



Full length article

Investigating artisanal fishers' support for MPAs: Evidence from the Tuscan Archipelago (Mediterranean Sea)

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ABSTRACT

In order to meet the “30 by 30” target of the EU Biodiversity Strategy, efforts for establishing new marine protected areas (MPAs) in European seas will increase in the upcoming years, thus affecting an increasing number of stakeholders. However, despite widely distributed across the globe, many MPAs fail to achieve their goals due to the little weight attributed to fishers' perception as well as their scarce involvement in the different stages of MPA, from planning to management. Using the Tuscan Archipelago as a model system, we gathered artisanal fishers' perceptions of MPAs and investigated potential drivers for MPA support. Information was also collected on the level of satisfaction on and involvement into current management of coastal environments, as well as fishers management proposals. Data was gathered from a sample of 27 artisanal fishers (representing 30 % of total fishers) through semi-structured interviews based on an opportunistic+snowball sampling strategy. Several fishers express positive perceptions towards the MPA concept, as long as fishers involvement is granted. Fishers open to the MPA concept are also available to change fishing gear and areas if an MPA includes their usual fishing grounds. Our results suggest that the effectiveness of MPAs in sustaining coastal biodiversity and associated harvestable stocks could be enhanced by the involvement of artisanal fishers in MPA establishment and management.

1. Introduction

Marine protected areas (MPAs) are a prevailing managerial tool for protecting marine habitats and can ensure a sustainable use of associated living resources [16,20,74,88]. MPAs can promote stewardship and prevent stock overexploitation, addressing the socio-ecological failures generated by the use of common property resources, by closing some areas to fishing, limiting the number of authorized users and regulating fishing methods [46,57]. European MPAs have the potential to provide both ecological and economic benefits to the fishery sector [69]. Acknowledging the declining trend of marine resources and the importance of MPAs in protecting biodiversity, the European Union has launched the EU Biodiversity Strategy, calling for 30 % of the EU seas and 30 % of the EU land to be protected by 2030 [34]. Today, only 11 % of the EU seas are under protection. Hence, the extension of MPAs in the

EU waters is set to increase substantially in the upcoming years, thus affecting an increasing number of stakeholders.

Involving relevant stakeholders is crucial for ensuring effective resource management, especially in the fisheries sector [9,22,36,72,100]. Providing socio-economic information on affected stakeholder groups, as well as gathering their knowledge and perception on resource management is a key turning point for designing successful conservation strategies [29,59]. Since conservation effectiveness depends on the degree of integration with the existing socio-economic context [56], understanding fisher perception of MPAs can be critical to reduce non-compliance [20,99] and to maximize their benefits [81,31,13]. Compliance with MPA regulations is affected by stakeholder support, trust, and participation in the MPA life cycle, from planning to adaptive management [63,71]. Hence, communication is pivotal to increase MPA acceptance and compliance, conflict prevention, as well as inclusion of

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stakeholders in management and planning [12,33,74,98,84,83]. Yet, in the context of MPAs, biotic and abiotic factors are often given more importance than socio-economic features [3,15,56,92], with fishers' opinion often neglected in the management process [60]. This limitation occurs although increasing evidence shows that MPA effectiveness is mainly affected by socio-economic factors, rather than by biophysical ones [14,17,74].

Several examples in the literature call for a better accounting of the human dimension if MPA effectiveness is to be achieved ([2,11,29,53,82]). Hence, to avoid failures, it is fundamental investigating if and how MPAs can ensure adequate levels of stakeholder satisfaction and compliance [74], alongside with the flexibility and adaptability of fishers with respect to new rules. However, several MPAs have failed to attribute enough weight to the needs, livelihoods, and perspectives of local fishing communities, possibly causing social and ecological failures [43,61,95]. Although the collection of information on fishers' perceptions about fisheries management is relatively common (e.g., [92,76]), few studies have extended this process to MPA establishment and management [81]. In this study, we collected information on fishers' knowledge and involvement in the decision-making process for fishery management in The Tuscan Archipelago (GSA 9). The area is acknowledged as one of the Mediterranean basin's Biodiversity Hotspots [75] and recognized as Man and the Biosphere reserve by UNESCO due to its wide array of geological, geomorphological and biological diversity, habitats, and endemic species representative of the Mediterranean region [91,103]. Due to these characteristics, the Tuscan Archipelago represents one of the potential MPAs (*Aree marine di riferimento*) legally defined by the Ministry of Environment in 1982 and 1991 (laws 979/82 and 394/91) i.e. those areas in which conservation through the establishment of an MPA is considered a priority. Of these 52 potential MPAs, 30 have already been created, while 22 have not. In the latter group is included the Tuscan Archipelago. Hence, a thorough analysis of local fishers' perception about MPAs is pivotal to ensure a participative process aimed at increasing acceptance. In particular, we: i) investigated the factors underpinning the perception of MPAs by fishers; ii) collected environmental management proposals from the fishing sector; iii) developed a data-collection protocol which could be uptaken by other case-studies in the EU.

2. Material and methods

2.1. Study area

Data were collected in the Tuscan Archipelago, on the islands of Elba, Giglio and Capraia, where professional fishing is practiced. Data collection was also extended to the mainland in Porto Santo Stefano and Porto Ercole since the local fleets can operate along the coast of Giglio Island (Fig. 1). The fishing fleets at Giglio and Capraia islands are composed exclusively by artisanal vessels, while those at Elba Island, Porto Santo Stefano and Porto Ercole include also industrial vessels. Table 1

Each data-collection site is characterised by different protection scenarios. A Special Protection Area (SPA), Site of Community Importance (SCI) and Site of Regional Interest (SRI) is found near the Portoferraio marina at Elba Island ("Scoglietto di Portoferraio", 1.5 km²). The area is open to swimming and diving, but is a no-take zone. An MPA (which is also a SCI/SPA) already exists around the island of Capraia, covering 168.4 km². The area is composed of six different zones: the two no-take zones (zones MA) sum a surface of 1.4 km² (less than 1 % of the total MPA), and are the only ones in which even swimming, snorkelling,

sailing, or navigation are forbidden. Bottom trawling and spearfishing are prohibited throughout the entire MPA. Artisanal fishing and pescaturism¹ as well as recreational fishing are permitted only for residents in zones MB, MC and MD (a detailed map of the MPA is available at: https://www.islepark.it/images/Capraia/capraia_zone_mare_2021_A3_senza_falco_web.pdf). Local artisanal fishers are entitled to use set nets (max. 2500 mt per boat), longlines (max. 600 hooks per boat), handlines, rods, trolling, pots, and harpoons. The remaining data-collection sites are under no form of special protection, despite many of them falling within the Tuscan Archipelago National Park. The waters surrounding the islands of Giannutri, Montecristo and Gorgona are under provisory protection from the institutional decree of the Park. Finally, the waters around the island of Pianosa were entrusted to the Park following the closing of the local prison.

2.2. Data collection

Data were collected through semi-structured interviews (Supplementary Material) targeting the artisanal fishing sector that, according to the European Union Data Collection Framework (DCF) criteria (EU 2022), is represented by vessels smaller than 12 m in overall length and not using towed gears (EU 2014; EMFF Regulation 508/2014). The same questionnaire was utilized across all data-collection sites. The sampled population consisted of n=27 fishers, each interviewed in person through questionnaires lasting between 30 minutes and two hours. All interviewees were boat owners, while only one was part of a boat crew. In all cases but one, the owner worked onboard the vessel. Sixty-five percent of vessels are one-man boats, while the remainder 35 % host two workers. Eighty-eight percent of sampled fishers were working on an individual base, while only the remaining 12 % was part of a cooperative. No information was collected on whether the fishers were organized as a union. The data collection was completed in 15 non-consecutive days between May and October 2022. The structure of the questionnaires was improved by a group of 10 global experts as per the Delphi technique [109]. Questions could be answered either on a five-point Likert-scale or on a multiple choice. Data were collected following an opportunistic+snowball sampling strategy, through which each respondent was randomly selected and was then asked to indicate colleagues for the interview. The main advantages of this technique lie in the possibility of carrying out data collection in case of limited time and financial resources [47]. Additionally, each fisher was given the opportunity to provide extra qualitative information to corroborate the answers provided (as e.g., in [76]). The following eight variables were investigated, to assess their potential impact over fishers' perception of fishery management and MPAs (Table 2):

2.3. Data analysis

Data from the 27 questionnaires was digitalized in an Excel database. Data analysis was mainly conducted in R (R [21]) by applying functions from the *tidverse* [106] and *stats* packages (R [21]). Plots were additionally modified using the *package scales* [107]. A Spearman's rank correlation coefficient [97] was determined to analyse the correlation among the different answers received by fishers. Kendall's Tau (for ordinal variables) and Kruskal-Wallis rank sum test (for categorical variables) were performed to identify variables significantly influencing fishers answers to the questions provided. Non-parametric tests were chosen because of the non-normal distribution of the data. Maps were created by using the *sf* package [79].

¹ The term "pescaturism" was mentioned for the first time in the Italian legislation in 1992, indicating the boarding of non-fisher individuals older than 14 years of age onboard fishing boats with a recreational or tourism commitment (Gazzetta [102,64]).

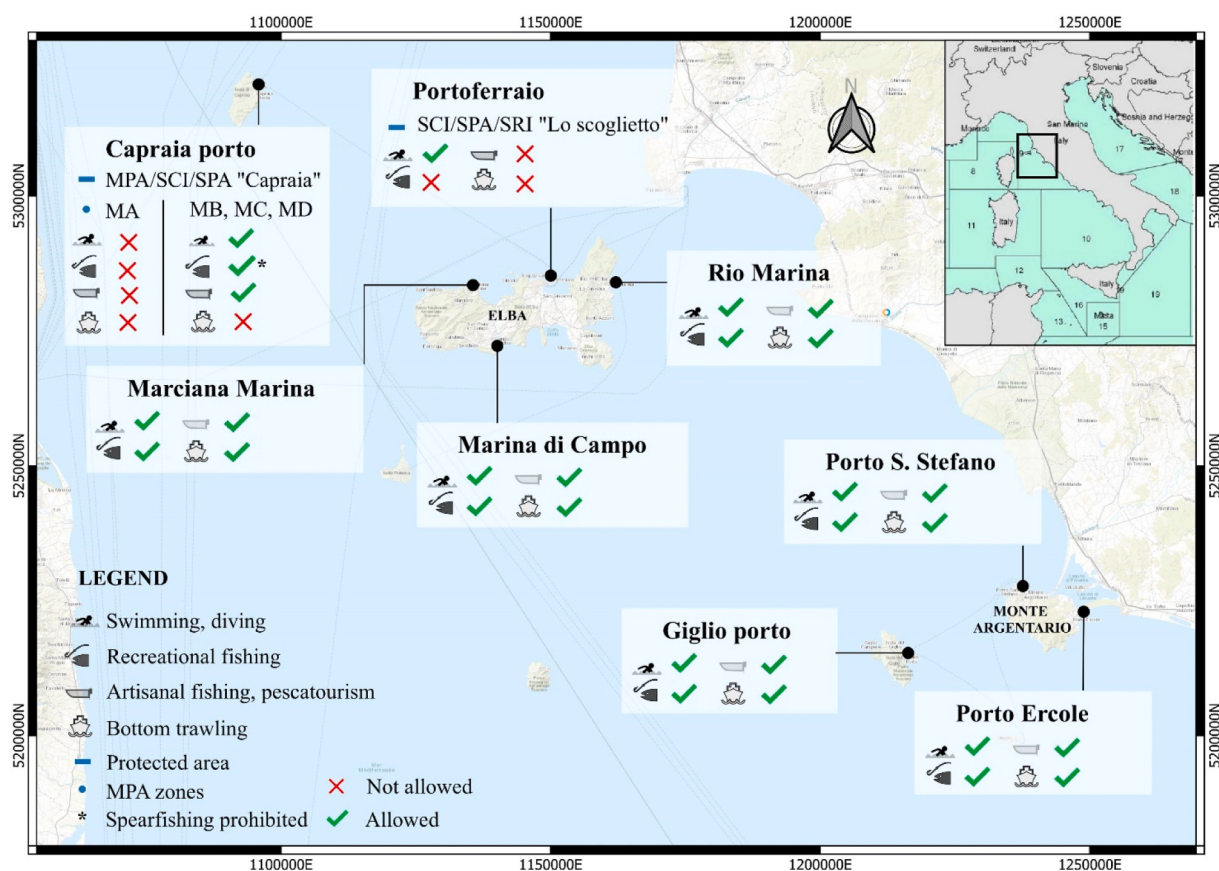


Fig. 1. Map of data collection sites and protection regimes in place for Tuscan Archipelago's artisanal fisheries (North-Western Mediterranean Sea, GSA 9).

Table 1

Survey site information and composition of the fishing sample.

Location	Professional fishing ports	Fleet size			Sampled units	Sample rate (artisanal fishery)
		Artisanal	Industrial	Total		
Capraia	Capraia Porto	9	0	9	4	44.4 %
Giglio	Giglio Porto	4	0	4	3	75.0 %
Elba	Portoferraio	23	11	34	5	21.7 %
	Marina di Campo	5	2	7	3	60.0 %
	Marciana Marina	8	1	9	2	25.0 %
	Rio Marina	2	0	2	1	50.0 %
Monte Argentario	Porto Ercole	17	6	23	1	5.9 %
	Porto Santo Stefano	23	26	49	8	34.8 %
Total		91	46	137	27	29.7 %

Table 2

Surveyed variables to assess fishers' perception about management and MPAs.

Group	Variable
Fisher information	• Age • Years of fishing experience • Education level • Incidence of fishing revenues over total household revenues • Region of origin
Fishing activity	• Fishing days per year
Business	• Commercial destination of the catch • Pescaturism as economic activity

3. Results

3.1. Perceptions of fishery management and MPAs

The large majority of fishers (71 %) stated that there is no fishery

management plan with clear goals and quantifiable objectives in place in the Tuscan Archipelago. Additionally, the present level of fishers' involvement was deemed as poor, with 87 % of respondents lamenting a total lack of involvement in the current management of marine living resources and coastal areas. When asked about MPAs, 74 % percent of fishers believes these are established for the right purposes, 68 % of them would recommend creating MPAs in the Tuscan Archipelago and 56 % declared their availability to change gear or area if an MPA is created in their usual fishing grounds. Concerning the involvement of fishers in the MPA life-cycle, 57 % of respondents would engage in the process of MPA establishment, and 80 % of fishers declared their availability to be involved in the event of consultations occurring for a new MPA in the region. Fig. 2

Spearman's rank correlation coefficient among the different answers received by fishers shows a significant positive correlation between questions 4 and 5 and between questions 5 and 6 (Fig. 3). Hence, those fishers believing MPAs are established for the right purposes would also

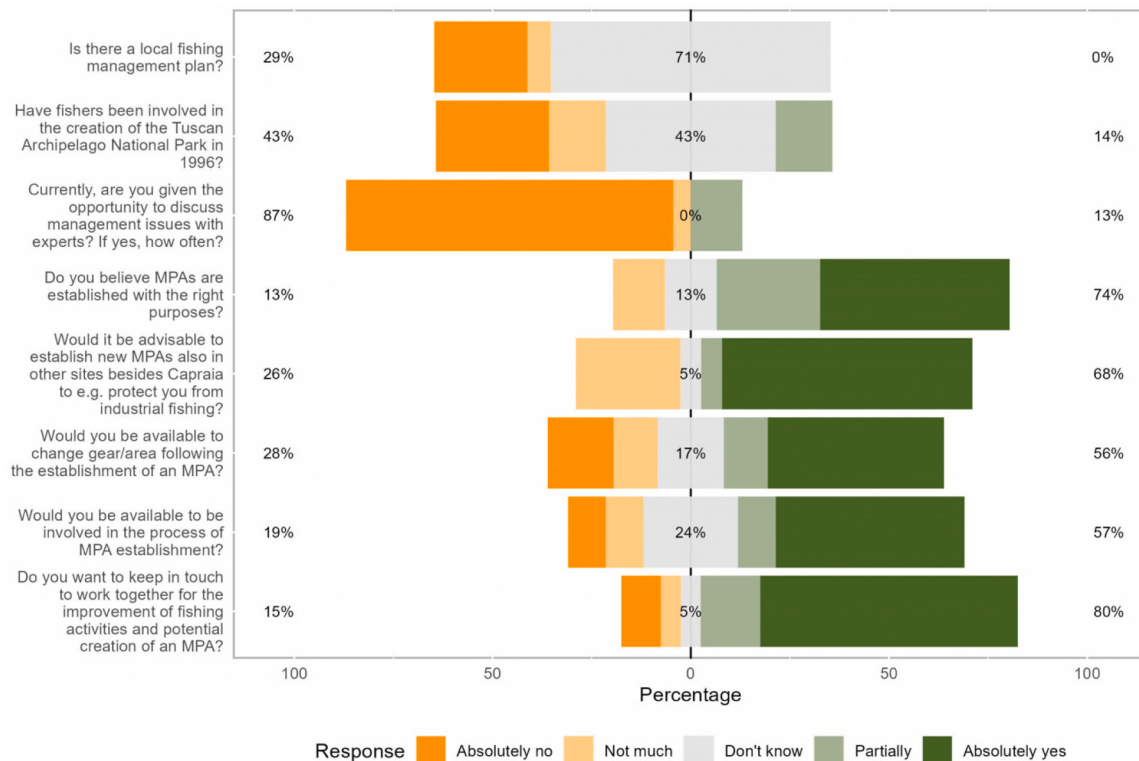


Fig. 2. Fishers' perception of management and MPAs in the Tuscan Archipelago, expressed in a Likert-scale from 1 (absolutely no) to 5 (absolutely yes).

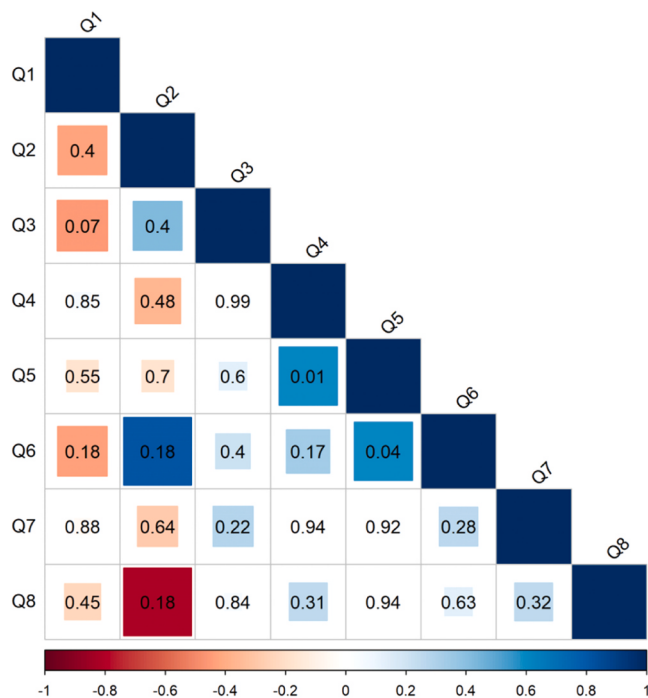


Fig. 3. Spearman R correlation among different Likert questions provided by fishers. Questions (Q1-Q8) are coded and follow the same order of the questions reported in Fig. 2. The size of each box indicates the degree of correlation (larger box, larger correlation), and the number indicates the p-value (p-value < 0.05 indicating a significant correlation).

welcome the expansion of the MPA coverage (both creation of new protected areas and expansion of existing ones) in their usual fishing grounds. They would be also keen to evaluate modifications in the gears

deployed and fishing grounds following new MPA establishment.

The Kendall's Tau and Kruskal-Wallis rank sum tests revealed that age, years of fishing experience, educational level, and the commercial destination of the catch (direct sale on the quay, to fishmongers, to wholesalers, etc...) had no significant effect on any of the answers provided by fishers on both management and MPAs. By contrast, fisher preferences are affected by the site of origin, incidence of fisheries revenues over total household revenues, number of fishing days per year, and by whether they practiced pescatourism alongside conventional fishing activities (Fig. 4).

3.2. Management proposals

During the survey, each fisher was asked what management measures could improve the socio-ecological performance of artisanal fisheries in the Archipelago. A summary of the main proposals received is provided in Fig. 5. Thirty-nine percent of surveyed fishers called for the introduction of new MPAs with a rotating "No-take zone". Following, 26 % of them called for a stricter control over illegal fishing. The main problems identified by fishers were: recreational fishers not respecting gear and minimum landing size regulations; purse seiners not respecting the 3 n.m. limits and using blind mesh catching undersized individuals of European anchovy (*Engraulis encrasicolus*); bottom trawlers not respecting the 3 n.m. limits (despite to a lesser extent now, thanks to anti-trawling structures installed); professional fishers not respecting the limits over the number of hooks per longline, total length of set nets, or amount of jars for targeting common octopus. "Redefine months of fishing closures" and "Implement paid seasonal fishing closures" rank third with 17 % of respondents. Calls for seasonal redefinition only came from fishers at the Elba Island. These include: extending until the end of June the use of "palamitara", a drifting net deployed near the surface or in the water column, used near the coast to catch Atlantic bonito [*Sarda sarda*] between the months of October and May. Other less common catches using the palamitara further from the coast include frigate tuna [*Auxis thazard*] and little tunny [*Euthynnus alletteratus*]; shifting the

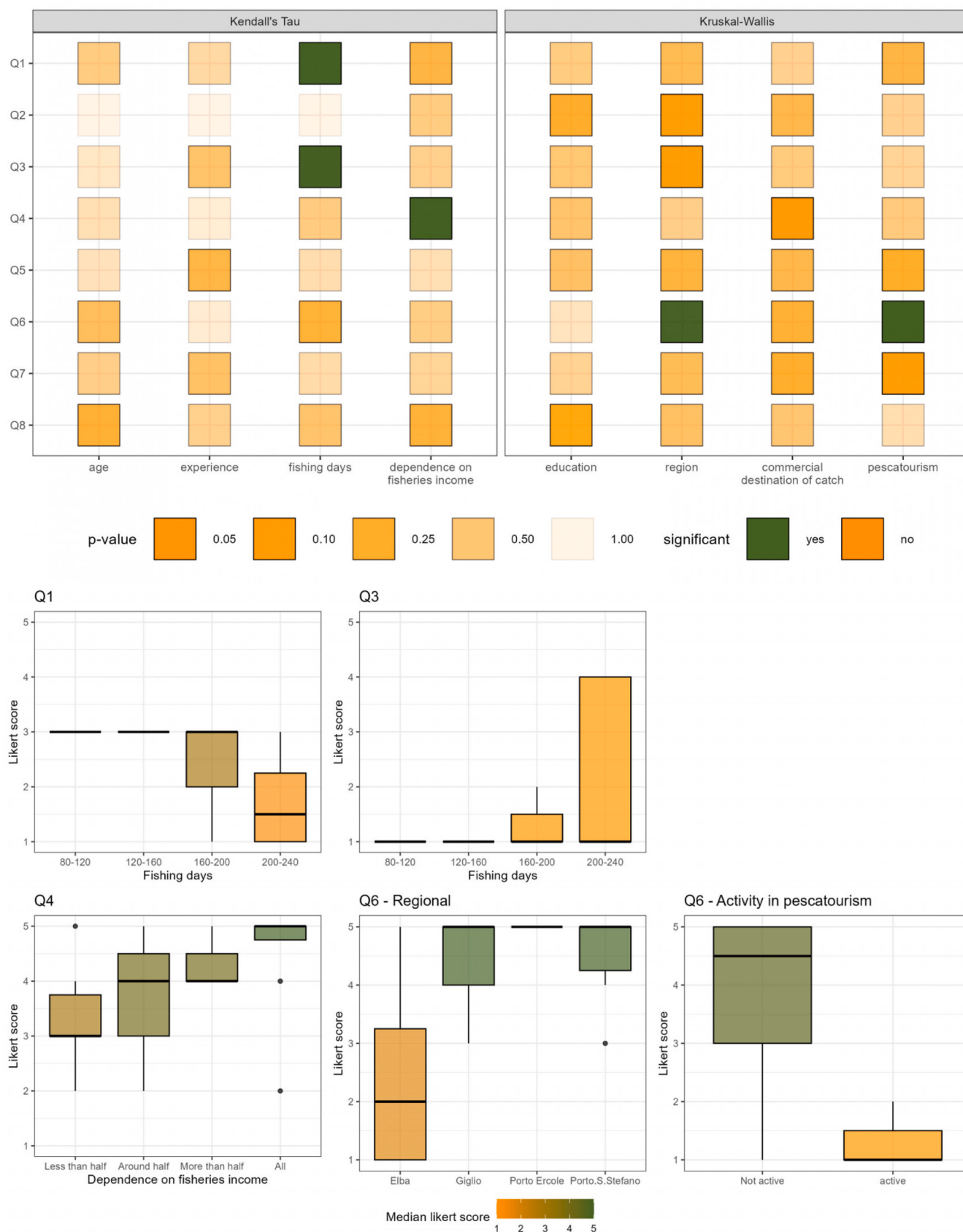


Fig. 4. Kendall's Tau and Kruskal-Wallis tests to assess the correlation between the Likert questions provided by fishers and the factors potentially affecting them. Questions (Q1-Q8) are coded and follow the same order of the questions reported in Fig. 2.

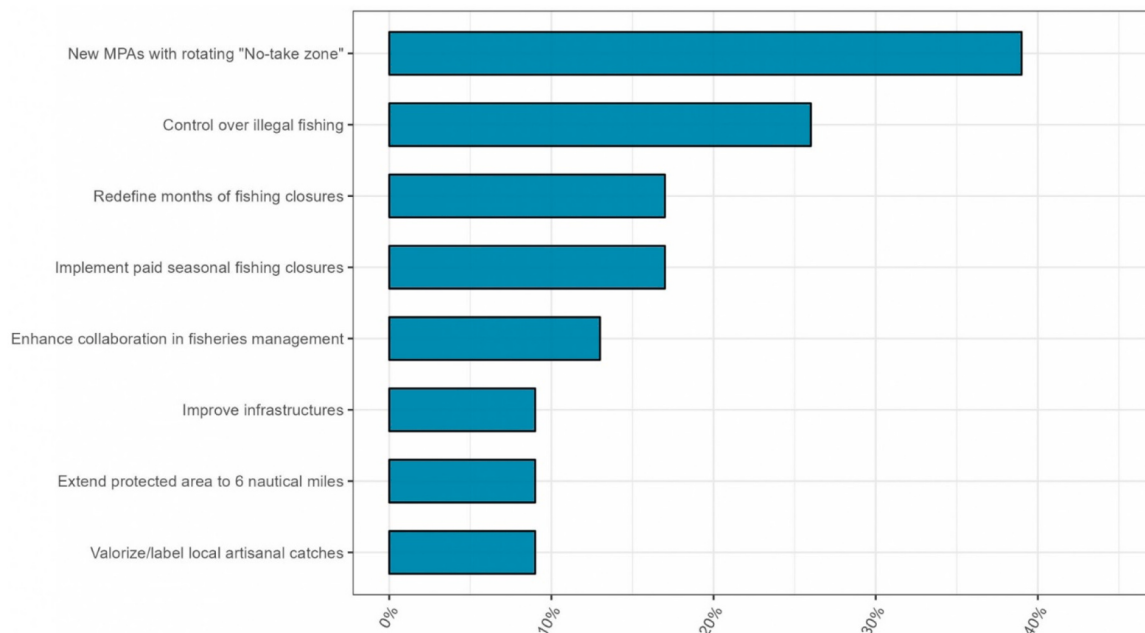


Fig. 5. Artisanal fishers' main proposals for improving fishery management in the Tuscan Archipelago. All other proposals were 4 % i.e., were raised by one fisher, only. These include: Obligation of organic soap onboard; Prohibit purse seining of *Seriola dumerilii*; Increase minimum catch size for *Epinephelus marginatus*; Allow artisanal fishing of *Thunnus thynnus*; Limit *Thunnus thynnus* fishing from recreational fishers; Provide artisanal fleet with adequate landing and mooring sites; Oblige recreational fishers to cut caudal fins of the catch to prevent selling; Allow fishing only to residents; Make EMFF calls more accessible; Make pescaturism more feasible; Make hychtyc tourism more feasible; Encourage direct sale on the quay.

European lobster (*Palinurus elephas*) fishing season from the period May–December to April–August, as closing in in September would protect reproducing individuals. For what concerns the introduction of paid seasonal fishing closures, these proposals mostly came from Porto Santo Stefano, except for one from Giglio. Some fishers called for paid closures during the summer season when, despite the good weather conditions, the tourism peak significantly hinders fishing activities. By contrast, one fisher asked for the measure to be introduced during the winter (January–April). Thirteen percent of surveyed fishers (all from Capraia and Porto Santo Stefano) called for better collaboration in the management process.

4. Discussion

4.1. Perceptions about management and MPAs

Surveyed fishers did not feel included in the management of those resources their activity depends on (Fig. 2), as reported by other studies (e.g., [49,92,41,42,81]). Yet, respondents expressed their desire to be involved into the management of marine environments, a key factor for sustaining MPA effectiveness in the region [26,29].

Fishers age does not affect MPA support and availability to change fishing behaviour. By contrast, fishing effort impacts perception and knowledge about management (Q1 and Q3), but not MPA support. This is in contrast with other studies showing that younger fishers tend to agree more with the establishment of MPAs and that part-time workers are more flexible and adaptable to MPA-related changes [96]. The statistical analysis revealed that the uncertainty about the legal framework in which a fisher operates is negatively correlated with the number of days spent at sea. This seems to indicate that more active fishers are also those more aware of the management system in place and could be those more active in the process of establishment of an MPA by the local authorities. Questions on MPA perception revealed an evident trend of acceptance of the local fishing community about this management system (Fig. 2). Further, the R-correlation matrix showed that fishers are not only open to the MPA concept, but are also willing to see MPAs

implemented in the Tuscan archipelago and “pay a cost” to see that happening (Fig. 3). The Kendall Tau’s statistic revealed that the highest the incidence of fishing income over total household income is, the more one fisher believes MPAs are created for the right purposes. This can be explained by the fact that those depending the most on the stocks for their livelihoods tend to appreciate more the attempts to protect them. Yet, no significant correlation could be found for the same variable and the follow-up question (“Would it be advisable to establish new MPAs also in other sites besides Capraia to e.g. Protect you from industrial fishing?”). This could indicate that the fishermen are convinced by the purpose, i.e., the theoretical approach and original intention of MPAs, but have doubts about their practical implementation process. Likewise, this could be an artifact due to the comparably small sample size. The latter issue could be clarified by expanding the extent of the survey and gathering the opinions of additional fishers active in the Tuscan Archipelago. Furthermore, in general terms, since our interviewing campaign encompassed about 30 % of the artisanal fishing fleet, the overall positive attitude towards MPAs could be not shared by fishers that were not included in our study. Nonetheless, our results show that the use of MPAs is recognized as a viable tool to protect marine resources at least by some components of the regional artisanal fishing community. Likely, these individuals could provide opportunities for starting a dialogue between management bodies and the broader artisanal fishery sector. The Kruskal–Wallis test revealed that fishers from Elba island and those that already engage in pescaturism alongside fishing are both less available to change gears and areas in case of MPA creation. For Elba, despite the relatively small sample size, a strong geographical pattern emerges, whose message is to be handled carefully by managers in case of MPA creation. These results highlight that the willingness of fishermen to cooperate in the implementation of MPAs can be highly heterogeneous even on a small geographical scale and that such specificities need to be thoroughly assessed in the process of inclusive fisheries management. The correlation with pescaturism seems to indicate a state of aversion to stricter regulations from those fishers that have already challenged themselves by engaging in revenue-diversification strategies and are benefiting from an acceptable income mix generated

by conventional fishing activities and pescaturism. In any event, fishers' response to MPAs will need to be assessed also after the implementation of the protection measure, to assess what factors (including the very same MPA design) can affect fishers' reaction to MPAs, as done e.g. by [55]. The absence of other strong, significant correlation among the other variables and fishers' perceptions proves the homogeneity of the Tuscan Archipelago's artisanal fishing communities' perception over current management and MPAs. That is, with the few exceptions explained above, the general perceptions highlighted in Fig. 2 are quite uniformly distributed among the study area. In general terms, however, the absence of statistical correlations could be due to the small size of the sample taken into account. This aspect could be dealt with by expanding the research to other areas, both in Italy and abroad.

4.2. 4.2 Management proposals

Fisher complaints were constructive and accompanied by several management proposals, the main one being that of introducing new MPAs with a rotating "No-take zone". As intended by fishers, the "No-take zone" of an MPA should not be fix, but alternate through time among different sites, in order to avoid some sites to be exposed to a high and steady harvesting pressure across long periods of time. This would allow the recovery of species that are sedentary or with limited dispersal at intensively fished sites. The concept of spatial and/or temporal rotational harvest schemes within MPAs finds support in the scientific literature [18,30,40,45,51,6,8], especially in the light of the potential inability of static MPAs to be effective in conditions of climate change and associated ecosystem restructuring and regime shifts [39,50]. Yet, this type of MPA design would rely on continuous data collection of main bio-ecological features, as well as compliance of marine users with conservation rules [39]. Some of the management proposals formulated by the artisanal fishers concern the recreational fishing sector (calls for increased control over illegal activities from recreational fishers not respecting gear regulations and minimum landing sizes, limit their catches of Atlantic bluefin tuna, and oblige them to remove caudal fins to the catch to prevent illegal selling). This aspect deserves full attention since the relationship between professional and recreational fishers is a significant problem in the Tuscan Archipelago [28]. Conflicts are also common in Italian and EU MPAs, due to shared fishing grounds, unregulated recreational fishing activities, as well as illegal sales of catches from non-professional fishers [19,27,69,78,38]. Future MPA designs in the Tuscan Archipelago will need to address the sources of these conflicts to enhance MPA functioning. The fact that the most common management proposal raised by fishers is in support for an MPA, along with the perceptions illustrated in Fig. 2, show that artisanal fishers from the Tuscan Archipelago advocate for increased protection of the resource upon which their livelihoods largely depend. This is somewhat surprising if compared to the feeling of aversion generally expressed by fishers worldwide with respect to the MPA management scenario and associated benefits for fishing activity (e.g., [92,65,62,5]). Italian artisanal fishers have shown contrasting views on the MPA topic, ranging from aversion/fear for lost fishing grounds to happiness for the gaining of exclusive fishing rights in the protected area as well as potential increased revenues [23,52,68]. However, the initial opposition is rapidly set aside once the MPA is created, as experienced by the positive perceptions and socio-economic benefits described by affected fishers in more than one case-study [104,35,90]. In the context of the Tuscan Archipelago, many fishers appear to embrace the concept of the MPA as management tool and they are also in favour of establishing new MPAs in the region and willing to adjust their fishing behaviour for achieving this result. Not only, many fishers expressed their desire to be engaged with scientists and managers for future work on MPAs in the Tuscan Archipelago (Q8, Fig. 2). These results represent an extremely positive starting point, confirming the intuition that, often, aversion to MPAs rises because the way their establishment and management is conducted, rather than as an opposition to conservation itself [85]. Yet, despite

the openness to change shown by some of the fishers, the large majority of them (71 %) ignores if there is a local fishery management plan, and 83 % of them points to a total lack of involvement in consultation/management. The fact that local surveyed fishers showed positive perceptions about MPAs can be explained by the significant crisis that they are facing in terms of decreased catches and revenues, mostly due to the presence of illegal fishing and conflicts with other marine users such as industrial fishers (trawlers and purse seiners), recreational fishers and tourists [28]. The feeling of permanent conflict, exasperation, and resignation with respect to the status quo has likely played a prominent role in shaping the support for MPAs from artisanal fishers in the Tuscan Archipelago, in what seems a drastic attempt to protect their livelihoods. If properly enforced, MPAs could indeed be useful in addressing many of the shortfalls currently affecting artisanal fishers' livelihoods.

Increasing control over illicit activities emerged as the second-ranking priority of fishers to achieve effective management in terms of both socioeconomic and ecological sustainability. In fact, compliance with rules is pivotal for ensuring the conservation of marine resources, especially in the framework of an MPA, whose establishment would otherwise be pointless [7]. Often, due to several factors including a lack of control over illegal fishing, the effectiveness of an MPA is undermined up to the point of becoming a so-called "paper park": an MPA that only exists in legal terms but is totally ineffective in reaching its socio-ecological goals [105,24,86,101]. Given that partial or total ineffectiveness is a problem affecting the majority (up to 70 %) of existing MPAs worldwide [32,44,89] mostly due to the inability to prevent illegal fishing activities, this call from Tuscan Archipelago fishers shall be dealt with the highest consideration. In fact, even in circumstances of sound co-management schemes built on high participation and engagement of stakeholders, a lack of enforcement encourages the spread of non-compliance, thus undermining the effectiveness of the MPA ([70,80]).

"Redefine months of fishing closures" and "Implement paid seasonal fishing closures" rank third with 17 % of respondents highlighting each of them as a management priority. The first issue confirms the proactive nature of the proposals received by fishers. Besides the demand for extension of the "palamitara" fishing season, the requests on European lobster advocates for a reduction of the fishing season, rather than its extension. Additionally, fishing with "palamitara" nets is already permitted throughout the entire year. However, since the gear is deployed near the coast, its usage is effectively forbidden between May and October, because regulations only limit fishing between sunset and dawn. Hence, the limitation comes for touristic purposes, and not for biological ones. Therefore, the extension of the "palamitara" season should be read as an attempt to redefine the agreements regulating the coexistence of different marine users, rather than by an attempt to increase the fishing pressure over a stock. The nature of the good intentions expressed by fishers seems to be confirmed by the geographical discrepancy arising between the demand for a redefinition of closures and relative fishers compensations. For instance, while all (n=4) proposals for a change in the fishing season came from fishers from Elba Island, none of them asked for a payment to refrain for going out at sea. Likewise, while 75 % of requests for financial compensation came from Porto Santo Stefano, none of these fishers mentioned the need of modifying the present framework of seasonal closures. Also in this case, recognizing fishers local ecological knowledge (LEK) is of high importance: previous studies based on fishers' ecological knowledge highlighted a correspondence between LEK and the best available scientific ecological knowledge (SEK) [73]. Consideration of fishers LEK enhances stakeholders acceptance and compliance, hence increasing the chances of successful marine resource management both inside and outside MPAs [4,77,80,94]. Assessing and welcoming fishers LEK represents a pivotal ground-breaking step towards the establishment of co-management systems (St Martin 2001). In this case, a seasonal modification was proposed not as a source of income nor as a measure to

increase the fishing effort, but rather to avoid catches of under-sized/reproducing individuals, as a tangible will of protecting the resources over which fishers livelihoods depend on.

Thirteen percent of respondents called for enhanced collaboration in fisheries management. Requests include higher inclusion of fishing representatives in the management process, increased dialogue and collaboration among fishers and with port authorities. In socio-ecological systems, decentralization and participation improve management performance, increase efficiency, trust, learning, and equity, contributing to shaping more informed decisions [1,25]. Co-management is also a widely accepted approach to fisheries governance, leading to increased legitimacy, equity, effectiveness, efficiency and acceptance [48,58,67,93]. Specifically, the recognition of artisanal fishing knowledge, perceptions, livelihoods, and organization is pivotal for solving the main challenges in cooperation and co-management that affect the artisanal fishing sector [10]. Yet, the evolution towards fishing co-management regimes can be a time-consuming process, as establishing trustful relationships and a cooperative work ethic among stakeholders can take many years [66]. Currently, no co-management consortium exists involving artisanal fisheries in the Tuscan Archipelago, and 83 % of fishers state they were never included in management, not even in a consultative way. Nonetheless, the inclusion of stakeholders (mainly, fishers) into management is a necessary element for ensuring success, both inside and outside MPAs ([10,29,54,80]; Di Cintio et al., 2023). This, in turn, can generate cascading benefits, such as the education of fishers to fisheries management or the establishment of co-management programs involving constructive collaboration and mutual learning among fishers, managers and scientists [37,87]. In general, the perceptions and management proposals indicate a positive propension of fishers towards a shared management system. Future efforts should focus on the identification of the most effective pathways to transform these perspectives into a well-functioning co-management scheme for the achievement of the sustainable exploitation of local fisheries resources within the context of MPAs.

5. Conclusions

The inclusion of key stakeholders, such as artisanal fishers, has been broadly identified by global literature as one of the main factors underpinning MPA acceptance and effectiveness. Although there is no definitive evidence that this will work in the Tuscan Archipelago, including artisanal fishers will likely improve MPA success in the area. Our study provides some points for leveraging the implementation of a bottom-up approach to marine resource management, in the view of a likely expansion of the MPA coverage in European Seas. Our study suggests that the local artisanal fishing sector could be generally in favour of MPAs, as long as their involvement in the MPA life-cycle is granted. These conclusions should be used by local management authorities as foundations to build sound, well-functioning MPAs in the Tuscan Archipelago. An analytic generalization process [108] would allow identifying the path for the applicability of our findings to the management of artisanal fisheries outside the Tuscan Archipelago.

CRedit authorship contribution statement

Federico Niccolini: Writing – review & editing, Validation. **Selene Di Genio:** Visualization. **Erik Sulanke:** Formal analysis, Data curation. **Antonio Di Cintio:** Writing – original draft, Methodology, Conceptualization. **Fabio Bulleri:** Writing – review & editing, Validation, Supervision. **Francesca Visintin:** Writing – review & editing, Validation. **Valerio Sbragaglia:** Writing – review & editing, Validation, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial

interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Data will be made available on request.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.marpol.2024.106260](https://doi.org/10.1016/j.marpol.2024.106260).

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