MARINE ECOSYSTEMS and Management

International news and analysis on marine ecosystem-based management

MEAM
www.MEAM.net
Vol. 5, No. 1
August - September 2011

Paying for EBM: Insights on Building Sustainable Financing for EBM over the Long Term

Management requires funding. Likewise, sustainable management requires sustainable funding. A cornerstone of EBM is that it ensures ecosystems will continue over time to provide the services that people require and want (e.g., food, clean water, biodiversity). Without dependable ways of financing management over the long term, EBM projects are at risk of failure.

Unfortunately, in these economically austere times the traditional stream of government funding for resource management is weakening. So practicing integrated, science-based management at the scales required by EBM means it is in managers' interest to develop new and diverse streams of support. EBM may have to rely on innovative financing mechanisms to sustain planning, research, monitoring, enforcement, and other management activities over long time frames.

Fortunately, there is a growing body of knowledge on developing alternative funding strategies — from user fees, to lotteries, to endowments and trusts, and more. Several projects and publications have emerged in recent years to inform planners and managers about new financing methods for management (see box "Resources on alternative funding mechanisms", page 2). In addition, the science of measuring the societal and financial value of ecosystem services — such as clean water — is informing how charges can be applied to ecosystem use that reflect actual value (see "The EBM Toolbox: Quantifying, mapping, and valuing ecosystem services", page 8).

Despite these advances, the field of alternative financing for ocean management is still new, and securing dependable long-term funding remains a significant and central challenge for EBM practice. In this issue, MEAM asked three practitioners — an EBM funder, a project director, and a fisheries manager — for their insights on making EBM financing sustainable. Notably, even with their different backgrounds, they each pointed out the importance of aligning EBM goals with the interests of management and stakeholders.

A. Turning EBM into "business as usual" can help lead to financial sustainability

By Bernd Cordes

[**Editor's note:** Bernd Cordes is a program officer at the David and Lucile Packard Foundation. The foundation's Conservation and Science Program provided funding for several site-based marine EBM projects in the Western Pacific. Some of the projects were funded previously by the foundation's Ecosystem-Based Management Initiative for Sustainable Coastal and Marine Systems, which was active from 2004-2009. A report with lessons from that initiative is available at **www.packard.org/wp-content/uploads/2011/03/Synthesis-Report-for-the-EBM-Initiative.pdf.**]

On EBM sustainability in general

EBM is big, multi-sectoral, multi-stakeholder, etc. A sustained EBM effort would require, at a minimum:

- A well-defined spatial area or linked habitats;
- A distillation of a limited, relevant set of ecosystem- or habitat-level indicators that point to ongoing environmental health (or lack thereof);
- A core set of scientists and citizen scientists (read: trained and skilled volunteers and observers);
- A very clear mechanism by which information and analyses are linked to decision-makers who can use the information to change resource use (if not, why do it?); and
- A funding source to continue the data collection and analysis. That funding source would have to be a combination of consistent and committed government allocations (state, provincial, national)

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to cover that basic, core level of monitoring over time (the "must know"; and to do this, you probably need legislation), along with grants from a combination of corporate and other private sector stakeholders (e.g., foundations, individual donations, and the industries utilizing resources in the area). The grants could fund the "above and beyond" minimum set — the information that would be "important to know" and not just the "must know".

Six years ago in the Conservation and Science Program's original request for proposals for site-based EBM initiatives, we asked each group of implementers to describe how — after the EBM initiative began — they were going to communicate the results and analyses to the people who could use the information to make decisions on a large scale. How was the information going to get into their hands and what would the mechanism be by which behaviors would change and resource use would alter over time? I don't remember any of the proponents — including the ones we funded — ever really giving a good answer to that question, because it is one of the hardest to answer. It is the key to longevity, for both financing and governance (which are tied, of course). Most of the groups we funded made it up as they went along — and a couple actually did pretty well in the end.

Resources on alternative funding mechanisms

Publications:

- The Little Biodiversity Finance Book
  (Global Canopy Programme, 2010)
  www.globalcanopy.org/materials/little-biodiversity-finance-book
- Sustainable Financing of Protected Areas
  (IUCN, 2006)
  http://cmsdata.iucn.org/downloads/emerton_et_al_2006.pdf
- Payments for Ecosystem Services: Getting Started in Coastal and Marine Ecosystems - A Primer
  (Forest Tends and The Katoomba Group, 2010)
  http://pdf.usaid.gov/pdf_docs/PNADT322.pdf

Websites:

- UN Convention on Biological Diversity: Economics, Trade, and Incentive Measures
  www.cbd.int/incentives/valuation.shtml
- Marine Conservation Agreements: A Practitioner's Toolkit
  http://mcatoolkit.org/
- Ecosystem Marketplace
  www.ecosystemmarketplace.com

But even that explanation of sustainability is incomplete. I find it hard enough to describe financial sustainability for a marine protected area, and EBM is so much more amorphous. It borders on "everyone is involved and responsible, so no one is ultimately accountable." That is a bit of an overstatement, perhaps, but not by much, especially when a large spatial area starts to overlap political lines and jurisdictions.

On making EBM financially sustainable

To make EBM financially sustainable, you need, of course, a long-term vision. It is not a sprint: it takes a long time to put the many pieces into place. There will never be just one or two sources of funding. First some entity or consortium funds EBM design at a particular place or, say, in a particular fishery. Then you establish baselines, observe use patterns, and monitor for many years, allowing enough time to establish the work being done as "the norm". You need the EBM (the way people actually utilize the resources and the way that use is measured and adapted to changing conditions) to become ingrained and ultimately seen as "business as usual" or best practice — by management and by stakeholders. It should, over time, become almost routine.

But to become routine, it has to have direct value to the relevant government agencies and the private sector actors and communities that most often interact with or live in that spatial area. Otherwise the EBM just maintains its status as a project — an addendum rather than core to the way people live and interact with their environment. You have to make it matter environmentally, socially, and financially to the actors that have the most vested interest in upsetting the ecosystem or maintaining it. Otherwise it will be much more expensive (and less financially sustainable) to implement over the long term.

This is true for MPAs, too, of course. It is one reason why we are devoting more time and energy in our grants toward financial sustainability and long-term governance in the Western Pacific program for which I am responsible. To make financial sustainability more likely, we are investing more in trust mechanisms that are closer to the places where the MPAs are being established. The Micronesian Conservation Trust, which supports biodiversity conservation and related sustainable development for the people of Micronesia, is an example (**http://mctconservation.org**). We are experimenting with marine conservation agreements, and investing in the conservation and organizational management skills of people who are going to be the next generation of environmental leaders. In addition, we are doing more to help local environmental law groups in, for example, Papua New Guinea and Fiji,

to help set the policy framework for government allocations of their budgets or for enforcement or, as in Palau, for the creation of "green fees" that are charged to tourists and help fund MPA networks. We are also investing in the design of specific tools to determine the costs of MPA management at specific places.

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B. Sustainability without government revenue

By Sibylle Riedmiller and Eleanor Carter

[**Editor's note:** Sibylle Riedmiller is project director of Chumbe Island Coral Park in Zanzibar, Tanzania; she is also the park's founder and main investor. Eleanor Carter is a former manager and ongoing adviser to the project. The park, a no-take MPA officially recognized by the Zanzibar Government, is run by a private company — Chumbe Island Coral Park Ltd. — that also manages the island's terrestrial environment, which includes a forest reserve and an ecotourism operation (**www.chumbeisland.com**). The company's goal is to create a model of sustainable management where ecotourism revenue provides full support for conservation and environmental education. It amounts to a small-scale EBM initiative: integrating land and water management, protecting ecosystem services, and providing alternative livelihoods to locals who work as rangers, ecotourism staff, administrative staff, and in other capacities.]

On financial sustainability through tourism

Since the year 2000, 100% of our park management operations — including all surveillance, enforcement, and monitoring and our core environmental education program for local schools — has been funded by tourism. This has even been the case when the occupancy rate was rather low: for example in 2000-2001, amid election turmoil in Zanzibar, the rate was only 37%. Notably, despite the current worldwide economic downturn, occupancy has been 70% these past two years. In other years it has been as high as 86%.

With our heavy dependence on tourism, there is a degree of vulnerability to global economic factors and this is certainly something we monitor closely. [Editor's note: a large share of Chumbe tourists are drawn from Europe.] However, being privately managed means that operations are maximized for efficiency and cost-effectiveness. We also ensure there are always sufficient funds available to "tide-over" any difficult periods. So far we have managed to remain operational despite fluctuations in tourism numbers. Should ever the global economic situation (or massive local problems that affect tourism) mean a more prolonged lack of income to the program, we would consider exploring temporary support from donors to get through such a period.

On creating efficient management

In government-run sites, costs can often be inflated due to a range of factors. A significant one is that staff who are not performing well in civil servant positions often still retain job security. This may result in higher-than-necessary staff numbers, and has the knock-on effect of demotivating other staff who are prepared to work hard. This reduces the efficiency of all park operations.

In donor-funded operations there is often little incentive to explore ways to maximize cost-effectiveness and keep expenditures efficient. This is especially the case in areas where funds "must be spent" by certain periods, and/or when yearly budgets consider gross expenditure from previous years (creating incentives for over-spending on occasion to ensure a healthy budget is maintained for subsequent periods).

Where funds come directly from either government or donor sources, there may be little link in park staff's minds to the root source of these funds (i.e., taxpayers' money, monies earned by an individual and given through a philanthropic gift, etc.) since staff throughout the vertical chain of management are removed from having to consider such issues. This can lead to a lack of cost/benefit assessment or deeper consideration of sustainability of "expenditure processes", and tends to focus on sustainability of incoming revenue (getting more funds from somewhere the following year[s]).

In contrast, in a situation like Chumbe where the staff is on the frontline of both ensuring funds are earned (through ecotourism operations) and spent (on management), the connection between the two is clear. There is strong motivation for all concerned to ensure both sides of the equation are effective and sustainable.

On reducing costs and increasing revenue by engaging stakeholders

Managers can reduce costs considerably if they build up good relations with the private sector. In Tanzania, that is namely the tourism industry. Dive operators can help with patrolling, reporting, and

monitoring, and hoteliers may be willing to help with education programs for local schools and other support to local communities. They may also collect donations from their guests for small well-designed projects where success is visible. There is often goodwill from the local tourism sector if they see the site is well-managed!

In large management areas where fuel costs for patrolling are a significant expenditure, engaging community members in management activities becomes vital. It ensures buy-in to the management program and compliance with zoning, and thereby reduces fuel costs associated with patrolling large areas.

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C. No simple, quick-fix answers to financial sustainability

By Kevern Cochrane

[**Editor's note:** Kevern Cochrane is Director of the Resources Use and Conservation Division of the Fisheries and Aquaculture Department of the UN Food and Agriculture Organization (FAO). His responsibilities include oversight of many of FAO's activities on implementation of the FAO Code of Conduct for Responsible Fisheries, including the development and promotion of an ecosystem approach to fisheries and to aquaculture.]

On general principles for sustainable financing of EBM

As with almost all big questions in fisheries and other sustainable uses of aquatic resources, there are no simple or quick-fix answers to achieving financial sustainability. What works for a commercial whitefish fishery in the North Atlantic, for example, will not necessarily work for a beach seine fishery in a tropical ecosystem along the coast of Africa or Asia. Nevertheless, there are some general principles that need to be respected as far as possible. The economic principles identified by the Convention on Biological Diversity provide important pointers that can be adapted to apply to EBM, namely:

- The ecosystem needs to be understood and managed in an economic context; and
- A management program should (a) reduce market distortions that adversely hinder implementation of EBM, (b) align incentives to promote EBM, and (c) internalize costs.

Particular problems arise, of course, when the social importance of ecosystem services is high but the economic returns are low — i.e., it costs more to implement EBM than the direct financial benefits that are returned. In such cases it is important to explore possible means, within EBM, to add value to the services generated and thereby increase financial viability. However, care needs to be taken that this does not lead to undesirable losses in social benefits and equity.

On whether catch shares or other resource privatization can lead to financial sustainability in ecosystem-based fisheries management

There is widespread agreement that some acceptable form of limiting access to a resource and ecosystem to a designated group of users is important to ensure a long-term commitment by them to sustainable use. Catch shares are a common and often-important component of limiting access, and — particularly when the shares are transferable — can provide a vehicle for increasing economic efficiency.

Catch shares therefore provide an important tool for fisheries management in many cases. However, they are neither a panacea nor applicable in all cases. Difficulties that can be encountered include the costs of monitoring and enforcement, which can make them impractical in many cases, and problems in applying them in multi-species fisheries. In addition, unrestricted freedom to transfer rights, including catch shares, can lead to social problems. There are no shortcuts: in selecting strategies in each case, the desired social and economic objectives first need to be identified and then the optimal combination of measures selected to achieve those objectives.

On financial sustainability of resource privatization in other marine sectors

The current global economic crisis has highlighted our very poor grasp of the likely outcomes from different economic models. The debates that are currently raging are frequently driven more by ideology than by careful and rational thought. In the midst of this uncertainty, a careful blend of privatization and approaches providing social safeguards for the smaller players and the most vulnerable seems the sensible way forward, whatever the sector. Again, the form and nature of the blend in each case will depend on its unique characteristics and the pre-identified objectives.

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Tundi's Take: Private Sector Investment in EBM Makes Good Business Sense

By Tundi Agardy, MEAM Contributing Editor (tundiagardy@earthlink.net)

"Engage the private sector" has become something of a mantra in marine management. But thus far, direct financial involvement by the private sector in ocean management has been relatively limited. While industries such as commercial fisheries, shipping, and offshore energy have been granted use privileges, there has been little private sector interest in investing in management measures to sustain the benefits that well-managed ecosystems provide.

This is true for myriad reasons:

1) There is an enduring assumption that the public sector (government) will manage ocean resources and space sufficiently;

2) Without the development of markets, the vast majority of social and economic values associated with coastal and ocean areas remain unaccounted for in capital market transactions; and

3) The commons property regime existing in ocean space makes mechanisms for engaging the private sector not so apparent.

Incentives for private sector engagement have not been made very clear to this point, so any financing of management that originates in the private sector is viewed more as a tax than as an investment.

Surveys of how coastal ecosystems are currently protected show that innovative financing mechanisms that tap into private sector funds are rare. With a few exceptions, the management of these areas has generally fallen to the public sector. Inequities exist in the way coastal areas are managed, such that taxpayers shoulder most of the costs of protection, while industries receive a comparatively free ride in deriving the benefits coastal ecosystems provide. There is room for a dramatic shift in the engagement of business in EBM.

With growing recognition of the value of ecosystem services, new sources of potential market demand for such services are emerging. Markets that involve payments for the protection of ecosystem services (such as payments for carbon sequestration, water quality maintenance, or biodiversity maintenance) are expanding on land, and there is growing awareness of the potential for carrying this seaward among business, investment, and conservation communities. Marine management can and should be supported by the very industries that realize the benefits of coastal and ocean ecosystems: the fishing industry protecting nursery habitats, for instance, or the tourism industry restoring mangroves for their roles in water filtration and in buffering land from storms.

We cannot assume the business community will become engaged in EBM because it is the right thing to do. Yes, companies can derive public relations value from charitable contributions to marine management efforts (performed either by governments or by NGOs). But a truly effective and sustainable financing strategy will have to be based on business models that demonstrate the profitability of investing in management.

I've recently been involved in assessing existing public/private partnerships in marine management. It appears that when this sort of co-management is structured as not-for-profit, businesses are reticent to support the efforts, or eventually withdraw. But when partnerships recognize the positive payoffs that effective management investment can provide, and structure their joint ventures so that real profits flow back to the business investors, sustainable financing can result. Undertaking projects that show that effective management is profitable for businesses by reducing financial risks and generating increased revenues will demonstrate that investing in EBM makes good business sense. M

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Marine Ecosystems and Management is published bimonthly by Marine Affairs Research and Education (MARE), a 501(c)(3) not-for-profit corporation, in association with the School of Marine Affairs, University of Washington. Financial support is provided in part by a grant from the David and Lucile Packard Foundation.

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Making Marine Spatial Plans Adaptable to a Changing Climate: Interview with Robin Craig

Due to human-induced climate change, sea surface temperatures are increasing. As a result, a gradual poleward shift in ocean ecosystems is underway. Described very simply, areas that were previously cold are becoming more temperate, and areas that were temperate are becoming more tropical. It is anticipated that, over time, ocean habitats and species ranges will follow the water temperature regime with which they are associated, provided there is adequate connectivity.

For marine spatial planning to provide for long-term, sustainable management of ocean ecosystems, the plans should take these future shifts into account. In other words, marine spatial planning must be adaptable to climate change.

However, despite the fact that spatial plans are typically crafted in an ecosystem-based manner, they do not automatically account for future alterations in marine ecosystems that climate change may bring. So although spatial plans can be revised every few years, that may not be adequate in and of itself: a plan that does not account for likely future changes could actually weaken the effectiveness of future revisions. As an example: a plan places an offshore wind farm in an area that is likely to become important habitat for commercially targeted fish populations, due to a shift in their species range.

A draft law review article in which Craig describes how to make marine spatial planning adaptable to climate change, including via the concept of anticipatory bidding for future use rights, is available at **http://ssrn.com/abstract=1887326**.

MEAM addressed making EBM adaptable to climate change in our December 2009 issue ("EBM in a Changing World: Strategies for Proactive Management Amid Climate Change", MEAM 3:3).

Making MSP anticipatory and dynamic

How can marine spatial planning (MSP) be made adaptable? Robin Craig, professor and associate dean for environmental programs at Florida State University (US), is authoring a book on ocean governance for the 21st century (*Comparative Ocean Governance: Placed-Based Protections in an Era of Climate Change*, forthcoming Edward Elgar Press 2012). She suggests that MSP and the zoning of the ocean should be *anticipatory* (based on observed trends in ecological response to climate impacts and predictions about resulting management needs) and perhaps also *dynamic* (with zones that move as part of their design, following the shifting of habitats and species). Below, MEAM talks with Craig about these concepts and making MSP adaptable to climate change:

MEAM: The process of marine spatial planning and ocean zoning is often politically heated, and it can involve a lot of negotiation to get people to agree on a zoning plan. The concepts of anticipatory zoning and dynamic zoning would add even more variables to such negotiations, including estimates of how ecosystems will change in the future (for anticipatory zoning) and the potential for regularly shifting boundaries (for dynamic zoning). How would you respond to a manager or stakeholder who says, "It's hard enough to do zoning as it is — why do we need to add these additional variables to the process?"

Robin Craig: Because adding those variables allows them to anticipate climate change rather than just react to it. In terms of cost-benefit analysis, anticipation may be far more effective than reacting after the fact.

MEAM: Do you foresee a future in which all marine spatial planning is done with anticipatory and dynamic zoning?

Craig: I do not expect dynamic zoning to be workable — or even desirable — everywhere, and the usefulness of the techniques (dynamic and anticipatory zoning) will vary dramatically among marine ecosystems. For example, many of the world's largest MPAs protect coral reefs. Even with climate change, the basic substrate of a coral reef is not going to move very quickly, and evidence from the Great Barrier Reef suggests that rising sea temperatures may slow coral growth anyway. In these ecosystems, therefore, anticipatory zoning for the ecosystem as a whole may not be necessary.

However, for specific species within the larger MPA, or for particular sub-ecosystems or assemblages of species, anticipatory and dynamic zoning may be helpful tools. For example, many coral reef MPAs shelter sea turtle populations. Therefore, these coral reef MPAs might benefit from adopting dynamic fishing zones that help fishers (assuming fishing is allowed) avoid bycatch of turtles — especially if the turtles' range starts to shift. Similarly, if sea turtles and seabirds start shifting their nesting sites because of increasing temperatures, a zoning system that can anticipate those shifts and, for example, ensure that a new hotel is not built on a beach that looks like it will serve as future habitat would be a good system to have in place.

MEAM: In which cases would anticipatory zoning be most useful?

Craig: Anticipatory zoning is likely to continue to be most useful for preemptively protecting (a) new fishing grounds, either because ice is melting or fish species are moving (or both), and (b) shifting, faster-moving key ecosystems like kelp forests, which can migrate faster than, say, coral reefs. Given how quickly overfishing and overuse can destroy marine

species and ecosystems, governments should probably already be anticipating new fisheries rather than reacting to market shifts, regardless of climate change.

MEAM: What effect will anticipatory and dynamic zoning have on the process of marine spatial planning?

Craig: The planning process does not need to be exceptionally longer than what currently occurs, especially as information regarding the local effects of climate change improves. One planning process, for example, could set up a "sea turtle avoidance zone" based on sea temperatures; the avoidance zone would then operate dynamically (and automatically) from that point forward, with fishing zones shifting daily based on sea temperature monitoring. Trend data could similarly allow for a scheduled shift in zones, triggered automatically from one planning process based either on timing (e.g., five years from now these beaches will be protected for seabird nesting) or on explicit biological/ecological/physical criteria.

MEAM: This sounds very precautionary.

Craig: That is basically what we are talking about here: How can managers employ a precautionary approach to marine management when the management baselines — water temperature, current patterns, ocean chemistry, species composition, species behavior, species range — are changing right before their eyes? I would argue that climate change makes a precautionary approach even more critical while it simultaneously makes a precautionary approach more difficult to implement. We need to start thinking about how to incorporate precautionary change — as opposed to just reactive change — into marine management. I hope these suggestions encourage some creative experimentation among marine managers.

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Notes & News

Report: Significant marine extinction possible unless multiple ocean stressors reduced

Multiple ocean stressors — warming, acidification, overfishing, and more — together represent a great risk to marine and human life if the current trajectory of these stressors continues, including the possibility of a major extinction event of marine species. This is the conclusion of 27 ocean experts who gathered at an April 2011 workshop at the University of Oxford, convened by the International Programme on the State of the Ocean (IPSO).

The workshop report concludes that the speed of climate-related changes to the ocean is near to or tracking the worst-case scenarios from scientific predictions, including from the Intergovernmental Panel on Climate Change. Meanwhile marine ecosystems' resilience to climate change impacts is being compromised by stressors like overexploitation, pollution, and habitat destruction. Workshop participants called for immediate reductions in carbon dioxide emissions and urgent action to restore the structure and function of marine ecosystems. "The findings underscore the need for more effective management of fisheries and pollution and for strengthening protection of the 64% of the ocean that lies beyond the zones of national jurisdiction," states the workshop report. More information on the workshop and IPSO in general is at **www.stateoftheocean.org**.

Report explains need for integration in coastal zone management with examples

A new report provides an overview of integrated coastal zone management (ICZM), focusing on the concept of integration and why it is essential for management of coastal and marine resources. Produced by the Solutions for Environmental Contrasts in Coastal Areas project (SECOA), an EU-funded initiative, the report surveys several types of integration (integrated resource planning, integrated assessments, integrated maritime policy, and more) and how they have been implemented in practice.

The main aim of the publication is to inform the evaluation of specific ICZM mechanisms under particular country contexts. The SECOA project is studying the social, economic, and environmental systems of coastal cities in eight European and Asian countries (Belgium, India, Israel, Italy, Portugal, Sweden, UK, and Vietnam). The project is developing a handbook of best practices in ICZM, based on the evaluation of mechanisms from the SECOA partner countries.

The 39-page report *Towards Integrated Coastal Zone Management: A Toolkit for Practitioners* is available from co-authors Michelle Portman and Itay Fishhendler of Hebrew University of Jerusalem at **mportman@cc.huji.ac.il**.

New textbook on marine conservation ecology

A new textbook describes the elements of marine biodiversity, the structure and function of ocean ecosystems, and several approaches to marine conservation and management. Significant attention is paid to marine protected areas, including decision-making on size, boundaries, numbers, and connectivity of such sites. The book also addresses relationships between fisheries and biodiversity. Authored by John Roff and Mark Zacharias, the 320-page book *Marine Conservation Ecology* is available in paperback for US $59.95 at **www.earthscan.co.uk**.

UN report released on oceans and sustainable development

In June the UN General Assembly released a report on oceans and sustainable development, with a focus on global progress to date in implementing ocean-related outcomes from major summits on sustainable development. The report also identifies gaps in implementation and science, and challenges to effective implementation, such as insufficient capacity, fragmented management, and enforcement difficulties.

Improved implementation of sustainable development goals will "require increased international and inter-agency cooperation and coordination, as well as continued efforts to build necessary capacity," states the report. "Political will and the targeted allocation of sufficient resources at all levels remain key components of the way forward." The report is intended for consideration by the General Assembly at its sixty-sixth session, which begins in September 2011. The report is available at **www.un.org/ga/search/view_doc.asp?symbol=A/66/70/Add.1**.

Book describes transition to ecosystem-based fisheries management from species-based management

A new book outlines the process of transitioning fisheries management from a system focused on individual target species to one that accounts for a broad array of ecosystem considerations (i.e., ecosystem-based fisheries management, or EBFM). Focusing on the experience of the US Western Pacific Fishery Management Council, the book represents the findings of a series of workshops that the council convened in recent years.

The book is arranged in three sections: ecosystem science and planning; ecosystem social science and planning; and ecosystem policy. Each section starts with an assessment of the current state of fisheries management, examines the data sources and modeling systems used to advance EBFM, and ends with practical methods for more thorough global implementation. The 312-page book *Ecosystem Based Fisheries Management in the Western Pacific*, edited by Edward Glazier, is available in hardcover for US $174.50 at **www.amazon.com**.

Editor's note: The goal of The EBM Toolbox is to promote awareness of tools for facilitating EBM processes. It is brought to you by the EBM Tools Network, a voluntary alliance of tool users, developers, and training providers.

The EBM Toolbox by Sarah Carr

Quantifying, mapping, and valuing ecosystem services

A growing number of tools help managers and policymakers to quantify, map, and value the many services that ecosystems provide to people. Tools can also help determine how management and policy decisions may affect such services. Three tools that aid in assessing ecosystem services are:

- ARtificial Intelligence for Ecosystem Services (ARIES; **www.ariesonline.org**). ARIES is a web-based tool for mapping and quantifying environmental assets and evaluating and comparing the impact of alternative policy and land/sea-use scenarios on the provision of ecosystem services. It has been used in projects involving carbon sequestration, flood and sediment regulation, water provision, aesthetics, recreation, subsistence fisheries, and coastal protection.
- Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST; **www.naturalcapitalproject.org/InVEST.html**). InVEST is a GIS toolbox for identifying where ecosystem services are provided and consumed, and how resource management decisions affect the economy, environment, and human well-being. It includes models for carbon storage, wave energy, recreation, fishery production, erosion control, habitat quality, water quality, crop pollination, and timber production.
- Multi-scale Integrated Models of Ecosystem Services (MIMES; **www.uvm.edu/giee/mimes**). MIMES is a suite of models for assessing the value of ecosystem services by linking the dynamics of the services to human welfare and simulating how the function and value of the services change under alternative management scenarios. The models are being used by the Massachusetts Ocean Partnership to examine trade-offs among different sectors in spatial planning.

Additional resources:

- The Decision Guide: Selecting Decision Support Tools for Marine Spatial Planning (**www.ebmtoolsdatabase.org/resource/msp-guide**) provides information on the tools above and their functionality.
- The Marine Ecosystem Services Partnership (**www.marineecosystemservices.org**) offers access to, and the ability to map, more than 2000 values of economic valuation data.
- The EBM Tools Network demonstration webinars (**www.ebmtools.org/tools_training/presentations.html**) provides recordings of webinars that provide detailed overviews of all of these tools and resources.

(Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at **www.ebmtools.org**.)