

SAFEGUARDING MARINE PROTECTED AREAS IN THE GROWING MEDITERRANEAN BLUE ECONOMY





RECOMMENDATIONS FOR RECREATIONAL FISHERIES **Front cover:** Catching a greater amberjack (*Seriola dumerili*) from a big game fishing boat © Bulentevren / Shutterstock

Publication

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EXECUTIVE SUMMARY

Around 9 million people fish for pleasure in Europe, generating about €6 billion annually. The Mediterranean is a very popular destination for recreational fishers. Nevertheless, unlike commercial fishing, recreational fishing is an activity that has not yet been properly assessed and managed in the region.

Recreational fishing can have a significant impact on particular fish resources and habitats, and with this in mind it's important that it's conducted responsibly right across the Mediterranean, particularly in marine protected areas (MPAs). Although recreational fishing has many social, economic and public health benefits, it also brings environmental issues.

Recreational fishing has been shown to be an important component of fishing mortality across the globe. Comprehensive data is lacking, but the EU broadly estimates that recreational fishing represents more than 10% of the total production of all fishing. While the subject is still poorly assessed, several scientific studies have shown that the fishing pressure exerted by recreational fisheries can in some areas be similar to, and even exceed, catches by commercial small-scale fishing fleets.

The impact of certain recreational fishing methods such as spear fishing, jigging and trolling on vulnerable species is a major concern. Other potential impacts from recreational fishing include the introduction of exotic species used as bait, pollution from fishing gear lost or abandoned at sea, and damage to sensitive habitats.

Furthermore, the general increase in recreational maritime activities in the Mediterranean coastal zones over the last decades has turned the sea into a space of conflicts over stakeholder access and rights. In particular, recreational fishers may find themselves at odds with commercial, small-scale fisheries (SSF). The situation is complicated by the lack of data and evaluation on the real effects of marine recreational fisheries, which are rarely managed. In addition, the absence of a common definition of recreational fisheries at the European level makes it more difficult to control and regulate activities in the sector.

This is where public authorities, MPA managers and recreational fishers themselves all have a role to play: effective collaboration will contribute to best practices being identified and implemented, regulations being better enforced, environmental impacts avoided or minimized, and a sustainable future created.



INTRODUCTION

Over the last 15 years, recreational fisheries have been developing rapidly in the countries surrounding the Mediterranean Sea, in line with the increasing numbers of tourists who are visiting its shores. At the same time, Mediterranean marine protected areas (MPAs) have also grown in number and size through efforts to conserve the region's marine ecosystems, which are increasingly suffering from anthropogenic pressures. These MPAs are a key tool for conservation, but their individual effectiveness is highly dependent on how well they integrate with their specific local conditions.

As recreational fishing continues to grow, its environmental impact is being increasingly debated, and the growth of the sector, especially in coastal and marine environments, is not without controversy. Recreational fishing comes with a number of issues that raise questions over its long-term sustainability, including pressure on fish resources, habitat degradation, biodiversity loss, social conflicts and pollution. Whether and how recreational fisheries can be sustainably practised in MPAs is an important question.

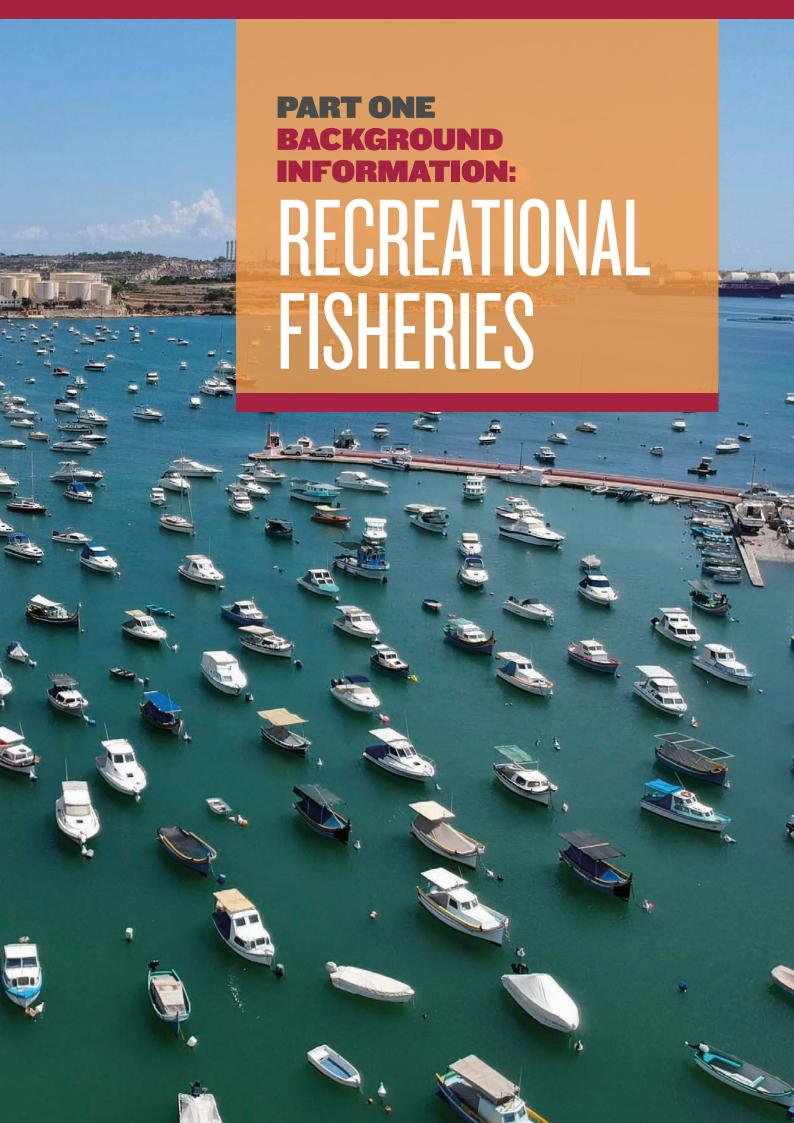
This report provides a summary of recommendations to public authorities, MPA managers and the recreational fisheries sector to achieve a sustainable use of marine resources.

The PHAROS4MPAs project explores how Mediterranean MPAs are affected by activities in the growing Blue Economy, and provides a set of practical recommendations for regional stakeholders on how the environmental impacts of key sectors can be prevented or minimized. Encouraging international collaboration across MPA networks and cooperation between state, industry and other actors, PHAROS4MPAs aims to enhance MPA management effectiveness and improve the conservation of marine ecosystems across the whole of the Mediterranean.

PHAROS4MPAs focuses on the following sectors of the Blue Economy:

- Maritime transport and industrial ports
- Cruise
- Leisure boating
- · Offshore wind farms
- Aquaculture
- Recreational fisheries
- · Small-scale fisheries





In the EU's Blue Growth strategy, coastal and maritime tourism is the biggest sector in terms of gross added value and employment. It employs more than 3.2 million people and generates a total of €183 billion in gross added value¹. Coastal tourism accounted for 40% of the GVA, 61% of the jobs and 24% of the profits of the total EU Blue Economy in 2016 [1] [2]; and it is expected to grow a further 2-3% by 2020 $^{[3]}$, particularly in the Mediterranean [4].

In 2017, southern Europe received about 270 million international visitors, or 20% of the world total [5].

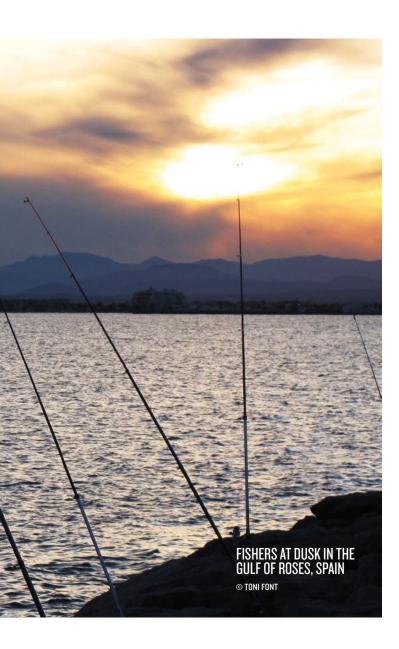
However, despite its considerable strategic potential, the coastal and maritime tourism industry faces socioeconomic and environmental challenges that threaten the important contribution it can make to economic growth in the Mediterranean [6] [7].

Tourism can have a negative impact on marine biodiversity and resources if its development is not managed responsibly. Therefore, biodiversity conservation and environmental protection should be priorities for the tourism industry in the Mediterranean – particularly in MPAs, which attract disproportionately high numbers of visitors in the first place due to their beauty, biodiversity and cultural importance [6]. Such efforts are becoming even more urgent in the face of the climate crisis.



¹ European Commission (2017). Coastal and maritime tourism. Retrieved June 04, 2019, https://ec.europa.eu/maritimeaffairs/policy/coastal_ tourism_en

1.1. DEFINITION OF RFCREATIONAL FISHERIES IN THE MEDITERRANFAN



EU Member States have not yet agreed on a common definition of marine recreational fisheries

[8]. The FAO technical guidelines for responsible fisheries define recreational fishing as "fishing of aquatic animals (mainly fish) that do not constitute the individual's primary resource to meet basic nutritional needs and are not generally sold or otherwise traded on export, domestic or black markets" [9]

In the Mediterranean, the General Fisheries Commission for the Mediterranean (GFCM) [10] produced the following definition for recreational fishing: "Fishing activities exploiting marine living aquatic resources for leisure or sport purposes from which it is prohibited to sell or trade the catches obtained".

For GFCM management purposes, recreational fishing is comprised of two major segments:

- Leisure fishing is fishing practised for pleasure
- Sport fishing pertains to fishing contests (competitions) practised within an established institutional framework.

This definition covers active fishing methods including line, spear, and hand-gathering and passive fishing methods including nets, traps, pots and set-lines. However, it should be noted that in some Mediterranean countries the use of methods such as nets, traps and pots is prohibited in recreational fisheries and only allowed in commercial fisheries.

One issue that remains to be solved is how to distinguish subsistence fisheries from strictly recreational fisheries. Since the economic crisis started in 2008, some recreational fisheries have been reported as subsistence fisheries [11] [12], in some cases providing supplementary income and competing with small scale fisheries (SSF) for the market [12].

The focus of this report is on recreational fisheries strictly speaking and does not consider subsistence fisheries, retired commercial fishers and fishing charters because there is a lack of information about these fishing categories [13].

1.2. IMPORTANCE OF RECREATIONAL FISHERIES IN FUROPF AND THE MEDITERRANEAN

Recreational fishing is one of the most popular leisure activities in coastal zones worldwide: it involves large numbers of people, and high levels of fishing effort [14]. In Europe there are almost 9 million practitioners, who generate around €6 billion annually for regional economies [15].

While it's estimated that more than 25% of the population practise recreational fishing in some northern European countries such as Norway and Iceland, the participation rate is closer to average in the Mediterranean with 2.70% in Greece, 2.06% in France, 1.32% in Italy and 0.61% in Spain^[16]. However, despite its popularity, recreational fishing is not yet properly assessed and managed at either a European or Mediterranean level.

Figure 1 shows potential recreational boat fishing areas around the marinas in Mediterranean EU countries [17]. The map illustrates the continuous presence of the sector all along the Mediterranean northern coasts, showing the large number of potential sites where boat and spear fishers can operate. In 2010, there were 946 active ports in Mediterranean EU countries, mainly distributed in Italy (253), Spain (191), Greece (135), and France (124).



SOURCE: IFREMER revised by WWF France (2019)

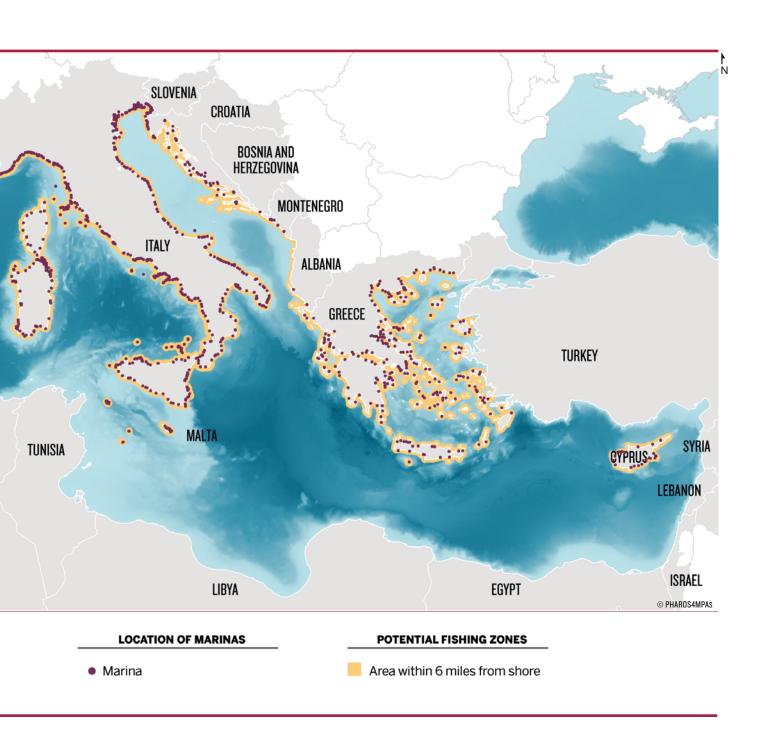


FIGURE I. Distribution of marinas and potential recreational fishing zones in EU Mediterranean countries, plus Montenegro, Albania, Bosnia and Herzegovina

The identification of port facilities exclusively or partially occupied for leisure activities is not yet possible in the other Mediterranean countries.

1.3. THE COMPLEXITY OF RECREATIONAL FISHERIES IN THE MFDITFRRANFAN

While a great deal more data is needed before we can make reliably accurate statements about how much recreational fishing takes place in the Mediterranean, a loose EU estimate suggests that it may represent more than 10% of the total production of all fishing [18]. The activity involves many different techniques, takes place from many different locations, and targets a broad range of taxa (finfish, shellfish, crustaceans etc) [13][19]. Each type involves different fishing techniques and practices, each with its own specific socio-economic implications and impact on marine ecosystems [13].

The following taxa are targeted in all Mediterranean subregions:

- Bluefin tuna (Thunnus thynnus)
- Small pelagics, particularly Scombridae such as Atlantic mackerel (Scomber scombrus) and Atlantic bonito (Sarda sarda)
- Large pelagics, particularly Carangidae such as greater amberjack (Seriola dumerili) and leerfish (Lichia amia)
- · Coryphaenidae, particularly dolphinfish (Coryphaena hippurus)
- Sparidae, particularly gilthead seabream (Sparus aurata) and common dentex (Dentex dentex)
- Cephalopoda, particularly European squid (Loligo vulgaris), common cuttlefish (Sepia officinalis) and common octopus (Octopus vulgaris)[19].

Despite the importance of recreational activities in Europe, this activity has been relatively little studied [20][21][22][23][24]. The lack of data is particularly striking in southern European countries, where recreational fisheries are booming. However, a number of studies have recently been published, providing data to better understand this activity [16][25][26].

KEY FACTS

In the Mediterranean, broad estimates suggest recreational fishing may represent more than 10% of the total production of all fishing [18]



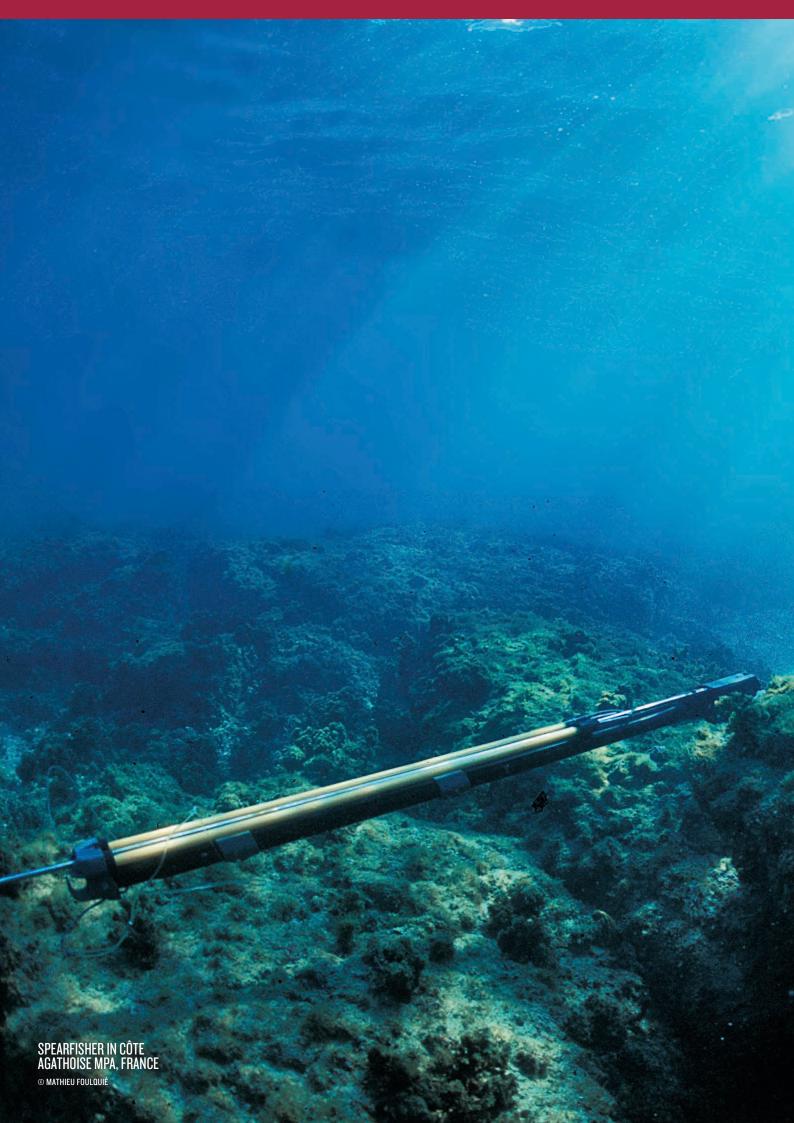
Marine recreational fishing (MRF) is an important activity in Europe, with 9 million participants [15].

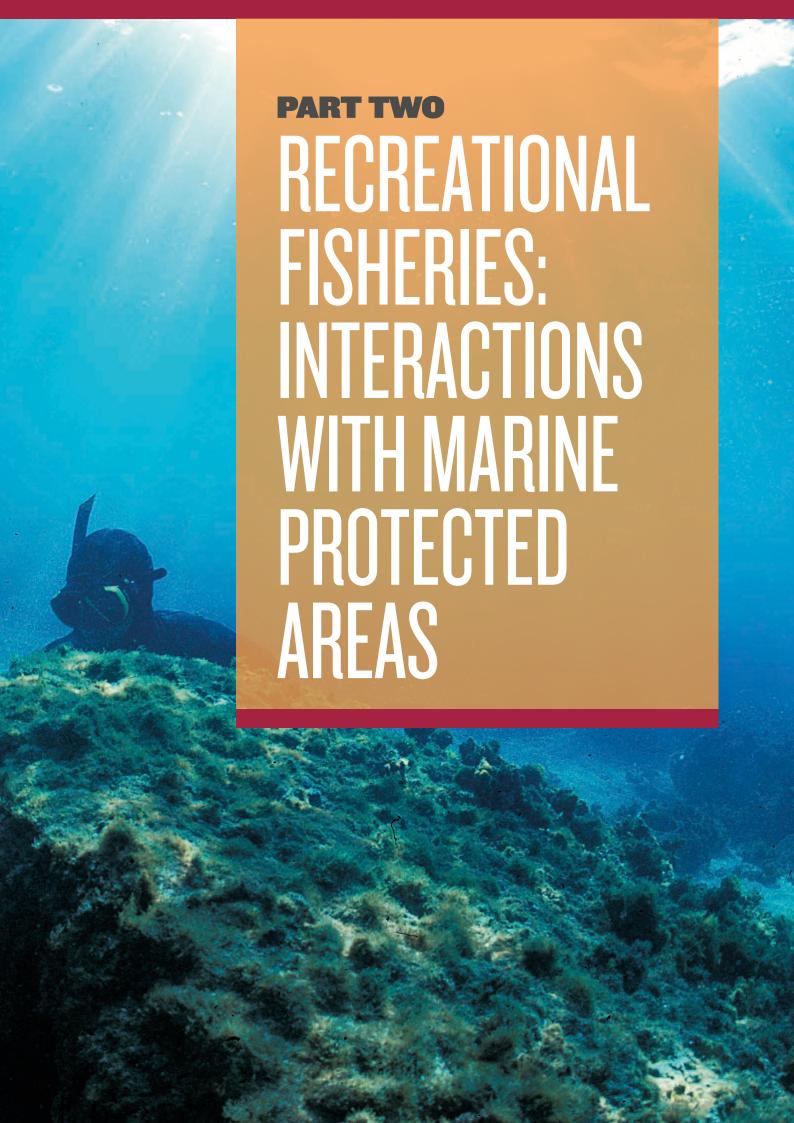
There is no 'systematic and comprehensive collection of information on fishing effort, recreational catches, expenses, social profile and access conditions of European recreational fishers' [25].

> The activity is poorly understood and poorly regulated.

TYPE (OF FISHING	TECHNIQUES USED
	Boat fishing	Handline
		Trolling
		Spinning
		Jigging
		Cork float
		Bottom fishing with rod
		Fishing for cephalopods using squid jigs
		Longline
		Chumming
		Traditional French bottom fishing for gilthead bream (Sparus aurata) 'à la pierre'
		Traditional Mallorcan <i>Xyrichthys novacula</i> bottom fishing
		Fish trap
		Fishing charters (trolling)
		Fishing charters (bottom fishing)
		Treble hooks
		Traditional Italian 'nattelli' surface fishing
	Shore fishing	Cast net
M		'Llencetes' (simple handline, single hook)
		Handline
		Bottom fishing with rod
		Cork float (fishing cap)
		Spinning
		'Au toc' fishing
		Treble hooks
		Squid jig (for cephalopods)
		Octopus jig
		Octopus fishing with chicken feet as bait
		Surfcasting
		Bubble floats
		Fishing with trident
		Traditional Italian 'nattelli' surface fishing
	Shellfish gathering	Underwater
		On foot
	Underwater fishing	From shore
49=-	(spearfishing)	From boat
		Different types:
		Hole fishing
		Stalking (hiding and waiting)
		Stalking ('Indian hunting')
		Ambush fishing (gliding)
	Competition fishing	Shore fishing
		Boat fishing
		Spearfishing

 TABLE I. Recreational fishing techniques (Source: Font et al., 2012)





Since the 1950s, the Contracting Parties to the Barcelona Convention have established a range of marine protected areas (MPAs) and other effective area-based conservation measures (OECMs). To date there are 1,231 MPAs and OECMs in the Mediterranean covering 179,798 km², which places a total of 7.14% of the sea under a legal designation [27]. The Convention on Biological Diversity (CBD) targets a 10% marine protection objective by 2020, known as the CBD Aichi target 11.

These sites are established at national level, at regional level (European or Mediterranean scale) or at international level under a wide variety of designations [27]. Marine Natura 2000 sites are considered as MPAs in some countries (e.g. France) while in other countries (e.g. Italy) they are not.

MPAs play a significant role in protecting fish communities and enhancing fish stocks within their designated boundaries [28]. Their success thus makes them attractive to recreational fishers, who may expect higher yields inside and in the close vicinity of these areas.

The number of recreational fishers has been assessed in some locations, but the overall number is still unknown. Table 2 shows the estimated number of recreational fishers in some MPAs. It shows large variations in different places, and reflects the necessity of collecting as much data as possible in order to estimate the fishing efforts in MPAs elsewhere.

Country	МРА	Size of MPA (ha)	Nr. of recreational fishers (year)
France	Côte Bleue	9873	10750* (2009)
	Cerbère Banyuls	650	1549 (2013)
	Bonifacio	79460	2229** (2018)
Spain	Cap de Creus	3056	1700 (2010)

TABLE 2. Number of recreational fishers in four **MPAs**

The success of MPAs in attracting fishers and tourists can result in conflicts between sectors involving recreational and commercial fishers, scuba divers and tour boats, among others as well as harm to the marine environment.

A common debate is whether or not commercial small-scale fishers and recreational fishers should be given equal rights to access an MPA and its resources. Many scientists and MPA managers believe that MPAs should primarily ensure the economic and social sustainability of commercial fishing activities [29][30].

According to the International Union for the Conservation of Nature (IUCN) there are six types of MPA according to their management objectives, as listed in Table 3.

Recreational fishing, in all its forms, is considered to be an extractive activity and, therefore, may not be compatible with ecosystem and wilderness qualities protection. Recreational fishing is potentially compatible with all categories listed above except in la, lb, ll and lll, provided that the establishment decree and the objectives of the MPA allow for this activity.

IUCN Categories	la	lb	
Brief denomination	Strict nature reserve	Wilderness area	
Management Objectives	Mainly for science	Mainly to protect wilderness qualities	
Recreational fishing compatible?	No	No	
TABLE O. D. A. C.			

TABLE 3. Potential compatibility for recreational fishing in several

This is an illustrative example only: any actual version would need to

In the Mediterranean specifically, it needs to be emphasized that IUCN categories have not been assigned to MPAs in most countries. Nevertheless, the criteria provide a useful framework for reflection.

Currently, multi-use MPAs are the most common type in the Mediterranean. Most multi-use MPAs in the region allow regulated recreational fisheries within their boundaries.

^{*} Observed in July/August

^{**} Number of fishers that declared their fishing activity to the MPA (Source: Modified from Font et al., 2012)



II	III	IV	V	VI
National park	Natural monument or feature	Habitat/species management area	Protected landscape/ seascape	Managed Resource Protected Area
Mainly for ecosystem protection and recreation	Mainly for conservation of specific natural/cultural features	Mainly for conservation through management intervention	Mainly for landscape/ seascape conservation and recreation	Mainly the sustainable use of natural resources
No	No	Yes	Yes	Yes

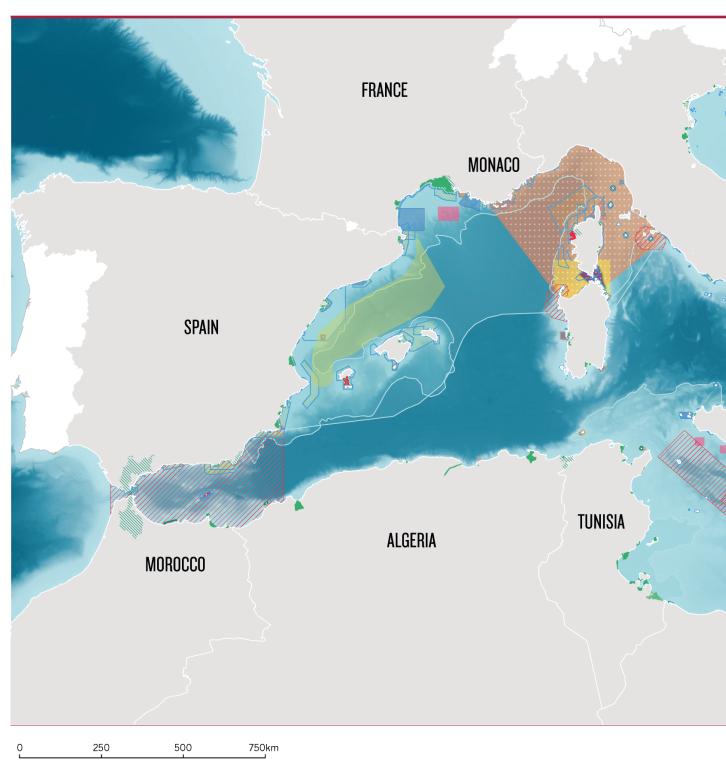
IUCN categories (Source: adapted from IUCN)

be developed through extensive dialogue, so the table should not be taken to reflect the formal view of the IUCN or its Commissions.

KEY FACTS

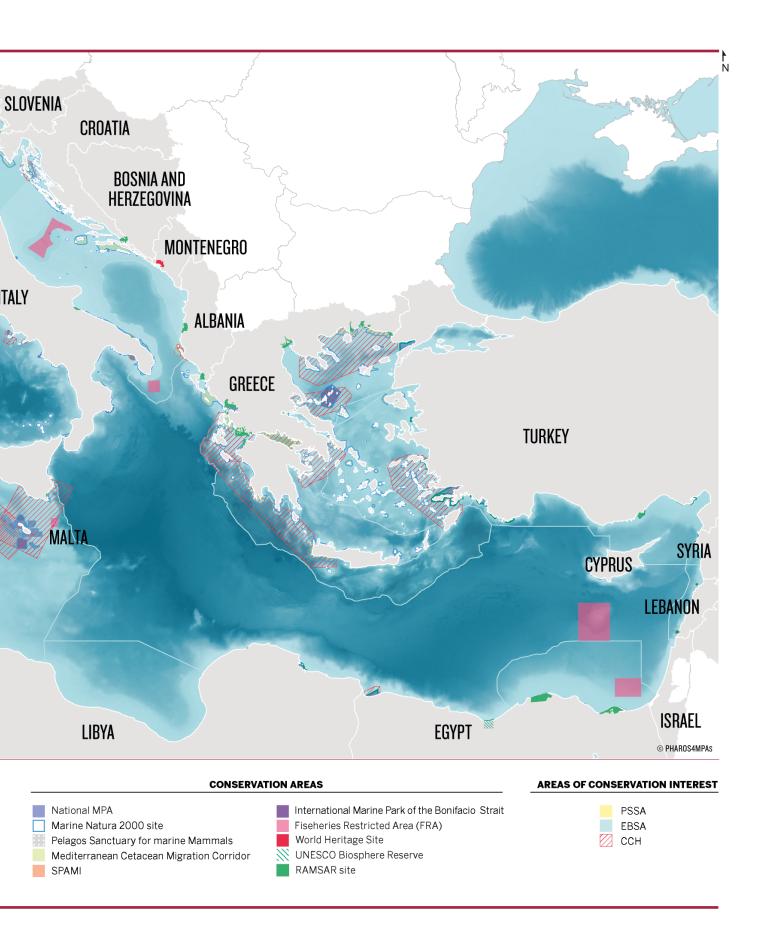
MPAs cover **7.14%** of the Mediterranean Sea surface area. They're mostly situated on the coast, and are particularly attractive destinations for recreational fishers.

Mediterranean MPAs are mainly multi-use. They allow access to significant numbers of recreational fishers, which often causes conflicts with commercial fisheries.



SOURCE: MAPAMED, MedPAN & UNEP-MAP-SPA/RAC (2017)

 $\begin{tabular}{ll} \textbf{FIGURE 2.} Different types of protected areas in the Mediterranean Sea \\ \end{tabular}$







3.1. SOCIAL BENEFITS AND IMPACTS

Recreational fishing has many social and public health benefits – for example it increases participants' quality of life, encourages social interactions, and increase practitioners' awareness of the environment and the importance of sustainability [31][32].

MPAs are generally perceived as positive for recreational fishing in the Mediterranean [33]. However, the increasing presence of recreational fishers in MPAs is itself a source of conflict, particularly when they are seen to be in competition with traditional activities like small-scale fisheries (SSF). This competition has prompted debates on whether declining small-scale fisheries, which contribute to providing seafood to populations, should be given priority regarding MPA resource management and access.

3.2. ECONOMIC BENEFITS

Recreational sea fishing is a popular hobby in most coastal countries, and makes a significant economic contribution [15][34].

It has been estimated recently that the total economic activity supported by recreational marine fisheries in Europe is around €10 billion, comprised of a direct expenditure of €5 billion, an indirect expenditure of €2 billion, and a further €3 billion of induced expenditure [15]. It generates almost 100,000 full time equivalent jobs in the EU (57,000, 18,000 and 24,000 from direct, indirect and induced expenditure, respectively). The amount varies between EU sea regions: the North Sea is the largest overall contributor, followed by the North-western Atlantic, Mediterranean, South-Western Atlantic and the Baltic Sea, with the lowest contribution from the Black Sea.

Boat fishers generate the highest amount of direct expenditure, due to the high cost involved in purchasing, maintaining and mooring their vessels, and on tourism-related services, such as transport and accommodation ^[13]. Given their popularity among recreational fishers, MPAs clearly have an important role as instruments to help achieve a sustainable blue economy.



3.3. FNVIRONMFNTAL

Assessing the impacts of recreational fisheries has become a priority for public authorities, as well as considering how best to manage and regulate these activities. This is reflected in the fact that the GFCM includes the issue in its current mid-term strategy (2017-2020) towards the sustainability of Mediterranean and Black Sea fisheries. This holistic approach to fish catches is important, as these fisheries are facing serious challenges: roughly 80% of all assessed stocks are fished outside safe biological limits, and catches are decreasing and commercial fleets shrinking across the region.

Recreational fisheries can exacerbate this situation in a number of ways, described below.

INCREASING FISHING EFFORT

Although data is scarce and varies between countries [19] (recreational fishing practices are difficult to assess since they're carried out by a mobile and highly heterogeneous population[8]), anecdotal evidence suggests that recreational fisheries see significant fishing activity in the Mediterranean, with pressure still increasing in some areas.

As an example, in the Balearic Islands the number of recreational fishing licenses increased dramatically during the first decade of the 2000s to reach 51,000 in 2011, but had dropped to 42,000 by 2015 (Figure 3). Given that there are still fishers who operate without a licence, it's estimated that there are currently 70 recreational fishers for every commercial fisher.

Clearly, such an increase in fishing effort is likely to lead to increased catch volumes, which will have an impact on stock numbers and the reproductive potential of vulnerable species.



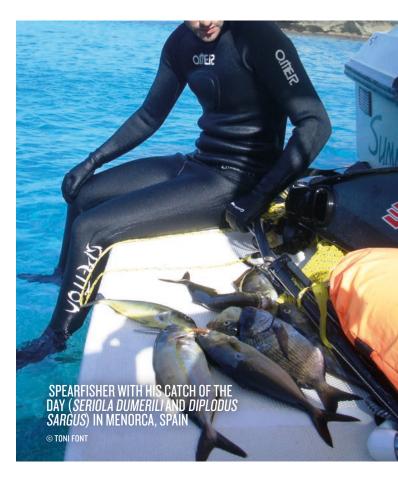
FIGURE 3. Number of licenses of the recreational fishery from the Balearic Islands during the period 1997-2015 (SOURCE: OLIVER & MASSUTÍ, 2016)



SIGNIFICANT CATCHES

Recreational fishing has been shown to be an important component of fishing mortality across the globe [15]. Failing to include recreational catch estimates in stock assessments can undermine their accuracy and lead to incorrect advice on fisheries management [19].

Comprehensive data is lacking, but the EU broadly estimates that recreational fishing represents more than 10% of the total production of all fishing [18]. While the subject is still poorly assessed, several scientific studies have shown that the fishing pressure exerted by recreational fisheries can in some areas be similar to, and even exceed, catches by commercial small-scale fishing fleets [14][35][36][37]. While this may not be a general pattern, such studies make it clear that recreational fishing should not be neglected as an extractive activity.



ILLEGAL FISHING

Illegal fishing may also add extra pressure on fishery resources – this is a problem in most coastal areas and MPAs [13]. In Spain, where fishing with a license is compulsory, the percentage of unlicensed fishers nevertheless ranges from 26% in the case of shore fishers in Cap de Creus to 39% in Tabarca [13][38][39], and even up to 59% in Mallorca [40]. Poaching not only negatively affects MPAs in terms of biomass and biodiversity, but it can cause serious economic losses and amplify conflicts between other stakeholders (e.g. small scale fishers, scuba divers, etc.).

IMPACT OF RECREATIONAL FISHING ON VULNERABLE **SPECIES**

According to recent studies [13][38][41], 41 out of 136 species (i.e. 30% of the total) captured by recreational fishers in nine Mediterranean MPAs are classified as vulnerable. However, in some areas such as Porquerolles (France), Côte-Bleue (France) and Serra Gelada (Spain), the proportion of vulnerable species in the catch surpasses 50%. Overall, vulnerable species make up nearly 20% of the total recreational catch in coastal waters (including MPAs) of the western Mediterranean [16].

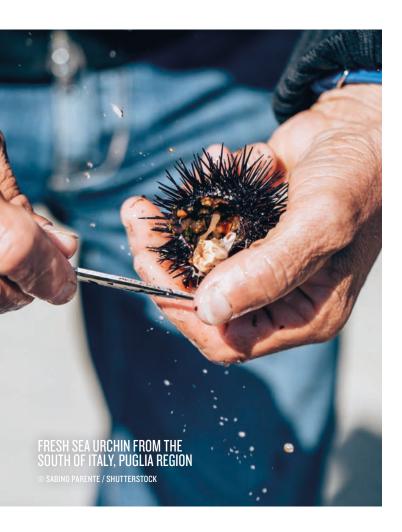
Clearly, recreational fisheries may pose a threat to vulnerable species, many of which have experienced marked declines in their populations in recent decades [16]. For instance, it was shown that spearfishing contributed to the decline of the brown meagre (Sciaena umbra) population in the Scandola MPA (Corsica)^[42].



IMPACT OF CERTAIN GEARS ON VULNERABLE SPECIES

Some recreational fishing methods (e.g. spearfishing) target species with a high economic value that are also exploited by artisanal fisheries. Many of these species - e.g. grouper (E. marginatus), red scorpionfish (S. scrofa) and common pandora (P. erythrinus) are endangered, and are included in international conventions (e.g. Barcelona, Bern or Washington conventions), laws (e.g. EU Habitats Directive) or lists (e.g. the IUCN Red List) [13][16].

Spearfishing is a very selective type of fishing since underwater fishers can see and choose the species to fish: this makes vulnerable species a target, particularly top predators and larger individuals. Although they are less selective than spearfishing, jigging and trolling to an extent may have the same effect as large lures are often used to attract the biggest fish [38][41][43][44].



Figures from available studies confirm that underwater fishers tend to focus their catches on vulnerable species: the mean vulnerability index of the totality of commercial species exploited worldwide is 48, but when it comes to spearfishing in Mediterranean MPAs, the mean index is 54.1^[16].

IMPACTS ON THE REPRODUCTIVE POTENTIAL OF SPECIES

Recreational fishers, particularly spearfishers, tend to selectively catch the largest individuals of a given species, which has an impact on the species' reproductive potential [37]. This is because larger individuals tend to produce a higher quantity and better quality of eggs and larvae, thus producing more offspring [45]; or because, in the case of sex-changing species, the demographic structure of the population is disrupted as the larger sex will be disproprtionately caught, leading to egg or sperm limitation.

For instance, the dusky grouper Epinephelus marginatus, a protogynous species, is born female and becomes male when it reaches a certain size; while the seabream Sparus aurata, a proterandric species, is born male and becomes female as it grows.

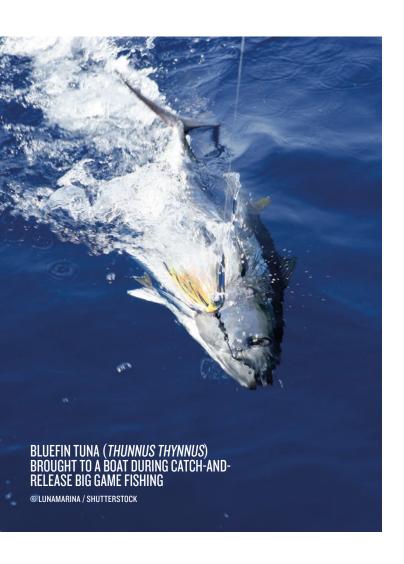
In fact, pressure comes at both ends of the size scale: some recreational fishers catch individuals below the legal minimum landing size [46], which damages the reproductive potential of the species as juveniles caught will never be able to reproduce.

DISRUPTION OF TROPHIC CHAINS

Some fish species targeted by recreational fishers are regulative species which help control the proliferation of other species, such as sea urchins.

When sea urchin populations become too big they may have an impact on the health of the algae communities on which they feed. On the other hand, sea urchins are appreciated as a traditional raw food around the Mediterranean and are intensively caught in certain periods, especially between the months of December and May^[43].

Sea urchin overfishing may lead to uncontrolled proliferation of certain algae, contributing to changes in the marine ecosystem [47]. Some other species exposed to recreational fishing – such as clams and mussels – also have key roles in ecosystems, but the impact of their removal is difficult to assess due to a lack of studies on the subject.



CATCH-AND-RELEASE AND FISH WELFARE

Catch-and-release is a common practice worldwide. with one of the most common reasons given for returning catches being that the fish are too small or that they are not worth eating. However, catchand-release does not seem to be widespread in the Mediterranean [48][49] despite a few initiatives promoting it, e.g. the Pesca Recreativa Responsible association³ in Spain, or Experience Pêche in Camargue, France⁴.

Despite the benefits of releasing fish back into the sea [13], catch-and-release is a practice that may still have negative effects. Certain handling techniques can cause great stress and subsequent death among fish, although many of the harmful effects can be avoided with careful handling. Appropriate practices include minimizing the duration of the activity, minimizing or eliminating handling and exposure to air, and using gear that reduces damage, stress or mortality (organic baits rather than artificial lures, barbless hooks rather than barbed hooks, etc.).

POTENTIAL INTRODUCTION OF **EXOTIC SPECIES USED AS BAIT**

The bait market offers several species that have been produced or harvested in other parts of the world such as Korea, USA, China, etc. The use of living exotic species as bait by recreational fishers in the Mediterranean is common, and in some MPAs it may account for up to 60-80% of the total bait used [46].

The risk is that these species may settle in the Mediterranean, if for instance fishers throw remaining live bait that they have not used into the sea. Bait species could then displace endemic species, changing the structure of the trophic chain. It's not just the bait itself which represents a potential threat - the boxes in which it's packaged may also contain other small invertebrate animals (e.g. crustaceans) or exotic algae that may end up settling in the new environment [46].

An example of this issue can be found in Mar Menor lagoon in the western Mediterranean. Here, an established population of the polychaetous annelid Perinereis linea has been reported for the first time outside its native distribution range in the northwest Pacific. This exotic worm reached Mar Menor via imported live-bait which was commonly used by anglers in the lagoon [50].



³ http://www.amprr.es/

⁴ www.experience-peche.fr

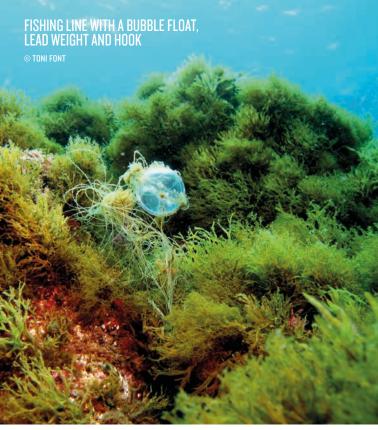
POTENTIAL IMPACTS OF FISHING GEAR LOST OR ABANDONED AT SEA

There is very little available information on lost fishing materials (fishing line, nets, hooks, leads etc.) in the Mediterranean, which makes the issue hard to regulate and manage – to the detriment of the marine environment [13].

Lines and nets can remain on the seabed for many years still capturing fish, particularly in rocky habitats, resulting in additional mortality of both target and non-target species [51]. Lost hooks may also pose a serious threat to marine fauna, while sessile organisms and coralligenous bottoms may have their growth compromised by the abrasive action of lost fishing nets and lines [52].

Furthermore, plastic fishing lines and lead (mostly from recreational fishers) and lost nets (mostly from commercial fishers) are a major source of marine pollution in some areas. As pointed out by the European Commission, fishing gear accounts for 27% of all beach litter - around 20% of all gear is eventually lost at sea⁵. In particular, lead (from sinkers or weights used by many fishers) is very toxic when dissolved in water, and may end up affecting organisms. Lead bioaccumulates and may be biomagnified through the trophic chain, before reaching human beings when they consume seafood. In a study conducted recently in Sant Feliu Guíxols (Catalonia, Spain) covering two zones of 4,700m² and 5.300m² where recreational fishers concentrate. lead sinkers made up 36% of the potentially harmful materials found on the bottom^[53].





⁵ European Commission (2018). New proposal will tackle marine litter and "ghost fishing". Retrieved March 20, 2018, from https:// ec.europa.eu/fisheries/new-proposal-will-tackle-marine-litter-and-%E2%80%9Cghost-fishing%E2%80%9D_ro

DAMAGE TO SENSITIVE HABITATS

Trampling on Cystoseira assemblages

The practice of shellfishing (e.g. for bivalves such as mussels and gastropods) is usually carried out on the infralittoral and media littoral rocky zones, where forests of the fragile Cystoseira species are found in some locations. Shellfish collectors and shore anglers trampling on the rocks may be partly responsible for the disappearance of a number of Cystoseira species in coastal areas including Cape Creus [13][54]. Additionally, tools such as knives are often used in shellfish collection, which can damage the rock and harm other species [38].

Unintended contact of spearfishers with sessile organisms

Although more research is needed on the damage caused by spearfishers, several studies have aimed to assess these impacts – and there is some evidence that cumulative disturbances can cause significant localized destruction of sensitive organisms in areas shared with high numbers of divers [55][56][57]. Inexperienced spear fishers, in particular, tend to come into contact more frequently with coralligenous assemblages [57].



Anchoring on Posidonia meadows

Conventional mooring chains scrub the substrate, and can destroy the immediate environment such as Posidonia oceanica meadows [58] [59]. Many Posidonia meadows in the Mediterranean are particularly exposed. In the Natura 2000 site « Posidonies du Cap d'Agde » (France), more than half of the recreational boat fishers cast anchor [60].

PRESSURE	IMPACT	TAXONOMIC GROUP/HABITAT	INTENSITY
Overexploitation of vulnerable species	Insufficient population recovery	Different vulnerable species, e.g. groupers	High
Additive predation	Perturbation of trophic chain	Sea urchin in coastal habitats	Low
Physical contact from boat anchors and trampling on sensitive habitats	Habitat degradation	Cystoseira and coralligenous assemblages as well as Posidonia meadows	High
Catch-and-release	Increased mortality	All fish	Medium
Exotic species	Ecosystem disturbance	All types of coastal habitats	Medium
Fishing gear lost or abandoned at sea	Pollution/Ghost fishing	All type of marine habitats	High

TABLE 4. Summary of pressures and impacts affecting taxonomic groups and habitats, together with the level of intensity

3.4. INTERACTIONS BETWEEN RECREATIONAL FISHERIES, SMALLSCALE FISHERIES AND OTHER SEA USES

There are frequent conflicts in Mediterranean MPAs between commercial small-scale fishers and recreational fishers. These are made worse by the asymmetric legal context of the two forms of fishing, reflected in a lack of recreational fisher data and management regimes, and the absence of a common definition of recreational fisheries at the European level.

This is further accentuated by:

- Competition on fishing resources, as the impact of recreational fisheries on stock not being assessed and the commercial fishing being controlled and managed through its impacts and state of fish stocks. This competition can take the form of a spatial competition on allocation or access to fishing areas (fishing grounds) and fish stocks. As mentioned above, in certain areas the total catch of recreational fishing is comparable or may even exceed that of commercial fishing [61].
- Competition on the market. Despite marine recreational and subsistence fishing are commonly defined as practices prohibiting the sale of catches, black market can take place, lowering the price of fish for SSF, directly affecting them.

A EU report [7] highlights that before policies on non-commercial fisheries can be properly considered, thorough monitoring and analysis of valid scientific data needs to be carried out.

THE DEVELOPMENT OF A LOCAL MANAGEMENT PLAN IN CAPE MILAZZO MPA. ITALY

Cape Milazzo is located on the northeastern coast of Sicily, and provides a useful example of how conflicts between small-scale commercial fishers and recreational fishers can be tackled in an MPA. The establishment of a local management plan (LMP) in the area has been a first step towards the eradication of illegal activities and the management of fishing grounds. The plan considers a series of restrictions, including on access to some fishing grounds by artisanal fishers. It shows that it is necessary to know the viewpoint of stakeholders, especially artisanal fishers, regarding the conflicts between stakeholders.

KEY FACTS -

Recreational fishing is a popular leisure activity with positive economic impacts in coastal zones

In the Mediterranean, a growing number of fishers is increasing fishing pressure on marine resources

Recreational fishers can damage sensitive habitats, introduce exotic species and pollute the sea (especially through lost or abandoned fishing gear)

Social conflicts often arise between recreational fishers and other stakeholders, particularly small-scale fishers

RECREATIONAL FISHERS IN CAP DE CREUS MPA, SPAIN

In Catalonia's Cap de Creus MPA recreational fishers, artisanal fishers, scuba divers and leisure boaters all use similar areas in a narrow stretch along the coast (Figure 4): the complexity of their interactions is a significant management challenge. Many recreational fishers fish near traditional small-scale fishing areas, and smallscale fishers often have the perception that other extractive and non-extractive maritime activities are threatening their livelihoods and cultural heritage [62][63][64]. Furthermore, there are two major sources of conflict between recreational fishers and scuba divers: i) recreational fishers often use the mooring buoys that the MPA managers put in place for scuba diving vessels; and ii) scuba divers complain that the recreational use of towed fishing lines close to diving sites poses a danger to them.

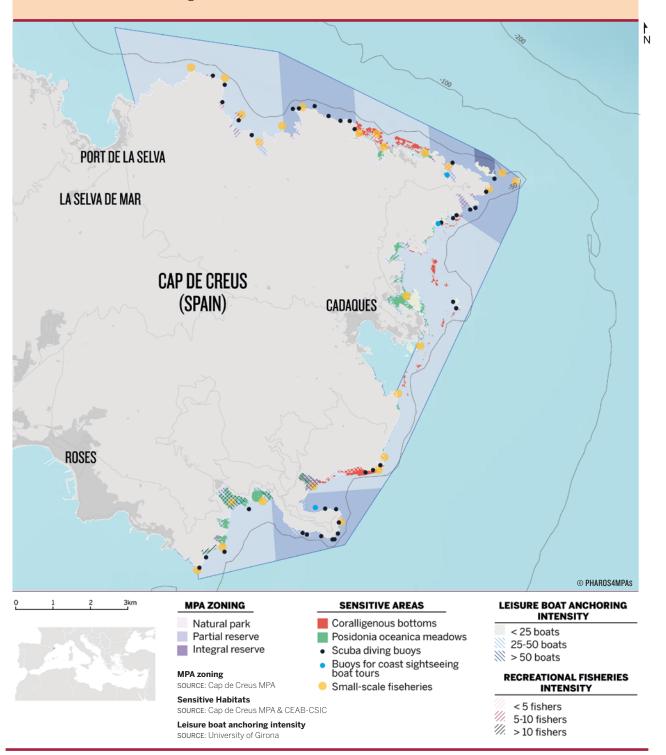
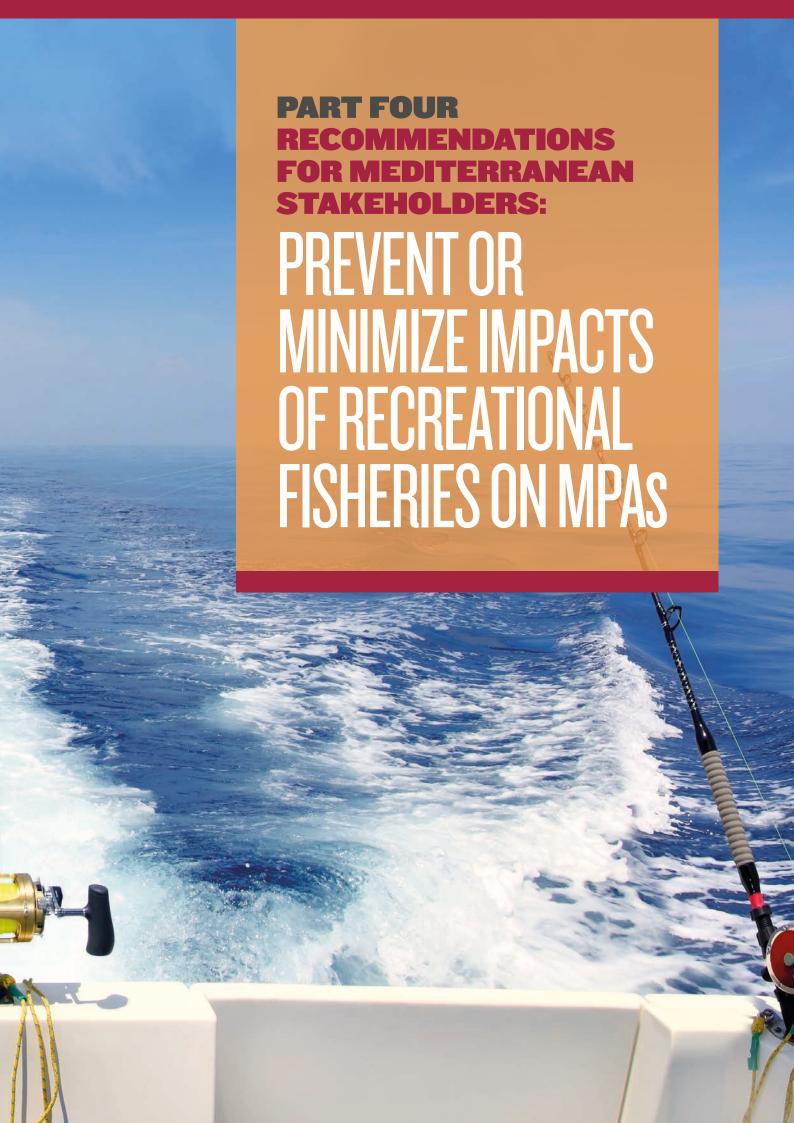


FIGURE 4. Cap de Creus MPA showing the areas where recreational fishers interact with small-scale fishers and leisure boating





This section gives an overview of recommendations for dealing with interactions between MPAs and recreational fishers in the Mediterranean Sea.

Three stakeholder groups are addressed:

- Public authorities
- MPA managers
- · Recreational fishers

4.1. PUBLIC AUTHORITIES

Unlike commercial fishing, recreational fishing in the EU largely remains under national control – however, in recent years they have been increasingly made subject to EU fisheries legislation. In 2009, a chapter on recreational fishing was included in the Council Regulation (EC) No 1224/2009. Article 55 of this regulation requires that "Member States should ensure that recreational fisheries on their territories and in Union waters are conducted in a manner compatible with the objectives and the rules of the Common Fisheries Policy".

This activity is also subject to the European regulation fixing fishing opportunities for certain fish stocks and groups of fish stocks (EC No 2019-124). Management measures are set for recreational fisheries targeting species that are subject to recovery plans, such as the European eel, bluefin tuna and swordfish in the Mediterranean, and on species with minimum conservation reference sizes (MCRS). Even so, European priorities focus only on a few species managed by the total allowable catch (TAC) system – the general management of marine recreational fisheries depends mostly on national and regional legislations [65].

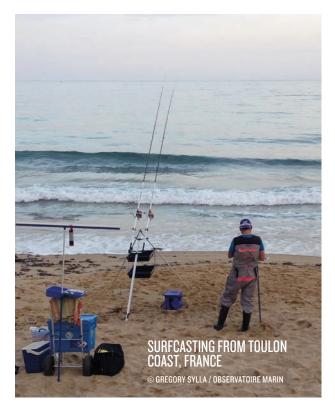
A clear, agreed Europe-wide definition of marine recreational fisheries is still needed for regulation and enforcement purposes. An appropriate definition should enable a clear distinction between different types of fishery, and the different methods of recreational fishing ^[8]. The definition should extend across the whole Mediterranean basin, where subsistence issues are also very important in some areas.

RECOMMENDATIONS FOR PUBLIC AUTHORITIES

Following the proposed amendments of the European Commission to Council Regulation (EC) No 1227/2009⁶, EU Members States are required to have a registration or licensing system for vessels and to collect information on catches. For species which are subject to EU conservation measures applicable to recreational fisheries, catch declarations must be sent to the relevant authorities. The prohibition on selling catches is maintained, and current derogations in the Mediterranean are removed (see amendments to Regulation (EC) No 1967/2006). Specific provisions are made regarding the control and marking of recreational fishing gears.

National and regional public authorities can have the greatest influence in minimizing the environmental impacts of recreational fisheries development.

Progress on Member States' implementation of the regulations on recreational fisheries should be actively monitored.



⁶ European Commission, Amendments 4 and 55; COM(2018) 368 final. Retrieved May 16, 2019, from https://ec.europa.eu/fisheries/sites/fisheries/files/docs/com-2018-368_en.pdf

LICENCES

Typically, fisheries legislation establishes three types of access regime for individual recreational fishers, recreational boats and divers. Licence regimes vary among countries in the Mediterranean. Six countries in the region - Albania, Croatia, Greece, Slovenia, Spain and the Syrian Arab Republic⁷ – have a licence system in force for boat recreational fishing, whereas there are no licence systems in Bosnia and Herzegovina, France, Greece, Israel, Libya, Malta and Turkey [19]. Table 5 shows how the use of licence systems varies across the basin.

COUNTRY	LICENCE SYSTEM
Albania	boat users
Algeria	boat users
Cyprus	boat users
Italy	*
Slovenia	boat users/spearfishing in sport contests
Spain	boat users**
Lebanon	spearfishing
Morocco	spearfishing
Tunisia	spearfishing

TABLE 5. Recreational fishery licence systems in Merditerranean countries

* In Italy, all fishers must apply for a membership of a national recreational fishing federation and report catches. **In Spain, the competent authority may subject the special authorization issued in respect of a recreational boat to an annual total allowable catch (TAC), licence-holders are also required to report catch data broken down by area and period

It is strongly recommended that national licence systems should be developed so that the numbers of recreational fishers (among other parameters) can be better evaluated. The licence system should include the obligation to report all catches - this is an essential element to obtain greater accuracy on the status of fish stocks and a clear assessment of the share of catches from recreational fisheries in relation to commercial fishing.

MONITORING

Monitoring of the impacts of recreational fisheries should be implemented by all Mediterranean states.

To improve information on recreational fisheries, the GFCM is currently developing a handbook to provide a clear methodological framework for adopting and/ or implementing suitably harmonized sampling and survey monitoring schemes [66].

Apart from these essential actions the EU, GFCM and national and regional authorities should also address the following areas:

• Maturity sizes: There is a need to establish a minimum conservation reference size (MCRS) above the size of maturity of each species (L50), especially those classified as vulnerable, in order to protect sexually immature individuals. In addition, a maximum conservation reference size for each species should be established (i.e. fishers must fish below this size): this would help to increase the volume of offspring and the quality of eggs and larvae, as larger individuals have higher reproductive potential. Implementing both these measures would also mitigate fishing pressure on hermaphrodite species.

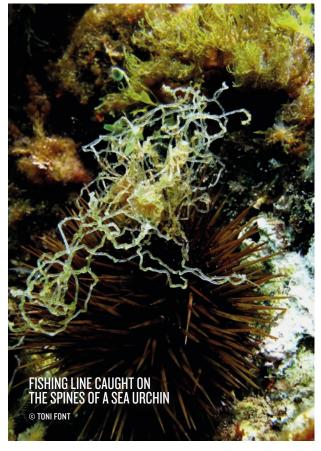


⁷ FAO (2004). Mediterranean access regimes to fisheries resources Retrieved June 01, 2019, from www.fao.org/3/y5880e/y5880e05.htm



- Species protection plans: When the situation of certain vulnerable species is critical, national authorities can prohibit the use of particular fishing methods until population dynamics studies are performed. For example, in French Mediterranean coastal waters (excluding Corsica) there is a ban on recreational hook and line fishing and spearfishing for brown meagre (Sciaena umbra)8, and a ban on commercial and recreational hook and line fishing and spearfishing for groupers (Epinephelus spp. and Mycteroperca rubra), until at least 20239.
- Lost fishing gear: More collaborative systems to report lost fishing gear and organize recovery and cleaning operations are needed for recreational fisheries, like the Ghostmed project in France. Gear improvements such as integrated GPS are already widely used in commercial EU fisheries [67], and they account for higher documented recovery rates [68].

Finally, **local public authorities** can be instrumental in implementing initiatives to incentivize and support recreational fishers to switch to more sustainable practices.





⁸ Arrêté n°2013357-0007. Portant réglementation de la pêche du corb dans les eaux territoriales en Méditerranée continentale. (2013). Retrieved September 27, 2018, from http://www.institut-paul-ricard. org/IMG/pdf/arrete-paca-lr-2013-corb.pdf

⁹ Arrêté n° 2013357-0004 du 23 décembre 2013. Portant réglementation de la pêche de différentes espèces de mérous dans les eaux territoriales en Méditerranée continentale. (2013). Retrieved September 27, 2018, from http://gemlemerou.org/cms/images/stories/GEM/Moratoire/ Moratoire_Continent_2013_2023.pdf

¹⁰ GhostMed project. Retrieved June 17, 2019, from https://ghostmed. mio.osupytheas.fr/

4.2. MPA MANAGERS

MPA management bodies usually have the power to regulate recreational fisheries, along with other public (regional and national) authorities. Proactively establishing a dialogue with the recreational fishing sector is crucial for implementing management actions which avoid or minimize its impacts on target and non-target species and habitats, reduce conflicts with other sectors, and maximize the economic benefits of the site.

4.2.1. SETTING UP CO-MANAGEMENT COMMITTEES

Good governance is a prerequisite for effective management, and community support is essential to achieve this objective. This is even more imperative in MPAs where fishery activities are integrated with conservation measures for both habitats and fish species, which are often affected by the same fishery. MPA managers should embrace co-management as a key tool where decision-making power, responsibility and accountability are shared between governmental agencies and other stakeholders, including local communities that depend on the MPA culturally and/or for their livelihoods [69].



While co-management strictly speaking is not always possible in MPAs governed by a management board, effective participatory management can still be achieved through specific fisheries committees set up under the management board in which participants share decisions, responsibility and accountability. Given the divergent values of different stakeholders. the high degree of scientific uncertainty, and the high stakes involved in marine resource management, the key challenge is to adopt a 'middle-ground' approach which combines topdown and bottom-up approaches. In any case, comanagement helps to reduce conflicts and increase compliance with management measures adopted.

Involving recreational fishers in MPA fisheries committees is not always straightforward, as recreational fishers may lack official representative organizations, and many do not belong to a representative organization even where one exists (in France, only 3% of marine recreational fishers belong to federations or other relevant organizations)^[70].

Nevertheless, in recent years recreational fishing organizations have been established in many Mediterranean regions and nations, including some at EU level such as the European Anglers Alliance.

INVOLVEMENT OF RECREATIONAL FISHERS IN DECISION-MAKING IN MPAS

In a study published in 2012, eight of the 21 Mediterranean MPAs analyzed involved recreational fishers in making decisions governing their activity [13]. MPAs such as Côte Bleue (France), Bonifacio (France), Cala Ratjada (Spain), Cabo de Gata-Nijar (Spain) and Torre del Cerrano (Italy) have on the other hand established frequent contact with these fishers. Others, such as the Golfe du Lion MPA (France) and the Calangues National Park (France) have representatives of recreational fishing federations on their governing body. To ensure regulations are relevant and accepted by stakeholders, they are prepared in a participative manner – in some cases they are also tested before being made permanent. In the Natural Reserve of the Straits of Bonifacio (France), some experimental recreational fishing regulations were tested for a six-month trial period during 2012. These included that recreational fishers should declare their intention to fish in the area to the Corsican Environmental Office before going out, and that the maximum catch would be limited to 5kg/person/day.

The test period was followed by a consultation with local stakeholders on whether to make the regulations permanent or not. This allowed the regulation to evolve until it was adopted permanently in 2018.

4.2.2. MONITORING

Monitoring is a key starting point for the MPA manager in order to identify and quantify both the number of recreational fishers and the impacts of their activity. Performing such studies regularly is necessary to understand not only the effects on marine communities but also the economic and social benefits produced by this activity. The collected data can contribute to establishing the MPA's carrying capacity and help develop science-based measures that ensure a sustainable recreational exploitation of the sea^[71].



To achieve such objectives, a clear sampling methodology is needed - and its scope will depend on the funds and human resources available (data can be gathered on foot, by boat, aerial-access, phone calls, emails etc). Interviewers must also be trained in recreational fishing in general so they can acquire valid information and avoid biases. Recreational fishing pressure parameters that should ideally be monitored include fisher numbers, methods, gear, species, catches etc., particularly for vulnerable species. Importantly, surveys should be regularly carried out over different months, days (including weekends) and times of day, as well as in areas with different levels of protection (e.g. in and outside the MPA).

Recreational fishers should also declare their captures to the MPA. For that purpose, a register of captures is needed. This will give the MPA manager useful information on fishing effort and the presence/absence of certain species. In Cabo de Gata Nijar (Spain), recreational fishers are asked to report their captures, along with where and when they are made, through a mobile application, facilitating data management and providing valuable information [72]. However, some MPAs have reported that data from fishers themselves are not always reliable, and independent scientific assessments are needed on a regular basis.

Monitoring programmes must go beyond the direct activities of the fishers themselves. Studies assessing the indirect impacts of recreational fishing on species and habitats - lost fishing gear, bycatch, anchoring, trampling, etc. - must also be considered. Monitoring also helps to assess the impact of the activity on the artisanal fishery [73].

It is also necessary to perform socio-economic monitoring to acquire socio-economic data. Regular economic data collection is for instance needed for estimating the economic impact of recreational fishing in MPAs and to know the social and economic value of recreational fishing.

Finally, regular monitoring to detect the presence or expansion of invasive species (algae, invertebrates and vertebrates) is also recommended, so action to minimise further ecosystem impacts can if necessary be taken as swiftly as possible [69][74].

Several publications give an overview of the different techniques that can be used to monitor recreational fishers and the impacts of their activity. The MedPAN publication on recreational fisheries in Mediterranean MPAs provides a sound review of monitoring techniques [13][75].



The zoning of an MPA can be a key tool in the sustainable management of recreational fisheries. Zoning must take into account the results of previous monitoring studies, as well as other criteria:

- The surface extent of the MPA
- The number of visitors per year
- The vulnerability of the species inhabiting the area
- Conflicts with other sectors (e.g. small scale fisheries, scuba divers, leisure boating)

Following the Avoid Mitigate Compensate approach, the primary and most effective measure is to ban recreational fishing from some sensitive and critical areas. As an example, the Portofino MPA is divided into three zones: recreational fishing is prohibited in zone A, which is a no-take zone, while it is regulated in zones B and C. [76] This type of zoning is a common pattern in Mediterranean MPAs.



Zoning approaches should aim to avoid gear interaction or conflicts of access to marine resources, both with other stakeholders (e.g. small-scale fishers) and among recreational fishers themselves (e.g. spearfishers vs. boat anglers). This spatial zoning should not only mitigate conflicts between individual users and different sectors but also contribute to diversifying captures.

The Natural Reserve of the Straits of Bonifacio (France) provides an example of this approach, where enhanced protection zones have been established for small-scale fishers close to no-take zones. In these zones spearfishing is forbidden and recreational fishing is limited to hand-held gears, while artisanal fisheries are authorized under the same conditions as in the open exploitation areas (Figure 5).

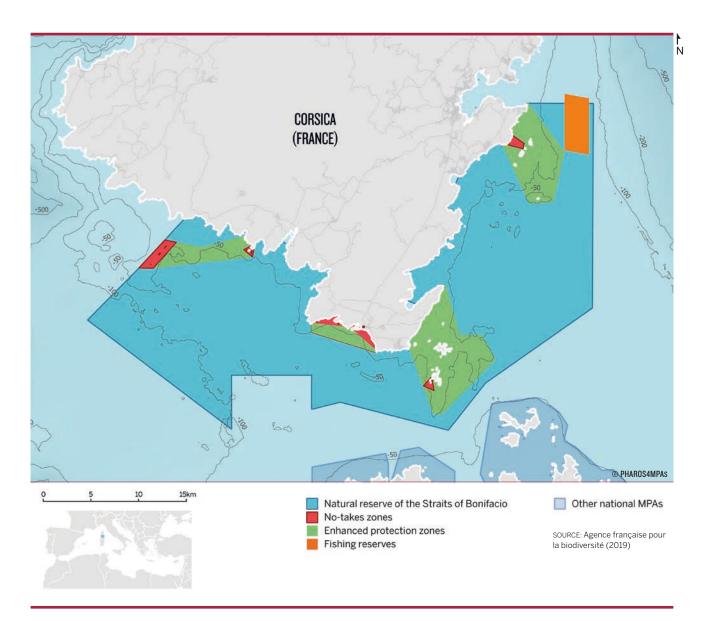


FIGURE 5. Map of the Natural Reserve of the Straits of Bonifacio (France) showing the different protection zones

Due to this zoning artisanal fishers' CPUE has increased: it's more than 2.3 times higher than in the MPA's open exploitation zone where all types of recreational fisheries are allowed (Figure 6).



FIGURE 6. Comparison of CPUE mean value (in g/patch of 50m/day) between open exploitation zones and enhanced protection zones of the Natural Reserve of the Straits of Bonifacio in 2018 (modified from Office de l'Environnement de la Corse, 2018)

Finally, some MPAs might find it helpful to close certain zones to recreational fishers on particular days of the week in order to allow species with complex reproduction habits to mate.

4.2.4.
ESTABLISHING FISHING
LICENCES AND OTHER
SUSTAINABLE MANAGEMENT
MEASURES FOR RECREATIONAL
FISHERIES

In countries without such a licence system, MPAs may still be allowed to issue licences themselves, depending on their regulatory framework. Whenever possible MPAs should establish an obligatory licensing system for fishers who want to fish within their boundaries, particularly in countries without a national license system.

Among the MPAs assessed in Font et al. [13], only 50% issue licences (Table 6). Licences (with or without an associated fee) are very useful, as they enable managers to monitor the number of fishers who come to the area as well as how their practices vary during the year – this data is important so appropriate management measures can be planned and put in place.

Some MPAs have the regulatory power to establish a recreational fishing fee in their area. However, in the study carried out by Font et al. [13], less than 30% of MPAs have done so. The establishment of recreational fishing fees when licences are issued is an effective mechanism towards sustainable management. These fees can contribute to lessening the environmental impacts of recreational fishing, covering the costs of management and – importantly – control measures.



Fees can however be a controversial issue, and their implementation needs to be thoroughly discussed with stakeholders. A number of studies demonstrate that most fishers are willing to pay if the fees are used for environmental protection. For example, a study

conducted in 2007 in the marine reserve of Cap de Creus showed that 64.6% of shore anglers were willing to pay a fee for fishing in the MPA, while 25.6% refused it [44]. Table 6 includes a number of MPAs using fees as an incentive for sustainable recreational fishing.

COUNTRY	MPA	FEE	RECREATIONAL FISHING LICENCE TO FISH IN THE MPA		
Spain	Alborán	No	Yes		
	Cap de Creus	No	No		
	Cala Ratjada	No	Yes		
	Cabo de Gata	No	No		
	Illes Medes	No	No		
France	Straits of Bonifacio	No	No		
	Cap d'Agde	No	No		
	Cerbere-Banyuls	No	Yes (maximum of 1600)		
	Côte Bleue	No	No		
	lles du Frioul	No	No		
	Posidonies de la côte palavasienne	No	No		
	Port-Cros	No	Yes		
Italy	Bergeggi	From 30€ to 100€ (depending on zone)	Yes (maximum of 200)		
	Capo Carbonara	20€ to residents and 50€ non-residents/ year	Yes		
	Capo Rizzuto	Shore fishing: 12€ residents / year and 18€ non-residents	Yes		
		Boat fishing: 24€ residents/year and 36€ non-residents			
	Cinque Terre	No	Yes		
	Miramare	No	No		
	Plemmirio	Boat + shore fishing: 20€ fishing	Yes (maximum 600)		
	Porto Cesareo	Boat fishing: 84€ /year	Yes		
		Shore fishing: 48€/ year			
	Portofino	Shore fishing: 50€ residents /year	No		
		110€ non-residents / year			
		Boat fishing: 220€ non- residents			
	Torre del Cerrano	No	Yes		
	Ventotene e Santo Stefano	Yes. 100€ /year non- residents	Yes (non-residents)		
Croatia	Brijuni	Yes from 25€ to 65€	No		
	Lastovo	No	Yes		
Slovenia	Madona Natural Monument	No	No		

 TABLE 6. Fees and fishing licences in different MPAs (Source: Font et al., 2012)

PORTOFINO MPA, ITALY

From 2003 to 2013, the Portofino MPA Authority issued 80 fishing permits for individual residents and 40 for members of local fishing clubs and associations: both groups were authorised, at a cost of approximately 50€ per year, to use all gears permitted by MPA rules. Non-residents were permitted to fish only in zone C, paying a fee of 250€ + VAT if going to fish by boat, or from the shore paying 130€ + VAT. Numbers varied between 20 and 90 anglers depending on the year. A condition of the permit was that all anglers were required to fill out a logbook, registering date, fishing sector, the number of fish caught and species [77].

4.2.5. REDUCING FISHING EFFORT AND LIMITING GEARS

Several countries (e.g. France, Spain, Greece, Italy, Croatia and Slovenia) have limited certain recreational fishing practices in particular core zones of their MPAs or in the whole MPAs [13]. Limitations include bans on fishing at night, minimum landing sizes different than for fish caught outside the MPAs, prohibition of particular fishing gears (usually spear fishing and jigging, as well as electric reels), prohibition of competitions, and gear and catch limitations to reduce fishing effort (e.g. a limited number of rods per fisher or boat, shorter soak times, weight limits on daily bags, etc.) [13][78][79].



As an example, in **Portofino MPA**, only authorized users can fish within the MPA. In addition, these authorized recreational fishers are limited to catching a total weight of 3 kilograms per day, unless this limit is exceeded with a single specimen.

Catch limits may need to apply not only to fish but also other species such as molluscs and sea urchins. Limiting the number of sea urchins per person and per outing is strongly recommended. This limit should be variable according to population fluctuations. In areas/years with particular low numbers of sea urchins, their collection could be banned entirely to allow the population to rebuild and prevent algae expansion.

Restrictions may also be placed on certain techniques, particularly spearfishing, jigging and trolling, as these are very selective types of fishing that usually target vulnerable species. Examples are found in Australia¹¹ and Florida¹², where regulations against jigging, trolling and spearfishing for certain vulnerable species have been implemented. In Spain's Canary Islands similar measures are enforced for jigging and trolling. [80]

Electrically powered devices, even those simply used to collect the line, mechanize the process of fishing – this makes the fisher's task easier, and thus multiplies extractive capacity. That's why we recommend prohibiting the use of these devices for recreational fishers in all MPAs. Electronic fishing gear is already banned in many MPAs in the Mediterranean, notably in French MPAs and in the Balearic Islands [81] [78].

¹¹ Government of New South Wales, Department of Primary Industry (2014). Fishing and diving rules at Greynurse Shark aggregation sites. Retrieved May 07, 2019, from www.dpi.nsw.gov.au/fishing/threatened-species/what-current/critically/grey-nurse-shark/new-fishing-and-diving-rules	
12 Florida Fish and Wildlife Conservation Commission (2019). Spearing Regulation. Retrieved January 03, 2019, http://myfwc.com/fishing/saltwater/recreational/spearing/	

Country	MPA	Fishing techniques prohibited			
Country	WIFA	in part or entire area			
France	Cerbère-Banyuls				
	Bonifacio	spearfishing			
	Port Cros/ Porquerolles	spearfishing			
	Calanques	electrically powered device			
Spain	Cap de Creus	spearfishing, shore fishing			
	Illes Medes/Costa del Montgrí	spearfishing			
	Cabo de Gata- Níjar	spearfishing			
	Cala Ratjada				
Italy	Cinque Terre	spearfishing			
	Miramare	(only shore fishing permitted)			
	Torre del Cerrano	spearfishing			
	Bergeggi	Spearfishing, jigging, fish traps			
	Capo Carbonara	spearfishing			
	Capo Rizzuto	spearfishing			
	Isole di Ventotene and S. Stefano	spearfishing			
	Plemmirio	jigging			
	Porto Cesareo	electromagnetic or hydraulic equipment, spearfishing, jigging, longline and trident			
	Portofino				
	Punta Campanella	jigging, spearfishing			
	Tavolara - Punta Coda Cavallo				
	Torre Guaceto	spearfishing			
Greece	Zakynthos	All techniques			
Croatia	Brijuni				
Slovenia	Madona (Natural Monument)	spearfishing, shellfish gathering			
	Zavod	All techniques			

TABLE 7. Different types of restrictions and prohibitions on recrea

Fishing techniques regulated in part or entire area	Limitations on number of rods, hooks and size of hooks	Maximum quantity allowed (from shore and/or boat per day)	Minimum landing size	Forbidden species	Fishing period restriction (prohibited time)	Non- native bait forbidden	Fishing competitions prohibited
	Χ		Χ		X (night)		
		X (5kg per person)	X	Crustaceans, E. margrinatus	X		
trolling	X						
		X (7 kg per person)					X
	X						X
	X	X	Χ	E. marginatus, P. americanus			
	X		X	E. marginatus, S. umbra, U. cirrosa, M. costae	X (night)		X
X		X (3 kg per person)		Epinephelus spp., P americanus, P. nobilis			
							Χ
	X	X (3 kg per person)			X (night)		
	Χ	Χ					Χ
	X	X (3 kg per person, 5 kg per boat)			X (night)		
	Χ		Χ				
	X	X (3 kg per person, 5 kg per boat)			X		
X	X	X (5 kg per person, 10 kg per boat)			X (night)	X	X
Χ	Χ						Χ
	X	X (3 kg per person, 15 kg per boat)		E. marginatus, S. umbra, S. latus		X	X
	X	X			Χ		X
		_					Χ
-	- X	X (2 kg per person and/or boat)	-	-	-	-	-
		and/or boat)					
-	-	-	-	-	-	-	-

tional fishing within Mediterranean MPAs (Source: adapted from Font et al., 2012.)

MPA managers should be aware which vulnerable species are found in their waters, in order to protect them. If the local status of these populations is critical, catch restrictions should be applied (e.g. limit the number of fish allowed per fisher) – this was successfully achieved with seabass in the North Atlantic in 2018, and also with other endangered species (*Dentex dentex, Conger conger, Seriola dumerili*, etc.) in many MPAs in the Mediterranean including Portofino ^[76], Calanques and Cerbere-Banyuls ^[79].

There are several regulations that establish a minimum landing size for certain fish, but they do not cover all vulnerable species. Minimum catch sizes based on maturity size (L50) should be set for all vulnerable species, to protect juvenile individuals and allow them to grow and breed. A maximum catch size for vulnerable species is also recommended, as recreational fishers tend to catch the bigger individuals, which produce more high quality eggs and hence more offspring [37] [82]. This measure would not only help protect individuals with the highest reproductive potential, but also those from size sexchanging species.



¹³ Préfet de la Région Provence-Alpes-Côte d'Azur. (2017). DIRM R93-2017-01-31-001 Arrêté du 31 janvier 2017 portant réglementation particulière de la pêche de loisir à des fins de consommation personnelle et familiale dans le coeur marin du Parc national des Calanques. Retrieved June 20, 2019, from http://www.prefectures-regions.gouv.fr/provence-alpes-cote-dazur/content/download/30470/208191/file/Recueil-r93-2017-014_4%20 f%C3%A9vrier%202017.pdf



GUIDE FROM THE CALANQUES NATIONAL PARK, FRANCE, SPECIFYING MINIMUM SIZES FOR ALL SPECIES TARGETED BY RECREATIONAL FISHERS.

© CALANQUES NATIONAL PARK

4.2.6. DEALING WITH LOST FISHING GEAR AND ITS IMPACTS ON THE MARINE ENVIRONMENT

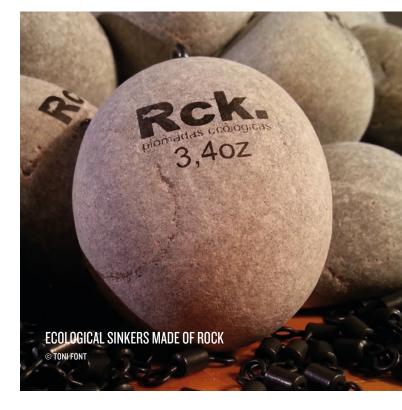
Several campaigns take place each year in which recreational fishers collaborate with local authorities to identify and recover lost fishing gear and plastics from the sea. These include the Plumbum project, the Asociación Canaria de Pescadores Submarinos Responsables initiative (ACPESUR), and the Ghostmed project [83].

PLUMBUM PROJECT - MURCIA, SPAIN

More than a hundred divers and others took part in the first year of the Plumbum project in 2017. Collectively, they removed 585.7kg of lead from the regional coastal seabed, most of which had been used for sport fishing. In addition, more than 60 diving clubs and other partners such as spearfishing associations installed collection points where any user can deposit recovered lead waste.

In 2016, the **Portofino MPA** management body suspended recreational fishing activity for two years in various sectors of the MPA, due to the high number of lines and longlines lost in the areas which were harming local coralligenous communities. During these two years, the lost fishing gear was removed. A study [76] showed that only 6% of recreational fishers entitled to use longlines in Portofino actually did so, therefore it appeared likely that the MPA could entirely ban recreational longlines without triggering strong stakeholder reactions - and that way avoid the problems they cause when the gear is lost.

Recreational fishing gear manufacturers should be required to use biodegradable and/or environmentally friendly materials - e.g. by including perishable escape hatches on traps, or by replacing traditional toxic lead sinkers with models made of stone - so that lost gear ceases to 'ghost fish' and does not pollute the marine environment.



Exotic baits to avoid are American 'worms', green Korean, red Korean and 'cord worm' – if they're thrown away they could end up altering autochthonous species' trophic chain. To avoid such problems, several Italian MPAs have already banned the use of exotic baits [13]. Other Mediterranean MPAs should follow this example if their recreational fisher monitoring shows a high use of exotic baits in the area.

Finally, in order to protect sensitive benthic habitats, floating anchors and eco-mooring should be considered - this would avoid boat fisher anchor damage to Posidonia meadows, for example. Angling and shellfish collection should be banned around rocks where Cystoseira forests are present, to avoid damage from trampling.

¹⁴ http://proyectoplumbum.com/

¹⁵ https://asociacioncanariapescadoressubmarinosresponsables.com/



ADVICE

 Catching vulnerable species should be avoided (for example, grouper, the brown meagre, the zebra seabream, etc.) as they have a very low reproductive capacity and extremely slow growth rate. Excessive pressure on these species may end up damaging future fishing yields and the environmental wealth of these areas. environmental wealth of th



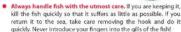
Some species have minimum legal landing sizes which must be respected. For more information, see the website http://www.20.gencat.ca/rportal/site/DAR. Any catches that do not meet these minimum landing sizes must be returned, alive, to the sea.



- Avoid using certain kinds of bait. Some of the most commonly used baits, such as the Korea worm and bloodworm, are produced and harvested outside the Mediterranean, and therefore present a potential risk to the ecosystem if these species are introduced into our environment. Never discard unused balt into the sea!
- Great care should be taken not to lose fishing gear (such as lead weights, lines, hooks) and other potentially harmful materials that often attach themselves to the seabed, where they accumulate over the years and damage the fragile ecosystem.
- batteries, etc.) in your fishing spot. Care must be taken to preserve the ecosystem intact! Take everything you bring to the fishing spot away with you when you leave!
- Respect the artisanal fishermen working in the Park. Always maintain the prescribed minimum distance (300 meters if fishing from a boat and 100 meters if you are spearfishing
- Be consistent and responsible when it comes to the size of your catch, Independently of the legally established limits, do not catch more fish than you can eat in the next day or so. Avoid having to freeze if!



Practice catch and release. Not just in the case of fish that are too small or undesirable. Try releasing a primi example and see how rewarding it is!





- If fishing from the shore, avoid doing so from cliffs where there may be nesting seabirds, some of which are endangered and legally protected.
- . If spearfishing, try to capture fish of small. Remember that if the largest adult fish are killed, you are reducing the ability of the species to reproduce. If you capture the smaller fish, you are reducing the number reaching sexual maturity.



- and empty so that liquids resulting from loss of oil, fuel or other substances do not end up leaking into the sea.
- not allowed to seagrass meadows and coral reefs should also be avoided. These highly sensitive habitats are vulnerable to the impact of anchors which can result in permanent damage





CAP DE CREUS AND ILLES MEDES BROCHURE PROMOTING RESPONSIBLE RECREATIONAL FISHING

© CAP DE CREUS NATURAL PARC

4.2.7. IMPLEMENTING AWARENESS-RAISING PROGRAMMES

To help engage recreational fishers, charters or codes of good practice can be agreed in a participatory way, then they can be distributed and even signed as a 'moral' contract. On a global scale, the FAO Code of Conduct of 2008^[84] provides a set of principles by which recreational fishers should act in order to minimize negative impacts on marine resources and ecosystems. Locally, some MPAs – such as Cap de Creus and Medes (Catalonia, Spain) - have also produced their own codes of conduct.

Environmental awareness-raising programmes are most effective when MPA managers engage with all relevant stakeholders - primarily recreational fishing organisations, but also specialized shops and public administrations - in their campaigns.

Specialized recreational fishing shops, for example, can be key to promoting the use of autochthonous baits and discouraging exotic baits and their substrates. The MPAs at Cap de Creus and Illes **Medes-Montgrí** in Catalonia, Spain, created a partnership with Normandie Appâts, Europe's leading recreational fishing bait company, through which the warning "Do not throw away worms in the sea!" was added to all bait packaging. In addition, more than 10 local fishing tackle and bait shops signed an agreement with the MPAs aiming to promote responsible fishing among their customers. The MPAs awarded these shops with a certificate of collaboration, so their customers could see the businesses respected the marine environment.

4.2.8. IMPLEMENTING EFFECTIVE CONTROL AND SURVEILLANCE

Regular surveillance of users combined with species monitoring within and around MPA waters is the most effective way to ensure regulations are enforced and poaching is prevented.

In some cases. MPAs involve fishers themselves in control and surveillance.

An interesting example is in Turkey's **Gökova MPA**, where all marine guards are drawn from the local fishing community (both small-scale and recreational fishers) so they know the area and its users. They have been in charge of guarding the MPA's no-take zones since 2013, and the results have been very positive including, for example, a spectacular increase in the number and size of dusky groupers (E. marginatus).





FIGHTING POACHING IN CALANQUES MPA

In 2018, four men were convicted over a major poaching operation ¹⁶ in the Calanques National Park. These poachers had illegally caught more than 24,000 sea urchins, many hundreds of kilograms of fish including protected and vulnerable species such as the dusky grouper (*E. marginatus*), and molluscs – with experts estimating total ecological losses at €166,000. The men were given suspended prison sentences of up to 18 months and were banned from the Calanques National Park. The Park also started a civil case in which the court will make the first decision ever over how much money in 'environmental damage' those found guilty must pay to a park in restitution. ¹⁷

¹⁶ MedPAN (2018). Poaching in the Calanques national Park: a historical trial in Marseille. Retrieved May 27, 2019, from http://medpan. org/poaching-in-the-calanques-national-park-a-historical-trial-inmarseille/

CUTTING OFF THE TAIL

One of the measures implemented by law in many Mediterranean countries (Spain, France, Italy etc.) is to mandate the clipping of the lower part of the caudal fin of certain species when caught by recreational fishers, in order to prevent their illegal sale to fishmongers and restaurants¹⁸ ¹⁹ [85]. This measure should be put in place in all MPAs.

¹⁷ The Gardian (2018). Pirates of the Med: the Mafia-style poachers threatening endangered fish. Retrieved January 02, 2019, from www.theguardian.com/world/2018/oct/13/pirates-of-mediterraneandivers-plunder-endangered-fish-marseille-calanques-national-park

¹⁸ MEDDE (2013). La pêche maritime de loisir: réglementation et bonnes pratiques. Retrieved February 13, 2019, from www. ecocitoyensdubassindarcachon.org/medias/files/bonnes-pratiqueset-reglementation-peche-de-loisir.pdf

¹⁹ AEBOE (2017). Pesca marítima y acuicultura de la Comunitat Valenciana. Retrieved June 17, 2019, from https://www.boe.es/boe/ dias/2017/03/07/pdfs/BOE-A-2017-2424.pdf

4.3. RECREATIONAL **FISHERS**

For the sake of a sustainable future for their sport among many other reasons, recreational fishers have a responsibility to minimize their impacts on MPAs.

WHERE TO CLIP THE CAUDAL FIN OF STRIPED RED MULLET (MULLUS SURMULETUS) © JOSEP LLORET

²⁰ BirdLife (2014). Bycatch Mitigation Practical information on seabird bycatch mitigation measures, Demersal Longline: Streamer lines. Retrieved June 22, 2019, from https://ww2.rspb.org.uk/lmages/ FS_1_tcm9-224849.pdf

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RECOMMENDATIONS TO RECREATIONAL FISHERS

- Find out about the particular features, threatened species and legislation of an MPA before going there to fish.
- Remember that recreational fishing in MPAs is about enjoying fishing in a special environment, not merely an extractive activity. Be aware of what you catch, and return undersized or unwanted fish to the sea.
- Respect all regulations concerning vulnerable and endangered species, from bans on catching particular species to minimum capture sizes.
- Learn from experienced fishers how to use gear safely (from hooks and lines to shellfishing knives), to avoid habitat damage and injuries to fish while handling them.
- Try not to lose your fishing gear. Report any lost fishing gear to local authorities, and don't attempt to undertake a removal operation without a partner and adequate preparation.
- · Don't throw excess bait worms or the contents of bait boxes into the sea - some are exotic species and may end up becoming established and having negative impacts on local wildlife. Avoid exotic baits such as American 'worms', green Korean, red Korean and 'cord worm'.
- Observe and monitor the presence of invasive species such as Caulerpa racemosa or pufferfish in the environment, on fishing gear or on anchors. Avoid touching or cleaning these species in situ to avoid further spreading, and inform MPA managers of the location of colonized zones.
- Be aware of sensitive habitats: use knives and tools correctly and carefully during shellfish collection, be careful not to trample on sensitive habitats such as coralligenous communities or Cystoseira forests while fishing from the shore. Do not anchor boats on sensitive, protected habitats such as Posidonia meadows, use organized moorings wherever possible. If mooring buoys are not provided, moor on sandy or muddy bottoms.
- Avoid bycatch of other marine species as far as possible. Watch out for the presence of marine birds and mammals, and follow the official recommendations when bycatch occurs²⁰.

ACRONYMS

ACPESUR Asociación Canaria de Pescadores Submarinos Responsables

CBD Convention on Biological Diversity

CFP Common Fisheries Policy

CPUE Catch Per Unit Effort

FAO Food and Agriculture Organization of the United Nations

GFCM General Fisheries Commission for the Mediterranean

Gross Value Added **GVA**

MCRS Minimum Conservation Reference Size

MPA Marine Protected Area

OECMs Other Effective Area-Based Conservation Measures

RF Recreational Fisheries

SPA/RAC Regional Activity Centre for Specially Protected Areas

SSF Small Scale Fisheries

UNEP-MAP United Nations Environment Programme – Mediterranean Action Plan

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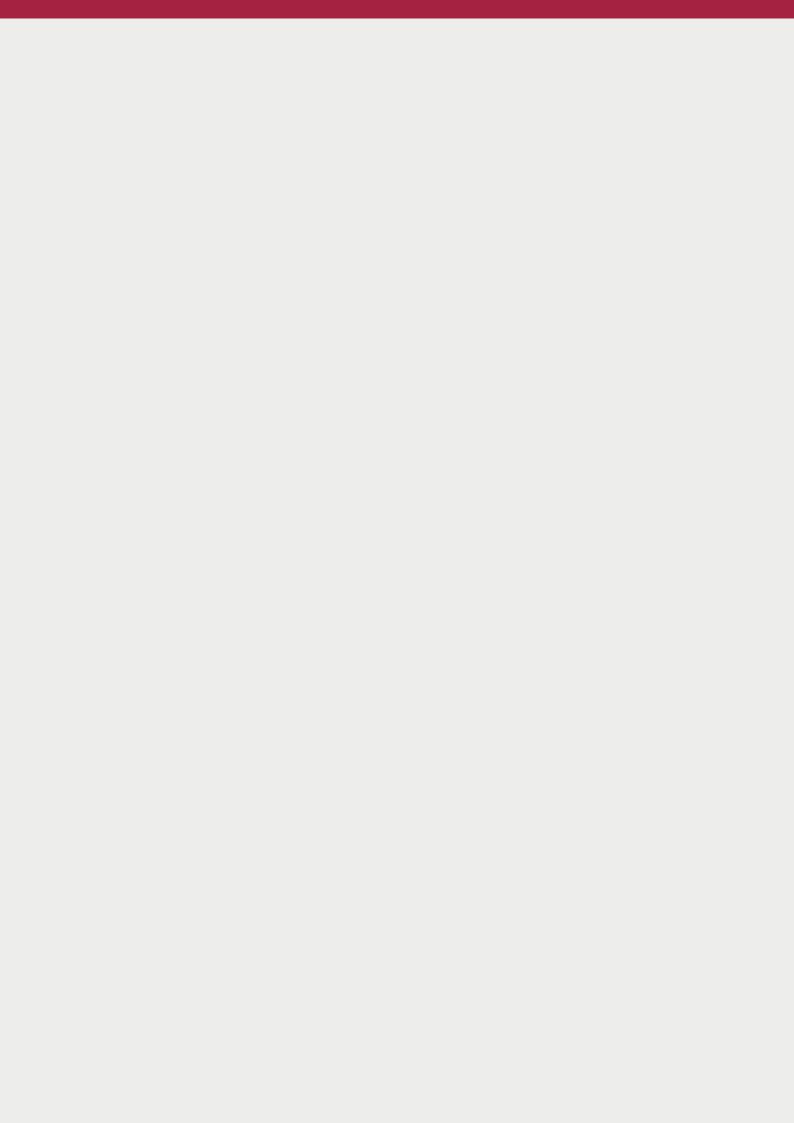
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HEPHAROS4M PROJECT IN NUMBERS

7.149⁄o of the Mediterranean Sea With €395 bn Gross Marine Product is under some form of protection, 1,231 MPAs (GMP) the Mediterranean Sea economy and OECMs covering 179,798 km²

is the **5th** largest in the region

MARITIME SECTORS



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LEISURE BOATING



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