

Issue PDF archive:  [MEAM40.pdf](#) <sup>[1]</sup>

## Turning science into policy: What scientists should (and should not) do when talking to policy-makers <sup>[2]</sup>

Science and policy-making would seem to be a natural mix:

- Scientists want their research findings to inform public policy.
- Resource managers and conservationists want to see science-based policy implemented.
- Many - and perhaps most - policy-makers want to develop policies that are consistent with science.

However, science is just one of many considerations (public sentiment, political feasibility, impacts on communities, impacts on businesses, available funding, existing legislation and treaties, etc.) that policy-makers need to juggle in their decision-making. So how do scientists and other proponents of science make sure it gets its due?

In this issue of MEAM, we speak with four experts who have extensive experience making and/or influencing public policy for coastal and marine ecosystems in different contexts and settings. These experts share their experiences and insights into what scientists and other proponents of science tend to do wrong, do right, and can improve in communicating science to policy-makers.

### A) Build trust with policy-makers instead of just focusing on short-term wins

**Editor's note:** Noah Idechong is an environmental activist from Palau. He served as chief of Palau's Division of Marine Resources where he promoted regional marine conservation that combined traditional and modern knowledge. He left that position to become the first director of the Palau Conservation Society. He later served as a member of the House of Delegates of Palau. As a legislator he helped enact progressive conservation programs such as the Protected Areas Network, the Micronesia Challenge, and the Palau Shark Sanctuary. He was named a "Hero for the Planet" by Time.com in 2000.

**MEAM:** What are the biggest challenges for translating science into effective policy-making for ocean planning and management?

**Noah Idechong:** My experience is within the context of a small island developing state where governance is weak and not fully developed, cultural knowledge is still strong, and technical capacity and expertise are low.

What I have found is that the lack of deep understanding of issues by legislators limits their effectiveness in the public policy-making process. Often the information needed to make critical policy decisions is not readily available and they have to resort to perceptions or secondhand information. Executive branches have direct access to information from local and international sources through meetings, workshops, and other means, but legislatures lack targeted programs that provide full and unbiased information on ocean issues needed for public debates.

Consequently, I think we should devote more time to asking policy-makers how we can support their decision-making rather than barraging them with what we think they need. Building connections and gaining their trust and respect would be useful for opening doors to information exchange.

**MEAM:** What have you seen scientists/advocates/resource managers do wrong when communicating with policy-makers?

**Idechong:** Increased understanding and collaboration between policy-makers and scientists, advocates, and resource managers would help expedite decision-making on critical ocean issues. Even when there is agreement on the issues and need for action, scientists, advocates, and resource managers often let various agendas (organizational or personal) get in the way of presenting complementary sets of information and recommendations that supportive policymakers need to gain buy-in from colleagues.

In addition, too few scientists get involved in policy discussions and informal conversations that lead to greater awareness of issues by policy-makers and their constituents. Condescending statements or attitudes by scientists toward lawmakers also do not help. Campaigns should invest in building long-lasting trust and respectful relationships with policy-makers rather than just on short-term wins.

**MEAM:** Do you have any examples of effective marine science communication to policy-makers?

**Idechong:** Palauan policy-makers have enjoyed support for conservation policy-making due to a long tradition of using a bottom-up approach that usually begins with traditional edicts then moves to local government then the national government. Scientists work hand-in-hand with fishermen, community leaders, and NGO partners to identify issues and research needs that contribute to enhancing local knowledge and the science needed for decision-making. At every step of the policy-making process, ownership of issues, efforts, and perceived benefits remains with the communities and local stakeholders so that any findings, information, and needed actions are shared among them. The weakness of this consensus-building approach is that it takes time to build. But in Palau's case, it has been effective in marine conservation and had some success in watershed management.

In our part of the world, there are also examples of issues such as restrictions on fishing gears and protection of iconic species where research has been conducted and the science facts are there, but the lack of participation by communities has led to rejection of findings and suggested policy.

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## B) When describing your science, lead with the "why" not the "what"

**Editor's note:** Chad English is director of science policy outreach for COMPASS (Communications Partnership for Science and the Sea). In this role, he helps build constructive dialogue between scientists and policymakers to drive new thinking and new approaches to both science and policy. He previously served as a policy fellow for the US Senate Committee on Commerce, Science and Transportation and the Chairman's Designee for the US House of Representatives Committee on Science.

**MEAM:** What are the biggest challenges for translating science into effective policy-making for ocean planning and management?

**Chad English:** My experience is primarily with high-level policy (e.g., legislation, rulemaking) rather than local management and decision-making about management in a particular place. The two biggest challenges in either setting, though, are timing and context. Policy-makers and managers work in a world of decision-points. If you show up after the decision (e.g., after the boundaries of a managed area have been set or after the catch levels have been decided) or try to share technical details before the conversation has really gotten started (e.g., if you'd tried talking to fisheries managers 10 years ago about ocean acidification), you're not going to find a receptive audience.

**MEAM:** What have you seen scientists/advocates/resource managers do wrong when communicating with policy-makers?

**English:** Forgetting to lead with the "why". Many researchers start with the "what" - what they've studied, what they did to study it, what they learned. This is all critical, but policy-makers and managers need to understand why it matters to them before they can really engage with and make sense of the science.

**MEAM:** Do you have any examples of effective marine science communication to policy-makers?

**English:** Ocean acidification is a great example. Scott Doney [of the Woods Hole Oceanographic Institute], Joan Kleypas [of the National Center for Atmospheric Research], and many others have done an outstanding job. Scott's well-written piece in *Scientific American* got the attention of Members of Congress in the United States. Along with Joanie and Ken Caldeira [of the Carnegie Institution] and Dick Feeley [of the NOAA Pacific Marine Environmental Lab] and others, Scott helped explain the risks and potential implications of ocean acidification and the limits of our knowledge and understanding of the topic. They all put it in the context of the decisions those Members of Congress could make (i.e., they directly addressed the decision-making context relevant to their audience), and the result was the very bipartisan Federal Ocean Acidification Research and Monitoring (FOARAM) Act. The rate at which that issue first showed up on the public agenda and then moved to an enacted policy was quite impressive and a testament to the effective communication of the many scientists involved.

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## C) Policy-makers and their constituents don't often read scientific journals

**Editor's note:** Maria Damanaki is global managing director for oceans at The Nature Conservancy. She recently finished a four-year tenure as European Union (EU) Commissioner for Maritime Affairs and Fisheries. As Commissioner, she introduced and implemented the Blue Growth agenda for Seas and Oceans in Europe, which aims to create 1.6 million new jobs in sectors such as coastal tourism, ocean energy, and marine biotechnology by 2020. In addition, she established legislation to create a common framework for Marine Spatial Planning across EU countries. She is also a prominent Greek politician who was consistently elected to the Hellenic Parliament from 1977 to 1993 and served as Vice President of the Parliament.

**MEAM:** What are the biggest challenges for translating science into effective policy-making for ocean planning and management?

**Damanaki:** Translating science into useful policy is a challenge in most fields and for all involved. From an environmental perspective the challenge is to understand the needs of nature and biodiversity as a whole, including people, communities, and their needs. The disruption of balanced ecosystems that occurred during the recent past of the planet history creates the problem, and our biggest challenge when translating science into action is to find ways to approach that balance again.

For ocean planning, to facilitate effective policy-making, marine science has to expand to solutions that address economic, social and other needs of the community. And additional consideration must be given to enforcement and implementation. Scientific information that is most useful provides options for the use of the information in tangible and practical ways.

**MEAM:** What have you seen scientists/advocates/resource managers do wrong when communicating with policy-makers, and have you seen effective examples?

**Damanaki:** The environmental community can be most effective at changing policy with focused, realistic, science-based recommendations that are targeted to the language that policy-makers understand and show a broad level of support from constituents. Publishing in scientific journals is important but not the only or most effective way to change things. Scientists and policy-makers have to work together to focus on practical solutions and implementation.

A common error scientists make is relying on publishing in scientific journals that are not often read by policy-makers or their constituents. Taking the scientific journal information and translating the results into practical recommendations for policy implementation is much more effective. For example, as the EU Commissioner of Fisheries, I welcomed the broad support the Commission received from over one million constituents in support of reforming the Common Fisheries Policy to address by-catch and manage fisheries in a responsible, science-based way. This led to a new EU fisheries policy, a decisive step for the viability of fish stocks, coastal communities, and key marine species ([www.theguardian.com/environment/2011/feb/03/fishing-food](http://www.theguardian.com/environment/2011/feb/03/fishing-food) <sup>(3)</sup>).

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## D) Understand policy-makers' concerns and how the science relates to those concerns

**Editor's note:** Lida Pet-Soede is strategic development leader for the Marine Program at WWF Indonesia, and former head of program for the WWF Coral Triangle Initiative. She has extensive experience designing and implementing strategic initiatives that put ocean conservation on the agenda of key decision-makers, globally and regionally.

**MEAM:** What are the biggest challenges for translating science into effective policy-making for ocean planning and management?

**Lida Pet-Soede:** A big challenge is the difference in the level of information scientists and political leaders have available for perceiving spatial and temporal trends in the marine environment and their ability to accept that human behavior is causing those trends.

For example, scientists can find significant trends over time and space with the analytical tools available to them, but the information that reaches political leaders is often simplified or combined with other information. This can make it impossible to detect cause and effect. Additionally, the scientific information may conflict with the personal experiences and observations of the casually observing political leader and his or her policy-making staff. He or she may then be easily led to believe that lower fish catches are just the result of weather patterns or that a sandy substrate has never sustained expansive mangrove forests.

When perceptions of the state of the ocean differ - and particularly when perceptions about the cause of that state of the ocean are not clearly and easily linked to human

behavior - policy-makers find it difficult to support management interventions that reduce options for voters to use the ocean as they like and need, or require other changes in their behavior.

The other big challenge relates to the difficulty that comes with predicting how fast a management intervention will show clear evidence of the intended improvement. Political leaders are required to balance many different and often competing needs of their country. If a management intervention does not show quick and undebatable evidence that it was the right decision, or when an actual improved situation does not bring benefits to the people most impacted by the changes, a political leader may not choose to support the change.

**MEAM:** What have you seen scientists/advocates/resource managers do wrong when communicating with policy-makers?

**Pet-Soede:** When we [scientists from environmental NGOs] go to meet a policy-maker, we often have our message all prepared and our suggestions for action all lined up. We are often focused on a singular issue, something that we have found from our research after working on it for some time. We are now ready to bring it to the decision-maker assuming he or she has nothing else to do other than serve the quite obvious need for a healthy ocean. And we often forget the daily context in which a policymaker does his or her job. A policy-making job does not involve a clear set of workable actions that start on Monday morning and are done by Friday afternoon.

I would advise practitioners to first listen to and understand what the policy-maker is currently concerned with and work hard to find ways to communicate how their recommendations are linked to those immediate concerns. For example, a government official tasked with sustaining food security by promoting expansion of aquaculture is probably very concerned with sourcing good-quality and affordable feed and disease-free fish fry. He or she may not immediately consider how the issuing of licenses to exploit oil and gas in a coastal area may affect the potential production levels of the fish farms in the long term.

Also, practitioners would really help themselves by pragmatically considering the small steps a policy-maker could reasonably take to start the shift required. For example, in Indonesia 10 years ago, there was rather immediate interest in adopting an ecosystem approach to fisheries management (EAFM), and the government of Indonesia wholeheartedly supported it. However, at those early days, we failed to provide a clear set of EAFM actions that we could all start with.

**MEAM:** Do you have any examples of effective marine science communication to policy-makers?

**Pet-Soede:** Two examples come to mind of groundbreaking studies that provided really eye-opening arguments for policy-makers to start considering their actions. In Indonesia, a calculation of the value of a healthy coral reef was made by translating some coral reef services (reef fisheries, coastal protection, future reef-related tourism) into monetary terms. That study has been instrumental in stimulating several large-scale coral reef conservation investments by the national government and international donors.

And in the Coral Triangle, a scenario analysis of the impacts of climate change on services that regional marine and coastal ecosystems provide (including marine biodiversity, food security and livelihoods) has been instrumental in stimulating large-scale regional collaboration for managing these ecosystems by national governments, international donors, and technical expert organizations.

In both cases, causal links between the environment and people's needs were underlying the analyses but were not the core of the advice to the policy-makers.

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## **BOX: More guidance on how scientists can communicate with policy-makers**

There is a growing number of resources to help scientists learn to communicate more effectively with policy-makers, the media, and the general public.

- Individualized and group trainings are available from the Communications Partnership for Science and the Sea [www.compassonline.org](http://www.compassonline.org) <sup>(4)</sup>.
- Two engaging books include Randy Olson's *Don't Be Such a Scientist* ([www.dontbesuchascientist.com](http://www.dontbesuchascientist.com)) <sup>(5)</sup> and Nancy Barron's *Escape from the Ivory Tower* ([www.escapefromtheivorytower.com](http://www.escapefromtheivorytower.com)) <sup>(6)</sup>.
- For a short, free, and entertaining primer on telling a good story using the And-But-Therefore template, there is Randy Olson's 2013 presentation at <http://youtu.be/ERB7ITvabA4> <sup>(7)</sup>

## **Tundi's Take: Science uptake requires good delivery AND a receptive audience** <sup>(8)</sup>

By Tundi Agardy, MEAM Contributing Editor ([tundiagardy@earthlink.net](mailto:tundiagardy@earthlink.net))

Scientists are rightfully exasperated by how hard it is to get science-based management in place. Whether it is providing historical data on what has led to the present-day condition of marine systems; providing recommendations on things like catch limits, pollution controls, and critical habitat to be protected; or predicting the outcomes of management interventions based on empirical models - scientists sometimes feel they are dishing up information that languishes on the table.

But communicating science is hard. The language is inherently technical, and the information is couched in nuance. Despite the mythology of scientific "truths", scientific information is more often than not probabilistic, and predictions rest as much on the veracity of assumptions as on the quality of the models. Scientists complain that the bar is set higher for evidence-based action in management of the environment or natural resources than it is for management of human systems such as societies or corporations. Thus, even with strong bases for science-based actions - like temporarily closing a fishery to allow a stock to rebound, installing sewage treatment to reduce nutrient inputs, denying a dam construction permit to maintain water flows to an estuary, or taking action to actively restore a degraded wetland - the unavoidable uncertainties are often used to prevent action and allow business-as-usual.

It is in the scope of EBM that these frustrations may be the greatest. Good, integrated management based on a foundation of social and ecological science is a complex endeavor. It is complicated to describe what needs to be done. There are a lot of moving parts, and a cumulative assortment of uncertainties that can be quickly used against the management agency by those who doubt the science, disagree with the investment of funds to carry out the management, or have vested interests in keeping things as they are. And this is when there is full agreement on management measures that need to be taken. When there are controversies - and especially when the media play up on the possible disagreements - then embracing the science and using it to steer decision-making is darn near impossible.

## **Ecosystem services communication needs to improve**

Some of the blame can be placed squarely on us in the scientific community. We need to be better communicators - both among ourselves so we can come to consensus and with the wider world that doesn't speak our language or always share our worldview. Most prominent in my mind is how poorly we've done communicating how an ecosystem services perspective can help attain EBM by demonstrating how the values of natural systems should figure into decision-making. We've done a horrendous job of describing nature's benefits and the risks that unsustainable use poses. We've created our own tangled and awkward vernacular to describe nature's benefits (*provisioning, regulating, supporting, and cultural services* - could there be any less sexy terms than these?). We've also used dubious techniques to attach values to those benefits, and we occasionally exaggerate claims about the costs of losing those benefits.

But not all fault lies in the message. Receivers of scientific information have to be listening to hear.

As practitioners of EBM and as providers of scientific information to support more effective marine management, we have to work not only to present our information in a way that is understandable and useful and compelling but also to create the demand for such information. Only if people want the science will they listen to what natural and social scientists have to say.

# Perspective: Learning to speak about Ecosystem Services <sup>[9]</sup>

By Christian Neumann, Linwood Pendleton, Marianne Kettunen, and Tundi Agardy

**[Editor's note:** Lead author Christian Neumann is a marine ecosystem services project manager for GRID-Arendal, a center that collaborates with the UN Environment Programme to support informed decision-making. This article is based on discussions of the focus group "Connecting people and ecosystems: How recognizing, demonstrating, and capturing ecosystem service values can support conservation and development" at the Third International Marine Conservation Congress, Glasgow, 2014.]

The recent scientific advancement of the Ecosystem Services concept and its application to planning and decision-making have increased understanding of the role that healthy, functioning ecosystems play for human well-being as well as social and economic development. Consequently, Ecosystem Services have received growing attention from policy-makers as well as the public. This increased attention reveals the science to a broader, non-scientific audience. This presents a challenge to both communities since they often do not speak a common language.

To overcome this challenge, it is worth keeping a few key aspects in mind.

## 1. Talk about the big picture

The concept of Ecosystem Services recognizes functional ecosystems as a foundation for social and economic development. It helps us communicate the link between very direct human needs such as clean, healthy drinking water and rather indirect management responses such as securing the quality of upstream ecosystems that provide a water purification function.

## 2. Know with whom you are talking

When communicating with the public, policy-makers, decision-makers, or private sector representatives, it is important to recognize that people may be familiar with the concept of Ecosystem Services but not with specific terminology. When communicating with non-scientific audiences, through press articles or stakeholder consultation, scientists should use language that reflects the reality and understanding of their audiences.

This situation-specific language should be developed through a "co-creative" process using bi-directional observation and listening. This work will not only promote a shared language; it will enhance knowledge of local Ecosystem Services and their cultural, social, and economic context.

## 3. Different kinds of values and metrics serve different audiences

Assessing the Total Economic Value (TEV) of Ecosystem Services, especially in monetary terms, has played an important role in bringing public attention to the value of nature's non-market elements. TEV can continue to play such a role in relevant circumstances. In the context of more concrete planning and decision-making situations, however, particularly when informing trade-off decisions, focusing on marginal values of Ecosystem Service change rather than total values may relate better to audiences' needs.

Values and metrics other than economic ones can also be highly relevant to stakeholders and decision-makers depending on local contexts and the objectives of the processes where the information is used. These include, but are not limited to, social values (e.g., safety, livelihoods, health, or social cohesion) and cultural values (such as identity or artistic or spiritual values).

Consequently, it is important to understand the target audience, its association with Ecosystem Services, and its information needs when designing and implementing assessments and valuations.

## 4. Credibility matters

Ecosystem Services can be used to support arguments for specific, existing objectives such as the conservation of a certain area, ecosystem, or habitat. To avoid undermining scientific credibility, it is important to reveal such objectives when communicating about Ecosystem Services. Similarly, care should be taken to not "oversell" claims about benefits associated with Ecosystem Services (e.g., coastal protection from extreme weather events) to avoid later disenchantment of stakeholders and policy- and decision-makers. Further, the usefulness of arguments for conservation based on Ecosystem Services might not work equally well in all circumstances (e.g., conservation of coastal vs. marine habitats).

Ecosystem Services as a concept is necessarily a reduction of complexity. A fine balance needs to be struck to communicate complexity without losing relevance and tangibility.

## 5. The language of Ecosystem Services creates new connections

When carefully applied in a relatable manner, without jargon, the concept of Ecosystem Services has the power to bring decision-makers and scientists from different disciplines together. The resulting exchanges build relationships and mutual understanding and serve to further support the concept itself.

By connecting people and ecosystems, the concept of Ecosystem Services can help reconcile environmental protection and sustainable use with social and economic development - as long as we speak a language everyone can understand.

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# Perspective: Getting around ideology - When facts divide more than unite <sup>[10]</sup>

By Jennie Hoffman

**[Editor's note:** Jennie Hoffman ([jennie@adaptationinsight.com](mailto:jennie@adaptationinsight.com)) is founder and principal of Adaptation/Insight and an expert in decision analysis and climate change vulnerability assessment and adaptation. Hoffman co-authored:

- *Climate Savvy: Adapting Conservation and Resource Management to a Changing World*
- *Scanning the Conservation Horizon: A Guide to Climate Change Vulnerability Assessment and*
- *Designing Climate-Smart Conservation: Guidance and Case Studies*

A friend recently sent me a link to an article about how we are past the point of no return with the melting of the West Antarctic Ice Sheet and therefore committed to significant sea level rise. She was concerned that reader comments on the article were universally dismissive, citing other sources claiming that sea level isn't going up at all. "If people don't believe there is a problem it will be hard to make changes," my friend wrote.

This got me pondering what's really going on with these sorts of "things are terrible" vs. "there's no problem" exchanges that come up in conservation and resource management.

When we hear people dispute the existence of climate change or overfishing or the perils of biodiversity loss or pollution, it may seem that facts are indeed the issue. Hence the instinct is to respond with more and more facts from more and more experts. But in polarized political environments, this may actually deepen people's commitment to their existing beliefs.

## Why is this?

When positions on particular societal risks become indicators for opposing ideological identities, people's need to affirm their loyalty to whichever camp they fall into tends to outweigh their desire for a dispassionate assessment of the evidence.<sup>1</sup> That is, ideologically motivated reasoning (e.g., "I know climate change doesn't exist so there must be problems with research that says it does") is evidence of a social need to affirm group membership rather than of defective reasoning per se. Calling people idiots for refusing to accept the evidence misses the point. Research shows that, no matter their position on the political spectrum, people are uniformly susceptible to this sort of bias.<sup>2</sup>

In this sort of atmosphere, a report seen as authoritative by one group may be seen by the other camp as an elaborate means to justify a biased agenda. While supporting one's connection to identity-defining groups matters tremendously on an individual level, it makes it harder for us as a society to agree on actions to take to reduce very real risks.

What does all this mean for my friend's concern? We need to get clear on the real hurdles for achieving the changes we want to see. For example, is it that some people truly don't believe in climate change after objectively examining the facts, or that what looks like debate about climate change is really people affirming their ideological identities regardless of the facts? If it's the latter, debating or even stating the facts again will move us farther from rather than closer to agreement.

## Getting around ideology

If the fundamental goal is gaining acceptance for a position that our audience sees as inextricably linked to a particular political stance (e.g., that climate change or overfishing is happening), there's no way around ideological issues. If our goal is more generally focused on reducing vulnerability to climate change effects or creating sustainable fishing livelihoods, here are some tips for discussing risk-reducing actions while sidestepping the issue of ideological identity.

- "Seek out critics and listen to them."<sup>3</sup> This lesson, which comes from a highly contentious process to designate a marine protected area, applies equally well to fraught discussion around adaptation to climate change, or other issues.
- Don't come into the process with a pre-determined solution. Hear what people have to say, and work together to come up with options that everyone can live with. Groups don't have to agree on the scientific facts or even on fundamental values to reach negotiated solutions.
- Get a skilled facilitator who is trusted by all parties. If the core problem is lack of understanding or agreement around values and objectives, this can matter more than bringing in science experts.

### References cited:

<sup>1</sup> Kahan, D.M. (2013). Ideology, motivated reasoning, and cognitive reflection. *Judgment and Decision Making*. 8: 407-424

<sup>2</sup> Crawford, J. T. (2012). The ideologically objectionable premise model: Predicting biased political judgments on the left and right. *Journal of Experimental Social Psychology*. 48: 138-151.

<sup>3</sup> Gershman, D. et al. Florida Keys National Marine Sanctuary case study. Accessed June 12, 2014, at <http://webservices.itcs.umich.edu/drupal/mebm/?q=node/66> [11]

## **Notes & News: Ocean governance and industry - Ocean carbon storage - Fishers' view of climate change - Ocean extinction event - EBM approaches - EBM Toolbox** [12]

### **World Ocean Council provides overview of ocean governance and policy for industry**

The World Ocean Council has released the first comprehensive review of international ocean governance and policy for the global ocean business community. The "International Ocean Governance: Policy Brief" is designed to provide the business community with information on key ocean policy processes and developments, guidance in evaluating the risks and opportunities associated with these developments, and assistance in determining which ocean policy processes merit industry involvement. The brief is at <http://bit.ly/WOCoceangovernance> [13]

### **New IUCN report explains ocean carbon storage and implications for policy-making**

The processes by which oceans store atmospheric carbon hold fundamental implications for future climate change, ocean acidification, and human welfare. A new IUCN report "The Significance and Management of Natural Carbon Stores in the Open Ocean" describes how atmospheric carbon is captured, stored and mobilized in the ocean, and provides an overview of the significance and value of major ocean carbon pools and sinks. The report aims to promote integration of these systems and processes into ocean decision-making at all scales. The full report and a summary are at <https://portals.iucn.org/library/node/44905> [14]

### **Report on fishers' views of a changing ocean**

A new report details a survey of nearly 600 commercial fishermen in the northeastern US about their experiences with and views on climate change. The survey was conducted in 2014 with fishermen active in the New England groundfishery and Maine and Massachusetts lobster fisheries. Roughly two-thirds of those interviewed believe climate change may leave them "unable to profit" and ultimately "forced out" of their fishery. In each fishery, at least 40% of those surveyed reported they are catching new fish species in areas where those species have not traditionally been found. The report is at <http://bit.ly/fishingandclimate> [15]

### **Study: Major ocean extinction event may be imminent but is avoidable**

A new study in *Science* magazine states that human effects on marine animals are increasing, and that these effects are contributing to a profound decrease in abundance of marine fauna, both large and small. Furthermore, climate change is likely to accelerate this "defaunation" of the oceans. In comparing the marine and terrestrial defaunation experiences, the authors conclude that this may be the prelude to a major extinction period, similar to that observed on land during the Industrial Revolution of the 1800s. Slowing ocean defaunation will require creating protected areas and carefully managing other ocean spaces, say the authors. The full results of the study are available for purchase at [www.sciencemag.org/content/347/6219/1255641](http://www.sciencemag.org/content/347/6219/1255641) [16]

### **Summary of EBM approaches of Australia, Norway, and Canada**

A new book *Governance of Marine Fisheries and Biodiversity Conservation: Interaction and Co-evolution* contains a chapter summarizing the approaches taken by Australia, Norway and Canada for the ecosystem-based management of marine fisheries and biodiversity. Aspects covered include EBM legislation and policy, convergence between fisheries and biodiversity management, methods to address and prioritize issues for ecosystem-based fisheries management, and integrated cross-sectoral management. This book chapter is available for purchase at <http://bit.ly/fisheriesgovernance> [17]

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

## THE EBM TOOLBOX: Tools for marine protected areas

By Sarah Carr

The OpenChannels Team was on the scene at the World Parks Congress in Sydney in November 2014 and provided insights on some new marine conservation tools featured at the Congress. (For the complete blog on what went down Down Under, see <https://www.openchannels.org/chat/wpc-2014> [18].)

- **Global Fishing Watch** (<http://globalfishingwatch.org> [19]): a prototype interactive web tool that enables users to visualize the global fishing fleet in space and time.
- **Map of Life** (<http://mol.org> [20]): a searchable map that assembles and integrates diverse sources of data (such as range maps and occurrence points) about species distributions and their dynamics over time.
- **Biodiversity Indicators Dashboard** ([www.natureserve.org/conservation-tools/projects/biodiversity-indicators-dashboard](http://www.natureserve.org/conservation-tools/projects/biodiversity-indicators-dashboard) [21]): a web dashboard currently being developed for the Tropical Andes, the African Great Lakes, and the Mekong to document and visualize data on key biodiversity indicators.
- **Open Data Kit** (<https://opendatakit.org> [22]): a free, open-source set of tools to build data collection forms or surveys, collect data on mobile devices and send to servers, aggregate collected data, and extract data in useful formats.
- **SMART** (Spatial Monitoring and Reporting Tool; [www.smartconservationtools.org](http://www.smartconservationtools.org) [23]) is a software tool and suite of best practices for measuring, evaluating and improving the monitoring and enforcement of protected areas.

**Note:** Sarah Carr is coordinator for the EBM Tools Network. Learn more about EBM tools and the EBM Tools Network at [www.ebmtools.org](http://www.ebmtools.org) [24]

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