How is Your MPA Doing? A Guidebook and Indicators to Evaluate Management Effectiveness of Marine Protected Areas

Lani Watson[1], John E. Parks[2], Robert Pomeroy[3],
Gonzalo Cid[4], Charles Ehler[4], Simon Cripps[5], Miguel Jorge[6]

[1]NOAA National Ocean Service, Special Projects
[2]Community Conservation Network
[3]Department of Agricultural and Resource Economics, University of Connecticut
[4]NOAA National Ocean Service, International Program Office
[5]World Wide Fund For Nature (WWF), Endangered Seas Programme
[6]World Wide Fund For Nature, U.S.

Abstract

An increasing need exists for the evaluation and understanding of the effectiveness of marine protected areas (MPAs) operating around the world. To meet this need, in 2000 IUCN's World Commission on Protected Areas-Marine and the World Wide Fund for Nature jointly initiated the *MPA Management Effectiveness Initiative* (MEI), an international collaborative project designed to create a methodology for planning and conducting performance evaluations of MPA management effectiveness. After a two-year participatory design and testing process, the initiative identified and described a set of biophysical, socioeconomic, and governance indicators that can be selected and adapted to fulfill different MPAs' evaluation needs while accounting for the different resources they have available. MPAs around the world field-tested a draft version of the methodology and indicators, providing feedback and results that were incorporated into the final version of the guidebook. Most of the participating pilot sites reported that in using this process they believe they were able to pick appropriate indicators for their site and follow the process described in the guidebook. Each site gained insights into ways to more effectively manage their sites. The most important constraints reported during this process include the restriction of time to perform the indicator measurements, interference of seasonal activities and weather, lack of experience to perform evaluation, and unfamiliarity with certain indicators and measurement methods. The methodology, indicators, and three pilot site demonstration cases were presented at the 2003 World Park Congress in Durban, South Africa. This paper presents an overview of the MPA-MEI methodology and indicators, results of the testing phase of the guidebook at MPAs around the world, and considerations for its application. The final guidebook will be published in 2004.

Why Evaluate the Management Effectiveness of Marine Protected Areas?

Broad expectations are being placed on marine protected areas (MPAs) as instruments to protect and/or restore marine biodiversity and ecosystem function, to reduce poverty, and to provide coastal communities with a strong foundation for economic growth. At the same time, it is well understood that MPAs are often challenged in their ability to achieve their objectives by, for example, insufficient financial and technical resources, lack of trained staff, and lack of scientific data on the effects of the MPA. These factors can all inhibit their abilities to achieve their objectives and to provide for informed management decision-making (*Kelleher et al., 1995*).

Performance evaluation of MPA impact and value is seen as a top priority to assess and adapt management needs where both, terrestrial and marine protected areas, are actively being implemented around the world. Evaluation of management effectiveness of protected areas can play a critical role in providing for and demonstrating long-term positive impacts on biodiversity and the human communities that depend on these resources (Hockings *et al*., 2000).

For the purposes of this paper, *management effectiveness* is defined as the degree to which a protected area is managed to achieve its goals and objectives however defined (Hockings *et al*., 2000). Assessing management effectiveness is an important way to document how protected areas are or are not meeting their stated goals and objectives. Therefore, evaluating management effectiveness should, theoretically, lead to improving protected area planning, implementation, and accountability, and provide the MPA with information with which to implement adaptive management.

In the early 1990s, 383 out of 1,306 MPAs were assessed for management effectiveness. Roughly one-third were judged to have met their management objectives, one-third partially met

their objectives, and the remaining had inadequate information, suggesting that perhaps one-third did not successfully meet their objectives (Kelleher, 1995). More recently in Southeast Asia, of about 332 MPAs whose management effectiveness can be determined, only 14% are effectively managed, 48% have partially effective management, and 38% have inadequate management (Burke *et al*., 2002). The mixed success of current MPA performance demonstrates an important and immediate need to build capacity for MPA management teams to evaluate the effectiveness of their strategies and actions so that they may be able to manage their efforts adaptively and improve the impact and scope of their protective strategies over time.

One of the factors that restrict effective decision-making in adaptively managing MPAs is a lack of information about the status and nature of conditions (including threats) operating within or around MPAs. Obtaining such information requires a periodic and comprehensive assessment of the natural and social processes occurring within and outside the boundaries of MPAs. As such, there is an increasing interest in the development and use of an adequately comprehensive set of indicators that measure the socio-economic, biophysical, and institutional (governance) outcomes from the process associated with MPA management. Organizations such as the IUCN, the World Bank, the Intergovernmental Oceanographic Commission, the World Resources Institute, the Community Conservation Network, and the National Oceanic and Atmospheric Administration (NOAA) have recently been developing efforts for identifying indicators for the performance evaluation of coastal resources management, demonstrating the importance these organizations place on instruments for monitoring the changes of coastal and marine resources, identifying and assessing socio-economic activities, and evaluating the institutional and legal aspects of the coastal resources governance.

Developing Tools to Assist MPA Practitioners

The marine environment is unique and there has been much work on developing survey techniques and management strategies to study and protect natural and cultural marine resources. The application of specific indicators to evaluate management effectiveness in marine ecosystems and coastal communities can serve multiple audiences, including donor agencies, policy makers, management teams, and conservation and development non-governmental organizations. Evaluation results also can be used for a number of purposes, such as, to highlight the progress of MPA management, to assist in identifying and setting new priorities for future management actions, and to ensure accountability and promote better management policies and practices by the agencies and organizations that are responsible for implementing national or local MPAs. Managers might not only use evaluation results to improve future performance and document achievements, but also to report and seek assistance in addressing barriers to stated management goals and objectives. Different stakeholder groups and coastal communities might additionally use completed evaluation results to see how far their interests have been taken into account and addressed in the management of an MPA.

In 2000, IUCN's World Commission on Protected Areas-Marine (WCPA-Marine) and the World Wide Fund for Nature (WWF) launched a collaborative initiative to improve the management of MPAs. The initiative focused on working with managers, planners, and other decision-makers to develop a set of indicators for assessing the effectiveness of MPA use. This initiative is aimed at both enhancing the potential and capability for adaptive management of MPAs as well as improving our understanding of how effective MPAs are now being used around the world. The initiative builds on other work done on measuring effectiveness in protected areas, including the IUCN Management Effectiveness Framework (Hockings, *et al.* 2000).

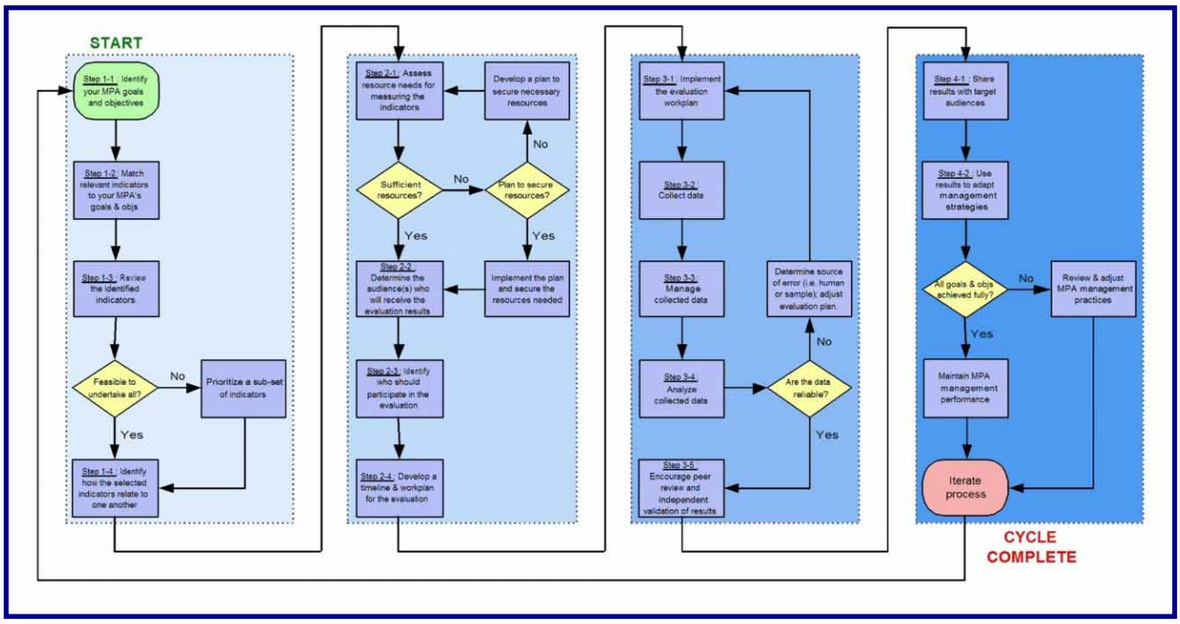
A primary product of the MPA MEI is a guidebook designed to provide step-by-step guidance to managers and other practitioners in: (a) selecting the relevant biophysical, socioeconomic, and governance indicators for the evaluation of a particular MPA, (b) developing a process for planning for and implementing this evaluation, and (c) using the results generated to inform and adaptively manage the MPA. Over the three-year period of the initiative, the following activities were carried out: 1) development of a set of indicators, 2) development of the guidebook methodology with the assistance of expert peer reviewers, and 3) field-testing the methodology and indicators at 18 diverse MPA sites from around the world.

<u>An overview of the guidebook's methodology:</u>

The cornerstone of the guidebook methodology is the selection and measurement of indicators of MPA management effectiveness. The guidebook outlines a four-part process to do this (see Figure 1): (1) select the appropriate indicators, (2) plan and prepare for the evaluation, (3) collect

and analyze data for the selected indicators, and (4) use evaluation results to adapt the MPA's management. In the guidebook, the guidebook is walked through the various steps needed to complete each of the four parts.

Figure 1: The four-part (shaded boxes) process and respective steps described in the guidebook in conducting an evaluation.



Identifying and developing indicators to assess the performance of MPAs is fundamental to evaluating whether their goals and objectives are achieved. There is a wide range of types of indicators that need to be considered when evaluating the overall management effectiveness of a protected area (Hockings, *et al.* 2000). The MPA MEI effort focused on output and outcome indicators. A survey of goals and objectives from MPAs around the world was conducted; these fell into three primary categories: governance, biophysical, and socioeconomic. Next, a survey was done of existing indicators used to measure various aspects of the marine environment and coastal communities. The indicators were then linked to the relevant MPA goals and objectives that they could measure.

The initial draft set of MPA goals, objectives, and indicators was reviewed, evaluated, and ranked by a group of experts at an Indicator Workshop in Venezuela, October 2001. Experts from 17 different countries with diverse backgrounds in MPAs and expertise in governance, biophysical, and socioeconomic fields of study participated. A profile was developed for each indicator that provides a description, methods for collecting data on each indicator, and guidance on analysis of the data (Box 1)**.** In order to help the users of the guidebook in selecting indicators and understanding how easy/difficult to measure they can be, each indicator has a difficulty rating based on the time, technical skills, finances and other resources necessary to undertake measuring the indicator. The set of indicator profiles was peer-reviewed and revised into a final draft. The indicators were developed with a wide range of MPAs in mind, so they are flexible and can be adapted to the specific conditions and situation of a particular MPA.

Box 1. Information provided for each indicator in the guidebook

- Name of indicator
- Goals/objectives related to indicator
- How difficult is it to measure?
- What is…? *(definition)*
- Why measure it? *(purpose/rationale)*
- What is required to measure it? *(resources)*
- How are data collected? *(method)*
- How are results interpreted/shared? *(analysis & communications)*
- Outputs
- Strengths and limitations
- Example *(from a pilot site)*
- References/useful information

Field testing the methodology at pilot MPAs

Field-testing was necessary to test and improve the use of the guidebook and indicator measurement methods. Eighteen MPAs around the world, representing a range of characteristics and purposes, volunteered to pilot the methods and steps outlined in the Guidebook (Figure 1 and Table 1). In a process initiated during a workshop held in Hawaii during September 2002, the MPA pilot sites from around the world selected a set of biophysical, socioeconomic, and governance indicators that were the most appropriate to be tested at their site, based on their aims, interests, capacity, and resources.

Figure 2. Map of participating MPAs

Table 1. List of participating MPAs that tested the guidebook.

MPA	Country	Latitude	Size (km2)	Type of Management
1. Achang Reef Flat Preserve, Piti Bomb Holes Preserve, & Tumon Bay Marine Preserve	Guam	0-15N	4.8 - 3.6	Conventional
2. Banc d'Arguin National Park	Mauritania	15-30N	12,000	Conventional
3. Banco Chinchorro Biosphere Reserve	Mexico	0-15N	1,443	Conventional
4. Bird Island Marine Sanctuary	CNMI	0-15N	1.3	Conventional
5. Bunaken National Park	Indonesia	0-15N	790	Co-Management
6. Channel Islands National Marine Sanctuary	USA	30-45N	4,349	Co-Management
7. Far Eastern Federal Marine Reserve	Russian Federation	30-45N	0.64	Conventional
8. Galapagos Islands Marine Reserve	Ecuador	0	135,000	Co-Management
9. Hol Chan Marine Reserve	Belize	0-15N	18	Semi-Government
10. Lenger Island MPA	Micronesia	0-15N	2	Community-Based
11. Loreto Bay National Park	Mexico	15-30N	2,065	Conventional
12. Mafia Island Marine Park	Tanzania	0-15S	822	Conventional & Co-Management
13. Miramare MPA	Italy	45-60N	1.2	Co-Management
14. Ngemelis & Ngerumekaol	Palau	0-15N	30 - 15	Conventional & Community–Based
15. Sian Ka'an Biosphere Reserve	Mexico	0-15N	6,000	Conventional
16. Tubbataha Reef National Marine Park	Philippines	0-15N	332	Co-Management
17. Upper Gulf of California and Colorado River Delta Biosphere Reserve	Mexico	30-45N	9,340	Conventional
18. Saguenay-St. Lawrence Marine Park	Canada	45-60N	1,138	Conventional

The testing phase at pilot sites lasted approximately six months (September 2002 through March 2003), additional sites not included in these results lasted longer. At the end of this period, pilot sites then submitted an evaluative report of testing results from their use of the guidebook and indicator measurement. The results from the pilot sites allowed the MEI team to appropriately revise and improve the guidebook and its methods in order to ensure that it is applicable and useful across a range of conditions. The pilot site feedback helped to validate and adjust the indicator while demonstrating that they could be used flexibly and adapted across varied conditions, scales and contexts in global MPA application. Pilot site experiences also were documented as case studies in conducting MPA management effectiveness assessments. The incentive for MPA participation as a pilot site was based in their ability to use indicators to build their capacity to adaptively manage their conservation efforts.

Results from field-testing and peer review:

Based on eleven of the sites that field-tested the methodology and indicators, a number of points were observed with regard to the use of the guidebook:

- Most of the pilot MPAs reported that they were able to effectively match the goals and objectives of their sites with those in the guidebook. Some sites found that did not have adequate or clearly defined goals and objectives in their management plans, and used the ones in the guidebook as surrogates to conduct the selection of their indicators. About 80% of the pilot sites reported having selected the necessary type and number of indicators for their management effectiveness evaluation. A few sites proposed some new socioeconomic and governance indicators to be added to the final version of the guidebook.

- The pilot MPAs selected a wide range of the number and type of indicator. On average, each site selected three biophysical, four socioeconomic, and five governance indicators. There was no correlation between the number and type of selected indicators and the characteristics of the pilot MPAs.

- Biophysical and socioeconomic indicators were reported as being the most expensive and time consuming to measure, due to the high cost of materials, time required for field trips and survey preparation, and the cost and time required to mobilize necessary technical support. Pilot sites reported that generally the costs of measuring selected governance indicators were four to five times less than what was required with biophysical and socioeconomic indicators. Biophysical indicators were the most time consuming and costly of the three sets tested.

- In general the methods used by pilot sites to measure the indicators were adhered to as suggested in the guidebook. Alternative measurement methods and data collection techniques were proposed by pilot sites for some indicators, depending on the capacity and resources of the implementing team. In some cases, methods suggested in the guidebook were part of already established monitoring systems at pilot sites, particularly in the case of biophysical indicators. Few alternative methods and techniques were proposed by pilot sites with established monitoring programs and/or qualified working teams.

- Adapting indicator measurement was achieved by pilot teams to address issues specific to their MPA, such as survey site accessibility, differing levels of participation of local communities, size and remoteness of the MPA.

A number of challenges and needs were also identified through the pilot site testing:

- Sites identified the need to have access to socioeconomic and governance specialists. The pilot MPA management teams were largely composed of natural scientists, and very few had social science expertise. In spite of the need for professional assistance in this discipline, the sites did report that they were able to measure the social indicators by following the guidebook instructions.

- The most commonly identified problems by pilot sites were the need for additional financial resources, time, and, most importantly, technical capacity and infrastructure to measure some of the indicators.

- Several sites reported specific limitations at their sites, such as restricted access to some areas of the MPA due to poor weather or distance, or reluctance of local populations to respond to interviews or participate in group evaluation activities as a result of distrust, unfamiliarity, or time requirements.

- Sites with no previous evaluation experience or established monitoring programs emphasized the need for clearly understanding and articulating site goals, objectives before selecting indicators.

Overview of the Indicators:

Around the world, MPAs are expected to operate under many different biophysical, socioeconomic, and institutional (governance) conditions. The causal relationships between such conditions operating in a given location and country, and the direct or indirect influence each has on the health of the area under protection, can be numerous and convoluted. Figure 3 presents a highly simplified representation of such complex relationships and how they inevitably influence whether or not a MPA is capable of achieving its goals and objectives. For example, the rules and regulations governing national fisheries use often directly influence the amount of fishing effort that is allowable within a country's coastal waters. Likewise, the legal orientation of private and communal ownership arrangements over the land—and in some cases, the sea—by institutions or individuals may strongly influence the socioeconomics of a country, such as the distribution of wealth and resulting economic status across society or even poverty rates and food security. In other cases, the existing social conditions may directly influence the natural setting in which a MPA operates. For example, the cultural practices of the dominant ethnic group or values, attitudes, and beliefs held by a specific set of coastal residents may directly determine which species or habitat types within nearshore waters are most heavily fished. The biophysical conditions influenced by operating institutional and socioeconomic conditions in turn influence

A common assumption that may be held by the public and decision-makers involved in the approval, implementation, and maintenance of a MPA is that despite whatever conditions are operating in the country and/or at the location, the MPA will inevitably achieve its stated goals and objectives with sustained time and effort. However, the reality is that even if designed appropriately given the operating conditions, no amount of time or effort will allow a MPA that is not managed effectively to succeed at achieving its intended aims.

In recognition of this need, the guidebook preliminarily (i.e., as a first attempt) identifies a set of 42 indicators: ten biophysical (see Table 2), sixteen socioeconomic (see Table 3) and sixteen governance indicators (see Table 4). Each set of indicators is associated with general goals and objectives that may be part of an MPA.

Table 2. Biophysical Goals and Indicators

Goals (# of associated objectives)	**Indicators**
1. Marine resources sustained or protected (6) 2. Biological diversity protected (7) 3. Individual species protected (4) 4. Habitat protected (4) 5. Degraded areas restored (5)	B1 - Focal species abundance B2 - Focal species population structure B3 - Habitat distribution and complexity B4 - Composition and structure of the community B5 - Recruitment success within the community B6 - Food web integrity B7 - Type, level, and return on o fishing effort B8 - Water quality B9 - Area showing signs of recovery B10 - Area under reduced human use/impacts

Table 3. Socioecomic Goals and Indicators

Goals (# of associated objectives)	Indicators
1. Food security enhanced or maintained (2) 2. Livelihoods enhanced or maintained (4) 3. Non-monetary benefits to society enhanced or maintained (6) 4. Benefits from the MPA equitably distributed (3) 5. Compatibility between management and local culture maximized (2) 6. Environmental awareness and knowledge enhanced (4)	S1 - Local marine resource use patterns S2 - Local values & beliefs re: the marine resources S3 - Level of understanding of human impacts S4 - Perceptions of seafood availability S5 - Perceptions of local resource harvest S6 - Perceptions of non-market and non-use value S7 - Material style of life S8 - Quality of human health S9 - Household income distribution by source S10 - Household occupational structure S11 - Community infrastructure and business S12 - Number and nature of markets S13 - Stakeholder knowledge of natural history S14 - Distribution of formal knowledge to community S15 - % of stakeholder group in leadership positions S16 - Changes in conditions of ancestral and historical sites, features, and/or monuments

Table 4. Governance Goals and Indicators

Goals (# of associated objectives)	Indicators
1. Effective management structures and strategies maintained (6) 2. Effective legal structures and strategies for management maintained (5) 3. Effective stakeholder participation and representation ensured (3) 4. Management plan compliance by resource users enhanced (6) 5. Resource use conflicts managed and reduced (1)	G1 - Level of resource conflict G2 - Existence of a decision-making and management body G3 - Existence and adoption of a management plan G4 - Local understanding of MPA rules and regulations G5 - Existence and adequacy of enabling legislation G6 - Availability and allocation of MPA administrative resources G7 - Existence & application of scientific research and input G8 - Existence & activity level of community organization(s) G9 - Degree of interaction between managers and stakeholders G10 - Proportion of stakeholders trained in sustainable use G11 - Level of training provided to stakeholders in participation G12 - Level of stakeholders participation and satisfaction in management process and activities G13 - Level of stakeholder involvement in surveillance, monitoring, and enforcement G14 - Clearly defined enforcement procedures G15 - Enforcement coverage G16 - Degree of information dissemination to encourage stakeholder compliance

The Biophysical indicators address various factors relating to the natural environment:

- Six focus on the biotic context (B1, B2, B3, B4, B5, B6), including two at the species level (B1, B2), one on habitat (B3), and three on community ecology (B4, B5, B6)
- One measures the ‘goods’ generated (B7)
- One is an abiotic measure (B8)
- Two are ‘aerial’ indicators of observed change (B9, B10)

The Socioeconomic indicators address various factors regarding the social context of stakeholders and neighboring communities:

- Three focus on people’s perceptions (S4, S5, S6)
- Seven focus on households or users (S1, S2, S3, S7, S9, S10, S13)
- Four look at people’s understanding (S2, S3, S13, S14)
- Seven focus on economics (S1, S6, S7, S9, S10, S11, S12)

The Governance indicators address various factors relating to the process used to manage, patrol, and enforce the MPA:

- Four focus on stakeholder participation (G9, G11, G12, G13)

- Four provide measurements on 'input' and 'process' aspects of management (G10, G11, G15, G15)
- Four are 'output' indicators focused on what has been achieved (G2, G3, G8, G12)

Considerations in Use of the Guidebook

All of the pilot site MPAs reported that they found the guidebook and the process outlined "useful" or "very useful", particularly as a learning experience for adaptive management of their MPAs and its relative effectiveness. This was particularly true with MPAs that had no prior experience in in-depth performance review and evaluation, or with no defined evaluation mandate at the local or national level. This finding contradicted the frequently voiced concern that the guidebook would be too technical and dense for most MPAs to undertake.

One of the major limitations reported by MPA managers in their process of using the guidebook was their lack of technical skill and experience in undertaking a management evaluation. This lack of experience is further complicated when there are either poorly defined MPA goals and objectives or an unclear management plan and work plan for the area. Pilot sites confirmed that their testing of the guidebook clearly illustrated the need and relevance of having appropriate and well-defined goals and objectives, particularly prior to conducting an evaluation of an MPA. Several MPA teams indicated that merely the act of clarifying and specifying their MPA's goals and objectives, as well as the assumptions underlying them, was one of the most practical outputs in their use of the guidebook. This consideration is particularly relevant to recently-implemented MPAs, which may assume that commencing a management effectiveness evaluation process early on will not necessarily provide immediate utility.

When pilot sites were asked why the guidebook was found to be a useful instrument in measuring their MPA's management effectiveness, they reported that they saw the guidebook as being flexible enough to adapt the process and indicators provided to the particular situation at each of the pilot site MPAs. This was reported even in the case of MPAs that were community managed and at sites with low to modest financial and technical support. The demonstrated ability for the guidebook to be adaptable to MPAs operating at a variety of scales, capacities, and budgets was of key importance to the development team and WCPA, and demonstrates how the need to provide management tools that can be used by MPA practitioners across a wide, disparate set of natural and social conditions operating across the world can be done (see Agardy *et al.* 2003).

In closing, the guidebook must be viewed as an initial effort. Undoubtedly, it can and should be improved upon in the coming years, based both on the application of newly emerging MPA science and on the experiences and feedback from MPAs actively engaged in management effectiveness. It is hoped that the use of this initial edition will lead to the development of additional indicators and refinement of existing ones that are useful to MPA teams conducting management effectiveness evaluations. Based on the experiences reported to date, evaluating the effectiveness of MPA management has the potential to assist managers and their supporting partner groups, decision-makers, donors, and other interested parties to undertake adaptive management, thereby strengthening management action, enhancing priority setting, and ensuring accountability.

References

Tundi Agardy, Peter Bridgewater, Michael P. Crosby, Jon Day, Paul K. Dayton, Richard Kenchington, Dan Laffoley, Patrick McConney, Peter A. Murray, John E. Parks and Lelei Peau. 2003. "Dangerous Targets? Unresolved Issues and Ideological Clashes Around Marine Protected Areas." *Aquatic Conserv: Mar. Freshw. Ecosyst.* 13(4): 353-367.

Burke, L.; L. Selig, & M. Spalding. 2002. Reefs at Risk in Southeast Asia. The World Resources Institute, Washington DC, USA.

Hockings, M.; S. Stolton & N. Dudley. 2000. Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas. IUCN, WCPA Best Practice Protected Area Guidelines Series #6. IUCN, Gland, Switzerland and Cambridge, UK.

Kelleher, G.; C. Bleakley & S. Wells. 1995. A Global Representative System of Marine Protected Areas, Volume I-IV. The Great Barrier Reef Authority, The World Bank and The World Conservation Union. IUCN, Gland, Switzerland and Cambridge, UK.

Pomeroy, R.; J. Parks & L. Watson. 2004. How is Your MPA Doing? A Guidebook of Natural and Social Indicators for Evaluating Marine Protected Area Management Effectiveness. IUCN, Gland, Switzerland and Cambridge, UK. Available online http://www.iucn.org/bookstore

Acknowledgements
The MPA Management Effectiveness Initiative has been possible with the generous support of the David and Lucille Packard Foundation, WCPA-Marine, the World Wide Fund for Nature, and the National Oceanic and Atmospheric Administration. The authors want to thank the active participation of the managers and staff of the participating MPAs pilot sites for their very valuable contribution and professional testing of the guidebook. Scores of external peer reviewers also provided very important contributions throughout the development and revision of the guidebook.

Figure 3. A conceptual framework of the operating conditions at MPA sites.