



## Review

## The role of MPAs in reconciling fisheries management with conservation of biological diversity

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## ARTICLE INFO

## Article history:

Available online 31 August 2012

## ABSTRACT

A workshop of over 100 participants, balanced between fisheries management and biodiversity conservation backgrounds, reviewed and synthesised experiences regarding policy and institutional frameworks for use of MPAs in the contexts of fisheries management and conservation of biological diversity. The workshop concluded that although fisheries managers and biodiversity conservation agencies may give differing and sometimes opposing weights to the many objectives that could be set for MPAs, only 25% of fisheries objectives and 30% of biodiversity objectives were considered to be potential sources of conflict. MPAs that segregate activities in space could contribute to resolving all but one of the potential conflicts over objectives associated with desired ecological outcomes. Conflicts over social or economic objectives could be improved, made worse, or not be affected by MPAs, depending on how the MPAs were developed and managed. Seven features of planning processes and six features of the governance processes for MPAs were identified that could help find broadly supported solutions to the conflicts that did occur. Once established, the management of the MPA should be inclusive and participatory, as well as continuously learning and adaptive. Approaches to ensure management had those properties were identified, including twelve specific mechanisms that should be available to the MPA managers. On the basis of these conclusions about objectives, planning, and management, a general framework for the governance of MPAs for both fisheries and biodiversity conservation was developed. Its ten general characteristics and twelve steps necessary for progress were identified. We discuss the special challenges of establishing and managing MPAs for fisheries and biodiversity conservation on the high seas that deserve further attention include information-sharing, coordination and defining jurisdictions and stake-holding.

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### 1. Introduction

There has long been a diversity of views on the role of marine protected areas (MPAs) in fisheries management, (e.g. [Agardy et al.](#),

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2003; Hilborn et al., 2004; Jones, 2007; Berkes, 2009). Agencies and stakeholders with different interests in the oceans have given different priorities to the multiple possible outcomes of MPAs and MPA networks, leading to extended processes of consultation and dialogue as MPAs are established (Geoghegan et al., 2001; Scholz et al., 2006; Rabaut et al., 2009). These processes have contributed to the slow pace of MPA network implementation (UNEP-WCMC, 2008; Toropova et al., 2010) despite commitments made at the World Summit on Sustainable Development in 2002 ([http://www.un.org/esa/sustdev/documents/WSSD\\_POI\\_PD/English/WSSD\\_PlanImpl.pdf](http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/WSSD_PlanImpl.pdf)), and subsequent endorsements by the United Nations General Assembly (UNGA Resolution 58/240).

The nature of fisheries management is changing, with ecosystem approaches to fisheries management and ecosystem-based management becoming widely endorsed (Garcia et al., 2003; Pikitch et al., 2004). Likewise MPA planners and managers are considering a wide range of types of MPAs, including multiple use MPAs (e.g. Agardy et al., 2011), and often promoting the benefits of MPAs for fisheries (Jones et al., 2011; FAO, 2011). These developments reflect an increasing convergence of views on a number of key issues related to MPAs and fisheries management:

- Environmental agencies have legitimate roles in ocean governance including fisheries;
- Fisheries agencies have legitimate roles in conservation of biological diversity;
- All agencies benefit from cooperating to select coherent and complementary measures;
- Spatial tools are essential for success in both fisheries management and conservation of biological diversity, but only as part of a larger suite of planned and integrated measures.

Evidence of this convergence of views is seen in both FAO (2011) and Jones et al. (2011).

On the other hand numerous examples of scepticism of MPAs remain by many fisheries interests, who still perceive MPAs as threats to their livelihoods, and of scepticism by biodiversity interests that spatial and temporal closures of areas by fisheries managers should really be considered as measures contributing to biodiversity conservation. Numerous publications are available on these conflicts (e.g. Christie, 2004; Bischof, 2010; Bavinck and Vivekanandan, 2011) and the Supplemental Material.

With a convergence of perspectives on the basic tenet that MPAs do have a role in fisheries management and that their impacts for biodiversity and for fisheries – both positive and negative – depend on how they are designed and managed, areas of dialogue on MPAs and fisheries have shifted focus. Core questions now focus on clarifying those roles – what is an appropriate balance of priority to conservation of biological diversity and to sustainable use of living marine resources, food security, and livelihoods? – and how should they be designed and managed – what are appropriate roles of diverse agencies, industries, and communities in the planning processes, and in management once MPAs are established? These questions can be posed both for individual MPAs and for networks of MPAs which are intended to provide a range of protections and permitted uses.

Release of the FAO (2011) Guidelines on fisheries and MPAs triggered an International Workshop Exploring the Role of MPAs in Reconciling Fisheries Management with Conservation, held in Bergen, Norway, 29–31 March, 2011. The organisers invited FAO and UNEP to join in hosting the expert meeting to ensure inclusiveness of perspectives of the nearly 100 experts in aspects of fisheries and/or MPA management. The workshop was also informed by the UNEP Technical Report on MPA governance (Jones et al., 2011).

The workshop was built around the three core issues, with objectives to:

- Review and synthesise experiences that will serve to inform implementation of MPAs as one of the tools to reconcile fisheries management and conservation of biological diversity;
- Review sectoral and cross-sectoral policy and institutional frameworks that enable MPAs to be used as one of the tools to reconcile fisheries management and conservation of biological diversity in different regions;
- Provide practical advice on sectoral (e.g. fisheries) and cross-sectoral management frameworks (e.g. Ecosystem Approach, Integrated Coastal Zone Management, Marine Spatial Planning) that can inform the appropriate implementation of MPAs, including input and guidance for dealing with management trade-offs when developing MPAs for various outcomes.

This paper presents the major conclusions from the joint workshop, explains their rationales, and builds on them a way forward that takes advantage of potential synergies and minimises conflicts between achieving fisheries management objectives and fulfilling commitments to MPAs and networks of MPAs for biodiversity conservation. The workshop dialogue forms the basis for this paper, arranged around three questions:

- What roles can MPAs play in fisheries management?
- How should MPAs intended to balance benefits for fisheries and biodiversity conservation be designed?
- How should such MPAs be managed?

All three questions are addressed in broad legal and cultural contexts, because spatial management, including MPAs, may occur in a range of governance models from fully developed countries with strong central government leadership to being an integral part of indigenous peoples and local community cultural and social rights and processes (Jentoft et al., 2007; Gray and Hatcher, 2008; Jones et al., 2011). These governance systems may view fisheries consequences of MPAs in different ways. Some may feel that MPA development should consider consequences for fisheries whereas others may feel that the *primary* goals of MPAs have little to do with fisheries, such that their consequences for fisheries is only a part of the dialogue about how they are managed. However, dialogue about the interactions between MPAs and fisheries is so ubiquitous that these questions are central to the activities of both MPA and fisheries management agencies.

The workshop and this paper use the characterisation of MPAs in the FAO guidelines that “*any marine geographical area that is afforded greater protection than the surrounding waters for biodiversity conservation or fisheries management purposes will be considered an MPA*”. Differences between this definition and the definitions of each of the six IUCN categories for protected areas (Kelleher, 1999; Dudley, 2008) present some complexities in dialogue among experts with diverse backgrounds. All IUCN categories meet the FAO definition. However, the FAO definition does not include the IUCN requirement that for any area to qualify as a protected area, “In case of conflict nature conservation objectives will be the priority”. This is a fundamental condition for the biodiversity community, and much of the contents of this paper are consistent with it. However, examples of fishery closures that were not called MPAs despite meeting the FAO definition were included in discussions at the workshop. Places where the broader FAO definition of MPAs was important for conclusions are highlighted. Also industry sectors other than fisheries (e.g. energy, tourism, shipping) influence the establishment and management of MPAs. These factors are only considered in the paper to the extent that they

directly influence MPAs for conservation of biological diversity and fisheries. Nonetheless MPAs for fisheries and biodiversity conservation should be nested in the larger context of integrated ocean and coastal management.

The workshop conclusions are organised around the three central questions listed above. The roles of MPAs are determined by the objectives that are set for them. Hence, the paper first provides an inventory of possible objectives for conservation of biodiversity and for sustainable harvest of fisheries, and then analyzes the degree to which MPAs would be considered to be compatible or incompatible with those objectives. The results form the basis for conclusions regarding the types of objectives for MPAs that can contribute to greater harmony or greater conflict between fisheries management and biodiversity conservation.

Given that appropriate MPA objectives are set, the paper considers the governance processes for both planning of MPAs and ongoing management of the MPA. Both sections follow the same structure: first a review of the concepts which form the basis for effective planning and management; next conclusions on the structural traits necessary for the planning and management processes to be effective; followed by the implications that the structural traits have for how the processes will operate. That detailed material, often in tabular form, will be valuable to practitioners actually planning or managing MPAs. Each section ends with some practical steps forward, the low-hanging fruit that might be readily implemented and/or have particularly high payoff. The paper ends with a summary of major emergent conclusions, of particular interest to policy makers and high-level managers.

## 2. What is the role of MPAs in fisheries management?

Examples were reviewed of a wide range of roles for MPAs in fisheries management. Often these roles are taken on by spatial measures such as gear-specific or general fisheries closures, selective allocation of access rights, etc, that are not labelled as MPAs but meet the FAO definition (see [Supplemental Material](#)). There have been many reviews of the circumstances that affect the degree to which MPAs created for biodiversity objectives can provide spillover and recruitment benefits to fisheries (García-Charton et al., 2008; Gaines et al., 2010; Goñi et al., 2010). These benefits can be large, moderate, or negligible, depending on a number of case-specific factors about *inter alia* the ecological setting of the MPAs, how they are managed, and other fisheries management measures also in place (Geoghegan et al., 2001; Hilborn et al., 2004; Stewart et al., 2009; McCook et al., 2010; Guidetti and Claudet, 2010; Russ and Alcala, 2011).

There have been fewer reviews of consequences for biodiversity of MPAs and other spatial measures implemented for fisheries management objectives. The workshop concluded that there is no simple answer to the question of whether such “fisheries MPAs” had positive, negative, or no consequences for biodiversity. The systems being managed are complex, diverse and dynamic, and it is difficult to show direct cause and effect linkages of fisheries closures and biodiversity outcomes. Rather, the outcomes are situation and time specific, and even what constitutes a benefit depends on the perspective of those doing the evaluation (See [Supplemental Material](#)).

A review of the objectives for MPAs was undertaken to provide insight into compatibility of MPAs for fisheries management with MPAs for conservation of biological diversity. In fisheries management it is well established that measures that reduce fishing capacity and effort or give preferential access to gears with lower ecosystem impacts are likely to produce biodiversity benefits (FAO, 2003). Beyond that high level but self-evident conclusion, outcomes of MPAs for fisheries and biodiversity were considered to be strongly influenced by the objectives of the MPAs.

### 2.1. Analysis of objectives

Necessary properties of policy objectives and goals are well established (Garcia, 2005; Francis et al., 2007; Orians and Policansky, 2009; Olsen et al., 2011a). They should be clearly defined, broadly supported, measurable, and incorporate precaution. Within this framework overarching objectives shared by most ocean users and managers include goals such as:

- Separate incompatible activities in space and/or time;
- Provide for sustainable uses of marine space;
- Minimise impacts of human activities on marine ecosystems;
- Maintain ecosystem functions, processes and services.

However, there are many more specific objectives that can be sorted into five general categories: objectives for 1) fisheries management, 2) conservation of biodiversity, 3) overall health of ecosystems, 4) general societal well-being, and 5) science and education. Participants prepared a list of objectives for MPAs proposed or adopted in various jurisdictions for various fisheries and/or biodiversity outcomes (Table 1).

This tabulation of objectives was analysed to provide insight into the extent to which objectives might be shared between fisheries management and biodiversity conservation interests, and where there could be potential conflicts. An expert opinion process was used to score each objective twice; once from the perspective likely to be taken by managers or groups with biodiversity conservation responsibilities and interests, and once from the perspective of managers or groups with fisheries management responsibilities. For each perspective an objective was scored as

- +1 – the objective was considered likely to be supported;
- 0 – the objective was considered likely to be considered neutral or irrelevant;
- 1 – the objective was considered likely to be opposed or a source of conflict.

Scoring was by consensus and reflects a general assessment of expected support. A score of +1 does not mean every conceivable measure proposed to achieve that objective would be supported, nor does a score of –1 mean every measure to achieve that objective would be opposed. Care was taken to consider whether a scoring might be different for MPAs being proposed from the “bottom up” by communities or from the “top down” by government agencies.

Scores were then summed across the two perspectives. Using this approach objectives that might be sources of serious conflict scored as 0 (–1 [opposed] from one perspective and +1 [supported] from the other. A score of 0 from being neutral to both perspectives did not occur, since if neither perspective considered an objective relevant it would be unlikely to be adopted). Objectives where there was potential for some difficulty in reaching agreement scored as 1 (supported by one perspective but not considered important by the other). Objectives on which there was compatibility between perspectives scored as 2 (supported by both).

For all objectives associated with human well-being, and a few biodiversity objectives, the expert process could not assign scores because a wide range of activities could be undertaken in pursuit of the objectives, and some of the activities might be supported and others opposed by adherents of any perspective. These were not included in the subsequent steps in the analysis. The analyses were seeking global compatibilities or incompatibilities between perspectives and because of the case-specific ways that human well-being objectives may be pursued, all such objectives have the *potential* for both greater agreement and for greater disagreement

**Table 1**

Candidate objectives for marine protected areas that were identified by participants in the Norway workshop (list of participants available at website reference). Overlap occurs among some objectives in a category, reflecting the different ways that different MPA management authorities have expressed goals. For the purposes of this synthesis some redundancy in the lists of objectives was not considered a problem, but gaps might be, so the lists were prepared inclusively. Score values explained in the text. Negative aggregate scores were considered unlikely, because it was implausible that an objective would be adopted if it was opposed by one or both perspectives but supported by neither. However, it was recognised that in jurisdictions where powerful industry sectoral interests can have an area closed to other users (e.g. military operations, energy production), it is possible that a MPA-like area could be created that would not be supported by either fisheries or biodiversity interests.

Category	Objective	Score	
Fisheries Management	Maximise food security	1	
	Sustainable use of living resources	2	
	Maintain structure, productivity and processes of harvested ecosystems	2	
	Maintain natural reproductive outputs of harvested populations	2	
	Restore reproductive outputs of depleted populations	2	
	Increase reproductive output of harvested populations using biomanipulation	0	
	Manage for resilience in fish populations	2	
	Manage for consistency of yield over time	1	
	Keep fishing pressures below MSY	2	
	Maintain biomass above a specified target level	1	
	Manage by-catch and reduce discards	2	
	Optimise fishing gears practices to reduce effect on non-target species	2	
	Protect 'essential fish habitats' from impacts of fisheries	2	
	Reduce IUU fishing	2	
	Achieve high compliance with the management plans	2	
	Satisfy market demands for fish	1	
	Reduce the cost of fishing	0	
	Maximise profit for fishing sector	0	
	Maintain employment in fishing sector	0	
	Reduce labour costs in fisheries	0	
	Maximise value of catch	1	
	Biodiversity Conservation	Protect endangered species and habitats	1
		Protect genetic and population diversity	2
Maintain representative ecosystems undisturbed from human activities		0	
Maintain ecosystem integrity		2	
Maintain ecosystem structure and process		2	
Maintain resilient ecosystems		2	
Protect vulnerable habitats		1	
Ensure protection/continued well-being of sensitive habitats, such as corals		1	
Protect areas of high biodiversity		2	
Protect critical habitats for species not commercially harvested		2	
Recovery of marine biodiversity		X	
Prevent spread of alien species		X	
Keep ecosystem clean and rich in biodiversity		X	
Maintain healthy and productive ecosystems		2	
Maintain Healthy Ecosystems		Minimise pollution	2
		Minimise destructive practices (including destructive fishing practices)	2
		Keeping the sea clean	2
	Reduce littering of oceans (including lost fishing gear)	2	
	Reduce eutrophication	2	
Maintain human well-being	Reduce negative impacts of aquaculture	2	
	Protect economies and cultures of coastal communities	–	
	Long-term delivery of ecosystem services for human well being	–	
	Provide alternative livelihoods to residents of coastal communities	–	
	Provide for tourism	–	
Support/maintain local communities	–		

**Table 1 (continued)**

Category	Objective	Score
Science and Education	Map and prepare inventories of existing habitats and species	0
	Provide field based education	2
	Maintain undisturbed areas for long-term monitoring and research (reference sites)	0

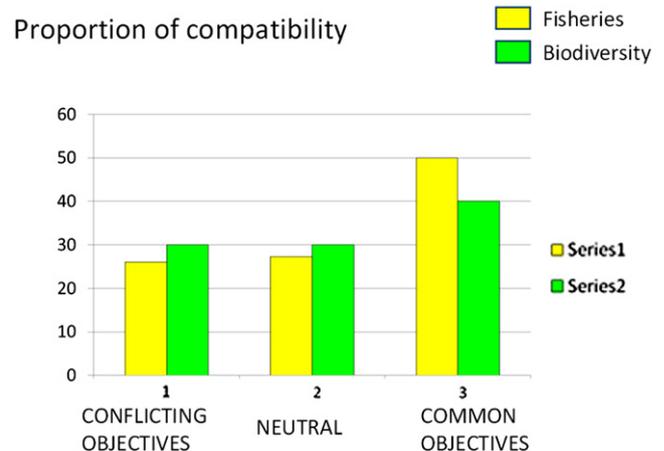
among perspectives, and do not provide data on global compatibilities or incompatibilities.

Analyses of the results found numerous compatibilities and some incompatibilities in our list of example objectives (Fig. 1). Half of all fisheries objectives and 40% of biodiversity objectives were considered likely to receive support from both perspectives. Only 25% of fisheries objectives and 30% of biodiversity objectives were considered to be potential sources of conflict. Although the results mostly reflect the experiences of workshop participants and not an exhaustive treatment of experience of all industry sectors and communities with all types of MPAs, this in itself is an encouraging finding, particularly if spatial measures can contribute to achieving the compatible objectives and address potential conflicts.

## 2.2. Conclusions about objectives for MPAs in fisheries management

With regard to defining the role of MPAs in fisheries management, our results (Table 1) suggest that spatial measures meeting the FAO definition of MPAs can help to achieve a large proportion of the compatible objectives. Such spatial measures are rarely the only possible tool for pursuing the shared objectives, but they are a class of tools familiar to managers from both perspectives. The management cultures of fisheries and biodiversity conservation have different histories with regard to the use of spatial measures, so some change in each culture may be needed for the two perspectives to mutually support the same spatial approaches to pursue shared objectives – a concern explored further in the following sections. As a generalisation however, the changes would focus on ensuring proactive engagement of all perspectives in designing the spatial measures, including the provision of appropriate incentives for participation.

Even more importantly with regard to the role of MPAs in fisheries management, measures that would segregate activities in space could contribute to resolving all but one of the potential conflicts over objectives associated with desired ecological outcomes (Table 1). The exception is the use of biological manipulations to



**Fig. 1.** Tabulation of compatibility of objectives from biodiversity conservation and fisheries management perspectives.

artificially enhance exploited stocks; an objective considered fundamentally at odds with conservation of naturally functioning ecosystems. Otherwise, appropriately designed and implemented MPAs by either biodiversity or fisheries agencies could contribute, and in some cases be sufficient, to resolve the conflicts over ecological objectives viewed differently by fisheries and biodiversity perspectives. Moreover, only two additional conflicts were considered at risk of being created if spatial measures were implemented. The fishing effort displaced by spatial closures might increase the risk of either more illegal or unregulated fishing, or lower compliance with management plans. However, fisheries managers have long acknowledged the need to manage effort that is removed from a fishery for any reason, including lower quotas or spatial closures. The use of MPAs to help reduce conflicts over management objectives does not create classes of management challenges that have not already been part of effort management for decades.

For conflicting objectives associated with economic or social benefits of fishing, the results suggest that conflicts could be reduced, not affected or made worse by use of spatial measures, including MPAs. The process followed in setting up a particular MPA and its design and management all may influence whether a MPA would reduce or amplify conflicts over economic and social objectives. In the short term essentially any measures that restrict the choices available to fishers for when, where, and how to fish are likely to be perceived as incompatible with achieving economic and often social objectives. Therefore MPAs primarily for biodiversity conservation are likely to be considered to make existing conflicts worse the more that they affect the spatial distribution of fishing. However, depending on how such a “biodiversity MPA” affects the productivity and availability of species targeted by a fishery, how the fishery is allowed to operate in and around the MPA, and the degree of dependence of local communities on the area included in the MPA, the medium to long term impacts of the MPA on economic objectives could be quite different from the short term ones.

These potential complementarities and conflicts underscore the need to connect the planning process for all MPA design and implementation with the planning for fisheries management, (and other industry sectors active in the area). If the planning process produces compromises considered equitable by participants, then opportunities for all types of MPAs to be at least neutral and possibly reduce conflicts over economic or social objectives are enhanced. Trade-off analyses can help explore the equity of alternative options, spatial or otherwise, to pursue objectives that are perceived to be in conflict (Brown et al., 2001; Meester et al., 2004).

Investigations into the trade-offs, both short-term and long-term, associated with the various spatial options need strong bases in ecological, economic, and social sciences. Since adoption of the “precautionary approach” in fisheries management, it has been a principle that as a stock approaches a biologically based reference point, the ecological objective of improving stock status should take increasing priority over economic and social objectives for the fishery (FAO, 1996). This has triggered substantial attention to estimating appropriate limit reference points for exploited stocks. These are ecological tipping points that represent the biomass below which productivity of the stock is impaired. Such work is not straightforward because of non-linearities in stock productivities due to density-dependent processes, and the impact of environmental factors on productivity (Brunel et al., 2010). The inflection points are commonly challenging to estimate for even target stocks of data-rich fisheries (Caddy and Mahon, 1995; Garcia and Staples, 2000; Haltuch et al., 2008). For the many other types of ecological objectives that may have associated tipping points, they have rarely been estimated (Rice, 2009; McClanahan et al., 2011). The economic and social objectives can have tipping points and these tipping

points may provide comparable fulcrums for considering the equity of outcomes of any type of MPA and fisheries management. Some economic tipping points, such as zero profit, have been explored. They have comparable complexities due to factors such as price elasticity (Griffiths and Wall, 2007), and they may have limited applicability in fisheries where profit is not the primary objective, such as many subsistence and small-scale fisheries. Tipping points for social objectives, such as inadequate community access to traditional resources, are important to decision-making, but have not been explored thoroughly in these analytical frameworks. Moreover, there is no accepted guidance on how tipping points for multiple objectives should be treated in integrated decision-making, for example, when social and ecological tipping points are approached simultaneously.

Given these challenges regarding adequacy of data and analytical methods, the processes to reconcile conflicting objectives – and therefore conflicting views on the role of MPAs in fisheries management – have to rely substantially on political and social processes to find equitable outcomes, and the application of precaution to ensure the tipping points are not exceeded. That raises the question of how to design these planning processes to produce equitable outcomes when participants have very different expectations, backgrounds, powers, and resources.

### 3. Governance for the planning process to be credible and legitimate to all perspectives

#### 3.1. Concepts to guide planning processes for MPAs in fisheries management

Our review of possible MPA objectives makes clear that the planning process for all types of MPAs must identify two kinds of objectives:

- Those which best promote compatible biodiversity and fisheries outcomes appropriate to the particular ecological and societal circumstances of the planning area; and
- Those which provide an equitable and politically acceptable balance when trade-offs have to be made between economic and social outcomes desired by fisheries interests and ecological outcomes desired by biodiversity conservation interests.

Moreover, if the participating agencies and interest groups are to gain and keep the support of their constituencies, they need to be able to show some victories as well as concessions, and that the final outcomes reflect their core mandates. The workshop identified the features of a planning process that could achieve those two goals, building on and not undermining other ongoing marine and coastal spatial planning and management initiatives.

Three general properties were acknowledged as necessary for any management planning process trying to provide benefits to biodiversity or harvested stocks (Table 2: rows 1–3). Spatial planning processes trying to provide social or economic benefits to communities, or trying to gain support for implementation from affected communities should have several additional properties (Table 2: rows 4–11). This broad basis for planning has a high likelihood of producing objectives that are explicit, measurable and provide adequate coverage, since the diverse participants are likely to demand clarity and specificity in outcomes to which all will commit. However the transaction time to reach these objectives can be long if the participating groups have very different goals and risk tolerances (Charles and Wilson, 2009; Charles, 2011; Ferse et al., 2010).

To have the properties listed above, the planning process also needs to be inclusive not only just of stakeholders, but also of

**Table 2**  
Properties of the governance processes for setting MPA objectives necessary for provision of benefits for both fisheries and conservation of biodiversity (esp rows 1–3) and for providing balances of social, economic, and ecological outcomes likely to gain broad support (esp. rows 4–10).

Property	Rationale	References
Take into account the biology, habitat and the life cycles of the resources that need to be conserved; Be flexible and adaptive;	Ensure that any MPA can deliver the expected ecological outcomes, whether for fisheries or biodiversity conservation. Allow new knowledge and changes in environmental conditions to be incorporated in improved specificity of objectives and management measures to achieve them.	Kelleher and Kenchington, 1992; Gaines et al., 2010 Katsanevakis et al., 2011; McCook et al., 2009, 2010
Identify available measures, including fisheries management measures, that are considered effective in meeting biological objectives;	Allow evaluation of efficiency of MPA vs alternative ways to achieve the objective(s).	FAO, 2003, 2011
Identify and ensure participation for all stakeholders likely to be affected by any type of MPA once established;	Promote a sense of ownership among local communities take into account the needs, usage patterns and proposals of local communities.	Sutton and Tobin, 2009; Ferse et al., 2010
Include direct discussion of what participants would consider equitable balances of benefits to communities and ecosystems, and of restrictions on potential users of the areas;	Build mutual understanding of social and economic values and weightings applied by different participants.	Geoghegan and Renard 2002; Christie, 2004
Identify and map existing tenure rights and rights holders;	Document the starting points from which participants will consider changes to be losses or gains.	Cinner, 2007; Diegues, 2008; Berkes, 2009
Identify existing forms of local governance of resources, local institutions, as well as existing practices/initiatives that contribute to conservation and sustainable use of resources;	Understand the processes already comprising governance of the area of concern, so those processes can be used to the extent possible, and accommodated with additional governance processes are needed.	Christie et al., 2003; Jentoft et al., 2007; Olsen et al., 2011a,b
Draw on the experiences and knowledge of local people;	Augment the information base on which discussions will draw, and communicate respect for the range of knowledge systems available.	Scholz et al., 2006; Ban et al., 2009
Be transparent during operations, and accountable once agreements and compromises are reached;	Give all stakeholders reason to trust that trade-offs were reached fairly, and that the spirit of all compromises will be respected in practice.	Oracion et al., 2005; McConney et al., 2003
Be conducted with sensitivity to the distribution of wealth and political power among interest groups participating in the processes.	Encourage processes to produce outcomes which are equitable even if there is not equity of power among participants.	Balmford and Whitten, 2003; Rosendo et al., 2011

a wide range of policy and management agencies who will have to work in a coordinated way to deliver its outcomes. These agencies have to cooperate because decisions about delineating and managing area-based activities, whether for biodiversity conservation, fisheries, or other objectives, affect the allocation of space to different and sometimes competing uses. In addition, the key trade-offs must reconcile objectives with both diverse social interests and with the strategic priorities of the agencies involved in planning and delivering any type of MPA, in order to meet their sectoral accountability requirements.

There is presently substantial debate about whether planning processes with the necessary properties can be delivered by existing sectoral management process, or if some form of “super-ministry” for MPA (and other spatial) management is necessary (e.g. Plasman, 2008; Olsen et al., 2011b). The meeting did not resolve this debate, but noted substantial progress on integrated spatial planning using a variety of institutional frameworks. Several examples were reviewed for developed countries with strong central governments and resources to invest. For less developed countries, a wide range of approaches has been taken to establish various types of MPAs and accommodate needs of dependent fishers who in some areas have no employment alternatives. In several of these cases both community initiatives and government leadership worked harmoniously, whereas in others, significant conflict was reported. An illustrative sample of the cases reviewed is presented in Table 3, with the partial information available on outcomes for each. More detailed information provided in the Supplemental Information.

The workshop concluded that any effective governance model for designing and implementing any type of MPA would have a number of characteristic traits:

- It would take a long-term perspective. Considering the number of institutions and agencies involved, the planning process will

take considerable time either to reach accord among sectoral agencies, or to create and agree on the powers given to a “super-agency” to undertake the planning. Moreover, once established, benefits of any type of MPA (and spatial tools in general) continue to accrue over time, with some important ecosystem-scale benefits not fully realised until the MPA has been in place for some time.

- It would provide incentives that encourage sceptical agencies lacking histories of working together cooperatively to do so, and that enable willing agencies to use an inter-sectoral product such as a multi-objective MPA to meet sectoral accountabilities linked to the agency’s core mandate. Such interagency cooperation can be built on the near-universal commitment of both fisheries and environmental agencies to an ecosystem approach to management, because more integrated management is an intrinsic part of an ecosystem approach (FAO, 2003; UNEP, 2011).
- It would provide a critical role for “bottom up” community involvement in MPA planning and co-management. In fact, community initiated MPA projects were considered particularly valuable, especially when they built on existing legal or traditional land tenure rights (Diegues, 2008; Kalikoski and Vasconcellos, 2011; Martin-Smith et al., 2004; Ban et al., 2009). It is important, therefore, that legal frameworks for all types of MPAs provide for community rights and their roles in managing resources on which they depend. In fact, when MPA processes helped in recognizing/strengthening existing tenure rights, communities took the lead in MPA establishment, planning and management, as in the case of locally managed marine areas (LMMAs) in the Pacific (Govan, 2009) or Marine Extractive Reserves in Brazil (Diegues, 2008; Kalikoski and Vasconcellos, 2011).
- It would provide full information on mutual benefits to all parties, specifically to:

**Table 3**

Case histories of experiences of various countries with top-down and bottom-up leadership in establishment of MPAs. Information on full outcomes for fisheries, biodiversity, communities and central economies not available for any of the case histories.

Country	Action	Reported outcomes	Reference
France	Created a new category of protected area (marine nature parks); Created a single ministry with many of the powers of the super-agencies discussed in text	Met EU Directives on greater engagement with commercial and recreational fishers; Long term consequences not yet evaluated	( <a href="http://www.aires-marines.fr/french-marine-protected-areas-agency.html">http://www.aires-marines.fr/french-marine-protected-areas-agency.html</a> ).
Italy	Adopted a system with MPAs taking fisheries into account; having three zones with different levels of protection level; with no-take zones (often placed in areas that are rarely fished anyway), and zones for artisanal fishing, and tourist uses	The process for MPAs for fisheries many of the characteristics of marine spatial planning; no reports on medium-term outcomes for fisheries or biodiversity	<a href="http://www.parks.it/indice/RM/Eindex.php">http://www.parks.it/indice/RM/Eindex.php</a>
Australia	Great Barrier Reef Marine Park has been managed as a zoned ecosystem scale MPA for 30 years with three broad categories of protection – strict no-take; benthic habitat protection with no trawling or dredging; and general use	The zoning and management processes involve extensive consultation and a process for compensation of demonstrable disadvantage	<a href="http://www.gbrmpa.gov.au/zoning-permits-and-plans">http://www.gbrmpa.gov.au/zoning-permits-and-plans</a> . (Kenchington and Day 2011)
Grenada	Community driven processes were central to creation of MPAs and their management plans	Generally harmonious relations between communities and central governance processes	<a href="http://www.oas.org/dsd/IABIN/Component1/ReefFix/Grenada%20Book/SystemsPlan2/System%20Plan%20Part1%20Intro_Background.pdf">http://www.oas.org/dsd/IABIN/Component1/ReefFix/Grenada%20Book/SystemsPlan2/System%20Plan%20Part1%20Intro_Background.pdf</a>
Cuba	Community driven processes were central to creation of MPAs and their management plans	Generally harmonious relations between communities and central governance processes	<a href="http://www.cbd.int/doc/nbsap/nbsapcbw-car-01/nbsapcbw-car-01-cu-01-en.pdf">http://www.cbd.int/doc/nbsap/nbsapcbw-car-01/nbsapcbw-car-01-cu-01-en.pdf</a>
India	Top-down processes for planning MPAs, primarily for biodiversity conservation, with central government leadership for national and international priorities.	Considered to cause detrimental displacement of fishers and loss of community livelihoods	Bavinck and Vivekanandan 2011
Costa Rica	Top-down processes for planning MPAs, primarily for biodiversity conservation, with strong engagement and funding by non-local NGOs.	Considered to cause detrimental displacement of fishers and loss of community livelihoods	Utting 1994; Fonseca 2009
Mozambique	Top-down political leadership considered essential to coordinate government sectors that were asked to operate outside their perceived traditional mandates	Successful development of MPAs with biodiversity outcomes. No reported negative social impacts.	Rosendo et al., 2011
Senegal	Top-down political leadership considered essential to coordinate government sectors to common goals	Successful development of MPAs with biodiversity outcomes. No reported negative social impacts.	Breuil, 2011
Malaysia	Top-down political leadership played central role in coordinating roles of government sectors	Successful development of MPAs with biodiversity outcomes. No reported negative social impacts.	<a href="http://earw.icriforum.org">http://earw.icriforum.org</a>

- Fisheries managers on how MPAs can assist in achieving their goals, targets and commitments, such as protection of essential fish habitat;
- MPA managers on how outreach to fisheries managers and the fishing industry may remove opposition to their plans and help them achieve their objectives; and
- Community and conservation agencies on how conservation objectives can be achieved through a variety of sector based tools with various types of MPAs as an important option.
- It would include mechanisms that ensure full sharing of knowledge among the different actors – scientists, affected communities, managers, and policy makers (Lundquist and Granek, 2005; Berkes, 2009; Grorud-Colvert et al., 2010) at all stages of setting up, monitoring and maintaining a MPA. Full sharing of knowledge among participants with very different technical backgrounds and different familiarity with local ecological knowledge often will be challenging (Ban et al., 2009; Ferse et al., 2010). Even among experts, the disciplines of conservation biology and fisheries science have evolved with emphasis on different technical specialities, and social sciences have traditionally been weakly incorporated in both of those expert communities, especially fisheries science (Christie et al., 2003; Garcia and Charles, 2009; Charles, 2011).
- It would take advantage of the significant efficiencies that can be realised in capacity building for policy-making and

management, as well as for the affected communities (McConney et al., 2003; Pomeroy et al., 2004). Many initiatives to share knowledge and build capacity for various types of MPA planning as well as management, both North–South and South–South were reported, although few of these have been documented.

- Tactically, it would emphasise the benefits of coordinating management and enforcement measures across agencies, highlighting the greater efficiencies in program delivery through such coordination.

Where appropriate it would build alliances among fisheries and environmental agencies, and affected communities against powerful interests incompatible to all their perspectives.

Designing and operating planning processes to have these traits would have a number of implications for the features that should be present in the governance processes.

Whatever the governance model, mechanisms for coordinating inter-ministerial/sectoral institutions must exist to reconcile biodiversity and fisheries objectives, and objectives from other major industry sectors as well. Solely from the perspective of planning for MPAs for fisheries management and biodiversity conservation the best case scenario would be a single “super-agency” legally responsible and accountable for the MPAs, and required to consult widely with all agencies and stakeholders

relevant to or affected by the MPA objectives. However, this best-case scenario should be viewed as one of multiple viable models even for MPAs, since most Ministries have other duties than just MPA design and management; many of which may not be well-served by such a governance model.

The mechanisms must clearly (ideally legally) define roles, including interagency responsibilities, and roles for communities and stakeholder, and must function at local, national, and international scales, as appropriate to the type of MPA and fisheries. Different types of exchange programs should be encouraged. The exchanges should include government, industry and community leaders and experts in diverse natural and social sciences.

At the international levels there should be mechanisms to ensure greater cooperation between regional seas organisations and regional fisheries management organisations (RFMOs) and arrangements, to allow regional and national experts to build networks to share experiences and best practices. Some such initiatives are already supported through Large Marine Ecosystem (LME) programs funded by the Global Environment Fund (GEF).

A governance model with the properties above would ensure inclusiveness of affected communities, interested stakeholders, diverse experts, and relevant institutions in planning processes for MPAs for both fisheries and biodiversity conservation. What concrete steps can be taken to speed progress on enacting these conclusions?

### 3.2. Practical steps forward

Regardless of the governance system being used to plan MPAs for fisheries and biodiversity conservation objectives, there are a number of necessary tasks. Although the planning processes are not rigidly stepwise, products of some tasks are necessary prerequisites for successive ones, so a logical order is needed. The initial parts of the planning process must focus on identification, analysis, harmonisation, and communication of clear and well-defined objectives. As the suite of objectives consolidate, the

planning moves to implementation framework, as outlined in the “GOIS” – Goals, Objectives, Indicators, Success – framework.

Several features must be present in the objective-setting part of the planning process, if it is to proceed successfully and efficiently (Table 4). Together these impact and conflict analyses help to identify where compatible objectives may lie, and that the nature of any necessary trade-offs that must be made.

Whenever analytical approaches are used to deliver some of those features, they should take into account time needed to reach various fisheries and biodiversity outcomes, and apply appropriate discount rates, including inter-generational bequest value (Balmford and Whitten, 2003). In any trade-off or conflict analyses it will also be necessary to consider the costs of not acting as well of acting and of any irreversible changes that could result from either action or inaction. The analyses need to quantify both the costs and benefits associated with any available options, and how the costs and benefits are distributed across society, because the acceptability of various options will depend on their perceived equity of distribution of costs and benefits, not just their absolute size.

This, in turn, means that the sustainable livelihoods of affected communities need to be considered broadly. In many areas there is limited occupational mobility of workers employed in fisheries, and extended-family and multi-generational (retirees) dependencies. Even if new employment opportunities are presented through, for example, ecotourism, not all displaced fishers may be able to share in those opportunities (Christie, 2004; Oracion et al., 2005). Consequently the planning process should evaluate the likelihood that fishers would be displaced to other areas, and the ecological and societal consequences of any such displacements. This includes consideration in the planning stages for sustainable financing for any type of MPA taking into account that community-based revenue streams may be altered by the establishment of MPAs primarily for biodiversity conservation in areas where fisheries were traditionally important to community livelihoods. The growing interest in “mainstreaming” ecosystem services in

**Table 4**

Features of governance and information processes that the workshop concluded were essential if MPA objective-setting is to proceed successfully and efficiently.

Action	Rationale	References
Identification of risk-tolerance of all participants, including stakeholders and communities, and agreement on how precaution will be applied in planning and management;	This information helps identify where areas of difficult reconciliation may lie	Gerber et al., 2007
Consolidation of a common, independent science-basis for planning, including the incorporation of TEK (Traditional Ecological Knowledge) and LEK (Local EK) and mechanisms for context-appropriate quality assurance of all information;	This information helps all participants in the process work from a common factual basis in their discussions	Ban et al., 2009
Agreement on a process for handling uncertainty in both analyses and dialogue;	Uncertainties are understood and their implications taken into account in planning	McCook et al., 2009; Bischof, 2010
Agreement on a framework for discussing the necessary properties of baselines, and management benchmarks (targets, limits, etc);	This process ensures all participants agree on the standards against which success of the MPA and impacts on ocean users will be evaluated.	Garcia and Staples 2000; Sainsbury and Sumaila 2003; McClanahan et al., 2011
Agreement on a framework for discussing the necessary properties of outlook trends;	This process ensures all participants will understand the types of information that will be available about potential consequences of MPA on biodiversity and fisheries	Dobbs et al., 2011; Kenchington and Day 2011
Identification of legal frameworks and policy and development goals in place for local and national governments, and at regional and global levels;	This information helps identify both external policy and legal constraints on the ability of agencies to compromise or insist on specific outcomes of the MPA, and where changes in mandates may be necessary for progress on MPAs for fisheries and biodiversity	Ribeiro 2010
To the extent information and resources allow, conduct:		
• Economic impact assessments, ecological impact assessments, and social impact assessments;	Provide information on likely consequences of MPAs on livelihoods, ecosystems, economies, communities.	Mangi et al., 2011; Sutton and Tobin, 2009; Fock, 2011
• Valuation of the ecosystem services provided by the larger area in which the planning is relevant;	Provide information on non-market as well as market-driven values of ecosystem components and processes possibly affected by MPAs	Grafton et al., 2011
• Constraint and opportunity analyses, conflict analysis and Strategic Environmental Assessment.	Formalise the governance context in which the MPA objectives will function.	Klein et al., 2010

national accounts (CBD 2020 Objective 2), or considering payment for ecosystem services processes (e.g. Blue Carbon – Nellemann, 2009) will also be relevant to any MPA planning.

As the planning processes converge on likely sets of reconciled objectives, additional considerations must be addressed, including other economic developments and demographic and environmental trends. As the requirements of institutions involved in implementation emerge, there must be an evaluation of capability of those institutions to meet them. Evaluation frameworks for the fisheries and biodiversity consequences of the MPAs within and beyond their boundaries must also be developed. This requires defining realistic and feasible indicators of both achievement of the objectives and of performance of institutions and partners, and scenarios developed for likely future conditions without as well as with MPAs in place. Agreement on baselines and scales for the indicators is also necessary, to allow the trajectories of the indicators to be interpreted relative to effects of and on all types of MPAs (Pomeroy et al., 2004; Borja et al., 2012). Likewise there needs to be discussion of the monitoring necessary to both allow periodic assessments of progress and performance, and to pick up any large and unexpected effects of implementing the MPAs or of externalities on the MPAs.

A number of operational features was identified that would be helpful, and sometimes necessary, for planning processes to have the properties outlined above and be able to complete their tasks. There is no single or simple framework that would have all the necessary features, however. Rather the processes must be context-specific, taking into account regional preferences and cultures, as well as legislation. Although the way the necessary properties are delivered must be adapted to local conditions, the planning processes will work best if they provide for:

- Comprehensive stakeholder identification;
- Formal stakeholder participation in process via representatives, consultations etc, as well as any informal linkages, differentiating as appropriate “stakeholders” from “rights-holders”, and noting that as stakeholder participation increases, so do transaction costs, creating a self-selection process that may not only lead to less interested parties dropping out but also potentially excluding the economically disadvantaged;
- Methods for being demonstrably responsive to stakeholder input, even when stakeholder preferences cannot be fully accommodated;
- Culturally appropriate methods of communicating with the public;
- Consideration of traditional values and institutions, and use of those institutions to the fullest extent possible;
- Financing and support for data discovery and information management and sharing, including TEK and LEK, so all parties have access to all information;
- Use tribunals and courts to address externalities that may derail a process that is moving forward; and
- Protection against likely pathways to failure. There must be ways to prevent:
  - Political processes from being used to get around the system of participation when political power is not equitably distributed among interest groups;
  - Radical groups from making the entire process confrontational, preferring failure to any degree of compromise on points of disagreement, or wishing to “hijack” MPA planning processes for other partisan objectives.

The reconciliation of biodiversity and fisheries objectives can be particularly challenging for the high seas. Nevertheless, progress

has been made in meeting international commitments for MPA networks in the Northeast Atlantic and Southern Ocean and for safeguarding biodiversity through greater spatial management of deep sea bottom fisheries in the high seas. RFMO/As and other sectoral conventions can be and in many cases have been updated to include explicit conservation mandates extending beyond just the exploited stocks. However, mechanisms to facilitate coordination among different conventions need to be established. One example at the regional level is the memorandum of understanding between the North East Atlantic Fisheries Commission (NEAFC) and the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) in the Northeast Atlantic. Coordination can also be facilitated by provision of a common basis of science advice for the various agencies that must cooperate in achieving the reconciled objectives, such as the role of International Council for the Exploration of the Sea (ICES) in the North Atlantic and of the CBD in facilitating regional workshops for identifying ecologically or biologically significant areas (CBD Decision X/29/para. 36). An important element for ensuring acceptance of the results is again ensuring wide participation amongst the relevant states, international bodies, and stakeholders.

#### **4. Governing MPA management to meet both fisheries and biodiversity objectives**

##### *4.1. Concepts to guide management of MPAs for fisheries management and biodiversity conservation*

Considering the information available on management of MPAs for fisheries and biodiversity objectives, there were two consistent messages: 1) management must be a continuously learning and adaptive process, and 2) it must be inclusive and participatory, respecting the rights of indigenous peoples and local communities. There are already clear cases made for why management for either fisheries or biodiversity conservation objectives has to be adaptive and learn from experience (FAO, 2003; McCook et al., 2010), and no special additional considerations were identified when a MPA has objectives for both. However, the inclusiveness of management becomes both more complex and more important when the MPAs are designed to deliver both fisheries and biodiversity objectives. Moreover, the multiple objectives reviewed in the Analysis of Objectives section contribute to even greater complexity of management of MPAs for fisheries and biodiversity. A wider range of experts is needed to evaluate the strengths and weaknesses of the many available management tools relative to the full suite of objectives. The local and traditional knowledge related to fisheries and other uses of marine biodiversity, including genetic resources, must be included fully and appropriately in these evaluations. Local fishery managers often are knowledgeable about local circumstances for fisheries they manage, but other sources of knowledge will be needed to broaden the view of current status of and threats to biodiversity components that are not exploited, as well as the roles of these biodiversity components in communities and livelihoods (Geoghegan and Renard, 2002; Lundquist and Granek, 2005).

The greater inclusiveness of management can be delivered in many ways, and often more than one approach must be pursued. Inclusiveness can be promoted by policy makers, communities, external development and conservation groups, and/or from “hands-on” officers within institutions. From regional to multi-national levels, consultations and collaboration needs to include affected communities, participants from affected industries and their respective sectoral management agencies from all appropriate levels of governments, scientists and holders of TEK and LEK, and relevant interest groups.

For multiple agencies and levels of government to collaborate in managing MPAs for both fisheries and biodiversity conservation objectives requires both a commitment to collaborate and a mandate (e.g. in legislation) to do so. The institutional commitment will have to be augmented by some form of social contracts with all relevant stakeholders for allocation of roles, responsibilities, and accountability for the management actions, as well as for sharing of benefits from the various outcomes of the MPA management. Such inclusive engagement also addresses the common requirement for prior consultation with other agencies and stakeholders before any one agency can implement policies and management plans for any type of MPA (Tompkins et al., 2002; Agardy et al., 2011).

These processes of managing MPAs for fisheries and biodiversity, already complex just because of their diversity of participants, face a number of other challenges. Planning MPA management on a large scale for networks of MPAs can provide more flexibility than planning focused on a single area. However, sooner or later management planning must consider specific options that potentially affect individual communities and users of marine resources and ecosystems. At that point some participants in the processes may react to outcomes on very local scales of personal activities, whereas others are focused on more aggregate outcomes. Consequently the costs and benefits of any option may be perceived differently, leading to a “Not In My Back Yard” syndrome for MPAs for any type of outcome. In addition, although the major categories of classical fisheries management tools (input controls on effort and output controls on catches; Cochran and Garcia, 2009) can readily be combined with spatial measures, some fisheries management measures, such as customary tenure institutions for community-based fisheries, can be undermined by establishment of biodiversity conservation MPAs that restrict fisheries in particular places (Cinner, 2007; Berkes, 2009; Rosendo et al., 2011). Workshop participants experienced in community-based fisheries management stressed the importance of transferring the same community-based approaches to MPA management generally.

Unilateral imposition of biodiversity conservation MPAs on fisheries can run counter to two important lessons learned from experience in fisheries management at both community and industrial scales; that compliance is essential for success of management, and that surveillance and monitoring of fishing activities is often necessary to ensure compliance (FAO, 2003). Even if a MPA primarily for biodiversity conservation is accompanied by promises of benefits to fisheries, if participants in the fisheries are sceptical of those promises they may be unwilling to comply with the resultant regulations, and try to avoid surveillance and monitoring efforts (Sethi and Hilborn, 2008; Evans et al., 2011). For MPA management in general to gain the mutual trust of all parties participating in planning, delivering, and enforcing the measures, it may have to overcome long histories of stakeholder interactions with different ministries. At the workshop many examples were presented of stakeholders responding well to those agencies with whom they have dealt effectively within past, but distrusting those whom they feel have not been receptive to their interests. Differing distributions of trust and distrust among stakeholders and agencies can affect communications while management plans for all types of MPAs are developed and compliance during implementation of the plans.

When participants in the management process come from agencies and well-organised interest and community groups, they may have accountabilities to their supervisors or constituencies and funders that present additional challenges to reaching consensus on ways to proceed. Agreement on management strategies and measures can require compromises so there are no complete winners in the processes, and participants from agencies,

industries, advocacy groups, and communities may have a hard time selling the compromises to their superiors or constituencies. Unwillingness of agencies to accept reductions in their traditional scope of decision making can also result in a lack of lead agency and champions committed to moving the management process forward. None of these are insurmountable challenges, but any of them may be encountered. What kinds of practical measures are available for addressing them?

#### 4.2. Practical steps for management

A number of practical steps can improve the ability to make and implement management decisions on MPAs that address both fisheries and biodiversity objectives. Some are steps that institutions can take, others are for communities and inclusive processes. At the level of federal and multi-lateral governments, many different Ministries have provided leadership in planning for MPA management (e.g. Tourism – Mozambique, Science and Technology – Malaysia, a special agency mandated for MPAs – Tanzania) or had leadership dispersed among a variety of Ministries (e.g. in Canada the Departments of Fisheries and Oceans, Environment, and Parks Canada all may manage MPAs). Cabinets have occasionally served as a neutral forum for dialogue among agencies about roles and responsibilities in MPA management, also elevating the priority of integrating fisheries and biodiversity conservation more generally in government. Many governments already have action-oriented inter-ministerial committees, and one with a relevant mandate can be used for these purposes. However, sometimes spontaneous collaboration amongst actors can be effective, if either common interests are recognised, or a clear champion for action on MPAs for biodiversity and fisheries is presented.

Multi-objective MPAs can bring agencies at federal or regional levels together around a common objective. If the processes seek ways for sectors to use their familiar tools to achieve a wider range of applications, they may facilitate building familiarity and trust among participating agencies, and form the basis for inter-agency committees which continue to work on MPA management. For example the power of fisheries agencies to close areas to fishing can be coordinated with actions of other agencies, long before (or even whether or not) the area becomes a legal MPA. New funding opportunities (such as MPA trust funds) can also bring agencies together at many levels of government, rather than expecting the collaborating agencies to commit existing funds to management measures agreed to in multi-departmental (or even more inclusive) settings.

Legal frameworks are needed that allow for multi-agency management actions and recognise community rights in managing resources on which the communities depend. Consequently an early step is a review of policies and regulations that set parameters for interagency cooperation and stakeholder and community engagement in management processes. Provision should be made thereafter for regular review of institutional arrangements and management measures for the MPAs.

When institutions are slow to move away from historical roles, practical steps may be available in the form of community led initiatives for better management of a specific area. For example Japan has had substantial success with community-based MPA-like measures using an adaptable legal framework. Community-led initiatives may bring institutions together for better future collaboration, whether or not the initial specific initiative produced agreement on management of a MPA for fisheries and biodiversity. Just as champions are valuable within institutions, champions within communities are also able to facilitate collaboration among groups, and even bring reluctant agencies into the management process. Cooperation can also be facilitated by various types of

**Table 5**

A list of mechanism that can facilitate likelihood that MPAs can deliver both fisheries and biodiversity objectives. All mechanisms emerged from workshop discussion with references to illustrate the use of each mechanism contributed post-meeting by participants.

Possible mechanisms	Illustrative references
Ensure sharing of knowledge among the different actors (scientist, communities, manager, etc), with all sources of knowledge given value;	Ritchie and Ellis 2010; Spalding 2011
Make explicit the priorities and objectives of each of the actors, particularly if individuals participating in management discussions are not the same as those participating in the planning discussions;	Ban et al., 2009; Bischof, 2010
Facilitate feedback between clarifying objectives and priorities of the different actors and the sharing of knowledge. This is a complex issue, as individuals may be reluctant to make public information that they consider commercially or culturally proprietary. The feedback mechanisms may help participants understand why individuals may view what appear to be simple requests for information from one perspective to be complex issues from another;	Charles and Wilson 2009
Conduct baseline studies on fishery, biodiversity, and socio-economic issues to enable monitoring of progress towards objectives;	Pomeroy et al., 2004; Yasue et al., 2010
Identify control areas for purposes of evaluating the consequences of the MPAs;	Russ, 2002; Pomeroy et al., 2004
Establish ongoing and participatory monitoring programs;	Monk et al., 2008; Yasue et al., 2010
Promote cooperative work among individuals from different interests, such as through linking the biodiversity aspects of MPA management to meeting the needs for protecting and where necessary enhancing essential fish habitat;	Friedlander et al., 2007
Use the growing interest in eco-certification of fisheries as an incentive for commercial fishing to seek common management measures with biodiversity interests;	Wessells et al., 2001
Confront and seek solutions to issues known to be “deal-breakers”, such as effort displacement in fisheries, both to avoid negative impacts on outside areas and other sectors and to communicate to fishers at risk of being displaced that their concerns are part of the management planning process;	Sutton and Tobin, 2009; Rosendo et al., 2011
Develop and support capacity for self-enforcement through local organisations, bringing the full fishing community into the management program; and	Govan, 2009; Ferse et al., 2010
Support more generally capacity development for sustainable fisheries, conservation of biodiversity, and MPA management in general.	Toropova et al., 2010; UNEP, 2011

exchange programs including government, industry and community leaders, and North–South networks of MPA managers are being developed (e.g. OSPAR-Abidjan initiative [http://www.ospar.org/content/content.asp?menu=00570622000000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=00570622000000_000000_000000)). For effective communication among all institutions and interest groups there is value from continuity, longevity and consistency of individuals in key roles.

Regardless of the specific roles of institutions and components of civil society, a number of activities can promote, and may even be necessary, for management of MPAs to deliver fisheries and biodiversity objectives. Many of these mechanisms, listed in Table 5, will need to be considered in the planning stages for all types of MPA design and management, even though their implementation will be at the management stages.

Also as was the case for the planning process there are special challenges of management of MPAs on the high seas, whatever their objectives. These focus particularly on compliance and enforcement, given the logistical difficulties in monitoring and surveillance of high seas fisheries. New tools such as Vessel Monitoring Systems are making relevant information more available for surveillance (Hall-Spencer et al., 2009), but these tools do not solve the issues of jurisdiction to act on the information. Stakeholder engagement in planning the management programs also has the same complexities as the planning process for setting the MPA objectives. It must confront all the same challenges about defining who qualifies as a stakeholder, how to provide equitable opportunities for engagement of those who are considered legitimate stakeholders when wealth and power may be inequitably distributed, who has jurisdiction to set and enforce management measures, how to share costs equitably among very different actors, and how to deal with additional sectors or groups who ask for inclusion after the process has been underway for some time, because they feel their interests may be affected.

All the concrete measures for addressing the similar challenges in the planning process for setting objectives for high seas MPAs should be considered in the processes for management of high seas fisheries and MPAs as well. There are many examples of efforts of intergovernmental agencies to promote such processes. Regional

Seas Organisations often follow up their TDA processes by providing fora where national environmental and biodiversity experts can share information for management as well as planning. The network of Secretariats of RFMOs serves a similar function for sharing of information and experience on MPA management among fisheries experts. OSPAR and NEAFC are acting to increase the compatibility of their respective management measures to protect jointly identified areas of special ecological significance. In some areas networks of MPA managers are being developed across jurisdictional borders, but these are in need of support and expansion (e.g. West African, Western Indian Ocean and Bay of Bengal). The Global Environment Facility already supports an exchange of learning across the Large Marine Ecosystem (LME) program managers (International Waters Learning Network), and there are moves to bring MPA discussions directly into those initiatives.

## 5. Final conclusions

From the review, analysis and dialogue undertaken at the workshop a number of conclusions has emerged about a way forward for harmonising MPAs for biodiversity conservation and fisheries management. Policy makers and managers should give particular attention to these conclusions as the context for planning and management:

- There are various types of MPAs, and individual MPAs can have multiple objectives, serving as one tool among several for fisheries management and biodiversity conservation;
- Both fisheries and environment interests have to accommodate other economically and/or socially important sectors (such as energy, shipping, coastal developments, tourism, military, recreation and culture), so developing MPAs for fisheries and biodiversity outcomes has to be viewed as only part of a much larger process to set fully integrated objectives and management strategies for sustainable use and conservation of the oceans;
- Appropriately designed and managed MPAs can contribute significantly to increased reconciliation between fisheries

management and biodiversity conservation, supported by growing willingness of and need for these two sectors to work together for conservation and sustainable use of resources;

- Institutional arrangements are critical to making MPAs work for both fisheries and biodiversity conservation. The institutional structures have to be clear and adapted to the local situation, respecting rights of indigenous peoples and local communities – no one size fits all;
- Legal frameworks are also important. They must not only permit and ideally promote inter-agency and private–public cooperation, but also take customary arrangements into consideration. However there remains no consensus on whether or not this will require a high level agency for integrated oceans management;
- Stakeholder and community participation is also crucial for success, creating a need for new or adapted coordinating mechanisms. Again no one size fits all;
- Objectives for both fisheries management and biodiversity conservation have common goals of sustaining habitats and resources. For fisheries management the priorities are typically sustainable human use and food security while for environmental management the priorities are maintenance of biodiversity and ecosystem processes that underpin natural resource productivity.
- There is far from full understanding of the impacts of MPAs on fisheries and biodiversity, and of how to design MPAs to have greatest likelihood of achieving their objectives. Therefore MPAs should be designed and managed to facilitate monitoring, evaluation of progress towards their fisheries and biodiversity objectives, and learning from experience.

Within this framework a number of steps is necessary for progress. Policy makers and managers should ensure that each of these activities is part of planning and implementation of MPAs, if they are to achieve their full potential for increasing sustainability of fisheries and conservation of biodiversity:

- Make capacity development for both sustainable fisheries and biodiversity-oriented MPA management and larger scale marine spatial planning a major component of international assistance and national development aid packages;
- Encourage collaboration and effective communication through bringing local, regional, national and international bodies for fisheries and conservation together on a regular basis;
- Promote commitment to collaboration at all levels of government, and find champions in leadership positions;
- Ensure legislative frameworks provide a mandate for organisations to collaborate with each other and with civil society for biodiversity conservation and sustainable use of resources;
- Establish action oriented inter-ministerial committees to improve inter-agency collaboration;
- Review regularly institutional arrangements and management measures including MPAs for either or both biodiversity and fisheries to drive improvements in design;
- Scale up MPA planning processes in general to national and regional levels to enhance conservation benefits and flexibility, rather than planning each MPA as a “one off” activity;
- Use case studies to communicate mutual benefits of MPAs as well as other tools to relevant agencies and stakeholders;
- Encourage social contracts to allocate roles, responsibilities, and accountability and to clarify shared benefits among local communities, private sectors and governments;
- Find and promote mechanisms that ensure real local participation and equitable sharing of benefits and costs for local communities;

- Ensure the engagement of all stakeholders and communities in all aspects of the process, from objective setting to implementation; and
- Ensure clearly defined responsibilities for all actors, with transparency and accountability of all parties.

This is an ambitious list of activities to pursue, although few points are unique to creating and managing MPAs for fisheries and biodiversity. Each item on the list is a part of the current trends to more ecosystem-oriented and more inclusive ocean policy and management including the current drive to establish overarching MSP plans for sea areas, a trend reflecting commitments already made by States and IGOs, and promoted by experts, NGOs and community leaders. Focussing efforts on MPAs for fisheries and biodiversity conservation merely provides a common theme around which a particularly diverse array of interests can all rally, and if successful, from which a particular broad array of benefits can accrue to both society and marine ecosystems.

### Acknowledgements

We would like to thank the Ministry of Fisheries and Coastal Affairs, Norway, the Nordic Council of Ministers, the Norwegian Agency for Development Cooperation and the Institute of Marine Research for funding the workshop on which this manuscript was based, and all participants for their contributions. We would also like to thank two reviewers and the Editor for suggestions which improved the manuscript.

### Appendix A. Supplementary material

Supplementary material related to this article can be found online at <http://dx.doi.org/10.1016/j.ocecoaman.2012.08.001>.

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