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ECOSYSTEMS AND SUSTAINABILITY

An overview of commercial fishers' attitudes towards marine protected areas

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Abstract Marine protected areas (MPAs) are attracting widespread attention worldwide as a tool for fishery management and marine ecosystem conservation. The establishment of MPAs has increased greatly in recent years mostly due to international commitments to the establishment of a global network of MPAs by 2012. MPAs have the potential to strongly affect the fishing industry, and their success depends, at least partly, on fishers' attitudes towards this management measure. However, research on MPAs tends to focus on the ecological and conservation aspects of this management approach and not on its human dimensions. Studies in attitudes, perceptions, beliefs and preferences related to MPA issues have been identified as priority social science topics in need of research. We present a 'rapid review', conducted systematically, of the literature published up to September 2009 and aimed at identifying the most investigated topics related to commercial fishers' attitudes towards MPAs, describing the main findings from these studies, and analysing the implications for management. Most published work focuses on fishers' attitudes towards issues of governance, conservation of biodiversity and the environment, and the impact of MPAs on fishing activity. Despite the recent increase in the literature on the human dimensions of MPAs, the present review reveals that little of this literature originates from empirical studies. Hence, given the forthcoming increase in the implementation of MPAs in the near future, research on fishers' attitudes towards these management measures is critically needed.

Keywords Fishers · Rapid review · Systematic · Marine protected areas · Attitudes · Perceptions · Beliefs

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Introduction

A marine protected area (MPA) is a generic term used to describe a wide range of marine areas which afford different protection and conservation strategies. MPAs have been established for a multitude of purposes but mostly as tools for fishery management and the conservation of species or habitats (Jones, 1994; Sumaila & Charles, 2002; Agardy et al., 2003; Guarderas et al., 2008; Guidetti et al., 2008). As such, MPAs vary widely in type and level of protection applied, ranging from areas that allow multiple-use to areas that restrict all human access (Gubbay, 1995; Kelleher, 1999; IUCN-WCPA, 2008). Sites which fit the definition of MPAs have been given a variety of names, including amongst others, marine reserves, sanctuaries, parks, no-take zones or areas, fishery exclusion zones, fishery reserves, closed areas. Besides the broad range of terms, the definition of the same term may vary significantly from one region or country to another (Christie & White, 2007). For example, in Kenya 'marine reserves' allow for non-destructive forms of fishing, whereas in Tanzania 'marine reserves' are no-take areas (IUCN-WCPA, 2008).

Marine protected areas have existed for hundreds of years, however, most statutory MPAs are quite recent and their establishment has increased greatly in recent years. Silva et al. (1986) listed 430 MPAs created by 1985, 10 year later Kelleher et al. (1995) estimated that this number had increased to more than 1,300 and, more recently, Wood (2007) reported that approximately 5,000 MPAs had been designated worldwide. This figure is now (in 2010) likely an under-estimate given the rapid progress in the implementation of this management approach. The recent rapid growth in the global establishment of MPAs observed so far has resulted mostly from international commitments initiated at the Johannesburg 2002 World Summit on Sustainable Development (WSSD), which called for the establishment of a global representative network of MPAs to restore degraded aquatic ecosystems and fish stocks to healthy levels by 2012. Following this, several other international commitments, such as the Evian agreement signed by the G8 group of nations in 2003 (Evian Summit—Marine Environment and Tanker Safety: G8 Action Plan, Evian, June 3, 2003, France), and the United Nations Convention on Biological Diversity in 2004, further reinforced the call for a network of MPAs. These global undertakings were complemented by various international agreements at more regional levels. For instance, at the European level the agreement by OSPAR and HELCOM members in 2003 ('OSPAR Convention'—Convention for the Protection of the Marine Environment of the North-East Atlantic; 'Helsinki Convention'—Convention on the Protection of the Marine Environment of the Baltic Sea Area), and recent legislation (the Marine Strategy Framework Directive (MSFD), Directive 2008/56/EC, of 17 June 2008) reinforce the call for the use of MPAs and MPA networks within European waters.

Marine protected areas are increasingly recognised as having linked social and ecological dynamics (Agardy, 2000; Mascia, 2004; Pomeroy et al., 2007; Charles & Wilson, 2009; Pollnac et al., 2010). However, most published research tends to explore the ecological and conservation aspects of MPAs and not its social, economic, cultural, political and institutional implications. Only recently has the literature started to address the human dimensions of MPAs; covering topics on socio-economic and cultural aspects of MPAs, MPA governance, and a broad exploration of the human dimensions of MPAs (e.g. Bunce et al., 1999; Mascia, 1999, 2003; Pollnac et al., 2001; Cicin-Sain & Belfiore, 2005; Christie & White, 2007; Jentoft et al., 2007; Pomeroy et al., 2007; Charles & Wilson, 2009).

Studies in attitudes, perceptions, beliefs and preferences related to MPA issues have been recently identified as priority social science topics in need of research by governmental agencies and NGOs highly involved in the implementation of MPA (see Wahle et al., 2003; Pomeroy et al., 2004, 2005; NOAA, 2005).

As mentioned previously, although MPAs have been established for a multitude of reasons, they are principally established either for marine ecosystem conservation or for sustainable fisheries exploitation. As such, commercial fishers are amongst those most directly affected by MPAs (Badalamenti et al., 2000; Jones, 2008) and that can impact on MPAs the most. The performance of MPAs depends, at least partly, on fishers' behaviour (Dimech et al., 2009; Suuronen et al., 2010) and a failure to understand their attitudes and perceptions towards issues related to MPAs may undermine their success (Himes, 2007; Jones, 2008; Charles & Wilson, 2009; Dimech et al., 2009).

Research on fishers' attitudes, beliefs, perceptions and preferences related to MPA issues examines the underlying motivations that may influence fishers' preferences, choices and actions (Wahle et al., 2003). As such, understanding the attitudes and perceptions of fishers towards MPAs could help predict their likely behaviour towards this management tool and contribute to its success.

Given the importance of the attitudes of commercial fishers to the success of MPAs we carried out a 'rapid review' in order to compile the literature which reports empirical evidence on commercial fishers' attitudes, perceptions, opinions and beliefs about MPAs. We also aimed to identify which are the most investigated issues, synthesise the main findings and analyse the implications for management and governance.

The rapid review was carried out systematically following Petticrew & Roberts (2006) guidelines. Systematic reviews are a form of structured literature review which aim to comprehensively identify, appraise and synthesize all relevant studies on a given topic in a systematic and critical fashion. Research results on a specific topic are sought using a 'search strategy' designed to locate as many sources of information as possible. Once the sources of data have been identified, they are assessed against pre-set criteria. All the stages of the process are clearly documented such that the work can be repeated and the same results obtained (Petticrew & Roberts, 2006). Systematic reviews are widely used as an aid to evidence-based decision-making. They are extensively used in the medical sciences, and more recently systematic reviews have been undertaken in a variety of fields, including biology, ecology and economics (Petticrew, 2001; Petticrew & Roberts, 2006). Several sets of guidelines for conducting systematic reviews in the social sciences and in conservation and environmental management have been described (Oxman, 1994; Petticrew & Roberts, 2006; Pullin & Stewart, 2006; CEBC, 2009).

Increasingly, due to time and financial constraints, rapid reviews rather than full systematic reviews are being undertaken (Watt et al., 2008a, b). The scope of rapid reviews are limited to enable the work to be undertaken as robustly as a systematic review but in a shorter period of time (Ganann et al., 2010). For instance, the search may be limited to certain years, range of databases searched, range of languages included, or by not extending the search beyond electronic searches (Petticrew & Roberts, 2006; Watt et al., 2008a, b; Ganann et al., 2010). All such limitations should be clearly specified in the reporting of the study.

The rapid review approach was chosen for the purposes of this study due to time and financial constraints and because it was considered that this would be suitable for providing this first overview on this topic.

Methodology

Search strategy and inclusion criteria

The current review consists of a literature search for relevant studies published in peer-reviewed journals, up to September 2009. The literature search was carried out by searching all databases in ISI Web of Knowledge, Scopus, Science Direct, Blackwell Synergy, IngentaConnect and JSTOR. A sensitive systematic search strategy which combined the terms 'marine protected areas', together with 'attitudes', 'perceptions', 'beliefs' or 'opinions', and 'fishers' and their synonyms, and used the truncation features of the databases was employed. The search strategy is available from the authors on request. Titles and abstracts were scanned by C.P. to identify studies potentially eligible for inclusion. A 20% sample of the retrieved records was also scanned by a second reviewer (K.M.). No major disagreements arose and any discrepancies in the studies selected for inclusion were resolved by discussion between the authors. The full text of the initially selected studies was then retrieved and a further selection process undertaken. References in all relevant papers were screened for additional papers. Criteria for inclusion in the rapid review were restricted to the following: (1) the study included a survey of commercial fishers; (2) the study reported data on attitudes, perceptions, opinions or beliefs about MPAs; (3) the study was published in a peer-reviewed journal indexed in the databases before September 2009.

The review question was intentionally left broad with the aim of identifying all articles investigating fishers' attitudes, perceptions and opinions on issues related to MPAs. Our rationale for specifying a broad research question was that no previous attempt has

been made to review systematically any of the work published in this field. Also, and although systematic reviews often benefit from spatial restrictions as country or cultural context may severely impact outcomes (Egan et al., 2009), no country or language restrictions were included in the search in order to collect all available data (i.e. although the search terms were in English, due to all the databases searched being indexed and having titles and abstracts available in English, no studies were excluded on the basis of being published in another language).

Data extraction and analysis

Data extraction followed the guidelines developed by Petticrew & Roberts (2006). Data extraction of the included studies was undertaken by C.P. The data extraction process was quality assured by K.M. who checked a random 20% sample of the data extracted. Extracted data included: descriptions of study sites (geographical boundaries, history of implementation of MPA, and management, governance, socio-economic and cultural aspects); information regarding the MPA (type, year of implementation, objectives, size, purpose of designation); description of the fishing activity; methodological information (number of participants in the survey, response rates, sample design, selection criteria, number of study sites, population size); method of data analysis; main results and conclusions. Some of the methodology and analysis undertaken in the studies are reported in Table 1.

The included articles were analysed descriptively. Statistical analysis or meta-analysis was not attempted due to the variability among included studies in their research questions, research methods, data collection methodologies, type of data collected and analysis conducted.

Results

Included studies

The initial literature search identified a total of 115 potentially relevant articles. After the examination of the abstracts, 84 were excluded due to not meeting the inclusion criteria and full text of the remaining 31 were obtained and considered for inclusion; of those, 17 were subsequently excluded due to not meeting the inclusion criteria. The screening of the reference lists of the studies considered for inclusion identified a further 44 potential relevant articles, 42 of which were subsequently found not to meet the selection criteria. In total, 16 articles met the inclusion criteria and were selected to be used in the review. See Fig. 1 for the flowchart showing the stages of identification of studies in the review.

The articles included in the review are summarised in Table 2. The articles reported surveys conducted in both developed and developing countries, related to a wide array of types of MPA designations, implemented both with conservation and fishery management purposes. The studies gathered information either solely from commercial fishers or from commercial fishers and other stakeholders. Furthermore, the review revealed that articles about fishers' attitudes, perception, opinions and beliefs regarding issues related to MPAs focused basically on three different topics; fishers' attitudes, perceptions and opinions regarding: (i) governance issues related to MPAs, (ii) environment and biodiversity conservation issues related to MPAs, and (iii) the impact of MPAs on the fishing activity. Most surveys (81%) gathered information on more than one of these topics.

Governance issues related to MPAs

Most articles reported on fishers' perception, attitudes, opinions or beliefs concerning governance issues related to MPAs. Information on this topic was collected in 14 out of the 16 studies, and the studies assessed fishers' perceptions on a wide array of issues related to governance. Ten articles reported on fishers' attitudes, perceptions or opinions regarding MPAs as management tools (Blyth et al., 2002; Mangi & Austen, 2008) and on the acceptance and effectiveness of these management measures (Suman et al., 1999; Himes, 2003; Gelcich et al., 2005; McClanahan et al., 2005, 2008; Jones, 2008; Oikonomou & Dikou, 2008; Suuronen et al., 2010). Three articles also reported on fishers' perceptions of costs and benefits of MPAs (Gelcich et al., 2005, 2009; McClanahan et al., 2008). Five articles reported information on fishers' attitudes regarding empowerment and participation in the management and

Table 1 Summary of methodology and analysis undertaken in the studies included in the systematic review

Study	Year of survey	Data collection method	Sampling method	Sample size		Main questions format	Comparison groups			Statistical analysis	
				Commercial fishers	Other		None	Different groups fishers	Fishers and other groups	Univariate/ bivariate	Multivariate
Blyth et al. (2002)	NA	Face-to-face semi-structured interviews	NA	17	3	Open-ended	−	+	−	+	+
Dimech et al. (2009)	2006	Questionnaires by telephone interview	Stratified	194	47	Likert-scale	−	+	−	+	+
Gelcich et al. (2005)	2003	Questionnaires and PRA	Random	60		Likert-scale	−	+	−	+	+
Gelcich et al. (2008a)	2004	Group sessions and face-to-face structured questionnaires	Random	217		Likert-scale	+	+	−	+	+
Gelcich et al. (2009)	2006	Face-to-face questionnaires, semi-structured interviews and focus groups	Judgement (representatives from fishing unions), random (fishers)	143		Likert-scale	+	+	−	+	+
Himes (2003)	2001	Face-to-face questionnaires and unstructured interviews	Snowball	94		Open-ended, categorical	−	+	−	−	−
Jiménez-Badillo (2008)	2005	Observational study, structured questionnaires, focus groups	Random	396		Multiple-choice	−	+	−	−	−
Jones (2008)	2005	Semi-structured interview	NA	37	20	Open-ended, categorical	+	+	+	−	−
Mangi & Austen (2008)	2007	Face-to-face questionnaires	NA	48	172	Ranking and rating approaches, Likert-scale	−	−	+	+	+
McClanahan et al. (2005)	2003	Self-completion questionnaires	Interview large proportion fishers	224	44	Rating scale	−	+	+	+	+
McClanahan et al. (2008)	2007	Face-to-face questionnaires	Systematic	184[a]	14	Likert-scale, other rating scale	−	+	+	+	+
Oikonomou & Dikou (2008)	2005	Self-completion questionnaires	Random	30	151	Likert-scale	−	−	+	+	−
Stump & Kriwoken (2006)	2002	Face-to-face and telephone surveys	Random	51		Likert-scale, categorical	−	+	−	−	−

Table 1 continued

Study	Year of survey	Data collection method	Sampling method	Sample size		Main questions format	Comparison groups			Statistical analysis	
				Commercial fishers	Other		None	Different groups fishers	Fishers and other groups	Univariate/ bivariate	Multivariate
Suman et al. (1999)	1996	Face-to-face questionnaires and mail surveys	Random	337	332	Likert-scale	–	–	+	+	–
Suuronen et al. (2010)	2007	Focus groups and survey	Judgment	22		Open-ended	+	–	–	–	–
Tonder & Jurvelius (2004)	1999	Face-to-face semi-structured interviews	NA	4	34	Open-ended	–	–	+	–	–

NA information not available, *PRA* participatory rural appraisal

[a] Sample size. Survey was carried out to head of households and all were involved in fisheries (information provided by authors)

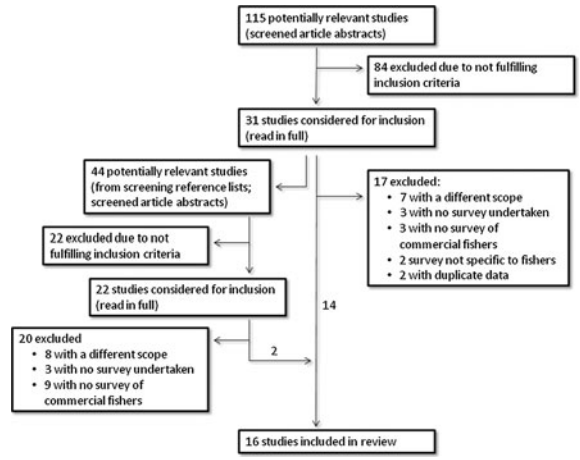

Fig. 1 Flowchart showing the stages of identification of studies in the systematic review

decision-making processes (Suman et al., 1999; Himes, 2003; Stump & Kriwoken, 2006; Oikonomou & Dikou, 2008; Gelcich et al., 2009). Three studies reported on fishers' perceptions regarding conflicts between different resource-users (Blyth et al., 2002; Dimech et al., 2009; Suuronen et al., 2010). And finally, eight articles reported on fishers' opinions concerning issues of compliance with, and enforcement of, rules and regulations (Blyth et al., 2002; Himes, 2003; Stump & Kriwoken, 2006; Jiménez-Badillo, 2008; Jones, 2008; Dimech et al., 2009; Gelcich et al., 2009; Suuronen et al., 2010).

Marine protected areas implemented for fishery management purposes (fishery MPAs) were generally accepted by fishers as effective and beneficial management tools (Suman et al., 1999; Himes, 2003; Gelcich et al., 2005; McClanahan et al., 2005; Jones, 2008; Dimech et al., 2009; Suuronen et al., 2010), while MPAs implemented for conservation purposes (conservation MPAs) were perceived less favourably (Suman et al., 1999; Himes, 2003; Tonder & Jurvelius, 2004; McClanahan et al., 2005, 2008; Jones, 2008; Oikonomou & Dikou, 2008; Gelcich et al., 2009).

Fishers' perceptions about the benefits and effectiveness of fishery MPAs over conservation MPAs do not seem to be affected by geographical location or different cultural backgrounds. Himes (2003) noticed that the majority of Italian fishers from within the fishery MPA, the Gulf of Castellammare Fishery Reserve (GCFR), perceived that overall this measure was successful and beneficial, while fishers from the

Table 2 Summary of studies included in the systematic review

Study	Country	MPA designation	MPA name	Year implemented	Purpose of MPA	Fishing within the MPA	Stakeholders in the survey		Topics investigated in the survey		
							Commercial fishers	Other	Governance	Conservation	Impact on fishing
Blyth et al. (2002)	UK	Voluntary fishery management system	Inshore Potting Agreement (IPA)	1978 (legally recognised in 2002)	Fishery management	Fishing allowed, with varying levels of temporal and spatial restrictions	+	−	+	+	+
Dimech et al. (2009)	Malta	Fisheries management Zone (FMZ)	Maltese Fisheries Management Zone	1971	Fishery management	Fishing allowed, with several restrictions (vessel sizes, fishing effort, spatial restrictions)	+	+	+	+	+
Gelcich et al. (2005)	Chile	Marine Management Area	Management and Exploitation Areas for Benthic Resources (MEABR)	Prior to implementation	Fishery management	Fishing allowed, with spatial restrictions in some areas	+	−	+	+	−
Gelcich et al. (2008a)	Chile	Marine Management Area	Management and Exploitation Areas for Benthic Resources (MEABR)	NA	Fishery management	Fishing allowed, with spatial restrictions in some areas	+	−	−	+	−
Gelcich et al. (2009)	Chile	Marine Management Area	Management and Exploitation Areas for Benthic Resources (MEABR)	1997	Fishery management	Fishing allowed, with spatial restrictions in some areas	+	−	+	+	−

Table 2 continued

Study	Country	MPA designation	MPA name	Year implemented	Purpose of MPA	Fishing within the MPA	Stakeholders in the survey		Topics investigated in the survey		
							Commercial fishers	Other	Governance	Conservation	Impact on fishing
Himes (2003)	Italy	Fishery reserve and Marine reserve	Egadi Islands Marine Reserve (EIMR), Gulf of Castellammare Fishery Reserve (GCFR)	1990 (EIMR), 1991 (GCFR)	Conservation and fishery management	Fishing allowed, EIMR divided into 4 zones with varying levels of spatial restrictions and GCFR closed to all bottom-towed gears	+	−	+	−	+
Jiménez-Badillo (2008)	Mexico	Marine park	Veracruz reef system marine park	1992	Conservation	Fishing allowed, with seasonal and gear closures	+	−	+	+	−
Jones (2008)	UK	No-take MPAs (NTMPAs)	NTMPAs in the South-west of England	Prior to implementation	Conservation	No fishing allowed	+	+	+	−	+
Mangi & Austen (2008)	International	Several designations of MPAs	Several MPAs in the Mediterranean Sea	Oldest in 1974, youngest to be implemented	Conservation and fishery management	Ranged from no-take zones to areas with limited fishing (seasonal or gear closures)	+	+	+	+	+
McClanahan et al. (2005)	Kenya	Several designations of MPAs (park and reserve)	3 MPAs (Diani, Malindi-Watamu, Mombasa)	Oldest 1968, youngest 1994	NA	Ranged from closed area to gear-restricted areas	+	+	+	−	+

Table 2 continued

Study	Country	MPA designation	MPA name	Year implemented	Purpose of MPA	Fishing within the MPA	Stakeholders in the survey		Topics investigated in the survey		
							Commercial fishers	Other	Governance	Conservation	Impact on fishing
McClanahan et al. (2008)	Tanzania	Marine park	Mafia Island Marine Park	1995	Conservation	Ranged from no-take zones to areas with general use (closed to illegal and destructive gear)	+	+	+	−	+
Oikonomou & Dikou (2008)	Greece	National Marine Park	National Marine Park of Alonissos (NMPANS)	1992	Conservation	Fishing allowed, with several prohibitions	+	+	+	+	+
Stump & Kriwoken (2006)	Australia	MPAs in general	System of MPAs in Tasmania	Prior to expansion in number	Conservation	NA	+	−	+	−	+
Suman et al. (1999)	USA	Marine sanctuary	Florida Keys National Marine Sanctuary (FKNMS)	1990	Conservation	Several degrees of protection (closed areas to areas where fishing is allowed)	+	+	+	−	−
Suuronen et al. (2010)	Sweden	Network of box closures	Box closures in the Baltic	First 1997 (subsequent increase in area)	Fishery management	No fishing allowed	+	−	+	−	+
Tonder & Jurvelius (2004)	Finland	Nature 2000 site	Lake Pihlajavesi Natura 2000 site	NA	Conservation	Fishing allowed	+	+	−	+	−

NA information not available

conservation MPA, the Egadi Islands Marine Reserve (EIMR), did not perceive benefits from this management measure. McClanahan et al. (2005) noted this same trend amongst Kenyan fishers, whom perceived more benefits from the gear-restricted areas (reserves) than from fisheries exclusion zones (parks). Blyth et al. (2002) noticed that UK fishers from the South-west of England, perceived the Inshore Potting Agreement (IPA), a fishery MPA, as a good system which protects traditional practices and the local fishing industry. More recently, Jones (2008) surveyed fishers also from the South-west of England about their general attitudes towards no-take MPA (prior to their implementation) and noticed that these fishers perceived these conservation MPAs should not be the way forward. Gelcich et al. (2005, 2009) noticed this same trend amongst Chilean fishers. The former noticing that most fishers perceived the Management and Exploitation Areas for Benthic resources (MEABR), a fishery MPAs, to be beneficial and effective and the latter that fishers did not see any benefits from no-take MPAs.

Only one study investigated fishers' attitudes towards a fishery MPA where no fishing was allowed (i.e. a no-take fishery MPAs). The survey was carried out to Swedish fishers targeting cod in the Baltic and collected information about their attitudes towards the network of box closures in the Baltic (closed in order to reduce total effort and fishing mortality of cod) (Suuronen et al., 2010). The survey found that fishers were overly pessimistic with respect to the no-take MPAs, considering their objectives to be inconsistent; they didn't think that reducing effort through the implementation of the network of box closures actually reduced the fishing mortality of cod. They found the no-take MPAs inefficient in the conservation of cod stocks; frequently emphasising that no-take MPAs cannot effectively protect migrating fish such as cod. They were also of the opinion that the enlargement of one of the boxes was unfair, and that the locations of the boxes was inappropriate and ineffective from a conservation point of view. Three other surveys investigated fishers' attitudes towards no-take MPAs, but they collected information about fishers' attitudes prior to the implementation of the MPAs. Stump & Kriwoken (2006) investigated Tasmanian fishers' attitudes towards the establishment of additional no-take MPAs. They found that fishers were of the opinion that an increase on the number of no-take MPAs was not necessary and that they were concerned with the possible deleterious impact an increase would have on the sustainability of Tasmania's commercial fisheries. Jones (2008) and Gelcich et al. (2009) investigated, respectively, UK and Chilean fishers' general attitudes towards no-take MPAs. Jones (2008) found that overall fishers were of the opinion that no-take MPAs are not good management measures, and that they should not be the way forward, considering that improving the wider-scale fisheries management approaches to be best. Gelcich et al. (2009) found that the vast majority of fishers showed a lack of understanding of the benefits associated with no-take MPAs. Furthermore, they perceived that the implementation of no-take MPAs would be highly controversial and that it would result in conflicts with authorities. UK and Tasmanian fishers also recognised the difficulty of achieving compliance with and enforcement of these particular measures (Stump & Kriwoken, 2006; Jones, 2008).

Swedish fishers perceived no-take fishery MPAs to increase gear conflicts outside the MPA (Suuronen et al., 2010). While, fishery MPAs in which fishing is allowed were perceived to avoid conflicts between different gear-users (Blyth et al., 2002; Dimech et al., 2009). In the case of the UK this is actually the primary function of the IPA (Blyth et al., 2002). However, Maltese fishers also perceived the Fisheries Management Zone (FMZ) (a 25-NM zone around Malta's waters created in the interests of fishery conservation which has limitations on fishing effort, vessels size and spatial restrictions on certain types of fishing activities) to reduce conflicts among users and that it was a good management measure for the local economy (Dimech et al., 2009).

Fishers' perceptions on issues of compliance with and enforcement of MPA rules and regulation were somewhat more variable. Chilean fishers perceived compliance with policy requirements of the MEABR to be good; however, they saw the lack of effective enforcement as a problem (Gelcich et al., 2009). On the other hand, UK and Mexican fishers recognised a lack of compliance with rules (Blyth et al., 2002; Jiménez-Badillo, 2008). All UK mobile-gear fishers admitted to fishing inside the IPA static-gear only zones (at the time of the survey the IPA was a voluntary agreement, nowadays its statutory) (Blyth et al., 2002). Mexican fishers recognised a lack of compliance with regulations in general and specially

with the closed season (Jiménez-Badillo, 2008). Furthermore, Maltese and Italian fishers perceived MPAs to have no impact on illegal fishing (Himes, 2003; Dimech et al., 2009). The Italian fishers also perceived the enforcement of regulations to be lacking. In fact, local fishers from the areas around the marine reserve (EIMR) perceived the lack of enforcement to be one of the main causes of management failure in the reserve (Himes, 2003). Swedish fishers also perceived the enforcement of regulations to be inadequate. They were of the opinion that the inadequate landings inspection system in the Baltic cod fishery had ruined fishers rule compliance and undermined the credibility of all management measures (Suuronen et al., 2010).

Participation in the management and decision-making processes was generally regarded as deficient (Suman et al., 1999; Himes, 2003; Stump & Kriwoken, 2006; Oikonomou & Dikou, 2008) and fishers who already were involved in the management process sought further empowerment (Gelcich et al., 2009). Suman et al. (1999) noticed that US fishers from the Florida Keys National Marine Sanctuary (FKNMS) displayed a high degree of alienation from the public process. Stump & Kriwoken (2006) noticed that less than half of the Tasmanian fishers interviewed participated in the public consultation process that accompanied the development of the MPA strategy. They were dissatisfied with the consultation process and the way the information had been delivered. Oikonomou & Dikou (2008) found that Greek fishers from the National Marine Park of Alonissos (NMPANS) perceived a total lack of communication with management bodies. Himes (2003) also noticed that most Italian fishers perceived communication to be lacking.

The length of time of MPAs existence affects fishers' perceptions of MPAs in different ways. McClanahan et al. (2005) noticed that Kenyan fishers from areas adjacent to older MPAs perceived more benefits from these management measures. While Oikonomou & Dikou (2008), on the other hand, noticed that Greek fishers' acceptance and support for the MPA decreased over time. These fishers emphasised that although they had been initially supportive of the establishment of the marine park, they were currently upset with the decrease in fish stocks and fishing grounds, and the lack of compensations for damages to gear caused by the Mediterranean monk seal. Mangi & Austen (2008) also noticed that fishers from several other Mediterranean countries believed that the potential of MPAs to deliver fisheries objectives declines the longer the MPA has been designated.

Several articles compared attitudes of fishers and other stakeholder groups towards several issues related to MPAs and noticed that in some cases attitudes varied and that in other cases fishers and other stakeholder groups expressed the same attitudes. Suman et al. (1999) noticed that the support for the FKNMS varied between different stakeholders groups, with fishers not supporting the MPAs while other stakeholders (divers and environmental group members) supported it. Mangi & Austen (2008) carried out surveys in several countries in the Mediterranean in order to assess the perceptions of stakeholders of the importance of MPAs as areas for conservation, fisheries management, research and education and tourism development. They found that fishers and other stakeholders (governmental officials, MPA managers, researchers, conservationists, recreational users and local residents) tended to have divergent views about what should be the most important objective of implementing MPAs. Fishers perceived fisheries management as the most important reasons to establish MPAs and conservation the less important, while government officials and MPA managers expressed exactly the opposite view. All other stakeholder groups scored conservation higher than fisheries management as a reason to establish MPAs (Mangi & Austen, 2008). On the other hand, several other surveys found that fishers and other stakeholder groups expressed similar attitudes towards MPAs. Jones (2008) found that, overall, neither fishers nor other stakeholders related to fishing (mainly enforcement officers) in the South-West Coast of England perceived no-take MPAs as good management measures and both groups expressed strong disagreement with their implementation, considering that it would be best to improve the wider-scale fisheries management approaches instead. Oikonomou & Dikou (2008) reported that there was a general conviction amongst the local community (fishers and other stakeholders) in the marine park in Greece that the management of the MPA was ineffective. McClanahan et al. (2005, 2008) found that Kenyan and Tanzanian fishers and other stakeholders (park services, marine attendants,

fisheries officers and fisheries department personnel) perceived MPAs to benefit the government more than fishers and local communities.

Conservation issues related to MPAs

Nine articles reported information regarding fishers' perceptions, attitudes, opinions or beliefs concerning issues related to the conservation of biodiversity or the environment. Studies gathered information mostly on fishers' opinions about the role and importance of MPAs as sites for the conservation of marine biodiversity (Mangi & Austen, 2008; Oikonomou & Dikou, 2008; Dimech et al., 2009; Gelcich et al., 2009), protection of marine species (Blyth et al., 2002; Gelcich et al., 2005) and protection of marine habitats (Blyth et al., 2002). Some studies also reported on fishers' general attitudes towards conservation and the value of natural resources (Tonder & Jurvelius, 2004; Gelcich et al., 2005; Jiménez-Badillo, 2008), perceptions regarding environmental issues (Gelcich et al., 2008a), and attitudes towards conservation measures (Tonder & Jurvelius, 2004).

Fishers displayed a range of attitudes regarding the conservation value of MPAs. Some studies found that fishers perceived MPAs to protect biodiversity and the environment (Blyth et al., 2002; Gelcich et al., 2005, 2008a, 2009; Jiménez-Badillo, 2008) and some that they did not (Oikonomou & Dikou, 2008; Dimech et al., 2009).

Differences in fishers' perception regarding MPAs as conservation measures were observed between different groups of fishers within the same study. Blyth et al. (2002) noticed that different gear-users in the south coast of England had different perceptions regarding MPAs ability to protect biodiversity. While most static-gear fishers were of the opinion the IPA protected benthic habitats, mobile-gear fishers perceived it did not, being of the opinion that static gears also caused damage. Regardless of this, fishers from both sectors agreed that the IPA functions as a reserve for species targeted by the towed sector. Gelcich et al. (2005, 2008a, 2009), surveying Chilean fishers from different fishing syndicates and livelihood strategies in different times, also found that they perceived MEABRs to be important for the maintenance of benthic resources and fish biodiversity, acting as reserves for resources. However, differences were observed between fishers from different fishing syndicates regarding their perceptions about conservation and the value of natural resources, with some having strong positive attitudes towards conservation and the intrinsic value of natural resources and others perceiving natural resources primarily as a source of income (Gelcich et al., 2005, 2008a). Jiménez-Badillo (2008) also noticed that Mexican fishers had a positive attitude towards conservation and that they were conscious of the need to conserve resources. The vast majority of Mexican fishers in the survey recognised that local marine resources had deteriorated and nearly half of them regarded overfishing as the cause of resource change. However, they perceived fishing resources primarily as a source of income. On the other hand, Dimech et al. (2009) noticed that most Maltese fishers had a negative or neutral perception that the FMZ helps to protect biodiversity.

Tonder & Jurvelius (2004) and Oikonomou & Dikou (2008) investigated fishers and other stakeholders' perceptions towards MPAs implemented for the protection of seals in different locations, the first in a Natural Marine Park in Greece and the latter in a Natura 2000 site in Finland. Both studies found that local individuals were of the opinion that the MPA was unnecessary. Furthermore, the Finnish fishers were unsympathetic towards the MPA even though the restrictions in the area did not apply to the gear most often used (Tonder & Jurvelius, 2004).

In general, stakeholders expressed more favourable attitudes towards MPAs as conservation tools the longer the MPA had been established. Mangi & Austen (2008), comparing fishers and other stakeholders from recent and longer established MPAs in the Mediterranean, found that their perceptions about the conservation value of MPAs progressively increased with the length of time that an MPA had been in place. Gelcich et al. (2008a) comparing Chilean fishers from different fishing syndicates, which were involved with the MEABR policy for various periods of time, noticed that there was a significant relationship between the amount of time engaged with the policy and positive environmental perceptions.

Impact of MPAs on the fishing activity

Information related to fishers' perceptions, attitudes, opinions or beliefs regarding the impact of MPAs on

the fishing activity was reported in 10 articles. Most of the studies gathered information precisely on fishers' perceptions regarding the impact of MPAs on their fishing activity (Himes, 2003; Stump & Kriwoken, 2006; Dimech et al., 2009; Suuronen et al., 2010). A few studies also collected information of fishers' perceptions of the benefits of MPAs for fish abundance and enhancement of stocks inside and outside the MPA area (Blyth et al., 2002; Stump & Kriwoken, 2006; Jones, 2008; Oikonomou & Dikou, 2008; Dimech et al., 2009; Suuronen et al., 2010). Five studies collected information on fishers' preferences for different types of closures (e.g. seasonal closures, spatial restrictions, gear restrictions) (McClanahan et al., 2005, 2008; Jones, 2008; Mangi & Austen, 2008; Suuronen et al., 2010).

For the most part, fishers perceived conservation MPAs and fishery MPAs with severe restrictions to have an overall negative impact on their fishing activity (Himes, 2003; Jones, 2008; Oikonomou & Dikou, 2008; Dimech et al., 2009; Suuronen et al., 2010). They tended to prefer gear-restriction zones or seasonal closures over more restrictive measures (McClanahan et al., 2005, 2008; Jones, 2008; Mangi & Austen, 2008; Suuronen et al., 2010).

Fishers had rather negative perceptions regarding the ability of MPAs to enhance fish abundance inside the protected areas or benefit stocks outside MPA boundaries (Stump & Kriwoken, 2006; Jones, 2008; Oikonomou & Dikou, 2008; Dimech et al., 2009; Suuronen et al., 2010). Swedish fishers found the no-take MPAs inefficient in the conservation of cod stock. They were of the opinion that in practice the cod boxes only displaced effort and increased the by-catch of juvenile cod out of the no-take area, mostly due to the intensified competition between different fleet segments outside the cod boxes (Suuronen et al., 2010). Maltese fishers mostly thought the FMZ did not benefit stocks outside the area and they had neutral perception about its ability to enhance fish abundance inside the area (Dimech et al., 2009). Greek fishers perceived fish stocks to be decreasing within the NMPANS (Oikonomou & Dikou, 2008). Both Tasmanian and UK fishers were concerned with the possible decline in catches in areas outside the no-take MPAs, due to perceiving that spillover will not compensate for loss of access and that the increase in effort in areas outside the no-take MPA will cancel any benefits from such areas (Stump & Kriwoken, 2006; Jones, 2008). Furthermore, UK fishers regarded fish stocks around south-west England to be too diverse, mixed and migratory for no-take MPAs to result in any benefits. They were of the opinion that the benefits for spawning grounds could be achieved through partial/seasonal closures (Jones, 2008). On the other hand, other surveys did find that fishers were of the opinion that MPAs acted as reserves to fishing resources (Blyth et al., 2002; Gelcich et al., 2005; Jiménez-Badillo, 2008).

Shortcomings of studies

Several problems which affect the reliability and validity of the studies were identified. The major shortcoming identified in several studies, which according to Petticrew & Roberts (2006) is quite common in the social sciences, was the vague reporting of methodological information. Some studies carrying quantitative research or that had a quantitative component as part of the research failed to report which survey sampling method was employed (Blyth et al., 2002; Mangi & Austen, 2008). Some studies failed to identify what proportion of the population was sampled (Gelcich et al., 2005, 2008a, 2009; Jiménez-Badillo, 2008; Mangi & Austen, 2008; McClanahan et al., 2005, 2008; Oikonomou & Dikou, 2008). Most failed to give information about the response rate (Himes, 2003; Gelcich et al., 2005, 2008a, 2009; Jiménez-Badillo, 2008; McClanahan et al., 2008; Oikonomou & Dikou, 2008). Some studies failed to carry any type of statistical data analysis to the quantitative data collected (Himes, 2003; Stump & Kriwoken, 2006; Jiménez-Badillo, 2008). In general, qualitative studies had clearly defined aims, and gave adequate descriptions of the sampling and data collection, but only two studies (Himes, 2003; Blyth et al., 2002) provided a justification for the sample size. There was also limited evidence of sample validation, with the exception of Jones (2008) and Suuronen et al. (2010) who report having carried informant feedback, no other article reported any kind of validation.

Discussion and conclusion

Understanding commercial fishers' attitudes and perceptions can be critical for the success of MPAs

(Himes, 2007; Jones, 2008; Charles & Wilson, 2009; Dimech et al., 2009). However, the views of the fishing industry are often neglected (Jones, 2008) and studies that actually collect information concerning commercial fishers' attitudes, perceptions and opinions regarding issues related to MPA make up only for a small proportion of the literature. Indeed, the present review revealed that although interest in the human dimensions of MPAs is growing, little literature originates from empirical studies aiming at examining commercial fishers' attitudes and perceptions about MPAs and issues of relevance to MPAs.

The unique social and ecological context of each location plays a critical role in MPA design, implementation and impacts (Pomeroy et al., 2007). The diversity of topics under investigation identified in this review is an indication of the heterogeneity of MPAs and of the variety of issues of concern surrounding MPAs in the different locations. Divergent attitudes and perceptions were observed amongst fishers from different locations and cultural backgrounds and within different groups of fishers from the same location. However, common trends in fishers' attitudes were also observed irrespectively of geographical locations and cultural contexts.

The review points to the fact that fishers' attitudes and perceptions tend to reflect their personal interests and concerns. Fishers who generally benefit the most from the implementation of the MPA or that are less affected by them tend to be more accepting and supportive of this management measures.

Fishers' attitudes in respect to their acceptance of MPAs were quite homogeneous. The review showed that fishers are more accepting of MPAs implemented for the purpose of fishery management rather than for conservation. This trend was observed amongst fishers from geographical locations and cultural contexts as different as the UK, Italy, Chile and Kenya.

The review also showed that fishers' perceptions about very restrictive MPAs are quite homogeneous. Fishers expressed negative attitudes towards no-take MPAs and tended to favour gear-restriction zones or temporal closures over more restrictive measures. As pointed out by Helvey (2004), the fishing industry is highly regulated and thus it may be unreasonable to expect fishers to accept very restrictive measures when other fishery management measures are already in place and the effectiveness of no-take MPAs is still poorly understood (Polunin, 2002; Willis et al., 2003; Kaiser, 2005). The strong emphasis given to no-take MPAs as a means to address broad conservation and sustainable fisheries exploitation has been questioned by several authors (Kaiser, 2005; Jones, 2006, 2007). While, there is general consensus amongst the scientific community on the use of no-take MPAs for restoring ecosystems (Murray et al., 1999; Pauly et al., 2002; Roberts et al., 2005) it is also suggested that the improvement of conventional fisheries management approaches (such as quotas, effort reduction, seasonal closures and technical measures) will work better in promoting sustainable fish stock yields (Shipp, 2003; Hilborn et al., 2004, 2006; Kaiser, 2004, 2005). In addition, despite empirical evidence showing that no-take MPAs have the ability to significantly increase species richness, biomass and density of fish (Halpern & Warner, 2002; Halpern, 2003; Stewart et al., 2009), the considerable uncertainty and shortage of information about the effect of no-take MPAs in temperate waters is a problem (Kaiser, 2005; Jones, 2007; Stewart et al., 2009). As such, several authors argue for a combined use of both no-take MPAs and conventional fisheries management approaches since both have limitations and the use of both together complement each other (Shipp, 2003; Hilborn et al., 2004, 2006; Kaiser, 2004, 2005; Roberts et al., 2005).

Fishers displayed a range of attitudes regarding the conservation value of MPAs, with some perceiving MPAs as good tool to protect biodiversity and the environment and some not. Indeed, empirical evidence from biological surveys suggests that MPAs have a positive effect in species richness, biomass and density in some of the places where the questionnaire surveys took place and not in others. The findings from the present review show that in some cases fishers' perceptions about the conservation values of MPAs are in accordance with biological findings and in some other cases not. For instance, fishers in Chile and the UK perceived the MPAs in which they were involved to act as a reserve for resources. However, while Gelcich et al. (2005, 2008a, 2009) noted that Chilean fishers perceived the MPA to be important for the maintenance of benthic resources and fish biodiversity, Blyth et al. (2002) observed that different gear-users in the UK had divergent opinions about the MPA's ability to protect benthic habitats. In fact, benthic surveys, in both

locations, showed an increase in benthic resource abundance in the protected areas (Kaiser et al., 2000; Gelcich et al., 2008b). In Malta, Dimech et al. (2009) noted that fishers had a negative or neutral perception that the FMZ helps to protect biodiversity. However, trawl surveys revealed significant differences between the inside and outside of the restricted fishing zone, with the inside area having twice as much biomass and larger individuals of some species of demersal communities than the outside (Dimech, 2008). On the other hand, Himes (2003) noted that the majority of Italian fishers from within the fishery reserve (area which is closed to all bottom-towed gears) perceived that overall this measure was successful and beneficial for their fishing activity. And indeed, studies demonstrated that catch per unit effort were much higher inside partial exclusion zones (which banned trawls) and that artisanal fishers within the area achieved higher catch rates than those outside (Pipitone et al., 2000; Whitmarsh et al., 2002). Again, fishers and the scientific community are in agreement regarding the inefficiency of the Baltic cod boxes for the conservation of cod stock. Suuronen et al. (2010) reported that Swedish fishers who targeted Baltic cod found these boxes to be inefficient in the conservation of cod stocks and indeed scientific advice indicates that the cod boxes have neither effectively reduced total effort of the cod fleet nor conserved the Baltic cod stock (ICES, 2004; Suuronen et al., 2010).

The review revealed that fishers' perceptions about their participation in the MPA decision-making process were also quite homogeneous, generally fishers perceived participation to be either lacking or insufficient. This lack of active involvement has consequences for the success of MPAs since if fishers feel alienated from the decision-making process it will be difficult to obtain their support for and compliance with the rules and regulations of the MPAs (Agardy et al., 2003; Mascia, 2004; Pomeroy et al., 2007; Viteri & Chávez, 2007).

The review showed a relationship between fishers' attitudes towards MPAs and the length of time MPAs have been established. Several studies found that fishers' attitudes towards MPAs tend to be more favourable the longer the MPA has been established. This positive relationship was found both regarding the benefits fishers perceive to arise from these management measures and the value they ascribe to MPAs as sites for conservation. However, it was also observed that Mediterranean fishers tended to perceive the potential of MPAs to deliver fisheries objectives to decline the longer the MPA had been designated. Mangi & Austen (2008) emphasise the need for management bodies to see fishers perceptions about this issue as a reason for concern, since a number of studies in the Mediterranean have demonstrated that the present MPAs satisfy both fisheries and ecosystem management objectives (e.g. Badalamenti et al., 2000; Whitmarsh et al., 2002, 2003; Goni et al., 2006). Fishers' participation in MPAs decision-making process could contribute to change their point of view on this matter. Gelcich et al. (2008a) noticed that there was a significant relationship between the amount of time engaged with the co-management of the MPA and positive environmental perceptions. They concluded that such a relationship establishes the potential for co-management to change fishers' perceptions and suggests that artisanal fishers may demonstrate more sustainable behaviours in the future.

This study has provided the first comprehensive and systematically derived overview of this topic. The inclusion criteria for the present systematic review will have resulted in some studies having been missed. For example the limitation to studies published in peer-reviewed journals means that interesting unpublished studies may have been excluded. However, it should be noted that there can be no guarantee of the quality of studies that have not been through a peer review process. Also the focus on commercial fishers will have inevitably resulted in other important studies examining non-commercial fishers and other stakeholders, being excluded. However, as is accepted practice in systematic reviews, the inclusion criteria are clearly documented in the report and the conclusions drawn in the paper relate only to the topics (i.e. attitudes, perceptions, beliefs and opinions about MPAs) and target population (i.e. commercial fishers) covered in the included studies.

In conclusion, this review of the literature on fishers' attitudes, perceptions, opinions and beliefs about MPAs revealed above all that the number of studies which communicate primary research in these topics is still considerably small. MPAs have different social, cultural, economical and environmental settings, and the unique context of each MPA plays a critical role in the way they will impact and be

impacted by the fishing industry. Although some homogeneity in commercial fishers' attitudes towards some issues related to MPAs can be observed, they also showed varied attitudes, both among and within groups, towards other issues.

Forecasting the impact of the fishing industry on MPAs, and vice versa, is critical for the management process and knowledge about fishers' attitudes and perceptions will lead to more successful planning and management of MPAs. Given the forthcoming increase in the implementation of MPAs, and more specifically no-take MPAs, in the near future research on commercial fishers' attitudes towards MPAs is all the more pressing.

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