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How Detailed Mapping of the Sea Floor Is Informing Ecosystem-Based Management

A habitat map, in its most basic sense, shows where particular plants and animals are likely to live. A map that shows the location of coral reefs, for example, suggests where there will be reef-associated species. Likewise for other seafloor habitats — sandy bottom, seamounts, seagrass meadows, and so forth.

The knowledge provided by habitat maps is incredibly valuable. Fishers want to find their target species as quickly and efficiently as possible, and detailed maps can help them do that. Resource planners who want to conserve particular species and habitats, or assign specific uses to compatible areas, use habitat maps to inform these decisions.

Prior to a decade or two ago, maps of the seafloor were relatively primitive. Older navigation systems resulted in features being mapped hundreds of meters or more from their actual locations. Habitats less than a certain size failed sometimes to appear on maps at all, depending on the spatial resolution of the surveying system.

Thanks to a combination of technological advances in survey equipment and the growing demand for detailed habitat knowledge, seafloor maps are improving quickly. Some of these maps rely on expensive high-tech systems like multi-beam sonar, while others use lower-tech methods and involve resource users in the surveying. In this issue of MEAM, we examine a range of techniques being used, and how they are informing the management of marine ecosystems.

Using multibeam sonar and video recording systems to improve scallop management

In Canada's Atlantic waters, the offshore scallop industry is able to catch its quota of scallops in far less time than it took 15 years ago, and has simultaneously reduced its impacts on the seabed. A main reason is state-of-the-art habitat maps.

In 1996, scallopers noticed a set of seafloor maps the Canadian Hydrographic Service (CHS) had created using multibeam sonar surveys. Multibeam sonar works by sending a fan of sound energy toward the seafloor, then recording the reflected sound through a set of receivers aimed at different angles. The survey generates accurate data on depth as well as seafloor habitat type — sand, gravel, mud, etc. In the Canadian case, the maps the scallopers saw were much more accurate than had existed previously. The industry recognized that if such maps were produced for their entire fishing area, they could focus their fishing effort just on areas of light gravel — the preferred habitat for scallops.

The results of this realization are profiled in the August 2002 issue of MPA News, MEAM's sister newsletter. (See box "Other sources on marine habitat mapping and EBM" on page 4.) The six companies of Canada's Atlantic offshore scalloping industry partnered with CHS and Natural Resources Canada (another federal agency) to outfit a retired scallop vessel with a multibeam sonar system. Over the course of two years, the industry mapped three large undersea banks.

The cost to industry was more than CAD $3 million (US $2.9 million). But the mapping effectively changed their fishing process from hunting to gathering. In addition, it reduced the area of seafloor dragged in pursuit of scallops by as much as 70% — a significant advance considering the impact of scallop dredging gear on seabed habitats. And federal fishery managers were now able to monitor the scallop stock's health on an almost bed-by-bed basis.

Down the Atlantic Coast in the eastern US, the scallop industry has applied similar high quality surveys to its work. However, its maps have been based primarily on video, not sonar. Since 1999, a scallop research team at the University of Massachusetts has partnered with the scallop industry based in New Bedford, Massachusetts, to complete 26 video and scallop-tagging cruises to Georges Bank, a major scalloping ground. The cruises have produced 700 hours of video footage as well as 17,000 digital images covering 7500 km^2 of seafloor. The collected data provide assessments of sediment/habitat distribution, scallop abundance, and size structure in closed and open fishing areas of Georges Bank. These data now provide a basis for regional management of essential fish habitat for scallops.

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When the University of Massachusetts research began, the Canadian scallop habitat mapping project — a few hundred kilometers away — had already been underway for a few years. So why did the Massachusetts team choose video for its mapping instead of multibeam sonar, which was already showing success up north? In short, they wanted to survey the scallop population as well as map its habitat.

"We wanted to count and measure the scallops within a known unit of area, plus we wanted to measure the animals associated with the scallops and the substrate they lived on," says Kevin Stokesbury of the University of Massachusetts at Dartmouth, who oversaw the study. With each video georeferenced, the researchers could work in an expandable way, with subsequent surveys gradually building a complete mosaic of seafloor habitat. "We also wanted to work cooperatively with the fishing industry using their vessels, so the sampling gear had to be mobile and compartmentalized," says Stokesbury. "And we did not want to be hampered by permits, so a non-invasive sample technique that would give us unlimited access to all areas of the bank, including closed areas, was essential." Multibeam sonar can be considered invasive, due to the potential impacts of its loud sound waves on marine life, particularly marine mammals.

"The habitat data have provided a new map of the sea floor of Georges Bank that is two orders of magnitude more precise than the previous maps used."

The video apparatus Stokesbury's team devised — consisting of three video cameras and a digital still camera, all mounted on a pyramid frame — was inexpensive. "To start, we didn't have much money so it had to be cheap," he says. "We kept things as simple as possible for the first few years. We tested all our gear and calibrated it in tanks on shore. The first version was very low-tech, just a couple of cables taped together and a video/TV from WalMart [a low-cost retailer]. We had to control the cable by hand. However, the images provided proof of concept and we were able to obtain some funding."

The research team discussed every development with the fishermen, who helped build some of the gear, including hydraulic systems to lower and lift the video apparatus between deck and the seafloor. (Georges Bank depths range from 20-45 meters.) Stokesbury says industry was very supportive of the research from the beginning. The bigger challenge was in convincing regional fisheries managers, who relied on a traditional dredge survey for their scallop stock data. "This took over 10 years of debate and critique, even though our work had been published in a number of scientific papers," he says. "Although the value of having two independent surveys to compare and contrast cannot be overstated, the use of a new cooperative survey design with fishermen met with a lot of resistance [from managers]." Management decisions now incorporate both the video survey and the dredge survey, the latter of which is conducted by the National Marine Fisheries Service.

The period of the video survey has corresponded with a strong rebound in the Georges Bank scallop stock and fishery. Stock estimates from the video survey supported the idea of allowing some access by scallopers to existing closures. The resulting system of rotating closures helped scallop landings increase nearly four-fold from the mid-1990s to the mid-2000s. Maps from the video survey are expected to continue to improve the fishery's management — informing decisions on the best areas to close or leave open, and addressing questions of gear impact on habitat. "The habitat data have provided a new map of the sea floor of Georges Bank that is two orders of magnitude more precise than the previous maps used," says Stokesbury. "Plus the survey design is a large Before-After-Control-Impact experiment, enabling us to track the impacts of fishing and the timing of habitat recovery."

Building a systematic understanding of the Barents Sea ecosystem

When Norway launched its Barents Sea Management Plan in 2006, it represented one of the world's first comprehensive marine spatial plans; it covered the oil and gas, fishing, and shipping industries while also safeguarding biodiversity. In crafting the plan, however, officials realized that much remained unknown about Norway's undersea environment. In fact, virtually none of the Barents Sea floor had been systematically mapped. The plan would need to be adapted over time as knowledge improved, and a concerted effort was necessary to improve that knowledge.

To address this need, Norway created the MAREANO program (the acronym stands for Marine AREA database for NOrwegian waters). Specifically, MAREANO is responsible for filling knowledge gaps related to seabed conditions, habitats, and biodiversity. The program is coordinated by the Norwegian Institute for Marine Research in collaboration with the Geological Survey of Norway and the Norwegian Hydrographic Service. Four ministries (fisheries, environment, trade, and petroleum) comprise a steering group.

In effect, MAREANO seeks to learn as much as possible about the Barents Sea benthic ecosystem, and it aims to do it relatively quickly: the entire Norwegian Barents Sea is expected to be mapped by 2020. Work is well underway. Using a range of methods including multibeam sonar, video surveys, biosampling grabs, and more, MAREANO researchers have been conducting detailed mapping of depth, sediments, bottom fauna, and pollutants in Norwegian waters.

"Since launch, MAREANO has found species that are new to science, including new amphipods and bivalves," says Börge Holte, head of MAREANO at the Institute of Marine Research. "The program has also documented new species for Norwegian waters and defined new habitat types and landscapes." One dis-

covery for Norwegian waters was a so-called "pig-tail" soft-bottom coral (*Radicipes* sp.), which dominates a particular deep-sea slope area between mainland Norway and Bear Island. It has been found nowhere else in Norway and may be in space-related conflict with fishing activities, says Holte.

MAREANO has found new coral reef areas, three of which are among the largest known cold-water reefs in the world, and vast sponge-dominated areas off northern Norway. In the case of the latter, program researchers anticipate studying how the significant sponge biomass influences benthic ecology in the Barents Sea, as well as production on nearby fishing grounds. "MAREANO is laying a platform for new questions that need to be answered to fulfill the Government's demand for ecosystem-based management of Norwegian marine resources," says Holte.

The Barents Sea Management Plan underwent its first official revision this year (2011). MAREANO findings contributed to the revision, particularly with regard to offshore areas already defined in the plan as valuable or vulnerable. The program provided new and detailed information about the biological and physical composition of the sea bottom in these areas. MAREANO also contributed insights on defining indicator species for particular habitats, as well as establishing a climate change monitoring program.

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Improved Seafloor Maps and The Gully

By Paul Macnab
Manager, The Gully Marine Protected Area, Canada

Until 1997, hydrographic coverage of The Gully, the largest submarine canyon in eastern North America, was minimal, with only 1% surveyed using single beam methods and widely-spaced vessel transects. Thankfully, that spotty treatment was expanded with multibeam surveys that supported the case for designation of The Gully Marine Protected Area in 2004. We now benefit from continuous hydrographic coverage for about 90% of the MPA. A number of multibeam surveys spanning MPA depths from 18 m to well over 3 km have revealed the size and shape of the canyon like never before. The Canadian Hydrographic Service and the Geological Survey of Canada undertook a series of shallow and mid-depth surveys, and deeper portions were mapped under special partnership arrangements with vessels of opportunity, including platforms mobilized by the oil and gas industry for nearby surveys.

Multibeam instantly exposed canyon features that were invisible in the first-generation hydrographic surveys. Geologists used additional data sources like sidescan sonar to interpret, classify, and map seabed characteristics, capturing the tremendous diversity of benthic habitats present in the MPA. Identified features include nine steep-sided feeder canyons and distinct ridge-valley formations along the main canyon walls plus bedrock outcrops. The thalweg or canyon floor clearly presents in the multibeam imagery as do notable bedforms at the head of the canyon including sand waves with some reaching heights over 11 m. Moraines, iceberg furrows, and other glacial relics are readily apparent on the canyon flanks. Seabed processes like erosion, sediment transport and deposition, slumping and gas seepage are also inferred from the survey data. Geological findings are presently being combined with optical survey results, biological records, grain size data, and oceanographic parameters to generate benthic habitat maps depicting texture, roughness, natural disturbance, scope for growth, and sensitivity. An example of a surficial geology map is at **http://apps1.gdr.nrcan.gc.ca/mirage/full_result_e.php?id=224961**.

Informing site management

There are many ways in which the improved seabed characterizations are informing site management. During the regulatory drafting process, the survey results enabled a more informed assessment of seabed risks as decisions were made about activities that would be allowed or restricted. Multibeam also produced an accurate basemap that in turn supported precise offshore legal descriptions including a fully protected core zone delineated along the 600-m isobath. A critical post-designation application has been in permitting. When MPA managers receive coordinates for proposed bottom-contacting activities, the locations are plotted in our GIS to enable direct comparison with seabed properties. This allows us to assess the likelihood and severity of impact before rendering an approval under the MPA regulations. Further, it provides an opportunity to suggest alternative locations where proponent objectives can still be met while avoiding potentially negative benthic impacts.

Having better seabed maps has also improved the planning process for research and monitoring activities. For example, when historical photographic and video sampling stations are compared with bottom type, we can gauge the extent of optical coverage and identify remaining habitat gaps for future sampling programs. We've also selected resilient low-slope environments for mooring deployments, and grab sample locations more likely to contain mud than sand, an important consideration when sampling for hydrocarbon contaminants trapped in surficial sediments. A final management application we'd mention relates to oceans literacy: Gully seabed maps and derived products like virtual fly-throughs and solid terrain models have been instrumental for stakeholder outreach and public education efforts.

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The work has only just begun, however. Holte describes the area of the Barents Sea mapped so far by MAREANO as very small. "The high-diversity shelf areas containing coral communities, the shelf slope areas, and the fish-rich bank areas still must be mapped," he says. "And knowledge of the most remote Norwegian offshore deep sea areas is almost nonexistent." Among the few deep sea discoveries made so far: seafloor seep areas that could be valuable for mining, and newly documented vent areas that could potentially support bioprospecting.

Mapping reefs by crowd-sourcing the work

Seafloor mapping does not always involve highly trained scientists. In South Africa, a program to map the country's reefs (coral, rocky, wrecks, and other types) harnessed a free workforce to do it: recreational divers with cameras.

The Reef Atlas Project, completed in December 2011 and managed by the South African National Biodiversity Institute (SANBI), created the first national map of the country's reef systems. "We undertook this project with the goal of including different reef habitats in South Africa's 2011 National Biodiversity Assessment," says Kerry Sink, SANBI marine program manager. (SANBI reports to the South African environment minister on the status of the country's biodiversity.) The atlas is based on underwater photographs and corresponding GPS coordinates submitted by reef users, primarily divers.

The project was inspired by a photograph that Sink saw on the cover of the *African Journal of Marine Science*. The photo was of a South African offshore reef complex (Riy Banks). "At the time there was very little information for reefs available, especially distant offshore reefs in our more temperate region," says Sink. "The photograph provided a glimpse of the biodiversity found on the reef, and thus the idea to use underwater images from the public was born." The project went on to take lessons from terrestrial atlas projects that were based on crowd-sourced information, such as the South African Butterfly Conservation Assessment and the South African Bird Atlas Project.

The crowd-sourced aspect was also born of necessity. SANBI had only a small project team to map the country's reefs — two people with many other commitments — and it was clear the project would require extra hands. "We needed to engage divers," says Prideel Majiedt, marine project manager for SANBI. It was not a straightforward process, however. The competitive nature of the dive industry in South Africa meant that many dive business operators were reluctant to publicize their preferred dive locations in any way, particularly with photos and GPS coordinates in the atlas database. By doing so, they could lose competitive advantage, or even alert fishers to healthy reef areas the fishers did not previously know.

"It was quite sensitive information," says Sink. "A commitment was made to keep dive business reef data confidential, and this effectively built trust and assisted with data sharing. The operators then helped us engage their clients. The resolution of maps based on the data and used in reports so far has been at a national scale, so the public can't use it to find new dive or fishing spots. In mid-2012, we will generate a map showing areas of high reef density, but we plan to have it as a broad polygon so you cannot read off individual points, thereby protecting the secret spots."

Ultimately the project gathered thousands of photos, mapped 340 reef systems, and determined threat status and protection levels for 19 different reef habitat types. "The project has helped identify priority reef types for improved management action," says Majiedt. "This includes those that should be included in new marine protected areas and those that need improved protection within existing MPAs." Atlas data on deep reefs and hard grounds were used in recent analyses to identify focus areas for offshore biodiversity protection, and to inform comments on mining prospecting reports. In the future, says Majiedt, the atlas data will be used to support further spatial planning.

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Other sources on marine habitat mapping and EBM

- GeoHab, an international forum on the geological and biological mapping of seafloor habitats. **http://geohab.org**
- "The role of marine habitat mapping in ecosystem-based management." Cogan, C. B., et al. 2009. *ICES Journal of Marine Science*, 66: 2033–2042. **http://icesjms.oxfordjournals.org/content/66/9/2033.full**
- "Using Multibeam Sonar to Map MPAs: Tool of the Future for Planning and Management?", MPA News, August 2002. **http://depts.washington.edu/mpanews/MPA33.pdf**

Tundi's Take:
The Allure of Fancy Maps — Do They Present False Promises?

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

We are light-years ahead of where we were just 20 years ago in terms of collecting, analyzing, and using spatial information to support marine management. I remember a time, not so long ago, when understanding of where the important areas were, and what areas were being used, was derived by drawing lines on big maps, then overlaying one transparent map on another to deal with complexes of information.

Then GIS came along and the big old maps were rolled up and put away. "Transparencies" were transformed into data layers — where the computing power of ever faster and more capable machines could answer the basic "where" questions. We now have software packages that can analyze in any way we instruct, and we have special decision-support tools to help us decide how to direct spatial management. We even have artificial intelligence, for those (unlike me) who have enough "natural" intelligence to know what to ask the powerful computers to do.

The ontogeny of mapping demonstrates just how far we have come. We have maps that display different data layers simultaneously, highlighting what we want to focus on at any point in time. We have maps that present not only real information (data), but also information derived from models — where the imagined is made to be almost real by showing it on a map. We have animations that can show changes over time (historic or predicted), and we have three-dimensional mapping, which can get us a lot closer to understanding how coastal and marine systems are structured, used, and changed by that use.

Fancy, information-rich maps are sexy — we cannot help but be seduced by them. But how integral to EBM is the investment of data collection, data management, and computing time that creating technologically sophisticated maps requires?

EBM is in some way always spatially explicit, and maps are integral to planning and to communicating management. But low-tech methods can also deliver the needed information, especially in the early stages of EBM. Expert opinion is often used to create the data layers that can show where ecologically important areas, vulnerable areas, or at-risk areas are. Importantly, such Delphic processes can also point to knowledge gaps. Conversely, fancy maps run the risk of portraying marine ecosystems as comprehensively known, presenting false promises regarding the reliability and uniformity of information.

Scientists are not the sole proprietors of information that is crucial to EBM. The information that resides in the minds of users of coastal and marine resources is just as immensely valuable. Though not as flashy, the maps that are generated through community mapping, user mapping, and surveys of traditional ecological knowledge and perception are critical to inform what needs to be managed where. So don't throw away those big old dusty rolled-up maps just yet. Harnessing every tool available and using different approaches to answer the "where" questions will yield even richer results than those alluring high-tech maps alone.

> "Don't throw away those big old dusty rolled-up maps just yet."

Letters to the Editor: Stakeholder Engagement in EBM

The lead article in our October/November 2011 issue was on stakeholder engagement in EBM, including the potential benefits and challenges associated with such involvement. We received several responses, including the letters below.

On direct and indirect consequences of extensive stakeholder engagement

Dear MEAM:

The recent MEAM issue on stakeholder involvement raised a number of vital issues. I think we have all learned that an exclusively top-down, command-and-control approach to marine governance is unlikely to succeed. However, I think we are learning that Judith Layzer's sobering warning needs to be taken seriously as well. It is equally unrealistic to expect that making all governance exclusively bottom-up and stakeholder-driven will be universally successful.

This topic was the subject of a dynamic and well-attended theme session at the recent ICES Annual Science Conference (ASC). Many papers in the session presented case histories on how allowing the planning and decision-making process to become more inclusive of stakeholders might break management impasses that had impeded progress on sustainable use of marine ecosystems, sometimes for decades. This good news generated enthusiasm. However, a few papers presented experiences that suggested tempering that enthusiasm: inclusive governance has it own challenges – different challenges, but real ones.

The discussion session following the papers was probably the most dynamic I have seen in decades of attending ICES ASCs. No one argued that the top-down model was ideal. But both direct and indirect consequences of extensive engagement emerged from the discussion. Directly, the increases in transaction costs and time to reach outcomes from expansively inclusive governance processes are real costs, and sometimes allow situations that satisfy no one to persist because consensus cannot be achieved on what direction of change to follow. But we all know that, and it can be a price worth paying for a stable outcome at the end.

A more indirect consequence of making governance more inclusive also emerged from the discussion. "Governance" has many steps; in EBM, there are steps for information collection, review, and synthesis (I'll refer to these as "science" steps) and then steps to reach consensus on what to do, given the information (the "consultation and decision" steps). Inclusiveness rarely permeates all these steps at the same time and at the same pace.

In the mid-1990s, when Canada's Department of Fisheries and Oceans established what is now the Canadian Science Advisory Secretariat to provide science advice to the consultation and decision steps, we made a commitment to make our process more open and inclusive to traditional and experiential knowledge. Although there were still rules of engagement to keep the process as impartial and evidence-based as possible, the science steps unquestionably were made much more inclusive of stakeholders. This worked well and the "science advice" was much richer for including the greater breadth of knowledge. However, many stakeholders remained unsatisfied with the roles that they had in other steps in the governance process. For fisheries issues, some biodiversity interests did not feel they were taken seriously in consultation processes, and lacked effective access to the decision steps. Fisheries interests certainly felt the same about processes engaged in establishing marine protected areas or identifying species for listing under the Species at Risk Act. They brought their dissatisfactions with their perceived roles in the other steps to the science processes where they did have access and status.

The consequences are easy to imagine. Even experienced meeting leaders could not keep partisan policy arguments from pervading what were intended to be policy-neutral evaluations of the information about complex ecosystem issues – what are status, trends, risks and threats? This could compromise the ability of the science steps to provide a universally accepted information basis that the consultation and decision steps could use to help resolve true differences among stakeholders on objectives and preferences for management actions.

These problems did not occur in every case, but they occur increasingly often. They are not a reason to turn our backs on inclusiveness in any of the steps. Done correctly, inclusiveness strengthens each step in governance. But there is a naivety to those who argue that just making some part of governance inclusive necessarily makes it better. Governance is complex. Its parts are all necessary and the steps have to work together effectively. Effective inclusiveness may be achieved in different ways in different parts of the overall process, and the whole has to evolve coherently to remain functional. We need to keep sharing experiences, as was done with the rich set of contributions in the previous MEAM issue.

In Palau, two types of stakeholder involvement in LMMAs

Dear MEAM:

In Palau we have two different stakeholder-involvement arrangements for locally managed marine areas (LMMAs) in each of the states that make up the Republic.

The first arrangement is where the state government (elected leaders) proposes the idea for an LMMA. A public hearing with all interested stakeholders is conducted to allow everyone to provide input before a decision is made. Although members of the community are the official resource owners, the LMMA is usually legislated and enforced by the state government with a director supervising the site's day-to-day operations.

The second arrangement is an attempt to co-manage LMMAs. States create an independent management board that comprises representatives of different stakeholder groups — including state government, traditional leadership, and the local community — to ensure collaborative decision-making.

Both of these arrangements have pros and cons and can work for different sites or communities.

One of the challenges involved with engaging stakeholders is that sometimes there can be a lack of "ownership" of problems, solutions, or ideas. This is very common and will often result in reaching a dead end. Our communities are divided by clans and families and for an idea to find root and grow, one must understand this social system and its history. The key to success in collaboration and community engagement is to identify the key people who head each clan or families that have strong influence. This is where engagement must begin.

A related challenge is that without wide buy-in for key management strategies — such as no-take zones or seasonal fishing of a key species — these strategies can seem imposed on a community. So it is very important that the community identifies its key natural resources, its vision for them, and what threats those resources face. At that point, solutions can be suggested along with examples of sites or communities that have faced similar threats. This process helps the community identify the solution with the best chance of success, and guarantees ownership of decisions even if sacrifices must be made by individuals or the community. It is clearly understood that it is for the good of their livelihoods.

Wayne Andrew
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And we need to keep in mind there is no miracle solution out there to the challenges of ocean governance in an ecosystem context – not even stakeholder engagement.

Jake Rice
Senior national advisor for ecosystem sciences, Department of Fisheries and Oceans, Ottawa, Canada. E-mail: **ricej@dfo-mpo.gc.ca**

On the importance of stakeholder involvement in EBM

Dear MEAM:
The following comments are derived from several decades of experience in applying the principles of EBM in both terrestrial and marine ecosystems in different regions and countries. I therefore believe that they are generally applicable to EBM:

• Most integrated ecosystem management programs depend on the support of local communities for survival. At the same time, effective management, especially of non-locals, may depend on formal government recognition of the contribution that management of an ecosystem makes to human welfare through maintaining biological productivity. It follows that design and management in EBM must be both bottom-up and top-down.

• Managers should understand the local communities and identify potential partners. They must listen to the many interests and seek ways to involve them as participants in resource management. It is recommended to build management partnerships using the collaborative management model, which is outlined in detail in Annex 1 of *Guidelines for Marine Protected Areas* (1999, IUCN, **http://cmsdata.iucn.org/downloads/mpaguid.pdf**).

• While marine conservation and sustainable use are sometimes seen as fundamentally different objectives, they are in fact intimately interrelated. Some attempts at EBM have failed because the main aim of management has been biodiversity conservation while that of the local community has been some level of resource use. Both aims should be reconciled within the ecosystem. There needs to be clarity from the outset about how the two sets of objectives relate to each other.

• Local people must be deeply involved from the earliest possible stage if EBM is to succeed. This involvement should extend to their receiving clearly identifiable benefits — environmental and economic — from the managed ecosystem.

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

The EBM Toolbox by Sarah Carr

Tools for stakeholder engagement (Part 2)

In the previous issue of MEAM (October/November 2011), The EBM Toolbox profiled some general and easy-to-use tools for stakeholder engagement. Some additional tools that are more specialized for use in conservation and management projects include:

• **Integration and Application Network Conceptual Diagramming Tools** (**http://ian.umces.edu/symbols**) can be used to produce conceptual diagrams or "thought drawings" that depict essential attributes of a system. The diagrams help clarify thinking and combine current scientific understanding with community priorities and values.

• **CanVis** (NOAA/USDA; **http://csc.noaa.gov/digitalcoast/tools/canvis**) is image-editing software that allows natural resource professionals with minimal computer skills to create photo-realistic simulations for visualizing potential impacts from coastal development or sea level rise.

• **MarineMap** (MarineMap Consortium; **www.marinemap.org**) allows stakeholders to draw prospective marine protected areas, predict the biological and economic effects impacts of proposals, select sites with optimal benefits for conservation and fisheries objectives, and share proposals with other stakeholders.

• **Open OceanMap** (Ecotrust; **www.ecotrust.org/marineplanning/OpenOceanMap.html**) helps collect local ecological and economic knowledge using an intuitive stakeholder interview process. It also provides a web-based interface for interviewees to review and verify information, and aggregates data to ensure confidentiality.

Webinar demonstrations of the tools are on the EBM Tools Network website at **www.ebmtools.org/tools_training/presentations.html**.

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

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Notes & News

UN report offers blueprint for ocean, coastal sustainability

A new report co-produced by several UN agencies (UNESCO, FAO, UNDP, IOC, and IMO) lays out the contribution of oceans and coasts to global sustainability and the roles of ocean sectors in the Green Economy. It also offers several proposals for reducing environmental stressors, restoring ecosystem function, reforming institutions and policy, and more. Prepared as a contribution to the UN Conference on Sustainable Development in June 2012, *A Blueprint for Ocean and Coastal Sustainability* is available at **www.unesco.org/new/en/natural-sciences/ioc-oceans/priority-areas/rio-20-ocean**.

Analysis of 350 case studies of coastal management in Europe

The EU-funded OURCOAST project — a three-year initiative to gather and share best practices among coastal management projects in Europe — has released a report analyzing 350 case studies of integrated coastal zone management across the continent. The report identifies several factors that contributed to successful cases, as well as limiting factors. To download *Comparative Analyses of the OURCOAST Cases*, go to **http://ec.europa.eu/ourcoast/download.cfm?fileID=1709**. (Note: the file is a PDF, although not identified by name as such. You might need to rename it with a .pdf suffix for your computer to open it correctly.)

US launches one-stop web portal for marine planners

The US National Ocean Council has launched a website to serve as a portal for data, information, and tools to support efforts in coastal and marine spatial planning. The site aims to be a one-stop hub, providing catalogs of datasets (government and otherwise), guidance on decision support tools, updates on regional spatial planning efforts in the US, and forums for public discussion. Go to **www.data.gov/communities/ocean**.

Challenges and good practices in ocean and coastal governance

A new issue of the biannual magazine *Tropical Coasts*, published by PEMSEA (Partnerships in the Environmental Management for the Seas of East Asia), focuses on challenges and good practices in ocean and coastal governance. The issue is based on discussions at the International Conference on Sustainable Coastal and Ocean Development, held during the East Asian Seas Congress in Manila, Philippines, in November 2009. The magazine is available at **http://bit.ly/PEMSEA**.

Report: Next steps for marine EBM in Arctic

A new report from IUCN examines barriers to marine EBM in the Arctic, and identifies collaborative steps that nations can take to advance EBM in the region. The publication summarizes the findings of a September 2011 workshop on the subject in Reykjavik, Iceland. The *Workshop Report: IUCN/NRDC Workshop on Ecosystem-Based Management in the Arctic Marine Environment* is at **http://cmsdata.iucn.org/downloads/arctic_workshop_report_iceland_final.pdf**.

Coastal development the main threat to Arabian Gulf ecosystems

A new report published by the United Nations University Institute on Water, Environment and Health (UNU-INWEH) examines challenges facing the coastal and marine ecosystems of the Arabian Gulf region, and concludes that current management strategies are insufficient to ensure the future health of resources. The main challenge is rampant coastal development, which has resulted in widespread loss of productive natural habitat. The authors recommend the tighter regulation of coastal development by a single lead agency at the national level, backed up by integrated and comprehensive laws and policies. The report *Managing the Growing Impacts of Development on Fragile Coastal and Marine Ecosystems - Lessons from the Gulf* is available at **http://bit.ly/LessonsfromtheGulf**.

Working paper examines EU policy landscape for marine spatial planning

A working paper by Wanfei Qiu and Peter Jones at University College London provides an overview of existing EU-level policy as it relates to marine spatial planning, and discusses interactions among key EU policies, directives, and related issues. The working paper "The Emerging Policy Landscape for Marine Spatial Planning in Europe: Overview of Key Policies, Directives and Regulations, and Their Interactions" is available at **www.homepages.ucl.ac.uk/~ucfwpej/pdf/EPLMSPEU.pdf**.

New forum on marine debris management and prevention

Marine Affairs Research and Education (MARE), publisher of MEAM, has launched a new online forum on marine debris management, research, and prevention. The MarineDebris.Info forum offers a listserv for online discussion and a regular webinar series on marine debris topics of interest. The first webinar in the series was held 12 December 2011 on preparations for the arrival of Japanese tsunami debris in the Northwestern Hawaiian Islands. For more information, go to **www.marinedebris.info**.