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The Role of Marine Protected Areas in EBM: Often Necessary, but Rarely Sufficient by Themselves

Marine protected areas (MPAs) can play an important role in promoting EBM in coastal seas, across ocean basins, and within large marine ecosystems. In working examples of EBM from around the world, the regulatory regimes that are able to move management from a single-species focus to a more holistic ecosystem focus are commonly embedded in protected areas. Examples of EBM that occur wholly within an MPA – from Australia's Great Barrier Reef Marine Park to Europe's Wadden Sea National Parks – are large-scale and integrative, considering many ecosystems in their management. But using MPAs to advance EBM approaches is much more complex (and has infinitely more potential) than merely designing MPAs or MPA networks that encompass large marine areas. MPAs serve a variety of functions in EBM. We review them here.

Achieving EBM through large-scale multiple-use protected areas

Marine protected areas can be thought of as spatial areas for coordinating a wide array of management measures, in order to address the full suite of threats to marine ecosystems and their ecological processes. At the same time, managers must keep in mind that managing ecosystems means addressing human needs and limitations. Thus, protected areas do not automatically become EBM tools as they scale up in size: the management regime that they impose must tackle a wide variety of issues and have maintaining

productivity, diversity, and ecosystem health as the overarching goal of management in order to be full-fledged EBM. Even such integrative MPAs may be unlikely to achieve EBM without coordinated management of areas outside protected area boundaries.

In applying EBM, marine managers often reach for MPAs and MPA networks among the first tools: they are likely to be necessary in the development of effective ecosystem-based management, but unlikely to be sufficient in reaching that overarching goal. Patrick Christie of the University of Washington, who has conducted extensive research on MPAs in the Philippines and Indonesia, describes the use of marine protected areas as “a good starting point for large-scale and integrative management, but not the solution to EBM challenges.”

EBM is a staged process that takes time. Using core protected areas to spatially “ground” marine management is a sound strategy that many marine planners and management agencies employ in attempting to operationalize EBM.

MPAs and MPA networks as a foundation for ecosystem protection

With increasing recognition of the threats to the marine and coastal environment, a wide variety of MPAs and related policy frameworks have been developed to conserve and sustainably use coastal and marine resources and ecosystems. Overarching goals for MPAs can be thought of as related to conservation or to sustainable use, though in many MPAs the goal is to practice both within a circumscribed spatial scale. MPAs can help achieve many objectives, including:

- Biodiversity conservation;
- Conservation of rare and restricted-range species;
- Maintenance or restoration of natural ecosystem functioning at local and regional scales;
- Conservation of areas vital for vulnerable life stages;
- Reducing or minimizing user conflict;
- Managing fisheries (e.g., using reserves to sustain or enhance yields, restore or rebuild stocks

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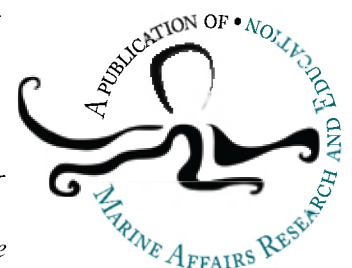
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of overexploited species, and provide insurance against management failures);

- Recreation;
- Education;
- Research; and
- Fulfilling aesthetic needs.

The use of individual marine protected areas has been flourishing; more recently, marine protected area networks are garnering attention. MPA networks are a way to plan MPAs strategically so that the whole is greater than the sum of its parts. Various sorts of MPA networks and systems include representative systems; systems of MPAs designed to protect a single

or suite of target species; MPA networks designed to protect sources and sinks of larval recruits for key species (such as corals or commercially important fish); and MPA networks aimed at protecting critical, linked habitats in a wider region — such as those that span coastal wetlands and soft- and hard-bottom communities offshore.

The government of New Zealand is investing in the development of marine protected areas as one of a number of steps aimed at applying EBM in its Exclusive Economic Zone. In 2000, New Zealand set a target of setting aside 10% of its marine environment in MPAs by 2010. To help build this representative MPA network, the New Zealand Government produced a *Marine Protected Area Policy and Implementation Plan* in 2006, and guidelines for

implementing that plan in 2008. Links to the policy and guidelines are at www.biodiversity.govt.nz/seas/biodiversity/protected/mpa_policy.html.

“The *MPA Policy* is the New Zealand Government’s commitment to a coordinated approach to protecting marine habitats and ecosystems,” says Ann McCrone of the NZ Department of Conservation. “New Zealand’s coastal marine environment has been divided into 14 broad biogeographic regions. An MPA plan-

ning forum will be convened in each of these regions comprising representatives of user groups to develop protection recommendations.” Such groups will include *tangata whenua* (New Zealand’s indigenous people); commercial, recreational, and customary fishers; NGOs; scientists; local and regional councils; tourism operators; and mining and petroleum interests.

Mike Donoghue of the NZ Department of Conservation says the protected areas are critical to the conservation of representative marine habitats, highly mobile species, and threatened endemic species with limited home ranges — in particular Hector’s and Maui’s dolphins. “Protected areas are a versatile tool for promoting conservation with communities, which helps us to find solutions with broad-based local support in a wide range of conservation and management challenges,” he says.

However, planners and managers are quick to acknowledge the importance of looking at areas beyond protected area boundaries. David Johnson, Executive Secretary of the intergovernmental OSPAR Commission, which oversees protection of the Northeast Atlantic marine environment, has stated that although countries have committed to EBM, achieving that goal has been difficult. “While core zones that form the basis of MPAs can conserve critical areas, it may be every bit as important to focus attention on the buffer zones around protected areas,” said Johnson at a recent meeting on Mediterranean high seas protected areas, held in Tunisia. “These areas must be carefully managed, since their condition will likely have a profound influence on the viability of these islands of protection.”

MPAs to protect key species

Protected areas that abate threats to a particular species in a particular place, or that conserve critical habitats for key species, can do more than provide species protection when the species in question is an *umbrella species* (having broad ecological requirements that are shared by many other species), *keystone species* (playing a pivotal role in ecosystem dynamics), or even *flagship species* (charismatic organisms drawing attention to conservation issues). Conservation measures aimed at mitigating threats to such species result in protection for whole communities of organisms, and indeed whole ecosystems. In light of this, investments in conservation of such species can be seen as investments in maintaining overall marine biodiversity and ecosystem functioning. Thus protecting key species using MPAs can be a powerful element of EBM.

A rational approach to conserving or restoring marine populations is to use strictly protected areas to safeguard critical habitats such as feeding areas, breeding areas, and resting or staging grounds. But since these areas are often separated by hundreds of kilometers, the areas between critical habitats are also of concern.

EBM Tip: On MPAs and integrated resource management

The following advice on integrating uses and sectors in the context of MPAs was excerpted by MEAM from *Guidelines for Marine Protected Areas* (IUCN, 1999), available at www.iucn.org/dbtw-wpd/edocs/PAG-003.pdf.

“The value of an MPA can be completely jeopardized if pollution from land-based sources cannot be controlled. Yet few MPA managers in the world can claim they have a decisive influence on activities on land. Nevertheless, influencing the management of the nearby land should be a long-term objective of management, and should be considered when the legal status and powers of the MPA are decided. The more influence the MPA manager has on the control of land-based pollution sources, in particular, the more effective the MPA will be.

“It is a mistake to try to integrate all the relevant uses and sectors at once. One reason why integrated management is so difficult is that managers have tried to deal with all activities at the same time. The key to success is to be selective and deal with the most important issues first. The others can be addressed as the program matures, its credibility grows, and the public accepts the need for integration.”

Identifying and then protecting migration corridors is one technique to ensure the links between the critical habitats remain unbroken. Another is to broaden management to a regional scale, utilizing comprehensive ocean zoning, to help address threats. Regulations within MPAs, within networks, and in the buffer areas in-between, should be tailored to those threats for MPAs to be able to meet their species conservation targets.

Management of MPAs for marine species conservation is complex, requiring sometimes even some knowledge of terrestrial environments, as well as marine ones. Jon Day, Director of Ecosystem Conservation and Sustainable Use for the Great Barrier Reef Marine Park Authority, provides the following example. In the Great Barrier Reef, some mobile marine species spend important parts of their lifecycle outside the MPA, such as the green turtle (*Chelonia mydas*). These turtles lay their eggs on the mainland or on islands that are outside the jurisdiction of the Great Barrier Reef Marine Park. Once they hatch (and if they survive), they move into nearshore marine areas in the adjacent State waters. They then migrate through the Great Barrier Reef Marine Park and across thousands of kilometers of open sea to other countries, where they may be hunted and killed. The females that survive then return to Australia to the same stretch of beach where they were born. This means that effective conservation of this species alone needs to consider local, provincial/state, national and international jurisdictions (both in the open sea and within various countries). Notes Jon Day, "One of the world's largest MPAs is still not large enough to encompass the full lifecycle of the green turtle. And there are many other examples of species that spend large parts of their lifecycle outside the MPA."

Special MPAs: Dynamic MPAs, MPAs on the high seas, and research MPAs

Out beyond the relatively fixed ecosystems of marshes, mangroves, rocky shorelines, seagrasses, and coral reefs, marine ecosystems tend to be highly dynamic, with seasonal and year-to-year changes. MPAs can help us apply EBM that encompasses these elements of offshore ecosystems in at least three ways: 1) through the use of dynamic or transient protected areas; 2) through the use of fixed MPAs on the high seas; and 3) through the use of MPAs that are established specifically to promote research on the ecology of understudied ecosystems and the efficacy of management in those areas.

Researchers and planners are exploring the concept of pelagic protected areas that have movable boundaries or are transient (lasting a short time). David Hyrenbach, an oceanographer at Hawaii Pacific University, admits their use is considerably more difficult than conventional MPAs, but suggests that physical oceanography can provide information on how to prioritize spatial management in pelagic environments. "Large-scale oceanographic conditions such as fronts, upwelling systems, and eddies can be used to predict concentrations of species amenable to spatially-explicit management," says Hyrenbach. "Supplementing such dynamic MPAs with diffuse management in surrounding areas, akin to the use of core areas and buffers in a zoning scheme, would move us closer to true EBM."

Jeffrey Polovina of the (U.S.) National Marine Fisheries Service's Pacific Islands Fisheries Science Center agrees. He has been working with colleagues to identify the temperature regimes where

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More coverage of EBM and MPAs

The April 2009 issue of MEAM's sister newsletter *MPA News* features an article on the relationship between MPAs and EBM, with examples from around the world. Go to <http://depts.washington.edu/mpanews/MPA106.htm>.

The EBM Spectrum

MEAM views ecosystem-based management as a process or journey rather than an endpoint. That journey involves a spectrum of EBM effort: from no EBM in practice (the status quo in many places)...to incremental EBM (sectoral management with some ecosystem-based decision-making)...to comprehensive, multisectoral EBM. In the context of MPAs, the EBM spectrum might appear as follows:

No to low EBM

Example: MPAs used merely to protect a fragment of habitat or a single stock needing recovery from fishing.

Incremental EBM ("EBM Lite")

Example: MPAs designed to protect the ecological functioning of an ecosystem by targeting key ecological processes. This could include a no-take MPA designated to protect important spawning grounds for key species, but which has not addressed land-based sources of pollution that threaten the MPA. Although management in this case has not comprehensively addressed all threats, EBM is still being practiced incrementally.

Full EBM

Example: MPAs that target key species and key processes, addressing the full suite of threats to both. Here MPAs would likely be nested within a comprehensive regional spatial plan.



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threatened loggerhead turtles congregate across the Pacific Basin. This information is then used to guide voluntary closures of the Hawaii longline fishery to prevent accidental take of loggerheads. Says Polovina, "Dynamic closed areas improve on fixed closed areas because they match the realities of [pelagic] species distributions better." (For more details on this innovative program to establish dynamic MPAs, go to www.int-res.com/articles/esr2008/5/n005p267.pdf.)

Similar fishery closures are being designed for other pelagic marine species, such as around bluefin tuna spawning areas in the Indo-Pacific.

Since large marine ecosystems are rarely confined to the waters of coastal nations, extending management to the high seas (beyond national jurisdictions) is a logical element of EBM. High-seas MPAs can help in this regard, but they are much less common than MPAs established in nearshore waters. The world's first trilaterally established MPA covering both national waters and high-seas areas is the Pelagos Sanctuary located in the Ligurian Sea region of the Mediterranean. Much conservation activity is currently focused on identifying key areas to protect

on the high seas — in the Mediterranean and beyond — as they are widely thought to have potential in significantly improving the potential for full EBM in these regions.

The paucity of high-seas MPAs suggests difficulties in using this tool in global commons. Irini Papanicolopulu, a senior research fellow in international law at the Università di Milano-Bicocca in Milan, points out that the United Nations Convention on the Law of the Sea obliges parties to take measures "necessary to protect and preserve rare or fragile ecosystems as well as the habitat of depleted, threatened or endangered species and other forms of marine life." Says Papanicolopulu, "It is evident that such measures must also include, where appropriate, the creation of

MPAs, both in waters subject to the jurisdiction of the coastal States and in the high seas."

Finally, there is the case of MPAs established as research sites to further EBM aims. EBM is facilitated by the use of adaptive management, which uses the management regime to derive information on ecosystem condition — with the aim of providing data to underpin adaptation of management (moving boundaries of protection, changing regulations within management areas, adding or removing catch limits, etc.) so it remains effective over time and changing conditions (both environmental and societal). MPAs can be central to adaptive management because they can provide the control sites and experimental conditions that make such data-sourcing possible.

MPAs as political motivators for EBM efforts

MPAs are useful not only for *in situ* conservation, but also in generating support for wider scale marine management. Protected areas can "put a face on a place" — allowing people to better relate to vast and seemingly amorphous tracts of ocean. Protected areas also provide engagement in planning, and can


Are no-take marine reserves the best way to study marine ecosystems in their natural state?

In March 2009, MEAM and the EBM Tools Network co-hosted a Web-based seminar on the relationship between EBM and ecosystem-based fisheries management. (For an audio recording or text transcript, go to www.ebmtools.org/about_ebm/meam.html.) Marine protected areas were discussed, particularly the use of no-take marine reserves to study the natural state of oceans. Knowledge of that natural state can help measure the ecosystem effects of fishing and other human activities. Webinar panelist Jake Rice, Senior National Advisor for Ecosystem Sciences with Canada's Department of Fisheries and Oceans, was skeptical that no-take marine reserves were the most useful way to study natural systems. In his words:

"Are no-take marine reserves the best place to find out about what a natural system really is like? I would say no. No-take marine reserves are a good way to learn what happens to areas that are not fished. But it does not matter what scale the no-take marine reserve is: there will be system dynamics that go well beyond it that are still influencing what goes on inside it — whether it is the absence of great whales that were fished out 200 years ago, or major oceanographic processes that transport important nutrients or recruits from other areas into it. The systems in which management needs to be most interested are not the areas that are [closed to all fishing], but areas where fishing is sustainable with all the information we have available."

Do you agree with Jake Rice that marine reserves are not a fully effective way to study natural systems? If so, what can be done to address their shortcomings? Or do you disagree with him? Let us know. E-mail your comments to editor@meam.net, and we will publish responses in a future issue.

be used to bring people into planning and management processes. They can also lift the discussion on management out of the constrained realm of scientists and management agencies, to broader discussions that involve user groups and affected communities.

Given the challenge of practicing EBM at the scales appropriate to large marine systems, this motivation is essential. MPAs can raise awareness about marine conservation, can be used in education about the marine environment, and can provide the framework to engage and empower stakeholders. An example of how MPAs have been promoted as a livelihood tool for Pacific Island communities is described in a piece by Hugh Govan of IUCN's World Commission on Protected Areas, available at <http://depts.washington.edu/meam/govan.pdf>. 

Conclusions

- Marine protected areas are one of many tools in the EBM arsenal; they are used to manage uses within ecologically important areas in marine and coastal ecosystems, protect critical habitats for threatened species, and help to resolve user conflicts and build stewardship.
- Since a large part of EBM is aimed at recovering depleted populations and degraded habitats, marine protected areas can also provide special protections to impacted species and habitats so that they may naturally recover from anthropogenic pressures.
- Using MPAs to address ocean issues at ocean basin or large marine ecosystem scales can pave the way to EBM.
- While MPAs and MPA networks are important tools to achieving this large scale management, they should be thought of as strategic mechanisms rather than ends in themselves.

Perspective Having Somewhere to Grow Up: Ecosystem-Based Management of Fisheries for Ocean Recovery

By Katherine Short

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There is a simple logic that creatures need a safe environment to breed, feed, and grow up, and objective science can provide the evidence in support of this. Such “safety” is needed both from direct impacts (such as fishing or dredging for shipping lanes) and from more diffuse impacts — as large as climate change or as insidious as invasive species arriving in ballast water. In addition to ensuring biological functioning, such safety is needed to also secure the resource base on which so many people rely, directly or indirectly, for food and livelihood. Providing such safety has proven difficult despite a wide variety of tools available and significant interest in accomplishing this important goal of marine management.


What is clear, though, is that engaging with stakeholders, ocean users, community groups, big international NGOs, governments, and indigenous peoples can produce longer-lasting objectives for less-damaging management and use. In its most concise terminology, this is EBM. In its longest form, it is varying scales, degrees, interpretations, and applications of the concept of ecosystem-based management.

WWF has been hard at work at both describing and promoting EBM, in both MPA and fisheries contexts. In 2007 it published an extensive set of case studies demonstrating EBM application (see *Implementation of Ecosystem-based Management in Marine Capture Fisheries: Case Studies from WWF's Marine Ecoregions*, available at http://assets.panda.org/downloads/wwf_ebm_toolkit_2007.pdf). It is great to see

copies of the WWF framework well-thumbed and dog-eared around the world as these principles gain more definition and momentum from being applied in specific situations.

What the oceans need is concerted, orchestrated, strategic action and clear, orchestrated “sharing of the space” amongst those trying to work in this realm. This is what fished species need in order to recover the “pillars of life” that many of these species formed, once upon a time, in marine ecosystems. We all need to focus on a meaningful recovery agenda that brings all the relevant tools to bear: campaigns...boycotts...retailer engagement... Marine Stewardship Council engagement...marine protected area networks, specific marine reserves and no-take zones... comprehensive EBM and oceans-management approaches that cover all users...management of bycatch and discards...fighting illegal fishing...and ecolabels or industry codes of practice that are stepping stones on the path to improvement.

These are all just tools in a toolbox that can sit unused without the guiding power of objectives shared by those who care about a given ecosystem, species, seafood commodity, or area.

It is high time for all of us together to use the space that EBM gives us to set these recovery objectives collectively with those in science, government, and industry with organizing bodies such as the new World Ocean Council. Some areas should be recognized and protected for their key role in regenerating entire areas and/or species rather than as species- or place-specific “pet projects” of one group or another that can be ignored by the rest, or that are sacrificed by industries that then block further efforts at protection. These areas need to be part of well-designed networks that support constructive efforts to bring user groups onside, and to empower participants to embrace change for good. Only then will such change offer a sustainable future for both maritime users and the marine environment. 

Perspective Ecosystem-Based Management and Marine Protected Areas: Coming Together in Working Seascapes

By Vera N. Agostini

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A plethora of conservation tools are often invoked to address the escalating crisis in marine ecosystems. Each one comes with its own acronym, group of supporters promoting it, and suite of donor-designed benchmarks to assess the implementation progress. This often creates confusion amongst stakeholders and practitioners as well as diversion of and competition for existing resources. At the end of the day we all have a job to do: design and implement conservation strategies that will be effective in working seascapes. Not a simple task, regardless of your favorite acronym.

Ecosystem-based management and marine protected areas are two such tools on the table. The genesis of each can be traced back to a specific point in time and need (or opportunity). Sadly the two camps are more divided than one would hope for, despite the clear synergies between the two.

Taking advantage of an “opportunity stream” for one tool to accomplish agendas for the other tool has too often come at the expense of effective demonstration and leveraging of links between tools. Energy, skill, and capacity devoted to each tool could instead be harnessed into a larger, more-effective whole. A lot could be gained from this “marriage”.

The Bird’s Head Seascope (BHS) is an excellent demonstration of the power of this marriage. Located on the north-west coast of West Papua (Eastern Indonesia), BHS is the center of the Coral Triangle, the most biodiverse region in the world. A system of MPAs has been established to protect this incredible biodiversity. A wide range of monitoring, education and outreach activities (largely funded by the

Walton Family Foundation) have made the MPA network an accepted tool on the ground to achieve conservation in BHS while maintaining the livelihoods of local people. The area is also increasingly becoming the target for development of a wide variety of economic sectors (e.g., fisheries, energy extraction, tourism). As a result, local governments in this region are facing difficult decisions in their attempt to balance sustainable development of an incredibly rich array of marine resources with conservation of globally significant marine diversity. The growing range of diverse objectives within the seascope as well as the obvious existing ecological, governance, and human connections have made the adoption of an Ecosystem-Based Approach to Management an increasing priority and focus for the BHS. The need to embed this within the existing MPA discourse has been apparent.

The Bird’s Head has had a history of activities, funded largely within the framework of the Packard Foundation’s Bird’s Head EBM initiative, effectively documenting important ecosystem components. The Nature Conservancy (TNC), Conservation International (CI), and World Wide Fund for Nature (WWF) have been working in partnership with local stakeholders to explore and describe the ecological, socioeconomic, and governmental processes that are most important to understand and include in management decisions in the Bird’s Head. Based on the results of these studies, TNC, CI, and WWF are in the process of assisting local and provincial governments to develop environmentally sound development policies. The existing MPA network and related activities are at the core of these policies with multi-use zoning emerging as a central piece. Effectively demonstrating the links between EBM and MPAs — and leveraging existing buy-in on the ground for MPAs to address use issues both inside and outside the protected areas — will clearly be a powerful avenue for the adoption of EBM in the Bird’s Head ecosystem.

EBM is about (a) perceiving the big picture; (b) recognizing and maintaining connections between habitats, biodiversity, and people; and (c) addressing the multiple needs and desires of people. The process underway to zone the existing MPA network in the BHS is an excellent way to address all of the above and get one step closer to effective EBM implementation. At a minimum it will bring a diverse group of players to the table. Achieving this in the BHS is the product of wise pooling of resources and capacity both amongst organizations as well as the MPA and EBM opportunity streams. A great deal can be learned from this marriage. ■

Thinking beyond individual MPAs

MEAM’s sister newsletter *MPA News* reported on the large-scale Bird’s Head Seascope initiative in its October 2006 issue. The article quoted Mark Erdmann, who represents Conservation International on the multi-institutional implementation team. Erdmann addressed the role of MPAs in the Bird’s Head Initiative:

“Each of our organizations has come to the realization that in order to deal most effectively with the global threats of overfishing and biodiversity loss in the oceans, we must not only work much more closely together as conservation partners, but also scale up our approach to tackle large-scale marine conservation. This entails thinking beyond the ‘traditional’ approach of setting up individual MPAs. Rather, it is about designing full networks of MPAs based on a broader EBM concept. That concept explicitly acknowledges oceanographic and genetic connectivity between MPAs and the important role of ecosystem-level processes that operate at a scale much broader than individual MPAs. By doing this, we also explicitly acknowledge the need for marine management tools that extend beyond ‘just’ MPAs, including policies to protect watersheds and regulate fisheries in non-MPA areas.”

Case Study Thinking Outside the (MPA) Box on EBM: Great Barrier Reef Marine Park

By Jon Day

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Marine protected areas, especially large multiple-use areas like the Great Barrier Reef Marine Park on Australia's east coast, provide many lessons for marine managers on how to implement ecosystem-based management. However, MPAs are only part of the equation for EBM.

MPAs often provide specific area protection for valuable features or important areas, but the traditional approach to MPAs usually means that the surrounding and connecting seas, as well as upstream land areas, remained subject to resource extraction, harvesting, and management by other resource agencies, or, in some cases, are subject to no management at all. The requirements for the effective protection of marine biodiversity should therefore also include regulation of land-based and maritime sources of pollution, integrated coastal zone management, and the direct regulation of harvesting marine resources.

Integrated coastal zone/ocean management (ICZOM) is increasingly accepted as an effective means of dealing with complex issues across large marine and coastal areas. To be really effective, however, ICZOM must address issues across all government agencies in all relevant jurisdictions (e.g., local, provincial/state and where necessary national government agencies); the land-sea interface; management issues across all uses and with all user groups; and inter-generational equity concerns. Such ICZOM should also utilize information from a wide variety of disciplines, including ecology, sociology and economics, and must consider the socio-political implications of management decisions as well as bio-physical considerations.

MPAs are only as healthy as surrounding waters

MPAs can provide a key contribution to long-term maintenance and viability of marine ecosystems. This is enhanced even more if there is a network of MPAs developed using a representative basis, and if the MPAs are adequate in size and connectivity. However, without a broader integrated and ecosystem-based strategy, any MPA (or network of MPAs) lacks a context. MPAs can only be as "healthy" as the surrounding marine waters because of the fluid nature of the marine environment and biological interdependency of neighboring communities. A broad-scale ecosystem-based approach that includes

MPAs is preferable to isolated highly protected enclaves within otherwise unmanaged waters.

MPAs can be an important tool to implement EBM. But the converse is also true: EBM is needed to create effective MPAs. This is because planning and managing MPAs is confounded by a number of factors, including:

- The interconnectedness of the marine environment (very high levels of connectivity in the marine environment and the biological interdependency mentioned above);
- The three-dimensional aspects of MPAs cause difficulties for planning and management. Most of our marine environments are not well-known, nor easily viewed, nor easily delineated for planning or management purposes;
- Ownership issues – most MPAs worldwide remain subject to the "tragedy of the commons"; no one owns them yet they are widely used, frequently leading to over-use.

The Great Barrier Reef Marine Park Authority (GBRMPA) has long taken an EBM approach to the management of the 344,400-km² Great Barrier Reef Marine Park, which differs from the management approach adopted in many other MPAs. How so? Many of the reasons relate to its size and its current management regime. Consider the following:

- The Great Barrier Reef has had legislation since 1975 that effectively requires an ecosystem approach, and allows for regulatory controls on activities well outside the jurisdictional area if they adversely affect the area. GBRMPA, for example, was able to develop regulations controlling aquaculture up to 5 km landward of the Marine Park in cases where aquaculture discharge was deemed as having, or likely to have, an adverse impact;
- Since the first zoning plans came into effect in the early 1980s, the entire area has been managed as a multiple-use integrated area, and today the Great Barrier Reef generates about AU \$6 billion (US \$4.4 billion) annually for the Australian economy from a diverse range of uses — the main ones being shipping and tourism, but also most types of fishing, including trawling, research, traditional use, etc.;
- Over the last 30+ years, management has evolved and adapted, and despite the jurisdictional complexities, continues to be well-integrated — for
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example, through complementary legislation for adjoining State and Federal waters — with very good cooperation with most sectors, especially the tourism industry; and

- The legislative controls apply equally to the airspace above the Marine Park (up to 3000 feet) as well as into the seabed.

While there are many other instances around the world where EBM within the MPA context is occurring, there are few areas where integrated management has implemented an EBM approach, including increasing resilience, at this sort of scale.

Finally, it must be noted that planning and managing MPAs needs to consider dynamic systems that are always subject to change. Because both natural systems and MPAs are never static, changes can and

do occur. Frequently the most obvious changes that affect MPAs relate to increasing levels and types of use as well as other changing circumstances, whether they are technological, social, political, or environmental changes.

How easy it is to achieve an "appropriate" level of management given these changing circumstances will depend on a number of factors. These include the type of change(s); the degree of insulation from any external influences, particularly if they are destructive; and the level of social and political acceptability, and the degree of community support for an MPA. It will also depend on its compatibility with existing uses (particularly those undertaken by local people) and its compatibility with existing management regimes and the surrounding management "environment". ■

The EBM Toolbox

New tools for designing and managing marine protected areas

Editor's note: The goal of The EBM Toolbox is to promote awareness of software tools for facilitating EBM processes, and to provide advice on using those tools effectively. It is brought to you by the EBM Tools Network (www.ebmtools.org), a voluntary alliance of leading tool users, developers, and training providers.

By Sarah Carr

Marine protected areas (MPAs) play a critical role in successful EBM. Traditionally, software tools for MPAs have helped with site selection (functionality that is still critically important and constantly improving). As MPAs mature, new tools are being developed for emerging needs such as stakeholder engagement and financial planning. Some of these new tools include:

- **MarineMap Decision Support Tool**

(<http://marinemap.org/marinemap>). MarineMap is a free tool that helps stakeholders to visualize geo-spatial data layers, draw prospective MPA boundaries, share prospective MPA boundaries with other users, and generate graphs and statistics to evaluate MPAs on science-based guidelines.

- **MPA EZ** – the CCIF MPA Financial Management Tool (<http://ccif.digitalclouds.net/costmodel/authentication/login>). MPA EZ is a free web- and Excel-based tool that provides an overview of an MPA's current financial situation. It helps ensure that resource allocation is in-line with management objectives, financial and physical resources are used efficiently, and financing portfolios are sustainable.

MarineMap and MPA EZ, along with a wide variety of other tools for MPA design and management, will be demonstrated live on 19 May 2009 at the MPA and EBM Tools Knowledge Café at the International Marine Conservation Congress in Fairfax, Virginia. The Café will provide an informal opportunity to learn about and preview the tools and discuss specific projects with tool providers. Learn more about the Café at www.ebmtools.org/tools_training/network_training.html.

(Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at www.ebmtools.org. Sign up for Network updates and contact Sarah at www.ebmtools.org/contact.) ■