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**MANTIS: Marine protected Areas Network Towards Sustainable fisheries in the
Central Mediterranean**

Work Package 4

Deliverable 4.1 - Good practices for Marine Management areas network governance

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WP4 – Designing and assessing an optimal management framework for the MMA network

Task 4.1 - Identify good practices and governance strategies for the identified networks of MMAs in each case study areas which take into account technical, administrative and legal barriers in implementing coherent networks of MMAs to enhance fisheries towards the MSY goal

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Abstract:

Objectives: the objectives of this task are the definition of the most appropriate governance system for the implementation of MPA network in the central Mediterranean, the identification of the potential costs in the establishment, maintenance, monitoring and governance of a network of MMAs and addressing the potential socio-economic benefits, related to the fishery sector, deriving from the implementation of the MMA network.



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Introduction

WP4 aims to design and assess a management framework including the establishment, maintenance, monitoring and governance of the MMA network, also considering the involvement of the stakeholders. The Deliverable 4.1 on “Good practices for MMAs network governance” is the first deliverable expected under WP4.

The Deliverable 4.1 has been divided in six sections:

- 1. Examples from Natura 2000 and other MPA networks are reported with the aim to describe the best practices followed in the establishment and implementation of some of these sites. The purpose of this analysis is to provide operational elements for the definition of the most appropriate management framework in the two case study areas covered by the project.
- 2. This section contains an overview of the existing Fisheries Restricted Areas (FRAs) in the Adriatic Sea and the Sicily Channel and a description of the management approaches, the objectives and goals, the management measures and the monitoring and control system implemented in each FRA.
- 3. The identification of the most appropriate procedures and tools to assess the establishment of MMAs is carried out in this section through a critical review of relevant projects (i.e. MAREFRAME, ECOFISHMAN and SOCIOEC) and a description of Impact Assessment Evaluation in fishery management and of the “Responsive Fisheries Management System” (RFMS);
- 4. The aim of this section is to provide an analysis of stakeholders’ perception and opinion on the state of fisheries, fishing activities and other marine uses, fisheries management and on stakeholders’ involvement in decision-making; the questionnaires on stakeholders’ perceptions collected during the two introductory meetings in Mazara del Vallo and Ancona have been reviewed;
- 5. This section focuses on the analysis of regulatory costs (typology and differences) adapted to a general network of MMAs; the analysis has been based on OECD Regulatory Compliance Cost Assessment Guidance (OECD, 2014);
- 6. The socio – economic benefits deriving from the implementation of the MMA network could be assessed through the “effectiveness evaluation” used for the identification of target and limit indicators. The selection of the most appropriate socio-economic indicators and reference points to measure the targets have been included in this section. On the basis of this list of indicators, one or two socio-economic indicators will be selected and used in SMART model (WP 3). The socio-economic analysis for each case studies on the basis of the simulations of WP 3 (task 3.3:SMART model) will be included in Deliverable 3.3 «Application of the models to the case of study: assessment of present situation and analysis of future scenarios».



1. Examples from Natura 2000 and other MPA networks and analysis of the management framework implemented in other fishing areas.

Examples from Natura 2000 and other MPA networks are reported in the next paragraphs with the aim to describe the best practices followed in the establishment and implementation of some of these sites. The purpose of this analysis is to provide operational elements for the definition of the most appropriate management framework in the two case study areas covered by the project.

1.1. The policy context and legal framework at international level on Marine Management Areas (MMA)

Ecosystems are complex and dynamic natural units that produce goods and services beyond those of benefit to fisheries (Garcia, 2003). Fisheries needs to be managed in an ecosystem-based context since they have a direct impact on marine ecosystems, which is also impacted by other human activities. The so-called “ecosystem approach to fisheries” (EAF) depends on the way in which fisheries management and ecosystem management, and their respective stakeholders, interface (Garcia, 2003). The ecosystem approach has also been identified as the approach to achieve the Aichi Target 6 which foresees that *“by 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits”*.

Best practices in fisheries management that could support ecosystem approach to fisheries within the European legislation framework are reported and analysed below, with a focus on two case studies from Natura 2000 sites.

Natura 2000 sites are established by the Member States of the European Union (EU) under the Birds and Habitats Directives (EC, 2009a; EC, 1992). However, fisheries management in these areas is governed by the Common Fisheries Policy (EC (2013a) and, in many cases, fisheries management measures affect fishing vessels of different Member States (MS). Article 11 of the CFP foresees that MS, to comply with their obligations under the Union environmental legislations, prepare and propose fisheries conservation measures (joint recommendations) to be then scientifically assessed and eventually adopted by the European Commission (EC) as delegated acts. This process is similar for Marine Strategy Framework Directive’s (MSFD; EC, 2008) purposes as most fisheries management proposals and decisions in European waters are to be addressed through the CFP, since fisheries an exclusive competence of the EU. A recent analysis conducted by Oceana illustrates the current slow progress made by MS in adopting fisheries management measures in relation to marine spatial protection tools under the MSFD (Oceana, 2017).

Therefore, there is a need to identify the objectives and the policy framework in which MMA are framed. The legal framework in which fisheries management measures of MMA might be established in European waters is summarised in Table 1.1.



Table 1.1 Review of the different fisheries regimes which may be established and implemented in MMAs in European waters

Policy framework	Types of area	Legal fisheries management regime	Objectives	Examples	
				Non-Mediterranean waters	Mediterranean Sea
Birds and Habitats Directives	Natura 2000 (e.g. Special Areas of Conservation and Special Protection Areas)	CFP Art. 11 and 18 Spatial management measures under Regional Fisheries Management Organisations (RFMO)	To achieve and maintain the Favourable Conservation Status of Europe's most vulnerable and threatened species and habitats; and to protect all wild birds and their most important habitats across the EU, through the adoption of fisheries conservation measures under the CFP.	Denmark: as per example reported in the case study	Natura 2000 sites have not yet adopted fishery conservation measures under the CFP Art. 11 and 18.
Marine Strategy Framework Directive	Several types of spatial protection measures and MMAs (e.g. national, regional and international)	CFP Art. 11 and 18 Spatial management measures under RFMO	To ensure the Good Environmental Status of all European seas by 2020, and specifically to contribute coherent and representative networks of marine protected areas, adequately covering the diversity of the constituent ecosystems.	Proposal by Portugal under the MSFD Programme (Portuguese Government, 2015) of measures to extend the national bottom trawling ban in the Portuguese EEZ to all foreign fishing fleet, in order to protect the seabed from adverse impacts of fishing activity.	Not designated yet
Mediterranean Regulation (EC, 2006)	Community fishing protected areas but also sensitive habitats	Mediterranean Regulation – Articles 4;5;6;8;13	Various measures to conserve and manage living aquatic resources or maintain or improve the conservation status of marine ecosystems, including:	Not applicable	Ban of the use of trawl nets, above seagrass beds of, in particular, Posidonia



Policy framework	Types of area	Legal fisheries management regime	Objectives	Examples	
				Non-Mediterranean waters	Mediterranean Sea
			<ul style="list-style-type: none"> - Establishment of fishing protected areas - Restrictions and prohibitions concerning fishing gears, and certain areas and sensitive habitats like maerl and coralligenous 		<p>oceanica or other marine phanerogams is prohibited.</p> <p>Ban of the use of towed gears within 3 nautical miles of the coast or within the 50 m isobath where that depth is reached at a shorter distance from the coast.</p> <p>In any case, the use of trawl nets is prohibited within 1,5 nautical miles of the coast.</p> <p>Ban on the use of towed dredges and trawl nets fisheries at depths beyond 1000m (10).</p>



Policy framework	Types of area	Legal fisheries management regime	Objectives	Examples	
				Non-Mediterranean waters	Mediterranean Sea
Mediterranean and Black Sea under GFCM	Fisheries Restricted Areas (FRA) (e.g. areas closed to demersal fisheries)	GFCM (FAO, 2016)	To protect nursery and spawning grounds, in addition to measures included in management plans; To protect vulnerable marine ecosystems		FRA in the Strait of Sicily: established to protect juveniles of hake and deep-water rose shrimp and support stocks recovery (GFCM, 2016) Ban of any towed demersal fisheries below 1000m depth (GFCM, 2005)



Policy framework	Types of area	Legal fisheries management regime	Objectives	Examples	
				Non-Mediterranean waters	Mediterranean Sea
Common Fisheries Policy	Fisheries Stock Recovery Areas	CFP – Art. 8	<p>To prohibit or restrict fishing activities in areas where there is clear evidence of heavy concentrations of fish below minimum conservation reference size and of spawning grounds. To this aim:</p> <ul style="list-style-type: none"> – EU Member States should identify suitable areas which may form part of a coherent network – The European Commission may be empowered to establish such biologically sensitive protected areas in a multiannual plan. 	MS still have to identify these areas	MS still have to identify these areas
National Legislations	MPA, Fish Stock Recovery Areas; MMA; real time closures; etc.	National legislative frameworks for both environmental and fisheries management (often only)	<p>Various types of instruments with their objectives:</p> <ul style="list-style-type: none"> - National MPAs for conserving species or habitats of national interest - National fisheries reserves/boxes to protect juveniles, spawning grounds etc. 		<p>Some examples: Fishery Reserve of Cap Roux (France, Ministerial decree from 2003)</p> <p>Parc naturel marin du Golfe du</p>



Policy framework	Types of area	Legal fisheries management regime	Objectives	Examples	
				Non-Mediterranean waters	Mediterranean Sea
		applicable to national fleet)			Lion (France; Decret n 2011-1269) 31 marine protected areas in Italy's coastal waters (Law 979/1982)



1.2 Case study: fisheries management under the Natura 2000 network in the Western Baltic Sea and the Kattegat

In 2014 Denmark, along with other EU Member States of the Baltic Sea Fisheries Forum (Baltfish), undertook a process to propose joint recommendations (EC, 2013b; EC, 2013c) to adopt fisheries conservation measures under Art. 11 of the CFP to protect certain habitats types sensitive to physical disturbances from fishing (e.g. reefs – Habitat code 1170 and bubbling reefs – Habitat code 1180) in 10 Natura 2000 sites located in Danish waters of the Western Baltic Sea and the Kattegat. This was the first Delegated Act for such a process in EU, which came into force 1st January 2016. Therewith Denmark “sets the terms of references” for joint recommendations and delegated acts for the fisheries management measures in Natura 2000 sites in EU.

With the aim to identify best practice and lessons learnt from setting fisheries management measures in Natura 2000 under CFP, we revised the decision-making process in the Danish Natura 2000 sites.

1.2.1 Danish Natura 2000 sites located within the 12 nautical miles:

Case study sites characteristics: the scope of the joint recommendation covers ten Natura 2000 sites located within the 12 nautical miles of Danish waters, seven in the Western Baltic Sea and three in the Kattegat (EC, 2013b). Sweden and Germany have fishing rights in the Danish territorial waters in Kattegat and both countries have therefore interest in the fisheries management of the Natura 2000 sites.

Site size: average size protected areas are small: between 3.4 and 86 km²; 15.4 km² on average.

Catches volumes: estimated average annual catches (cumulative) amount to 52.1 tons (2010–2012). Danish, Swedish and German vessels contribute respectively to 34%, 65% and 1% of these catches. In particular, 44% of the Swedish catches are from traps to catch edible crabs in the “Læso Trindel & Tønneberg Banke”.

Monitoring of fishing activities: control and enforcement of fishery management measures in marine Natura 2000 sites in Denmark is currently based on the Vessel Monitoring System (VMS) and risk-based systems coordinated by the Fishery Monitoring Centre (FMC), which displays all Nature 2000 sites in the Danish V-track system. VMS is mandatory for fishing vessels over 12m Length Overall (LOA) (EC, 2009b). The control areas are small, and since the automatic sent VMS data from vessels is transmitted every 2 hours, the vessel could pass the Natura 2000 sites in the time period between two VMS pings, (EC, 2009b). But authorities are alerted when a vessel (> 12m) enters the control area, which is placed around any Natura 2000 site which has fisheries management measures. The minimum size of the control area is 4 nautical miles. Within this area, any vessel activity will be detected. Every day FMC receives a list of vessels which have been detected in control areas the previous day and authorities have the opportunity to react on it (EC, 2013b). In case a vessel has been detected within a Natura 2000 site, the vessel fishing pattern is analysed and the vessel is contacted with the purpose to inform the vessel of the current fisheries measures. The Danish V-track system allows for real-time control and for administrative control.



Vessels < 12m are not required to have a VMS system on board and will therefore not be detected by the current control system. In 2016 around 205 (Danish Agrifish Agency, 2017) commercial vessels below 12m are registered to operate in these areas, of which two thirds of the active vessels are below 10m LOA (STECF, 2016a).

Monitoring of the sites and the progress: control and enforcement of the proposed management measure should be monitored for effective implementation of the measures by the Danish National Monitoring Programme (NOVANA). The Danish Centre for Environment and Energy (DCE) monitors reefs in 34 Natura 2000 sites. Boulder reefs in 12 areas are monitored yearly, whereas the boulder reefs in the 22 remaining sites are monitored every 6 years. In addition, the Danish Agency of Water and Nature Management monitor macro algae coverage and fauna on transects on reefs in the coastal zones. Monitoring of benthic fauna includes species diversity, species composition, density and biomass. In 2017 supplementary monitoring on benthic fauna will be completed in 2 areas and all 6 areas will be revisited in 2021.

The policy process

2011	Mapping of the habitat types in Danish waters.
Summer 2014	Denmark initiated the procedure with Sweden and Germany for adopting a joint recommendation for conservation measures in seven Natura 2000 sites in the Kattegat and three sites in the Baltic Sea
End 2014 – Beginning 2015	Stakeholders’ consultations with the Baltic Sea Advisory Council and the North Sea Advisory Council (NSAC) were carried out. National coordination meetings and stakeholders’ consultations took place in the ‘Natura 2000 Dialogue Forum’ involving environmental NGO’s, fishermen organizations and research institutes.
During 2014	The Danish Ministry of Food, Agriculture and Fisheries considered that there was a need to introduce restrictions on certain fishing activities in the area and therefore submitted proposals for fisheries regulation to the European Commission in 2014.
March 2015	Denmark and Sweden jointly recommended fisheries management measures to the EC, for adoption as a delegated act. Germany, which also had fisheries interests in the concerned sites, supported but a different approach would have been followed in their own sites (EC, 2013b)
April 2015	STECF (STECF, 2015) advised on the need for appropriate measures to prevent fishing activity in the areas as to achieve the conservation objectives (See Table 2 below)
June 2015	EC published the Delegated Act “Commission Delegated Regulation (EU) 2015/1778 establishing fisheries conservation measures to protect reef zones in waters under the sovereignty of Denmark in the Baltic Sea and Kattegat”
January 2016	The delegated act 2015/1778/EU entered into force on 1 January 2016 and governs all fishing activities of EU vessels in the respective sites.



Table 1.2 Management measures proposed and related scientific advice for Danish Natura 2000 sites located within the 12 nautical miles:

Management proposal by Danish authorities	Scientific advice	Consultation inputs
<p>Ban for fishing activity using mobile bottom contacting gear, i.e. beam trawls, bottom otter trawls, Danish and Scottish seines, and dredges.</p> <p>All areas mapped as reefs (1170) and bubbling reef (1180) as well as a buffer zone of (240m. wide)</p> <p>In addition, for the three Natura 2000 sites in the Kattegat where bubbling reef are present, the ban encompassing all types of fishing gear.</p>	<p>STECF (STECF, 2015) concluded that the proposed conservation measures are a step forwards to minimise the negative impacts of fishing activities on the reef habitats and ensure that fisheries activities avoid the degradation of the marine environment as stipulated under the Article 2(3) of the CFP.</p> <p>STECF further identified some control and enforcement issues of the proposed fisheries management measure in the sites. It considered that for effective implementation of the measures, the following should be revised:</p> <ul style="list-style-type: none"> - Extending the Danish control system that alerts authorities when vessels enter the control area to all fishing vessels equipped with VMS operating in proximity to the areas, including other EU fishing vessels. This includes an assessment of current VMS ping frequency; - Identify adequate control systems where the fishing ban extents to passive gears (often used by small boats which are not equipped with VMS <12m LOA). <p>ICES (ICES, 2013) advised on a closure three times warp length if the water is below 500m deep.</p>	<p>Stakeholders: <u>North Sea Advisory Council (NSAC, 2014)</u>: proposed a reduction of buffer zones when fishermen could prove the area is fished in a manner which prevents the gear being pulled into the area while the vessel at the same time stays outside the area;</p> <p><u>NGOs (Oceana and WWF):</u> - criticised the lack of ecosystem based approach to fisheries management. The sites are often too small, so that the area designation might allow protecting the site, however there is no space for recovery;</p> <p><u>Danish fisheries producer organization (Danish Agrifish Agency, 2016)</u>: preferred a longer period of fisheries data reference considering that 4 years would not be sufficient.</p> <p>Member States: <u>Sweden</u>: recognised the need to adapt control means to improve the effectiveness of compliance and to implement mandatory AIS systems to all vessels (Danish Agrifish Agency, 2016)</p>



Fisheries management measures in the sites established with the Delegated Act:

- a ban for fishing activity using mobile bottom contacting gears in certain reefs zones of the Natura 2000 sites, i.e. beam trawls, bottom otter trawls, Danish and Scottish seines, and dredges.
- a ban for any fishing activity in the three Natura 2000 sites of Kattegat where bubbling reef are present.

1.2.2. Natura 2000 sites located outside 12 nautical miles (offshore)

Case study sites characteristics: The second Danish regional process concerns four offshore Natura 2000 sites in the Kattegat and three offshore Natura 2000 sites in the Baltic Sea, where Sweden, Germany, and to some degree Estonia, Poland, Lithuania, Latvia and Finland have fishing rights.

The process for a new joint recommendation to protect reefs (habitat code H1170) and bubbling reefs (habitat code H1180) structure in the Western Baltic Sea and the Kattegat has started in 2016 as to regulate fishing activities exercised by *all* vessels including fishing vessels carrying the flag of other Member States of the EU in Danish territorial waters.

The Danish part of the Western Baltic Sea is an important fishing area for Denmark, Sweden and Germany, and to some extent also Poland; although the highest fishing effort is carried out by Denmark. Nevertheless, Danish, Swedish and German fishing activities within the seven Natura 2000 sites constitutes less than 0.2% and 1% of the total VMS effort in Kattegat and Western Baltic Sea for bottom mobile gears and for all gears combined, respectively.

The policy process

May 2016	A second regional process was launched in order to protect reef structure of seven additional sites that are under Danish national territorial waters in Western Baltic Sea and the Kattegat and where Baltfish members share fishing opportunities.
May - August 2016	Member States ad hoc working groups have been held to define the proposal for a joint recommendation The Danish AgriFish Agency held pre-consultation meeting in May 2016, and presented the proposal for a joint recommendation at the Natura 2000 Dialogue Forum in May 2016
November 2016	The proposal for fisheries management measures were sent to EC and Baltfish on 16th November 2016.
December 2016	STECF (STECF, 2016b) advised on the need to ensure no-take zones for all the reefs and their buffer zones. STECF also reported that additional effort was required to ensure protection of harbour porpoise, grey/harbour seals, sandbanks, mudflats, lagoons site and several bird species. Moreover, to achieve the conservation objectives, appropriate measures to prevent fishing activity should be put in place.



July 2017

The delegated act was published “Commission Delegated Regulation (EU) 2017/1181 of 2 March 2017 amending Delegated Regulation (EU) 2017/117 establishing fisheries conservation measures for the protection of the marine environment in the Baltic Sea and repealing Delegated Regulation (EU) 2015/1778”



Table 1.3 Management measures proposed and related scientific advice for Danish Natura 2000 sites located within the 12 nautical miles:

Management proposal by Danish authorities	Scientific advice	Consultation inputs
<p>A ban for fishing activities with mobile bottom contacting gear in areas mapped as reefs (habitat 1170)</p> <p>A 240 meters wide buffer zone, which is equivalent to 6 times the average water depth</p>	<p>STECF (STECF, 2016b) concluded that the proposed conservation measures are a step forwards to minimise the negative impacts of fishing activities on the reef habitats and ensure that fisheries activities avoid the degradation of the marine environment as stipulated under the Article 2(3) of the CFP.</p> <p>STECF noted that in one area the proposed boundaries of the no-take zones are positioned very close to the reefs and in some cases do not encompass a buffer zone as defined by the ICES Guidelines.</p> <p>STECF noted that additional measures would have been necessary to ensure the protection of other species and habitats listed in some sites, in particular: harbour porpoise, grey and harbour seals, sandbanks, mudflats, lagoons and several, bird species.</p> <p>The restrictions proposed would ensure adequate protection of the reef structures from direct impact from fishing activities, provided that there is full compliance. However:</p> <ul style="list-style-type: none"> - The proposal does not indicate how the activities of German and Swedish vessels will be monitored or how control and enforcement 	<p>Stakeholders:</p> <p><u>NSAC</u> (EC, 2013c): questions on how can Denmark secure environmental favourable conditions in the areas by only imposing fishing restrictions;</p> <p><u>NGOs</u> (EC, 2013c): More coherent protection zones and a holistic and ecosystem based approach would provide more protection (and restoring) of the habitat and species located near it;</p> <p><u>Danish Fishermen Producers Organisation</u> (EC, 2013c): supported the thematic approach and site specific measures, rather than total closure at site level</p> <p>Member States (EC, 2013c):</p> <p><u>Sweden</u>: interested in discussing the eco-system based approach and the linkages to the MFSD provisions. The Danish proposal solely addresses physical damage to reefs and bubbling reefs. These sites have also been designated for other habitats and species, e.g. sandbanks, harbour porpoise and seabirds;</p> <p><u>Germany</u>: Need for ensuring adequate protection of harbour porpoise, since some of the sites concerned are also designated for harbour porpoise.</p>



	<p>activities will be extended to such vessels. Also potential fishing activities of vessels from Estonia, Poland, Lithuania, Latvia and Finland are not taken into account;</p> <ul style="list-style-type: none">- Fishing vessels not equipped with VMS will not be detected by the current control system;- Since the control areas are small, VMS vessels could enter the sites in the time period between two VMS pings period, currently set at frequency of two hours	<p>Need for a linkage between the proposal and the MSFD and size of buffer zones in the Kattegat. DTU Aqua and ICES have given scientific advice on buffer zones.</p>
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1.3 Conclusions and best practices identified:

- i) **Precautionary approach and science based management:** when establishing MMA, as in the case of Natura 2000 in Denmark, it is crucial that decision policy makers base the proposed fisheries management measures on the best available scientific advice; this would ensure effective delivery of the expected results and achievement of the objectives. In both the cases of Natura 2000 sites - inshore and offshore - STECF has advised on the need for proper monitoring and control adapted to the areas, as well as changes in delineation methods for buffer zones to be more precautionary. However, in both cases these requirements have not been taken into account by Denmark and the Member States involved in drafting the joint recommendation. This might put at risk the protection of the Natura 2000 sites and it could be detrimental to achieve the objectives MS are bound to.

In contrast to this example, the UK has taken a more precautionary approach when designing fisheries management to its MPAs. Where uncertainty remains around fishing impacts, the UK has taken a zoned approach (DEFRA, 2017) to identifying management areas. In particular, the criteria to be considered when defining the zoning of the MMA should cover, as far as practicable, the following:

- a) the range of sedimentary habitat sub-types that occur within the site (e.g. encompassing the various depth ranges);
- b) cover the geographic spread of the habitat within the site;
- c) include all areas where there is evidence to support the presence of highly sensitive biological communities;
- d) where possible, include large areas of continuous feature rather than smaller, fragmented areas.

This practically results in rich sedimentary habitats adjacent to reefs structures to be protected within a larger management area. This approach is proposed on a precautionary basis to prevent any new fishing areas being developed within the boundaries of the managed area, particularly between patches of habitats types.

- ii) **Assess the full potential and sufficiency of proposed measures:** The scientific assessment of the proposed measures should not be limited to the proposed measures *per se* but it should ensure they maximize the potential and likelihood of reaching the conservation objectives defined for the targeted areas.

The adequacy, sufficiency and level of ambition of the Joint Recommendations should therefore be taken into account through a gap-analysis between the non-action baseline and the maximum potential anticipated effects of the proposed measures.

Consequently, the European Commission, or the body in charge, should clearly request STECF, or the scientific committee of reference, in its Terms of Reference to assess against this maximum potential option, and then strictly follow scientific recommendations to ensure that proposed management measures meet the highest possible potential conservation benefits and the objectives for which the MMA are set. In addition, socio-economic impacts of the measures proposed should be evaluate.



- iii) **Adopt integrated MMA that encompass all protected habitats and species at once:** a main weakness of the approach taken by Denmark for its Natura 2000 sites lies in the “piecemeal approach”, which consists in proposing fisheries management per single habitats and species types, instead of including all listed habitats and species types of one sites at once.

Such sequencing approach of setting management measures results in leaving out several threatened species and habitats without protection meanwhile. In the Danish case, many Natura 2000 sites were also designated for protecting sandbanks habitats (1100), large shallow inlets and bays (1160) and harbor porpoises.

Only an integrated approach on all features at the same time will respect the ecosystem-based approach to fisheries management and the precautionary approaches, and tackle all possible individual and cumulative impacts from fishing activities. By avoiding sequenced processes, an integrated MMA will also speed up and facilitate the implementation of such measures and thus reduce delay in making the targeted area effective.

- iv) **Adopt common methodology for assessing the impact of fisheries on marine Natura 2000 sites:** it would be important that MS adopt consistent methodologies to establish fisheries management measures in Natura 2000 sites. This particularly relevant considering that the guidelines have already been developed. If Denmark, Germany and Sweden had followed these guidelines, the shortcomings of the JR highlighted may have been avoided.

MS should then use the following guidelines:

1. Common methodology for assessing the impact of fisheries on marine Natura 2000:

<http://ec.europa.eu/environment/nature/natura2000/marine/docs/Fisheries%20methodology.pdf>

2. Overview of the potential interactions and impacts of commercial fishing methods on marine habitats and species protected under the EU Habitats Directive:

<http://ec.europa.eu/environment/nature/natura2000/marine/docs/Fisheries%20interactions.pdf#page=27&zoom=auto,-82,792>

- v) **Define and implementing proper enforcement:** the case study showed that the scientific advice stressed the need for proper control of fishing activities in the control areas. The STECF advised on the need to control and enforce activities of all the fishing vessels operating in the vicinity and in the Natura 2000 sites. It stressed the need to also foresee measures to monitor small scale fishing vessel not equipped with VMS, as well as to adjust VMS signals frequency as to ensure no fishing activity might take place within Natura 2000, in particular when control areas are small. However, the final Delegated Act merely recognizes the need for additional control and enforcement measures and does not identify nor propose these, despite the clear scientific advice.

In contrasts to this situation, it is interesting to compare with more recent draft Joint Recommendations from other EU Member States, which consistently propose to



adapt fisheries controls to improve effectiveness of compliance. Examples comprise, for instance:

- increased VMS signal transmission (the Netherlands)¹,
- extended buffer zones (the Netherlands)²,
- mandatory AIS equipment (Sweden)³,
- mandatory surveillance cameras to record by-catch (Germany)⁴.

Adequate enforcement is indispensable for improving law enforcement and compliance in MMAs. The effectiveness of enforcement and monitoring, control and surveillance (MCS) ought to be a primary consideration when designated areas to be protected in the marine environment (29).

- vi) **Stakeholders' consultation:** the drafting process of the joint recommendations included a stakeholders' consultation phase which allowed stakeholders to provide their feedback on the measures proposed. Stakeholders' consultation is a key element of the CFP that should be guaranteed and streamlined in all decision making process. The consultation process carried out by Denmark has resulted to be quite transparent to all stakeholders, as illustrated by the fact that the government circulated most of the documents to the Member States and the stakeholders at the same time. Also most of the documents were made available online, both in Danish and English, on the responsible ministry's homepage.

Therefore, to ensure proper transparency in the consultation process some weaknesses must conversely be avoided, such as initiating parallel informal consultations among targeted stakeholder groups. Also, it is important that proper feedback and justifications on political trade-offs resulting from the public consultations are provided and reported from MS.

- vii) **Regionalisation under the CFP and the role of the Member States:** under the CFP, the technical measures rules, and the newly introduced regionalisation process, Member States are responsible for:
- a. adopting the necessary fisheries conservation measures to comply with the environmental obligations both in their networks of marine protected areas – or MMA - (Art. 11), as well as outside, when relevant (Art. 7);
 - b. identifying spawning and nursery grounds which may form part of a coherent network of Fish Stock Recovery Areas (FSRAs, Art. 8)

Member States have sole competence for the implementation of fisheries conservation measures under the CFP and environmental legislation. However, progress is extremely slow and very few examples exist. The Danish example is the

¹ In the draft Dutch joint recommendation under CFP article 11 for "Klaverbank", vessels carrying on board any prohibited gear types and travelling under six knots within the alert zone shall transmit their VMS data every 10 minutes.

² In the draft Dutch joint recommendation under CFP article 11 for "Klaverbank", a 4NM wide alert zone around the management zones is proposed.

³ In the Swedish joint recommendation under CFP article 11 for "Bratten", compulsory use of AIS as a complement to VMS for all vessels fishing in the area is foreseen (Art. 5 Delegated Regulation (EU) 2017/118).

⁴ In the draft German joint recommendation under CFP article 11 for Natura 2000 sites within the German EEZ, all fisheries using gillnets and entangling nets must use cameras to monitor the species fished in order to record the by-catch of harbour porpoises in certain Natura 2000 sites.



only case for Natura 2000 so far adopted⁵, while none exist for other MPAs, nor for FRAs. However, a number of other Member States, including the UK, Belgium, the Netherlands or Germany, are currently in the process of preparatory consultations for joint recommendations under article 11 of the CFP.

Also, in the case of MMA designated for nature conservation purpose, it is crucially important for the initiating Member States to engage early enough with environmental experts, in particular to conduct comprehensive impact assessments on the specific nature conservation objectives of the areas. Similarly to what is required for Natura 2000⁶, these evaluations should be the basis for the development of management measures that may take into account socio-economic aspects. The case studies presented show that informal consultation was primarily started within MS fisheries groups (e.g. Baltfish in the Baltic Sea) where expertise on marine nature conservation might be not as high as for fisheries.

Final remarks:

Overall, when defining MMAs, it is important to identify the objectives of the MMA, then defining the policy context in which these areas are going to be defined and established. As per the policy context (Table 1), the scope of MMA might vary from protection aimed at nature conservation, to fisheries related protection (spatial or temporal) to support the recovery of commercial fish stocks, or even to other goals (e.g. species management area, cultural heritage). In this context, there is therefore a need to clearly set objectives when defining a network of MMAs and subsequently to identify the adequate category of spatial management tools together with the required fisheries management measures.

Although the processes presented in this case study have been aligned with the requirements of the CFP, it raised the general concern that scientific advices have not been properly addressed and followed in the final policy decision while available guidelines have been ignored too. In the Mediterranean, the need to align fisheries management measures to scientific advice can be considered crucial. Indeed, continuous failure to implement scientific advices has led to serious overexploitation and mismanagement of the fish resources (Cardinale et al., 2017; Vielmini et al., 2017).

Finally, we remark that fisheries control and MMA enforcement is essential to ensure good implementation of MMA (Guidetti et al., 2008). This has proved to be particularly relevant in the Mediterranean Sea, where there is a need to effectively support marine ecosystems preservation as well as to support the recovery of fish stocks – since over 90% of the stock assessed are overexploited (Cardinale, et al., 2017).

⁵ The Natura 2000 Swedish site of Bratten in the Kattegat was also included into the Danish joint recommendation presented in the case study

⁶ See guidance on marine Natura 2000 http://ec.europa.eu/environment/nature/natura2000/marine/index_en.htm



2. Examples from MMAs in the two case studies (Adriatic Sea and Strait of Sicily)

The existing and new Marine Managed Areas in the two case studies have been reported in deliverable D2.1 – MPAs maps. The objective of the present section is to provide an overview of the existing Fisheries Restricted Areas (FRAs) in the Adriatic Sea and the Sicily Channel in order to explain the management approaches, the objectives and goals, the management measures adopted and the monitoring and control system implemented in each FRA.

The analysis covers:

- for the Sicily Channel, the Maltese's Fisheries Management Zone and the three FRAs established under the GFCM multiannual management plan (Recommendation GFCM/40/2016/4),
- for Adriatic Sea, the Pomo Pit closed area.

2.1. Malta's Fisheries Management Zone

Malta has managed fishing in a zone under its national jurisdiction surrounding the archipelago beyond its territorial waters, since 1971. After Malta became a member of the European Union (EU) in 2004, fishing in Maltese waters became subject to the Common Fisheries Policy retaining the 25NM as a Fisheries Management Zone (FMZ) in the interests of fishery conservation. Since the entry into force of UNCLOS in 1994, this zone can be considered as a sub-set of an Exclusive Economic Zone (EEZ).

2.1.2 Objectives and Goals

The objective of the original Maltese Exclusive Fishing Zone (EFZ) was to protect local small-scale fisheries by excluding large commercial fishing vessels, in particular bottom trawlers. During EU accession negotiations the Maltese authorities raised concerns that deregulation of the zone between 12 NM and 25 NM may lead to a substantial increase in fishing intensity in this area. It was argued that in line with the Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries, a precautionary approach should be adopted and fishing effort should not be increased, in particular with regards to demersal trawl fishing.

During technical discussions held as part of the accession negotiations, evidence was presented that the stocks found on the continental shelf of the Malta Bank and in shallow waters (less than 200 m) surrounding the Maltese Islands were isolated from the adjacent areas, and that the Malta Bank constitutes an important spawning area (Camilleri, 2007). It was further argued that due to the oceanographic characteristics of the area, larvae from outside the zone would be unlikely to serve as an important source of recruitment. Moreover, satellite imagery was used to show that the water masses surrounding Malta are oligotrophic and thus of limited productivity, increasing the vulnerability of the area to potentially negative effects caused by high exploitation rates (Camilleri, 2007)⁷. From a socio-economic perspective the Maltese authorities successfully highlighted the fact that the Maltese fishers are economically, geographically and culturally dependent on artisanal fisheries, and that the introduction of

⁷ Technical discussions carried out in 2004 which were published in 2007



large-scale industrial practices would disrupt the artisanal nature of Maltese fishing operations (Camilleri, 2007). These arguments were accepted, and in the interests of fishery conservation, the 25-NM zone was retained as a Fisheries Management Zone (FMZ) with a fishing effort regime when Malta joined the EU in 2004.

2.1.3 Legal and Institutional Framework

Until Malta joined the EU, the most important piece of legislation regulating fisheries in the EFZ was Malta's 1934 Fish Industry Act, which underwent only minor changes over the years (Camilleri, 2005). The national legislation included a ban on trawling within territorial waters, which initially extended to 3 NM, and was increased to 12 NM in 1971 by Act XXXIII of 1971 (Territorial Waters and Contiguous Zone Act to extend the territorial waters of Malta and to make provision for a contiguous zone, as amended by Acts: XLVI of 1975, XXIV of 1978, XXVIII of 1981, I of 2002, X of 2005 and XXIX of 2014). In 2001 the Maltese Fisheries Conservation and Management Act was enriched (to make provision for the regulation, conservation and management of the fisheries of Malta and matters incidental thereto, as amended by Legal Notice 426 of 2007; and Acts XV of 2009, IV of 2013 and XXXIV of 2014).

During Malta's EU accession negotiations, a new management regime was proposed (Camilleri, 2003), which, *inter alia*, suggested the restriction of demersal trawl fishing to trawlable areas identified during a survey carried out by the FAO in 1978 (Giudicelli, 1978). The FMZ management regime was included in Council Regulation EC 813/2004 (amending Regulation (EC) No 1626/94 [laying down certain technical measures for the conservation of fishery resources in the Mediterranean] as regards certain conservation measures relating to waters around Malta), and the provisions were subsequently maintained when Council Regulation EC 1967/2006 (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) was introduced on the 21st December 2006. Article 26 of EC 1967/2006 (hereafter referred to by its commonly used name 'the Mediterranean Regulation') which sets out effort regime including measures limiting fishing effort, capacity, vessel size, engine power and fishing areas for certain types of fishing within the Maltese FMZ.

More recently the Maltese authorities implemented management plans for the lampara purse seine, bottom otter trawler and dolphinfish (*Coryphaena hippurus*) fisheries taking place within the FMZ through Legal Notice 354 of 2013 (implementation and enforcement of certain fisheries management plans order) in line with Article 17 of 1967/2006.

2.1.4 Management Approaches and Measures

The measures adopted for the management of resources within the FMZ essentially limit fishing capacity and fishing effort by restricting vessel size and engine power. Fishing within the FMZ is generally limited to fishing vessels smaller than 12 metres overall length which are not using towed gears. A number of fishing activities conducted by vessels larger than 12 m are however allowed to operate by way of derogation, including a (limited) number of trawlers, vessels fishing for dolphinfish, and vessels fishing with small pelagic purse seines and longlines.

The total fishing effort of vessels, expressed in terms of the overall fishing capacity, was set in the Treaty of Accession, and cannot exceed the average level observed in 2000-2001 (i.e. prior to Malta's accession to the EU). Moreover, a specific fishing capacity ceiling exists for trawlers operating in the FMZ in general, and for trawlers operating at depths of less than 200 m specifically. The Mediterranean Regulation specifies that capacity limits should be subject to periodical reviews. Such a review was conducted as part of the introduction of management plans lampara purse seine, bottom otter trawler and dolphinfish fisheries, which contain provisions to reduce fishing effort as well as fishing capacity for lampara and bottom trawl fisheries, in order to ensure sustainable exploitation of fishing resources within the FMZ.

Trawlers not exceeding an overall length of 24 m are allowed to operate within the FMZ, but only in certain areas within the FMZ; trawlable areas are described in Annex V (a) of EC 1967/2006. These trawl zones were also reviewed when drafting the trawl fishing management plan. A spatial analysis comparing the distribution of sensitive bottom types such as seagrass, deep-water corals and maerl beds to the location of legal trawl zones revealed a maerl bed exposed to trawling pressure off the south-eastern coast of Malta. In order to address this situation, the trawl zones were amended and all areas where conclusive evidence exists for the presence of maerl beds were closed to trawling in 2012 (Figure 2.1). Work is ongoing to ascertain whether further areas to the south-east of Malta where rhodoliths have in the past been recorded are in fact maerl beds.

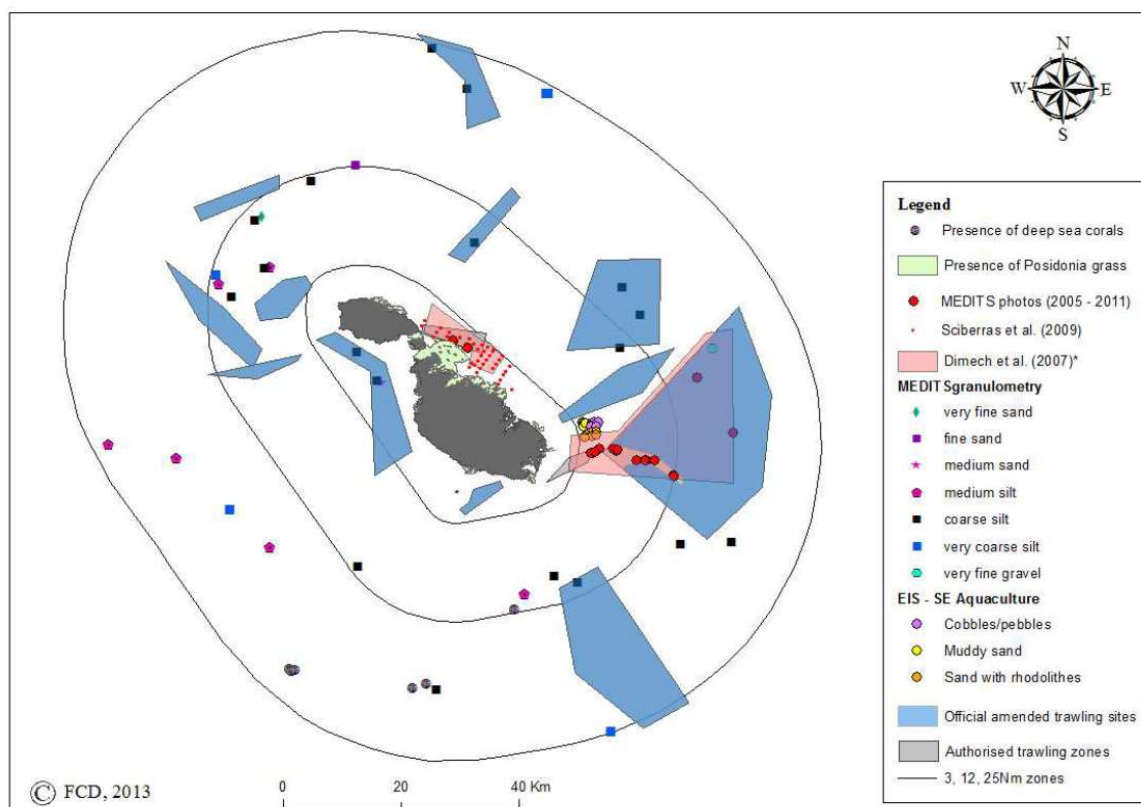


Figure 2.1 Map of the 25-Nautical Mile Maltese Fisheries Management Zone, showing bottom types and habitats overlying (i) the original authorised trawling zones (as included in EC 1967/2006) in grey shading and (ii) the official amended trawling sites (as included in Legal Notice 354 of 2013) in blue shading.

The common dolphinfish fisheries using Fish Aggregating Devices (FADs) shall be prohibited from 1 January to 14th August of each year (unless poor weather has limited the fishing season, in which case it can be exceptionally extended to January), and the number of vessels participating in the fishery is limited to 130. Fishing vessels participating in the fishery are granted a special permit and are allocated one of the straight-line FAD courses on an annual basis. The FADs are distributed along transects all around the Maltese Islands, with the exception of another existent management measure reserving an area known as the 'swordfish corridor' to the south-west of Malta, which is reserved for surface longline fishing (Figure 2.2). The coordinates of the FAD courses remain constant from year to year, but their total length may change depending on the fishing vessel which will be targeting a particular transect. During the fishing season the dolphinfish aggregate under the FADs, and authorised vessels catch the species by use of a surrounding net. There is no size restriction on vessels which take part in the dolphinfish fishery.

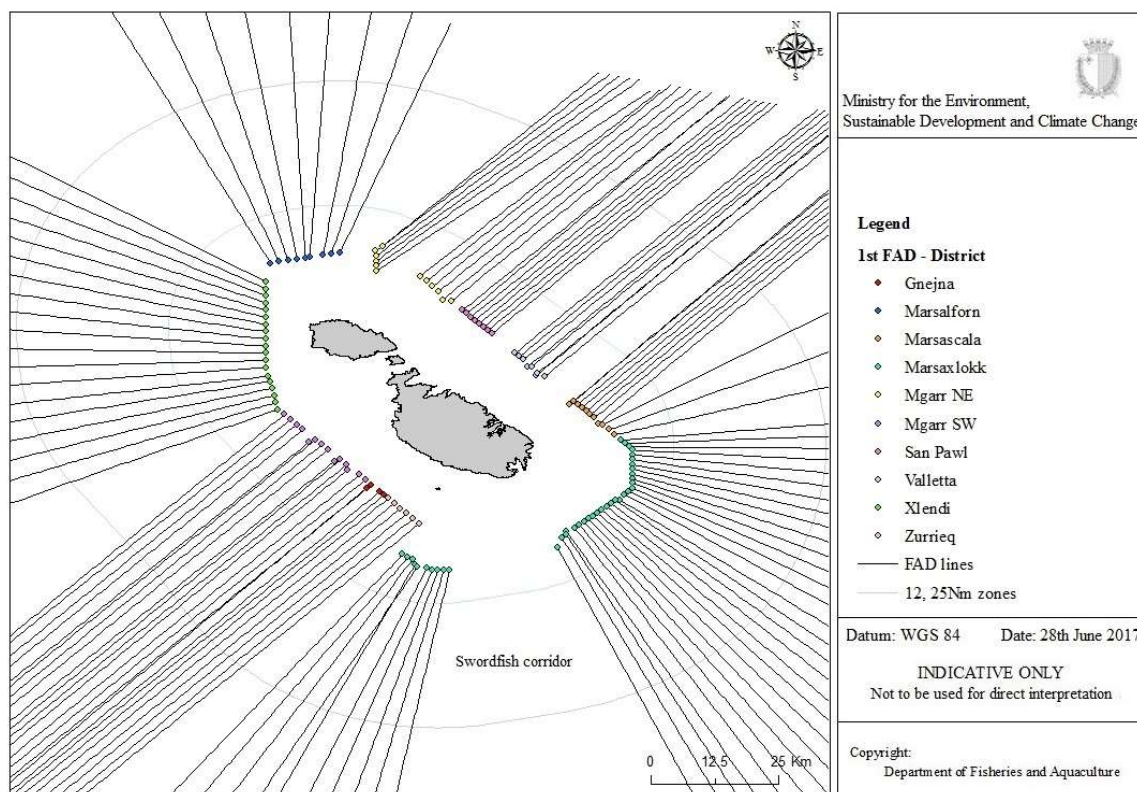


Figure 2.2 Map of the 25-Nautical Mile Maltese Fisheries Management Zone, showing distribution of dolphinfish course lines, and the district to which such course lines are allocated (coloured points).

2.1.5 Monitoring and Control System

The Armed Forces of Malta (AFM) and the Police Force's Administrative Law Enforcement



(ALE) carry out patrols in waters under Malta's jurisdiction to monitor and enforce fisheries regulations, as part of their general course of operation. The ALE patrols coastal and internal waters up to 3 NM from the coast, whilst the AFM patrols Maltese territorial waters, the 25-NM FMZ around Malta as well as the High Seas beyond such limits. Air surveillance is also performed by the (AFM). It is pertinent to note that by virtue of the Fisheries Conservation and Management Act (Chapter 425, Act II of 2011), all members of the AFM and Malta Police Force are Fisheries Protection Officers (FPOs) for the purpose of the Act and have the relevant powers at law.

Vessels operating within FMZ may only carry out fishing activities if granted an authorization by the Department of Fisheries and Aquaculture (DFA) within the Ministry for the Environment, Sustainable Development and Climate Change (MESDC). Any sightings by the AFM both of Union vessels or third country vessels which are not in possession of a valid fishing permit are reported to the DFA for legal action. Additionally, in 2012, the DFA procured a Rigid Hull Inflatable Boat (RHIB) for the scope of carrying out additional independent spot-checks at sea. Community – Based (EU) joint deployment plan missions (JDP) supervised by the European Fisheries Control Agency (EFCA), are also performed which provide the framework for the exchange of inspectors (Fisheries) between member states.

Further controls on the fleet's activities are carried out through the use of a Vessel Monitoring System (VMS) for vessels with lengths overall above 12 m. Since 2012, the Automatic Identification System (AIS) has in addition been used to monitor the activities of vessels of 15m and over. Remote monitoring of the dolphinfish purse seine, the lampara fishery for small pelagics, as well as the small scale artisanal 'tartarun' surrounding net fishing fleets is being carried out via GPRS since 2014 for vessels below 12 m length overall.



2.2. Fisheries Restricted Areas established under the GFCM multiannual management plan (Recommendation GFCM/40/2016/4)

In 2016 three Fisheries Restricted Areas (FRA) have been established under the General Fisheries Commission for the Mediterranean and Black Sea (GFCM) as part of the management measures foreseen in the multiannual management plan for shared demersal stocks of hake and deep-water rose shrimp in the Strait of Sicily⁸.

The three FRA adopted correspond to nursery areas for European hake (*Merluccius merluccius*) and deep-water rose shrimp (*Parapeneaus longirostris*) in the northern sector of the Strait of Sicily, where “nursery areas” are defined as the spatial persistence of hot spots of recruit densities over long periods (Garofalo et al. 2011).

The locations of these nursery areas match with zones of relatively high production, where upwelling and other enrichment processes regularly occur in time. Due to the stability over time of these nurseries, the three FRA have been identified as essential fish habitats (EFH) for the juvenile life stage of European hake and deep-water rose shrimp (Fiorentino et al. 2008; Garofalo et al. 2011).

The scientific advisory committee (SAC) of the GFCM has recurrently considered that the stocks of European hake and deep-water rose shrimp are in overexploitation in the geographical subareas (GSA) 12, 13, 14, 15 and 16. Also, in 2015 the 17th SAC positively validated a proposal for the establishment of three fisheries restricted areas (FRA) in the Strait of Sicily as a measure to protect juveniles. Then in 2016 the SAC⁹ advised on the need for the adoption of a management plan aimed at ensuring the conservation of demersal stocks in the Strait of Sicily, including, along with a reduction in fishing effort, the establishment of FRA to protect juveniles.

At policy-making level, in 2015, at the 39th session of the GFCM a preliminary recommendation¹⁰ was adopted setting the basis for management measures in the Strait of Sicily which was then followed in 2016 by the adoption of the multiannual management plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (GSA 12 to 16). This plan established three fisheries restricted areas in the Strait of Sicily (see below and **Annex I**).

This plan is not yet fully implemented by EU and national legislation and, for this reason, currently, the three fisheries restricted areas in the Strait of Sicily are not implemented.

2.2.1 Legal and institutional framework

At national level:

In GSA 16, the Italian government set an Italian National Strategic Plan for Fisheries and the Italian National Operative Program (2007-2013): Management Plan GSA 16 (Sicily Strait) for trawlers over 18m length. Such a plan was approved in 2011 and became only partially operative mainly focusing its intervention in regulating the fleet capacity.

⁸ REC.CM-GFCM/40/2016/4 establishing a multiannual management plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (GSA 12 to 16)

⁹ GFCM-SAC Subregional Committee for the Central Mediterranean (SRC-CM), February 2016 (<http://www.fao.org/gfcm/reports/technical-meetings/detail/en/c/396373/>)

¹⁰ Recommendation GFCM/39/2015/2 on the establishment of a set of minimum standards for bottom trawling fisheries of demersal stocks in the Strait of Sicily, pending the development and adoption of a multiannual management plan



The Maltese Islands are surrounded by a 25 nautical mile Fisheries Management Zone (FMZ), where fishing activities, including those targeting demersal species, are managed in line with provisions included in Council Regulations EC 813/2004 and 1967/2006 (see part II, section 1, of the present document for further details on the Maltese FMZ). Moreover, the Maltese government adopted a national management plan for bottom otter trawlers through Legal Notice 354 issued in October 2013¹¹..

In GSA 14, Tunisia has in place a ban for bottom trawling in the Gulf of Gabés from July to September every year.

At international level:

The management of shared demersal fish stocks in the Mediterranean Sea is under the purview of the GFCM. In 2014 a revised and updated GFCM agreement (FAO, 2016) - also called “GFCM basic text” - was adopted which is also based on the 1995 FAO Code of Conduct for Responsible Fisheries.

In particular, the basic text foresees, among other principles and objectives, that:

- A subregional approach to fisheries management should be fostered (Art. 5);
- The precautionary approach should be adopted, while the absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures (Art. 5);
- GFCM recommendations shall be based on the best scientific advice available, taking into account relevant environmental, economic and social factors (Art. 5);
- GFCM shall adopt multiannual management plans based on an ecosystem approach to fisheries to guarantee the maintenance of stocks above levels which can produce maximum sustainable yield (Art. 8);
- The establishment of fisheries restricted areas for the protection of vulnerable marine ecosystems, including but not limited to nursery and spawning areas, in addition to or to complement similar measures that may already be included in management plans (Art. 8).

In 2015, the 39th GFCM session adopted some management measures pending the development and adoption by the GFCM of a multiannual management plan for the fisheries targeting hake and deep-water rose shrimp in GSA 12-16. Then, on the 3rd of June 2016, at the 40th GFCM session, the multiannual management plan for the fisheries exploiting European hake and deep-water rose shrimp in the Strait of Sicily (GSA 12 to 16)³ was adopted and it entered into force, according to the GFCM basic text rules, on the 1st of October 2016.

¹¹ Subsidiary Legislation 425.09, Implementation and Enforcement of Certain Fisheries Management Plans Order, Legal Notice 354 of 2013, 25th October 2013 (<http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=12111&l=1>)



2.2.2 Management approaches

The multiannual management plan (MAP) for the Strait of Sicily has been adopted at GFCM level and contracting parties, mainly Italy, Malta and Tunisia, are directly responsible for its direct implementation.

In line with Article 14 of the GFCM basic text any GFCM decision is binding to the GFCM contracting parties.

2.2.3 Objectives and goals

Three MMA or FRA have been established under the GFCM MAP³ for demersal fisheries targeting hake and deep-water rose shrimp in the Strait of Sicily, encompassing the marine waters of GSAs 12, 13, 14, 15 and 16 (see Fig. 2.3).

The MMA have been established with the aim contributing to achieve the specific objectives of the MAP that are:

- a) Apply the precautionary approach to fisheries management;
- b) Ensure that exploitation levels of European hake and deep-water rose shrimp are at the maximum sustainable yield (MSY) by 2020 at the latest;
- c) Protect nursery areas and essential fish habitats important for the stocks of European hake and deep-water rose shrimp in the Strait of Sicily;
- d) Gradually eliminate discards, by avoiding and reducing, as far as possible, unwanted catches, and by gradually ensuring that catches are landed;
- e) Provide for measures to adjust the fishing capacity of the fleets to levels of fishing mortalities consistent with the MSY, with a view to having economically viable fleets and without overexploiting marine biological resources.

Overall, there is global acceptance to adopt a wider ecosystem approach to fisheries (EAF) using models that represent ecological processes important to the species in the ecosystem (FAO, 2008). In particular, the identification of spawning and nursery areas allows identifying discrete areas where the reduction of fishing pressure throughout the year - or in discrete periods - could be a valuable management tool (Caddy, 1999; Largier, 2003).

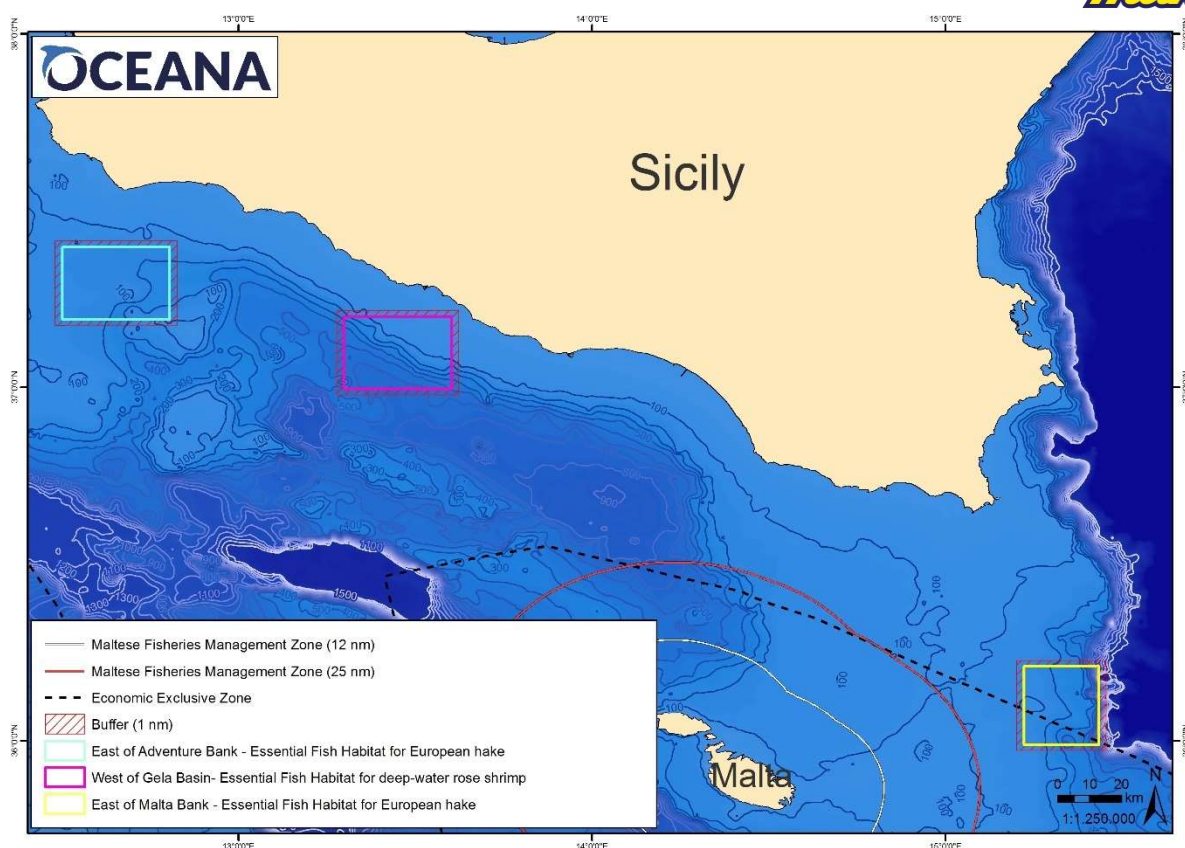


Fig. 2.3: Fisheries Restricted Areas (FRA) established under the multiannual management plan in the Strait of Sicily

In particular, in GSA 15 and GSA 16, the GFCM Subcommittee on Stock Assessment reported the stocks of deep-water rose shrimp and hake as overexploited and for the latter a low biomass level has also been recorded (SAC-GFCM, 2014). These two stocks represent an important part of demersal landings and the effects of overfishing are highlighted also by the reduction in the production levels. As matter of fact, the bulk of the trawl catches in the Sicily channel has been notably composed of recruits.

The over-fishing of demersal resources has been a major issue in the Strait of Sicily (central Mediterranean) since the early eighties (Fiorentino et al., 2008). The regulation of fisheries has so far been based on limitations of fishing capacity (licenses), minimum landing sizes, net mesh sizes, temporary fishing closures (Fiorentino et al., 2008) and areas closed to trawling within the Maltese FMZ (Annex V of EC 1967/2006), but the establishment of no-fishing zones, particularly within nursery areas, has been increasingly advocated as a further component of the fishery management strategy under the Mediterranean Regulation¹².

Taking into account that in the Mediterranean mixed fisheries, selectivity of demersal trawl fisheries cannot be improved beyond certain level, spatial closures on nursery grounds have been widely advocated as a more effective means of limiting the capture of juveniles and

¹² 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



enhancing the long-term sustainability of the fishery (Garofalo et al. 2011).

The temporary or permanent restriction of fishing activity on spawning grounds is historically believed to be effective for preserving the reproductive potential of populations, and for enhancing recruitment. Furthermore, reducing fishing effort on juvenile stages is of the utmost importance when juveniles are the primary target of unselective fishing gear, as it is the case in the Strait of Sicily (Garofalo et al. 2011).

Closure to fisheries of essential fish habitats (EFH) allows for proper juvenile protection in overfished stocks, in agreement with an ecosystem-based approach to fishery management. Indeed, in 2010 UNEP/RAC SPA put forward a proposal recommending that fishing with any towed gear be restricted in correspondence of the EFHs in Adventure and Malta Banks (UNEP-MAP-RAC/SPA 2010).

A wide array of sound scientific literature qualified the FRA adopted under the MAP as Essential Fish Habitat, i.e. habitats essential to critical life-history stages of target species Fiorentino et al., 2003; Abella et al. 2008; De Juan & Leonart, J. 2010; Fortibuoni et al. 2010; Garofalo et al. 2011; Vega Fernández et al. 2012; Gristina et al. 2013).

The establishment of FRA, where trawling fishing activities are prohibited, is an essential tool for maintaining or rebuilding stocks and protecting their habitats. Moreover, all the areas are habitats essential to critical life-history stages of target species and as such, the three areas meet one of the criterion for being included in a network of marine protected areas (Roberts et al., 2003) to be implemented with the goal of achieving sustainable fisheries (Roberts et al., 2005).

2.2.4 Description of management measures

The MAP applies to bottom trawls above 10 meters length overall fishing for European hake and deep-water rose shrimp in the Strait of Sicily, when the total catches of those species represents at least 25 percent of the catch in live weight or value.

In particular, within the established FRA:

- i. Any fishing activity with bottom trawlers is not allowed;
- ii. Buffer areas have been set up around the FRA in order to avoid accidental access to the FRA;
- iii. Any fishing activity with bottom trawlers in the buffer areas shall ensure their frequency of transmission of vessel monitoring system (VMS) signals. Those vessels not equipped with VMS transponder and aiming to fish in the buffer areas shall be equipped with any other system of geolocalisation allowing control authorities to track their activities;
- iv. The GFCM scientific committee (SAC) should identify additional nursery areas of European hake in the entire Strait of Sicily, with special attention to GSA 12, 13, and 14.

The MAP also foresees a temporal closure in the Gulf of Gabès (GSA 14). In particular, any fishing activity with bottom trawlers is not allowed between the coast and the 200 meters depth



isobaths of GSA 14. This closure applies from 1 July, until 31 September every year.

Furthermore, to regulate the fisheries the following measures have also been established under the plan:

- i) A the list of authorised vessels to operate under this plan has been established and the countries involved have to communicate their list to the GFCM. Vessels authorised have to record all their catches of European hake and deep-water rose shrimp;
- ii) Fishing vessels targeting European hake or deep-water rose shrimp in the Strait of Sicily shall be equipped with a VMS in accordance with Recommendation GFCM/33/2009/7;
- iii) By 30 November 2016, the countries involved in the MAP have to identify measures which will lead to a reduction in fishing effort - in terms of number of fishing days, fishing vessels and catch limits – in order to ensure the MAP goals are achieved;
- iv) Landing ports in which landings of European hake and deep-water rose shrimp from the Strait of Sicily may take place have to be designated by the countries concerned (i.e. Italy, Malta, Tunisia);
- v) For each designated landing port, the permitted landing and transshipping times and places should be set and inspection coverage during all landing and transshipping times and at all landing and transshipping places should be ensured;
- vi) It is prohibited to land or transship from fishing vessels any quantity of European hake and deep-water rose shrimp fished in the Strait of Sicily at any place other than landing ports designated.

The MAP also incorporates specific measures already in place under the GFCM and the EU Mediterranean Regulation⁵ which regulate:

- The minimum mesh size of the codend of demersal trawl nets¹³;
- Minimum standards for the establishment of a vessel monitoring system (VMS) in the GFCM area of application¹⁴;
- The prohibition of any fishing activity with trawl nets within three nautical miles of the coast or within the 50 meters isobath where that depth is reached at a shorter distance from the coast¹⁵.

2.2.5 Monitoring and control system

An observation and inspection programme shall establish before 2018 by the countries involved, through GFCM, as to ensure compliance with the conservation and management measures contained in this recommendation. This programme may inter alia comprise the

¹³ Recommendation GFCM/33/2009/2

¹⁴ Recommendation GFCM/33/2009/7

¹⁵ Recommendation GFCM/36/2012/3



following elements:

- a) High seas inspection;
- b) Procedures for an effective investigation of an alleged violation of the conservation and management measures contained in this recommendation, and for reporting to the GFCM on the actions taken, including procedures for exchanging information;
- c) Provisions for appropriate action to be taken when inspections reveal serious violations as well as the expedient and transparent follow-up of such actions in order to uphold the flag State's responsibility within the intended programme;
- d) Port inspections;
- e) Monitoring of landings and catches, including statistical follow-up for management purposes;
- f) Specific monitoring programmes, including boarding and inspection;
- g) Observer programmes.

Also, as part of the provisions foreseen in the MAP, a working group has been established to develop integrated monitoring, control and surveillance (MCS) measures. The first meeting was held in May 2017 as “*ad-hoc session on integrated MCS measures for demersal fisheries in the Strait of Sicily*”, as part of the working group on VMS of the GFCM. On that occasion, the expert of the European Fisheries Control Agency (EFCA), informed the ad-hoc session on the elaboration of a pilot project for the Strait of Sicily, pursuant to the recommendation GFCM/40/2016/4 aimed at implementing an observation and inspection programme to ensure compliance with the conservation and management measures contained in the recommendation. The pilot project, managed by the EFCA, includes joint operational activities and inspections, exchange of information, training and capacity building, procedures for dealing with sanctions and the application of technology for detecting potential IUU activities.



2.3 Jabuka/Pomo Pit Closed area

The Pomo Pit (also called Jabuka Pit) is one of the most important habitats for the most important shared demersal stocks of the Adriatic Sea. Although it covers less than 10% of the total surface of the Adriatic Sea, it is one of the most important fishing grounds especially for the bottom trawl fishery which apply a high fishing pressure on the resources of the area. It is a region where cold nutrient rich waters from Northern Adriatic flow near the bottom and get trapped by the bottom shape. It has thus waters with more nutrients near the bottom than near surface waters. These conditions encourage a high abundance of fish and invertebrates and the area has long been known as a productive fishing ground, due to the high presence of some species whose stocks are commercially important like hake, shrimps, Norway lobsters and cephalopods. In addition, the Pomo Pit is an important (or the main) nursery area for many demersal species and in particular for the stock of hake in the northern and central Adriatic. It is distant 40 nautical miles from the Italian coast and it extends inside the Croatia territorial waters (UNEP-MAP-RAC, 2015).

2.3.1 Legal and Institutional Framework

The establishment of Jabuka/Pomo Pit FRA was based on long-time assessment of biological resources and analysis carried out by a working group through FAO AdriaMed project that showed a decline in biomass of these commercial species. The working group proposed a MMA closed to trawlers and in 2015 a bilateral agreement between Italy and Croatia, which took into account the advice of AdriaMed scientists (Adriamed, 2011) introduced a fishing closed area. The Pit was then re-opened to trawling in 2016.

In May 2017, the Scientific Advisory Committee (SAC) of the General Fisheries Commission for the Mediterranean (GFCM), endorsed a proposal for the establishment of a Fisheries Restricted Area (FRA) in the Jabuka/Pomo Pit, with a core area closed to demersal fisheries and a surrounding buffer area with limited and monitored fishing. In October 2017, recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea was adopted.

2.3.2 Management Approaches

Croatia and Italy reached an agreement in May 2017 to ban fishing near Jabuka Pit. The agreement was reached following several months of negotiations between Croatian and Italian administrations, backed by scientists, the fishing sector and non-governmental organizations in both countries.

In May 2017, Croatia introduced a new ban on demersal fisheries in an area of the Pit of approximately 2500 sq. km, published in the Official Gazette (NN 47/2017 http://narodne-novine.nn.hr/clanci/sluzbeni/2017_05_47_1106.html).

Italian Ministry introduced a national regulation with two Ministerial Decrees (Ministerial Decree No.466 of 1 June 2017 and Directorial Decree of 21 July 2017) on the establishment of a protection area and on procedures for the implementation of the Pomo Pit closed area.

Finally, the recommendation GFCM/41/2017/3 aligned the two national legal frameworks and introduced a single institutional framework.

The establishment of the closed area is fully supported by Italian and Croatian fishermen; in the months before the adoption of the GFCM recommendation, fishermen were consulted by national administrations and, at the end, the final provisions have been fully endorsed by local

stakeholders.

2.3.3 Objectives and goals

The protection of the most important nursery and spawning grounds of the overexploited species in Adriatic, such as European hake and Norway lobster.

2.3.4 Description of management measures

The Jabuka/Pomo Pit FRA has been divided in three zones as reported in fig.2.4

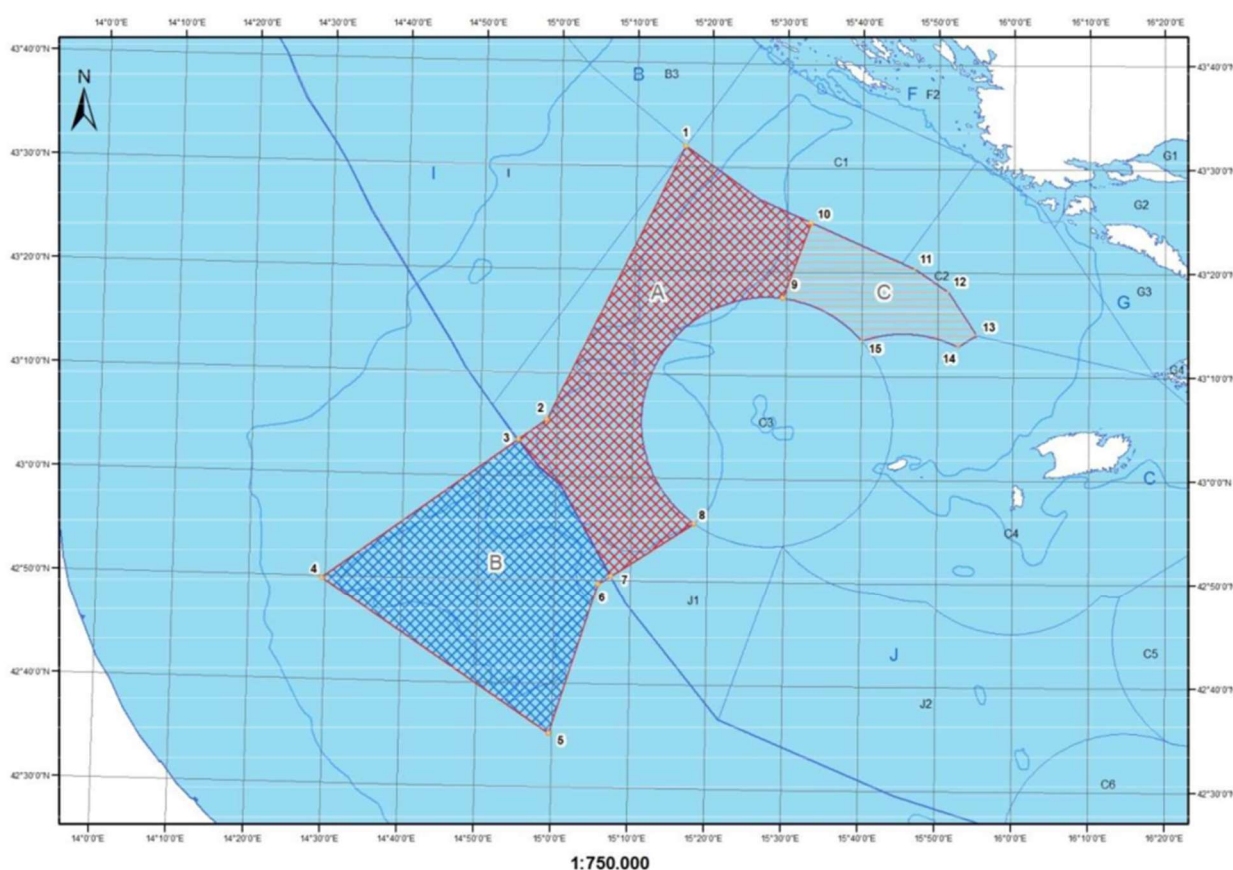


Fig. 2.4: Geographical coordinates of the Jabuka/Pomo Pit FRA (Adriatic Sea) – Source: Annex I Rec. GFCM/41/2017/3

Only fishing vessels in possession of a specific authorization shall be entitled to fish in Pomo Pit FRA.

In the three areas, fishing activity has been regulated in this manner:

in zone A, any recreational fishing activity and professional fishing activity with bottom-set nets, bottom trawls, set longlines and traps shall be prohibited.

in zone B, fishing activities with bottom-set nets, bottom trawls, set longlines and traps shall be prohibited, from 1 September to 31 October each year and starting from 2017.



in zone C, fishing activities with bottom-set nets, bottom trawls, set longlines and traps and recreational fisheries shall be prohibited, from 1 September to 31 October each year and starting from 2017.

Management measures include restriction in fishing time (i.e. two fishing days per week in zone B, only Saturday and Sunday in zone C).

2.3.5 Monitoring and Control System

Fisheries activities will be monitored by VMS or AIS and through electronic logbooks; all the fishing vessels authorized to fish in zone B and/or zone C shall be equipped with vessel monitoring systems (VMS) and/or automated identification systems (AIS).

Evaluation of the establishment of FRA to the status of the stocks will be monitored through two scientific surveys in spring - summer and autumn - winter period under framework of MEDITS and FAO AdriaMed. Furthermore, special working group (composed by the scientist, administration and fishermen) will be established to coordinate all activities and for preparation of annual report of the status of the resources with proposal of further regulation measures.



Annex I: Description of the FRA - Essential Fish Habitats (EFH) in the northern sector of the Strait of Sicily:

EFH for European hake (*Merluccius merluccius*)

The occurrence of two main nursery areas for hake, one on the eastern side of the Adventure Bank and the other on the Malta Bank at depths ranging between 100 and 200 m has been extensively documented (Fiorentino et al. 2003; Abella et al. 2008; Gristina et al. 2013).

On both Banks, the nurseries extend from about 100m to the upper slope. Mean density of recruits in the nursery areas varied between 460 and 1260 individuals per km², with a mean of 990 (CV= 31%; Fiorentino et al. 2003). The strength of recruitment results to be very stable in the Strait of Sicily. Modest seasonal changes in nursery location were observed with a shift towards shallower/inshore waters in spring, probably due to a reduction in water stratification. The location of nurseries in the Strait of Sicily corresponds to the permanent cyclonic gyres on Adventure and Malta Banks (Abella et al. 2008). Indeed, these locations coincide with zones characterised by a relatively higher production, where upwelling phenomena and other enrichment processes were detected. The comparison of the nursery location with the main oceanographic features in the Strait of Sicily suggests that the eddies and the frontal systems produced by the AIS, play a major role, influencing and maintaining over the years the localization of spawning areas as well as the spatial structure of nurseries. These mesoscale structures are thought to retain larvae and juveniles, and sustain the feeding of the juveniles' aggregation, which are concentrated in areas of the continental shelf where the anomalies are repeated to a greater or lesser extent every year (Abella et al. 2008).

The area east of the Adventure Bank, extending from the 100 m bathymetry up to 400m, provides a recruitment ground for European hake and other species of commercial interest like horned octopus, greater forkbeard and Norway lobster (Garofalo et al. 2011). This area is characterized by the large cyclonic vortex, Adventure Bank Vortex (ABV). The hake nursery grounds coincide with zones characterised by a relatively high production, in terms of food for larvae, thanks to the upwelling generated by the cyclonic vortex thus turning into favourable conditions for feeding and growth (Garofalo et al. 2011). Therefore, the frontal systems produced by the AIS in the Strait of Sicily play a major role, influencing and maintaining over the years the localization of spawning areas as well as the spatial structure of nurseries. The recruitment of European hake occurs all year round (Ragonese et al., 2004).

The nursery of the Malta Bank is delimited by the Ionian Front on its eastern side (Abdella et al. 2008). As for the hake nursery described for the Adventure Bank, the oceanographic characteristics of Malta Bank play a key role in influencing the distribution of the nursery. The thermal filament east of the Malta Bank, are thought to play an important role in retaining and concentrating hake recruits in the identified nursery areas (Fiorentino et al. 2008).

In addition to the EFH for hake, for this area it has also been reported a high abundance of young-of-the-year of *Parapeneus longirostris* that has been identified as nursery for this species (Fig. 3) (Fortibuoni et al. 2010). As for hake, favorable recruitment conditions for the deep-water rose shrimp in Malta Bank are generated by the oceanography of the area, as the Ionian Shelf-break cyclonic Vortex (ISV) acts as a retention area with low current velocities (García Lafuente et al., 2002) and dispersal is contained by the Ionian Slope Front (ISF). The co-occurring of EFH for European hake and deep-water rose shrimp highlights the importance of



protecting this ground as an Essential Fish Habitat in a multi-species fisheries management contest as foreseen by the ecosystem approach.

EFH for deep-water rose shrimp (*Parapeneus longirostris*): This stable spawning area for *Parapeneus longirostris* is located western to the Gela Basin, along the south coast of Sicily, across the outer shelf-upper slope (i.e. between the shelf break and the upper slope). Indeed, the outer shelf corresponds to the preferential depth range for the recruitment processes of this species and here maximum value of aggregation of the young-of-the-year (i.e. individuals in their first year of life) have been recorded during all seasons (Fig. 3). The maximum density indices (n/km^2) recorded for the young-of-the-year (YOY) range between 22,743/ km^2 and 36,449/ km^2 at depth between 100 - 300 m in springtime and 100 - 200 m in autumn. (Fortibuoni et al. 2010).

The spatial stable patterns of *P. longirostris* EFH has been connected to the peculiar oceanography of the area. On one side the AIS has a meandering nature that benefits eggs and larvae from linked enrichment and concentration zones induced by alterations in the vorticity along the flow axis (García Lafuente et al. 2002). Moreover, the presence of a 'stagnant point' (still water) - where the stream impinges the shore on the eastern side of the Adventure Bank, approximately where a nursery area of *P. longirostris* is found - provide suitable conditions for recruitment due to the stable conditions resulting from the low velocities associated with the bifurcation of the AIS. These oceanographic characteristics, including the role of the AIS in connecting the spawning and the nursery areas, lead to the high abundance of deep-water rose shrimp and the temporal persistence of nurseries (Fortibuoni et al. 2010).



Annex II: Geographical coordinates of the Fisheries Restricted Areas (FRA)

FRA 1: *East of Adventure Bank*

Fisheries Restricted Area		Buffer Area	
Latitude	Longitude	Latitude	Longitude
37° 23,850' N	12° 30,072' E	37° 24,849' N	12° 28,814' E
37° 23,884' N	12° 48,282' E	37° 24,888' N	12° 49,536' E
37° 11,567' N	12° 48,305' E	37° 10,567' N	12° 49,559' E
37° 11,532' N	12° 30,095' E	37° 10,528' N	12° 28,845' E

FRA 2: *West of Gela Basin*

Fisheries Restricted Area		Buffer Area	
Latitude	Longitude	Latitude	Longitude
37° 12,040' N	13° 17,925' E	37° 13,041' N	13° 16,672' E
37° 12,047' N	13° 36,170' E	37° 13,049' N	13° 37,422' E
36° 59,725' N	13° 36,175' E	36° 58,723' N	13° 37,424' E
36° 59,717' N	13° 17,930' E	36° 58,715' N	13° 16,682' E

FRA 3: *East of Malta Bank*

Fisheries Restricted Area		Buffer Area	
Latitude	Longitude	Latitude	Longitude
36° 12,621' N	15° 13,338' E	36° 13,624' N	15° 12,102' E
36° 12,621' N	15° 26,062' E	36° 13,624' N	15° 27,298' E
35° 59,344' N	15° 26,062' E	35° 58,342' N	15° 27,294' E
35° 59,344' N	15° 13,338' E	35° 58,342' N	15° 12,106' E



3. Identification of the most appropriate procedures and tools to assess the establishment of MMAs network

3.1 Introduction

The most appropriate procedures to establish and manage a MMA network in the Mediterranean, in the light of the most recent development of fisheries policies, should be based on a participatory approach, where the different actors strongly interact among them, having the same common aim: achieve the main objective of enhancing fisheries toward the MSY goal. The designation, implementation, and management of MPAs should consider conservation outcomes as well as socioeconomic impacts and financial and institutional sustainability (Pascual, 2016). The implementation of marine areas often creates conflicts among stakeholders, as access to valued ecosystems, localities, and stocks is prohibited or heavily curtailed. These conflicts, in return, may affect the social, economic, and institutional dimensions, which are critical to the success of MMAs.

The participatory approach is one of the main element of the so called “responsive management” that has been studied and evaluated in different EU research projects.

In particular, ECOFISHMAN¹⁶ (ended in February 2014), EU FP7 project, developed a new management system, called Responsive Fisheries Management System (RFMS), based on the concept of the results based management (RBM), whose basic rationales, according to the Commission’s Green paper on the reform of the Common Fisheries Policy, is the shift in the burden of proof. According to these concepts, the ECOFISHMAN project has developed a management system which transfers the responsibility for (fisheries) management to resource users. Three main actors are identified: a) *authority*, the entity entrusted with the final responsibility for resource management which specifies the measurable objectives to be reached; b) *operators*, organised group of resource users (e.g. association of fishermen with fishing rights in a given fishery); c) *auditor*, entitled to evaluate whether the contract between the authority and the operators has been fulfilled in the sense that the outcome targets listed in the (potential) management plan have been achieved.

The involvement of relevant stakeholders will enhance the achievement of such a structured responsive system. This aspect has been further exploited by the SOCIOEC¹⁷ project which recommended to involve stakeholders in a proper evaluation of the potential effects of a (new) management measure and/or framework. Strong stakeholders’ involvement should be envisaged in the different stages of the analysis, from a) setting the scene (definition of the nature and scale of the “problem”) to b) giving inputs for scenarios to c) evaluating results of simulations and giving feedback for potential improvements. Stakeholder involvement is also essential in the pre-screening of the acceptability of the management framework proposed: higher is the acceptability higher is the compliance and the effectiveness of a management measure. SOCIOEC also determined the socio-economic and spatial effects of these management measures (Impact Assessment, IA) paying special attention to fishermen’s

¹⁶ ECOFISHMAN (Ecosystem-based Responsive Fisheries Management in Europe) Project ID: 265401 Funded under: EU FP7-KBBE <http://www.ecofishman.com> , http://cordis.europa.eu/fp7/home_en.html

¹⁷ SOCIOEC (Socio economic effects of management measures of the future CFP) Project ID: 289192 Funded under: FP7-KBBE <http://www.socioec.eu/>, http://cordis.europa.eu/result/rcn/182523_en.html

behavioral responses (e.g. incentives), to the potential links of management measures with uncertainties and externalities (e.g. oil price, interest rates, fish market prices).

3.2 The process of establishment of a MMA

Planning is the very basic precondition for every management action. Without proper planning, it is not possible to reach any achievements. According to Černecký (2011), the process of planning is cyclic (figure 1). After first finalization of management plan the reassessment should be done based on monitoring and management effectiveness. Continuous process is part of management planning process, that never ends.

The relevant steps in the process of establishment of a MMA are the following (figure 3.1):

- a) Budget
- b) Data collection and basic evaluation
- c) Stakeholder involvement
- d) Strategic plan and management objectives
- e) Management measures
- f) Socio – economic benefits
- g) Implementation of the plan
- g.1) Monitoring and management effectiveness

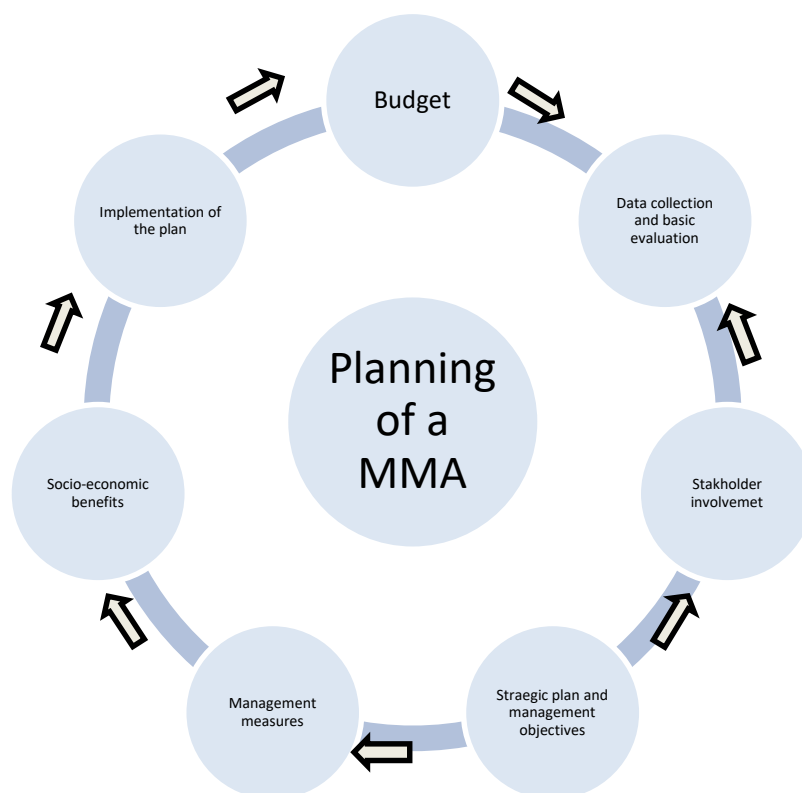


Figure 3.1 The process of establishment of a MMA (adapted from Černecký, 2011)

Budget

The financial plan should consider the feasibility to fulfill management goals. The definition of the budget and financial planning is discussed in section 5 of the present deliverable.

Data collection and basic evaluation

There are several investigations methods, which differ in resources and time needed for



gathering the data. Use of existing data is cheapest and easiest way of data collection, however the requested data may not exist already. In these cases, additional data collection should be necessary. In the process of establish a MMA, two issues should also be considered:

the use of incomplete data, or bad interpretation of data could lead to numerous problems in process of preparation and implementation of the plan, especially in stakeholder involvement, proper objectives definition and management measures proposal. Participation from other interested sector in the data collection process could lower the costs and could enhance a better validation of information.

the planning phase should include as many aspects as possible due to better acceptance, economical sustainability, demography and cultural values. The more aspects are included, the higher value of the area is visible. This means that not only ecosystem, biological and economic data should be included but also demographic data, data on the all relevant economic sectors affected by the MMA (not only fishery activities); even cultural and social information could be beneficial.

Work Package 2 of MANTIS project is aimed at setting-up a robust and efficient information infrastructure to support the spatial modelling and the development of assessment tools.

Stakeholder involvement

Several EU projects suggested models to understand how to integrate stakeholders in management. A conceptual model of results based management in fisheries was proposed by ECOFISHMAN that suggested as a way for public authorities to delegate specific management and documentation responsibilities to resource users. The model comprises three defining features: (1) that authorities define measurable objectives for the utilization of fisheries resources; (2) that resource users are made responsible for achieving these objectives and for (3) providing documentation that allows for an audit of the extent to which they are met (K. Nolde Nielsen, 2015).

This model is presented and adopted to the present deliverable in the following section (3.3 The governance structure of a MMA).

Strategic plan and management objectives

Objectives are very important part of management plan, however in long term perspective the planning should start not by definition of objectives, but with the vision definition. Vision is defining the long-term status, which should be reached followed by goals, objectives, targets and activities. (Figure 3.2). Understanding the difference between the terms Vision, Goals, Objectives, Tasks – is key for planning and eventually for fulfilling the Vision.

Planning typically starts with a vision and a mission. Then managers develop a strategy for realizing the vision and mission; their success and progress in achieving vision and mission will be indicated by how well the underlying goals and objectives are achieved.

A vision statement usually describes some broad set of goals (for instance “healthy and diverse marine ecosystems through science-based conservation and management”, “marine environments that are resilient in the face of change”, etc.).

Goals are typically outcome statements, while objectives are very precise, time-based, and measurable actions that support the completion of goals. Goals and objectives are an essential element in planning and are a key referent point in many aspects of managing and controlling.



Figure 3.2 Logical structure of a strategic plan (Carpenter, 2010)

The definition of the objectives should be very clear, logical, and precise and time bounded in order to make the proper assessment and achieve proper results, which could be later used for reassessment of management plan and self critique if the objectives are not reached.

Objectives must be SMART - Specific, Measurable, Achievable, Realistic, and Time-Bound (Doran, 1981). If objectives miss one of the SMART definitions, it is huge weakness for every strategic planning and assessments of results.

In setting a MMA, the primary objectives are connected to the protection of species and habitats. Secondary objectives could be possibly based on development of regional identity, increase tourism, conservation of cultural heritage, creation of new attraction, possibilities for recreation, research on nature and conservation of landscape.

Management measures

Management measures are important in a way of practical actions done on the site. There is lot of measures to choose from and often it is not very easy to identify the most important one. However, the practice indicates that of the measures are used repetitively.

In this perspective, the CFP, as stated in Article 11, stipulates specific procedures to facilitate the adoption and implementation of the fisheries conservation measures necessary to comply with obligations under the Union environmental legislation.

WP3 of the MANTIS project will apply bio-economic models to simulate the adoption of alternative management measures such as the set-up of areas closed to fisheries or other technical restrictions of the fishing activity or loss of EFHs or fishing grounds due to human activities different from fisheries. WP3 will also evaluate the possible effects of management measures on the redistribution of fishing effort, including small scale and recreational fisheries as well as the possible congestion of zones remaining fully open to all fisheries (e.g. increase in conflicts between fishermen and with other users of the sea).

Socio – economic benefits

Socio economic benefits are highly connected to the sustainability of the (MMA) site. The socio – economic benefits deriving from the implementation of the MMA network could be based on the “effectiveness evaluation” used for the identification of target and limit indicators, as developed in the SOCIOEC project (Malvarosa et al, 2015). Section 5 of the present deliverable describes the identification of the socio-economic objectives and specific targets, the selection of the most appropriate socio-economic indicators and the reference points to measure the targets.



Implementation of the MMA

Practical implementation of the MMA is an important part of successful achievement and overall success. In particular, monitoring system need to be the part of management every time, where any action on site is taking place.

The design of a suitable scientific monitoring and control framework to assess the effects of a coherent network(s) of protected areas on the populations of several important fish stocks and on their bio-economic effectiveness in terms of allowing fisheries to achieve MSY objectives, within the EAFM, is investigated in WP4 of the MANTIS project.

3.3 The governance structure of a MMA network

The implementation of a MMA can only be ensured by defining a governance structure in which the roles and responsibilities related to the management, monitoring and control activities in the implementation are clearly defined.

The governance structure that is proposed in this report reflects the latest approaches in terms of co-management and responsive management (Sampedro et al 2017; ECOFISHMAN project) demonstrating that stakeholders are widely involved in the management, control and monitoring phases.

Figure 3.3 below illustrates the organs and stakeholders concerned, the roles and flow of information that will characterize the governance structure of a MMA.

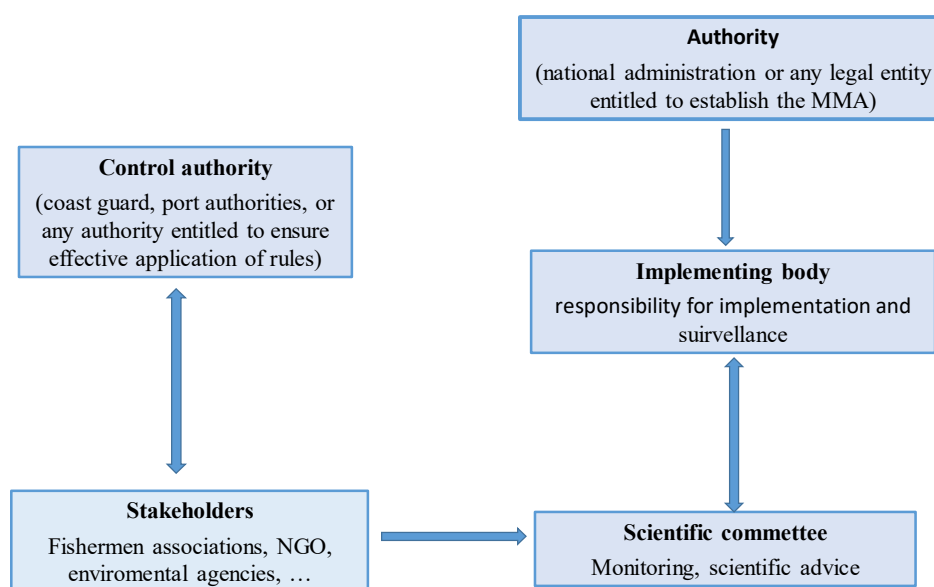


Figure 3.3 Proposed governance structure

The *authority* is an organizational entity enacting authority in pursuit of the management objectives decided for a MMA. It represents the interests of the public, and it is ultimately responsible for the establishment, general strategy and the financial support of a MMA.

At the time of establishment of a MMA, an *Implementing Body* should be appointed (which may take the form of a Consortium and may be made up of representatives of the main recipients of the MMA, eg. category associations and other stakeholders). The Implementing Body is responsible for coordination, management and administration. The Implementing Body will play the role of filtering between the Authority and the recipients of the MMA, namely the



fishermen, who will have to implement the measures and, to a certain extent, also monitor the actual application of the same measures. Fishermen, in fact, could be required to cooperate through supervisory actions (eg. sentinels) with the Coast Guard, whose task is to carry out controls on the area so that the measures provided for are respected.

A key role in the governance of the MMA will be the monitoring activities, aimed at verifying the results of the implementation of the proposed measures. In this respect, it is crucial to identify, at the same time of the establishment of the MMA, the responsible body (*Scientific Committee*) of the monitoring. The designated Scientific Committee will be responsible for monitoring the key indicators identified as being able to measure the achievement of the objectives and to produce progress reports. The main purpose of the Scientific Committee is to evaluate whether, or the extent to which, the outcome targets have been achieved.



4. Stakeholder engagement results

4.1 Questionnaire-based survey

A questionnaire was developed to gather information from stakeholders at the scale of the North West (NW) Mediterranean, Adriatic and Strait of Sicily.

The questionnaires have been collected during the two introductory meetings in Mazara del Vallo and Ancona (see deliverables 2.1 and 2.2 - Introductory meetings reports).

The aim of this section is to provide an analysis of stakeholders' perception and opinion on:

- the state of fisheries,
- fishing activities and other marine uses,
- MPAs in the region,
- fisheries management,
- and on stakeholders' involvement in decision-making.

4.1.1 Description of the questionnaire

Contents and form of the questionnaire were determined through an extensive discussion among all partners of the Safenet project (involving multiple meetings both physical and virtual, and considerable exchange of draft versions of the questionnaire) with the aim to facilitate the interaction with stakeholders as much as possible and to allow the collection of information in a standardised way in order to be used for different project activities. The questionnaire was also evaluated by Mantis project partners and integrated with their observations. The questionnaire is structured as a PDF file with active fields that can be extracted and gathered into a database for subsequent statistical analysis. It has been produced in the four Mediterranean Advisory Council (MEDAC) languages (English, Spanish, French and Italian) plus Catalan and Maltese, in order to allow fishers to interact in their native language.

The questionnaire includes closed and open-ended questions in order to obtain data that can be analysed through statistical methods while allowing respondents to provide free comments to enlarge the scope of their responses. The main topics dealt with by the questionnaire are the following:

- Personal information: age, country, current occupation, years of experience, geographic area in which the activity of the respondent is mainly based and if the activity of the respondent takes place within or around a Marine Protected Areas (MPAs).
- Opinion about the state of fisheries: current state of the fishery in the respondent's region, perceived changes of the state of the fishery, main threats to a good status of fish stocks.
- Opinion about fishing activities and other marine uses: most impacting fishing activities and fishing techniques, possible conflicts between professional fishing and other marine uses.
- Opinion about protected areas in the respondent's region: their impact on local fisheries, how they affected fishers' behavior, their main benefits.
- Opinion about fisheries management objectives: main objectives towards good fisheries management, most relevant indicators of the achievement of the objectives.



- Suggestions about management measures: recommended measures to decrease the impact on fish stocks, measures to enhance the effectiveness of MPAs.
- Opinion on the relevance and willingness of involving stakeholders in fisheries management

4.1.2 Description of the dataset

In the framework of the Mantis project, the questionnaire mainly targeted the professional fishing sector. It was distributed during the introductory meetings with stakeholders in Mazara del Vallo and Ancona and was spread by project partners to stakeholders in Croatia and Malta. The main target of this questionnaire were professional fishers, however we retained the information also from the questionnaires compiled by other stakeholders attending the meetings (MPA managers' / staff members, Authorities and Non Governmental Organisations (NGOs)). Similarly, questionnaires reached some recreational fishers too, but we did not consider them in the following analysis, since the sample size was too low to be representative. Information retrieved from questionnaires should be integrated with information collected during the 4 introductory meetings held so far in Mazara del Vallo, Ancona, Split and Chioggia, which is available in the corresponding reports. Overall, 64 stakeholders compiled the questionnaires, 17 from the Adriatic (Italy and Croatia) and 47 from the Strait of Sicily (Sicily and Malta) (Tab.4.1). A category fishers/fishers' associations representatives was created to include professional fishers using set nets, pots, traps, set longlines (professional fisher 1), professional fishers using trawl nets or purse seines (professional fishers 2), other gears (professional fishers 3, generally using bottom longlines), retired professional fishers, fishing boat owners, representatives of fishers associations and representatives of producers organisations (Tab.4.2). Overall this category included 45 respondents, 8 of whom were from Croatia, 14 were Italians (4 working in the Adriatic, 10 in the Strait of Sicily (SoS)) and 23 were from Malta.

Table 4.1 Geographic distribution and profession of the respondents.

Region	Questionnaires
Adriatic	17
Authority	1
Fisher/Fishers association representative	12
MPA	1
Recreational fisher	1
Researcher	2
Strait of Sicily	47
Authority	2
Fisher/Fishers association representative	33
MPA	2
Other	1
Recreational fisher	7
Researcher	2
Total	64



Table 4.2 Professions within the category fishers/fishers association representatives

Activity	Number
Fishers association representative	5
Fishing boat owner	3
Producers Organization	1
Professional fisher 1	20
Professional fisher 2	6
Professional fisher 3	5
Retired professional fisher	5
Total	45

The majority of fishers (32/45) were between 30 and 60 years old, 10 were over 60 years old and only 3 were less than 30 years old (Tab.4.3)

Table 4.3 Age repartitions among fishers

Age class of fishers/fishers association representatives	Number
<=30	3
30-50	15
50-60	17
60-80	10
Total	45

For the sake of simplicity, we will from now on refer to the category “fishers’/fishers associations representatives” with the shorter “fishers”, while the category “others” includes researchers, authorities and MPA staff.

4.1.3 Analysis and results

Stakeholders’ perception about the state of fisheries

The majority (58%) of fishers perceived as acceptable the state of fisheries in the Adriatic, while 41 % considered it as negative or very negative. In the SoS, 57% of fishers considered it negative or very negative, and 30 % acceptable. The analysis suggests some differences between the perception of the fishing sector and that of other stakeholders: more than 70 % of the latter considered the state of fisheries either negative or very negative both in the Adriatic and in the SoS (Fig.4.1).

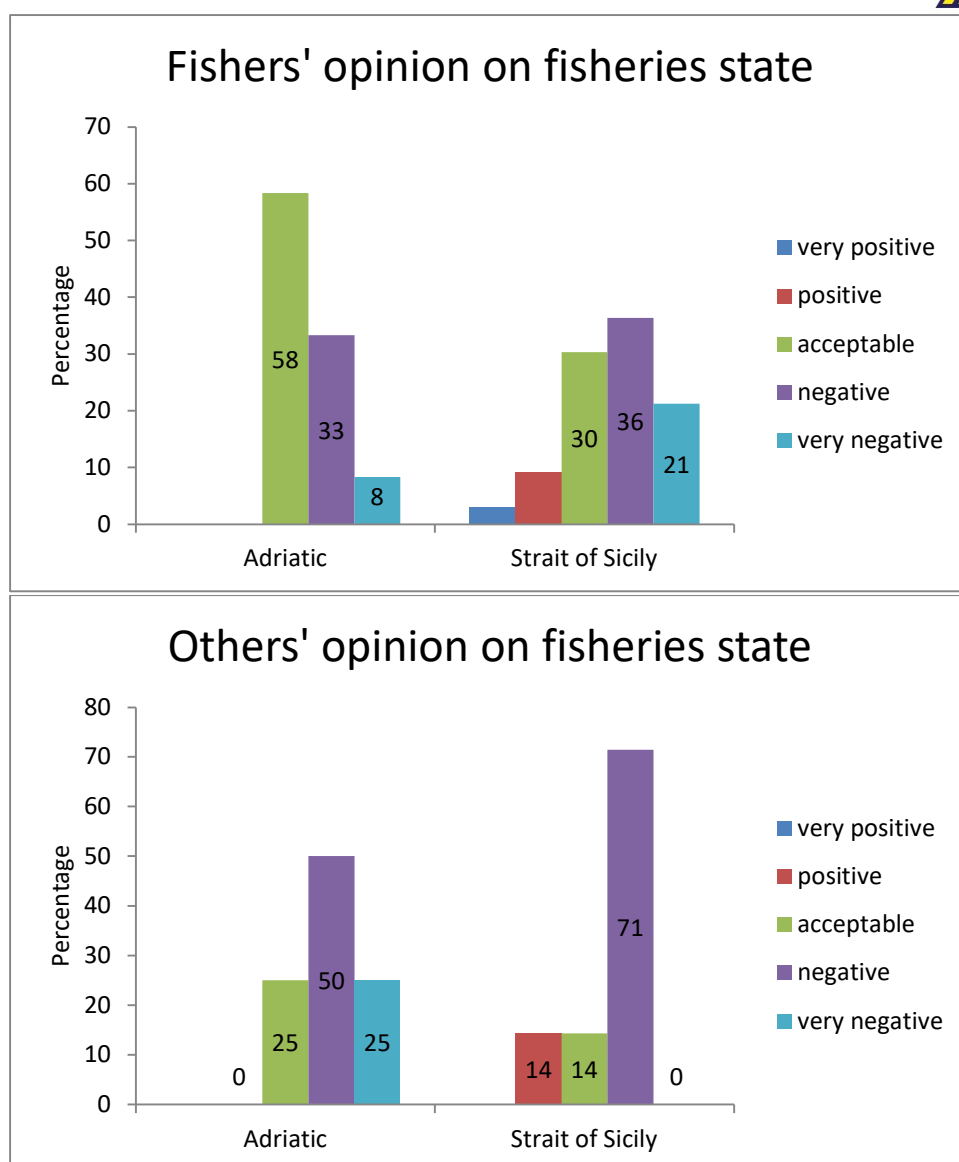


Fig.4.1 Stakeholders' opinion about the state of fisheries in their region. "Others" include authorities, researchers and MPA staff.

According to the majority of stakeholders (all but recreational fishers) (71% in the Adriatic, 60% in the SoS) fisheries have worsened in both areas in the last 10 years.

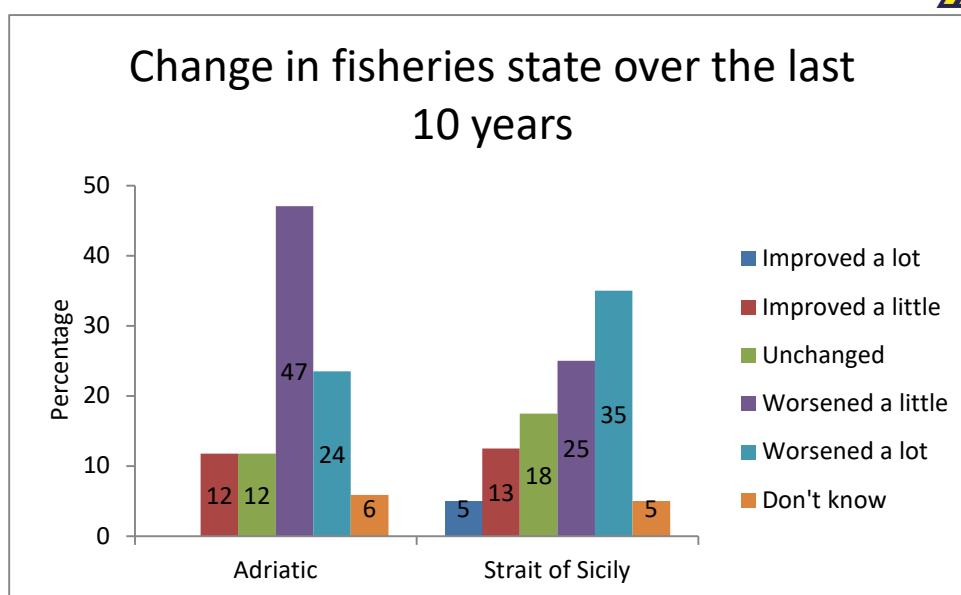
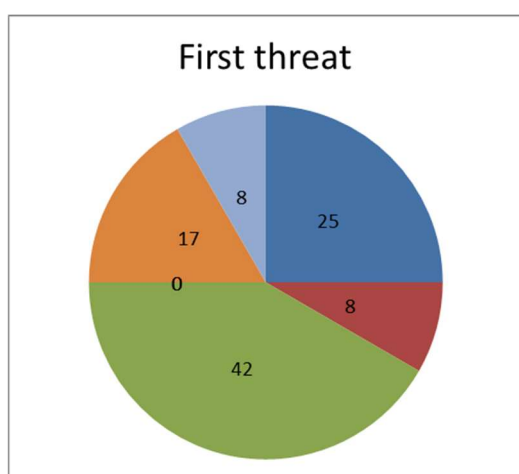


Fig.4.2 All stakeholders (fishers and others) opinion about the change in the state of fisheries occurred in the last 10 years in their region

According to fishers, the main perceived threat to the state of fish stocks in the Adriatic were bad fisheries management (42%), excessive fishing effort (25%), and climate change (17%). Illegal fishing was also considered an important second threat by 25 % of fishers (Fig.4.3). Perceptions of other stakeholders were similar (graph not shown here), except they never considered climate change as a threat.

In the SoS, pollution was considered the main threat by fishers (27%), followed by bad fisheries management and excessive fishing effort. The latter two threats ranked first also as second most important threats, followed by lack of transnational agreements (17%) and illegal fishing (10%) (Fig.4.4). Perceptions of other stakeholders were similar (graph not shown here).



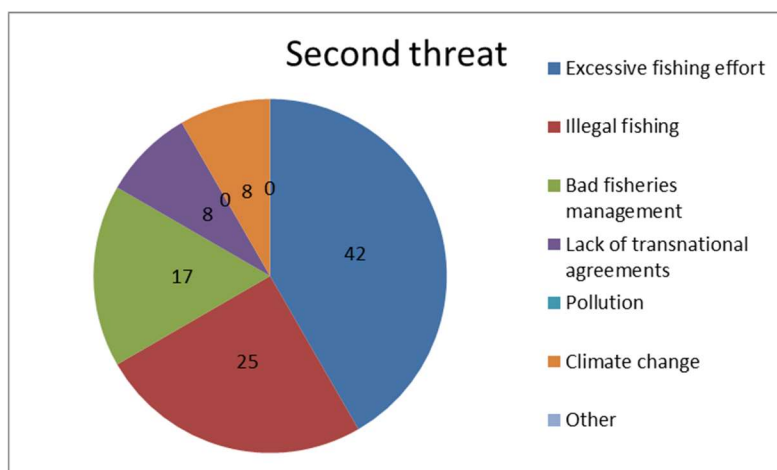


Fig.4.3 Fishers' opinion about the first and second most important threat affecting the state of the stocks in the Adriatic. Numbers indicate percentage of respondents.

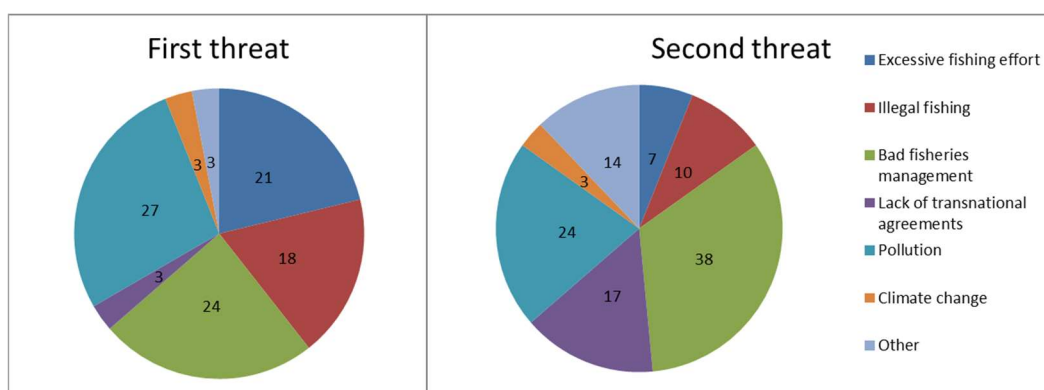


Fig.4.4 Fishers' opinion about the first and second most important threat affecting the state of the stocks in the Strait of Sicily. Numbers indicate percentage of respondents.

Stakeholders' opinion about fishing activities and other marine uses

Semi-industrial fishing (including trawlers and purse seiners as identified in the questionnaire) and illegal fishing were considered the most impacting activities by the majority of stakeholders (respectively 58% and 20%). Illegal fishing was also the second most important threat for most stakeholders, followed by recreational fishing (32%) (Fig.4.5) Bottom trawling and fixed nets were considered the most impacting technique in the Adriatic by respectively 42% and 33% of fishers, while in Sicily bottom trawling (55%) was followed by purse seine (12% of fishers). Bottom trawling was considered the most impacting technique in both regions by most other stakeholders (>70%) (Fig.4.6).

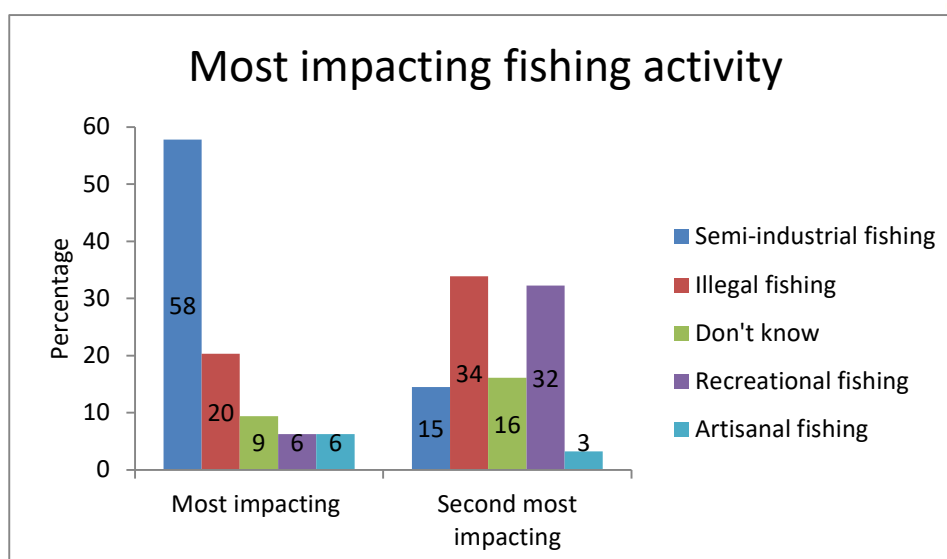


Fig.4.5 All stakeholders' (fishers and others) opinion about the most impacting fishing activity in their area

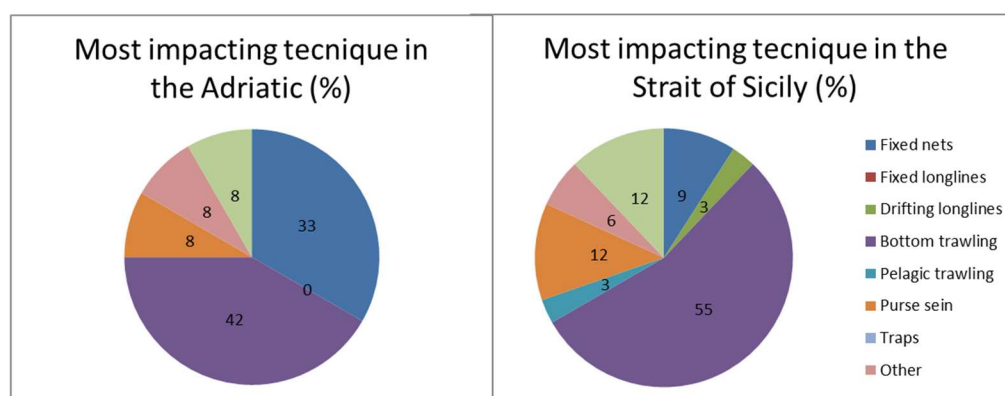


Fig. 4.6 Fishers' opinion about the most impacting fishing techniques in the Adriatic and in the SoS

Conflicts were analyzed from the fishers' point of view only. The majority of conflicts occur with scuba diving and semi-industrial fishing in both regions, followed by recreational fishing and artisanal fishing (as defined in the questionnaire, artisanal fishing includes set nets, pots, traps, set longlines)(Fig.4.7):

- In the Adriatic, conflicts were claimed mainly by Croatians and were due to conflict for space, especially between trawlers and longliners, while divers were accused of disrespecting rules at sea, jeopardizing security at sea and damaging fishing tools.
- In the SoS, recreational fishing was a cause of conflicts. An Italian fisher claimed illegal fish selling on the market from recreational fishers, another one claimed about Libyan vessels owned by Italians, who illegally use those vessels to fish in Libyan waters, transfer the fish to Italian vessels and sell it on the Italian market. An Italian artisanal fisher claimed about trawling on important habitats. According to Maltese fishers, recreational fishers fish like professional ones, catch undersized



fish, sell fish on markets and are subject to no controls. Shipping was also considered an issue in Malta, due to the several large vessels anchoring on fishing grounds and damaging longlines. In Malta, moreover, the presence of many foreign fishers working excessively was also mentioned as a cause for everyday conflicts among fishers.

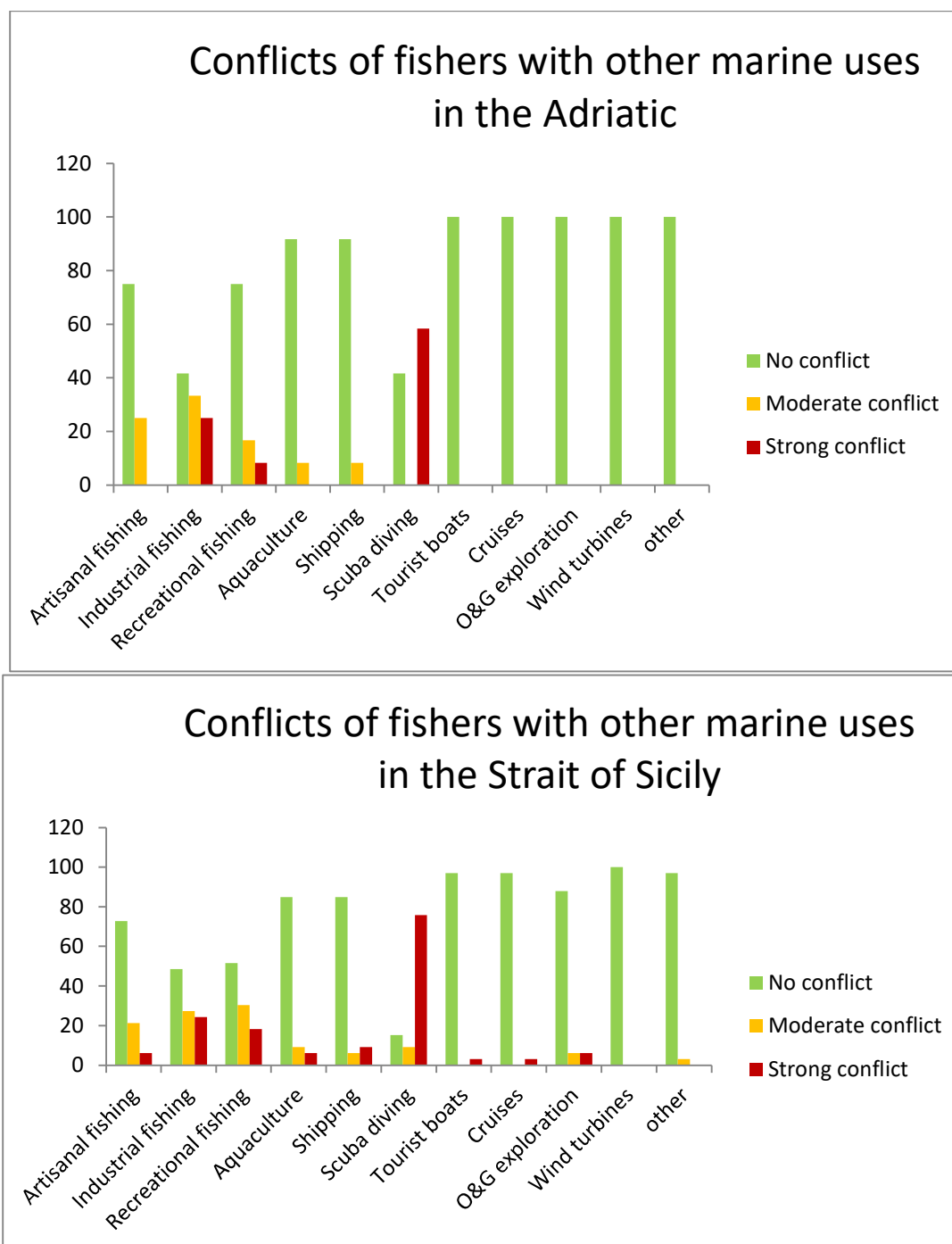


Fig.4. 7 Conflicts of fishers with other marine users in the Adriatic and in the SoS



Stakeholders' opinion on MPAs in the region

49 out of 64 respondents perform their activities within or nearby a protected area. 12 protected areas were mentioned in the questionnaires (Tab.4.4).

Table 4.4 Protected areas within which or close to which respondents perform their activities.

Protected Area	Region	Country
Pelagie MPA	Strait of Sicily	Italy
Egadi MPA	Strait of Sicily	Italy
Filfla MPA	Strait of Sicily	Malta
Fisheries Management Zone Malta	Strait of Sicily	Malta & Italy
Jabuka Pit	Adriatic	Croatia
Mljet National Park	Adriatic	Croatia
Lastovo MPA	Adriatic	Croatia
Kornati National Park	Adriatic	Croatia
Blitvenica	Adriatic	Croatia
Natura 2000 Torre del Cerrano MPA	Adriatic	Italy
Tegnué SIC	Adriatic	Italy
Tremiti MPA	Adriatic	Italy

Both the majority of fishers and of other stakeholders believe that MPAs have an overall positive effect on local fisheries (>60%). 13% of fishers think they don't have any impact at all (Fig.4.8). In both regions >70% of fishers think MPAs protect biodiversity and increase fish abundance/size both within and outside the MPA (Fig.4.9). However, they do not think MPAs help to reduce conflicts among users (ca 30 % of fishers in both areas), nor that they help to reduce illegal fishing (30% in the SoS and 42% in the Adriatic). In the SoS, the majority of fishers (61%) think that recreational fishers benefit mostly from MPAs (Fig 4.9). Open ended comments revealed that:

- 7 fishers from Malta ask for more controls on recreational fishing or total ban of all types of fishing activities in Maltese protected area.
- An artisanal fisher in the Egadi MPA claimed that although the MPA is working well in terms of protection, more cooperation with the fishing sector is needed.
- Croatian fishers claim more control and surveillance is required within protected areas. At present protected areas are lacking controls and are hence attracting illegal fishing and causing overcrowding of fishing instruments.

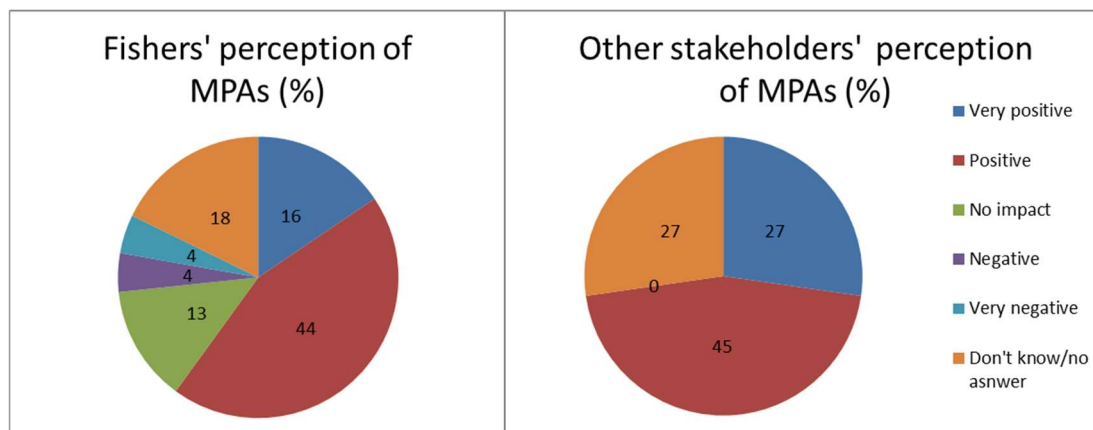
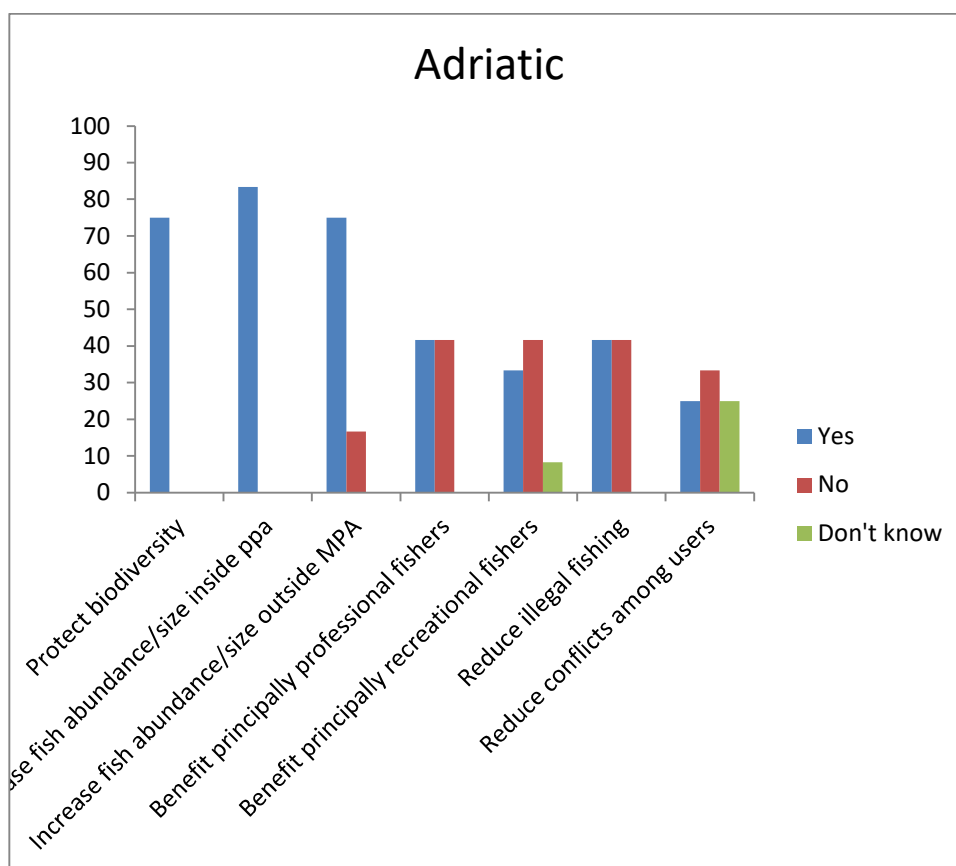


Fig.4.8 Stakeholders' perception on the impact of MPAs on fisheries in their region.



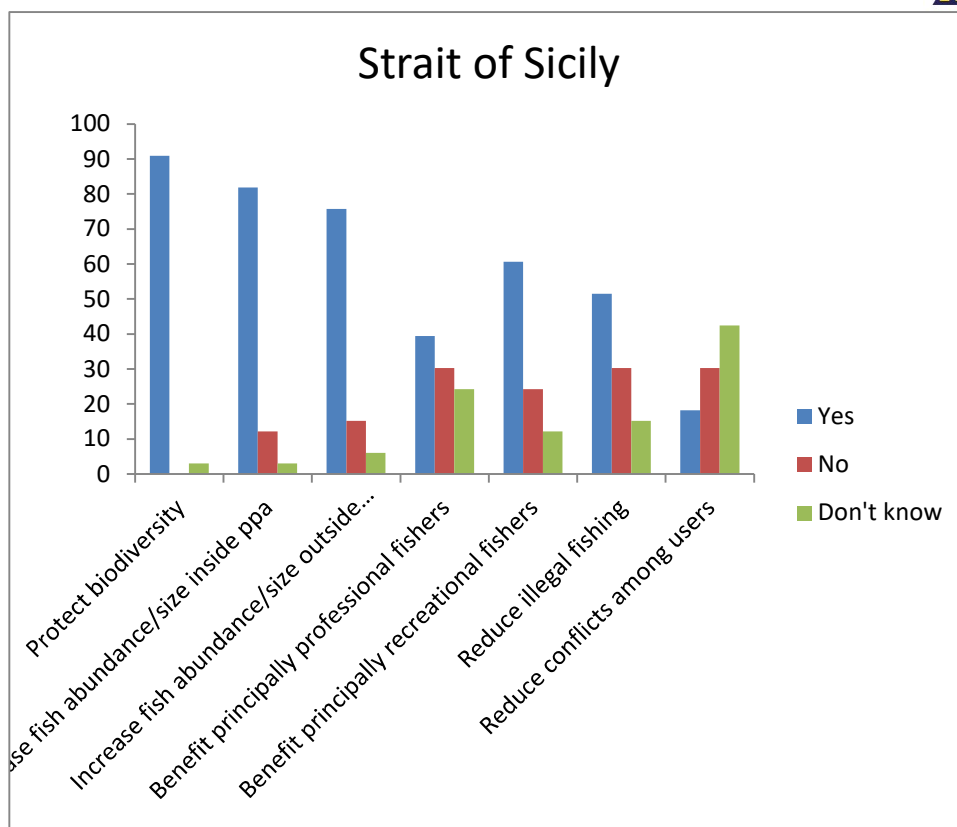


Fig.4. 9 Fishers' perception on the different impacts of MPAs in the Adriatic and in the SoS.

Stakeholders suggestions on fisheries management

According to fishers, the most important fisheries' management objectives in the SoS should be ensuring fishers' revenues (33%) followed by protecting fish stocks and ecosystems. In the Adriatic, guaranteeing the amount of catch was considered equally important as ensuring revenues and protecting fish stocks (24% each) (Fig.4.10).

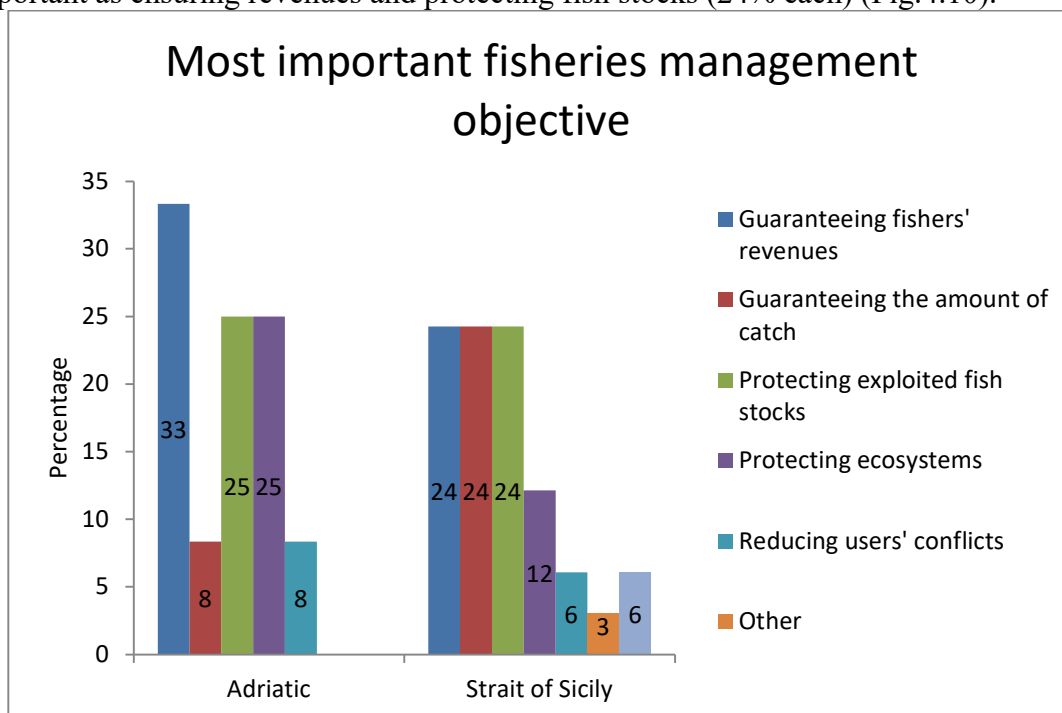


Fig.4.10 Most important objectives that fisheries management should pursue

When asked about the most important management measures that should be implemented in order to reach the objectives mentioned in the previous question, 50% of Adriatic fishers supported the introduction of seasonal fishing closures, followed by increasing spatial closures (33% selection as second most important measure) in important areas for the survival of target stocks and enforcing existing management measures (25% as 2nd important option). Seasonal closures were also the preferred option in the SoS (21%), closely followed by increasing the minimum reference size and enforcing existing management measures. Reducing fishing effort was considered the second most important measure by 15% of fishers (Fig.4.11).

Open comments showed again a strong complaint on the need to enforce bans on recreational fishing in the SoS and to control and stop illegal fishing. A fisher from Malta suggested that giant red shrimp (*Aristaeomorpha foliacea*) fishing grounds located to the southwest and northwest of Gozo within the 25 nautical mile Maltese Fisheries Management Zone should be re-opened to trawl fishing. A Sicilian fisher stressed the issue of illegal fishing occurring because of boat owners from Mazara del Vallo, whom are using Libyan vessels to fish red shrimp in the Gulf of Sirte and selling them at Sicilian markets.

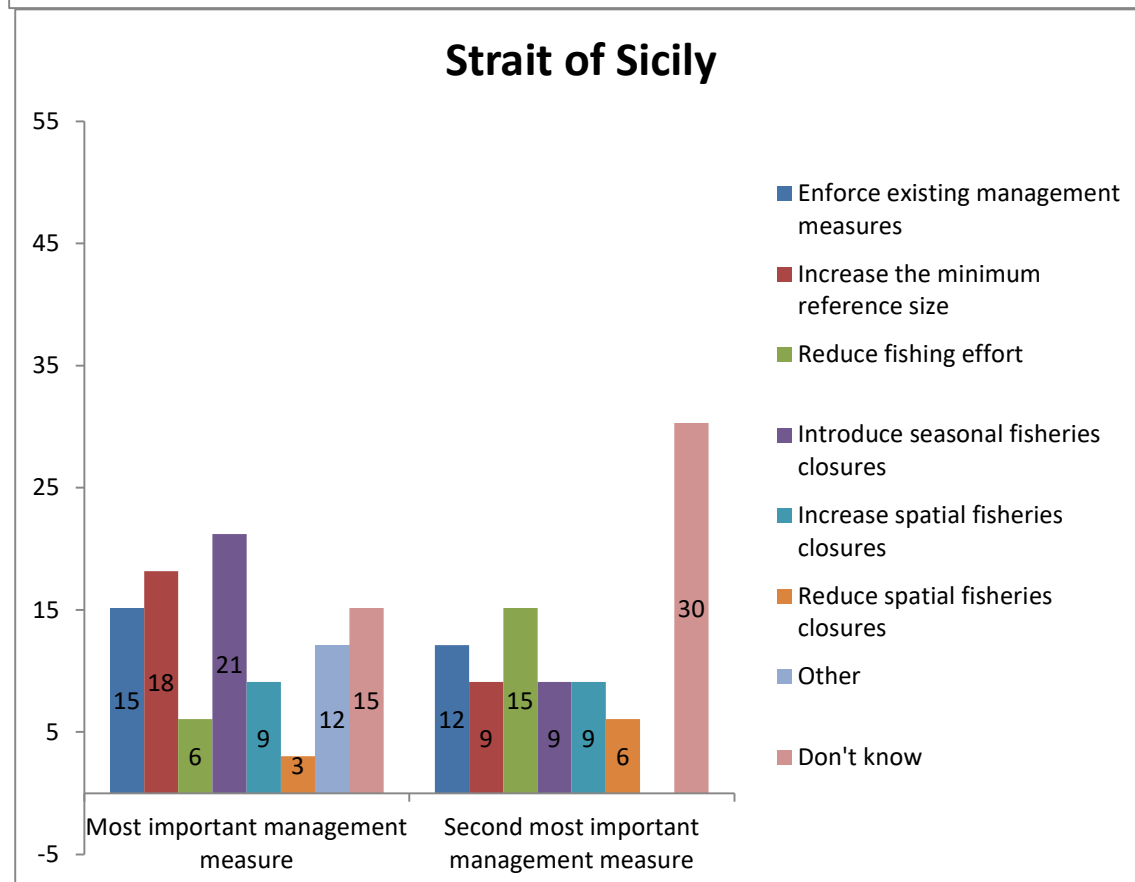
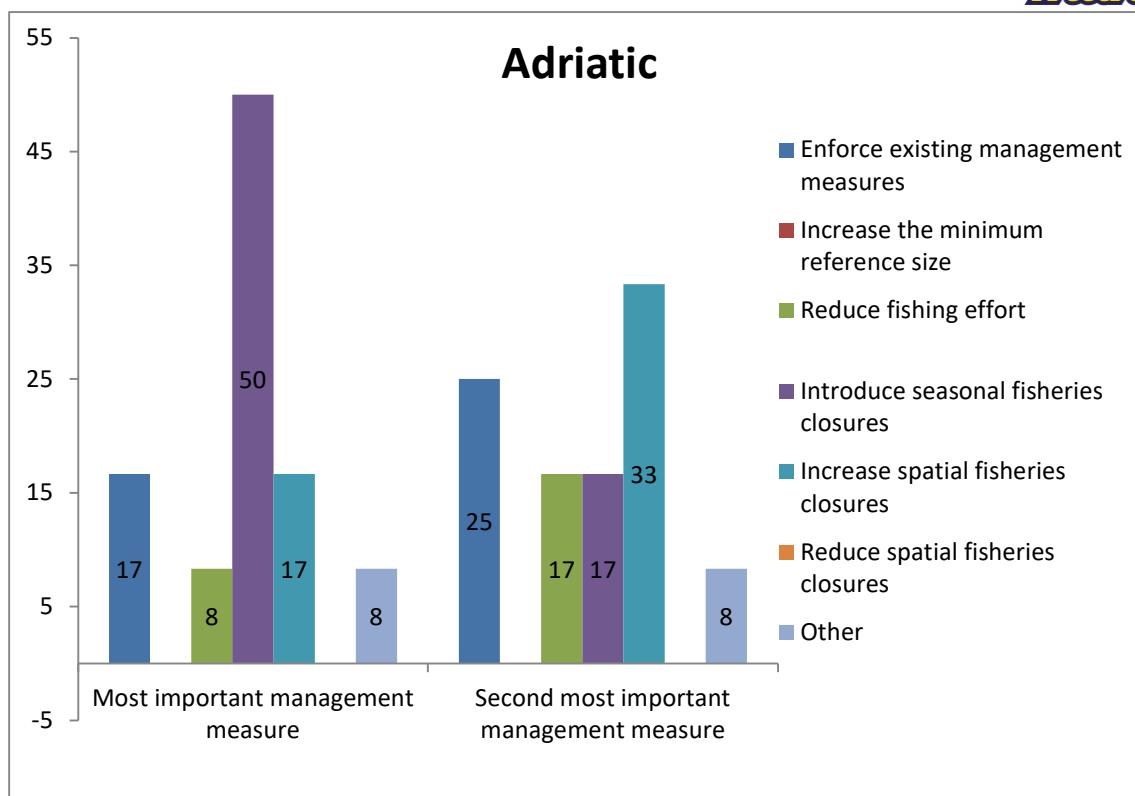


Fig.4.11 Fishers opinion about most important management measures.

Stakeholders' opinion on stakeholders' involvement in decision-making

Few Adriatic stakeholders answered the last question. Among those who answered, 30% have been involved at least once in participatory processes, and the majority were interested in being involved in such processes. In the SoS, the large majority of fishers (>60 %) stated they had never been involved, 48% believed it was important to involve them, however 45% were not interested. In open ended comments, 5 Maltese fishers complained about the lack of involvement of the fishing sector from the Department of Fisheries and Aquaculture when establishing measures or controls.

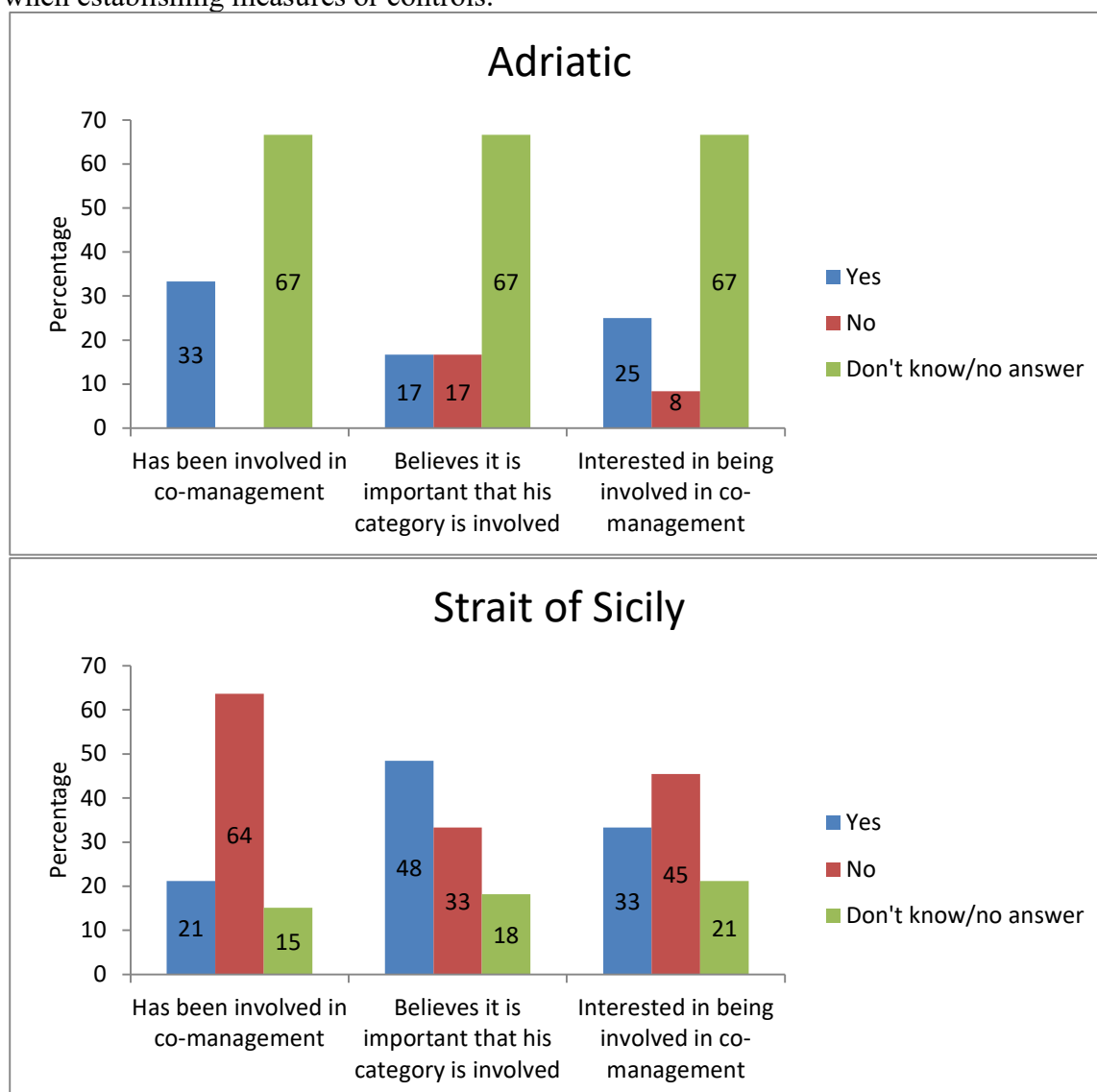


Fig.4.12 Fishers opinion about involvement of the fishing sector in participatory processes.

4.1.4 Preliminary conclusions from questionnaire surveys

The preliminary results presented in this report allow to draw a first picture of the key concerns of fisheries stakeholders in the Adriatic and in the SoS. Data suggest a worse perception on the state of fisheries in the SoS compared to the Adriatic. Authorities, researchers and MPA staff seem to perceive a worse condition of the state of fisheries compared to the fishing sector,



however all stakeholders agree in stating a degradation of fisheries in the last ten years. Bad fisheries management and excessive fishing effort were considered as the main threats in both regions, while pollution was strongly perceived only in the SoS and climate change only in the Adriatic. Illegal fishing was also perceived as a big threat in both areas. Main conflicts occurred between artisanal fishers and divers both in the Adriatic (especially Croatia) and in the SoS, and between Maltese professional fishers and recreational ones and shipping.

Concern for illegal fishing arose often while answering to different questions: for instance, while most fishers do consider MPAs as a useful tool to protect biodiversity and fish stocks they also strongly believe they are not efficient against illegal fishing, on the contrary, they often attract illegal fishing, both from recreational fishers and from poachers. Improved monitoring and control measures were thus considered necessary not only by researchers, but by most fishers too, especially in Malta and Croatia. The general perception is also that MPAs don't help reducing conflicts among users since they cause overcrowding of fishing activities in an area. The introduction of seasonal fisheries closures was considered the best approach both in the Adriatic and in the SoS. In the Adriatic, spatial closures were also recommended. The enforcement of current fisheries management measures was recommended in both areas (in particular stopping illegal fishing and introducing controls and bans on recreational fishing), while in the SoS increasing the minimum reference size for target species was also requested. Adriatic fishers were not very responsive to the issue of involvement in co-management, in fact the majority of them didn't answer the question. In the SoS, the majority of fishers stated not having being involved in co-management initiatives, however answers were similarly balanced between those who believed it important to involve the sector and were willing to be involved, and those that had the opposite opinion. In particular fishers from Malta wished for more involvement of their sector by the Department of Fisheries and Aquaculture in the definition of management measures.

4.2. Introductory meetings

4.2.1 Synthesis of fishers' suggestions collected during introductory meetings

The results arising from the questionnaire analysis should be considered together with main perceptions and management suggestions arising from the introductory meetings, who have seen the participation of professional fishers (mostly trawlers) in Mazara del Vallo, Ancona, Split and Chioggia.

Mazara del Vallo (trawlers, Strait of Sicily): Fishers agreed with respecting the fisheries restricted areas recently established in the northern side of the SoS, and provided information to identify essential fish habitat for the project target species in the southern side of the SoS, supporting the closure and enforcement of controls on African vessels in such areas.

Ancona (trawlers, central Adriatic) spatial and seasonal closures were supported by the fishers attending the meeting, in particular:

- Full protection of Jabuka Pit (including longliners), and a larger area managed through rotation of fishing boats.
- Protection of the coastal zone up to 6 miles, followed by management of the fishing activity after the trawling ban, such as reduction of fishing days in order to avoid market saturation and keep prices stable.
- Anticipation of the biological ban to June and July to protect cephalopods with high economic value.



- Protection of the refuge area called “Zona Barbare” in the waters corresponding to the Marche region

Split (trawlers, central Adriatic): stakeholders supported spatial measures on Jabuka Pit, in particular:

- Full support to the new management proposal for the Jabuka Pit area advocated by the Italian and Croatian governments.
- Suggestion of a permanent ban in South Adriatic for trawling where the depths are over 500 m, in order to protect adult spawners

Chioggia (bottom trawlers and otter trawlers (rete a divergenti), Northern Adriatic): According to participants, management of fisheries in the Northern Adriatic should have specific measures, different from other areas, due to its particular characteristics (very shallow, fishes reaching adult stage at small sizes). Additional spatial management measures are not considered appropriate in this area by stakeholders, since nursery grounds for target species occur in the coastal lagoons and within 3 miles from coast, where fishing is already banned. Once they grow up to legal fishing size adults spread all over the northern Adriatic, hence it is impossible to identify other stable concentration areas. The main suggested measures for the target species are mainly technical and enforcement measures, such as:

- Red mullet (mainly targeted by trawling)
 - increasing the biological ban duration of two weeks, to allow red mullets to reach fishable size.
 - Setting a limit of 60 fishing hours equal for all boats (both larger and smaller ones) for 10 weeks after the ban.
 - Allow to fish with traditional mesh size of 20 mm between April and July, when only adults are caught, instead of the imposed 40 mm diamond mesh size.
- Common sole (mainly targeted by Mediterranean beam trawls (rapido trawls):
 - Set a fixed common length of 4 meters for the bar in contact with the sea bottom (rampone) for both large and small boats, which would automatically lead to a reduction in fishing effort.
 - Increase tolerance for marketable fish size (reference size is 20 cm, allow for selling 19 cm too since it is caught despite respecting all rules – mesh size, distance from coast, season)
- Measures on the market:
 - Enforce controls over illegal fish selling at the fish market, especially from recreational fishers
 - Allow for public auctions
 - Implement taxes on foreign fish (Croatia)
- Other measures:
 - Include all fishing activities, also artisanal and recreational in the 3 miles ban
 - Properly enforce the 3 miles ban against illegal activities: confiscate fishing licence if caught



- Set fixed annual fishing licences specific for fishing technique, with fixed number of fishing days. Allow for change of licence only with a penalty of 10 fishing days less.
- Allow the diversification of the fishing activity to catch big-scale sand smelt (*Atherina boyeri*) during the biological ban on red mullet and sole.

5. Definition of the budget and financial planning

5.1 Introduction

One of the objective of the task 4.1 is to assess potential costs in the establishment, maintenance, monitoring and governance of a network of MMAs.

This section focuses on the analysis of regulatory costs (typology and differences) adapted to a general network of MMAs.

The assessment of costs will be addressed under an efficiency evaluation approach. According to the EU guidelines on Impact Assessment (EC, 2009c), the evaluation of a public project, e.g. a management measure, a management plan, an MPA or a network of MMAs, should take into account the efficiency evaluation. Efficiency is the extent to which objectives can be achieved for a given level of resources/at least cost (http://ec.europa.eu/smart-regulation/index_en.htm). This implies the estimation of all the relevant and potential (financial) costs as well as the potential (socio-economic) benefits. The last are addressed in terms of socio-economic impact on fishing activities (see next chapter).

The different types of regulatory costs are illustrated in figure 5.1

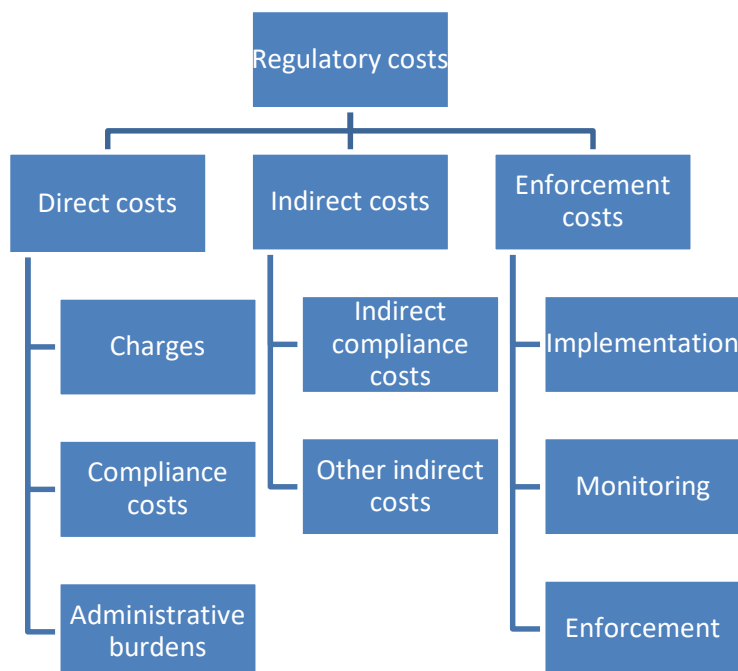


Fig.5.1 Different types of regulatory costs (adapted from OECD, 2014)

Direct costs from regulation include charges, direct compliance costs and administrative burdens because of activities performed by stakeholders and public authorities to comply with obligations and requirements included in legal rules.

Enforcement costs are associated with activities linked to the implementation of the MMAs such as planning, monitoring and enforcement.

Indirect costs are experienced by other stakeholders, not directly targeted by the network of MMAs. They are incidental to the main purpose of the regulations and affect third parties. In the case of the enter in force of a network of MMAs, indirect costs can be related to extractive activities or recreational activities (such as diving, marine mammal watching, sailing); for



example, the creation of a MMAs can lead a decreasing tourist flows, due to regulatory restrictions imposed on tourists or their activities (Alban, 2006).

Regulatory costs can be categorized also in terms of the main stakeholders affected (see fig.5.2).

Type of costs		Fishery sector	Public administration	Other stakeholders
Direct costs	Charges	□		
	Substantive compliance costs	*		
	Administrative burdens	*	*	
Indirect costs	Indirect compliance costs			*
	Other indirect costs			*
Enforcement costs	Implementing		*	
	Monitoring	*	*	
	Enforcement	*	*	

Fig.5.2 – Impact of regulatory costs on different stakeholders (adapted from Better Regulation Tool #58, UE)

5.2 Direct costs

Regulatory charges include fees, levies, taxes. These typologies of costs affect vessel owners in case the MMAs provides for the introduction of special fishing permits and the payments of a charge in order to obtain the fishing permits.

An important category of direct costs is the so called substantive compliance costs, which encompass those investments and expenses that are faced by vessel owners in order to comply with requirements linked with the establishment and maintenance of a network of MMAs.

According to OECD classification (OECD, 2014) substantive compliance costs include the following broad categories:

Type of substantive compliance costs	Definition (OECD, 2014)	Fishery sector
Implementation costs	The costs regulated entities incur in familiarising themselves with new or amended regulatory compliance obligations, developing compliance strategies and allocating responsibilities for completing compliance-related tasks	Vessel owners must face one-off costs such as staff training and participation in stakeholder meeting in the first phase of implementation of the network
Direct labour costs	Direct labour costs are the costs of staff time devoted to	Labour costs necessary to comply with new



	<p>completing the activities required to achieve regulatory compliance. Only the costs of staff directly involved in undertaking these activities should be included</p>	<p>management measures and regulatory obligations. They are recurrent costs.</p>
Equipment costs	<p>Business will need to purchase items of capital equipment to comply with many kinds of regulations. This can include both machinery and software (e.g. programs required to undertake real-time monitoring)</p>	<p>This typology of cost will depend on the planned monitoring and control system. For example, in Pomo Pit MMA, all the authorized fishing vessels will be subject to satellite monitoring by VMS (Vessel Monitoring System) or AIS (regardless of the lengths) and to catch reporting in logbook by electronic means. The purchase costs of the VMS or AIS should be included in this typology of costs.</p>
Materials costs	<p>Materials costs are the incremental costs incurred in changing some of the material inputs used in the production process in order to ensure regulatory compliance (thus, they are sometimes called “input costs”). They are therefore ongoing costs.</p>	<p>This typology of cost will depend on the management measures in place in each MMAs. They can include: costs for the purchase of new selective gears, changes in fishing gears and vessel, adaptation of vessel’s facilities (in particular for small scale vessels)</p>
Costs of external services	<p>This cost category can be defined as the cash cost of payments made to external suppliers providing assistance in achieving regulatory compliance. External service providers are likely to be used where achieving compliance requires specific technical expertise that the firm may lack, or where significant</p>	<p>IT services Data-processing services Technicians for changes in structure and vessel equipment</p>



	<p>compliance obligations are imposed with little notice given or time for forward planning, thus straining capacity.</p>	
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Administrative burdens are those costs borne by stakeholders as a result of administrative activities performed to comply with information obligations included in legal rules. Information obligations can be defined as regulatory obligations to provide information and data to the public sector or third parties (OECD, 2014).

The cost of implementing an Electronic Recording and Reporting System (ERS) used to record, report, process, store and send fisheries data (catch, landing, sales and transshipment) is included in this category of costs. The electronic logbook where the master of a fishing vessel keeps a record of fishing operations is the system used by the authorities of the MMAs to collect all the information obligations (fishing area, time spent at sea, duration of fishing activities and more).

5.3 Enforcement costs

Enforcement costs are associated with activities linked to the implementation of the MMAs such as planning, monitoring and enforcement; these costs are direct born by public authorities. Enforcement costs ca be split in the following categories:

implementation: they include the cost of publicizing new requirements, establishing licensing or permit systems, dealing with queries and applications. Implementation costs can be estimated first defining the activities required to implement and enforce legislation, then estimating their frequency (OECD, 2014). These costs can vary significantly on the basis of:

- location, number and size of MMAs in the network
- number of fishing vessels that will have to comply with the MMAs
- management measures implemented in the MMAs and in the buffer zones (seasonal closure, restrictions concerning fishing gears, ...)

monitoring costs: they include the cost needed to assess management’s efficiency in achieving the MMAs goals; in detail, costs linked with:

- the definition of proper protocols for data collection and analysis
- the implementation and management of a reliable IT system and
- the establishment of the responsible body for the monitoring (*Scientific Committee*)

enforcement costs: these include the cost of running inspections, processing sanctions, handling complaints by the enforcing authority. Depending on the type of rule and the regulatory option chosen, enforcement might be very cheap or very costly for public authorities. The enforcement costs of spatial measures are considered lower than conventional management measures (Alban et al., 2006) on the basis of the fact that:

spatial measures are easy to understand, which make them easier to understand checking enforcement id relatively easy with appropriate IT system and equipment (VMS). In any case, support by fishers may have a favorable influence on enforcement costs.

A network of MMAs in transboundary areas (this is the case of both the Adriatic and Strait of Sicily case studies) face special challenges because responsibilities and authorities are shared by the countries (FAO, 2011). In these cases, the enforcement costs are allocated among the national jurisdictions.



6. Potential socio-economic benefits deriving from the implementation of the MMAs network

6.1 Introduction

The implementation of an MMAs network is expected to produce socio-economic effects deriving from changes in landings, prices and costs. When the creation of an MPA includes the implementation of a no-take zone, this would determine a reallocation of fishing effort in areas left open to fishing. This would affect both the amount of landing per unit of effort and the landings composition. If the fishing zones of the MPA are more productive than the remaining ones, landings are expected to decline. In multi-species fisheries, the landings composition would be also affected as the concentration of each species differ in different fishing zones. Changes in the amount and composition of landing are expected to impact also on fish prices. Variations in the quantities supplied on the market and the quality of the product, in terms of species and fish size, would determine changes in prices. Regarding the impacts on costs, these are mainly related to the spatial reallocation of fishing effort. Fishers generally act as economic agents aimed at maximizing their profits. When a fishing zone is closed to fishing, they will reallocate their fishing effort in the most profitable area among those available. If that area is more distant from the port than the previous fishing zone, the cost of travelling to fishing grounds (mainly fuel costs) would increase. The effects of the implementation of an MMAs network on landings, fish prices and costs vary along time as a result of the stock recovery due to the creation of MPAs. To monitor the socio-economic effects for the fishing sector, an approach based on indicators and reference points has been used.

Indicators-based approaches to management have been widely used since the early '90s to measure the effects of fishery management systems on the four dimensions of sustainability: environmental, economic, social and institutional (Rice and Rochet, 2005). The use of indicators for evaluating the status of fisheries has been adopted by many international organizations. FAO in the Technical Guidelines for Responsible Fisheries (FAO, 1999) defined a general list of indicators and reference points in fishery. In 2002, a document on fisheries-related indicators used by the OECD was published for a workshop on "Tools for measuring (integrated) Fisheries Policy aiming at sustainable ecosystem" (Le Gallic, 2002). More recently, a report on the evaluation of new Fishery Performance Indicators was published by The World Bank (The World Bank, 2012).

At European level the indicators-based approach has greatly increased also thanks to the fisheries data collection programmes of the European Commission (Regulation (EC) 199/2008, and subsequent Commission Decisions No 949/2008 and 93/2010), which have made available biological and economic data on a regular basis. Data collected through the EU Data Collection Regulation until 2008 and the Data Collection Framework thereafter have been used, among others, to calculate indicators for the impact assessment studies related to the reform of the Common Fisheries Policy (EC, 2010).

To evaluate the performance of an indicator, this is generally compared to an appropriate reference point. As reported in Caddy & Mahon (1995), reference points should be associated with either a critical or an optimal state, where the former identifies a limit which is necessary to avoid (LRPs, limit reference points) and the latter a target to be attained by the system (TRPs, target reference points).

In studies aimed to simulate the effects of different management scenarios, like an ex-ante impact assessment or a study for the definition of multiannual management plans, comparing indicators to reference points is not sufficient to provide a clear evidence to policy makers. Indeed, this comparison is carried out within the single scenario, while an additional



comparison level among different scenarios is needed. Generally, the values expected for an indicator in the forecasting period are compared among the different scenarios or compared for each scenario to its current value. For instance, in the study for the preparation of multiannual management plans for the Mediterranean and Black Sea (EC, 2016), where several management scenarios were simulated for a number of fisheries, the percentage variations of each selected indicator respect to its value in the Status Quo scenario¹⁸ were reported for each alternative scenario. Furthermore, the values of indicators at baseline (current values) were also reported. The current values of indicators and the values expected under the Status Quo scenario can be considered as additional reference values than those suggested in Caddy & Mahon (1995). The plurality of reference values or comparison levels complicates the synthesis of results, which should be readily understandable to policy makers. One of the aims of the MANTIS project is to simulate the effects of different management scenarios, based on combinations of different networks of existing and new MMAs and variations in fishing effort. In this project, a synthesis of results is carried out through the approach proposed in the FP7 project SOCIOEC¹⁹ based on the use of effectiveness indicators.

6.2 Effectiveness Indicators

The EC guidelines for the IA (EC, 2015) suggest to compare the simulated management options based on their performance against the relevant criteria of effectiveness, efficiency and coherence. Effectiveness is the extent to which different options would achieve the objectives, efficiency is a measure of the benefits versus the costs, and the coherence of each option is assessed in comparison with the overarching objectives of EU policies.

To measure the effectiveness of each management options and allow comparison among them, the FP7 project SOCIOEC (Malvarosa et al., 2015) proposed the use of two new distance measures for the synthesis of results deriving from the comparison of indicators and reference points: the Target Effectiveness Indicator (TEI), used with TRPs, and the Limit Effectiveness indicator (LEI), used with LRPs. TEI and LEI allow to measure effectiveness in terms of if and how much targets are achieved, including a comparison with the baseline scenario.

When an indicator is compared to a TRP, TEI allows to evaluate the effectiveness considering the distance of the indicator value from both the TRP and the current value:

$$TEI_s = \frac{(I_s - I_{curr})}{(I_{TRP} - I_{curr})}$$

TEI for the management scenario *s* is calculated as the distance between the value of the indicator under scenario *s* and its current value divided by the distance between the value of the TRP and the indicator current value. The interpretation of the TEI when the TRP is lower or higher than the current value is reported in the following table.

Table 6.1 Interpretation of the Target Effectiveness Indicator (TEI)

Table 1 – Interpretation of the Target Effectiveness Indicator (TEI)

Value	TRP < current value	TRP > current value
TEI ≤ 0	Result deriving from the (simulation) implementation of the new measure is greater than or equal to the baseline scenario and greater than the TRP (result ≥ current > TRP). There is a deterioration.	Result deriving from the (simulation) implementation of the new measure is less than or equal to the baseline scenario and less than the TRP (result ≤ current < TRP). There is a deterioration.

¹⁸ The Status Quo is the scenario where no change to the current management system is assumed.

¹⁹ SOCIOEC (Socio economic effects of management measures of the future CFP) Project ID: 289192 Funded under: FP7-KBBE <http://www.socioec.eu/>, http://cordis.europa.eu/result/rcn/182523_en.html.



Value	TRP < current value	TRP > current value
$0 < TEI < 1$	Result deriving from the (simulation) implementation of the new measure is less than the current value and greater than the target (TRP < result < current). There is an improvement, but the target is not achieved.	Result deriving from the (simulation) implementation of the new measure is greater than the current value, but less than the target (current < result < TRP). There is an improvement, but the target is not achieved.
$TEI \geq 1$	Result deriving from the (simulation) implementation of the new measure is less than or equal to the target and less than the current value (result \leq TRP < current). The target is achieved.	Result deriving from the (simulation) implementation of the new measure is greater than or equal to the target and greater than the current value (current < TRP \leq result). The target is achieved.

Source: Malvarosa et al., 2015

When an indicator is compared to a LRP, the limit level and the current value are considered in different steps:

$$I_s \geq I_{LRP} \rightarrow LEI_s = 1$$

$$I_s < I_{LRP} \text{ and } I_s \geq I_{curr} \rightarrow LEI_s = 0$$

$$I_s < I_{LRP} \text{ and } I_s < I_{curr} \rightarrow LEI_s = -1$$

The value of LEI for the management scenario s equals 1 if the value of the indicator under scenario s is higher or equal to the LRP. When it is lower than LRP but higher than the current value, LEI equals zero. When the value of the indicator under scenario s is lower than LRP and the current value, LEI is -1. The interpretation of the LEI is reported in the following table.

Table 6.2 Interpretation of the Limit Effectiveness Indicator (LEI)

Value	Interpretation
LEI = -1	Result deriving from the (simulation) implementation of the new measure is worse than the current value and worse than the LRP (Result < LRP and Result < current)
LEI = 0	Result deriving from the (simulation) implementation of the new measure is higher than the current value even if still lower than the LRP. This reflect a still negative situation (LRP has not yet been overcome) even if characterised by a positive trend (Result < LRP and Result \geq current)
LEI = 1	Results deriving from the (simulation) implementation of the new measure is higher or equal to the LRP. This reflect a completely positive situation as LRP has been overcome (Result \geq LRP and Result \geq current)

Source: Malvarosa et al., 2015

6.3 Socio-economic indicators

Indicators generally used in socio-economic analysis can be classified according to five dimensions: economic, social, governance, technical and productive. The economic dimension refers to sector profitability and includes economic variables, like revenues, prices and costs. The social dimension is mainly related to the people employed in the fishing sector; this is aimed to study attributes like salary, education, age and gender. The governance or institutional dimension refers to the financial efficiency of management, the level of compliance with regulations, the extent of transparency and participation in decision making processes. Finally, technical indicators include variables related to fleets activity and capacity, while production indicators are aimed to measure the physical production.

The most important indicators to evaluate the potential socio-economic benefits for the fishing sector deriving from the implementation of the MMAs network belong to the economic and social dimensions. Generally, these indicators are compared with LRPs.

Regarding the economic dimension, one of the most used indicators to measure the economic performance of a fleet is the Return on Investment (ROI). This is a measure of the efficiency of an investment and is generally used to compare several different investments. ROI, which is expressed as a percentage, is calculated by the ratio between the return of an investment and its



costs. For an economic sector, it can be estimated by comparing profits to the capital invested. In this case, ROI measures the profitability of a sector in relation to its total assets. The higher the return, the more efficient the sector is in utilising its assets. The capital invested in the sector should include both tangible and intangible assets. In the fishing sector, vessels, fishing gears and other equipment can be considered as tangible assets; while intangible assets are generally referred to the fishing rights. When data on intangible assets (fishing rights) is not included in the calculation of this indicator, the name “Return on Fixed Tangible Assets (ROFTA)” is preferred to ROI. In the Mediterranean fishing sectors, where fishing rights exist just in few cases, like tuna fisheries, ROI and ROFTA are generally equivalent.

ROI and ROFTA are generally compared to the rate of theoretically risk-free investments, like the long-term public bonds. The risk-free rate represents a LRP for these indicators. When the indicator is higher than the LRP, the fleet is in a healthy condition and is able to replace large capital items as this becomes necessary. On the contrary, when the indicator is lower than the LRP, the investment in the fishing sector is not worthwhile from an economic viewpoint because greater gains may be obtained by investing elsewhere.

Other important profitability indicators are EBIT (Earning Before Interests and Taxes), EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization) and the net profit margin. EBIT is a measure of profit that includes all expenses except interest and income tax expenses, while EBITDA excludes also depreciation and amortization. These are measure of profit aimed to indicate the profitability of the operating activities. A relative measure of profitability is generally obtained by dividing measures of profit by revenues. One of the most used relative indicator of profitability is the net profit margin, which is calculated as the ratio between net profit and revenue.

Another important economic indicator used to calculate the contribution of a fleet or a fishing sector to the National economy is the Gross Value Added (GVA). The indicator, calculated as income minus operating costs, indicates the remuneration of the production factors (capital and labour). Clearly, salaries paid to the crew are not included in the operating costs. The GVA divided by revenues can be used to calculate the percentage of revenues directed to salary, profit, opportunity cost and depreciation.

ROI and ROFTA, including the assets employed by the fleet in their calculation, have been used in some STECF sub-groups (e.g., STECF 16-18) to estimate the long-term economic sustainability of that fleet. The same STECF sub-groups have used the ratio between the current revenue and the break-even revenue (CR/BER) as an indicator of short-term economic sustainability. This break-even revenue (BER) is defined as the revenue value at which the gross cash flow equals the fixed costs. When the ratio between current revenue and BER is greater than 1, enough cash flow is generated to cover fixed costs, indicating that the fleet is economically viable in the short term. Conversely, if the ratio is less than 1, the cash flow is insufficient to cover fixed costs and the fleet is economically unviable in the short term. The BER is a LRP for the current revenue or, equivalently, the value 1 is a LRP for the ratio CR/BER.

Regarding the social dimension, the number of people employed by a fleet is the main indicator used to evaluate the effects of alternative management options. Other social indicators are aimed to measure potential changes in the average salary for the crew. These indicators are the average wage per employee and the average wage per full time equivalent (FTE). These indicators are generally compared to a minimum salary or an average salary registered in comparable sectors, like agriculture. Other social indicators are the GVA per employee and the GVA per FTE. As for the economic indicators, also social indicators are generally compared with LRPs.



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