESP	20934	Arrecife Barrera De Posidonia	National		
ESP	20955	Peñones De San Cristóbal	National		
ESP	151248	Cap De Norfeu	National		
ESP	151292	Punta Del Fangar	National		
ESP	195974	Ricarda-Ca L`Arana	National		
ESP	196045	Archipielago De Cabrera	National		X
ESP	196166	Ses Salines D Eivissa I Formentera	National		
ESP	196213	Delta De L`Ebre	National		
ESP	196284	Cabo De Gata-Níjar	National		
ESP	196293	S Albufera Des Grau	National		
ESP	348792	Illa De Tabarca	National		X
ESP	348802	Irta	National		
ESP	348804	Isla De Terreros E Islas Negra	National		
ESP	348851	Estrecho	National		
ESP	348860	Fons Marins Del Cap De Sant Antoni	National		
ESP	349119	Costes Del Maresme	National		
ESP	349123	Grapissar De Masia Blanca	National		
ESP	349127	Cap De Creus	National		X
ESP	349166	Alborán	National		
ESP	349187	Acantilados De Maro-Cerro Gordo	National		
ESP	349430	Serra Gelada	National		
ESP	389004	Cap Gros-Cap De Creus	National		
ESP	389077	Aiguamolls De L`Alt Empordà	National		
ESP	389087	Cap De Creus	National		
ESP	389088	Cap De Santes Creus-Litoral Meridional Tarragoní	National		
ESP	389097	Delta De L`Ebre	National		
ESP	389123	Illes Medes	National		X
ESP	389127	Massís De Les Cadiretes	National		
ESP	389140	Muntanyes De Begur	National		
ESP	389150	Pinya De Rosa	National		
ESP	389221	Castell-Cap Roig	National		
ESP	389228	Costes Del Garraf	National		
ESP	555523638	Costes Del Maresme	Regional		
ESP	555523677	Litoral Meridional Tarragoní	Regional		
ESP	555523679	Costes Del Tarragonès	Regional		
ESP	555523681	Grapissar De Masia Blanca	Regional		
ESP	555523683	Montgó	Regional		
ESP	555523697	Serra Gelada I Litoral De La Marina Baixa	Regional		
ESP	555523717	Alguers De Borriana-Nules-Moncofa	Regional		
ESP	555523722	Serra D'irta	Regional		
ESP	555523762	Badies De Pollença I Alcúdia	Regional		
ESP	555523768	Costa De Llevant	Regional		
ESP	555523773	Àrea Marina Del Nord De Menorca	Regional		X
ESP	555523774	Àrea Marina Del Sud De Ciutadella	Regional		
ESP	555523806	Cap Negre	Regional		
ESP	555523807	Cala D'algairens	Regional		
ESP	555523808	Punta Redona - Arenal D'en Castell	Regional		
ESP	555523809	Cala En Brut	Regional		
ESP	555523810	Caleta De Binillautí	Regional		
ESP	555523811	Àrea Marina Punta Prima - Illa De l'Aire	Regional		
ESP	555523812	De Cala Llucalari A Cales Coves	Regional		

ESP	555523813	Arenal De Son Saura	Regional		
ESP	555523815	Es Rajolí	Regional		
ESP	555523819	Port Des Canonge	Regional		
ESP	555523820	S'Estaca - Punta De Deià	Regional		
ESP	555523832	Cala Figuera	Regional		
ESP	555523834	Punta De n'Amer	Regional		
ESP	555523835	Àrea Marina Costa De Llevant	Regional		
ESP	555523837	Portocolom	Regional		
ESP	555523841	Àrea Marina Cap De Cala Figuera	Regional		
ESP	555523842	Costa De l'Oest d'Eivissa	Regional		
ESP	555523843	Es Amunts D'eivissa	Regional		
ESP	555523844	Àrea Marina De Ses Margalides	Regional		
ESP	555523845	Àrea Marina De Tagomago	Regional		
ESP	555523846	Area Marina Del Cap Martinet	Regional		
ESP	555523847	Àrea Marina De Cala Saona	Regional		
ESP	555523848	Àrea Marina De Platja Detramuntana	Regional		
ESP	555523849	Àrea Marina De Platja De Migjorn	Regional		
ESP	555523850	Nord De Sant Joan	Regional		
ESP	555523868	Fondos Marinos De Punta Entinas-Sabinar	Regional		
ESP	555523869	Fondos Marinos Levante Almeriense	Regional		
ESP	555523874	Alborán	Regional		
ESP	555523878	Arrecifes De Roquetas De Mar	Regional		
ESP	555523879	Islote De San Andres	Regional		
ESP	555523899	Estrecho Oriental	Regional		
ESP	555523900	Fondos Marinos Marismas Del Rio Palmones	Regional		
ESP	555523901	Fondos Marinos Estuario Del Rio Guadiaro	Regional		
ESP	555523926	Acantilados Y Fondos Marinos Tesorillo-Salobreña	Regional		
ESP	555523927	Acantilados Y Fondos Marinos De Calahonda-Castell De Ferro	Regional		
ESP	555523929	Acantilados Y Fondos Marinos De La Punta De La Mona	Regional		
ESP	555523983	Calahonda	Regional		X
ESP	555523988	Fondos Marinos De La Bahía De Estepona	Regional		
ESP	555523989	El Saladillo-Punta De Baños	Regional		
ESP	555524030	Franja Litoral Sumergida De La Región De Murcia	Regional		
ESP	555524031	Mar Menor	Regional		
ESP	555524049	Valles Submarinos Del Escarpe De Mazarrón	Regional		
ESP	555524051	Zona Marítimo-Terrestre Del Monte Hacho	Regional	X	
ESP	555546001	Del Montgrí, Les Illes Medes I El Baix Ter	National		X
ESP	555546014	Marina De Les Medes	National		
ESP	555546019	Ses Salines D Eivissa I Formentera	National		
ESP	555546020	S Albufera Des Grau	National		
ESP	555548913	Prat De Cabanes I Torreblanca	Regional		
ESP	555552483	Reserva Marina De La Isla De Alborán	National		
ESP	555552484	Reserva Marina De La Isla De Tabarca	National		X
ESP	555552485	Reserva Marina De Las Islas Columbretes	National	X	X
ESP	555552486	Reserva Marina De Cabo De Gata-Níjar	National		X
ESP	555552487	Reserva Marina De Cabo De Palos-Islas Hormigas	National	X	X
ESP	555552488	Reserva Marina De Levante De Mallorca-Cala Ratjada	National	X	

ESP	555552489	Reserva Marina De Masía Blanca	National	X	
ESP	555562410	Tamarit-Punta De La Móra-Costes Del Tarragonès	National		
ESP	555578073	Cap Enderrocat I Cap Blanc	Regional		
ESP	555580778	L'Albufera	Regional		
ESP	555588805	Cabo De Gata-Nijar	National		
ESP	555588820	Estrecho	National		
ESP	555588831	Alborán	National		
ESP	555588835	Islote De San Andrés	National		
ESP	555588857	Fondos Marinos Marismas Del Río Palmones	National		
ESP	555588858	Fondos Marinos Estuario Del Río Guadiaro	National		
ESP	555588883	Acantilados Y Fondos Marinos Tesorillo-Salobreña	National		
ESP	555588884	Acantilados Y Fondos Marinos De Calahonda-Castell De Ferro	National		
ESP	555588886	Acantilados Y Fondos Marinos De La Punta De La Mona	National		
ESP	555588918	Acantilados De Maro-Cerro Gordo	National		
ESP	555588945	Calahonda	National		
ESP	555592920	Espacio Marino Del Cabo De Les Hortes	Regional		
ESP	555593031	Sistema De Cañones Submarinos Occidentales Del Golfo De León	Regional	X	
ESP	555593032	Canal De Menorca	Regional		
ESP	555593033	Sur De Almería - Seco De Los Olivos	Regional		X
ESP	555593034	Espacio Marino De Illes Columbretes	Regional	X	
ESP	555593035	Espacio Marino De Alborán	Regional		
ESP	555593036	Espacio Marino De Ifac	Regional		
ESP	555596224	Reserva Marina De Cabo Tiñoso	National		
ESP	555596226	Corredor De Migración De Cetáceos Del Mediterráneo	National		
ESP	555638694	Parc Natural Maritimoterrestre Es Trenc-Salobrar De Campos	National		
ESP	555700944	Reserva Marina Del Freu E Isla De La Dragonera	National	X	
ESP	555722070	Cap De Creus	Regional	X	X
ESP	555722072	El Montgrí-Les Medes-El Baix Ter	Regional		X
ESP	555722083	Massís De Les Cadiretes	Regional		
ESP	555722084	Litoral Del Baix Empordà	Regional		
ESP	555722099	S'Albufera Des Grau	Regional		
ESP	555722105	Illots De Santa Eulària, Rodona I Es Canà	Regional		
ESP	555722106	Muntanyes D'artà	Regional		
ESP	555722107	D'Addaia A s'Albufera	Regional		
ESP	555722871	Aiguamolls De l'Alt Empordà	Regional		
ESP	555722883	Cabo De Gata-Nijar	Regional		
ESP	555722885	Tagomago	Regional		
ESP	555722898	Arxipèlag De Cabrera	Regional		
ESP	555722903	Delta De l'Ebre	Regional		
ESP	555722907	Espacio Marino De Tabarca	Regional	X	
ESP	555722909	Ses Salines d'Eivissa I Formentera	Regional		X
ESP	555722924	Espacio Marino De Orpesa I Benicàssim	Regional		
ESP	555722953	Costes Del Garraf	Regional		
ESP	555722985	Illots De Ponent d'Eivissa	Regional		
ESP	555722986	La Mola	Regional		

ESP	555722987	Cap De Barbaria	Regional		
ESP	555723012	Acantilados De Maro-Cerro Gordo	Regional		
ESP	555723020	Espacio Marino De La Marina Alta	Regional		
ESP	555723021	Espacio Marino De Cabo Roig	Regional		
ESP	555723025	Espacio Marino Del Entorno De Illes Columbretes	Regional		
ESP	555723028	Es Vedrà - Es Vedranell	Regional		
ESP	555723035	Salinas Y Arenales De San Pedro Del Pinatar	Regional		
ESP	555723040	Sa Dragonera	Regional		
ESP	555723043	Estrecho	Regional		
ESP	555723056	L'Almadrava	Regional		
ESP	555737493	Monumento Natural Afloramiento Volcánico Y Playa Fósil De Cap Negret	National		
FRA	4044	Cerbere Banyuls	National	X	X
FRA	7168	Scandola	National		X
FRA	106741	Iles Bruzzi Et Ilot Aux Moines	National		
FRA	106767	Agriate	National		
FRA	147435	Domaine Du Rayol	National		
FRA	147513	Massif De L'esterel	National		
FRA	178244	Saint Florent	National		
FRA	178271	Bouches De Bonifacio	National		X
FRA	181594	Ilots De Stagnolu Et Ziglione	National		
FRA	181595	Ilot De Roscana	National		
FRA	193389	Port D'alon - Nartette	National		
FRA	345972	Le Cap Taillat	National		
FRA	555526732	Herbiers De L'etang De Thau	Regional		X
FRA	555526734	Posidonies De La Cote Palavasienne	Regional		
FRA	555526735	Posidonies Du Cap D'agde	Regional	X	
FRA	555526747	Cours Inferieur De L'aude	Regional		
FRA	555526759	Complexe Lagunaire De Salses	Regional		
FRA	555526771	Posidonies De La Cote Des Alberes	Regional		
FRA	555526777	Embouchure Du Tech Et Grau De La Massane	Regional		
FRA	555526787	Prolongement En Mer Des Cap Et Etang De Leucate	Regional		
FRA	555526788	Cotes Sableuses De L'infralittoral Languedocien	Regional		
FRA	555526789	Bancs Sableux De L'espiguette	Regional		
FRA	555526835	Baie Et Cap D'antibes - Iles De Lerins	Regional		
FRA	555526847	Camargue	Regional		
FRA	555526853	Calanques Et Iles Marseillaises Cap Canaille Et Massif Du Grand Caunet	Regional		X
FRA	555526858	La Pointe Fauconniere	Regional		
FRA	555526859	Cap Sicie - Six Fours	Regional		X
FRA	555526860	Rade D'hyeres	Regional	X	X
FRA	555526868	Corniche Varoise	Regional		
FRA	555526871	Embouchure De L'argens	Regional	X	
FRA	555526872	Esterel	Regional	X	
FRA	555526873	Cap Martin	Regional		
FRA	555526874	Cap Ferrat	Regional		
FRA	555526875	Embiez - Cap Sicie	Regional		
FRA	555526876	Baie De La Ciotat	Regional		
FRA	555526877	Cote Bleue Marine	Regional	X	X

FRA	555526878	Lagune Du Brusc	Regional		
FRA	555526886	Agriates	Regional		
FRA	555526890	Porto Scandola Revellata Calvi Calanches De Piana	Regional		X
FRA	555526902	Embouchure Du Stabiaccu Domaine Public Maritime Et Ilot Ziglione	Regional		
FRA	555526903	Iles Cerbicale Et Frange Littoral	Regional		X
FRA	555526906	Plateau De Pertusato - Bonifacio Et Iles Lavezzi	Regional		X
FRA	555526922	Iles Et Pointe Bruzzi Etangs De Chevanu Et D'arbitru	Regional		X
FRA	555526942	Baie De Stagnolu Golfu Du Sognu Golfe De Porto Vecchio	Regional		
FRA	555526945	Plateau Du Cap Corse	Regional		
FRA	555526946	Grand Herbier De La Cote Orientale Corse	Regional		
FRA	555526947	Bouches De Bonifacio - Iles Des Moines	Regional		
FRA	555526948	Pointe De Senetosa Et Prolongements	Regional		
FRA	555526949	Golfe D'ajaccio	Regional	X	X
FRA	555526950	Cap Rossu Scandola Pointe De La Revellata Canyon De Calvi	Regional		
FRA	555547183	Golfe Du Lion	National	X	
FRA	555561883	Pointe De Beauduc	National		
FRA	555561929	Cap Corse Et Agriate	National		
FRA	555562002	Batterie Du Graillon	National		
FRA	555597292	Iles Du Cap Corse	National		
FRA	555597311	Embouchure Du Rizzanese	National		
FRA	555635565	Grands Dauphins De L'agriate	Regional		
FRA	555635566	Recifs Du Mont Sous-Marin D'ajaccio Et Des Affleurements Rocheux De Valinco	Regional		
FRA	555635567	Recifs Du Mont Sous-Marin De L'agriate	Regional		
FRA	555643632	Grands Dauphins Du Golfe Du Lion	Regional		
FRA	555643635	Recifs Des Canyons Lacaze-Duthiers, Pruvot Et Bourcart	Regional		X
FRA	555702237	Embouchure Du Fleuve Var	National		
FRA	555559581;555559618	Calanques	National		X
FRA	663;555559566	Port-Cros	National	X	X
FRA	555643631	Recifs Du Banc De L'ichtys Et Du Canyon De Sete	Regional		
FRA	N/A	Ile Du Grand Rouveau - Les Embiez	National		
GRC	13380	Ethniko Thalassio Parko Zakynthou	National	X	X
GRC	13385	Ethniko Thalassio Parko Alonnisou Voreion Sporadon	National	X	X
GRC	15178	Ethniko Ygrotopiko Parko Delta Evrou	National		
GRC	177845	Ethniko Parko Schinia Marathona	National		
GRC	328988	Zones Apolytis Prostasias AP1, AP2, AP3 Kai AP4 Ethnikou Parkou Limnothalasson Mesolongiou	National		
GRC	328992	Zones A1, A2, A3, A4 Kai A5 Ethnikou Parkou Schinia - Marathona	National		

GRC	328993	Zones Prostasias Tis Fysis PF1, PF2, PF3 Kai PF4 Ethnikou Parkou Limnothalasson Mesolongiou	National		
GRC	328995	Zones A2, A3, Ia, Ib, P1, P2, P3, Y, Kai Y' Ethnikou Thalassiou Parkou Zakynthou	National		
GRC	328996	Zones A2, A3, A4, A5 Kai A7 Periochis A Ethnikou Thalassiou Parkou Voreion Sporadon	National		
GRC	329003	Ethniko Parko Limnothalasson Mesolongiou – Aitolikou, Kato Rou Kai Ekvolon Acheloou Kai Evinou Kai Nison Echinadon	National	X	
GRC	341325	Vatatsa - Divari - Ormos Valtou - Drepano Dimou Igoumenitsas	National		
GRC	341329	Tsairi Dimou Epanomis	National		
GRC	341380	Ygrotopoi Kai Nisia Kolpou Atalantis	National		
GRC	341412	Bara Agiou Mama Sti Thesi Lorida Dimou Neon Moudanion	National		
GRC	341461	Limni Vistonida - Lagous Dimou Avdiron	National		
GRC	341481	Delta Evrou Dimon Tra¿Anoupolis Ferron	National		
GRC	341838	Alyki Kitrous (Pydnas)	National		
GRC	341853	Stergios-Aliakmonas (Aiginiou)	National		
GRC	341863	Delta Axiou (Chalastras)	National		
GRC	341885	Fanari-Porto Lagos	National		
GRC	341918	Ygrotopos Kai Akti Psalidiou Dimou Ko	National		
GRC	341922	Ethniko Ygrotopiko Parko Delta Evrou - Periochi Prostasias Tis Fysis - Zoni A	National		
GRC	341923	Ethniko Ygrotopiko Parko Delta Evrou - Periochi Prostasias Tis Fysis - Zoni B	National		
GRC	341929	Ethniko Ygrotopiko Parko Delta Evrou - Zoni TH	National		
GRC	349972	Ethniko Parko Anatolikis Makedonias Kai Thrakis - Periochi Prostasias Tis Fysis	National		
GRC	349973	Ethniko Parko Anatolikis Makedonias Kai Thrakis	National		
GRC	349975	Ethniko Parko Ygrotopon Amvrakikou	National		
GRC	349976	Ethniko Parko Ygrotopon Amvrakikou - Periochi Prostasias Tis Fysis	National		
GRC	349977	Periochi Perivallontikou Elegchou Ethnikou Parkou Ygrotopon Amvrakikou (Zoni C)	National		
GRC	349979	Ethniko Parko Ygrotopon Amvrakikou (Zoni B: Periochi Eidikon Rythmiseon)	National		
GRC	349993	Zones A1 Kai A6 Periochis A Ethnikou Thalassiou Parkou Alonnisou Voreion Sporadon	National		
GRC	349994	Zoni Eidikon Rythmiseon B1 Ethnikou Thalassiou Parkou Alonnisou Voreion Sporadon	National		
GRC	349995	Zoni Oikistikon Rythmiseon B2 Kai B3 Kai Zoni B4 Ethnikou Thalassiou Parkou Alonnisou Voreion Sporadon	National		
GRC	349996	Zoni A8: Periochi Eidikon Rythmiseon Ethnikou Thalassiou Parkou Alonnisou Voreion Sporadon	National		

GRC	349997	Zoni A9: Periochi Eidikon Rythmiseon Ethnikou Thalassiou Parkou Alonnisou Voreion Sporadon	National		
GRC	392893	Ethniko Parko Axiou - Perioches Apolytis Prostasias Tis Fysis AP1, AP2, AP3, AP4	National		
GRC	392895	Ethniko Parko Axiou - Perioches Prostasias Tis Fysis PD1, PD2, PD3, PD4	National		
GRC	392896	Ethniko Parko Axiou - Periochi Prostasias Tis Fysis PA	National		
GRC	392899	Ethniko Parko Gallikou, Axiou, Loudia, Aliakmona, Alykis Kitrous, Limnothalassas Kalochoriou	National		
GRC	392913	Ethniko Parko Ygrotopon Kotychiou - Strofylias	National		
GRC	392914	Perioches Prostasias Tis Fysis Stenon Kai Ekvolon Acheronta Kai Kalama Kai Elous Kalodikiou Kai Perifereiaki Zoni	National		
GRC	555526952	Fengari Samothrakis, Anatolikes Aktes, Vrachonissida Zourafa Kai Thalassia Zoni	Regional		
GRC	555526954	Delta Evrou Kai Dytikos Vrachionas	Regional		
GRC	555526960	Limnes Kai Limnothalasses Tis Thrakis - Evryteri Periochi Kai Paraktia Zoni	Regional		
GRC	555526966	Ormos Potamias - Akr. Pyrgos Eos N. Gramvoussa	Regional		
GRC	555526967	Kolpos Palaiou - Ormos Eleftheron	Regional		
GRC	555526968	Delta Nestou Kai Limnothalasses Keramotis - Evryteri Periochi Kai Paraktia Zoni	Regional		
GRC	555526972	Delta Axiou - Loudia - Aliakmona - Evryteri Periochi - Axioupoli	Regional		
GRC	555526974	Limnothalassa Epanomis Kai Thalassia Paraktia Zoni	Regional		
GRC	555526994	Akrotirio Elia - Akrotirio Kastro - Ekvoli Ragoula	Regional		
GRC	555526995	Paliouri - Akrotiri Kai Thalassia Zoni	Regional		
GRC	555526996	Platanitsi - Sykia - Akr. Rigas - Akr. Adolo	Regional		
GRC	555526997	Akrotirio Pyrgos - Ormos Kypsas - Malamo	Regional		
GRC	555527009	Karla - Mavrovouni - Kefalovryso Velestinou - Neochori	Regional		
GRC	555527011	Oros Pilio Kai Paraktia Thalassia Zoni-Spilaia Malaki Kai Skeponi	Regional		
GRC	555527013	Skiathos - Koukounaries Kai Evryteri Thalassia Periochi	Regional		
GRC	555527018	Amvrakikos Kolpos, Delta Lourou Kai Arachthou (Petra, Mytikas, Evryteri Periochi, Kato Pous Arachthou, Kampi Filippiadas)	Regional	X	
GRC	555527020	Ekvoles (Delta) Kalama	Regional	X	
GRC	555527029	Paraktia Thalassia Zoni Apo Parga Eos Akrotirio Agios Thomas (Preveza), Akr. Keladio - Ag. Thomas	Regional		
GRC	555527030	Kolpos Lagana Zakynthou (Akr. Geraki - Keri) Kai Nisides Marathonisi Kai Pelouzo	Regional		
GRC	555527031	Nisoi Strofades	Regional	X	

GRC	555527034	Esoteriko Archipelagos Ioniou (Meganisi, Arkoudi, Atokos, Vromonas)	Regional		
GRC	555527035	Paraktia Thalassia Zoni Apo Argostoli Eos Vlachata (Kefalonia) Kai Ormos Mounta	Regional		
GRC	555527036	Dytikes Aktes Kefalonias - Steno Kefalonias Ithakis - Voreia Ithaki (Akrotiria Gero Gkompos - Drakou Pidima - Kentri - Ag. Ioannis)	Regional		
GRC	555527037	Limnothalassa Korission (Kerkyra)	Regional		
GRC	555527038	Nisoi Paxoi Kai Antipaxoi Kai Evryteri Thalassia Periochi	Regional		
GRC	555527039	Paraktia Thalassia Zoni Apo Kanoni Eos Mesongi (Kerkyra)	Regional		
GRC	555527041	Delta Acheloou, Limnothalassa Mesolongiou - Aitolikou, Ekvoles Evinou, Nisoi Echinades, Nisos Petalas	Regional		
GRC	555527060	Limnothalassa Kotychi, Brinia	Regional		
GRC	555527061	Paraktia Thalassia Zoni Apo Akr. Kyllini Eos Toumpi - Kalogria	Regional		
GRC	555527062	Thalassia Periochi Kolpou Kyparissias - Akr. Katakolo - Kyparissia	Regional		
GRC	555527064	Oros Ochi - Kampos Karystou - Potami - Akrotirio Kafirefs - Paraktia Thalassia Zoni	Regional		
GRC	555527066	Megalo Kai Mikro Livari - Delta Xeria - Ydrochares Dasos Ag. Nikolaou - Paraktia Thalassia Zoni	Regional		
GRC	555527068	Koilada Kai Ekvoles Spercheiou - Maliakos Kolpos - Mesochori Spercheiou	Regional	X	
GRC	555527086	Ori Gidovouni, Chionovouni, Gaidourovouni, Korakia, Kalogerovouni, Koulochera Kai Periochi Monemvasias Spilaio Solomou Trypa Kai Pyrgos Ag. Stefanou Kai Thalassia Zoni Eos Akrotirio Kamili	Regional		
GRC	555527088	Ekvoles Evrota, Periochi Vrontama Kai Thalassia Periochi Lakonikou Kolpou	Regional		
GRC	555527092	Limnothalassa Pylou (Divari) Kai Nisos Sfaktiria, Agios Dimitrios	Regional		
GRC	555527095	Thalassia Periochi Stenou Methonis	Regional		
GRC	555527096	Ethniko Parko Schinia - Marathona	Regional		
GRC	555527097	Vravrona - Paraktia Thalassia Zoni	Regional		
GRC	555527098	Sounio - Nisida Patroklou Kai Paraktia Thalassia Zoni	Regional		
GRC	555527100	Antikythira - Prasonisi Kai Lagouvardos	Regional		
GRC	555527101	Nisides Kythiron - Prasonisi, Dragonera, Antidragonera	Regional		
GRC	555527102	Limnos - Chortarolimni - Limni Alyki Kai Thalassia Periochi	Regional		X
GRC	555527103	Agios Efstratios Kai Paraktia Thalassia Zoni	Regional		
GRC	555527104	Lesvos - Dytiki Chersonisos - Apolithomeno Dasos	Regional		
GRC	555527105	Lesvos - Kolpos Kallonis Kai Chersaia Paraktia Zoni	Regional		
GRC	555527106	Lesvos - Kolpos Geras, Eli Ntipi Kai Charamida	Regional		X

GRC	555527107	Samos - Paralia Alyki	Regional		
GRC	555527109	Samos - Oros Kerketefs - Mikro Kai Megalo Seitani - Dasos Kastanias Kai Lekkas, Akr. Katavasis - Limenas	Regional		
GRC	555527110	Ikaria - Fournoi Kai Paraktia Zoni	Regional		
GRC	555527111	Voreia Chios Kai Nisoi Oinousses Kai Paraktia Thalassia Zoni	Regional		
GRC	555527112	Vrachonisides Kalogeroi Kai Thalassia Zoni	Regional		
GRC	555527113	Kasos Kai Kasonisia - Evryteri Thalassia Periochi	Regional		
GRC	555527114	Kentriki Karpathos - Kali Limni - Lastos - Kyra Panagia Kai Paraktia Thalassia Zoni	Regional		
GRC	555527115	Kastellorizo Kai Nisides Ro Kai Strongyli Kai Paraktia Thalassia Zoni	Regional		
GRC	555527116	Rodos - Akramytis, Armenistis, Attavyros, Remata Kai Thalassia Zoni (Karavola-Ormos Glyfada)	Regional		
GRC	555527118	Notia Nisyros Kai Strongyli, Ifaistiako Pedio Kai Paraktia Thalassia Zoni	Regional		
GRC	555527119	Kos - Akrotirio Louros - Limni Psalidi - Oros Dikaios - Alyki - Paraktia Thalassia Zoni	Regional		
GRC	555527120	Astypalaia - Anatoliko Tmima, Gyro Nisides Kai Ofidoussa Kai Thalassia Zoni (Akr. Lantra - Akr. Vrysi)	Regional		
GRC	555527121	Arkoi, Leipsoi, Agathonisi Kai Vrachonisides	Regional		
GRC	555527122	Vrachonisia Notiou Aigaiou - Velopoula, Falkonera, Ananes, Christiana, Pacheia, Fteno, Makra, Astakidonisia, Syrna - Gyro Nisia Kai Thalassia Zoni	Regional		
GRC	555527124	Anafi - Chersonisos Kalamos - Roukounas	Regional		
GRC	555527126	Paraktia Zoni Dytikis Miloy	Regional		X
GRC	555527127	Nisos Polyaigos - Kimolos	Regional		
GRC	555527128	Nisos Antimilos - Thalassia Paraktia Zoni	Regional		
GRC	555527129	Sifnos - Profitis Ilias Mechri Dytikes Aktes Kai Thalassia Periochi	Regional		
GRC	555527130	Notia Serifos	Regional		
GRC	555527131	Voreiodytiki Kythnos - Oros Atheras - Akrotirio Kefalos Kai Paraktia Zoni	Regional		X
GRC	555527132	Anatoliki Kea	Regional		
GRC	555527133	Voreia Amorgos Kai Kinaros, Levitha, Mavra, Glaros Kai Thalassia Zoni	Regional		
GRC	555527134	Mikres Kyklades - Irakleia, Schoinoussa, Koufonisia, Keros, Antikeria Kai Thalassia Zoni	Regional		
GRC	555527135	Kentriki Kai Notia Naxos - Zas Kai Vigla Eos Mavrovouni Kai Thalassia Zoni (Ormos Karades - Ormos Moutsounas)	Regional		
GRC	555527137	Nisoi Despotiko Kai Strongylo Kai Thalassia Zoni	Regional		
GRC	555527149	Voreioanatoliko Akro Kritis - Dionysades, Elasa Kai Chersonisos Sidero (Akra Mavro Mouri - Vai - Akra Plakas) Kai Thalassia Zoni	Regional		
GRC	555527150	Nisos Koufonisi Kai Paraktia Thalassia Zoni	Regional		

GRC	555527153	Prassano Farangi - Patsos - Sfakoryako Rema - Paralia Rethymnou Kai Ekvoli Geropotamou, Akr. Lianos Kavos - Perivolia	Regional		
GRC	555527155	Imeri Kai Agria Gramvoussa - Tigani Kai Falasarna - Pontikonisi, Ormos Livadi - Viglia	Regional		
GRC	555527156	Nisos Elafonisos Kai Paraktia Thalassia Zoni	Regional		
GRC	555527157	Chersonisos Rodopou - Paralia Maleme - Kolpos Chanion	Regional		
GRC	555527159	Ormos Sougias - Vardia - Farangi Lissou Mechri Anydrous Kai Paraktia Zoni	Regional		
GRC	555527165	Asfendou - Kallikratis Kai Paraktia Zoni	Regional		
GRC	555527166	Nisoi Gavdos Kai Gavdopoula	Regional		
GRC	555527167	Paralia Apo Chrysoskalitissa Mechri Akrotirio Krios	Regional		
GRC	555558912	Ethniko Parko Ygrotopon Kotychiou - Strofylias, Zoni A - Periochi Prostasias Tis Fysis	National		
GRC	555635568	Thalassia Periochi Thrakis	Regional		
GRC	555635571	Thalassia Zoni Chersonisou Athona	Regional		
GRC	555635576	Thalassia Zoni Apo Argostoli Eos Ormo Mounta	Regional		
GRC	555635578	Thalassia Periochi Diapontion Nison	Regional		
GRC	555635579	Nisides Lichades Kai Thalassia Periochi	Regional		
GRC	555635580	Thalassia Periochi Kai Yfaloi Voreioanatolikis Evvoias	Regional		
GRC	555635581	Thalassia Zoni Anatolikis Evvoias Apo Akra Oktonia Evvoias Eos Zarakes	Regional		
GRC	555635584	Thalassia Periochi Pafsania - Ypothalassia Ifaisteia Methanon	Regional		
GRC	555635585	Korinthiakos Kolpos	Regional		
GRC	555635586	Thalassia Zoni Notias Manis	Regional		
GRC	555635587	Thalassia Periochi Notias Messinias	Regional		
GRC	555635588	Paraktia Kai Thalassia Zoni Makronisou	Regional		
GRC	555635592	Thalassia Periochi Nisidon Tokmakia	Regional		
GRC	555635594	Thalassia Periochi Notias Patmou	Regional		
GRC	555635596	Paraktia Kai Thalassia Zoni Voreias Anafis	Regional		
GRC	555635597	Thalassia Zoni Androu	Regional		
GRC	555635598	Thalassia Periochi Koloumvo	Regional		
GRC	555635599	Thalassia Periochi Dytikis Kai Notiodytikis Kritis	Regional		
GRC	555721933	Thalassia Periochi Kavalas - Thasou	Regional		
GRC	555721936	Ethniko Thalassio Parko Alonnisou - Voreion Sporadon, Anatoliki Skopelos	Regional		
GRC	555721944	Folegandros Anatoliki Mechri Dytiki Sikino Kai Thalassia Zoni	Regional		
GRC	555722217	Limnothalassa Angelochoriou	Regional		
GRC	555722222	Ekvoles Potamou Strymona	Regional		
GRC	555722223	Limnothalassa Agiou Mama	Regional		
GRC	555722227	Dytikes Kai Voreioanatolikes Aktes Zakynthou	Regional		
GRC	555722230	Limnothalasses Stenon Lefkadas (Palionis - Avlimon) Kai Alykes Lefkadas	Regional		

GRC	555722231	Alyki Lefkimis (Kerkyra)	Regional		
GRC	555722236	Voreia Karpathos Kai Saria Kai Paraktia Thalassia Zoni	Regional		X
GRC	555722237	Nisos Gyaros Kai Thalassia Zoni	National		X
HRV	2520	Mljet	National	X	
HRV	2523	Kornati	National		
HRV	10940	Brijuni	National	X	X
HRV	15636	Limski Zaljev - Rezervat	National		
HRV	16179	Malostonski Zaljev	National		
HRV	63664	Telašćica	National		X
HRV	63669	Prvić I Grgurov Kanal	National	X	
HRV	81173	Zrće	National		
HRV	81191	Zavratnica	National		
HRV	146756	Limski Zaljev	National		
HRV	146760	Datule Barbariga	National		
HRV	377856	Pantan	National		
HRV	377978	Donji Kamenjak I Medulinski Arhipelag	National		
HRV	377980	Sitsko-Žutska Otočna Skupina	National		
HRV	377982	Labin, Rabac I Uvala Prklog	National		
HRV	378015	Lastovsko Otočje	National	X	
HRV	378024	Kanal - Luka	National		
HRV	555578202	Nacionalni Park Brijuni	Regional	X	
HRV	555578264	Palagruža	Regional		
HRV	555578550	Golubinka Kod Handrake	Regional		
HRV	555578551	Ljubičica Kod Handrake	Regional		
HRV	555578553	Nevjestina Špilja	Regional		
HRV	555578557	Špiljice Kod Mola Od Orašca	Regional		
HRV	555578577	Limski Kanal - More	Regional		
HRV	555578578	Plomin - Moščenička Draga	Regional		
HRV	555578579	Vrsarski Otoci	Regional		
HRV	555578580	Cres - Rt Grota - Merag	Regional		
HRV	555578581	Cres - Rt Pernat - Uvala Tiha	Regional		
HRV	555578582	Cres - Rt Suha - Rt Meli	Regional		
HRV	555578583	Lošinj - Vela I Mala Draga	Regional		
HRV	555578585	Lošinj - Uvala Krivica	Regional		
HRV	555578588	Ilovik I Sv. Petar	Regional		
HRV	555578589	V. I M. Srakane	Regional		
HRV	555578590	Podmorje Plavnika I Kormata	Regional		
HRV	555578591	Podmorje Otoka Suska	Regional		
HRV	555578592	Podmorje Otoka Unije	Regional		
HRV	555578593	Uvala Soline	Regional		
HRV	555578594	Mala I Vela Luka Na Poluotoku Sokol, Krk	Regional		
HRV	555578595	Podmorje Otoka Prvić	Regional		
HRV	555578596	Podmorje Otoka Grgur I Goli	Regional		
HRV	555578597	Supetarska Draga Na Rabu	Regional		
HRV	555578598	Zaljev Kampor Na Rabu	Regional		
HRV	555578599	Dolfin I Otoci	Regional		
HRV	555578600	Podmorje Trstenika	Regional		
HRV	555578601	I. Strana V. I M. Orjula	Regional		
HRV	555578602	Obala Između Rta Šilo I Vodotoč	Regional		
HRV	555578603	M. Draga - Žrnovica	Regional		
HRV	555578604	Sv. Juraj - Otočić Lisac	Regional		
HRV	555578605	Uvala Ivanča	Regional		

HRV	555578606	Uvala Malin; Uvala Duboka	Regional		
HRV	555578607	Uvala Zavratnica	Regional		
HRV	555578608	Uvala Krivača	Regional		
HRV	555578609	Uvala Vrulja U Velebitskom Kanalu	Regional		
HRV	555578610	Uvala Jurišnica	Regional		
HRV	555578611	Uvale Svetojanj V. I M.; Uvala Lusk	Regional		
HRV	555578612	Uvala Caska - Od Metajne Do Rta Hanzina	Regional		
HRV	555578613	Pag - Od Uvale Luka V. Do Rta Krištofor	Regional		
HRV	555578614	Paška Vrata	Regional		
HRV	555578615	Košljunski Zaljev	Regional		
HRV	555578616	Stara Povljana	Regional		
HRV	555578617	Uvala Vlašići	Regional		
HRV	555578618	Uvala Dinjiška	Regional		
HRV	555578619	Ljubačka Vrata	Regional		
HRV	555578620	Vinjerac - Masleničko Ždrilo	Regional		
HRV	555578621	Ražanac M. I V.	Regional		
HRV	555578622	Olib - Podmorje	Regional		
HRV	555578623	Silba - Podmorje	Regional	X	
HRV	555578624	Premuda - Vanjska Strana	Regional		
HRV	555578625	More Oko Otoka Grujica	Regional		
HRV	555578626	Planik I Planičić	Regional		
HRV	555578627	Otoci Škrda I Maun	Regional		
HRV	555578628	More Oko Otoka Škarda	Regional		
HRV	555578629	Plićine Oko Maslinjaka; Vodenjaka; Kamenjaka	Regional		
HRV	555578630	Plićine Oko Tramerke	Regional		
HRV	555578631	Prolaz Između Zapuntela I Ista	Regional		
HRV	555578632	Brguljski Zaljev - O. Molat	Regional		
HRV	555578633	Bonaster - O. Molat	Regional		
HRV	555578634	JI Dio O. Molata	Regional		
HRV	555578635	Luka Soliščica; Dugi Otok	Regional	X	
HRV	555578636	Uvala Golubinka - Rt Lopata	Regional	X	
HRV	555578637	Uvala Sakarun	Regional	X	
HRV	555578638	Z. Obala Dugog Otoka	Regional	X	
HRV	555578639	Uvala Brbišćica	Regional	X	
HRV	555578640	Uvala Zagračina	Regional	X	
HRV	555578641	J Rt O. Zverinac	Regional	X	
HRV	555578642	Rivanjski Kanal Sa Sestricama	Regional		
HRV	555578643	Otok Jidula Do Rt Ovčjak; Prolaz V. Ždrelac	Regional		
HRV	555578644	Punta Parda	Regional		
HRV	555578645	J Dio O. Iža I O. Mrtovnjak	Regional		
HRV	555578646	Otok Tukošćak I O. Mrtonjak	Regional	X	
HRV	555578647	Otok Karantunić	Regional		
HRV	555578648	Uvala Sabuša	Regional		
HRV	555578649	Rončić	Regional		
HRV	555578650	V. I M. Skala	Regional		
HRV	555578651	Uvala Sv. Ante	Regional		
HRV	555578652	Otok Vrgada SI Strana S O. Kozina	Regional		
HRV	555578653	Uvala Makirina	Regional		
HRV	555578654	Uvala Grebaštica	Regional		
HRV	555578655	Uvale Oko Rta Ploča	Regional		
HRV	555578656	Uvala Stivančica	Regional		
HRV	555578657	Uvala Tijašnica	Regional		

HRV	555578658	Blitvenica	Regional		
HRV	555578659	JZ Strana Šolte - I	Regional		
HRV	555578660	JZ Strana Šolte - II	Regional		
HRV	555578661	Pakleni Otoci	Regional		X
HRV	555578662	JI Strana O. Visa	Regional		
HRV	555578663	Otok Vis - Podmorje	Regional		
HRV	555578664	Biševo More	Regional		
HRV	555578665	Brusnik I Svetac	Regional		
HRV	555578666	Otok Jabuka - Podmorje	Regional		
HRV	555578667	Arkanđel	Regional		
HRV	555578668	Kosmač M. I V.	Regional		
HRV	555578669	Merara	Regional		
HRV	555578670	Muljica V. More	Regional		
HRV	555578671	Hrid Muljica More	Regional		
HRV	555578672	Murvica	Regional		
HRV	555578673	Otoci Orud I Mačaknar	Regional		
HRV	555578674	Fumija I - Podmorje	Regional		
HRV	555578675	Krknjaši	Regional		
HRV	555578676	Fumija II - Podmorje	Regional		
HRV	555578677	Recetinovac	Regional		
HRV	555578678	Mrduja	Regional		
HRV	555578679	Podmorje Otočića Mrduja	Regional		
HRV	555578680	Otoci Lukavci	Regional		
HRV	555578681	Pelegrin - Podmorje	Regional		
HRV	555578682	Kabal - Podmorje	Regional		
HRV	555578683	Šćedro - Podmorje	Regional		
HRV	555578684	Zlatni Rat Na Braču - Podmorje	Regional		
HRV	555578685	Palagruža - Podmorje I	Regional		
HRV	555578686	Otočić Galijula	Regional		
HRV	555578687	Uvala Vrulja Kod Brela	Regional		
HRV	555578688	Sveti Petar	Regional		
HRV	555578689	Osejava	Regional		
HRV	555578690	Ušće Cetine	Regional		
HRV	555578691	Brač - Podmorje	Regional		
HRV	555578692	U. Ramova; U. Krvavica	Regional		
HRV	555578693	Uvala Klokun	Regional		
HRV	555578694	Uvala V. Duba	Regional		
HRV	555578695	Uvale Vira Donja I Vira Gornja	Regional		
HRV	555578696	Crni Rat - O. Brač	Regional		
HRV	555578697	Uvala Lovrečina	Regional		
HRV	555578698	Otok Hvar - Od Uvale Dubovica Do Rta Nedjelja	Regional		
HRV	555578699	Uvala Vlaška - Hvar	Regional		
HRV	555578700	Uvala Bristova - Hvar	Regional		
HRV	555578701	Uvala V. Pogorila - Hvar	Regional		
HRV	555578702	Uvala M. Pogorila - Hvar	Regional		
HRV	555578703	Uvala M. Moševčica - Hvar	Regional		
HRV	555578704	Uvala V. Moševčica - Hvar	Regional		
HRV	555578705	Uvale Divlja Mala I Divlja Vela - Hvar	Regional		
HRV	555578706	Uvale Kruševa; Pokrvenik I Zaraće - Hvar	Regional		
HRV	555578708	Pelješac - Od Uvale Rasoka Do Rta Osičac	Regional		
HRV	555578709	Otok Proizd I Privala Na Korčuli	Regional		

HRV	555578710	Otok Korčula - Od Uvale Poplat Do Vrhovnjaka	Regional		
HRV	555578711	Pupnatska Luka	Regional		
HRV	555578712	Uvala Orlanduša	Regional		
HRV	555578713	Pavja Luka	Regional		
HRV	555578714	Cres - Lošinj	Regional		
HRV	555578715	Rt Rukavac - Rt Marčuleti	Regional		
HRV	555578716	Stonski Kanal	Regional		
HRV	555578717	Sveti Andrija - Podmorje	Regional		
HRV	555578718	Uvala Slano	Regional		
HRV	555578719	Sjeverna Obala Od Rta Pusta U Uvali Sobra Do Rta Stoba Kod Uvale Okuklje S Otocima I Akvatorijem	Regional		
HRV	555578721	Akvatorij Uz Konavoske Stijene	Regional		
HRV	555578722	Ušće Krke	Regional		
HRV	555578723	Obalna Linija Od Luke Gonoturska Do Rta Vratnički	Regional		
HRV	555578724	Medulinski Zaljev	Regional	X	
HRV	555578725	Pomerski Zaljev	Regional	X	
HRV	555578726	Ljubački Zaljev	Regional		
HRV	555578727	Ninski Zaljev	Regional		
HRV	555578729	Lun - Podmorje	Regional		
HRV	555578730	Uvala Stara Novalja	Regional		
HRV	555578731	Medvjeđa Pećina Kod Uvale Lučica (Lošinj)	Regional		
HRV	555578732	Špilja Kod Iškog Mrtovnjaka	Regional		
HRV	555578741	Uvala Drašnica - Vrulja	Regional		
HRV	555578745	Uvale Jaz; Soline I Sulinj Na Krku	Regional		
HRV	555578746	Zaljev Sv. Eufemije Na Rabu	Regional		
HRV	555578747	J. Molat-Dugi-Kornat-Žirje-Zlarin-Murter-Pašman-Ugljan-Rivanj-Sestrunj-Molat	Regional	X	
HRV	555578750	Lastovski I Mljetski Kanal	Regional		
HRV	555578751	Pantan	Regional		
HRV	555578752	Akvatorij J Od Uvale Pržina I S Od Uvale Bilin Žal Uz Poluotok Ražnjić	Regional		
HRV	555578753	Ušće Raše	Regional		
HRV	555578754	Ušće Mirne	Regional		
HRV	555578755	Sedlo - Podmorje	Regional		
HRV	555578756	Kosmerka - Prokladnica - Vrtlac - Babuljak - Podmorje	Regional		
HRV	555578757	Uvale Tratinska I Balun	Regional		
HRV	555578758	Žirje - Kabal	Regional		
HRV	555578759	Kaprije	Regional		
HRV	555578760	Kakanski Kanal	Regional		
HRV	555578761	Tetovišnjak - Podmorje	Regional		
HRV	555578762	Kukuljari	Regional		
HRV	555578763	Murterski Kanal	Regional		
HRV	555578764	Medvjeđa Špilja (Morska)	Regional		
HRV	555578767	Hvar - Otok Zečevo	Regional		
HRV	555578768	Krk - Od Rta Negrit Do Uvale Zaglav	Regional		
HRV	555578769	Krk - Od Uvale Zaglav Do Crikvenog Rta	Regional		
HRV	555578770	Krk - Od Crikvenog Rta Do Rta Sv. Nikole	Regional		
HRV	555578771	Rt Gomilica - Brač	Regional		
HRV	555578772	Hvar - Od Uvale Vitarna Do Uvale Maslinica	Regional		

HRV	555578773	Južna Obala Hvara - Od Rta Nedjelja Do Uvale Česminica	Regional		
HRV	555578774	Šolta Od Uvale Šipkova Do Grčkog Rata	Regional		
HRV	555578775	Pantan - Divulje	Regional		
HRV	555578777	Uvala Modrič	Regional		
HRV	555578778	Otoci Rovinjskog Područja - Podmorje	Regional		
HRV	555578779	Uvala Remac	Regional		
HRV	555578780	Područje Oko Rta Tatinja - Hvar	Regional		
HRV	555578781	Podmorje Istočne Obale Otoka Krka	Regional		
HRV	555578782	Čiovo Od Uvale Orlice Do Rta Čiova	Regional		
HRV	555578783	Podmorje Kostrene	Regional		
HRV	555578784	Podmorje Poluotoka Lopar - Rab	Regional		
HRV	555578785	Viški Akvatorij	Regional		
HRV	555578786	Podmorje Kod Rabca	Regional		
HRV	555578787	Uvala Škvaranska - Uvala Sv. Marina	Regional		
HRV	555578788	Podmorje Oko Rta Č†Uf Na Krku	Regional		
HRV	555578789	Babuljaši I Okolni Grebeni	Regional		
HRV	555578790	Otočić Drvenik	Regional		
HRV	555578791	Brač - Podmorje Od Rta Gališnjak Do Druge Vale	Regional		
HRV	555578792	Uvala Divna - Pelješac	Regional		
HRV	555578793	Nacionalni Park Kornati	Regional		
HRV	555578794	Park Prirode Telašćica	Regional	X	
HRV	555578798	Badija I Otoci Oko Korčule	Regional		
HRV	555578802	Malostonski Zaljev	Regional		
HRV	555578804	Lokrum	Regional		
HRV	555578808	Silbanski Grebeni	Regional	X	
HRV	555578810	Elafiti	Regional		
HRV	555578812	Novigradsko I Karinsko More	Regional		
HRV	555578813	Otok Zeča	Regional		
HRV	555578823	Akvatorij Zapadne Istre	Regional		
HRV	555578824	Nacionalni Park Mljet	Regional	X	
HRV	555578825	Park Prirode Lastovsko Otočje	Regional		
HRV	555623573	Grebeni U Jabučkoj Kotlini	Regional		
HRV	555698365	Ušće Neretve	National		
ITA	555529506	Acquafredda Di Maratea	Regional		
ITA	555721768	Adriatico Settentrionale – Emilia-Romagna	Regional		
ITA	555721776	Adriatico Settentrionale Veneto - Delta Del Po	Regional		
ITA	555529483	Alimini	Regional		
ITA	555529475	Aquatina Di Frigole	Regional		
ITA	166438	Arcipelago Di La Maddalena	National		X
ITA	555721960	Arcipelago La Maddalena	Regional		
ITA	32674	Arcipelago Toscano	National		X
ITA	555578838	Area Marina Di Miramare	Regional		
ITA	390513	Area Marina Protetta Isola Di Bergeggi	National	X	X
ITA	555721733	Banchi Di Marettimo	Regional		
ITA	555529938	Berchida E Bidderosa	Regional		X
ITA	555722541	Bosco Di Volano	Regional		
ITA	555722690	Bosco Pantano Di Policoro E Costa Ionica Foce Sinni	Regional		
ITA	555529466	Bosco Tramazzone	Regional		

ITA	555529978	Bruncu De Su Monte Moru - Geremeas (Mari Pintau)	Regional		
ITA	555721772	Calafuria - Area Terrestre E Marina	Regional		
ITA	555529679	Calanchi Di Palizzi Marina	Regional		
ITA	182732	Capo Caccia - Isola Piana	National	X	X
ITA	555529930	Capo Caccia (Con Le Isole Foradada E Piana) E Punta Del Giglio	Regional		X
ITA	178838	Capo Carbonara	National		X
ITA	555529988	Capo Di Pula	Regional		X
ITA	555529927	Capo Figari E Isola Figarolo	Regional		X
ITA	182731	Capo Gallo - Isola Delle Femmine	National		
ITA	555691182	Capo Milazzo	National		X
ITA	555528198	Capo Mortola	Regional	X	
ITA	555529976	Capo Pecora	Regional		
ITA	13168	Capo Rizzuto	National		
ITA	555529676	Capo S. Giovanni	Regional		
ITA	555529677	Capo Spartivento	Regional		
ITA	555721953	Capo Spartivento	Regional		
ITA	555529926	Capo Testa	Regional		X
ITA	555641768	Capo Testa - Punta Falcone	National		
ITA	555528724	Cavana Di Monfalcone	Regional		
ITA	13160	Cinque Terre	National	X	X
ITA	390449	Costa Degli Infreschi E Della Masseta	National		
ITA	555624506	Costa Del Piceno - San Nicola A Mare	Regional		
ITA	555529975	Costa Di Nebida	Regional		X
ITA	555529536	Costa Ionica Foce Agri	Regional		
ITA	555529537	Costa Ionica Foce Basento	Regional		
ITA	555529538	Costa Ionica Foce Bradano	Regional		
ITA	555529539	Costa Ionica Foce Cavone	Regional		
ITA	555529474	Costa Otranto - Santa Maria Di Leuca	Regional		
ITA	555529000	Costa Tra Ancona E Portonovo	Regional		
ITA	555529693	Costa Viola E Monte S. Elia	Regional		
ITA	555529931	Coste E Isolette A Nord Ovest Della Sardegna	Regional		X
ITA	555529365	Costiera Amalfitana Tra Nerano E Positano	Regional		
ITA	555722595	Da Capo Testa All'isola Rossa	Regional		
ITA	555530004	Da Is Arenas A Tonnara (Marina Di Gonnesa)	Regional		
ITA	555529979	Da Piscinas A Riu Scivu	Regional		
ITA	555722594	Da Tavolara A Capo Comino	Regional		
ITA	555721775	Dall'Isola Dell'asinara All'argentiera	Regional		
ITA	555528673	Delta Del Po: Tratto Terminale E Delta Veneto	Regional		
ITA	555529461	Duna Di Campomarino	Regional		
ITA	555529680	Fiumara Amendolea (Incluso Roghudi, Chorio E Rota Greco)	Regional		
ITA	555529865	Foce Del Fiume Simeto E Lago Gornalunga	Regional		
ITA	555529965	Foce Del Flumendosa - Sa Praia	Regional		
ITA	178854	Foce Dell' Isonzo	National		
ITA	555721967	Foce Dell'isonzo - Isola Della Cona	Regional		
ITA	555529352	Foce Volturno - Variconi	Regional		
ITA	555529924	Foci Del Coghinas	Regional		
ITA	178890	Foci Dello Stella	National		

ITA	555529051	Fondali Antistanti Punta Morelle	Regional		
ITA	555529056	Fondali Antistanti S. Marinella	Regional		
ITA	555528287	Fondali Anzo	Regional	X	
ITA	555528251	Fondali Arenzano - Punta Ivrea	Regional	X	
ITA	555528196	Fondali Arma Di Taggia - Punta San Martino	Regional	X	
ITA	555528253	Fondali Boccadasse - Nervi	Regional	X	
ITA	555528184	Fondali Capo Berta - Diano Marina - Capo Mimosa	Regional	X	
ITA	555529661	Fondali Capo Cozzo - S. Irene	Regional		
ITA	555528232	Fondali Capo Mele - Alassio	Regional	X	
ITA	555528199	Fondali Capo Mortola - San Gaetano	Regional		
ITA	555529064	Fondali Circostanti l'Isola Di Palmarola	Regional		
ITA	555529065	Fondali Circostanti l'Isola Di Ponza	Regional	X	
ITA	555529068	Fondali Circostanti l'Isola Di S. Stefano	Regional		
ITA	555529067	Fondali Circostanti l'Isola Di Ventotene	Regional		
ITA	555529066	Fondali Circostanti l'Isola Di Zannone	Regional		
ITA	555529583	Fondali Crosia-Pietrapaola-Cariati	Regional		
ITA	555529625	Fondali Da Crotone A Le Castella	Regional		
ITA	555529707	Fondali Da Punta Pezzo A Capo Dell'armi	Regional		
ITA	555529742	Fondali Del Golfo Di Custonaci	Regional		
ITA	555578867	Fondali Del Plemmirio	Regional		
ITA	555529741	Fondali Dell'arcipelago Delle Isole Egadi	Regional		
ITA	555578863	Fondali Delle Isole Pelagie	Regional		
ITA	555529743	Fondali Dell'isola Dello Stagnone Di Marsala	Regional		
ITA	555529921	Fondali Dell'isola Di Capo Passero	Regional		
ITA	555529827	Fondali Dell'isola Di Salina	Regional		
ITA	555529785	Fondali Dell'isola Di Ustica	Regional		
ITA	555721734	Fondali Dello Zingaro	Regional		
ITA	555529887	Fondali Di Acicastello (Isola Lachea - Ciclopi)	Regional		
ITA	555529919	Fondali Di Brucoli - Agnone	Regional		
ITA	555721784	Fondali Di Capo Milazzo	Regional		
ITA	555529839	Fondali Di Capo San Marco - Sciacca	Regional		
ITA	555529569	Fondali Di Capo Tirone	Regional		
ITA	555529660	Fondali Di Capo Vaticano	Regional		
ITA	555721783	Fondali Di Capo Zafferano	Regional		
ITA	555529624	Fondali Di Gabella Grande	Regional		
ITA	555529786	Fondali Di Isola Delle Femmine - Capo Gallo	Regional		
ITA	555529659	Fondali Di Pizzo Calabro	Regional		
ITA	555529708	Fondali Di Scilla	Regional		
ITA	555529639	Fondali Di Staletti	Regional		
ITA	555529826	Fondali Di Taormina - Isola Bella	Regional		
ITA	555721785	Fondali Di Torre Salsa	Regional		
ITA	555529920	Fondali Di Vendicari	Regional		
ITA	555528223	Fondali Finale Ligure	Regional	X	
ITA	555529897	Fondali Foce Del Fiume Irminio	Regional		
ITA	555528257	Fondali Golfo Di Rapallo	Regional	X	
ITA	555529572	Fondali Isola Di Cirella-Diamante	Regional		
ITA	555529571	Fondali Isola Di Dino-Capo Scalea	Regional		
ITA	555528297	Fondali Isole Palmaria - Tino - Tinetto	Regional		
ITA	555528229	Fondali Loano - Albenga	Regional	X	
ITA	555578853	Fondali Marini Di Baia	Regional		
ITA	555578854	Fondali Marini Di Gaiola E Nisida	Regional		

ITA	555722669	Fondali Marini Di Ischia, Procida E Vivara	Regional		
ITA	555722670	Fondali Marini Di Punta Campanella E Capri	Regional		
ITA	555528258	Fondali Monte Portofino	Regional		
ITA	555528252	Fondali Nervi - Sori	Regional	X	
ITA	555528219	Fondali Noli - Bergeggi	Regional		
ITA	555528194	Fondali Porto Maurizio - San Lorenzo Al Mare - Torre Dei Marmi	Regional	X	
ITA	555528276	Fondali Punta Apicchi	Regional	X	
ITA	555528264	Fondali Punta Baffe	Regional	X	
ITA	555528263	Fondali Punta Di Moneglia	Regional	X	
ITA	555528286	Fondali Punta Levanto	Regional	X	
ITA	555528265	Fondali Punta Manara	Regional	X	
ITA	555528284	Fondali Punta Mesco - Rio Maggiore	Regional		
ITA	555528285	Fondali Punta Picetto	Regional	X	
ITA	555528266	Fondali Punta Sestri	Regional	X	
ITA	555528195	Fondali Riva Ligure - Cipressa	Regional	X	
ITA	555528200	Fondali San Remo - Arziglia	Regional	X	
ITA	555528230	Fondali Santa Croce - Gallinara - Capo Lena	Regional	X	
ITA	555529575	Fondali Scogli Di Isca	Regional		
ITA	555529062	Fondali Tra Capo Circeo E Terracina	Regional		
ITA	555529061	Fondali Tra Capo Portiere E Lago Di Caprolace (Foce)	Regional		
ITA	555529050	Fondali Tra Le Foci Del Fiume Chiarone E Fiume Fiora	Regional		
ITA	555529052	Fondali Tra Le Foci Del Torrente Arrone E Del Fiume Marta	Regional		
ITA	555529053	Fondali Tra Marina Di Tarquinia E Punta Della Quaglia	Regional		
ITA	555529055	Fondali Tra Punta Del Pecoraro E Capo Linaro	Regional		
ITA	555529054	Fondali Tra Punta S. Agostino E Punta Della Mattonara	Regional		
ITA	555529063	Fondali Tra Terracina E Lago Lungo	Regional		
ITA	555529060	Fondali Tra Torre Astura E Capo Portiere	Regional		
ITA	555528211	Fondali Varazze - Albisola	Regional	X	
ITA	555722587	Formiche Di Grosseto	Regional		
ITA	182719	Gaiola	National		
ITA	555722596	Golfo Di Orosei	Regional		X
ITA	555529961	Is Arenas	Regional		
ITA	555529962	Is Arenas S'Acqua E S'Ollastu	Regional		
ITA	555530003	Is Compinxius - Campo Dunale Di Bugerru - Portixeddu	Regional		
ITA	555529967	Isola Dei Cavoli, Serpentara, Punta Molentis E Campulongu	Regional		
ITA	555529892	Isola Dei Porri	Regional		
ITA	555722600	Isola Del Toro	Regional		
ITA	555722601	Isola Della Vacca	Regional		
ITA	182734	Isola Dell'asinara	National		X
ITA	555529932	Isola Dell'asinara	Regional		X
ITA	555528841	Isola Di Capraia - Area Terrestre E Marina	Regional	X	X
ITA	555722590	Isola Di Giannutri - Area Terrestre E Marina	Regional		
ITA	555722606	Isola Di Gorgona - Area Terrestre E Marina	Regional		
ITA	555722599	Isola Di Mal Di Ventre E Catalano	Regional	X	

ITA	555722572	Isola Di Montecristo E Formica Di Montecristo - Area Terrestre E Marina	Regional		X
ITA	555722571	Isola Di Pianosa - Area Terrestre E Marina	Regional		X
ITA	555529521	Isola Di S. Ianni E Costa Prospiciente	Regional		
ITA	555529973	Isola Di San Pietro	Regional		X
ITA	16154	Isola Di Ustica	National	X	X
ITA	555529937	Isola Rossa - Costa Paradiso	Regional		
ITA	555529971	Isola Rossa E Capo Teulada	Regional		
ITA	13172	Isole Ciclopi	National		X
ITA	13178	Isole Dello Stagnone Di Marsala	National		
ITA	178828	Isole Di Ventotene E Santo Stefano	National	X	X
ITA	13170	Isole Egadi	National	X	X
ITA	182733	Isole Pelagie	National	X	X
ITA	555529928	Isole Tavolara, Molara E Molarotto	Regional		
ITA	13164	Isole Tremiti	National		X
ITA	555529438	Isole Tremiti	Regional		
ITA	555529407	Isolotti Li Galli	Regional		
ITA	555529936	Lago Di Baratz - Porto Ferro	Regional		
ITA	555722611	Laguna Di Marano E Grado	Regional		
ITA	555529798	Laguna Di Oliveri - Tindari	Regional		
ITA	555529501	Le Cesine	Regional		
ITA	555529946	Lido Di Orrì	Regional		
ITA	555529467	Litorale Brindisino	Regional		
ITA	555722682	Litorale Di Gallipoli E Isola S. Andrea	Regional		
ITA	555722622	Litorale Di Porto d'Ascoli	Regional		
ITA	555529481	Litorale Di Ugento	Regional		
ITA	555721971	Mare Della Magna Grecia	Regional		
ITA	555529520	Marina Di Castrocucco	Regional		
ITA	14691	Miramare Nel Golfo Di Trieste	National	X	X
ITA	555529480	Montagna Spaccata E Rupi Di San Mauro	Regional		
ITA	178986	Monte Orlando	National		
ITA	555529925	Monte Russu	Regional		X
ITA	555722550	Ortazzo, Ortazzino, Foce Del Torrente Bevano	Regional		
ITA	555529485	Palude Del Capitano	Regional		
ITA	555529496	Palude Del Conte, Dune Di Punta Prosciutto	Regional		
ITA	555529939	Palude Di Osalla	Regional		
ITA	555722715	Parco Marino Di Punta Degli Infreschi	Regional		
ITA	555722714	Parco Marino Di S. Maria Di Castellabate	Regional		
ITA	178945	Parco Regionale Del Delta Del Po (VE)	National		
ITA	182720	Parco Sommerso Di Baia	National		
ITA	13176	Penisola Del Sinis - Isola Mal Di Ventre	National		X
ITA	555722544	Pineta Di Casalborsetti, Pineta Staggioni, Duna Di Porto Corsini	Regional		
ITA	390450	Plemmirio	National	X	X
ITA	555529994	Porto Campana	Regional		
ITA	13167	Porto Cesareo	National		X
ITA	555529497	Porto Cesareo	Regional	X	
ITA	5977	Portofino	National	X	X
ITA	555529001	Portonovo E Falesia Calcarea A Mare	Regional		
ITA	555529503	Posidonieto Capo San Gregorio - Punta Ristola	Regional		

ITA	555529465	Posidonieto Isola Di San Pietro - Torre Canneto	Regional		
ITA	555529456	Posidonieto San Vito - Barletta	Regional		
ITA	555529972	Promontorio, Dune E Zona Umida Di Porto Pino	Regional		X
ITA	13165	Punta Campanella	National		
ITA	555529987	Punta Giunchera	Regional		
ITA	555529974	Punta S'aliga	Regional		
ITA	555529478	Rauccio	Regional		
ITA	390447	Regno Di Nettuno	National		X
ITA	555578836	Relitti Di Posidonia Presso Grado	Regional		
ITA	555528781	Relitto Della Piattaforma Paguro	Regional		
ITA	14646	Riserva Naturale Oasi Del Simeto	National		
ITA	31105	Riserva Naturale Pineta Di Ravenna	National		
ITA	15308	Riserva Naturale Po Di Volano	National		
ITA	555722536	Sacca Di Goro, Po Di Goro, Valle Dindona, Foce Del Po Di Volano	Regional		
ITA	390448	Santa Maria Di Castellabate	National		
ITA	555529960	Sassu - Cirras	Regional		
ITA	555578846	Scarpata Continentale Dell'arcipelago Toscano	Regional		
ITA	555578845	Scoglietto Di Portoferraio	Regional		
ITA	555529379	Scoglio Del Vervece	Regional		
ITA	555578848	Scoglio Dell'argentarola	Regional		
ITA	555529587	Secca Di Amendolara	Regional		
ITA	390493	Secche Della Meloria	National	X	
ITA	555578844	Secche Della Meloria	Regional		
ITA	555529057	Secche Di Macchiatonda	Regional		
ITA	20721	Secche Di Tor Paterno	National		
ITA	555529059	Secche Di Tor Paterno	Regional	X	
ITA	555529058	Secche Di Torre Flavia	Regional		
ITA	555529990	Serra Is Tres Portus (Sant'Antioco)	Regional		
ITA	555529695	Spiaggia Di Brancaleone	Regional		
ITA	555529966	Stagni Di Colostrai E Delle Saline	Regional		
ITA	555529964	Stagni Di Murtas E S'Acqua Durci	Regional		
ITA	555722681	Stagni E Saline Di Punta Della Contessa	Regional		
ITA	555529970	Stagno Di Cagliari, Saline Di Macchiareddu, Laguna Di Santa Gilla	Regional		
ITA	555529950	Stagno Di Corru S'Ittiri	Regional		
ITA	555529952	Stagno Di Mistras Di Oristano	Regional		
ITA	555529922	Stagno Di Pilo E Di Casaraccio	Regional		
ITA	555529989	Stagno Di Piscinnì	Regional		
ITA	555529993	Stagno Di Porto Botte	Regional		
ITA	555529956	Stagno Di Putzu Idu (Salina Manna E Pauli Marigosa)	Regional		X
ITA	555529949	Stagno Di S'Ena Arrubia E Territori Limitrofi	Regional		
ITA	555529923	Stagno E Ginepreto Di Platamona	Regional		
ITA	13174	Tavolara - Punta Coda Cavallo	National		X
ITA	555578834	Tegnùe Di Chioggia	Regional		
ITA	555578835	Tegnùe Di Porto Falconera	Regional		
ITA	555529459	Torre Colimena	Regional		
ITA	390446	Torre Del Cerrano	National		
ITA	555578851	Torre Del Cerrano	Regional		

ITA	15263	Torre Guaceto	National	X	X
ITA	555529469	Torre Guaceto E Macchia S. Giovanni	Regional		
ITA	555529495	Torre Veneri	Regional		
ITA	555578837	Trezze San Pietro E Bardelli	Regional		
ITA	555721769	Tutela Del Tursiops Truncatus	Regional		
ITA	178865	Valle Cavanata	National		
ITA	555722612	Valle Cavanata E Banco Mula Di Muggia	Regional		
ITA	555722534	Vene Di Bellocchio, Sacca Di Bellocchio, Foce Del Fiume Reno, Pineta Di Bellocchio	Regional		
ITA	555529658	Zona Costiera Fra Briatico E Nicotera	Regional		
MLT	330745	Żona Fil-Baħar Bejn Rdum Majjiesa U Għar Lapsi	National		
MLT	555530255	Żona Fil-Baħar Bejn Rdum Majjiesa U Għar Lapsi	Regional		
MLT	555546263	Żona Fil-Baħar Fil-Limiti Ta' Għar Lapsi U Ta' Filfla	National		
MLT	555546264	Żona Fil-Baħar Fil-Limiti Tad-Dwerja (Għawdex)	National		
MLT	555546265	Żona Fil-Baħar Bejn Il-Ponta Tal-Ħotba U Tal-Fessej (Għawdex)	National		
MLT	555546266	Żona Fil-Baħar Fil-Bejn Il-Ponta Ta'san Dimitri (Għawdex) U Il-Qaliet	National		
MLT	555578883	Żona Fil-Baħar Fl-Inħawi Ta' Għar Lapsi U Ta' Filfla	Regional		
MLT	555578884	Żona Fil-Baħar Fl-Inħawi Tad-Dwejra (Għawdex)	Regional		
MLT	555578885	Żona Fil-Baħar Bejn Il-Ponta Tal-Ħotba U Tal-Fessej (Għawdex)	Regional		
MLT	555578886	Żona Fil-Baħar Bejn Il-Ponta Ta' San Dimitri (Għawdex) U Il-Qaliet	Regional		
MLT	555589821	Żona Fil-Baħar Fit-Tramuntana	National		
MLT	555589822	Żona Fil-Baħar Fl-Inħawi Tal-Graben Tat-Tramuntana Ta’ Għawdex	National		
MLT	555589823	Żona Fil-Baħar Fil-Grigal	National		
MLT	555589824	Żona Fil-Baħar Fil-Lvant	National		
MLT	555589825	Żona Fil-Baħar Fix-Xlokk	National		
MLT	555589826	Żona Fil-Baħar Fin-Nofsinhar	National		
MLT	555589827	Żona Fil-Baħar Fl-Inħawi Tal-Graben Ta’ Medina	National		
MLT	555589828	Żona Fil-Baħar Fil-Lbiċ	National		
MLT	555589829	Żona Fil-Baħar Madwar Għawdex	National		
MLT	555589831	Żona Fil-Baħar Fil-Punent	National		
MLT	555589832	Żona Fil-Baħar Fil-Majjistral	National		
MLT	555623617	Żona Fil-Baħar Fil-Punent	Regional		
MLT	555623618	Żona Fil-Baħar Fl-Inħawi Tal-Graben Tat-Tramuntana Ta' Għawdex	Regional		
MLT	555634474	Żona Fil-Baħar Fl-Inħawi Tal-Majjistral Tal-Graben Ta'malta	National		
MLT	555634475	Żona Fil-Baħar Fl-Inħawi Tal-Punent Tal-Graben Ta'malta	National		
MLT	555643616	Żona Fil-Baħar Fl-Inħawi Tal-Graben Ta'medina	Regional		

MLT	555643625	Żona Fil-Baħar Fl-Inħawi Tal-Punent Tal-Graben Ta' Malta	Regional		
MLT	555643626	Żona Fil-Baħar Fl-Inħawi Tal-Majjistral Tal-Graben Ta' Malta	Regional		
ROM	63636	Acvatoriul Litoral Marin Vama Veche - 2 Mai	National		
ROM	555531227	Delta Dunării - Zona Marină	Regional	X	X
ROM	555531255	Izvoarele Sulfuroase Submarine De La Mangalia	Regional	X	X
ROM	555531357	Plaja Submersă Eforie Nord - Eforie Sud	Regional	X	X
ROM	555531429	Vama Veche - 2 Mai	Regional	X	X
ROM	555531433	Zona Marină De La Capul Tuzla	Regional	X	X
ROM	555578931	Cap Aurora	Regional	X	X
ROM	555578941	Costinesti - 23 August	Regional	X	X
ROM	555624581	Canionul Viteaz	Regional	X	
ROM	555624598	Lobul Sudic Al Cmpului De Phyllophora Al Lui Zernov	Regional	X	
SVN	196471	Krajinski Park Strunjan	National		
SVN	326354	Škocjanski Zatok	National		
SVN	326403	Strunjan	National	X	X
SVN	555535199	Debeli Rtič	Regional		
SVN	555535203	Med Izolo In Strunjanom - Klif**	Regional		
SVN	555535205	Škocjanski Zatok	Regional		
SVN	555560265	Strunjan	National		
SVN	555641767	Krajinski Park Debeli Rtič	National		

6.6 Examples of discrepancy and errors found between databases

Database	Type of discrepancy or error	Description of an example
MAPAMED / WDPA	Difference in the marine surface area between databases	The MPA designation "Agriates" (WDPA_ID: 555526886). The same total area (296.70km2) is reported on both WDPA and MAPAMED for this MPA. However, we found a difference in the marine surface area (227.82km2 on WDPA and 228.97km2 on MAPAMED) between the two databases.
MAPAMED / WDPA	Difference in MPAs reported in each database	The MPA "Illa del Toro" presents on the MAPAMED database was not included on the official list provided by the Member State ministry and used to supply the WDPA and EEA list. The same issue arose for several other MPAs.
MAPAMED	Error in WDPA_ID reported	The MPA "Capo Pecora" (WDPA_ID: 555529976). The WDPA_ID reported in MAPAMED is different (55529976) from the one of the WDPA database. The error comes from a missing digit (5) in the code. This type of error was also observed for several other MPAs.
WDPA / MAPAMED / EEA/ Member State National database	Error of marine surface area in the WDPA and/or EEA databases	For example, for the MPA designation "Agriate" (WDPA_ID: 106767), the total area reported in the WDPA database and the EEA database is 57.95km2 with an absence of marine area. However, in MAPAMED and in the Member State national database the MPA has an area of 11.06km2 and a marine area of 6.68km2. This same discrepancy occurred for also for other MPAs (e.g. "Port D'Alon - La Nartette" (WDPA_ID: 193389)).
WDPA/ EEA/ Member State National database	Discrepancy in the designation name	The MPA "Islote de San Andrés" (WDPA_ID: 555588835) is reported by the WDPA as a Natura 2000 site but with a national designation type. This MPA is present in the Member State national database and in the CDDA database as a Protected National Area (PNA). The discrepancy comes from the fact that this MPA is also designated as a Natura 2000 site and for this designation has a different WDPA_ID: 555523879.

6.7 Overlapping designations and definition of Marine Protected Areas as unique geographical areas

When examining the 949 MPA designations identified in this study it was realised that it was necessary to account for overlap between designations. This was particularly relevant for Chapter 1 and Chapter 2 where the fishery data, as well as the automatic identification system (AIS) data and the Seabed data were linked to the MPA shape files retrieved from the World Database on Protected Areas (WDPA) in Protected Planet (www.protectedplanet.net). Each shape file has a unique identifier, i.e., WDPA_ID, which refers to unique combinations of geographical area and designation. As a result, the same data (fishery or other) are assigned different WDPA_IDs referring to the same geographical area.

An MPA is defined as a unique geographical area assigned the designations of all WDPA_IDs that overlap this area by ≥90%. Two or more geographical areas that have ≥90% of their areas in common are considered to be duplicates and only the area with the largest geographical extent is retained. The procedure is described below with reference to Figure 6-1 showing potential configurations of overlapping WDPA_IDs.

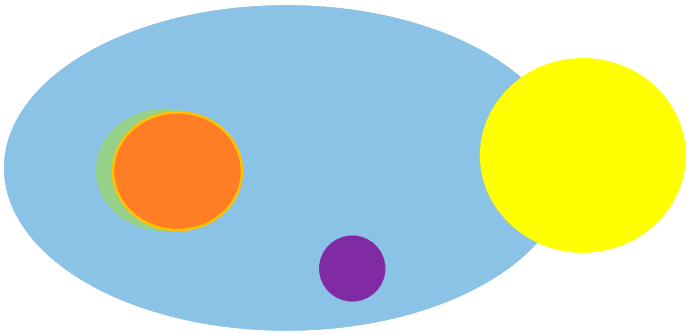


Figure 6-48 . Possible WDPA_ID overlap configurations. The coloured circles or ellipses denote the geographical areas of five different WDPA_IDs. The green and orange WDPA_IDs have ≥90% of their areas in common

STEP1. For each WDPA_ID (say green in Figure 6-1) we find other WDPA_IDs (if any, here orange and blue) that overlap its area by 90% or more. This set of WDPA_IDs (green, orange and blue) and their designations are assigned a unique identifier (mpa#). This defines a unique MPA (mpa#) having a combined designation, namely "Desig blue_Desig green_Desig orange". The above is repeated for each WDPA_ID in the list of the 951 WDPA_IDs.

STEP2. It can happen that two or more WDPA_IDs have ≥90% of their areas in common, as happens with green and orange in Figure 6-1. In this case, the unique set of WDPA_IDs (green, orange and blue assigned now a unique identifier mpa#) will appear twice, namely when the overlaps of green WDPA_ID are checked and when the overlaps of the orange WDPA_ID are checked. To remove this duplicate, the area with the larger extent of the two (here green) and the data (fishery or other) corresponding to this WDPA_ID are kept and assigned to mpa#.

In the hypothetical configuration of Figure 6-1 we end up with 4 different MPAs:

1) Blue MPA with "Desig blue" as its area is not covered ≥90% by any other WDPA_ID.
2) Yellow MPA with "Desig yellow" as its area is not covered ≥90% by any other WDPA_ID.
3) Purple MPA with "Desig blue_Desig purple", i.e., having the designation of purple WDPA_ID and inheriting the designation of the blue WDPA_ID which covers its area by 100%.
4) Orange-green MPA with "Desig green_Desig orange_Desig blue", having the area of larger of the two areas that compose it (here green) and the designations of the combined orange, green and blue WDPA_IDs.

When accounting for overlap we considered **878 to be a more realistic number of unique MPA designations**.

6.8 Questionnaire administered to MPA managers and authorities

This questionnaire is carried out as part of the framework of the MAPAFISH-MED project. This project is supported and funded by the European Commission.

This questionnaire aims at collecting information on the characterization of MPAs and their associated fishing activities in the Mediterranean and Black Seas. It shall lead to an improvement of the evaluation and integration of fisheries in MPA management.

Thank you for taking the time to participate in this survey. Response to this request is voluntary and all information will be treated anonymously. The survey should take around 30 minutes. If you have any questions, please do not hesitate to contact the research team ([39]) by email: mapafish.med@gmail.com.

General MPA information

Please note that all the information gathered in this questionnaire will be treated anonymously and the personal information asked here is only for internal use.

Please repeat this questionnaire from the beginning if you can provide the information for more than one MPA.

Organization type

- Environmental local or national agency
- Academic or university structure
- Marine protected area
- Fisheries organization
- Other (please specify)

Organisation name:

Role in the organisation:

- MPA manager
- Program officer
- Researcher
- Fisher
- Other (please specify)

Please indicate the name of the MPA you will provide information for:

Stage of establishment:

- **Proposed/Committed**, by a governing or other organizing body (the intent to create an AMP has been made public)
- **Designated**, by law or other authoritative rulemaking (the MPA is established or recognized through legal means or other regulations)
- **Implemented**, with activated regulations (The MPA has gone from existing "on paper" to being operational and "in force in the water" with plans for management activated)
- **Actively managed**, with continuous monitoring and adaptive management (MPA management is ongoing, including monitoring, periodic review and changes made as needed to achieve conservation of biodiversity and other ecological and social objectives).

Types of governance:

([39]) SZN (ITA); COISPA (ITA); CIBM (ITA); CNR-IRBIM (ITA); CoNISMa (ITA); Nisea (ITA); HCMR (GRC); UTH (GRC); FRI (GRC); IO-BAS (BGR); NIMRDn (ROM); IOF (HRV); FRI (GRC); DFMR (CYP); WWF (international); CNRS (FRA)

- Consortium among public administrations
- Consortium among private administrations
- Consortium among public and private administrations
- Local Public administration
- Regional Public administration
- National Public administration
- Private organization
- other (please specify…):

Level of protection:

Please fill the following table for each zone that constitute the MPA (N.B. please do not indicate the number of protection levels, but the total number of zones into which the AMP is divided even if with the same protection level):

Zone name	Size in km^2	Year of creation	Your perception of the MPA level of protection *Fully; Highly; Lightly; Minimally*	Your perception of the MPA degree of isolation *Low, Medium, High*
1:				
2:				
3:				
4:				
5:				
6:				
>6:				

- ***Fully Protected:*** *No extractive or destructive activities are allowed, and all manageable impacts are minimized.*
- ***Highly Protected:*** *Only light extractive activities are allowed with low total impact, and all other manageable impacts minimized.*
- ***Lightly Protected:*** *Some protection of biodiversity exists but moderate to significant extraction and other impacts are allowed.*
- ***Minimally Protected:*** *Extensive extraction and other impacts are allowed, but the site still provides some conservation benefit to the area.*

Degree of isolation *(i.e. degree that reef habitat surveyed is isolated by habitat boundaries from adjacent fished reef):*

- **Low**, shallow (<25 m) reef habitat extends continuously across MPA boundary
- **Medium**, a small (1–20%) percentage of zone boundary breached by continuous shallow reef habitat
- **High**, MPA zone isolated from fishing areas by depth (>25 m) or sand barriers of at least 20 m width (includes the offshore MPAs)

Understanding the MPA governance and management

Note: In case of multiple zones MPAs please answer the following part taking into account the whole MPA area.

Is there an MPA board?

- Yes
- No

Who is involved in the MPA governance and/or management?

- Association representative of professional Fishers
- Individual professional fishers
- Association representative of recreational Fishers
- Individual recreational Fishers
- Academic scientists
- Tourist operators (e.g., diving centers)
- other stakeholders (please specify...)
- None of the above

Does any fishers sit in the board dedicated to decision-making and governance of your MPA, having decisional power?

- Yes
- No

How do you evaluate the current interaction between fishers and the management body within the MPA?

- No interaction at all
- Informal interaction, but no regular meetings are organized (e.g., discussion on the dock)
- Unidirectional from the MPA management body toward fishers (e.g., the MPA informs fishers about regulations, ongoing projects and results, etc.)
- Bidirectional (Both fishers and the MPA management body are able to express their own views and ideas and fisher viewpoints are then considered in MPA's decisions)
- Proactive (Fishers actively propose or organize meetings with shared decision making)

Does the MPA have a management plan? (*i.e., a management plan, is a formal planning tool with which MPA managers identify the goals, identify the exact steps and resources needed to achieve those goals, and continually evaluate how well the process is working. Please note that the official regulation is a different kind of document.)*

- There is no management plan
- A management plan is being prepared or has been prepared but is not being implemented
- An approved management plan exists but it is only partially implemented
- An approved management plan exists and is implemented

If the MPA has a management plan, does the management plan include:

- Clearly stated conservation objectives (e.g., the MPA was designated to protect a given habitat, species)
- Clearly stated and quantitative goals (for biodiversity conservation and other goals e.g., abundance or biomass thresholds)
- Clear fisheries management objectives (e.g., the MPA should enhance fisheries, the MPA should support small-scale fishing)
- Clear specific strategies to achieve those objectives and goals

If the MPA has a management plan, is there a specific plan for Small Scale Fisheries (SSF)? *(i.e., SSFs refers to fishing operated by relatively small vessels, <12 meters total length, ('length overall', LOA), and not using towed gear, as formally defined by the European Maritime and Fisheries Fund (EU, 2014)).*

- There is no specific plan for SSF
- A specific plan for SSF is being prepared
- A specific plan is dedicated to SSF (or specific actions for SSF are included in the management plan)
- The MPA SSF plan is a part of an official broader plan of SSF

If there is a specific plan for SSF, does it contain quantitative goals? *(e.g., threshold for acceptable ratio fish biomass inside MPA/outside MPA, small scale fisheries catch inside MPA/outside MPA, fishing effort inside the MPA)*

- Yes
- No

If replied "yes", please specify the main 1-2 goals:

Is the MPA management adaptive? *(There is an established process to communicate and use the results from scientific monitoring (biological, social or management) to inform MPA management (and eventually modify/revise the management plan)*

- Yes
- No

How do you evaluate enforcement in the MPA? *(i.e., extent of surveillance effort and compliance to regulations that restrict fishing, both through overt policing and through community support for regulations)*

- High level of enforcement (poaching very occasional if any, patrol very active and continuous)
- Medium level of enforcement (illegal fishing occurring but limited by infrequent surveillance)
- Low level of enforcement (common illegal fishing and virtually non-existent surveillance)

Can MPA staff sufficiently enforce MPA rules?

- The staff have no effective skills/resources/legal power to enforce MPA legislation and regulations
- There are major deficiencies in staff skills/resources/legal power to enforce MPA legislation and regulations (e.g., lack of skills no patrol budget)
- The staff have acceptable skills/resources/legal power to enforce MPA legislation and regulations but some deficiencies remain
- The staff have excellent skills/resources/legal power to enforce MPA legislation and regulations

Monitoring

Which of the following types of data are collected with a well-established timeframe in the monitoring and evaluation program?

- Ecological information *(e.g., assessment of abundance and biomass of commercially exploited fish and invertebrate species)*
- Social information *(e.g., information on human wellbeing and perceptions of fishers operating in the MPA*)
- Governance/management information *(e.g., type of governance scheme, level of stakeholder engagement into decision making processes)*
- Economic information *(e.g., revenue and income of fisheries)*
- None of the previous

Does the MPA have the following level of information?

- The MPA has baseline ecological data regarding fish biomass before its establishment
- The MPA has baseline socio-economic data regarding fishers' catches before its establishment
- The MPA has baseline data regarding fishers' socioeconomic characteristics

Are fishing activities monitored within and/or around the MPA?

- Yes, within the MPA
- Yes, around the MPA
- Yes, within and around the MPA
- No

If yes, since when?

Did the MPA deliver ecological benefits (i.e., reserve effect: increase of fish density and/or size and/or biomass inside MPA's borders)?

- Yes
- No
- No information available

In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge):

Does the MPA has some fisheries management objectives?

- Yes
- No

Is there any evidence of fish spillover and/or larval export from within the MPA?

- Yes
- No
- No information available

In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge):

Is there any evidence of CPUE (catch per unit of effort) increase within and/or around the MPA after its implementation?

- Yes
- No
- No information available

In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge):

Is there any evidence of an increase of fisher's income after the MPA implementation?

- Yes
- No
- No information available

In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge):

Is there any evidence of fishing activities/effort displacement due to the establishment of the MPA?

- Yes
- No
- No information available

If yes, specify (in %) the fishing effort displacement out of the total:
In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge

Please indicate how many different levels of protection are present within the whole MPA:

- 1
- 2
- 3
- 4
- 5
- 6

Please provide a name for each level of protection zones present within the MPA

Note: Please regroup the zones of the MPA that have the same uses and regulations allowed under a same name

- Name of level of protection 1:
- Name of level of protection 2:
- Name of level of protection 3:

Fishing activities inside of the MPA

Please fill in the following table by ticking the options that are allowed / present within the MPA or for each protection level (in case of an MPA with multiple protection levels) even if limited (e.g., time, size, restrictions on gear …) or regulated (e.g., quotas, limited entry …):

Activity	« Name of level of protection 1»	« Name of level of protection 2»	« Name of level of protection 3»
Net: Cast nets			
Net: Drift nets >2.5km			
Net: Drift nets <2.5km			
Net: Gillnets			
Net: Beach seining			
Net: Boat seining			
Net: Bottom otter trawl			
Net: Purse seining (bottom)			
Net: Purse seining (pelagic)			
Net: Otter twin trawl			
Net: Bottom pair trawl			
Net: Trammel nets			
Dredges (bivalves)			
Hand dredges (bivalves)			
Fish aggregating devices (FADs)			
Hand harvesting commercial			
Hand harvesting recreational			
Line: Longlines (pelagic)			
Line: Single lines (hooks, pole and line, rod, troll)			
Spearfishing			
Traps: Fish traps			
Traps: lobster/octopus/crab traps			
Vessels: Professional fishing vessels larger than 12 m length			
Vessels: Professional fishing vessels smaller than 12 m length			

COMMERCIAL FISHING

What types of restrictions/regulations on small-scale fisheries are applied by the MPA management when a fishing activity is allowed?

- Limited entry → if ticked opens a "regulation/restriction details" box
- Gear restrictions → if ticked opens a "regulation/restriction details" box
- Time restrictions → if ticked opens a "regulation/restriction details" box
- Total allowable catch → if ticked opens a "regulation/restriction details" box
- Size limits → if ticked opens a "regulation/restriction details" box
- Quotas → if ticked opens a "regulation/restriction details" box
- Territorial use rights → if ticked opens a "regulation/restriction details" box
- Permanent spatial closure → if ticked opens a "regulation/restriction details" box
- Time-area closure → if ticked opens a "regulation/restriction details" box
- Other restrictions/regulations → if ticked opens a "regulation/restriction details" box
- None of the previous

Who is allowed to fish within the MPA *(e.g., local fishers resident in the MPA territory)*?
Do fishers need any authorization to fish within the MPA?

- Yes
- No

Based on which elements are the applications accepted or rejected?

How many authorizations are provided per year to small scale fishers (number of boats)?

- Please specify the number:
- Information not available

Is there any "numerus clausus" *(i.e., a maximum number of authorizations set up a priori)?*

- Yes
- No
- If yes, please, specify:

Please provide a measure (per year) of small-scale fishing effort within the MPA in Days At Sea *(or in more details when available: e.g. meters of authorized net per day OR number of hooks deployed):*

- Information not available
- Days At Sea (DAS):

In case you have indicated a measure of fishing effort, please provide a reference (e.g., from a report, paper or expert knowledge):

What are the species most targeted/caught by commercial fishers within the MPA?

- European hake (*Merluccius merluccius*)
- White seabream (*Diplodus sargus*)
- Red scorpionfish (*Scorpaena scrofa*)
- Striped red mullet (*Mullus surmuletus*)
- Cuttlefish (*Sepia officinalis*)
- Gilthead seabream (*Sparus aurata*)
- Common pandora (*Pagellus erythrinus*)
- Spiny lobster (*P. elephas*)
- Octopus (*Octopus vulgaris*)
- Grey mullets (Mugilidae)
- other (please specify):
- Information not available

In case of an answer different than "information not available", please provide a reference (e.g., from a report, paper or expert knowledge):

Is there an estimate, for the fishers operating in the area where the MPA is located, of the contribution of fishing inside the MPA to their total catch/income?

- <5% of total catch/income comes from the MPA
- 5-10 % of total catch/income comes from the MPA
- 10-20 % of total catch/income comes from the MPA
- > 20 % of total catch/income comes from the MPA
- Information not available

In case of an answer different than "information not available", please provide a reference (e.g., from a report, paper or expert knowledge):

Is there any initiative/activity aiming to promote the concept of sustainable fishing in the MPA (e.g., eco-labelling, seafood awareness campaigns, MPA-labeling)?

- Yes
- No

If yes, please provide a description of the initiative here:

RECREATIONAL FISHING

Is any form of recreational fishing allowed within the MPA?

- Yes
- No

If recreational fishing is allowed, indicate the most used fishing methods (and associated potential regulations/restrictions):

- Hand harvesting recreational. → *if ticked opens a "regulation/restriction details" box*
- Line: longlines (bottom) → *if ticked opens a "regulation/restriction details" box*
- Line: Longlines (pelagic) → *if ticked opens a "regulation/restriction details" box*
- Line: Single lines (hooks, pole and line, rod, troll) → *if ticked opens a "regulation/restriction details" box*
- Spearfishing → *if ticked opens a "regulation/restriction details" box*
- Traps: lobster/octopus/crab traps → *if ticked opens a "regulation/restriction details" box*
- Others please specify: → *if ticked opens a "regulation/restriction details" box*

In case of a positive answer, please provide a reference (e.g., from a report, paper or expert knowledge):

If recreational fishing is allowed within the MPA: is there any data about recreational catches?

- Yes
- No
- No information available

In case of a Yes or No answer, please provide a reference (e.g., from a report, paper or expert knowledge):

What are the species most targeted/caught by recreational fishers within the MPA?

- Gilt-head bream (*Sparus aurata*)
- European bass (*Dicentrarchus labrax*)
- Dusky grouper (*Epinephelus marginatus*)
- Common dentex (*Dentex dentex*)
- Golden grouper (*Epinephelus costae*)
- White seabream (*Diplodus sargus*)
- Mullus barbatus (red mullet)
- Two banded seabream (*Diplodus vulgaris*)
- Mahi-mahi or common dolphinfish
- (*Coryphaena hippurus*)
- European eel (*Anguilla anguilla*)
- Octopus (*Octopus vulgaris*)
- Cuttlefish (*Sepia officinalis*)
- other (please specify):
- Information not available

In case of an answer different than "information not available", please provide a reference (e.g., from a report, paper or expert knowledge)

Do recreational fishers need any authorization to fish within the MPA?

- Yes
- No

How many authorizations are provided per year? Please specify the number:

- Information not available

OTHER ACTIVITIES INSIDE OF THE MPA

Please fill the following table by ticking the propositions that are valid/present within the MPA or for each zone within the AMP or for each protection level (in case of AMP with multiple protection levels):

Activity category	Activity	Name of level of protection 1	Name of level of protection 2	Name of level of protection 3
Anchoring	Anchoring allowed anywhere	☐	☐	☐
	Anchoring allowed except in sensitive habitat but anywhere else	☐	☐	☐
	Anchoring is allowed only in dedicated areas	☐	☐	☐
Aquaculture	Aquaculture: **Unfed low scale** *(e.g., Algae - Bivalves - Sea cucumbers - Herbivorous fish- low scale Integrated multi-trophic aquaculture (IMTA))*	☐	☐	☐
	Aquaculture: **Unfed large scale** *(Medium or high density (i.e., semi-intensive to intensive; up to commercial scale) unfed aquaculture (e.g., algae, bivalves, sea cucumbers), or integrated multi-trophic aquaculture (IMTA))*	☐	☐	☐
	Aquaculture: **Fed low scale** *(medium-density fish cages or shrimp farms (i.e., semi-intensive; commercial scale)*	☐	☐	☐
	Aquaculture: **Fed large scale** *(e.g., High-density fish cages, or introduction of feed supplements which have the potential to introduce disease)*	☐	☐	☐
Dredging/ dumping	Dredging and dumping for navigation purposes	☐	☐	☐
	Dumping of dredged spoil to reduce coastal erosion	☐	☐	☐
	Dredging and dumping occurs and may have impacts that are incompatible with the conservation of nature	☐	☐	☐
Infrastructure	Artificial reefs made from material that does not adversely affect surrounding area	☐	☐	☐
	Artificial reefs or other infrastructure that may leach pollutants into surrounding waters	☐	☐	☐
	Renewable energy structures with low impact *(small number wind turbines or floating wind turbines)*	☐	☐	☐
	Renewable energy structures with large impact (large scale wind farms or large tidal turbine structures)	☐	☐	☐
	Ports, harbors, or marinas of low scale (no ships and limited number of boats present)	☐	☐	☐
	Large-scale ports or areas where large ships are present	☐	☐	☐
Mining, mineral oil	Oil and/or gas prospecting or exploitation (e.g., oil platforms)	☐	☐	☐

and/or gas prospecting or exploitation	Prospecting, exploring, or mining for recovery of sand, gravel, or minerals	☐	☐	☐
Non-extractive activities	Nondestructive recreational or cultural activities (Snorkeling, Swimming, SCUBA Diving, Presence of motorized or non-motorized vessels for non- extractive purposes, cultural/ceremonial gatherings, education, teaching and other uses with minimal to low impact)	☐	☐	☐
Other human threats for the MPA	Pollution	☐	☐	☐
	Marine litter	☐	☐	☐
	Boating	☐	☐	☐
	Land-based activities	☐	☐	☐

6.9 Detailed procedure to assess the stage of establishment of an MPA

To assess MPAs' stage of establishment, a detailed online questionnaire (Annex 6.8) was designed and developed within the study. This was necessary because the information required is not available in any pre-existing databases. The questionnaire was translated into the relevant languages (Spanish, French, Italian, Croatian, Greek, Bulgarian, Romanian; English was used for Malta and Slovenia). A link to the online questionnaire was sent using registered emails to all identified MPA managers/practitioners and relevant national/regional authorities. The process of identifying individuals to target used a mixed approach of pre-existing contacts, study partner knowledge and contacts and snowballing techniques. The relevant questions followed 3 categories of information (Table 6-1):

- Questions related to the stage of establishment.
- Questions on management plan, fisheries management, and conservation objectives.
- Questions on fisheries and biodiversity conservation outcomes.

To perform a holistic and integrated assessment on the stage of establishment, beside the self-assessment provided by the respondents, we also assigned MPAs to a stage of establishment by triangulating answers from different sections of the questionnaire, enabling us to better account for different interpretations of certain terms by respondents. The MPA Guide (Grorud-Colvert et al., 2021) was used as the main framework for this part of the study. The different criteria in the MPA Guide were used to guide the design of the questions and to determine which questions were relevant to assess the stage of establishment. Responses to the questionnaire from the section on management were combined with the answers to questions on governance, enforcement, and monitoring. It is important to consider this information to have an overview of how the MPA works and what is being done in each MPA to classify the MPAs more accurately under the four stages of establishment.

Table 6-11 List of questions asked in the questionnaire to assess the stage of establishment of the investigated MPAs.

Questions:
Which stage of establishment do you feel your MPA has reached? (list provided for the respondent to indicate among the four stages)
Does the MPA have a management plan?
If the MPA has a management plan, does the management plan include (selection among the appropriate options):
-Clearly stated conservation objectives
-Clearly stated and quantitative goals
-Clear fisheries management objectives
-Clear specific strategies to achieve those objectives and goals
If the MPA has a management plan, is there a specific plan for Small Scale Fisheries?
If there is a specific plan for small-scale fisheries, does it contain quantitative goals?
Please specify the main 1-2 goals of the specific plan for small-scale fisheries:
Is the MPA management adaptive?
Does the MPA deliver ecological benefits? If yes, please explain and provide a reference
Does the MPA have some fisheries management objectives?
Is there any evidence of fish spillover and/or larval export from within and/or around the MPA? If yes, please explain and provide a reference
Is there any evidence of CPUE (catch per unit of effort) increase within and/or around the MPA after its implementation? If yes, please explain and provide a reference
Is there any evidence of fishing activities/effort displacement due to the establishment of the MPA? If yes, please explain and provide a reference
Please provide an estimate, if available, of the fishing activities/effort displacement (in %) due to the establishment of the MPA:
Additional information: Please If you have any documents about your MPA that you could share with us (e.g., management plan, legislations/regulations etc...) please provide a link to it or send it to mapafish.med@gmail.com

By July 2023 we had received answers for 162 of the MPAs considered relevant for this study via the questionnaire out of the 949 MPAs identified.

The assessment of the stage of establishment of each MPA was performed in two steps. The first considered the **respondents' self-assessment** of the stage of establishment. A clear definition of each stage was provided to the respondents to help ensure a standardized and unbiased assessment.

The expanded guidance within the MPA Guide provides more detailed information about each category/stage of establishment, outlining key elements/achievements that should be present or have been reached for an MPA to be considered in one or another stage (see Box 6.1 for an overview).

Box 6-10 Key points of the MPA Guide adapted from (Grorud-Colvert et al., 2021) used when assessing the stage of establishment of the MPAs in this study

In general, establishing an MPA is created following a series of steps by governing or other authorities based on their local and national context. The MPA Guide indicates how these steps can be referred to and create different STAGES of establishment. The MPA Guide (which we used to guide our assessment of the stage of establishment) specifies that there are minimum criteria for an MPA to achieve each different stage of establishment (Proposed/Committed, Designated, Implemented, Actively Managed), and provides guidelines for best practices that are detailed in the STAGES Expanded Guidance.

It may take several years between an announcement of intent to create an MPA to the time when in situ protection and management occurs. In other situations, an MPA may be designated and implemented simultaneously if the announcement has legal authority and a management plan. Below the description of each STAGE is provided along with the key criteria that we considered when assessing the MPAs of interest to this study:

- Proposed/Committed - at this stage the intent to create an MPA is made public. An MPA must be announced in some formal (although non-binding) manner by means of a statement by a government, community, conservation organization, or other organizing group. The MPA site must be identified, ideally with clear goals and informed by stakeholder and rights-holder participation, and that of Indigenous or other local peoples, and scientific knowledge of the social-ecological context.
- Designated - at this stage the MPA is established or recognized through legal means or other authoritative rulemaking. A designated MPA must satisfy three minimum criteria: (i) defined boundaries, (ii) legal gazetting or equivalent Indigenous or traditional authorization or customary recognition, and (iii) clearly stated goals and process to define allowed uses and associated regulations or rules to control impact. MPA boundaries (including zones within the MPA) are ideally published, unambiguous, and known to local users. A designated MPA should have a database ID number in the WDPA that signifies official recognition of the MPA. The MPA should be long term; for example, it should not have a sunset clause or review process that allows for rescinding protection in less than 25 years. MPAs that are proposed/committed or designated are not yet implemented with changes in activities and thus will not accrue biodiversity conservation benefits. Protection does not begin until implementation. MPAs that are designated for an extended period of time without being implemented are often referred to as "paper parks." These situations may reflect a lack of capacity and support.
- Implemented - at this stage the MPA has transitioned from existence "on paper" to being operational "in the water," with management plans activated. Biodiversity conservation benefits begin to accrue at this stage, not before. Resource users are aware of the rules, and mechanisms to promote compliance and enforcement exist. Management plans for regulating MPA activities are in place. Stakeholders are engaged, users are aware of regulations, financial and human resource management systems are established, and performance measures are part of a plan to evaluate and monitor the MPA. Ideally, governance and administrative structures for

management, implementation, and sustainable financing are specified (such as in management plans). Zones and their goals should be described, if applicable. A management body should exist to implement and review plans.

- Actively Managed - at this stage MPA management is ongoing, including monitoring, periodic review, and adjustments made as needed to achieve biodiversity conservation and other ecological and social goals. All necessary MPA management activities for sustained functioning and achievement of goals continue. The MPA management authority documents, monitors, and evaluates MPA outcomes. Adaptive management will lead to adjustments in plans and activities as needed to ensure good compliance, stakeholder and rights-holder collaboration, and achievement of MPA goals.

The expanded guidance of the MPA Guide was used to design questions to ask and determine the stage of establishment for the 162 MPAs that completed the relevant sections of the questionnaire. The respondents' self-assessment was then compared with an assessment (run by the consortia) based on their answers to a series of other questions on governance and existence of a management plan, monitoring strategy, and ecological and fisheries data. In this way the information is in a sense triangulated which is hoped to provide an accurate picture that can complement the one arising from the self-assessment.

A simplified overview of the four stages of establishment as reported in the MPA Guide is provided in Figure 6-2 and based on that, we developed a procedure to evaluate the stage of establishment combining the different answers to the questionnaire as illustrated in Figure 6-3. It is important to note that the MPA Guide provides a conceptual framework and general guidance on how to classify MPAs into Stages of Establishment, but no operational guidelines are available and must be developed for each case study. We put together a procedure to classify MPAs that is reported in Figure 6-3. However, our procedure describes the most common cases, and it must be adapted on a case-by-case basis, accounting for the multitude of possibilities in terms of management, regulations, monitoring etc., that can be faced in an MPA. The final assessment of each MPA stage of establishment was based on the expert-knowledge of the consortium and following the general principles of the procedure developed. A similar approach was performed by Sullivan-Stack et al., (2022) as a first attempt to operationalize the 'Stage of Establishment MPA Guide', using information available through scientific literature and individuals' expert direct knowledge. As in our assessment, no fixed criteria exist to precisely assess all MPAs globally using a strict decision tree for example. Despite this we defined the conditions that must be met to fall within each stage of establishment and the second step (i.e., the assessment carried out by the consortia) was not always a linear process, and each MPA was treated on a case-by-case basis and assessed in response to all the information provided and yielded from the questionnaire. In some cases, MPAs did not fit "neatly" into the guide developed (Figure 6-3), for example, say MPAs that do not have any management plan but that do have clear rules and regulations in place with ongoing efficient enforcement and monitoring and could therefore potentially be considered as actively managed. In this light the two assessments of the stage of establishment must be seen as concomitant, with one not being considered as more accurate or superseding the importance of the other.

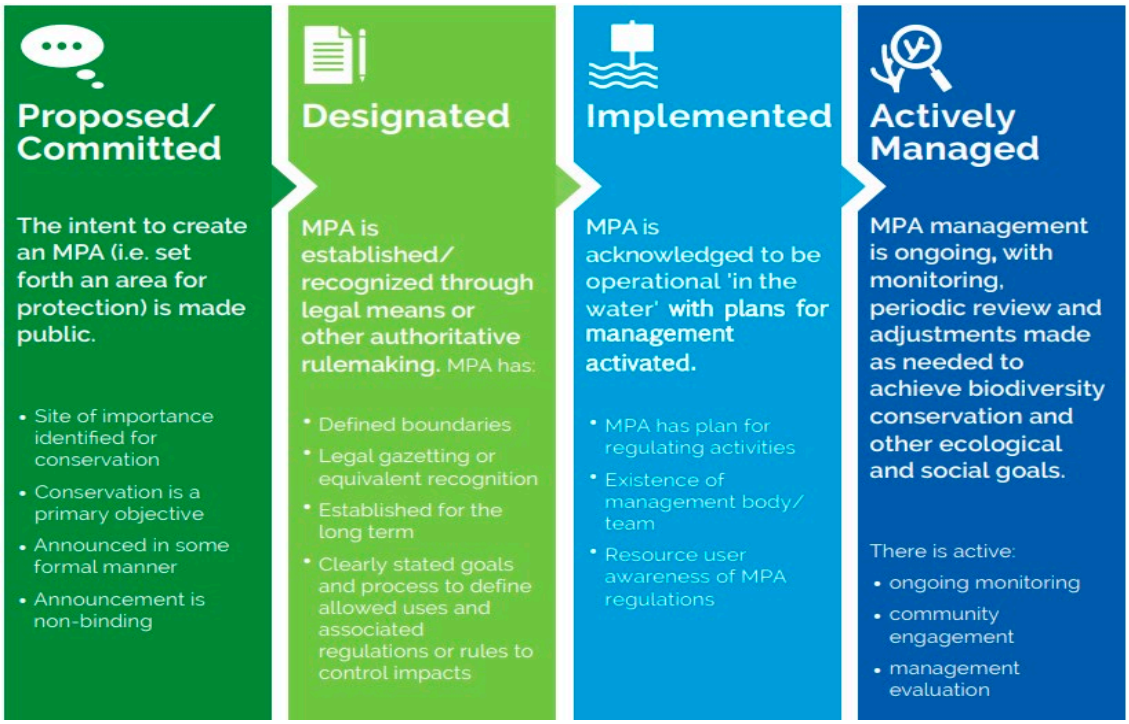


Figure 6-49 Overview of the categorisation under the four stages of establishment (source: MPA Guide extended guidance (Grorud-Colvert et al., 2021))

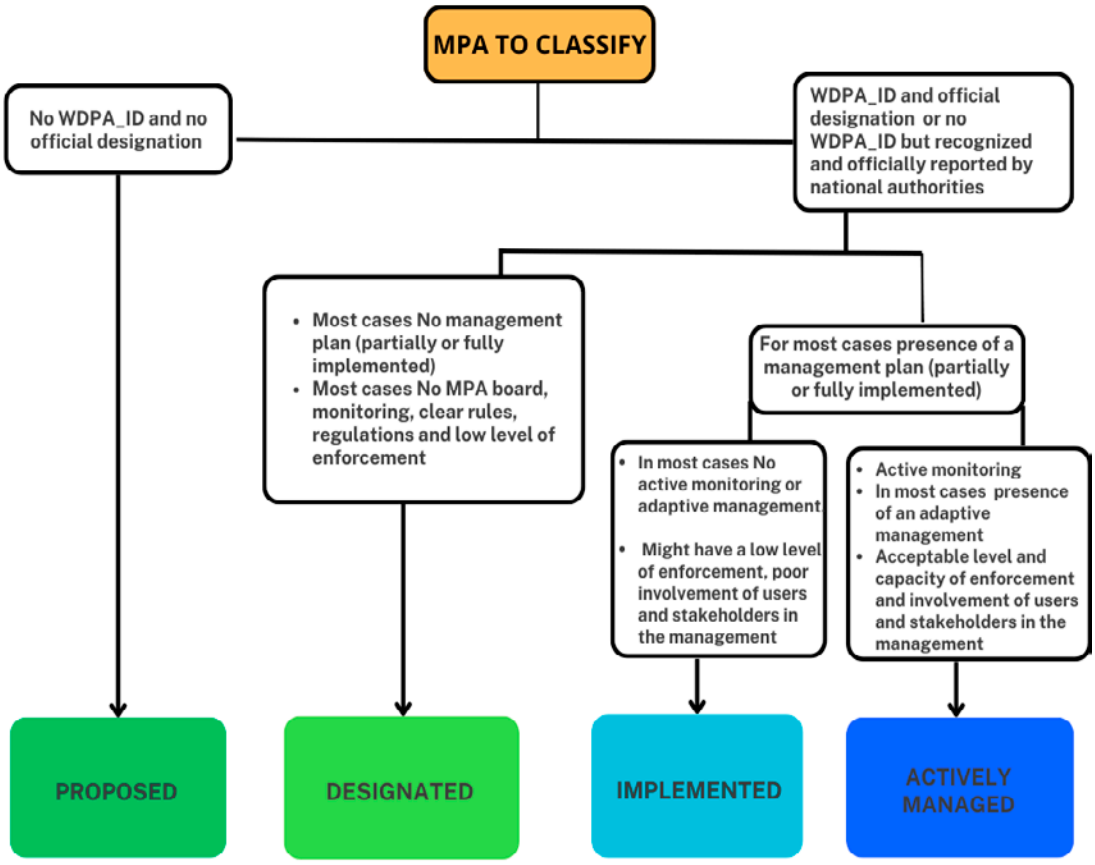


Figure 6-50 General guidance based on the MPA Guide developed to assess the stage of establishment from respondents' answers to a series of questions

To perform the second step to assess the MPAs under the four stages of establishment (Figure 6-3), we first looked to see if the MPA had a WDPA_ID and an official designation reported on European databases. If the MPA was not officially designated / reported, it was considered to have reached the proposed stage only. However, some MPAs in our study were not yet reported on the WDPA database but recognized by the national authority and were therefore considered to have reached a stage of establishment beyond proposed.

We then looked at the management plans. If the MPAs had an approved and partially or fully implemented management plan, the MPAs would be considered at least as implemented (i.e., they could also be assessed as actively managed depending on other answers).

For 19 Italian MPAs, a single individual responded to the questionnaire providing answers for all 19 and indicated the presence of an implemented management plan. However, as far as we can see following a web-based search (using a series of search terms/strings) it appears these 19 MPAs do not have a management plan. The MPAs were classified by the respondent as designated, with no MPA board, as a result these MPAs were also evaluated as designated during the second phase of assessment.

Some MPAs where no indication of an implemented management plan was reported, were classified as implemented because there was a reported presence of clear rules and regulations in place, an acceptable enforcement level, adaptive management and for some a clear monitoring system.

To move the implemented MPAs to the actively managed category, the MPA had to justify the presence of monitoring in the MPA, and the presence of an adaptive management. Moreover, the level of enforcement and the capacity of the staff to enforce the rules was also considered.

It is to note that two Cypriot MPAs (Kavo Gkreko and Kakoskali) were considered as actively managed without having a reported management plan or adaptive management. This assessment was based on the assessment of the respondent and the presence of clear rules and regulations, monitoring and level of enforcement and staff capacity to ensure the rules and regulations are respected.

Finally, information about the objectives and whether conservation and fisheries measures were considered within the management plan was extracted using the answers to the questionnaire.

6.10 Procedure to assess the levels of protection of an MPA/zone

To assess and establish the level of protection of the 162 MPAs that completed the relevant sections of the questionnaire (Table 6-2 and Table 6-3), we developed a procedure using expert knowledge and the MPA Guide (Grorud-Colvert et al., 2021).

Table 6-12 List of questions of the questionnaire relevant to the assessment of the levels of protection of an MPA/zone

Questions:
Please provide the following information regarding your MPA/zone: Your perception of the MPA level of protection* (*Fully; Highly; Lightly; Minimally)*
Please indicate how many different levels of protection are present within the whole MPA
Please provide a name for each level of protection zones present within the MPA
Please fill in the following table by ticking the options that are allowed / present within the MPA or for each protection level (in case of an MPA with multiple protection levels) even if limited *(e.g., time, size, restrictions on gear ...)* Or regulated *(e.g., quotas, limited entry ...)*: list of fishing gears provided (see Annex 6.8)
Indicate the most used fishing methods for recreational fishing within the MPA (select the appropriate options): (see Annex 6.8 for options).
Please fill the following table by ticking the propositions that are valid/present within the MPA or for each zone within the MPA or for each protection level (in case of MPA with multiple protection levels): options provided for each activity (Mining, Dredging/dumping, Anchoring, Infrastructure, Aquaculture, Non-Extractive Activities). (see Annex 6.8).

Table 6-13 List of questions of the questionnaire that were used to report on fisheries restrictions/regulations and general information.

Questions:
Are fishing activities monitored within and/or around the MPA?
Please give the "regulation/restriction details"
Is any form of recreational fishing allowed within the MPA?
Indicate the most used fishing methods for recreational fishing within the MPA (select the appropriate options):
Please specify any potential regulations/restrictions associated to these fishing methods within the MPA
Did the MPA deliver ecological benefits?
Is there any evidence of fish spillover and/or larval export from within and/or around the MPA
Is there any evidence of CPUE increase within and/or around the MPA after its implementation
What types of restrictions/regulations on small-scale fisheries are applied by the MPA management when a fishing activity is allowed?
Give the regulation/restriction details

Based on the MPA Guide and the Expanded Guidance for Levels of Protection (Grorud-Colvert et al., 2021) instructions for each of the potential impacts of the seven activities considered to classify an MPA into its respective level of protection (Box 6.2) (mining, oil, and gas extraction; dredging and disposal;

anchoring; infrastructure development; aquaculture; fishing, comprising subsistence, professional, and recreational fishing, encompassing the extraction of wild marine organisms, including gleaning; and non-extractive activities), we developed the following tables (Table 6-4 and Table 6-5). These tables include the potential impacts within the seven activities that are considered when assessing the levels of protection of an MPA. Each impact has its own **impact score** and linked level of protection, all based on the guidelines of the MPA Guide and Expanded Guidance for Levels of Protection (Grorud-Colvert et al., 2021).

Box 6-11 Definition of the 4 Levels of Protection of an MPA, adapted from Grorud-Colvert et al., (2021) used when assessing the levels of protection in this study and the colour code we assigned to each

- **FULLY PROTECTED**: Within fully protected areas, no activities that involve the extraction or destruction of resources are permitted, and all activities that may lead to avoidable harm are minimised. The term 'fully protected' extends beyond the restrictions on extractive activities and underscores the affirmative objectives of this approach, in contrast to the term 'no-take,' which primarily emphasises the prohibitions. Fully protected areas may also accommodate non-extractive, low-impact tourism, or culturally significant activities, if they maintain a low environmental footprint. However, activities with the potential for significant impact, such as aquaculture, are only sanctioned for restoration purposes and not for resource extraction.
- **HIGHLY PROTECTED:** These areas only permit light extractive activities with minimal overall environmental impact, while actively minimising other impacts that can be mitigated. This approach might include authorising low-impact cultural or traditional activities with limited extraction levels, thereby enhancing conservation efforts. Some MPAs may accommodate a small amount of subsistence or small-scale fishing with negligible impact, contingent on the number of fishers and gear types employed, typically allowing up to five or fewer low-impact gears. Examples of such low-impact gear include hand lines or the collection of marine resources by free divers, and these practices can be compatible with the designation of an area as highly protected (Horta e Costa et al., 2013). Within highly protected areas, authorised activities extend to low-impact tourism and low-density, unfed aquaculture. These areas may also permit low-impact cultural and traditional activities, such as sustainable fishing by Indigenous communities, as an additional layer of conservation effort.
- **LIGHTLY PROTECTED:** Lightly protected areas provide some level of biodiversity conservation, but they allow moderate to significant extraction and other impacts. These MPAs may offer protection to specific species or habitats, but they permit a greater number of activities with larger impacts compared to highly protected areas. Multiple fishing gear types may be utilised, and fishing can occur using less selective gear types. Tourism activities might have moderate impacts on habitats and species, such as damage from intensive recreational diving. Aquaculture may be conducted using semi-intensive, unfed methods or small-scale, low-density fed methods. The majority of MPAs worldwide tend to fall within the lightly protected or minimally protected categories (Sala et al., 2018) as they aim to balance

biodiversity conservation goals with resource utilisation and development objectives.

- **MINIMALLY PROTECTED:** In minimally protected areas, extensive extraction and other impacts are permitted, but certain conservation benefits are still provided. Highly destructive activities like industrial fishing are prohibited in these areas (IUCN, 2020). While extensive extraction and other impacts take place, the site still meets the IUCN definition of an MPA by achieving some biodiversity conservation. However, minimally protected MPAs are less likely to deliver substantial conservation benefits for both nature and human interests. These areas often allow various high-impact gear types for extraction and may include medium- to high-density aquaculture and activities like large-impact anchoring and infrastructure development.

The colour code for each impact and level of protection in the tables (Tables 6-4, 6-5 and 6-6) is the same as used in the MPA Guide (Grorud-Colvert et al., 2021) Considering this and based on the answers of the respondents from the questionnaire regarding activities present in the MPA/zone, we were able to assign an impact colour code (Figure 6-4) corresponding to one of the 4 levels of protection of MPAs to each activity, plus the Incompatible level. When a respondent answered "N/A", we considered it as a no: i.e., when indicated no presence of anchoring, or no presence of any other activity or a N/A as an answer, we gave it a score of 1 (fully), same was the case when the answer was "none".

Impact scenario	Protection Level
GREEN	Fully
DARK GREEN	Highly
YELLOW	Lightly
RED	Minimally
GREY	Incompatible

Figure 6-51 Colour code assigned to each level of protection.

Table 6-14 Types of fishing gears allowed within the MPAs/zones and their impact score

GEAR	Scenario 1 (Optimistic, low impact)	Scenario 2 (Pessimistic, high impact)
Net: Cast nets	LOW	
Net: Drift nets >2.5km	HIGH	
Net: Drift nets <2.5km	MODERATE	
Net: Gillnets	MODERATE	
Net: Beach seining	MODERATE	
Net: Boat seining	MODERATE	
Net: Bottom otter trawl	HIGH	INCOMPATIBLE if >12m vessel
Net: Purse seining (bottom)	HIGH	INCOMPATIBLE if >12m vessel
Net: Purse seining (pelagic)	HIGH	INCOMPATIBLE if >12m vessel
Net: Otter twin trawl	HIGH	INCOMPATIBLE if >12m vessel
Net: Bottom pair trawl	HIGH	INCOMPATIBLE if >12m vessel
Net: Beam trawl	HIGH	INCOMPATIBLE if >12m vessel
Net: Trammel nets	MODERATE	
Dredges (bivalves)	HIGH	
Hand dredges (bivalves)	LOW	
Fish aggregating devices (FADs)	HIGH	INCOMPATIBLE if >12m vessel
Hand harvesting commercial	LOW	MODERATE if >12m vessel
Hand harvesting recreational	LOW	
Line: Longlines (pelagic)	MODERATE	HIGH if >12m vessel
Line: Single lines (hooks, pole and line, rod, troll)	LOW	
Spearfishing	LOW	
Traps: Fish traps	LOW	MODERATE if >12m vessel
Traps: lobster/octopus/crab traps	LOW	
Vessels: Professional fishing vessels larger than 12 m length	case by case	INCOMPATIBLE if red gears are allowed
Vessels: Professional fishing vessels smaller than 12 m length	LOW	

Table 6-15 Colour codes for the different categories of fishing gears that might be allowed within the MPAs/zones

FISHING	Impact Scenario	Protection Level
NO	GREEN	Fully
Low impact gears types (5 or fewer only green)	DARK GREEN	Highly
Moderate impact gears (10 or fewer only green and yellow)	YELLOW	Lightly
High impact gears (more than 10 and/or red type gears)	RED	Minimally
High impact gears that are incompatible with conservation (includes any grey)	GREY	Incompatible

Table 6-16 Impacts scoring system for the six other activities allowed within the MPAs/zones assessed in this study. Colour-coded impacts table: green = low impact, yellow = moderate impact, red = high impact, grey = incompatible with the conservation of nature. PL= Protection Level

MINING, MINERAL OIL AND/OR GAS PROSPECTING OR EXPLOITATION	Scenario 1 (Optimistic, low impact)	Scenario 2 (Pessimistic, high impact)
NO	Fully	Fully
Oil and/or gas prospecting or exploitation (e.g., oil platforms); Prospecting, exploring, or mining for recovery of sand, gravel, or minerals	Incompatible	Incompatible
DREDGING/DUMPING	**PL scenario 1 (Optimistic, low impact)**	**PL scenario 2 (Pessimistic, high impact)**
NO	Fully	Fully
Dredging and dumping for navigation purposes	Lightly	Minimally
Dumping of dredged spoil to reduce coastal erosion	Minimally	Incompatible
Dredging and dumping occurs and may have impacts that are incompatible with the conservation of nature	Incompatible	Incompatible
ANCHORING	**PL scenario 1 (Optimistic, low impact)**	**PL scenario 2 (Pessimistic, high impact)**
NO	Fully	Fully
Anchoring is allowed only in dedicated areas	Fully	Highly
Anchoring allowed except in sensitive habitat but anywhere else	Fully	Lightly
Anchoring allowed anywhere	Highly	Minimally
INFRASTRUCTURE	**PL scenario 1 (Optimistic, low impact)**	**PL scenario 2 (Pessimistic, high impact)**
NO	Fully	Fully
Artificial reefs made from material that does not adversely affect surrounding area	Fully	Highly

Artificial reefs or other infrastructure that may leach pollutants into surrounding waters	Highly	Lightly
Renewable energy structures with low impact (Small number wind turbines or floating wind turbines)	Highly	Lightly
Renewable energy structures with large impact (Large scale wind farms or large tidal turbine structures)	Lightly	Minimally
Ports, harbours, or marinas of low scale (no ships and limited number of boats present)	Fully	Minimally
Large-scale ports or areas where large ships are present	Minimally	Incompatible
AQUACULTURE	**PL scenario 1 (Optimistic, low impact)**	**PL scenario 2 (Pessimistic, high impact)**
NO	Fully	Fully
Aquaculture: **Unfed low scale** *(e.g. Algae - Bivalves - Sea cucumbers - Herbivorous fish- low scale Integrated multi-trophic aquaculture (IMTA))*	Highly	Highly
Aquaculture: **Unfed large scale** *(Medium or high density (i.e., semi-intensive to intensive; up to commercial scale) unfed aquaculture (e.g., algae, bivalves, sea cucumbers), or integrated multi-trophic aquaculture (IMTA))*	Lightly	Lightly
Aquaculture: **Fed low scale** *(medium-density fish cages or shrimp farms (i.e., semi-intensive; commercial scale)*	Lightly	Minimally
Aquaculture: **Fed large scale** *(e.g., High-density fish cages or introduction of feed supplements which have the potential to introduce disease)*	Minimally	Incompatible
NON-EXTRACTIVE ACTIVITIES	**PL scenario 1 (Optimistic, low impact)**	**PL scenario 2 (Pessimistic, high impact)**
NO	Fully	Fully
(Snorkeling, Swimming, SCUBA Diving,Presence of motorised or non-motorized vessels for non-extractive purposes, cultural/ceremonial gatherings, education, teaching and other uses with minimal to low impact)	Highly	Lightly

Based on the MPA Expanded Guidance for Levels of Protection (Grorud-Colvert et al., 2021; Horta e Costa et al., 2013), for Table 6-5, we assigned a category to the fishing gears used in an MPA according to the answers received from the questionnaire. And any that allowed industrial fishing, were directly classified as incompatible with the MPA conservation goals.

To classify the MPA/zone, we first looked at the answers provided in the questionnaire for the fishing gear(s) allowed within the MPA. Each gear following the MPA Expanded Guidance for Levels of Protection, Table 6-5, is associated with an impact score (low, moderate, large, or incompatible). Once all the fishing gears present with their impact were compiled, we counted the total number of fishing gears allowed and followed Table 6-5, to classify the zones. This classification is not only based on the level of

impact of each fishing gear, but also accounting for the quantity of fishing gears allowed, as some zones for instance allow few but highly destructive fishing gears. After this step, a first classification of the fishing activity within the MPA was obtained.

It is to note in Table 6-5, that there are two possible impact scenarios (see below) for some of the fishing gears, as described in the MPA Guide. To stay conservative, in line with the IUCN 2020 report, when a fishing gear could be associated in the MPA Guide with two different possible impacts (e.g., Longlines can have either a medium or high impact depending on the scale of the operation), if the respondent indicated the presence of fishing vessels larger than 12m within the MPA/zone, then we selected the highest impact score for that fishing gear (IUCN, 2020).

Once the level of protection for the fishing gear was established, we proceeded to classify the other six activities allowed within the MPA/zone based on their impact. For these activities, we followed the MPA Guide framework (Grorud-Colvert et al., 2021) and gave two possible scenarios of impact to each activity (scenario 1 and scenario 2) to stay conservative (Table 6-6), as we did not have a full picture of the whole impact (i.e., intensity, duration).

- **Scenario 1**: considered as the "optimistic" one, where we took the highest scores for each activity (the ones with the least impact), to assign a level of protection. The activity with the lowest score (within the highest scores), is the one that leads the classification. For example, for one MPA, the activity "anchoring" had the answer "allowed everywhere". Looking at Table 6-6, we can see that this impact can be considered as "highly" or "lightly", while the rest of the activities in this MPA had a response where the final impact was "fully". In this case, the highest scores for the activities are, "fully" for all except, "highly" for anchoring. So, for this scenario, we take the "highly" score from the anchoring activity, as it is the one leading, and assign it to the whole MPA.
- **Scenario 2**, considered as the "pessimistic" one. In this scenario, we kept the lowest scores for each activity (the ones with the highest impact), to assign a level of protection. Taking the example above mentioned, in this case, we will still have a "fully" impact for all the activities, except for anchoring, which has a "lightly" one, as it is the lowest score given to this activity. In this scenario, the final level of protection would be "lightly" for the whole MPA.

These two scenarios were applied to both the analysis of the fishing activity as well as to the one on the other activities, and to the overall assessment of each MPA/zone once combining the results from these two analyses, as shown in Figure 6-5.

After the classification of all the activities, the one with the highest impact was kept giving a final scenario 1/scenario 2 assessment of the impact of the activities.

Once we had all the activities classified, we then compared the result of the fishing assessment with the assessment of the activities to keep the most impactful of both (e.g., if the fishing assessment gave a yellow impact and the activities assessment a green, we kept the yellow).

An example of the explained steps to classify an MPA into its level of protection can be seen in Figure 6-5. From left to right, we first assessed the fishing activity impact score, and we then did the same for the six other activities.

For this, we first looked at the fishing gears provided for the question: "Please fill in the following table by ticking the options that are allowed / present within the MPA or for each protection level (in case of an MPA with multiple protection levels) even if limited *(e.g., time, size, restrictions on gear ...)* or regulated *(e.g., quotas, limited entry ...)*: (LIST OF FISHING GEARS PROVIDED). Then, with this information, we first gave a score to each fishing gear based on Table 6-4, and then, with the number of fishing gears allowed and their respective score, we gave an impact level following Table 6-5 to the fishing activity, which, in this example, was highly.

For the other activities, the same procedure was followed. We first looked at the answers provided by the respondents, (which correspond to the impacts for each activity) to each activity (i.e., anchoring is allowed only in dedicated areas), and then, based on the answers, we followed Table 6-6, and gave a score to each impact (answer) for each activity. Following this, the activity with the highest impact was kept giving a final scenario 1/scenario 2 assessment of the impact of the activities. In this case, we kept the highly and lightly of the non-extractive activities.

Finally, as seen, in this case, fishing activity was classified as highly, and the outcome for the other activities was highly and lightly. We can observe that anchoring has two scores (fully and highly) and non-extractive activities as well (highly and lightly). The first score for these two activities belongs to scenario 1, and the second one, to scenario 2. So, the final assessment is a high protection in the scenario 1 (coming from the fishing and non-extractive activities), and scenario 2 is lightly, coming from the non-extractive activities.

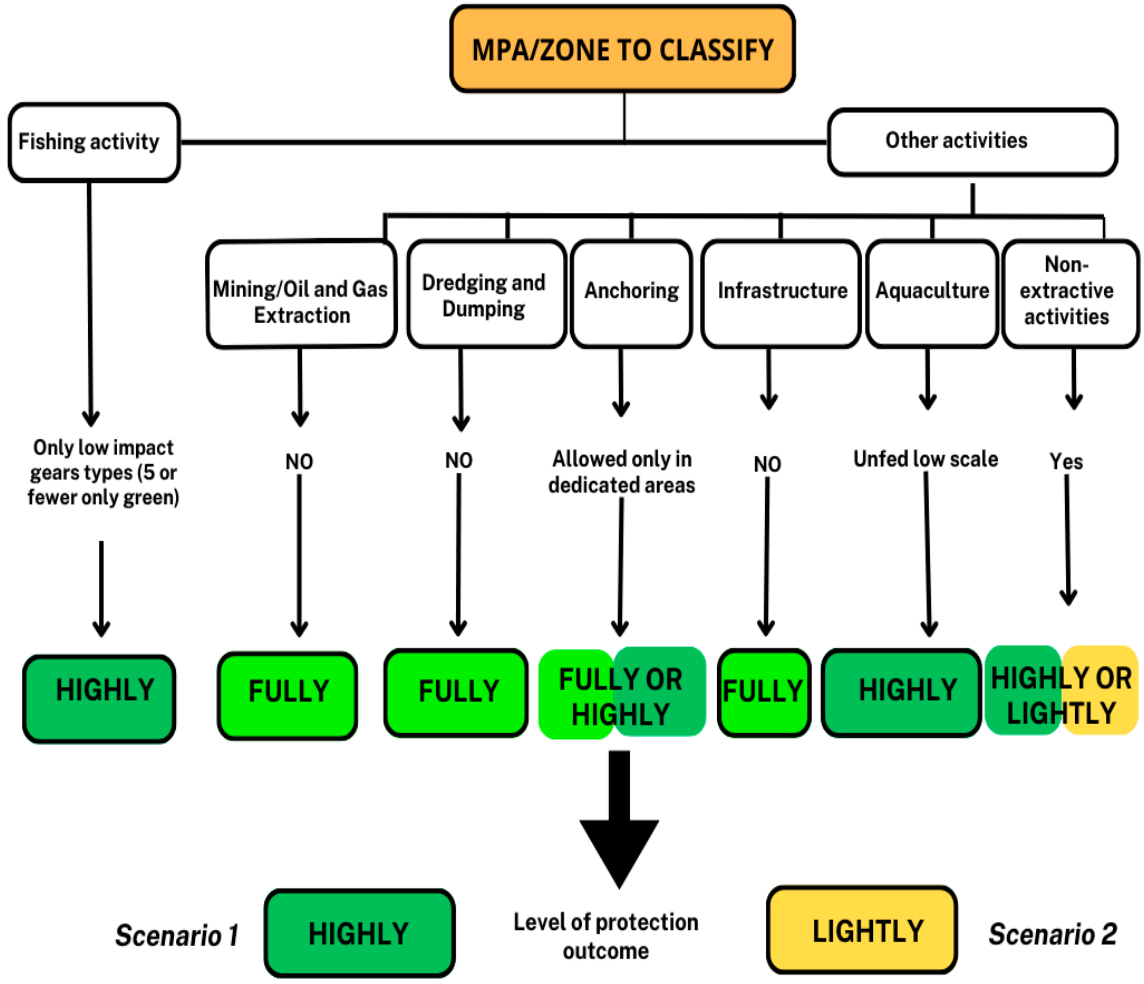


Figure 6-52 Example of the procedure followed to assess the level of protection of an MPA/zone applying general guidance from the MPA Guide (Grorud-Colvert et al., 2021) to respondents' answers to a series of questions related to the impacts of the activities allowed within the MPA/zone

As mentioned above, the following guidelines of the MPA Guide to assess the level of protection are generic and broad. The MPA guide being a global worldwide tool used to assess MPAs, it must be adapted to the available data. For our study, in certain cases we had to assess the impacts of the activities allowed within an MPA/zone on a case-to-case basis. Therefore, we present here a series of comments based on what the respondents were asked to reply to for certain activities allowed within the MPAs and their supposed impact.

- Dredging and dumping: The impact of "*dredge spoils to reduce coastal erosion*" does not provide an idea of the quantity that is dredged or dumped, therefore, to stay conservative we decided to establish scenario 1 as minimally (red) and scenario 2 as incompatible (grey).
- Anchoring: The "anchoring allowed anywhere" does not provide a sufficient indication of the scale in terms of duration and intensity of the anchoring, size of the anchors. Therefore, it was decided to consider scenario 2 as minimally protected, to stay conservative, but there is an arguable option that this impact could also be classified as lightly in assessments like this one, depending on the case and region.

- Infrastructure: For the impact from "Ports, harbours, or marinas of low scale (no ships and limited number of boats present)", we decided to put minimally protected as scenario 2, but same as above, depending on other cases, it could be argued that it could be classified as lightly.
- Non extractive activities: In this activity, we only have two options: either presence of these activities or absence of them. With the lack of the type and intensity of the activity allowed, it was decided to keep the level of protection with a conservative range, from highly on scenario 1, to lightly on scenario 2

6.11 List of articles and documents of the literature review

Title of the paper/document	Link
Distribution of *Posidonia oceanica* (L.) Delile meadows around Lampedusa Island (Strait of Sicily, Italy)	Http://dx.doi.org/10.1080/17445647.2016.1195298
Recreational fisheries in Portofino Marine Protected Area, Italy: Some implications for the management	Http://dx.doi.org/10.1111/fme.12241
Multi-disciplinary approach of reported and unreported fisheries in a new established MPA: The case of Cavo Greco, Cyprus	Http://dx.doi.org/10.1016/j.rsma.2021.101922
The Status of *Posidonia oceanica* at Tremiti Islands Marine Protected Area (Adriatic Sea)	Http://dx.doi.org/10.3390/biology11060923
Fish Assemblages of Mediterranean Marine Caves	Http://dx.doi.org/10.1371/journal.pone.0122632
Assessing the potential of an artisanal fishing co-management in the Marine Protected Area of Torre Guaceto (southern Adriatic Sea, SE Italy)	Http://dx.doi.org/10.1016/j.fishres.2009.10.006
Native predators control the population of an invasive crab in no-take marine protected areas	Http://dx.doi.org/10.1002/aqc.2921
Ecological Status of Coralligenous Macroalgal Assemblages in the Marine Protected Area (MPA) Isole Ciclopi (Ionian Sea)	Http://dx.doi.org/10.3390/plants10020329
Performance of a baited underwater video system vs. The underwater visual census technique in assessing the structure of fish assemblages in a Mediterranean marine protected area	Http://dx.doi.org/10.12681/mms.26639
Enhancing fish Underwater Visual Census to move forward assessment of fish assemblages: An application in three Mediterranean Marine Protected Areas	Http://dx.doi.org/10.1371/journal.pone.0178511
The carrying capacity and the effects of protection level in three marine protected areas in the Balearic Islands (NW Mediterranean)	Http://dx.doi.org/10.3989/scimar.03531.02H
Metiers, effort and catches of a Mediterranean small-scale coastal fishery: The case of the Cote Bleue Marine Park	Http://dx.doi.org/10.1016/j.fishres.2014.02.006
Monitoring the traditional fishing effort in marine protected areas on the French Mediterranean coast	
The management of artisanal fishing within the Marine Protected Area of the Port-Cros National Park (northwest Mediterranean Sea): a success story?	Http://dx.doi.org/10.1093/icesjms/fsn188
A strategic approach to assess the bundle of ecosystem services provided by *Posidonia oceanica* meadows in the bay of Marseille	
Marine protected areas overall success evaluation (MOSE): A novel integrated framework for assessing management performance and social-ecological benefits of MPAs	Http://dx.doi.org/10.1016/j.ocecoaman.2020.105370

The Influence of Boundary Habitat Continuity on Spillover from a Mediterranean Marine Protected Area	Http://dx.doi.org/10.1007/s41208-022-00396-7
Distribution and dynamics of Posidonia oceanica beds along the Alberes coastline	Http://dx.doi.org/10.1016/S0764-4469(00)00135-9
Fitting the size of no-take zones to species movement patterns: a case study on a Mediterranean seabream	Http://dx.doi.org/10.3354/meps10723
Movement patterns of the parrotfish *Sparisoma cretense* in a Mediterranean marine protected area	Http://dx.doi.org/10.1016/j.marenvres.2012.09.006
Assessing the potential of marine Natura 2000 sites to produce ecosystem-wide effects in rocky reefs: A case study from Sardinia Island (Italy)	Http://dx.doi.org/10.1002/aqc.3026
Mass mortality hits gorgonian forests at Montecristo Island	Http://dx.doi.org/10.3354/dao03284
Integrated Environmental Accounting for Assessing the Value for Money in Marine Protected Areas: the Case of Tremiti Islands (Italy)	Http://dx.doi.org/10.5890/JEAM.2022.09.004
Rocky reef fish assemblages at six Mediterranean marine protected areas: broad-scale patterns in assemblage structure, species richness and composition	Http://dx.doi.org/10.1080/11250003.2012.686523
Multi-scale spatial heterogeneity, habitat structure, and the effect of marine reserves on Western Mediterranean rocky reef fish assemblages	Http://dx.doi.org/10.1007/s00227-003-1170-0
Effects of artisanal fisheries on the scorpaenids (*Scorpaena spp*.) Reproduction in the marine protected area of Cap de Creus (NW Mediterranean)	Http://dx.doi.org/10.1016/j.fishres.2012.07.023
Assessing the effects of marine protected area (MPA) on a reef fish assemblage in a northwestern Mediterranean marine reserve: Identifying community-based indicators	Http://dx.doi.org/10.1016/j.biocon.2005.12.030
Taxonomic relatedness does not reflect coherent ecological response of fish to protection	Http://dx.doi.org/10.1016/j.biocon.2015.06.002
Temporal variability in abundance of the sea urchins *Paracentrotus lividus* and *Arbacia lixula* in the northwestern Mediterranean: comparison between a marine reserve and an unprotected area	Http://dx.doi.org/10.3354/meps168135
Population Structure and Growth of the Threatened Pen Shell, *Pinna rudis* (Linnaeus, 1758) in a Western Mediterranean Marine Protected Area	Http://dx.doi.org/10.12681/mms.1597
Marine soundscape and fish biophony of a Mediterranean marine protected area	Http://dx.doi.org/10.7717/peerj.12551
Fishery management in a marine protected area with compliance gaps: Socio-economic and biological insights as a first step on the path of sustainability	Http://dx.doi.org/10.1016/j.jenvman.2020.111754
Density and distribution patterns of the endangered species Pinna nobilis within a *Posidonia oceanica* meadow in the Gulf of Oristano (Italy)	Http://dx.doi.org/10.1017/S002531540999141X
Recovery Trends of Commercial Fish: The Case of an Underperforming Mediterranean Marine Protected Area	Http://dx.doi.org/10.1371/journal.pone.0146391

Analysis of small-scale fisheries value chain: An interview-based approach in Italian Marine Protected Areas	Http://dx.doi.org/10.1016/j.fishres.2022.106358
Is the establishment of MPAs enough to preserve endangered intertidal species? The case of *Patella ferruginea* in Mal di Ventre Island (W Sardinia, Italy)	Http://dx.doi.org/10.1002/aqc.2579
Population trends of the fan mussel *Pinna nobilis* from Portofino MPA (Ligurian Sea, Western Mediterranean Sea) before and after a mass mortality event and a catastrophic storm	Http://dx.doi.org/10.1080/24750263.2020.1850891
Increased predation of juvenile European spiny lobster (*Palinurus elephas*) in a marine protected area	Http://dx.doi.org/10.1080/00288330.2005.9517324
Acoustic fish communities: sound diversity of rocky habitats reflects fish species diversity	Http://dx.doi.org/10.3354/meps12812
The Gyaros Island Marine Reserve: A biodiversity hotspot in the eastern Mediterranean Sea	Http://dx.doi.org/10.1371/journal.pone.0262943
Multiple Processes Regulate Long-Term Population Dynamics of Sea Urchins on Mediterranean Rocky Reefs	Http://dx.doi.org/10.1371/journal.pone.0036901
Improving marine protected area governance through collaboration and co-production	Http://dx.doi.org/10.1016/j.jenvman.2020.110757
Spatial distribution, abundance and habitat use of the endemic Mediterranean fan mussel *Pinna nobilis* in Gera Gulf, Lesvos (Greece): comparison of design-based and model-based approaches	Http://dx.doi.org/10.12681/mms.14156
Sandbar shark aggregation in the central Mediterranean Sea and potential effects of tourism	Http://dx.doi.org/10.1002/aqc.3517
Fishers' perceptions as indicators of the performance of Marine Protected Areas (MPAs)	Http://dx.doi.org/10.1016/j.marpol.2011.06.002
Organization Science improves management effectiveness of Marine Protected Areas	Http://dx.doi.org/10.1016/j.jenvman.2019.03.052
Evidences of fishing impact on the coastal gorgonian forests inside the Portofino MPA (NW Mediterranean Sea)	Http://dx.doi.org/10.1016/j.ocecoaman.2020.105105
Ordinary and Extraordinary Movement Behaviour of Small Resident Fish within a Mediterranean Marine Protected Area	Http://dx.doi.org/10.1371/journal.pone.0159813
The influence of environmental characteristics on fish larvae spatial patterns related to a marine protected area: The Medes islands (NW Mediterranean)	Http://dx.doi.org/10.1016/j.ecss.2011.02.006
Sfm-Based Method to Assess Gorgonian Forests (Paramuricea clavata (Cnidaria, Octocorallia))	Http://dx.doi.org/10.3390/rs10071154
Diversity, structure and spatial distribution of megabenthic communities in Cap de Creus continental shelf and submarine canyon (NW Mediterranean)	Http://dx.doi.org/10.1016/j.pocean.2022.102877
Large-Scale Assessment of Mediterranean Marine Protected Areas Effects on Fish Assemblages	Http://dx.doi.org/10.1371/journal.pone.0091841
Reconciling fisheries and habitat protection in Romanian coastal marine protected areas	Http://dx.doi.org/10.3989/scimar.04028.25B

The demersal fish assemblages of the infra and circalittoral coastal rocky bottoms of the Aeolian Archipelago (Central Mediterranean Sea) studied by Remotely Operated Vehicle (ROV)	Http://dx.doi.org/10.12681/mms.23297
Sea urchin harvest inside marine protected areas: an opportunity to investigate the effects of exploitation where trophic upgrading is achieved	Http://dx.doi.org/10.7717/peerj.12971
Identifying epibenthic habitats on the Seco de los Olivos Seamount: Species assemblages and environmental characteristics	Http://dx.doi.org/10.1016/j.dsr.2018.03.015
Intraannual variability of an artificial reef fish assemblage in the marine reserve of Tabarca (Alicante, Spain, SW Mediterranean)	
A multidisciplinary approach to identify priority areas for the monitoring of a vulnerable family of fishes in Spanish Marine National Parks	Http://dx.doi.org/10.1186/s12862-020-01743-z
Sublittoral soft bottom assemblages within a Marine Protected Area of the northern Alboran Sea	Http://dx.doi.org/10.1017/S0025315414002082
Comparison of diver operated stereo-video and visual census to assess targeted fish species in Mediterranean marine protected areas	Http://dx.doi.org/10.1016/j.jembe.2019.151205
The Structure of Mediterranean Rocky Reef Ecosystems across Environmental and Human Gradients, and Conservation Implications	Http://dx.doi.org/10.1371/journal.pone.0032742
Assessing the Effectiveness of Marine Reserves on Unsustainably Harvested Long-Lived Sessile Invertebrates	Http://dx.doi.org/10.1111/j.1523-1739.2011.01795.x
Protection changes the relevancy of scales of variability in coralligenous assemblages	Http://dx.doi.org/10.1016/j.ecss.2016.03.026
Benchmarking eleven biodiversity indicators based on environmental DNA surveys: More diverse functional traits and evolutionary lineages inside marine reserves	Http://dx.doi.org/10.1111/1365-2664.14276
Spillover of spiny lobsters *Palinurus elephas* from a marine reserve to an adjoining fishery	Http://dx.doi.org/10.3354/meps308207
A 25-year marine reserve as proxy for the unfished condition of an exploited species	Http://dx.doi.org/10.1016/j.biocon.2016.09.002
Biological monitoring of a marine reserve ('Cote bleue' marine park, Marseilles Bay, Mediterranean Sea, France).	
Fish assemblage of the marine protected area of Cinque Terre (NW Mediterranean Sea): First characterization and assessment by visual census	Http://dx.doi.org/10.1080/02757540600720193
Marine benthic forms of the Marine Protected Area Capo Caccia-Isola Piana (Sardinia, Italy)	Http://dx.doi.org/10.1080/17445647.2018.1486242
The effects of protection measures on fish assemblage in the Plemmirio marine reserve (Central Mediterranean Sea, Italy): A first assessment 5 years after its establishment.	Http://dx.doi.org/10.1016/j.seares.2013.01.004

Detecting conservation benefits in spatially protected fish populations with meta-analysis of long-term monitoring data	Http://dx.doi.org/10.1007/s00227-006-0557-0
Marine Protected Areas Management in the Mediterranean Sea-The Case of Croatia	Http://dx.doi.org/10.3390/d14060448
Assessment of fish communities in a Mediterranean MPA: Can a seasonal no-take zone provide effective protection?	Http://dx.doi.org/10.1016/j.ecss.2018.04.012
Does fish growth respond to fishing restrictions within Marine Protected Areas? A case study of the striped red mullet in the south-west Adriatic Sea (central Mediterranean)	Https://doi.org/10.1002/aqc.3776
Local communities, Marine Protected Areas and diving tourism in the Cyclades	Https://ejournals.epublishing.ekt.gr/index.php/ekke/article/view/25952
Exploring the economic and social impacts of protected areas from the perspective of local communities: the case of the protected area "Chortarolimni, Lake Aliki and the marine area", Lemnos Island	Https://hellanicus.lib.aegean.gr/handle/11610/18392
Exercising sustainable management and sustainable development of natura areas: case study of Saria in Karpathos	Https://hellanicus.lib.aegean.gr/handle/11610/21563
Assessment of the environmental status of the National Marine Park of Alonissos North Sporades using indicators	Http://dx.doi.org/10.26240/heal.ntua.12449
Pre-valutazione dell'effetto Riserva presso i cinque parchi marini della Liguria-Annualità 2010	Http://www.remare.org/progetti/effetto-riserva/relazionefinaleliguria5.pdf
Monitoraggio delle risorse alieutiche con l'ausilio di sistemi informativi geografici in una riserva naturale marina e sito natura 2000.	Https://www.openstarts.units.it/handle/10077/2555
Valutazione dell'indicatore bio-fisico dello sforzo di pesca per valutare l'efficacia di gestione di un'area marina protetta.	Http://dspace.unive.it/handle/10579/3467
Modelli di gestione partecipata per le aree marine protette in Italia: l'area marina protetta Regno di Nettuno come contesto sperimentale	Https://arcadia.sba.uniroma3.it/handle/2307/4091
Evaluación del efecto reserva sobre la ictiofauna de hábitat rocoso en las reservas marinas de la Isla de Tabarca (Alicante) e Isla del Toro (Mallorca)	Https://rua.ua.es/dspace/handle/10045/77973
Comparaison des inventaires de poissons dans les aires marines protégées de Méditerranée: influence de la surface et de l'ancienneté	Https://www.researchgate.net/profile/Patrice-Francour/publication/228375257_Comparaison_des_inventaires_de_poissons_dans_les_aires_marines_protegees_de_Mediterranee_influence_de_la_surface_et_de_l'ancienneté/links/02bfe50d07ff835ac5000000/Comparaison-des-inventaires-de-poissons-dans-les-aires-marines-protegees-de-Mediterranee-influence-de-la-surface-et-de-lanciennete.pdf

Suivi et évaluation de la pêche professionnelle au sein d'une Aire Marine Protégée : protocoles d'enquêtes et indicateurs de pression et d'impact. Application au Parc Marin de la Côte Bleue	Https://archimer.ifremer.fr/doc/00100/21103/
Présentation et analyse d'une cogestion de la ressource halieutique au sein d'une aire marine protégée: exemple de la réserve naturelle des bouches de Bonifacio (Doctoral dissertation, Université de Sherbrooke.).	Http://savoirs.usherbrooke.ca/bitstream/handle/11143/7189/cufe_Ferracci_Franck_essai182.pdf?Sequence=1
L'importance du processus de planification dans la rédaction du Plan de gestion de l'aire marine protégée de l'îlot Kakoskali, Chypre.	Https://halieutique.institut-agro-rennes-angers.fr/files/fichiers/memoires/201604.pdf
Recensement des mérous bruns (Epinephelus marginatus) de la réserve naturelle de cerbère-Banyuls (France, méditerranée) effectué en septembre 2001, après 17 années de protection	Https://sfi-cybium.fr/sites/default/files/pdfs-cybium/08-Lenfant%20130.pdf
Etude socio-écologique appliquée à la gestion de la plaisance dans une aire marine protégée: Cas de l'amp Tavolara-Punta Coda Cavallo.	Https://orbi.uliege.be/handle/2268/27610
Plan de Management al ROSCI0269 Vama Veche - 2 Mai	Http://www.rmri.ro/VV2M/Downloads/2016_planmanagement_vamaveche.pdf
Raport privind starea mediului marin şi costier în anul 2017	Http://www.anpm.ro/documents/840114/39194986/2017+Capitolul+II.3+Mediul+marin+si+costier.doc/7574560c-5e6c-4d7a-b29c-c96a4c321b5f
Raport privind starea mediului marin şi costier în anul 2016	Http://www.anpm.ro/documents/18093/34129503/Capitolul+II.3+Mediul+marin+si+costier.pdf/068624bd-6992-4fb6-bb45-859514e0dc2a
Planul de Management al Rezervației Biosferei Delta Dunării	Http://sgglegis.gov.ro/legislativ/docs/2014/01/w2nphs85kcdr0b1zgj3f.pdf
Valutazione dell'effetto Riserva attraverso il campionamento della fauna ittica nell'area Marina Protetta Isola di Bergeggi	Https://www.ampisolabergeggi.it/296/studi-e-pubblicazioni/monitoraggi-scientifici/
Valutazione dell'effetto Riserva nell'area Marina Protetta Isola Ciclopi	
Monitoraggio delle specie ittiche focali presso l'Area Marina Protetta di Torre Guaceto	
Monitoraggio delle specie ittiche e delle attività di piccola pesca presso l'Area marina Protetta di Torre Guaceto	
Questionner l'efficacité de la gouvernance d'une AMP: le cas de Natura 2000 en mer	Https://journals.openedition.org/vertigo/30565

6.12 Variables examined/measured in the reviewed studies

Variables	Number of studies	% of studies
Abundance / density	50	51
Species richness	29	30
Size / size structure	24	24
Biomass	22	22
CPUE (catch per unit effort)	12	12
Stakeholder engagement	8	8
Fisheries revenue / income	5	5
Maximum length	5	5
Diversity / Shannon Weiner Index / Simpson Index	4	4
Human wellbeing	4	4
Home range	3	3
Mortality	3	3
Spatial distribution	3	3
Number of jobs	3	3
fishing effort	2	2
Management performance	2	2
Movement pattern	2	2
Percent coverage	2	2
Sound abundance	2	2
Sound richness	2	2
Fishers' perceptions	2	2
IPUE (income per unit effort)	2	2
LPUE (landings per unit effort)	2	2
Price per kilo of species	2	2
Degree of marine conservation awareness among managers	1	1
Implementation of control measures and compliance with norms and rules	1	1
Interactions on different fisheries	1	1
Larval distribution	1	1
Magnitude of recreational fisheries	1	1
Management type	1	1
MaxN	1	1
Morphometrics	1	1
Number of MPA employees	1	1
MPA organizational size	1	1
Price to shop	1	1
Price to wholesalers	1	1
Recruitment	1	1
Resident status	1	1
Shell burial level	1	1
Shell orientation	1	1
Social-ecological effectiveness	1	1
Spatial occupation	1	1
Governance structure	1	1

6.13 Classification of Mediterranean and Black Sea MPAs under five broad designation categories.

Designation type	Description/Features
National	This category is used to refer to a broad range of national MPA designations including for example: national parks and marine protected areas. These two labels are used in several Member States, however the remaining nationally designated MPAs are assigned different labels according to the country of designation. As such, the objectives, regulations and zoning designs applied vary per designation type and per Member State. The same is true of the governance of nationally designated MPAs, with a variety of governance arrangements found, as well as differences in the presence/absence of management plans. Enforcement levels may also vary between Member States and also within Member States between MPAs.
Regional-SCI	This category refers to Natura2000 sites of Community importance. These sites represent the first step in the Natura 2000 network. Member States first carry out comprehensive assessments of each of the habitat types and species present on their territory. They then submit lists of proposed sites of Community importance (pSCIs). Once sites of Community importance (SCIs) have been adopted, Member States must designate them as special areas of conservation (SACs), as soon as possible and within six years at most. In general Natura 2000 sites are more homogeneous in that they are often composed of one zone and apply a similar governance structure.
Regional-SAC	This category refers to special areas of conservation (SACs), Natura 2000 sites designated under the Habitats Directive (Art. 3 and 4). Member States designate these SACs to ensure the favourable conservation status of each habitat type and species throughout their range in the EU. The objective of these Natura2000 sites is to ensure that the natural habitat types listed in the Habitat Directive's Annex I and the habitats of the species listed in its Annex II are maintained or, where appropriate, restored to a favourable conservation status in their natural range.
National, Regional-SCI	This category refers to sites where nationally designated MPAs and Natura 2000 sites of Community importance are found to overlap (≥90%).
National, Regional-SAC	This category refers to sites where nationally designated MPAs and Natura 2000 special areas of conservation are found to overlap (≥90%).

Source of information: https://ec.europa.eu/environment/nature/natura2000/sites/index_en.html

6.14 Descriptive summary table with selected information from specific Med & BS MPAs published studies.

MS	MPA name	Species	Outcome
Spain	Tabarca	39 coastal	Abundance of fishes inside the reserve was, on average, 1.22 times higher than outside the reserve boundaries. Positive effect of protection was found for *Boops boops, Diplodus annularis, Diplodus cervinus, Epinephelus marginatus, Epinephelus costae and Epinephelus aeneus*
Spain	Cabo de San Antonio	11 coastal	Lack of surveillance, due to budget reduction, affected the MPA effectiveness
France	Port Cros	14 coastal	Artisanal fishing does not jeopardize the conservation objectives of the MPA
France	Cerber Banyuls	25 coastal	Catch abundances and weights for recreational fishermen were respectively 40% and 50% higher within the buffer zone of partial protection in the reserve than in surrounding areas
Italy	Torre Guaceto	*Diplodus* spp.	Torre Guaceto MPA provides effective protection to the local white seabream population
Spain	Cabo de Gata-Nijar	*Caretta caretta*	Commercial-artisanal trammel nets have a mild impact on *C. caretta*, with a very low by-catch rate.
France	Cote Bleue	11 coastal	Improvement in biodiversity and increase in specific richness, abundances, biomass and the proportion of large individuals of the species fished
Italy	Portofino	40 coastal	Positive spillover effect (attracts anglers who could have an impact estimated at about 5% of the total catch)
Romania	Danube Delta	*Sprattus sprattus, Engraulis encrasicolus, Trachurus trachurus, Scophthalmus maximus*	Temporal trends of catch of the marine commercial species strongly decreased despite the establishment of the reserve since 1990

6.15 Fishing effort share by fishing gear type in the 603 studied Mediterranean and Black Sea MPAs.

Fishing gear	Inside	Outside
OTB	18.1%	81.9%
PTM	28.9%	71.1%
PS	22.1%	77.9%
GTR	28.1%	71.9%
HMD	4.3%	95.7%
GNS	21.5%	78.5%
LLS	26.0%	74.0%
TBB	17.9%	82.1%
LLD	18.9%	81.1%
TB	21.2%	78.8%
FPO	22.3%	77.7%
OTT	34.8%	65.2%
MIS	25.5%	74.5%
DRB	2.8%	97.2%
TX	11.7%	88.3%
LA	20.6%	79.4%
HAR	6.0%	94.0%
OTM	19.5%	80.5%
PTB	32.7%	67.3%
GND	4.5%	95.5%
SV	36.7%	63.3%
GTN	28.0%	72.0%
GNC	14.5%	85.5%
GN	22.7%	77.3%
OT	4.9%	95.1%
PT	32.3%	67.7%
PS1	18.5%	81.5%
LHP	27.0%	73.0%
LL	5.5%	94.5%
NETS	27.7%	72.3%
GEN	24.1%	75.9%
FPN	53.3%	46.7%
FYK	12.2%	87.8%
LHM	0.0%	100.0%
LX	16.0%	84.0%
FIX	0.0%	100.0%
SB-SV	**84.2%**	15.8%
TBN	18.2%	81.8%
TBS	20.0%	80.0%
TM	0.0%	100.0%
LTL	40.0%	60.0%
PS	0.0%	100.0%
MISC	50.0%	50.0%
Grand Total	**19.8%**	**80.2%**

Source gear codes: https://openknowledge.fao.org/server/api/core/bitstreams/9dac7a84-9efc-4fe6-83af-25b7862245f6/content

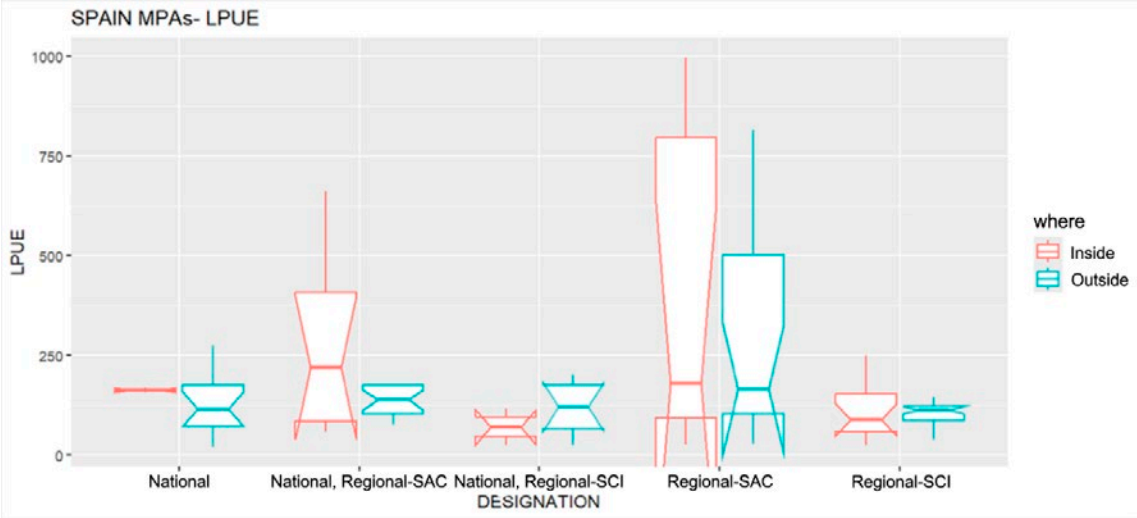
6.16 Fishing effort share of towed gears with direct contact to seabed by MPA designation type

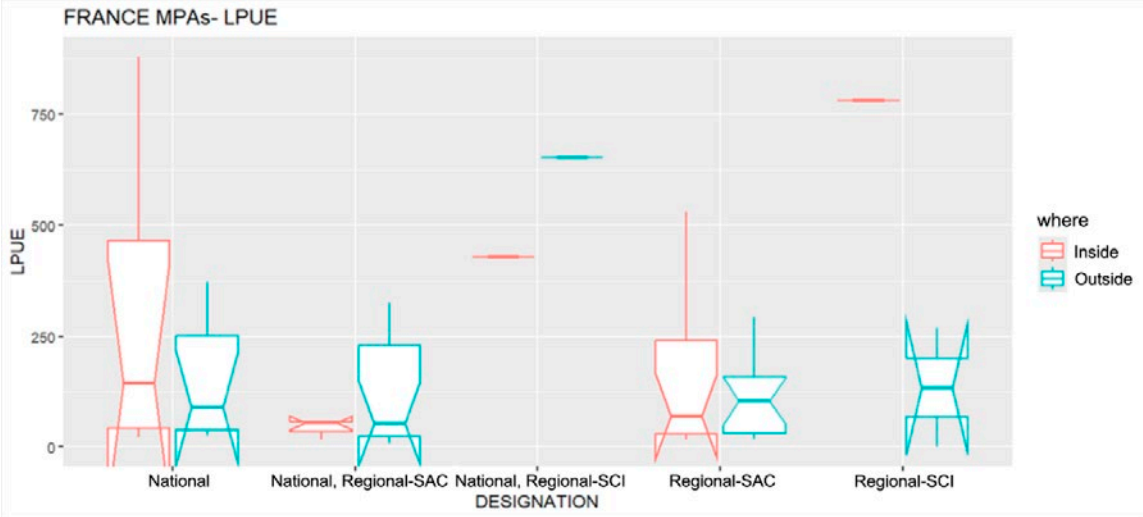
Designation type	Inside	Outside
National	10.4%	89.6%
National, Regional-SAC	13.0%	87.0%
National, Regional-SCI	5.4%	94.6%
Regional-SAC	7.7%	92.3%
Regional-SCI	37.6%	62.4%
Total	**16.9%**	**83.1%**

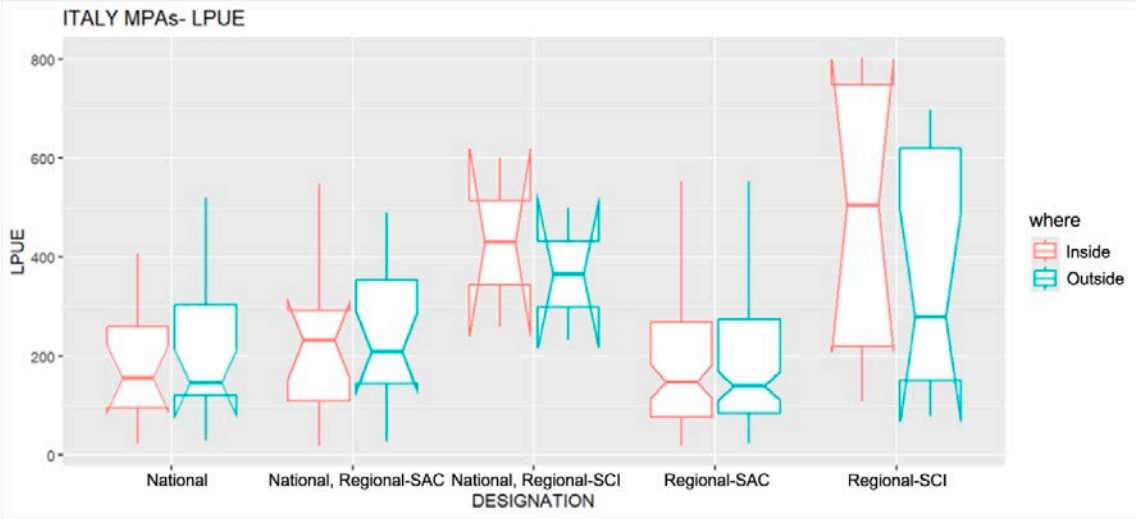
6.17 Catch share (%) for major species by MPA designation type inside and outside of the MPAs

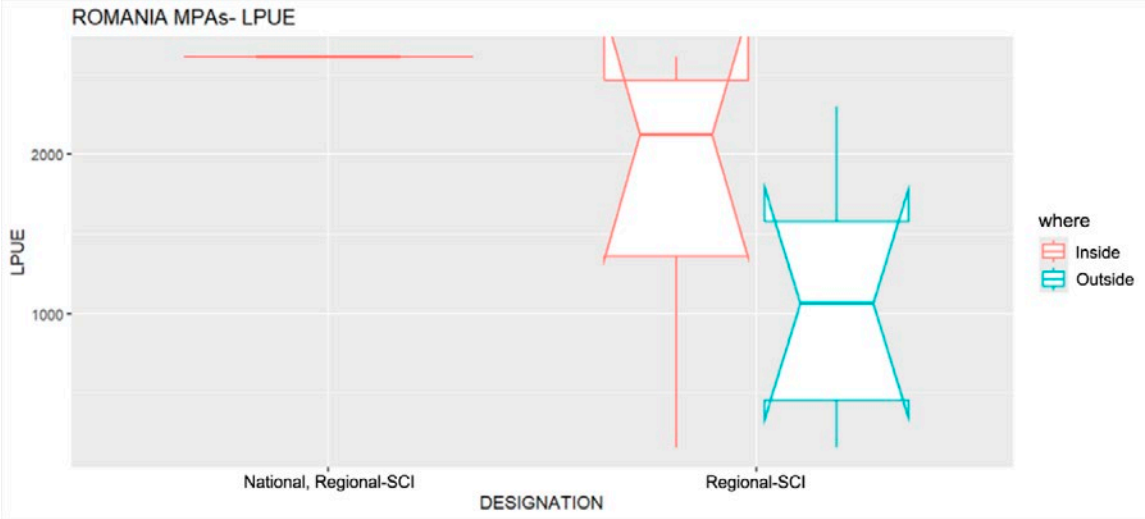
Species/taxa	National (%)		National, Regional-SAC (%)		National, Regional-SCI (%)		Regional-SAC (%)		Regional-SCI (%)	
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside
Engraulis encrasicolus	1.16	98.84	18.96	81.04	6.74	93.26	17.62	82.38	42.03	57.97
Sardina pilchardus	1.22	98.78	8.02	91.98	0.02	99.98	6.71	93.29	46.05	53.95
Chamelea gallina	4.20	95.80	0.99	99.01			5.36	94.64	1.21	98.79
Parapenaeus longirostris	6.62	93.38	14.15	85.85	8.90	91.10	7.28	92.72	40.44	59.56
Squilla mantis	12.51	87.49	4.63	95.37	22.31	77.69	5.90	94.10	35.43	64.57
Chelon ramada	0.61	99.39	33.46	66.54			1.05	98.95	39.00	61.00
Merluccius merluccius	13.22	86.78	14.49	85.51	5.58	94.42	7.92	92.08	40.14	59.86
Mullus barbatus	10.73	89.27	8.19	91.81	11.58	88.42	5.51	94.49	62.70	37.30
Callista chione	0.00	100.00					2.09	97.91		
Solea solea	8.28	91.72	18.98	81.02	12.45	87.55	4.95	95.05	40.55	59.45
Bolinus brandaris	1.09	98.91	7.09	92.91	0.00	100.00	1.23	98.77	38.92	61.08
Sardinella aurita	1.71	98.29	13.14	86.86	0.53	99.47	9.18	90.82	45.92	54.08
Sepia officinalis	9.04	90.96	20.97	79.03	5.19	94.81	5.59	94.41	46.84	53.16
Octopus vulgaris	15.25	84.75	18.49	81.51	24.63	75.37	6.10	93.90	30.97	69.03
Scomber scombrus	16.28	83.72	10.47	89.53	13.50	86.50	7.38	92.62	62.10	37.90
Euthynnus alletteratus	9.68	90.32	0.93	99.07	11.12	88.88	4.92	95.08	47.20	52.80
Mytilus galloprovincialis	0.00	100.00	0.00	100.00			4.66	95.34	13.88	86.12
Merlangius merlangus	39.98	60.02	1.43	98.57			11.60	88.40	33.27	66.73
Xiphias gladius	6.54	93.46	21.95	78.05	3.58	96.42	9.24	90.76	21.44	78.56
Scomber japonicus	0.58	99.42	1.11	98.89	3.17	96.83	4.88	95.12	42.36	57.64

6.18 Boxplots of LPUE (kg/DAS) by MPA designation type inside and outside of protected area for the Mediterranean and Black Sea






ITALY MPAs- LPUE
LPUE
800
600
400
200
0
National
National, Regional-SAC
National, Regional-SCI
Regional-SAC
Regional-SCI
DESIGNATION
where
Inside
Outside


ROMANIA MPAs- LPUE
LPUE
2000
1000
National, Regional-SCI
Regional-SCI
DESIGNATION
where
Inside
Outside

6.19 LPUE (kg/DAS) for groupers/lobsters (upper panel) and Chondrichthyan (lower panel) by designation type, within/outside the EU Mediterranean and Black Sea MPAs

LPUE Chondrichthyans	DESIGNATION TYPE											
	National		National, Regional-SAC		National, Regional-SCI		Regional-SAC		Regional-SCI		Total	
Country	Inside	Outside	Inside	Outside	Inside	Outside	**Inside**	Outside	Inside	Outside	Inside	Outside
BGR				0.00			0.41	0.00	0.00	0.01	0.23	0.00
ESP	16.51	9.22	2.23	3.10	5.50	7.25	2.57	6.69	8.56	6.90	7.58	6.29
FRA	10.05	3.11	3.00	3.24	16.23	8.02	2.81	2.44	8.92	6.31	7.41	3.61
GRC	0.09	0.41	1.45	1.05			0.67	1.06	0.25	1.49	0.58	1.02
HRV	7.34	0.44	4.54	8.67	13.12	0.68			0.75	1.41	0.90	1.41
ITA	0.48	2.01	1.51	1.22	0.00	0.10	1.27	1.81	0.80	0.55	0.92	1.49
MLT	17.08	11.08	5.22	9.3							16.42	10.53
ROM					0.00				13.22	9.90	12.67	9.90
Total	**2.59**	**2.15**	**1.68**	**1.51**	**5.31**	**4.80**	**1.25**	**1.84**	**1.74**	**1.01**	**1.72**	**1.71**

LPUE	DESIGNATION TYPE											
Groupers/ Lobsters	National		National, Regional-SAC		National, Regional-SCI		Regional-SAC		Regional-SCI		Total	
Country	Inside	Outside	Inside	Outside	Inside	Outside	**Inside**	Outside	Inside	Outside	Inside	Outside
ESP	0.23	0.08	0.02	0.06	1.76	0.11	**0.04**	0.07	0.10	0.09	0.21	0.08
FRA	2.01	1.45	6.24	3.07	0.00	0.04	**2.42**	1.31	0.02	0.02	1.76	1.30
GRC	0.01	1.05	0.25	0.34			**0.27**	0.54	0.14	0.36	0.22	0.54
HRV	0.00	0.02	8.41	8.86	0.00	0.01			0.28	0.51	0.36	0.56
ITA	0.27	0.07	1.60	0.54	0.07	0.04	**0.23**	0.15	0.12	0.05	0.25	0.14
Total	**0.41**	**0.12**	**1.39**	**0.51**	**1.42**	**0.08**	**0.28**	**0.17**	**0.12**	**0.08**	**0.28**	**0.17**

6.20 AIS derived fishing intensity (fishing hours/km2 in the period 2012-2021) for towed gears operating over seabed habitats with biogenic reefs, inside the Mediterranean and Black Sea MPAs

EMODnet MSFD_BBHT	DESIGNATION TYPE					Total
	National	National, Regional -SAC	National, Regional -SCI	Regional -SAC	Regional -SCI	
Circalittoral rock and biogenic reef	6.7	1.9	10.3	20.2	5.3	**9.5**
Infralittoral rock and biogenic reef	2.1	4.0	1.7	6.1	5.4	**4.8**
Offshore circalittoral rock and biogenic reef	32.5	6.2	3.6	7.6	11.3	**9.2**
Upper bathyal rock and biogenic reef or Lower bathyal rock and biogenic reef	0.3	3.0	70.9	11.3	21.2	**12.4**
Total	**2.3**	**3.9**	**10.2**	**8.0**	**7.0**	**6.4**

6.21 Description of the five case studies

Five case study sites were selected based on their geographic location ensuring there was at least one MPA per subregion of the Mediterranean and Black Sea, on the consortia's level of knowledge of each site, relationship with MPA managers and potential stakeholders and ecological/socio-economic data availability.

6.21.1 Cerbère- Banyuls, France

The Cerbère-Banyuls Marine Protected Area (a Nationally designated MPA) was the first French marine reserve, located in the Western Mediterranean Sea, and covers 6.5 km^2, of which 0.65 km^2 prohibits all human activities except those associated with scientific research (i.e., no-take/fully-protected zone). The creation of the marine reserve was driven by multiple drivers: since 1960, fishing yields from small-scale fisheries declined about 50% in the area, larger fishing vessels were being used; tourism-based activities expanded; and concerns were raised by the public about water quality. To address these considerations, the municipality of Cerbère commissioned an investigation by the Arago laboratory of Banyuls-sur-Mer. In 1971, the results indicated the need to create an MPA, and underlined the protection of particular species. The MPA was established in 1974 by a national order, at this time the fishing pressure was still high inside the MPA, and in consultation with the small-scale fishers, a no-take zone was created in 1978, by an order of the maritime prefect of the Mediterranean Sea. The national decree 90-790 of 6 September 1990 cancelled and replaced the order of 1974, following consultation between national and local administrations, as well as with local stakeholders.

The objectives of the MPA are to conserve the local habitats and their specific diversity; to control human activities in a way that they are compatible with conservation of ecosystems; to favour the reserve effect by implementing protection measures outside the MPA; to have an impact on public (education and culture); to constitute an opportunity for scientific research; to procure economic benefits; to participate in maintaining small-scale fisheries. The MPA falls under the authority of the department of Pyrénées-Orientales and is managed by a team of 5 full-time employees, supported by 7 more staff members during the summer season. Any decisions regarding the MPA must be submitted to the MPA board, which gather once a year to evaluate and to direct management actions, to validate the management plan, and to approve scientific programs.

The MPA is characterized by the presence of diverse key benthic habitats, such as *Posidonia oceanica* seagrass meadows, coralligenous outcrops, immerged caves, rocky reefs and sandy/muddy bottoms, most of which belong to Annex 1 of the conservation of natural habitats and of wild fauna and flora directive (92/43/EEC). The MPA is home to 1700 vegetal and animal species, among which 53 (41 animals and 12 vegetal) have protection status under national, European or international regulatory decrees, have been included on a red list, or have been selected by an expert committee. Emblematic species of the MPA are the dusky grouper (*Epinephelus marginatus*) and the brown meagre (*Sciaena umbra*), both protected by a national moratorium prohibiting their fishing since 1993 and 2003, respectively, and are particularly abundant in the MPA. Other species of interest in the MPA which

also attract divers, include the sharpsnout seabream (*Diplodus puntazzo*), the black seabream (*Spondyliosoma cantharus)*, the common dentex (*Dentex dentex*), and the Mediterranean slipper lobster (*Scyllarides latus*).

Two villages are close to the MPA: Banyuls-sur-Mer and Cerbère, in which the economy and population has decreased slightly in the last decades, whereas in the surrounding area beyond these communities the economy and population has increased faster than the national trend. The MPA is a well-known touristic destination, and visits to the area increase by 80% during the summer. While small-scale fishers are progressively decreasing, the number of scuba-diving centres (more than 20,000 dives inside the MPA per year), boats and jet-ski rentals, recreational fishing and spearfishing, and other tourism-based activities are growing in the area around the MPA, leading to conflicts between users during high season. Today, only 3 fishers are still based in Banyuls-sur-Mer (2 of which are officially retired) and fish within and outside the MPA. Other small-scale fishers (less than 20) are in ports around the MPA and occasionally fish in/near the MPA, but the small-scale fleet dynamic is declining with many fishers being older than 60 years and no generational renewal. Today, the MPA is not affected by large-scale fisheries since they are not allowed to fish within 3 nautical miles (the exterior border of the reserve being ~ 1 nautical mile).

In 2023, the MPA launched a project to extend its boundaries which involves all stakeholders in a public participation process. The final draft of the extension project will soon be submitted to the national government for approval and includes a doubling of the current area of the MPA, with two more no-take zones accounting for approximatively 1 km^2 in addition to the 0.65km^2 that already exists.

6.21.2 Egadi Islands, Italy

The Egadi MPA covers a total surface area of 540km^2 (in territorial waters) and is located off the western coast of Sicily which includes the islands of Favignana, Levanzo, Marettimo and the islets of Formica and Maraone. It falls within the Geographical Sub Areas 10 and 16 according to the General Fisheries Commission for the Mediteraanean (GFCM). Egadi Islands MPA was established in 1991 with the inter-ministerial decree of 27 December 1991 of the Minister of the Environment and the Minister of Merchant Marine. Some protection measures were subsequently modified by decree of 6 August 1993. It is one of the largest MPA in Europe (D'Anna et al., 2016). The driver behind the MPAs designation was a political decision negotiated with local environmental groups which lobbied the Ministry of the Environment to create a protected area to prevent oil drilling in adjacent waters (D'Anna et al., 2016; Himes, 2003). The boundaries and zoning scheme of the MPA were imposed by the Ministry, which placed the highest level of protection in ecologically valuable areas that were also traditional fishing grounds for small-scale fishers.

The priority objective of the MPA is maintaining or restoring to a favourable conservation status the main natural features of the marine environment. The 1991 MPA designation decree and management plan sets the following aims: (1) protecting the marine environment; (2) protecting the marine biological resources; (3) educating the public about the characteristics of marine habitats; (4) supporting

scientific research; (5) increasing the protection of local archaeological sites; (6) promoting the socio-economic development connected to the environmental features of the area.

When the MPA was designated neither fishers nor residents were given the opportunity to discuss the MPA design, and most of them were obstinately opposed to its existence from the beginning (D'Anna et al., 2016). After being managed by the Coast Guard from 1991 to 2000, the management responsibility was transferred to the Municipality of Favignana in 2001. Since 2010 the MPA falls under the responsibility of the Italian Ministry of the Environment which assigns the Mayor of Favignana as director who in turn assigns the MPA manager who performs the daily management and links the Municipality to the MPA. This period in the MPA history has been characterized by increased public participation, the appointment of a director recommended by the Ministry of the Environment and the adoption of the first MPA executive regulation.

The MPA has a Commission which is an advisory MPA board that includes nine delegates from different authorities and categories, comprising one economic stakeholder, two scientists and one representative from environmental organizations. A Technical-scientific Committee provides advice to the MPA Management Body, the Director and the MPA Commission. The Coastal Guard is responsible for the enforcement of the regulatory framework of the MPA, as well as of Sicilian and national fishery regulations (D'Anna et al., 2016).

The Egadi Islands are an area of high biodiversity, hosting many protected species such as: the rare monk seal (*Monachus monachus*), which was presumed extinct in Italy; the sea turtle (*Caretta caretta*); cetaceans, such as bottlenose dolphins, sperm whales and dolphins; some species of sharks; hundreds of species of fish; and an important colony of the storm petrel (*Hydrobates pelagicus*), a rare seabird endemic to the Mediterranean. *Astroides calycularis*, a colonial scleractinian coral characterized by the bright orange color of its coenosarc and polyps, inhabits extensive colonies found mainly along the cliffs. The coastal areas and the sea floor of the Egadi islands hosts hundreds of superficial and submerged caves, due to the calcareous nature of the substrates. The low brightness of the overhanging seabed in many cases favours the development of corals. The roughness of the limestone also increases the settlement of larvae and the formation of shelters occupied by a rich cryptic fauna. Within the MPA are important habitats such as the reef-building gastropod *Dendropoma petraeum*, many submerged caves, and sciaphilic populations and meadows of *Posidonia oceanica*. The coasts of the islands are home to delicate environments created from the shells of *Dendropoma petraeum*, a species of sea snail, in association with calcareous algae, which is essential for the protection of the coastline from erosion.

The area is characterized by both a high biodiversity and the occurrence of sensitive species and habitats (Donati, 2015; Vitale et al., 2004) and different human impacts due to multiple uses of the sea, including different kind of fisheries (small scale fisheries, trawlers, purse-seiners, tuna traps), tourism, shipping and others (D'Anna et al., 2016). Currently about 100 small scale fishers are authorized to fish inside the MPA, but only a fraction of them (around 40) regularly operate in the area. Approximately 20 large scale fishers (mostly trawlers) operate in and around the MPA.

The economy of Sicily is welfare-dependent and based on agriculture, fishing and tourism with a high level of unemployment, as is the case in most regions of southern Italy. Land use in the three major islands of the Egadi archipelago is different. Favignana is the most populated island, hosting the largest number of resident people (about 75%) and tourists, where most of the productive activities in the area take place. For this reason, unlike Levanzo and Marettimo – where settlements have largely developed within the historic center – Favignana has recently developed tourist resorts (e.g., holiday homes, accommodation, villages/camping areas), given that its historical settlements are located outside the historic centre and are mainly linked to mining and farming activities. An important issue still under discussion is how to manage the balance between tourism and the resident population looking to encourage local jobs and avoiding depopulation and the invasive use of natural resources that may seriously affect their integrity.

The Egadi MPA belongs to the Natura 2000 Network under the Habitats Directive (92/43/EEC), has been declared a SPAMI (Specially Protected Areas of Mediterranean Importance under the Barcelona Convention) and it is included in the List of the Regional Activity Center for Specially Protected Areas (RAC/SPA) of the UN Environment Program (UNEP).

The MPA is divided into four areas with different protection levels and with different access possibilities and use limitations: (1) Zone A of integral reserve, (2) Zone B of general reserve, (3) Zone C and (4) D both of partial reserve. The MPA includes an area (about half of the total surface) in which trawling (including bottom trawling) is allowed (zone D) and regulated.

Few studies assessing the reserve effect and fisheries benefits of the MPA have been carried out, and the few available suggest no significant ecological and fisheries effects ((Di Franco et al., 2016; Guidetti et al., 2008), unpublished data of some MAPAFISH-MED partners).

6.21.3 Gyaros, Greece

The Gyaros Island MPA is in Greece. In 2011, Gyaros and the surrounding marine area of three nautical miles from its coastline, was listed among the European Natura 2000 sites and was established as a Wildlife Refuge. In 2019 under the Greek Government Gazette 389/Δ'/4.7.2019/ΥΠΕΝ/ΔΔΦΠΒ/58979/1531 it became an MPA and in 2022 under Greek Government Gazette 586/Α'/15.9.2022/ΥΠΕΝ/ΔΔΦΠΒ/92566/2630 it became a full no-take MPA. Between mid-June and mid-September 2022, the MPA was re-opened to SSFs. Since mid-September 2022 the MPA has been a full no take MPA.

The drivers of the MPAs designation were both opportunistic, extending it from a Wildlife Refuge to an MPA, but also to protect threatened or endangered species and habitats and to enhance/replenish fisheries resources of economic value. The island has a dark history as it served as a place of exile since the Roman era and during the recent past. After WWII, Gyaros was established as a concentration camp for displacing political prisoners up until 1974. Afterwards, it was converted to a firing range for the Hellenic Navy up to 2002. As a result of the restricted access to human activities Gyaros has enjoyed a particular 'protected' status for more than five decades; however, a recent study (Dendrinos and Adamantopoulou, 2018) identified

large number of cases of illegal fishing in the area and moreover the state of fish stocks did not show significant differences with other areas that are normally fished and which are even closer to residential areas or fishing ports.

The total area protected covers 250km^2. Until 2022, the MPA was zoned into concentric rings with varying levels of protection around the island of Gyaros, however following the recent gazetting in 2022 the 3nm surrounding the island is a fully- protected area. There is no official management plan, but the objective of the MPA is to address the need for further shielding and protection of the fish fauna of the island of Gyaros and the marine environment in general.

The MPA falls under the responsibility of the Management Unit of the Central Aegean Protected Areas- Natural Environment and Climate Change Agency (NECCA) - Ministry of Environment and Energy, who are also responsible for its day-to-day management and enforcement. Notably, the MPA was established after a lengthy consultation process (2016-2019) among a consortium of diverse stakeholders, the so-called "Gyaros co-management Committee". Although currently any decision-making process concerning the MPA is to be driven through "*consultation with local communities, the primary sector and any stakeholders involved within their areas*", so far NECCA has been gathering 'opinions' limited solely to scientific advice; no other involved stakeholder has been consulted during the one year that the authority is active.

It should be noted that the process to establish Gyaros as an MPA started in 2013 as it was discovered that the island is home to a sizeable Mediterranean monk seal (*Monachus monachus*) breeding colony, reportedly the largest in the Mediterranean Sea (Dendrinos et al., 2020; Karamanlidis et al., 2013).

Key marine habitats include: *Posidonia oceanica* seabeds), coralligenous reefs and maerl beds. Key avifauna include: largest breeding colonies of the Mediterranean Shearwater (>1000 pairs), the breeding Mediterranean Shags (20 pairs), a large colony of Eleonora's Falcons (217 pairs) and several pairs of other raptors, such as Bonelli's Eagle (1 pair), Long-legged Buzzard (1 pair), Common Buzzard (3-4 pairs) and Kestrel (3-5 pairs). Key Marine fauna include: Mediterranean noble pen shell-*Pinna nobilis* (IUCN Critically Endangered); Dusky grouper-*Epinephelus marginatus;* Mediterranean slipper lobster- *Scyllarides latus*. Several commercially important species are quite abundant inside the MPA; just to mention the more common: groupers (*Epinephelus* spp.), spiny lobsters *Palinurus elephas*, scorpionfish (*Scorpaena* spp.), Mediterranean parrotfish *Sparisoma cretense*; Black seabream *Spondyliosoma cantharus*; and Red porgy *Pagrus pagrus*.

Gyaros has been uninhabited since the 1970s. Three neighbouring islands Syros, Andros and Kythnos are the most connected islands to Gyaros, and were therefore considered in this study. Andros is largely dependent on the primary sector with the secondary and tertiary sectors being less developed. By contrast, Syros has a limited primary sector, yet has a moderately developed secondary sector and an adequately developed tertiary sector, given it is the administrative centre of the Cyclades region. Kythnos being the smallest of all three neighbouring islands, has a limited economic activity, mostly depending on the primary sector, as tourism is still developing. One reason is the infrequent connection with the mainland and the small size of ferries operating on this route. The surrounding islands of the North Cyclades complex host 220 officially registered small-scale fisheries vessels, while the whole Cyclades area

hosts more than 1,000 small-scale fisheries vessels (HELSTAT, 2020; Kavadas et al., 2013); however, the actual number of active vessels is much lower. According to the official statistics (HELSTAT, 2020), the Cyclades SSFs land more than 1,900 tons of fish, with their main target species being: striped red mullets *Mullus surmuletus*, bogue *Boops boops*, chub mackerel *Scomber colias*, scorpionfish *Scorpaena scrofa*, parrotfish *Sparisoma cretense*, and spiny lobster *Palinurus elephas*.

Fisheries contribute very little to the economic development of the three neighbouring islands which are home to a dwindling number of small-scale fishers. At the time of study Syros had 100 licenced and 15 actively fishing SSFs, while Andros had 60 licensed and 10 active. Finally, Kythnos had 12 licensed, 8 of them active. It should be noted that inshore/amateur fishers are an important sector that have potential negative impacts on marine resources. In the neighbouring islands, only 1 trawler and 1 purse seiner are registered; both can be accounted as belonging to the large-scale fishery sector. However, the area is frequently visited by foreign large-scale fishery vessels; their activity is difficult to measure. Based on VMS/AIS fishing footprint, their effort is limited in the area surrounding Gyaros. Their activity has been greatly reduced since 2018, when a surveillance and guard program became fully operational. In general, the Greek fishing fleet is in a state of rapid decline (25,000 vessels in 1995; 12,000 vessels in 2022) and so are the catches. In the surrounding area of Gyaros, current catches are the lowest since 1990; the peak was 8000 tons in 1994 and are currently down to 1900 tons. Tourism is one of the most important economic sectors for the Cyclades islands.

No commercial activity is allowed in the MPA. Currently there is an effort to install offshore wind farms within the protected zones (3 n.m. from the coastline); however, this is still under debate. No recreational activity other than sailing and diving are allowed in the MPA. Anchoring is allowed only in certain anchoring buoys and diving in designated underwater trails. The terrestrial part of the MPA is considered a monument of historical importance and access is not allowed. Furthermore, the island, being a military firing range for many years, is not safe for visitors as it is full of scattered ammunition.

6.21.4 Ropotamo, Bulgaria

Ropotamo is a Special Area of Conservation (SAC) in Bulgaria and belongs to the Natura 2000 network under the European Habitats Directive (92/43/EEC). The MPA covers 982 km^2, of which 89.9% is marine (881.91 km^2). The protected area includes both coastal and marine areas along the Bulgarian Black Sea coast. The terrestrial part includes wetlands of international importance according to the Ramsar Convention.

The driver for Ropotamo SAC was the Natura 2000 network which requires Member States of the European Union to designate protected areas to reach regional and international targets by 2030. Ropotamo was designated as a site of community interest (SCI) in 2007 by Ministerial Decision No. 122/02.03.2007 (promulgated SG 21/2007). The marine part was modified by Ministerial Decision No. 660/01.11.2013 (promulgated SG 97/2013). It was designated as an SAC by the Ministry of Environment and Water under Order No. RD – 1042/17.12.2020 (promulgated SG 19/2021), according to the Habitat Directive with prohibitions and restrictions on

activities contradicting the conservation objectives of the site. The terrestrial part was extended by Ministerial Decision No. 564/30.07.2021 (promulgated SG 64/2021).

The MPA falls under the responsibility of the Black Sea Basin Directorate (BSBD) – Varna, Regional Inspectorate of Environment and Water – Burgas and the Ministry of Environment and Waters (MoEW). At present no management plan for SAC Ropotamo has been developed or implemented. The specific objectives of SAC Ropotamo and measures for their achievement were developed and approved by the Minister of Environment in 2023. This document will serve as the basis for the development of a management plan.

In 2017, the MoEW approved a new management approach for the Natura 2000 network that envisions establishment of management bodies at regional level in addition to the current national governance by Natura 2000 Department at MoEW. However, the reform is still underway and regional management bodies are not set up yet. The approach requires development of management plans for all protected areas. To authorise this requirement, a Law on Amendments and Supplements to the Law on Biological Diversity has been prepared. Now, these laws have been adopted by Decision of the Council of Ministers No. 147/05.03.2020. Consideration of the laws is pending at the National Assembly. In this regard, the development of plans for the management of the protected areas is pending, but this process can only start after the adoption of the new laws. The management plan development shall be funded by the Operational Program "Environment" for the period 2021-2027. A National information and communication strategy for the Bulgarian Natura 2000 network was developed for 2014 - 2023 with the objectives to evaluate the major challenges, information needs and to define communication activities, establish the required funding, and deadlines for the sites' implementation. An information system for Nature 2000 has been established in Bulgaria, which offers shared access to up-to-date data for all stakeholders.

Ropotamo SAC's objectives are to protect and maintain the specified types of natural habitats, the habitats of the specified species, their populations and distribution within the boundaries of the area to achieve and maintain their favourable conservation status in the Black Sea biogeographical region; if necessary, improving the condition or restoring the types of natural habitats, the habitats of the specified species and their populations.

Ropotamo SAC is characterized by a variety of habitats with high conservation importance, high biodiversity, good ecological status– including the unique biogenic reefs of the European oyster (*Ostrea edulis*), the rare sciophilous association of the red alga *Phyllophora crispa* on infralittoral rocks, productive communities of photophilic brown macroalgae (*Cystoseira* spp.), mussel banks (*Mytilus galloprovincialis*) on sediments, with a wide variety of invertebrates and fish, sand banks and seagrass meadows. The marine area is an important habitat for genus *Alosa* species, providing feeding grounds and migration routes to spawning grounds. The area is important for the three small cetacean populations found in the Black Sea. The zone is the largest MPA of the ecological network Natura 2000 in the Bulgarian Black Sea.

The following types of natural habitats and species are listed as being under protection: Sandbanks which are slightly covered by sea water all the time (code

1110); Estuaries (1130); Mudflats and sandflats not covered by seawater at low tide (code 1140); Coastal lagoons (code 1150); Large shallow inlets and bays (code 1160); Reefs (code 1170); Submerged or partially submerged sea caves (code 8330); habitats for marine mammals: harbor porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*) and fishes (*Alosa immaculata* and *Alosa tanaica*).

In the terrestrial part of the protected area, there are several small villages with approximately 6383 residents (2022) in total and small fishing communities with fishing harbors. During the summer, the population is significantly boosted by tourism, which brings additional income to the local communities but brings its own anthropogenic challenges. In the area of the protected area, there is only one fishing port, Primorsko, accounting for ~ 129 registered professional small-scale boats. These boats have lengths between 3.60 and 11 m. In the surrounding area beyond the protected area there is another harbour, Tsarevo, which has ~179 registered large-scale and small-scale fishery boats (lengths between 3.95 – 14.20 m), that use SAC Ropotamo for fishing. No specific prohibitions related to fishing gear and target species are currently in place in the protected area. In general, the Fisheries and Aquaculture Act prohibits the use of bottom trawls and dredges for fishing in all marine waters under national jurisdiction. Seasonal fishing closures are introduced annually during the spawning period in spring by the Minister of Agriculture and Food. The area is used for aquaculture of blue mussels. The main economic sector is tourism (82.4% of income and 81% of employment), followed by agriculture, forestry and fisheries (5.48% of income and 3.9% of employment) and other underdeveloped industries – construction, processing industry and other.

6.21.5 Torre Guaceto, Italy

The Torre Guaceto MPA is in the south of Italy on the Adriatic side (north-east of Salento peninsula, Puglia, Italy), and covers 22.27km^2. It was designated in 1991 by Ministerial Decree (Decreto Ministeriale 4 dicembre 1991 - Istituzione della riserva naturale marina denominata "Torre Guaceto" (G.U. 19 maggio 1992, n. 115)). The driver of the MPA was to reverse trends of overfishing and environmental decline. Torre Guaceto MPA was established in a complex context, characterised by a poorly performing regional economy, large shadow economy, high levels of unemployment and crime. Prior to the designation of the terrestrial and marine protected areas, the environment was highly degraded. Fishing activities were not well controlled and illegal fishing was common, including the use of dynamite fishing. The objectives of the MPA were designed to: protect the coastal and marine ecosystems and heritage; support studies to improve knowledge about the area to develop appropriate management strategies; disseminate knowledge related to coastal and marine environments; support sustainable exploitation of fisheries resources; and promote sustainable socio-economic development of the area.

The MPA falls under the responsibility of the Ministry of the Environment, as do all nationally-designated MPAs in Italy. Torre Guaceto is also a Special Area of Protection under the European Birds Directive (2009/147/EC). The SPA site includes the adjacent Macchia S. Giovanni, and extends for 798km^2, 95% of which is marine. The MPA has an implemented management plan and since 2001, daily management of the MPA is under the responsibility of the Management Consortium of Torre Guaceto,

composed by the two municipalities with territorial jurisdiction, i.e., Brindisi and Carovigno, and WWF Italy. Prior to this the responsibility fell to the Italian Coast Guard. In 1991, when the MPA was created, fishing was forbidden, but the regulations were not enforced. In 2000 the terrestrial protected area was designated, and in the same year the managing Consortium to manage both the terrestrial and marine protected areas.

Key habitat types include rocky reefs, *Posidonia oceanica* seagrass beds, macroalgae and coralligenous assemblages. A reserve effect (i.e., an improvement in the density and size of fish species) in Torre Guaceto after the designation of the MPA and the onset of effective management has been documented by several studies (e.g., (Di Franco et al., 2016; Guidetti et al., 2014; Sala et al., 2012). The improvements in target species populations in Torre Guaceto translates into economic benefits for the resident fishers. This was particularly true in the years immediately after the four-year ban on fishing was lifted in 2004. In 2005 the average catch per unit effort (CPUE) inside the MPA was almost five-fold compared to that outside the MPA (Claudet and Guidetti, 2010; Guidetti et al., 2010). Fish catch has since declined, as fishing activities have resumed, but for a certain number of years catch remained the double of that of surrounding waters (Claudet and Guidetti, 2010).

The MPA has three different levels of protection: A, B, and C. There are two A Zones (1.8 km^2 in total), which are fully-protected areas (no-take and no access). Zone B (1.6 km^2) is a highly-protected zone, no-take but access buffer zone, used for swimming, research activities and guided tours. Zone C (~ 18.9 km^2) is used for the abovementioned activities and by small-scale fishers. Fishing can be carried out only by small-scale, fulltime fishers who have been living in Carovigno and Brindisi (the two municipalities near Torre Guaceto) since 2013. This rule prevents fishers acquiring residence in these villages to obtain permission to fish in the MPA. Currently, 13 small scale fishers are authorized to fish inside the MPA and rules limit the number of days and gears used.

6.22 Surveys for stakeholders:

6.23 Small-scale fishers (SSF)

- MPA ID:
- COUNTRY:
- DATE:

MAPAFISH-MED SURVEY – SMALL SCALE FISHERS

Please read the following "VERBAL CONSENT SCRIPT":

- You are being asked to participate in a survey for an EU funded research project entitled - ***Mapping of marine protected areas and their associated fishing activities: Mediterranean and Black Seas*** **(MAPAFISH-MED)**.
- This research is being undertaken by Stazione Zoologica in collaboration with all the MAPAFISH-MED project partners (feel free to contact Antonio Di Franco (antonio.difranco@szn.it) and/or Kate Hogg (kate.hogg@szn.it) if you have any questions).
- The project focuses on fishing activities in places within and surrounding marine protected areas in the Mediterranean and Black Seas. You are being asked to participate because you have a lot of expertise and knowledge on this topic.
- The benefit of participating in this study is that it will allow your voice to be heard and to inform management strategies for fisheries inside and around marine protected areas.
- The results of the project will be published in various formats, including publications and reports, and shared with managers and decision-makers.
- All data collected through this questionnaire will be anonymous. No names or personal information will be included. The data will be securely stored by the project partnership but may be shared with other researchers.
- If the data is shared with other researchers, no personal information will be included.
- Data will be used in the project's reports at an aggregated level.
- The survey will take about 45 minutes of your time. Your participation is voluntary, and you can withdraw from the study at any point.

Please confirm that you are willing to participate and be interviewed for this study.

Please check this box to verify that you have read the verbal consent script and confirmed the consent of the interviewee to participate in the study ☐

Interviewer (Name, Signature, Date):

INSTRUCTIONS TO INTERVIEWER: Quickly explain to the interviewee that there are 4 sections to the survey that focus on 1) Fishing activities, 2) Change in fishing activities overtime, 3) perceptions of MPA management, and 4) background information about the respondent. When you arrive at each section of the survey, quickly introduce what that section is about.

Note to interviewer: Small-scale coastal fleet (SCF) - includes all vessels under 12 metres using static gears; Large-scale fleet - segment includes all vessels over 12 metres using static gears and all vessels using towed gears

SECTION 1 – FISHING

REMINDER TO INTRODUCE SECTION: Explain to the interviewee that this section of the survey is to help us to understand more about their fishing activities.

- How many years have you been fishing?
- And here in xx? *(Note to interviewer: give name of the local area)*
  Note to interviewer try to clarify from their answer if this was before or after the MPA was created and limited fishing activities…. So select the correct response:

Ok so you started fishing here **before** or **after** the MPA was created and the regulations were applied to fishing activities (or whatever is relevant as a key point for your MPA e.g., management body present, regulations enforced) etc.

- Before
- After

Note to interviewer: remember this response for section 2.

Are you a

- Boat owner
- Captain
- Crew member
- Fish from Shore

How many people work on the boat in total?

If owner, how many boats do you own?

What is the overall length of your boat(s) from bow to stern in meters? (if more than one boat, list size for each one separately)

Have you always operated as a small-scale fisher?

- Yes
- No
- Don't know
- No answer

If no, **when** and **why** did you change? *(NOTE TO INETRVIEWER PROMPT: try to understand the year or if it had anything to do with the creation of the MPA, its regulations or a key point in the MPAs history)*

In the last 5 years have you used your boat for any other activity other than fishing?

- pesca tourism
- support aquaculture
- monitoring or data collection in the MPA
- surveillance of the MPA
- other please describe
- none

On average, over the year, how many days of the week do you fish inside and outside the MPA?

- __Days of the Week Fishing Inside the MPA
- __Days of the Week Fishing Outside the MPA
- If you fish outside of the MPA, how far from the MPA are the areas you generally fish (in nautical miles)?

(NOTE TO INTERVIEWER can prompt maximum 1 nautical mile, so very close to the MPA, or 5 nautical miles from the MPA, or 10 or more…)

SECTION 2 – CHANGE IN FISHING ACTIVITIES OVER TIME

REMINDER: Explain that this section is to help us to understand their perceptions of how fishing activities have changed over time (in relation to the MPA). In this section you will use TWO – THREE copies of the map of the area with grid lines, when fishers indicate where they fish(ed) please shade in the Map.

How have fishers here historically agreed/decided how to distribute fishing grounds among fishers within the local community (who fishes in what area/fishing grounds)? *(PROMPT: are there historical family fishing grounds, or is it based on gear/ target species/ or is there no agreement, or your fishing activities overlap?)*

NOTE TO INTERVIEWER use the answer to the previous questions in section 1 to guide which questions to ask in this section. If were fishing before use grids NOW and BEFORE, if after use grids NOW and NO MPA.

NOTE TO INTERVIEWER – USE GRID 1: NOW.

- Please, can you indicate on the map where the fishers in this community fish?
- If you are happy to, please can you indicate more specifically where you fish? (please, indicate one or more polygons for each combination of gear and target fish)
- What types of gears do you use? Circle or shade table below for each gear mentioned
- What species/groups of species are you targeting? Circle or shade for each gear mentioned
- What time of year do you use (NOTE TO INTERVIEWER: list the gear types they mentioned and shade calendar) to fish?

What gear types did you use?	What species/groups do you target?	What time of year do you fish											
		J	F	M	A	M	J	J	A	S	O	N	D
Fixed nets (e.g., trammel, gillnet)	Red mullet												
	Scorpionfish												
	Seabreams												
	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Bottom Longlines	Hakes												
	Sea-breams												
	Other (specify)												
Pelagic Longlines	Tuna-like species												
	Sword-fish												
	Other (specify)												
Pots/Traps	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Harvesting techniques	Clams, oysters, urchins												
	Other (specify)												

Note to interviewer: based on the answers above select the correct question below:

- If fish with nets: How many meters of net do you use when you go fishing? _____ meters
- If fish with pots/traps: how many pots/traps do you set when you go fishing? _____
- If fish with pelagic longlines: How many hooks do you use when you go fishing? _____ hooks
- If fish with bottom longlines: How many hooks do you use when you go fishing? _____ hooks

Use grid 2:Se Grid 2: Before MPA
Ask only if they fished before the MPA

- Please, can you indicate on the map where the fishers here fished before the MPA was established?
- If you are happy to, please can you indicate where you fished before the MPA was established? (please, indicate one or more polygons for each combination of gear and target fish)
- What types of gears did you use? Circle or shade table below for each gear mentioned
- If you have changed boat what was the overall length of the boat(s) from bow to stern you were using? (if more than one boat, list size for each one separately)
- What species were you targeting? Circle or shade for each gear mentioned
- What time of year did you use … (list gear types mentioned and shade calendar)

What gear types did you use?	What species/groups do you target?	What time of year do you fish											
		J	F	M	A	M	J	J	A	S	O	N	D
Fixed nets (e.g., trammel, gillnet)	Red mullet												
	Scorpionfish												
	Seabreams												
	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Bottom Longlines	Hakes												
	Sea-breams												
	Other (specify)												
Pelagic Longlines	Tuna-like species												
	Sword-fish												
	Other (specify)												
Traps	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Harvesting techniques	clams, oysters, urchins												
	Other (specify)												
Purse seines													
Beach seines													
Beam Trawl													
Bottom trawl													
Dredges													
Other (specify)													

ASK ONLY IF THEY FISHED AFTER THE MPA

USE GRID 3: **NO** MPA

Please try and imagine that there had never been an MPA here… the MPA was never created…Please, can you indicate on the map where you would fish? Can prompt… if you consider fuel costs, distance, habitat type, fish availability(please, indicate one or more polygons for each combination of gear and target fish)

- What types of gears would you use? Circle or shade table below for each gear mentioned
- What type of vessel would you use to fish with?
- What species would you target? Circle or shade for each gear mentioned
- What time of year would you use … (list gear types mentioned and shade calendar)

What gear types did you use?	What species/groups do you target?	What time of year do you fish											
Fixed nets (e.g., trammel, gillnet)		J	F	M	A	M	J	J	A	S	O	N	D
	Red mullet												
	Scorpionfish												
	Seabreams												
	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Bottom Longlines	Hakes												
	Sea-breams												
	Other (specify)												
Pelagic Longlines	Tuna-like species												
	Sword-fish												
	Other (specify)												
Traps	Lobster												
	Cephalopod												
	Multi species fish												
	Other (specify)												
Harvesting techniques	clams, oysters, urchins												
	Other (specify)												
Purse seines													
Beach seines													
Beam Trawl													
Bottom trawl													
Dredges													
Other (specify)													

*Note to interviewer: if the maps indicate **different** fishing grounds before and after the MPA ask:*

So I see from the maps of fishing grounds that they changed between the before and after the MPA. When the MPA was created did you:

- Reduce your overall fishing activity
- Move part of your activity to fishing grounds that you were already using before the MPA was created
- Move all of your activity to fishing grounds that you were already using before the MPA was created
- Moved part of your activity to new fishing grounds that you were not using before the MPA was created
- Moved all of your activity to new fishing grounds that you were not using before the MPA was created
- Don’t know
- No answer

Did the MPA change how the fishers here *agreed/decided who fishes in what area/fishing grounds?*

- Yes… how?
- No
- Don't know
- No answer

We are going to ask you a series of questions, please tell us on a scale of 1 to 5 if, you feel, there has been an increase or a decrease where 1 is a large decrease, 2 decrease, 3 neutral, 4 increase and 5 is a large increase.

Note to interviewer: if they ask for clarification about what large or small decrease/increase means remind them that it's just their perception/how they feel.

What effect does the MPA have on…

	1	2	3	4	5	No Answer	Don't Know
Your access to productive fishing grounds?							
The costs associated with your fishing activity?							
The quantity of fish you catch?							
The size of the fish you catch?							
The percentage of discards you have to deal with in your catch							
The quantity of higher value species you catch?							
The quantity of lower value species you catch?							
The profitability of your fishing business?							
The price per kilo for the fish you catch in the MPA?							
The income you personally receive from fishing?							
The income you receive from other activities (e.g., pescatoursim, tourism)							
The number of other commercial fishers fishing in the areas that you fish?							
The number of recreational fishers fishing in the areas that you fish?							
The number of other users or activities (e.g., diving, tourism, aquaculture) in the areas where you fish?							
The overall level of poaching?							
Your need to diversify your livelihood to meet a satisfactory level of well-being?							
Your ability to diversify your livelihood? *(if needed Prompt e.g., thanks to increased opportunities provided by the MPA for tourism, or improvements to their financial/technical situation or capacity)*							

- On a scale of 1 -5 how well do you feel with how you have adapted your fishing activity to the MPA? (where 1 is not well at all and 5 is very well)
- On a scale of 1-5 how supportive are you of the MPA? (where 1 is totally opposed and 5 is very supportive)
- On a scale of 1-5 what has been the overall impact of the MPA on your fishing "business"? Where 1 is very negative and 5 is very positive.
- How strongly do you agree that the MPA is necessary to protect the seabed and marine species? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA is necessary to protect fish spawning and nursery areas and juveniles? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA is necessary to protect fish stocks? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA can contribute to minimise incidental catches of sensitive/vulnerable species? Where 1 is totally disagree and 5 is completely agree
- How compatible do you feel small scale fishing activities are with the goal of the MPA to protect marine ecosystems and fish stocks? Where 1 is not at all compatible and 5 is very compatible. By compatible we mean how well do you think they exist together.

SECTION 3 – PERCEPTIONS OF MPA MANAGEMENT & GOVERNANCE

REMINDER: Explain that this section is to help us to understand their perceptions of and satisfaction with MPA management.

We are going to ask you another series of statements, please tell us on a scale of 1 to 5 how strongly you agree where 1 is completely disagree and 5 is strongly agree.

	1	2	3	4	5	Don't know	No answer
When the MPA was created **small-scale** fishers were treated fairly							
When the MPA was created **large scale** fishers were treated fairly							
When the MPA was created **small-scale** fishers were adequately consulted regarding its design or what areas would be included							
When the MPA was created **large scale** fishers were adequately consulted regarding its design or what areas would be included							
If decisions are made about the MPA **now** regarding its design or new measures fishers are adequately consulted							
The MPA (management) aligns with the livelihood needs of local fishers							
Traditional knowledge of local fishers is documented and included in the MPA management							
The MPA is generally well and effectively managed (e.g. defining clear conservation objectives and measures, and monitoring them appropriately).							

On a scale of 1 -5 how much involvement is there of small-scale fishers from your community in MPA decision-making and management activities? Where 1 is no involvement at all and 5 is very high level of involvement

SECTION 4- BACKGROUND INFORMATION ABOUT THE INTERVIEWEE

REMINDER TO INTRODUCE SECTION AND EXPLAIN: Explain to the interviewee that this section of the survey is to help us to understand more about who they are and how much they rely on small-scale fisheries.

Interviewee's gender?

- Male
- Female
- Non binary
- Prefer not to say

What is your age group?

- 20-30 years old
- 30-40 years old
- 40-50 years old

- 50-60 years old
- 60+ years old

What is your highest level of education completed?

- Elementary school
- Middle school
- High school
- University degree – Bachelors or higher
- None

How many people live in your household?

Where does the interviewee live? *(Could be filled out directly by the interviewer).*

Village name:

How many years have you lived in this village? Please list # of years:

Where are you from originally?

- the local town or village
- the nearby area (same county, province, etc)
- the same country
- another country

What percentage of your household (family) income comes from small- scale fisheries?

- less than half (of household income comes from small-scale fisheries)
- more than half (of household income comes from small-scale fisheries)
- all (of household income comes from small-scale fisheries)

NOTE TO INTERVIEWER: to be asked only if the reply to the previous question was option 1 or 2.

5.8b How many livelihoods, including fishing, do you participate in?

- 1 (only fishing)
- 2
- 3
- 4+

(in case reply is different from "1 (only fishing)", ask "what are the other occupations you are employed in?"

Do other immediate family members fish for a living?

- Yes
- No

END OF SURVEY

REMINDER TO INTERVIEWER:

- Ask the interviewee if they have any questions for you/us or anything else that they want to tell us about the impact the MPA has had on their fishing activities.
- Thank the interviewee for taking time to participate in the interview.

6.23.1 Large-scale fishers (LSF)

- MPA ID:
- COUNTRY:
- DATE:

MAPAFISH-MED SURVEY – LARGE SCALE FISHERS

Please read the following "VERBAL CONSENT SCRIPT":

- You are being asked to participate in a survey for an EU funded research project entitled - ***Mapping of marine protected areas and their associated fishing activities: Mediterranean and Black Seas*** **(MAPAFISH-MED)**.
- This research is being undertaken by Stazione Zoologica in collaboration with all the MAPAFISH-MED project partners (feel free to contact Antonio Di Franco: antonio.difranco@szn.it and/or Kate Hogg kate.hogg@szn.it if you have any questions).
- The project focuses on fishing activities in places within and surrounding marine protected areas in the Mediterranean and Black Seas. You are being asked to participate because you have a lot of expertise and knowledge on this topic.
- The benefit of participating in this study is that it will allow your voice to be heard and to inform management strategies for fisheries inside and around marine protected areas.
- The results of the project will be published in various formats, including publications and reports, and shared with managers and decision-makers.
- All data collected through this questionnaire will be anonymous. No names or personal information will be included. The data will be securely stored by the project partnership but may be shared with other researchers.
- If the data is shared with other researchers, no personal information will be included.
- Data will be used in the project's reports at an aggregated level.
- The survey will take about 45 minutes of your time. Your participation is voluntary, and you can withdraw from the study at any point.

Please confirm that you are willing to participate and be interviewed for this study.

Please check this box to verify that you have read the verbal consent script and confirmed the consent of the interviewee to participate in the study ☐

Interviewer (Name, Signature, Date):

INSTRUCTIONS TO INTERVIEWER: Quickly explain to the interviewee that there are 4 sections to the survey that focus on 1) Fishing activities, 2) Change in fishing activities overtime, 3) perceptions of MPA management, and 4) background information about the respondent. When you arrive at each section of the survey, quickly introduce what that section is about.

Note to interviewer: Small-scale coastal fleet - includes all vessels under 12 metres using static gears; Large-scale fleet - segment includes all vessels over 12 metres using static gears and all vessels using towed gears

SECTION 1 – FISHING

REMINDER TO INTRODUCE SECTION: Explain to the interviewee that this section of the survey is to help us to understand more about their fishing activities.

- How many years have you been fishing?
- And here in … Note to interviewer: give name of the local area?

Ok so you started fishing here **before** or **after** the MPA was created and the regulations were applied to fishing activities (or whatever is relevant as a key point for your MPA e.g., management body present, regulations enforced) etc.

- Before
- After

Are you a:

- Boat owner
- Captain
- Crew member
- Fish from Shore

How many people work on the boat in total?

If owner, How many boats do you own?

What is the overall length of your boat(s) from bow to stern in meters? (if more than one boat, list size for each one separately)

In the last 5 years, have you used your boat for any other activity other than fishing?

- pesca tourism
- support aquaculture
- monitoring or data collection in the MPA
- surveillance of the MPA
- other please describe
- none

Have you always operated as a large-scale fisher?

- Yes
- No
- Don't know
- No answer

If no, when and why did you change? *(NOTE TO INETRVIEWER PROMPT: try to understand the year or if it had anything to do with the creation of the MPA, its regulations or a key point in the MPAs history)*

SECTION 2 – CHANGE IN FISHING ACTIVITIES OVER TIME

REMINDER: Explain that this section is to help us to understand their perceptions of how fishing activities have changed over time (in relation to the MPA).

How have the fishers here agreed/decided who fishes in what area/fishing grounds? *(PROMPT: are there historical family fishing grounds, or is it based on gear/ target species/ or is there no agreement, or your fishing activities overlap?)*

NOTE TO INTERVIEWER if unsure from their previous answer about how long they have been fishing here and year of MPA establishment ask the following question, or use the answer to the previous questions to guide which questions to ask in this section

Do you think the MPA change how the fishers here *agreed/decided who fishes in what area/fishing grounds?*

- Yes… how?
- No
- Don't know
- No answer

We are going to ask you a series of questions, please tell us on a scale of 1 to 5 if there has been an increase or a decrease where 1 is a large decrease, 2 is decrease, 3 is neutral, 4 is large increase and 5 is a large increase.

Note to interviewer: if they ask for clarification about what large or small decrease/increase means remind them that it's just their perception/how they feel.

What effect does the MPA have on…

	1	2	3	4	5	No Answer	Don't Know
Your access to productive fishing grounds?							
The costs associated with your fishing activity?							
The quantity of fish you catch?							
The size of the fish you catch?							
The percentage of discards you have to deal with in your catch							
The quantity of higher value species you catch?							
The quantity of lower value species you catch ?							
The profitability of your fishing business?							
The income you personally receive from fishing?							
The income you receive from other activities (e.g., pescatoursim, tourism)							
The number of other commercial fishers fishing in the areas that you fish?							
The number of recreational fishers fishing in the areas that you fish?							
The number of other users or activities (e.g., diving, tourism, aquaculture) in the areas where you fish?							
The overall level of poaching?							
Your need to diversify your livelihood?							
Your ability to diversify your livelihood?							

- On a scale of 1 -5 how well do you feel with how you have adapted your fishing activity to the MPA? Where 1 is not well at all and 5 is very well.
- On a scale of 1-5 how supportive are you of the MPA? (where 1 is totally opposed and 5 is very supportive)
- On a scale of 1-5 what has been the overall impact of the MPA on your fishing "business"? Where 1 is very negative and 5 is very positive.
- How strongly do you agree that the MPA is necessary to protect the seabed and marine species? Where 1 is totally disagree and 5 is completely agree

- How strongly do you agree that the MPA is necessary to protect fish spawning and nursery areas and juveniles? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA is necessary to protect fish stocks? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA can contribute to minimise incidental catches of sensitive/vulnerable species? Where 1 is totally disagree and 5 is completely agree
- How compatible do you feel large scale fishing activities are with the goal to protect marine ecosystems and fish stocks? Where 1 is not at all compatible and 5 is very compatible. By compatible we mean how well do you think they exist together.

SECTION 3 – PERCEPTIONS OF MPA MANGEMENT & GOVERNANCE

REMINDER: Explain that this section is to help us to understand their perceptions of and satisfaction with MPA management.

We are going to ask you another series of statements, please tell us on a scale of 1 to 5 how strongly you agree where 1 is completely disagree, 2 is disagree, 3 neutral, 4 agree and 5 is strongly agree.

	1	2	3	4	5	Don't know	No answer
When the MPA was created **small-scale** fishers were treated fairly							
When the MPA was created **large scale** fishers were treated fairly							
When the MPA was created **small-scale** fishers were adequately consulted regarding its design or what areas would be included							
When the MPA was created **large scale** fishers were adequately consulted regarding its design or what areas would be included							
If decisions are made about the MPA **now** regarding its design or new measures fishers are adequately consulted							
The MPA (management) aligns with the livelihood needs of local fishers							
Traditional knowledge of local fishers is documented and included in the MPA management							
The MPA is generally well and effectively managed (e.g., defining clear conservation objectives and measures, and monitoring them appropriately).							

On a scale of 1 -5 how much involvement is there of large-scale fishers from your community in MPA decision-making and management activities? (where 1 is no involvement at all and 5 is very high level of involvement)

SECTION 4- BACKGROUND INFORMATION ABOUT THE INTERVIEWEE

REMINDER TO INTRODUCE SECTION AND EXPLAIN: Explain to the interviewee that this section of the survey is to help us to understand more about who they are and how much they rely on small-scale fisheries.

Interviewee's gender?

- Male
- Female
- Non binary
- Prefer not to say

What is your age group?

- 20-30 years old
- 30-40 years old
- 40-50 years old
- 50-60 years old
- 60+ years old

What is your highest level of education completed?

- Elementary school
- Middle school
- High school
- University degree – Bachelors or higher
- None

How many people live in your household? List #

Where does the interviewee live? Village name *(Could be filled out directly by the interviewer).*

How many years have you lived in this village? Please list # of years:

Where are you from originally?

- the local town or village
- the nearby area (same county, province, etc)
- the same country
- another country

END OF SURVEY

REMINDER TO INTERVIEWER:

- Ask the interviewee if they have any questions for you/us or anything else that they want to tell us about the impact the MPA has had on their fishing activities.
- Thank the interviewee for taking time to participate in the interview.

6.23.2 Key informants (KIs)

- MPA ID:
- COUNTRY:
- DATE:

MAPAFISH- MED SURVEY – KEY INFORMANTS (KIs)

Please read the following "VERBAL CONSENT SCRIPT":

- You are being asked to participate in a survey for an EU funded research project entitled - ***Mapping of marine protected areas and their associated fishing activities: Mediterranean and Black Seas*** **(MAPAFISH-MED)**.
- This research is being undertaken by Stazione Zoologica in collaboration with all the MAPAFISH-MED project partners (feel free to contact Antonio Di Franco: antonio.difranco@szn.it and/or Kate Hogg kate.hogg@szn.it if you have any questions.
- The project focuses on fishing activities in places within and surrounding marine protected areas in the Mediterranean and Black Seas. You are being asked to participate because you have expertise and knowledge on this topic.
- The benefit of participating in this study is that it will allow your voice to be heard and to inform management strategies for fisheries inside and around marine protected areas.
- The results of the project will be published in various formats, including publications and reports, and shared with management and decision-makers.
- All data from this project will be anonymous. No names or personal information will be included. The data will be securely stored at Stazione Zoologica but may be shared with other researchers.
- If the data is shared with other researchers, no personal information will be included.
- The survey will take about 45 minutes of your time. Your participation is voluntary, and you can withdraw from the study at any point.
- Please confirm that you are willing to participate and be interviewed for this study.

Please check this box to verify that you have read the verbal consent script and confirmed the consent of the interviewee to participate in the study. ☐

Interviewer (Name, Signature, Date):

INSTRUCTIONS TO INTERVIEWER: Quickly explain to the interviewee that there are 4 sections to the survey that focus on 1) Institutional background and their job role, 2) Change in fishing activities overtime, 3) perceptions of MPA management, and 4) background information about the respondent. When you arrive at each section of the survey, quickly introduce what that section is about.

Note to interviewer: Small-scale coastal fleet (SCF) - includes all vessels under 12 metres using static gears; Large-scale fleet - segment includes all vessels over 12 metres using static gears and all vessels using towed gears

SECTION 1 – INSTITUTIONAL BACKGROUND

REMINDER TO INTRODUCE SECTION: Explain to the interviewee that this section of the survey is to get a little information about the institution they work for/represent and their role.

- Current position
- Length of time in this institution:
- Organisation/department:
- What are the main purposes and priorities of your organisation or department?
- What are your main responsibilities?

- What role have you had in any of the decisions made regarding the (NAME) MPA?

SECTION 2 – CHANGE IN FISHING ACTIVITIES OVER TIME

REMINDER: Explain that this section is to help us to understand their perceptions of how fishing activities have changed over time (in relation to the MPA).

- Do you know if the fishers here have ways to agree or decide where each fisher will fish? If needed prompt: For example, traditional family fishing grounds, target species, or gear type?
- Do you think this changed when the MPA was established and actively managed? If yes, in what way?
- What effect do you think the MPA had on fishers when it was first created and what about now?
- If you can, please can you indicate on the map any changes in fishing grounds or activities that you are aware of following the MPAs creation?

We are going to ask you a series of questions, please tell us on a scale from 1 -5 if there has been a decrease or increase where 1 is a large decrease, 2 decrease, 3 neutral, 4 increase, and 5 is a large increase*. Note to interviewer: if they ask for clarification about what large or small decrease/increase means remind them that it's just their perception/how they feel.*

In your opinion what impact does the MPA have on…

	1	2	3	4	5	No Answer	Don't Know
Fishers access to productive fishing grounds?							
The costs associated with their fishing activity?							
The quantity of fish they catch?							
The size of the fish they catch?							
The percentage of discards they have to deal with in your catch							
The quantity of higher value species they catch?							
The quantity of lower value species they catch?							
The profitability of their fishing business?							
The price per kilo for the fish they catch in the MPA?							
The income they receive from fishing?							
The income they receive from other activities (e.g., pescatourism, tourism?)							
The number of other commercial fishers fishing in the same areas?							
The number of recreational fishers fishing in the same areas?							
The number of other users or activities (e.g., diving, tourism, aquaculture) in the same areas							
The overall level of poaching							
Fishers' need to diversify their livelihood							
Fishers' ability to diversify their livelihood							

On a scale of 1 -5 how well do you feel the local fishers have adapted their fishing activity to the MPA? (where 1 is not very well and 5 is very well).

Overall on a scale of 1-5 what has been the overall impact of the MPA on local fishers fishing "business"? Where 1 is very negative and 5 is very positive.

SECTION 3 – PERCEPTIONS OF MPA MANAGEMENT & GOVERNANCE

REMINDER: Explain that this section is to help us to understand their perceptions of and satisfaction with MPA management.

- On a scale of 1-5 how supportive are you of the MPA? (where 1 is totally opposed and 5 is very supportive)

- How strongly do you agree that the MPA is necessary to protect the seabed and marine species? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA is necessary to protect fish spawning and nursery areas and juveniles? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA is necessary to protect fish stocks? Where 1 is totally disagree and 5 is completely agree
- How strongly do you agree that the MPA can contribute to minimise incidental catches of sensitive/vulnerable species? Where 1 is totally disagree and 5 is completely agree
- How strongly do you feel that the MPA is achieving its conservation objectives? *Prompt to interview please read a brief summary of the conservation objectives)* Where 1 is very strongly and 5 is not at all.
- Do you think that small scale fishing activities are compatible with the objectives of the MPA? Where 1 is not at all compatible and 5 is very compatible. By compatible we mean how well do you think they exist together. Please explain your answer
- If you feel they are incompatible, do you have any suggestions as to how the situation could be improved?
- Do you think that large scale fishing activities are compatible with the objectives of the MPA? Where 1 is not at all compatible and 5 is very compatible. By compatible we mean how well do you think they exist together. Please explain your answer
- If you feel they are incompatible, do you have any suggestions as to how the situation could be improved?
- Could you describe how decisions about marine management are taken in the area? How, and by whom?

We are going to ask you another series of statements, please tell us on a scale of 1 to 5 how strongly you agree where 1 is completely disagree, 2 disagree, 3 neutral, 4 agree and 5 is strongly agree.

	1	2	3	4	5	Don't know	No answer
When the MPA was created **small-scale** fishers were treated fairly							
When the MPA was created **large scale** fishers were treated fairly							
When the MPA was created **small-scale** fishers were adequately consulted regarding its design or what areas would be included							
When the MPA was created **large scale** fishers were adequately consulted regarding its design or what areas would be included							
If decisions are made about the MPA **now** regarding its design or new measures fishers are adequately consulted							
The MPA (management) aligns with the livelihood needs of local fishers							
Traditional knowledge of local fishers is documented and included in the MPA management							
The MPA is generally well and effectively managed (e.g. defining clear conservation objectives and measures, and monitoring them appropriately).							

- On a scale of 1 -5 how much involvement is there of local fishers in the MPA decision-making and management activities? Where 1 is no involvement at all and 5 is very high level of involvement
- On a scale of 1 -5 how much involvement of local fishers do you think there should be in the MPA decision-making and management activities? (Where 1 is no involvement at all and 5 is very high level of involvement) Why?

SECTION 4– BACKGROUND INFORMATION ABOUT THE INTERVIEWEE

REMINDER TO INTRODUCE SECTION AND EXPLAIN: Explain to the interviewee that this section of the survey is to help us to get a few questions about who they are

4.1. Interviewee's gender?

- Male
- Female
- Non binary
- Prefer not to say

4.2. What is your age group?

- 20-30 years old
- 30-40 years old
- 40-50 years old
- 50-60 years old
- 60+ years old

4.3. What is your highest level of education completed?

- Elementary school
- Middle school
- High school
- University degree – Bachelors or higher
- None

END OF SURVEY

REMINDER TO INTERVIEWER:

- *Ask the interviewee if they have any questions for you/us or anything else that they want to tell us about the impact the MPA has had on their fishing activities*
- *Thank the interviewee for taking time to participate in the interview.*

6.24 Large-scale fishers: Analysis of AIS and VMS data

The comparison of the information provided by AIS and VMS data in the whole domain for each case study including the MPA and the surrounding areas showed that, in general (Figure 6-6 A), the AIS data covers more vessels than the VMS data. However, the overall value of fishing hours in the two systems is very similar (Figure 6-6B), as the apparent distribution of fishing effort for each vessel (considering the different transmission frequencies of the two signals) is clearly different in favour of the VMS system (Figure 6-6 C). The analysis of the AIS and VMS systems in the different case studies, however, revealed important differences. In the case of the Egadi Islands, Ropotamo and Torre Guaceto, the AIS system made it possible to reconstruct the activity of a greater number of fishing units and, at the same time, to quantify a greater number of fishing hours. In the case of Banyuls and Gyaros, however, it was the VMS system that provided the most coverage of the fleet and its activities.

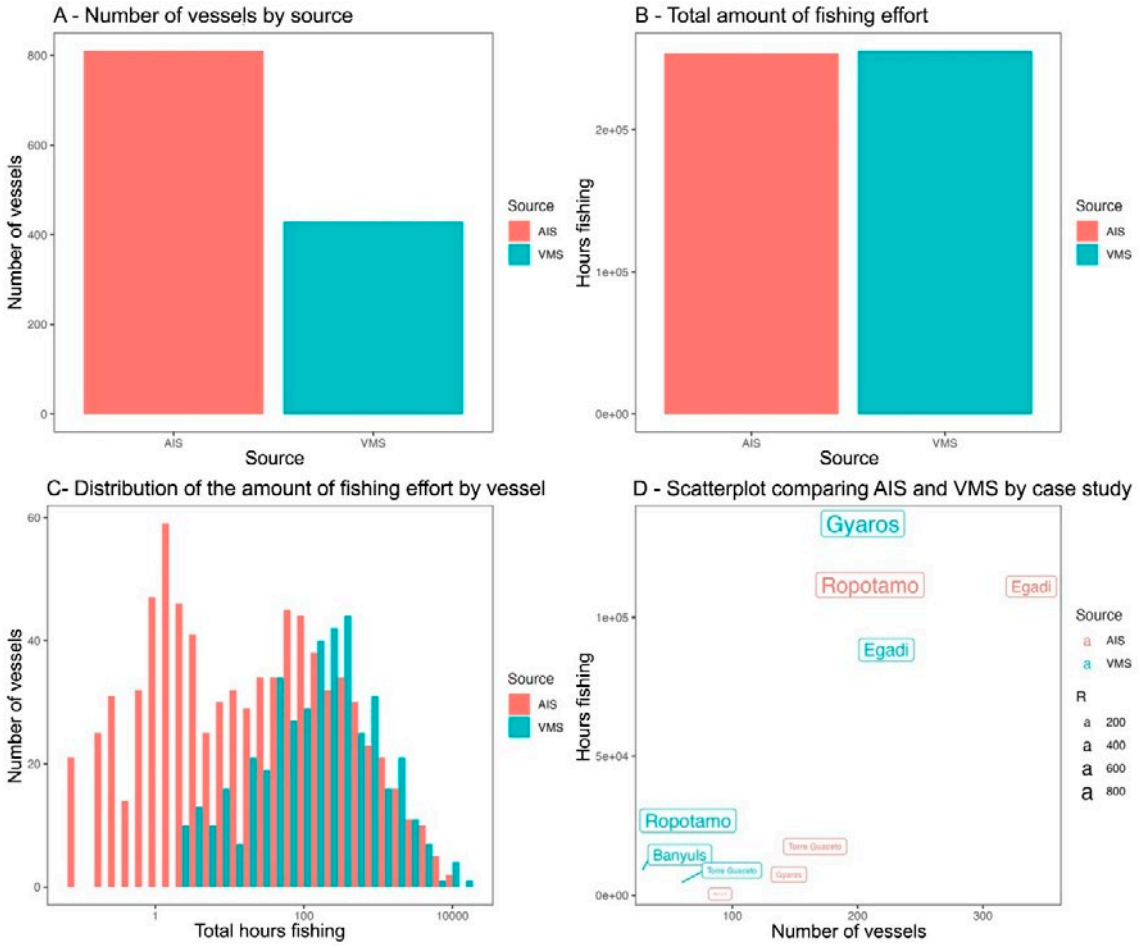


Figure 6-53 General comparison between AIS and VMS data. The main statistics are plotted by source. A - Barplot of the total number of fishing vessels in the AIS and VMS datasets; B - Barplot of the total amount of fishing effort in the AIS and VMS datasets; C - Distribution (histogram) of the total effort (hours fishing) by vessel and system; D - Scatterplot in which the number of vessels (x-axis) is plotted against the hours fishing (y-axis), for each case study, and the size of the label is proportional to the ratio between these two values.

6.25 Maps of fishing footprint and fishing grounds by case study

The maps of fishing footprint and fishing grounds are presented per case study site. Each map represents a metier used by large-scale fishers, as inferred by the analysis of AIS and VMS data. The final map in each case study represents the digitised results obtained via the small-scale fishers' surveys. A very brief description of the patterns highlighted is provided for each map.

Case study 1: Banyuls

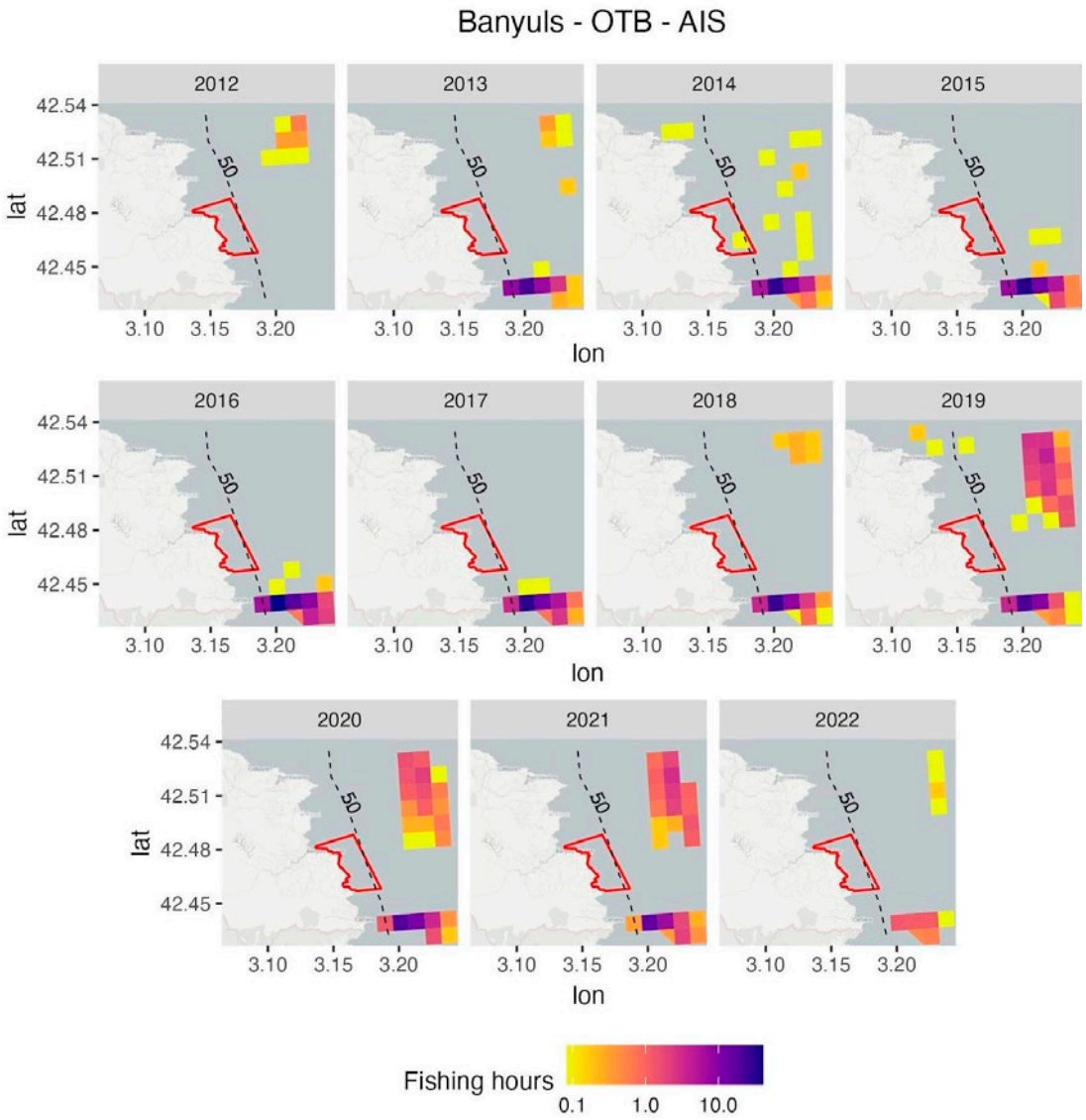


Figure 6-54 Bottom otter trawl (OTB) – Fishing footprint from 2012 to 2022 in Banyuls (Source: AIS)

OTB was mainly concentrated in a fishing ground south of the MPA, but an increasing activity with this metiér was observed from 2019 in a fishing ground located northeast of the protected area. The red line indicates the MPA borders.

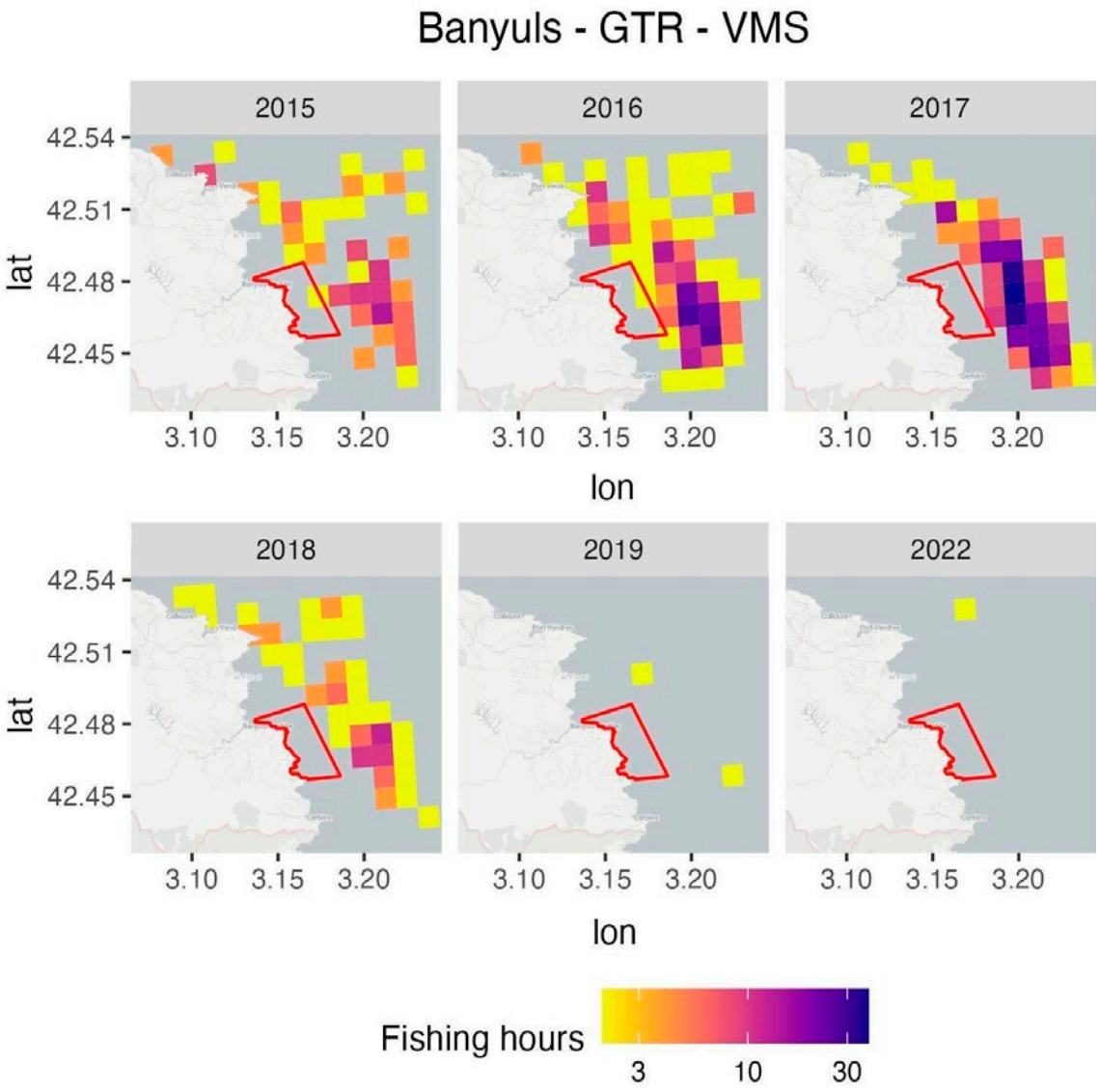


Figure 6-55 Trammel nets (GTR) – Fishing footprint from 2015 to 2019 and in the year 2022 in Banyuls (Source: VMS)

Fishing effort was widely distributed in the area from 2015 to 2018, also showing a slight overlap with the MPA area. From 2019 on, it almost completely disappeared. The red line indicates the MPA borders.

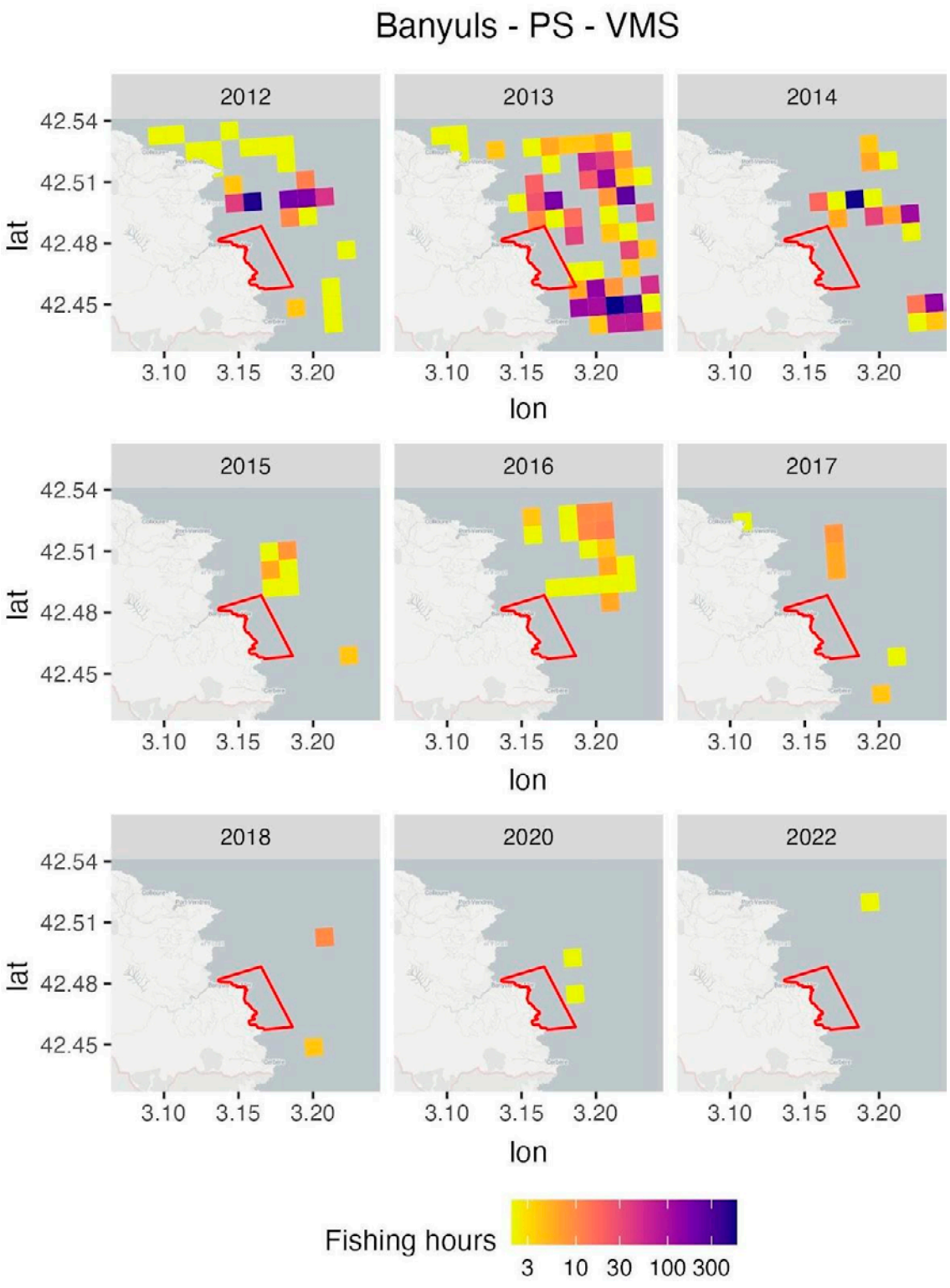


Figure 6-56 Purse seine (PS) – Fishing footprint from 2012 to 2022 in Banyuls (Source: VMS)

PS shows a wide array of distribution in the first years of the considered period, although being absent inside MPA borders. Then, it drastically reduces. The red line indicates the MPA borders.

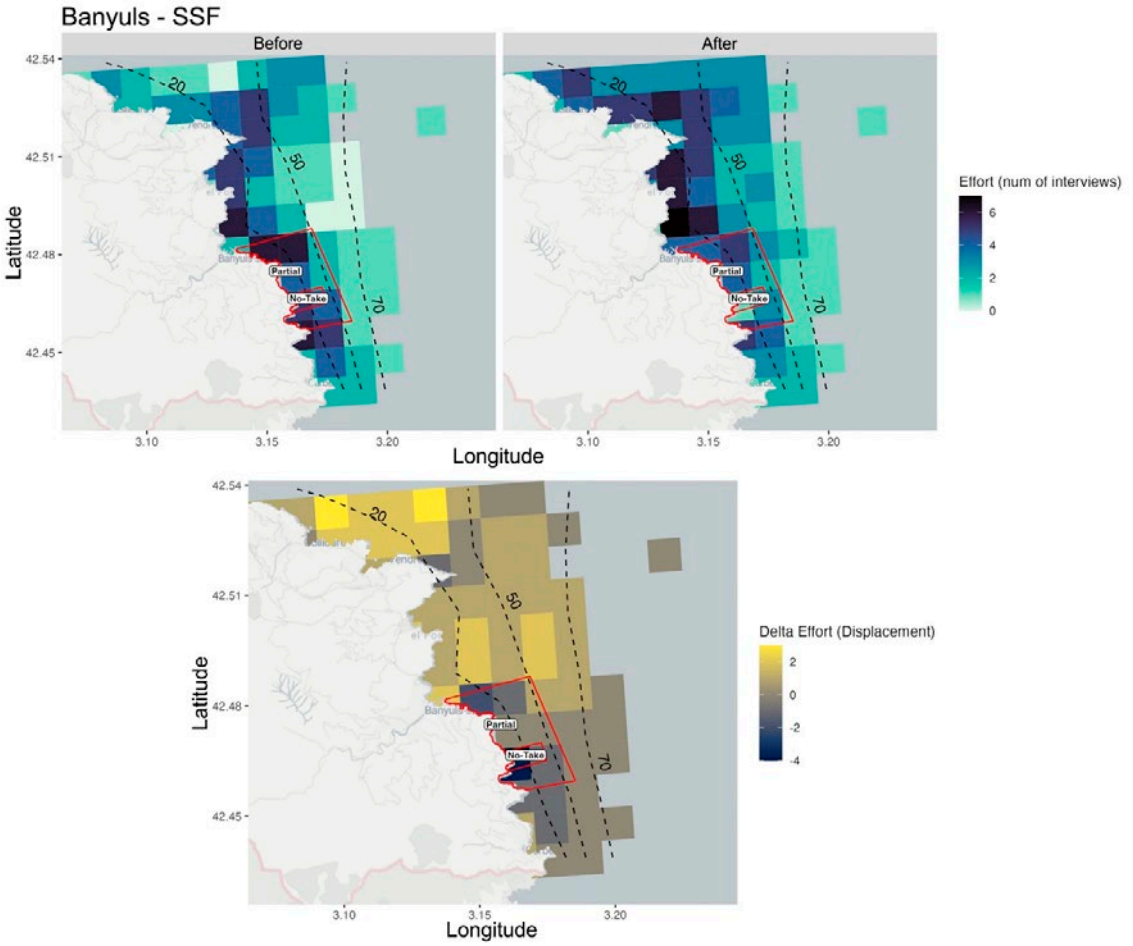


Figure 6-57 Fishing footprint of Small-Scale Fishery (in Banyuls before and after the implementation of the MPA (Source: Digitized questionnaires)

SSF surveys reveal that after the implementation of the No-Take Zone (1974), the effort was redistributed outside its borders. Delta effort value was gathered from the difference between effort value after the MPA implementation and the one before. The red line indicates the MPA borders.

Case Study 2: Egadi islands

No Take Zones in the area are present west of Marettimo Island and around the Island of Maraone.

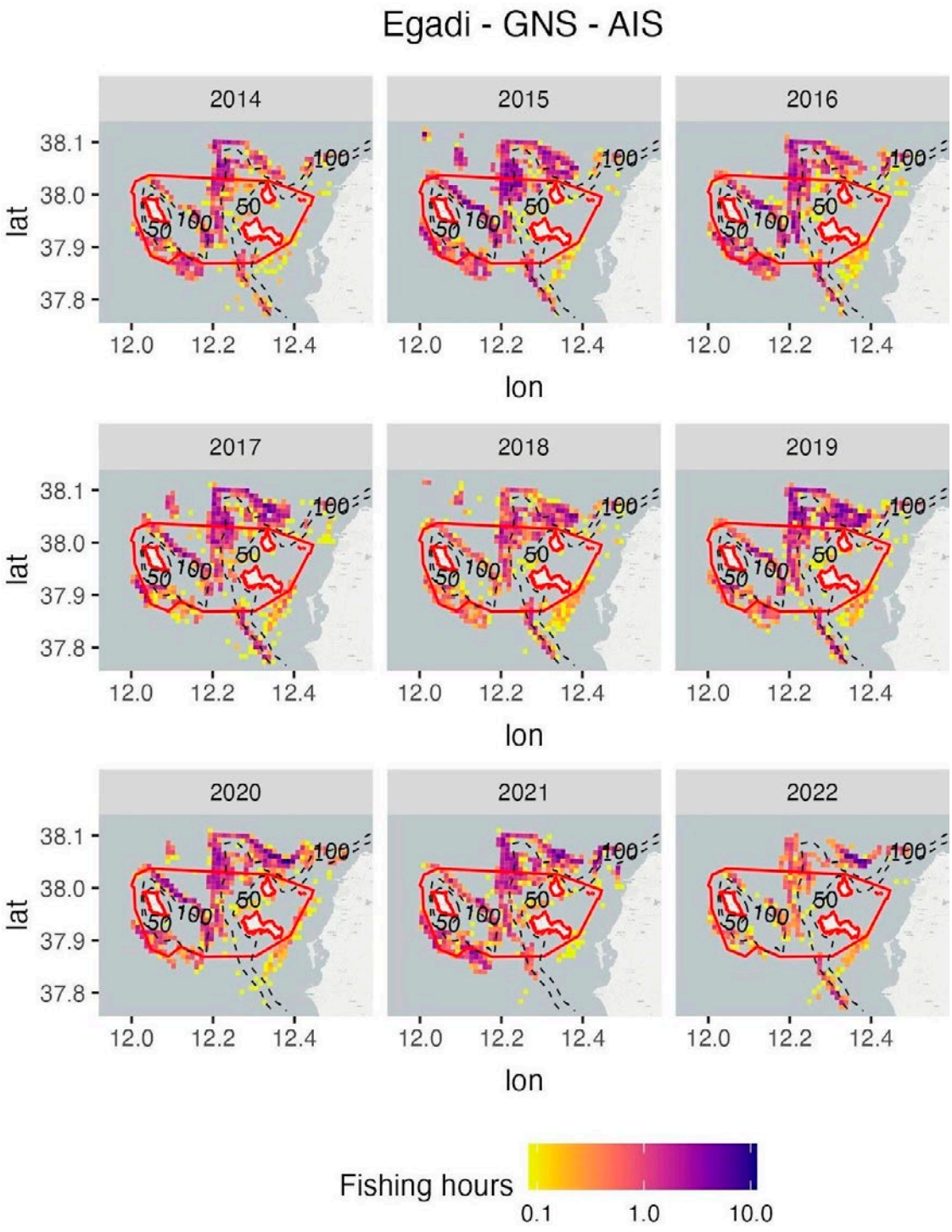


Figure 6-58 Gillnets (GNS) – Fishing footprint from 2014 to 2022 in Egadi (Source: AIS)

GNS is widely present in the area, with effort distribution showing little changes over time. This activity is exerted far from the fully protected zones. The red line indicates the MPA borders.

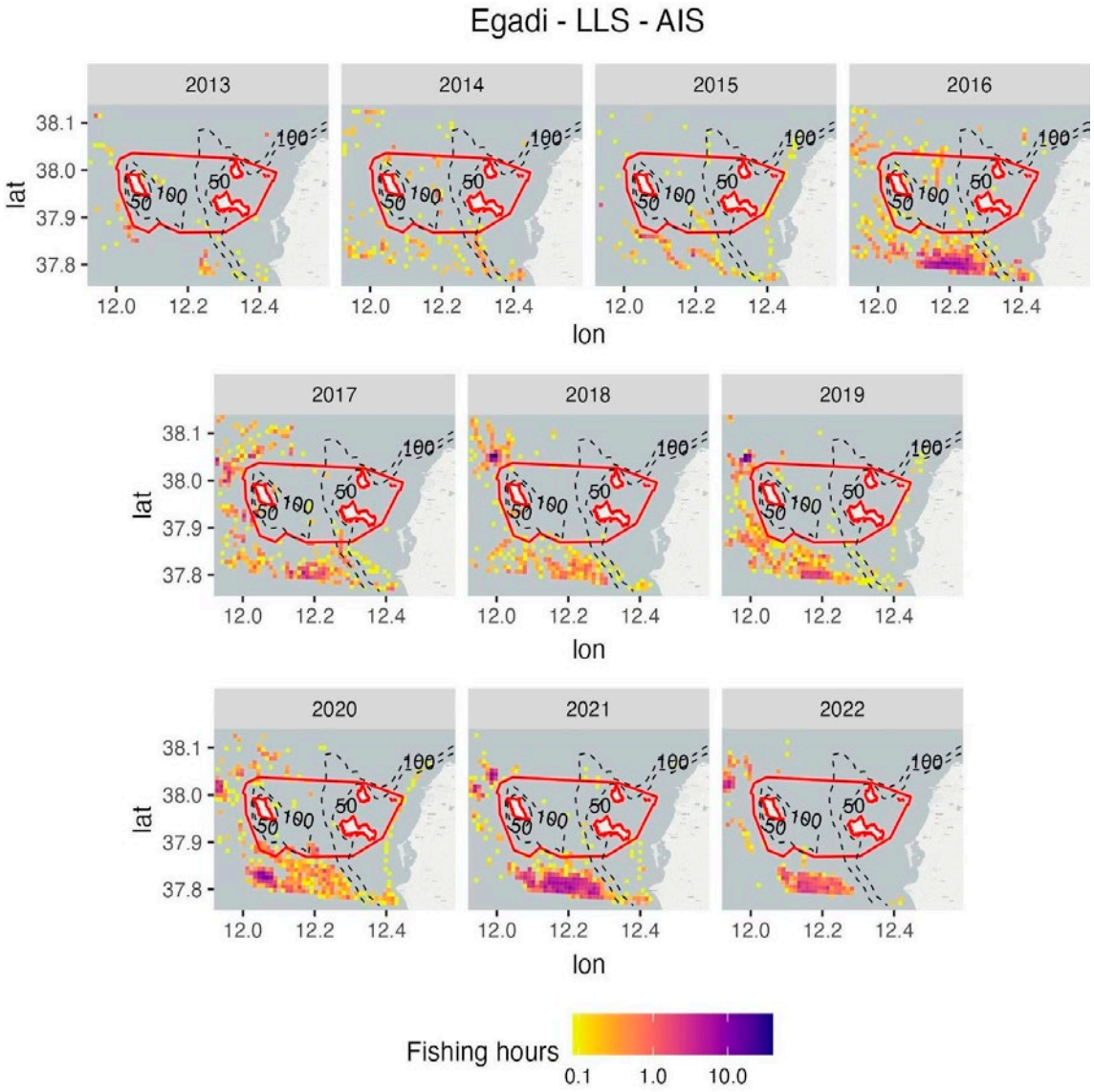


Figure 6-59 Longlines for demersal species (LLS) – Fishing footprint from 2013 to 2022 in Egadi (Source: AIS)

LLS activity is mainly concentrated on a large fishing ground south of the Egadi islands. Fishing effort in this area, however, shows significant fluctuations over time. The red line indicates the MPA borders.

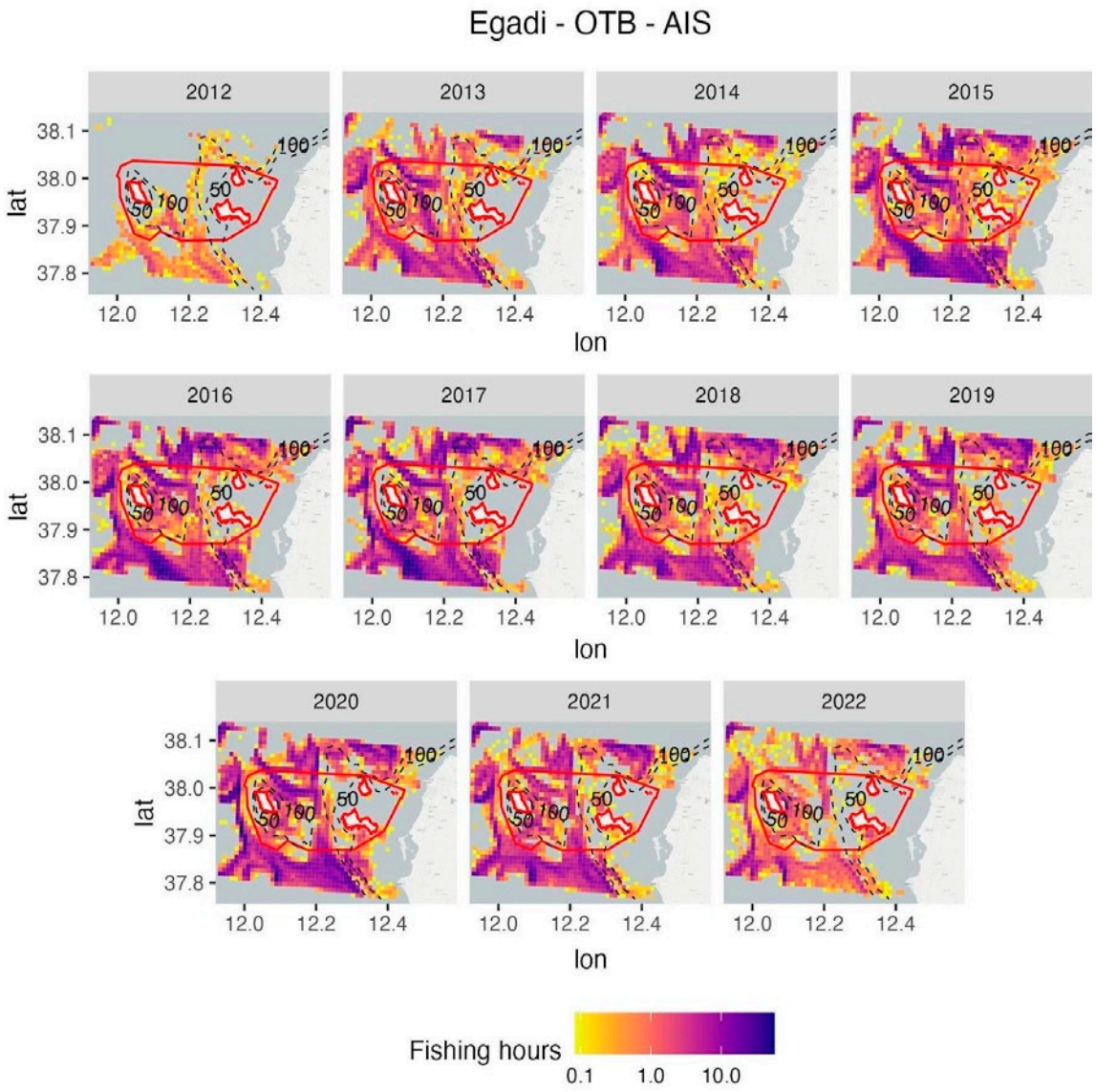


Figure 6-60 OTB – Fishing footprint from 2012 to 2022 in Egadi (Source: AIS)

OTB is widely present across the case study, and its distribution shows little change over time. Fishing associated with this metiér is also practised in the immediate surroundings of No-Take Zones, although with low effort values. The red line indicates the MPA borders.

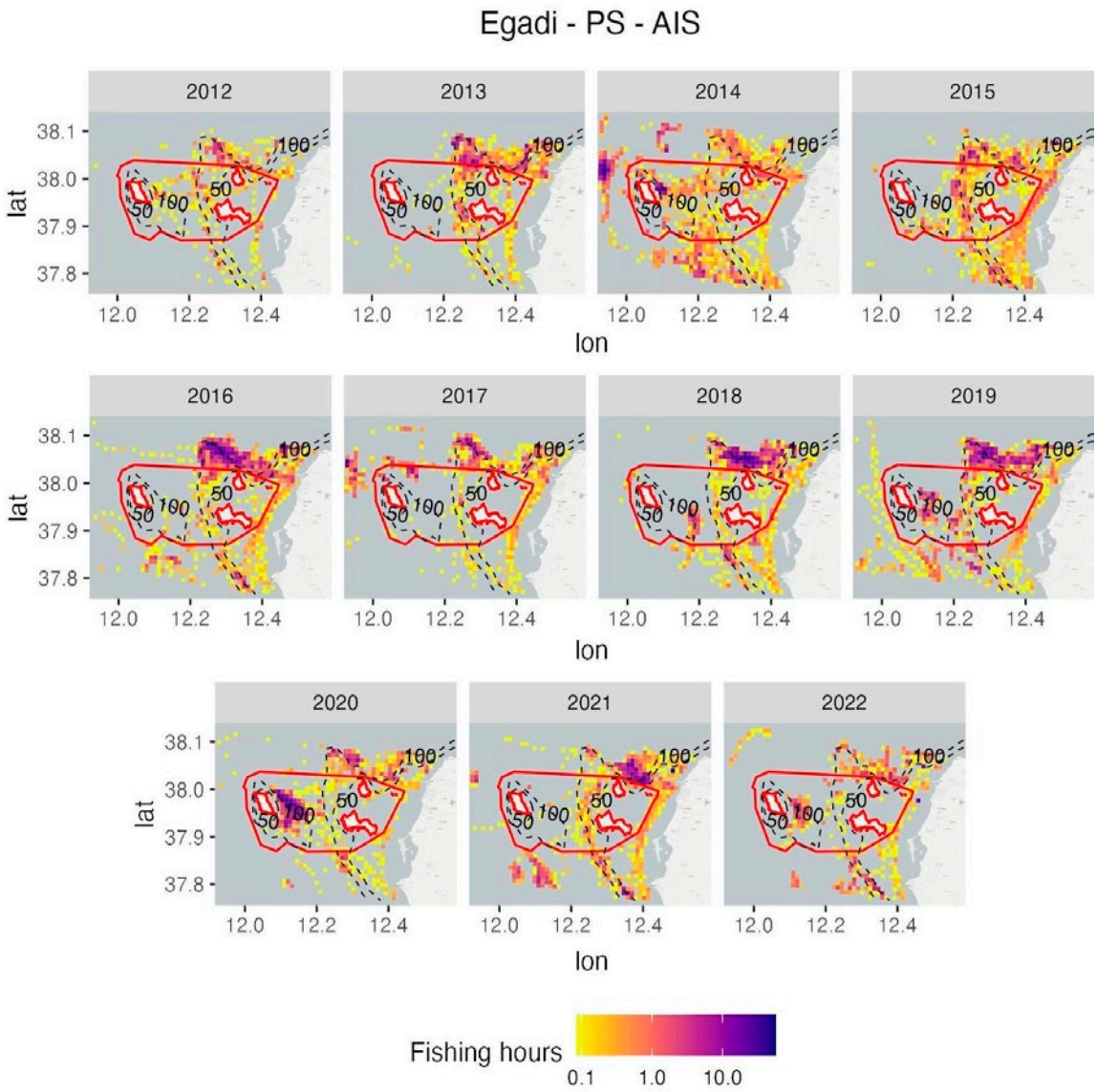


Figure 6-61 PS effort distribution from 2012 to 2022 in Egadi (Source: AIS).

PS is present in and around the MPA. The highest values of effort, although with fluctuating values, are mostly located in a fishing ground outside the northeastern border of the protected area. The year 2020 shows high values of effort East of the Island of Favignana. The red line indicates the MPA borders.

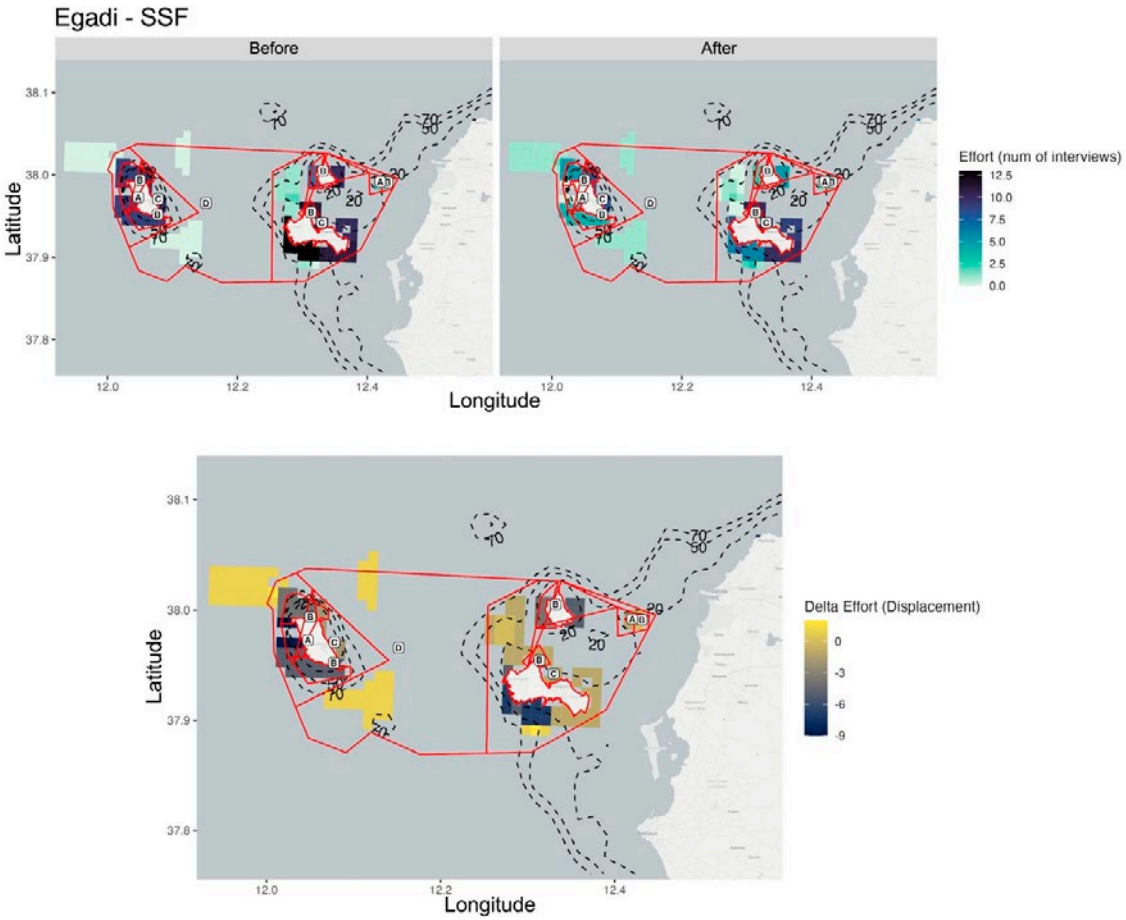


Figure 6-62 Effort distribution of small-scale fishery in Egadi before and after the implementation of the MPA (Source: Digitized questionnaires)

The surveys revealed that the implementation of no-take zones (1991) had a significant impact on the redistribution of small-scale fishing effort: fishing grounds along the western coast of Favignana Island were abandoned. Fishing along the southwestern coast of the Island of Levanzo also declined since 1991. Delta effort value was gathered from the difference between effort value after the MPA implementation and the one before. The red line indicates the MPA borders.

Case study 3: Gyaros

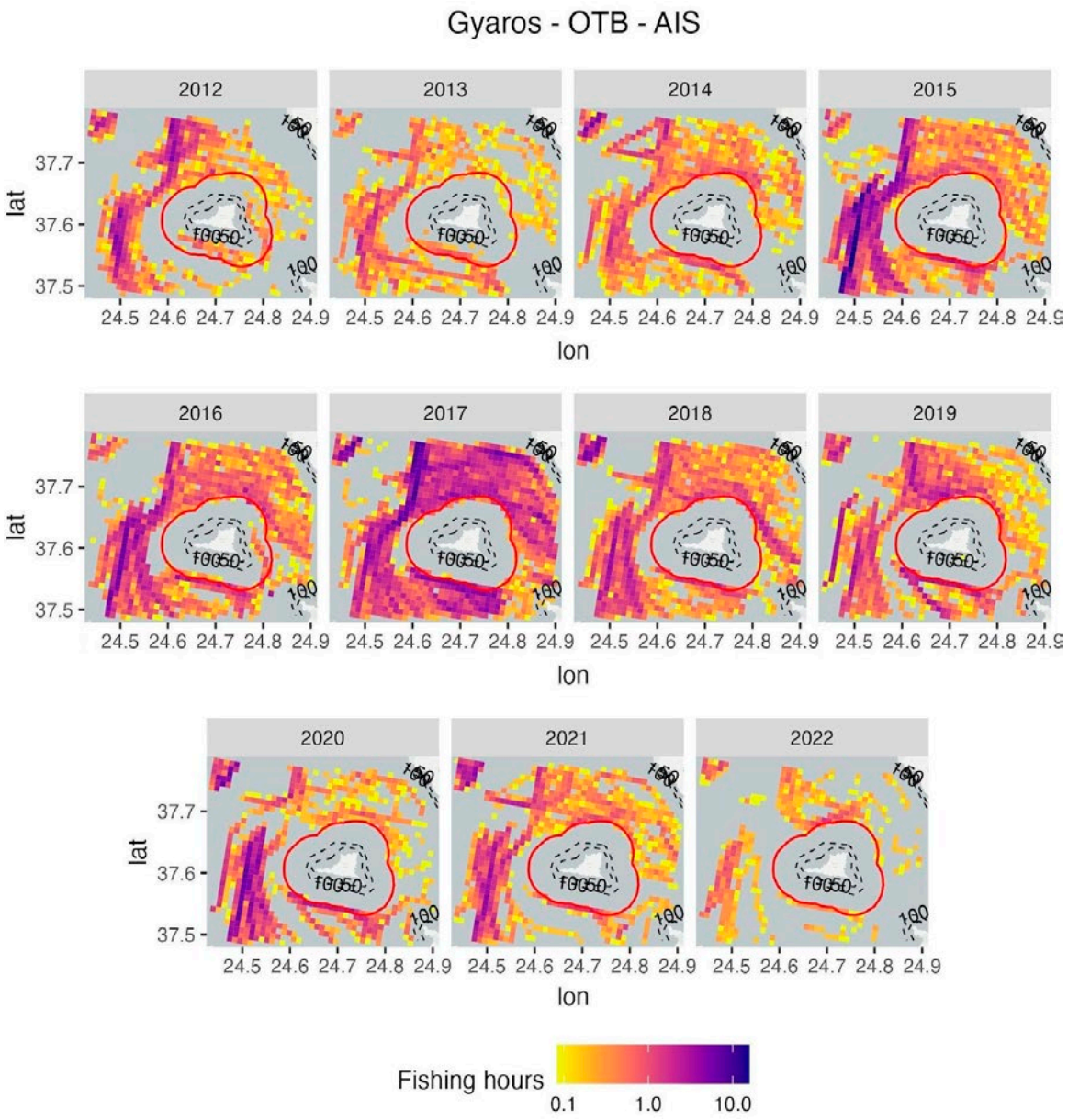


Figure 6-63 OTB effort distribution from 2012 to 2022 in Gyaros (Source: AIS)

AIS data reveal a wide and stable distribution of effort for OTB, mainly concentrated off the western coast of Gyaros island.

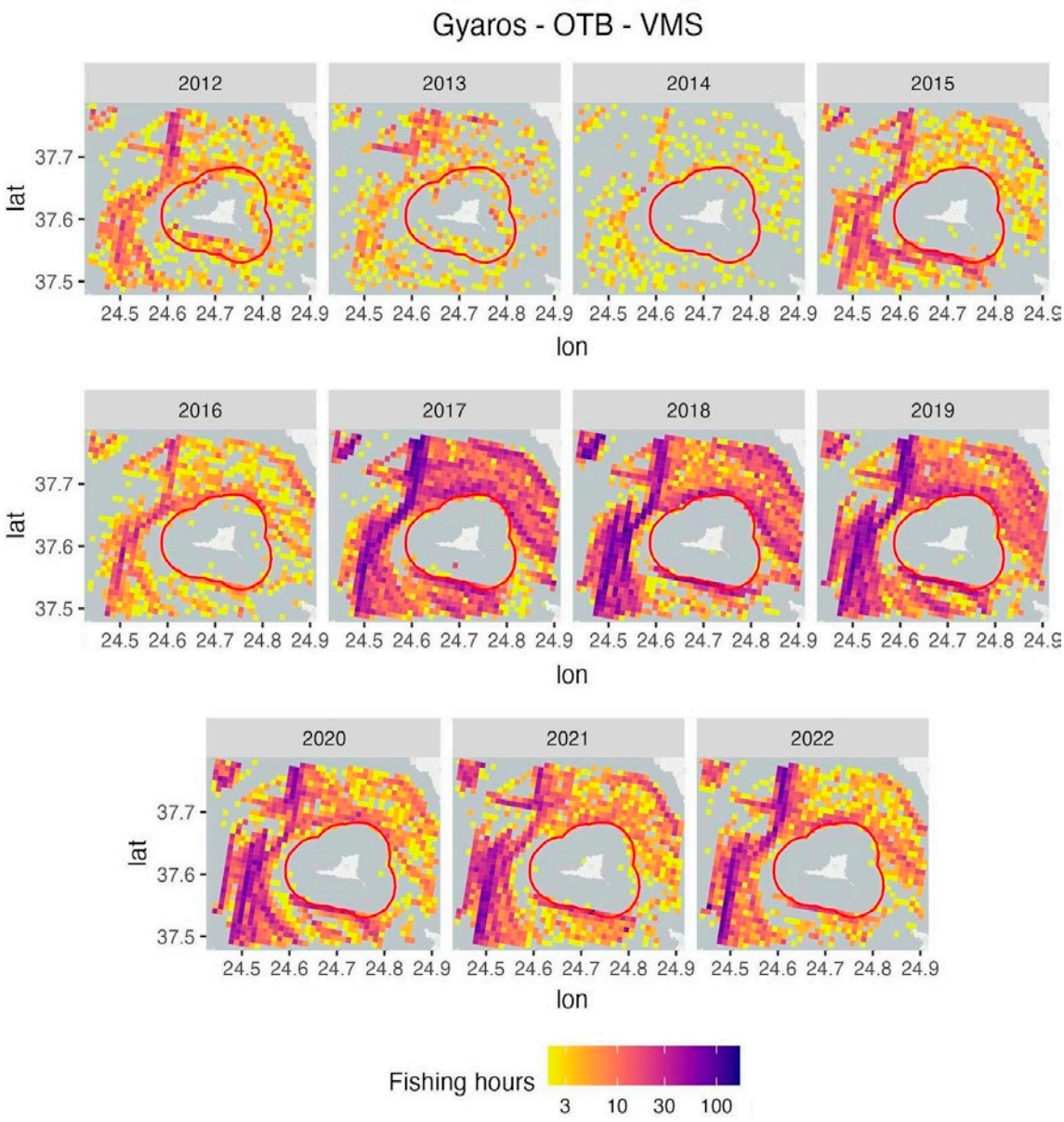


Figure 6-64 OTB effort distribution from 2012 to 2022 in Gyaros (Source: VMS)

VMS data reveal a wide and stable distribution of effort for OTB, mainly concentrated off the western coast of Gyaros island. The same "trawling lane" is highlighted by the highest values of AIS and VMS pings. The red line indicates the MPA borders.

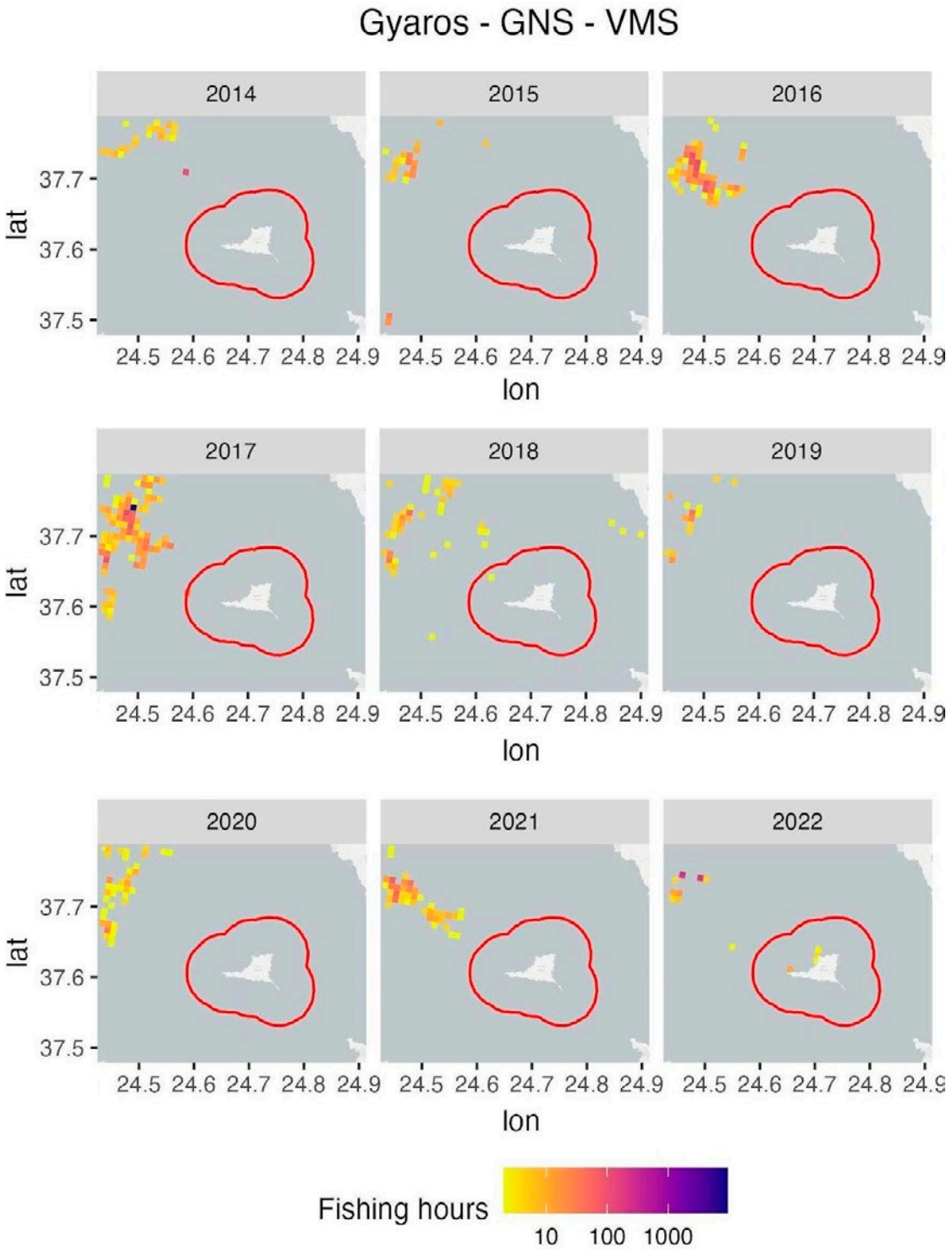


Figure 6-65 GNS effort distribution from 2014 to 2022 in Gyaros (Source: VMS)

GNS was mainly concentrated on a fishing ground northwest of the Island of Gyaros. The amount and the spatial distribution of effort varied over time. The red line indicates the MPA borders.

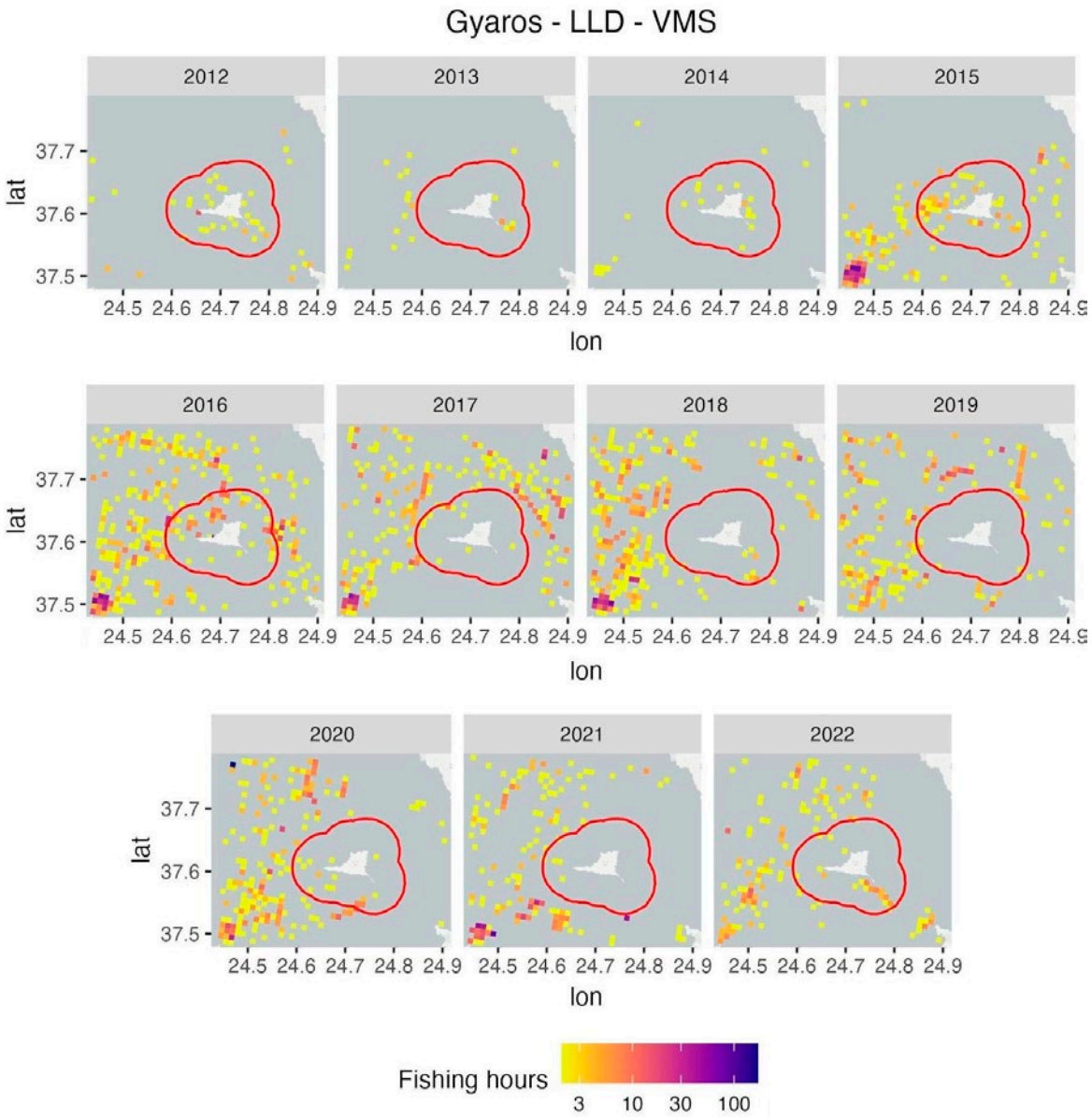


Figure 6-66 LLS effort distribution from 2012 to 2022 in Gyaros (Source: VMS)

LLS was distributed all along the Island of Gyaros, although with fluctuations in its effort distribution. LLS was widely present inside the borders of the MPA. The red line indicates the MPA borders.

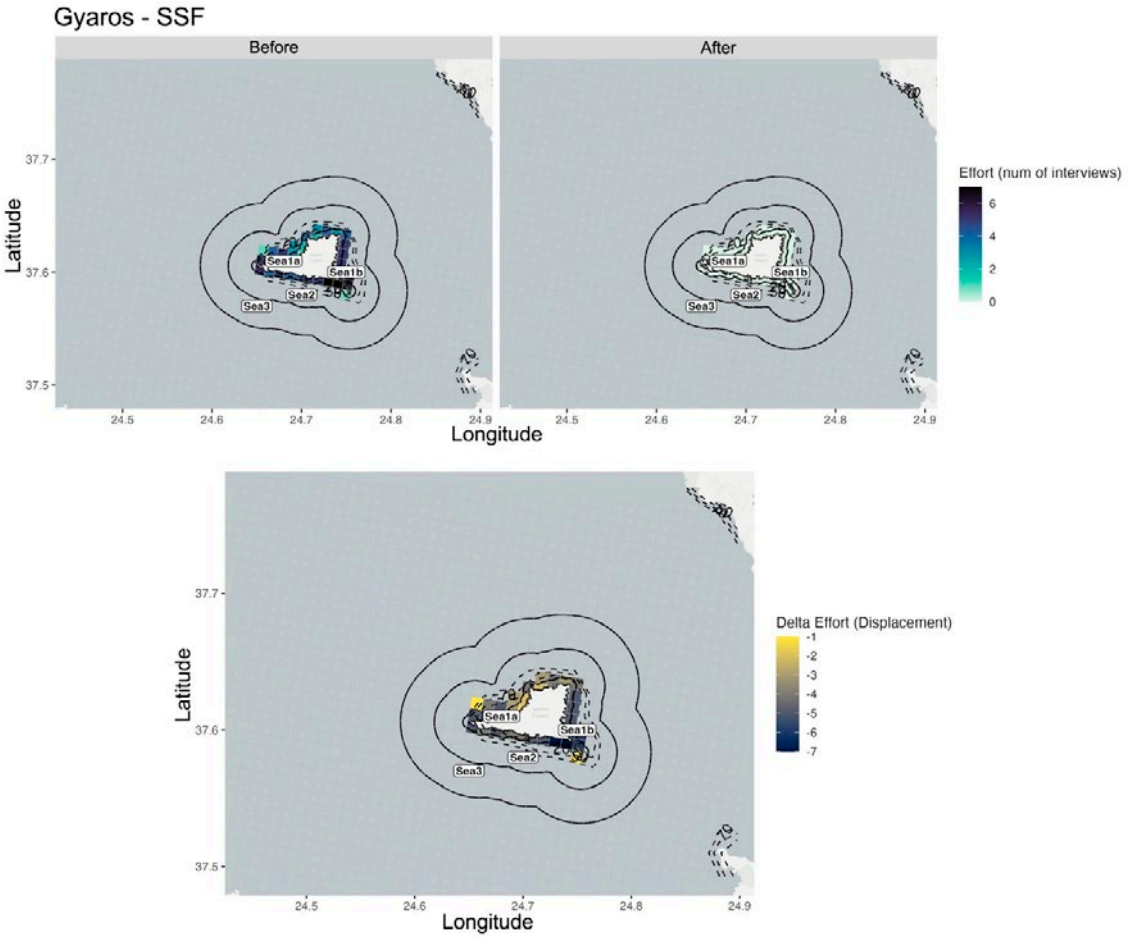


Figure 6-67 Effort distribution of small-scale fishery in Gyaros before and after the implementation of the MPA (Source: Digitized Questionnaires)

Before the establishment of the MPA (2019) there was a stable and important fishing ground all around the coast of the Island of Gyaros. After 2019, small-scale fishing activities completely disappeared from the MPA and were ultimately relocated outside the case study borders. Delta effort value was gathered from the difference between effort value after the MPA implementation and the one before. The red line indicates the MPA borders.

Case study 4: Ropotamo

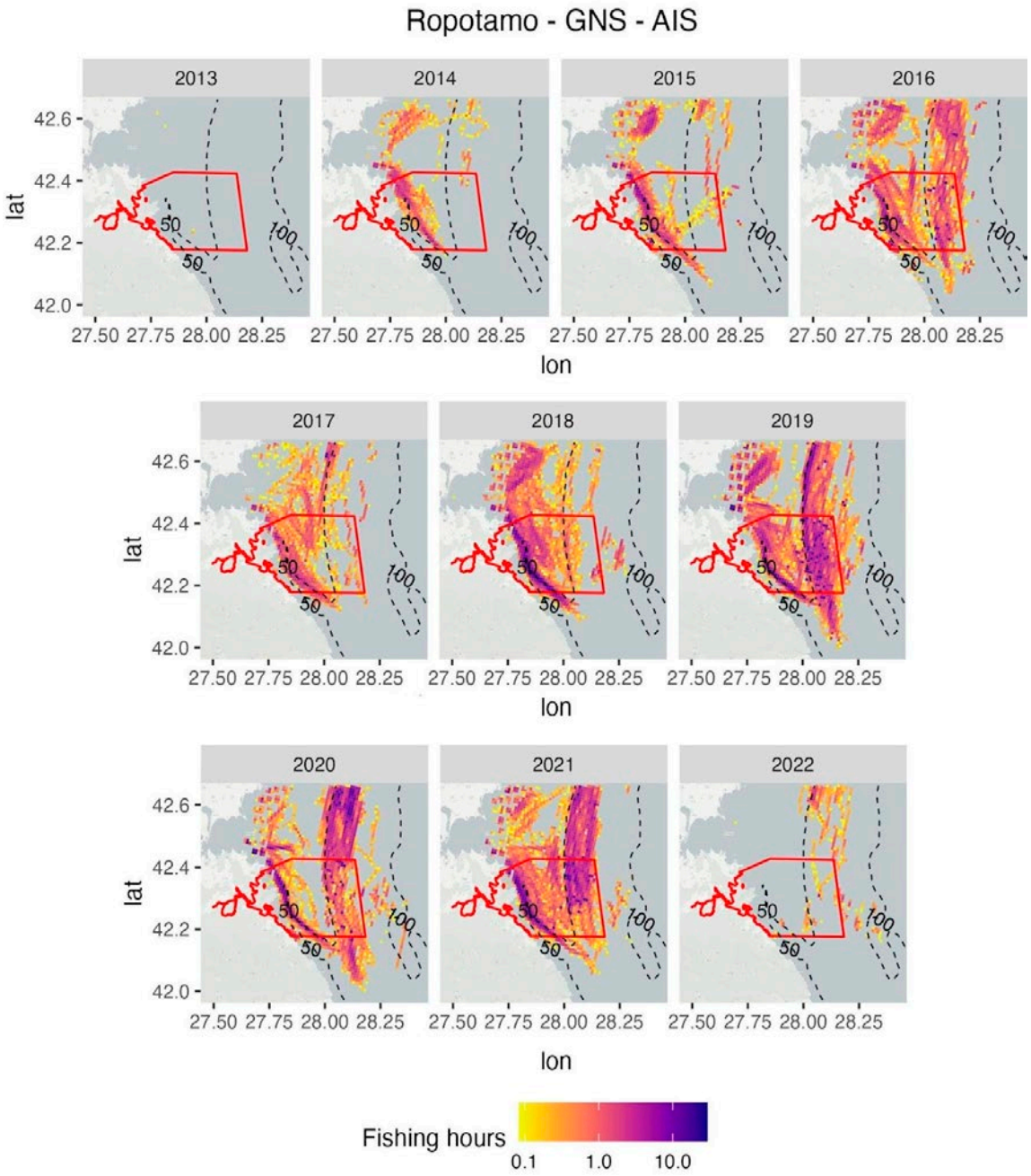


Figure 6-68 GNS effort distribution from 2013 to 2022 in Ropotamo (Source: AIS)

GNS is widely distributed inside and outside the MPA borders. Effort progressively increased from 2013 to 2021. The red line indicates the MPA borders.

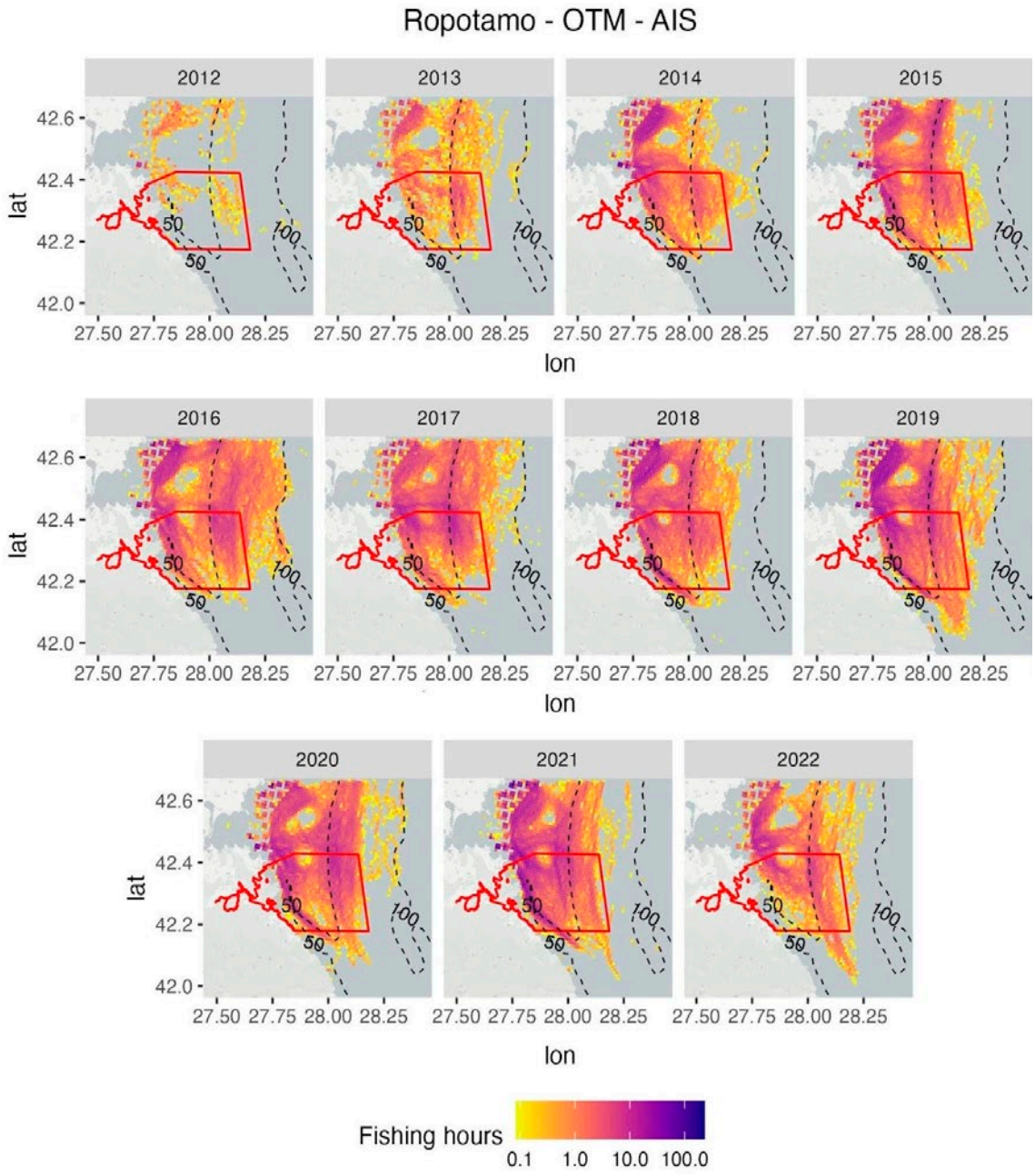


Figure 6-69 OTM effort distribution from 2012 to 2022 in Ropotamo (Source: AIS)

Effort associated with OTM was distributed quite evenly and with high values outside and inside the borders of the MPA. The red line indicates the MPA borders.

Case study 5: Torre Guaceto

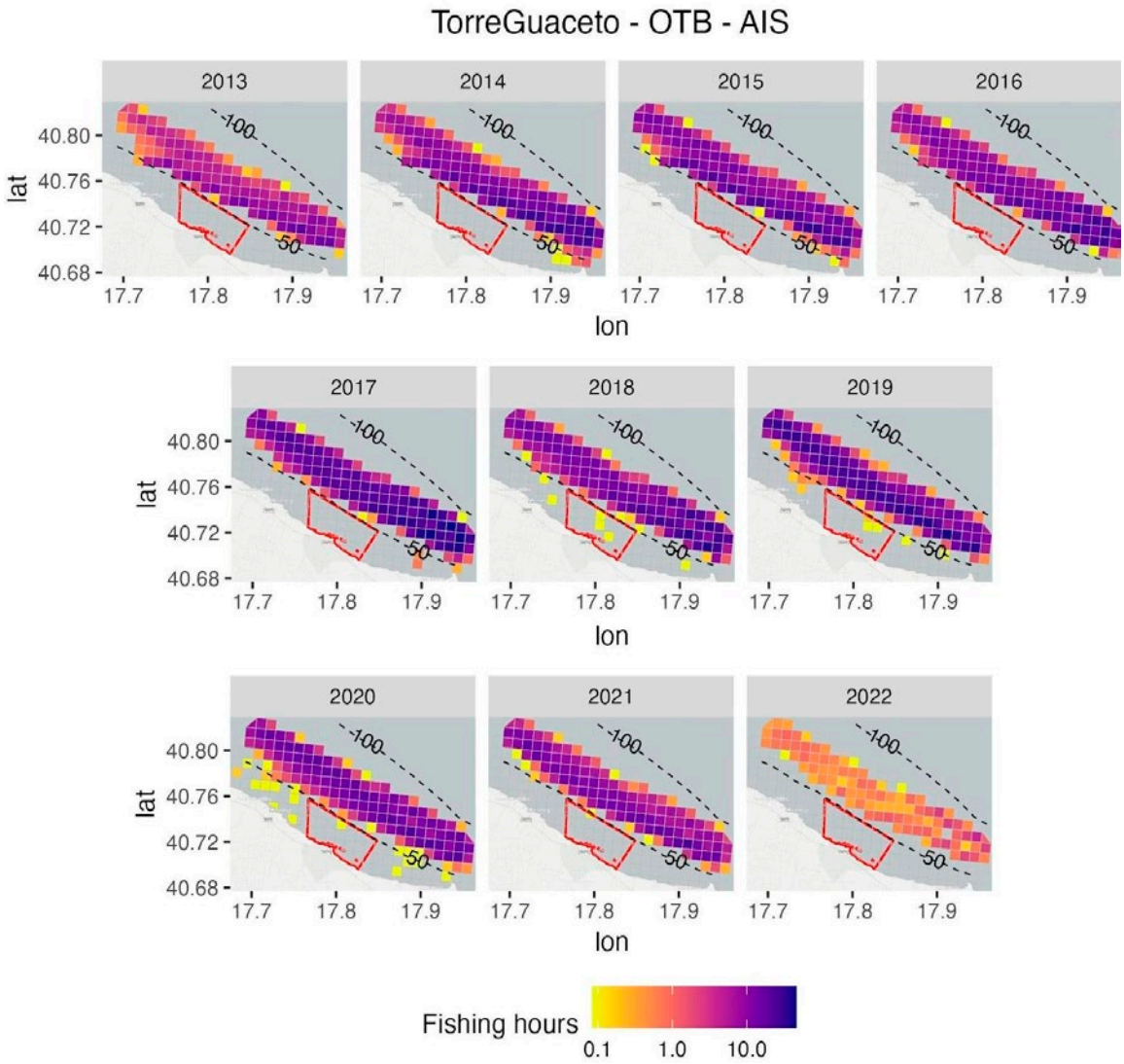


Figure 6-70 OTB effort distribution from 2013 to 2022 in Torre Guaceto (Source: AIS)

The area outside the MPA was found to be an important and stable fishing ground for OTB, with little variations in effort values and distribution over the years. The red line indicates the MPA borders.

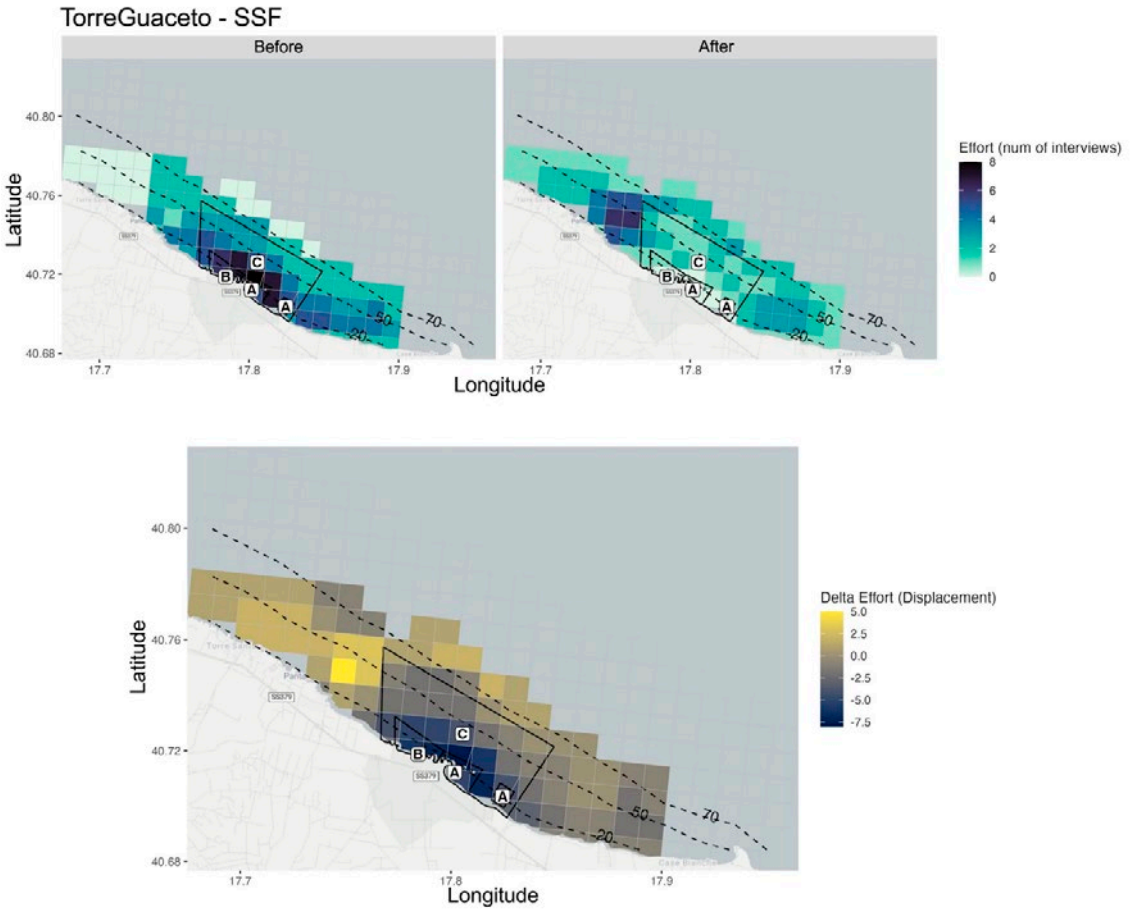


Figure 6-71 Effort distribution of small-scale fishery in Torre Guaceto before and after the implementation of the MPA (Source: Digitized questionnaires)

The surveys reveal a significant redistribution of effort from the no-take zone (Zone A) to the surrounding areas of the MPA. Delta effort value was gathered from the difference between effort value after the MPA implementation and the one before. The red line indicates the MPA borders.

6.26 Survey responses for large-scale fishers and key informants

The following tables provide results for some of the key questions asked to LSF and KIs

Table 6-17 Key informants' opinions on the impact of the MPA on different variables

	Perceived effect (%)						
	Large decrease	Decrease	No effect	Increase	Large increase	Don't know	No Answer
What impact does the MPA have on…							
…their access to productive fishing grounds?	11	22	50	11	0	6	0
…the costs associated with their fishing activity?	0	0	63	16	5	11	5
…the profitability of their fishing business?	16	11	16	37	0	16	4
…the income they personally receive from fishing?	0	32	16	26	11	15	0
…the income they receive from other activities?	0	0	47	21	11	21	0
…the quantity of fish they catch?	0	21	26	32	5	0	16
…the size of the fish they catch?	0	26	21	32	5	0	16
…the percentage of discards they have to deal with in your catch	0	11	28	6	0	33	22
…the quantity of higher value species they catch?	6	11	22	28	17	11	6
…the quantity of lower value species they catch?	0	16	42	21	0	16	5
…the price per kilo for the fish they catch in the MPA?	0	11	32	36	5	16	0
…the number of other commercial fishers fishing in the areas that they fish?	0	22	26	26	0	26	0
…the number of recreational fishers fishing in the areas that they fish?	0	17	6	33	28	16	0
…the number of other users or activities in the areas where they fish?	0	0	21	37	26	16	0
…the overall level of poaching?	21	37	16	11	11	4	0
…their need to diversify their livelihood to meet a satisfactory level of well-being	0	0	21	42	21	16	0
…their ability to diversify their livelihood?	0	21	21	37	5	16	0

Table 6-18 Large-scale fishers' opinions on the impact of the MPA on different variables

	Perceived effect (%)						
	Large decrease	Decrease	No effect	Increase	Large increase	Don't	No Answer
What impact does the MPA have on…							
…your access to productive fishing grounds?	29	17	41	4	8	0	0
…the costs associated with your fishing activity?	0	0	38	49	13	0	0
…the profitability of your fishing business?	17	17	42	25	0	0	0
…the income you personally receive from fishing?	4	43	40	13	0	0	0
…the income you/they receive from other activities?	0	11	78	0	0	0	11
…the quantity of fish you catch?	8	34	50	8	0	0	0
…the size of the fish you catch?	4	29	67	0	0	0	0
…the percentage of discards you have to deal with in your catch	0	13	66	21	0	0	0
…the quantity of higher value species you catch?	0	25	67	8	0	0	0
…the quantity of lower value species you catch?	8	8	67	17	0	0	0
…the number of other commercial fishers fishing in the areas that you fish?	25	46	8	13	4	4	0
…the number of recreational fishers fishing in the areas that you fish?	8	17	17	38	17	3	0
…the number of other users or activities in the areas where you fish?	4	4	38	46	4	4	0
…the overall level of poaching?	0	4	21	54	17	4	0
…your need to diversify your livelihood to meet a satisfactory level of well-being	0	0	79	13	0	4	4
…your ability to diversify your livelihood?	0	4	75	13	0	0	8

Table 6-19 Key informants' opinions on the importance of the MPA for conservation

	Level of agreement (%)						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know	No Answer
How strongly do you agree that the MPA…							
…is necessary to protect the seabed and marine species?	0	0	5	11	84	0	0
…is necessary to protect fish spawning and nursery areas and juveniles?	0	0	0	16	84	0	0
…is necessary to protect fish stocks?	0	0	5	21	74	0	0
…can contribute to minimise incidental catches of sensitive/vulnerable species?	5	0	16	37	42	0	0

Table 6-20 Large-scale fishers' opinions on the importance of the MPA for conservation

	Level of agreement (%)						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know	No Answer
How strongly do you agree that the MPA…							
…is necessary to protect the seabed and marine species?	29	17	8	38	4	4	0
…is necessary to protect fish spawning and nursery areas and juveniles?	21	25	0	33	17	4	0
…is necessary to protect fish stocks?	29	29	4	25	13	0	0
…can contribute to minimise incidental catches of sensitive/vulnerable species?	25	25	29	17	4	0	0

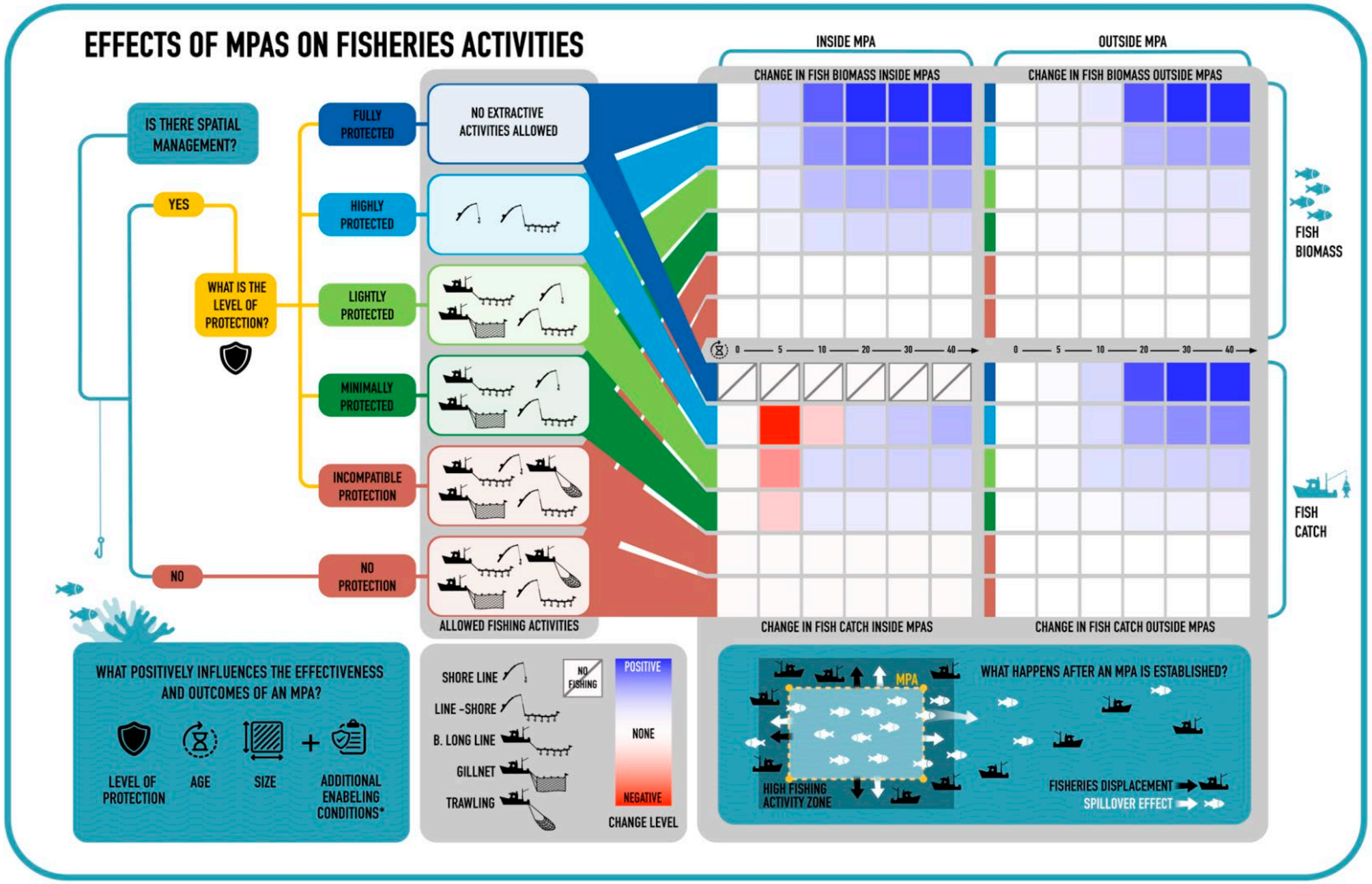
Table 6-21 Key informants' opinions on management and governance aspects of the MPA

	Level of agreement (%)						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know	No Answer
How strongly do you agree with the following statements…							
When the MPA was created small-scale fishers were treated fairly	5	11	5	21	37	21	0
When the MPA was created large scale fishers were treated fairly	11	16	5	11	21	21	15
When the MPA was created small-scale fishers were adequately consulted regarding its design or what areas would be included	11	11	5	37	26	10	0
When the MPA was created large scale fishers were adequately consulted regarding its design or what areas would be included	21	26	0	21	11	5	16
If decisions are made about the MPA now regarding its design or new measures fishers are adequately consulted	5	16	5	26	37	11	0
The MPA (management) aligns with the livelihood needs of local fishers	5	11	26	26	22	5	5
Traditional knowledge of local fishers is documented and included in the MPA management	5	32	5	26	11	21	0
The MPA is generally well and effectively managed (e.g. defining clear conservation objectives and measures, and monitoring them appropriately)	5	21	11	21	26	11	5

Table 6-22 Large-scale fishers' opinions on management and governance aspects of the MPA

	Level of agreement (%)						
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Don't know	No Answer
How strongly do you agree with the following statements…	0	0	0	0	0	0	0
When the MPA was created small-scale fishers were treated fairly	25	21	37	17	0	0	0
When the MPA was created large scale fishers were treated fairly	42	38	12	8	0	0	0
When the MPA was created small-scale fishers were adequately consulted regarding its design or what areas would be included	33	33	18	8	4	0	4
When the MPA was created large scale fishers were adequately consulted regarding its design or what areas would be included	46	46	4	0	4	0	0
If decisions are made about the MPA now regarding its design or new measures fishers are adequately consulted	71	25	4		0	0	0
The MPA (management) aligns with the livelihood needs of local fishers	46	25	17	8	4	0	0
Traditional knowledge of local fishers is documented and included in the MPA management	50	34	8	8	0	0	0
The MPA is generally well and effectively managed (e.g. defining clear conservation objectives and measures, and monitoring them appropriately)	42	29	4	17	0	0	8

6.27 Conceptual model



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