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Perceptions of threats facing Cabo de Palos - Islas Hormigas MPA and potential solutions

Running head: Perceived threats facing Cabo de Palos – Islas Hormigas MPA

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Perceptions of Threats Facing Cabo de Palos- Islas Hormigas MPA and Potential Solutions

Abstract

Many marine protected areas (MPAs) face a multitude of threats to the ecosystems that they have been established to conserve. This study is based on 111 interviews conducted in 2013-2014 designed to discover the perceptions of stakeholders about the threats, the causes of the threats, and their responses to the threats, to a well-established MPA – Cabo de Palos - Islas Hormigas (CPH-MPA). This MPA was created to safeguard fisheries and associated artisanal fishers, but over time it has become a tourism 'hotspot.' Resilience theory, which incorporates ecological resilience, social resilience, and individual resilience, helps us to analyze stakeholders' responses to threats by categorizing them into passive, adaptive, and transformative responses. We found respondents identified four main threats – over-fishing, excessive scuba diving, pollution, and invasive species; attributed the threats to three main causes – ineffective management, poor environmental stewardship, and climate change; and expressed three kinds of responses – do nothing, adapt, or transform – with a preference for adaptation and (especially) transformation. The lesson of this study is that it shows how, unless drastic action is taken to curb recreational diving activities, the CPH-MPA is in danger of changing from a fishing reserve to a largely unregulated leisure diving venue, which is unlikely to fulfill the requirements of resilience; ecological, social, or individual.

Key words: marine protected areas; resilience; perceptions; threats; solutions; adaptation; transformation

Introduction

Marine ecosystems are some of the world's most valued and productive ecosystems and, unsurprisingly, among the most heavily degraded, with human pressures such as pollution, resource

exploitation and extraction continually increasing (Crain, Halpern, and Beck 2009; Halpern et al. 2008). Marine protected areas (MPAs) are a favored management tool of many marine scientists to address the well-documented global problems of marine habitat degradation, overfishing, resource extraction, illegal fishing and user conflicts over resource use (Caveen et al. 2013; Silva and Lopes 2015; Halpern et al. 2008; Crain, Halpern, and Beck 2009; Micheli et al. 2013). However, establishing an MPA does not guarantee success in conservation, because considerable effort is needed to maintain the MPA in place. This study investigates the perceived threats facing an MPA in southeast Spain – the Cabo de Palos-Islas Hormigas MPA (CPH-MPA) – which was established in 1995 as a reserve of fisheries interest (BOE núm. 161 de 7 de julio y Decreto 15/1995 de 31 de marzo) (BORM núm. 92 de 21 de abril de 1995) (BOE 2010) but has experienced a massive influx of recreational scuba divers which threaten its future ecologically, economically and socially. The main method of analysis used in the study is perceptions research. Through 111 semi-structured interviews, we analyze the perceptions of different actor groups associated with the CPH-MPA about what they see as the main threats, their causes, and the actor groups' responses to those threats to the marine environment in this reserve (Himes 2007; Ressurreição et al. 2012; Abecasis et al. 2013; Hak, Nadaoka, and Le Phu 2016). Perceptions-based studies are increasingly accepted as a means of obtaining critical insights into how to improve conservation effectiveness, the results from which can be incorporated into policy (Bennett 2016; Beyerl, Putz, and Breckwoldt 2016). Understanding how coastal areas and their management are perceived by the stakeholders affected by them will help define MPA management approaches that better reflect local needs and desires (Agardy, Notarbartolo di Sciara, and Christie 2011; Crain, Halpern, and Beck 2009; Abecasis et al. 2013). The study is underpinned by the theoretical framework of resilience theory (Walker and Salt 2006). There are three main elements of resilience theory - ecological resilience, social resilience, and individual resilience - each of which is relevant to the analysis. Our results include the finding that stakeholders' reactions to threats can be categorized into passive, adaptive, and transformative responses, of which adaptation and (especially) transformation offered the most promising ways of dealing with the threats to the MPA. In the following section, the resilience theoretical framework is described, and then the research methods used in this study are explained. After that, the results of the fieldwork are presented

and discussed, and in the concluding section, there is a summary of the paper's findings; several recommendations for CPH-MPA; and a note on the wider implications of the findings for our conception of what an MPA is.

Theoretical framework

This paper is informed by resilience theory. The concept of resilience has long been recognized in many academic fields. For example, ecologists have described resilience in an ecosystem in two ways: one that focuses on the speed of its return to equilibrium following a disturbance; and the other that focuses on whether the system can or cannot recover its original equilibrium (Walker and Salt 2012). Sociologists have studied collective ways in which societies cope with extreme threats to their stability (Lucini 2013; Olsson et al. 2015; Garmezy 1971; Luthar, Cicchetti, and Becker 2000). Psychologists have found marked differences in the resilience of individuals faced with traumatic and disastrous circumstances (Bonanno 2004; Olsson et al. 2015). Drawing on this extensive literature, we can divide resilience theory into three forms: (1) ecological resilience theory; (2) social resilience theory; and (3) individual resilience theory. As we shall see, all three forms of resilience are exemplified in the perceptions expressed by various respondents about the threats facing the CPH-MPA, the causes of those threats, and (above all) in their responses to the threats.

Ecological resilience theory

In the literature, there is a distinction between ecological resilience meaning the capacity of an ecosystem for adaptation, and its capacity for transformation (Bown, Gray, and Stead 2013). An ecosystem's capacity for adaptation is its ability to adapt to threats by absorbing them, thereby retaining its own integrity or current configuration (Walker and Salt 2006). An ecosystem's capacity for transformation is its ability to respond to threats which it cannot absorb, by changing its configuration and transforming itself into a different kind of ecosystem (Folke et al. 2005). Interestingly, Pitcher (2005) sees transformability not in terms of 'fundamentally new configurations', but of the ecosystem being transformed 'back to the future' – i.e. restored to its pristine past. We will see that some respondents refer to the CPH-MPA's capacity to absorb the threats facing it, while other

respondents regret what they see as its transformation from a fishing reserve to a diving reserve, and wish they could turn the clock back to the past.

Social resilience theory

Social resilience is the capacity of a people collectively to respond to environmental, socio-economic, political or other threats to their well-being, by adjustments of their own behavior in order to maintain social equilibrium or welfare. Significantly, social resilience may not always coincide with ecological resilience: "Systems may be ecologically resilient but socially undesirable, or they may be socially resilient but degrade their environment" (Folke, Colding, and Berkes 2003:354). This raises the question of whether the concept of resilience is a technical term or a normative term. Ascher (2001) claims that although many writers treat it as if it is a purely technical term, it has strong normative undertones in that it presupposes that features of the ecosystem are worth saving. Walker et al. (2002:3) state that: "The goal of resilience management is to prevent an SES (social-ecological system) from moving into undesirable configurations." So resilience is not an end in itself but a means to other ends. Indeed, as Holling and Gunderson (2002) point out, resilience is not always good (a 'bad' society may be very successful in resisting reform), so the aim is not resilience per se, but the kind of resilience that satisfies human aspirations, which include ecological, socio-economic, and governmental values. As Gallopín (2006) points out, this means that adaptability has morphed from a biological concept into an ethical concept. We will see respondents enunciating normative conceptions of social resilience in the form of perceptions of their collective responsibility for both causing and dealing with the threats facing the CPH-MPA.

Individual resilience theory

This ethical dimension of resilience is even more pronounced in the conception of individual resilience. Individual resilience theory is about the way individual humans respond to threats to their well-being. Faced by the insecurity of neo-liberal economic life, Chandler (2014) and Chandler and Reid (2016) draw a contrast between two modes of individual resilience: modernist and postmodernist. The modernist mode encapsulates the notion that resilience lies in actively adapting to

the circumstances that face you. The postmodern mode encapsulates the notion that resilience lies in transforming the circumstances that face you. There is a third response to insecurity that Chandler and Reid (2016) mention, which encapsulates the notion that resilience lies in passively accepting the circumstances that face you.

Passivity

Passive people either complacently see nothing under threat, or resignedly see the disadvantaged circumstances as a given, beyond their control. The complacent people ignore the warning signs of an unsustainable future. The resigned people adopt a coping strategy of hanging on (the business as usual approach), characteristic of older fishers who have lost most of their fishing opportunities but are determined to continue fishing because it is a way of life or vocation rather than a job or a means of remuneration. Several administrators complacently held that the CPH-MPA was not under threat, while some fishers expressed the view that they were powerless to prevent the threats. Passivity is not a 'solution' to a perceived threat but a response to it.

Adaptation

Adaptation is a mode of resilience in which individuals do not complacently or resignedly accept the circumstances in which they find themselves, but take positive steps to adapt to those circumstances. Chandler (2014:5) refers to this mode of resilience in terms of "responding ('bouncing back') from disaster or crisis"; "a process through which crises make us stronger, more flexible, and more open to new opportunities"; "about how we can act […] to minimize the effects of crises." As Chandler (2014:6) notes, this mode of resilience, which he calls the classical or modernist mode, focuses on "the subject's internal capacity to withstand pressures or stresses which were understood to be externally generated." In what follows, there are many examples of adaptive behavior reported by respondents.

Transformation

Transformation is a mode of individual resilience that rejects the classical or modernist mode of adaptation that focuses on the individual's ability to adapt to circumstances, and instead embraces the strategy of changing those circumstances. Transformation is a post-classical or post-modernist mode of resilience, which seeks to reshape the world, not adapt to it. Chandler says: "for me the problems are in the world, not in our heads […] [we need] to remake the world rather than to remake the human" (Chandler and Reid 2016:169). We will see that many respondents reported that their response was to transcend the threats that beset the CPH-MPA.

In the results section, we shall see that our respondents exhibit all of these responses to threats facing the CPH-MPA, especially the responses characterized in individual resilience theory.

Methods

Study area

The CPH-MPA (Fig.1.), located at 37°39N, 0°26W, covering 19km^2, was established in 1995 by the Spanish government with the objective to: "protect, regenerate and develop fishing resources to maintain sustainable fisheries, enabling artisanal fishermen in the area to preserve their traditional way of life and to support other low-impact activities (for example scuba-diving and environmental education) that contribute to economic development in the surrounding area" (BOE núm. 161 de 7 de julio y Decreto 15/1995 de 31 de marzo) (BORM núm. 92 de 21 de abril de 1995) (BOE 2010). The management responsibility is divided along the territorial baseline between the National Ministry of Agriculture, Food and Environment and the Council of Agriculture and Water of the Region of Murcia. Considered a biogeographic frontier, CPH-MPA is home to species from the Mediterranean sea as well as the Atlantic (Rossi, Giacomi, and López 2014), which, along with its unique geomorphology of being a narrow continental shelf formed by a series of sea hills and islets, has created a biodiversity hotspot (Calvín-Calvo et al. 1998). Studies show that protection has resulted in an increase in the abundance and biomass of numerous commercially important species, and a

recovery of the marine ecosystem (Felix-Hackradt et al. 2013; García-Charton et al. 2004; Hackradt et al. 2014). The village of Cabo de Palos, which is historically linked to the artisanal fishing industry, is surrounded by a developed tourist area to the north (La Manga and Mar Menor) and an industrial area to the south (Escombreras). Until the 1960s, the village had no electricity or running water, but this changed with the development of tourism. The village maintains a small but declining artisanal fishing fleet, in 1993 15 boats were registered, 10 in 2010, at the time of study (2013) only 6 of these vessels were operating (BOE 2010). To gain access to CPH-MPA, these artisanal vessels must have been operating in the area for four years before the establishment of the MPA, and legislation does not permit the addition of new vessels. In total the region of Murcia has 4 *cofradías*. In 2008 the census recorded 236 vessels: 171 artisanal, 33 trawlers, 24 purse seiners, and 8 long liners (Esparza 2010). The artisanal fishers from CPH-MPA belong to the second largest *cofradía* in the region - Cartagena (54 boats). *Cofradías* are local non-profit corporations with public rights, which represent the interests of the fishing sector by acting "as consultative and cooperative bodies for the administration, undertaking economic, administrative and commercial management tasks and with the ability to cooperate in matters of regulating access to the resources and informing over infractions occurring in their territory" (Pascual-Fernández 1999:71). Since the creation of the CPH-MPA, the scuba diving industry has grown substantially from no dive centers operating in the village in 1995 to nine at the time of study (2013). Various regulations apply to the dive industry, including a recently modified divers quota (which was increased from the original limit but was less than the actual number of dives undertaken given frequent breeches of the legislation) (BOE 2010; BORM 2014), a dive fee of $4 per dive (introduced in 2014 post fieldwork), and restrictions on the number of divers per boat and boats per buoy (BORM 2014; García-Charton 2016).

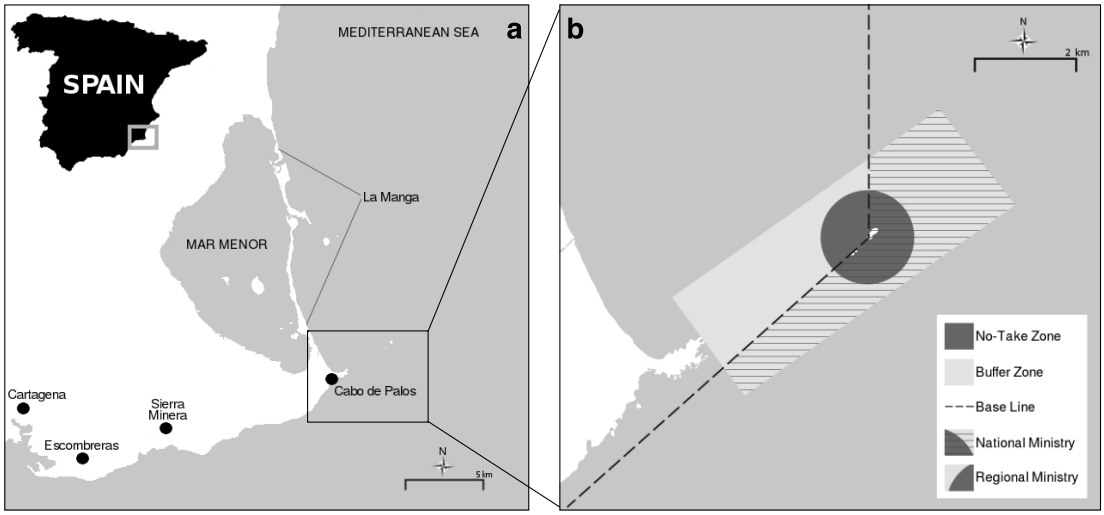

Figure 1: (a) Study site location; (b) CPH-MPA zoning and management responsibility

Data collection

Data were collected using semi-structured interviews (total = 111) conducted with marine resource users (fishers n=17, marine tourism operators n=38), additional community members (n=44), and key informants (KIs) (n=12). KIs included representatives from the relevant MPA administrations, authorities, research institutes, NGOs, and fisher and dive sector union/association representatives. Four trained research assistants along with the primary author conducted interviews in Spanish and gathered field notes. Of the 121 individuals identified as eligible to participate (individuals were considered to be eligible to participate if they were employed full-time in occupations associated with use of the MPA, were identified as knowledgeable about the MPA, were involved in its management, or were community residents), 10 refused, giving a response rate of 91% - representing 92% of marine resource users, 100% of the key informants identified and 4% of the village's adult population. Marine resource users and KIs were targeted primarily through purposive, opportunistic and snowball sampling (Bryman 2012). Community residents were selected randomly from a community map selecting every *nth* house. Approximately 78% of total respondents were male (91% of resource users (fishers and divers), 56% of community members, and 92% of KIs). Prior to fieldwork a pilot study helped fine tune and validate the survey layout and question phrasing. Part of a larger Ph.D. study (Monitoring Mediterranean Marine Protected Areas (ITN-MMMPA) the

questionnaire covered aspects of: environmental change, marine management; social capital; and also gathered household and demographic information. Of particular relevance to this research, respondents were asked to provide their perceptions on: the health of the environment; changes seen over the last 10 years; the most significant threats to the marine environment surrounding the reserve; their causes; and recommendations to management. Three validation and feedback meetings were held in the community with resource users, community residents, and KIs who had participated in the project, in which the projects findings were presented and interpretations of these findings were discussed.

Data analysis

Audio recordings and field notes were transcribed verbatim, and professionally translated from Spanish to English. Responses to open-ended questions were manually coded and analyzed using Nvivo10® qualitative analysis software (QSR 2012) through an 'open coding' method (Bryman 2012). Open coding involves assessing similarities and differences in responses to questions and grouping of conceptually similar responses or opinions together into 'categories', which were defined using a common theme (Bryman 2012). Dominant themes were selected through an inductive process of reading and re-reading the transcripts, identifying repeated words and themes within and between interviews, and grouping the codes generated into collections of similar content (Bryman 2012). Memos were generated as themes emerged, which created an analysis trail demonstrating the decision-making process during analysis and how conclusions were reached (Christie 2005). This analysis approach ensured that the themes directly reflected the issues that emerged from the interviews rather than from hypotheses to be tested. This paper does make some use of quantification through analyzing the frequency of response of threats and causes to indicate when responses were held by many respondents.

Results

There are three parts to the Results section: interviewees' perceptions of threats; causes; and their responses to the threats.

Threats

Although many threats were mentioned, the majority (48 out of 62 individual threats) by resource users, respondents perceived four main threats to the sustainability of the CPH-MPA (identified from frequency of mentions) (Table 1): (1) over-fishing; (2) excessive diving; (3) pollution; and (4) invasive species.

Table 1. Respondents' perceptions regarding threats and causes to CPH-MPA (%)

		Fishers & Sector reps n=19	Divers & Sector reps n=39	Community n=44	Government n=3	Researchers & NGOs n=6
Threats	Over-fishing	27.8	45	31.8	100	100
	Excessive diving	11.1	20	20.5	100	100
	Pollution	66.7	57.5	81.8	0	16.7
	Invasive species	11.1	15	0	33.3	16.7
Causes	Ineffective management	55.6	60	29.5	33.3	66.7
	Poor environmental stewardship	22.2	50	77.3	66.6	50
	Climate change	11.1	7.5	0	66.6	16.7

Over-fishing

Respondents held there was too much fishing pressure on the reserve (41.4%: 46 individuals). Some said artisanal fishers took too many fish- a researcher said: "*general fishing pressure, including artisanal fishing, is unacceptable given the existing resources."* But 59% of those 46 respondents who mentioned over-fishing referred to industrial or trawl fishers and to illegal fishing by 'recreational' fishers, rather than artisanal fishing. On trawl fishers, an artisanal fisher said: *"The worst thing are trawlers that sweep everything away."* On illegal fishing, an administrator said: "*The greatest threat right now is illegal fishing by non-professional fishermen who fish the larger-sized protected species of this area."* On recreational fishers, a *cofradía* member said: "*Nobody controls these people […] this happens because those are wealthy people and the authorities turn a blind eye when they want because it's in their interest to let them do what they please."*

Excessive diving

Many respondents complained that the level of scuba diving was out of control (23.4%: 26 individuals). An administrator described it as being on an *"industrial*" scale. A fisher said there were 36,000 divers and another fisher said: "*What we actually have is a diving reserve instead of a fishing reserve."* In 2013 at the time of interview there were 26,388 immersions. This figure is still substantially lower than the 'theoretically' permitted maximum number of dives per year- 54,550, however it must be noted that the annual number misrepresents the breaches in legislation as numbers in peak season regularly exceed the 75 divers a day limit with figures reaching 300-400 immersions per day (BORM 2014; García-Charton 2016). Seasonality of tourism, poor weather and difficult diving conditions restrict number of divers at other times of the year (BORM 2014; García-Charton 2016). The damage inflicted on the coralliginous habitat by this overcrowding was incalculable. A KI said: *"It has international prestige, people come with little experience and due to the strong currents people grab anything from the bottoms not to be dragged along, they destroy everything, that's the biggest problem of Cabo de Palos."*

Pollution

For divers, fishers and residents, responses associated with pollution (including land and marine-based sources) were the most frequently cited threat with 71 out of these 102 (70%) respondents mentioning it, though neither researchers (one mention) nor the administration (no mentions) considered it a serious threat. Divers specifically reported pollution from boats spilling oil and paint, which produces toxic sludge: *"if the sludge was analyzed both the port and the reserve would be closed."* Other divers reported raw sewage discharged from broken emissaries. The community members interviewed (also including fishers and divers) spoke strongly of plastic waste and agricultural fertilizers dumped into the sea, causing mucilage blooms and slime which they reported prevented fishing and impacted diving.

Alien/invasive species

Several respondents expressed concern about the increase in what they perceived as alien/invasive species (9%: 10 individuals). The MPA regional administration reported the arrival of *Caulerpa*

racemosa (sea grapes)- an invasive algae, which was a threat to *Posidonia oceanica* (neptune grass), coralligenous and maerl habitats. A diver also reported damage done to sponges by *C. racemosa.* A researcher reported an invasive coral, *Oculina patagónica,* which displaced some native communities and increased the urchins' population.

Causes

Respondents blamed the threats on three key causes: (1) ineffective management; (2) poor environmental stewardship; and (3) climate change.

Ineffective management

Thirty two percent of respondents (36 individuals) criticized lack of law enforcement. For instance, a diver said that: "*Nobody controls the restaurants that buy illegal fish.*" The reasons put forward for poor law enforcement were many and varied. *Cofradía* representatives blamed the government's prioritization of tourism: "*They don't really take the reserve seriously because it would harm the tourist industry more than the fisheries sector, and they are interested in preserving tourism because it brings more money*." A researcher claimed the government was not ideologically committed to environmentalism, while an NGO representative asserted it only paid lip service to conservation objectives. Another researcher criticized the administration for ignoring their expert reports. A diver even accused the administration of corruption: "*they're corrupted, their only aim is to fill their pockets with money, they don't give a shit about what's going on in the place they manage."* A researcher blamed lack of cohesion between the autonomous community and the state, while another KI blamed the ignorance of the administration: *"The chief of the Fisheries Service is a man who before this was in charge of horses' vaccinations and the Director General is a woman who was in charge of sheep's vaccinations […] they don't know the sea or the fisheries sector.*" Many other respondents (15.3%: 17 respondents) blamed the lack of stakeholder consultation. Administrators attributed their inadequate performance to a reduced budget.

Poor environmental stewardship

Selfishness was suggested as another cause of some of these threats. An administrator said people fish illegally because the black market (i.e. direct sale of illegally caught goods to restaurants, markets etc.) is lucrative. A resident of the community said: *"Money moves everything."* Other respondents (24.3%: 27 respondents) put it down to lack of environmental knowledge. For example, a diver said that: *"education is one of the problems because we don't have yet an environmental awareness clearly defined and clearly rooted in our society."* A community resident complained that: *"People often don't care beyond their home doorway."*

Climate change

The third cause mentioned by respondents was climate change. For example a researcher said: *"if you are talking about the problem of coastal erosion within the reserve there are problems in the beaches, but this is a problem of the greenhouse effect, the rise of the sea level."* A fisher claimed that: *"Slime is a consequence of changes in water temperature from cold to warm."*

Responses

Respondents perceived they had three different kinds of response to these threats, which match the three kinds of individual resilience outlined in the theoretical framework: (1) passivity; (2) adaptation; or (3) transformation.

Passivity

Passivity is either a complacent or a fatalistic, response to the problems facing the CPH-MPA. Passivity implies an unwillingness to bring about change. An example of complacent passivity was when respondents said they did not need to do anything, as, when asked if they had any suggestions, an administrator said: "*No, I think that it is more or less in line with other European marine reserves and I think at the moment it works fine."* The representative of the *cofradía* said that overall the impact of the peak diving season was short-lived and the environment could withstand these intermittent periods of pressure. A diver claimed that diving was well controlled, while a community representative asserted that divers: "*protect the bottoms better than anybody else."* The regional MPA

administration said that pollution was not a real threat: *"the level of pollution is very low and the renewal of the waters is very high due to the currents in the area",* while a researcher claimed the reserve could recover quickly from pollution incidents. An example of fatalistic passivity was respondents saying they could not change anything, as when a diver said they were powerless: *"You can't challenge the administration. As an individual you're nothing."*

Adaptation

'Adaptation' is an active response to change one's behavior to suit the change in circumstances facing the CPH-MPA. For example, a fisher spoke of how fishers have already adapted their fishing activities to suit their current circumstances by switching between gears or targeting new species. Some divers accepted they must change their behavior to be more environmentally responsible, while other divers said their clubs had already begun to adapt their activities by, for example, controlling the number of immersions The administration said they had adapted to meet changed financial circumstances: *"when there is no public money to invest in guards there are civil servants from the Region of Murcia doing night shifts […] the forced adaptation to harder conditions involves keeping the same line of work."* Community residents urged people to behave more responsibly, while an NGO representative called for more social and environmental awareness. Divers sought collaboration: *"we have realized that each working alone we achieve nothing"; "There must be a sense of coexistence and symbiosis."*

Transformation

'Transformation' is a response to change the external circumstances facing the CPH-MPA. Eight kinds of transformation were recommended: (1) stakeholder participation (SP) in management decisions; (2) stronger enforcement of existing regulations; (3) new regulations to control diving; (4) more flexible application of EU Directives; (5) transformation of the reserve; (6) more ecological research; (7) provision of environmental education; and (8) direct support for artisanal fishing.

(1) On SP, many actors suggested that the external circumstances facing them should be transformed by establishing a more participative and bottom-up form of governance (24.3%: 27 individuals). A

cofradía representative said management should take more account of the views of fishers who work in the reserve every day, while a community member urged the administration: "*to listen more to local people"* and an NGO representative suggested making SP compulsory. A diver wanted self-management for divers, while a community member suggested fishers' self-manage, because fishers: *"really know the area [...] It should be managed from within."* A researcher and an NGO representative recommended co-management so that all stakeholders could take part in decision-making. A member of the administration recognized that it needed to work more closely with civil society.

(2) On stronger enforcement of existing regulations, divers said more surveillance was needed, along with "*very severe sanctions*" against violators of regulations including stronger action taken against restaurateurs who bought illegally caught fish. Researchers said the MPA's funding system must be secured to ensure adequate enforcement. Thirty three percent of respondents (37 individuals) recommended making improvements to enforcement.

(3) On new regulations to control diving, 15 divers (38.5%) themselves suggested that the regulations controlling diving should be enhanced, and they proposed a raft of new restrictions, including minimum qualifications for divers to allow them to dive; establishment of reserve guides to control all immersions; a requirement that all dives take place within diving centers; and a limit on boats in diving centers to three, with a maximum of 10 divers per boat. This was a reflection of an interesting finding, contrary to expectations, that the most frequently cited suggestions put forward by the resource users (though by no other group) were a great number of new and stricter regulations (mostly related to the dive industry).

(4) On applying EU Directives more flexibly, a *cofradía* representative said there should be more efforts made to adapt EU legislation to meet local needs: "*we think that you must adapt the law to the different situation of the area, and every place has a different fishing specialty."*

(5) Twenty-seven percent of respondents (30 individuals) suggested transforming the reserve itself. Several divers said the working of the reserve should be reformed to spread out the pressure of diving

to different sites, and to introduce a zoning system to separate diving from fishing (33%: 13 divers). Another diver suggested expanding the reserve: *"If the whole of Cabo de Palos was a reserve we would get rid of illegal fishermen. We would earn in diversity, everything would get full of species",* which was a proposal endorsed by an administrator. A researcher held that more MPAs should be created to form a connected network.

(6) On more ecological research, researchers said that very little continuous monitoring was carried out in the CPH-MPA, and that there was insufficient contribution from experts to management decisions.

(7) On provision of environmental education, many community residents recommended more information brochures and publicity campaigns in the high season (47%: 21 individuals). Thirty-two percent (36 individuals) of all respondents suggested improving outreach and public education. A diver and an administrator suggested adding environmental awareness to the educational curriculum. Another diver proposed a compulsory environmental awareness course for divers.

8) On direct support for artisanal fishing, the administration was in favor of environmental certification for artisanal fishing, though it noted: *"We have already done some theoretical study on branding […] We are also talking to MSC but it's very difficult, it's an ecological label that is not well adapted to artisanal fishing."*

Discussion

In this Discussion section, we show how the above results can be interpreted through the lens of the resilience theoretical framework. First, there are elements of ecological resilience in the statements made by some respondents that the CPH-MPA has the adaptive capacity to absorb the threats posed by over-fishing, excessive diving, pollution and climate change. There are also contrasting elements of ecological vulnerability in the statements made by other respondents that the CPH-MPA was in danger of deteriorating into a degraded ecosystem because it was incapable of absorbing those threats and retaining its current identity. Interestingly, administrators tended to focus on threats that they had

the jurisdiction to manage, such as the activities of fishers and divers, whereas resource users and the local residents identified the threats that were affecting their everyday lives, including pollution, mucilage blooms and invasive species. Another striking result was the complete failure of government officers to mention pollution-related threats, which were prioritized by the resource users and local community. This finding alone suggests that the government officers managing the MPA are unaware of the local condition and community needs, and brings to light issues of jurisdictional capacity and competency.

Second, there are elements of social resilience in that the increasing dominance by divers may be socially (and economically) resilient, but at the expense of ecological resilience because it could inflict lethal damage on the fragile coralligenous substrata. Conversely, there are elements of social vulnerability in the hostile perception of fishers to the possibility of a shift from a fishers' reserve to a divers' reserve. Fishers saw such a shift as a disastrous prospect, thus illustrating a normative concept of social resilience. More broadly, there is a failure of social resilience to be found in the incapacity of the actors in the CPH-MPA to collectively deal with the problems facing the reserve. For example, many respondents attributed the causes of illegal fishing to the onset of the Spanish economic crisis and its associated cuts to public sector finance, along with environmentally unsound consumption choices and business practices from restaurants willing to purchase illegally caught produce. Similarly, many respondents blamed the explosive growth of the dive industry and consequent threats posed to fishing and the ecosystem from dive activity on the administration's failure to enforce existing rules and regulations, and the lack of legislative consistency between the two administrations regarding dive quotas, a situation replicated in other cases (Jentoft et al. 2012; Fabinyi 2008). As found in other areas (Abecasis et al. 2013; Ressurreição et al. 2012) social vulnerability was also evident in the reasons given by respondents for pollution, with visitors, tourists and individuals external to the community blamed for causing pollution and litter because of lack of awareness of the fragility of the marine environment.

Third, there are obvious elements of individual resilience in the perceptions expressed by interviewees about their responses to the threats – passivity, adaptation, and transformation. Although respondents

expressed more responses in the category of transformative resilience than in the two other categories, there were some striking examples of both passive and adaptive resilience. For example, on passive resilience, there was an extraordinary level of complacency among some administrators about the condition of the CPH-MPA, and a deep level of fatalism among some resource users about its future. On adaptive resilience, there was much emphasis by several respondents on how they could adapt to the changing conditions facing them, and how some of them were already adapting to those conditions. Another illustration of adaptive resilience was that several respondents held that resource users should take some responsibility by becoming environmental stewards. On transformative resilience, all groups were attracted to the idea of expanding the MPA, implying that the current protection afforded for vulnerable species is insufficient and would be improved if other important habitats and areas subject to erosion and development (e.g. sea-grass beds, beaches and coves) were also protected. The four groups also expressed themselves in favor of better enforcement of existing regulations, and the creation of new regulations (mostly related to the dive industry) to improve the current enforcement system. Regulation enforcement has been reported as a frequent priority of MPA users worldwide, with inadequate attention to compliance cited as another common failure of MPAs (Agardy, Notarbartolo di Sciara, and Christie 2011; Abecasis et al. 2013; Dimech et al. 2009; Trenouth et al. 2012; Guidetti et al. 2008; Pomeroy et al. 2015). Another transformative response was about properly financing the management of the reserve (Gill et al. 2017). One radical idea was to ring-fence the funding to prevent it from being cut during periods of austerity. Another response was to introduce diver fees and/or take profits from the dive industry, to fund surveillance and employ resource users as MPA wardens (an idea that has worked positively in other cases increasing community stewardship and social acceptance) (Roberts and Jones 2013; Pomeroy, Katon, and Harkes 2001; Jentoft 2000). Since the interviews were conducted, a diver fee has been introduced- the results of which are yet to be seen and especially as how/if the money is to be 'used' by the regional administration to feed back into the MPA is complicated by tax regulations. The fact that many divers perceived such proposals as fair, shows that they recognized the need for greater control over their own activities, and that they were prepared to forfeit immediate profit to ensure long-term sustainability. Many of these ideas have been adopted successfully in other regions - e.g. fees and

monitoring carrying capacities (Davis and Tisdell 1995; Fabinyi 2008; Badalamenti et al. 2000; Milazzo, Badalamenti, and Ceccherelli 2004; Milazzo et al. 2002). Several other studies have found that resource users frequently acknowledge that tighter controls are essential for the long-term viability of resources (both for extractive and non-extractive use) (Yates 2014; Dimech et al. 2009; Trenouth et al. 2012; Abecasis et al. 2013; Pomeroy et al. 2015).

Another transformative response was to embrace stakeholder participation. All actor groups expressed support for more participative opportunities. Resource users, for instance, aspired to involvement as MPA wardens and for greater decision-making power; researchers emphasized the need for greater expert involvement, claiming that current management decisions are taken without sufficient research evidence; and administrators favored more consultation with users (Massaua, Thomas, and Klinger 2016)- ideas which are endorsed in much of the literature (Voyer et al. 2015; Hogg et al. 2013; Massaua, Thomas, and Klinger 2016). Another perception shared by all groups and prioritized by government officers and the wider community was to increase awareness and outreach by improving current levels of environmental awareness, communication, and availability of information. On this and other issues, however, administrators' responses were often brief and guarded, which may be either because they lacked local site knowledge (the MPA administrators are based in Madrid, 480km, and Cartagena, 35km, from CPH-MPA), respectively, or because they diplomatically adopted a non-committal stance.

Conclusion

This paper is a study of stakeholders' perceptions of different kinds of threats to a MPA in southeast Spain (the CPH-MPA); the causes of those threats; and stakeholders' responses to them. We have found that respondents identified four main threats – over-fishing, excessive diving, pollution, and invasive species; attributed the threats to three main causes – ineffective management, poor environmental stewardship, and climate change; and revealed they had three kinds of response to the threats – passivity, adaptation, or transformation – with emphasis on adaptation and (especially) transformation. We recommend that MPA policy makers take account of these stakeholder

perceptions, especially where they incline towards transformation, because unless some major reforms take place, the CPH-MPA is in danger of transition from a fishing reserve to a diving reserve, which may not fulfill the requirements of ecological, social, or individual resilience. The wider implication of this study is to highlight a central issue for MPAs – that they are not static entities but dynamic systems, and that over a period of time, they may change fundamentally from their original purpose (Jentoft, Chuenpagdee, and Pascual-Fernández 2011). In the case of CPH-MPA, it is gradually changing from a reserve designed to safeguard the future of artisanal fishers to a reserve that serves the interests of recreational scuba divers. Such a change raises an important question of legitimacy: is the increasing dominance by divers a development that violates the 'social contract' of the original terms of the MPA to which local fishers signed up 20+ years ago? Or is it a development that follows a natural process of global economic evolution from which no occupational group can claim protection (Oracion, Miller, and Christie 2005)? In other words, are MPAs moral constructs for environmental stewardship, or economic vehicles for touristic development?

Ethics statement

Permission to conduct this study was granted by the Ministry of Agriculture, Food, and Environment in Spain, and ethics approval was obtained through submission of an ethics assessment to the University of Murcia Ethical Committee. Participants were informed of the aims of the project, how data would be used, and how they could access the study results. Researchers obtained oral consent from participants before conducting interviews. Personal identifying information was replaced with respondent ID numbers to ensure anonymity.

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