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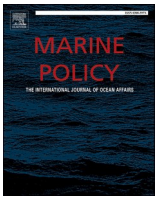

The role of the Spanish Mediterranean Fisher's Guilds in Maritime Sustainability

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ABSTRACT

The fisheries sector is making significant changes by specifically addressing coastal management and tackling the socio-environmental crisis it is currently facing. Notably, a fundamental change in the attitude and behavior of fishers and their institutions is observed, where sustainability of the environment and marine resources is becoming a priority issue.

Focusing on the Fisher's Guilds of the Spanish Mediterranean, this work analyses the scope of these changes in the management of natural resources through their concrete actions, the factors that enhance or limit such actions, as well as any lingering resistance. For this, we have combined quantitative techniques, through a closed questionnaire, and qualitative techniques, through semi-structured interviews.

We can confirm that the guilds play a growing and active role in the environmental management of their territory of influence. However, it is necessary to equip them with greater human and material resources, to support a strong, determined leadership committed to the environment and, above all, to build a framework of joint collaboration in decision-making that goes beyond mere appearances.

1. Introduction

Impacts from fisheries on the environment have been abundantly described and researched [1–5]. It can be dysfunctional, intensely exploitative, and environmentally destructive [6–9]. It is stated that free access and the inexistence of well-defined property rights generate over-exploitation, since there are no incentives for individuals to rationalize their use [10,11], all this eventually leads to what is known as the 'tragedy of the commons' [12]. Thus, the centralized or 'top-down' management based on expert knowledge and applied fundamentally on the basis of the *Maximum Sustainable Yield (MSY)* criterion by the Administration, is felt to be justified.

Traditional governance of the oceans is frequently represented as failing, especially when ensuring environmental sustainability of the oceans and coastal areas [13,14]. In the case of the *European Union* (EU), the European institutions themselves attribute many of the shortcomings of the *Common Fisheries Policy* to an over-centralized and unresponsive "top-down" decision-making process. The importance of prioritizing the participation of fishers in the decision-making process is a big push factor in its reform [15]. In order to overcome past mistakes, our waters require a more coherent manner of management [16]; therefore, any reforms should be based on an expanded set of management approaches in which all stakeholders involved feel represented and able to contribute with their knowledge to reach the desired sustainability. Thus, it should involve concepts and models of co-management [17], a process of management in which the government shares power with resource users, with each given specific rights and responsibilities relating to information and decision-making. There are other more nuanced models to be considered, such as *Adaptive Co-Management* [18], which has its foundations in the convergence of two independently evolved concepts, adaptive management (focused on learning by doing) and co-management. The *Stakeholders Theory* [19] of organizational management and business ethics stresses the interconnected relationships between a business and its customers, suppliers, employees, investors, communities, and others who have a stake in the organization. Finally, *Community-based Management* [20,21] is defined as a bottom-up

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approach to organization which can be facilitated by an upper government or NGO structure which aims for local stakeholder participation in the planning, research, development, management, and policy making for a community. All of the above have been widely addressed in the literature, in which the general consensus calls for the need to involve all relevant stakeholders in fisheries management - especially fishers and their representative organizations.

However, the question is not which theoretical model to apply, but rather to understand the unique conditions under which its application offers certain guarantees of success. There is wide evidence of the sustainability of biological resources by small-scale fisheries in coastal areas where local government institutions persist. For example, the study by Al-Fattal [22] shows how specific contexts can determine the management model. Although the tragedy of the commons hypothesis is a realistic prognosis in the case of the European Union, at a local level collaboration between institutions and stakeholders takes shape through traditional institutions such as the *Prud'homies* [23] or the *Cofradias* (Guilds) [24] or even more recently with newly created institutions such as the *Co-management Northern* Bohuslan (CNMB) [25] or the *Fisheries Local Action Groups* (FLAGs) [26,27].

In Spain, autonomous regions are responsible for fishing in inland waters, for shell fishing and aquaculture, as well as for the management of the fishing sector and the marketing of fishery products, as is laid out in the unitary framework (*Law 3/2001 of March 26, 2001, the State Maritime Fishing Law*). Within each region, fishers are members of the fishers' guilds, non-profit institutions that represent the interests of shipowners and fishers, and which act as consultation and collaboration bodies for the competent administrations in matters of maritime fishing and the management of the fishing sector.

Therefore, Spain presents a suitable scenario to study the possibilities of a system that involves fishers in fisheries management. Not only because Spain is one of the largest producers in terms of volume in the EU [28], but also because of the presence of the fishers' guilds which are deeply rooted in the territory and with a great legitimacy for fishers [29–36].

Fishers the world over belong to traditional working communities with a strong sense of place [37]. In Spain, fishers' guilds have their roots in both religious and medieval institutions (being documented since the 11th century). Throughout their long history, they have changed in name, function, and structure; they have been banned, ignored or instrumentalized by different political regimes, but they have stood the test of time and are still active today [38]. Currently, there are 198 fishers' guilds scattered along the Spanish coast.

Their work has traditionally focused on economic, social, and administrative aspects. Thus, they carry out the channeling, control and first sale (through Dutch auction in fish markets) of every fish caught in their territory. They manage the labor and administrative procedures of their members, they impose their own measures on their fishery resources, fishing gear, schedules, etc. and finally monitor compliance and provide various services such as diesel, ice, social services, health services, etc. [29,31,38,39].

Environmental issues have not seemed to have held much importance within the fishers' associations; moreover, they have been perceived as issues opposed to their particular interests and have led to harsh confrontations with both the administration and environmental groups. However, the delicate situation that the fishing sector is now facing due to climate change, overfishing, water pollution, etc. seems to be causing changes in the attitude and behavior of the fishers' associations and their members with respect to defending the environment and marine resources. Both are becoming priority issues -if not survival factors- for the sector.

Focusing on the fishers' guilds of the Spanish Mediterranean, this paper analyzes the scope of these changes in the management of natural resources through their concrete actions, as well as any resistance that may persist. They continue to be better known for their control, for their administrative, logistic, or economic tasks, or for their folkloric role in the communities where they are established (festivals and traditions). Their recent initiatives in the environmental field are going almost unnoticed and are hardly considered by the management systems, despite the fact that today their participation is key to the environmental sustainability of our coast [18,29].

Thus, the main hypothesis of this work is that in a model of co-management of fishery resources, the institutions representing fishers (in this case, guilds) should play an active role in maritime environmental management.

The general aim is to answer the following question: Which are the best cooperation options considering the characteristics of the fishers' guilds?". To this, the specific aims are firstly to analyze the consistency and extent of the environmental actions carried out by the guilds; secondly, pinpoint which factors enhance or limit environmental actions carried out by these guilds. Thirdly, to check to what extent collaborative forms of management are possible as expressed in the *Common Fisheries Policy*, *European Maritime Policy* or *Integrated Coastal Zone Management,* since, as will be shown, the environmental rules and regulations in place are one of the recurrent causes of mistrust between the different administrations and the guilds.

2. Methodology

The area of study involved five regions (with eleven provinces) located from the northeastern corner of Spain to the southernmost area of the Iberian Peninsula (see Fig. 1). All of them have a Mediterranean climate, characterized by mild winters and hot summers.

The 11 provinces form the Spanish Mediterranean coast (four peninsular regions and one island), represented one of the most populated areas of Spain (18,451,943 inhabitants, approximately 39% of the total Spanish population). In this analysis, we only considered the four Andalusian provinces which are located on the Mediterranean coast (we excluded the ones located on the Atlantic coast). The analyzed regions had a very tertiary economy, with a very strong tourism sector, although the primary sector still played an important role, along with a particularly significant industrial sector in the north.

The Spanish Mediterranean fleet was characterized by having mixed, multi-specific fisheries with high commercial value (86,851 tons live weight worth 328,768 million Euros in 2018). It consisted of a total of 2356 vessels (about 26% of the Spanish national fleet), with a capacity of 50,799 GT and a power of 215,485 kW. (see Table 1). Over 62% of the ships were artisanal; the next most important vessels were trawlers (24%), purse seine (9%) and fishing line (5%) [40]. They directly employed 7588 associated workers in 68 guilds (see Map 1). All professional fishers were members of guilds.

This research combined quantitative techniques, through a closed questionnaire (Appendix 1), and qualitative techniques, through semi-structured interviews. On the one hand, a survey was carried out with the main skippers or managers of the guilds. This study was part of a

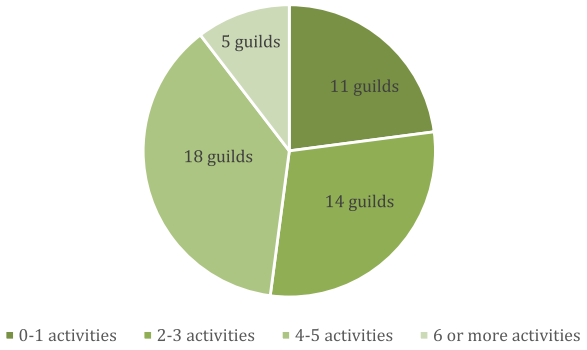


Fig. 1. Number of guilds with voluntary environmental actions.
Source: Authors' own elaboration from the guild questionnaire.

Table 1
Technical characteristics of the Spanish Mediterranean fleet by Home Port region, 2019.

Region	No. vessels	Gross register tonnage	Power kW	Length (average meters)
Catalonia	670	17,528	75,890	13.85
Valencian Region	557	17,866	63,867	14.94
Balearic Islands	326	2937	17,111	9.53
Andalusian Mediterranean	620	9052	45,688	11
Murcia Region	177	3396	12,929	11.17
Total	2350	50,779	215,485	49.32

Source: MAPA, *Census of the Operational Fishing Fleet, December 31, 2019* [40].

more ambitious project that aimed to analyze various aspects related to the work, management, and the main problems of the fishers' associations. One of the issues considered when designing the survey was the relationship of the fishers' associations with environmental management; for this purpose, a specific section with six questions was prepared. 75% of the 68 guilds in the Spanish Mediterranean answered the questionnaire (51 guilds). The others chose not to answer the questionnaire or did not answer when contacted, between October 2018 and March 2020. Guilds were contacted via email or by phone and interviews were carried out in person.

The questionnaire, with 41 closed questions, consisted of a list of topics to be addressed according to the objectives of the research. Questions were grouped into the following sections:

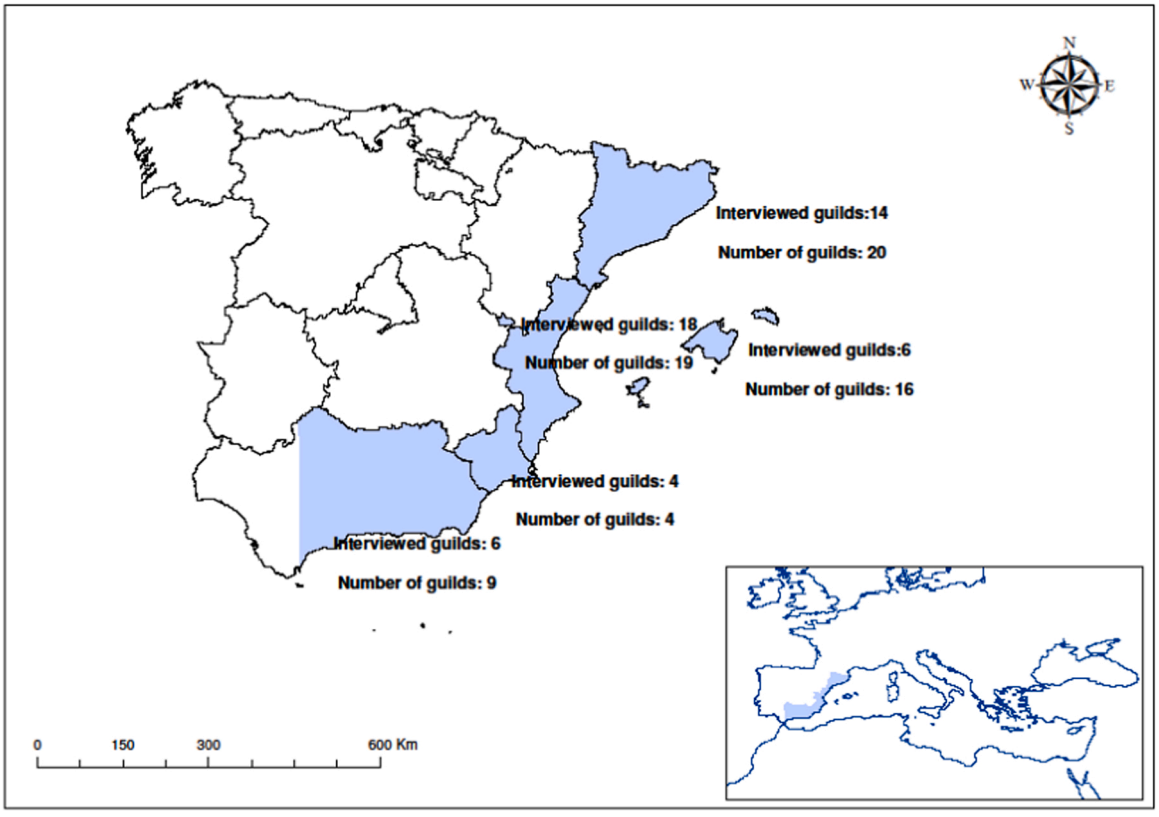
- Socio-economic characterization and general information of the guilds and fishers. Questions 1–12.
- Guilds management system. Questions 13–21.
- Guilds main problems. Questions 22–23.
- Guilds and environmental management. Questions 24–29.
- Guilds and diversification activities. Questions 30–31.
- Guilds relations with other stakeholders and institutions. Questions 32–38.
- General open answer questions. Questions 39–41.

For this specific research, we used some of the questions raised in the first section and, to greater extent, the questions raised in the section "Guilds and environmental management (questions 24–29), as well as one of the general open answer questions (question 39) formulated specifically for this research (see Appendix 1).

Afterwards, a descriptive analysis was carried out to study the relationship between the environmental proactiveness of the guilds (analyzed using the answers to question 27) and different characteristics of the guilds. Organization size and its influence on a proactive environmental attitude was extensively studied. In our case, guilds' size was an easy aspect to determine based on the information provided in the first section of the survey. In the analysis, the number of affiliated fishers had been used, although other available indicators could be used, for example, the number of boats (which had been used in the statistical analysis), turnover or the quantities unloaded.

A Spearman correlation analysis was applied. The Spearman correlation is a non-parametric measure of dependence, which studies the statistical dependence of two variables. Thus, and by means of a monotonic function, the Spearman correlation assessed the strength of relationship between two variables.

On the other hand, if quantitative analysis provided us with a radiography of the situation at a given time, qualitative analysis allowed us to go in depth into those aspects that were not covered by the questionnaire. For this reason, after the questionnaire, we conducted a semi-structured interview with the same respondents to the questionnaire (51 in total) and completed this information with interviews with small scale



Map 1. Map showing study area and interviewed guilds.
Source: own elaboration.

fishers from the different fishers' guilds (30 male respondents between 38 and 50 years old). The purpose was not to analyze an individual, nor their psychological motivation, but rather the subject of study was analyzed through the experience on this subject of a certain number of individuals who, at the same time, were part and consequence of the action studied. All this was intended to deepen the perceptions and concrete actions carried out by the fishers, who, eventually, could favor or hinder environmental sustainability.

Snowball sampling [41] was used to contact them. A semi-structured questionnaire was used for interviews, conducted as a dialog, enabling a certain degree of flexibility and freedom to discuss predefined sets of issues/topics to guide the conversation [42].

First, we created an interview guide with planned topics and questions to be addressed. We looked for a fluid conversation, not following a structured protocol of questions; so other questions could emerge from the dialog between interviewer and interviewees [43]. Table 2 shows the topics we addressed.

The interviews were recorded and transcribed for their analysis. The responses were organized and grouped into categories which arose from the data in interaction with the research questionnaire.

The material was analyzed using a thematic approach [44] to explore and uncover deep-seated emotions, motivations, and attitudes and to capture an insider (emic) perspective. We used those excerpts that came up repeatedly in our interviews and that represent the collective thinking of our social reference group [45].

3. Results

3.1. Consistency and range of environmental actions

Fishers provided critical information on habitats, fluctuations, and behaviors of different species etc. that helped to establish regulations that are contextualized temporally and spatially while still being legitimate for users.

> "So, I tell all the biologists. They sample once a month, I sample every day, every day I sample. We know something, don't we?" (Skipper-small scale Andalusia)

> "I have talked with the head of the fishing service, right? Well, at the moment I am not being listened to, but there will come a time when they realize. We, as fishers, are noticing that fish eggs are being laid later and later. Let's say that the season for albacore, bonito (tuna) or frigate mackerel, which used to be in November or December, is now appearing in March. The amberjack, as everyone knows, appears in December, January, February, well, there are amberjacks of a kilo now, on May 28, never seen before. The biological closures that we are doing right now have to be changed, the fish are changing their egg clutches, the administration does not seem to be paying much attention now". (Senior skipper, Murcia).

Table 2
Interview protocol.

Topics	Guidelines
Socio-demographic information	Age
	Fishing gear
	Background in the fisheries sector
	Learning
Problems in the fisheries sector	Economic, environmental, institutional, and social
	Internal/external to the sector
Alternatives/Solutions	Intra-sector
	From outside (administration, consumers, etc.)
Environment	Perception and opinion
	Problems
	Individual actions
	Joint actions

Source: Authors' own elaboration.

Even though the monitoring of rules had usually been conducted by the authorities, 80% of the fishers' guilds had collaborated in the control of these measures (question 24), with three out of four establishing their own fishing rules (question 26 and 27). These rules affected the territory assigned to each guild (see Table 3), such as the establishment of closures, shares, minimum sizes, the delimitation of fishing areas, prohibition of simultaneous use of more than one fishing gear or the reduction of discards. In addition, other environmental improvement activities were carried out, such as the collection of marine debris or the establishment of systems to increase reproduction (question 27).

There were collaboration programs between NGOs or local administrations and fishers' guilds that favored some of these measures, such as the collection of marine debris. It is also true that many fishers changed their attitude towards and perceptions of the problems:

> "It hasn't been easy, we used to look the other way, because nothing was done inland either, maybe you took it out of the sea but then from land they threw all the rubbish into the sea, and it wasn't worth it. Now it seems that we have become aware of it, and that our cleanup work is being considered. Officially we have been bringing garbage from the bottom of the sea to land for the last 25 years" (trawler, Catalonia).

> "We are in favor of not killing small species (.) even if it is commercialized. Then, we made an agreement not to fish it and to sanction whoever fished it, the Guild itself made an agreement that if any boat fished or commercialized it, they would be sanctioned. And the truth is that it works." (Small scale, Catalonia).

> "The Guild, on its own, initiated the development of a census of the fleet authorized to fish in the lagoon, because with increased eutrophication, the catches of certain species, with a very high commercial value, grew quickly and attracted outsiders. Then, in order to avoid them purchasing licenses and boats in such a small lagoon, we made a proposal for a census that the region accepted and is pending publication as an official rule." (Main Skipper, Murcia).

The economic problems that most of the fisheries had been suffering, led them to adopt a more pro-environmental attitude. However, even if the motivation was purely economic, it provoked first, and reinforced later, the idea of going beyond pure economic benefit.

> "That is to say, to cut the shares to be able to maintain a minimum price of fish and those things. And that's the direction we are going… (Manager, Valencian Community)

Well, it's very good because in the case of the farmer, for example, they are very poorly organized, losers, because they plant, they get hail and then tomatoes at two cents, the oranges sell for nothing, everything thrown away. We, at least, have a well-organized guild, in the sense that we take the fish and at the end of the week we are paid for what we have sold. We have a superior quality service. Very good". (Trawler, Valencian Community).

Table 3
Environmental measures self-imposed by the guilds.

Environmental measures	Guilds (%)
Marine debris collection	83.33
Closures	43.75
Fishing quotas	41.6
Delimitation of fishing zones	37.5
Minimum size	22.91
Artificial reefs	16.66
Systems to increase reproduction	14.58
Reduction of discards	12.5

Source: Authors' own elaboration from the guild questionnaire.

"The truth is that Cartagena and its Main Skipper are committed to a responsible and sustainable fishery, it is as clear as day to me, otherwise we are going to be ruined and that would be a disaster." (Small scale Murcia)

"I hope that all the plans, the co-management committees and all that, will end up succeeding in increasing the price of fish. Then, the fewer fish caught, the higher the price we can sell at, this would be great." (Small scale Catalonia)

"That is why the guilds are important, to manage our resources knowing our reality." (Trawler, Catalonia)

The thread of these previous extracts was repeated by others interviewed. The economic motivations, more individualistic and focused on the short term, had been diluted in the guild where actions were channeled towards the long term. This involved nurturing the resources within its sphere of action.

"And that is what the Guild is for, it is the mother, the umbrella organization. All these initiatives could not be done by individuals, they are the work of the Guild. It is the way to not hurt each other." (Small scale, Valencian Community)

"There have been regulations since the seventies, and they have all been openly flouted! On the other hand, for the last 7 years we have had regulation from the sector itself and we have not ignored it, because there is no reason to. I do not want to propose anything that I am not able to comply with or that I am not willing to comply with. In Girona we have joint management areas, enclosure areas, and a series of joint fishing sanctuaries between Blanes and Palamós that come from the sector itself. They are respected without any problem. We have study areas for Norway lobster, proposed by the sector itself and they are respected. I believe that this is the way forward, as long as the competent administrations allow us to do so. Many times, the administrations are afraid of "this is mine and I have to manage it myself" (Manager, Catalonia)

The fishers pointed out that some measures, such as closures managed by the administration, were not very effective. The administration had taken effective control of the activity with few resources and had not prioritized the biological cycles of the species; therefore, the closures were adjusted to administrative location criteria, while the fishers demanded a spatiotemporal closure model linked to biological criteria:

"Until now, the closures were a very strict thing that did not make any sense; they set a time of year and then it had to be done and that was that. It's obvious that it doesn't produce good results or make any sense. The fishers should be the ones to decide when". (Guild Manager, Catalonia).

Most of the guilds carried out several of these actions simultaneously. As shown in Fig. 2, almost half of the guilds analyzed had established more than three environmental actions on their own.

3.2. Factors which enhance or limit environmental actions

The elements which could favor or hinder the environmental actions of the guilds were determined based on the data obtained in the first part of the survey.

Size is the first element considered. Although the environmental activities that the guilds carried out were quite heterogeneous, a simple descriptive analysis showed that as the size of the guilds increased, the number of environmental actions carried out also increased. This was true until above a certain number of actions (four), where it no longer depended on the size of the guild (see Fig. 2). The smallest guilds (45 fishers on average) carried out very few environmental actions (or simply limited themselves to collaborating in the collection of debris from the sea), then there was a group of small guilds (around 100 members on average) that together with the collection of debris, implemented one or two further actions (largely establishment of quotas or closures); it was the medium and large guilds (over 160 fishers on average) that applied other types of actions, normally more complex and requiring greater financing and control. Of the measures shown in Table 4, the three with the lowest application rate: the effective reduction of discards, the installation of artificial reefs to increase fish production and systems to increase the reproduction of species through artificial substrates, were the most expensive and complex for the fishers' associations.

With the aim of verifying the existence of environmental proactivity according to the size of the fisheries, a Spearman correlation analysis was used. The Spearman correlation is a non-parametric measure of correlation, which studies the statistical dependence of two variables. We considered the number of members and/or ships as a measure of the fishery size. Thus, the correlation between the fishery members and/or the number of ships and the environmental actions carried out by the fisheries considered in the study were analyzed. These correlation levels are given in Table 5.

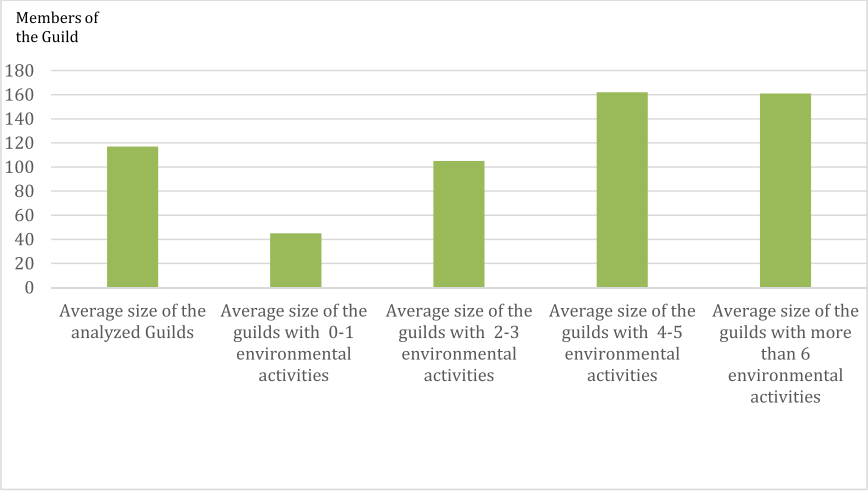


Fig. 2. Size of the guilds according to the number of fishers and the number of environmental actions carried out.
Source: Authors' own elaboration.

Table 4
Number of environmental actions according to the guild's size.

	Total		0–1 actions		2–3 actions		4–5 actions		+ 6 actions	
	Size[a]	N Act[b]	Size	N Act	Size	N Act	size	N Act	size	N Act
Mean	117	3.16	42.7	0.54	104.8	2.46	163.1	4.47	161.2	6.6
Median	92.5	3	14.05	0.16	103.5	2	108	4	160	6
St. Dev.	111.1	1.98	44.43	0.52	51.99	0.51	155.5	0.51	100.2	0.89
Kurtosis	7.52	0.53	3.55	2.44	0.87	2.31	3.69	2.26	0.21	0.31
Range	595	8	145	1	168	1	594	1	265	2

[a] Size: Members of the Guild.
[b] N Act. Number of environmental actions.
Source: own elaboration.

The two variables showed a degree of correlation greater than and/or closer to 0.5 with a high level of significance (at level 0.001). Therefore, in general terms, there was no conflict between the size of the fisheries and their environmental proactivity. In fact, we could state that the greater the number of members and/or the number of ships the more environmentally proactive the fisheries were.

When studying this kind of correlation by regions, Catalonia showed the highest degree of positive correlation, with values that ranged from 0.709 to 0.747 when considering number of members (at a significance level of 0.01) and number of ships (at a significance level of 0.01), respectively (See Table 6).

Furthermore, when studying provinces (See Table 7), Valencia and Almería led with values equal to 1.000 (at a significance level of 0.01), followed by Barcelona showing results that ranged from 0.866 to 1.000 (at a significance level of 0.05 and 0.01), for number of members and number of ships respectively. Girona took third place (0.882 at a significance level of 0.05) when considering the number of members. However, when considering the number of ships, Girona also showed a high degree of positive correlation (0.838 at a significance level of 0.05). All these results confirmed that Catalonia was the region with the highest degree of correlation (Barcelona and Girona being provinces of Catalonia).

It should be pointed out that an important factor, with respect to the extent and consistency of environmental actions, was the strength of leadership within the guild, and the ability to mediate between the most dynamic groups and the more reluctant ones.

> "I'm telling you that here, at the level of the Guild, we are doing very well. Nowadays we sell on the Internet, that didn't even exist before. The Main Skipper and the manager are just the best! Manolo, the manager of the Guild, runs the whole show. He is down to earth, a guy from the village, who has always looked out for the people". (Small scale, Valencian Community)

> "I believe that the biggest mistake that any guild can make is to underestimate the role of the secretary, in this case, Isabel, who is there 24 h a day, and is in charge. The fact of having a good secretary, or a great secretary is what makes the others, those of us at this table, do well. She has been made with the strength that if she says "white", it is "white" and we listen because we, the fishers, have seen that she is a very honest person who suffers for us. Here there is a good board because of a great secretary, and she makes us do better". (Senior skipper, Catalonia).

Table 5
Correlation between environmental proactivity and fishery size (members and ships as a measure of size).

		Members	Ships
Environmental proactivity	Correlation coefficient	0.521	0.451
	Sig. (bilateral)	0.001	0.001
Correlation is significative at level 0.001			

Source: Authors' own elaboration.

Table 6
Correlation between environmental proactivity and fishery size (members and ships as a measure of size). Most representative Region "Catalonia".

Catalonia region		Members	Ships
Environmental proactivity	Correlation coefficient	0.709	0.747
	Sig. (bilateral)	0.01	0.01
Correlation is significative at level 0.01			

Source: Authors' own elaboration.

Table 7
Correlation between environmental proactivity and fishery size (members and ships as a measure of size). Most representative Provinces.

		Members	Ships
Valencia province			
Environmental proactivity	Correlation coefficient	1.000	1.000
	Sig. (bilateral)	0.01	0.01
Correlation is significative at level 0.01			
Almeria province			
Environmental proactivity	Correlation coefficient	1.000	1.000
	Sig. (bilateral)	0.01	0.01
Correlation is significative at level 0.01			
Barcelona province			
Environmental proactivity	Correlation coefficient	1.000	0.866
	Sig. (bilateral)	0.01	0.05
Correlation is significative at level 0.01			
Girona province			
Environmental proactivity	Correlation coefficient	0.882	0.838
	Sig. (bilateral)	0.05	0.05
Correlation is significative at level 0.01			

Source: Authors' own elaboration.

Both the measures and the general regulations are meaningless without an efficient control system. Once again, the fishers' guilds played a fundamental role in environmental management. 39 of the guilds studied claimed to carry out controls that contributed to compliance with environmental regulations (question 24). Twelve of the guilds have established their own controls on minimum weights and sizes and a further four control schedules or quotas. As for the method of control, it was not standardized and we observed a great variety: from simple observation, to control of documentation or the use of cameras (question 24, b). It was acknowledged that the sale of fish in Spain was almost always carried out on the premises of the guilds, and it was here where most of the controls were implemented.

A variety of sanctions to transgressors of these rules are imposed by the guilds. In addition to having the obligation to report offenders to the authorities, many decide to impose financial fines, although most choose internal sanctions that involve leaving the offender out of additional

benefits or bonuses; making them wait last in the auction or delaying the departure time when fishing; they can be excluded from services such as the delivery of ice or boxes, and there have been cases of expulsion of the offender from the guild (question 25).

3.3. The need of collaborative forms of management

This brought us back to our starting hypothesis. To tackle the issue a question in the last part of the survey was asked directly to find out whether a more sustainable model could be achieved by giving the fishers associations more responsibility for fisheries management (question 39).

As we can see in Fig. 3, 67% of the guilds answered yes, and justified their answer by the first-hand knowledge that fishers had of their environment, as well as the sector's own interest in maintaining the marine environment and fish stocks. But there was a not insignificant percentage that showed their doubts. These doubts had to do with a strong feeling of not being listened to:

> "Anyway, we go to meetings in Madrid and we only listen; if we ask, they do not answer us, they say later on. they do their own thing." (Manager, Andalusia)

> "There are things that they (biologists) do not listen to and they have to listen because, yeah, you can study, you can read books. But I believe that you learn more from the ones who live it, the one who lives this is the one who learns, that's how it is." (Trawler, Valencian Community)

> "For me, I don't care about one thing or the other, being a politician, not being a politician, being right-wing or left-wing. I don't care. What I want is that I can be heard anywhere." (Manager, Murcia)

The most repeated phrase in practically all the interviews was "they don't listen to us", showing a lack of confidence that could hinder collaboration.

4. Discussion and conclusions

In light of the dramatic environmental situation of the Mediterranean [1,46] the administration has established a range of environmental regulations and measures focused mainly on regulating the extraction of resources. Among them, shares, license limits, the establishment of minimum sizes, the types of boats and gear allowed, and the establishment of temporary or spatial closures are the most used. However, their effectiveness depends fundamentally on appropriate scientific knowledge, the involvement and cooperation of all stakeholders and an efficient control system on the part of an administration that usually lacks sufficient resources [47].

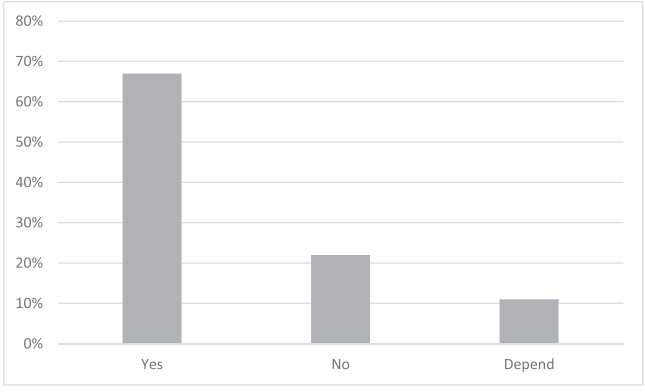


Fig. 3. Proportion of fishers' guilds respondents who agree, disagree, or neither agree nor disagree with the question: Would a more sustainable fishing model be achieved if the guilds had more responsibility for fisheries management?. Source: own elaboration.

According to our hypothesis, in each of these factors -knowledge, control system and cooperation- the fishers associations play a fundamental role. Their members have contextualized and updated knowledge of the marine environment that can complement scientific data. It should not be forgotten that much of the basic knowledge of the resource and the motivations to use it sustainably resides with the fishers themselves [48–50].

According to the first specific aim, we have analyzed the environmental actions carried out by the guilds. As can be seen, most of the guilds establish their own fishing rules. In fact, guilds and fishers carry out numerous environmental actions such as the collection of marine debris, the establishment of closures, shares and minimum sizes or the delimitation of their fishing zones. Guilds also generate their own specific rules for their territory and ensure their compliance. These actions are carried out either on their own initiative or together with the administration, in some cases collaborating in the control of the established norms. However, in many cases more restrictive norms are put in place by the guilds, that go beyond the imperative law [30,51], because it is in their own interest to maintain the resources better (and thus ensure their own profitability and survival).

The statistical analysis carried out by region shows that size is a determining factor. Guilds need to reach a minimum critical size in order to be able to take on environmental management. An analysis of the actions shows that the most complex ones are usually carried out together with other agents such as universities or NGOs, as well as by outsourcing the services to professionals, hired by the guild itself, the public administration, or other stakeholders. This requires guilds to have a minimum size and count on the necessary human, technical and economic capacities. Promoting joint actions by guilds could be a promising strategy.

Another key issue is the role played by the decision-makers of fishing institutions. A strong and active leadership, aware of its environmental responsibility, promotes and applies actions that reconcile the economic and ecological interests necessary for the survival of the sector. Strong leadership usually results in innovative initiatives, crucial in successful fishery co-management [52–54]. This factor may be even more decisive than the size of the guild. In fact, our qualitative analysis has found that small guilds, but with a dynamic leadership, are involved in all types of actions.

All previous analysis leads us to the third specific aim, to see to what extent collaborative forms of management are possible, in other words "are the fishing institutions prepared to manage their fishing resources by means of a true co-management? ".

These issues have been fueling an interesting debate, which can be considered polarized between two different models [55]. On the one hand, the *Ecological Understanding Model* emphasizes the role of local agents and their knowledge of their environment and, therefore, in their capacity for its conservation and their ability to adapt to the changes that may occur. On the other hand, the *Depletion Crisis Model* questions whether these systems can be considered to represent 'conservation' and, therefore, whether their management can be entrusted to resource users. In this sense, it is argued that such management can not focus on sustainability, as it has neither been designed to do so nor does it prevent or mitigate resource depletion or habitat degradation [56]. Its actions have been limited to expressing a mere reaction to resource scarcity and conservation has only been a collateral effect of a management designed to maximize yield.

In any case, we consider that the fishers' motivations have not invalidated a fisheries co-management model where the guilds are in charge of the fishery resources within their sphere of influence. As we have seen, guilds have, to a greater or lesser extent, knowledge, practices, regulations, and control systems aimed at environmental sustainability. Nevertheless, as our informants indicate repeatedly, 'listening and being heard' is where co-management should begin.

Guilds are institutions that have been around for hundreds of years

and still represent a large part of the Spanish fishing sector and play a fundamental role in fisheries management. In addition to their classic social and economic functions, they now play a necessary role in environmental sustainability. An environmental sustainability that requires deeper and better understanding, capable of generating contextualized and updated rules and actions, as well as the necessary means for their control.

Both national and European legislation show the political will to move towards a co-management model for sustainable fisheries. However, there are many doubts that need to be addressed, even at an academic level, about the authenticity of the fishers' environmental interests as well as their scientific capacity. Thus, current environmental fisheries management comes from the top down, based on scientific information used to justify an environmental regulation managed and controlled by the administration.

However, this model shows weaknesses and lacks legitimacy among those who have to carry it out: the fishers. In fact, as the analysis has shown, the fishers themselves and their institutions are the ones who best know the context in which the rules are to be applied, and without their complicity it is very difficult to implement effective means of control. Furthermore, they also have much to contribute to the biological and environmental information that is handled.

Thus, as we have pointed out in the main hypothesis of this work, guilds seem to play a growing and active role in maritime environmental management, although it is possibly still too early to speak of environmental co-management, among other reasons, due to the reluctance of the administration itself. Therefore, it is essential to deepen the knowledge of the factors that enhance or limit such actions and to ascertain the extent to which collaborative forms of management are possible.

In summary, to achieve true co-management, fishing institutions must be given competencies and responsibilities. In Spain, guilds are becoming aware of this fact and in recent years have been taking on an increasingly active role in the environmental management of their territories. This requires greater human and material resources, a strong determined leadership committed to the environment and, above all, an openness on the part of the public administration to include them in the decision-making process.

The emergence of FLAGs in the Spanish Mediterranean during the period of the European Maritime and Fisheries Fund (2014–2020) may represent an important change in environmental management in the fisheries field. The regulations of these funds expressly point to the possibility of financing environmental actions, in fact, the first estimates defined around 8.5% of the projects financed in Spain as environmental projects [27]. Therefore, new possibilities of environmental co-management appear where fishers and their institutions have new responsibilities and resources, as well as the possibility of collaborating with other stakeholders such as NGO's, companies, public institutions, universities, etc. From an academic point of view, this opens the door to new research in the involvement of fishers in environmental management, their relationship with other stakeholders and, above all, the possibility of having quantitative data on the environmental actions financed, since the difficulty in obtaining or the lack of such data has been one of the major limitations of this research.

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CRediT authorship contribution statement

Paloma Herrera Racionero: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Resources, Supervision. **Luis Miret-Pastor**: Formal analysis, Investigation, Resources, Writing – review & editing. **Roberto Cervelló-Royo**: Validation, Data curation, Writing – review & editing. **Miguel Rodilla-Alama**: Investigation, Formal analysis.

Availability of Data and Material

The information has been obtained through surveys. If necessary, the database can be made available.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2022.105058.

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