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Assessing the potential of an artisanal fishing co-management in the Marine Protected Area of Torre Guaceto (southern Adriatic Sea, SE Italy)

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ABSTRACT

In this study we investigated the potential of a fishing protocol adopted within the buffer zone of the Marine Protected Area of Torre Guaceto (SE Italy, Adriatic Sea) on fishing yields. The protocol, agreed with local fishermen and the MPA authority, aimed at regulating the fishing pressure within the MPA in the perspective to balance conservation and socio-economic needs. Fishing was completely banned in the entire MPA from 2001 to 2005. In 2005 fishing resumed within the buffer zone surrounding no-take zones. From 2005 to 2008 we monitored artisanal professional fishing (strictly exerted by trammel nets) within the buffer MPA, and compared CPUE (kg km^{-1} of net) with those obtained outside the MPA (where fishing grounds are fully open to professional and recreational fishing). Catches were higher inside than outside the MPA. Overall assemblage structures (evaluated on wet weight data) were significantly different from inside to outside the MPA, with the two most important commercial species, i.e. *Mullus surmuletus* and *Scorpaena scrofa*, accounting for ~40% of the catch inside the MPA and ~20% outside. In 2005, average CPUE within the MPA was about five-fold (~50 kg km^{-1} of net) the mean value obtained outside. Such value then declined and tended to stabilize around 25 kg km^{-1} of net in 2007 and 2008. Average CPUE outside the MPA, instead, was ~10 kg km^{-1} of net and remained quite stable across years. This study shows that the use of fishing co-management protocols within MPAs that properly involve local fishermen in the decision process is a promising approach to balance fishermen's and conservation needs.

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1. Introduction

The coastal Mediterranean has been fished by humans since the prehistory (Desse and Desse-Berset, 1998; Sala, 2004). Artisanal fisheries (i.e. the professional component of small-scale fisheries mostly practiced using traditional methods) are part of the history and culture of this region, where at present artisanal vessels account for about 60–80% of the professional fishing fleets (Colloca et al., 2004; European Commission, 2004). Artisanal fisheries, therefore, are important in the Mediterranean region from a socio-cultural and economic point of view (Donati and Pasini, 1997; Colloca et al., 2004; Guidetti et al., 2008a). In the recent years, however, the increase of the operating costs (e.g. fuel, personnel), the extremely advanced age of artisanal fishermen and the significant decrease of catch and income per vessel, led to dramatic reductions of artisanal fleets in many Mediterranean countries (up to 50%; Gòmez et al., 2006). This state of crisis carries the risk of an extinction of the artisanal fishery in the Mediterranean basin together with its related cultural heritage (Gouillou and Crespi, 1999; Gòmez et al., 2006; Guidetti et al., 2008a; IREPA, 2008).

Marine Protected Areas (hereafter MPAs, i.e. areas of the sea characterized by regulated human uses, often including "no-take zones") were found to have the potential to enhance local fisheries (Gerber et al., 2003; Crowder et al., 2000; Harmelin-Vivien et al., 2008). Most of the available evidence all over the world, however, is theoretical or model-based (e.g. Gerber et al., 2003; White et al., 2008), while assessments in real contexts are scant. The results of fishing management in proximity of or within buffer zones of MPAs strictly depend on local socio-cultural conditions (e.g., which regulate the relationships among fishermen and their attitudes towards the conservation issues; Gelcich et al., 1995; Mascia, 2003) that theoretical and model studies can hardly take into account. Although it is indubitable that model-based studies may provide important indications on the effects of protection measures on fishery resources within MPAs, there is a urgent need of field studies in order to assess whether MPAs can actually work in enhancing local fisheries.

Fishery enhancement following the establishment of MPAs can be attributed to different mechanisms related to protection measures, MPA design and management. Fishermen, in fact, can get benefits from "fishing the line" near marine reserves, by exploit-

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ing spillover of target species from MPAs (Kellner et al., 2007; Goñi et al., 2008; Forcada et al., 2009; Guidetti, 2007). In addition, in many Mediterranean MPAs regulated fishing activities are allowed within buffer zones often surrounding no-take areas. Especially where MPAs' borders encompass pre-existing communities of fishermen a total fishery ban is not conceivable, but specific regulations can be adopted to reduce the overall fishing impact (e.g. excessive exploitation, destructive fishing practices on habitats) possibly enhancing local artisanal fisheries in the long-term (Boudouresque et al., 2004; Stelzenmuller et al., 2007; Cadiou et al., 2009). In terms of whole recovery of fish stocks, no-take reserves have been found generally more effective than buffer MPAs (or partial reserves; see Lester and Halpern, 2008; Di Franco et al., 2009), but buffer zones can better balance human uses and conservation goals, especially in traditionally crowded regions (Di Franco et al., 2009). MPAs with buffer zones, from this perspective, can be important scenarios for experimenting with novel approaches to artisanal fishing management in order to aline this traditional extractive activity with conservation needs (Guidetti and Claudet, in press).

In this study we report the results of a co-management project of an artisanal fishery practiced at a MPA in southeastern Italy (Adriatic Sea). Here a unique approach has been adopted involving a protocol for exploiting local fishing resources that was agreed with fishermen and the local MPA authority. The general issue investigated here stems from the appreciation that many commercial stocks in regularly fished (by commercial and recreational fisheries) grounds showed for long clear signs of overfishing in SE Italy (e.g. low yields and small individual size of many commercial fishes; Guidetti, 2006; Guidetti and Claudet, in press). The potential for a more sustainable exploitation of fishing resources by local artisanal fisheries is here tested by comparing catches obtained within the buffer zone of the studied MPA (where the co-management protocol was adopted) with those obtained outside, during a 4-year survey.

2. Materials and methods

2.1. Study area and data collection

This study was done at the MPA of Torre Guaceto (SE Italy, southern Adriatic Sea; Fig. 1). The rocky coast is characterized by a gently sloped rocky plateau, declining from the water surface to ~10–12 m depth over coarse sand. Rocky bottoms alternate with sand and *Posidonia oceanica* seagrass beds at about 12–20 m depth. From about 25 to 35–40 m depth, coralligenous formations (i.e. biogenic hard substrates formed by concretioning organisms like coralline encrusting red algae and mainly bryozoans, serpulids and sponges) alternate with sand, and at deeper stands sandy–muddy bottoms widely dominate. Habitat mapping is available only for the bottoms included in the MPA (Terlizzi et al., 2002; Fraschetti et al., 2005), but aerial photographs, other unpublished material and direct observations suggest that habitat composition and patchiness within the MPAs' borders are typical of the study region and therefore similar outside the MPA.

Along the coastline, the study area at and around the Torre Guaceto MPA is characterized by an indented rocky coasts alternating with sand beaches. The 10–12 boats owned by artisanal fishermen regularly operating in the study area (sometimes they chose to fish outside the MPA borders) usually take refuge in the sheltered inlets close to small fishing villages, except for those settling at Villanova where the only harbor in the area is present, at about 15 km north to the MPA. All the boats operating in the area are dedicated to small-scale artisanal fishery. Local fishermen mostly use fixed nets (trammels and gillnets depending of season and target species), but some fishermen sometime choose to use longlines for seabreams and traps for octopuses. The recreative fisheries are not particularly intense in the area, even though they are increasing year by year. Most of recreational fishermen use angling (pole fishing and an increasing use of the destructive practice called vertical jigging), longlines and spearfishing.

The Torre Guaceto MPA was formally established in 1991, but effective enforcement started around 2001 (Guidetti et al., 2008b). The whole MPA covers about 2227 ha and it is subdivided into (i) two no-take/no-access zones (called A zones according to the Italian law) covering 179 ha, where any fishing is banned and access forbidden except for the MPA's staff, scientists and police forces (e.g. coast guard); (ii) the general reserve zone (B zone) covering 163 ha, where access (i.e. swimming) is permitted but fishing banned; (iii) the partial reserve zone (C zone, hereafter called 'buffer zone' as it is the true buffer towards the exterior of the MPA), covering 1885 ha, where access and regulated navigation are permitted. In the buffer zone no extractive activities were allowed

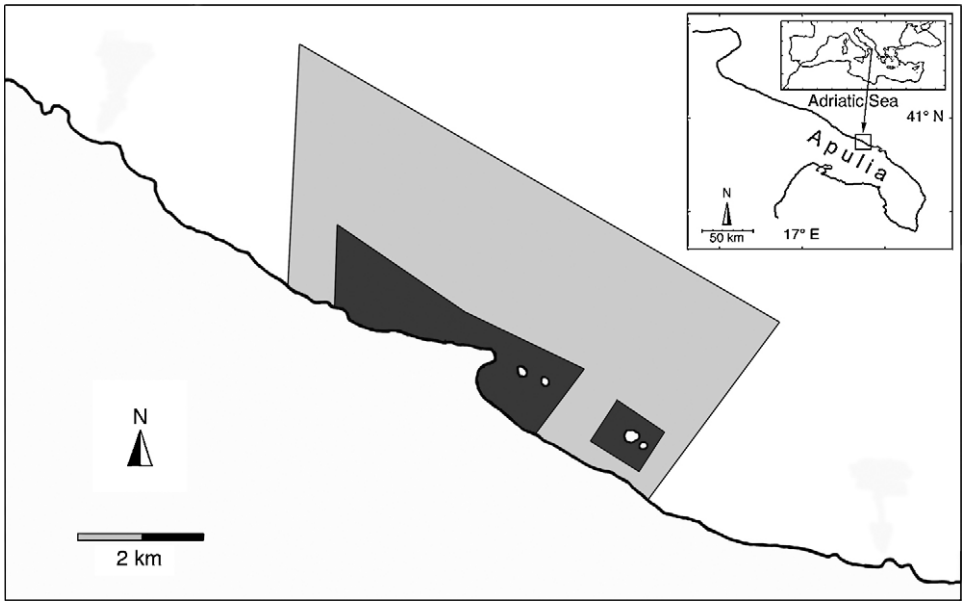

Fig. 1. Geographical location of the study area. Boundary lines delimit the MPA of Torre Guaceto. The dark grey areas represent the no-take zones (where fishing is prohibited), while the light grey area is the portion of the MPA open to fishing according to the co-management protocol.

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