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RESPONSIBLE
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Suppl. 4

FISHERIES MANAGEMENT

4. Marine protected areas and fisheries

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4. Marine protected areas and fisheries

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PREPARATION OF THIS DOCUMENT

The Guidelines were finalized by the FAO Fisheries and Aquaculture Policy and Economics Division (FIP) and the Fisheries and Aquaculture Resources Use and Conservation Division (FIR).

The document was drafted by K. Cochrane, D. Gréboval, R. Pomeroy, J. Sanders, M. Sissenwine and L. Westlund based on information assembled in an expert workshop on *Marine Protected Areas and Fisheries Management: Review of Issues and Considerations*[1], held on 12–14 June 2006, and subsequent reviews. The experts participating in the workshop were L.W. Botsford, J.C. Castilla, A. Charles, P. Christie, M. Hatziolos, A. Herrera, D. Japp, G. Kelleher, Y. Kondo, C.G. Lundin, E.J. Molenaar, M. Ngoile, A. Parma, M. Sissenwine, J Y Weigel and T. Young, as well as FAO staff and consultants: K. Cochrane, C. de Young, D. Gréboval, B. Kuemlangan, J. Sanders, A. Skonhoft and H. Watanabe. Written contributions were also provided by A.K. Hurd, K. Martin, M.B. Mascia, I. Meliane, F. Micheli, R.B. Pollnac, R.S. Pomeroy, M.A. Samoilys and A.T. White.

Additional significant contributions to the text were made by F. Douvere, C. Ehler, A. Neiland, S. Kininmonth, T.R. Young, T. Agardy, P. Christie, B. Creese, A. Jeudy de Grissac and M. Sowman. FAO staff and consultants – P. Barros, A. Hjort, B. Kuemlangan and C. Loxley – also contributed important comments, reviews and assistance. The illustrations in this document were designed and drawn by Manuela D'Antoni.

The Guidelines on *Marine protected areas and fisheries* should be read as a supplement to the FAO Technical Guidelines on *Fisheries management* (FAO, 1997), on *The ecosystem approach to fisheries* (FAO, 2003a) and on *The human dimensions of the ecosystem approach to fisheries* (FAO, 2009a).

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[1] The outcome of the workshop is documented in FAO, 2007a.

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ABSTRACT

This document on *Marine protected areas (MPAs) and fisheries* has been developed to provide information and guidance on the use of marine protected areas (MPAs) in the context of fisheries. As MPA implementation moves ahead in the arena of marine biodiversity conservation, many people feel that the fisheries aspects are not fully understood nor always appropriately taken into account, and that guidance specific to this sector is needed. These Guidelines look specifically at fisheries features of MPAs, but also address the interface between fisheries management and biodiversity conservation and provide support for MPAs with multiple objectives.

The Guidelines are divided into two sections: the first discusses definitions and context, and provides background information on fisheries management, the ecosystem approach to fisheries (EAF) and MPAs as a tool for fisheries management, including socio-economic and biological impacts. The second section considers the planning and implementing of MPAs including the institutional, legal and policy context, the planning process and actual implementation considerations. Conclusions and future directions are offered in the last chapter of this section, while a selection of annexes offers in-depth information on a few key issues.

The document highlights the need for increased coordination across sectors and agencies/departments. Integration of diverse interests and viewpoints is required if we are to successfully manage our oceans and their resources for future generations. As with all fisheries management, good governance – including adequate stakeholder participation – is key to successful and equitable management outcomes.

CONTENTS

ACRONYMS AND ABBREVIATIONS

CAR	comprehensiveness, adequacy and representativeness (MPA network principles)
CBD	Convention on Biological Diversity
CCRF	Code of Conduct for Responsible Fisheries (FAO)
COFI	Committee on Fisheries (FAO)
CORALI	Coral Reefs and Livelihoods Initiative
CPUE	catch per unit effort
EA	ecosystem approach
EAF	ecosystem approach to fisheries
EEZ	exclusive economic zone
ESD	ecologically sustainable development (Australia)
GFCM	General Fisheries Commission for the Mediterranean
GIS	geographic information system
GPS	Global Positioning System
ICM, ICZM, ICAM	integrated coastal (zone or area) management
ICRAN	International Coral Reef Action Network
IMO	International Maritime Organization
IPOA	International Plan of Action
ISA	International Seabed Authority
IUCN	International Union for Conservation of Nature
LMMA	locally managed marine area
MARPOL	International Convention for the Prevention of Pollution from Ships
MCS	monitoring, control and surveillance
MPA	marine protected area
MSY	maximum sustainable yield
NAFO	Northwest Atlantic Fisheries Organization
NEAFC	Northeast Atlantic Fisheries Commission
NGO	non-governmental organization
NOAA	National Oceanic and Atmospheric Administration (United States)
PES	payment for environmental services
PPP	percentage population protection
PSSA	particularly sensitive sea areas
RFB	regional fishery body

RFMO/A	regional fisheries management organization/ arrangement
RRA/PRA	rapid/participatory rural appraisal
SEAFDEC	Southeast Asian Fisheries Development Centre
SEAFO	South East Atlantic Fisheries Organization
SLED	sustainable livelihoods enhancement and diversification
SPR	spawning per recruit
TAC	total allowable catch
TURFs	territorial use rights in fisheries
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFSA	Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (United Nations Fish Stocks Agreement)
VME	vulnerable marine ecosystem
VMS	vessel monitoring system
WCPA	World Commission on Protected Areas
WWF	World Wide Fund for Nature (in the United States, World Wildlife Fund)
WSSD	World Summit on Sustainable Development (Johannesburg, South Africa, 2002)
WSSD-POI	Plan of Implementation of the World Summit on Sustainable Development

PREFACE

These Guidelines have been through a long and complex preparation process. Marine protected areas (MPAs) are currently much discussed and often strongly promoted from a biodiversity conservation perspective. However, spatial-temporal closures, of which MPAs are one category, have a long history in fisheries management. Views on how and when to use MPAs and what they can achieve differ significantly among diverse political, social and professional groups, and also among individuals. In preparing these Guidelines, it was found that MPA planning and implementation can be controversial and that there is often a lack of clarity with regard to both objectives and processes. It is thus recognized that these Guidelines may not comply with everyone's perspectives, but it is hoped that they constitute a contribution to the global wisdom on MPAs and their role in achieving sustainable livelihoods, responsible fisheries and a healthy environment.

We initiated work on the Guidelines because of a need to know more about how MPAs work in the context of fisheries. We felt that as MPA implementation moves ahead in the arena of marine biodiversity conservation, the fisheries aspects are not always fully understood nor appropriately taken into account, and that guidance specific to this sector is needed. As the fisheries sector moves toward management according to EAF, which requires maintenance of biodiversity it is necessary to look at the full range of potential tools for achieving the goals of management. Accordingly, while these Guidelines look at some fisheries specific features of MPAs, their goal is to address the full range of dimensions of fisheries management, thus providing support for MPAs with multiple objectives.

Fisheries management is about achieving optimal and sustainable utilization of fishery resources for the benefit of humanity. This requires safeguarding ecosystems and conserving biodiversity. 'Conventional' fisheries management approaches, regulating fishers' behaviours and controlling fish mortality, is important in achieving this sustainability objective – if efficiently implemented. However, because of the failure of conventional measures in many cases, MPAs have increasingly been promoted. Fisheries management, at the same time, is also evolving towards more integrated approaches through EAF. As a management framework, EAF is not a new approach, but a practice in evolution, progressively making more explicit the inclusion of broader ecosystem considerations– including both environmental and human

dimensions – with a view to achieving sustainability. MPAs can be useful for achieving objectives related to fisheries management and biodiversity conservation, but to meet the majority of fisheries management goals they generally must be implemented in combination with other, more conventional management measures.

These Guidelines aspire to enhance understanding of how MPAs can be used together with other management tools within a reconciled framework (i.e. where fisheries management objectives exist in tandem with other sectoral objectives). No single recipe can be followed to guarantee success for the use of MPAs because each situation will be unique in terms of its biological, ecological, social, economic and legal characteristics. However, the wealth of experience and knowledge that is available should nevertheless enable good guidance to be provided on the design and implementation, or improvement of existing, MPAs. These Guidelines represent a common understanding of the roles of MPAs relative to fisheries at the moment they were developed, rather than a final recommendation on these roles or the relative importance of MPAs. So, as with many continually evolving topics, FAO will continue to investigate technical aspects of MPAs within a fisheries context and will be producing further guidance on specific aspects of MPAs as the information available evolves.

Kevern Cochrane
Director
Fisheries and Aquaculture Resources Use and Conservation Division

BACKGROUND

1. From ancient times, fishing from oceans, lakes and rivers has been a major source of food, a provider of employment and other economic benefits for humanity. Ocean productivity seemed particularly unlimited. However, with increased knowledge and the dynamic development of fisheries and aquaculture, it was realized that living aquatic resources, although renewable, are not infinite and need to be properly managed, if their contribution to the nutritional, economic and social well-being of the growing world's population was to be sustained.

2. However, for nearly three decades, because of the dramatic increase of pollution, abusive fishing techniques worldwide, and illegal, unreported and unregulated fishing, catches and landings have been shrinking and fish stocks declining, often at alarming rates.

3. Stock depletion has negative implications for food security and economic development and reduces social welfare in countries around the world, especially those relying on fish as their main source of animal protein and income such as subsistence fishers in developing countries. Living aquatic resources need to be properly managed, if their benefits to society are to be sustainable.

4. Sustainability of societal benefits requires a recovery of depleted stocks and maintenance of the still-healthy ones, through sound management. In this regard, the adoption of the United Nations Convention on the Law of the Sea, in 1982 was instrumental. The law provides a new framework for the better management of marine resources. The new legal regime of the oceans gave coastal States rights and responsibilities for the management and use of fishery resources within the areas of their national jurisdiction, which embrace some 90 percent of the world's marine fisheries.

5. In recent years, world fisheries have become dynamically developing sectors of the food industry, and many States have striven to take advantage of their new opportunities by investing in modern fishing fleets and processing factories in response to growing international demand for fish and fishery products. It became clear, however, that many fisheries resources could not sustain an often uncontrolled increase of exploitation. Overexploitation of

important fish stocks, modifications of ecosystems, significant economic losses, and international conflicts on management and fish trade still threaten the long-term sustainability of fisheries and the contribution of fisheries to food supply.

6. In light of this situation, while recognizing that the recovery of depleted stocks is still urgent and avoiding depleting still-healthy stocks as important, FAO Member States have expressed the need to further develop aquaculture as the only immediate way to bridge the gap between the dipping capture fisheries output and the increasing world demand for seafood.

7. Indeed, in the last three decades, aquaculture has recorded a significant and most rapid growth amongst the food-producing sectors and has developed into a globally robust and vital industry. However, aquaculture also has been shown at times to carry the potential to cause significant environmentally and socially adverse impacts.

8. Thus, the Nineteenth Session of the FAO Committee on Fisheries (COFI), held in March 1991, recommended that new approaches to fisheries and aquaculture management embracing conservation and environmental, as well as social and economic, considerations were urgently needed. FAO was asked to develop the concept of responsible fisheries and elaborate a Code of Conduct to foster its application.

9. Subsequently, the Government of Mexico, in collaboration with FAO, organized an International Conference on Responsible Fishing in Cancún in May 1992. The Declaration of Cancún, endorsed at that Conference, was brought to the attention of the United Nations Conference on Environment and Development Summit in Rio de Janeiro, Brazil, in June 1992, which supported the preparation of a Code of Conduct for Responsible Fisheries. The FAO Technical Consultation on High Seas Fishing, held in September 1992, further recommended the elaboration of a code to address the issues regarding high seas fisheries.

10. The One Hundred and Second Session of the FAO Council, held in November 1992, discussed the elaboration of the Code, recommending that priority be given to high seas issues and requested that proposals for the Code be presented to the 1993 session of the Committee on Fisheries.

11. The twentieth session of COFI, held in March 1993, examined in general the proposed framework and content for such a Code, including the elaboration of guidelines, and endorsed a time frame for the further elaboration of the Code. It also requested FAO to prepare, on a "fast track" basis, as part of the Code, proposals to prevent reflagging of fishing vessels which affect conservation and management measures on the high seas. This resulted in the FAO Conference, at its Twenty-seventh Session in November 1993, adopting the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, which, according to FAO Conference Resolution 15/93, forms an integral part of the Code. It was also recognized and confirmed that issues of responsible aquaculture development and aquaculture sustainability should be addressed in the formulation process so that these be appropriately covered in the envisaged Code.

12. This implicit recognition of the importance of governance in aquaculture is underlined in Article 9.1.1 of the Code, which requires states to "establish, maintain and develop an appropriate legal and administrative framework to facilitate the development of responsible aquaculture". In addition, at the beginning of the new millennium, there is growing recognition of the significant potential for the use of ocean and coastal waters for mariculture expansion. The outstanding issue in this area is that, unlike in capture fisheries, the existing applicable principles of public international law and treaty provisions provide little guidance on the conduct of aquaculture operations in these waters. Yet, experts agree that most of the future aquaculture expansion will occur in the seas and oceans, certainly further offshore, perhaps even as far as the high seas. The regulatory vacuum for aquaculture in the high seas would have to be addressed should aquaculture operations expand there.

13. The Code was formulated so as to be interpreted and applied in conformity with the relevant rules of international law, as reflected in the 10 December 1982 United Nations Convention on the Law of the Sea. The Code is also in line with the Agreement for the Implementation of the Provisions of this Law, namely the 1995 Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. It is equally in line with, inter alia, the 1992 Declaration of Cancún and the 1992 Rio Declaration on Environment and Development, in particular Chapter 17 of Agenda 21.

14. The development of the Code was carried out by FAO in consultation and collaboration with relevant United Nations Agencies and other international organizations, including non-governmental organizations.

15. The Code of Conduct consists of five introductory articles: Nature and scope; Objectives; Relationship with other international instruments; Implementation, monitoring and updating; and Special requirements of developing countries. These introductory articles are followed by an article on General principles, which precedes the six thematic articles on Fisheries management, Fishing operations, Aquaculture development, Integration of fisheries into coastal area management, Post-harvest practices and trade, and Fisheries research. As already mentioned, the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas forms an integral part of the Code.

16. The Code is voluntary. However, certain parts of it are based on relevant rules of international law, as reflected in the United Nations Convention on the Law of the Sea of 10 December 1982. In capture fisheries, the Code also contains provisions that may be or have already been given binding effect by means of other obligatory legal instruments amongst the Parties, such as the Agreement to Promote Compliance with Conservation and Management Measures by Fishing Vessels on the High Seas, 1993. In aquaculture, the provisions of the Code implicitly encourage participatory governance of the sector, which extends from industry self-regulation, to co-management of the sector by industry representatives and government regulators and to community partnerships. Compliance is self or enforced by peer pressure, with industry organizations having the ability to exclude those who do not comply and governments only checking periodically.

17. The Twenty-eighth Session of the Conference in Resolution 4/95 adopted the Code of Conduct for Responsible Fisheries on 31 October 1995. The same Resolution requested FAO inter alia to elaborate appropriate technical guidelines in support of the implementation of the Code in collaboration with members and interested relevant organizations.

18. The expanding role and increasing contribution of aquaculture to economic growth, social welfare as well as global food security was recognized and reiterated at international levels such as the 1995 FAO/ Japan Conference on the Contribution of Fisheries and Aquaculture to Food

Security, the 1996 World Food Summit, the 1999 Ministerial Meeting on Fisheries, the 2000 FAO/NACA [Network of Aquaculture Centres in Asia and the Pacific] Conference on Aquaculture in the Third Millennium and its Bangkok Declaration and Strategy, and most recently, the 2009 World Summit on Food Security.

19. The application of the ecosystem approach to fisheries and aquaculture as strategies for the development of the sector contributes to the implementation of the provisions of the Code, thereby enforcing the technical, ecological, economic and social sustainability of the industry.

20. The concepts and principles of the ecosystem approach to fisheries (EAF) are not new. The Code itself is based on these, and their roots may be found in a number of international instruments and agreements, including the:

- 1972 Declaration of the United Nations Conference on the Human Environment (Stockholm Declaration);
- 1982 United Nations Convention on the Law of the Sea;
- 1992 Rio Declaration and Agenda 21 adopted by UNCED;
- 1992 Convention on Biological Diversity;
- 1995 United Nations Fish Stocks Agreement.

21. Even more recently, the World Summit on Sustainable Development (Johannesburg, South Africa, 2002) adopted a political declaration and a Plan of Implementation in relation to capture fisheries, ecosystem health and the conservation of biodiversity. In the Plan of Implementation, States agreed to "Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012 and time/area closures for the protection of nursery grounds and periods, proper coastal land use and watershed planning and the integration of marine and coastal areas management into key sectors" (paragraph 32c).

22. An essential step towards defining EAF was taken in 2001 with the adoption of the FAO Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem, which, among other recommendations, requested that FAO prepare "…guidelines for best practices with regard to introducing ecosystem considerations into fisheries management". Supplementing publication of

Fisheries management (FAO, 1997), FAO has since published several technical guidelines on EAF.

- The ecosystem approach to fisheries (FAO, 2003a)
- Best practices in ecosystem modelling for informing an ecosystem approach to fisheries (FAO, 2008a)
- The human dimensions of the ecosystem approach to fisheries (FAO, 2009a)

23. This document on *Marine protected areas and fisheries* should be considered a complement to the existing FAO Technical Guidelines on *Fisheries Management*.

INTRODUCTION

The need to safeguard our marine environment better and manage the use of existing aquatic resources for sustainability is increasingly being recognized worldwide. In fisheries management, the consideration of wider ecosystems, including the human component, is now extensively accepted, and methods such as the ecosystem approach to fisheries (EAF) are being promoted.

The use of marine protected areas (MPAs) has taken on greater importance lately in discussions of how to protect marine ecosystems and reverse the degradation of aquatic habitats. MPAs are commonly described as a tool for biodiversity conservation and as part of the ecosystem approach (EA). Spatial-temporal fishing closures are also used in fisheries management, and MPAs and fisheries are linked through this common avenue of spatial management and through EAF.

GUIDELINES ON MARINE PROTECTED AREAS IN THE CONTEXT OF FISHERIES

The Johannesburg summit of 2002[2] heightened attention on MPAs. Its Plan of Implementation (WSSD-POI) called on nations to promote the conservation and management of important and vulnerable marine and coastal areas, both within and beyond national jurisdiction, including developing and facilitating:

> *… the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012 and time/area closures for the protection of nursery grounds and periods, proper coastal land use and watershed planning and the integration of marine and coastal area management into key sectors.* (United Nations, 2002).

The range of MPA objectives called for in the WSSD-POI includes fisheries objectives within the context of broader conservation objectives.

[2] World Summit on Sustainable Development (WSSD), Johannesburg, South Africa, September 2002.

However, although the call for MPAs and MPA networks has been reiterated in various fora – for example, in the 5th World Parks Congress, 2003, and in meetings of the Convention on Biological Diversity (CBD) and the Group of Eight (G8) – there remains a certain confusion as to what is meant by an MPA and by representative networks, and there are several definitions available. Currently, moreover, most published MPA implementation guidance has been compiled with a biodiversity focus and does not necessarily include a fisheries perspective. Thus, in 2005, the Twenty-Sixth Session of the FAO Committee on Fisheries (COFI) requested the Fisheries and Aquaculture Department to fill this gap by developing technical guidelines on the design, implementation and testing of MPAs in relation to fisheries. This request was reaffirmed by the Twenty-Seventh Session of COFI and also supported by the United Nations General Assembly. FAO has developed the present Guidelines in response.

PURPOSE AND TARGET AUDIENCE

The purpose of the Guidelines on *Marine protected areas and fisheries* is to address the interface between fisheries management and biodiversity conservation and to provide guidance in implementing MPAs with multiple objectives, when one of the primary objectives is related to fisheries management. Their focus is on those aspects of MPAs related to fisheries, and hence the Guidelines do not seek to be an exhaustive guide on MPAs. Other guidelines and documents deal with MPAs from a more direct biodiversity conservation perspective (Box 1). Within the fisheries context, the Guidelines seek to cover issues relevant to MPAs in all ocean zones, that is, from territorial waters to the high seas, and discuss concepts both with regard to MPAs as single units and MPA networks.[3] All types of MPAs are included, not only 'no-take zones' (areas under total protection), although protected areas for cultural or archaeological purposes, energy production, etc., or areas designated for aquaculture are not explicitly dealt with. Such areas may nevertheless have spin-off effects on fisheries management and biodiversity conservation.

With the current evolution of fisheries management towards EAF, management measures combining more-specific fisheries management purposes with broader biodiversity conservation objectives are increasingly needed and are becoming more common. At the same time, many countries

[3] The text tends to use the term 'MPAs' also in relation to MPA networks. The term 'MPA networks' is generally only used when referring specifically to aspects that are particular to networking.

have made commitments under international agreements to use MPAs or MPA networks to conserve biodiversity, and many of these commitments involve reaching specified targets for some proportion of waters under protected area designation. The use of MPAs is thus becoming more widespread.

However, in many places, planning and implementation have been fragmented, with at the very least a lack of coordination, and in the worst cases, conflicts between biodiversity conservation and fisheries interests. These conflicts typically arise when countries rush to designate MPAs in order to reach biodiversity conservation targets, without regard to how such designations will affect coastal communities, fishing patterns, catches or fisheries management. Similarly, conflicts can arise when fisheries managers plan fishing closures without coordination with biodiversity conservation interests. These Guidelines highlight the benefits of greater coordination and complementary approaches, and outline specific ways in which the targets of fisheries management and biodiversity conservation can be bridged, taking bioecological and human dimensions into account.

The target audience for these Guidelines includes policy- and decision-makers, managers and scientists in both fisheries and biodiversity conservation disciplines. They should be of interest to officials and staff in government agencies, non-governmental and intergovernmental organizations and other entities involved in the promotion, planning and implementation of fisheries management arrangements and of MPAs from a conservation perspective.

As with the other documents in the FAO Technical Guidelines for Responsible Fisheries series, the MPA Guidelines were developed to support implementation of the FAO Code of Conduct for Responsible Fisheries (the Code or CCRF) (FAO, 1995). Although prepared as a stand-alone document, the Guidelines should be seen as a complement to the other FAO technical guidelines on fisheries and EAF management (Box 1).

STRUCTURE OF THE GUIDELINES

Part 1 discusses definitions and provides background on fisheries management and EAF, and on MPAs as a tool for spatial management. It also describes the likely and potential effects of MPAs on fish stocks, ecosystems and people. **Part 2** considers the institutional, legal and policy context of MPAs, and offers information and guidance on the planning and implementation of MPAs and on what data are needed. Lessons learned and likely future developments are discussed in the last chapter.

The Guidelines are structured around questions and answers covering a wide range of issues within the main subject areas, and they discuss key

concepts and issues. As appropriate, examples from the MPA case studies carried out during development of the Guidelines[4] and from other literature have been included to illustrate ideas and concepts.

[4] FAO commissioned 16 MPA case studies in Africa, South America and the Caribbean, Asia and the Pacific, and Europe (the Mediterranean) in order to collect experiences in implementing policies and establishing MPAs. The results of the case studies will be published separately.

BOX 1
Recommended reading

The Guidelines provide information on MPAs in a fisheries context and discuss how the targets of fisheries management and biodiversity conservation can be bridged. Other guidelines and documents provide information and background on related issues, including fisheries management and MPAs for biodiversity conservation.

FAO documents

The FAO Technical Guidelines for Responsible Fisheries series, supporting implementation of the CCRF, includes the following volumes with relevance to the context of MPAs and the present Guidelines:

- Fisheries management (FAO, 1997).
- The ecosystem approach to fisheries (FAO, 2003a).
- The human dimensions of the ecosystem approach to fisheries (FAO, 2009a).

In addition, there are several supporting FAO Fisheries and Aquaculture Technical Papers:

- A fishery manager's guidebook: management measures and their application (FAO, 2002).
- A fishery manager's guidebook, 2nd ed. (Cochrane and Garcia, 2009).
- The ecosystem approach to fisheries: issues, terminology, principles, institutional foundations, implementation and outlook (FAO, 2003b).
- Human dimensions of the ecosystem approach to fisheries: an overview of context, tools and methods (FAO, 2008b).

As part of the preparation of the present Guidelines, an expert workshop was held and the proceedings published as:

- Report and documentation of the Expert Workshop on Marine Protected Areas and Fisheries Management: review of issues and considerations (FAO, 2007a).

Documents by other organizations

A number of excellent documents and guidelines on MPAs are available from international or regional organizations and non-governmental organizations (NGOs):

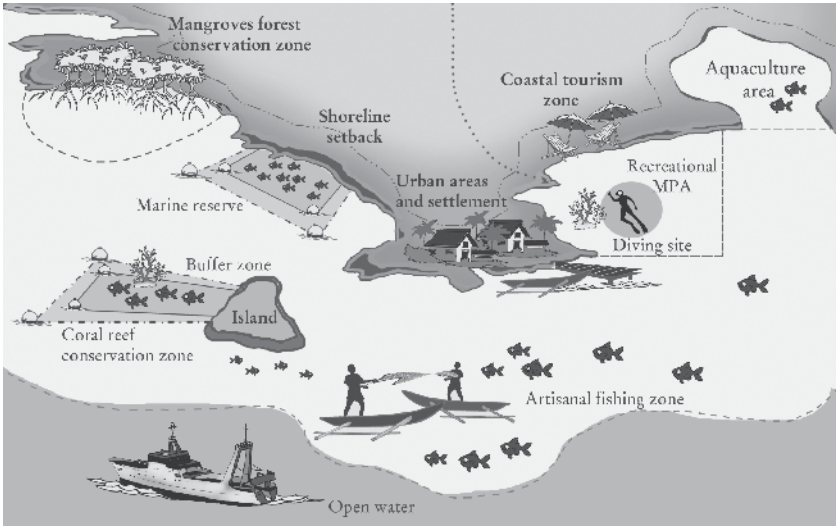
- Establishing resilient marine protected area networks: making it happen (IUCN-WCPA, 2008).

(Box 1 cont.)

- Creating and managing marine protected areas in the Philippines (White, Aliño and Meneses, 2006).
- Regional guidelines on the use of fisheries refugia for capture fisheries management in Southeast Asia. In SEAFDEC, 2006.
- Scaling up marine management: the role of marine protected areas (World Bank, 2006).
- How is your MPA doing? A guidebook to natural and social indicators for evaluating marine protected areas management effectiveness (Pomeroy, Parks and Watson, 2004).
- Marine reserves: a guide to science, design and use (Dahlgren and Sobel, 2004).
- Marine and coastal protected areas: a guide for planners and managers (Salm, Clark and Siirila, 2004).
- Managing marine protected areas: a toolkit for the Western Indian Ocean (IUCN, 2004).
- Guidelines for marine protected areas (Kelleher, 1999).

PART 1

What are MPAs and what do they do?



1. MPA DEFINITION AND CONTEXT

The term 'marine protected area' or MPA has gained prominence in the dialog on fisheries management and biodiversity conservation since the early 1990s. The concept and its application continue to evolve and recent developments – particularly with regard to rapidly increasing recognition of the threat of climate change and the related focus on ecosystem resilience – have brought MPAs to the forefront of discussions in global marine conservation and management strategies. But what exactly is an MPA and why do we set up MPAs or MPA networks?

This chapter attempts to answer these basic questions paying particular attention to the fisheries perspective. The concepts of fisheries management and EAF are discussed in the following chapter.

While the Code of Conduct for Responsible Fisheries does not refer explicitly to MPAs, their use is implied in the recommendation for management measures – including closed areas, seasons and reserved zones – to minimize waste, discards, bycatch, lost or abandoned gear, catch of non-target species (fish and non-fish species), and negative impacts on associated or dependent species, in particular endangered species. The FAO technical guidelines for The ecosystem approach to fisheries (FAO 2003a) recognize that MPAs can contribute to achieving sustainable fisheries.

1.1 WHAT IS AN MPA?

These Guidelines do not propose a single definition for MPAs, but explore the full range of spatial management measures and area closures in a broader sense with relevance to fisheries – and generally refer to them as MPAs. For the purposes of this document, **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**.[5]

[5] This broad characterization includes very large areas, such as exclusive economic zones (EEZs) at the extreme, but the term MPA is usually understood to apply to areas specifically designated to protect a particular ecosystem, ecosystem component or some other attribute (e.g. historical site).

However, the MPA concept is applied diversely around the world, and with different names for similar policies. MPAs can range from small village-level community-managed areas to large, zoned national parks. The specific rules associated with an MPA vary by context and names are not used consistently. A 'reserve' in one country may prohibit fishing, while a 'reserve' in another country may allow non-destructive fishing. Other terms used, to name a few, are fully protected marine areas, no-take zones, marine sanctuaries, ocean sanctuaries, marine parks, fishery closed areas, fisheries refugia and locally managed marine areas (LMMAs).

Probably the most widely accepted definitions of MPAs have been the ones established by the International Union for Conservation of Nature (IUCN) and the CBD (Box 2). Other organizations and individual countries have also established definitions of MPAs, with a biodiversity conservation or fisheries management focus (Box 3).

Commonly, there are also different categories of MPAs attached to established definitions. These Guidelines are intended to provide guidance relevant to all of them, especially at the interface between fisheries management and biodiversity conservation. IUCN recognizes six different categories of MPAs, classified according to their objectives and ranging from fully protected areas (no-take zones where no extraction is permitted) to multiple-use areas (where a range of resource uses are allowed) (Table 1).

TABLE 1
IUCN categories of protected areas

Category	Description
I	Protected area managed mainly for science or wilderness protection (Strict Nature Reserve/Wilderness Area)
II	Protected area managed mainly for ecosystem protection and recreation (National Park)
III	Protected area managed mainly for conservation of specific natural features (Natural Monument or Feature)
IV	Protected area managed mainly for conservation through management intervention (Habitat/Species Management Area)
V	Protected area managed mainly for landscape/seascape conservation and recreation (Protected Landscape/Seascape)
VI	Protected area managed mainly for the sustainable use of natural ecosystems (Managed Resource Protection Area)

Sources: IUCN, 1994, and Dudley, 2008.

BOX 2
IUCN and CBD definitions

IUCN has defined an MPA as:

> *Any area of the intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment (Kelleher, 1999).*[1]

More recently, a revised definition of a protected area has been provided by IUCN and developed within the WCPA framework.[2] This definition is applicable to both MPAs and protected areas on land:

> *A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (Dudley, 2008).*

The ad hoc Technical Expert Group associated with the CBD Programme of Work on Marine Biodiversity has adopted a similar definition for marine and coastal protected areas:

> *A 'Marine and Coastal Protected Area' means any defined area within or adjacent to the marine environment, together with its overlying waters and associated flora, fauna, and historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine or coastal biodiversity enjoys a higher level of protection than its surroundings* (CBD, 2004a).

[1] IUCN. Resolution 17.38 of the IUCN General Assembly in 1988 (reaffirmed in Resolution 19.46 in 1994).

[2] The World Commission on Protected Areas (WCPA) is a network of protected-area expertise (for both land and marine environments). It is administered by IUCN's Programme on Protected Areas and has over 1 400 members, spanning 140 countries.

The World Bank has developed a scheme to classify the most common forms of MPAs according to area coverage and degree of protection – from minimal to full protection. The following graph provides a method (based on a review of MPAs by the World Bank) for organizing some of the most common

BOX 3
What is an MPA? – examples of national definitions

In **Brazil**, there are two main categories of protected areas: (i) areas under total protection (no-take zones) and (ii) areas for sustainable use. The main difference between the two relates to permission to extract natural resources and to live inside their boundaries, which is forbidden in the first category and allowed in the second. Within these two categories, there are different types of no-take and sustainable-use protected areas, each of them with specific objectives.

In the **Philippines**, there is a wide range of terms used for MPAs, which may vary depending on the legislation, designating authority and type and quality of the resources and the intent. However, in practice, a standardized terminology is emerging among policy-makers: MPAs are defined as "any specific marine area which has been reserved by law or other effective means and is governed by specific rules or guidelines to manage activities and protect part of the entire enclosed coastal and marine environment".

In **Senegal**, the concept of MPAs continues to be the subject of numerous discussions with regard to their objectives, origin, legal status, relevant institutions, and design and implementation approaches. In the legal framework, the role of MPAs has been defined as "protection, on a scientific basis, for current and future generations, of important natural and cultural resources and ecosystems representative of the marine environment". In practice, MPAs in Senegal have two main characteristics. First, the purpose of MPAs is to contribute to the conservation of marine and coastal biodiversity. Second, an area of particular interest can be designated according to bioecological, territorial or socio-economic considerations and given special management measures for improving conservation, while taking the livelihoods of the resource users into account. Recently, an MPA (Aire du Patrimoine Communautaire Kawawana) was created in the Casamance province on the initiative of a fishers' association. It was inspired by various international conventions promoting traditional area management by local communities.

In the **United States of America**, the term 'marine protected areas' is defined by a Presidential Executive Order as: "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein". In practice, MPAs are defined areas where natural or cultural resources are given greater protection than in the surrounding waters. MPAs are applied

(Box 3 cont.)

to a range of habitats, and an MPA classification scheme results in a great variation in purpose, legal authorities, management approaches, level of protection and restrictions on human uses.

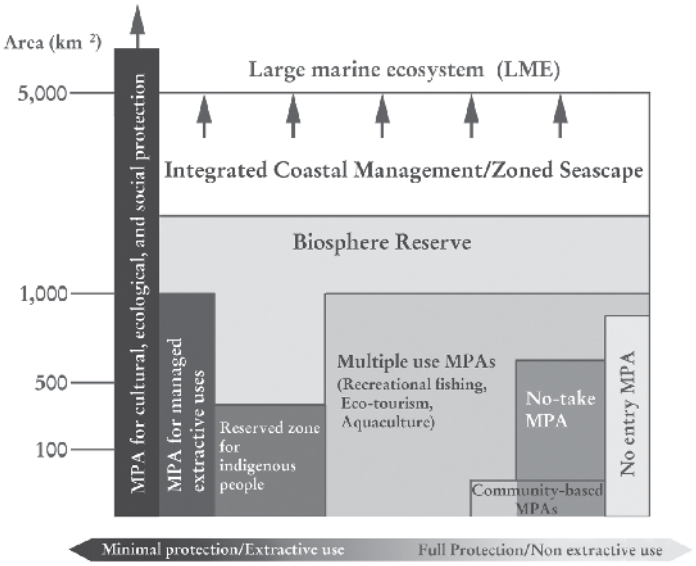
Sources: Kalikoski and Vasconcellos, (forthcoming); Christie and Eisma-Osorio, (forthcoming); Breuil, (forthcoming); National Marine Protected Areas Center (www.mpa.gov /welcome.html).

forms of MPAs (see Figure 1). Size and degree of environmental or fisheries protection are two important scales influencing MPA effects. According to this, any MPA can be characterized along a gradient of size and protection.

1.2 WHAT ARE THE PRIMARY REASONS FOR ESTABLISHING MPAs?

MPAs are generally designated with biodiversity conservation objectives, to protect fishery resource species or habitat, or with a broader ecosystem purpose

FIGURE 1
World Bank MPA classification scheme



Source: Based on World Bank, 2006.

within the framework of EAF. Within this context, MPAs tend to be conceived and implemented to achieve a subset of a wide variety of potential objectives. A list of examples of objectives for establishing MPAs is provided below:

- rebuilding fish stocks;
- ensuring sustainability of fish stocks and fisheries;
- protection of marine biodiversity and critical habitats;
- support local and traditional sustainable marine-based lifestyles and communities;
- increase resilience to climate and other environmental changes;
- facilitate the resolution of multiple stakeholder conflicts;
- facilitate scientific research, education and recreation;
- protect cultural and archaeological sites.

In addition to these, other indirect objectives could be envisioned:

- generating 'spin-off' benefits to the coastal economy, creating opportunities for alternative uses and thereby helping diversify the economy (e.g. through tourism and biodiversity conservation work or recreational fisheries), which in turn can reduce stress on fish stocks;
- provide a hedge against uncertainty, a form of conservation 'insurance policy';
- generating non-market values such as 'indirect' (or use) values, 'existence' (or non-use) values[6] and option (or future use) values;
- raising awareness of the importance of certain places in supporting fisheries production and biodiversity conservation;
- providing a demonstration of the successful integration of management across sectors and achievement of multiple goals (for instance, maintaining fisheries and conserving biodiversity).

Spatial-temporal fishing closures as a management tool have a long history in fisheries and predate the current concept of MPAs for biodiversity conservation. These may not have been thought of as biodiversity conservation measures, but were established with fishery conservation and improving long term fishery yields in mind. The protection of certain life stages of marine species (e.g. banning of fishing in spawning areas) and of recruits to fish stocks of interest to commercial fisheries (e.g. limiting fishing in areas with high

[6] Non-use values, also referred to as 'passive use' values, are values that are not associated with actual use, or even the option to use a good or service, but with its intrinsic significance for culture, aesthetics, heritage, bequest, etc. 'Existence value' is the non-use value that people place on simply knowing that something exists, even if they will never see it or use it.

abundance of juvenile fish) are noted in the preceding list. Similar reasons for establishing MPAs or spatial-temporal fishing closures include:

- protecting a particular habitat important to commercially exploited fish stocks, for example an MPA on a tropical coral reef could be designed to improve reef quality and increase fish biomass;
- protecting depleted stocks and their habitats during the rebuilding phase of a fishery, that is, stopping fishing on stocks that have collapsed, or are close to collapse, to allow the resource to recover;
- potentially protecting genetic structure, that is, through preventing genetic bottlenecks when populations are reduced, maintaining a reserve of diverse age groups and sizes of the target species and of genetically diverse subpopulations (typically through an MPA network) to safeguard genetic traits of the fish population;
- limiting bycatch by closing areas, temporally or permanently, where bycatch and discard rates are high;
- allocating use rights in specific locations in order to reduce competition between user groups or to enhance opportunities for certain groups of users (for example, artisanal or recreational fishers).

Moreover, most MPAs are likely to have consequences for fisheries and fishery resources – even when established without explicit fisheries management objectives in mind. In the same way, it is probable that fisheries spatial management measures will have biodiversity conservation outcomes. As fisheries management is increasingly moving towards EAF, fisheries MPAs with explicitly broader, combined objectives are likely to become more common (MPAs 'with multiple objectives'). The reasons for establishing MPAs with both fisheries management and biodiversity conservation objectives could be, for example, the protection of habitats, food web integrity and biodiversity, and the reduction of bycatch, discarding and other negative effects on harvested species, endangered species and other species society wants to protect.

Other protected areas have been established without explicit fisheries management or biodiversity conservation objectives. These include military zones and energy production areas, or areas for the protection of cultural and archaeological values, where fishing and other uses are prohibited or limited. These are not addressed in the Guidelines, but could have effects on both biodiversity conservation and fisheries.

The key to success is to be clear about the objectives and potential effects – both with regard to fisheries management and biodiversity conservation – when planning and implementing MPAs. Early involvement of stakeholders

and a participatory process that takes the human dimensions of MPA planning and implementation into account are other prerequisites for achieving the objectives.

1.3 WHAT ARE THE RISKS OF MPAs?

MPAs may well be a compelling tool to use in fisheries and conservation management regimes but they are subject to the same pitfalls and difficulties as any other available tool. Blanket MPA targets with a 'one size fits all' approach will not suit all habitat types, objectives and must be treated with caution. Poorly-informed and over-optimistic implementation of MPAs will result in more failures arising from inappropriate use, faulty design, poor implementation or all three. Therefore, the establishment of MPAs must be seen as one of the tools to be considered in the overall goal of achieving sustainable use of oceans. A major risk of excessive emphasis on MPAs alone is that it will, and probably already has in some cases, diverted limited and already over-stretched international, national and local capacity and resources from other priorities and approaches that, in many cases, may have been more effective and appropriate for the problems being addressed (Cochrane, 2006).

In addition, there is a further risk that the designation of an MPA could be seen as goal in its own right, with proponents forgetting that they are just one tool, undoubtedly a potentially useful tool, amongst a number of possible options for achieving sustainable, equitable and optimal use of marine ecosystems. To avoid this, the promotion of careful planning, a basis in sound science, and a focus on management effectiveness must occur in tandem with increased interest in the establishment of MPAs.

MPAs impact both the biological environment and people. The process by which an MPA is planned and implemented greatly influences what benefits and costs it generates and hence its impact. If an MPA is planned and implemented without involving the coastal communities and resource users concerned, and without considering their situations and needs, there is a risk of failure. This could involve several aspects, including a lack of acceptance of the MPA and hence enforcement difficulties, and hardship for those communities and resource users that it affects. With regard to the lack of acceptance, this could, in an extreme case, lead the MPA becoming a 'paper park', that is, something that has been formally designated and exists on paper but not in practice, because the relevant provisions and regulations are not respected. Unfortunately, paper parks are common, with estimated rates reaching nearly 80–90 percent in some countries. Lack of community support is a major reason for management

failure, but other factors such as lack of funding and ineffective management also play major roles.

The resource-use restrictions that an MPA implies are likely to affect different groups of people and stakeholders in different ways. When planning an MPA, it is important to ensure that it will not deprive particular groups of their livelihoods without providing alternatives. This is particularly important for coastal MPAs in contexts of poverty or in areas with limited livelihood options. The designation of MPAs needs to be based on a combination of bioecological and socio-economic criteria, ensuring long-term sustainability, but also considering and mitigating short-term costs. The best way to ensure successful MPAs is to use a participatory planning and implementation process.[7]

1.4 WHAT IS AN MPA NETWORK?

An MPA network refers to two or more MPAs that complement each other. IUCN defines an MPA network as "a collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels designed to meet objectives that a single reserve cannot achieve" (IUCN-WCPA, 2008).

Ecological networks are formed when the natural connections among and within sites enhance ecological functions. In order to enhance the administration and management of ecological networks, social or institutional networks are formed through communication, sharing of results and coordination among institutions. Both types of networks should be considered, social/institutional and ecological, in order to optimize the benefits of a more holistic approach.

The World Wide Fund for Nature (WWF) considers that for a network to be representative, it should afford protection across and within the multiple dimensions of ecosystem complexity (WWF International, [no date]). The CBD has established a number of criteria for a network to be considered representative. These include: (i) biologically and ecologically significant areas; (ii) 'representativity'; (iii) connectivity; (iv) replicated ecological features; and (v) adequate and viable sites (CBD, 2007). Principles of comprehensiveness, adequacy and representativeness (CAR) are applied to

[7] The human dimensions of MPAs are discussed further in Chapter 4, and planning and implementation processes in Part 2.

MPA networks in Australia.[8] A CAR MPA network includes the full range of ecosystems (*comprehensiveness*), maintains viability of species and ecosystems (*adequacy*) and reflects the biodiversity of the ecosystems from which they are derived (*representativeness*). These criteria and principles concern bioecological features and do not cover socio-economic aspects or the human dimensions of the network.

1.5 WHY DO WE NEED MPA NETWORKS?

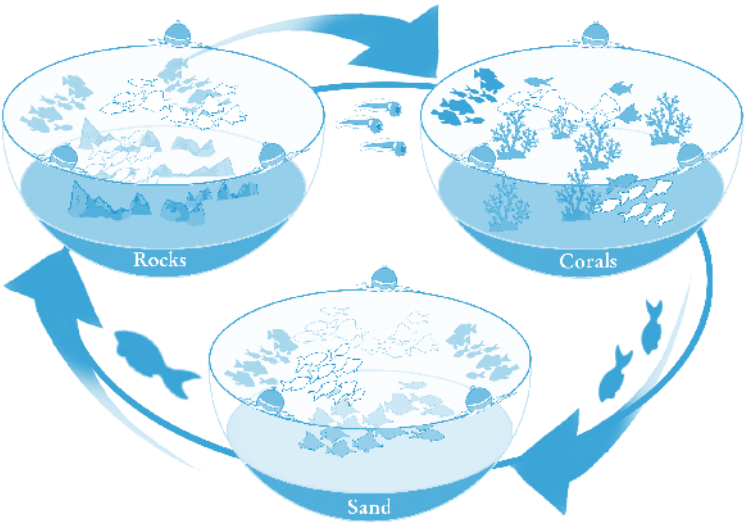
The marine environment is made up of many geographical spaces with different physical, chemical and biological features, and is populated by communities of marine species that persist through time by interacting across the region. Some fish populations with highly mobile adults may congregate in specific locations for spawning, while others may be more sedentary and restricted to a specific habitat, interacting with neighbouring fish populations and marine communities through mobile larvae. Networking adds the potential benefit of MPAs supporting each other through connections between them (see Figure 2). Such connections could be currents transporting fish eggs and larvae, thus potentially adding to more-sustainable fish populations. Networks may act synergistically relative to a single MPA. Thus the whole is greater than the sum of the parts when a network of MPAs:

- takes advantage of the heterogeneous distribution of a fishery resource, habitat and important biodiversity areas to afford more protection than would be possible using a single MPA of the same size;
- protects various areas of particular importance to a fish population, such as spawning grounds and nursery areas; or
- potentially protects genetic structure through maintaining a reserve of genetically diverse subpopulations to safeguard genetic traits of the fish population.

MPA networks may involve zoning, in which different areas can have diverse levels of protection. Multiple MPAs in an area can be flexible with regard to which activities are allowed in which areas (no-take areas, fishing with certain types of gear, recreational fisheries, etc.), while still having common fisheries management and biodiversity conservation objectives.

[8] The Government of Australia's MPA site can be accessed at www.environment.gov.au/coasts/mpa.

FIGURE 2
Protecting different life stages through network connectivity



A network of smaller MPAs may have more flexibility to mitigate undesirable social impacts than a single large MPA. The protective benefits of MPAs, as well as the costs incurred through access and usage limitations, are often more easily distributed among coastal communities and other user groups of marine ecosystems in an MPA network than in a large, single MPA. It may also offer opportunities to spread costs and disadvantages across multiple communities, rather than concentrating them in one community – as could be the case with a single large MPA. This could be particularly relevant in tropical developing countries, where the entire coastal zone is being exploited by the communities located along that coast.

Fishers may benefit more from a network than from a single MPA if it increases the number of adult fish that migrate across the boundaries of the protected areas (the spillover effect that makes fish available to fisheries). This is a result of the normally greater amount of boundary per unit area protected than in a single MPA. It will, however, increase the vulnerability of fish

resources, and the appropriate balance between protection and spillover should be sought. Thus MPA networks must be designed with the mobility of the targeted fish species in mind, to ensure that an appropriate level of protection is afforded to the fish moving across the MPAs in the network. If a network is made up of MPAs that are too small, they may offer very little or no protection for adults of mobile species. In addition, unless an MPA is large enough to retain some of its pelagic eggs and/or larvae, it is not self sustaining.

An MPA network can also operate in a social sense by fostering shared management responsibilities, common management policies, economic efficiencies and learning opportunities. It can strengthen the governance of individual MPAs by providing common rules and sharing of knowledge and experience. On the other hand, if it is too large and stretches across a very broad spectrum of administrative layers and structures, it may become difficult to govern.

An additional potential benefit of a network of MPAs rather than a single (presumably larger) MPA, is that the network may be more resilient to a wide range of threats. A network can provide extra robustness to local disasters, such as an oil spill, or to a management failure. If the network spreads protection over a broad geographical area and along a gradient of climatic regimes, it may provide more resilience to climate change than would a concentration of MPA protection in one or a few places.

MPA networks in relation to fisheries management are discussed further in the subsequent chapters on the effects of MPAs.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 1

With a view to facilitating understanding of the purpose of MPAs and MPA networks and their effects, the meaning and characteristics of this conservation and management tool must be clearly defined within a particular context. In spite of its popularity and frequent use in international fora, there is no universal definition of the term MPA. It may be necessary to define different types of MPAs according to local needs and circumstances.

- Clear terminology will facilitate understanding of the MPA and related concepts. For the purpose of these Guidelines, an MPA is any marine geographical area that is afforded greater protection than the surrounding waters for biodiversity conservation or fisheries management objectives. These Guidelines consider all types of MPAs, including no-take areas and areas with sustainable use arrangements.
- MPAs are established with a variety of objectives. Moreover, in most cases, they will produce cross-sectoral outcomes, some of which may be undesired, even when not designated for multiple objectives. The main objectives for establishing an MPA should be clearly defined, and the likely additional impacts, positive/negative social effects and other unintended effects must also be identified and considered. The process by which an MPA is planned and implemented greatly influences its outcome. Applying a participatory approach involving concerned resource users and other stakeholders is fundamental for successful MPA planning and implementation.
- MPA networks are composed of two or more MPAs that are linked in diverse ways (e.g. biological or institutional) and complement each other. If properly designed, they may offer benefits over single MPAs.

2. FISHERIES MANAGEMENT AND THE ECOSYSTEM APPROACH TO FISHERIES (EAF)

In relation to fisheries management, MPAs have variously been characterized as a new name for spatial-temporal fishing closures and as a necessary new approach to replace fisheries management measures that have failed. Worldwide recognition is given to the need to take a broader, integrated ecosystem approach to fisheries management, including both environmental and human dimensions. Approaches such as EAF are increasingly being promoted. But what are fisheries management and EAF, and what role do MPAs and area closures play in this context?

This chapter discusses some of these important concepts and how MPAs and MPA networks relate to them. It also offers an introductory consideration of how they can bridge pure fisheries management and biodiversity conservation objectives. Subsequent chapters will look more specifically at the effects of MPAs on the biological, ecological and human dimensions of fisheries.

The Code of Conduct for Responsible Fisheries emphasizes that fisheries management shall promote maintenance of the quality, diversity and availability of fishery resources and that management measures shall also take wider ecosystem considerations into account.

2.1 WHAT IS FISHERIES MANAGEMENT?

The FAO Technical Guidelines on Fisheries Management series defines fisheries management as the "integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and accomplishment of other fisheries objectives" (FAO, 1997, p. 7).

Fisheries management aims to achieve the optimal and sustainable utilization of the fishery resource for the benefit of humanity, while maintaining biodiversity. Biodiversity is an integral part of ensuring future generations the

same choices for resource use that current generations are allowed – and hence an important aspect of sustainable fisheries management.

Conventional fisheries management is largely informed by scientific information, which is used to develop the rules under which a fishery operates to ensure its sustainability. Management approaches using sources of information such as indigenous and local knowledge are also increasingly being applied.

Fisheries management generally regulates fishers' use of fishery resources by controlling the fish mortality generated by the fishery. Fish mortality is a way of expressing the fraction of the fish population removed by the fishery annually. Typically, management is directed towards maintaining fish stock abundance and a size and age structure that give the maximum average yield or catch sustainable over the long term. This is achieved through various management rules and regulations aimed at controlling, either directly or indirectly, the level of fish mortality for different size or age groups of the population. This is sometimes summarized as maximum sustainable yield (MSY). When regulating the use of fishery resources, economic efficiency and the social dimensions of the fishery must also be factored into management analysis.

Many types of fisheries management tools exist, including:

- Input controls: access controls and fishing effort limits (e.g. restrictions on the number of boats/licenses, gear or trips);
- Output controls: catch limits such as total allowable catch (TAC) quotas;
- Technical measures: restrictions on the size of fish that can be caught or retained, or gear restrictions;
- Spatial-temporal measures: zoning and area-time-gear type closures.

Successful fisheries management is not simply the result of applying rules and regulations to control how much, where, when and how fishers fish. Indeed short-term input or output controls (be they spatial, temporal, or gear-based) are best considered as complementary measures. The fundamental issue is to develop fisheries management arrangements that capture the social and economic forces that allow and motivate fishers to operate efficiently and flexibly within the limits of resource and ecosystem sustainability. This means, in one way or another, fisheries management needs to be premised on providing fishers with secure tenure systems and addressing the management of fishing capacity through proper incentives.[9]

[9] To address the issue of overcapacity in world fisheries, an International Plan of Action (IPOA) for the management of fishing capacity was agreed in 1999. See also FAO, 2008c.

Fisheries management arrangements can be implemented under various governance systems. While centralized, state-controlled command-and-control systems are still common, there has been a trend towards increasingly decentralized fisheries management during the last decades. Various forms of co-management governance systems are applied in many parts of the world, based on partnerships between governments and resource users with shared responsibility and authority for fisheries management.[10] These governance systems are often combined with rights-based approaches to fisheries management, that is, property rights in the form of access or management rights are allocated to individuals, groups of individuals or communities[11] (e.g. individual transferable quotas [ITQs], days at sea allocations, community access quotas, or territorial use rights in fisheries [TURFs]).

In spite of the availability of a variety of fisheries management tools, many fishery resources are in a precarious state due to overfishing and, in the case of some coastal and diadromous species,[12] environmental degradation. Fisheries management fails for many reasons. Common causes are the open-access nature of fishery resources, insufficient capacity to apply and enforce appropriate management systems, and subsidies. In addition, an increased understanding of the interactions among diverse ecosystem components has led to a growing recognition of the need to manage fisheries in a broader environmental perspective. The scope of fisheries management has widened in recent years to consider aspects beyond the abundance, size and age structure of the target fishery resource. The principles for and approach to effective, integrated and responsible fisheries management contained in the CCRF reflect this wider scope and thus also relate to EAF.

2.2 WHAT IS THE ECOSYSTEM APPROACH TO FISHERIES?

EAF[13] has evolved based on an appreciation of the interactions that take place between fisheries and ecosystems, taken in a broader perspective. The purpose of an EAF is "to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services

[10] See also Part 2, Chapter 6, Section 6.8, "What are the key MPA design considerations?"

[11] See Glossary, "Use, management and property rights".

[12] Fish that migrate from fresh water to salt water, or vice versa.

[13] For more information on EAF, see FAO, 2003a, 2003b and 2009a. It should also be noted that there are several approaches similar to EAF applied by diverse organizations and countries (see Glossary, "Ecosystem approach [EA]").

provided by the aquatic ecosystems" (FAO, 2009a, p. 6). Accordingly, fisheries management according to EAF "strives to balance diverse societal objectives by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions, and applying an integrated approach to fisheries within ecologically meaningful boundaries" (FAO, 2003a, 14). Thus EAF requires the inclusion in the management paradigm of interactions between the core of the fishery – fish and fishers – and the other elements of the ecosystem, including the human system relevant to management (see Figure 3).

EAF is closely linked to other approaches in the field of development, natural resource and spatial area management, for example the sustainable livelihoods approach and integrated management. These approaches are complementary to EAF and, indeed, there is a substantial overlap in terms of their underlying principles, philosophy and methods. MPAs and other spatial management tools can support EAF, while EAF, in turn, can be used as a management approach to implementing an MPA. EAF represents a more explicit bridging mechanism between fisheries management and biodiversity conservation, bringing together bioecological and human considerations.

It should be remembered that EAF is still an evolving practice and, at least in the short term, will be an extension of the current approach to fisheries management. The evolution is occurring now: today's fisheries management captures more of the elements of an ecosystem approach than it did a decade ago, but less than will be captured a decade from now. The pace at which this is happening varies in different parts of the world and in diverse situations, but conventional fisheries management is changing shape. It should also be noted that EAF does not replace or diminish the need to assess and control fish mortality on target and bycatch species in order to sustain fisheries, nor the need to control fishing capacity in order to avoid economic waste.

When referring to fisheries management in the Guidelines, this situation of evolution is generally intended, and the term 'fisheries management' implies fisheries management as it is developing with EAF (even when EAF is not explicitly mentioned).

2.3 WHAT ABOUT THE PRECAUTIONARY APPROACH?

The precautionary approach is a basic principle of the CCRF, involving the application of prudent foresight in dealing with uncertainties in fisheries systems. It implies the explicit consideration of possible undesirable outcomes and the inclusion of appropriate contingency and mitigation measures.

FIGURE 3
Moving towards EAF – examples of the shifting focus

Source: Based on FAO 2009a.

Undesirable outcomes include not only overexploitation of fishery resources and negative environmental consequences, but also unacceptable social and economic consequences. Hence, both long-term and short-term costs and benefits are involved and should be considered in the adoption of the precautionary approach.

Because uncertainty can be expected to be greater when widening fisheries management to include ecosystem considerations, the precautionary approach frequently gains even greater importance within EAF. One objective in establishing MPAs can be to provide a hedge against such uncertainty, constituting a sort of 'conservation insurance'.[14] At the same time, there is the possibility that an expanded ecosystem focus can help explain trends in fish stocks and hence contribute to less uncertainty.

2.4 HOW ARE MPAs AND OTHER SPATIAL MANAGEMENT TOOLS USED IN FISHERIES MANAGEMENT?

Definition of space is a fundamental concept in fisheries management, applying to management units with geographical specifications that – to the extent practicable – correspond to the geographical range of the fishery being managed. At the largest scale, the international regime of oceans is based on defined areas as set out in the United Nations Convention on the Law of the Sea (UNCLOS).[15] These include the EEZ – within which a coastal state has sovereign rights and responsibilities with regard to, inter alia, fisheries management – and the high seas and the Area[16] – beyond national jurisdiction. There are international and regional agreements regulating certain aspects of marine areas beyond the limits of national jurisdiction, as well as of some areas cutting across these and EEZs or parts of EEZs.

Some states apply zoning in their EEZs as a basic measure for directing where different types of fishing or other activities may take place. A typical example is a coastal area reserved for small-scale or artisanal fishing only, banning larger fishing vessels and trawlers. Closures (spatial-temporal-gear or spatial-temporal-fishing types) are one of the oldest forms of fisheries management. Some common reasons for establishing such measures were

[14] See also Chapter 3, Section 3.4, "How do MPAs work as a hedge against uncertainty?"

[15] The United Nations Convention on the Law of the Sea of 10 December 1982 is the fundamental instrument establishing international regimes for the oceans. Institutional and legal aspects of MPAs are discussed further in Part 2, Chapter 5.

[16] See Glossary.

given in Chapter 1, section 1.2, "What are the primary reasons for establishing MPAs?".

Box 4 gives examples of various fisheries management measures based on the zoning and spatial considerations used in India.

Certain allocations of use rights, such as the TURFs mentioned earlier, are also area-specific, and the management objective here is to allocate use rights in specific locations in order to reduce competition among user groups, to enhance opportunities for certain groups of users or to improve management and compliance with fisheries rules and regulations by providing users with increased responsibility for and authority over fishery resources (see example from Chile in Box 5).

With the move of fisheries management towards EAF – that is, a broader conception of ecosystem well-being – the use of spatial management tools will probably become more prevalent. In line with the principles of EAF, it is likely that it will become more common to designate and implement MPAs with multiple objectives, covering both fisheries management and biodiversity conservation considerations.

2.5 IN WHAT SITUATIONS ARE MPAs USEFUL AS A FISHERIES MANAGEMENT TOOL?

MPAs should not be viewed as a solution for all fisheries management problems. They do not address key issues for the overall management of the area beyond the boundary of an MPA. Nor do they redress past unsuccessful fisheries management that has, in many cases, led to overcapacity, overfishing and economic loss. Moreover, if MPAs were to be used as the sole mechanism for limiting the amount of fish to be caught, with a view to sustaining fish populations, the extent of the area to be protected might be unrealistically large, particularly for mobile fish species, even if successful in meeting ecological objectives, the approach would waste a large portion of potential economic benefits. In many circumstances, MPAs will be inferior to an appropriate mix of other fisheries management tools in terms of the combined protection offered, potential yield and economic performance, as long as these tools are effectively implemented.

With the move towards an ecosystem approach in the management of the world's oceans, however, MPAs can be a very useful component within the fisheries management toolbox. In several situations, there is a need for a greater consideration of MPAs as a main management measure, although the best results may still be achieved with a combination of fisheries and

BOX 4
Use of various fisheries management tools in India

Countries use different approaches to fisheries management as well as different sets of fisheries management tools within those approaches. These depend on numerous factors, for example the types of fisheries and resources, and the preferred governance approach and political reality of the country. This MPA case study has made the following information on India available:

Fisheries management is undertaken mainly through licensing, prohibitions on certain fishing gear, regulations on mesh size and establishment of closed seasons and areas. Under the Marine Fishing Regulation Acts (MFRA), zones are demarcated by each state based on distance from the shoreline (from 5 to 10 kilometres [km]) or on depth. These inshore zones, where trawling and other forms of mechanized fishing are not permitted, are perhaps the most important spatial fisheries management measure in place. The closed season or 'monsoon fishing ban' is another important spatial-temporal management measure. It is implemented on both the east and west coasts of India for a period of 47 days and 65 days, respectively, during what is considered to be the spawning and breeding season.

Several state-specific management measures exist. In Orissa, for example, fishing regulations have been adopted by the State Fisheries Department, under the MFRA, to restrict and regulate fishing activities in territorial waters. Regulations also protect the nesting and breeding grounds of turtles, both within and outside the Gahirmatha (Marine) Wildlife Sanctuary, through designation of 'no-fishing' and 'no-trawling' areas. There is also a mandatory requirement under the MFRA in some states that trawlers use turtle excluder devices (TEDs).

It is important to draw attention to certain fisheries management initiatives of local fishing communities that are 'space-based'. Communities living along the coast often have a spatial perception of their 'rights', in which fishing by outsiders or the use of certain gear is regulated. Traditional fishing communities on the shores of Pulicat Lake, Tamil Nadu, practise a rotational system of access to resources, called the padu system, that serves to reduce conflicts and the pressure on resources. In coastal areas of Kerala, a similar system of rotational access to resources is practised that defines the group of rights holders, resource boundaries and fishing sites. However, these systems of self-governance are not legally recognized for management purposes in India.

Source: Ramya (in press).

BOX 5
Areas for Management and Exploitation of Benthic Resources (AMEBR) in Chile

The Chilean Fisheries and Aquaculture General Law provides for the establishment of different types of special areas as part of fisheries management. Areas for Management and Exploitation of Benthic[1] Resources (AMEBR) are areas that aim to ensure sustainable use of marine resources by assigning territorial use rights to legally recognized artisanal fisheries organizations. This has become a common management tool and is adopted by most such organizations in Chile.

AMEBRs can only be established within five nautical miles of the shore and in inland areas (rivers and lakes). The average surface area is 190 ha and the number of fishers involved nationwide is approximately 16 500 of a total number of about 52 000 artisanal fishers in Chile. In order to be granted an AMEBR, a community must constitute a legal organization (e.g. artisanal fishers' association or fishers' cooperative). Establishing an AMEBR involves extensive consultations among government organizations and local communities to assess feasibility. Based on these consultations – and assuming there are no conflicts with other users – exclusive use rights to the area can be granted to the association or cooperative and a management plan developed. The plan must be approved by the Under-Secretariat for Fisheries, and thereafter the National Fisheries Service can establish an 'agreement of use' with the fisheries' organization for a period of four years.

In addition to the provisions of the Fisheries and Aquaculture General Law, the management plan of an AMEBR specifies a set of actions to ensure the sustainable management of the fishery. The fishers themselves control the fishing area, generally through establishment of a control committee. Government authorities monitor that the provisions of the management plan are followed. The fishers' organization might lose the exclusive right to manage the area if actual exploitation is in violation of the management plan.

Source: FAO, 2007a.

[1] 'Benthic' refers to organisms that live on or in the seabed.

ecosystem management tools. Multiple tools are available for achieving fisheries objectives and these should be selected and balanced within the relevant policy and management frameworks.

Used wisely, MPAs can generate both bioecological and socio-economic benefits. However, not all MPAs have the same benefits, which will depend on the specific local circumstances (both natural and human), the type of MPA and the protection it offers, and legal and governance attributes. In coastal areas where local communities are directly affected by the declaration of MPAs, it is particularly important to involve communities as early in the process as possible. In situations where complete or partial closure of the fishery is required, long-term sustainable alternative livelihood options should be identified and developed in consultation with the affected communities. Where the benefits of MPAs accrue elsewhere or could be gained by other stakeholders, mechanisms must be established to ensure that benefits (economic and sociocultural) flow directly back to the community, guided by the principle of equitable benefit-sharing and internalization of costs and benefits.

Within this context, some situations in which MPAs can be useful in fisheries management and can create sustainable benefits include:

Controlling fish mortality of sedentary species in data-poor situations

For fisheries targeting relatively small stocks of sedentary fish or invertebrate species (i.e. organisms whose movements are short-range), MPAs can be an effective management tool. The use of an MPA as a tool for controlling fish mortality does not require a reliable estimate of population size, as do some alternative management tools (e.g. TACs). For this reason MPAs can be particularly useful in some data-poor contexts. MPAs may also be useful in situations where the capacity to implement other forms of management is lacking. However, establishing effective MPAs would still require effective enforcement as well as reliable information on population distribution densities and habitat preferences.

Assisting management of multispecies fisheries

It may be difficult to manage a multispecies fishery with numerous species-specific rules and regulations, particularly if information is limited on a large number of species. In this case, MPAs might afford protection to assemblages of species associated with particular types of habitat. A combination of species-

specific management measures and MPAs to protect multiple species may be a useful approach.

Minimizing bycatch

The places and seasons in which bycatch occurs are generally reasonably consistent from year to year and thus can be predicted. Experienced fishers know where and when to expect large amounts of bycatch. They usually want to avoid unwanted bycatch because they recognize it as wasteful, and it creates additional work in sorting the catch. However, there are many cases in which both the retained bycatch and discarded bycatch are abundant, in which case, fishers may consider discards an acceptable 'cost'. Nevertheless, MPAs may be an effective fisheries management tool for addressing a bycatch problem if they are located in areas and seasons of high bycatch and discards.

Protecting habitat and biodiversity

The unintended effects of fisheries on habitat and biodiversity have become a greater concern in recent years. Habitat changes potentially have an adverse affect on the future productivity of fisheries (e.g. loss of shelter of juvenile fish from predators). In addition, habitat and biodiversity protection are often desirable in relation to the direct and indirect services such preservation provides to society, regardless of its effect on fish productivity and fisheries, and MPAs may be used to protect areas of particular concern in terms of habitat and biodiversity.

Buffering against uncertainty

MPAs may be used in combination with other fisheries management tools as a hedge against uncertainty to make management more robust. In case conventional management fails – due, for example, to assessment errors – MPAs can provide a buffer against the consequences of failure. However, the effectiveness of the MPA in the context of fisheries management – for example the degree to which it achieves its objective to sustain fish populations – will be dependent on its design and the characteristics of the fish populations being protected. Knowledge of these characteristics will be essential for an adequate design, but crucial processes such as larval dispersal patterns, for example, are generally poorly known.[17]

[17] See also Chapter 3, Section 3.4, "How do MPAs work as a hedge against uncertainty?"

Delegating management responsibilities or tasks

In certain areas, co-management arrangements[18] provide a way to share the management burden between government and local communities or users. MPAs can circumscribe the area in which this divestment of management responsibility or management tasks can be accomplished. Such tasks include patrolling and surveillance; monitoring (and sometimes even scientific research); maintenance of buoys, signage and other controls; enforcement; and public outreach and education associated with fisheries management and biodiversity conservation. The benefits of co-management approaches include increased participation of stakeholders, empowerment of local communities and users through participatory management, and a lightening of the burden of management for the government.

Protecting traditional and cultural use rights and practices

Although it is often assumed that MPAs will be in conflict with the rights and traditional practices of indigenous peoples, formal protected areas can provide a mechanism for recognizing and protecting traditional fishing grounds and places of cultural importance and practices. In some cases, indigenous peoples may need support in having such areas and practices protected from external threat. The CBD encourages "the establishment of protected areas that benefit indigenous and local communities, including by respecting, preserving and maintaining their traditional knowledge" (CBD, 2004b). A joint policy statement to this effect has been issued by IUCN, WCPA and WWF (Principles and Guidelines on Indigenous and Traditional Peoples and Protected Areas), calling for "the development of policies for protected areas that safeguard the interests of indigenous peoples, and take into account customary practices ...".[19] When indigenous communities are concerned about the conservation and maintenance of traditional and customary practices, MPAs can be employed to protect customary use rights and practices, as well to achieve fisheries management and biodiversity conservation objectives. The involvement of the indigenous peoples concerned in the planning and implementation of the MPA will be critical to its success.

[18] See above and also Chapter 6, Section 6.8, "What are the key MPA design considerations?" in Part 2.

[19] Available at http://assets.panda.org/downloads/pa_princguide_en.pdf.

Protecting and enhancing local livelihoods

The declaration of MPAs in coastal areas where local communities depend on marine resources for food and income is often associated with negative impacts and the loss of livelihoods. In other instances, however, the declaration of MPAs can lead to the protection of small-scale fishing areas (for example, demarcation of an exclusive coastal area for small-scale fishers) and enhancement of local livelihoods where fishery resources recover and catches improve over time, in the MPA and in surrounding waters.

Resolving user conflicts

In areas where user conflicts occur, zoning through the establishment of MPAs with different use patterns can help resolve such conflicts. In this way, diverse user groups can be assigned different areas for their activities. These use rights can be combined with delegation of responsibilities (see also "Delegating management responsibilities or tasks" above).

2.6 HOW CAN MPAs BE USED TO BRIDGE FISHERIES MANAGEMENT AND BIODIVERSITY CONSERVATION?

MPAs will generally have both biodiversity conservation and fisheries outcomes, whether or not they have been established explicitly for both purposes. To date, however, the entities using MPAs for the purpose of biodiversity conservation have often worked independently from fisheries managers, who look to MPAs to supplement conventional fisheries management. But there is great potential in having these approaches planned in concert, or at least in ways in which they can complement one another. Bridging the two worlds not only eliminates duplication of effort and overlap (and possible conflicts that arise from overlapping initiatives), but can also lead to enhanced efficacy of management. Biodiversity conservation is vital to fisheries management, especially so when it is implemented according to EAF. At the same time, fisheries management considerations are critical in effectively conserving biodiversity.

However, the two objectives can be viewed differently by diverse groups of people, and reconciling these priorities can be difficult. The goals and objectives of an MPA are established by individuals and institutions, and many MPAs address biological, socio-economic and governance needs. Strong conservation objectives, that is, focusing on maintaining biodiversity through protecting areas from most human interventions, and yield maximization for fisheries management purposes can be contradictory.

To gain maximum benefit, both the fisheries management and biodiversity conservation effects must be considered and taken into account in MPA planning and implementation processes, which requires appropriate processes. MPAs should be considered in a wider perspective, and planning and implementing them in a holistic and integrated spatial management framework is the ideal. The need for integrated coherent management frameworks is discussed further in Chapter 5 in Part 2.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 2

MPAs and MPA networks can constitute an important management tool, especially for achieving both biodiversity conservation and direct fisheries management objectives. However, there are many management options in addition to MPAs that may produce better effects. The management context needs to be understood and combinations of appropriate measures implemented accordingly.

- Fisheries management aims to achieve optimal sustainable utilization of fishery resources, generally focusing on limiting fish mortality to sustainable levels, while also taking broader ecosystem considerations into account. EAF expands the conventional fisheries management framework to explicitly consider a wider range of aspects of the fishery and its ecosystem, including its human dimensions.
- A precautionary approach to the management of marine resources should be adopted, promoting the use of the best tools and measures available according to defined objectives and case-specific circumstances.
- Spatial-temporal-gear closures are historically some of the most common fisheries management measures. In the broadened context of EAF, it is likely that spatial management measures and MPAs with multiple objectives, for example for fisheries management and biodiversity conservation, will increase in importance.
- MPAs are not always the preferred management measure, but can be very useful in a number of contexts, e.g. for fisheries targeting relatively small stocks of sedentary fish or invertebrate species, in some data-poor contexts and for addressing bycatch problems when in discrete areas or specific seasons. For MPAs to generate maximum benefit, stakeholders must be involved.
- MPAs will generally have both biodiversity conservation and direct fisheries management outcomes, whether or not they have been established for both these purposes explicitly. To gain the most benefits, the two concepts need be bridged when planning and implementing MPAs.

3. BIOLOGICAL AND ECOLOGICAL EFFECTS OF MPAs IN A FISHERIES CONTEXT

The effects of MPAs and MPA networks on fishery resources, ecosystems and people depend on a variety of factors, including where they are located, how big they are, how many there are, the nature of protection within the MPA (is all fishing prohibited or only fishing with some gears?), and the movement of the fish species (at all life stages) across MPA boundaries. It is also important to consider activities occurring outside the MPA itself.

This chapter examines how MPAs work with respect to bioecological systems and fish yield. There will also be indirect biological and ecological effects of MPAs, depending on how humans, especially fishers, react to the establishment of an MPA and the related management framework. The human dimensions of MPAs and their effects are discussed in the next chapter.

The Code of Conduct for Responsible Fisheries states that appropriate fisheries management measures should be adopted for the long-term sustainability of fishery resources. Fishing capacity and effort should be commensurate with the productive capacity of the resources, and measures should be taken to rehabilitate fish populations when required. Resource users should safeguard aquatic ecosystems and protect habitats from negative outcomes.

3.1 WHAT ARE THE KEY FACTORS THAT DETERMINE THE EFFECTS OF AN MPA OR MPA NETWORK?

Some key factors determining the protective effects of MPAs on fishery resources include:

- The *location* of an MPA determines what it protects. The more concentrated the fishery resources, habitat or biodiversity in the MPA location, the more protection the MPA provides. Conversely, placing an MPA where there are fewer organisms to protect provides proportionally less protective benefit. The networking benefits of

MPAs are also determined by the location of MPAs relative to each other (their connectivity).[20]

- The *size* of an MPA and the *number* of MPAs in a network – and the *total area* they cover – are other factors determining their effect. Obviously, the larger the total area protected, the greater the protective benefit, all other factors being equal. What is less obvious is the relative effect of a single MPA compared with multiple MPAs of the same total area. For species that are immobile (except for drifting eggs and large) a single MPA can sustain a population if it is large enough for a sufficient number of drifting eggs and larvae produced in the MPA to settle within its boundaries. Multiple independent or unconnected MPAs of the same total size will be less able to sustain a population. However, if the smaller MPAs are connected (larvae drift between them), they may be better at sustaining a population.
- The *nature of protection* in an MPA determines the effect on species and habitats. MPAs that prohibit all human extractive activity within their boundaries will provide greater conservation benefit than MPAs that allow some activity, such as fishing with certain gears or for specific species. From a fisheries point of view, the local context and the nature of the activities allowed – or not allowed – will determine the effects on diverse subcategories of the fishery resources and on fishers.
- The effectiveness of MPAs is also determined by *the movement of animals* in and out of MPAs. Less movement means more protection for the species or population within the MPA. However, MPAs may benefit populations and fisheries beyond their borders by exporting eggs and larvae to support recruitment outside MPAs (although there is little evidence of this benefit), and by migration of legal-sized individuals, so that they can add to the fishery resources outside MPAs (the 'spillover' effect; see section 3.2).
- Even with complete protection inside an MPA, benefits may be jeopardized by *activities outside the MPA*. The greater the fishing pressure on stock outside MPA boundaries, the larger the portion of stock protected by MPAs must be to sustain the resources being fished. Also, activities outside MPAs that degrade habitat and water quality may undermine the effectiveness of MPAs (e.g. because water

[20] See also Section 3.3, "What happens in MPA networks with regard to sustaining fish populations and supporting fishing yields?"

quality will not honour MPA boundaries). The effects of the MPA are conditioned by the effectiveness of management of all human activities, including fisheries, outside of the MPA.

While some factors listed are beyond management control, others are part of MPA design and implementation decisions. A monitoring system tracking environmental changes, production (biomass, number and size of individuals) and user satisfaction will inform managers as to how MPA management could be changed to improve its effects. Such changes generally concern the boundaries of the MPA, zoning within it, and its rules and regulations including its relation to fisheries management measures or regulations in the wider area where it is located.[21]

3.2 WHAT HAPPENS TO FISH AND THEIR ECOSYSTEMS WITHIN MPAs?

One of the most common types of indicators of the effect of MPAs, and the one for which there is the most empirical evidence, concerns the biological response within MPAs, such as the density, biomass and size of animals. There is substantial scientific evidence that, when designed appropriately, there are more fish and bigger fish, with a higher biomass, inside MPAs than outside (Box 6). It appears that the increases are greatest for higher trophic levels and for species with greater body size. It is reasonable to expect that these

BOX 6
Effects on biomass

One study of MPA effects on biomass summarizes results from 69 no-take MPAs by comparing measurements within MPAs to the same areas before the MPAs were established, or to reference areas presumed to be ecologically comparable except for protection from fishing. The results indicate on average a 91 percent increase in the density (number per unit area) of fish and a 192 percent increase in biomass (weight per unit area). The greater increase in biomass than in density implies an increase in mean size of organisms, which the study estimated to be 31 percent on average.

Source: Halpern, 2003.

[21] MPA monitoring systems and adaptive management are discussed in Chapter 7 in Part 2.

effects would be greater for species with limited mobility, but conclusions are inconclusive because of limitations of the available data.

Sustainability of fish populations

MPAs contribute to sustaining a population by allowing animals within MPAs to mature and spawn, thus increasing the reproductive output of populations above what it would have been under fishing pressure. If enough of a population is afforded protection in an MPA – that is, the MPA contains a sufficiently large number of individuals – the population should persist regardless of the intensity of fishing outside the MPA.

For a population to be self-sustaining in this way, a single MPA must be large enough to ensure that sufficient eggs and larvae survive within the boundaries of the MPA. In contrast, a network of smaller MPAs could provide protection to spawning aggregations in one MPA and juveniles in a second MPA that receives eggs and larvae from the first. In the case of mobile species, the extent of the area contained in an MPA will have to be large to sustain the population, particularly if fishing intensity outside the MPA is high. MPAs can also have positive effects on fish populations not targeted by fisheries. If fishing is restricted through MPAs in areas where bycatch is an issue, the reduced fishing effort on bycatch species can support the sustainability of these fish populations.

Prohibiting fishing in areas where fish concentrate reduces the fish mortality per unit of fishing effort, and as long as fishing effort does not increase outside the MPA, fish mortality can be decreased. The issue of controlling fishing effort outside the MPA so that displacement of effort does not compromise the outcomes of the MPA is discussed in the next chapter.[22]

Preserving genetic diversity

There is value in a fish population being genetically diverse, although the benefits are difficult to quantify. Fishing may influence the biological characteristics passed on from one fish generation to the next. It usually targets larger fish, and removing these favours reproduction by younger (and smaller) fish, a trait that can be inherited and can eventually lead to overall smaller fish. Keeping a reservoir of larger fish can counteract this trend. Moreover, genetic variation may provide higher resilience against changing environmental conditions, for

[22] See Chapter 4, Section 4.5, "How are MPAs likely to affect fishers' behaviour, fishing effort and fishing capacity?"

example some individuals in a fish population may grow well in warmer water and others better at colder temperatures. If fishing reduces the longevity of a fish population considerably, some of these variations may be lost. An MPA can help preserve genetically diverse subpopulations within its boundaries if other solutions providing wider protection of habitat diversity cannot be applied.

Effects on habitats and biodiversity

There is irrefutable evidence of the alteration of some types of habitat by fishing. Some heavy, mobile bottom-fishing gear (e.g. beam trawls and otter trawls) alter habitats if used in sensitive areas, and particularly damage habitat-forming communities such as cold and warm coral reefs and seagrass beds. The indirect effects that these alterations may have on fish populations include reduction in productivity as a result of loss of shelter from predators or of habitats critical to spawning. Empirical evidence of the effects on populations tends to be limited to nearshore populations such as those dependent on wetlands, riverine systems and tropical coral reefs, but this may be mostly due to lack of data from other areas. Many factors in addition to fishing affect these nearshore areas.

MPAs can protect habitats within their boundaries, and there is evidence that they can also facilitate recovery of certain disturbed habitats (Box 7). However, intensification of fishing outside MPAs as a reaction to the implementation of the MPA may adversely affect habitats outside MPAs, even as habitat inside recovers, potentially offsetting the benefits of the protected area. MPA implementation thus needs to be accompanied by complementary fisheries management measures.[23]

A project to assess recovery after earlier experimental, intensive repeated trawling on the Great Barrier Reef (northeast Australia) used video recordings to document changes in the seabed habitat fauna. Selected areas were trawled repeatedly in 1995 and then resurveyed by video camera on four occasions over the following five years. There was apparent recovery for all 20 species analysed in the study (and for the multispecies composition of the assemblages). However, recovery rates varied greatly, and the predicted time frame for recovery of large benthos was more than five years, for some up to many decades.

A review of published studies on the effects of MPAs on biodiversity documents an average increase in the number of species inside MPAs by

[23] Ibid.

BOX 7
Recovery of benthic fauna on Georges Bank (United States) and in the Great Barrier Reef area (Australia)

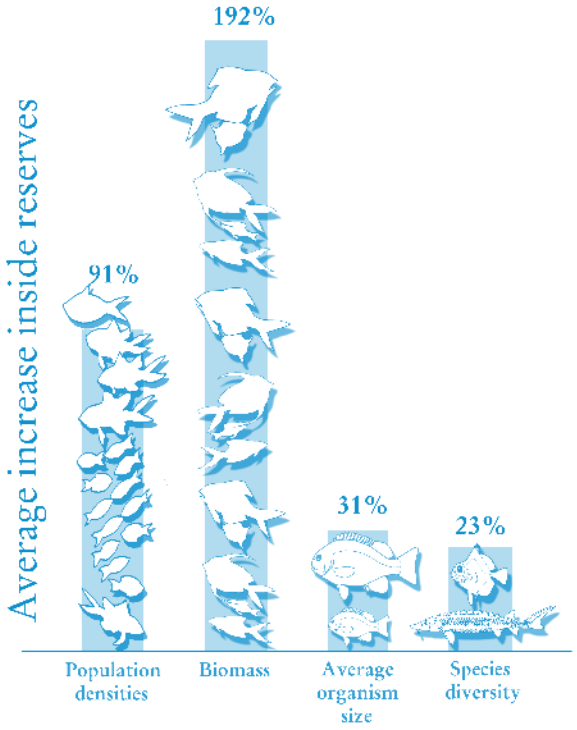
Marine protected areas that prohibit the types of fishing (such as mobile bottom-fishing) that damage habitats of concern and habitat-forming species (such as corals and sponges) are an obvious form of effective management. They can also result in the recovery of habitat that has previously been damaged by fishing. For example, changes in benthic habitat have been documented in protected areas on **Georges Bank** (northeastern United States) five years after closure to fishing by mobile bottom gear. There was a significant shift in species composition and in benthic fauna cover, and an increase in abundance (number of organisms in samples) by a factor of 4, in biomass by a factor of 18, and in production by a factor of 4. The greater increase in weight (biomass) than in numbers indicates that the mean size of organisms has increased. Evidence of recovery is clear, although changes in the functional value of the habitat are not well documented or understood.

A project to assess recovery after earlier experimental, intensive repeated trawling on the **Great Barrier Reef** (northeast Australia) used video recordings to document changes in the seabed habitat fauna. Selected areas were trawled repeatedly in 1995 and then resurveyed by video camera on four occasions over the following five years. There was apparent recovery for all 20 species analysed in the study (and for the multispecies composition of the assemblages). However, recovery rates varied greatly, and the predicted time frame for recovery of large benthos was more than five years, for some up to many decades.

Sources: Collie *et al.*, 2005; Pitcher *et al.*, 2008.

23 percent (Halpern, 2003; see Figure 4). Also, if the MPA provides a sanctuary for rare species, or species low in numbers, which then disperse outside the MPA as their abundance increases, it will increase biodiversity outside the MPA. However, estimates of species richness are sensitive to sampling intensity and exact measurements of changes are difficult to make. While it seems reasonable to expect an increase in species richness within MPAs, careful experimental design to demonstrate this type of MPA effect will be required.

FIGURE 4
Average increases in densities, biomass, organism size and species diversity inside reserves



Source: Botsford *et al.*, 2006; Halpern, 2003.

3.3 HOW DO MPAs AFFECT FISHERY PRODUCTION OUTSIDE THEIR BOUNDARIES AND CAN THEY CONTROL FISH MORTALITY?

MPAs may contribute to higher fishery production by their effect on the amount of fishery resource available to fisheries outside the MPA. As was seen previously, this may happen in two ways: improved recruitment and the spillover effect:

- Increased reproduction within an MPA can result in increased recruitment to the population external to the MPA and consequently an increase in the number of fish available to the fishery(ies). The evidence that this occurs is limited and ambiguous, although it is reasonable to expect that it may occur in some instances.
- Fish afforded protection by MPAs grow within the areas and some of them (unless they are sedentary species that lack mobility) spill over beyond MPA boundaries and become available to fisheries.

While there is evidence that the spillover of animals from MPAs to the area around them can contribute to yield from fisheries (see examples in Box 8), in most cases there is little empirical evidence indicating that these increases make up for the loss of fishing area within MPAs (i.e. that there is a net gain as a result of spillover from MPAs). However, one example of where this was demonstrated was a recent study that discussed an increase in number combined with an increase in biomass of lobsters (*Palinurus elephas)* within an MPA in the Mediterranean which more than compensated for the loss of fishing area in the location studied (Goñi *et al.*, 2010).

Modelling studies[24] exist that address the potential sustainable yield using MPAs as a fisheries management tool – compared with other conventional management tools, such as setting TACs or using other measures to control fish mortality. Some of these studies indicate, under the assumptions made in the models, that the potential number of fish caught sustainably can be the same for management using MPAs or conventional fisheries management. However, the models also show that conventional fisheries management would result in 10–50 percent more yield in weight than management that relies solely on MPAs to control fish mortality (again, depending on model assumptions).

Moreover, the elimination of fish mortality on a portion of the population (within MPAs) means that, to maintain yields, fish mortality on the remainder of the population (outside MPAs) must be higher than it would need to be with conventional fisheries management, resulting in a lower catch per unit of effort (CPUE) and a higher cost per unit of catch for a lower total yield.

Understanding how resource users may respond to area-based management such as an MPA is key, not only to impact assessment, but may have important implications for MPA design. Closing or restricting access to a particular area, like an MPA, will most likely cause resource users to displace their activities

[24] See, for example, NRC, 2001; Hastings and Botsford, 1999; and Hilborn, Micheli and De Leo, 2006.

BOX 8
Examples of spillover effects

An example of empirical evidence of the spillover effect for one MPA and the fisheries concerned is the experience of the **Apo Island Marine Reserve** in the Philippines. The fishery benefits that have developed from the reserve over the last 20 years include "higher catch rates, less fishing effort, and enhancement or at least maintenance of total catch of Acanthuridae and Carangidae". Spillover is thought to occur outside the Apo Reserve for several reasons: the biomass of two main species increased closer to the reserve more than it did farther away; catch per unit effort of Acanthuridae was significantly higher closer to the reserve; and the percentage of these two main species in fisheries catch increased from 42.5 percent in 1980/81 to 73.5 percent in 2000/01, showing a change in the pattern of fishing by fishers, who no longer needed to travel far from the island.

On the **west coast of Hawaii**, a network of fish replenishment areas (FRAs) was designated in 1999. The FRAs were primarily established to help resolve conflicts between different resource users – aquarium fishers and dive tour operators – but have also proved to have a spillover effect on populations of yellow tang, the main target species for aquarium fish collectors. Researchers have found that while the densities of yellow tang were similar in all areas before the closures, the closed areas had five times the density of target-sized fish in 2007. Spillover effects were noted in boundary areas (open areas within one kilometre of an FRA boundary), with significantly higher densities of adult yellow tang than in open areas further away. The number of aquarium fishers along the coast has doubled between 1999 and 2007 and total yellow tang catches have increased. This increased exploitation has led to a considerable decrease in juvenile fish in open areas – which is the size targeted by fishers – but the availability of reproductive adults supports the population and appears to constitute a buffer against overexploitation.

Sources: Williams *et al.*, 2009; Russ *et al.*, 2004.

to a second-choice fishing area. These issues are further discussed in the next chapter on the social and economic impact of MPAs.[25]

[25] See Chapter 4, Section 4.5, "How are MPAs likely to affect fishers' behaviour, fishing effort and fishing capacity?".

3.4 WHAT HAPPENS IN MPA NETWORKS WITH REGARD TO SUSTAINING FISH POPULATIONS AND SUPPORTING FISHING YIELDS?

Some marine populations, due to their life histories and exchange rates with other communities, exist with only limited – but important – interactions across regions, resulting in heterogeneous populations. Other species have higher levels of interaction that result in a more homogenous marine community across a region. Matching the migration capacity to regional oceanographic processes facilitates understanding of how marine populations function. If these types of interactions can be determined, then creating a network that offers protection to communities with significant links may be important in sustaining populations.

The life cycle of many species involves stages that include production of eggs and larvae, dispersal, settlement and growth before the individuals themselves reproduce. Different factors affect mortality at each stage of the life cycle and often life stages take place in different areas or habitats. The nursery area for a particular species, for example, may be in a sandy area with eelgrass, while the adult stage may occur over a coral reef, and spawning in yet another type of habitat. Thus MPA networks can constitute a useful method to protect species at their various life stages by providing protection for different areas or types of habitat.

MPA networks can be useful when a large amount of space must be covered by using many smaller MPAs, rather than one large one. This could potentially provide protection for various subpopulations in order to increase resilience.

The networks could potentially have positive effects on fishing yields where spillover is thought to occur due to the larger boundary area available for fishing – and hence access to animals that move across the boundary. This could be beneficial to fishers and their communities, as the costs and benefits are likely to be spread across a wider group of stakeholders, but high spillover means lower protection, so an appropriate balance needs to be sought.

The implementation of MPA networks is only just starting to yield evidence of the effects on regional fish populations. Notwithstanding the limited number of scientific publications in this area, the use of networks is likely to provide a complementary management tool for sedentary targeted species, for specific life stages of more mobile species and for the preservation of ecosystem function. For mobile species, in particular, the use of conventional fisheries management measures (i.e. quotas or effort limits, gear restrictions, limits with regard to the size of fish landed, etc.) will be required.

3.5 HOW DO MPAs WORK AS A HEDGE AGAINST UNCERTAINTY?

Depending on the particular circumstances, MPAs can provide a buffer against the failure of other fisheries management measures. They may be less susceptible to the inherent imprecision of resource assessments, although it is still necessary to know enough about the spatial distribution of fishery resources and their movements to effectively design MPAs for fisheries management purposes. In some cases, they may be more easily enforced than other forms of fisheries management.

In terms of the effectiveness of MPAs as a hedge against failure of conventional management, hypothetical models demonstrate that MPAs could be effective in controlling fish mortality. However, this required protection, in these examples, of an unrealistically large portion of the area inhabited by a species (i.e. at least 50 percent and much more as management uncertainty increases) (Lauck *et al.*, 1998). A study using a model for Icelandic cod demonstrated that combining catch quotas with a large MPA effectively reduced the risk of stock collapse, while simultaneously maintaining a reasonably high yield (Stefansson and Rosenberg, 2005). However, the best performance was still achieved by simply setting the target fish mortality rate low.

Fish and animal distribution patterns change over time, particularly in a world experiencing unprecedented global climate change. Thus an MPA established today that provides enough protection to sustain a population, may be inadequate later as climate changes and populations shift. In addition, the effectiveness of MPAs as a tool to sustain a population may be more susceptible to disasters, such as an oil spill, than conventional fisheries management, which protects a population over a larger geographical area. A network of MPAs that spreads protection over a broad geographical area and along a gradient of climatic regimes may be more robust to climate change and disasters than MPA protection concentrated in one or a few places. For sedentary species with sporadic recruitment events in both time and space, rotating area closures can be used to protect concentrations of recent recruits until they grow to the optimal size for harvesting. This requires close monitoring of recruitment events but the benefits may be worth it (Hart and Rago, 2006; Williams *et al.*, 2006).

KEY CONCLUSIONS AND RECOMMENDATIONS No. 3

MPAs and MPA networks have biological and ecological effects both within and outside their boundaries. Many aspects of the potential effects on fishery resources and fish populations are not clearly understood, and in most cases MPAs should not be the sole fisheries management tool, but one that complements other, more conventional measures.

- The protective effects inside an MPA or MPA network will depend on a number of factors, including MPA location, size and number (in a network), the nature of protection, movement of animals in and out of the protected area(s), and activities outside the MPA. Inside MPAs, it is likely or possible that there will be more and bigger animals of some species, more reproductive output – potentially sustaining fish populations – preservation of genetic diversity, protection of habitats, increases in biodiversity and reduction of bycatch and discards.
- Outside MPAs, the potential positive effects include spillover of animals and dispersal of fish eggs and larvae from within MPAs. MPAs may contribute to higher fishery production by making this spillover available to catch and by an increase in reproductive output, contributing to recruitment to the fishery. However, there is little evidence that there is a net gain in yield compared to the situation without MPAs. Available information indicates that management of fisheries using solely MPA spatial approaches results in a lower potential yield than if the fishery is regulated by conventional fisheries management. Likely negative effects include an increase in fishing pressure outside the MPA, and high costs per unit of catch.
- Experience of the effects of MPA networks on fish populations is limited, but they are likely to constitute a useful management tool for sedentary target species, specific life stages of species and preservation of ecosystem functions.
- Combining MPAs with other fisheries management tools will probably make fisheries management more robust to uncertainty and management failures. However, relying solely on MPAs as a fisheries management tool may require protection of unrealistically large areas and lead to appreciably lower total yields and higher costs than are potentially achieved by conventional management.

4. SOCIAL AND ECONOMIC IMPACT: THE HUMAN DIMENSIONS OF MPAs

The previous chapter discussed biological and ecological effects of MPAs and MPA networks in a fisheries context. MPAs also create positive and negative socio-economic impacts and will affect different groups of resource users in different ways, depending on how they are planned, designed and implemented, and according to the case-specific context. All management measures – for fisheries management and for biodiversity conservation – are about directing and influencing human behaviour. Thus this behaviour needs to be understood. Stakeholder involvement is crucial, and MPA objectives, to be successful, must reflect a balance between scientific, social and economic needs and realities.

This chapter looks into the social and economic effects of MPAs and how the human response may affect their outcomes. The institutional, legal and policy frameworks needed to support MPA planning and implementation – ensuring that processes are integrated and holistic and taking both the bioecological and human dimensions into consideration – are discussed in Part 2.

The Code of Conduct for Responsible Fisheries establishes that fisheries management and biodiversity conservation decisions should take relevant economic and social factors into consideration and recognize the important contributions of artisanal and small-scale fishers to employment, income and food security.

4.1 WHAT ARE THE SOCIO-ECONOMIC BENEFITS ASSOCIATED WITH MPAs?

MPAs can lead to both positive and negative socio-economic outcomes. These effects can be both direct and indirect and include impacts on incomes, livelihood opportunities, migration, cultural habits and ecosystem services. Some positive effects may only be apparent in the longer term, and special efforts to address or mitigate potential negative impacts are often needed so as not to undermine benefits. Diverse sectors and stakeholder groups may be affected in different ways. Depending on the local circumstances and the

design of the MPA, commercial, artisanal and recreational fishers, the tourism sector, shore-based industries, biodiversity conservation interests and others will not gain the same benefits or bear the same costs.

Well-designed MPAs that are planned through a participatory process and use the best available information can offer important benefits to specific user groups and local communities, in addition to longer-term benefits to governments and to the common good. The biological and ecological benefits discussed in the previous chapter provide valuable ecosystem services – mostly within MPAs, but sometimes beyond them as well. Such benefits include maintenance of or increase in fisheries productivity, maintenance of biodiversity and stock structure and protection of habitats. MPA establishment can also spur economic development or poverty reduction if the revenues generated from visitor use or payment for environmental services (PES)[26] are funnelled back to local communities. In some cases, MPAs are used to gain certification for fisheries products, adding value to those fisheries and increasing profit margins for fishers.

MPAs can also empower marginalized communities or user groups, especially if co-management arrangements exist.[27] Similarly, drawing stakeholders into MPA planning processes can create opportunities for better government and civil society engagement in general. In areas where traditional uses are at risk, MPAs can safeguard them, as well as areas of cultural importance. From a governance perspective, multiple-use MPAs can provide a demonstration of how to effectively integrate management across sectors (and bridge the worlds of fisheries management and biodiversity conservation). Finally, MPAs – by flagging the special value of specific places – can be used to generate political will for more-effective marine management in general.[28]

4.2 WHAT ARE THE KEY SOCIO-ECONOMIC CHALLENGES WHEN ESTABLISHING MPAs CLOSE TO FISHERY-DEPENDENT COASTAL COMMUNITIES?

MPAs relatively close to the coast can either help or hurt the local people and communities. Diverse groups within a community or within the fisheries sector may be affected in different ways. For example, resource users that have

[26] See Box 28 in Chapter 7. See also Chapter 7, Section 7.9, "How can long-term political commitment and sustainable resourcing for MPAs be addressed?" in Part 2.

[27] See also Chapter 6, Section 6.8, "What are the key MPA design considerations?" in Part 2.

[28] See also Chapter 2, Section 2.5, "In what situations are MPAs useful as a fisheries management tool?" in Part 2.

relatively high economic mobility (such as large-scale fleets that can move their fishing operations to other areas) are affected differently from small-scale fishers, who may be dependent on nearby fishery resources. Subsistence or traditional fishers, depending on fishing for their livelihoods, are more vulnerable to restrictions in resource access than recreational fishers. When certain fishing activities continue to be allowed (e.g. with small-scale passive gear), while others are prohibited (e.g. trawling), there may be a significant reallocation of benefits among diverse groups of fishers.

An important distributional issue for MPAs is that the benefits tend to be diffuse while costs are concentrated. A potential cost to the fisher is that catch (and revenues) may be decreased, at least in the short term, as a result of the implementation of a closure. Coastal communities adjacent to the MPA, especially those with a high economic dependence on the fishery, may face a disproportionate impact as a result of aggregate reduction in fishing revenue. On the other hand, they could also potentially capture most of the benefits in the form of reduced variations in aggregate catch levels, increased total catches or more valuable larger-sized fish catches owing to spillover effects. Such benefits may not occur immediately, although there are cases in which the biological response – and hence the socio-economic impact – is quite rapid. Examples include coral reef MPAs or where the establishment of an MPA limits the use of destructive fishing methods.

The MPA can also lead to changes in the local economy, providing unexpected opportunities. New types of visitors can lead to diversification of the local economy through businesses, jobs, and income and tax revenues. Potential increases in revenue from these visitors could eventually offset immediate losses to fishers due to the MPA, and could contribute to building a sustainable local economy less dependent on an uncertain fishery resource. MPAs can reduce potential conflicts between fishers and other users by providing areas in which non-fishery users can pursue non-consumptive uses of the resource. MPAs may also alter migration patterns by restructuring economic opportunities, drawing people to local communities in the case of some reserves and displacing them from adjacent communities in others. These shifting migration patterns frequently change the demographic profile of user groups and coastal communities.

The way costs and benefits are distributed will depend on the particular circumstances and the way the MPA has been designed – including access and tenure arrangements. Resource reallocation can be an explicit objective of the MPA. By prohibiting or limiting certain activities and regulating access to a protected area, benefits and costs among diverse resource users

are redistributed and the interests of, for example, traditional or small-scale fishers can be protected.[29] If the benefits are likely to be generated only in the longer term for certain groups of fishers or other community members, it is important to combine resource management with the promotion of livelihood opportunities that provide economic benefits in the short run to address any economic disruptions to the individual or household. However, the local context must be considered, as viable alternative livelihoods are not always feasible or not socially and culturally desirable.

4.3 WHAT ARE THE SOCIO-ECONOMIC IMPLICATIONS OF DESIGNATING MPAs IN A POVERTY CONTEXT?

Implementing MPAs in fishery-dependent communities requires a very good understanding of the local situation. The livelihoods of stakeholders may be vulnerable to changes, in particular if poverty is an issue. Research suggests variation in the social impacts of MPAs on four principal dimensions of poverty: wealth, health, political empowerment and education (Mascia, 2004). With respect to wealth, MPA establishment generally induces shifts in resource access and use and hence has – as mentioned earlier – a reallocation effect within and among stakeholder groups. For those gaining preferential resource access, MPA establishment tends to result in increases in income, food security and material assets, while those losing access may suffer corresponding losses or have to adopt mitigation strategies by shifting resource-use patterns or livelihood strategies.

Resource users engaged in mobile forms of use have greater flexibility to respond to shifting marine resource governance regimes (such as MPAs), and are therefore better able to mitigate negative outcomes and to capture benefits. Poor, small-scale fishers are often at the end of the scale, with limited powers to adapt satisfactorily. If the MPA implies a significantly reduced area available for fishing, this may result – at least in the short term – in higher levels of congestion, or fishers may be forced to travel to other, sometimes more distant, fishing grounds. The effects could be higher fuel, labour and other operating costs and a potential increase in capital expenditures in the fishery (e.g. the need for larger boats and engines and new technology, such as the Global Positioning System [GPS]). This could increase the hardships on local fishers, especially the poorest among them. Moreover, shifts in fishing grounds and travel time as a result of the MPA may potentially result in increased occupational risks to

[29] Ibid.

fishers. The combination of inadequate vessels and lack of experience of the displaced fishers in operating in the new environments poses the potential of greater occupational risks.

MPA design in a poverty context needs to take these circumstances into account and to ensure that poorer stakeholder groups are not negatively affected. This could include securing resource-use rights for specific groups of fishers, or researching alternative or supplementary livelihood opportunities.

The social impact of MPAs on health, political empowerment and education would generally follow shifts in patterns of access to fishery resources. However, variation (spatial, temporal and across MPAs) in the magnitude and extent of these social impacts remains largely unexamined and unexplained, highlighting the need for further study to better understand MPAs in relation to poverty reduction.

4.4 HOW ARE MPAs PERCEIVED BY FISHERS AND OTHER STAKEHOLDERS?

Whether fishers support or oppose MPAs depends on their perception of the risks and opportunities, and on the process by which MPAs are introduced, designed and managed. Although there are many instances of fishers establishing MPAs or seeking help in doing so, either as a way to establish preferential use rights (i.e. reduce competition with 'outside' fishers), to catalyse transition out of a fishing economy (through tourism) or to protect habitats or marine resources that they feel are in peril, fishers more often than not oppose the establishment of MPAs. This is due to the issues discussed earlier, as well as to fishers' experience with past management measures, their natural antagonism towards and suspicion of managers and regulators, and their concerns about resource-use rights and access reallocation. Any management measure is, rightly or wrongly, often perceived by fishers as being costly to them by limiting their ability to fish and earn a living. Any proposal to restrict use of the sea, as is also true on land, will always be controversial. Perceptions of MPAs are shaped and reshaped into many forms by diverse stakeholder groups, and they are often difficult to change once positions have been established.

Communication about the purpose and intent of the MPA must be clear, transparent and presented early in the process, so that any misperceptions can be addressed. The different perspectives of individuals and local groups should be understood and considered. If people, individually or as a group, feel that they have not been part of the decision-making process of the MPA, and have not been able to actively participate in and influence the process, it will be difficult to

BOX 9

Impacts of MPAs on livelihoods – the Hangberg case study, South Africa

The community of Hangberg is situated above Hout Bay harbour, in the Cape Town municipal area, adjacent to the Table Mountain National Park MPA. In 1950, Hout Bay was zoned as a white residential suburb under the Group Areas Act 41, while the harbour was reserved for so-called 'coloured' occupation. This marginalized harbour community became known as Hangberg, and many traditional fishers continue to live there today. Harvesting of west coast rock lobster (Jasus lalandii) has taken place for centuries in this area, with strong customary use rights evolving from the nineteenth century. The fishery was embedded in the social, cultural and political context of the community, but was significantly affected by the export-oriented focus of the commercial industry. With increased government restrictions on access to the lobster resource from the early- to mid-1900s, customary fishing practices were severely limited. Nevertheless, traditional fishing continued, often illegally, as a means to supply food and basic income. Thus the Hangberg community has been identified by the authorities and the commercial industry as a problem area, due to perceived high levels of illegal fishing or poaching. This is particularly evident in the Karbonkelberg Sanctuary, which is a no-take zone adjacent to the fishing community.

However, research conducted among the Hangberg fishers paints a different picture, one that highlights the injustice of being excluded from their traditional fishing grounds. Although the Table Mountain National Park MPA was only promulgated in 2004, designation of the Karbonkelberg Sanctuary simply reinforced an existing Hout Bay lobster sanctuary, which was declared a no-take zone in 1934, and all fishing was prohibited within the sanctuary zones.

Creation of this MPA in 2004 entrenched the original lobster sanctuary and completely ignored the historical rights of the Hangberg fishers to access marine resources in order to secure a livelihood. Given that these fishers use rudimentary rowing boats, most without an engine, it is extremely difficult for them to access fishing grounds outside the sanctuary.

The fishers' sense of injustice is further exacerbated by the fact that commercial vessels are permitted to harvest lobster in the Karbonkelberg Sanctuary during March of every year. The commercial fishery is allocated a research quota of 30 tons per annum, which is seen as a critical source of scientific data for monitoring lobster growth rates. While scientists argue that

(Box 9 cont.)

this experimental fishery is not suited to small-scale fishers' gear due to the location of tagged lobster in waters deeper than 30 metres (m), the Hangberg fishers have never been consulted about this fishery. Further, the fishers express anger and frustration that they are entirely excluded from any form of access to the sea adjacent to them, while they witness the extraction of lobster by holders of commercial rights. The response of the fishery authority, however, is to enhance law enforcement efforts and to address poaching by administering fines and confiscating boats, gear, bait and catches.

Source: Sowman *et al.*, 2010.

obtain support and compliance (Box 9). The process by which MPAs are planned and implemented can thus influence people's perceptions and support.

4.5 HOW ARE MPAs LIKELY TO AFFECT FISHERS' BEHAVIOUR, FISHING EFFORT AND FISHING CAPACITY?

When new management measures such as MPAs are introduced, fishers will adapt their behaviour to sustain or maximize their share of potential benefits. Closing fishing completely (or partially with regard to time and gear) by establishing an MPA is likely to displace fishing effort to areas outside the MPA if there is no other change in fisheries management to prevent it. As a result, the effect on the fish population through decreased fish mortality within MPAs may be offset by increased fish mortality outside the protected area, particularly for mobile species moving in and out of the MPA. Intensified fishing outside the MPA could also potentially have other negative effects, for example on habitats or non-target species. Moreover, as noted above,[30] MPAs may lead to lower CPUE when fishing effort is displaced, and the cost of fishing will thus be increased. To effectively sustain fish populations and achieve other objectives, such effects on fishing and the likely behavioural change of fishers must be understood and accounted for in management. Optimally, the MPA should be accompanied by management or other measures restricting effort or catch in the whole fishery area (Box 10). For example, this could include quotas or limitations on access by restrictive licensing or, potentially, properly

[30] See Chapter 3, Section 3.2, "How do MPAs affect fishery production outside their boundaries and can they control fish mortality?"

BOX 10
Changes in fishing patterns in the Baltic cod fishery

A study looked into fishers' responses and the effects of spatial-temporal fishing closures in the Baltic Sea, introduced during 1997–2005, to protect cod stock. The study found that fishing effort displacements contributed to poor performance of the established MPAs. Based on logbook information and interviews with Swedish fishers, the study suggested that the MPA policy might have contributed considerably to increased discarding of juvenile cod by displacing effort to areas dominated by smaller fish. Swedish fishers also felt that the MPAs intensified competition between various fleet segments, and that they were unfairly treated by the fishing closures compared with fishers from other countries. They declared that they would favour seasonal fishing bans or effective effort control measures (limited days at sea) instead of spatially restricting MPAs. Such measures would be more effective and affect all fishers more equally.

Source: Suuronen, Jounela and Tschernij, 2010.

designed buy-out schemes (noting, however, that there are many examples of schemes that have been ineffective in reducing capacity in the long term).

If no additional management measures are introduced and if the MPA is a no-take zone (i.e. no fishing is allowed), its effect on fishing capacity is generally neutral; capacity – and fishing effort – is just reallocated in space. When displacement leads to lower returns in the short and medium term, further investment in fishing capacity will not be encouraged. In the longer term, investment may occur if spillover effects are very positive. In the case of MPAs in which certain types of fishing continue to be permitted (for example, small-scale fishing vessels using passive gear), further investment is likely to occur in the small-scale fleet, unless restricted by other management measures. This would be particularly likely if there are actual or perceived increased catches or larger fish giving higher returns.

Statistical or mathematic modelling techniques have been used to predict the likely reactions of fishers to the establishment of area closures, with some promising results. These models can assist managers analyse the likely effect on effort patterns of the introduction of MPAs and the possible need of complementary management measures, like overall effort reductions (see

BOX 11
Modeling effort displacement from marine protected areas

Economic models of fishing location choice have received considerable attention particularly in assessing recreational fishing demand, but have been adapted to commercial fisheries as well. Simply put, fishers are presumed to be attracted to specific locations based on its attributes. For recreational fishers these may include catch rates, visual amenities, and distance from a launch site. In commercial fisheries the primary site attribute is assumed to be expected profit. Changing the available sites permits evaluation of the economic impact of losing preferred fishing locations and predicts which alternative locations may be most likely to be affected. Empirical applications of fishing location choice have used either statistical or math programming approaches where the former has received the majority of attention. Statistical models have been used to explore economic incentives to change fishing locations (Dupont, 1993), closures to reduce sea turtle interactions in longline fisheries (Curtis and McConnell, 2004), and time/ area closures for Stellar sea lion habitat protection (Berman, 2006). Although less commonly used, math programming approaches have been the primary analytical tool for evaluating management effects in the New England groundfish fishery. Since 1994, the groundfish fishery has been managed through effort controls in terms of days at sea. Over time, the portfolio of management controls has expanded to include trip limits and combinations of seasonal and year-round closures. The economic model that has been developed to evaluate the suite of control measures in the groundfish fishery has been used to assess the biological and economic impacts of fishery management alternatives including area closures as well as to inform managers on which areas to close and for how long.

Source: Provided by Eric Thunberg and John Walden, NOAA Northeast Fisheries Science Center.

Box 11). The need to monitor fish mortality outside MPAs is discussed in Part 2.[31]

[31] See Chapter 7, Section 7.7, "How are MPAs monitored and what is management effectiveness?" in Part 2.

4.6 WHAT ARE THE SOCIAL AND ECONOMIC ADVANTAGES OF MPA NETWORKS OVER SINGLE MPAs?

When MPAs are established and fishing restrictions introduced near where people live in coastal communities, the design of a single MPA could potentially be difficult, as each community will be differentially affected in relation to the distance from the protected area and its dependence on the affected fishery resources. Acquiring community support is likely to be facilitated if the benefits and costs of the MPA for the affected fishing communities are as evenly distributed as possible. An MPA network can more easily achieve this goal than a single MPA.

The ability to modify the location of an MPA with minimal loss of effectiveness is also a major benefit of implementing a network. If a site that initially was included in a proposed MPA network is found to be an important fishing ground, it could possibly be excluded and other areas selected for protection instead. A single MPA solution is likely to lack this flexibility.

Fishers may prefer several small MPAs to one large one, as this would provide more boundaries along which to fish to capture potential spillover from the closed areas. Several smaller MPAs may also allow easier, faster and more flexible transit to and from still-open fishing grounds. Complex networks with many boundaries may, however, be more difficult to enforce, and they require more resources for monitoring, control and surveillance (MCS).

4.7 WHY ARE THE HUMAN DIMENSIONS OF MPAs SO IMPORTANT?

As with other management measures, MPAs attempt to regulate human behaviour – for the benefit of humans themselves and of the environment. This can only be done successfully if the human dimensions are understood and taken into account. People have different views and values, and participatory approaches are needed for successful MPA planning and implementation. The process by which an MPA is designated is key to whether it will be accepted, respected and hence able to provide the benefits for which it has been established and to meet its objectives.

MPAs are designated with a variety of objectives, with biodiversity conservation often being a main one. International commitments have been made to designate MPAs, such as the WSSD-POI target to establish representative MPA networks by 2012, for safeguarding biodiversity, protecting marine ecosystems and promoting sustainable development. This international MPA movement takes place through multiple avenues, but not always within a broader, reconciled framework. If these efforts are to result in effective MPAs,

this issue must be resolved. There is a need to bridge fisheries management and biodiversity conservation, to see MPAs as a management tool with multiple objectives and to take both bioecological and socio-economic dimensions explicitly into consideration.

MPA planning and implementation processes must consider the human dimension and be supported by enabling policies, institutional structures and legal arrangements. In Part 2, the first chapter discusses these requirements and how MPAs should be embedded within broader management frameworks.

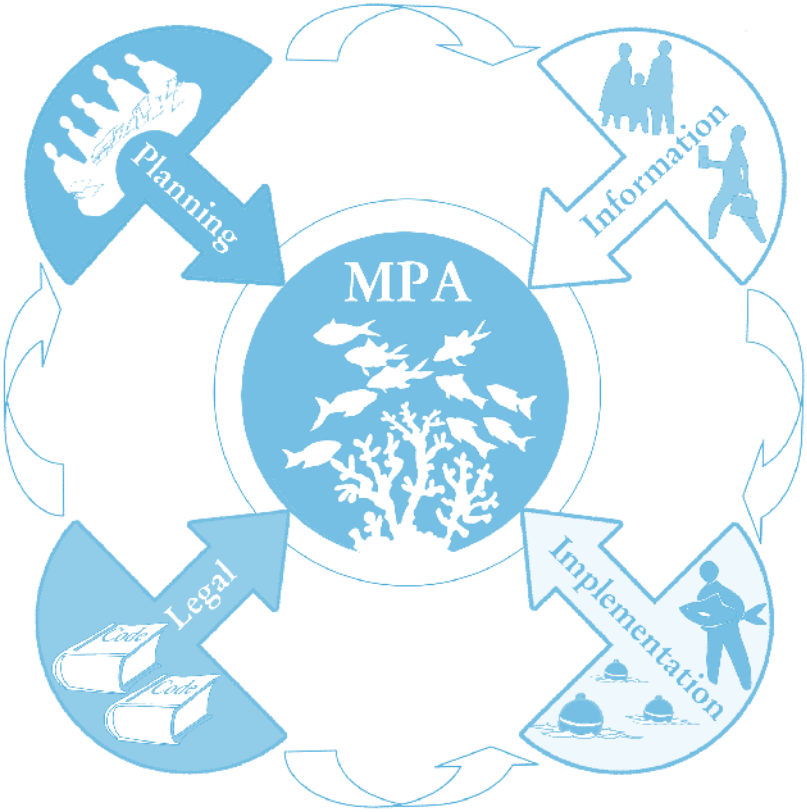
KEY CONCLUSIONS AND RECOMMENDATIONS No. 4

MPAs and MPA networks have social and economic impacts affecting different stakeholder groups in different ways. Successful MPA planning and implementation must build on an understanding of these impacts and how fishers and others will react to the MPA designation and its management rules and regulations. To be successful, it is crucial to take both the environmental and human dimensions into account when planning and implementing MPAs and MPA networks.

- MPAs will directly and indirectly affect people. These socio-economic impacts include effects on income, livelihood opportunities, migration and cultural habits, as well as on ecosystem services. Well-designed MPAs can offer important benefits, both to the environment and to the people concerned.
- MPAs serve as resource reallocation mechanisms and it is important to understand their distributional impact over time and among diverse stakeholder groups. This is particularly important in fishery-dependent communities or a poverty context. Vulnerable stakeholder groups should be supported, and undesirable socio-economic impacts should be addressed early in the planning process.
- To gain acceptance and support for MPA designations, effective communication and stakeholder participation strategies are important. MPA planners and managers should work closely with stakeholders to consider the different perspectives of individuals and local groups.
- Fishers' behaviour and the effects of MPAs on fishing pattern, effort and capacity have to be understood. MPAs generally must be supported by other fisheries management measures outside the protected area itself, in order to avoid displacement of fishing effort or other effects that may cancel the positive effects of closure.
- An MPA network can be more flexible than a single MPA when it comes to distributing costs and benefits. It can also help manage risk, both with regard to threats to biological and ecological values and to socio-economic benefits, but enforcement may be more difficult.
- The human dimensions of MPAs cannot be ignored, as management is about directing human behaviour. Successful MPA planning and implementation requires people-oriented processes and approaches as well as enabling policy and institutional and legal frameworks.

PART 2

Planning and implementing MPAs



5. LEGAL, INSTITUTIONAL AND POLICY FRAMEWORKS FOR MPAs

To be successful, MPAs and MPA networks require supporting legal, institutional and policy frameworks, as well as long-term political commitment. MPAs are tools for achieving defined objectives and are most effective when embedded within integrated marine governance and spatial management frameworks. This integration requires intersectoral coordination. Good governance, including stakeholder participation, is key to successful and equitable management outcomes.

This chapter looks into legal, institutional and policy frameworks and the related requirements for MPA planning and implementation. MPA frameworks must evolve and adapt over time, and the processes by which MPAs are planned and implemented are discussed further in subsequent chapters.

The Code of Conduct for Responsible Fisheries prescribes that states should ensure that appropriate policy, legal and institutional frameworks are in place for fisheries management and biodiversity conservation, as well as processes for the integration of fisheries into coastal area management.

5.1 WHY ARE APPROPRIATE LEGAL, INSTITUTIONAL AND POLICY FRAMEWORKS IMPORTANT FOR MPAs?

An appropriate legal and institutional framework is a necessary foundation for effective policy development and for the use of MPAs as a tool in fisheries management and biodiversity conservation. Unfortunately, in many countries, these frameworks for MPA planning and implementation have focused on conservation issues only, or fisheries management only, but rarely at both in a balanced manner, sometimes leading to variable and unpredictable outcomes. Or, as a relatively new tool, MPAs have sometimes been designated without sufficient reference to the existing institutional and legal context. This exposes them to risk of failure and loss of credibility.

The success of MPAs as a management tool is ultimately a matter of effective implementation. While policy cannot create compliance or make management effective, it is a critical enabler. Institutional arrangements

include both the broad framework of rules and processes that guide societal and economic activities and the entities that operate within this framework (government agencies, institutions, committees, councils, organizations, etc.). The legal framework of laws and regulations defines the rights, responsibilities, options and restrictions applicable to all affected stakeholders, and provides the basis for protection and enforcement of rights and responsibilities.

The effectiveness of policy performance is linked to the quality of the institutions and laws affected by or created under the policy-making process. When appropriate laws and institutions are not in place, it may be difficult to achieve the desired policy goals and MPA objectives. This link between the goals and objectives and the legal and institutional frameworks needs to be clearly understood. Appropriate legislation and institutional structures should be developed to support fisheries management and biodiversity conservation goals and objectives, as well as more-specific MPA objectives, and to enable a range of environmental, economic and social benefits and incentives. The implementation of legislation and allocation of adequate resources for the efficient operation of institutional structures are vital. However, the funding of government agencies, and hence of institutional frameworks, is often decided by political and administrative (budgetary) processes, rather than by legislative provisions. Political will is critical in this context, and no amount of legislation can be effective without political support to the allocation of appropriate levels of resources to sustain implementation.

5.2 WHAT ARE THE MAIN INTERNATIONAL LEGAL FRAMEWORKS RELEVANT TO MPAs?

A number of international instruments relevant to MPA designation and management are in force at national, regional and global levels. While some of these directly discuss, recommend or require the use of MPAs, most do not. The relevance of these instruments lies in their focus on the jurisdictional areas they create and the related rights and responsibilities, the policy objectives of sustainability, and the sustainable use and management of marine resources and habitats.

There are binding instruments ('hard' law) and voluntary agreements ('soft' law). International law of the sea, especially as embodied in UNCLOS, clearly distinguishes between marine areas under national control and those beyond the control of any single country. These are international waters or the 'high seas'[32]

[32] See the Glossary for a definition of 'high seas' as used in these Guidelines.

with reference to the water column,[33] and 'the Area' in relation to the seabed beyond the limits of national jurisdiction. UNCLOS is a detailed and well-accepted convention that comprehensively addresses the use and conservation of the ocean and its resources. Its obligations balance the "freedom of the high seas" (in particular regarding high seas fisheries) with the shared obligation of all countries to protect the oceans against the destruction of ecosystems and the collapse of shared fisheries.

Soft-law instruments include voluntary codes of conduct, non-mandatory provisions and incentive programmes. Voluntary instruments often allow for more wide-ranging recommendations than hard law and can hence provide additional guidance. The WSSD-POI provides important guidance on the conservation and management of marine and coastal areas. Another soft-law international instrument is Agenda 21, adopted at the 1992 United Nations Conference on Environment and Development (UNCED). It constitutes a comprehensive plan of action to be implemented at global, regional, national and local levels by states, international organizations (both intergovernmental and non-governmental) and major stakeholders in every area in which humans affect the environment. Agenda 21 and the Rio Declaration on Environment and Development have been adopted by more than 178 governments. Important soft-law instruments referring directly to fisheries include the CCRF and its related International Plans of Action (IPOAs).

Box 12 lists the main international instruments relevant to MPAs.

Considering the increasingly globalized world, international policy coherence is important in achieving fisheries management, biodiversity conservation and sustainability objectives. International instruments can provide an important support to national policy. At the same time, to become effective, global commitments must be converted into implementable national policies and legislation. They must be reconciled with national priorities and sustainable development goals, taking the local environmental and human dimensions into consideration. Hard law instruments, in particular, require enabling national legislation so that obligations, such as those contained in UNCLOS and the CBD – which otherwise bind states only at the international level – can also be applied to individual juridical persons who are state subjects.

[33] Everything between the air and the seabed. There is a distinction because the actual seabed of the ocean has different laws and regulations as opposed to the water above it.

BOX 12
International instruments relevant to biodiversity conservation, sustainable fisheries and MPAs

A number of international instruments and agreements have been adopted during the last few decades to promote sustainable fisheries and conservation of the environment. Most are voluntary, but some qualify as binding agreements. The more important instruments include:

Hard law:

- United Nations Convention on the Law of the Sea of 10 December 1982 (UNCLOS)
- Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (United Nations Fish Stocks Agreement [UNFSA])
- Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (1995) (FAO Compliance Agreement)
- Convention on Biological Diversity (CBD)
- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 International Convention for the Prevention of Pollution from Ships (MARPOL) and binding resolutions adopted by the International Maritime Organization (IMO)
- The Convention on Wetlands of International Importance (the Ramsar Convention)
- Regional instruments: binding resolutions from regional fishery bodies (RFBs) and regional seas conventions
- Convention on the Protection of the Underwater Cultural Heritage of the United Nations Educational, Scientific and Cultural Organization (UNESCO)
- IMO and its associated instruments

Soft law:

- Code of Conduct for Responsible Fisheries (CCRF) and related IPOAs and other instruments (FAO)

(Box 12 cont.)

- Rio Declaration on Environment and Development and Agenda 21 –UNCED, 1992
- Declaration of the International Conference on Responsible Fishing (Declaration of Cancún), 1992
- World Summit on Sustainable Development (WSSD) and its Plan of Implementation (WSSD-POI) (United Nations), 2002

5.3 WHAT CAN BE DONE TO ADDRESS PROBLEMS IN NATIONAL LEGAL AND INSTITUTIONAL FRAMEWORKS?

Many countries face considerable challenges in implementing MPAs with multiple objectives within appropriately integrated frameworks due to existing legal and institutional regimes. It is not uncommon that one authority has the mandate for designation and management of MPAs for biodiversity conservation purposes and another, a fisheries department, is responsible for fisheries-management-related MPAs. In the European Union, for example, MPAs for marine biodiversity conservation are the responsibility of member states under the Natura 2000 programme, whereas fisheries management in European Union marine waters falls under the Union's Common Fisheries Policy governed from Brussels. This division of responsibilities is often mirrored at the national level; in most countries, fisheries and biodiversity conservation are managed by different departments, which are not necessarily linked (Box 13).

While MPAs have often been designated using existing legal and institutional frameworks, in many countries there is a need to revise existing provisions or develop new legislative and institutional frameworks. Cross-departmental arrangements are needed to ensure that multiple-objective MPAs are implemented effectively, and this should be reflected in the revised or new frameworks. Development of new national legislation should also be undertaken, with a view to coordinating with international, regional, bilateral and other instruments and frameworks addressing MPAs, fisheries management and biodiversity conservation. Moreover, such development should take account of key factors such as expertise/capacity, political/civil service support, other stakeholder support, costs and timing.

Legislative processes can be very costly in both human resource and economic terms. Normally, the specialist services of institutional and legal experts will be needed to determine whether existing laws suffice to impose

BOX 13
Examples of national legislative MPA arrangements

In **Senegal**, MPAs have been covered by forestry legislation (Code Forestier 1998) and have fallen under the responsibility of the National Parks Department of the Ministry of Environment (Direction des Parcs Nationaux/Ministère d'Environnement, de la Protection de la Nature, des Basssins de Rétention et des Lac Artificels). However, more recently created MPAs have instead been designated by presidential decree or by provincial governor approval. In 2009, a new Department for Community Areas (Direction des Aires Communautaires) was created within the Ministry of Maritime Affairs (Ministère de l'Economie Maritime, de la Pêche et des Transports Maritimes). This department will have responsibility for community-managed MPAs. There have also been attempts to establish procedures that would facilitate coordination of MPA designation between the two ministries. Moreover, in 2010, a marine inter-ministerial committee (Comité Interministériel de la Mer) was created that will, among other things, facilitate the development of an ecosystem approach to marine management.

In the **Philippines**, the authority to establish and manage MPAs is held by three jurisdictions: the Department of Environment and Natural Resources, the Department of Agriculture – Bureau of Fisheries and Aquatic Resources, and the local government unit (LGU). Both national government agencies have responsibilities for protecting marine environments, although their mandates may sometimes overlap. The Local Government Code of 1991 contains several important measures that enhance the administrative abilities of the LGU, including political autonomy and the ability to generate and mobilize economic resources through taxes and fees. LGUs possess broad powers to control fishing activities in coastal waters and are able to set conditions for marine resource use by local ordinance, including the establishment of MPAs. LGUs do not require the approval of the national government agencies to establish MPAs.

Sources: Breuil (in press), Decree No 22.02.2010*01656 (Senegal); Eisma-Osorio *et al.*, 2009.

the necessary mandates and to properly empower the relevant agencies, or whether they should be broadly revised, replaced or supplemented. It is important to document and characterize the existing arrangements as a first step, before deciding what kind of measures are needed. Where MPAs are already in operation, information regarding relevant institutional, practical and legal relationships – and analysis of their performance relative to the existing institutions and laws – could prove useful in revealing both the strengths and weaknesses of MPAs and related frameworks.

Legislative and institutional development processes are situation-specific and national law varies from one country to another. Each particular law or institutional mandate depends on a great many factors (social, political, institutional, etc.), as well as on policy goals and objectives. The legal and institutional processes in diverse sectors also tend to differ. For example, national experience with terrestrial protected areas and resource management may have only limited relevance to MPAs. Although the overall policy goals and objectives may be the same or similar (i.e. biodiversity conservation and sustainable resource utilization), the manner in which legal measures apply and are implemented can be completely different for ocean and terrestrial issues.

There are many reasons for this variability, including (i) different rules governing use and ownership of marine resources; (ii) different enforcement needs in oceans; and (iii) different capacities to implement and enforce laws. In addition, within the marine sector, legal and institutional needs may vary greatly depending on the location of MPAs. For many developing countries, in particular, legal and implementation challenges depend on location (how far is the MPA from the country's shoreline?) and capacity (is the country able to effectively regulate, oversee, implement and enforce legislation, particularly in more remote ocean areas?).

In legal and institutional frameworks, it will be essential to determine the extent of the mandate relating to MPA governance (or the division of responsibilities among relevant agencies) in a way that ensures that there are no unintended gaps in overall governance of marine matters, and that there is a basis for determining the mandates of the agencies involved in any areas of overlap. Potential solutions include the setting up of supervisory, advisory or oversight bodies, coordinating commissions, cooperation protocols, joint policy statements, prearranged agreements between various government departments and other stakeholders, or specific MPA authorities. In the United States of America, a national system of MPAs has been established by presidential

BOX 14

The establishment of national coordinating mechanisms for MPAs: examples from Belize and New Zealand

In **Belize**, MPA management previously evolved in a piecemeal manner, leading to contradictory decisions by various government departments. In response, the Coastal Zone Management Authority and Institute requested legislative authority to govern all activities related to MPAs. The Authority suggested that the broad vision and conservation focus of the organization made it the ideal agency to oversee the management of Belize's MPAs. The Fisheries Department, it was argued, had too narrow a vision, focused on fish stocks and economic gain. The issue has now been addressed in a new National Protected Area Policy and System Plan, which includes provisions for establishing a commission that will be responsible for implementing the plan's policies. While there has been a long delay in appointing the commission, in 2009 it was in the final stages of development, and hopes are high that implementation will begin in the near future. Whether this arrangement will be successful in increasing coordination remains to be seen.

In **New Zealand,** a Marine Protected Areas Policy and Implementation Plan was released jointly by the Department of Conservation and the Ministry of Fisheries in 2006. This policy sets out a framework for establishing new MPAs and outlines the mechanisms for coordinating their management. These include the definition of protection standards as a basis for assessing what management tools are needed, as well as processes enabling a multi-agency approach to MPA planning, both in nearshore and offshore areas. Planning for nearshore MPAs will be implemented at a subnational level, while those offshore will be planned and implemented at the national level. Both the nearshore and offshore processes will be designed to allow for constructive engagement with *tangata whenua* (indigenous peoples), other user groups, and the public to ensure that MPA planning is inclusive, without compromising biodiversity protection objectives. Both processes will be underpinned by a commitment to minimize the adverse impacts of new MPAs on existing users of the marine environment and on traditional settlement rights.

Similarly, planning and development of New Zealand's MPA network will involve a range of central and local government agencies and marine users, *tangata whenua*, and those with an interest in the marine environment. The resulting network will be comprehensive – protecting both representative areas

(Box 14 cont.)

and areas that are outstanding or rare. A range of management tools will be used, including marine reserves, Fisheries Act tools, and tools under the Resource Management Act.

Source: Pomeroy and Goetze (forthcoming); Government of New Zealand, 2008.

executive order[34] to ensure comprehensive MPA planning, coordination and support. In France, the law on marine nature parks of 2006 created the French Marine Protected Areas Agency (Agence des aires marines protégées).[35] Examples of national arrangements from Belize and New Zealand are given in Box 14.

National legal provisions must define the governance systems or management approaches available to MPAs. Considering the ongoing trend in many countries of decentralization of natural resource management functions and the emphasis on stakeholder involvement, it is important that legislation has the ability to support community-based MPAs or co-management if the policy context includes the intention to move in this direction.[36] Related issues that must be addressed are human rights protections and the more-specific livelihood concerns of coastal communities or traditional users of the proposed MPA.

In summary, a national legal and institutional framework must include a variety of components. Most particularly, it must: (i) address and develop relevant institutions; (ii) enunciate institutional mandates and how coordination between institutions and agencies will take place; (iii)) define overall governance systems applicable to MPA management; (iv) adopt standards and processes for the designation and planning of MPAs; (v) provide a framework for the rules and regulations that will govern MPA implementation; (vi) enshrine civil protections and human rights, clearly stipulating the requirements and restrictions applicable to MPAs in this respect; (vii) adopt effective enforcement and administrative measures; and (viii) provide a legal basis to enable the MPA

[34] Presidential Executive Order No. 13158 of 26 May 2000.

[35] See www.aires-marines.fr/index.php.

[36] See also Section 5.5, "What are the institutional requirements at the level of individual MPAs?"

BOX 15
Indicators of good legislation and legislative processes for MPAs[a]

- Clear and direct legal authority/mandate;
- Support or acceptance by relevant community and stakeholder groups;
- Clear provisions or understandings regarding integration with the current framework or delimitation between various potentially applicable legal and administrative systems;
- Nature of the legal mandate of each provision or instrument within the framework (binding, non-binding, mandatory, voluntary, etc.);
- Linkage to policy objectives – role in their achievement;
- Role and mechanisms by which scientific analysis and monitoring is integrated as an essential tool for systematic validation of MPA effectiveness in achieving those objectives;
- Capacity (human, financial and practical) to deliver the actions and outcomes necessary to make that connection (i.e. to enforce the law or support other kinds of mandates); and
- Reasonable financial expectations with regard to logistical matters.

Source: Young, 2007.
[a] Whether new legislation or the adaptation/application of existing frameworks or both.

administration to meet its financial and logistical needs. Indicators of excellent legislation are shown in Box 15.

5.4 WHAT ARE THE KEY POLICY FRAMEWORK CONSIDERATIONS AND HOW DO MPAS RELATE TO BROADER SPATIAL MANAGEMENT STRATEGIES?

Management measures, such as MPAs, are more successful when used within a coherent policy framework. An MPA is not an aim in itself, but a tool to achieve policy goals and objectives, and it thus needs to relate to relevant policy frameworks. MPAs with a single objective should be in line with a specific sectoral policy. MPAs with multiple objectives may be embedded in several policy frameworks. Policy coherence then becomes important, and there should be harmonization of policies and plans for MPAs when implemented for fisheries management and biodiversity conservation objectives, or other sectoral purposes.

BOX 16
What are marine spatial management frameworks?

Spatial management frameworks provide a mechanism for strategic marine management that permits a view of the 'big picture' – making it possible to manage current and potential conflicting uses, the cumulative effects of human activities and marine protection. Marine spatial planning is a type of integrated management approach that provides a practical way to more-rational organization of the use of marine space in an open and planned way. It is a "public process of analysing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic, and social objectives that usually have been specified through a political process" (UNESCO-IOC, 2010). Marine spatial planning allows for cross-sectoral and holistic approaches to establishing zoning plans and regulations. These plans and regulations can then guide the granting or denial of individual permits for the use of marine space. Spatial management frameworks can be established and implemented at various scales: subnational area, country, subregion or region.

Key characteristics of spatial management frameworks include:

- ecosystem-based: balancing biological, ecological, economic and social goals and objectives for sustainable development;
- integration: cutting across sectors, agencies and levels of government;
- place- or area-based: looking at the allocation and use of space;
- adaptive: learning from experience;
- strategic and anticipatory: focusing on the long term;
- participatory: ensuring that stakeholders are actively involved in the process.

Sources: Ehler and Douvere, 2009; UNESCO-IOC, 2010.

Policy frameworks exist at different scales. In addition to sectoral policies, including fisheries management, there are broader ocean governance and spatial planning and management approaches and strategies that can have cross-sectoral application. Marine spatial management frameworks (Box 16) and integrated coastal zone or area management frameworks (ICM, ICZM, ICAM) are examples of approaches to integrated management (FAO, 1996b). They include mechanisms for managing multiple and potentially competing

uses of designated areas and their resources through ecosystem boundaries and cross-sectoral and institutional approaches.

5.5 WHAT ARE THE INSTITUTIONAL REQUIREMENTS AT THE LEVEL OF INDIVIDUAL MPAs?

Within the broader legal, institutional and policy frameworks, suitable institutional and administrative arrangements are needed for managing and implementing individual MPAs or MPA networks. These arrangements should reflect the objectives of the MPA and be built around partnerships between diverse government departments and stakeholder groups.

MPAs may be managed under a variety of governance systems or management approaches, and the institutional set-up and administrative arrangements will vary from one situation to another. The three general categories of overall approaches are centralized (or government managed), community-based (or locally managed), and collaborative (or co-management). The differences primarily relate to the degree of stakeholder participation in management and administrative arrangements, and the location of management authority and responsibility. In many countries, decentralization of management to local governments and communities is increasing, and the general trend in fisheries and ecosystem management is towards improved and increased involvement of stakeholders. There is general acceptance of the many benefits that shared responsibility and participatory decision-making can generate. Support and compliance are likely to increase if people, individually and as a group, feel they have been informed, have been part of the decision-making process for the MPA, and have been able to actively participate in and influence the process. Disruptions to livelihoods can be minimized and mitigated more easily if those concerned are part of the planning and implementation processes.

MPAs implemented in inshore areas, where local coastal communities are the direct users of the resources, generally have different requirements than MPAs in offshore areas, where users tend to have greater mobility and be less dependent on specific natural resources and areas. Experience shows that it is particularly important in small-scale coastal MPAs to give due attention to community rights and stakeholder participation, and community-based or co-management approaches are likely to be appropriate. As mentioned previously,[37]

[37] See Section 5.1, "Why are appropriate legal, institutional and policy frameworks important for MPAs?"

BOX 17
Great Barrier Reef Marine Park Authority (Australia)

The Great Barrier Reef Marine Park Act of 1975 created the GBRMP and is the key act with respect to the park. It established the GBMRP Authority, which is the main advisor to the Government of Australia on Marine Park control, care and development. The Authority is responsible for park management and provides for regulations, fee collection and enforcement. The act was amended in 2008/09 to improve its integration with other legislation and make it more effective in protecting and managing the Great Barrier Reef in the future. The amendments allow Marine Park management to be guided by such concepts as ecological sustainability, the precautionary principle, and ecosystem-based approaches. The amendments also increase traditional-owner knowledge of and interest in management through the requirement that at least one member of the GBRMP Authority be an indigenous person.

The GBRMP Authority focuses on five major areas: fisheries; tourism and recreation; water quality and coastal development; conservation heritage and indigenous partnerships; and climate change. It has four reef advisory committees (RACs) providing advice on each of these areas with the exception of climate change. The Authority is also advised on Marine Park management issues at the local level by voluntary, community-based committees called local marine advisory committees (LMACs). These community fora – consisting of representative interest groups, government representatives (e.g. of the Queensland Parks and Wildlife and Queensland Department of Primary Industries and Fisheries) and the local community – discuss issues regarding marine resources and their concerns. The LMACs function as advisory bodies and provide a communication mechanism between the community and the Authority.

Source: Government of Australia, Great Barrier Reef Marine Park Authority.

provisions that allow for such governance systems must be reflected in the overarching legal, institutional and policy frameworks for MPAs.

Box 17 describes the Great Barrier Reef Marine Park Authority (GBRMP) in Australia as an example of a legal and institutional set-up for a marine park with protected areas. MPA administrative arrangements and the various

governance systems available to MPAs are discussed further in the context of MPA planning and implementation in Chapters 6 and 7.[38]

5.6 WHAT ABOUT MPAs IN TRANSBOUNDARY AND INTERNATIONAL WATERS?

MPAs in transboundary areas (i.e. across national jurisdictions) have many potential advantages, but face special challenges because responsibilities and authorities are shared by the countries. They offer a unique political option for countries to build confidence through joint fisheries management and biodiversity conservation, and can facilitate collaborative research.

Transboundary collaboration becomes particularly important in designating MPA networks.[39] Globally and regionally, the protected area network approach seems useful, and perhaps even necessary to conserve and sustain all types of ecosystems and biological interactions – without preventing reasonable uses of land or marine areas. The most advanced multinational application of the network approach originated in terrestrial protected areas in the European Union, and the concept has spread more broadly, including to MPAs. For MPAs with biodiversity conservation objectives, an individual country may find it difficult to preserve all relevant ecosystems solely by actions within its own national waters. From a fisheries management perspective, shared fish stocks and related ecosystems and habitats are common, and to make an MPA network effective, it may need to span the waters of several countries. Networks of MPAs could facilitate the management of fisheries on an ecosystem scale.

To allow transboundary MPAs to function, appropriate institutional arrangements are needed. These can be in the form of overarching mechanisms for marine spatial management frameworks, facilitating joint MPA management (Box 18) or through the establishment of specific agreements between states and between the competent authorities in the concerned countries, referring specifically to the MPA. RFBs could play a role in establishing and managing transboundary MPAs.[40] The regional seas conventions of the United Nations Environment Programme (UNEP), designed to promote regional cooperation on marine and coastal environmental issues, are also an important mechanism in the establishment of transboundary MPAs.

[38] See Chapter 6, Section 6.8, "What are the key MPA design considerations?" and Chapter 7, Section 7.1, "What administrative arrangements are needed for MPA implementation?"

[39] See also Chapter 1, Section 1.4, "What is an MPA network?" and Section 1.5, "Why do we need MPA networks?"

[40] See next section and Annex 1 for more information on RFBs.

BOX 18
Benguela Current Commission

The Benguela Current Commission (BCC) was formally established when the Governments of Angola, Namibia and South Africa signed the BCC Interim Agreement in 2006 and 2007, allowing joint management of the marine resources of the Benguela Current Large Marine Ecosystem (BCLME). The three countries will collectively manage transboundary environmental issues such as shared fish stocks and will work together to mitigate the impacts of marine mining and of oil and gas production on the marine environment.

The BCC is headed by a Ministerial Conference supported by a management board, a secretariat and working groups. Committees include Living Marine Resources, Minerals and Oil, Ecosystem Health and Environment, and an Ecosystem Advisory Committee. One important element of the interim agreement is that by 2012 the contracting countries shall strive to bring into force a binding legal instrument that will establish a comprehensive implementation framework for an ecosystem approach to conservation and development of the BCLME. Regional management structures such as the BCC can play a vital role in facilitating joint management of MPAs and interaction with other activities in the transboundary area, such as fisheries, hydrocarbon exploitation and offshore diamond mining.

Sources: Cochrane *et al.*, 2007; BCLME Programme, no date.

5.7 WHAT IS THE INSTITUTIONAL AND LEGAL SITUATION FOR MPAs IN INTERNATIONAL WATERS?

In international waters and other marine areas, MPAs represent an opportunity for the global community to cooperate. However, the creation of MPAs in areas beyond the limits of national jurisdiction is a legally uncertain proposition. If an MPA in such waters is a unilateral or regional creation, it is binding only on the governments, individuals, companies and vessels of (or flagged by) the countries that made the designation. Thus MPAs in these areas can only be functional if they are supported by other countries or mandated in generally agreed international law.

To further compound the matter, non-living resources (i.e. minerals) of the seabed in the Area, or in areas beyond the limits of national jurisdiction, are regulated by the International Seabed Authority (ISA), established under

UNCLOS. The ISA is also empowered to take measures to ensure protection of the marine environment, including flora and fauna, in connection with the various uses of the seabed (see Annex 1 for further information).

Efforts to create high-seas MPAs have taken two tracks. One involves creating high-seas MPAs on an area-by-area basis, relying on existing international law for legal justification and as a basis for calling on all countries to recognize management measures determined by the RFBs, including potential high-seas MPAs. Using this approach, a number of RFBs have identified protected areas (e.g. General Fisheries Commission for the Mediterranean [GFCM], Northeast Atlantic Fisheries Commission [NEAFC], etc.), including limited-take and seasonal-fishing zones and other managed-use/conservation areas. RFBs are critical vehicles for promoting long-term sustainable fisheries where international cooperation is required in conservation and management. However, they do not always y have a mandate that explicitly includes biodiversity conservation; their conventions tend to focus on fisheries management. Nevertheless, an increasing number of RFBs incorporate management according to EAF inclusive of biodiversity conservation, in addition to the precautionary approach, and seek to adopt management measures consistent with EAF principles.[41]

The second track focuses on developing international consensus to adopt one or more new international instruments that will mandate the creation of high-seas MPAs and stipulate the standards by which such areas will be identified, established and managed. This second approach is more focused on the future, seeking a long-term system that will be subject to international law. Its proponents hope that such an instrument will be better able to achieve international goals of conservation and environmental protection.

However, the United Nations Fish Stocks Agreement, which seeks to implement UNCLOS, already mandates that countries must comply with fisheries management rules adopted by RFBs (even RFBs to which a country is not a member), as long as those rules are adopted for fisheries management purposes and "do not discriminate in form or in fact against the fishermen of any State". Accordingly, as long as they are created through or under RFBs and are consistent with the resource management and conservation provisions of UNCLOS, high-seas MPAs can (in the right circumstances) be legally established for the management of living resources of the high seas.

[41] See also Annex 1.

No matter which approach is used, the most important legal elements regarding the international regime for high-seas MPAs appear to be obtaining international acceptance of: (i) the purposes and means for identification and establishment of high-seas MPAs; (ii) a clear statement of the legal rights and duties of countries and stakeholders within each type of MPA in areas beyond the limits of national jurisdiction; and (iii) a body of scientific information and awareness through which open issues relating to MPAs (both within and outside of national waters), the roles and rights of users of marine resources, and national/regional impacts of high-seas MPA protection can be understood.

MPAs and MPA networks in the high seas are discussed further in Annex 1.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 5

Planning and implementation of MPAs and MPA networks must be supported by appropriate legal, institutional and policy structures, including cross-sectoral coordination mechanisms and provisions for stakeholder participation. Most countries have frameworks for fisheries management, as well as for biodiversity conservation or sustainable use of natural resources. However, these existing frameworks may not suffice to meet the needs of designation and management of MPAs with multiple objectives and should be revisited as required. Policy coherence and the use of marine spatial management frameworks are important elements of successful fisheries management and biodiversity conservation.

- Legislation and institutional structures must be in place that support MPA objectives – defined within the framework of national policy goals relevant to fisheries management and biodiversity conservation – and that enable a range of environmental, economic and social benefits and incentives.
- A number of international instruments and agreements, both binding and voluntary, directly or indirectly support the designation of MPAs. These commitments must be reconciled with policies and priorities at local and national levels.
- At the national level, legislation should include standards, processes and other guidance for MPA designation and management. Institutional arrangements should include the necessary provisions for cross-departmental coordination and collaboration, stakeholder consultation and participation, and implementation of decentralized governance systems, as applicable.
- Planning and implementation of MPAs should be embedded in relevant policy and management frameworks. These exist at different scales and for different sectors, and MPAs with multiple objectives may need to be embedded in several frameworks.
- Institutional and administrative arrangements are needed for managing and implementing individual MPAs or MPA networks. These arrangements should be nested within the overall legal, institutional and policy frameworks and should reflect the objectives of the MPA. Arrangements will vary from one situation to another, based on the overall governance system. Nevertheless, independently of the type of governance approach, stakeholder participation in decision-making with regard to MPA planning and implementation is imperative for successful outcomes.

- MPAs in transboundary and international waters pose particular challenges, and special institutional and legal arrangements are often needed. RFBs are critical vehicles for promoting long-term sustainable fisheries where international cooperation is required in fisheries management and conservation.

6. THE MPA PLANNING PROCESS

The purpose of MPAs and MPA networks is to help solve problems and achieve goals and objectives within the policy frameworks and management systems of which they are an integral part. These policy goals and overarching objectives do not necessarily refer explicitly to MPAs but to sustainable fisheries, biodiversity conservation and socio-economic targets. Against this background, the process of setting up an MPA involves a number of choices and decisions: the first would be to define the need for an MPA and the goals it is expected to achieve. The MPA planning process needs to be based on participation, transparency and equity. As mentioned in Chapter 5, good governance is another key to successful MPA management outcomes and this is true already at the planning stage.

This chapter presents the various steps of the planning process, including some key design aspects. Implementation arrangements and information for MPA planning and implementation are discussed in subsequent chapters.

The Code of Conduct for Responsible Fisheries affirms that conservation and management decisions for fisheries should be based on relevant environmental, economic and social factors. Long-term management for sustainable fisheries and ecosystem objectives should be translated into management actions and formulated as fisheries management plans or other management frameworks. Decision-making processes should be transparent and should include stakeholder participation.

6.1 WHAT ARE THE MAIN ENTRY POINTS FOR MPAs INTO FISHERIES AND EAF MANAGEMENT?

The main starting points for MPAs being proposed or considered in a fisheries management context include:

- Initiatives from within the fishery sector: as a management measure within an EAF process (i.e. when evaluating the available management measures), it has been agreed that a suite of management measures, including an MPA or MPA network is the best option for achieving policy and management objectives; or

- Initiatives from outside the fishery sector: as part of a biodiversity conservation initiative or other sectoral plan, it has been decided that an MPA will be designated.
- Spatial management measures already in place under existing frameworks must also be considered. Managers may need to assess such measures to determine: (i) if those in place are meeting their objectives (or if in fact they must adapt the objectives to include broader EAF objectives); (ii) if they should be adapted based on changes in the fishery or ecosystem; or (iii) if they appropriately consider fishery effects or impacts.

The fisheries effects of these decisions must be evaluated and fed into the MPA design process, as well as into the relevant fisheries and EAF management systems and the overarching planning framework. The processes should be iterative and adaptive, with loops and linkages between policies and plans at various levels. Cooperation at different levels and scales is required: between relevant authorities and between these and stakeholders (e.g. fishers and coastal communities).

6.2 HOW DO MPAs RELATE TO OVERARCHING NATIONAL OR SECTORAL POLICY GOALS AND DEVELOPMENT OBJECTIVES?

When deciding to set up an MPA, it should have been concluded that it is a suitable management tool for meeting or contributing to overarching policy goals and development objectives. These goals and objectives may be defined within integrated marine governance and spatial management frameworks,[42] or in legal terms as obligations that a particular sector or industry has to meet. In fisheries, for example, it is common to define overfishing as a problem and sustainable yield as an objective. The legal framework may also define other problems by holding fisheries accountable to other laws that apply to all industry sectors. For example, fisheries are usually subject to environmental laws that protect environmental quality, biodiversity and endangered species. There may also be governmental policies that relate to problem identification and objectives, such as policies that seek industry efficiency or full employment, or refer to environmental protection and biodiversity conservation.

These high-level legal requirements and policy goals must be translated through a series of steps into management decisions and actions applicable to

[42] See also Chapter 5, Section 5.4, "What are the key policy framework considerations and how do MPAs relate to broader spatial management strategies?"

the MPA. Within the framework of the overall policy and legal requirements, clear, specific goals and specific operational objectives – contributing to the overarching goals – should be defined. The planning process will lead to a plan that will guide MPA management.

6.3 WHAT IS THE PROCESS FOR PLANNING AN MPA?

The steps of the planning process are similar to those of an EAF process. Because MPAs should be embedded in broader management frameworks, as mentioned previously, their planning process needs to be couched within and coordinated with these broader plans.

When it has been decided that an MPA is a suitable management measure that will contribute to the overall policy goals and objectives, the planning process follows a number of common steps (see Figure 5), which are discussed in the following sections.

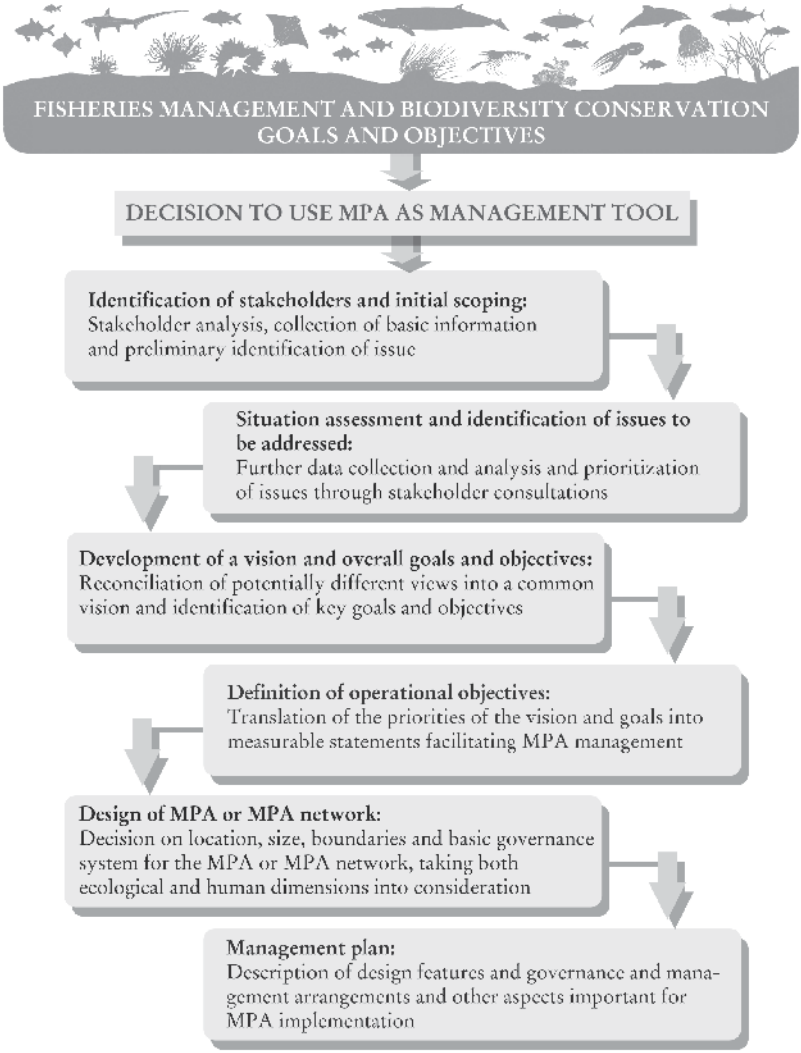
However, the steps are not necessarily always exactly the same in all MPA planning processes – or the process may be less formal. It is also often iterative. MPA management needs to be adaptive,[43] and hence planning outcomes may need to be revisited and plans changed. Depending on overall objectives, local circumstances, related planning frameworks and processes, planned size and location of the MPA, etc., the actual steps and how they are carried out will vary. Nevertheless, the key elements are likely to be same – although perhaps in a different order or framed differently. Box 19 offers an example from the Philippines. MPA implementation is discussed further in Chapter 7.

6.4 WHEN AND HOW SHOULD STAKEHOLDERS BE INVOLVED IN MPA PLANNING?

Early involvement of stakeholders in the MPA planning process is important. The diversity and type of information brought to bear on decisions depends on who has the right to participate in decision-making processes. Consequently, participatory planning arrangements generally increase the amount of information integrated into MPA planning and implementation. Thus participatory processes increase the likelihood that decisions, including with regard to the site and delineation of the MPA, will be based on accurate assessments of socio-economic conditions and environmental dynamics.

[43] See Chapter 7, Section 7.8, "What is adaptive management in the context of MPA implementation?"

FIGURE 5
Common steps of an MPA planning process



BOX 19
MPA planning and implementation in the Philippines

Community-based MPA planning in the Philippines follows a well-established series of steps based on the principles of community organizing (see Figure 6). MPA designation is usually initiated once development or environment specialists become integrated into a coastal community, either by living in the community or by spending considerable time becoming known to community members. The process begins with participatory and scientific surveys of environmental and social conditions. An educational programme for community members using formal and informal methods raises awareness of the importance of marine and fishery resources and management options. From this starting point, community leaders, scientists and resource users conduct baseline surveys of fisheries and ecological conditions using participatory and scientific methods, select a site for the MPA based on the surveys, and work with local authorities to formally declare the MPA.

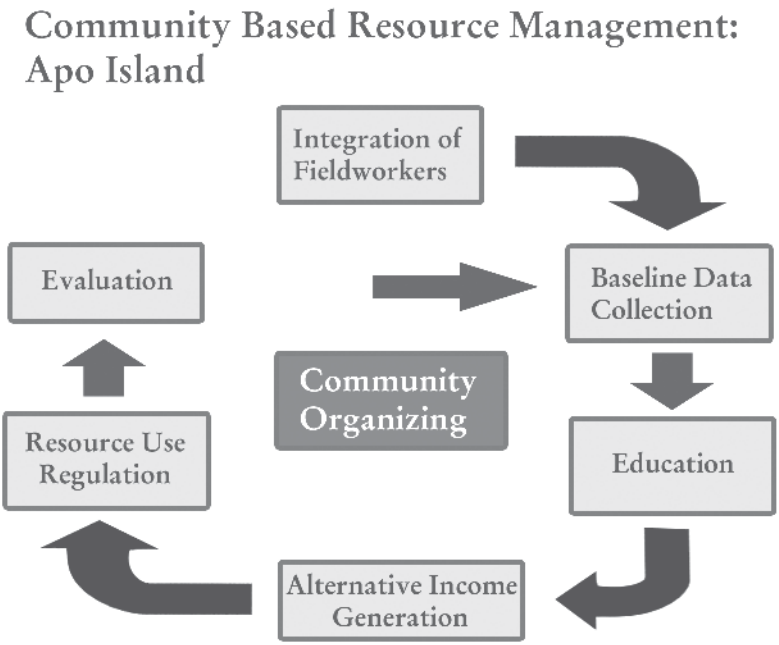
Once an ordinance is passed by municipal authorities, the MPA is usually enforced by community members through government-supported *bantay dagat* (sea guardian) groups. Fishers are deputized to apprehend or report violators of MPA and fisheries rules and regulations. Simultaneously with MPA implementation, development of alternative livelihood activities is common and encourages resource users to organize programmes such as consumer cooperatives, livestock-rearing and ecotourism development. Many, but not all, MPAs are monitored periodically by scientists and residents, which in some cases has resulted in important term-series datasets on MPA effects. Evaluation of MPA management effectiveness and outcomes is an ongoing activity that informs adaptive management of the MPA and alternative livelihood activities. This process has been implemented in hundreds of locations in the Philippines, resulting in a proliferation of MPAs ranging from 4 to 100 hectares in size.

Sources: White, Salamanca and Courtney, 2002; Christie and White, 2007a.

Participatory MPA planning arrangements also tend to enhance the perceived legitimacy of decisions (Box 20).

It is important to be very clear about what one means by stakeholder participation. There are several types of participation, ranging from communication, where there is little direct engagement of stakeholders, to negotiation, where decision-making power is shared among the various

FIGURE 6
General steps for community-based MPA planning in the Philippines



Sources: White, Salamanca and Courtney, 2002; Christie and White, 2007a.

stakeholders. Between these two extremes, other levels of participation are possible. Unfortunately, it is not uncommon that a term that indicates a high level of stakeholder participation is used to describe practices that, in reality, are limited. This often causes frustration from the start – jeopardizing successful MPA management – and should be avoided.

Not all stakeholders have the same stake or level of interest in the MPA and the resources being managed, and thus may be less or more active and have entitlements to diverse roles in the MPA process. A fundamental question is who should be involved. It is important to remember that 'stakeholders' includes not only fishers, but also other community members, resource users, and other sectoral and institutional interests. A stakeholder analysis is usually

BOX 20

Fishers and community participation in planning fish refugia in Viet Nam – the Phu Quoc case study

The seagrass meadows on the eastern shore of Phu Quoc Island – at the southern tip of Viet Nam – were selected as a demonstration site during implementation of the UNEP/GEF South China Sea Project. This was owing to their high species diversity, large extent and the possibility of extending the boundaries of an existing land-based national park to include part of the seagrass beds. After initiation of the demonstration project, it was suggested that the possibility of establishing fisheries refugia in the area be evaluated, as imposing a no-take zone would conflict with the traditional usufruct rights of the Ham Ninh commune.

In 2006, the fisheries refugia concept (an area with specific management measures to protect fish during critical life stages)[1] was introduced to the Phu Quoc archipelago as a potential means of improving the management of fish stock and habitat links at Ham Ninh. The concept was well received by the Kien Giang Department of Science and Technology and Department of Fisheries, as well as by commune representatives.

Subsequent consultations were undertaken with commune fishers, fish traders and women involved in inshore gleaning and processing. However, few or no data on the distribution and abundance of fish eggs and larvae were available for identification of spawning locations or important nursery locations for fish stocks. This problem was largely overcome by the active involvement of local fishers in all consultations and exercises to identify refugia sites. The level of acceptance by commune fishers of the refugia concept was such that they ultimately led activities to identify specific spawning and nursery areas, in consultation with local fisheries, Environment Department staff, and army border officials.

This consultative process provided enough interaction between all sectors that management issues and solutions could often be discussed and agreed at sea, aboard small fishing vessels. Such dialogue was necessary to enable the sharing of ideas and perspectives required to identify solutions to problems of food source and income for the local community.

Source: Pernetta and Paterson, (forthcoming).

[1] See Glossary.

conducted to identify and differentiate stakeholders and help define who should be involved. Important attributes for stakeholder analysis in the context of MPAs and fisheries include:

- the various stakeholders related to the fishery resource and marine area;
- the group/coalition to which they belong or can reasonably be associated with;
- the kind and level of interest (and concerns) they have in the fishery resource and the marine area;
- the importance and influence that each stakeholder has on the fishery resources or its management;
- stakeholders' positions towards the use or conservation of fishery resources and marine habitats.

It is crucial that this process of stakeholder selection is transparent and that all who believe themselves stakeholders are allowed to argue their case for entitlement.

For the effective continuation of the MPA planning process, it may be advisable to identify a few individuals who can represent the interests of larger stakeholder groups. Support and capacity-building of the poorer or marginalized groups of stakeholders may be needed to ensure that they are able to take part effectively in the planning process (and subsequent implementation). Group formation, training and community organizational development are important tools in this respect.

A reliable stakeholder analysis requires research to provide information about stakeholders. It will typically include a socio-economic assessment to learn about the social, cultural, economic and political conditions of individuals, households, groups, communities and organizations, as well as about the power relationships between various stakeholders and stakeholder groups.

Together with the stakeholder assessment and analysis, a preliminary collection of basic information on the fishery system and the marine area is needed in the early stages. This scoping exercise should include bioecological, socio-economic and institutional aspects, and should take note of particular issues, problems and opportunities relevant to the designation of an MPA. The stakeholder analysis and scoping results will provide the basis for a more-detailed situation assessment and for identifying the issues to be addressed.

6.5 HOW ARE THE ISSUES TO BE ADDRESSED BY MPAs IDENTIFIED AND PRIORITIZED?

Working closely with stakeholders, the initial scoping exercise needs to be expanded into a more-detailed situation assessment and an MPA profile. This profile should cover a number of aspects and be compiled in close collaboration with the stakeholders.[44] This will assist in identifying the issues that the MPA is expected to address and resolve.

When taking a holistic and integrated approach to MPA planning, the process of identifying and agreeing on pertinent issues is likely to be complex. With a broad range of stakeholders and views on what aspects are important, prioritization becomes a critical element of the process. Several methods and approaches can help – as well as in the subsequent steps of defining goals and objectives. These include the hierarchical tree or framework approach, cost–benefit analyses, risk assessments and distributional impact reviews (Box 21). All these approaches are complementary, and the various methods can be used to calculate inputs for, or in combination with, more general analytical frameworks for decision-making assistance.[45]

6.6 WHAT IS A VISION AND WHAT ARE USEFUL MPA GOALS AND OBJECTIVES?

A vision is a description of the ideal state of the fishery and the marine area that stakeholders aspire to and arises directly from the planning process that concluded that an MPA is one of the tools to be used for addressing the main issues identified (see Chapter 2 and Section 6.1). This vision encompasses both biological and ecological status and takes account of socio-economic circumstances and governance arrangements, and constitutes a basis for the formulation of goals and objectives. The interests and objectives of different groups and the issues that have been identified in the stakeholder analysis and in the participatory situation assessment should be shared, recognizing that the perceptions and aspirations of the groups may sometimes appear difficult to reconcile and may require repeated facilitation and negotiation. Particularly if planning takes place in a poverty context or in situations where food security is a concern, it is important that the goals and objectives of MPAs reflect a

[44] The types and sources of information for MPA planning and implementation are discussed in Chapter 8.

[45] See also Chapter 8 and FAO, 2003a, 2009a, as well as the related FAO Fisheries Technical Papers (FAO 2002, 2003b, 2008b). Information on the Australian ESD framework is available at www.fisheries-esd.com/

BOX 21
Tools for analysis and prioritization

Various analytical frameworks can assist in the decision-making and prioritization process when selecting what issues an MPA should address and what the goals and objectives should be:

- *hierarchal or problem tree* is often used as part of participatory planning and helps define root causes by clustering identified problems and issues. The hierarchical tree framework, developed in Australia within the concept of ecologically sustainable development (ESD), starts with the two main concerns for such development – human and bioecological well-being – and adds a third main component related to governance and the ability to achieve.
- *analysis* is used to determine the economic efficiency of various options from among which decision-makers must choose. Simply put, future costs and benefits are estimated for each option and the sum of their net present values (NPV) calculated. The alternative with the highest NPV is the preferred choice. A considerable challenge in this process is to measure the costs and benefits. While it may be feasible to put values on economic costs and benefits – such as changes in income and fishing expenditures – social and ecological costs and benefits are more difficult to express in monetary terms.
- *assessments* are essentially used to determine whether the probability of a particular hazard or threat, combined with the magnitude of its impact or cost in case it does occur, is considered acceptable or not when compared with some standard or benchmark. In the context of ESD in Australia, a risk matrix has been developed categorizing 'likelihood' and 'consequences' of hazards into six levels. By multiplying the likelihood score by the consequences score, risk ratings for the various scenarios are arrived at. These then guide decisions on what actions different issues may require.
- *impact reviews* examine not only total costs and benefits (as in cost–benefit analysis), but who will benefit and who will not, as well as the temporal and spatial distribution of costs and benefits. This is an important aspect of equity and is particularly relevant when planning MPAs in a poverty context, where certain community groups may be highly vulnerable.

Source: FAO, 2008b.

balance between the needs and realities of sustainable exploitation, biodiversity conservation and socio-economic requirements.

The vision provides a framework for defining goals and objectives. A goal – or broad purpose – is a statement of what the MPA is ultimately trying to achieve within the context of broader goals defined at the sectoral (e.g. within an EAF) or intersectoral level. A useful goal has these characteristics:

- a brief and clear definition of the desired long-term vision or conditions that will result from effective management of the MPA;
- typically phrased as a broad mission statement; and
- simple to understand and to communicate.

Most MPAs have biological, socio-economic and governance goals and objectives. In some cases, they are also put in place to achieve cultural goals. Examples of potential goals of MPAs are listed in Box 22. In Box 23, an

BOX 22
General goals for MPAs in the context of fisheries

MPAs should contribute to some of the following goals.

Biological/ecological goals:

- sustaining or protection of fishery resources;
- protection of biological diversity;
- protection of individual species;
- protection of habitat;
- restoration of degraded areas.

Social and economic goals:

- fostering of food security;
- improvement of livelihoods;
- non-monetary benefits to society;
- equitable distribution of benefits from the MPA;
- maximum compatibility between management and local cultures;
- enhanced environmental awareness and knowledge.

Governance goals:

- maintenance of effective management structures and strategies;
- maintenance of effective legal structures and management strategies;
- effective stakeholder participation and representation;
- enhanced management plan compliance by resource users;
- management and reduction of resource-use conflicts.

Source: Based on Pomeroy, Parks and Watson, 2004.

BOX 23
Goals and objectives of the Prince Edward Islands MPA in South Africa

The process of developing the plan for the Prince Edward Islands MPA began in June 2004 with an announcement by the Marine and Coastal Management branch of the Department of Environment Affairs and Tourism (DEAT) that they intended to declare one of the largest MPAs in the world around the Prince Edward Islands. Following this announcement, DEAT, with support from WWF-South Africa, put together a process to develop a spatial marine biodiversity conservation plan that would inform delineation of the proposed MPA. This plan was developed with extensive consultation with stakeholders, including the fishing industry and interested civil-society groups. Proposed regulations were also developed through a series of workshops and consultations with all stakeholders. The stated objectives of the Prince Edward Islands MPA were to:

- contribute to a national and global representative system of MPAs by providing protection for unique species, habitats and ecosystems;
- serve as a scientific reference point that can inform future management of the area;
- contribute to recovery of the overexploited Patagonian toothfish (*Dissostichus eleginoides)*;
- reduce incidental mortality of seabirds, particularly albatrosses and petrels, in the Patagonian toothfish fishery, and control the bycatch of fish and marine species other than Patagonian toothfish in the commercial fishery.

Within the framework of these objectives, three broad focal areas were identified: biophysical, socio-economic and governance. These focal areas relate to diverse goals: maintain biodiversity; contribute towards the long-term viability of marine fisheries, and recovery of the stocks of the Patagonian toothfish; promote ecotourism; and ensure that appropriate and effective legal structures are developed for protecting the biodiversity of the MPA and the activities that benefit from it.

Source: Japp and Currie Potgieter, (forthcoming).

example is provided of the definition of goals and objectives in consultation with stakeholders of the Prince Edward Islands MPA in South Africa.

Because MPAs will have multisectoral effects, multiple goals should be considered even when the original initiative to designate an MPA has emerged from one particular concern. For example, when setting up an MPA for biodiversity conservation, its harmonization with relevant fisheries policies and legislation, and its potential contribution to sustainable fisheries should also be explored. If the effects on fisheries are internalized in the planning and design process, instead of being dealt with as an externality, the outcomes are likely to be more useful. Setting clear goals and objectives helps ensure more-effective management and facilitates the monitoring of progress. When the specific MPA objectives are set, decisions on the site, scale and other design aspects of the MPA should follow. These decisions should be goal- and objective-driven.

Poorly designed or articulated goals and objectives can be a serious problem and can jeopardize the desired outcomes. Adequate time and resources must be allocated to this process before moving on to the design and more-operational aspects of MPA planning.

6.7 HOW ARE THE OPERATIONAL OBJECTIVES FOR AN MPA SET?

The vision and broadly defined goals of MPAs must be translated into specific objectives, with direct and practical meaning, that can be used in MPA implementation and performance evaluation. An operational objective is a measurable statement of what must be accomplished to achieve a related goal. Attaining a goal is typically associated with the achievement of two or more corresponding operational objectives. A useful operational objective is SMART:

S – specific and easily understood;
M – meaningful and written in terms of what will be accomplished, not how to go about it;
A – agreed, with stakeholders' responsibilities defined;
R – realistic and relevant; and
T – time-bound, that is, defined within a limited time period.

As with the identified issues, in a participatory process more potential objectives may be identified initially than can realistically be assigned to the MPA, and it could be necessary to prioritize. This is a process that requires effective participation and negotiation.

6.8 WHAT ARE THE KEY MPA DESIGN CONSIDERATIONS?

To achieve the assigned goals and objectives, the MPA needs to be designed and decisions made on management measures – where the MPA will be located, how large it will be, the borders, and the activities allowed within it. Decisions must also be made with regard to governance, and the preferred management approach must be supported by the overall policy and legislative framework.

There may be several options for achieving the same objective. In order to enable stakeholders to make informed decisions on which of the possible options may best serve the goals and their interests, information on their potential effects and outcomes should be gathered and made available.

Design considerations are discussed in the following paragraphs with regard to site selection, the amount of area needed for the MPA and governance options. These features will be documented in the management plan, together with implementation and management arrangements. These aspects are discussed further in Chapter 7 of this document.

How is the site for an MPA selected?

The selection of sites for MPAs and their delineation depend on objectives, spatial information – biological, ecological and socio-economic – and legal and institutional frameworks. Objectives define what is to be protected by MPAs, spatial information determines where MPAs should be located, including the specification of MPA boundaries, and legal and institutional frameworks determine if there is the authority to establish and enforce MPAs in the locations selected as a priority for protection.

The site-selection process may involve sophisticated models or it may rely on the judgements of local people, based on fishing experience and traditional ecological knowledge. It will often be useful to develop a set of site-selection criteria based on objectives, available information and legal frameworks. These criteria can be used to identify priority areas in which to establish the MPAs. They can help ensure objectivity in the selection of sites and boundaries. Depending on the MPA objectives, criteria could include, for example, social acceptance, aesthetics, accessibility, importance to fisheries, nature of threats, representativeness, uniqueness and vulnerability.[46]

[46] See Salm, Clark and Siirila, 2004, for examples of criteria and a discussion of the site-selection process.

BOX 24
Outline of zoning provisions in the Great Barrier Reef

- *use zone/general use 'A' zone*: least restrictive of all the zones; it provides for all reasonable uses, including shipping and trawling. Prohibited activities include mining, oil drilling, commercial spear-fishing and scuba spear-fishing.
- *protection zone/general use 'B' zone*: provides for all reasonable uses, including most commercial and recreational activities. Shipping and trawling are prohibited, as well as those activities not allowed in general use 'A' zone.
- *park zone/marine national park (MNP) 'A' zone*: provides for appreciation and recreational use, including limited line fishing (one line/hook per person). Spear-fishing and collecting are prohibited, as well as those activities not allowed in general use 'B' zone.
- *zone/marine national park 'buffer' zone*: similar to and adjacent to MNP 'B' zones, but allows pelagic trolling. All those activities not allowed in MNP 'A' zone are also prohibited.
- *park zone/marine national park 'B' zone*: provides for appreciation and enjoyment of areas in their relatively undisturbed state. It is a 'look, but don't take' zone, in which all forms of extraction (including fishing) are prohibited.
- *research zone*: set aside exclusively for research. Entry and use for other reasons are prohibited.
- *zone*: provides for preservation in an undisturbed state. All entry is prohibited, except in an emergency, with the exception of permitted scientific research that cannot be conducted elsewhere.

Source:. Day, 2002, p.143, Table 1.

Zoning is an important component of overall MPA management. Zones within an MPA can be used to permit or restrict diverse uses in different areas of the MPA or an MPA network. They can assist in reducing user conflicts and providing greater protection for ecologically sensitive areas, while allowing access to other areas for extractive purposes or tourism. In a multi-use MPA, a preliminary zoning plan to accommodate the various uses should be developed. As consultations with stakeholders are held, this may subsequently

be amended to reflect user-group expectations and needs. The selection of an MPA site is usually a compromise between longer-term biological and ecological considerations, and the more immediate needs of people and their current use of the resources.

Climate change may undermine the robustness of MPAs in terms of sustaining populations and protecting habitat and biodiversity. As the distribution of organisms responds to climate change, MPAs that were once positioned strategically based on historical distributions of organisms may no longer be in the optimal place. A network of MPAs with the potential to afford protection as the climate changes – and biological distributions respond – may be more effective in this context than depending too heavily on a single MPA. Longer-term changes in conditions, especially if difficult to forecast, also call for adaptive management and flexibility in implementation processes.[47]

How much is enough area for MPAs?

When considering MPAs for fisheries management purposes, there is no 'one size fits all' or percentage-share answer for the appropriate size or scale or number of MPAs. The adequate size or number will depend on the management objectives and approach taken, as well as on the characteristics of the ecosystems or species being managed. The area needed for protecting a specific life stage of a targeted fish species will necessarily be different from that required to address the protection of specific vulnerable habitats, and the size and location of an MPA designed to protect new recruits will differ from one for protecting spawning concentrations.

In general, it may be said that the size of the MPA should be larger when the fish or the habitat to protect are more or less uniformly distributed across an area, when fish are highly mobile, and when no other (or limited other) effective fisheries management measures are applied to the area. Conversely, the protected area can be smaller if the fish are geographically concentrated (assuming the MPA is placed where they are concentrated) and are relatively sedentary, or other effective fisheries management measures are in force. Of course, if the goal of the MPA is to protect biodiversity, other considerations may apply.

The following are the main questions to ask when defining the size necessary for an effective MPA for fisheries management purposes. ANNEX 2

[47] See also Chapter 7, Section 7.8, "What is adaptive management in the context of MPA implementation?" and Chapter 1, Section 1.5, "Why do we need MPA networks?" in Part 1.

offers further information on MPA size considerations from a fish-population sustainability perspective. The first and primary question is:

- *What needs to be protected and what are the main threats?* (e.g. fish may need protection from fishing, or habitats from fishing gear impact or from other human activities).

If the MPA is designed to protect a particular life stage, the following questions should be considered. They are phrased in terms of the life stage of a single species. In the more-typical case of an MPA to protect a multispecies community through multiple life stages, it will be necessary to ask the same questions, but taking into account the life histories and distribution of the full range of species in the community. In that case, it would probably be more practical to select some key, representative species that together can be taken to represent the community as a whole in terms of life history and distribution and to answer the questions for the representative species combined:

- If the aim is to provide direct protection of fish from fishing, *what life stage or stages should be protected?* (e.g. spawning aggregations, juveniles or recruits).
- *What percentage of the total potential production or biomass at each life stage needs to be protected?* (percentage population protection [PPP]). A key reference point needs to be considered, based on the required spawning per recruit (SPR) ratio, in order to achieve the objectives required (e.g. 30–50 percent for MSY or depending on the degree of precaution, multispecies reasons, economic considerations etc.).
- *What other management measures are already in place to protect this life stage?* (e.g. fishing input, output or technical measures, closed seasons, habitat protection, other MPAs).
- Based on recent trends in recruitment, *how much additional PPP is required, above that offered by existing management measures, to achieve the percentage of protection required for this life stage?* If data, information and analytical expertise are available, this question could be answered through a variety of stock-assessment methods. In the absence of these requirements, an approximate answer may still be possible. If recruitment has been very low in recent years because of fishing or other human activities that can be spatially regulated, it is likely that current PPP is far short of the required percentage and that close to the full target percentage needs additional protection. If recruitment has been lower than usual, but years of average

recruitment are still being observed, an additional 10–20 percent of PPP may be required (i.e. boosting from the likely 20–25 percent [based on recent recruitments] to the required 35–40 percent PPP).

- *Is an MPA the most efficient way to achieve this additional protection?* This is a complex question that requires consideration of a number of aspects discussed in Chapters 3 and 4 in Part 1.
- Having decided that an MPA is the required tool and having estimated the additional PPP required from the MPA, *how much of the total area of occurrence of the species or community needs to be protected by an MPA or network of MPAs?* This requires knowledge of the spatial distribution and mobility patterns of the species or community and should also take into account effort redistribution.[48]

Finally, distribution of the species or species groups in question must be examined:

- *Is the life stage (or community) distributed evenly across the area?* If distribution is even, the percentage area to be protected is equal to PPP required. If the species or community is concentrated in some areas, as is typical of most marine species, which site or sites can be considered for MPAs, and how big would the MPAs at those sites need to be to include the required PPP?
- *Will it be most efficient to have a single MPA to provide the required protection or would it be more efficient to have a network of smaller MPAs?* This is a very important question. Considering only the PPP required, unless the community and the species making it up are very evenly distributed across their entire range, it will almost certainly be a more-efficient use of space to have a network of MPAs offering the required protection by focusing on areas of concentration and essential habitat. In the final decision on how to design the network to provide the required protection, consideration also must be given to other factors discussed elsewhere in the Guidelines (e.g. impacts on stakeholders, spillover, effectiveness of governance and management, capacity for enforcement, robustness to change, etc.).

[48] See also Chapter 4, Section 4.5 "How are MPAs likely to affect fishers' behaviour, fishing effort and fishing capacity?"

What are the main governance systems available for MPAs?

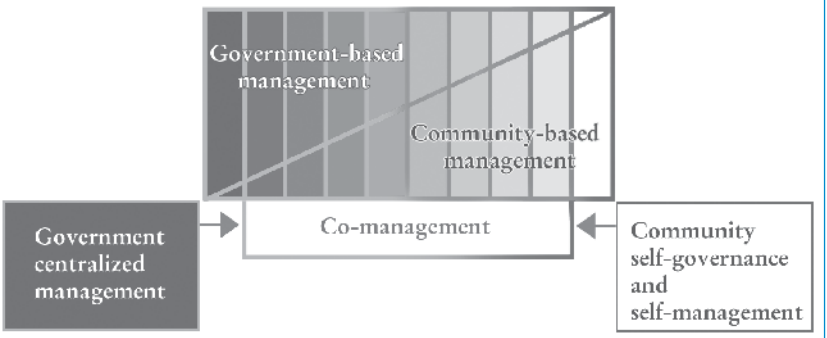
A range of governance systems – or management approaches – is available for MPA implementation, representing varied levels of resource-user and community involvement: centralized, community-based, traditional or co-management. Depending on local circumstances, existing overarching policy and legal frameworks and the objectives of the MPA, one or another of these approaches may be best suited to MPA management. The choice of governance system is fundamental for MPA management and implementation, and the planning process should establish what the appropriate arrangements are.

There has been a growing trend towards increased decentralization of governance in general, as well as in fisheries management. Management responsibilities, or management rights, are increasingly shared among the central and local levels of government, communities and other stakeholders. Co-management systems are gaining in popularity, in particular in the small-scale fisheries sector. These systems represent combinations of government-led or -supported natural resources management approaches – often from the provincial, district or local level – with community-based systems.

Co-management arrangements can take many forms, with varying degrees of responsibility assigned to the participating parties. Classification of co-management systems requires a simplification of complex realities, as there is a continuum of possibilities, covering the sharing of diverse forms of power. Conceptually, one can distinguish cases in which the decision-making authority remains with the government, but resource users are involved in implementing management decisions. Other arrangements include the delegation of decision-making powers to resource users and other stakeholders.

If the delegation of authority to users is complete, it may become a community-based management system with minimal or no involvement by the government (see Figure 7). Commonly, however, governments continue to have a role; at least functions such as research and enforcement, in particular with regard to legal sanctions, will generally remain with government authorities. It is important to ensure that the various government agencies concerned are sufficiently involved in the process – both at central and local levels. At a minimum, the agencies responsible for fisheries management and biodiversity conservation, as well as MCS authorities, should collaborate in the co-management process, with a clear definition of the responsibilities of each party.

FIGURE 7
Continuum of co-management arrangements



Source: Pomeroy and Berkes (1997, 466, Figure 1).

It is worth noting that a co-management system can evolve without a corresponding *de jure* (i.e. legally enshrined user and management rights). However, it is likely to be more effective if the community or co-management group has legally protected, exclusive rights. There is growing agreement among policy-makers, fishery managers and researchers that ensuring that fishers have well-defined and secure rights is at the core of good fisheries governance. When designating MPAs for co-management, user and management rights with regard to the MPA and its fishery resources must be clearly defined.

6.9 WHAT IS AN MPA MANAGEMENT PLAN?

The MPA management plan should document the chosen design features and governance and management options. As mentioned previously,[49] MPAs are most effective when embedded within integrated ocean governance and spatial management frameworks. This means that management plans for MPAs should be part of broader fisheries management and biodiversity conservation plans and clearly in line with relevant policies. Sometimes a separate MPA management plan may not be needed; the plan can be integrated into overall marine or

[49] See Chapter 5, Section 5.4, "What are the key policy framework considerations and how do MPAs relate to broader spatial management strategies?"

ecosystem management plans. However, for MPAs that are relatively large, include zoning, and are near shore and associated with coastal communities (and for which management is thus relatively complex and demanding), special management arrangements and plans tend to be needed.

When the main features of the management plan have been drafted, it may be worthwhile to take stock of what has been accomplished so far, assess the coherence of the plan and identify possible implementation challenges. MPA management plans should also describe the relevant implementation and administrative arrangements and responsibilities. The next chapter will discuss key elements of an MPA management plan and its administrative arrangements, as well as other implementation aspects.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 6

Planning of MPAs and MPA networks should be done through integrated and participatory decision-making processes, based on good governance principles. Clear, specific goals and operational objectives should be defined within the framework of the overall policy framework and overarching goals.

- The MPA planning process is similar to an EAF process. It is flexible and depends on the case-specific circumstances, but generally covers the following steps:
- *Identification of stakeholders and scoping:* Participation of stakeholders is key to successful MPA planning and implementation. They should be identified and involved from the beginning of the process.
- *Situation assessment and identification of issues:* The issues to be addressed by MPA management must be identified and prioritized based on bioecological, social and economic information and through negotiation with stakeholder groups.
- *Development of a vision and overall goals and objectives:* Developing an MPA vision is a useful way to reconcile divergent views and create a common understanding of priorities to help define goals and objectives.
- *Definition of operational objectives:* Based on the goals, specific operational objectives having direct and practical meaning should be formulated to support MPA implementation and performance evaluation.
- *Design of MPA:* Key design features to consider in the MPA planning process include:
  - selection of MPA sites and a decision on how much area needs to be protected;
  - definition of the type of governance system that will apply to the MPA (centralized, community-based, traditional or co-management);
- *Preparation of management plan:* The MPA management plan documents the chosen design features and governance and management options. It also describes the relevant implementation and administrative arrangements and responsibilities.

7. MPA IMPLEMENTATION

The MPA or MPA network planning process, discussed in the previous chapter, establishes the framework for MPA implementation. This framework is documented in the management plan, and complemented by the details of implementation, administrative arrangements and responsibilities. An implementation start-up period will probably be needed, as well as continuous monitoring and the flexibility to adjust plans and decisions if outcomes are not satisfactory.

Closely linked to the MPA planning process presented in Chapter 6, this chapter discusses implementation and administrative arrangements and the operationalization of MPA management plans. The information needed for MPA planning and implementation is discussed in the next chapter.

The Code of Conduct for Responsible Fisheries urges states to ensure that effective legal and administrative systems are in place for fishery resource conservation and management. Decision-making processes should be transparent and resource users involved in implementation processes. Procedures and mechanisms for conflict resolution should be established.

7.1 WHAT ADMINISTRATIVE ARRANGEMENTS ARE NEEDED FOR MPA IMPLEMENTATION?

Implementation and administrative arrangements should be included in the overall management plan. Provisions are needed for staff and general administration, including facilities and equipment, budget and finance. Moreover, the following implementation and administrative functions should be covered (see also subsequent sections):

- defining, interpreting and implementing rules and regulations that apply to the MPA;
- ensuring compliance and enforcement;
- implementing activities that support MPA management, such as capacity-building and incentives;
- providing and communicating information on the MPA;
- addressing and mitigating conflicts, as required;

- promoting management effectiveness and carrying out monitoring and performance evaluation;
- ensuring that experiences and lessons learned inform decisions and practices through adaptive management mechanisms;
- resourcing MPA implementation and ensuring sustainability.

Implementation and administrative arrangements may be finalized in the first year of operation (if funds are available), or set up incrementally over a fixed period of years. The first year of operation may involve only the managers or several staff performing a range of functions, including collection of information to supplement the initial MPA profile,[50] community organization and education, general office management and setting up administrative routines. When implementing an MPA under community-based or co-management arrangements in a coastal area with communities that may lack experience with this type of engagement, particular attention should be paid to capacity and organizational development, so that stakeholders can participate effectively in MPA management and administration as required.[51]

Analogous to the need to integrate MPAs within broader policy and management frameworks, MPA administration should also be coordinated within relevant overarching fisheries management and biodiversity conservation or other spatial management implementation systems. In some cases, when MPAs are used as a specific management tool within a broader system, they will not require their own administrative support. Monitoring, enforcement and communication functions can be performed as part of the overall implementation of, for example, an EAF management plan.[52]

An advisory or management committee should be established to provide advice on management. The advisory committee can serve a number of functions including advising on the development of rules and regulations, approving work plans and budgets, and evaluating progress. The advisory committee can be composed of people from the local community, local leaders, government agencies and elected officials. Advisory committees may be more active in management decision-making in MPAs with co-management or community-based management.

[50] See Chapter 8, Section 8.1, "What is the basic information needed for MPA planning and implementation and how it is it generally collected?"

[51] See also Section 7.4, "What do capacity-building and incentives mean in the context of MPA implementation?"

[52] Or there may be no need for a specific MPA management plan; see also Chapter 6, Section 6.9, "What is an MPA management plan?"

The number of staff members depends on the circumstances of the particular MPA. Staff should be well trained. Managing MPAs effectively calls for an understanding of the resource being protected, the people in the area, an ability to work and communicate with local people and visitors, and competence in specialized areas. Staff also need a minimum of equipment to perform their tasks, such as boats, binoculars, radio communications, computers, etc.

7.2 WHAT ARE THE KEY CONSIDERATIONS WHEN DRAFTING RULES AND REGULATIONS FOR MPAs?

Within the overall legislative framework discussed in Chapter 5, the rules and regulations applying to an MPA should accurately reflect decisions made when deciding on management options and establishing the management plan. The rules and regulations should:

- accurately interpret management decisions and relate to the management context;
- be legally defensible within the jurisdiction in which they apply;
- be enforceable, so that violators can be apprehended and prosecuted;
- specify a penalty schedule that is fair in terms of the severity of violations, yet adequate to serve as a deterrent;
- be subject to public comment prior to being finalized.

Ideally, decisions should be well documented and rules and regulations unambiguous. Interpreting MPA decisions and drafting rules and regulations usually require the services of legal professionals, but stakeholders should be consulted throughout the drafting process. One option is to establish rules and regulations through a management board or with advice from an advisory committee with representation drawn from all stakeholder groups.

7.3 WHAT ABOUT COMPLIANCE WITH AND ENFORCEMENT OF MPA MANAGEMENT RULES AND REGULATIONS?

The FAO Technical Guidelines on Fisheries Management series explains the need for effective MCS systems to allow for full and expedient implementation of fisheries conservation and management plans.[53] For MPAs, the situation is the same: rules and regulations must be followed and their compliance enforced to protect the designated area according to the established management plan. Compliance with this plan, and its agreements and decisions, is essential to

[53] See Cochrane and Garcia, 2009, Ch. 14.

the effectiveness of the whole management programme and to achieving the agreed objectives.

MCS can take many forms and will vary according to local contexts and situations. There needs to be an enforcement mechanism that specifies who is responsible, the means of enforcement, and the penalties for non-compliance. While national and local governments have responsibility for law enforcement, under community-based and co-management agreements, fishers and other stakeholders sometimes play an extended role in the enforcement of rules and regulations. Resource users may also decide to self-enforce MPA rules and regulations when they believe that they benefit from compliance. Ideally, self-enforcement should be formally empowered by agreement with the responsible government agencies, so that it is legitimate, rather than a form of vigilantism.

MCS systems are in place in most countries and should be used for MPAs, although complementary systems may be required. Application of technology can play a critical role in enforcement of fisheries and spatial management rules and regulations. For example, vessel monitoring systems (VMS) can be used to monitor the position of fishing vessels. VMS units are placed on fishing vessels, and the unit interfaces with a GPS system equipped with a transmitter, which reports vessel positions via satellite to officials charged with fishing vessel operations. The unit can be configured so that it cannot be tampered with by the vessel's crew and so it reports automatically on schedule. VMS officials can remotely check or query the systems for positions at any time. The units are also capable of reporting additional data, such as amount of catch, although such information needs to be entered into the system by vessel crew. It is increasingly common for fisheries management rules and regulations to require VMS, although it is usually applied only to large-scale fisheries.

When and where applicable, VMS can be a powerful tool to enforce MPAs, as it is difficult for vessels to enter an MPA without being detected. However, the system requires a certain level of capacity to function effectively for enforcement. For example, data transmitted must be analysed and acted on, and it may not be suitable for small-scale fisheries in developing countries, where there are large numbers of fishers widely dispersed in sometimes remote places, and fisheries management authorities have limited capacity. Moreover, in many developing countries, small-scale fishers are often among the poorer groups of society, and MPA management enforcement needs to be seen in this context. Still, VMS use for small-scale fisheries is increasing, sometimes with the notion of safety-at-sea.

Enforcement is more than the presence of police – or other authorized people – arresting or fining violators. It involves the application of a broad range of approaches by various institutions and stakeholders to change or modify behaviour. When widespread compliance is achieved, resource users and stakeholders have reached an adequate level of knowledge and a positive attitude on the issues, and usually behave within the bounds of socially accepted practices and legal requirements.

7.4 WHAT DO CAPACITY-BUILDING AND INCENTIVES MEAN IN THE CONTEXT OF MPA IMPLEMENTATION?

To support MPA management – and compliance with the established rules and regulations – there are a number of key mechanisms that should be considered as part of implementation. These include capacity-building and incentives.

Capacity-building may be a prerequisite for effective stakeholder participation. Stakeholders' interactions are improved when each can appreciate the other's use of the MPA – and understand the ecosystem, the fisheries, the social and economic dynamics, etc. With a higher number and broadening range of stakeholders, the potential differences in ability to participate in management also increase. Capacity-building should be facilitated to empower all stakeholders to effectively play their role in the management of the MPA. The implementation of MPAs with multiple objectives may involve changes in the responsibilities and priorities of fisheries departments, ministries of environment and other agencies, and may require appropriate training of staff affected by these changes. This could include enhancing knowledge and understanding of fisheries measures and objectives for biodiversity conservation managers, or of biodiversity conservation considerations for fisheries officials.

Technical training in monitoring, evaluation and adaptive management is particularly helpful to local resource users and managers in developing countries and should be done on a regular basis. Training programmes and long-term funding support must be generated so that interdisciplinary capacity can continue to be built.

Another critical factor for successful stakeholder participation in MPA implementation is organizational development. Early core-group formation can facilitate planning and implementing support to and capacity-building for diverse stakeholder groups. It also helps participation through representation: various interest groups may take part in meetings and committees through their representatives.

In the context of EAF, the use of positive incentives is generally promoted and this is an important implementation mechanism for MPAs as well. A major focus of conventional fisheries management in the past has been to establish sets of rules and regulations, with negative incentives (penalties) for failing to comply. Positive incentives, on the other hand, are designed to induce desired behaviour, potentially decreasing the reliance on finding and punishing rule-breakers. Positive incentives are part of compliance and can be of an institutional, legal, economic or social character. The type of instrument that should be used in each case will depend on the local situation and the objectives that have been set.[54]

Considering that there are potentially significant distributional implications from the benefits and costs of an MPA,[55] there may be stakeholders for whom the value of the MPA may be or appear negative, at least in the short term. Such participants cannot be expected to participate and comply with MPA management decisions without there being some considerations that these individuals can factor into their decision-making to induce support for the MPA. Incentives and support, for example in the form of development and poverty-reduction programmes, are generally required. Particularly when implementing MPAs in a poverty context, combining management with supplementary or alternative livelihood opportunities that provide benefits in the short run is essential in addressing any economic disruptions to the individual, household or community (Box 25). Thus suitable incentives can be vital to participation and to the long-term sustainability of the MPA.

Creation of successful alternative livelihood programmes is challenging and may create controversies if perceived as inequitable, for example if benefiting only some families. Identification of successful alternative livelihoods will require economic and social feasibility studies, participation by the affected individuals or communities, and analysis of the biological and ecological consequences. MPA programmes and community members should focus on products that make use of the skills and social norms of fishing community

[54] Incentives are discussed in more detail in FAO, 2008b and 2009a (see also Box 1).

[55] See Chapter 4, Section 4.2, "What are the key socio-economic challenges when establishing MPAs close to fishery-dependent coastal communities?"

BOX 25
Alternative livelihoods in Samoa

In Samoa, the government Fisheries Extension Programme has assisted communities in developing recognized village fisheries management plans for various locally managed marine areas (see also Box 33). As most subsistence fishers require seafood for their families on a daily basis (more than 40 percent of all Samoan households fish), and up to 22 percent of households receive income from fishing, it is unreasonable to expect fishing communities to adopt conservation measures that will reduce catches, even if only at the start, without offering alternatives and incentives. Accordingly, the Samoan extension programme includes the promotion and development of sources of seafood alternative to those from the present heavy and destructive exploitation of nearshore reefs and lagoons. These alternatives include the promotion of village-level aquaculture and the restocking of depleted species of molluscs in village areas; and new types of fish and shellfish options, through tilapia farming and hatchery-reared giant clams.

Source: Friedman and Kinch, (forthcoming).

members. Under the Coral Reefs and Livelihoods Initiative (CORALI),[56] further development and piloting has taken place of an approach to sustainable livelihoods enhancement and diversification (SLED). Lessons learned from CORALI regarding the steps of the SLED approach are summarized in Box 26.

7.5 WHY ARE INFORMATION AND COMMUNICATION IMPORTANT IN MPA IMPLEMENTATION?

Closely related to capacity-building is the need to ensure that relevant information is communicated to those concerned in a timely, accessible and comprehensible way. 'Relevant information' is information that stakeholders

[56] CORALI is a collaborative programme under two projects: Management of Climate Change Impacts on Coral Reefs and Coastal Ecosystems in Tsunami-affected Areas of the Andaman Sea and South Asia (IUCN/Foreign Affairs of Finland/International Coral Reef Action Network [ICRAN]/IMM Ltd), and Institutional Strengthening and Capacity Development for the Long-term Management and Conservation of MCPAs Encompassing Coral Reefs in South Asia (UNEP/EU/South Asia Cooperative Environment Programme [SACEP]/ICRAN/ IMM Ltd).

BOX 26
Sustainable livelihoods enhancement and diversification

An important activity of the Coral Reefs and Livelihoods Initiative (CORALI) has been development and testing of a systematic approach to SLED. A review of past global experience identified a number of lessons. These have been sorted according to the three main steps in the SLED process – discovery, direction and doing:

Discovery phase (understanding the complexity of livelihoods and their relationship with natural resources, the wider economy and society, and developing a vision)

- understanding how people's livelihoods have evolved;
- recognizing and responding to the complexity of people's lives;
- recognizing the different needs of diverse stakeholder groups;
- recognizing the importance of context;
- recognizing the interdependence of livelihood components;
- recognizing that people can be powerful change agents themselves; and
- engaging in meaningful participation.

Direction phase (understanding and analysing the opportunities for achieving the visions developed during the discovery phase)

- developing a shared understanding of the need for change;
- understanding what helps people decide to change;
- understanding what is important to people about their livelihoods;
- sharing a vision of the future; and
- understanding the options for change.

Doing (developing people's capabilities and adaptive capacity, together with networks to support the plans for sustainable livelihood development)

- understanding local power relationships;
- building shared leadership and partnership;
- understanding and matching needs to the market;
- developing a plan for the future, turning visions into reality;
- enhancing existing livelihoods where possible;
- building on existing diversity;
- building on people's strengths;
- building innovative capacity and continuing livelihood development;
- catering for a diversity of skill levels;
- adopting multi-pronged and multi-agency approaches;

(Box 26 cont.)

- sequencing support for interventions;
- raising awareness in government and NGOs, and facilitating support;
- building the capacity of service providers and creating an enabling environment;
- working through local institutions;
- clustering support;
- building entrepreneurial capacity early; and
- targeting service provision.

Sources: IMM Ltd, 2008a, 2008b.

need in order to understand and participate in decisions regarding MPA management and implementation.[57] A good communication strategy – outlining means and processes for information-sharing with stakeholders, politicians and other groups at various stages of MPA planning and implementation – is essential for successful MPA management. Communication on MPAs is important for several reasons and at several levels:

- informing resource users and others that might enter MPAs (such as vessel traffic that transits MPAs) about rules and regulations that specify prohibited activities, including processes to obtain permits and user fees;
- explaining to stakeholders the importance and rationale for MPAs as spatial management tools, and for what purposes (biodiversity conservation, fisheries management or other);
- engaging stakeholders in the management of the MPA, as appropriate and required;
- enhancing literacy on ocean issues, including fisheries, using MPAs to illustrate important messages; and
- raising public awareness and promoting political support for MPA implementation, both at central and local levels.

Communication should promote internal discussion within stakeholder groups and organizations. Discussion allows different viewpoints to be aired and discussed, trust and credibility to be created, and group cohesion to be strengthened. This can be accomplished by building on a common focus or

[57] Information for MPA planning and implementation is discussed further in Chapter 8.

issue and holding meetings that foster contact and trust and allow bridges to be built among stakeholders. Moreover, political commitment is required to support MPA planning and continued implementation over time. The MPA communication strategy needs to take this into consideration.

7.6 WHAT RESOLUTION MECHANISMS ARE AVAILABLE IN THE CASE OF CONFLICT IN IMPLEMENTING MPAs?

Controversy and conflict are associated with almost all MPAs because, as mentioned previously, they commonly reallocate resources (access and wealth) within and among groups.[58] Conflicts can occur 'inside' the MPA, that is, between resource users directly involved in the MPA and its management, or 'outside' the MPA, between direct and indirect stakeholders. Attitudes of all stakeholders towards the MPA must be understood and monitored, as they will shift over time. An understanding of the basis for diverging views and conflicts is needed, whether due to data and facts, needs and interests, values, or relationships. The willingness to compromise – and attitudes towards various approaches for conflict management – should be assessed, so that serious conflicts can be responded to early in the MPA planning and design process. Conflicts may provide an opportunity to refine and improve MPA design, as long as they are acknowledged and responded to appropriately.

In spite of the best intentions, initially benign disagreements between stakeholders may escalate into conflicts that hamper MPA implementation. Conflict-resolution mechanisms can use formal and informal processes for resolving disputes. The means for appropriate conflict resolution are context-specific and must be culturally relevant. Dispute settlement procedures should be agreed in advance and could form part of the documentation and formal agreements governing MPA administration and be included in implementation and administrative plans.

Conflict-resolution mechanisms permit information exchange, clarification of resource use rights, and adjudication of disputes related to decision-making, resource use, monitoring and enforcement. Critical questions in the design of these mechanisms include "Who may participate?" and "Who adjudicates?" Other important design issues include the frequency and location of conflict-resolution activities. Readily accessible and low-cost mechanisms enhance regime performance directly by mitigating social conflict and thereby minimizing resource overexploitation and dissipation of MPA benefits.

[58] See Chapter 4 in Part 1.

Conflicts among MPA stakeholders contribute to the high rate of MPA failure.[59] Focusing primarily on biological evaluation criteria may result in an MPA being classified as a success, when, in fact, the reality is much more complex. Any particular MPA may initially be both a biological 'success' – resulting in increased fish abundance and diversity and improved habitat – and a social 'failure' – lacking broad participation in management and producing an inequitable distribution of economic benefits and social conflicts. Short-term biological gains will likely disappear unless these social issues and conflicts are addressed.

Box 27 gives an example of successful conflict resolution in Saint Lucia. ANNEX 4 includes more information on voluntary conflict resolution through conflict management.[60]

7.7 HOW ARE MPAs MONITORED AND WHAT IS MANAGEMENT EFFECTIVENESS?

Monitoring and evaluation systems are needed to ensure that MPA goals and objectives are achieved. Accordingly, MPA monitoring systems track changes in the state of MPA-associated bioecological and socio-economic variables. Monitoring is also needed to assess management's efficiency in achieving the intended results, using process-based indicators that focus on administrative structures and the procedures used. This should allow managers and decision-makers to evaluate to what degree the MPA is meeting its objectives (management effectiveness) and how good the applied procedures are in achieving the planned outcomes (management efficiency).

'Management effectiveness' is thus the degree to which management actions are achieving the defined goals and objectives. By assessing management effectiveness, managers can learn if changes are needed to improve future outcomes. Such changes would be based on diagnosis of specific issues, learning and adaptation.[61] To assess management effectiveness, continuous monitoring, feedback and evaluation of information relative to the objectives are required.

Monitoring systems vary in what they measure and who does the measuring, as well as where, when and how measurements are made. Participatory MPA

[59] See White, Salamanca and Courtney, 2002; Pollnac, Crawford and Gorospe, 2001; Christie *et al.*, 2003; and Christie *et al.*, 2009.

[60] For more information, see Christie, 2004.

[61] See the following section "What is adaptive management in the context of MPA implementation?"

BOX 27
Conflict in the Soufriere Marine Management Area, Saint Lucia, the Caribbean

In the town of Soufriere in Saint Lucia, resource-use conflicts among fishers, tourist divers, yachters, hoteliers and other local people were common. The conflicts involved tourist divers cutting pot lines to protect coral reef fish, and yachtsmen anchoring near traditional fishing grounds and access to beaches. The major conflicts were solved through a public consultation process, which in 1994 led to the establishment of the Soufriere Marine Management Area, a zoned MPA. The Soufriere Regional Development Foundation, the Fisheries Department and the Caribbean Natural Resources Institute worked together with the goal of getting an agreement that would let the coastal activities coexist in harmony. Interest groups were conducted by professionals through a negotiation, conflict-resolution and participatory planning exercise, so that everyone could feel empowered and negotiate on an equal footing. The process involved broad-based consultations, together with meetings with a more targeted focus. The interest groups were represented by teams of three to six people. The benefits to the major user groups included improved definition of use rights through zoning, developments in the protection of the coral reef habitat, and an increase in reef fish populations.

Source: Brown, 1997.

monitoring, which involves resource users and other non-scientists in data collection and analysis, provides a mechanism for increasing awareness, improving resource management and empowering communities. It can also promote transparency of MPA management and implementation processes.

Carefully designed monitoring systems generally include robust performance indicators and baseline data, and sometimes control sites. Well-defined indicators and baseline data are fundamental in tracking MPA performance and they permit management adjustments as required. Indicators that can be used in monitoring the *biological and ecological effects* of MPAs include measures of relative change in fish density, catch rates, fish community composition and other similar quantities. These indicators can be used as the basis for providing advice on possible other fisheries management measures.

Measures of relative change in income, wealth or wealth disparity among specific groups or subgroups (e.g. fishers and divers, line fishers and net fishers) can be useful indicators of the distributive *socio-economic and distributional effects* of an MPA establishment. The effect of MPAs on economic equity may also be measured using indicators that track the net economic effect on populations of particular concern, such as women, minorities, poor people, the elderly or traditional cultures. The geographical distribution (e.g. local versus national) of costs and benefits can also offer information on economic equity. In addition to providing a basis for mitigating disparities in benefits that may be considered unfair, such information can also facilitate early identification of potential conflicts.

The monitoring system needs to measure the effects of creating an MPA, both within and outside its boundaries. This is particularly important from a fisheries perspective, as the establishment of an MPA could shift fishing pressure from one species group to another, thereby increasing the mortality of that second species group and competition for its capture. Fishing effort could also be shifted from the area of the MPA to areas outside the MPA,[62] with both bioecological and socio-economic consequences.

Thus the MPA monitoring system should include indicators that permit following such potential developments closely, and with provisions for introducing changes in management or mitigating actions as required. Recent work (Babcock and McCall, in review; McGilliard *et al.*, 2010; see Box 28) has explored the potential of using the annual density ratio of fish outside a no-take marine reserve to those inside the reserve in a control rule (or pre-agreed way to determine the appropriate regulations) to determine the direction and magnitude of change in allowable fishing effort or catches in the following year, with relatively promising results. This kind of methodology, based on using simple indicators to direct fisheries management measures, may well find much greater application in the near future, in particular when data are limited.

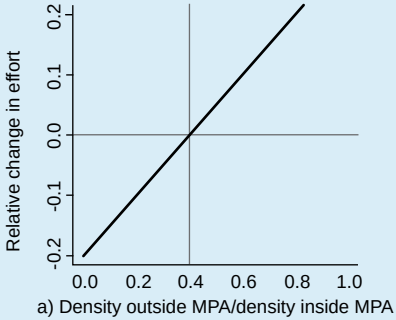
Pomeroy, Parks and Watson (2004) provide excellent practical guidance on MPA monitoring and evaluation. FAO (2003a) discusses the need for solid monitoring systems, including regular reviews and measures that provide information on the performance of the various components of an EAF policy and management system. It provides information on defining

[62] See also Chapter 4, Section 4.5, "How are MPAs likely to affect fishers' behaviour, fishing effort and fishing capacity?" in Part 1.

BOX 28

Fishery management control rules based on the ratios of fish density inside versus outside no-take marine reserves

McGilliard *et al*. (2010) used management strategy evaluation (testing management strategies in a simulated fishery) to evaluate the performance of the density ratio control rule (Figure 1a). Their study found the parameters of the control rule that maximized cumulative catch (over 100 years) for each



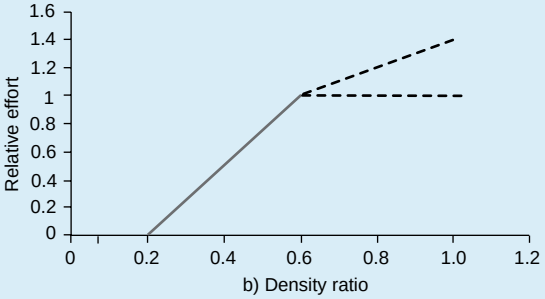


Figure 1. Examples of density ratio control rules: (a) The ratio of the density outside to inside the marine protected area (the "density ratio"; x-axis) determines the direction and relative amount of change in fishing effort in the following year. The x-intercept and slope of the rule can be modified to optimize long-term catches for a particular biological scenario. The vertical grey line shows the x-intercept of the density ratio control rule. (b) The density ratio is defined the same way, but the control rule specifies effort relative to effort in the previous year. If the density ratio is above the target (60 percent) effort is allowed to increase.

(Box 28 cont.)

scenario. They found that it is possible to design a density ratio control rule that performs well for a variety of assumptions about biology and initial stock status. Species with especially long or unusual movement patterns were an exception and would need to be managed under a different parameterization of the density ratio control rule. Babcock and McCall (in press) conducted a management strategy evaluation based on the biology and fisheries for five species in the California nearshore fishery, applying the density ratio control rule from the year that the marine reserves were established (Figure 1b). In the long term, the control rules performed well by increasing total biomass and maintaining yield for all species and several scenarios about fleet distribution and fish biology, except in some scenarios with high levels of movement of adult fish.

Advantages of using density ratio control rules are that no historical catches or stock assessments are required, the control rules are driven by monitoring data, and they allow the management system to respond appropriately to environmental fluctuation. In addition, density ratio control rules can be applied at a more local spatial scale than is common for stock assessment-based control rules. However, density ratio control rules are only effective for species that tend to accumulate density in marine reserves, and the method would be most effective for protected areas that have been established long enough for fish density to build up.

Source: Babcock and McCall (in review) and McGillard *et al.*, 2010.

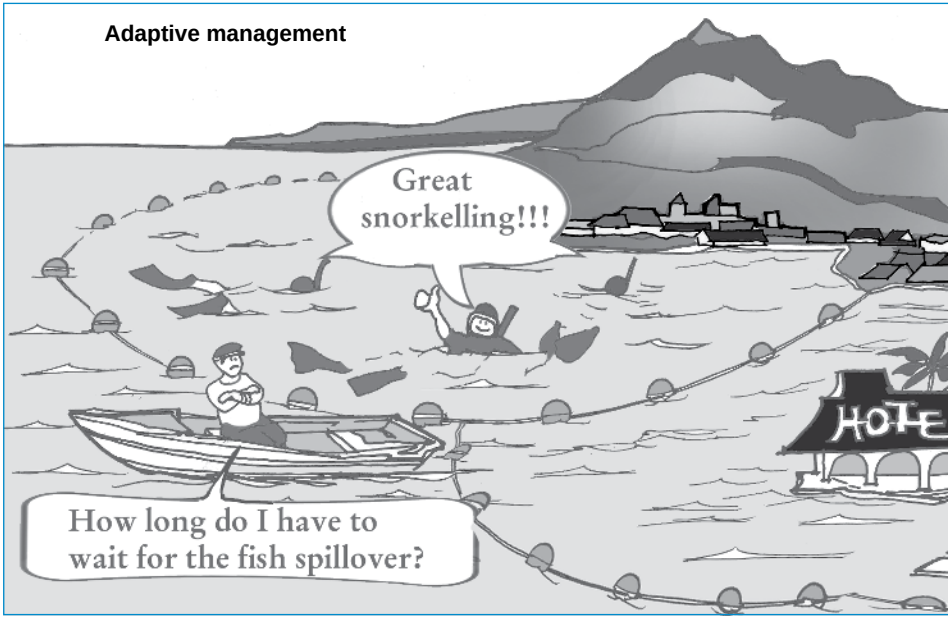
indicators within the framework of a sustainable development reference system.[63]

7.8 WHAT IS ADAPTIVE MANAGEMENT IN THE CONTEXT OF MPA IMPLEMENTATION?

Adaptive management is a fundamental concept underlying the evaluation of management effectiveness; it can also be applied to other types of systems.

[63] See also FAO, 1999.

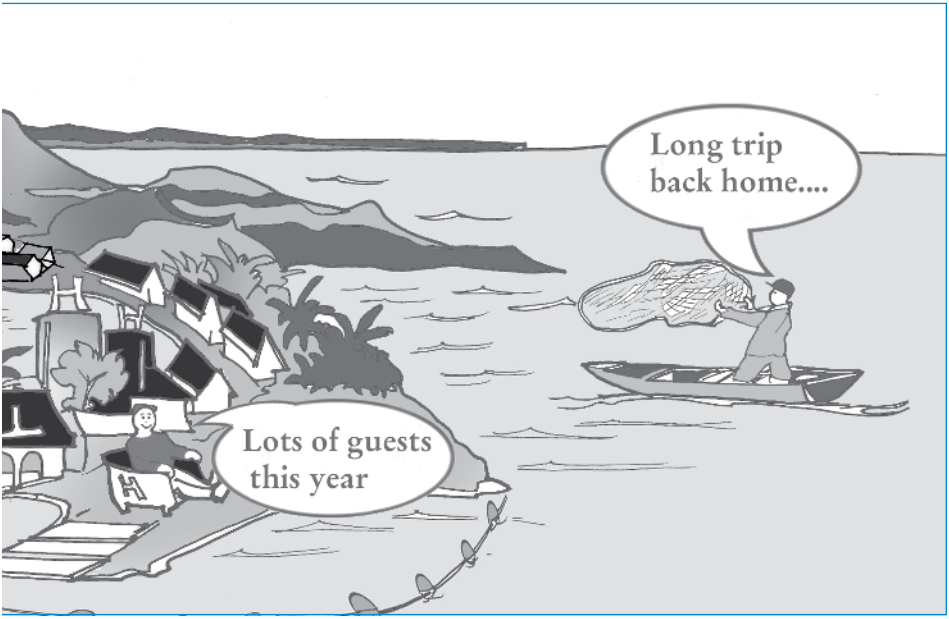
Adaptive management



Management efficiency (referring to administrative structures and procedures)[64] can be improved through the application of adaptive management approaches. This type of management is a cyclical process of systematically testing assumptions, generating learning by evaluating the results of such testing, and further revising and improving management practices. In an MPA, the results of adaptive management accelerate progress towards achievement of the goals and objectives.

Marine and coastal systems and the communities that rely on them are ever-changing. MPAs will be maximally effective when the management that takes place within them is responsive to changing conditions. Such changes are not only environmental, but also include those related to the human dimension (social, political, economic and governance). In addition, the scope of changes relevant to the effective implementation of MPAs includes those occurring at the MPA site, as well as to the context in which the MPAs exist. Adaptive

[64] See also the previous section in this document on "How are MPAs monitored and what is management effectiveness?"



management is participatory, involving fishers and other stakeholders as partners with managers in the process, and relies on traditional and local knowledge along with scientific data. It is particularly important in times of change, be it climatic change or resource depletion, and allows for a flexible yet structured management approach.

Adaptive management is necessary to the full spectrum – from top-down government processes (such as legislatively mandated periodic review of MPA boundaries, zones and management regimes), to more bottom up and informal amendments made by primary stakeholders and stewards. It is especially important in information-limited situations, where the need for management action may be great, but the cost of formal scientific information is often prohibitive. All good fishers learn from their successes and failures. For example, a fisher will try a new fishing method, monitor the results, and see how the results compare to what was predicted to happen. Based on the new information, the fisher may accept the fishing method, may adapt the fishing method to improve on it, or may reject it. This learning and adaptation is the basis of adaptive management, which goes one step further: it relies on

systematic feedback learning and the progressive accumulation of knowledge for improved management. FAO (2003a) also discusses the need for adaptive management.

7.9 HOW CAN LONG-TERM POLITICAL COMMITMENT AND SUSTAINABLE RESOURCING FOR MPAs BE ADDRESSED?

Sustainable MPAs require long-term political commitment from the relevant authorities and financial support. Such support is often linked to the degree of awareness among politicians and decision-makers, both at central and local levels, as well as in the communities concerned and in civil society. And it is needed over the long term, independently of electoral cycles or difficult circumstances.

Political commitment is often a precondition for financial support. Although MPAs should be implemented as part of a broader management system and thus possibly share some overhead costs with it, they will require financial resources for specific operations and facilities related to planning, implementation, coordination, monitoring, enforcement, etc.

Funding for fisheries management historically came primarily from governments. However, other sources may also be available. In some cases, the fishing industry pays some management costs, either directly (e.g. industry-funded research or enforcement projects) or through 'user fees' collected by government. In addition, particularly in developing countries, the costs of fisheries management and MPAs are often paid by donors – interested in promoting stewardship, wise use of marine ecosystems and sustainable livelihoods for people dependent on the industry. The donors may include charitable trusts, development organizations and biodiversity-conservation-oriented NGOs. However, this type of funding is often channelled through projects that are limited in time, and alternative sources may be needed to ensure sustainable long-term funding.

Innovative financing mechanisms are emerging for marine conservation and management generally, and to support MPA planning and operations specifically, especially as government budgets are increasingly stretched thin. Such financing mechanisms include PES initiatives (Box 29). PES systems and the associated market incentives have the potential to achieve significantly better and more cost-effective conservation and management outcomes than currently result from projects that seek to isolate and protect coastal areas from human encroachment. By clarifying the linkages between ecological function,

BOX 29
Payment for environmental services

Payment for environmental services (PES) is an emerging policy approach used predominately in the agriculture sector and in the context of land use. It is a market-based economic instrument that can involve both the private sector and the government. It strives to give environmental services an economic value that reflects the real social, environmental and economic benefits generated in order to encourage an increase in their production, in contrast to a situation in which providers of environmental services tend not to be compensated and users do not pay. One reason for the political interest in PES is that many of the providers of environmental services are poor population groups – farmers – and the approach may offer an avenue for combining ecosystem/biodiversity conservation with poverty reduction.

Source: FAO, 2009a, based on FAO, 2007b.

ecosystem service delivery and market incentives, PES systems can become a standard tool for financing MPA planning, as well as MPA implementation.

Financing mechanisms should be assessed as part of the MPA planning process, with a sustainable financing strategy included in the management plan. Too much dependence on external sources will affect sustainability. Thus MPA management should consider how to go about generating revenues, and several sources may be required.[65]

[65] For more information on sustainable resourcing of MPAs, see Spergel and Moye, 2004.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 7

Successful MPA and MPA network management requires comprehensive implementation structures and administrative arrangements, reflecting objectives and the chosen governance approach and management system.

The MPA management plan should include details of these structures and arrangements, and cover all operational elements for effective and efficient MPA management. Provisions are needed for staff and general administration, and the following implementation and administrative functions should be covered:

- *Rules and regulations:* These are needed to implement MPA objectives and management decisions and should be established within the overall legal framework. The developing and interpreting of rules and regulations generally requires legal professionals and should involve stakeholders as well.
- *Compliance and enforcement:* Compliance with MPA rules and regulations needs to be supported through a robust system for MCS and enforcement. Such a system can include a variety of measures, ranging from self-enforcement to more technical solutions (such as VMS).
- *Other implementation mechanisms:* Capacity-building and incentives such as organizational development, technical training and support to supplementary or alternative livelihood opportunities favour compliance and successful MPA management outcomes. Consultation and participation in planning are essential in obtaining a high level of compliance.
- *Communication:* Resource users and others must be informed about the MPA and its management plan. Such communication is essential in obtaining compliance with MPA rules and regulations.
- *Conflict-resolution mechanisms:* Conflicts between stakeholders may arise, and mechanisms must be in place from the beginning to deal with this eventuality. Appropriate solutions are context-specific and should be culturally relevant.
- *Management effectiveness and monitoring systems:* Monitoring, feedback and evaluation of information relative to the objectives should be in place to support effective MPA management. Appropriate systems are needed that track progress towards the achievement of goals and objectives and allow managers to assess the effectiveness and efficiency of management. Robust performance indicators and baseline data are fundamental in arriving at

insights into the changes in environmental and socio-economic systems resulting from MPAs.

- *Effective adaptive management:* by learning from experience and adapting decisions and practices accordingly, MPA management can be improved. Adaptive management is an essential approach that must be incorporated into MPA implementation.
- *Political commitment and sustainable resourcing:* sustaining of MPAs may require substantial financial support. The three main sources of funding are government funds, user fees (e.g. PES) or other systems of private-sector financing and external funding (e.g. donor funding through international cooperation mechanisms). The MPA must be designed from the start with thoughts on and plans for resourcing.

8. INFORMATION FOR MPAs

In order to plan and implement an MPA or MPA network, relevant information is needed. Considering the holistic and integrated approach that should be taken to MPA planning and implementation – and the cross-sectoral outcomes and desirable multiple objectives characteristic of MPAs – a wide range of data and information sources must be considered. However, information gathering and research should be well defined and specific to objectives, decisions to be made and activities to be carried out; only essential information should be sought. This applies to biological and ecological information and is equally important for social science research and data collection, as this area often includes particularly time-consuming, costly and intrusive processes.
This chapter focuses on fisheries-related information needs, sources and methods in the planning and implementation process, with a view to contributing to reconciled fisheries management and biodiversity conservation outcomes.[66]

The Code of Conduct for Responsible Fisheries states that conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitat, as well as relevant environmental, social and economic factors. The absence of adequate information should not be a reason for failing to protect fishery resources and their environment.

8.1 WHAT IS THE BASIC INFORMATION NEEDED FOR MPA PLANNING AND IMPLEMENTATION AND HOW IT IS IT GENERALLY COLLECTED?

The information needs of an MPA are similar to those of an EAF, but with more emphasis on spatial information. It is understood that some desirable information will be lacking in most situations, and in many a great deal will be missing. This does not preclude using MPAs as a management tool. Good judgement, often informed by experience elsewhere, may still allow MPAs to be a useful option, particularly compared with others for which desirable information may also be lacking. In general, more and better information

[66] For an overview of information and knowledge-sharing and their current and potential role in supporting the implementation of the Code of Conduct for Responsible Fisheries, see FAO, 2009b.

leads to better management. However, good judgement based on whatever information is available will usually be better for fisheries, ecosystems and the marine environment than inaction and a deteriorating situation while more information is being gathered.

As part of the MPA planning process, information needs to be collected on fisheries, the ecosystem and marine environment, resource-use activities and people in order to create an MPA socioecological profile. This profile will serve as the basis for planning and as a baseline for future monitoring and evaluation. The MPA profile should include at least four assessment components:

- *Biological and ecological assessment:* for example, types of habitats and locations, biodiversity and productivity, environmental conditions, sea-bottom quality and morphology, fish-stock assessment data, fish distribution patterns and seasonal changes, timing of spawning, life history stages;
- *Social assessment:* for example, attitudes, perceptions, beliefs and values of various stakeholder groups, resource-use patterns, relationships among user groups, differences of opinion, value of the MPA and related resources, demographic characteristics and socio-economic trends, likely impacts of the MPA on stakeholders, informal/traditional marine governance systems, people's attitudes and willingness to participate in an MPA;
- *Financial and economic assessment:* for example, financial, value chain and cost–benefit analyses, economic impact assessments, distributional impact reviews;
- *Institutional and governance assessment:* for example, identification of organizations/stakeholders and their roles, review of governance structures, including mechanisms for facilitating participation, assessments of relevant policy and cross-sectoral coordination frameworks, legal structures.

The information and analysis of each component should be content-rich and comprehensive. At the same time, the MPA profile needs to include an overall integrated review, combining and comparing information from all components. This holistic review, which should be a synthetic summary and analysis of the profile, will be a key reference document. More information on the assessments needed for each of the components listed is given in the following sections.

In addition to collecting and analysing contextual information, the assessments should include a preliminary identification of existing and potential

problems, needs and opportunities relevant to the MPA and its planning process. An implementation feasibility assessment, including the identification of challenges and opportunities in ensuring management effectiveness and efficiency, should be an integral part of the MPA profile. Special efforts should also be made to identify potential externalities, that is, the effects of MPA designation and management imposed on third parties. Knowing what can be expected, increases the possibility of adequately addressing the issues – and internalizing externalities – and this is likely to contribute to successful MPA outcomes. Adequate stakeholder participation is crucial in these 'issue investigation' processes.[67]

To the extent possible, the data collected and the methods used should be standardized and comparable. It is particularly important to consider standardization early in the process, when data on baseline conditions are collected, to ensure that they can be used for monitoring throughout MPA implementation. In addition to collecting baseline and feasibility information, MPA programmes should initiate collection of management effectiveness data very shortly after MPA initiation to enable adaptive management. Various standard methods and databases exist on MPA management effectiveness.[68]

While some information used in the MPA profile comes from secondary sources, other information will come from scientific studies by experts and from participatory research with resource users and other community members. Scientific information is important for the MPA profile, and the best available scientific information should be used to assist in planning and decision-making. However, the traditional, local and indigenous knowledge (Box 30) of resource users and other community members (including women, youth and elders) also constitutes critical information for planning and implementation.

The two types of information are thus usually complementary, and a significant amount of information can and should come from the community. The type of information collected by scientists often differs from that obtained from resource users, and the tools and methods for collecting the information are also different. A number of tools and methods are available that involve the extensive participation of local community members in gathering and analysing information and in obtaining traditional, local and indigenous knowledge (see

[67] See also Chapter 6, Sections 6.4 and 6.5, "When and how should stakeholders be involved in MPA planning?" and "How are the issues to be addressed by MPAs identified and prioritized?"

[68] The World Bank has developed a scorecard approach for self-assessment of MPA progress (World Bank, 2004).

BOX 30
Traditional ecological knowledge, local knowledge and indigenous knowledge

Traditional ecological knowledge may be defined as "a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes, 1999, p. 8). Traditional ecological knowledge is both cumulative and dynamic, building on experience and adapting to change. It is an attribute of societies with historical continuity in resource use in a particular environment. Practical knowledge that does not have such historical and multigenerational character, but is more recent, is usually referred to as local knowledge. Another concept is indigenous knowledge. This is more broadly defined as the local knowledge held by indigenous peoples or local knowledge unique to a given culture or society.

This collective knowledge, based on centuries of resource use or much more recent interactions with the environment, can promote more-effective MPA design by bringing information not captured by formal science into the decision-making process. In particular, local knowledge may help contextualize general scientific understandings of natural and social phenomena.

Sources: Berkes, 1999; Christie and White, 2007b.

also Box 31). The best approach to combining local and traditional knowledge with scientific knowledge may be through managers and fishers working together to 'co-produce' knowledge.[69]

8.2 WHAT BIOLOGICAL AND ECOLOGICAL INFORMATION AND DATA COLLECTION ARE NEEDED FOR MPA?

Bioecological information is critical in bringing together fisheries management and broader biodiversity conservation with a view to furthering the ultimate aim of enhancing both. At a minimum, baseline information is desirable on the types of habitats (and their locations) in the area, biodiversity and productivity, environmental condition (water quality, intactness of benthos, etc.) and trends in these general parameters. A full range of methods can be used to derive

[69] See Berkes, 2009, pp. 52–74.

this information from the domains of fisheries biology, general ecology, oceanography and marine biology.

It is important for both fisheries management and biodiversity conservation purposes to have a good description of the sea-bottom quality (soft, hard, mixed) and morphology. A strong linkage exists between the types of seabed and the presence of ecosystems or species of fauna and flora (fixed, sedentary or migratory). Specialized fisheries target specific sea-bottom types, and MPA selection should consider important sea-bottom areas or types needing protection.

From a fisheries management perspective, detailed fisheries information is necessary. Stock assessments (which could include multispecies assessments) can be used to determine the fishery resource species in need of greater protection (i.e. through a reduction in fish mortality).To assess whether MPAs are an appropriate tool to protect these species, one needs to know where they are concentrated. This information can be gathered from fishing vessel logbooks, for example, if catch locations are recorded accurately with sufficient spatial resolution. Placing observers on fishing vessels is a way to overcome the shortcomings of fishing vessel logbooks. Scientific surveys can also be conducted to identify areas where fish concentrate. It may be necessary to conduct seasonal surveys to take account of seasonal distribution patterns.

An important source of information on the spatial and temporal distributions of fishery resource species may be traditional, local and indigenous knowledge, available with fishers – and other resource users – who do not use logbooks. Systematic methodologies for making this information useful for planning include rapid or participatory rural appraisal (RRA/PRA) and participatory mapping. The creation of participatory maps of resource use and habitat distribution is helpful. Participatory approaches and methods that have generally been used for collecting social information have also begun to be applied in the biological fields and have proven effective (see Box 31).

In addition to information on the movement of juvenile and adult fish, information on the timing of spawning, duration of planktonic life history stages (i.e. egg and larval) and currents can be used to model the dispersion from spawning grounds to settlement areas of young juveniles. Knowledge of significant habitats in the lifecycles of fish resources is likely to be important. Such information is particularly useful in the design of MPA networks.[70]

If MPAs are to be used to reduce bycatch and protect habitat and biodiversity, areas and seasons where bycatch is high must be known, as well as the location

[70] See also Section 8.6, "What knowledge and information are needed to design an MPA network?"

of biodiversity hotspots and habitats of particular concern. Information on bycatch is usually obtained during fishing operations, either from logbooks, observers or traditional, indigenous or local knowledge.

8.3 WHAT SOCIAL INFORMATION ON COASTAL COMMUNITIES IS REQUIRED FOR MPAs?

All types of biodiversity conservation, fisheries and ecosystem management affect people, and people react differently depending on their background, situation and individuality. MPAs may have objectives that relate to particular segments of society – such as providing livelihoods to disadvantaged groups – or that aim to protect habitats for more-general benefits to society at large. Regardless, policy-makers are usually concerned with who is affected and how, because acceptance of management decisions usually depends on a general sense of fairness and equity. This requires a good understanding of coastal peoples and communities.

Fishers, fishing households and fishing communities worldwide are not homogeneous. It is critical to recognize that each location has its unique social and ecological context, which should influence MPA design, management and outcomes. This often makes it difficult to transfer lessons from one location to another and to understand behaviour and the incentives that drive behaviour. That said, however, social science has identified some generalities about coastal people and communities that may affect MPA planning and implementation, and that are important to consider. Coastal communities in many locations around the world face a growing degree of insecurity as a result of poverty and their high dependence on natural resources. This vulnerability is often compounded by declining resources, high population growth, few alternative livelihoods, limited access to land, economic and political marginalization, unsustainable land-use practices and development, competition and conflict over resources, health burdens and civil strife.

MPA planning and implementation should seek to understand: the diversity of coastal people and communities, especially in relation to their livelihood strategies; the means by which households adapt to reduce their risks; the incentives that drive the decisions of resource users; and the sources of vulnerability to stresses and shocks. Key social science information for MPA planning and implementation (Christie *et al.,* 2003) includes:

- attitudes, perceptions, beliefs and values of diverse stakeholder groups in relation to the MPA and resource use, as well as their willingness to participate in an MPA;

- use patterns, uses of the marine environment, users of the environment, and relationships among user groups;
- differences in opinion between users and government, or between diverse stakeholder groups;
- value of the MPA and the related resources (for livelihoods, food security, income, traditions);
- demographic characteristics and socio-economic trends;
- likely impacts of the MPA on the stakeholders and communities concerned;
- informal/traditional marine governance systems being used or used in the past.

Social scientists use existing sources of demographic data (such as the results of government censuses), as well as conducting their own surveys to collect community profile data. The community profile is an important component of the MPA profile (see Section 8.1) and usually characterizes cultural (race, religion, ethnic background, etc.), educational, gender, age and other aspects of fishers, fishery workers and their communities. Information on fishers that actually fish in candidate areas for protection, compared with fishers that do not, is particularly of interest. Broader information profiling entire communities affected by fisheries management, their dependence on fisheries, and alternative livelihoods available to them is also essential. In some cases, such information is used to prepare a social impact assessment for fisheries management alternatives.[71] Box 31 gives an overview of methods for collecting social information and inputs into community profiles. Many of these tools are also useful for gathering bioecological, economic and institutional information, discussed in various subsections of this chapter.

8.4 WHAT ARE THE KEY MPA FINANCIAL AND ECONOMIC INFORMATION NEEDS?

Fisheries management measures usually change the costs of and income from fishing. Financial analyses of fishing operations and an understanding of how the MPA may change costs and income, as well as the consequences of these changes, should be part of the information fed into the planning and design process. For example, if MPAs divert fishing from areas where fish

[71] The United States National Marine Fisheries Service has issued Guidance for Social Impact Assessment, revised 19 March 2001 (also available at www.st.nmfs.gov/st1/econ/cia/sia_appendix2g.pdf).

BOX 31
Participatory information collection methods and human dimension tools

A number of tools and methods can be used to gather and analyse information relevant to the human dimension. Many of these methods are participatory and particularly suited to obtaining traditional, local and indigenous knowledge:

- *Rapid/participatory rural appraisals (RRA/PRA)* involve learning directly from individuals or groups of people. RRA or PRA entails tapping local knowledge and gaining information and insight from local people using a range of interactive tools and methods. These tools and methods are broad, varied and may include secondary data review, workshops, interviews, participatory mapping techniques, diagrams and graphics.
- *Asset mapping* is an important information acquisition and dissemination process that provides a shared community view of the important assets of the entire community. The mapping highlights the interconnections among assets and how to access them. This information would guide planning and decision-making on the location and boundaries of MPAs, as well as on issues of access, and could be used to devise strategies for building assets to sustain and enhance community development.
- *Social mapping* is a visualization technique that allows stakeholders to draw maps illustrating their human relationships and their interrelationships with the natural resources and other features of a particular location. The social map reflects perceptions, attitudes, beliefs and values among stakeholders, the output of which is easily understood and shared by various parties. This information can serve as the basis for discussions and decision-making.
- *Institutional analysis* is the investigation of how formal and informal rules (institutions) shape human behaviour. Institutional analysis focuses on how individuals and groups construct institutions, how institutions operate by patterns of interaction, how they are linked and the outcomes they generate. Without institutional analysis, a clear understanding of the complex interactions and relationships among factors within MPAs is not likely to be achieved. Social mapping is a technique that can also be used when undertaking an institutional analysis.
- *Social impact assessment (SIA)* is a tool to identify and assess the social consequences that are likely to result from a specific action prior

(Box 31 cont.)

to decision-making. The SIA identifies key social and cultural issues of the interested and affected stakeholders. This is achieved by collecting qualitative and quantitative social, economic and cultural data that are used to describe and analyse all reasonable alternatives to the action. It is ultimately concerned with recognizing the most socially beneficial course of action.

- *Conflict management and negotiation* is used to apply skills that can help people express their differences and solve their problems for mutually beneficial outcomes. Due to the fact that conflicts are inevitable in multistakeholder situations, conflict management is used to reach solutions in the least disruptive or harmful manner.
- *Participatory monitoring and evaluation (PM&E)* involves the assessment of change in processes that involve many people or groups, each of whom is affecting or affected by the impacts being assessed. By implementing PM&E during policy and planning cycles, a greater efficiency of information exchange can be attained, which facilitates consensus-building. This process is important, as it promotes transparency and accountability while ensuring that stakeholders and beneficiaries are fully engaged in the initiative.

concentrate to areas of lower concentration, the CPUE is likely to be lower, which translates into a higher cost per unit of catch, or overall reduced catch and income. Economic information can be used to model the redistribution of fishing effort in response to MPAs.[72] The redistribution of fishing effort displaced from MPAs is a key factor in determining the effectiveness of MPAs and their economic impact. MPAs may also change the costs of transit from fishing grounds to ports. It is likely that not only the harvest sector is affected by an MPA.

Fish processing and marketing activities that depend on a certain supply of fish may also be affected by changes in fishing activities. To better understand the full economic effects of a proposed MPA, an economic analysis of the value chain is needed. Such assessments should also cover the impact on communities in a broader sense with regard to food security, employment and local revenue generation. These aspects are closely related to some of the social

[72] See also Annex 3.

dimensions discussed, and may be included in a socio-economic assessment when preparing community (and overall MPA) profiles.

Cost and benefit assessments were mentioned in the context of prioritizing issues and setting objectives. Cost–benefit analysis is a tool for comparing, over time, the benefits of proposed projects with their costs in order to help users identify the alternative offering the maximum net benefit (benefits minus costs). The more the benefits exceed the costs, the more society will benefit from the project activity or policy decision. An analysis of the impact of an MPA on society as a whole, expressed in economic terms, would include negative and positive externalities. These assessments are also called economic impact assessments and can be conducted at the level of diverse societal subsets and for various stakeholder groups. Such distributional impact reviews provide knowledge of the distributional effects of the MPA and of the various design features and governance and management options.[73]

While financial, value chain and cost–benefit analyses, economic impact assessments and distributional impact reviews can provide important – sometimes vital – information to MPA planning and implementation, it should be recognized that they can be complex exercises. Often the skills of an economist would be required, but the data needed may not be available. In financial and economic analyses, costs and benefits must be expressed in monetary terms. For many aspects of an MPA, it may be difficult to assign such values, because there are no market prices for the costs and benefits. They have different values to different individuals and societies and they occur over a wide range of time scales.

However, approaches have been developed for assessing and valuing diverse types of ecosystem services and for environmental accounting. Other economic valuation methods are also available, for example for discounting values over time and for calculating shadow prices (i.e. the true economic price of a good or service).[74] Despite the available methods and frameworks, some costs and benefits may remain difficult to assess objectively. Still, identifying likely costs and benefits constitutes an important thought process, and lack of

[73] See Chapter 6, Section 6.5, "How are the issues to be addressed by MPAs identified and prioritized?" and Box 21.
[74] See Glossary.

precise data should not prevent managers and decision-makers from assessing costs and benefits as part of MPA planning and implementation processes.[75]

8.5 WHAT INFORMATION IS NEEDED TO UNDERTAKE AN INSTITUTIONAL ASSESSMENT FOR MPAs?

The importance of appropriate institutional, legal and policy frameworks for MPAs was discussed in Chapter 5. Thus, when planning MPAs, it is necessary to investigate what the existing institutional set-up looks like and what changes may be required at national and local (MPA-related) levels. Such assessments are crucial to development of the management plan and to creating an enabling environment for MPA management. Some key elements of an institutional assessment include (Pomeroy and Riviera-Guieb, 2006, Section 7.4.7):

- Identification of the resource user groups, government agencies and other organizations and stakeholders involved in resource management, an analysis of their roles in management, and evaluation of the existing level of stakeholder involvement in managing resources;[76]
- Identification of the relationships among stakeholder groups and of the existing political and economic power structures in the society/community;
- Identification of relevant governance systems, including existing property rights and tenure arrangements (formal and informal), decentralization policies and responsibilities at various levels of government (village, municipal, district, provincial, regional, national, international) and community (customary, traditional), as well as existing mechanisms for stakeholder participation.

The assessment should also look into overarching policy frameworks and the mechanisms available for achieving the cross-institutional collaboration and coordination required by the MPA. Similarly, the legal framework must be reviewed and understood. Equally important is understanding of customary resource management systems and the – perhaps informal – rules that govern

[75] More on cost–benefit analysis in an EAF context can be found in FAO, 2008b. Moreover, the Canadian Government's guidelines are a good example of conducting cost–benefit analyses at the government level (available at www.tbs-sct.gc.ca/fin/sigs/revolving_funds/bcag/bca2_e.asp).

[76] This process is closely related to the stakeholder analysis discussed in Chapter 6, Section 6.4, "When and how should stakeholders be involved in MPA planning?", but focuses more on larger institutional setups than on groups of individuals.

resource utilization. Effective MPA management can only be achieved if rules, regulations and responsibilities are rooted in the legal system and in customary practice, as applicable. A solely legal basis for MPA establishment will not ensure its success in many parts of the world.

8.6 WHAT KNOWLEDGE AND INFORMATION ARE NEEDED TO DESIGN AN MPA NETWORK?

In MPA networks, connectivity is important, and information on how fish move and how eggs and larvae are dispersed is needed. While restricting extractive activities such as fishing in an MPA will not, *per se*, ensure that connectivity is protected, there is evidence that the integrity of marine community interactions is heavily reliant on the preservation of established demographic patterns. These patterns include, in particular, the distribution of age classes and life stages across the fish population.

When adequate information is available, hydrographic models can be applied to predict passive drift and spatial connectivity within a fish population. Genetic studies can also be used to evaluate spatial connectivity (how animals in one place relate to animals in another place). Invariably this research will tend to highlight that some marine communities are more spatially connected than others and protection can be assigned based on key elements of that marine community network.

This can entail identifying the highly interactive, the isolated and the connecting marine communities. The highly interactive communities will have strong connections – such as larval exchange or migration of juveniles or adults – with the neighbouring marine communities, while the isolated communities, most likely as a result of isolating water currents, will be only rarely connected. Other communities are able to act as 'stepping stones', connecting one cluster of marine species communities to another. By understanding the role each marine community plays in maintaining the function of a healthy marine system, the MPA planner can select areas to be protected that adequately represent the core ecosystem functions of the region. The principles of comprehensiveness, adequacy and representativeness (CAR)[77] are also applied to the MPA network, but with an additional focus on connectivity function.

In an optimal situation, the MPA network is designed when the roles and connections between fish populations and marine communities have been

[77] See Chapter 1, Section 1.4, "What is an MPA network?" for an explanation of the CAR principles.

clarified and a comprehensive list of species and their associated ranges has been compiled for each life cycle stage. However, detailed data are often not available and approximations will have to be used. Expert opinion can be useful, as can traditional, indigenous and local knowledge, substituting or complementing insufficient scientific data. A key consideration is the distance between and size of MPAs. The minimum distance ideally should allow a significant number of individuals to connect the neighbouring reserves.

In an MPA network in the Philippines, it was decided that community-based MPAs should be separated by no more than 5 km from one another and be no smaller than 20 hectares in area, with one of five MPAs no smaller than 50 hectares. These recommendations were based on an assessment of the genetic connectivity of one fish species, the longevity of the planktonic phase of key commercial fish, and social feasibility.[78] Other considerations, such as associations with habitats (i.e. rocky shorelines for mussels), will determine what configurations are possible. The dispersal success for passive larvae tends to diminish rapidly with distance, so reserves large enough to retain local recruits will be important.

In addition to bioecological data, information regarding the social connections between human communities and governance opportunities and challenges is equally essential.[79] Social network analysis that identifies communication linkages between community members is helpful. In short, MPA networks should be conceptualized as socioecological constructs and, as such, require multidisciplinary information.

8.7 HOW CAN TOOLS SUCH AS GEOGRAPHIC INFORMATION SYSTEMS, SCENARIO DEVELOPMENT AND MODELLING HELP MPA PLANNING AND IMPLEMENTATION?

In order to manage the complex issues affecting MPAs, managers often turn to technology for help in understanding and analysing the resources at their disposal and the context in which planning takes place. 'Decision-support tools' are defined as interactive, computer-based systems that arrange and present spatial data to support informed, objective and, in some cases, participatory decision-making. Such tools – for example, geographic information systems (Box 32) and remote sensing – are increasingly used to map and analyse resources within

[78] 'Social feasibility' is the possibility of putting MPAs in place based on the issues in local communities (support, fishing, etc.).

[79] That is, whether fisheries operate under different rules, jurisdictions, etc. in different areas, or whether tribes or indigenous groups govern their own areas, etc.

BOX 32
Geographic information systems

A geographic information system (GIS) is a computer system capable of capturing, storing, manipulating, analysing and displaying data that describe the geography of a particular place. Put more simply, a GIS combines layers of information about a place to provide a better understanding of it. What layers of information are used and combined depends on the purpose. Remote sensing is a technique of gathering information at a distance on terrestrial and oceanographic features. Remotely sensed data can include aerial photographs, satellite imagery, acoustic data and radar imagery. The use of remotely sensed data is increasing, owing to recent advances in GIS and image-processing capabilities. Information is now available for most personal computers.

and around the MPA. Scenario development and modelling are other tools that can help decision-makers in MPA planning and implementation.

These tools can enhance the objectivity and rigour of MPA planning and implementation, but decision-makers and managers should realize that even such high-tech processes are value-laden. The choice of tool used, of information to be input, of data layers, and the way the results are evaluated are all subjective decisions. As in Delphic processes (such as planning supported by expert opinion or participation of stakeholders), human beings ultimately decide what information to include and how the outputs are used in decision-making. These choices are influenced by the particular value systems and opinions of the individual. This subjectivity should be acknowledged and not masked by suggesting that computer-enabled processes are somehow more scientific, and thus more 'truthful', than processes using lower technologies. They do, however, frequently assist in analysing and presenting abundant and complex information in a more easily understood manner.

GIS, with the application of decision-support tools, can help evaluate a suite of proposed management actions or outcomes based on assigned criteria. The tools can be applied to support siting, zoning or monitoring, and the inclusion of cultural and social information is important. GIS can also be used in a participatory process and thus facilitate consultations and collaboration with stakeholders. The computer-based software Marxan has been widely used to identify networks of reserve sites that would meet biodiversity targets, while minimizing costs to resource users such as fishers. A comparative review of

methodologies and computerized tools for the selection of candidate MPAs was published in 2004 by the Department of Fisheries and Oceans, Canada, and is available online.[80] Marzone,[81] a newer iteration of Marxan, helps planners evaluate zoning options within MPAs.

Scenario development[82] can help planners communicate the plausible futures that users and other stakeholders will face if certain management actions are taken. Such scenarios – which are essentially data-driven stories of how conditions will change in the future – allow decision-makers to make informed choices, and allow the public to understand the types of trade-offs being made in the process of implementing MPAs.

Modelling is used to consistently and concisely express hypotheses about the state and dynamics of systems, and to test them against available information. Many types of models are used as the basis for fisheries management, such as stock assessment models that include risk assessment and bioeconomic models. Ecosystem models are also increasingly available (FAO, 2008a; Cochrane and Garcia, 2009, Ch. 13). Another class of models addresses the choices made by fishers and other resource users. Understanding how resource users may respond to area-based management such as an MPA is key, not only to impact assessment, but also to MPA design. Closing or restricting access to a particular area such as an MPA will mostly cause resource users to displace their activities to a second-choice fishing area.

Models may differ in terms of the form of equations used to describe the dynamics of the system or the parameters of the equations. An important role of research is to gather additional information and improve understanding, so that the number of plausible models is reduced.[83]

8.8 HOW DO WE COPE WITH INFORMATION-DEFICIENT SITUATIONS WHEN PLANNING AND IMPLEMENTING MPAs?

Over the past century, much progress has been made in the scientific study of fisheries, marine ecology, oceanography, social dynamics and institutions. Yet despite the accumulation of a great deal of scientific data, there are many situations in which there is little scientific information, especially for multispecies small-scale fisheries in tropical seas. In small-scale fisheries,

[80] Available at www.dfo-mpo.gc.ca/csas/csas/publications/resdocs-docrech/2004/2004_082_e.htm

[81] University of Melbourne, Australia (available at http://eshowcase.unimelb.edu.au/packages/marzone).

[82] For more information on this tool, see Peterson, Cumming and Carpenter, 2003.

[83] See Annex 3 for more information on models.

BOX 33
Locally-Managed Marine Area Network

The Locally-Managed Marine Area Network comprises a group of practitioners involved in various marine conservation projects in Asia and the Pacific that have joined together to increase the success of their efforts. It is a learning and information exchange. An LMMA is a nearshore area managed by local communities or resource-owning groups. Participating projects use a common LMMA strategy and work together to achieve goals. The Network is interested in learning under which conditions an LMMA strategy works, or doesn't work, and why. Through their Web site, members share knowledge, skills, resources and information in order to collectively learn how to improve marine management activities and increase conservation impact.

Source: LMMA Network(www.lmmanetwork.org/home).

landings are often widely distributed and the number of operators high, and data may not be available or may be difficult to collect. There is a growing appreciation that small-scale fisheries assessment and management approaches must be fundamentally different from those used in large-scale industrial fisheries (Garcia *et al.*, 2008). While fisheries management can be based on extensive research, sophisticated models and large amounts of data, these approaches are not always possible or appropriate, and it is evident that in many situations fisheries assessment and management systems are required that can work with much lower inputs of data and information.[84]

The same is true for MPAs, and fisheries management and biodiversity conservation are commonly needed in situations where information is limited. These circumstances are incorporated into UNCLOS and other international agreements, which state that management should be based on the best available scientific information, but should not be delayed due to inadequate information. These are also principles of the CCRF.

One challenge faced by management officials is to look beyond conventional scientific methods and learn how to access other information. Traditional, indigenous and local knowledge and participatory data collection

[84] See Garcia *et al.*, 2008, for a discussion of approaches to addressing assessment and management needs in small-scale fisheries; also Cochrane and Garcia, 2009, Chapters 3 and 13.

methods may be particularly useful in these situations – or studies on similar fisheries in other locations, with a suitable safety margin. Improved availability and user-friendliness of information systems can facilitate this process. Social and professional networking can also play an important role in this respect. Web-based networks are available for some of these aspects, for example the LMMA network (Box 33). With the generally increasing popularity of Internet networking, this type of structure for information- and experience-sharing could develop further in the future.

8.9 IS THERE A NEED FOR MORE RESEARCH ON MPAs?

A long list of potential research topics related to MPAs and fisheries merits attention:

- biological and ecological aspects (e.g. larval dispersion patterns and juvenile and adult movements for specific species);
- linkages in and between marine communities;
- effects of a fishery target species on other species in the ecosystem;
- socio-economic issues (e.g. changes in fishers' behaviour regarding fishing patterns and displacement of effort triggered by diverse types of MPAs or combinations of management measures, ecosystem service valuation methods and other aspects of cost–benefit analyses); and
- governance (e.g. best practices for stakeholder involvement and co-management systems, and for intersectoral coordination and collaboration).

For some types of research, an experimental design of MPAs of different sizes, different spacing (in a network) or in different habitats and ecosystems would ideally need to be set up to thoroughly test how well various methods work in achieving diverse targets and objectives. However, it is difficult to find areas that are similar enough to serve as replicate samples. Moreover, the response time for the variables being tested is likely to be long (several years). There is generally resistance to this type of experiment because of the possibility of undesirable outcomes (both for the marine environment and for people). Thus it is difficult to set up experimental MPAs and, consequently, data from systematic evaluations of the performance of existing MPAs are needed.

All MPA management systems must include robust and standardized monitoring processes, allowing for comparison, to assess how well objectives are being achieved. Certain research topics can be incorporated

into such systems, but this often requires careful planning from the outset. For comparisons over time, data from baseline surveys – that is, of the status before the MPA was established – play a key role. There may be other issues that are better investigated by comparing MPAs, and some (e.g. related to the behaviour and biology of fish species) can be dealt with outside the context of MPAs. Yet other topics may lend themselves to a modelling approach. Many of the models currently used in fisheries management, such as stock assessment or bioeconomic models, are also of interest to MPA management, as are the more recent ecosystem models.[85]

Some research topics and their eventual results apply to a broader spectrum of MPAs, while others may be site- and situation-specific. In particular, site-specific research should be closely linked to the monitoring of management performance and fed into adaptive management processes. Documentation and publication of research results will contribute to global aggregate knowledge on how to successfully use MPAs and should be strongly encouraged.

[85] See also Chapter 6 and Annex 3.

KEY CONCLUSIONS AND RECOMMENDATIONS No. 8

As part of MPA and MPA network planning and implementation, information needs to be collected on bioecological, social, financial and economic, institutional and governance aspects of the MPA. Assessments should also identify existing and potential problems, needs and opportunities relevant to the MPA and its planning and implementation processes. Multidisciplinary information and analyses are required.

- Key bioecological information includes ecological data (habitats, biodiversity, environmental conditions, etc.) and fisheries data (stock assessments, spatial distribution and mobility, characteristics during various life stages, etc.). Depending on the objectives of the MPA, areas and seasons with high bycatch levels and the location of biodiversity hotspots and habitats of concern may also be needed. For small-scale fisheries, comprehensive scientific data may not be available and greater use of local knowledge and alternative assessment methods should be explored.
- All management is about people, and social information providing a good understanding of coastal communities and other resource users is key to successful MPA outcomes. Community profiles should be used, including data on demographic, cultural and social aspects that are important to MPA planning and implementation.
- MPAs have economic and distributional impacts and these effects must be understood. Financial, value chain and cost–benefit analyses, economic impact assessments and distributional impact reviews are important tools.
- Appropriate institutional, legal and policy frameworks are fundamental to successful MPA implementation. The relevant frameworks should be assessed and their implications for MPA planning and implementation understood.
- For MPA networks, connectivity has to be considered. Knowledge is required of the spatial dynamics of life cycles and interactions among organisms, as well as of the social connections between human communities and governance support.
- Computer-based technologies can assist in planning and implementing MPAs. GIS, decision-support tools, scenario development and modelling are other methods that can help decision-makers.

- Lack of (scientific) information should not unreasonably delay the designation of MPAs. Flexible approaches should be applied to data gathering through the use of multiple information sources, including traditional, local and indigenous knowledge.

9. LESSONS LEARNED AND FUTURE DIRECTIONS

MPAs and MPA networks have become increasingly popular as a tool for protecting biodiversity and habitats and for preserving sites with particular importance. Spatial management, including MPA-type measures, has a long history in fisheries, and fisheries management is evolving into EAF, paying increased attention to ecosystem linkages and overall health. The question is how to use MPAs more effectively to fulfil multiple objectives in an integrated spatial management approach for the benefit of the marine environment and sustainable livelihoods. Further attention to the reconciliation of fisheries management and biodiversity conservation will be important as more-extensive use of MPAs take place.

The accumulated experience so far with MPAs and MPA networks provides valuable lessons that should make MPAs more effective in the future. This section summarizes some key conclusions and looks into future opportunities and challenges in planning and implementing MPAs in support of both biodiversity conservation and sustainable fisheries – providing benefits to those who depend on marine resources for their livelihoods and to society overall.

9.1 WHAT ARE THE KEY LESSONS ON MPAS AND FISHERIES?

The cumulative global experience of MPA planning and implementation continues to grow. Some important conclusions to date on how MPAs work in relation to fishery resources, fisheries and fishers, and in bridging fisheries management and biodiversity conservation include:

- MPAs and MPA networks are tools among many other fisheries management and biodiversity conservation measures. As such, they have strengths and weaknesses and should not be considered a 'magic bullet'. They are effective for management when planned and implemented under the right circumstances and through appropriate processes. Both the opportunities and the limitations they represent should be respected.
- There are various entry points into MPAs – from a biodiversity conservation or a fisheries management perspective – but MPAs will

have multisectoral effects whether they have been designed with multiple objectives or not. To ensure that externalities are capitalized on or mitigated, depending on the particular situation, MPAs must be embedded within broader policy and spatial management frameworks, and appropriate cross-sectoral coordination and collaboration established at all levels (national, regional and local).

- When designed appropriately, it is likely that there will be benefits for fishery resources inside and close to MPAs (as a result of spillover) – in terms of abundance, biomass and size of resource species. In general, conservation benefits are likely to be greater for more sedentary species, and fisheries benefits should be greater for species with intermediate mobility. MPAs can also play an important role in the protection of habitats and critical life stages, and in reducing bycatch.
- However, the exclusive use of MPAs to control or reduce fish mortality, that is, as a fisheries management tool to sustain fish populations, is likely to result in overall lower yield potential and higher costs of fishing. MPAs should be combined with other management measures that control fishing effort outside the protected area, or fishing effort will probably be displaced with potentially negative consequences. Hence, MPAs must be an integral part of overall fisheries management plans and should not be viewed as a stand-alone fisheries management tool unless they are the only viable option, such as in situations where the capacity to implement other forms of management is lacking.
- Because MPAs decrease the fishing area, they are likely to mean – at least in the short term – lower yields for fishers in those situations in which they cannot fish efficiently elsewhere. Benefits from changes in the fishery resource thanks to MPAs may be realized only in the longer term. Coastal communities adjacent to MPAs, especially those with a high economic dependence on the fishery, could thus face a disproportionate impact as a result of aggregate reduction in fishing revenue. Efforts should be made to minimize disruptions to lives and livelihoods through impact assessment, identification of alternative livelihoods and strategies to address the disruptions.
- The socio-economic impacts of MPAs can be positive and negative, direct and indirect, affecting sectors and stakeholders adjacent to and beyond the MPA site(s). MPAs have distributional effects and different

stakeholder groups are affected in different ways. Stakeholder involvement in planning and implementation is crucial for the success, in particular, of coastal MPAs. People, individually and as a group, should be made to feel that they have been part of the decision-making process and have been able to actively participate in and influence it. Without this, it will be difficult to obtain support and compliance.

- Appropriately designed MPA networks typically have several benefits over single MPAs. A network may be more flexible with regard to the distribution of social and economic costs and benefits among various stakeholders (fishers), while still achieving fisheries management and biodiversity conservation objectives. A network is also likely to provide higher resilience to catastrophic events and other changes in the environment, such as climate change.
- MPAs imply a long-term management undertaking, and political commitment and sustainable resourcing are required. Adequate support in terms of manpower and other resources must be planned from the outset and could include multiple funding sources.

9.2 WHAT IS THE FUTURE OF MPAs?

The current trend towards greater emphasis on MPAs as a fisheries management and biodiversity conservation tool will continue, within the framework of EAF and in the context of the international commitments made to conservation and sustainable development. In order to make the most of the contribution of this spatial management measure to achieving healthy marine ecosystems and sustainable fisheries, and meeting broader societal objectives – including poverty reduction and food security where these are a major concern – there are both opportunities and challenges.

MPAs and opportunities in an increasingly integrated world

Many developments support MPAs as an opportunity for improved fisheries management and biodiversity conservation. At the same time, as the world becomes more globalized and integrated, the need to decentralize decision-making and allow those directly concerned to assume increased responsibility is also recognized. These and other opportunities related to MPAs in an increasingly integrated world include:

- *Integrated marine spatial management:* MPAs as a tool for fisheries management and biodiversity conservation must be integrated within broader spatial management to balance diverse environmental and

societal values and needs. An MPA is a management tool that, if wisely planned and implemented, constitutes an opportunity to support cross-sectoral approaches and to bridge fisheries management and biodiversity conservation objectives.

- *Decentralization policies and co-management:* Current trends of devolution of power to local levels of government and communities, for example through fisheries and ecosystem co-management arrangements, support stakeholder involvement in MPA planning and implementation. This is an important development that MPAs can both benefit from and contribute to: experiences from MPA management can inform policy on decentralization and shared responsibilities.
- *MPA networks:* The move towards designating MPA networks – rather than single MPAs – constitutes an opportunity for a more flexible approach to management through MPAs. As with single MPAs, careful holistic, integrated and participatory planning of MPA networks is required for successful outcomes.
- *Sustainability of MPAs:* Sustaining of MPAs requires sound management to achieve objectives and to have ongoing communication with and engagement of stakeholders in order to engender political will and support, and ensure sustainable financing. The currently increasing general recognition of the value of the environment and of ecosystem services constitutes an opportunity to explore innovative approaches to financing, such as PES schemes.
- *Research and new technologies:* Much has been learned about the response of marine ecosystems within and near MPAs, but careful long-term monitoring and well-designed and applied research are necessary to enhance the understanding of results and outcomes. This applies, in particular, to the broader spatial scales of fisheries and ecosystems and to their social and economic impacts. New technologies, such as VMS, GIS and systems for information-sharing, constitute an opportunity to apply new approaches to MPA planning and implementation.

MPAs and challenges in a changing context

Marine management and the use of MPAs will be influenced by a number of ongoing developments, including increased economic globalization, trends in political and governance systems, and climate change. MPAs should be

adaptable to such changes and planned with sufficient flexibility. A number of challenges must be addressed in this respect:

- *Competition for resources: The* increasing demands on resources and space – including, for example, from expanding aquaculture and recreational fisheries – render intersectoral coordination urgent. While MPAs constitute a tool for managing resources in a spatial context, they will not reduce the demand for resources, but MPAs should contribute to a more-efficient use of existing resources and coordination among resource users.
- *Legal, institutional and policy frameworks:* To work effectively as a management tool for multiple objectives and to create cross-sectoral benefits, MPAs must be supported by the appropriate institutional structures. Today, however, these are still often lacking. Coordination and collaboration among government agencies and with stakeholders is required if the necessary legal, institutional and policy arrangements are to be developed.
- *Ocean governance:* More attention is being paid to ocean governance due to recognition of the value of the marine environment and the ecosystems our oceans represent, and of the spatial and natural resources they contain. It is important that the development of ocean governance and the future use of the oceans are equitable in two senses: there needs to be balance between bioecological and socio-economic needs, that is, both environmental sustainability and people's livelihoods must be considered, and there has to a fair distribution of costs and benefits among diverse groups of people. These are challenging principles that must be taken into account when planning and implementing MPAs.
- *High seas management:* An important part of the changing ocean governance scene relates to international waters and the high seas. The designation of MPAs in the high seas for both fisheries management and biodiversity conservation purposes poses new management challenges and may require innovative solutions with regard to legal and institutional structures. Existing RFBs already play an important role, which may need to be adjusted and expanded.
- *Food security and poverty reduction:* In situations in which MPAs will negatively affect food security, poverty and livelihoods – in the short run – the identification and development of alternative or supplementary livelihood activities must be undertaken. This can

constitute an important challenge, particularly in areas where the dependence on current marine resource patterns is high. Both affected resource users and relevant (cross-sectoral) government departments should be engaged in this process to ensure that alternative or supplementary livelihoods are sustainable. Moreover, the scope and objectives of MPAs must reflect a balance between scientific and social and economic needs and realities.

- *Social buy-in and compliance:* Only meaningful public and stakeholder participation can ensure compliance and long-term sustainable support. This is valid for coastal MPAs, where nearby communities have a direct stake in the MPA, as well as for the high seas, where the global community at large – through its governments, representative organizations and international fishing companies – must acknowledge and support the necessity of conservation and sustainable fisheries management measures. Ensuring participation and stakeholder buy-in is a critical challenge for future MPAs.
- *Climate change:* Climate change is an issue that is highly relevant to MPAs and that may undermine their robustness in terms of sustaining populations and protecting habitat and biodiversity. As the distribution of biota[87] responds to climate change, MPAs once strategically positioned based on historical distributions may no longer be in the right place. A network of MPAs – with the potential of affording protection as the climate changes and biological distributions respond – may be more effective than dependence on a single MPA. Nevertheless, longer-term changes in conditions are difficult to forecast, and this challenge also calls for adaptive management and flexibility in the implementation process.
- *Large MPAs:* MPAs are now being declared across wide stretches of open ocean, such as the Papahānaumokuākea Marine National Monument (Northwestern Hawaiian Islands Marine National Monument, 2006), which covers 362 000 km^2; the Phoenix Islands Protected Area (PIPA), encompassing 184 700 km^2 (2006); or the Micronesia Challenge, which aims to conserve 30 percent of nearshore resources by 2020.[88] Such large MPAs will constitute

[87] The total complement of animals and plants in a particular area.

[88] This commitment includes the Federated States of Micronesia, the Republic of the Marshall Islands, the Republic of Palau, the Territory of Guam and the Commonwealth of the Northern Marianas Islands.

specific challenges in assessing socio-economic situations and trade-offs, MCS requirements and in assuring effective management.

The increasing acceptance and application of MPAs in many parts of the world is an integral part of global efforts to safeguard our oceans. However, designating MPAs without due consideration of their consequences and practical feasibility will only create 'paper parks', without benefits to the environment or humanity, and even with potential costs in the form of, for example, lost livelihoods and income. Thus they must not be seen as a panacea that will cure all problems: both the environment and fisheries require holistic thinking and actions targeted at specific problems and their underlying causes. At the same time, MPAs constitute a great opportunity, but as with many worthwhile endeavours, considerable time, effort and perseverance will be required to make MPAs and MPA networks fulfil their potential.

ANNEX 1

MPAs AND MPA NETWORKS IN THE HIGH SEAS

The 1982 United Nations Convention on the Law of the Sea (UNCLOS) is often referred to as the 'constitution for the oceans'. It clearly distinguishes between areas of the ocean under national jurisdiction and those beyond, which are generally referred to as the high seas or 'the Area'.[1] Because they are outside national jurisdictions, environment and fisheries governance in the high seas and in 'the Area' pose particular challenges, which also obviously reflect on the opportunities to designate and manage MPAs and MPA networks. A number of efforts have been made to improve fisheries management beyond the limits of national jurisdiction, for example through regional fisheries management organizations or arrangements (RFMO/As),[2] but there is still limited experience in implementing MPAs, both in the field of fisheries management and in biodiversity conservation.

GOVERNANCE REGIMES FOR THE HIGH SEAS AND AREAS BEYOND NATIONAL JURISDICTION

UNCLOS provides the general framework for establishment of conservation and management measures in the high seas, but is not exhaustive in terms of elaborating the mechanisms or tools for conservation. It does, however, provide that coastal states and states that engage in fishing in the high seas must seek "to agree on the measures necessary to coordinate and ensure the conservation and development of such stocks".[3] Moreover, it also envisages the protection of "rare or fragile ecosystems", and where living marine resources are "depleted, threatened or endangered", their habitats are to be protected.[4]

[1] See Glossary for definitions of these terms as they are used in the Guidelines.

[2] The mandates of Regional Fishery Bodies vary. Those that have a management mandate are called regional fisheries management organizations (RFMOs). They adopt fisheries conservation and management measures that are binding on their members. The difference between a RFMO and a regional fisheries management arrangement (RFMA) is that the former has established a Secretariat that operates under a governing body of member States, while the latter has not.

[3] Article 63.

[4] Article 194.

The 1995 Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas (the FAO Compliance Agreement) and the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (the United Nations Fish Stocks Agreement) are also relevant – and build directly on provisions contained in UNCLOS. The former emphasizes the primary responsibility of a flag State[5] to exercise control over vessels entitled to fly its flag, while the latter underscores the duty of states to cooperate in the conservation and management of straddling and highly migratory fish stocks.

Together these instruments form the legal framework against which marine living resources in the high seas are managed by states and through RFBs. When viewed collectively, these instruments confirm that in such areas states enjoy the freedom to allow their nationals to engage in fishing activities. However, this freedom is not unfettered: it is subject to an obligation to protect the marine environment, to protect and conserve living marine resources and to cooperate with other states for conservation purposes.

The Convention on Biological Diversity is also relevant to the high seas and to *in situ* protection of marine biodiversity. The scope of the convention includes marine areas within areas of national jurisdiction and beyond, in relation to its areas of competence. The CBD generally operates through national implementation. The convention emphasizes the overall global objective of conservation of biodiversity.

The International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO, 2009c) were adopted in August 2008. These guidelines provide advice not only on how to manage deep-sea fisheries, but also on how to take conservation of these resources into consideration. They list criteria for the identification of vulnerable marine ecosystems (VMEs) and potential management responses from states or RFBs, including the establishment of spatial management measures such as MPAs.

Specific activities that occur in or impact the high seas or areas beyond the limits of national jurisdiction, namely shipping and deep-sea mining, are also subject to special international legal regimes. Relevant aspects of these

[5] The flag State in relation to a fishing vessel is the State under whose laws the fishing vessel is registered or licensed.

BOX 34
Additional international instruments relevant to biodiversity conservation, sustainable fisheries and MPAs in the high seas

A number of international instruments and agreements are applicable to the high seas. In addition to the instruments listed in Box 12 in Chapter 5, agreements that are specifically relevant to the high seas include, but are not limited to:

Hard law:

- Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982
- Convention for the Regulation of Whaling

Soft law:

- International Guidelines for the Management of Deep-Sea Fisheries in the High Seas (FAO, 2009c)
- United Nations Resolutions 61/105 – Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks and related instruments.

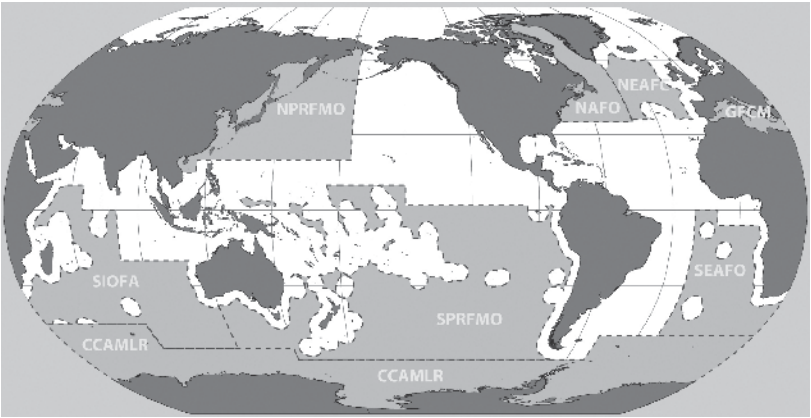
regimes are discussed below under "Spatial management measures in the high seas".

Other international instruments – both 'hard' law (binding) and 'soft' law (voluntary instruments) – are of relevance to environmental and fisheries management, both in waters under national jurisdiction and in the high seas. Some of these were also mentioned in Chapter 5, Box 34 provides a list of additional instruments.

Regional fishery bodies (RFBs)

Currently, there are nearly 50 RFBs worldwide, only about half of which are RFMO/As with a management mandate. However, only a limited number of RFMO/As are able to institute binding measures on members in areas beyond national jurisdiction. As of January 2010, the following RFMO/As had the legal competence to manage discrete demersal fisheries. These include the Commission on the Conservation of Antarctic Marine Living Resources

FIGURE 8
Competence areas of RFMO/As



(CCAMLR); the General Fisheries Commission for the Mediterranean (GFCM); the Northwest Atlantic Fisheries Organization (NAFO); Northeast Atlantic Fisheries Commission (NEAFC); and the South East Atlantic Fisheries Organization (SEAFO). Other RFMO/As are being negotiated or await ratification, such as the recently negotiated South Pacific Regional Fisheries Management Organization (SPRFMO), the Southern Indian Ocean Fisheries Agreement (SIOFA), and the North Pacific Fisheries Commission (NPRFMO) (see Figure 8).

Special considerations for high seas fisheries and habitats

High seas fisheries target pelagic and demersal fisheries. Targeted pelagic fish generally include tuna and tuna-like fish. These fisheries are extensively managed by RFBs. Due to varying issues, RFBs, for the most part, have not chosen to use MPAs as a conservation and management mechanism.

With regard to demersal fisheries, current fishing practices have potentially significant effects on vulnerable species and habitats in the high seas (as in waters under national jurisdiction). The establishment of MPAs in the high

seas based on the principles of the precautionary and EAF approaches may constitute an important tool to prevent or reduce such negative outcomes.

Deep-sea fisheries in the high seas, which typically target demersal and bentho-pelagic species, have been identified as a possible threat to vulnerable species and habitats. Two characteristics of these fisheries make them of particular concern. First, some species targeted may only be able to sustain a low exploitation rate due to the fact that they are slow-growing, long lived or late maturing. Second, fishing gear is often utilized that is in contact or is likely to be in contact with the seafloor during the fishing operation. Many of these fisheries are conducted on isolated oceanic topographic structures such as seamounts, ridge systems and banks, but also in the deep superjacent waters lying above the continental shelf.

Negative effects on VMEs may occur in one of two ways, either through damage to structural elements or damage to the ecosystem, for example by the removal of a species, which alters the way in which the ecosystem functions. The most vulnerable ecosystems are those that are both easily disturbed and slow to recover.

Spatial management measures in the high seas

At present, spatial management measures that regulate or restrict human activities in the high seas have only been created within sector-specific contexts, that is, by RFMOs or under conventions or agencies such as the IMO.[6]

RFMOs that regulate deep-sea fisheries have begun protecting benthic marine environments in the high seas by introducing closures in which the use of certain gears, particularly bottom-contact ones, is banned. For example, SEAFO has identified a number of vulnerable marine areas and temporarily closed some of these areas to bottom-fishing pending further research. NAFO has closed five seamount areas and 12 additional areas containing high concentrations of corals and sponges to bottom-contact gears. GFCM has prohibited trawling in areas deeper than 1 000 m and has declared three closed areas to protect sensitive habitat.[7] NEAFC also closed five areas on the mid-Atlantic ridge in 2009, added to the five already closed in the Rockall-Hatton Bank area in 2007.

[6] See also Chapter 5, Section 5.2, "What are the main international legal frameworks relevant to MPAs?"

[7] GFCM Recommendation REC-GFCM/30/2006/3.

The ISA was established to regulate deep seabed mining in marine areas beyond the limits of national jurisdiction (the Area) and to protect the marine environment from any harmful effects of mining activities, including exploration. It is currently developing criteria for a "preservation reference zone" in relation to nodule mining. An example is the Clarion-Clipperton Zone of the Pacific Ocean, where a preservation reference zone is being considered as part of the design for an MPA for seamounts and abyssal nodule provinces in the Pacific. In this particular zone it is proposed that no mining or exploration should take place.

In 2008, the CBD conference of the parties adopted scientific criteria (COP Decision IX/20, paragraph 14) for identifying ecologically or biologically significant marine areas in need of protection, and scientific guidance for designing representative networks of MPAs. These scientific criteria are designed to apply to the open ocean, including areas beyond national jurisdiction. However, the criteria are to be applied to the scientific identification of ecologically and biologically sensitive areas (EBSAs) and do not have management implications.

IMO is mandated to establish a regulatory framework for international shipping that includes environmental concerns. IMO has two types of spatial management tools at its disposal: 'special areas' and 'particularly sensitive sea areas' (PSSAs). Special areas include specific restrictions on discharges and pollution from shipping. PSSAs are a slightly broader tool and require specific prohibitions, restrictions and application of measures, such as strict restrictions on discharge (through MARPOL) and equipment requirements for ships, such as oil tankers; routing measures to redirect vessels away from sensitive areas; and installation of vessel traffic services to improve vessel safety. In October 2009, IMO had recognized 12 PSSAs, including the Great Barrier Reef in Australia and the Baltic Sea. No PSSAs have yet been declared in the high seas, though the tool does allow for use in areas beyond national jurisdiction, and proposals for high seas PSSAs are being developed. In this respect IMO is important, as it provides an existing, globally accepted international mechanism for the establishment of protected areas in relation to shipping activities.

Future prospects for MPAs in the high seas

Fisheries management and biodiversity conservation pose particular challenges in the high seas with regard to legal and institutional structures and processes, as the areas are beyond national jurisdiction. The current major threat to the open oceans is considered to be fishing, but tomorrow other activities that

constitute potential threats to marine biodiversity may increase – such as bioprospecting, mining, energy development and CO_2 sequestration – requiring a more complicated set of management arrangements.

In spite of these challenges, there are positive developments. RFBs now manage the majority of the world's marine fish resources, although, unfortunately, too few target stocks are sustainably managed. In the face of this, the international community has reiterated the vital role of RFBs and the need to strengthen and modernize them. The Conference on Governance and High Seas Fisheries and the United Nations Fish Stocks Agreement – Moving from Words to Action was held at Saint John's, Newfoundland and Labrador, Canada, 1–5 May 2005. The ministers invited by Canada to participate in a round table concurrent with the conference issued a declaration in which they recognized that RFBs "are the most effective means of cooperating in the conservation and management of high seas fish stocks." They also recognized that RFBs today face new challenges and responsibilities and that there is a need for political will to further strengthen and modernize them.[8]

Many RFBs are working to strengthen governance through performance reviews, promotion of transparency, enhancement of MCS measures and implemention of EAF and the precautionary principle. RFMOs have also been moving towards increased cross-sectoral coordination and collaboration (Box 35). Industry also has an important part to play, and may collaborate to voluntarily form protected areas (Box 36).

[8] The need to further strengthen and modernize RFMOs was also recognized in the 2006 and 2010 United Nations Fish Stocks Review Conference, UNGA Resolutions, FAO Committee on Fisheries and other forums.

Box 35

Work by the North East Atlantic Fisheries Commission (NEAFC)

The north-east Atlantic has been one of the few areas where various management agencies have been working across sectors to protect vulnerable marine species and ecosystems. NEAFC has introduced a number of interim areas closed to bottom-trawling and other static gears within the regulatory area, in an effort to protect and preserve VMEs where they have been identified. In conjunction with its counterpart in the north-east Atlantic, the OSPAR Commission (for the protection of the marine environment of the north-east Atlantic), NEAFC has sought to harmonize environmental protection across the region by signing a memorandum of understanding. By working cooperatively and ensuring a free flow of information between the two bodies, it will ensure that the areas under their jurisdiction are subject to uniform governance.

NEAFC has stated that "Fishing is totally dependent on healthy ecosystems and clean oceans. NEAFC, as the competent organization for regulating fisheries in the high seas of the North East Atlantic, hopes that cooperation with other organizations in the regulation of other human activities in the oceans will ensure that no irreversible changes in environmental quality take place" (NEAFC, 2009). It has also recently entered into a cooperation agreement with IMO and is considering entering into one with ISA as well.

Source: NEAFC press release embargoed 11 December 2009, 09:00 am GMT (available at www.neafc.org/system/files/10122009_imo_pressrelease.pdf).

BOX 36

Southern Indian Ocean Deepwater Fishers' Association (SIODFA) and benthic protected areas

Four major fishing companies have come together to form SIODFA. This association has voluntarily adopted measures to cease bottom- and mid-water-trawling in eleven benthic-protected areas in the southern Indian Ocean. Within these areas, bottom-trawling and dredging are forbidden by SIODFA members. In addition, members have pledged to share scientific data collected by the organization and have instituted other measures to improve fisheries management while no regional management regime exists.

Source: Shotton, 2006.

ANNEX 2

WHAT AMOUNT OF MARINE PROTECTED AREA IS NEEDED TO SUSTAIN FISH POPULATIONS?

The effectiveness of MPAs in sustaining resource populations – inside and outside MPAs – and their effect on fishery yield is more difficult to assess than the biological response within MPAs. MPAs contribute to sustaining populations by allowing a higher proportion of the animals within them to survive long enough to mature and breed, thus increasing the reproductive output of the populations above what it would have been without MPAs. Clearly, if enough of a population is afforded protection in an MPA, the population will persist, regardless of the intensity of fishing outside the MPA. The question is, how much area is enough? The answer has two parts. First, how much spawning output is enough? Second, how effectively will MPAs protect fish populations so that enough of them can reproduce, that is, how to design MPAs that effectively control fish mortality?

SPAWNING PER RECRUIT AND MOBILITY

How much spawning output is enough can be addressed in terms of lifetime spawning per recruit (SPR) relative to an unfished population.[1] A review of empirical evidence provided a variety of estimates of the SPR necessary to sustain a population, ranging from 20 to 35 percent (Mace and Sissenwine, 1993). The lower value corresponds to an estimate of the minimum level necessary to sustain populations and the higher value corresponds to the level leading to a population abundance corresponding to maximum sustainable yield. Other studies conclude that 35–40 percent of the unexploited SPR is necessary for MSY, although even higher values may be appropriate for some species (Clark, 1990; Myers, Bowen and Barrowman, 1999; Ralston, 2002).

The effectiveness of MPAs in protecting fish so that they can reproduce depends also on the mobility of the fish once they reach the size or age vulnerable to fishing (both juveniles and adults). Suggestions that 20 percent of marine habitat be set as an MPA target were based on the desire to achieve at

[1] See Sissenwine and Shepherd, 1987, for the rationale behind this approach.

least 20 percent SPR for sedentary species.[2] Thus, if 20 percent of recruits settle in MPAs on average, and they are completely protected and do not migrate across MPA boundaries, protecting 20 percent of the area inhabited by the species should allow the population to be sustained, regardless of the intensity of fishing outside the MPA – if 20 percent SPR is enough. Clearly, the area that needs to be protected increases as the mobility of the species increases, so that fixed-location MPAs will not be a realistic option for sustaining highly mobile species. On the other hand, the amount of area that needs to be protected to sustain the population decreases as intensity of fishing outside of the MPA decreases, as some fish that migrate outside MPA boundaries will survive long enough to spawn.

MPA SIZE AND SPACING

Models have been used to evaluate the size and spacing of MPAs needed to sustain a population. Assuming that the biomass within the MPA is sufficiently large to be self-sustaining (also taking environmental variability into account), that conditions that affect dispersal of eggs and larvae do not vary spatially and that spawning only occurs within MPAs, a single MPA will sustain a population if the typical distance that eggs and larvae disperse is equal to or less than the linear dimension of the MPA (Botsford, Micheli and Parma, 2007). The size of the population will be a function of the size of the MPA. In this case, reproduction within the MPA will supply the MPA with recruits. If the dispersal distance of eggs and larvae exceeds the linear dimension of individual MPAs, the total fraction of area protected by MPAs must equal or exceed the SPR needed to sustain the population. Under the assumption of random dispersion of eggs and larvae (which is not always the case), the spacing of MPAs in a network is not very important for sustainability as long as the total fractional area protected is adequate (equal to or greater than a sustainable level of SPR) (Kaplan and Botsford, 2005).[3]

EXPORT OF EGGS AND LARVAE

Evidence of the export of eggs and larvae from MPAs and effects on recruitment have also been reviewed (Botsford, Micheli and Parma, 2007). While the number of studies is not large, there is some suggestive evidence of

[2] See NRC, 1999, 2001. It should also be noted that the World Parks Congress has called for strictly protected MPAs covering 20–30 percent of each habitat to contribute to a global target for healthy and productive oceans by 2012.

[3] See also "Modelling networks of MPAs to sustain fish populations" in Annex 3.

the beneficial effect of MPAs on reproductive output and recruitment outside MPAs. For example, there is documentation of larval export and an increase in queen conch larvae production within a 409 km^2 no-take area in the Bahamas (Stoner, Mehta and Ray-Culp, 1998). Also, areas of intense fishing for sea scallops on Georges Bank correspond to the location where a biophysical model of passive larvae drift from a 20 000 km^2 protected area has been used to predict the main juvenile settlement (Murawski *et al.*, 2000). In other situations, however, the effect on recruitment is difficult to demonstrate. In a large protected area where sea scallop was intensively exploited, the protection afforded by closing a large area to fishing and reductions in effective fishing effort outside the closed area – as a result of several management interventions (such as a reduction of more than 50 percent in days of fishing allowed) – contributed to an improvement in the resource, with biomass increase by a factor of 31 inside the MPA, and by a factor of 6 outside closed areas during the same time period.

Despite this, however, there was no significant difference in average recruitment (Hart, 2005, p. 6). Thus this dramatic improvement in the status of sea scallops in the area seems to have been a result of increased survival of recruits, not reproductive output. In summary, there is some evidence that eggs and larvae are indeed exported from MPAs, but, at the same time, there is little evidence of a positive effect on recruitment. This is not unexpected, given the high variability of recruitment success in most marine species. It is nevertheless reasonable to expect that MPAs may function as insurance if the stocks outside them become very seriously depleted. Improved monitoring and research on the dynamics of recruitment of marine species are needed to better understand these aspects.

ANNEX 3

MODELS USED FOR FISHERIES MANAGEMENT AND MPAs

Many types of models exist for fisheries management, such as stock assessment and bioeconomic models. Here the focus is on models that are particularly relevant to MPAs in a fisheries context and which address MPA effects on fish mortality, networks of MPAs for sustaining fish populations, and risk management.

MODELLING THE EFFECTS OF MPAs ON FISH MORTALITY

If fishing effort in an area to be protected by MPAs is eliminated, it is reasonable to expect fish mortality to be reduced by the same amount as the fraction of the catch foregone because of the MPA. For example, if the area to be protected by an MPA had accounted for 20 percent of the total catch, then fish mortality would be reduced by 20 percent. However, the actual reduction in fish mortality will be less, because the fishing effort is usually displaced to another area, rather than being eliminated. A key aspect of predicting the effects of a proposed MPA on fish mortality is to model what happens to effort displaced from an MPA.

One approach is to model the effects of an MPA by assuming that displaced fishing effort will be redeployed so as to maximize economic benefits. Benefits depend on costs and revenues. The cost of fishing may depend on the area fished, particularly as a function of the distance from fishing ports. Revenues also depend on the area fished as a function of the concentration of fish. While an MPA may be designed to reduce fish mortality on specific species, revenues may depend on area-specific concentrations of a broader group of species. Such models require spatial data on multispecies concentrations of fish and the cost differences.

Statistical or mathematical modelling techniques have been used to predict the likely reactions of fishers to area closures (see Box 11). These approaches allow scientists to evaluate in advance how effective fishing closures will be in achieving fish mortality targets. They also allow managers to take into account

the effects of the closed area on other species, so that they do not unknowingly cause overfishing as a result of effort redeployment. More-comprehensive modelling approaches have also been described in the scientific literature, although they are not routinely applied.[1]

Modelling networks of MPAs to sustain fish populations

The effectiveness of MPAs as a source of reproductive products depends on the amount of area protected and the mobility of the protected fish species. It also depends on the suitability of the habitat protected for the species of interest. For more-mobile species, more area needs to be protected to achieve the same amount of reproductive output. Patterns of dispersion and advection in the planktonic early-life-history stages of fish species, and the location of MPAs and spacing between them, determine whether populations within MPAs can be self-sustaining, independently of the intensity of fishing outside. Models have been developed to address these aspects of MPA design.[2] However, they require data on the movement patterns of juvenile and adult fish and the oceanographic currents that transport planktonic stages. The problem is further complicated by the behavioural patterns of larval fish, which migrate vertically in the water column depending on currents and light conditions, thus influencing how they are dispersed and advected.

Models to evaluate and manage risk through robust fisheries management

In fisheries management there is a need to understand risks (the probability that the outcome of a management decision will be 'negative'), and to develop the means to deal with those risks and the underlying uncertainties that produce them. This may involve two distinct tasks (Charles, 2001, Chapter 11):

- *Risk assessment* involves technical approaches to analysing uncertainty, measuring risks, and predicting the outcome of given harvesting and management scenarios within an environment of uncertainty. Risk assessment involves: (i) assessing the likelihood that certain undesired outcomes will occur; and (ii) assessing the impact or importance of the consequences if that outcome does occur. The relative importance of the risk is then a product of the likelihood and the impact. For example, a low likelihood of a hurricane may be more

[1] For example, Pelletier and Mahevas (2005) describe "A spatially explicit fisheries simulation model for policy evaluation".

[2] These models were reviewed in Botsford, Micheli and Parma, 2006.

important than a high risk of a more moderate storm. Risk assessment can be undertaken using sophisticated quantitative models, but can also be performed using qualitative methods, including stakeholder opinion.

- *Risk management* involves efforts to manage, reduce or otherwise cope with risks in fisheries both through technical (analytical) means designed to drive 'optimal' management plans in the face of uncertainty – perhaps to minimize certain risks or to balance risk and fishery benefits – and through structural (design) approaches involving the creation and adoption of robust management approaches and the precautionary approach. Risk management concerns decisions about the 'best' course of action in the face of risk.

The use of MPAs as a hedge against uncertainty is mentioned in several places in these Guidelines (e.g. in Chapter 3). A more comprehensive approach to risk assessment is to use so-called 'operating models', which represent the full range of uncertainties in fisheries management and help evaluate management options in terms of robustness. Operating models can represent fisheries and ecosystems spatially and they can include MPAs as a management tool, either in isolation or combined with other management measures. Such models do not reduce uncertainty, but they more realistically represent it, and they allow decision-makers to identify the options that are most robust to uncertainty in terms of achieving objectives. An example of a particularly complete operating model is 'Atlantis',[3] developed by Australian scientists. This model not only characterizes an entire ecosystem, but it also includes key elements of the management process such as implementation uncertainty.

[3] Atlantis was developed by Beth Fulton and Anthony Smith of Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia. It is being adapted for applications outside Australia. A PowerPoint presentation is available at www.ices06sfms.com/documents/Session No 1 (1 Smith.ppt, 341,32,AMS, phase 2, Atlantis).

ANNEX 4

CONFLICT MANAGEMENT

Conflicts over fisheries and marine resources have many dimensions including, but not limited to, power, technology, politics, gender, age and ethnicity. Conflicts take place at a variety of levels, from household to community, regional, societal and global scales. The intensity may vary from confusion and frustration over the directions fisheries management is taking to violent clashes between groups over resource property rights and responsibilities (Pomeroy and Riviera-Guieb, 2006).

SOURCES OF CONFLICT

Conflict may result from power differences between individuals or groups or through actions that threaten livelihoods. The use of natural resources is susceptible to conflict for a number of reasons (Buckles and Rusnak, 1999):

- Natural resources are embedded in an environment or interconnected space where actions by one individual or group may generate effects far off-site.
- Natural resources are embedded in a shared social space where complex and unequal relations are established among a wide range of social actors – fishers, fish traders, boat owners, government agencies, etc. Those actors with the greatest access to power are best able to influence natural resource decisions in their favour.
- Natural resources are subject to increasing scarcity due to rapid environmental change, increasing demand and their unequal distribution.
- Natural resources are used by people in ways that are defined symbolically. Aquatic species and coral reefs are not just material resources that people compete over, but are part of a particular way of life, an ethnic identity and a set of gender and age roles. These symbolic dimensions of natural resources lend themselves to ideological, social and political struggles that have enormous practical significance for their management and the process of conflict management.

TYPOLOGY OF CONFLICTS

Conflicts may arise due to different causes and at various levels. Generally speaking, conflicts can be categorized into four groups based on the central critical situation or the cause. Varying types of solutions may need to be sought depending on the cause of the conflict:

- *Data and facts:* These types of conflicts can often be resolved by obtaining additional data, carrying out more studies, etc.
- *Needs and interests:* These conflicts may occur over sharing the benefits of projects, choices in the allocation of resources, or the financing of external costs. This type of conflict is the focus of most conflict management.
- *Values:* Conflicts over values, where values can be defined as deeply held beliefs, are usually not amenable to negotiation or other conflict management approaches. Here the solution may be to agree to disagree.
- *Relationships:* These are often caused by personality conflicts and may be resolved through mediation by a third party.

Conflicts may be well-defined (sharp boundaries and constraints; clear solutions may exist) or ill-defined (unclear objectives and values; difficult to identify solutions). Relationships and the balance of power among the parties involved are important issues in all conflicts. Differing value systems may affect the relationship between the parties. Imbalances of power are not conducive to even-handed negotiation.

Fisheries and coastal management conflicts are usually multi-issue, multiparty conflicts, which adds to the complexity of dealing with them.

THE CONCEPT OF CONFLICT MANAGEMENT

Conflict management is about helping people in conflict develop an effective process for dealing with their differences. It is a voluntary and collaborative approach that recognizes that the parties in a dispute have diverse and frequently opposing views about the proper solution to a problem, but acknowledges that each group's views, from the group's perspective, may be both rational and legitimate. Thus, the goal of people working in conflict management is not to avoid conflict, but to develop the skills that can help people express their differences and solve their problems through collaboration.

The emphasis on the word 'voluntary', or mutually agreed on, is essential and refers to the fact that conflict management approaches will only work if all parties to the conflict are convinced that they will be treated fairly, or at least

may be better off by participating than they would be otherwise. This implies that as long as one of the parties feels that it can force its own solution, or could obtain a total victory at acceptable costs through the courts, or would actually benefit from no action, then conflict management approaches will not work.

CONFLICT ASSESSMENT

A first step in conflict management is assessment. An analysis of a particular conflict can provide insights into the nature, scope and stage of conflict and the approach(es) to its management. Four main factors should be analysed in determining the scope, nature and stage of a conflict:

- *Characterization of conflict and stakeholders:* The type of conflict encountered, the number of stakeholders, and the relationships among them. The nature and origin of conflict are analysed, as well as the balance of power among the parties.
- *Stage in the project cycle:* Conflicts at the 'beginnings' stage are likely to be different from conflicts at the implementation stage. New stakeholders may arise as the project proceeds. This requires that management be flexible and adaptive to changing circumstances.
- *Stage in the conflict process:* A determination of whether conflict is at a point at which interventions may be accepted.
- *Legal and institutional context:* The formal and informal institutions involved, the manner in which conflicts are resolved through them, and the formal legal doctrines or customary practices may influence the appropriate approach.

Five responses of people to conflict have been identified, depending on the importance of achieving a goal or maintaining personal relationships:

- *Accommodation*: When one party wants to maintain personal relationships with the other party, he or she may choose to accommodate the other party's goal.
- *Withdrawal*: One party may opt to avoid confrontation or withdraw from the conflict because he or she is neither interested in maintaining a personal relationship nor concerned with achieving a goal. Withdrawal can often persuade reluctant and more powerful parties to negotiate towards consensus.
- *Force*: One party holds more power over another party and is not concerned about damaging relationships and is keen on achieving the goal.

- *Compromise*: One party may have to give up something, which results in a 'win–lose' outcome.
- *Consensus*: Involves avoiding tradeoffs and seeking a 'win–win' outcome through better understanding of the issues at stake and negotiation.

APPROACHES TO CONFLICT MANAGEMENT

'Conflict management' is often used as the overarching term for both conflict prevention, or consensus-building, and conflict resolution. It refers to a variety of collaborative approaches, including conciliation, negotiation and mediation. They differ in the extent to which the parties in conflict control the process and outcome. *Conciliation or arbitration* consists of an attempt by a neutral third party to communicate separately with disputing parties to reduce tensions and reach agreement on a process for addressing a dispute. The third party has legal authority to impose a solution. *Negotiation* is a voluntary process in which parties meet 'face-to-face', with or without the assistance of a facilitator, to reach a mutually acceptable resolution of the issues in a conflict. *Mediation* involves the assistance of a neutral third party, a mediator, who helps the parties in conflict jointly reach agreement in a negotiation process, but has no power to direct the parties or impose a solution in a dispute. Through conflict resolution approaches, multiparty 'win–win' options are sought by focusing on the problem (not the person) and by creating awareness of interdependence among stakeholders.

Conflict resolution approaches are dependent on specific cultural, institutional and legal conditions, such as volunteerism, willingness to publicly acknowledge a conflict, and administrative and financial support for negotiated solutions, which may not be present in every context. Attitudes towards compromise, consensus or mediation vary. In some societies, openly discussing conflict may involve 'losing face'. Conflict resolution approaches may be counterproductive if the process brings groups together to mediate their differences when the causes of conflict and obstacles to resolution are beyond their control. There is also concern that a dependence on mediators to resolve conflict may develop, to the neglect of building local capacity to do so. In addition, there is a need to acknowledge that people may use other mechanisms, such as peer pressure, ostracism or public humiliation to resolve disputes. Western approaches to conflict management should be balanced with the systematic study of local practices, insights and resources used to manage conflict.

Multistakeholder analysis of problem areas and conflicts may serve as an aid to conflict management that is able address the complex interactions between stakeholders and natural resources at various levels. Such analysis offers a general analytical framework for examining the differences in interests and power relations among stakeholders, with a view to identifying who is affected by what and who can influence current patterns of natural resource management. This knowledge can facilitate *consensus-building.* Various methods such as PRA, participatory research, class, power and gender analysis can also be used.

Problem analysis from the points of view of all stakeholders can help separate the multiple causes of conflict and bring a wealth of knowledge to bear on the identification and development of solutions. When stakeholders come to recognize for themselves the common interests and strategic differences that connect them to each other, new opportunities can emerge for turning conflict into collaboration. This approach is especially appropriate in early, strategic stages of the planning process, to develop directions or strategies supported by a large number of stakeholders.

SELECTING AN APPROACH

Conflict is a dynamic process that generally progresses from initiation to escalation, controlled maintenance, abatement and termination/resolution. There are generally four stages to every conflict, with appropriate approaches to management:

- Potential or dormant conflict (consensus-building/relationship-building);
- Erupting conflict, with positions being developed (range of options, depending on the nature of conflict and relationship of parties);
- Evolving conflict, progressing towards a stalemate (mediation or arbitration) or towards resolution/abatement (no assistance or facilitation);
- Resolved conflict (depends on situation).

Choosing the correct approach through which to address a particular conflict is in itself a strategic choice. Parties to a dispute must first decide whether to seek resolution to a conflict through a non-consensual process or through more collaborative means. Once the decision has been made to use alternative conflict management processes, the parties must decide on which specific approach to employ. No single approach is effective in all cases. The circumstances of conflict and therefore the obstacles to agreement vary from one case to another.

Disputes may involve many or few parties, the problem may be more or less urgent, emotional investment of the stakeholders may vary, the public interest may or may not be at stake, and the factors involved may be well understood or may be uncertain. Gaining expertise in conflict management includes learning about the specific advantages and disadvantages of the various approaches, and assessing which is best for addressing a particular conflict situation.

FURTHER READING

The Forestry Policy and Planning Division of FAO, in close collaboration with the Regional Community Forestry Training Center (RECOFTC) in Bangkok, Thailand, has developed a comprehensive training package on Community-based Forest Resource Conflict Management. While focused on forestry, the process is also relevant to conflict management in fisheries and coastal resources (FAO and RECOFTC, 2002).

GLOSSARY

'(the) Area'
The seabed and ocean floor and subsoil thereof, beyond the limits of national jurisdiction.
Source: United Nations, 1982, UNCLOS Part 1.

Benthic
Refers to organisms that live on or in the seabed.

Biodiversity (biological diversity)
The variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Source: CBD, 2000.

Bycatch
Organisms taken in a fishery that is targeting other species or another size range of the same species. That part of the bycatch with no economic value is usually discarded and returned to the sea, usually dead or dying.
Source: FAO, 2003a.

Ecosystem
An organizational unit consisting of an aggregation of plants, animals (including humans) and microorganisms, along with non-living components of the environment.
Source: FAO, 2003a.

Ecosystem approach (EA)
The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and equitable, sustainable use. It is based on the application of appropriate scientific methodologies focused on levels of biological organization that encompass the essential processes, functions and interactions among organisms and their

environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems.
Source: CBD, 2000.

Ecosystem approach to fisheries (EAF)
An approach to fisheries management and development that strives to balance diverse societal objectives by taking into account knowledge and uncertainties regarding biotic, abiotic and human components of ecosystems and their interactions, and by applying an integrated approach to fisheries within ecologically meaningful boundaries. The purpose of EAF is to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems.
Source: FAO, 2003a.

Ecosystem services
The conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life. Examples include provision of clean water and food (fishery resources), maintenance of liveable climates (carbon sequestration), pollination of crops and native vegetation, and fulfilment of people's cultural, spiritual and intellectual needs.
Source: FAO, 2005a.

Exclusive economic zone (EEZ)
A zone under national jurisdiction (up to 200 nautical miles wide) declared in line with the provisions of the 1982 United Nations Convention on the Law of the Sea (UNCLOS), under which a coastal state has the right to explore and exploit, and the responsibility to conserve and manage, the living and non-living resources of the zone.
Source: FAO Fisheries Glossary (www.fao.org/fi/glossary/).

Fishery
The term 'fishery' can refer to the sum of all fishing activities for a given resource, for example, a hake or shrimp fishery. It may also refer to the activities of a single type or style of fishing for a particular resource, for example a beach seine fishery or trawl fishery. The term is used in both senses in this document and, where necessary, the particular application is specified.
Source: FAO, 2003a.

Fisheries management measures
Specific controls applied in a fishery to contribute to achieving the objectives, including input controls (fishing effort limitations), output controls (catch quotas), technical measures (gear regulations, closed areas and time closures), and socio-economic incentives (access and use rights).
Source: Cochrane, 2002.

Fisheries refugia
Spatially and geographically defined marine or coastal areas in which specific management measures are applied to sustain important species (fishery resources) during critical stages of their life cycle, with a view to their sustainable use.
Source: UNEP-SCS, no date.

Fishing capacity
The amount of fish (or fishing effort) that can be produced for a period of time (e.g. a year of a fishing season) by a vessel or a fleet that is fully utilized and for a given resource condition.
Source: FAO Fisheries Glossary (www.fao.org/fi/glossary/).

Fishing effort
The total amount of fishing activity on the fishing grounds over a given period of time, often expressed for a specific gear type, for example number of hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day. Fishing effort would frequently be measured as the product of: (i) the total time spent fishing, and (ii) the amount of fishing gear of a specific type used on the fishing grounds over a given unit of time. When two or more kinds of gear are used, they must be adjusted to some standard type in order to derive an estimate of total fishing effort.
Source: FAO, 2003a.

Fish mortality
Fish mortality (F) refers to the proportion of the available fish being removed by fishing. It is usually expressed as an instantaneous rate and should reflect all deaths in the stock due to fishing, not just the fish actually landed. For management purposes, it is important to consider how F is distributed among age groups (based on Restrepo, 1999.)
Source: FAO, 1997; and FAO Fisheries Glossary (www.fao.org/fi/glossary/).

Fish population
A group of fish of one species that shares common ecological and genetic features and occupies the same geographical space. The fish stocks defined for the purposes of stock assessment and management do not necessarily coincide with self-contained populations.
Source: Based on Restrepo, 1999.

Fish stock (fishery resource)
The living resources in the marine community or fish population from which catches are taken in a fishery. In a particular fishery, the fish stock may be one or several species of fish, but the definition is also intended to include commercial invertebrates and plants. From the fisheries management point of view, the most suitable definition of 'stock unit' is probably the one provided by Gulland (1969; 1983), who proposed, on operational criteria and practical grounds, that a group of fish can be treated as a 'stock' and managed as an independent unit if the results of assessment and the impact of management measures do not differ significantly from what they would be in the case of a truly independent stock.
Source: FAO, 2006.

Governance
The formal and informal arrangements, institutions, and mores that determine how resources or an environment are utilized; how problems and opportunities are evaluated and analysed, what behaviour is deemed acceptable or forbidden, and what rules and sanctions are applied to affect the pattern of resource and environmental use.
Source: Juda, 1999.

High seas
UNCLOS uses this term to include everything not within any country's EEZ, territorial sea, internal waters, contiguous zone or archipelagic waters. The seafloor beyond national outer continental shelves (OCS), extending from territorial seas to a distance between 200 and 350 nautical miles from the baseline, and in which countries have rights regarding the exploitation of non-living marine resources and sedentary living resources on or in the seabed, is referred to as 'the Area' (q.v.). In this document, the terms 'high seas and 'areas

beyond national jurisdiction' are used to refer to both the Area and the high seas according to the UNCLOS definitions.
Source: FAO, 2007a.

Integrated management
Integrated management (whether of oceans, coasts, watersheds, etc.) is a term used for several approaches, or mechanisms, for managing multiple (competing) uses of a certain designated area (e.g. integrated coastal [zone or area] management – ICM, ICZM, ICAM – and integrated ocean management – IOM). These uses include sectors such as fisheries, aquaculture, forestry, oil and gas, mining, agriculture, shipping and tourism. Integrated management involves managing multiple stakeholders (e.g. local communities and industries), as well as interactions among people and other components of ecosystems, and among multiple levels of government. There are several approaches to integrated management.
Source: FAO, 2008b.

Livelihood
A means of securing the necessities of life. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets, both now and in the future, while not undermining the natural resource base (based on Chambers and Conway, 1992).
Source: FAO Fisheries Glossary (www.fao.org/fi/glossary/).

(Marine) community
A group of ecologically-related populations of various species of organisms occurring in a particular place and time. NB: Not to be confused with a human community.
Source: UNEP-WCMC Glossary of biodiversity terms (www.unep-wcmc.org/reception/glossary.htm).

Monitoring, control and surveillance (MCS)
Activities undertaken by the fishery enforcement system to ensure compliance with fishery regulations. A suite of MCS activities includes: (i) *Monitoring* – the collection, measurement and analysis of fishing activity, including, but

not limited to: catch, species composition, fishing effort, bycatch, discards, area of operations, etc.; (ii) *Control* – the specification of the terms and conditions under which resources can be harvested; and (iii) *Surveillance* – the regulation and supervision of fishing activity to ensure that national legislation and terms, conditions of access and management measures are observed.
Source: FAO, 2005b.

Open-access fishery
A condition describing a fishery open to anyone who wants to fish.
Source: FAO, 2003a.

Reference point
A reference point indicates a particular state of a fisheries indicator corresponding to a situation considered desirable ('target reference point'), or undesirable and requiring immediate action ('limit reference point' and 'threshold reference point'). Also referred to as a 'reference value'.
Source: Caddy and Mahon, 1995.

Resilience
Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure, identity and feedbacks of regulation mechanisms.
Source: Based on Walker *et al.,* 2004.

Recruitment (to a fishery)
The number of fish added to the exploitable stock in the fishing area each year, through reproduction and growth of young fish to an exploitable size or migration (i.e. the fish move into the fishing area).
Source: FAO Fisheries Glossary (www.fao.org/fi/glossary/).

Sedentary (species)
Sedentary organisms have been defined, at the harvestable stage, as either immobile on or under the seabed or unable to move except in constant physical contact with the seabed or the subsoil (FAO Fisheries Glossary, based on UNCLOS Article 77[4]). However, in this document "sedentary organisms are those whose movements are short-range when compared with the spatial

scale of the fishing process (fleet displacements) or pelagic larval dispersal" (Hilborn *et al.*, 2004, 200).
Source: FAO Fisheries Glossary (www.fao.org/fi/glossary/); and Hilborn *et al.*, 2004.

Shadow price
In economic analysis, this is the true economic price of a good or service. It is calculated based on the opportunity cost for those goods and services that do not have a market price, perhaps because they are set by government. Shadow-pricing is often used in cost–benefit analysis when the purpose is to capture all the variables involved in a decision, not merely those for which market prices exist.
Source: The Economist (www.economist.com/research/economics/alphabetic.cfm?letter=s).

Stakeholder
Any individual, group, organization or sector in society that has a clearly identifiable interest in the outcome of a policy or decision-making situation. The interest may be in the form of a specific management responsibility, a commercial interest (resource supply, revenue, employment, trading activity), a subsistence need or some other commitment, as a member of civil society.
Source: FAO, 1999.

Sustainable use of living marine resources
The use of living marine resources in a way and at a rate that does not lead to the long-term decline of their productive capacity, thereby maintaining their potential to meet the needs and aspirations of present and future generations.
Source: Based on Cochrane, 2002.

Sustainable yield
The amount of biomass or the number of units that can be harvested currently in a fishery without leading to long-term decline of the population.

Target species
Those species that are primarily sought by the fishers in a particular fishery: the subject of directed fishing effort in a fishery. There may be primary as well as secondary target species.
Source: FAO, 2003a.

Use, management and property rights

Fisheries management measures can be seen from the perspective of use rights, that is, the rights held by fishers and communities that define by whom and how the fishery resources can be used. Use rights can be divided into two categories: access rights and withdrawal rights. Rights to participate in the management of the resources are referred to as management rights. Both use rights and management rights fall under the overall heading of property rights, describing the relationship between people and various forms of property.
Source: Charles, 2002; and FAO, 2005c.

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This document has been developed to provide information and guidance on the use of marine protected areas (MPAs) in the context of fisheries. As MPA implementation moves ahead in the arena of marine biodiversity conservation, many people feel that the fisheries aspects are not fully understood nor always appropriately taken into account, and that guidance specific to this sector is needed. These Guidelines look specifically at fisheries features of MPAs, but also address the interface between fisheries management and biodiversity conservation and provide support for MPAs with multiple objectives.

The Guidelines are divided into two sections: the first discusses definitions and context, and provides background information on fisheries management, the ecosystem approach to fisheries (EAF) and MPAs as a tool for fisheries management, including socio-economic and biological impacts. The second section considers the planning and implementing of MPAs including the institutional, legal and policy context, the planning process and actual implementation considerations. Conclusions and future directions are offered in the last chapter of this section, while a selection of annexes offers in-depth information on a few key issues.

The document highlights the need for increased coordination across sectors and agencies/departments. Integration of diverse interests and viewpoints is required if we are to successfully manage our oceans and their resources for future generations. As with all fisheries management, good governance – including adequate stakeholder participation – is key to successful and equitable management outcomes.

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