

MARINE ECOSYSTEMS *and* Management

News and analysis on ocean planning and ecosystem-based management

MEAM

www.MEAM.net

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Upcoming events on OpenChannels.org, and links to recent events

Hi everyone,

OpenChannels.org is back to a full schedule of live webinars and chats with experts. For an up-to-date list of our upcoming events, go to <http://openchannels.org/upcoming-events-list>. Here are a few highlights:

- Live Chat on Community Engagement in Ecosystem Service Assessments with the VALMER project.
19 December 2014: 1 pm EST / 10 am PST / 6 pm GMT
- Keeping the Promise of Sydney - Next Steps for the Marine Agenda from the World Parks Congress.
8 January 2015: 1 pm EST / 10 am PST / 6 pm GMT
- An Ocean of Story Maps, by Dawn Wright of ESRI.
20 January 2015: 2 pm EST / 11 am PST / 7 pm GMT

We also have recordings of all our completed events, dating back several years. Here are some of our recent ones if you missed them:

- Restoring the Resilience of Caribbean Coral Reefs. Recording available at openchannels.org/node/8364
- Ocean Planning's Impact: An economic, environmental, and social retrospective. Recording available at openchannels.org/node/8289
- Making Blue Carbon Work: Building Blue Carbon Projects and the GEF Blue Forests Project. Recording available at openchannels.org/node/8231
- Fish Carbon: Meeting the Climate Change Challenge. Recording available at openchannels.org/node/8213

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John B. Davis

MEAM Editor / OpenChannels Supervisor

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Perspective: Ocean tipping points and the language of change

By Carrie Kappel and Benjamin Halpern

Tipping points occur when small shifts in human pressures or environmental conditions bring about large, sometimes abrupt changes in a system — whether in a human society, a physical system, an ecosystem or our planet's climate.

A diverse collaboration among natural and social scientists, law and policy experts, managers, indigenous peoples and other stakeholders called the Ocean

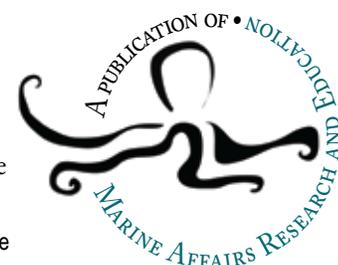
Tipping Points project (oceantippingpoints.org) is finding that the tipping point concept provides a valuable toehold into cooperative ecosystem-based science and management. Viewing and describing ecosystem change through the lens of ocean tipping points provides a simple, powerful and common language for communication among these diverse groups and their different ways of knowing the ecosystem. It brings our attention to the ecosystem level. And it focuses attention on how the influences of multiple stressors cascade through an ecosystem via human and species interactions.

Across the world's oceans, we have witnessed dramatic ecosystem shifts in diverse habitats, including coral reefs, pelagic systems, seagrass beds, and kelp forests, among others. Many of those changes persist today. These socio-ecological systems often remain locked in regimes that are less productive, less desirable, and less manageable for people. Reversing the shifts and restoring de-

continued on next page

Editor's note:

Carrie Kappel is lead principal investigator of the Ocean Tipping Points collaborative, and a center associate at the National Center for Ecological Analysis and Synthesis (NCEAS) at the University of California Santa Barbara (UCSB). Ben Halpern is a co-principal investigator on Ocean Tipping Points and director of UCSB's Center for Marine Assessment and Planning; he is also a professor at UCSB's Bren School of Environmental Science & Management.



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graded ecosystems have proven difficult and costly. Understanding the complex interactions among humans, climate, and marine food webs that lead to ocean tipping points has also been challenging.

Promising new research

New scientific research aimed at understanding and perhaps even predicting socio-ecological system change has emerged in recent years. This science, including its underlying concepts about ecosystem tipping points, has the potential to help society avoid the negative consequences of surprising shifts in marine ecosystems, and more generally advance the goals of ecosystem-based management.

Despite these advances, it can be difficult for scientists, managers, traditional ecological knowledge holders and other community members to come to a shared understanding about something as complex, hard to observe, and multi-faceted as ecosystem change. Given differences in values and experiences, each group may pay attention to different aspects of the socio-ecological system.

Differences between how scientists and non-scientists recognize species distinctions can lead to very different perceptions of species diversity and species' decline. As a simple example, on the Pacific Coast of the US, two very similar-looking fish — bocaccio and greenstriped rockfish — underwent very different population trends between 1977-2001. While bocaccio declined, greenstriped rockfish increased. A significant proportion of fishermen (about 40%, according to a survey) were unable to differentiate the two species. As a result, these fishermen might not have recognized the potential extinction risk to bocaccio as its decline was masked by the increase in the other species.

Furthermore, shifting baselines — where individual perspectives on what a "normal" ecosystem should look like change over time as the system changes — make it hard for different groups to agree on how much a system has changed and which changes matter. Deciding on an appropriate baseline can be especially tricky when you are working across diverse cultures with different historical reference points and cultural and institutional memory (e.g., of indigenous and European origins). Differences in training and language (such as scientists' jargon or policymakers' acronyms) compound the communication challenge, and scientific uncertainty clouds the picture. This inability to speak the same language about the changes we have observed, their impacts, and potential actions that could be taken impedes successful marine management.

Applying the concept of tipping points to site management

In British Columbia, Canada, we are working to bring the concept of tipping points to the Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site, which is co-managed by the Haida Nation of indigenous people and the federal government of Canada. Here we are partnering with managers and local experts to integrate traditional ecological knowledge with data on multiple fisheries and non-fisheries species, their interactions, oceanographic conditions, and human use to understand dramatic changes that have been observed in the nearshore pelagic ecosystem.

The various groups involved have at times struggled to overcome differences in their perception of the ecosystem and the accompanying communication challenges. However, they are coming together to try to understand historic and potential future tipping points in their marine ecosystem. Our partner from the Council of the Haida Nation, Cindy Boyko, explains, "Gwaii Haanas is important to me as a Haida woman; it holds the stories of who we are as a people. As caretakers of Haida Gwaii, our ancestral homeland, understanding what has already happened and what to watch for will be key in figuring out how to manage effectively in the future."

In Gwaii Haanas and more generally, the tipping points concept helps illuminate and make concrete two ideas that are central to modern management but often contentious or confusing for different groups: risk assessment and precautionary management. In a system that responds nonlinearly to increasing pressures, risk also rises in a nonlinear fashion. As you approach the tipping point, the probability of dramatic ecosystem change rises sharply, and so does the attendant risk of impacts to society and the cost of mitigating those risks.

The more precisely you know the threshold and the more confident you are in your ability to maintain conditions at a given point along the curve, the closer you can get to the threshold.* However, if the threshold is uncertain or prone to shifting, or if the outcomes of your management actions cannot be known precisely, then precaution is warranted. Nowhere is the precautionary principle more valuable than in this case, where the risks rise steeply with increasing pressure on the ecosystem. Carefully analyzing the costs and benefits of crossing the tipping point can help you set an appropriate precautionary buffer.

Perhaps all of us in the ocean science and management communities have witnessed surprising changes in the places that we know and care about, and that common experience gives us a place to begin a conversa-

* Note: The Ocean Tipping Points project uses the terms *threshold* and *tipping point* interchangeably.

tion. Changes in ecosystems affect people. They not only affect the places people care about, but also the services that sustain us. Providing clear ways to talk about the costs and benefits of these changes that resonate across social, cultural, and political lines is essential to better managing these systems. Not every system experiences a tipping point as change occurs, but many do, and the concept and language around tipping points has proven a powerful way for diverse

groups to understand and communicate about ecosystem change. Much work remains to be done, of course, to translate these ideas and emerging science into change on the water. But sometimes progress simply requires finding the right words. ■

To comment on this article:
<http://openchannels.org/node/8441>

For more information:

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“Even if you don’t know for sure that your system is prone to tipping points, it’s important to pay attention to the potential risk”: Interview on the Ocean Tipping Points project

MEAM followed up with Carrie Kappel and Ben Halpern of the Ocean Tipping Points project to ask about examples of tipping points being incorporated in management, and what advice they have for others working to link science to management.

MEAM: In your perspective piece, you talk about the need for managers to change the way they think about and manage ecosystem dynamics to account for tipping points. Do you know of any examples where this is being done?

Carrie Kappel: We asked ourselves that same question when we first started the Ocean Tipping Points project. So several individuals on our team dug through the literature to see. They searched management documents and reports and found lots of successful examples from around the world. The results from that work have just been published (<http://rstb.royalsocietypublishing.org/content/370/1659/20130276>). We also just posted a guest blog on this paper at OpenChannels.org (<http://openchannels.org/node/8381>).

Ben Halpern: Back in the 1980s, Florida Bay in the southeastern US was experiencing mass die-offs of seagrass and declining water quality. Understanding the cause of the die-offs was difficult, but eventually scientists and managers discovered that declining freshwater inputs due to upstream diversions for agriculture and other uses were primarily to blame. They were able to quantify the threshold level of freshwater that must flow into the bay to maintain seagrass, and set hard management targets to avoid dipping below that level. Since they implemented the program, there have been no further seagrass die-offs in the bay.

Is there always a tipping point, or do some ecosystems just continue to degrade without an abrupt change occurring?

Kappel: There is *not* necessarily always a tipping point. Many ecological responses to increasing stress are actually linear and manifest as a gradual, steady degradation. But species interactions (including human ones) and other ecosystem linkages mean that a single nonlinear response to stress can cascade through a system and lead to abrupt changes. Many of those species

interactions also take nonlinear forms, which can further contribute to abrupt ecosystem level shifts in response to changing environmental conditions. Even if you don’t know for sure that your system is prone to tipping points, we think it’s important to pay attention to the potential risk of dramatic change in your system. Given how common nonlinear responses are, how they can cascade through systems, and the risks associated with crossing tipping points, precaution argues for assuming that there may be a tipping point in the absence of evidence to the contrary. Investing in understanding the true underlying dynamics of your ecosystem can allow you to relax that assumption if you don’t find evidence of thresholds.

Your project is working to span the gap between science and management. What advice do you have for others who want to do the same?

Kappel: We are definitely still learning, but there are a number of things that have worked well. Our team is quite large and diverse, which means we have broad expertise in house, including legal, social science, economic and ecological disciplines. This diversity helps us tackle tipping point questions from many angles and thus strengthens our understanding and the potential for uptake. We also have engaged managers and outside experts via advisory groups to our project, and both have provided invaluable feedback and insight along the way as we think about how to translate our science into practical solutions.

Halpern: Most importantly, we are working in two case study regions — Hawaii (US) and Haida Gwaii (Canada) — to help us focus, refine and explore how general results apply in specific, and very different, contexts. Case studies always force one to face reality rather than remain in the realm of theory. As we’ve listened to people who live and work in these regions, we have learned what kind of science would be useful to them. It is about meeting them where they are, and providing advice when asked, rather than expecting them to simply adopt our ideas. ■

To comment on this interview:
<http://openchannels.org/node/8442>

New Year's resolutions for ocean planning and management: Practitioners offer their suggestions for 2015

Each annum as the Earth begins another lap around the Sun, many people use the new year as an opportunity to set resolutions. These commitments — made to meet a goal or reform a habit in the coming year — typically pertain just to the people making them. However, for this issue of MEAM, we invited ocean planners and managers to apply resolutions to their field in general for 2015.

As anyone who has set a personal New Year's resolution can attest, it is not always easy to stick to the plan. With this in mind, we asked for resolutions that could be integrated in practitioners' daily routines and would thus, in theory at least, be more achievable. We phrased our question as follows:

If you could suggest one simple thing that ocean managers — or planners, or conservationists, or industry — do for 5-10 minutes each day in 2015, what would it be?

The responses of ten practitioners are below.

Consider how to engage the ocean business community

Paul Holthus, paul.holthus@oceancouncil.org

Founding CEO and President of the World Ocean Council, an industry leadership alliance on corporate ocean responsibility (www.oceancouncil.org)

"I would suggest that ocean managers, planners, and conservationists consider how to address the need and opportunity to engage the ocean business community — specifically to:

- Realize that those who undertake economic activities to provide us all with ocean-based goods and services (energy, protein, transport, etc.) in response to society's needs are essential allies in maintaining ocean health and productivity.
- Recognize that there are good people in responsible companies who also care about the ocean for this generation and those to come.
- Work to proactively engage members of the ocean business community to develop dialogue, trust, understanding and constructive relationships in defining and addressing shared ocean sustainability challenges.
- Identify the science, data and information needs that ocean stakeholders (government, environment community, industry, science community) can provide as the basis for collaboratively and objectively identifying problems, risks and solutions."

Make time to think, including about impacts of your actions

Meryl Williams, meryljwilliams@gmail.com

Director of AsiaPacific-FishWatch, which delivers essential information on fish harvested or farmed for food in Asia-Pacific (asiapacfish.org)

"Think: 'Let your mind go, let yourself be free.' For 5-10 minutes a day, ocean managers need to trade the restless seas of their daily work for the quiet waters of still reflection. Today's ocean managers are constantly in motion, propelled by urgent conflicts, opportunities, responsibilities and uncertainty. To reach quiet reflection, a necessary measure is to block the daily barrage of electronic and physical information and contacts that interrupts and distracts thinking. In contemplation, managers can take stock of the waypoints reached and new directions to reach desired destinations. And just as in Aretha Franklin's song, managers need to *think* (bit.ly/ArethaThink), deeply, about the positive and negative that their actions and campaigns are trying to do to others. In an interconnected world, the good deeds of nature conservation and the striving after profits and control all affect others — often unintentionally."

Think about desirable futures for marine regions

Charles (Bud) Ehler, charles.ehler@mac.com

Marine planning consultant to UNESCO's Intergovernmental Oceanographic Commission in Paris, France; co-author of the *Guide to Marine Spatial Planning* (2009); author of a new *Guide to Evaluating Marine Spatial Plans* (2014)

"As I travel around the world to learn about and evaluate marine planning processes and plans, I'm always surprised about how few actually address the future — that's what planning is all about. We can't change the past, only the future.

"I wish marine planners and managers would think and communicate more about desirable futures for marine regions and how these futures can be achieved rather than focusing only on analyzing current conditions — as too many of our current marine plans and processes do. That would include learning to write SMARTer objectives, inventing alternative spatial scenarios and more forward-looking management plans, and monitoring and evaluating appropriate indicators of the performance of those marine plans. The ocean would be in a better place with more strategic, future-oriented plans and planning that considers where we want to be and how to get there, rather than only analyzing where we are today."

Share your experiences with colleagues

Ilona Porsché (ilona.porsche@giz.de) and **Christian Neumann** (Christian.Neumann@grida.no)

Ilona Porsché is head of project for Blue Solutions, a global platform to share knowledge for sustainable management and equitable governance of oceans (bluesolutions.info). Christian Neumann is Blue Solutions coordinator at GRID-Arendal.

“When we have finished fixing up our boat, bike or house, or we’ve been on a long hike or exciting vacation, we happily share our experiences. We share what worked or didn’t work so well. We enjoy sharing with our friends, and we enjoy learning from them — it helps us to do the things we care about better.

“We believe that ocean managers gain experiences in their projects, programs or daily duties that others would love to learn. We suggest that managers spend five minutes every day — or, at the least, a half hour at the end of the week — to reflect upon the key factors that made their recent work successful: the approaches, ideas, or ways to overcome challenges that really worked. And we suggest that they actively share those experiences, be it with a colleague across the room or across the ocean, so we build a learning community, helping each other to manage the things we care about better.”

Think big

Ayana Elizabeth Johnson, ayana@waittinstitute.org
Executive director of the Waitt Institute (waittinstitute.org)
and coordinator of the Barbuda Blue Halo Initiative (barbuda.waittinstitute.org)

“Envision the future and how we can get there. Dream and then plan to make it happen. Remember why people resist change in ocean management, and figure out how to balance the long- and short-term needs of communities. It is so easy to get bogged down in to-do lists, details, and personalities. Keep yourself motivated by thinking big and strategically. And look at those videos of adorable and impressive ocean creatures (trunkfish?! mimic octopus?!) to remember why you fell in love with the ocean in the first place.”

Take steps to manage and protect the high seas

Kristina Gjerde, kristina.gjerde@eip.com.pl
High seas policy advisor for the IUCN Global Marine and Polar Programme

“I would like to give a bit of publicity to the Promise of Sydney [from the 2014 World Parks Congress] and

call on my colleagues to support Recommendation 5:

Recommendation 5 — Take steps to protect and manage biodiversity in the high seas, including the seabed, by developing, adopting and bringing into force an international instrument under the UN Convention on the Law of the Sea and through regional efforts in Antarctica, the Arctic, the Sargasso Sea and elsewhere.”

Watch the sunset and sunrise

Wen Bo, savechinaseas@163.com
Policy and Media Advisor, Global Exploration Fund-China of the National Geographic Society, and a Pew Fellow in Marine Conservation

“If my office or residence happens to be along the coast, I would watch the sunset every now and then, as well as take photos and put them up on the wall and share via social media. If waking up early enough, I would go to see the sunrise by sea at least once a month. Doing this, I would not be too different from astronauts orbiting around the Earth, who can say, ‘I am here, and there are the Earth and the Sun.’ The moments of seeing sunrise and sunset are the moments when we can reflect on our planetary dwelling. It helps remind us of the ocean planet and, as conservationists, how vital and unique our efforts have been. It is one of the greatest jobs on Earth to ensure our healthy planet through time and space.”

Meet with your elected representatives

Sabine Jessen, sabine@cpawsbc.org
National Director, Oceans Program, for the Canadian Parks and Wilderness Society

“Over the years as an ocean advocate in Canada, I have met with many politicians about ocean issues. One of those meetings has stayed with me. It was with a politician from a coastal constituency who had been given some responsibility for ocean issues in Canada. I asked about his familiarity with these issues, and he answered by saying that he had never had a constituent raise ocean issues with him, and as a result had not taken the time to inform himself about them. It seems obvious to say that in order to get traction on ocean issues we need to make them important to politicians, by linking them to their constituency and to their future election. Not only should we be meeting with our elected representatives about our issues, we need to encourage and help others to do the same. Not only will this influence how elected officials think and decide as individuals, but it also creates the political space for key decision makers and Cabinets to make the decisions that are necessary for better ocean management.”

Remember that ecosystem conservation is the foundation for sustainable management

Peter Jones, p.j.jones@ucl.ac.uk

Senior lecturer in Geography at University College London, and author of *Governing Marine Protected Areas*:

Resilience Through Diversity

(www.routledge.com/books/details/9781844076635/)

“Remember that the degradation of marine ecosystems must not be what continues to happen while you are busy making other plans. Planners tend to try to deconstruct nature into taxonomies and compartments, to reconstruct nature as an assemblage of ecosystem services, and to plan for the future of these compartments and the services that they deliver in a linear way. Marine conservation thus becomes a

sectoral objective, the costs and benefits of which must be traded off against those of other sectoral objectives under different scenarios, as we confidently strive towards an optimal integrated-use model of marine spatial planning.

“However, marine ecosystems are not suited to this way of thinking, due to their particular complexity and unpredictability. Spend a few minutes each day pondering on the mysterious, fascinating and wild nature of marine ecosystems, remembering that their restoration is not a sectoral priority amongst others. Rather, it is the foundation of ecosystem-based marine spatial planning, the only foundation on which a resilient future can be built.” ■

To comment on this article:

<http://openchannels.org/node/8443>

Tundi's Take: Time Well Spent

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

When I heard this issue of MEAM was posing a question to practitioners on what simple thing they should do for a few minutes each day, I had a one-word answer: “Pray!” Not because I’m a religious person, but because sometimes it seems only a miracle could stop the spiraling degradation of the seas. But I can’t get away with a flippant reply like that....

It’s easy for those of us who sit in our offices and write about what should be done to make suggestions to those who not only ponder but also – more importantly – do the hard work of marine management. I’ll be curious to see the responses from practitioners in the field, busy fighting fires in their backyards. But to my mind the one really useful thing managers (or planners) could do each and every day is to stop and take stock of what they are doing, and whether it is working.

Here I don’t mean undertaking rigorous evaluations, using established benchmarks and dreaded logframes – though there is an important place for objective monitoring and evaluation too. Instead, I’m thinking more of a meditation – a time to think about context, a grounding in reality. To remind oneself (or the authority, or agency practicing marine management): what is the specific

purpose of the management activity or program, and are strides being made toward that purpose? Such a daily (or weekly, if we’re allowed the flexibility to pool our few minutes each day to make it a half-hour a week) pause could not only lead to better management for the specific area or issue, it could allow good EBM to come to scale.

How? Reflecting on the goals and objectives of management, and continually taking stock, will allow course corrections if management is going off track. But many times the answer to this simple meditation will be positive – goals understood and articulated, progress being made. In those cases, managers and planners might commit to replicating their success or scaling up, such that the advantages of EBM are felt more widely, and effective management spreads like wildfire.

In fact, my remedy is not all that different from praying – and the result might be just the kind of miracle we’ve all been praying for. ■

To comment on Tundi's Take:

<http://openchannels.org/node/8444>

“When I heard this issue of MEAM was posing a question to ocean planners and managers on what simple thing they should do for a few minutes each day, I had a one-word answer: ‘Pray!’”

Notes & news

Study on economic, social, and environmental impacts of MSP cases

To date, studies on ocean planning have generally focused on the process and, to a lesser extent, its potential benefits for conservation and coastal communities. There has been little evidence compiled so far to document the actual impacts of ocean plans in practice.

A new study by the Redstone Strategy Group examines the economic, environmental, and social impacts of five established ocean plans: the US state of Massachusetts, the US state of Rhode Island, the Great Barrier Reef Marine Park, Norway's Barents Sea, and Belgium. The study shows that each of the plans resulted in broadly shared benefits:

- Economically, the plans delivered on average US \$60 million per year in economic value from new industries (primarily wind), and retained value in existing industries;
- Environmentally, plans increased marine protection, ensured that industry avoided sensitive habitat, helped reduce carbon emissions, and reduced the risk of oil spills; and
- Socially, the plans encouraged constructive engagement, broad participation, and marine research transcending the plans themselves.

The study "Ocean Planning's Impact: An economic, environmental, and social retrospective" is awaiting journal publication. For more information, email Jason Blau of Redstone Strategy Group at jasonblau@redstonestrategy.com

The study was the focus of an hour-long webinar hosted by OpenChannels and the EBM Tools Network on 4 December 2014. The webinar recording is at <http://openchannels.org/node/8289>

Publication explores new climate change mitigation concept: Fish Carbon

A new report highlights the roles that marine vertebrates — including fish, mammals, and turtles — play in the oceanic carbon cycle, and their potential value in countering global climate change, namely by sequestering carbon. The report refers to this concept as Fish Carbon. It describes eight ecological and physiological mechanisms by which marine vertebrates store carbon or otherwise help to mitigate climate change. The publication's aim is to support mainstreaming of Fish Carbon into marine management, climate change discussions, and scientific research.

"While reducing emissions remains at the forefront of national and international climate change initiatives, the vital role of ocean ecosystems as carbon sinks, including the contribution of marine vertebrates, is largely overlooked in the policy arena and may be undervalued," write the authors. The report *Fish Carbon: Exploring Marine Vertebrate Carbon Services* was jointly produced by GRID-Arendal, a collaborating center with UNEP, and Blue Climate Solutions, a project of The Ocean Foundation. It is available at www.grida.no/publications/fish-carbon

The report was the subject of an OpenChannels webinar on 24 November 2014. A recording of the webinar is at <http://openchannels.org/node/8213>

New manual on assessing blue carbon in coastal ecosystems

Coastal ecosystems store significant amounts of carbon from the atmosphere and ocean, and are increasingly recognized for their role in mitigating climate change. A new manual, "Coastal Blue Carbon: methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows", describes protocols for sampling methods, laboratory measurements, and analysis of blue carbon stocks and fluxes. Produced by the International Blue Carbon Initiative, the manual aims to foster the integration of coastal blue carbon into national climate change mitigation policy and coastal management. The guide is available at <http://thebluecarboninitiative.org/manual>

New publications on mangroves in coastal and marine management

Wetlands International has published two new guides on the roles of mangroves in coastal and marine ecosystem management:

- *The Role of Mangroves in Fisheries Enhancement* walks readers through the science of mangrove forests and their ecological links to adjacent ecosystems. It also makes recommendations for the joint management of mangroves and fisheries, with case studies to illustrate. The 54-page guide is at bit.ly/mangrovesinfisheries
- *Mangroves for Coastal Defence: Guidelines for Coastal Managers and Policy Makers* analyzes the role that mangroves play in defense against waves, storms, tsunamis, erosion and sea level rise, and outlines a practical approach for coastal decision makers. This 42-page guide is at bit.ly/mangrovesforcoastal

Both publications were co-produced with the University of Cambridge and The Nature Conservancy.

To comment on any notes & news items: <http://openchannels.org/node/8445>

New interactive MSP game available

A new, more advanced version of the Maritime Spatial Planning Challenge, a computer-supported game for MSP practitioners, is now available. Jointly developed by the Dutch Ministry of Infrastructure and the Environment, the Technical University of Delft, and the International Council for the Exploration of the Sea (ICES), the updated version follows an earlier iteration released in 2011.

The MSP Challenge gives planners insight into the diverse factors involved in sustainable planning of human activities in the marine and coastal ecosys-

tem. For players, the goal is to plan and manage the development in their EEZ from 2015 until 2050 as well as they can. The game's real-time simulator gives players feedback on conflicts, effects, and the overall performance of their planning. The new version, MSP Challenge 2050, focuses on the North Sea and involves seven countries. It was played for the first time in March 2014 with an international group of spatial planning experts in Delft. The 2011 version of the game focused on the Baltic Sea. For more information, go to www.mspchallenge.org

Editor's note: The goal of our regular EBM Toolbox feature is to promote awareness of tools for facilitating EBM.

The EBM Toolbox: Tools and resources most commonly used to address climate change impacts on marine ecosystems

By Sarah Carr

To this point, there has been a lack of information on which tools and resources have been used to address current and potential climate change impacts on marine ecosystems, as well as which have proven most effective. To help address this information gap, the EBM Tools Network and **OpenChannels.org** conducted a survey in October-November 2013. The survey asked practitioners which tools and resources they had used when addressing climate change impacts on marine ecosystems. We took a broad view of "tools and resources" for the survey, including written guides, models, protocols, replicable methodologies, computer software, apps, and databases. In all, 102 practitioners participated.

Below are the tools cited most often by respondents, and how the tools are being used:

Coastal Resilience

6 citations; www.coastalresilience.org

Uses cited in the survey:

- Visualizing impact of sea level rise on coastal communities
- Estimating vulnerability and adaptive capacity to focus adaptation planning
- Demonstrating scenarios for coastal communities in sea level rise, resilience, flood insurance, and adaptation-planning discussions

Geographic Information Systems (GIS)

5 citations of Esri ArcGIS, www.esri.com; 2 citations of general GIS platforms

- Mapping locations of ecosystems, critical habitats, key resource areas, population influences, and threats
- Planning surveys

Reef Check

3 citations; www.reefcheck.org

- Monitoring comparative reef health across the country and comparing project success
- Comparing patterns in coral cover using data from multiple sources

Sea Level Affecting Marshes Model (SLAMM)

3 citations; www.warrenpinnacle.com/prof/SLAMM

- Identifying likely changes of estuarine marshes to a variety of sea level rise scenarios
- Sharing mapping scenarios with municipalities to help develop land-use planning policy and land-conservation projects that mitigate marsh losses from sea level rise

Atlantic Gulf Rapid Reef Assessment (AGRRA)

2 citations; www.agrra.org

- Rapidly assessing changes in reef condition during and after ecological perturbations

Marine Geospatial Ecology Tools (MGET)

2 citations; <http://mgel.env.duke.edu/mget>

- Acquiring satellite data (sea surface temperature, productivity, etc.)

Sea Level Rise and Coastal Flooding Impacts Viewer

2 citations; <http://coast.noaa.gov/slr/>

- First-order mapping of sea level rise inundation for community planning
- Demonstrating scenarios for coastal communities in sea level rise, resilience, flood insurance, adaptation planning discussions.

Many thanks to all of our survey respondents for their input! 

Note: Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at www.ebmtools.org

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