UNEP

Taking Steps toward Marine and Coastal Ecosystem-Based Management

AN INTRODUCTORY GUIDE

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List of Acronyms

CBD: Convention on Biological Diversity

CBD COP IX and X: Ninth and Tenth Conferences of the Parties to the Convention on Biological Diversity

CCAMLR: Commission for the Conservation of Antarctic Marine Living Resources

DPSIR: Drivers-Pressures-State-Impacts-Responses framework

EA: Ecosystem Approach

EAF: Ecosystem Approach to Fisheries

EBA: Ecosystem-Based Adaptation

EBFM: Ecosystem-Based Fisheries Management

EBM: Ecosystem-Based Management

EIA: Environmental Impact Assessment

EU: European Union

FAO: Food and Agriculture Organization of the United Nations

GEF: Global Environment Facility

GEO: Global Environmental Outlook

GIS: Geographic Information System

HELCOM: Helsinki Commission (Baltic Marine Environment Protection Commission)

ICES: International Council for the Exploration of the Sea

ICZM: Integrated Coastal Zone Management

IEA: Integrated Ecosystem Assessment

IMO: International Maritime Organization

IUCN: International Union for Conservation of Nature

IWCAM: Integrating Watershed and Coastal Areas Management project

LME: Large Marine Ecosystem

MPA: Marine Protected Area

MSP: Marine Spatial Planning

NGO: Non-Governmental Organization

OSPAR: Convention for the Protection of the Marine Environment of the North-East Atlantic (originally the Oslo and Paris Conventions)

PES: Payments for Ecosystem Services

SEA: Strategic Environmental Assessment

TDA: Transboundary Diagnostic Analysis

UN: United Nations

UNEP: United Nations Environment Programme

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNGA: United Nations General Assembly

Foreword: Why Ecosystem-Based Management of Oceans and Coasts?

Healthy marine and coastal ecosystems provide many valuable services - from food security, resources for economic growth and recreation alongside tourism and coastline protection. They are also recognized as crucial reservoirs of biodiversity at a time when the loss of species on both land and in the sea is an increasing cause for concern.

Among the most productive ecosystems on the planet, oceans and coasts ensure the well-being for a growing global population, which is likely to rise to over nine billion by 2050. They regulate global climate and offer essential adaptation capacity. The future role of ecosystems for human well-being depends increasingly on developing the capacity of countries to manage human uses and impacts in order to ensure their health and self-repairing capacity is not undermined.

Central to a transformational response to decades of overfishing, pollution and unplanned urban development will be moving from sectoral marine and coastal management, to a joined approach that marries the seemingly competing interests for ocean and coastal resources and space, such as environment, tourism, fisheries and energy generation, within a robust framework and a spatial planning perspective. This is central to ensuring equitable access among diverse interests and users.

The Ecosystem Approach lays out a series of principles to guide management towards long-term sustainability of marine and coastal ecosystems. With this Guide, UNEP seeks to assist countries and communities to take steps towards making marine and coastal ecosystem-based management operational - from strategic planning to on-site implementation. An important aim of this Guide is to facilitate the implementation of UNEP's

overarching Ecosystem Management Programme and new Marine and Coastal Strategy in countries and regions - in line with its Medium Term Strategy 2010-13.

The Marine and Coastal Ecosystem-Based Management (EBM) Guide outlines operational considerations in an accessible language, drawing upon practical experiences and lessons across the globe – from tropical coastlines to temperate estuaries and polar ocean ecosystems. An important message is that this is an incremental process and there are different paths toward EBM. Cross boundary considerations and working with neighbours and even countries far away will be an essential component.

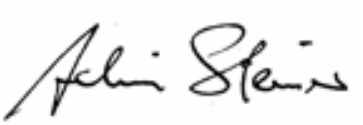
The UNEP Regional Seas Programme is uniquely placed to assist while also acting as a forum for practical engagement with other regional and international organisations, such as regional fishery management organisations, initiatives of the International Maritime Organisation, and other relevant bodies.

The target audience of the Guide includes planners and decision-makers in local, national and regional governments and communities across a broad spectrum of interests and uses. The Guide is not a technical manual or textbook; rather it is an introduction to EBM principles and applications, providing an overview of core elements and pathways to getting started.

This Guide is intended to complement UNEP's work, such as the Green Economy providing guidance on making changes in the way we interact with ecosystems, as well as the Blue Carbon Initiative, which explores the potential for mitigating climate change by investing and re-investing in healthy coastal ecosystems that capture and store carbon.

Moreover, EBM offers a valuable solution for harnessing marine and coastal ecosystems in adapting to climate change and other potential disasters.

I am sure this Guide will prove a valuable resource in assisting coastal countries and communities to move from theory to practical ecosystem-based management of our oceans and coasts.



Achim Steiner
UN Under-Secretary General and Executive Director UNEP

Imagine this scenario…

A very productive and valuable ocean area lies at risk. Previously the area provided people with everything they needed: food, energy, recreation, and more. But now there are problems. Runoff from farms and towns upstream has started to pollute the water. Coastal wetlands where fish produced their young are being filled to build condominiums. Offshore energy platforms for oil and wind are being built near coral reefs and in key habitats for whales, turtles, and seabirds.

The people gather to decide what to do. Farmers, builders, fishermen, conservationists, politicians, energy industry people — everyone is there. They use science to understand how the various parts of the ocean ecosystem connect to each other, and how the ecosystem connects to people. They look at the ways they are impacting the environment and decide which impacts most need to be addressed by management. Together they plan how uses of the ecosystem can be managed better and special areas can be protected.

Then they put those changes into effect. Practices at upstream farms and in towns are improved to reduce runoff. Wetlands are protected from development. Fishing areas and seasons are managed to allow stocks and habitats to recover. And offshore energy projects are placed to have less of an impact on sensitive marine habitats.

The people enjoy the benefits of these changes, including a healthier and more resilient ecosystem, larger catches of fish, and fewer conflicts between groups of users. By basing the plan on solid knowledge of how the ecosystem and people are connected, and by involving all stakeholders and government agencies in the planning, the new management system is widely accepted and embraced. And several institutions continue to help with management, improving the plan as circumstances change. The prospects for this area's future are now far better than before.

This scenario is ecosystem-based management.

SECTION I
Making the Case for Marine and Coastal EBM

WHY IS CHANGE NECESSARY?

People have been managing uses of marine and coastal ecosystems for centuries — from tribal authorities establishing marine tenure and taboos on resource use, to the modern era of complex governance. Yet today, the degraded condition of many seas and the overall decline in their diversity and productivity threaten our coastal communities and human well-being. The oceans' ability to maintain their diversity and productivity, and to provide a wide array of valuable services to people, are being compromised.


Runoff pollution from copper mining

Decades of overfishing, pollution, and habitat destruction have left marine and coastal ecosystems in decline. Ecosystem health is compromised when waterways are dredged carelessly or excessively, when wetlands are filled in, or when coastal development is carried out with little concern for the environment. Sediment transport and hydrology can be altered by land and freshwater use in watersheds. With too many nutrients ending up at the coast from agricultural run-off and sewage, coastal waters are among the most chemically altered environments in the world. Coasts are vulnerable to major impacts from sea level rise, erosion, and storm events, and many marine and coastal systems have passed thresholds for healthy functioning, placing the sustainability of nearby human populations at risk.

Part of the decline of marine and coastal ecosystems is due to negligence or a lack of awareness. Often people do not realize their actions are causing harm because many of these ecosystems are out of sight, out of mind. Other times they may have alternate imperatives such as food security, and feel they have no options but to use marine and coastal resources unsustainably.

Another reason for management failure is conflict: between various uses, between the cultures of different user groups, and between jurisdictions charged with management. Vested interests are clashing.

There is also fragmentation of jurisdictions and decision-making. Coastal planners look almost exclusively at the land side of the coastal zone. Watershed management authorities focus on freshwater flows. Fisheries managers address exploitation of fish (often a single stock at a time). Shipping authorities take responsibility for ports, ship traffic, and

"EBM is aimed at conserving and sustaining ecosystem services to benefit current and future human generations."

-Michael Sissenwine, former Chief Science Advisor, National Marine Fisheries Service, USA

safety at sea. Navies address national security interests. Conservationists and environmental ministries protect threatened species, reefs, and wetlands. Developers and tourism ministries eagerly eye sites for new resorts. And local communities interject their own needs and demands for economic, social, and environmental management in the mix, not always with an ecologically sound vision. Amid all this, marine and coastal management often targets only a single use (or set of related uses) at a time. It fails to consider how these multiple and cumulative uses can affect ecosystems.

A new way of management is needed to ensure long-term sustainability of oceans and coasts.

DEFINING EBM

Ecosystem-based management, or EBM, is an approach that goes beyond examining single issues, species, or ecosystem functions in isolation. Instead it recognizes ecological systems for what they are: a rich mix of elements that interact with each other in important ways. This is particularly important for oceans and coasts. A single commercially valuable fish species, for example, may depend on a range of widely separated habitats over its life, depending on whether it is young or adult, feeding, spawning, or migrating. It needs access to each habitat at the right time, as well as ample food, clean water, and shelter.

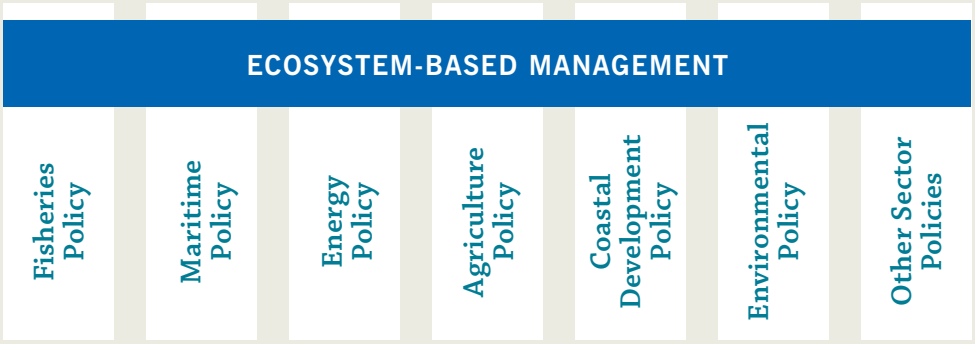
Because humans depend on an array of ocean and coastal functions for our well-being — including fish as food, for example — EBM recognizes that our welfare and the health of the environment are linked. Put another way, marine and coastal systems provide valuable natural services, or "ecosystem services", for human communities. Therefore, to protect our long-term wellbeing, we need to make sure marine and coastal ecosystem functions and productivity are managed sustainably. This means managing them in a way that acknowledges the complexity of marine and coastal ecosystems, the connections among them, their links with land and freshwater, and how people interact with them.

Management must be integrated, just as ecosystems are interconnected. One of the most important aspects of EBM is that it is **fundamentally a place-based approach**, where an ecosystem represents the place. Across an entire "place", EBM aims to manage each of the human uses at a scale that encompasses its impacts on marine and coastal

THE "E" IN EBM

Marine and coastal ecosystems are the focus of EBM. They cover land, sea, and air, and include a variety of interconnected habitats and species. Humans are fully part of ecosystems, too. As such, urban and transformed landscapes must also be considered in ecosystem-based management.

EBM PROMOTES INTER-SECTORAL COORDINATION



"Ecosystem-based management cannot be implemented through single-sector policy alone. Different sector policies must all contribute to a cross-sectoral approach. In the case of fisheries, for example, EBM addresses both the impacts OF fisheries on marine ecosystems and the impact ON fisheries from other sectors, such as coastal development, offshore energy, and so forth. In this way, cross-sector integration and within-sector contributions are both needed."

-Poul Degnbol, Head of Advisory Programme, ICES

ecosystem function, rather than scales defined by jurisdictional boundaries. Regional-scale management is an important practice in a range of places, including within the framework provided by regional governance mechanisms, such as the Regional Seas Conventions and Action Plans and other regional frameworks.

To summarize the above, EBM involves two changes in how management is practiced: (1) each human activity is managed in the context of ALL the ways it interacts with marine and coastal ecosystems, and (2) multiple activities are being managed for a common outcome. To describe this, the terms **ecosystem-based management** and **ecosystem approach** (EA) are often used interchangeably, and they mean generally the same thing.

There is, on the other hand, an important distinction between fully cross-sectoral EBM (or fully cross-sectoral EA) and applying ecosystem-based policies within an individual sector. Some fisheries management agencies, for example, have adopted "ecosystem-based fisheries management" or EBFM (often referred to as an "ecosystem approach to fisheries", EAF), which considers the status of commercial fish stocks and ecosystem components that interact with those stocks: predators, prey, habitats, etc. In doing so, fisheries management has made progress in maintaining or even enhancing fisheries productivity for many stocks. But adopting environmentally-oriented management measures in just one sector falls short of the integrated goal-setting and management that full EBM entails, and which is needed to ensure the sustainability of a complete range of ecosystem services. As such, although EBFM may be an important component of successful EBM, it does not equal EBM in itself. Rather, full EBM may serve as a cross-sectoral mechanism to facilitate overall planning and coordination of individual sector policies, such as fisheries, shipping, energy, tourism, and so forth — through which each sector can apply sector policies to implement EBM (see figure above).

Ecosystem-based management of terrestrial systems began in the 1950s. But its application in the marine and coastal environment is relatively new, developed in response to the declining state of coastal and marine ecosystems. Although the term “ecosystem-based management” has been defined in numerous ways, the core elements of it include:

- Recognizing connections among marine, coastal, and terrestrial systems, as well as between ecosystems and human societies.
- Using an ecosystem services perspective, where ecosystems are valued not only for the basic goods they generate (such as food or raw materials) but also for the important services they provide (such as clean water and protection from extreme weather).
- Addressing the cumulative impacts of various activities affecting an ecosystem.

- Managing for and balancing multiple and sometimes conflicting objectives that are related to different benefits and ecosystem services.
- Embracing change, learning from experience, and adapting policies throughout the management process.

Each of these core elements is examined in more detail in Section II of this introductory guide.

It is important to recognize **there are multiple paths to implementing EBM**. Ecosystem-based management is being put into practice in different ways in different places, and across different scales. Often it combines and improves management practices that are already in place. The intent of this guide is to draw on a variety of experiences of marine and coastal EBM practitioners to describe how EBM is envisioned, how it is put into practice, and how its success can be measured around the world.

"Ecosystem-based management builds on existing knowledge and management structures and develops these further. It is not about throwing out what we have and replacing it with something else."

-Alf Håkon Hoel, editor of Best Practices in Ecosystems Based Oceans Management in the Arctic

In addition, **EBM is as much a process as an end point**. It does not require a single giant leap from traditional, sectoral management to fully integrated, comprehensive management. Instead, EBM can be achieved in a step-by-step, incremental, and adaptive process. This guide will show what such a process can look like.

Finally, **EBM does not require managing all aspects of a system at once**. Instead, an EBM initiative founded on good knowledge and understanding of ecological and social systems can allow for thoughtful prioritization of the most important management actions and activities. It is better to manage the most critical elements effectively than to become paralyzed by trying to manage everything else at the same time.

HOW IS EBM AN IMPROVEMENT ON CURRENT MANAGEMENT?

The problems affecting oceans and coasts are not new to managers and planning agencies — most managers address these challenges in their daily work. Successful steps within an EBM process include things that coastal and marine managers are often already doing, such as resource or stock assessment, environmental assessment, pollution

THE EBM SPECTRUM

Ecosystem-based management is as much a process or journey as 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.

No EBM or Low EBM	*Incremental EBM*	*Comprehensive EBM*
Individual species management	Managing groups of species	Managing whole ecosystems
Single sector management — fisheries, for example	Integrated management of two sectors — fisheries and offshore energy, for example, to avoid user conflicts	Integrating all sectors that impact, or are impacted by, the ecosystem
Restricted scale management — local only, for example	Coordinated management at local and state levels	Coordinated management at all levels relevant to the ecosystem
Short-term perspective: what do we need from the ecosystem this year?	Medium-term perspective: what services do we need the ecosystem to provide 5 years from now?	Long-term perspective: what will the ecosystem look like in 20 years with climate change?
Managing commodities	Managing activities with those commodities in mind	Managing activities with system functioning in mind

monitoring, fisheries management, and many other activities.

What sets EBM apart is its holistic, integrated approach. It seeks to link previously sector-based management, like forestry and fisheries, and to consider the full range of uses that affect an ecosystem or ecosystems. This requires deliberate work to build collaboration and coordination across diverse sectors that may be isolated from, or even in conflict with, one another.

EBM also considers impacts that need to be managed or mitigated over wide areas. Just as coastal zone management has worked to increase integration of management, including consideration of cumulative impacts, EBM looks at ecosystems as units with ecological and social links, rather than as purely political units. It looks both out to sea and inland, connecting terrestrial, coastal, and marine systems.

Embedded within EBM is the concept of resilience and maintenance of ecosystem function. Resilience is the ability to return toward a previous state following a disturbance – whether that disturbance is natural, as in a hurricane event or tsunami, or whether it is human-induced, such as the physical destruction of a reef by dynamite fishing or an oil spill disaster. This recovery can occur in individuals, populations, or entire communities of organisms. Investing time and energy to make ecosystems as healthy and productive as possible helps to maintain their resilience. This is especially important in a world that must address the challenges of climate change while simultaneously pursuing sustainable development to meet coastal community needs.

Another defining element of EBM is its core intent of securing the long-term delivery of a variety of benefits that support human well-being. EBM does this by sustaining critical ecosystem structures, functions, and processes. Quality of human life depends on ecosystem services from healthy ecological systems, such as clean water, air, and beaches, sustainable fisheries, and recreational opportunities. In EBM, goals and successes are defined in terms of sustaining ecosystem services.

Thus, EBM builds on other important and existing management approaches; it does not try to reinvent them. If integrated coastal zone management (ICZM) is already practiced in a region, for example, adopting an EBM approach would start with an examination of the broader area (considering boundaries relevant to the ecosystem, not just political and jurisdictional boundaries) and assess both ecological and social connections at play. If a region has a well-established network of MPAs, adopting an EBM perspective might begin by adding management practices that link land and sea conservation, or reviewing whether the MPA's configuration matches the properties important for ecosystem integrity and resilience.

EBM IS SCIENCE-BASED

Science provides key guidance in ecosystem-based management. In fact, EBM is often described as a science-based process. By building management from a foundation of the best available knowledge, ecosystems and the services they provide can be managed or restored in relatively predictable ways — or at least in ways that follow demonstrable scenarios.

UNEP DEFINITIONS FOR ECOSYSTEM APPROACH AND EBM

"The ecosystem approach is a strategy for the integrated management of land, water and living resources that provides sustainable delivery of ecosystem services in an equitable way."

Source: UNEP Ecosystem Management Programme

"In ecosystem-based management, the associated human population and economic/social systems are seen as integral parts of the ecosystem. Most importantly, ecosystem-based management is concerned with the processes of change within living systems and sustaining the services that healthy ecosystems produce. Ecosystem-based management is therefore designed and executed as an adaptive, learning-based process that applies the principles of the scientific method to the processes of management."

Source: UNEP (2006) Ecosystem-based Management – Markers for Assessing Progress

Both natural and social science capacity are needed to develop robust management regimes. Natural science is necessary to understand the limits or bounds of the ecosystem to be managed, to understand basic facts about its functioning, and to describe linkages between and within ecosystems. A basic understanding of ecology is needed to assess the state and trends in condition of ecosystems, and to predict future conditions. And it can also help identify limits to use that allow for staying within sustainable bounds.

Meanwhile, social science allows us to understand the values, attitudes, societal structures, customs, and laws that underlie human behaviors and impacts, to place a value on ecosystems and their services, and understand what drives patterns of human use. Importantly, both natural and social science should be supplemented by traditional and user knowledge on species and ecosystems, the value of resources and services, and human impacts on each. Together this knowledge supports the development of management scenarios. Such scenarios are story lines that describe how human behaviors drive changes in ecosystems and what those changes will mean for human communities. A combination of natural and social sciences can help us better understand ecosystem vulnerabilities, the threats they face, and the extent to which management addresses those threats effectively.

Ultimately, science allows managers and decision-makers to evaluate trade-offs in order to make informed decisions. However, science — or rather scientists — should avoid making those decisions for society. Such societal decisions should be informed, but not led, by science.

EBM CAN GROW FROM EXISTING LEGAL AND REGULATORY FRAMEWORKS

The movement to adopt ecosystem approaches to address marine and coastal issues has been underway for some time, although the recognition of a need for holistic management lagged behind that of terrestrial environments. In 2002, participants at the World Summit on Sustainable Development in Johannesburg stated, "Oceans, seas, islands and coastal areas form an integrated and essential component of the Earth's ecosystem and are critical for global food security and for sustaining economic prosperity

USING SCIENCE SUCCESSFULLY IN EBM

- Be careful that appraisals of available scientific information do not present excuses for not taking management measures. In most instances, we know enough to do better.
- Utilize both natural sciences and social sciences to generate the information needed to support management.
- Embrace uncertainty by making it apparent, but do not let it distract attention from the things that are known. We often know enough to make an initial choice of direction for action, even if we are uncertain about many details. Decisions in other fields are made in the presence of uncertainty; marine management should not be held to a higher standard of certainty.
- Ensure that the science used to support planning and management is defensible — i.e., relevant, credible, and legitimate.
- Be aware that scientific input should not stop when management is implemented. Good EBM uses information and knowledge flowing from management measures to improve scientific understanding of ecosystems, human behavior, and the efficacy of management.
- Use science effectively and judiciously. Do not let science become an objective in itself, nor allow technical expertise to displace social dialogue and participatory decision-making.

INTERNATIONAL AGREEMENTS LAYING THE GROUNDWORK FOR EBM

The global community has made numerous commitments to environmental targets under a range of international agreements and proclamations, dating back to the 1972 UN Conference on the Human Environment in Stockholm. These include the World Conservation Strategy 1987; commitments to sustainability of oceans, seas, coastal areas and their living resources made under Chapter 17 of Agenda 21 agreed at the Rio Summit on Sustainable Development in 1992; and the UN Convention on the Law of the Sea, which came into effect in 1994. Targets for protected areas were made under the Convention on Biological Diversity (CBD) in 2004 and 2010, and vows to reduce poverty while keeping resource use within sustainable limits were stated in the United Nations Millennium Development Goals.

Other agreements that encourage parties to adopt an ecosystem approach include the Implementation Agreement on Parts V, VII, XI and XII of the UN Convention on the Law of the Sea; the UN Agreement on Straddling and Highly Migratory Fish Stocks; the UN Code of Conduct on Responsible Fisheries (adopted in 1995); and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (adopted in 1995). In addition to these commitments to adopt an ecosystem approach, many nations have declared commitments to reaching various protected area targets, including the 2020 target for representative marine protected areas under the CBD. The CBD Strategic Plan and Targets also go beyond MPAs, providing guidance on many tools and approaches to implementing EBM (for example, Target 6 places fisheries in an ecosystem context, and calls for impact assessments and integrated decision-making).

and the well-being of many national economies, particularly in developing countries." They further emphasized that "ensuring the sustainable development of the oceans requires effective coordination and cooperation, including at the global and regional levels, between relevant bodies." Among the actions they identified was to "encourage the application by 2010 of the ecosystem approach."

EBM can be the natural outgrowth of such commitments, building on the legal international agreements in a region, and the existing regulations countries have adopted concerning management. In addition to national frameworks for marine and coastal management, such as legislation that protects the coastal zone or enables fisheries management, many bilateral and multilateral agreements exist that pave the way toward EBM. Such international frameworks allow for wider scale approaches to fisheries management (as for example, regional fisheries management organizations), greater ability to deal with transboundary pollution (e.g., protocols dealing with land-based sources of pollution in a region), and greater ability to develop cross-sectoral approaches (as shown by UNEP Regional Seas, or some of the Large Marine Ecosystem initiatives, for instance). The box above summarizes some of the major existing international agreements that facilitate the adoption of EBM approaches.

DECISION-MAKING AT LOCAL, NATIONAL, AND INTERNATIONAL LEVELS

"In order to respond effectively to today's oceans challenges, societies must establish means to agree on the concerns that have first call on scarce domestic and international resources. This involves decision-making at local, national, and international levels. Success at the international level is contingent on local and national processes that truly engage affected constituencies. At the same time, when the scale of the problem extends beyond national boundaries or when a national problem is exacerbated by external influences, it cannot be solved by a single nation. This sets a dual agenda for the 21st century: to maintain the benefits and functions of marine ecosystems for the communities dependent upon them and for human society as a whole, and to reconcile the sector-specific thread of international legal instruments with the more comprehensive, ecosystem-based approach necessary to diagnose complex problems, determine the relative importance of different sources of stress, and establish priorities. Where logical ecosystem-based units of ocean management converge with international institutional arrangements is at the regional level."

Lee Kimball, *International Ocean Governance* (IUCN, 2003)

UNEP's Regional Seas Programme has helped to create the context in which EBM can flourish in many regions of the world. Regional Seas Conventions and Action Plans articulate common goals and establish the legal framework by which

"EBM will more often than not start small and scale up. In reality, it is not at all trivial to develop management regimes that cross jurisdictions — be they local government jurisdictions, provincial/state, or national — because governance systems usually don't exist for cross-jurisdiction management. Thus EBM can start WITHIN jurisdictions, and usually does."

-Alan White, The Nature Conservancy

countries can develop ecosystem approaches. In many cases, this regional scale is considered an appropriate level to promote EBM most effectively.

As marine and coastal management proliferates and matures, the context for taking steps toward EBM is becoming more favorable. Developing effective EBM in a particular place will require an understanding of the legislative frameworks, international agreements, and evolving perspectives on dealing with uncertainty that exist in that region.

EBM EMBRACES THE PRECAUTIONARY APPROACH

Existing legal frameworks have also enabled the adoption of the *precautionary approach*. The precautionary approach builds on the precautionary principle agreed at the World Summit on Sustainable Development (2002), which states: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." In other words, when scientific knowledge is incomplete, regulators should err on the side of caution (that is, act in the least risky manner) within reasonable economic and social limits. In some legal systems, including the European Union's, the precautionary approach is formalized in statutory law, and the concept arises often in ecosystem-based management.

This precautionary approach reflects a shifting of the "burden of proof". Traditionally, regulators have had to prove that an activity is unsafe before regulating or disallowing it: i.e., a proposed activity has been assumed to be safe until proven otherwise. Under the precautionary approach, the proponent of a new or expanded activity must show the activity is safe before it is fully allowed, shifting the burden of proof from the public sector to the private sector. Thus, the fishing industry may shoulder the costs of collecting data and conducting analyses to show that an increase in quota would not adversely affect stocks, food webs, and biodiversity. Similarly, a marina developer proposing to convert coastal wetlands may need to finance studies to show the development would not adversely impact the delivery of ecosystem services — such as provision of fish nursery areas, filtering of pollutants, and maintaining hydrological balances.

COSTS AND BENEFITS OF EBM

The goal of EBM is to make marine and coastal management more effective, more efficient, and less costly than the additive costs of uncoordinated sectoral management.

CASE STUDY / *Implementing the precautionary approach: CCAMLR*

Upon concerns in the 1970s that catches of krill — the base of the Antarctic marine food web — were becoming unsustainable, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) was negotiated, and came into force in 1982. The aim of the convention is to protect the marine life of the Southern Ocean while allowing sustainable use. CCAMLR now has 25 Member States and 34 total parties.

Significant effort goes into expanding CCAMLR's knowledge base with long-term studies and careful monitoring of human activities in the region. But CCAMLR recognizes that much about the Southern Ocean ecosystem remains unknown, and there are risks involved in managing amid such uncertainty. To account for this, the precautionary approach is central to its management. This means that CCAMLR collects all the data it can, then weighs the extent and effect of the uncertainty in such data before making management decisions. For example, under CCAMLR, conservative krill catch limits are set to take account of the needs of associated species (including seabirds and marine mammals) in a manner that preserves the ecological sustainability of all the species concerned. / **www.ccamlr.org**

There is no question that building a robust EBM process, which involves integrating and coordinating management across sectors and at large scales, will involve some new costs in itself. Such costs are incurred during the planning process, for example — gathering information, synthesizing and analyzing it, and presenting it to the public and decision-makers. The greater the scale of planning and the more uses that have to be accommodated, the greater the number of stakeholders that need to be involved. This adds to costs in both time and money.

Implementing EBM also has its costs. These include for scientific research to better understand the ecosystem, and to evaluate the efficacy of management. Coordinating and communicating among different agencies and authorities requires time and money. And again, these costs increase as the size and scope of EBM are broadened.

However, although these costs can be significant, the alternative — i.e., continuing with conventional, sectoral management — carries its own significant expenses. In fact, EBM-led coordination and cooperation among management agencies can conceivably lead to cost savings over the long term:

- There are economies of scale achieved in having different management agencies work together to undertake training, research, and monitoring and surveillance. Instead of having two, or five, or ten agencies conducting overlapping research, for example, one joint team can do it.

- More importantly, ineffective management is expensive management. Every time habitats and services are lost, it represents a substantial cost to society. Loss of wetlands, for example, means a loss of nursery areas for valuable fish species and a loss of coastal protection from storms — with substantial impacts on humans in both cases. Having to restore or rehabilitate those ecosystems incurs even more costs. In terms of ensuring sustainable ecosystem services, the cost-benefit ratio of doing EBM may be less than the additive cost-benefits of conventional management.

EBM also offers greater payoffs when there are changing or novel environmental conditions — which characterize most coastal and marine ecosystems today in this era of global change. EBM lowers the risks of unexpected losses by employing a broad-based scientific understanding of the ecosystem and the factors impacting it, and builds increased capacity to absorb unexpected fluctuations in services. In general, the resilient marine and coastal ecosystems that result from good EBM practice have so much to offer humankind that management costs are minor compared to the benefits that result.

Moreover, EBM provides benefits by underpinning ecosystem-based adaptation (EBA). EBA concerns the management of biodiversity and natural resources in ways that help vulnerable communities cope with the impacts of climate change. EBA strategies can include, for example, managing coastal habitats (e.g., mangroves, sand dunes, and saltmarshes) to shield communities and infrastructure against storm surges, or ensuring that forest systems remain healthy to provide clean drinking water despite changing conditions. In Kampong Bay Basin, Cambodia, a study of climate vulnerability allowed planners to analyze different climate change projections and relevant management responses; in turn, this allowed managers to evaluate trade-offs among specific management measures (see Kampong Bay, Cambodia: the climate perspective in water-related development: www.crbom.org/SPS/Docs/SPS06-KgBay-0.pdf). By utilizing the resilience of ecosystems for climate change adaptation, EBA is a direct application of EBM.

"The harsh reality is that we cannot afford *not* to do ecosystem-based management, and we had better start straight away with whatever resources and knowledge we have."

-Kevern Cochrane, Fisheries Management and Conservation Service, UN Food and Agriculture Organization

PLANNING FOR URBAN DEVELOPMENT - WITH OR WITHOUT AN ECOSYSTEM PERSPECTIVE

A small coastal city is poised to experience rapid population growth. It is faced with a choice of minimizing short-term costs and letting development occur unchecked, or doing careful planning as it expands, taking ecosystem considerations into account. Such urban planning focuses on ecosystem services, the connections between activities on land and the condition of the coast and ocean, and the trade-offs that need to be made for development to be more sustainable and equitable.

Unplanned development

The city decides to engage in minimal planning as the city expands. Without restrictions in place, the city grows right up to the water's edge. The shoreline is hardened, and green space is eliminated in favor of additional development. Roads cut directly through wetlands and coastal plains, damaging them irreparably. Agriculture is unregulated and unzoned. As a result, urban and agricultural run-off become a significant issue and water quality and coastal recreation are compromised.

Planning with an ecosystem perspective

The city decides to invest in urban planning that includes consideration of the surrounding coastal and marine ecosystem. It keeps urban run-off to a minimum by keeping green space and other porous surfaces intact. It prioritizes maintaining the natural shoreline by including a buffer between development and the coast. It elevates roads to minimize damage to sensitive wetlands. Agriculture is practiced sustainably, and does not abut the coastline. Residents continue to enjoy the coastal recreation opportunities because the water is clean and productive.

Degraded and unproductive

Healthy and productive

SECTION II

Examining the Core Elements of EBM

Ecosystem-based management is a holistic approach that takes into account the interactions within a given ecosystem. These interactions include those between different parts of an ecosystem; between land and sea; between humans and nature; and between uses of ocean resources and the ability of ecosystems to serve those uses. There are several core elements that must be put into practice at some point in an EBM process:

1. Recognizing connections within and across ecosystems
2. Utilizing an ecosystem services perspective
3. Addressing cumulative impacts
4. Managing for multiple objectives
5. Embracing change, learning, and adapting

Taken together, these core concepts set ecosystem-based management apart from traditional management. They are key overarching considerations as the practitioner begins to implement EBM. It is important to note, however, that although all of these elements are essential, they can be addressed incrementally given the situation and existing programs in a particular area.

This section briefly describes these fundamental concepts and provides examples of projects that are addressing them in innovative ways.

"Take a walk through your watershed. In doing so, you will gain an appreciation for the diversity of land uses and the complexities of ecosystems. The more we are able to make tangible connections to the watersheds and ecosystems in which we live, the more likely we are to translate that perspective into our decisions."

-Lisa Lurie, Agriculture Water Quality Manager, Monterey Bay National Marine Sanctuary, USA

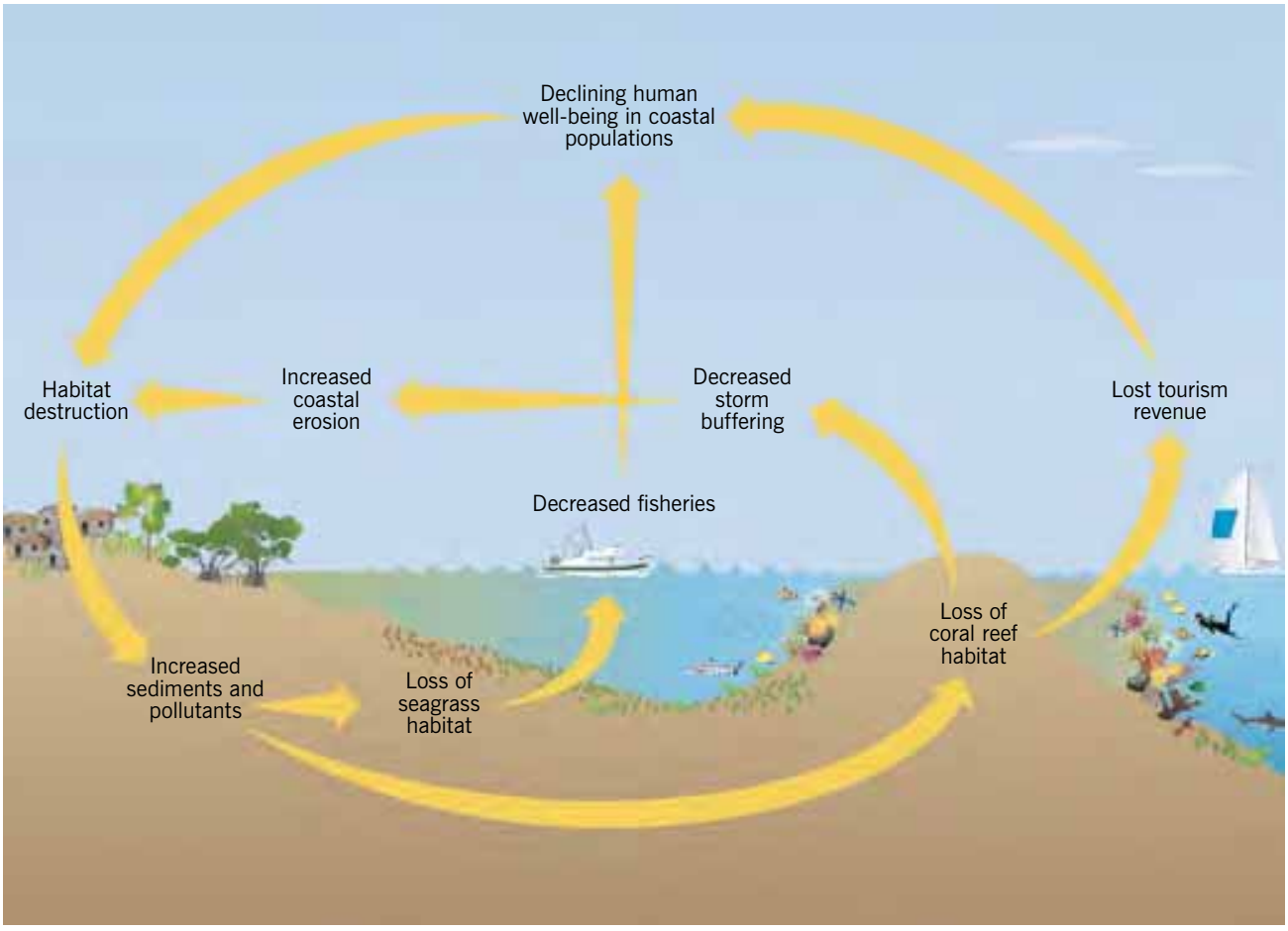
CORE ELEMENT 1: RECOGNIZING CONNECTIONS WITHIN AND ACROSS ECOSYSTEMS

Natural systems are highly complex. Energy can flow between components within an ecosystem, or between whole ecosystems themselves. It also flows between people and the ecosystems they use or otherwise impact. Disruptions to any part of an ecosystem — such as changes in the presence of a specific species, the structure of a habitat, or the occurrence of natural processes — can directly or indirectly affect many other components. The linkages among marine, coastal, and terrestrial systems in particular can be highly relevant to species that straddle those systems — including humans.

Management of these systems is often under the control of different agencies or sectors, which may not communicate fully with one another. This disconnect can significantly undermine progress toward conservation goals. EBM practitioners should assess ecological linkages from the start, build sectoral integration and communication, and continue to learn and update knowledge through scientific advice and monitoring.

Recognizing these connections can facilitate the eventual integration and coordination of management. The distinction drawn here between the two is that integration suggests players are operating under (and are subject to) an overarching arrangement, while coordination suggests an agreement without binding commitment. Although management may be integrated within a jurisdiction, it is typically coordinated between jurisdictions.

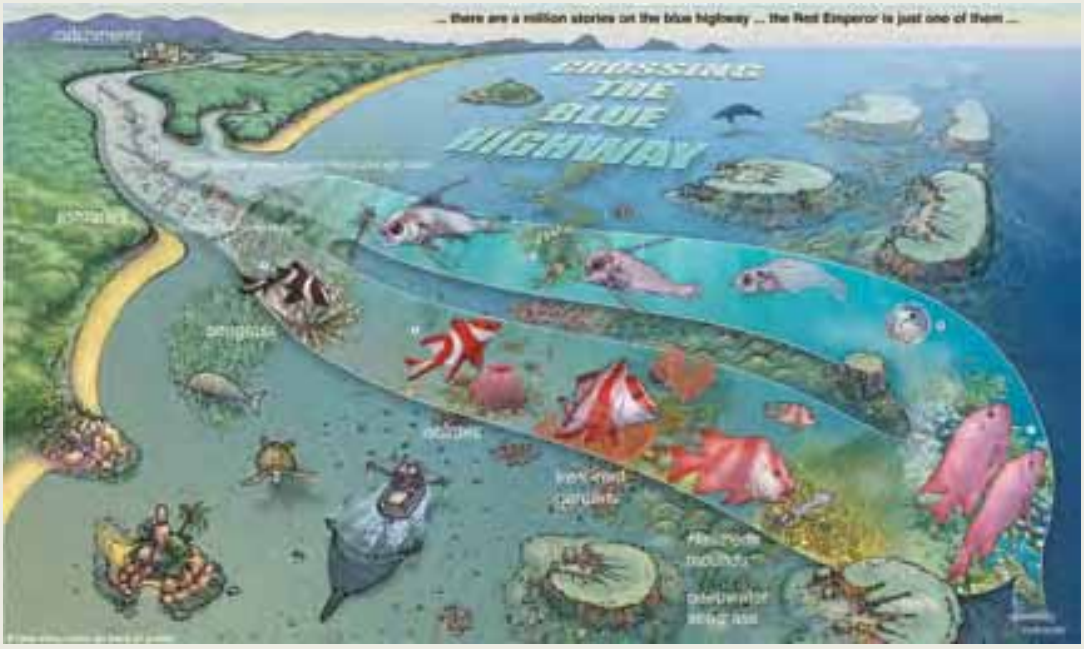
RECOGNIZING CONNECTIONS



CASE STUDY / *Recognizing connections in Australia: Habitats fit for an emperor*

Prized by recreational fishers on the Great Barrier Reef (Australia), the red emperor fish moves through several habitats as it grows to adulthood. The larvae are spawned in the outer reef ecosystem then drift inshore, finding shelter and food in coastal seagrass meadows. As they mature, the juvenile fish gradually migrate back to the reef, spending time in a series of distinct environments along the way (see illustration).

For the red emperor, these ecosystems are linked. Anything that affects one link — such as coastal runoff degrading seagrass meadows — impacts the red emperor population throughout the system. A sustainable red emperor fishery, and a healthy Great Barrier Reef in general, both depend on the quality of each of the points on the "Blue Highway". For this reason, the Great Barrier Marine Park Authority has developed zoning regulations within the park that maximize the protection of all the linked critical habitats of this valuable and iconic species.
/ **www.abc.net.au/science/bluehighway/default.htm**



CASE STUDY / *PANGAS: Combining science and fisher knowledge to understand ecological connections*

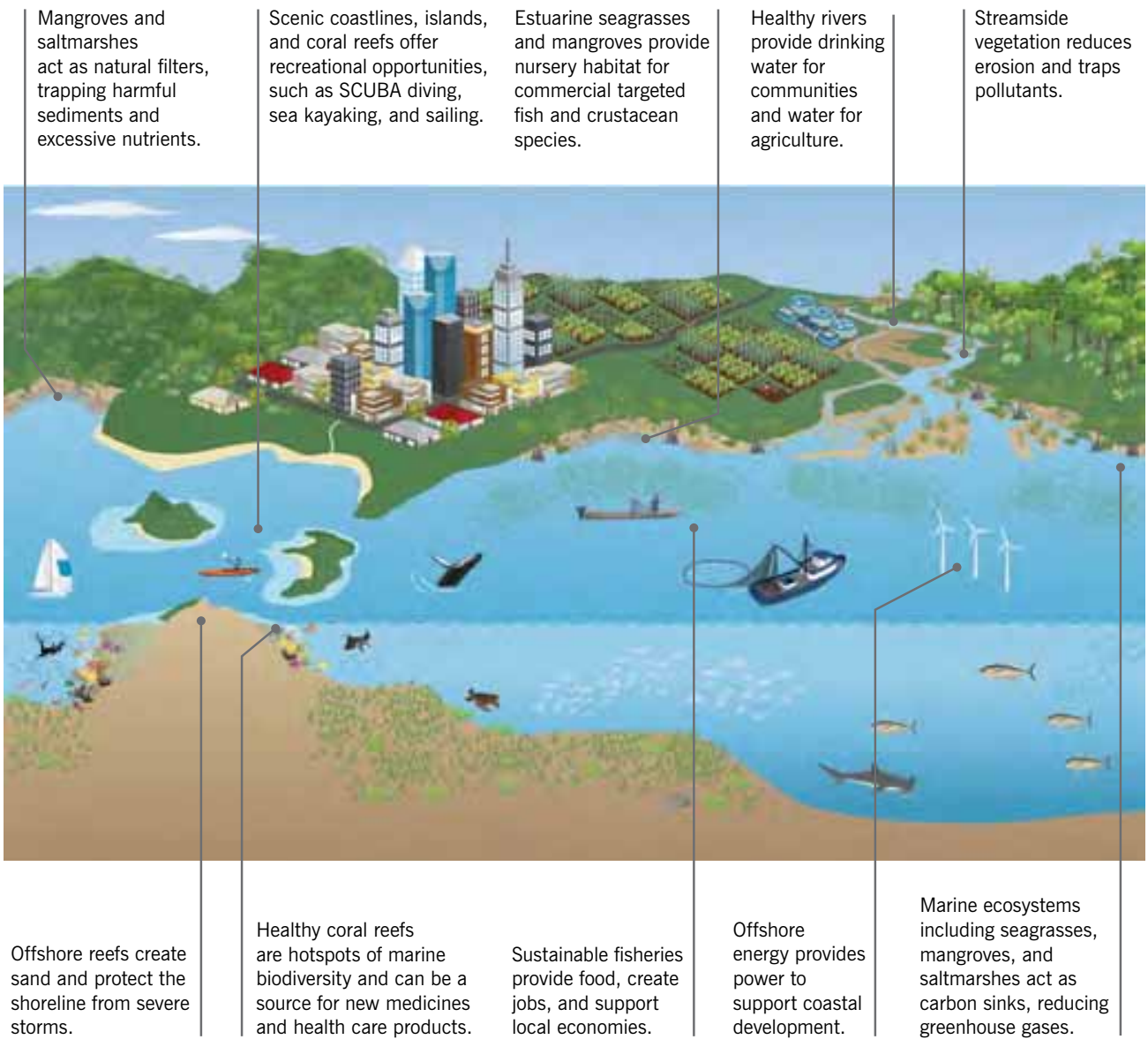
Project PANGAS (Pesca Artesanal del Norte del Golfo de California – Ambiente y Sociedad, or Small-scale Fisheries in the Northern Gulf of California – Environment and Society) is an interdisciplinary alliance of six institutions working with the communities of the Northern Gulf of California, Mexico, to improve the sustainability of small-scale fisheries and the health of the rocky reef ecosystem. A key element of PANGAS is understanding how populations of economically important species in the Northern Gulf — like grouper, octopus, scallops, and snapper — are connected across the large spatial scale of the region. PANGAS combines fisher knowledge with existing biological information to develop a basic understanding of larval movement. It then incorporates that information into oceanographic models to predict the most important locations of sources and sinks for larvae (genetic testing is used to validate the models). This information is being included in management plans for seven economically important species in the Northern Gulf.
/ **www.pangas.arizona.edu/en/public**

CORE ELEMENT 2: APPLYING AN ECOSYSTEM SERVICES PERSPECTIVE

Ecosystem processes are critical to the functioning of coastal and marine systems. When they also contribute to human well-being, they are known as ecosystem services. Substantial positive economic values can be attached to many of these services, which include providing food, buffering land from storms, offering recreational opportunities, maintaining hydrological balance, storing carbon, and providing space for shipping.

Developing an ecosystem services perspective is important for planners and managers when establishing priorities for management. Priorities can be determined by focusing on the areas and habitats that deliver the greatest amount of ecosystem services, or the ecosystem services of highest value. Alternatively, priorities can be based on the most critical threats to the delivery of ecosystem services or to highly valuable areas. Methods and tools for determining priorities vary by place, given differences in information availability and resources available, as well as cultural considerations regarding how decisions are made within a society. Regardless of these

VALUING ECOSYSTEM SERVICES



CASE STUDY / *Ecosystem services valuation and links to policy in the Mediterranean Sea*

The semi-enclosed Mediterranean Sea encompasses a large, rich, and diverse set of coastal and marine ecosystems. The 21 developed and developing countries that border it have exerted pressures on Mediterranean habitats and resources for millennia, causing decline in the ecosystem services upon which so many cultures, communities, and countries depend. Some of the most ecologically important marine habitats (and also among the most valuable, from an ecosystem services sense) are the most impacted. Seagrass meadows, for example, continue to be lost and degraded in all subregions, and the condition of coastal lagoons continues to decline.

The Blue Plan Regional Activity Center – a technical component of the Mediterranean Action Plan – produced an initial ecosystem services valuation report as part of the Barcelona Convention's Ecosystem Approach Process. The study concludes that the annual resource rent relating to the production of fisheries resources of Mediterranean origin is almost 3 billion Euros, while the value of marine habitats supporting recreational activities including tourism is in excess of 17 billion Euros. Further ecosystem service values include carbon sequestration (2.2 billion Euros annually); protection against coastal erosion (530 million Euros); and waste assimilation (estimated at 2.7 billion Euros). The aggregate value of all five services studied (fisheries production, recreation, climate regulation, erosion control, and waste treatment) was assessed conservatively at over 26 billion Euros annually. While the findings of the study are under review, the magnitude of the value estimates for the different ecosystem services studied has already had implications for policy. As countries discuss how to move together toward a more EBM-based approach to marine management, priorities have centered on those habitats that provide the bulk of these valuable services.

/ **www.planbleu.org/publications/Cahier8_marin_EN.pdf**
/ **www.unepmap.org**

variables, however, assessing marine and coastal areas for their relative value can be done with traditional and user knowledge, supplemented by whatever level of scientific information exists.

A focus on ecosystem services can enable authorities to identify and implement innovative financing to maintain those services. One example involves schemes called Payments for Ecosystem Services, wherein a business or jurisdiction that benefits from a particular service pays a fee to have that service delivery assured. For example, a tour operator might pay a local community not to fish on a diverse patch of reef, thereby preserving the site's value to divers. Or coastal landowners might pay into a fund to enhance management of mangroves or other wetlands, thereby maintaining shorelines and reducing their risks from coastal storms. Investment in maintaining habitats and biodiversity like this, namely to keep ecosystem services flowing, can make good business sense. Such innovative financing lessens the management burden of traditional management entities, and allows more direct engagement of

local communities, user groups, industries, and other stakeholders who benefit from the services that nature delivers. For a list of publications on the use of innovative financing, as well as other publications on EBM in general, see the appendix on page 65.

"Making an assessment of the extent of all human activities is a first, simple, and achievable step that only requires access to statistics of each individual sector. If the data also can be mapped, managers get a first impression of where the human footprint on the ecosystem is highest."

-Erik Olsen, Head, research program on oil and fish, Institute of Marine Research, Norway

CORE ELEMENT 3: UNDERSTANDING AND ADDRESSING CUMULATIVE IMPACTS

The human activities that take place within an ecosystem often overlap with each other, and their impacts can be intensified as a result. Impacts can also accrue over time. By examining such cumulative impacts, it is possible to assess the total effect of various human actions on an ecosystem, as well as that ecosystem's ability to sustain delivery of desired services.

Analyzing impacts according to their causes allows for a tailored management response. The suite of management responses taken under EBM needs to be considered as a whole, with management choices evaluated as trade-offs when they overlap. This is because managing for multiple uses may not allow for so-called "win-win opportunities": something may be lost as something is gained, making it necessary to evaluate trade-offs between various uses. Planners can use spatial analysis to predict overlapping threats and develop a better understanding of the effects and interactions of multiple stressors. To account for cumulative impacts, practitioners may need to begin to build regulatory mechanisms that encourage or require goal-setting and evaluation across sectors.

CUMULATIVE IMPACTS

Intensive fishing

Intensive fishing occurs when fish and other marine species are caught at a rate faster than they can reproduce, reducing fish stocks below an acceptable level. In severe cases, intensive fishing can alter the balance of ecosystems, leading to shifts in food webs and leaving ecosystems more vulnerable to other disturbances.

Intensive fishing + Agriculture

Poor agricultural practices result in sediment and nutrient runoff to waterways and oceans, leading to decreased water quality, algal blooms, macroalgal overgrowth, and decline in seagrass habitat. Combining intensive fishing and poorly managed agriculture can have a devastating impact on nursery habitat for already suffering fish populations.

Intensive fishing + Agriculture + Coastal development

Coastal development and shoreline hardening increases the runoff of pollutants such as sewage and chemical fertilizers into the ecosystem. Layering new impacts can have unexpected and compounding effects on ecosystem health. Comprehensive land use planning, low-impact development, and smart growth practices can address cumulative impacts by reducing impervious surfaces, preserving open space, and fostering more livable coastal communities.

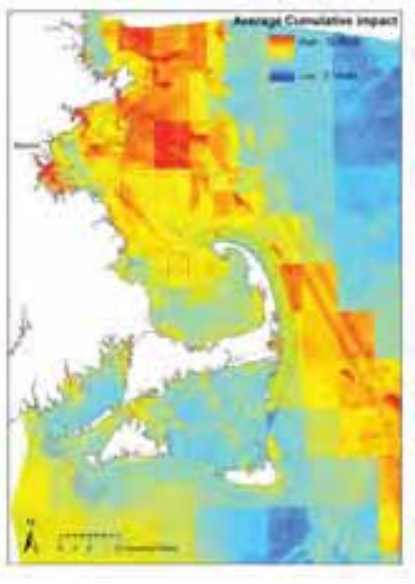
CASE STUDY / *Considering cumulative impacts in Massachusetts, USA*

The US state of Massachusetts is developing solutions for managing the many human uses of its waters. A recent law (May 2008) mandates the development of a plan to manage the state's coastal waters, including taking into account how human uses overlap, interact, and potentially magnify the impact of one another.

The state is working with a team of researchers to understand how to plan for and avoid these adverse cumulative impacts. The methods to do this start with understanding the vulnerability of a habitat to each human use. This means assessing what uses are compatible or incompatible with particular habitats, based on expert judgment and best available science. In Massachusetts, for example, coastal habitats such as barrier beaches and saltmarshes are highly vulnerable to coastal engineering that heavily modifies the shoreline, but they are less sensitive to nearshore aquaculture. The research team has compared this information to data on spatial patterns and intensity of each use, and scored the relative cumulative impact across the study grid.

The maps and cumulative impact scores allow planners to understand which future coastal activities can be placed in which places. Now in development by the research team is a GIS software tool to model how different uses will impact particular habitats, giving state planners a way to predict impacts before permits are issued.

/ **www.malegislature.gov/Laws/SessionLaws/Acts/2008/Chapter114**
/ **www.nceas.ucsb.edu/GlobalMarine**



Cumulative impacts on an ecosystem

This map shows the cumulative impacts of various human activities on marine ecosystems in the waters off Massachusetts, USA. The impacts of assorted ocean uses — including shipping, commercial fishing, pipeline construction, and other activities — were calculated based on the intensity of use and assessed ecosystem vulnerability. Warmer colors represent greater cumulative impact; cooler colors represent lesser cumulative impact. (Zones indicated on the map represent an array of ocean management areas defined in the 2009 Massachusetts Ocean Management Plan, including areas where wind energy development was considered and areas where no uses would be permitted.)

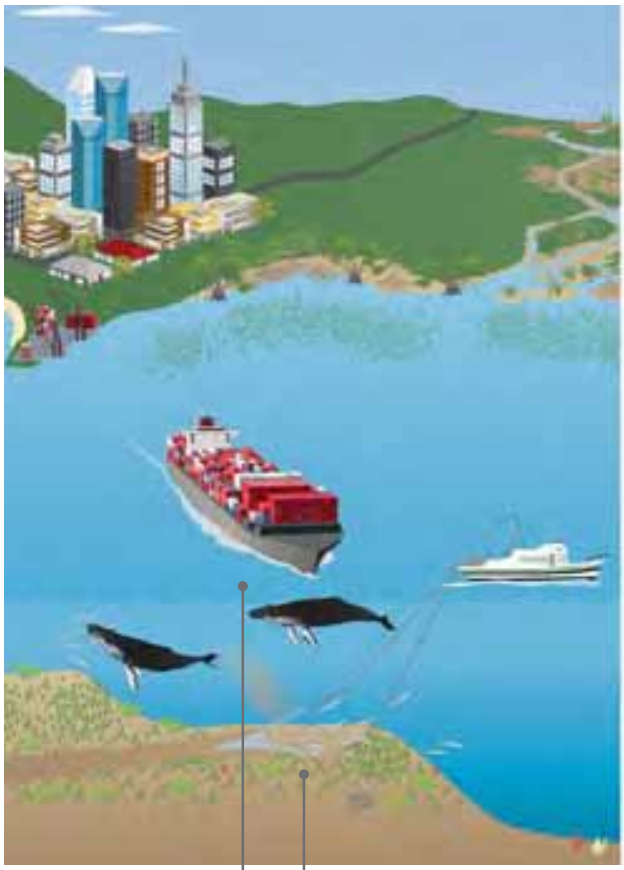
CORE ELEMENT 4: MANAGING FOR MULTIPLE OBJECTIVES

EBM focuses on the diverse benefits provided by marine and coastal systems rather than on single ecosystem services. Such benefits or services include vibrant commercial and recreational fisheries, renewable energy from wind or waves, coastal protection, and recreation. Fundamentally, the primary goal of any EBM project is to secure the long-term delivery of multiple ecosystem services that support human well-being by sustaining critical ecosystem structures, functions, and processes.

The process of EBM must determine which individual objectives are desirable — a tricky task when more and more objectives are considered and some are incompatible with one another. It must also figure out a harmonized management system that can guarantee those objectives are met over time. While it is possible to achieve multiple objectives, managers must accept that progress toward those objectives may not be uniform, and meeting some objectives may take time. They may have to convince stakeholders to accept the uneven progress as well, which can be a challenge when stakeholders have had to compromise to reach agreement on a suite of compatible objectives.

MANAGING FOR MULTIPLE OBJECTIVES

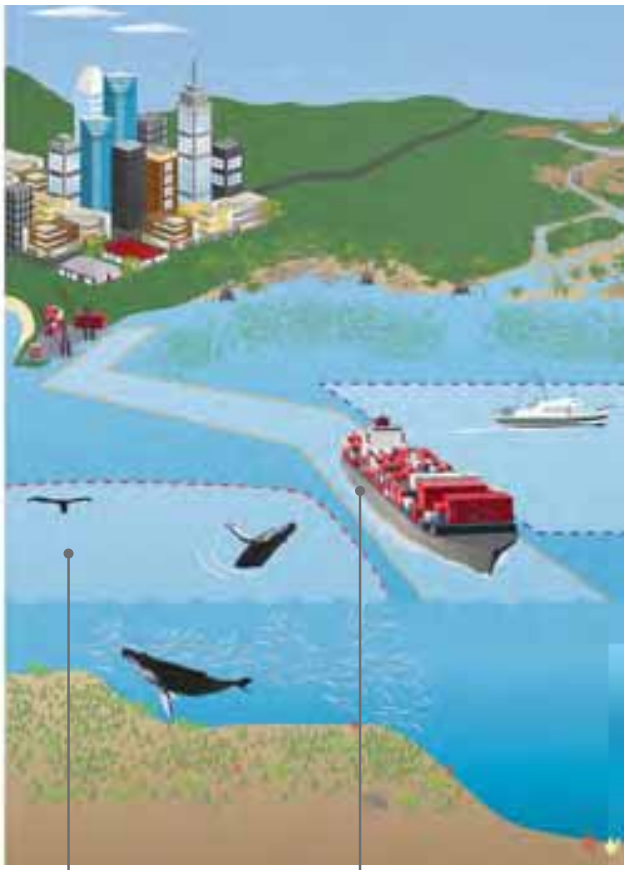
Conflicting uses



Shipping corridor passes through important feeding habitat for endangered whales, causing collisions.

Bottom fishing in the whale habitat leads to ocean floor disturbance and a decline in food sources for whales.

Accomodating uses and reducing conflict



Key whale feeding habitat is closed to shipping traffic and fishing, and whale mortality decreases. Ocean floor recovers from fishing activity, biodiversity increases, and ecosystem processes are restored.

Shipping corridor is re-routed and new zones are created to support sustainable fishing in less sensitive habitats.

CASE STUDY / *Seaflower MPA, Colombia: managing for multiple objectives*

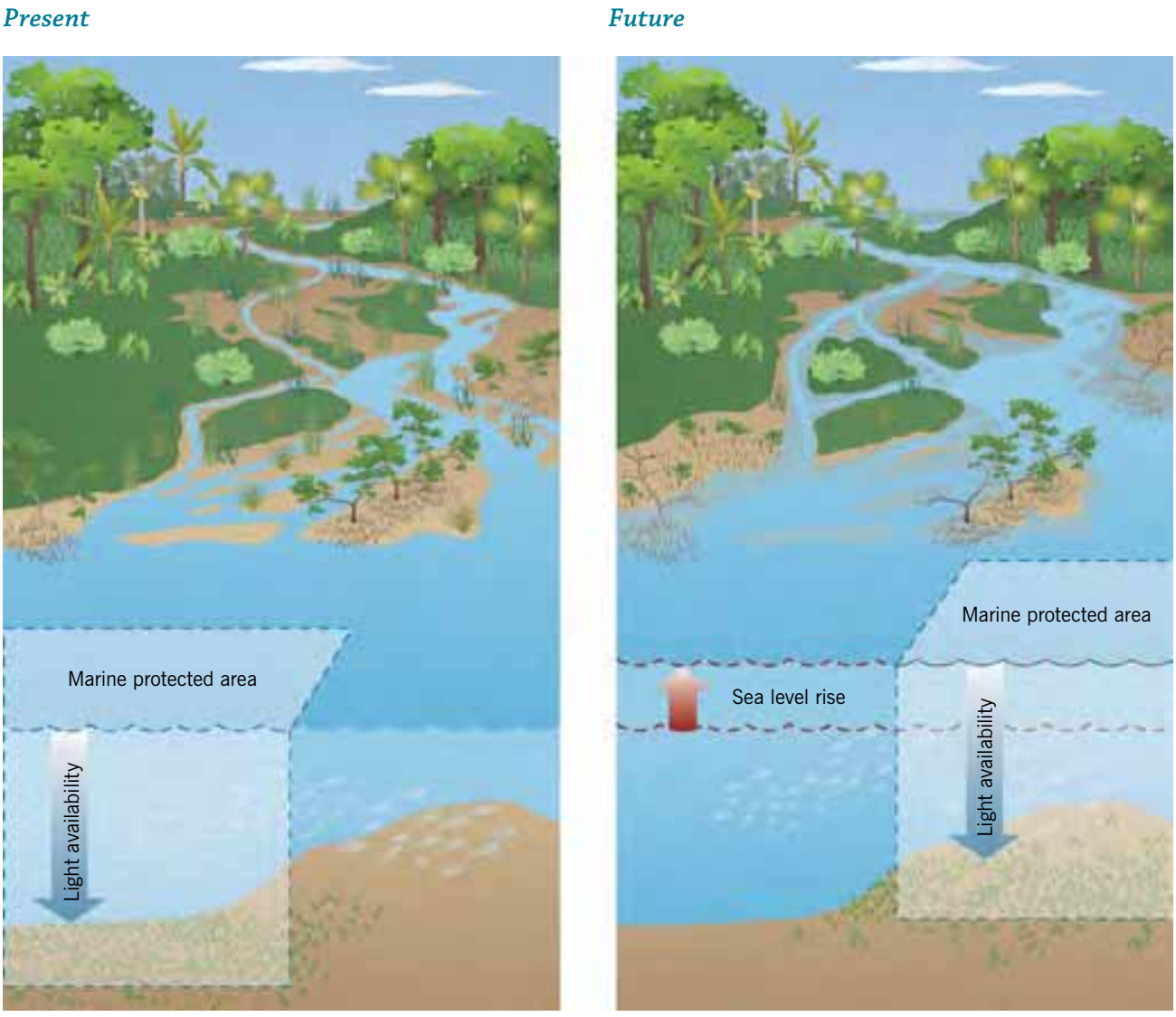
The San Andres Archipelago of Colombia is home to the largest open ocean coral reefs in the Caribbean. It is also home to an indigenous human community that depends on the reef ecosystem for food and other services. To manage the ecosystem and resources it provides, the regional autonomous governmental authority CORALINA takes an integrated approach: conserving biodiversity while protecting the livelihoods and tenure of the archipelago's people.

CORALINA has achieved this through several methods, all with the view that a healthy ecosystem and sustainable use (fishing, harvesting, tourism) go hand in hand. It designated the 65,000-km2 Seaflower Marine Protected Area in 2005, a zoned MPA that is no-take in some areas while allowing artisanal use and locally run tourism in others. It established a regulatory system for managing commercial fishing, tourism, and other uses of the reefs. And it works continuously to keep local awareness high of the importance of ecosystem health to human health. When CORALINA launched its EBM plans a decade ago — on the heels of a four-year comprehensive, island-wide environmental education program — the San Andres population showed such a strong understanding of the value of their marine resources that they were willing to contribute an average of almost US $5 per capita per month to coral reef conservation, should such a financial mechanism be put in place. / **www.coralina.gov.co**

CORE ELEMENT 5: EMBRACING CHANGE, LEARNING, AND ADAPTING

Neither ecological nor social knowledge will be complete at the start of any EBM initiative, and change is constantly occurring within any ecosystem. Therefore, it is essential that practitioners regularly collect information and monitor the effects of management decisions, and that they engage stakeholder communities in these processes as well. At consistent intervals, strategies should be evaluated then adapted to new learning and new conditions. Experimentation, innovation, monitoring, learning, and change should be aspects of any EBM initiative.

EMBRACING CHANGE, LEARNING, AND ADAPTING



The management goal in the above situation is to restore and protect sensitive seagrass habitat and associated species. Over time, sea level rises and seagrass beds begin to shift location in order to stay within their tolerant zones of depth and light availability. Managers monitor the ecosystem, observe these changes, and advocate for altering the protected area boundaries in order to more effectively meet management goals.

In this scenario, managers also notice the retreat of mangrove forests as a result of sea level rise. They understand the connection between healthy mangroves, healthy seagrass beds, and healthy communities, and advocate for a broader set of management strategies in order to help human communities and the environment adapt to climate change and protect valuable ecosystem services.

CASE STUDY / *Adaptive management in practice – Locally Managed Marine Areas in Indonesia*

The Locally-Managed Marine Area (LMMA) Network is a group of practitioners involved in community-based marine conservation projects in the Indo-Pacific. They have joined together to share experience and lessons on improving their management of LMMAs. Coastal communities in eastern Indonesia have been active in LMMA activities for nearly 10 years and have based their work on a robust adaptive management cycle.

Villages engaged with LMMA in Indonesia (I-LMMA) conduct an annual cycle of planning and review to learn from their conservation, education, and livelihood activities, and make improvements to their work based on the results. An annual plan for the upcoming year's management activities is created using a conceptual model. Community members conduct monitoring throughout the year, and there is regular reporting of results back to the village. Based on the newly gathered information, the village decides how to adapt the next iteration of site management to stay on track to meet its goals. In one community, for example, a sea cucumber protected area was created and community members collected information to assess how well it worked. When the results showed that the protected area did not account for movement of the sea cucumbers, and that expanding it would lead to more effective management, the community decided to enlarge the protected area. The community continues to track the effects.

One lesson from the I-LMMA adaptive management experience is that it is important to set clear management objectives at the outset of a project. Clear objectives will help a project team select a small and targeted set of indicators that are directly tied to management decisions — reducing effort, lowering costs, and improving the connection between data and decisions. / **www.lmmanetwork.org**

Adaptive management is particularly important in the face of climate change and growing human impacts on coastal systems. Climate change may affect the distribution of species and habitats, influence the spread of invasive species and pathogens, and undermine natural productivity. In response, management will need to be amended and improved as necessary.

The mechanisms for making management as responsive to changing conditions as possible will vary by place and culture. It is thus important to establish appropriate mechanisms formally as EBM is developed. In other words, it is not enough to say that management will be revised as time goes on. The processes by which information is gathered, fed into the management appraisal process, and used to amend management should be identified in advance with clear timetables.

SECTION III
Moving toward EBM

The goal of this section is to describe the general series of phases in an EBM process, illustrated with cases and examples. Although there are common elements that should guide the core of EBM in all cases (as described in Section II), EBM will look different in different places, tailored to the unique mix of ecological, social, and political conditions in a specific geographic area.

While implementing an EBM process will require some changes to be made to existing management frameworks, it should take advantage of — not undermine or ignore — the existing capacity, momentum, or progress. A good EBM process begins with a thorough assessment of the current management practices and policies already in place. It then identifies opportunities to begin building an ecosystem focus into those management frameworks and into stakeholders' mindsets and perceptions.

Embarking on EBM entails a strategic and iterative process that includes three main phases: visioning, planning, and implementation.

We recognize that in the following descriptions of these phases, the emphasis on specific activities occurring in particular phases may seem oversimplified, as some elements are common to all phases of EBM (the need for communication, for example). However, the description of each phase centers on the key aspects — the ones that will be the main focus of planning and management activity.

THREE PHASES OF EBM

Visioning Phase: Establish a Foundation for EBM

- Identify target geographic area and key concerns
- Build interest, expand participation, and create settings for sectors to come together
- Develop a common understanding of the ecosystem
- Take stock of existing management practices
- Set overarching goals

Planning Phase: Chart the EBM Process

- Assess the ecosystem
- Evaluate EBM governance options, and create legal frameworks to support multi-sectoral management
- Identify measurable objectives
- Prioritize threats, evaluate management options, and examine trade-offs
- Choose management strategies for EBM implementation

Implementation Phase: Apply and Adapt EBM

- Apply management then monitor, evaluate, and adapt
- Continue to communicate and educate
- Secure sustainable financing for EBM implementation over time

"There are many 'right ways' to move forward. EBM will be implemented differently in different historical, social, and ecological contexts."

-Karen McLeod and Heather Leslie, co-editors, Ecosystem-Based Management for the Oceans

Note that many if not all of these phases can be features of conventional sectoral management as well. What differentiates EBM from standard approaches is that these steps are undertaken across sectors and scales that recognize ecosystem connections and multiple, cumulative impacts. EBM responds to the need to develop a holistic vision for marine and coastal management, while also coordinating management to make it as efficient and effective as possible. That being said, as discussed in Section I, there are financial and time costs for these better outcomes. As management becomes more integrated and covers larger scales, the greater the short- and perhaps medium-term costs may be. However, those costs can be managed partly by focusing on issues that breach, or appear likely to breach, sectoral divisions. Furthermore, the long-term benefits from full EBM are likely to be greater than conventional management, as an array of ecosystem services are sustained over time.

Moving toward EBM starts with recognizing weaknesses in existing management and identifying the value of a comprehensive, integrated approach. Institutions or individuals initiate the process of developing a vision for EBM, and from this all planning and subsequent realignment of management flows. In the context of Regional Seas, this process might be catalyzed by the Secretariat for a particular regional seas agreement and build upon assessments and regional outlooks for biological diversity. In the context of national scale EBM, this visioning is likely to be driven by the government agency or agencies with marine and coastal management mandates. In other settings, particularly at more local scales, visioning may come from communities or particular user groups.

A key factor in making the process of EBM work is acknowledging the complexity of EBM, and responding by building or bringing in expertise in social dynamics and engagement. Clear communication and transparency in decision-making is critical for success in EBM. Short-changing this aspect will likely lead to misunderstanding and lengthy delays. It is key to plan ahead and identify talented facilitators, negotiators, and meeting planners who will commit to the duration of the EBM process.

While much of the following discussion is devoted to planning EBM, it may be critical to apply a time limit to the planning process. Planning can offer valuable opportunities to gain insight and reach out to new stakeholders and partners, but the fundamental purpose of EBM is to manage. Where resources and enabling legislation are devoted solely to planning and little thought is given to implementation of plans, EBM will remain a theory and not an actual practice.

CASE STUDY / *Initiating a vision for EBM in Port Orford, Oregon, USA*

Over the past decade the fishing community in Port Orford, Oregon, witnessed changes in its nearshore waters: a decline in longline fisheries, dramatic losses in revenues as a result of declining salmon stocks, and a boom-and-bust urchin fishery. Feeling disempowered by the existing top-down fishery management system, local fishermen created the Port Orford Ocean Resource Team (POORT), an NGO to give them a voice in management and protect the long-term health of their marine environment. Based on community input, POORT developed a vision for local sustainable fisheries and a vibrant nearshore ecosystem. To achieve that vision, POORT realized a broad approach would be needed — beyond just designating a marine protected area, for example. Ultimately POORT established a "community stewardship area", which includes traditional fishing grounds and upland terrestrial watersheds. The NGO also helps educate local fishermen on issues of interest, facilitates collaborative research, and engages with state resource management officials to advise them on local concerns. In short, POORT provides a framework on which community-initiated marine policy and research activities can now be carried out. / **www.oceanresourceteam.org**

Visioning Phase: Establish a Foundation for EBM

This phase involves building the foundation for EBM — from identifying the targeted geographic area and key issues, to developing overarching management goals. Although some chronology is implied in the listing of these initiatives, they can be undertaken in parallel. In fact, the first four can be done simultaneously to lay the groundwork for the important task of setting goals.

IDENTIFY TARGET GEOGRAPHIC AREA AND KEY CONCERNS

The general geographic area that an EBM effort will target must be determined at an early stage of planning so that activities can be strategically placed, and appropriate communities can be engaged. It should be recognized, however, that EBM does not require exact, demarcated boundaries in the same way that marine protected areas do. Boundaries should be fluid and can be expected to expand or shrink over time to account for changing conditions, knowledge, or strategies. In addition, subdivisions of the major area may be important for aspects of planning and assessment, and possibly implementation.

The region to be included in an EBM framework can be determined through consideration of a number of factors. These include:

- Known ecological boundaries.
- Areas of significant ecological value and use.
- The condition of various areas.
- The geographic scope of existing administration, including existing legal and regulatory frameworks.
- The recognition of opportunities that might exist to improve management (namely by reforming sectoral management to include ecosystem considerations, and by integrating management).

Managers may choose to "start small", with practical considerations guiding the determination of the focal area. By beginning EBM at a relatively small geographic scale, managers can build constituency support, funding, and understanding of the system. Then as knowledge, support, and funds increase, the boundaries of the EBM focus area can expand as well. However, potential drawbacks to starting small may exist as well. Some key ecosystem processes may not scale down well, and some industries may operate only at larger scales. There may also be social or legal equity requirements that prevent applying special opportunities or constraints to one group of citizens based on where they happen to live or work. The balance of benefits and constraints to starting small will be case-specific.

An EBM project in Morro Bay, California, USA, provides an example of the start-small approach. After three years of operation exclusively within the bay, the project team decided to extend its boundaries beyond the bay to include areas and stressors that affect regional ecosystem health. This decision was built on early science and practical experience that helped deepen its understanding of the system, and retarget the project to become more ecologically meaningful. The team also began investigating potential replication of its model at a region-wide scale.

Similarly, in the Cook Islands in the South Pacific, the national government worked with local community leaders to develop an integrated management plan for a particular lagoon (Takitumu) on the island of Rarotonga. Using the lagoon as a pilot site, the plan served first to demonstrate the benefits of EBM, then was subsequently expanded to a "whole-of-island" approach for Rarotonga.

In still another example, the US National Marine Sanctuary Program has conducted biogeographic assessments of its protected sites — defining the abundance and locations of species inside and outside the sites' boundaries. In part, these assessments are designed to inform a potential revision of sanctuary boundaries where important habitats are found outside of protected zones. The idea is to encompass additional habitats essential to the sanctuary ecosystem under the site's protective management umbrella.

Alternatively, managers may determine their initial focus area to be large enough to encompass all strongly interlinked habitats and communities – with the eventual aim of having EBM address the entire system. The legislation and policy for the Great Barrier Reef Marine Park took this approach. In 1980 the park's managing authority established multi-use zonation for the 344,000-km^2 area, with five geographic sections that were progressively zoned over many years. Later, from 2002-2004, the authority reviewed and rezoned the entire area again in response to biophysical research, management experience, and extensive public input. Even if EBM is planned in a stepwise fashion, as in the starting-small case, it still makes sense to consider the outer limits of the larger ecosystem or ecoregion, and the links between habitats within it, to lay the groundwork for future adaptive management.

The geographic size and scope of an EBM plan will also affect the choice of strategies and tactics that are employed in that area. As the boundaries expand, management tactics will need to adapt in order to accommodate additional or emerging issues. Like geographic boundaries, strategies and tactics must be fluid and dynamic in an EBM process, continually adapting to changing conditions and new knowledge (see "The Planning Phase: Choose management strategies for EBM implementation", page 48).

CASE STUDY / *Identifying logical target areas for EBM in the Benguela Current, south western Africa*

The highly productive Benguela Current Large Marine Ecosystem (BCLME) is one of four major coastal upwelling systems in the world. To safeguard the ecosystem's productivity, the BCLME Project was launched in 1995. The project fosters a cooperative approach to management, addressing challenges shared by Angola, Namibia, and South Africa, including the management of valuable fish stocks across national boundaries, harmful algal blooms, alien invasive species, and transboundary pollutants.

The Benguela Current Commission (BCC) was established by international agreement to enable the three countries to establish priorities and develop harmonized management responses. Guided by the Commission, the three southwest African countries collectively manage transboundary environmental and resource issues including recovering and sustaining fish stocks; improving the condition of degraded habitats; and mitigating ecosystem impacts of various sectors, including offshore oil and gas production, mining, mariculture, shipping and transport, and tourism.

Because this productive upwelling system provides important ecosystem services for each of the three countries, and the countries also share the challenges involved in managing the marine ecosystem effectively, a joint EBM approach was needed. EBM under the rubric of the BCLME would work only if the entire upwelling area were considered; hence the management approach encompasses the entire nearshore and offshore areas of the three countries. Identifying the target areas in this case meant encapsulating the entire upwelling area and adjacent nearshore, so that management could be holistic and effective. It is an example of where "starting large" with an EBM process, rather than starting small, was necessary. / **www.bclme.org**

CASE STUDY / *Drawing in stakeholders in the Gulf of California, Mexico*

Conservation of species and habitats in the Gulf of California has long presented challenges. In past decades, conservation initiatives regularly set conservationists (who were often outsiders) against local communities and fishers. But in recent years there has been somewhat of a turnaround, due partly to planning processes that are participatory and incentive-based. Such planning has allowed better fishing technologies to proliferate, and has encouraged cooperation among institutions. The World Wildlife Fund and the Mexican NGO COBI (Comunidad y Biodiversidad, A.C.), among others, have teamed with the Mexican government to reform the General Law of Sustainable Fisheries and Aquaculture (2007), and to create incentive programs such as eco-certification of lobster caught in the Gulf. In turn, this has increased trust among local communities, and has allowed stewardship to improve.

The case of the vaquita (*Phocoena sinus*) exemplifies this improvement, to an extent. This small, critically endangered porpoise is endemic to the northern Gulf, and is routinely killed as bycatch by artisanal fishers (the fishers use gillnets to target shrimp and finfish, and the vaquitas get caught in the nets and drown). Working with fishers, the government of Mexico presented a buyout program for gillnet permits in 2007, and created a start-up fund for alternative livelihoods in tourism. Fishers could also choose to use funds to purchase new fishing gear that did not cause bycatch of vaquita. A year later, after working with fishing cooperatives and NGOs, the government offered an additional option: compensation in return for not fishing with gillnets inside a designated vaquita reserve. The participatory planning process and the choice of options have helped support compliance with the regulations. Although survival of the vaquita is far from assured (fewer than 300 exist), there is now some prospect that the species may not face inevitable extinction.
/ **wwf.panda.org/what_we_do/endangered_species/cetaceans/about/vaquita/**

Entry points to EBM vary. Often the first issue on which resource management agencies focus is amending fisheries management to make it more holistic – a management approach commonly called the Ecosystem Approach to Fisheries (EAF) or Ecosystem-Based Fisheries Management (for more information, see pg 51). In many parts of the world, fisheries management has moved from single species management to multispecies management, and recently toward more ecosystem-oriented approaches: i.e., making sure there are adequate nursery areas, prey, and other factors for the targeted species. Managers are also assessing the impact of their fisheries on bycatch species, habitats, and ecosystem processes.

Agencies involved in managing fisheries using an ecosystem approach are addressing EBM from a sectoral perspective. But full EBM requires a consideration of wider aspects of management beyond fisheries management: for example, coastal management, marine biodiversity conservation, pollution controls, and even watershed management.

BUILD INTEREST, EXPAND PARTICIPATION, AND CREATE SETTINGS FOR SECTORS TO COME TOGETHER

Although involving appropriate stakeholders in an EBM process is one of the first and most critical elements of success, this step is sometimes given scant attention. Participation in the planning of marine and coastal management has often involved only the most obvious resource users (usually fishers) and the government agencies with direct jurisdiction over the area in question. The result of such limited participation can be a backlash against the emergent regulations from user groups (and even agencies) not included in the planning. In the interest of achieving an adequate management plan, with buy-in from those it will affect, planners should broaden the community of practice to involve all relevant stakeholders as early in the process as possible.

Regardless of the scope and scale of the place being managed, there needs to be a transparent hierarchy of engagement. Two typical tiers of engagement include an **implementing group** and a broader **constituent group**.

"We have found that perhaps the single-most important aspect for effective EBM capacity building has been in finding the right local people. These people are able to broker the collaborative alliances between stakeholders - many of whom may not necessarily communicate with, let alone trust, one another."

-Vincent Sweeney, GEF, IWCAM Regional Project Coordinator, St. Lucia

The implementing group includes the organizations that are responsible and accountable for the work. Engaging in the EBM process is often a part of their institutional work-plans. This group generally includes management agencies, relevant biophysical and socio-economic scientists, active for-profit sectors like a tourism board, water resources boards, and, often, environmental NGOs.

The constituent group includes the stakeholders who have a vested interest in the focus area, and may already have a voice in determining and assessing management strategies. A successful move toward EBM will mean engaging a broad base of people and/or organizations that have a stake in how the ecosystem is being managed — from the private sector, public sector, science and conservation communities, and policymaking arena. Not every organization in this group may need to be involved in every stage of an EBM process; some may simply need to be informed of decisions.

Early and consistent engagement of both types of groups will help to break down sectoral barriers, facilitate trust and information-sharing, and allow for a broad understanding and vision of the region being managed. Each organization's role and responsibilities must be agreed upon and made transparent at the start of the process. Ideally this is done through the development of a framework for collaboration and communication. In the case of large areas, the framework should incorporate overall sectoral and research expertise, as well as local consultative groups with detailed understanding of the nature and usage of subunits of the larger area.

Participatory processes can be unwieldy and inefficient at times. EBM at large scales and in complicated arenas of maritime use can be bogged down indefinitely. For this reason, strong leadership and binding timelines are important in planning, if not essential. It is also important to accept that not all EBM processes will be able to launch robust and comprehensive participatory processes immediately. The form and nature of effective participatory processes depend substantially on the cultural and governance context of affected communities. In some settings, for example, broad community participation may not be an inherent or accepted part of the culture. In others, logistical considerations may prevent full-scale participation but identification and engagement with leaders or champions is important. Planners should thus aim for maximum participation, within reason, and as appropriate.

Reaching out to as broad a stakeholder base as possible can also help to address equity issues, wherein certain parts of society who might not otherwise have a voice become empowered to take part in management of their environment and livelihoods. An example from Mafia Island in Tanzania provides one example (see box below).

CASE STUDY / *Participatory planning on Mafia Island in Tanzania*

In 1992 a conglomerate of interests — including Shell Development Tanzania, Ltd., Tanzanian government agencies, scientific institutions, and WWF — worked with the communities of Mafia Island, Tanzania, to address the destruction of coral reefs there by fishers from outside the area who used dynamite as a fishing tool. In a series of workshops aimed at developing specific goals and objectives for management, WWF reached out to the stakeholder groups that were most obvious, including resident and non-resident artisanal fishers and the government. Upon further investigation, it was discovered that another important stakeholder group — women subsistence fishers, who plied the reef and shoreline for shellfish and octopus — hesitated to become involved in community meetings. Their culture did not predispose them to participating in community meetings, which were usually attended only by men. After some encouragement, women fishers contributed to the planning process, which resulted in a plan for Mafia Island Marine Park that addressed their own needs as well as those of other stakeholders. Here the participatory planning helped, perhaps inadvertently, to address equity issues in determining management outcomes.

CASE STUDY / *Understanding how people use the ocean in California, USA*

Over the past decade, the US state of California has actively expanded its system of marine protected areas through its statewide Marine Life Protection Act Initiative, and comprehensive marine spatial planning could be a future consideration for the state.

To help inform and advance these processes, the National Marine Protected Areas Center and the Marine Conservation Biology Institute (an NGO) worked together to develop the California Ocean Uses Atlas, which maps the full range of significant consumptive and non-consumptive human uses of California's state and federal waters. Spatial data for nearly 30 commercial and recreational ocean uses — like offshore oil and gas development, motorized boating, and commercial benthic fishing — were gathered through a series of participatory mapping workshops. These meetings brought together regional ocean use experts throughout the state.

One key product of the atlas is an online mapping tool for visualizing ocean uses. The mapping tool allows users to answer simple spatial questions on overlapping human uses in California's ocean and coastal areas, and display data on uses relative to marine protected areas and other background layers. Other US states, including New Hampshire and Hawaii, have begun developing their own ocean uses atlases using the same methodology.
/ **www.mpa.gov/dataanalysis/atlas_ca/**
/ **www.dfg.ca.gov/mlpa**

DEVELOP A COMMON UNDERSTANDING OF THE ECOSYSTEM

Before new scientific assessments are done, planners should assemble all existing information about the region of interest. There may be adequate existing information to support the planning process without having to conduct new assessments, which take time. If, however, there is little information about the system, the action of assessment must be done early, as described later in the Planning Phase of this guide. In understudied areas, looking at assessments from other regions of comparable scale and biophysical characteristics can be helpful.

A diverse group of stakeholders at the planning table should be encouraged to help piece together sectoral data and other information to build a broad picture of the ecosystem, the existing threats, and factors leading to those threats. There is value in both scientific and more informal sources of knowledge: in the latter case, oral history and accounts of current activity can help build a common, information-rich picture of the area. A map or GIS display might be a result of this process — identifying human uses, management jurisdictions, and existing management measures, and providing a good basis for stakeholders to add their information or proposals.

This process may lead to new questions in addition to answers. Stakeholders will encounter information they did not previously know, which may foster additional concerns. These new questions, however, will help shape assessments of the ecosystem and the development of research on uses.

TAKE STOCK OF EXISTING MANAGEMENT PRACTICES

No marine or coastal planning occurs in a vacuum. Management of ocean and coastal uses normally already exists in some form, whether adequate or not. A key to successful EBM is to build on what is there — improving the management and making it more efficient and effective.

Improving management requires understanding what management systems already exist and how effective or ineffective they are, sector by sector. In other words, the institutions and individuals driving the EBM process need to take stock of fisheries and coastal management policies; assess

"In addition to setting long-term goals, set some shorter-term ones and celebrate their accomplishment, both to recognize the stewardship efforts of the community and to maintain collaborative momentum among the partners."

-Magnus Ngoile, Policy Coordinator, Agulhas and Somali Current Large Marine Ecosystems Project

the oversight and control of shipping, energy, and other industries; and make note of conservation measures such as protected areas and special regulations for wildlife and habitats.

At the same time, the people driving an EBM process should undertake a governance assessment. Such an assessment examines what governance mechanisms are already in place, such as mechanisms to involve stakeholders in planning and management processes, or to integrate management effectively.

Regional approaches to evaluating current management can be particularly useful: the multi-national nature of such analyses can help foster greater objectivity and transparency in making assessments. Existing management is also analyzed in initiatives that explore what informational and governance-related gaps need to be filled in a region. In the Western Indian Ocean region, for example, five mainland states (Somalia, Kenya, Tanzania, Mozambique, and South Africa) and five island states (Madagascar, Comoros, Seychelles, Mauritius, and La Reunion [France]) together created a UNEP Regional Seas Convention. Called the Nairobi Convention, it oversees the protection, management, and development of the marine and coastal environment of eastern Africa. In response to capacity-building needs that the Contracting Parties identified, regional training for coastal and marine management has been carried out in the region by UNEP, the Western Indian Ocean Marine Science Association and the Secretariat for Eastern African Coastal Area Management. This has included training for MPA managers and ICZM practitioners, as well as courses on topics like environmental assessment of tourism and aquaculture. These efforts do not represent full-fledged EBM in themselves. However, they provide an important step toward EBM by building regional capacity for it and by engaging proactively with other regional authorities responsible for additional uses that affect marine and coastal space and resources.

CASE STUDY / *Recognizing the need for a regional governance framework: Cartagena Convention*

The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region — known as the Cartagena Convention — provides the legal framework for cooperative regional and national actions throughout the Caribbean. In itself, the convention represents how Caribbean states recognized the need for a regional governance umbrella, transcending what they could achieve at the national level.

Various protocols have been negotiated by the Contracting Parties that pertain to specific marine management issues, such as species and habitat conservation (Specially Protected Areas and Wildlife Protocol, or SPAW), land-based sources of pollution (LBS Protocol), and oil spill pollution (Oil Spills Protocol). UNEP's Caribbean Environment Programme guides the execution of initiatives under the Convention. As examples of the regional services the convention provides, its SPAW subprogram:

- Assists with management of coastal and marine ecosystems, particularly through sustainable practices;
- Mobilizes political will and actions of governments and other partners for the conservation and sustainable use of coral reefs and associated ecosystems;
- Communicates the value and importance of various marine habitats, including their ecosystem services, threats to their sustainability, and actions needed to protect them; and
- Promotes the EBM approach and the principles and values of good governance for conservation and management.

/ **www.cep.unep.org**

CASE STUDY / *Participatory goal-setting in the Bijagos Archipelago of Guinea-Bissau*

The Boloma Bijagos Biosphere Reserve — a vast archipelago of 88 islands, located on the wide continental shelf of the west African country of Guinea-Bissau — is home to a diverse group of people. Resident Bijagos people, ethnically distinct from Guinea-Bissau mainlanders, inhabit some of the larger islands and are hunter-gatherers, as well as small farmers. Nyominka fishers utilize the islands on a seasonal basis, catching and processing fish that they take back to market in their native Senegal. Mainlanders and European foreigners (mostly Portuguese and Dutch) run tourism and other businesses.

In the early 1990s, the local office of IUCN began working with these stakeholders — as well as the provincial and national governments and international aid agencies — to identify ways that a UNESCO Biosphere Reserve designation could enhance livelihoods while conserving nature. Ultimately the design of the Biosphere Reserve reflected several specific objectives that various groups deemed as important. It protected sacred sites that were culturally important to the Bijagos people. It maintained fish populations, which supported both the fishing and tourism sectors. And its conservation of ecological linkages would support the ever-changing dynamics of the archipelago as a whole. Today the 1012-km^2 land and sea reserve acts not only to put EBM into practice, but also to give a voice to underrepresented people in the management of their coastal region.

SET OVERARCHING GOALS

Once there is a common understanding of the ecosystem and a preliminary assessment of key threats, stakeholder teams can work together to create an initial set of over-arching goals for an EBM process. At this early stage of planning, a team must also pair each goal with a plan for measurement and evaluation. Adaptive management is a key aspect in EBM, and must be planned at the start, not retroactively.

Stakeholders should be encouraged to share their own goals for EBM, based in part on the assembled information about ocean and coastal uses, values, and condition. Planners should engage them in exploratory discussions, including on issues of group identity and what incentives would best lead to community-oriented and ecologically sustainable behavior. After each group has expressed its individual goals, planners can initiate a consensus-based process to formulate a shared set of goals to which all stakeholders can agree.

CORE CAPACITIES NEEDED FOR VISIONING PHASE

The visioning phase of EBM entails bringing people and institutions together, perhaps for the first time. Therefore the most essential capacities for carrying it out pertain to social skills. As in the other phases of embarking on EBM, not all of this capacity needs to be "in-house" for the principal planning entity. Expertise can be assembled as needed, whether in task forces and or other temporary associations of individuals and institutions that oversee or contribute to the process. Key capacities include communication/outreach, assessment, conflict resolution and negotiation, and facilitation.

Strong institutions and individuals capable of leadership are needed to drive the EBM process through this visioning phase. However, these institutions may not only be the conventional government institutions that we usually associate with ocean management. They can be temporary governmental or intergovernmental task forces, community groups, or individuals with some standing in one or more user groups.

Planning Phase: Chart the EBM Process

This phase addresses how a plan for EBM is set. Although access to good information is important in each of the three EBM phases, it is crucial for the planning phase — with assessments of ecosystems, evaluations of governance options, and more. What is considered good information does not have to be data derived from formal science either; it can come from local and traditional knowledge as well. Importantly, information flow in the planning process is not one-way. Information must flow from users (and local communities and scientists and managers) and also back to each of them in a continually enriching loop.

Again, while the three phases necessary for developing and implementing EBM (visioning, planning, implementation) should be applicable in any marine or coastal management situation, how those phases are applied and which tools are utilized will vary according to circumstances. These circumstances pertain to the nature of the management problems, the social and cultural context, the capacity of local institutions to carry out the management measures, and the timeframes available for putting EBM in place.

The process of instituting EBM is valuable not only for the plan that emerges, but in its own right as well. An effective planning process identifies and engages with new stakeholders, recognizes connections between use and condition of the system, and helps determine sustainable limits to use.

At the core of planning EBM are assumptions that should be stated openly. These assumptions include that some areas are more important than others for achieving certain goals, and that this relative importance can drive the establishment of spatially explicit rules and regulations.

ASSESS THE ECOSYSTEM

To know what EBM will achieve, it is necessary to know how the ecosystem operates, what values it provides human beings, how it is being used and impacted, and how it is doing under existing management. This represents a more rigorous extension of the process of developing a common understanding of the ecosystem, which was described in the visioning phase of EBM.

Needed is a focus on key ecosystem functions, status of ecosystem services, and factors driving human impacts on those services. This is not to say that everything must be known with certainty. In some cases it may be reasonable to draw on scientific understanding of similar but better-researched locations, and assess the extent to which the ecosystem in question conforms to the better-studied area. However, assessments need to be integrated across three elements:

- Ecosystem characteristics — such as an ecosystem's biophysical boundaries, the ways its components are connected to one another, the overall ecosystem status, and projected trends in condition;
- Different uses and industry sectors — including how they impact ecosystems and what social and economic benefits these sectors provide; and
- Social, economic, and environmental dimensions of what it means for a particular ecosystem to be used sustainably.

Multiple formal assessment methods exist for coastal and marine systems. The key aspects of any assessment are to understand how communities and economies depend on their uses of marine and coastal ecosystems; the threats to those ecosystems' structure, functioning, and processes; and the responses of ecosystems to those pressures. In the Baltic Regional Sea, for example, assessment is guided by the HELCOM

Convention, using an Integrated Ecosystem Assessment (IEA) method for holistic assessment of ecosystem conditions that examines both pressures and inherent sensitivities to those pressures (see www.helcom.fi/BSAP_assessment/en_GB/main).

Being able to identify key pressures and ecosystem responses allows managers to tackle priority problems, regardless of which assessment protocols are used. In certain settings, particularly information-rich environments, an expanded five-step version of the IEA concept may be utilized, as proposed by the US National Oceanic and Atmospheric Administration. This assessment begins with a scoping step, where ecosystem objectives and threats are identified. The second step involves determining what ecosystem indicators will be useful in tracking EBM, and setting benchmarks and targets so that management effectiveness may be evaluated. A third step involves risk analysis, evaluating the risks to features of the ecosystem described by the indicators. (These risks are those posed by human activity and by natural variability.) A fourth step uses ecosystem modeling frameworks to evaluate different management strategies, allowing decision-makers to evaluate trade-offs and make informed choices. And in the fifth and final step, the IEA process leads to a continuous system of monitoring and evaluation, so that adaptive management may be realized.

Some countries have started to apply the expanded IEA approach described above, or some variant of it. However, information availability and capacity to assess information, and supplement it with modeling, varies around the globe. For example, while UNEP, the countries of the EU, and the US National

ECOSYSTEM ASSESSMENT TOOLS

Ecosystem assessments are needed to provide background information for integrating management in an EBM framework. Tools for assessment help planners to focus on key information regarding ecosystem conditions, trends over time, and how systems can be expected to change. Assessment tools also identify the most salient threats and the drivers behind them; because these threats vary, so too do the assessments. Some are very high-tech, rigorous in nature, and large in scale. Others are more rudimentary and smaller in scale, depending on the questions being asked and the availability of information.

Most assessments follow the DPSIR framework (Drivers-Pressures-States-Impacts-Responses). Under this framework, drivers of change and individual pressures (threats) are identified, the resulting state of the environment/ecosystem is determined, and the response is anticipated. There are a variety of tools available to apply this conceptual framework, including the Global Environmental Outlook (GEO) covering global, regional, and national integrated assessment processes (see **www.unep.org/geo**), and Transboundary Diagnostic Analysis (TDA). TDA was developed in the context of the Global Environment Facility's Large Marine Ecosystem programs. It is often used to assess large scale marine ecosystems, including in areas beyond national jurisdiction, or across ecosystems that span national borders.

Because there are many ways to assess marine environments, the UN General Assembly in 2009 endorsed an initiative to develop a standardized way of assessing the condition of the marine environment at all scales (UNGA 60/30). Chapters 2 and 3 of the UN Assessment of Assessments report (IOC-UNEP 2009) describe the so-called Regular Process in guiding countries to systematically and objectively evaluate pressures, the state of coastal and marine ecosystems, and existing and potential responses (**www.unga-regular-process.org**).

At smaller scales, assessments are often less technical and resource-intensive, using case studies rather than expansive databases. Under the Millennium Ecosystem Assessment, for instance, many sub-global assessments were done that focused either on a subset of ecosystem services, or a more limited number of ecosystem types in a region (in contrast to the global assessment, which analyzed all ecosystem services delivered from all ecosystems worldwide). Small-scale assessments can be community-based, whereas large-scale assessments are typically undertaken by national and multinational institutions. Regardless of scale, the value of all these assessment tools is the same: identifying information needs and priorities for management in an objective and defensible way. / **www.MAweb.org**

"Perfect ecological and socio-economic data are rarely available. So instead start with the best data that you have."

-Ameer Abdulla, Senior Advisor, IUCN Global Marine Programme

Oceanic and Atmospheric Administration are applying different forms of Integrated Ecosystem Assessment methods, the Global Environment Facility (GEF) recommends an assessment called Transboundary Diagnostic Analysis. Institutions should use the method most appropriate to their region. However, application of different methods makes comparing and contrasting regions more difficult, and also hampers cross-region learning. For this reason, the UN General Assembly recently adopted a Regular Process for the Global Reporting and State of the Marine Environment, including socio-economic aspects. This standardized approach can be used anywhere, and UNEP has provided further guidance under the preparatory phases for a Regular Process for a Global Marine Ecosystem Assessment (see box on assessment tools, page 41).

The time, effort, and cost going into such assessments, and the sophistication of the tools used, also vary according to place and circumstance, including institutional capacity. Assessments can be time- and resource-intensive. So while it is important to include as much relevant data as possible within time constraints (including to help ensure that stakeholder groups' interests are represented), it is also important not to get mired in this step unnecessarily. Long assessment processes can hinder momentum for the rest of an EBM process. Assessment should be an iterative process, meaningfully relating performance against bio-physical and socio-economic management objectives. As more data are gathered, management strategies are routinely adapted to fit the emerging information and changing circumstances.

The extent to which new data are needed depends on the scope of the assessment and existing data availability for the concerned area. Planners can determine data availability by asking a few key questions:

- How well has the ecosystem been studied?
- How well-known are human uses and impacts?
- What is known about the contributions of various uses to social and economic well-being?
- What should be the geographic scope of EBM?
- How effective is current management in meeting objectives and goals?

Assessing management effectiveness has been the focus of entire manuals (see Appendix). A good example of a cross-sectoral management effectiveness assessment is the Great Barrier Reef Global Outlook Report, prepared in 2009. This assessment not only focuses on the degree to which management has met its objectives, but also looks to the future in terms of what adaptation may be needed to account for increased population growth, expanded coastal development, and climate change impacts — see www.gbrmpa.gov.au/corp_site/about_us/great_barrier_reef_outlook_report.

The amount of existing information will dictate the right scope of any new data collection and assessment. Assessments will also vary according to the scale of EBM, the type of ecosystem being managed, and the location. Emphasis on specific benefits from ecosystem uses and threats to those ecosystem services will reflect the particular EBM needs. In an offshore area where fishing is the sole ocean use, for example, emphasis should be on assessing the resource base, the fisheries-related changes to biodiversity and food webs, and the condition of the benthic habitat. In contrast, for a heavily polluted nearshore area, assessments of water quality or of complex interactions between multiple uses and impacts may be paramount. Assessments need to be tailored so that they can be applied efficiently, thereby allowing EBM practitioners to move past visioning and planning to actual implementation.

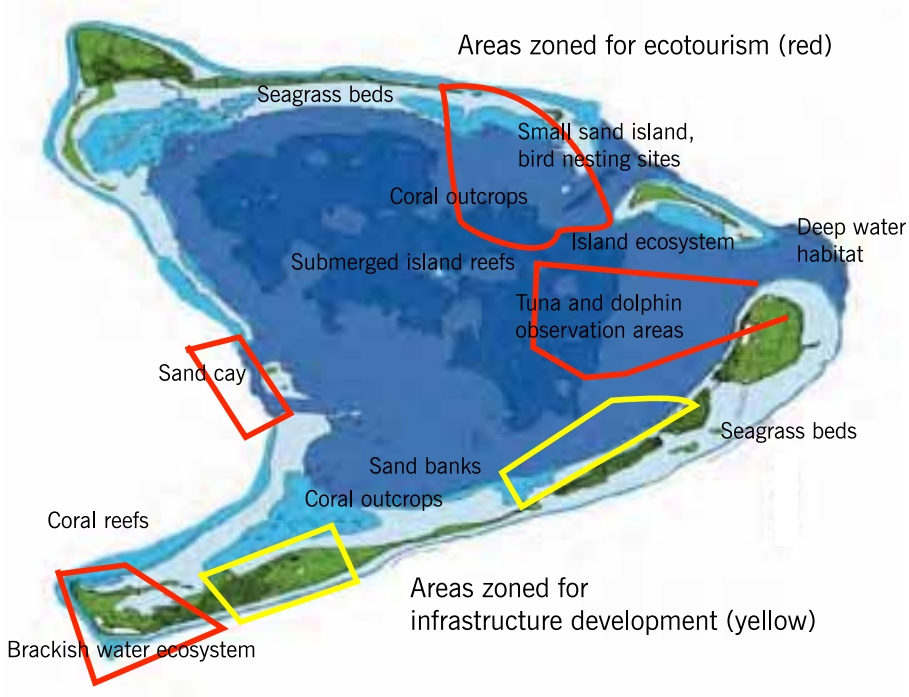
CASE STUDY / *Applying assessments at different scales: Addu Atoll, Republic of Maldives*

In the Indian Ocean nation of Maldives, the management of Addu Atoll established a vision — set within an EBM framework — for improved economic development, tourism, education, public health, and environmental conservation. To support a plan to bring that vision to life, planners launched a series of assessments at various scales.

At the large scale, planners performed an Integrated Ecosystem Assessment (IEA) to provide an overview of overall environmental status and human impacts. Within that, smaller scale Strategic Environmental Assessments (SEAs) helped analyze existing sector policies to identify areas most suitable for particular activities, such as shipping lanes, trawl fisheries, wind farms, resort development, or even military exercises. These assessments aimed to coordinate sectoral management and guide prospective development for maximum sustainability. At an even more focused scale, Environmental Impact Assessments (EIAs) were performed to evaluate the potential impacts of any proposed activity. EIAs were used in different contexts not only to predict the impacts of urban development, but also the intensification of resource use (e.g., shifting a fishery from an artisanal to commercial scale of operation) and the effects of proposed regulations.

In Addu Atoll, the resulting EBM plan works at three planning and management scales: entire atoll; clusters of islands (north, south, and eastern groups); and individual islands. Planning at each of these scales has its own focus and outputs. This is because of regulatory requirements or because the availability of knowledge on ecosystem linkages and planning tools leads to certain planning outputs at particular scales. National planning focuses on broad environmental assessment using IEA, policymaking, and strategic planning (e.g., location of protected areas or market development strategies). Smaller scale planning uses assessments for particular sectors, proposed developments, or regulatory changes, using SEAs and EIAs.

/ **www.gefcoral.org/Portals/53/downloads/EBM%20Framework-Addu%20Atoll.pdf**



Zoning for Addu Atoll

This map indicates zoning of areas for human activities and economic development. The zoning was informed by a Strategic Environmental Assessment to review sector policies and priorities, and Environmental Impact Assessments to assess and agree on acceptable levels of impact for proposed uses as the basis for common planning across sector agencies.

"Sometimes it is necessary to set up completely new institutions and jurisdictions, but this can take years before they are fully operational. Wherever possible it is greatly preferable to work with and through development of existing institutions to achieve the overarching policy and program frameworks needed to achieve EBM."

-Richard Kenchington, Professor, University of Wollongong, Australia

EVALUATE EBM GOVERNANCE OPTIONS AND CREATE LEGAL FRAMEWORKS TO SUPPORT MULTI-SECTORAL MANAGEMENT

A diverse mix of regulations needed to manage ecosystems effectively — each pertaining to a particular use and addressing a particular threat — can be implemented effectively only through an integrated approach. Governance that allows and promotes cooperation between agencies, between governments, and between government and other institutions is essential to implementing an EBM plan. Having the right governance arrangements, based on sociopolitical realities, is critical. If institutional structures are insufficient to manage a set of regulations associated with EBM, then government institutions may need to be restructured.

Finding the right balance of governance arrangements is important. A recent UNEP study explored the governance of marine protected areas, analyzing more than 20 case studies from around the world to determine how MPAs may be governed most effectively and equitably. Specifically, the report examined how best to balance three main approaches to MPA decision-making — top-down, bottom-up, and market-based — in different contexts. A main focus of the study was how the three approaches utilize various incentives to steer people to behave in certain ways, namely in favor of biodiversity conservation. These include economic incentives, interpretative incentives (promoting awareness of an MPA and its policies), legal incentives (enforcement of laws), and more — in all, the report lists 40 distinct incentives. The study suggests that it is the combination and inter-

CASE STUDY / *Developing an effective marine and coastal governance system: Namibia*

Over the past decade, Namibia has worked to advance its marine and coastal EBM activities. Central to this is the ongoing development of an integrated coastal policy, which attempts to balance nature conservation with the needs of a growing population. At the same time, Namibia has been involved in expanding its coastal park system: as of 2011, the entire coastline is now captured in an uninterrupted string of national parks.

The Namibian government has also designated the Namibian Islands MPA, Namibia's first marine park, spanning almost one million hectares of islands and important ocean habitat for birds, rock lobster, finfish, and marine mammals. The MPA accommodates many different uses, including commercial and recreational fisheries, ecotourism, oil and gas development, and even diamond mining. This cross-sectoral management has meant that even though the protected area was designed with fisheries management in mind, the reach of management extends beyond fisheries to a wide variety of uses. Planning the MPA involved representatives from different line ministries (Ministries of Environment and Tourism, and Fisheries and Marine Resources), regional and local authorities, the private sector, and conservation NGOs. Namibia also plays a central role in the Benguela Current LME project.

With these many obligations for management, the need to find an effective and appropriate governance system has been clear. To evaluate governance options, various possibilities were outlined in the form of a green paper. Significant stakeholder engagement went into developing the policy options, and additional public feedback is expected concerning prioritization of issues, institutional structure for ocean and coastal management, and other issues of appropriate governance.

Aspects of governance emerge even in the way Namibia defines its target area for coastal and marine policies. Both socio-economic and ecological criteria have been used to determine the landward extent of the coastal zone, which includes the communities affecting the ocean environment and affected by it, and the geographic area covered by persistent sea fog. Seaward from shore, the focal area of management includes the Namibian portion of the Benguela LME to 200 nautical miles offshore. / **www.nacoma.org.na**

connection of different incentives from different categories that makes governance frameworks more resilient. (The report *Governing Marine Protected Areas: Getting the Balance Right* is at www.mpag.info.)

Many publications on ecosystem approaches and EBM have stressed the need for regional governance, where the scale of coordinated or cooperative management extends across interconnected ecosystems and human social systems. While regional governance may not be achievable in short time frames, program cooperation through UNEP Regional Seas Programmes and liaising with other regional frameworks (Regional Fisheries Management Organizations, the International Maritime Organization, etc.) can provide a basis for developing common agendas. Management institutions facing such a reality should identify what the most pressing issues are – then, from among those, work on the ones that are most achievable given the governance structures. This includes how their own agencies might be restructured to allow better integration of management, and how they can better communicate and work with other agencies that have an influence on marine and coastal ecosystem use and condition.

The path toward robust ecosystem-based management generates some additional management burdens for governance, at least in the short term. However, governance arrangements that involve government agencies, civil society, and the private sector together can complement fully government-led marine and coastal management. The ways in which non-governmental organizations can engage in EBM are diverse. Small local NGOs, and the regional offices of large international groups, can play vital roles in facilitating engagement of parties that inherently operate on different scales, such as small-scale artisanal fisheries and large-scale market-driven ones. Such NGOs can provide the catalyst needed to bring different stakeholders together to forge community-based management projects. Conservation have also helped complement the exploration of innovative

management and financing mechanisms for marine conservation, particularly in cases where governments have had trouble funding such mechanisms. These include the use of limited entry schemes, individual transferable quotas, fishing cooperatives, alternative livelihood training, and vessel buy-back programs. Conservation NGOs have helped move fisheries toward greater sustainability by synthesizing the ecosystem science in various user-friendly ways – often extending formal scientific knowledge with equally important user knowledge. Finally, NGOs have helped push for fisheries agreements and management programs that occur at regional scales, which are appropriate for conserving shared or mobile fish stocks.

Some of the most crucial aspects of managing coastal and ocean resources are the monitoring, surveillance, and enforcement activities that address compliance with regulations. Yet this potentially important role for civil society is often overlooked, in part because many of these activities were historically carried out by government enforcement and national security agencies. There are some risks involved in civil society's involvement: there can be concerns about a lack of effective control over the enforcers, as well as substandard legal status of community-gathered evidence in developed states. However, EBM may lead government agencies to look for responsible, cost-effective ways to share the burden of these management activities with institutions outside government, while maintaining rigorous management.

"Governmental and non-governmental organizations from the West African sub-region have recognized that the existing problems need to be addressed at a regional scale if the structure and the functions of the marine and coastal ecosystems are to be conserved at a regional scale."

-Charlotte Karibuhoye, MPA Program Coordinator for Fondation Internationale du Banc d'Arguin (FIBA)

IDENTIFY MEASURABLE OBJECTIVES

Precise measurable objectives need to be set so that stakeholders can develop a common understanding of what EBM is helping to achieve. Such objectives are linked back to the common understanding or vision, taking into account the realities of what is possible given the level of knowledge, the existing governance frameworks and management measures, and the time and resources available to plan and implement objectives. EBM objectives may include things like "no reductions in biodiversity", "increased fisheries productivity", "reduced pollution", "minimized conflicts between users", "reduced shoreline erosion", and so forth. Analyses of trade-offs among uses and the development of scenarios can help guide objective-setting, although trade-off examination is also an important facet of choosing management strategies, tactics, and tools.

The objective-setting process should be repeated as appropriate over time, particularly as understanding grows of imminent and long-term threats across sectors and geographic areas. Assessing threats involves determining status and trends in ecosystem condition, human use, human expectations, delivery of ecosystem services, and management capacity.

PRIORITIZE THREATS, EVALUATE MANAGEMENT OPTIONS, AND EXAMINE TRADE-OFFS

Designing and conducting comprehensive research, assessment, monitoring, and management programs that address all facets of ecosystems and their uses is not feasible for most locations. Nor is it a prerequisite for EBM. Focusing management on what matters the most, and connecting the management activities that may have previously been planned and executed in isolation, is what is most vital. Even small steps in that direction can be useful — and even transformative — parts of the EBM process.

Important in this endeavor is to evaluate ecosystem conditions, and what impacts (natural and human-induced) are affecting that condition. Management must be tailored to threats, and as a result management responses will vary by place.

Determining what threats (real or potential) might affect ecosystems and their ability to continue to provide services requires a broad-brush look at direct and indirect uses of the sea, and of habitats with ecological connections to the sea (watersheds, adjacent lands, etc.). Threats are typically evaluated in a pressure-state-response framework, where threats are assessed according to the magnitude and duration of the pressures exerted, as well as the impacts on ecosystems, services, and species (the state). The response is how the governance, in this case EBM, reacts to the potential (or real) impacts.

Ecosystem threats will vary from place to place. However, assessments and analyses may consider the following list of threats, adapted from the EU Marine Strategy Framework Directive (Annex III on descriptors of Good Environmental Status, http://ec.europa.eu/environment/water/marine/ges.htm):

- Loss of species or other key changes to biodiversity;
- Presence of non-indigenous or invasive species;
- Decreases in fisheries populations due to exploitation;
- Food web alterations;
- Eutrophication;
- Impacts on sea floor integrity due to trawling, dredging, mining, reclamation;
- Toxic environmental contaminants;
- Marine litter; and
- Energy/noise pollution.

In addition, evaluations of how humans affect ecosystems should be based on an understanding of the drivers behind these impacts — whether they are social factors (poverty, conflict,

development pressures, poor governance), capacity factors (insufficient information, lack of technology, inadequate political will), or scaling factors (global change impacts, resource depletion in the wider area).

Just as a systematic approach is needed for looking at potential pressures, there needs to be a systematic approach for looking at impacts on special ecosystem features (whether those features are areas or species). This is another essential part of threat assessment. States and intergovernmental entities — the Convention on Biological Diversity (CBD), the Food and Agriculture Organization (FAO), the International Maritime Organization (IMO), and more — are developing, testing, and adopting scientific criteria to identify which ecosystem features are "ecologically or biologically significant" (as under CBD COP IX and X Marine and Coastal Decisions), or "vulnerable marine ecosystems" (as under UNGA 61/105 and FAO Deep Sea Fishery Guidelines), or "particularly sensitive sea areas" (as under IMO). It is the intersection of pressures and these special ecosystem features that can help identify the conservation priorities for sectoral management, and even more so for EBM.

There are few situations in which only a single threat impacts a coastal or marine system. Thus, wherever possible, threats should be assessed cumulatively, since in most cases threats to ecosystems and the services they provide are multiple in nature and add up over time. Looking at how multiple and cumulative threats or impacts attenuate one another (i.e., acting in a kind of negative synergy) is essential to designing a management response that minimizes impact and steers use in a sustainable direction.

CASE STUDY / *OSPAR's Identification of Pressures*

OSPAR is a legal instrument for allowing a cooperative approach to EBM in the Northeast Atlantic ("OSPAR" refers to the Oslo and Paris Conventions from which it developed). The OSPAR Commission, comprising 15 signatory countries and the EU, oversees regional assessment, scientific research, and planning. Its assessment strategy is among the most advanced of any regional sea.

The Commission assists its Contracting Parties in meeting their obligations under the EU Marine Strategy Directive, which requires assessment for EBM purposes. One way it does this is by assessing the distribution and cumulative intensity of eight broad sets of ecosystem pressures:

1. Climate change
2. Eutrophication
3. Hazardous substances
4. Radioactive substances
5. Offshore oil and gas development
6. Fishing
7. Emerging uses (wind farms, mariculture)
8. Loss of species and coastal and marine habitat.

The pressure categories are scored according to their impact on eight ecosystem components across the OSPAR region (marine birds, cetaceans, seals, fish, rock and biogenic reef habitat, coastal sediment habitats, shelf sediment habitats, deep-sea habitats). This assessment allows tracking of changes in status in response to these pressures, and provides guidance on which pressures should be the focus of new or amended regulations. Countries set their own regulations but follow OSPAR recommendations to the extent possible. (Much of the research and assessments is done by ICES, in response to requests from OSPAR.)
/ **www.ospar.org**

"The future of ocean management lies in considering how uses are interdependent and the trade-offs that result from choosing one activity over another."

-Barry Gold, Gordon and Betty Moore Foundation

Assessing all the threats, the way they interact with one another, and the outlook if they are not addressed allows for priorities to emerge in an EBM planning process. These priorities should be what EBM attempts to address in an integrated fashion. Once priority threats have been identified and management goals set in response, decision makers and planners can consider the socio-economic benefits expected from conducting the potentially threatening activity in the target area. After this, decision makers and planners can evaluate trade-offs and make informed choices. The resulting marine and coastal management will focus management efforts on the most important activities affecting a particular ecosystem as a result. Being able to frame management decisions in terms of trade-offs should lead to an EBM system that addresses cross-sector impacts and is more transparent, thus making it more fair and equitable.

A generic process for assessing trade-offs includes:

1. Valuing ecosystem services in terms of societal, economic, and ecosystem benefits;
2. Weighing explicit trade-offs, using a governance process that involves as many stakeholders as possible;
3. Resolving disputes among sectors; and
4. Forming a consensus on best choices and the expected results of those choices.

Trade-off analysis can be employed at different stages and scales, and for different purposes. In order to use trade-off analysis to make informed choices, information is needed not just on ecosystem services but on how ecosystems are interconnected and how services flow from ecosystems to the users that benefit (or lose) from them. Information on the flow of ecosystem services raises public awareness about interconnectedness of ecosystems and the intrinsic relationship between ecosystem health and human well-being. Such information on flows can help to make the case for truly integrated management approaches (especially bridging the divides among watershed management, coastal zone management, and marine management) to stress how this improves the efficiency of overall management.

It is important to note that these values shift over time, so management should be adaptive to make it more effective and to have EBM result in increased long-term benefits to society.

The factors that result in degradation of natural areas and unsustainable exploitation of living resources — including problems in governance — need to be identified. Part of this involves reviewing existing capacities for handling all aspects of EBM: research, monitoring, assessment, and communication, among other skills and backgrounds. Furthermore, the costs of undertaking an EBM approach should be approximated, and the ability of existing institutions to use funds effectively should be determined.

CHOOSE MANAGEMENT STRATEGIES FOR EBM IMPLEMENTATION

Developing effective management for ecosystems can include a mosaic of different strategies and tactics that are implemented at a range of scales, from local up to regional. It is critical, however, that any management measure taken, regardless of scale, is evaluated and chosen based on its ability to support the health and management of the entire ecosystem, as well

as the cultural and legal situations where it will be applied. Strategies and tactics should not favor just one ecosystem component, industry sector, community, or socioeconomic group.

The term "management strategy" is used here to describe an approach for helping a team to implement EBM. If an objective of an EBM initiative is to restore fish nursery ground productivity, for example, potential strategies might include the development of no-take marine protected areas to increase the density of adult spawning fish, as well as coastal management that decreases land-based runoff into sensitive nearshore nursery environments.

Choosing or adapting strategies should be rooted in a participatory process, and grounded in good knowledge of existing management measures already in place. EBM is unlikely to start with a blank slate, as some form of marine or coastal management already exists in most areas of the world. An EBM process can help improve and expand upon existing practices, encourage consideration of the broader ecosystem within which they are embedded, and forge connections between them.

It is also likely that the set of strategies with which a project starts (as well as the various tactics and tools for implementing the strategies) will not be the same through the duration of the project. Environmental conditions, social and political context, and resource availability may change over time, and strategies should be adapted to fit those changes. Regular monitoring and evaluation will help keep a project team informed about the utility and success of the set of management strategies they are employing, and give them the ability to adapt measures to fit the current context.

Several important management strategies are described below. This is not an exhaustive list. There is overlap among them, and some will be more important than others in particular places. However, each of these is important to consider, if not include, in most EBM processes.

Integrated Coastal Zone Management

Coastal countries have been moving toward more inclusive, cross-sectoral management of activities in the coastal zone (coastal lands as well as nearshore waters) for some time. Integrated coastal zone management (ICZM) policies at the national level began to emerge in the 1980s, and more localized entities had been practicing an integrated approach for far longer. Some nations with advanced ICZM perceive that they are already practicing EBM. ICZM in these countries may be refined toward EBM by moving from political boundaries to ecological boundaries — linking land use activities in the coastal zone and nearshore waters, and addressing ecosystem services, livelihoods, and equity issues. For this reason, it may make sense to begin with the firm foundation that ICZM policies can provide and move toward ecosystem valuation as a first step in the direction of fuller EBM. ICZM can also be "pushed out to sea" to begin influencing fisheries policies, shipping and transportation issues, the offshore energy sector, and other uses that could be brought into a full-fledged EBM framework.

A majority of the 177 countries with coastlines have coastal zone management plans and/or departments that deal with coastal issues in an integrated way. An example to illustrate ICZM in an EBM context is the case of integrated management in Kenya's Tana River region (watershed, river mouth, and nearshore waters). The Tana River watershed faces pressures from hydropower development, extraction of water for drinking water and large scale irrigation, and the

indirect impacts of poorly managed land use. To address these challenges, management authorities and NGOs have looked for ways to link the management of the Tana River basin and delta to that of Ungwana Bay, into which the river flows. Benefits of using a fully integrated coastal management strategy as part of EBM include reduced coastal erosion due to adequate sediment supply being delivered via the river, healthy ecological functioning of the coastal ecosystems, maintenance of fisheries potential in the delta, reduced saline intrusion in groundwater, and overall food security.

Restoration of coastal habitats is an important tactic in ICZM. Under the framework of EBM, coastal restoration is occurring across the globe, in developing and developed countries alike. In Chilika Lagoon, India, an integrated coastal lagoon restoration program has demonstrated the benefits of management that links coasts and river basins. Such a linked management approach was necessary to increase the tidal influx and build up the desired salinity gradient on the marine side, while controlling sediment loads and ensuring optimum freshwater flow on the riverine side. A restoration plan, incorporating coastal processes and watershed management, was implemented through coordination among national and international institutions, NGOs, and community-based organizations. By engineering a channel to improve flushing in the lagoon, fisheries have improved and the socioeconomic standing of the community has been heightened.

Marine Spatial Planning

Marine spatial planning (MSP) is a way to develop the big picture view of what uses of marine resources and space are occurring where, and determine what should be occurring where, with less impact and less user conflict. Smaller scale, spatially-explicit management measures such as zoning of areas for multiple use, designation of MPA networks, or individual protected areas can (but do not always) flow from MSP. A benefit of MSP is that it allows planners and managers to integrate information about ecosystem features, how humans impact them (and vice versa), and how they are connected to other ecosystems (or affected by other uses). This information can then be mapped to form the basis of (a) place-based sectoral regulations pertaining to specific uses, (b) plans for future research, monitoring and evaluation to fill information gaps, and/or (c) a comprehensive ocean zoning plan.

Coastal planners and marine resource managers have used different tools for MSP processes, varying in information content, scientific rigor, and level of technology used. On the relatively low-tech end, participatory planning can result in maps of assigned zones, as often occurs in community-based marine protected area design. On the high-tech end, planning can be supported by powerful, computerized decision-support tools such as MARXAN with Zones. MSP might be thought of as the visualization and mapping side of EBM — but it can also help to drive the organizational restructuring necessary for management integration.

Coastal countries from around the world are beginning to apply MSP, from subregional planning efforts to national level initiatives. The European Union has created a roadmap for MSP to help guide Member States. UNEP Regional Seas have begun assisting Contracting Parties in using MSP to fulfill existing commitments for protecting biodiversity, promoting integrated coastal management, and establishing networks of MPAs. One example of a multi-level MSP process supporting EBM is in East Kalimantan

Province, Indonesia, where the Bontang City Government is working with stakeholders to develop zoning plans for watersheds, wetlands, bays, the coastal zone, and marine systems offshore. Spatial plans were generated at the national, provincial, and district levels, led by a consortium of national and local government institutions. Uses accommodated in the spatial plans include coastal transport, coastal and industrial fishing, sea transport, energy development (oil and alternative energy), research, marine tourism, and more (see illustration on page 62).

Watershed Management

When marine and coastal managers cannot influence what occurs upstream from their sites, they may be seriously handicapped in stopping degradation from declines in the quality, quantity, and duration of freshwater flows reaching estuaries and coasts. For this reason, coastal and marine management agencies should be at the table in the planning of activities and development of policies affecting coastal watersheds. This is what is meant by integration: dialogue across previously separate management sectors, and working together toward a common goal of maintaining ecosystems and the services they provide.

Watershed management is among the oldest strategies for environmental management in existence – occurring as a response to hazards or conflicts over the availability of water for drinking and/or irrigation. Large scale watershed management efforts include the Mekong River Commission in southeast Asia, the Murray Darling River Basin Commission in Australia, and the Chesapeake Bay Commission in the eastern USA. A smaller-scale example of watershed management as a strategy for implementing EBM comes from South Africa. There a commission was established in 1983 to foster cooperation in the Incomati River basin, shared by South Africa, Swaziland, and Mozambique. The Tripartite Permanent Technical Committee (TPTC) strives to conduct an EBM approach to reduce flood impacts, ensure equity in water allocation, reduce water pollution, enhance coastal fisheries productivity, and encourage sustainable development. (Moreover, in many countries, efforts to implement National Programmes of Action for the Protection of the Marine Environment from Land-based Activities can serve as key steps toward EBM [see www.gpa.unep.org].)

Fisheries Management

There are very few marine examples where fisheries — whether artisanal, recreational, or commercial — are not one of the management challenges facing planners of integrated management approaches. Developing effective means for regulating and controlling fisheries thus becomes an important strategy to use in the move toward EBM. Effective fisheries management in the EBM context means identifying appropriate stocks for harvest; reasonable and verifiable levels of effort and harvest that do not undermine food web dynamics or ocean productivity and diversity; appropriate places for fisheries activities (and, conversely, areas that should be left fisheries-free as no-take or control areas); and useful methods

of harvest and cultivation (aquaculture) that minimize damage to the environment as well as incidental catch and waste. Such strategic and ecosystem-based fisheries management will also have to consider the drivers behind unsustainable fisheries practices, such as subsidies that promote spiraling over-capitalization and over-exploitation.

Ecosystem-based fisheries management (EBFM) is an important subset of marine and coastal EBM, since EBFM considers the impact fisheries have on all components of the broader marine environment, as well as the impact of other marine and coastal activities on fisheries. This includes managing the impact of fishing on target species as well as by-product species, by-catch species, and threatened, endangered and protected species, habitats, and communities. EBFM strives to balance diverse societal objectives by taking account of the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions. It then applies an integrated approach to fisheries management within ecologically meaningful boundaries. Another way to look at the EBM-EBFM link is to think of EBM as the starting point for better fisheries management. In effect this means re-orienting management toward EBM in order to achieve EBFM: making ecosystem-based management an important complement to existing fisheries management approaches.

There are many examples of effective EBFM used in the context of EBM. One case comes from Brazil, which has used a variety of tactics, embedded in a broader fisheries management strategy, to minimize impacts on the ecosystem and lessen the chance that further fisheries

CASE STUDY / *Evolving management strategies in the Bird's Head region, West Papua, Indonesia*

In the Bird's Head region of West Papua, Indonesia, ecosystem-based management has helped protect the region's marine diversity for the benefit of local communities. This is being achieved through the commitment and leadership of district and provincial governments, the engagement of local communities, and the technical support of NGOs, universities, and other partners.

The first stage of this initiative focused on the establishment of MPAs. Resulting from this work, eight new MPAs have been designated by district governments in the region since 2005, bringing the region's total to twelve. The MPA network was developed with the broader ecosystem in mind, and incorporated considerations of the communities' high reliance on coastal resources for food and income. For example, as the team developed proposed zoning plans for the MPA network in the Raja Ampat Archipelago, equal priority was given to maintaining access to traditional fishing grounds as biodiversity protection.

Over the course of the project, it became clear that additional strategies were needed to address threats like unsustainable coastal development, strip mining, and illegal fisheries, which could not be addressed by MPA networks alone. Planners used photos from aerial surveys (originally intended to assess marine resource use) as evidence of the impact that expanding and poorly managed coastal development, land reclamation, and runoff from road construction were having on mangroves, seagrass, and coral reefs throughout Raja Ampat. The government is now developing spatial management plans for both the land and sea ecosystems in the Bird's Head, and the NGO partnership is providing technical support and scientific guidance.

The evolution of strategies in the Bird's Head was driven by two major factors. First, trust was built between government, academics, and NGOs. As trust grew, the opportunities for input on management planning, beyond just MPAs, also grew significantly. Second, the partnership is flexible and adaptive. As new threats have emerged in the region, the partners refocused work on the root causes of damage to the ecosystems about which they were most concerned. The shifting and tweaking of project strategies has ensured that the team in the Bird's Head is addressing the most pressing threats and the most promising opportunities in the region.

/ **www.coraltrianglecenter.org/home.htm**
/ **conserveonline.org/workspaces/tnccoraltriangle/documents/ecosystem-based-management-reports-indonesia**

development will negatively impact other ecosystem services. Using a concept known as "extractive reserves", planners have engaged fishing communities in broader, integrated planning efforts. These extractive reserves are for fishing only, providing assurance that one objective of management is to ensure the continued livelihood of fishers. Other tools or tactics employed by the state and national government, working in conjunction with communities and industry, include fisheries refugia (protecting essential fish habitat); areas zoned for multiple use; gear and effort restrictions to reduce incidental catch and waste; and support for artisanal fisheries and family-based aquaculture. In 2010 the government of Brazil committed the equivalent of US $17 million for fisheries surveillance and enforcement to prevent overfishing and illegal fishing within Brazilian waters.

Marine Protected Areas

Marine protected areas (MPAs) can be a useful tool in implementing EBM by regulating different human uses in an area. They range from small, highly specialized areas (such as no-take reserves protecting a single fish stock from overfishing) to large, complex, multi-use areas. Generally speaking, MPAs are used to protect special habitats or species, maintain livelihoods, facilitate restoration, or control access to areas important for recreational, cultural, or historical reasons. Protected areas can allow managers to safeguard areas most critical for ecosystem function and the delivery of ecosystem services. Protected areas also provide needed conservation of areas that are vulnerable, or which support rare species. And they offer sites for research and monitoring necessary not only for furthering knowledge but also assessing management effectiveness. While individual protected areas usually address a narrow set of objectives (especially when they are small), networks of protected areas can address a wide range. This is especially true when planning of MPAs and MPA networks occurs within a broader initiative, such as marine spatial planning.

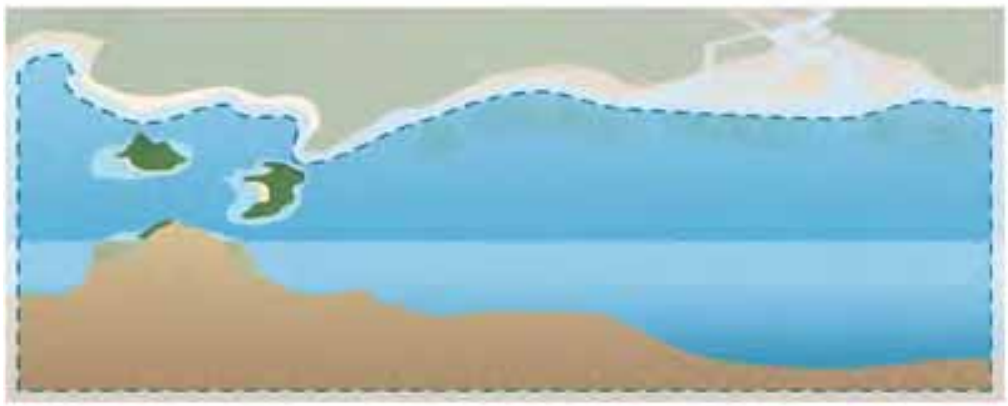
However, it is important to look critically at MPAs as well, because some are mere paper parks. MPA shortcomings can occur when MPAs: (1) are ecologically insufficient by virtue of their small size or poor design; (2) are inappropriately planned or managed; (3) fail due to the degradation of the unprotected surrounding ecosystems; (4) do more harm than good due to displacement and unintended consequences of management; or (5) create an illusion of protection when in fact no protection is occurring. The MPA tool can be used to its full potential only when there are clearly stipulated objectives, and when the management that is undertaken addresses priority threats to resources or resource use. Pitfalls can be avoided by integrating MPA planning in broader marine spatial planning and ocean zoning efforts.

Examples of MPAs used in an EBM context are numerous, and many occur elsewhere in this guide. It should be noted that because multiple-use MPAs can demonstrate how various uses can be managed in an integrated way within a single rational framework, they readily provide a model for EBM planning and implementation. Partly for this reason, several of the examples of EBM in practice that appear in this guide originate from MPAs: not because MPAs are a necessary tactic or tool to employ in EBM, but because the discrete nature of protected areas allows experimentation with EBM approaches and integration – and often represent where the first steps along the EBM journey are taken.

GEOGRAPHIC SCOPE OF MANAGEMENT STRATEGIES

Integrated Coastal Zone Management

ICZM focuses on the land side of the coastal zone, typically encompassing the coastal plain as well as the nearshore marine environment.

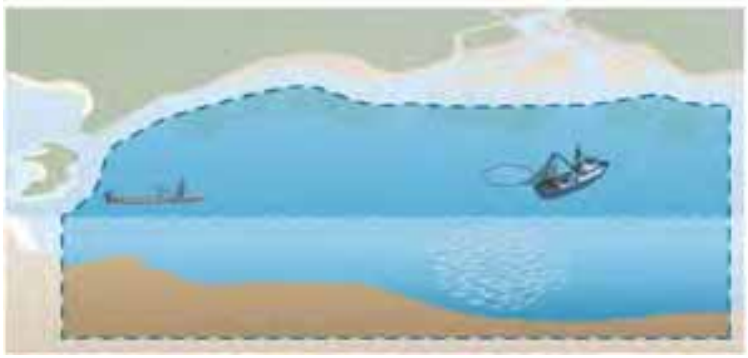


Marine Spatial Planning

MSP covers the marine environment, either within a single jurisdiction (such as territorial seas or within federal waters) or across many jurisdictions (provincial or state waters, territorial seas, and even areas beyond national jurisdiction).

Watershed Management

Watershed management extends through drainage basins; the focus of management is primarily on activities that affect water flows, and secondarily on activities that affect water quality, including inputs of sediment and chemical contaminants.



Fisheries Management

Conventional fisheries management focuses on commercially targeted fish stocks; however, there has been an effort to move from single to multi-species management, and essential fish habitat protections have incorporated linkages to a variety of habitats.

Marine Protected Areas

MPAs can vary in scope from small no-take zones targeting the water column and/or benthos, to large MPAs that include vast areas of land and sea.

ECOSYSTEM-BASED MANAGEMENT

The geographic scope of EBM can collectively cover that of all five of the main management strategies: 1) the coastal lands and nearshore environment of ICZM; 2) the marine environment of MSP; 3) the rivers and drainage basins in watersheds that drain into the sea; 4) the waters supporting exploited fish stocks; and 5) the coastal and marine environments encompassed by MPAs.

CORE CAPACITIES NEEDED FOR THE PLANNING PHASE

Much of the emphasis in marine and coastal ecosystem-based management is on getting the science right, allowing for capture of the information necessary for planning.

Natural science, especially ecological science, is necessary to define the ecosystem to be managed, to understand basic facts about its functioning, and to articulate linkages between and within ecosystems. Basic ecological understanding is required to assess the state of ecosystems, and to look at trends in condition to determine whether thresholds are being approached (and to be able to predict future condition). Natural science can also help identify limits to use that allow planners to keep those uses within sustainable bounds.

Social science is just as important. It allows planners to place a value (economic as well as non-market) on ecosystems and their services, and understand patterns of human use. Social science is needed for developing scenarios, or story lines, that describe what changes in ecosystems will mean for people. Such science is also needed to evaluate trade-offs, assess risks, and practice risk management. A combination of natural and social sciences can help planners and stakeholders to better understand ecosystem vulnerabilities, and what priorities exist for reformulating and integrating management.

Implementation Phase: Apply and Adapt EBM

This phase addresses how EBM can be implemented, as well as how it can be amended over time to stay effective and sustainable over the long term.

Marine and coastal management initiatives can falter when time and energy are invested predominantly in planning, with too little attention given to implementing the plan. To be successful, a significant part of the EBM planning process must include elaboration of how to implement integrated management, including a clear understanding of how the costs of surveillance, monitoring, education, and other activities will be financed.

APPLY MANAGEMENT THEN MONITOR, EVALUATE, AND ADAPT

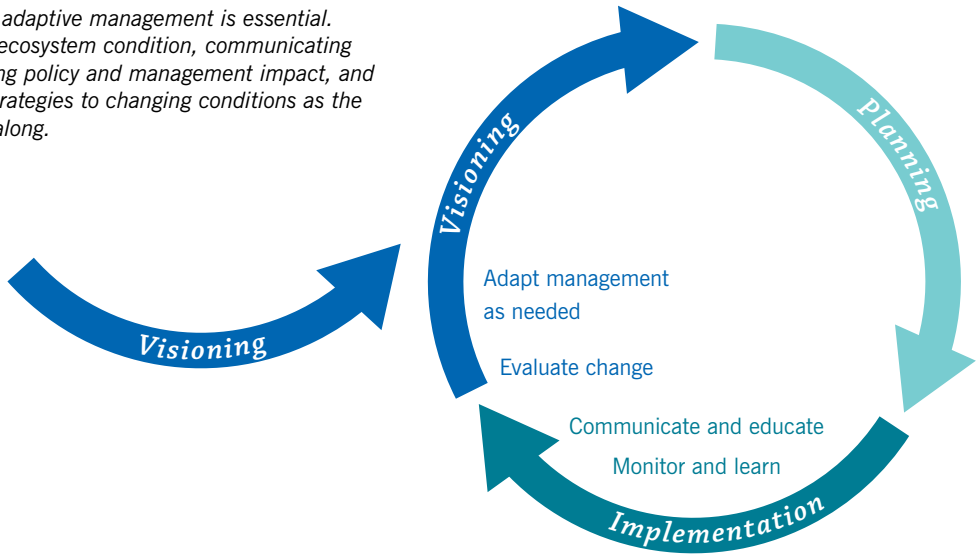
An EBM project requires good monitoring and feedback loops to keep partners informed, on track, and able to assess progress and make strategic changes. Without establishing effective monitoring of progress toward a project's goals, it can be difficult to understand and document real progress. Furthermore, without active monitoring, a project is at risk of drifting away from its original intention.

Adaptive management is an essential component of EBM, and must be embraced. The fundamental concepts of adaptive management are useful in helping a project track progress and adapt and refine strategies as efficiently as possible. It also allows scientifically rigorous testing and measurement of the efficacy of management.

Developing the right kind of monitoring plan can be challenging and can consume a significant amount of resources. Time and expense can be reduced by carefully tying all monitoring to the already defined set of goals, objectives and strategies. It is important to try not to measure everything in a system, but rather just the critical elements or "indicators" that will help a project

EBM ADAPTIVE MANAGEMENT CYCLE

For EBM to be effective, adaptive management is essential. This involves monitoring ecosystem condition, communicating new knowledge, evaluating policy and management impact, and adapting management strategies to changing conditions as the EBM process continues along.



CASE STUDY / *Madagascar and community-level EBM -- Building a body of local monitors*

Southwest Madagascar is home to one of the largest and most biologically diverse coral reef systems in the Western Indian Ocean. A locally-managed marine area called Velondriake ("to live with the sea" in the local Malagasy dialect) shows how community-based ecosystem monitoring can lead to changes in resource management.

In 2004, the coastal village of Andavadoaka closed a nearby reef flat to octopus harvesting for a period of seven months. Octopus is the primary commodity in the region, and Andavadoaka fishers wanted to see if the temporary closure would lead to increased and perhaps more sustainable yields. Upon reopening of the reef flat to harvest, the number and average weight of octopus caught was significantly greater than before the closure, as well as compared to control sites. This success inspired over 100 similar octopus closures by communities along the southwest coast, and helped persuade the Malagasy government to create a national octopus closure each year as well.

Management of these octopus closures has ultimately led to the creation of the 650-km2 Velondriake locally-managed marine area, encompassing 25 villages and over 6500 residents. Conservation initiatives within the managed area include banning destructive fishing practices in the entire area, as well as temporary octopus closures, six permanent marine no-take zones protecting critical habitats, and a permanent mangrove reserve.

While partner NGO Blue Ventures collects underwater data on reef and fish health, a community-based monitoring program has proved invaluable, both for increasing local knowledge of ecosystem function and building community buy-in. The program facilitates community field trips to nearby reserves – octopus, marine, or mangrove – where village members count octopus holes, commercially important fish species, and mangrove trees both within and outside the reserves. Observing first-hand that the reserves have a positive effect on the number of octopus, fish, and mangroves is a powerful teaching tool. / **www.livewiththesea.org**

know whether it is succeeding or not. The monitoring can build on what is already being done.

Data sources for monitoring can vary widely. Original data need to be collected, but often information can be harvested from existing sources. Monitoring needs to be able to track not just biological change — which can be very slow and expensive to observe — but also social change and milestones in governance. Are new concepts gaining traction within target communities? Is there evidence of sustained changes in use and behaviors? Are new sectors engaging with the work? Has policy shifted as a result of the project? These questions are important in helping understand the impact of a project.

Periodic review and evaluation of monitoring data against the set goals and objectives (and associated timelines) will allow a team to identify problem areas, reformulate strategies, and change tactics being used on the ground. This needs to happen regularly, throughout the management process. If treated this way, management effort can be perceived as an adaptive process. Strategies are developed, tested, and assessed. In cases where a strategy fails, the team adapts and new strategies are launched.

Adaptive management will be essential in an increasingly dynamic world besieged by climate change impacts. Improved management through EBM will allow coastal and marine ecosystems to adapt to changes in temperature, salinity, current regimes, sea levels, and more. Planners who anticipate the changes can benefit from lifting barriers to natural adaptation, such as removing obstacles that prevent the inland movement of wetlands in response to rising sea levels. Managing for resilience will also allow coastal and marine habitats that provide ecosystem services such as shoreline stabilization and storm buffering to protect human lives and assets as climate change effects increase.

"It is dangerous to generalize what adaptive management looks like in different parts of the world. I have seen residents of rural villages in the developing world do a great job of monitoring and testing the assumptions behind their actions when provided with good coaching support. The key in all cases is to use models and terms that are accessible and understandable to the decision makers."

-Nick Salafsky, Foundations of Success

CONTINUE TO COMMUNICATE AND EDUCATE

Ecosystem-based management will not be effective without communication on why EBM is needed, how it promotes integrated approaches, and how it benefits society. EBM is a complex concept that requires a diverse set of communication tools, especially given the wide variety of stakeholders who are part of an EBM process. Developing clear and effective communication plans should be an integral part of any EBM initiative. As such, communications professionals are often brought onto EBM teams. This is done both to help develop communication plans and to train EBM partners and supporters in accurately describing what EBM is and why it is needed.

The first step in thinking about communications for any project is to identify the audiences that need to be targeted. Will the target audiences include scientists, industry representatives, decision-makers, resource managers, the people whose behaviors must change, or some other group? It is important to consider each of their perspectives and levels of understanding of ecosystem health, social and economic well-being, and management issues when a communications plan is developed. An early part of EBM communications can involve explaining general principles of EBM and correcting misinterpretations of the process.

Once the audience has been determined and assessed, communication needs to focus on what the audience is being asked to do. It is rare for a communication strategy to simply "inform" an

CASE STUDY / *Communicating and educating in the Philippines*

Examples of public education about marine issues, including ecology, resource management, and conservation, are plentiful around the world. However, public awareness and education about the marine environment in the Philippines may be unparalleled, thanks in large part to the work of the Coastal Conservation and Education Foundation (CCEF).

CCEF works throughout the Philippines to communicate marine issues to local communities and authorities. It has established field-level service programs that educate and encourage coastal communities and local governments to protect and manage their local coastal and marine ecosystems for long-term sustainable use, and it assists in this management where possible.

CCEF has permeated all aspects of resource governance in Philippines society: government (working with local authorities), business (through its Corporate Responsibilities Program), and civil society (through internships, volunteering, and staff-based outreach). Its stated core activity is to develop local government expertise in coastal resource management. Thus its communication and education strategy extends beyond the public to decision-makers. It also hosts study tours for both national and international groups wishing to learn firsthand how locally driven coastal resource management is initiated and sustained. / **www.coast.ph**

Distributed by CCEF, this comic book informs Philippine fishermen about sustainable and unsustainable fishing techniques.

CASE STUDY / *Learning from Neighbors – The West Coast EBM Network*

The West Coast EBM Network is a partnership of community-based initiatives focused on sharing techniques and lessons for implementation of EBM along the US West Coast. The initiatives that are members of the Network are at different stages of progress, and are using various models and strategies for EBM at their sites. But they share the common thread of being place-based and community-driven, as well as relatively small in scale.

The network takes a two-pronged approach. First, it supports each initiative in achieving its own individual goals. Second, it enables collaboration around shared issues and a shared regional agenda. To achieve the first goal, the initiative participants visit each other's sites, attend an annual meeting, and communicate regularly by phone and email to learn about practices that are working (or not working) at individual sites. For example, staff from more advanced projects have participated in strategic planning processes of newer projects to provide support, ideas, and guidance. Several sites are also replicating novel outreach and stakeholder engagement techniques that have proven successful in other initiatives.

The network has the ability to organize a range of coastal communities around common goals and priorities and speak out on them as a group. With this unified voice, the network can influence management and policy discussions happening at the state, regional, and federal levels along the West Coast. / **www.westcoastebm.org**

audience. More typically, an audience will be asked to change its behavior or collaborate with a project in some way. It should be made clear why this request will benefit the audience, and if there is not a direct benefit, what might motivate them to take the action anyway.

Trying to communicate overarching EBM concepts to a general audience can be a challenge. Messages about ecosystem-based management need to begin with problems the audience cares about, such as declines in water quality from run-off, beach closures from storm and sewage overflow, and coastline alteration. These issues must then be connected to an underlying management problem. Once this connection is clearly understood, messages about the need for, and benefits of, ecosystem-based management will be better received.

Furthermore, it may not be entirely necessary to use the term "ecosystem-based management" with all audiences. Audiences such as coastal communities, fishers, and even elected officials may be less familiar with EBM and may be confused by the term or interpret it incorrectly. Alternative terms to describe this management concept, which may resonate more with these groups, include integrated management, comprehensive management, or terms with special, already established meanings for local communities.

EBM, given its scale and complexity, also benefits from communication and learning between EBM projects and experts around the world. EBM practitioners often feel that they are starting from scratch, or experiencing insurmountable challenges. As with other specialized skills, the opportunities to share experience with peers is extremely important. Interacting and learning from other EBM initiatives can help speed progress and disseminate new ideas and innovations.

It is helpful to form networks of EBM practitioners within a given geography, where political structures and environmental stressors are similar. Examples abound, and include the Locally Managed Marine Area network in the Western Pacific, the US West Coast EBM Network (see case study above), and MedPAN – the Mediterranean MPA practitioners network. It may also be useful for EBM practitioners to engage in networks that are focused on specific issue areas or aspects of EBM. The EBM Tools Network, for example, is an alliance of EBM tool users, providers, and researchers who interact

"When communicating with local communities, the media, and non-scientific audiences, we tend to use the term 'ridge to reef management'. The term is readily understood by Fijians who have traditionally governed their natural resources from terrestrial forests out to the reef's edge. However, when we communicate with decision-makers, we use the terms 'ecosystem management' or 'ecosystem-based management' as a way to incorporate human dynamics, cross-sectoral engagement, and ecosystem linkages into national-scale planning."

-Stacy Jupiter, Wildlife Cnservation Society in Fiji

to discuss and troubleshoot technical tools for implementing EBM (www.ebmtools.org). Such networks can be instrumental in sharing information and ideas across a broad geographic area, and providing assistance to EBM initiatives in remote locations.

SECURE SUSTAINABLE FINANCING FOR EBM IMPLEMENTATION OVER TIME

For EBM to provide a lasting solution to the challenges facing oceans and coasts, it requires sustainable financing to support day-to-day management, coordination, and information exchange among agencies, as well as the continual adaptation that good EBM requires. This means not only securing budgets for government agencies involved in marine and coastal management, but potentially tapping the private sector as well for support.

Private sector investments in coastal conservation can finance EBM, as is the case with the privately owned and operated Chumbe Island Marine Park in Zanzibar, Tanzania. Revenue from user fees collected by the park's private ownership covers the bulk of the costs of management (monitoring, enforcement, outreach, maintenance, etc.). Other examples beyond Chumbe include less direct private sector protection of services, including a range of funding flows that originate in the private sector. These include developer-financed conservation or restoration/rehabilitation projects, such as those undertaken as part of no-net-loss-of-wetlands regulations. It also includes public/private partnerships such as municipal governments teaming up with chambers of commerce, or private financing of public sector resource management. This can involve generation of conservation funds through licensing fees (fishing and hunting, for example). As mentioned earlier in this guide, it is essential in the establishment of public-private partnerships to ensure that the interests of public and private partners are aligned, and the achievement of management goals is not weakened.

There are many other mechanisms that provide opportunities for sustainable financing. Funding can come from a share of lottery revenues, dedicated revenues from wildlife stamps, tourist related fees, fees for ecolabeling and certification, and fishing licenses or fishing access agreement revenues. There can also be fees for non-renewable resource extraction, fines for illegal activities, campaigns to establish trust funds, fees for bioprospecting, and income derived from local enterprises (such as the sale of handicrafts). An example of indirect payments for coastal and marine ecosystem protection is the growing movement of communities hiring watchdogs to monitor compliance with existing pollution and/or fishing regulations, and to publicly

CASE STUDY / *An innovative private-public partnership for long-term financing*

Mexico's Fund for Protected Areas (or FANP by its Spanish acronym) is a unique partnership that helps ensure secure, long-term financing for the country's protected areas. Created in 1997 with a US $16 million donation from the World Bank's Global Environment Facility, the FANP has grown via additional donations into a $76 million endowment that supports 23 Mexican protected areas — roughly one-third of the total area protected under federal decree.

The FANP is a private-public partnership. It is housed within the privately run Mexican Fund for the Conservation of Nature, which manages the endowment's investments and ensures that the interest it generates is quickly and efficiently channeled to protected areas. The Mexican government, through its National Commission for Protected Areas, ensures that the funds are allocated to specific, strategic conservation priorities. The partnership is an effective one. The privately operated endowment guarantees consistent, independent management of funds across political administrations, while government oversight of how the funds are applied ensures they are used for the conservation of the nation's highest priority protected areas. / **www.thegef.org/gef/news/2010IYB/Working_Together_Biodiversity**

CASE STUDY / *Testing innovative financing mechanisms in Kiribati*

The Phoenix Islands Protected Area (PIPA), part of the nation of Kiribati, comprises 408,250 km^2 of mid-ocean wilderness in the central Pacific. Full legal designation of the PIPA, which occurred in 2008, represented only the first phase of an ongoing effort to ensure the long-term management of the Phoenix Islands. Three percent of the protected area (more than 12,500 km^2) is already zoned as no-take, and a further ten percent has use restrictions. The next goal is to increase the no-take area to nearly 30%.

With a significant share of national GDP coming from fishing permit revenue from foreign fleets, closing an area of that size to fishing could adversely impact Kiribati's economy. To make such a vast fishing closure a reality and ensure its financial sustainability, Conservation International (CI) and the New England Aquarium (NEAq) are working with the Kiribati government to create an endowment. The PIPA endowment will finance core management of the protected area (estimated at US $300,000 per year) and will also compensate the Kiribati government for lost revenue from fishing licenses. The initial target size of the endowment is US $13.5M, which will support the expanded fishery closure; the intention is to raise those funds by the end of 2014. The endowment is considered a "conservation incentive agreement": a pact in which resource owners commit to protecting habitats or species in exchange for a steady stream of benefits. The endowment will empower this small island developing nation to take strides in conservation the scale of which have rarely been accomplished elsewhere.
/ **www.phoenixislands.org**

blow the whistle when infractions occur. Thus governments need not shoulder the burden of coastal and ocean management alone.

At the same time, there is growing attention to more direct involvement of markets in protecting ecosystem services. Recognition of the immense value of ecosystem services has opened the door to innovative approaches to conservation and greater engagement of the private sector. EBM can provide members of the business community with ways to engage more fully in the kinds of marine conservation that can support their sustainable use of marine resources.

Market-based approaches to marine and coastal conservation include coastal Payment for Ecosystem Services (PES) systems and associated market offsets. These have the potential to achieve more cost-effective conservation outcomes than currently result from non-market-based projects seeking to isolate coastal areas from human encroachment. By allowing managers of coastal lands or marine resources – be they government agencies or local communities and user groups – to "sell" the protection of ecosystem services to the buyers who most benefit and value them, new revenue streams for management can be generated.

Understanding the value of ecosystems through the services they provide can be a catalyst for innovative financing to support EBM. Valuation methods are diverse, ranging from contingent valuation to willingness-to-pay measures, but all methods try to capture market and non-market values. (For resources on determining the value of marine ecosystem services, see Appendix.)

Ensuring that EBM is sustained and continues to deliver the benefits of effective, comprehensive, and streamlined management requires a long-term mindset.

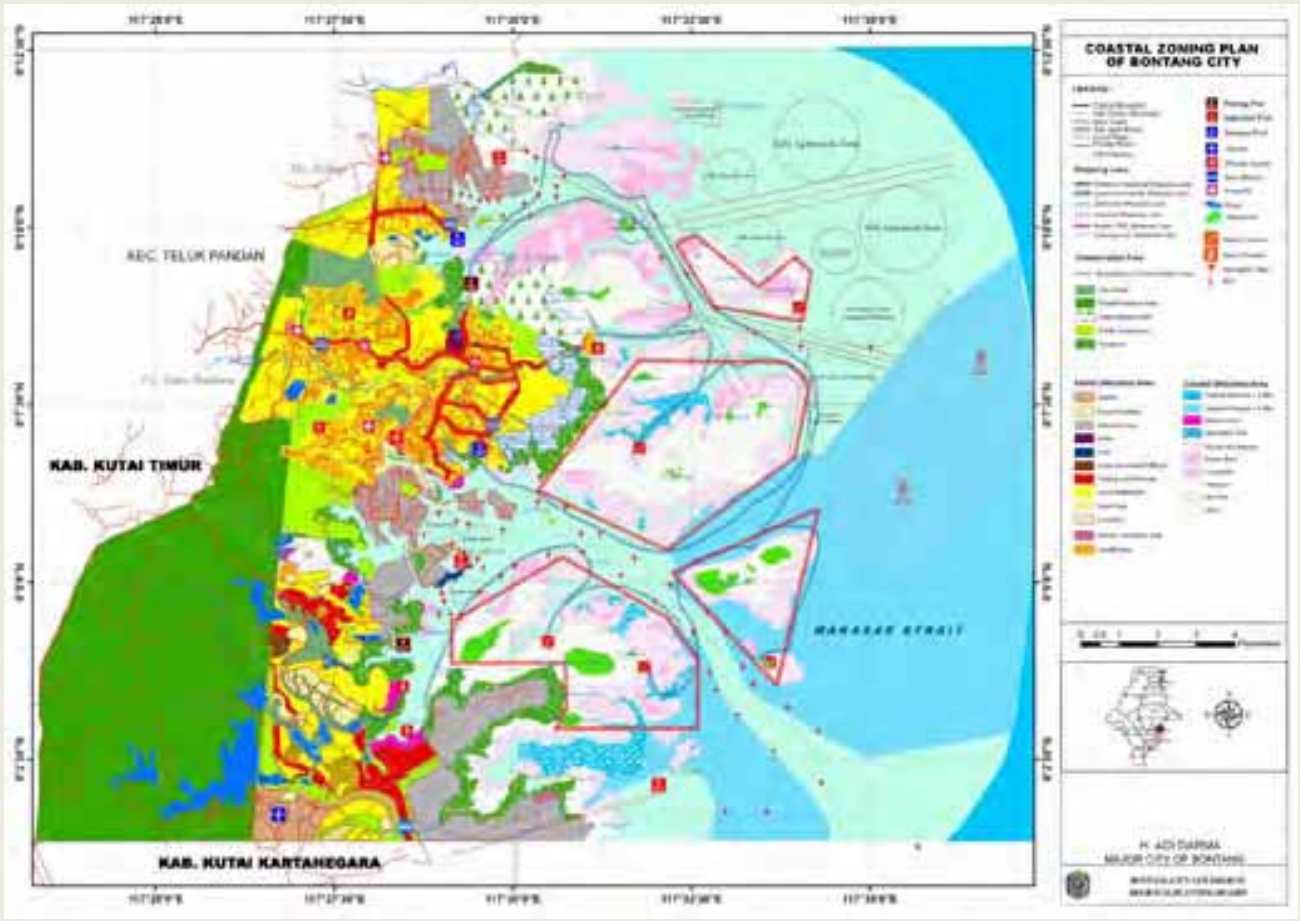
CORE CAPACITIES NEEDED IN THE IMPLEMENTATION PHASE

Political capacity is needed for successful EBM implementation. Coordination among different management entities will occur only when there is the political will to do so, and real leadership is needed to drive the process. Other socio-political and social skills sets are needed, too – including communication skills (serving a broad array of needs), facilitation, negotiation and dispute resolution, organizational management, project management, and budgeting and accounting.

CASE STUDY / *Coastal zoning map developed by Bontang City Government, East Kalimantan Province, Indonesia*

By balancing multiple objectives and sectoral priorities, this integrated coastal zoning plan allocates space for different human uses in Bontang's coastal watershed, wetlands, bays, and offshore marine systems. These spaces allow for shipping lanes, pipelines, ports, tourism development, conservation areas, urban development, and public infrastructure (marked with different colors in the map). Informed by knowledge of ecosystem processes and function, and consultation with stakeholders across different sectors and interests, the plan also addresses the use of marine resources, such as in fishing and mariculture.

Reference: Bontang City Government (2011) Integrated Coastal Zone Planning (in Process of Legal Adoption), Bontang City Government, East Kalimantan Province, Indonesia. (For more on balancing management strategies, see “The Planning Phase: Choose management strategies for EBM implementation", pages 48-55.)



Concluding Thoughts

A commitment to ecosystem-based management could reverse trends in marine and coastal ecosystem decline while improving human well-being The concept of EBM can be described relatively simply. It is a process that uses ecosystem science — our knowledge of the connections among living organisms, natural phenomena, and human activities — as well as economic science and social science to guide our uses of the ocean and coast. Deriving this knowledge in a participatory way, and using it to determine priorities and drive integration of management across all sectors, is the essence of EBM. By doing so, we can ensure that those uses are sustainable for society and the environment over the long term.

Attaining comprehensive EBM can seem a daunting, complicated challenge. At its full scale, EBM requires ocean and coastal management to coordinate its efforts across agencies and sectors — some of which may be entrenched in sector-by-sector management. Furthermore, to ensure the sustainability of the ocean, marine managers and key stakeholders must begin to take into account factors far above the high tide line, including the impacts of land-based runoff and other terrestrial impacts on the marine environment.

But steps in the direction of EBM are feasible across geographic, cultural, and socio-economic contexts. The necessary changes need not be sudden. The best way to proceed is to chart out small, feasible steps that move sectoral management from narrowly focused to broadly based, and from a limited approach to an integrated one. Taking those steps and observing what works and what does not will ensure progress toward EBM. When some elements of EBM may already be employed in current management, practitioners have a head start. As the benefits begin to accrue from the changes put in place — improved conservation outcomes, fewer user conflicts, more efficient management — the journey toward EBM becomes less intimidating and more natural.

EBM prepares society to face new and emerging issues. It can help coastal populations to adapt to climate change by helping ecosystems to be more resilient to warming, sea level rise, and changes in ocean acidity. It can also focus management effort on habitats capable of buffering human communities from climate change impacts: the protection of mangroves and temperate wetlands, for example, can help buffer inland areas from severe storm impacts. Ecosystem-based management is key to developing green economies, by pointing public and private sector investment at maintaining and enhancing natural infrastructure and renewable energy. In this context, EBM plays an important role in addressing poverty and, in certain cases, preventing conflict. Where these problems overlap with coastal issues (such as diminished marine resources or reduced access to coastal areas), socioeconomic information collected and assessed under EBM can help in determining the root causes of poverty and conflict, and inform solutions.

Planners and managers can learn from one another how to facilitate the EBM journey. Establishing peer-to-peer networks of managers to exchange information, and continually building the community of EBM practice, will ensure that EBM becomes ever more effective and easier to achieve. Whether one's path toward ecosystem-based management starts with small steps that make minor adjustments to the way coastal or marine systems are managed…or whether it makes a big leap toward an integrated and holistic approach to management at the regional scale…it is a path marked by discovery, opportunities for learning, and constant capacity for growth. With each passing step, we can move collectively toward the hopeful scenario that prefaced this guide.

Appendix: SOURCE MATERIAL ON MARINE AND COASTAL EBM

General EBM	*Description of Material*	*Website or Reference*
Convention on Biological Diversity	Website on the ecosystem approach	www.cbd.int/ecosystem/
COMPASS	Consensus statement on ecosystem-based management	www.compassonline.org/science/EBM_CMSP/EBMconsensus
Environmental Law Institute	Book: *Ocean and Coastal Ecosystem-Based Management — Implementation Handbook*	ELI, Washington, DC (2009). www.elistore.org/reports_detail.asp?ID=11350
McLeod, K. and H. Leslie	Book: *Ecosystem-Based Management for the Ocean*	Island Press, Washington, DC (2009). islandpress.org/ebm
David and Lucile Packard Foundation	Descriptions of EBM projects from the Packard Ecosystem-Based Management Initiative	www.packard.org/ecosystem-based-management-initiative/
UNEP	Book: *Ecosystem-based Management: Markers for Assessing Progress*	UNEP, Nairobi (2006) www.unep.org/pdf/GPA/Ecosystem_based_Management_Markers_for_Assessing_Progress.pdf
Core Principles	***Description of Material***	***Website or Reference***
Crowder, L. and E. Norse	Article: "Essential ecological insights for ecosystem-based management and marine spatial planning"	Marine Policy (2008) 32(5):772-778
Granek, E. F., et al.	Article: "Ecosystem Services as a Common Language for Coastal Ecosystem-Based Management"	Conservation Biology (2010) 24:207–216
Kidd, S., A. Plater, and C. Frid	Book: *The Ecosystem Approach to Marine Planning and Management*	Earthscan, London, UK (2011). www.earthscan.co.uk
Ruckelshaus, M. et al.	Article: "Marine Ecosystem-Based Management in Practice: Scientific and Governance Challenges"	BioScience (January 2008) 58 (1): 53-63
Putting EBM into Practice	***Description of Material***	***Website or Reference***
Agardy, T.	Book: *Ocean Zoning - Making Marine Management More Effective*	Earthscan, London (2010) www.earthscan.co.uk
Arkema, K.K., S. C. Abramson, and B.M. Dewsbury	Article: "Marine ecosystem-based management: from characterization to implementation"	Ecology and Environment (2006) 4(10):525-532
Clarke, P. and S. Jupiter	*Principles and Practice of Ecosystem-Based Management: A Guide for Conservation Practitioners in the Tropical Western Pacific* (2010)	www.wcs.org/files/pdfs/EBMguide0510_low.pdf
EBM Tools Network	Website showcasing tools used in EBM	www.ebmtools.org
Ehler, C. and F. Douvere	Book: *Marine Spatial Planning: A Step-by-Step Approach toward Ecosystem-Based Management*	UNESCO, Paris (2009) www.unesco-ioc-marinesp.be
FAO (UN Food and Agriculture Organization)	Technical paper: *Human Dimensions of the Ecosystem Approach to Fisheries*	FAO, Rome (2008). www.fao.org/docrep/010/i0163e/i0163e00.htm

Appendix cont'd: SOURCE MATERIAL ON MARINE AND COASTAL EBM

Putting EBM into Practice	*Description of Material*	*Website or Reference*
Fanning, L, R. Mahon, and P. McConney	Book: *Towards Marine Ecosystem-based Management in the Wider Caribbean*	Amsterdam University Press, Amsterdam (2011) www.aup.nl
Håkanson, L. and A.C. Bryhn	Book: *Tools and Criteria for Sustainable Coastal Ecosystem Management: Examples from the Baltic Sea and Other Aquatic Systems*	Springer, Berlin (2010) www.springer.com
Halpern, B.S. et al.	Article: "A global map of human impact on marine ecosystems"	Science (2008) 319:948
IUCN	Report: *Sustainable Financing of Protected Areas*	IUCN, Gland, Switzerland (2006). cmsdata.iucn.org/downloads/emerton_et_al_2006.pdf
Kay, R. and J. Alder	Book: *Coastal Planning and Management*	Taylor and Francis, New York (2008, 2nd edition)
Marine Affairs Research and Education	Newsletter: *Marine Ecosystems and Management* (MEAM)	www.MEAM.net
SeaWeb EBM Initiative	Communication materials on marine EBM	www.seaweb.org/resources/ebm/SeaWebsEBMCommunicationsProject.php
Tsallis, H. et al.	Article: "The many faces of ecosystem-based management: Making the process work today in real places"	Marine Policy (2008) 34:340-348
UNEP	*IEA Training Manual: Training manual on integrated environmental assessment and reporting*	www.unep.org/geo/GEO_assessment.asp
Ecosystem Services Valuation	*Description of Material*	*Website or Reference*
CGIAR	Article: "Ecosystem Services Valuation & Watershed Services: An Annotated Literature Review"	gisweb.ciat.cgiar.org/wcp/download/ecosystem_valuation.pdf
Convention on Biological Diversity	Website with materials on valuing biodiversity; see also CBD Global Canopy Programme's "The Little Biodiversity Finance Book"	www.cbd.int/incentives/valuation.shtml
Ecosystem Valuation Website	Website that defines and explains concepts related to how economists approach ecosystem valuation	www.ecosystemvaluation.org/1-02.htm
Forest Trends MARES Program	Guidebook: *Payments for Ecosystem Services: Getting Started in Coastal and Marine Ecosystems - A Primer*	pdf.usaid.gov/pdf_docs/PNADT322.pdf
The National Academies Press	Report: *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*	NAP, Washington, DC (2004). www.nap.edu/openbook.php?record_id=11139&page=R2
The Economics of Ecosystems and Biodiversity (TEEB)	International initiative on global economic benefits of biodiversity, showcasing valuation tools, findings, and policy implications	www.teebweb.org
World Changing Tools	Webpage: Ecosystem Goods and Services Series: Valuation 101	www.worldchanging.com/archives//006048.html
UNEP	*Guidance Manual for the Valuation of Regulating Services* (2010)	hqweb.unep.org/pdf/Guidance_Manual_for_the_Regulating_Services.pdf
UNEP	Website with materials on valuing biodiversity	www.unep.org/ecosystemmanagement

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