Research Article

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: http://dx.doi.org/10.12681/mms.18043

Recreational fisheries within the Portofino MPA and surrounding areas (Ligurian Sea, Western Mediterranean Sea)

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Handling Editor: Konstantinos TSAGARAKIS

Received: 19 June 2018; Accepted: 9 February 2019; Published on line: 30 April 2019

Abstract

In the Mediterranean Sea, recreational fishing is a popular activity and anglers catch a significant amount of fish which could represent more than 10% of the total harvesting in a littoral area. The Portofino Marine Protected Area, established in 1999 in the Ligurian Sea (North-Western Mediterranean), traditionally hosts a well-developed recreational fishery. Aim of this study has been to characterize the activities of the local anglers, analysing their annual harvesting within and around the Portofino MPA and the species composition of the catches. This was possible studying data from the mandatory anglers' logbooks, and through interviews and surveys at sea. In 2015, the 340 checked anglers fished, in average, 1 kg/day, on average, mainly by trolling or handlining systems. Each fisherman, during 25 (± 21) trips, fished approximately 25 kg/year, for a total harvesting of about 8-9 t/year. *Seriola dumerili*, with 230 kg/year, was the species most caught in terms of biomass. It was followed by *Coryphaena hippurus* (130 kg/year). In addition, the analysis of catches occurring during local fishing competitions organized off the MPA limits suggested a harvesting capacity for each angler varying between 0.7 and 1.1 kg/angler per day, depending on the used gear (handlining, trolling, spear-guns). Finally, 36% of the anglers claimed to hook often the hard bottom seabed, often losing nylon lines. Consequently, the Management Body of the Portofino MPA has been advised to suspend recreational fishing activities in the most busy areas for a period of two years, calling for a complete removal of the lost fishing gears.

Keywords: Recreational fisheries; fishing pressure; Marine Protected Areas; Portofino MPA; Mediterranean Sea.

Introduction

Since the 1970's, marine recreational fishing has become a popular activity, resulting in a surprising number of anglers who have been able to significantly increase their catch capacity by using more and more efficient equipment (Pitcher & Hollingworth, 2002; Gaudin & De Young, 2007; Arlinghaus & Cooke, 2009). In some zones, recreational fishing seems to exceed the artisanal harvest, provoking drastic negative effects on several littoral populations (McPhee *et al.,* 2002; Coleman *et al.,* 2004; Cooke & Cowx, 2004; 2006; Lewin, *et al.,* 2006; Lloret & Riera, 2008; Lloret *et al.,* 2008; Lloret & Font, 2013). Nonetheless, recreational fishing is an open-access activity, neither controlled nor investigated, especially in the Mediterranean inshore, where it could represent more than 10% of the total fishing catches (Morales-Nin *et al.,* 2005; Font & Lloret, 2011; Font *et al.,* 2012). Impact from angler fishing may be especially relevant within the Marine Protected Areas (MPAs) which aims to protect the local fish stocks (Guidetti, 2006; Guidetti & Sala, 2007; Albouy *et al.,* 2010; Alós & Arlinghaus, 2013) and, at the same time, to guarantee the social benefits gained by the recreational fishing (MEDAC, 2016).

In the Mediterranean Sea, the Portofino MPA (Ligurian Sea) was established in 1999 and traditionally hosts a well-developed recreational fishing, which increased in the last decades, often competing for space at sea with other activities like artisanal fisheries, scuba diving and yachting (Bava *et al.,* 2007; Cattaneo-Vietti & Tunesi 2007; Cappanera *et al.,* 2012; Cappanera *et al.,* 2014; Barrier *et al.,* 2014; Markantonatou *et al.,* 2014; Prato *et al.,* 2016; Venturini *et al.,* 2016; 2017; 2018). During the last 18 years of protection, fish biomass in Portofino MPA certainly increased, showing an average value of 17.5 kg/125 m², among the highest recorded inside the Italian MPAs (Guidetti *et al.,* 2015). This status generates a positive spill over effect, but attracted a number of anglers who could fish about 3 t/year, corresponding up to the 5% of the total annual local artisanal yield (Venturini

et al., 2017). However, these data have to be considered as rough estimates, because the final harvesting is certainly influenced by the real potential of the area in terms of catchable biomasses, by the fishing ability of the single angler as well as by his honesty in providing data.

The main aims of this research were to elaborate the mandatory logbooks filled out in 2015 by admitted anglers, checking their veracity with those recorded from similar fishing activities and competitions conducted around the MPA.

Table 1. Number of anglers and types of survey inside and outside of Portofino MPA.

	Type of survey		
	logbook	**interviews**	**fishing competitions**
n. anglers inside MPA	250	20	-
n. anglers outside MPA	30	40	620 (for 38 fishing competitions)

Materials and Methods

Data from 250 mandatory logbooks filled out in 2015 by all angler categories authorised to fish within the Portofino MPA (fishing association members, residents with limited permission, residents with full permission, no residents) were analysed, giving particular attention to the annual number of trips, the seasonal period, the fishing timetables, the used techniques and the species caught in terms of weight (kg). In addition, another 30 logbooks, compiled optionally by other anglers fishing outside the MPA, between Genoa-Quinto and Lavagna harbour (Fig. 1), were analysed in the same way. Moreover, to check the veracity of the logbook data, 20 surveys were carried out at sea in 2016 both inside and outside the MPA, controlling 60 anglers during the year (Table 1), with an average of about 3 anglers interviewed per survey. Finally, the ability of the local anglers and divers as well as the real potential of the area in terms of catchable biomasses were assessed by analysing the average data from 17 local trolling (kg/day/angler) and 11 handlining competitions (kg/angler/day) as well as in 10 spearfishing competitions (kg/day/diver) carried out from 2012 to 2016 in the waters surrounding the Portofino MPA. These competitions last for 4/5 hours and included both individual contestants or teams of 2/3 anglers.

In total, 340 anglers were interviewed by obtaining data in terms of age, sex, annual number of trips, and fishing techniques. They were also asked to express their general feeling regarding possible changes in the quality and quantity of fish caught and any improvements occurred after 1999, when the MPA was established (Table 1).

Each caught fish was analysed in terms of average and total weights and as percent frequencies. The number of trips (in the year) and the kg/day/anglers were assessed in order to provide an estimate of the total catches.

SIMPER analyses (Similarity Percentage) were performed to identify which taxa were primarily responsible for observed differences between groups (for % species frequency and for % on total weight, inside and outside the MPA) (Table 4-5). The overall significance of the difference was assessed by the ANalysis Of Similarities (ANOSIM) (Bray-Curtis similarity measure, permutation N: 9999) (Clarke, 1993).

Results

In 2015, the 340 checked anglers fishing within the Portofino MPA and surrounding waters were for the most part males (95%), 72% of whom over 50 years old. They used many types of gears: surface (27%) and deep trollings (23%) were the most popular as well as handlining from boats (19%), followed by shore rods (14%) and bottom longlines

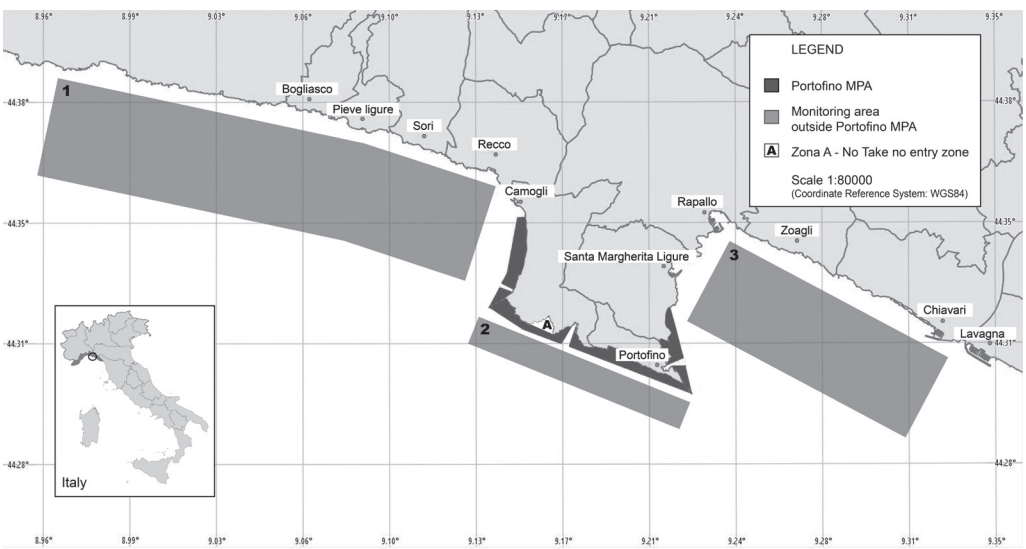

Fig. 1: Map of the monitored area. In dark grey, the Portofino MPA surface (about 370 hectars). Inside the MPA A zone, all human activities are forbidden. In grey, the recreational fishing grounds (about 6,500 hectars) around the MPA: 1: Bogliasco (shortly after Genova Quinto) - Camogli stretch. 2: off the southern front of the Portofino Promontory. 3: the Tigullio Gulf.

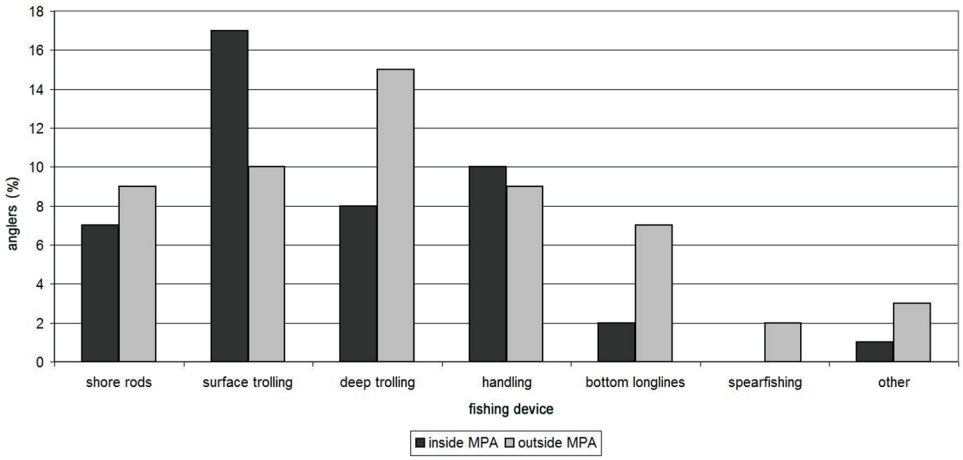

Fig. 2: Percentage of fishing gears used inside and outside the Portofino MPA.

(9%). Low percentages were recorded for spear-guns (2%) and other various techniques (3%) (Fig. 2).

The analysis of the data from the compulsory logbooks, filled out by each of the authorized anglers, helped to define the most abundant species caught in terms of weight and frequency within the MPA (Table 2). In total, the 250 admitted anglers caught 40 species of fish and 4 species of cephalopods. The greater amberjack, *Seriola dumerili*, was the species most caught in terms of biomass (230 kg/year). It was followed by the common dolphinfish, *Coryphaena hippurus* (130 kg/year), the common dentex, *Dentex dentex* (76 kg/year), the yellowmouth barracuda, *Sphyraena viridensis* (70 kg/year), seabreams, *Diplodus* spp. (59 kg/year), European seabass, *Dicentrarchus labrax* (55 kg/year), gilthead seabream, *Sparus aurata* (55 kg/year), bullet tuna, *Auxis rochei* (49 kg/year), and the saddled seabream, *Oblada melanura* (44 kg/year).

Among the cephalopods, the highest catches were re-

Table 2. Fish and cephalopod catche s (kg) and catch frequencies (%) inside and outside the Portofino MPA, according to the total annual weight of the catches (source: Portofino MPA logbooks filled out in 2015 and 2016 surveys). For some fish (*Diplodus*, *Mugil*, *Mullus*, *Scomber*, *Serranus*, *Trachurus*), anglers have had difficulties to distinguish the species, so only genera are reported.

	Catches inside the MPA				Catches outside the MPA			
species	**average weight (kg) ± sd**	**total weight (kg)**	**% on total weight**	**% species frequency**	**average weight (kg) ± sd**	**total weight (kg)**	**% on total weight**	**% species frequency**
Fishes								
Seriola dumerili (Greater amberjack)	4.54 (± 2.07)	229.50	19.45	0.87				
Coryphaena hippurus (Common dolphinfish)	0.56 (± 0.31)	130.25	11.04	9.32	0.52 (± 0.29)	8.32	2.43	1.85
Dentex dentex (Common dentex)	1.36 (± 1.15)	76.02	6.44	1.56				
Sphyraena viridensis (Yellowmouth barracuda)	0.84 (± 0.32)	70.00	5.93	1.84	0.84 (± 0.32)	6.70	1.96	0.92
Diplodus spp.	0.31 (± 0.09)	58.87	4.99	11.58				
Dicentrarchus labrax (European seabass)	2.42 (± 1.07)	54.69	4.64	1.33				
Sparus aurata (Gilthead seabream)	0,80 (± 0.47)	54.54	4.62	2.43	0.67 (± 0.32)	8.01	2.34	1.39
Auxis rochei (Bullet tuna)	1.16 (± 0.32)	49.18	4.17	1.93	1.93 (± 0.67)	199.28	58.15	11.91
Oblada melanura (Saddled seabream)	0.14 (± 0.02)	43.74	3.71	16.67	0.10 (± 0.06)	5.44	1.59	6.13
Pagellus spp.	0.28 (± 0.19)	41.51	3.52	6.25	0.25 (± 0.04)	4.98	1.45	4.98
Sarda sarda (Atlantic bonito)	0.52 (± 0.69)	37.53	3.18	3.31	0.19	0.19	0.06	0.12

continued

Table 2 continued

species	Catches inside the MPA				Catches outside the MPA			
	average weight (kg) ± sd	total weight (kg)	% on total weight	% species frequency	average weight (kg) ± sd	total weight (kg)	% on total weight	% species frequency
Spondyliosoma cantharus (Black seabream)	0.22 (± 0.15)	29.53	2.50	6.34				
Mugil spp.	1.12 (± 0.97)	17.26	1.46	1.10				
Pomatomus saltatrix (Bluefish)	0.15 (± 0.09)	11.37	0.96	2.57	1.44 (±1.24)	5.76	1.68	0.46
Euthynnus alletteratus (Little tunny)	0.64 (± 0.24)	10.61	0.90	0.78	0.91 (± 0.45)	10.86	3.17	1.39
Serranus spp.	0.11 (± 0.10)	11.48	1.0	9.2				
Pagrus pagrus (Red porgy)	0.18 (± 0.11)	9.87	0.84	1.93				
Muraena helena (Mediterranean moray)	0.30 (± 0.30)	4.15	0.35	0.37				
Scorpaena spp.	0.44 (± 0.25)	3.41	0.29	0.32				
Conger conger (European conger)	0.27 (± 0.22)	3.31	0.28	0.55				
Scomber spp.	0.07 (± 0.03)	3.08	0.26	2.66	0.17 (± 0.06)	23.82	6.95	17.57
Trachurus spp.	0.04 (± 0.02)	2.15	0.18	2.48	0.15 (± 0.07)	53.48	15.6	40.23
Phycis phycis (Forkbeard)	0.67 (± 0.54)	1.64	0.14	0.14				
Merluccius merluccius (European hake)	0.61 (± 0.43)	1.22	0.10	0.10				
Coris julis (Mediterranean rainbow wrasse)	0.02 (± 0.01)	1.01	0.09	0.41				
Lithognathus mormyrus (Sand steenbras)	0.18 (± 0.09)	0.83	0.07	0.28	0.17 (± 0.08)	0.34	0.10	0.23
Spicara maena (Blotched picarel)	0.05 (± 0.04)	0.76	0.06	1.56				
Belone belone (Garfish)	0.05 (± 0.01)	0.69	0.06	0.64				
Boops boops (Bogue)	0.04 (± 0.02)	0.36	0.03	1.10	0.09 (± 0.14)	9.02	2.63	11.56
Balistes capriscus (Grey triggerfish)	0.06	0.06	0	0.05				
Mullus spp.	0.05	0.05	0	0.05				
Synodus saurus (Atlantic lizardfish)					0.08	0.15	0	0.23
Trachinotus ovatus (Pompano)					0.35	0.35	0.10	0.12
Cephalopods								
Sepia officinalis (Common cuttlefish)	2.85 (± 3.39)	109.5	9.28	0.73				
Octopus vulgaris (Common octopus)	1.44 (± 0.35)	61.23	5.19	2.62				
Todarodes sagittatus (European flying squid)	0.25 (± 0.35)	31.85	2.70	3.12	0.75 (± 0.36)	6.00	1.75	0.92
Loligo vulgaris (European squid)	0.36 (± 0.03)	18.27	1.55	3.77				

corded for the common cuttlefish, *Sepia officinalis* (110 kg/year), common octopus, *Octopus vulgaris* (61 kg/year), European flying squid, *Todarodes sagittatus* (32 kg/year) and the European squid, *Loligo vulgaris* (18 kg/year).

In terms of catch frequency, the most fished species within the Portofino MPA was the saddled seabream (17%), followed by seabreams (12%), common dolphinfish (9%) and painted combers (*Serranus scriba* and *S. cabrilla)* with 9%.

In the waters surrounding the MPA (Fig. 1), the considered 30 anglers fished only 17 species of fish plus one cephalopod, the European flying squid (Table 2). In terms of biomass (kg/year), bullet tuna and horse mackerels (*Trachurus* spp.) were the most significant species, reaching 199 kg and 54 kg, respectively. They were followed by mackerels (*Scomber* spp.) (24 kg), little tunny (*Euthynnus alletteratus*) (11 kg), bogue (*Boops boops*) (9 kg), dolphinfish (8 kg), gilthead seabream (S*parus aurata*) (8 kg), and the yellowmouth barracuda (6 kg). Among the most frequent species, horse mackerels, reaching 40% of the harvest, were first, followed by mackerels (18%), bullet tunas (12%), bogues (12%) and saddled seabreams (6%).

The daily catches inside and outside the MPA have fluctuated from 1 kg/day/angler to 1.8 kg/day/angler respectively, while the annual number of declared trips varied greatly, from 7 to 53 fishing days/year (Table 3).

According to a SIMPER analysis, *Trachurus* spp., *Scomber* spp., *Diplodus* spp. mostly contributed to the dissimilarity of the per cent frequencies between the inside and outside catches (Table 4). Always according to a SIMPER analysis (Table 5), *Auxis rochei*, *Seriola dumerili*, *Trachurus* spp., *Coryphaena hippurus* and *Sepia* spp. mainly defined the differences in terms of weight percentage. The overall significances of the differences were assessed by a ANalysis Of Similarities (ANOSIM). For both the analyses, the two ANOSIM were similar (Permutation N: 9999; Mean rank within: 1.5; Mean rank between: 4.5; R: 1, p (same): 0.33).

The analysis of the catches occurred during a number of local fishing competitions carried out between 2012 and 2016 around the Portofino MPA revealed strong variations among the considered years (Figure 3), but enough to permit the quantification of a mean fishing capacity for each type of gear used (Table 6). On average, during 4 hours of activity in the 17 considered trolling competitions about 1.1 kg/day/angler was harvested, mainly bullet tunas, little tunnies, horse mackerels, yellowmouth barracuda, Atlantic bonitos (*Sarda sarda*) and mackerels. The 11 handlining events taken into consideration reached about 0.7 kg/day/angler, mainly consisting of bogues, axillary seabream (*Pagellus acarne*), blotched picarel (*Spicara maena*), combers, and horse mackerels. Finally, 10 local spearfishing competitions permitted

Table 3. Comparison of recreational fishing capacities inside and outside the Portofino MPA (source: logbooks filled out in 2015, and the interviews and monitoring activities carried out at sea, during 2016).

Type of investigation		mean n. of trips/year	Catches (kg/day/anglers)
Inside MPA	**logbooks**	12.05 (± 8.65)	0.84
	interviews	27 (± 9.23)	1.13
Outside MPA	**logbooks**	7 (± 6.84)	2.42
	interviews	53 (± 32)	1.10

Table 4. SIMPER analysis for the percent frequency of each fish catches inside and outside the MPA. The main species, whose cumulative contribution exceeds the 90%, are arranged according to their contribution to the dissimilarity.

Taxon	Av. dissimilarity	Contribution %	Cumulative %
Trachurus spp.	18.88	25.49	25.49
Scomber spp.	7.456	10.07	35.56
Diplodus spp.	5.791	7.821	43.38
Oblada melanura	5.271	7.118	50.5
Boops boops	5.231	7.064	57.57
Auxis rochei	4.991	6.74	64.31
Serranus spp.	4.601	6.213	70.52
Coryphaena hippurus	3.736	5.045	75.57
Spondyliosoma cantharus	3.17	4.282	79.85
Loligo vulgaris	1.885	2.546	82.39
Sarda sarda	1.595	2.154	84.55
Octopus vulgaris	1.31	1.769	86.32
Todarodes sagittatus	1.1	1.486	87.8
Pomatomus saltatrix	1.055	1.425	89.23
Pagrus pagrus	0.9651	1.303	90.53

Table 5. SIMPER analysis for the percent total weight of each fish catches inside and outside the MPA. The main species, whose cumulative contribution exceeds the 90%, are arranged according to their contribution to the dissimilarity.

Taxon	Av. dissimilarity	Contribution %	Cumulative %
Auxis rochei	27	32.99	32.99
Seriola dumerili	9.728	11.89	44.87
Trachurus spp.	7.712	9.423	54.3
Sepia officinalis	4.641	5.671	59.97
Coryphaena hippurus	4.306	5.262	65.23
Scomber spp.	3.346	4.088	69.32
Dentex dentex	3.221	3.935	73.25
Octopus vulgaris	2.596	3.172	76.42
Diplodus spp.	2.496	3.049	79.47
Dicentrarchus labrax	2.321	2.835	82.31
Sphyraena viridensis	1.986	2.426	84.73
Sarda sarda	1.56	1.907	86.64
Boops boops	1.3	1.589	88.23
Spondyliosoma cantharus	1.25	1.528	89.76
Sparus aurata	1.14	1.393	91.15

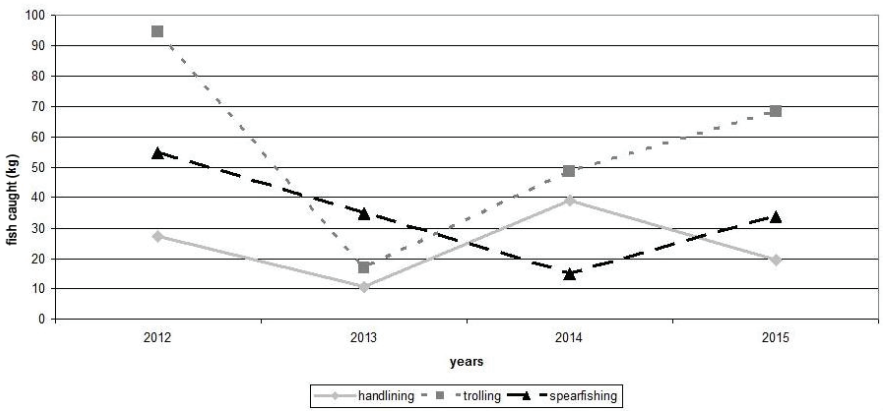

Fig. 3: Trends of fish caught (kg) during several fishing competitions (handlining, trolling and spearfishing) in the surrounding areas of the Portofino MPA (2012-2016).

to catch, on average, 1.1 kg/day/diver, mainly seabreams, wrasses (*Labrus* spp.), mullets (*Mugil* spp.), European conger (*Conger conger*), Mediterranean moray (*Muraena helena*), salemas (*Sarpa salpa*) and scorpionfishes (*Scorpaena* spp.). The catching of the dusky grouper (*Epinephelus marginatus*) is forbidden by law during the competitions.

Thanks to a series of interviews conducted among 340 anglers fishing in the Portofino MPA as well as in the surrounding area, it was possible to ascertain their general feeling. 61% of respondents claimed that the MPA establishment had not led to any changes regarding the species caught and yield. However, among those who perceived a change (39%), an increase in catches of the Eastern Atlantic barracuda, bluefish (*Pomatomus saltatrix*), dolphinfish and the Atlantic bonito (*Sarda sarda*) was recorded, while a decrease in catches of octopus and the gilthead seabream was observed.

Finally, the majority of the anglers (54%) affirmed to hook the bottom with nylon lines frequently and 36% of them admitted to lose often their lines.

Discussion

Today, the recreational fishing is considered to be a significant threat to the coastal fish populations (Lewin *et al.,* 2006). This is especially true within the Mediterranean MPAs which are called to safeguard and recover the deeply affected inshore fish stocks (Micheli *et al.,* 2004) and at same time, to ensure correct fishing practices by the local fishermen and anglers, when and where the fishing is partially allowed.

During 2015, inside and outside the Portofino MPA, anglers fished, on average, for 3-4 hours/day, taking about 1 kg/day. Considering an average of 25 (± 21) annual trips, each fisherman harvested approximately 25 kg/year and consequently a gross estimate of 8-9 t/year for about 340 anglers.

Taking into consideration only the logbook data filled out by the authorized anglers in the year 2015, the main value did not change significantly from the gross estimate (9 kg/year/angler) reported for the year 2014 by Venturini *et al.,*

Table 6. Comparison of the fishing capacities of expert anglers and divers during different fishing competitions held in the surrounding areas of the Portofino MPA (2012-2016).

Type of fishing competitions	n. of day competitions (2012-2016)	mean anglers for competitions	kg/day competitions	kg of day competitions/ n. of anglers	Main species caught
handlining	11	36 (± 11.7)	25.17	0.70	*Boops boops, Pagellus acarne, Spicara maena, Serranus* spp., *Trachurus* spp.
trolling	17	41.5 (± 6.1)	44.86	1.08	*Auxis rochei, Boops boops, Euthynnus alletteratus, Sarda sarda, Scomber* spp., *Sphyrena viridensis, Trachurus* spp.
spearfishing	10	38.1 (± 9.1)	41.62	1.09	*Conger conger, Diplodus* sp., *Labrus* spp., *Mugil* spp., *Muraena helena, Sarpa salpa, Scorpaena* spp.

(2017). However, this value triples, reaching an annual yield of about 30 kg/angler, analysing the data obtained by the interviews of the same anglers. This significant difference can be clarified by the fact that the anglers do not always tick their catches in the logbook, especially for small fish such as wrasses and small serranids, considered as by-catches (Di Franco *et al.,*, 2016). Moreover, the comparison between the catches carried out inside and outside the MPA showed different results in terms of species caught. Outside the MPA, in fact, the majority of the anglers used trolling techniques and consequently the percentage of the species commonly fished by handlining decreased. However, one of the principal fish target of the trolling, the greater amberjack, was caught only inside the MPA, suggesting that this species exhibits an inshore behaviour, as suggest the huge catches performed by the littoral tuna trap operating inside the Portofino MPA (Cattaneo-Vietti *et al.,* 2014).

The analysis of the catches occurred during the local fishing competitions allowed a quantification of the harvesting capacity for each type of gear used in this area. On average, the catches were very similar, ranging between 0.7 and 1.1 kg/angler for 4 hours of activity. In other words, the quantity of fish did not seem to vary considerably, regardless of the prey target and the gears used: the average catch remained fairly constant and still less than national legal limits (5 kg/day/angler) according to the National Law n. 963/65 or the Portofino MPA rules 2008 (3 kg/day/angler). However, it is necessary to take into account that a few experienced anglers or divers can sometimes reach ten times above the declared amount of fish, with peaks of hundreds of kg/year, counterbalancing the many who fish very little (Cabanellas-Reboredo *et al.,* 2017).

Also spearfishing, certainly the recreational fishing activity with the highest impact on the inshore fish stocks (Morales-Nin *et al.,* 2005), was in accordance with the catches reported by the other techniques, suggesting a strong depletion of the inshore fish stocks in the stretch of the Ligurian coast considered (Cattaneo-Vietti, 2006). In this context, the request by some divers to open the spearfishing within the MPA appears unacceptable today, because it would interfere with the spill over processes that are being developed after restrictions have been adopted, on the same behaviour of the fish, and could have negative ethical and educational repercussions (Di Franco *et al.,* 2009).

One of the main management concerns related to recreational fishing within the MPA Portofino has emerged from the same anglers statements who claimed to hook often the hard bottom seabed with their nylon lines. This provokes severe lesions to the gorgonian coenenchyme, increasing the colonies friction and eventually causing the rupture of the branches (Bavestrello *et al.,* 1997; Parravicini *et al.,* 2010; Bo *et al.,* 2014). Following these considerations, in 2016, the Management Body of the Portofino has suspended recreational fishing activities in some areas for a period of two years, calling for a complete removal of lost fishing gear.

Conclusions

In conclusion, our results, coming from a wide number of interviews and filled logbooks, suggested that the data obtained from the anglers were discordant, often inconsistent and have to be always interpreted. Secondly, the pro-capita daily harvesting appeared to be modest and below the maximum permitted by law, but this is most likely due to a general decrease of the coastal populations along the coastal stretch of Liguria (Cattaneo-Vietti *et al.,* 2010).

In our opinion, the Portofino MPA is characterized by excessive fishing pressure with too many recreational fishing licenses being granted. Moreover, the Portofino MPA extension appears to be too limited for favouring an adequate natural rebuilding. In order to respond to these findings, it will be important to take management measures so as to mitigate the human impact.

Aknowledgements

This study was carried out with the collaboration of the Coastal Guard of Camogli and local Fishing Clubs and Associations (Pescatori Dilettanti Rapallesi, Lega Navale of Rapallo, Lega Navale of Genova Quinto) who voluntarily participated in the monitoring. The authors wish to thank Dr. M. Canessa (University of Genoa) for her contribution to the data analysis and Prof. P. Brandolini (University of Genoa) for his help with the local Fishing Clubs. Funding for this study was provided by

the Ministry of the Environment and Protection of Land and Sea of Italy (MATTM).

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