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Turning science into actions: What scientists can do to inform marine resource management

A primary goal for many marine scientists in academia or non-governmental research organizations is improving understanding of marine ecosystems so they can be better managed and conserved. But remaining primarily in the academic realm and publishing relevant findings in academic journals alone may not be sufficient (or timely enough) to inform on-the-ground and in-the-water decision making. A [study of the utility of primary scientific literature to coral reef MPA managers in Australia, Kenya and Belize](#) found average publication lag times of more than three years for relevant scientific research and more than half of relevant scientific articles behind paywalls (arrangements in which access to a website or document is restricted to users who have paid to subscribe to the site).

Ideally, a [wide range of organizations and institutions should contribute](#) to connecting scientists with marine resource managers to work on pressing knowledge needs. Academic institutions need to recognize the value of and reward knowledge sharing activities in their hiring and promotion decisions. Funding organizations should – and many already do – promote and support collaboration and knowledge sharing as well as research. And scientists can become involved with “[boundary organizations](#)” that already facilitate collaboration and information flow between researchers and managers in many regions and scientific study areas. (Read about the work of a [boundary organization working in the Western Indian Ocean](#).)

Even in the face of institutional constraints, however, there are many things that marine scientists as individuals can do to work more effectively with marine managers and to inform marine management. In this article, marine scientists, communicators, and funders who are successfully bridging the gap between scientific research and management in locations around the world share what they have learned about informing marine resource management.

“A best guess based on incomplete science is often an improvement over the status quo”: Three tips for marine scientists for making their research more useful for managers

By Elizabeth McLeod

Editor's Note: Elizabeth (Lizzie) McLeod is The Nature Conservancy's climate adaptation scientist for the Asia Pacific region and science lead for the Reef Resilience Network which provides scientific guidance and resources to help coral reef managers globally address the impacts of climate change and local threats. She can be reached at emcleod@tnc.org.

1. Engage marine managers at the design stage of research and throughout the process. Ideally, project proposals should include managers as partners and a funding source to cover their time and costs in support of the research. Research objectives, timing, and outputs should be developed jointly with managers. By doing so, researchers will develop an understanding of local conditions, existing science, what science is actually needed to inform management, and opportunities to link their research with ongoing policy and management developments (e.g., the rezoning of an MPA).

Aligning the timing of research deliverables and management and policy opportunities is key. Understanding the timing of when research outputs will be needed and when key conservation actions or policy decisions, for example, will occur is critical to ensuring application of the outputs. If the research outputs come too late, then they are unlikely to be used and may undermine any management decisions made while the research was underway. Also, managers should participate in research and data collection to ensure that their expertise and local data are built upon and that they fully understand and can interpret the science. Finally, managers should be involved in helping to communicate the outcomes of the research to local stakeholders to ensure that they understand and have ownership over the research outputs.

2. Understand how much science is actually needed to inform a management decision. In some cases, research projects produce outputs that are too complex to be understood or applied in the field, or require significant investments in data collection that do not change the management response. An expensive coastal modeling project incorporating numerous datasets may provide detailed projections of inundation based on multiple scenarios of sea-level rise, when the management decision (relocate to higher ground) would be the same regardless of the scenario. A simpler and cheaper coastal assessment could have led to the same management outcome. Further, researchers need to understand that managers and researchers require different degrees of certainty in the science to make a management decision. Management decisions are sometimes made opportunistically, or more often, with limited scientific support. Thus a best guess based on incomplete science (with its uncertainties) is often an improvement over the status quo.

3. Ensure project goals are management priorities. The goal of a collaborative project with managers should be a conservation/management outcome, not a publication. Peer reviewed publications are important. However, in some cases, presentation of the research is held up (embargoed by a science journal), and important opportunities to share the data to inform and leverage management actions are missed. In other cases, significant effort is placed in developing the publication, when a project report that is simple and well-illustrated is likely to have greater relevance to managers and decision makers and, therefore, more likely to be adopted and used to inform management. Understanding not only the needs on the ground, but also the most relevant content, who will access and use the results, and formats for sharing project results is important to ensuring research results are applied. Finally, researchers can participate in regional networks of marine managers (e.g., [PIMPAC](#), [WIOMSA](#), [CaMPAM](#)) and global networks that link scientists together with marine managers (e.g., [Reef Resilience Network](#)). Doing so can help them to learn more about local threats and management challenges and contribute to ongoing management activities. Further, sharing project results through these networks helps to leverage research outcomes and can also create additional opportunities to work with managers in the region.

Academic journals are where good ideas go to die

By Nick Wehner

Editor's Note: Nick Wehner is project manager for OpenChannels, the knowledge hub for the global community of practice on ocean planning, EBM, and MPAs. In 2016, he wrote a series of blogs on the topic of "making your marine science matter." He can be reached at nwehner@openchannels.org.

Have you ever struck up a conversation with your grandmother about an academic journal article you both read? Me neither. It probably doesn't help that academic journals articles are (generally) behind prohibitive paywalls, often contain few figures to aid explanation, and are written solely for scientific audiences. Until journals realize that selling bound volumes almost exclusively to academic libraries is about as useful to today's world as selling rotary telephones, publishing your results that are relevant to conservation and management in an academic journal alone is akin to "idea suicide". First, only academics use academic journals. Second, the big journals are primarily in English. And third, nonprofits doing the actual conservation work often can't afford academic journal subscriptions. If you would like your hard work to be read, shared, and perhaps even used for real-life conservation and management, then you need to put your ideas in a place and format that is *accessible*.

What does accessibility mean in this case?

- Formats like blogs, podcasts, and editorials can get your work out to much larger audiences than journal articles.
- Use social media to spread the word about your research and results.
- Tailor your message and writing style to your intended audience. (Hint: it shouldn't be the general public!) Consider getting translations of your blogs, etc. into languages other than English.
- Make it easy to find your work electronically. For instance, don't use acronyms in your titles. (Try setting a Google Alert for "MPA" and you will see what I mean.)
- Where figures tell the story better than text, use them.

In short: let your common sense lead you, not your tenure committee.

The Science for Active Management Program: Bridging the gap between science and management in Western Indian Ocean MPAs

By Jennifer O'Leary

Editor's note: Jennifer O'Leary is a marine conservation biologist with the California Polytechnic State University and California Sea Grant as well as a 2016 Pew Marine Fellow. She has worked with communities in the western United States, coastal East Africa, and Pacific Islands for 20 years to put in place science-based management of marine resources. She can be reached at jkoleary@calpoly.edu.

Management effectiveness studies of MPAs in the Western Indian Ocean (WIO) have revealed that management decisions are often made without sufficient data. In response to this and other problems with MPA management, the Science for Active Management (SAM) Program launched as a pilot program in Mombasa, Kenya, in 2009. The goal of the program was to help management agencies use scientific data in an adaptive management framework to assess MPA status, determine where management action is needed, and assess the impact of management actions in a system of continual learning and community engagement. The success of the program in increasing conservation action, engaging communities, and improving ecosystem status has led to its expansion to all national MPAs in Kenya and Tanzania and a pilot program in the Seychelles.

Over the past eight years, SAM has learned that incorporation of science into management decision making requires investment of scientists in five key areas:

1. Building capacity of managers to understand scientific methods and results
2. Developing management frameworks that make it clear to managers what types of data are needed and how they can be used
3. Increasing managers' access to data
4. Focusing science on management needs
5. Providing long-term mentoring and support to guide managers' transition to data-based, adaptive management. In the WIO context and at the scale of national MPA networks, this has meant 5-10 years of mentoring to implement sustainable, agency-wide change.

Some examples of changes that we have been able to document through the SAM program include:

- *Development of measurable objectives:* In the nations using the SAM approach (Kenya, Tanzania, and Seychelles), each nation has gone through a process involving MPA staff, community members, and scientists to elect a suite of management priorities and develop measurable targets for these. The presence of targeted objectives has helped focus management and drive management action. It has also provided transparency in the management process and helped communities engage in aspects of MPA management that interest or concern them.
- *Implementation of monthly monitoring:* In all three nations, MPA staff members conduct monthly beach and marine monitoring (using standardized methods) and enter and summarize their own data. By doing this, they have moved from "black box" management where managers did not know the ecological and social status of their MPA systems, to a more empirical understanding of their system.
- *Data-based management actions:* By using data to assess status, managers have become clear about where action is needed to improve status. Dozens of successful conservation initiatives have occurred in SAM MPAs in the last three years, but a few warrant special mention. In Mombasa Marine Park and Reserve, as bleaching observations increased due to warming water, MPA staff worked with fishing communities to remove illegal fishing (seine nets) from the fished reserve surrounding the fisheries closure. In Mafia Island Marine Park, during SAM monitoring, staff noticed a major outbreak of crown-of-thorns. The MPA staff mobilized the local diving community and carried out a removal, stopping the outbreak and protecting corals. In Kisite Marine Park and Reserve in Kenya, the MPA staff initiated a monthly island trash clean up event following increases in marine litter. The trash arrives on the island via currents and is a major hazard to marine life. The MPA warden helped the community link with retailers willing to buy used flip flops, benefitting the local economy. Thousands of kilograms of trash have been removed.
- *Development of staff passion and skills:* Perhaps most importantly, the SAM program has energized MPAs. At the inception of the program, staff knowledge of marine systems was low and there was little problem-solving or investment in MPAs by staff. Staff members are now actively engaged in understanding marine ecological and social systems, and continuously try new approaches to enhance conservation. Further, staff skills in basic areas such as swimming have dramatically increased. For example, in Kenyan MPAs, previously, only 20% of staff were able to swim, but all MPAs now have 80-90% of staff swimming and participating in monthly monitoring.
- *Improved ecological status:* Though ecological change can be slow, especially for corals that are notoriously slow-growing, there have been notable improvements. The removal of harmful fishing gear around the Mombasa Marine Park has resulted in a measurable increase in seagrass and the revival of species that have not been seen in that region for a decade. In Tanzania, the MPA managers at Mafia Island Marine Park and Reserve were the first in the nation to document coral bleaching during a recent warming event, but also documented remarkable levels of coral recovery from bleaching as waters cooled.

The SAM program's long-term mentoring of managers in the use of science and support of active conservation partnerships between managers, stakeholders, and scientists now provides a tested, globally relevant model for making science work for conservation.

Translate scientific jargon into stories managers can use

By Asha de Vos

Editor's Note: Asha de Vos is a Sri Lankan marine biologist and educator. She is the first person from Sri Lanka to earn a doctorate in marine mammal research. Her research on blue whales within the Northern Indian Ocean has led to this population being designated as a species in urgent need of conservation research by the

International Whaling Commission. She is a National Geographic Explorer, a TED Fellow, and a Pew Fellow in Marine Conservation. She can be reached at <https://www.facebook.com/ashadevos>.

As scientists, we are encouraged and trained to speak 'Science' – and discouraged and untrained from speaking a language without jargon that could easily be understood and digested by the public. We invest most of our writing time preparing peer-reviewed manuscripts that will only be read by our scientific community, and we cruise the conference circuit speaking 'Science' in an attempt to solve pressing global issues. We live in a world where only about 0.1 % of the population is defined as an academic scientist, so these attempts to create change while talking only amongst ourselves are clearly futile. After all, the fire starter for the spread of ideas and the launch of movements is people talking to people, a simple but powerful ingredient.

Solving global issues like protecting the oceans requires a global response – it requires an army. To leave the planet a better place than we found it – a solemn pledge we should all make to our future generations – we need to translate our jargon into stories and conversations that can be used by managers and can be grasped by the 99.99 %. Ultimately it is critical for us as scientists, as conservationists, to make people agents for change and fellow soldiers in our quest for a safer planet.

Tracing shark research results to real world change

Editor's note: An excerpt from the story "Discovering the global payoff of supporting shark research" by the Lenfest Ocean Program is found below. The Lenfest Ocean Program is a grant-making program that funds scientific research on policy-relevant topics concerning the world's oceans and communicates the results of the supported research to decision makers and other interested audiences. Angela Bednarek, project director at the Lenfest Ocean Program, can be reached at abednarek@pewtrusts.org for additional information.

"In 2015, Charlotte Hudson, director of the Lenfest Ocean Program, attended a scientific workshop at Shanghai Ocean University. The scientists who provide information to China's vast high-seas fishing fleet work at the university's fisheries department. There she met a young research scientist whose office walls were lined from floor to ceiling with fishermen's logbooks, which record each boat's itinerary and catch data.

Although Hudson was only permitted to flip through one of the logbooks, she quickly identified unexpected evidence of a significant accomplishment by her program. Inside the front cover were several images of sharks. The scientist explained that these images identified species that fishermen were banned from catching. Hudson realized that she was looking at the real-world result of a project she helped create in 2006: to identify which shark species were most at risk from pelagic longline fishing."

Read how a [funding organization mobilized to increase policy uptake of research it sponsored](#)

Other Tips for Scientists Interested in 'Making Their Marine Science Matter'*

- Always go back to people [who helped you with your research to let them know what you found as soon as you are able](#) Even if your results are inconclusive or your analysis has been delayed, let them know.
- Avoid publishing your research in journals that require paid subscriptions if you can. If this is not possible, make every effort to share your results as broadly as possible. Sometimes you can share a galley proof of a publication even if you cannot share a copy of the final publication. Consider making draft research publications available on a pre-print server (e.g., [PeerJ Preprints](#), [OSF PrePrints](#)).
- Write as simply as possible. Put your main points up front. [Make management-related conclusions clear](#). Provide a [management-oriented summary in research articles](#) or a separate sheet for managers that summarizes key points.
- Take advantage of [knowledge brokers and boundary organizations that facilitate knowledge exchange between researchers and practitioners in the scientific and geographic areas you work in](#).
- Synthesize the [state of knowledge in your research area for practitioners](#)
- Remember to take advantage of the two-way flow of communication and learn managers' observations, knowledge, and insights to advance your own ecosystem understanding.

* Several of these tips are derived from suggestions overheard at the 4th International Marine Conservation Congress *Making Marine Science Matter* held in July-August 2016 in St. John's, Newfoundland and Labrador, Canada.

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