a decision-maker's guide to using science

SCIENCETOACTION

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www.science2action.org

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Purpose of this guidebook

Recognizing the importance of informed decisions and the differences between the scientific and decision-making processes, this guidebook provides practical tips on how to best bring these worlds together. In doing so, this guidebook emphasizes the roles of facilitating, synthesizing, translating, and communicating science to inform conservation action. It is geared toward the perspective of scientists and decision-makers working in tropical developing nations and focusing on marine resource management issues. However, the concepts are applicable to a broad range of scientists and decision-makers worldwide.

SCIENCETOACTION

What is a decision-maker?

A decision-maker is someone who selects a course of action among several choices that is followed by government, businesses, or other stakeholders. Decision-makers occur at all scales. The owner of a global supermarket may decide to only sell sustainable seafood. However, the family member responsible for food decides which stores to patronize and which products to buy. A nation's parliament may endorse an international convention calling for more marine managed areas (MMA) while a village chief may set the timeline and boundaries for a MMA in his community. All of these individuals make decisions that affect the sustainability of marine resources.

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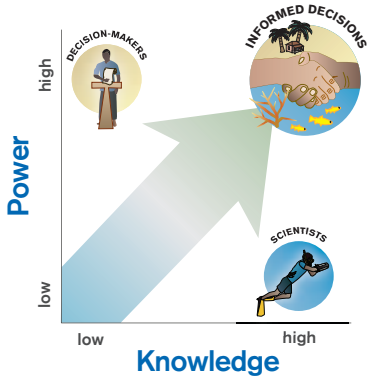
Why work with scientists?

Creating social change and solving environmental problems requires both knowledge and power. Scientists have knowledge, but typically limited authority to change behavior. Decision-makers have power, but may lack in-depth knowledge of particular problems. Linking these two groups brings knowledge together with power to make informed decisions that can drive social change.



Why is feeding science into decision-making so difficult?

Scientists and decision-makers come from two different worlds with varying objectives, languages, and processes. While scientists are motivated by discovery and often judged by their peers based on their publication rates and journal status, decision-makers are under pressure to make immediate decisions and are accountable to their constituents on numerous issues.

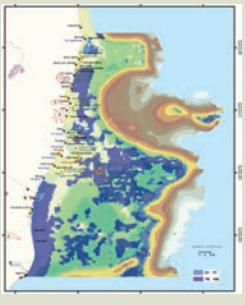
In order to examine questions critically, scientists typically have a particular area of expertise, such as the carbon storage rates of mangroves or the economic cost-benefits of tourism. In contrast, decision-makers are responsible for numerous issues ranging from health care to climate change and are, therefore, typically generalists who have to consider not only the latest science on a particular issue, but also the economic, cultural, health, and political impacts of their decisions.

While scientists typically conduct research over a period of years, decision-makers often need answers within one hour to one week.

Both scientists and decision-makers are accustomed to being sought after—scientists for their expert knowledge and decision-makers for their decision-making power. As a result of their differing objectives, expertise, and timelines, scientists and decision-makers have limited capacity and time to seek each other out, understand each other, and collaborate.

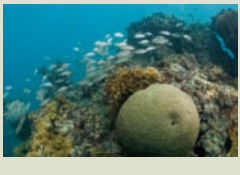
Science supports adaptive management

Abrolhos, Brazil



Priority areas in blue.

Habitat mapping conducted by CI and Universidade Federal do Espírito Santo, documented that Abrolhos has the largest reef system in the South Atlantic—seven times larger than previously documented. These scientific insights spurred discussions with the government agency, Chico Mendes Institute (ICMBio), about expanding the area of MMAs in the Abrolhos region. Through a stakeholder participatory process facilitated by ICMBio and CI, data from the habitat mapping, ecological, and socioeconomic monitoring and cross-shelf studies were used to identify priority areas for conservation in the Abrolhos Bank, which are currently being implemented.



The Science Process

A scientist—whether an anthropologist, economist, biologist or physical oceanographer—systematically tests hypotheses. Scientists may conduct research to address specific questions, such as the resilience of a population to disturbance, or conduct monitoring to determine the effects of management decisions on nature and human well-being.

The science process traditionally includes:

- **planning phase**—a hypothesis, an explanation for an observed phenomenon, is defined and research methods are identified;
- **data collection and analysis**—primary data are collected and analyzed by the research team; and,
- **results dissemination**—results are shared through peer-reviewed publications and presentations at academic conferences.

Increasingly, the scientist's traditional role of collecting and analyzing his own data is being redefined. The concept of a scientist has expanded to someone who also synthesizes existing datasets and draws on knowledge from "gray literature" (materials that have not undergone the peer-review publication process). Scientists work in universities, government agencies, nongovernmental organizations, and the private sector.

Scientist tailors research plans and results to local context
Locally Managed Marine Areas, Fiji

When Josh Drew first contemplated a doctorate in 2004, he had no idea two years later he would be sitting in a remote Fijian community, talking with a village chief about how fish population connectivity is analogous to village-to-village family ties. Typical of most academic scientists, Josh focused first on defining a hypothesis. His adviser was examining genetic connectivity throughout Indonesia and was interested to investigate to what extent Fiji was genetically distinct and whether there was intra-connectivity within the Fijian archipelago. Through an initial grant from the U.S. National Science Foundation, Josh began investigating this hypothesis. In planning his research, Josh refined his methodological approach, but also reached out to in-country NGOs to determine how his research might build on existing work and how it might be tailored to management initiatives in Fiji. Over the subsequent two years, Josh worked with Wildlife Conservation Society and then with CI to ensure active community engagement from initiation through result dissemination, including returning to the villages to highlight the key messages using posters he developed with CI and Partners in Community Development Fiji to highlight his main points and spark discussion. These dialogues, facilitated by the Fiji Locally Managed Marine Area Network—a partnership of government authorities, non-government organizations, community leaders, academic institutions and private sector bodies—led to greater village interest in MMAs, including ultimately, the establishment of new LMMAs in Nagigi, Yadua, and Beqa.

Tip 1. Communicate information needs

Many scientists want to do research that will contribute to decision-making. However, without guidance from decision-makers they are left to presume what will be useful based on their perspective of policy issues. Decision-makers are the best people to advise scientists regarding what information is needed. Information requests might include habitat maps, trade-off analyses of management options, or economic valuations. For example, if a new marine managed area is being considered, then maps of critical nursery grounds or sacred sites may be important.

While individual decision-makers can tell a scientist what they think is needed, the results are more likely to be relevant and more widely used if consensus is achieved by the key decision-makers. Scientists may be engaged in these discussions to advise on what is feasible and suggest what might be useful based on studies elsewhere, but policy objectives need to be the driver. Consensus might be achieved through an advisory council or through workshops bringing together the major stakeholders (government agencies, user groups, non-government organizations, scientists) to discuss policy objectives and subsequently information needs.

As needs arise, it is critical that they be conveyed to the scientists so that they can plan their research around them. Otherwise, once scientists have secured their funding and planned their research it is much more difficult to make significant changes. Suggestions to convey these needs to scientists include:

- posting priority information needs through science and conservation-oriented websites, newsletters, blogs, listserves and/or bulletin boards;
- promoting needs through relationships with a few scientists who can also post as well as discuss informally with colleagues; and,
- communicating needs through government agencies that issue permits to scientists (e.g., fisheries department).

Development motivates targeted science

Owen Anchorage, Western Australia

In Western Australia, scientific research was motivated by decision-makers committed to minimizing impacts. Cockburn Cement dredges shell sand for production of cement and lime, and there was concern regarding the potential impact on seagrass meadows and habitat. The state government required that Cockburn Cement establish that dredging would have minimal impact on marine habitats, or that they could be rehabilitated. Cockburn Cement initiated research in 1994 and has spent over AUS$9 million to date to support research on seagrass function and growth, micro-propagation, planting/transplanting techniques, and ecological function of seagrass. The research, rehabilitation, and shell sand mining continue, and the process has resulted in strong relationships between state government, the mining company, and researchers, leading to effective management of these marine resources and a well-informed public.

Dredging channels in Owen Anchorage.

Tip 2. Partner with scientists

Perhaps the most efficient and effective way to access and use science is to engage scientists directly in decision-making. Establishing relationships with scientists directly can greatly facilitate conveying the key relevant messages for decision-making. The more engaged scientists are in this process, the more likely knowledge will contribute to decision-making and also the more likely they and their colleagues will tailor their future research to management needs.

The following are a few mechanisms to facilitate this partnership:

- Science advisory councils provide a systematic process for soliciting feedback while acknowledging the members' service.
- Informal, one-on-one inquiries facilitate timely advice.
- Contracts or memoranda of understanding provide a formalized means of soliciting feedback, and solidifying a relationship.

Identifying the scientists with the appropriate expertise to a particular policy can be time-consuming. Instead, by developing long-term trusted relationships with a few experts on a breadth of issues (e.g., economics, climate change, ecology), decision-makers can tap into expertise as needed. These trusted experts can be extremely valuable given the short turn-around needs of many management decisions. They can also serve as portals to additional expertise. For example, if a hotel development is being considered, the decision-makers can seek advice from ecologists and economists, who might also recommend incorporating advice from experts on tourism best practices.

Accessible science underpins conservation

Sulu-Sulawesi Seascape, Philippines

For several years, scientists from University of the Philippines and other local academic institutions conducted biophysical studies in the Sulu-Sulawesi region. In 2005, CI began working with them, providing funds to do targeted work and feeding their results into a marine protected area (MPA) priority planning process engaging over 100 partners including local government units (LGUs), NGOs, and community groups. These results were translated into key messages, which were then discussed with communities. Witnessing the ecological and socioeconomic benefits and challenges of MPAs, other LGUs are now requesting—and even providing counterpart funding for— scientific studies to inform the establishment of new MPAs. As a result, CI is seen less as a funder and more as a technical advisor and translator of science into understandable, useful information for decision-making.

Together, scientists and practitioners raise awareness

Locally Managed Marine Areas, Fiji

The concept of the Yambula Management Support Team (YMST) emerged as Fijian communities expressed interest in enhancing the management of their natural resources. In response, the Fiji Locally Managed Marine Area Network recruited a team of scientists and community members experienced with LMMAs to travel to 5 communities to share their observations and experiences regarding MMAs. In the case of Yadua Island—one of the first areas visited—the discussions led to the villages proposing a permanent LMMA and a temporary LMMA in their surrounding waters. The YMST continues to work with the communities, raising awareness regarding science-based best practices and ensuring that new development projects are within conservation guidelines.

Tip 3. Plan and fundraise together

An important way of ensuring research is designed to inform decision-making is to plan the research with the scientists. Planning from the beginning allows for clarification of respective interests and expectations, including:

- When do the scientists anticipate being able to share results, even preliminary findings? It is important to highlight critical decision-making dates, such as budget deadlines, that the scientists may not be aware exist.
- What materials will facilitate influencing the decision-making process, such as photographs illustrating key points, a one-page summary of the key messages with clear recommendations based on the scientific analysis, or a short presentation?
- What level of certainty is needed? Scientists are accustomed to a statistical "95% confidence interval", which means they are 95% certain the results are accurate. This level may be much higher than the needs of decision-makers, which may simply be what the scientists, based on their experience and analysis, believe to be the situation and best course of action.

It is important to articulate in writing the agreed plans with the scientists. Scientists traditionally prepare a research plan. Co-authoring sections that go beyond the traditional hypothesis, methods, and budget to describe the transfer of the research to policy issues can ensure both parties are pursuing the same objectives. These sections might discuss the anticipated relevance of the research to policy issues, target audiences, communication strategy, and supporting materials. It is also important to ensure a portion of the budget (15% is recommended for most studies) is allocated to science communication, which may include travel expenses to return to the region, the scientists' time, meeting costs, and the planning and production of printed and online communication materials.

If this joint planning process is started early enough, the scientists and decision-makers can fundraise together. Joint fundraising can be a powerful means of gaining support since donors are increasingly prioritizing the application of science to management needs, which a joint proposal demonstrates.

Decision-makers drive science priorities
Birds Head Seascape, Indonesia

Following extensive community consultations, the Kamana Regency in southern Birds Head Seascape (BHS) was established as a marine protected area, based in part on studies of perceptions, resource use, and ecosystem mapping. Recently, the *bupati* (regency head) discussed with CI the need for specific socioeconomic, ecological, and geophysical data to inform decision-makers concerned with rezoning of the area. Consequently, when funding from the Walton Foundation became available to World Wildlife Fund scientists for community-focused socioeconomic monitoring in BHS, they agreed to prioritize Kamana as a study site.

Tip 4. Engage in science

To help build the connection between scientists and decision-makers, decision-makers can become engaged in data collection and analysis. While they may not be able to serve as a full member of the research team, they can visit and witness some aspects of the data collection and analysis. By participating in data-gathering workshops and providing feedback on analysis tools, they can provide input and gain more understanding of the research. As a result, they are more likely to use the information in decision-making. This engagement is also an opportunity for building the relationship between scientists and decision-makers.

Tip 5. Establish a research ethic

An underutilized mechanism for ensuring that science feeds back into decision-making is to establish a set of research ethics to which scientists are expected—and even required — to adhere. These ethics can be articulated as part of the permitting process. For example, requirements might include:

- discussing plans with national decision-makers (e.g., fisheries department) and community leaders (e.g., village council) before starting research;
- tailoring research to address management issues (within reason);
- for foreign scientists, engaging at least one in-country scientist in order to build capacity;
- at the conclusion of the data collection phase (and before formal analysis), discussing impressions with community leaders and national decision-makers (e.g., community leaders, fisheries department staff);
- within three months of completion of the formal analysis and manuscript submission, returning to discuss the findings with community leaders and decision-makers; and,
- providing a one-page summary of the key findings relevant to policy issues and recommendations with key graphs and other visuals included.

Scientists often want to return to an area in which they have conducted research in order to conduct additional studies. Therefore, they have a vested interest in ensuring they are meeting the expectations of the permitting agency and other key players who have the authority to prevent continued work.

Communities articulate cultural sensitivity
Locally Managed Marine Areas (LMMA), Fiji

Visiting scientists are not uncommon in Fiji, where rich marine resources, a strong stewardship culture, and an English-speaking population attract researchers from around the world. These visitors often do not appreciate the customs and expectations for visitors to Fijian communities. After a number of culturally offensive incidents, the Fiji Locally Managed Marine Area (FLMMA) Network worked with community leaders to define appropriate behavior for researchers. These expectations include holding an initial meeting with the community to discuss interests and plans, sharing findings as research progresses, and within one or two years, sending the final results to FLMMA and the community. They were written into a letter of agreement that all visiting scientists are requested to sign before entering a community. Projects in FLMMA communities are also encouraged to contribute a portion of their budget to the FLMMA Trust, which enables FLMMA to assist the project with introductions and with sharing the outputs and outcomes throughout the network of LMMAs.

Tip 6. Motivate collaboration

Incentives can go a long way to encouraging scientists to collaborate with decision-makers. They demonstrate that the decision-maker is interested in what the scientist is doing and considers it important and relevant enough that he is willing to provide resources to make it happen. Incentives can include:

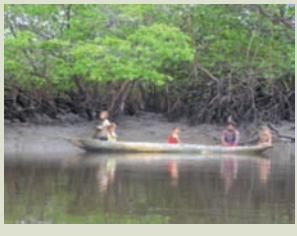
- funding, such as grants to conduct research of interest to the decision-makers;
- resources, such as boat time, equipment or other facilities; and,
- staff time to serve as part of the data collection team, to assist with analysis, to help articulate the key messages relevant to decision-makers, to disseminate the results to decision-makers and/or to share these findings during relevant policy processes.

Tip 7. Solicit key messages and recommendations

Decision-makers usually need and want only two or three of the most important scientific messages related to current issues that they are facing. Often the best way to solicit these messages is to have a discussion with the scientist in the relevant field. The decision-maker can begin by clarifying the issues at hand (e.g., proposed dredging) and then asking the scientist what insight he has from his work that would help address the issue (e.g., documentation of the impacts of dredging or the vulnerability of the species and habitats). The decision-maker might ask for a short summary with key visuals, particularly photos illustrating points (e.g., before/after dredging). Alternatively, it may be more productive to have someone with a communication background join the discussion who can then combine the key messages with the relevant visuals into a succinct document. This document can then be the basis for sharing results with other decision-makers.

Key scientific messages lead to global recognition policy

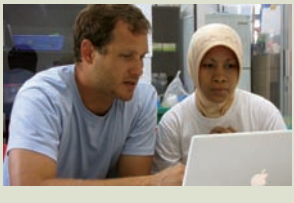
Abrolhos, Brazil



When the Chico Mendes Institute (ICMBio) of the Brazilian government decided to pursue Ramsar status for wetlands of Abrolhos National Park, which would provide international recognition of the wetlands' importance, the staff consulted with Conservation International scientists regarding relevant information to support the application. The scientists culled the results from their socioeconomic and ecological monitoring, connectivity, and mapping studies to demonstrate that the Abrolhos region is high in biodiversity and has cultural significance to neighboring communities. ICMBio used this information in the application, and subsequently, Abrolhos National Park was declared a Ramsar site in February 2010.

Partnerships evolve to long-term capacity

Birds Head Seascape, Indonesia



In 2005, with funding from The David and Lucile Packard Foundation, Paul Barber from Boston University began genetic connectivity studies in Indonesia with the purpose of identifying critical source and sink areas. The research included a partnership with the State University of Papua (UNIPA) to jointly conduct the data collection and analysis, as well as a two-month internship for UNIPA scientist Hamid Toha at Boston University. Originally, UNIPA did not have the equipment to perform the laboratory work, and consequently, the samples were shipped to Boston University. However, Barber and Toha received an additional grant from the Packard Foundation to build an on-site genetics lab that is now the basis for marine species genetic analyses in the region. As this BU-UNIPA partnership strengthened and greater ties were made with the NGOs in the region particularly CI and WWF, UNIPA has made biodiversity conservation science its top institutional priority. Subsequently, Barber has expanded his work to three university partnerships throughout Indonesia. He is committed to building their scientific capacity through similar partnerships with the University of California, Los Angeles, where he is now based. These efforts culminated with the opening of the Indonesian Biodiversity Research Center in June 2010.

Science communication enables science to inform decision-making. Science communicators (SCs) are people who understand both the science and decision-making processes, and are able to bridge these two worlds. SCs have strong communication skills that enable them to cull key scientific insights from complex, multi-disciplinary literature and feed these messages to the appropriate decision-makers. SCs have the unique ability to ***facilitate, translate,*** and ***catalyze*** science into conservation action, employing the tips highlighted in this guidebook. Non-governmental organizations often undertake this role, but policy-oriented academic institutions and government agencies can also adopt these responsibilities.

S2A tips for scientists

1. partner with decision-makers
2. identify information needs
3. synthesize existing science
4. plan with decision-makers
5. build capacity
6. identify key messages
7. produce supportive materials
8. discuss with decision-makers

Initiation **Data Collection & Analysis** **Dissemination of Results**

Science Process

SCIENCETOACTION

Decision-Making Process

Issue Identification

Assessment of Impacts
(politics, economics, culture, environment)

Implementation

S2A tips for decision-makers

1. communicate information needs
2. partner with scientists
3. plan and fundraise together
4. engage in science
5. establish a research ethic
6. motivate collaboration
7. solicit key messages and recommendations

science communicators

the link between scientists and decision-makers

Tip 8. Discuss with decision-makers

Communicating key messages to the decision-makers is the pivotal point at which science may influence a decision. To have the greatest impact, it is important to strategize how best to reach the decision-makers. In many cases, it may be a one-on-one meeting. In other situations, making a point at a public meeting or speaking at an organizational meeting (e.g., department of fisheries staff meeting or tourism association meeting) may reach more decision-makers in the immediate context of their decision-making.

When articulating points, always consider the perspective of the decision-maker. First, clarify the issue and why it is in his/her interest to address this issue. Then, highlight the action for them to take and the relevant science to support the action. Finally, further explain the science as requested.

Practice with non-science family and friends, keeping in mind the need to convey points simply and easily. Employ stories and analogies to emphasize key points. Avoid technical detail, including methods, realizing that a busy decision-maker may only be available for a few minutes.

Perhaps most importantly, stay engaged in the decision-making process, recognizing that doing so may mean engaging in discussions for months if not years from the time of the original research. Engagement may include participating in advisory councils, institutional partnerships with key stakeholders, or informal one-on-one periodic conversations with decision-makers.

Science leads to mutual benefits
Nosi Ankao, Madagascar

A climate change vulnerability assessment in 2008 identified areas likely to be resilient to climate change, including the underwater canyons along Nosi Ankao in Northwest Madagascar. To investigate this area more closely, a team of natural and social scientists from CORDIO, Conservation International, Centre National de Recherches Océanographiques, and the University of Florida conducted a rapid assessment. In the process, the team met with a local private company that has a seaweed farming concession from the government, employs villagers from the region, and has discouraged fishing in the area. Recognizing that formalized protection of the area could benefit both the company and the community, the parties sought to establish a co-managed marine managed area.

Science-to-Action (S2A) Table

The table below illustrates a system for thinking through the science-to-action process: identify the decision-makers, the actions they might take, the relevant science messages, the appropriate supportive materials, and subsequently, the outreach activities.

Target Decision-makers	Desired Actions	Relevant Science Messages	Supportive Materials	Outreach Activities
Ministers of tourism and fisheries	Support the creation of a new marine managed area	▪ Neighboring MMAs have been found to increase fisheries production, tourism revenues, average income, and livelihood opportunities for the communities (based on socioeconomic monitoring). ▪ The newly mapped reefs and surrounding habitats host tremendous biodiversity (based on ecological assessments), which could attract tourists and support a sustainable ecotourism industry.	▪ One-page policy brief with graphs comparing inside to outside MMAs ▪ Map of area showing biodiversity with photos embedded	▪ Meetings with ministers and senior staff ▪ Discussions with tourism association and fishermen cooperative

Tip 6. Identify key messages

Once the data are analyzed and the results have been articulated, it is time to communicate these findings to the decision-makers. In many cases, the overall study may still be under way, but part of the analysis may be complete and ready to be shared.

As noted previously, decision-makers are generally not concerned with waiting for the peer-reviewed publications or establishing a 95% confidence interval. Their priority is eliciting the key messages relevant to their decisions. With that in mind, there are a few key steps for translation:

- Review key management decisions or issues being considered by decision-makers, such as whether or not to establish a new marine managed area. Often these issues will be quite different from what was originally envisioned.
- Determine the ideal action for decision-makers to take, such as ministers endorsing the establishment of a new MMA.
- For each action, consider which of the messages emerging from the research are most relevant. Focus on one to three points. In the case of MMA establishment, insights as to the benefits to tourism and fisheries may be powerful arguments for ministers of tourism and fisheries. The S2A Table (page S-9) provides a means of thinking through these plans.

Tip 7. Produce supportive materials

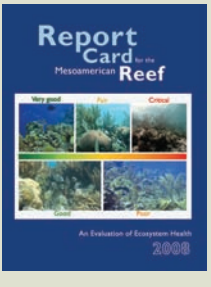
Conveying the key messages to decision-makers can be greatly enhanced with materials that illustrate the key points. Depending on the decision-maker, these materials can range from a one-page policy brief to a poster to a short video. Consider the situation in which discussions will be held with the decision-maker and what media they might naturally prefer. Ministers often prefer a one-page memo with bulleted recommendations, whereas community members often welcome posters that can be easily referenced. Videos can be powerful, but they require the decision-maker's time for viewing. Radio and television spots can be useful for a broader audience, such as the general public. The following are some tips for developing effective science communication materials:

- Use minimal text with simple language.
- Highlight relevant facts and statistics with simple graphics, preferably photos or conceptual illustrations.
- Provide graphics such as photos, maps, tables, plots, short video clips, and conceptual diagrams.
- Include context so the decision-maker can see the big picture and the local relevance.

See *Communicating Science Effectively* (*iwapublishing.com*) for more information and visit *http://ian.umces.edu/symbols/* for downloadable graphics.

Science-based Report Card catalyzes action

Mesoamerican Reef, Belize



The Healthy Reefs Initiative's 2008 Report Card for the Mesoamerican Reef (available at *www.healthyreefs.org*) found that more than 50% of the 326 reefs surveyed were in poor condition. The widely distributed, well-illustrated, and easy-to-read Report Card was a synthesis of numerous analyses of reef conditions that drew media attention and pressure on the government to act. The Prime Minister of Belize, after receiving these results, publicly expressed his commitment to action. This support helped achieve full protection of key grazers, particularly parrotfish, which was a recommendation in the Report Card. This success was a result of compelling scientific evidence made publicly accessible and understandable, a straightforward management response, and the generation of political support at all levels of the power continuum.

Tip 4. Plan with decision-makers

Involving decision-makers in planning research from the beginning is an important way of ensuring that the science will be useful for decision-making. It allows for clarification of respective interests and expectations, including:

- When will the results, even preliminary, be available? Keep in mind that decision-makers need insight, not publications. Nor do they typically require a 95% confidence interval. The sooner key findings can be shared, the more relevant and useful they will be.
- Are there critical decision-making dates, such as government budget deadlines? Releasing findings to coincide with these key dates can greatly enhance decision-makers' interest and subsequently impact.

Traditionally, a research plan focuses on the hypothesis, methods, and budget. More practical is a 'workplan' that has the research as a core component, but also includes discussion of the relevance of the research to management objectives: anticipated conservation impacts; target audiences for the results; how these audiences will be engaged; and, supportive materials beyond peer-reviewed publications. Important to include is a budget allocation for translating the science into accessible information and disseminating this information through discussions with decision-makers. For most applications, approximately fifteen percent of the budget is recommended as a minimum target for this 'science communication' component to cover return travel, the scientist's time, meeting costs, and product design and printing, most of which will be determined once results are finalized. The workplan is best written with the decision-makers.

If this joint planning process is started early enough, the scientists and decision-makers can fundraise together. Joint fundraising can be a powerful means of gaining support since donors are increasingly prioritizing the application of science to management needs, which a joint proposal demonstrates.

Tip 5. Build capacity

An increasingly popular concept, "capacity building" refers to empowering people to achieve their own successes. Capacity building can be on multiple scales from a foreign scientist who works with an in-country colleague to share expertise to a scientist who trains community residents in monitoring protocols. Capacity building includes:

- working with senior scientists to share expertise;
- engaging and mentoring junior scientists and community members;
- giving seminars and talks to explain methods and share expertise;
- actively engaging in networks of colleagues;
- contributing to local to global databases; and,
- providing equipment and resources.

Capacity building is critical for influencing decision-making because the more people in the country and communities who appreciate the research, the more advocates there will be for the policy recommendations. In addition, there will be more people drawing on the findings when decisions are made, which is often unpredictable. Capacity building provides a couple of additional benefits:

- Engaging local expertise demonstrates respect.
- Locals are more knowledgeable of the environment, previous research, cultural norms and political realities, and therefore, they can help ensure a smooth research process.

Closely related to capacity building is the process of continually updating and engaging stakeholders—which may include village chiefs, fisheries staff, business leaders—regarding research progress. These discussions regarding early insights can influence decision-making before the results are final.

Tip 2. Identify information needs

To be most useful, research needs to be responsive to decision-making needs from the beginning. Doing so requires understanding existing processes, clarifying relevant policy issues, and then identifying the information needs. In the case of establishing a new marine managed area, the information need may be a map of habitats and human uses of the area. Identification of information needs is best articulated by the decision-makers since they are the ones who know their objectives. Ideally decision-makers meet and decide on these needs and then communicate these to the scientists. In reality, it is often upon the scientist to talk with decision-makers directly to understand needs. These discussions can occur one on one with the scientists talking with the decision-makers whose authority seems most relevant to their research.

Decision-makers best define needs
Coiba, Panama

When CI received funding from the Gordon and Betty Moore Foundation for a global analysis of marine managed areas, the proposed Coiba National Park (CNP) in Panama was selected as a priority location for the research. Marrying the global program themes with the information needs for park management became the challenge. Consultations with the Department of Fisheries and other institutions provided useful insight. However, the most progress was made by co-hosting a workshop with the Smithsonian Tropical Research Institute—which was managing the CNP planning process—to bring together the major stakeholders from the communities, government, private sector, and academia to discuss the research needs given park management objectives. The resulting priorities not only helped CI scientists tailor research to the priority needs for marine conservation science and identify key science partners, but helped inform other scientists of these needs as well.

Tip 3. Synthesize existing science

In many situations, the science already exists to address information needs, but it may not be accessible (i.e., only exists in peer-reviewed journals to which most decision-makers do not have access) or may not be articulated to address the issue. Consequently, one of the most useful roles of a scientist is to cull through existing research, pull out the relevant findings, and synthesize these key insights as they relate to the issue.

Synthesis is often more powerful than primary data collection
Galapagos Islands, Ecuador

Galapagos was the ideal location for a climate change vulnerability assessment due to the uniqueness of the natural resources and human dependence on them. The assessment actively engaged decision-makers in the process and was intended to provide insight into the likely effects of climate change on biodiversity and consequently, the impacts on ecosystem services such as tourism and fisheries. Instead of spending limited time on new research, teams of climatologists, ecologists, and social scientists located and synthesized existing information. The results showed that the Galapagos penguin, sea turtles, and giant tortoises are highly vulnerable. As a result, tourism is likely to be affected negatively, given the iconic nature of these species. This new information is now being incorporated into the Galapagos National Park management plans in an attempt to mitigate the effects of climate change on key habitats and species.

Tip 1. Partner with decision-makers

Fundamental to influencing the decision-making process is having a strong partnership with decision-makers throughout the scientific process. The more engaged decision-makers are in the research, the more likely the results will be relevant to their needs—and, consequently, the more likely the results will be used in decision-making.

Identifying the appropriate decision-makers involves anticipating the types of management issues the science might inform. An economist conducting a national-level economic valuation of marine resources might identify ministers of tourism and fisheries. In contrast, a geneticist analyzing fish population connectivity among neighboring islands might identify the village chiefs. In many situations, an introduction through a mutual colleague can facilitate a positive relationship.

For this relationship to work, there must be mutual **respect** and **trust**, which can be enhanced by the following:

- Encourage two-way discussions to ensure mutual understanding and to identify similar interests.
- Listen to the decision-makers to understand their concerns and information needs and adapt the information provided accordingly.
- Explain points in simple, concise terms without sacrificing content.
- Start with basic concepts and then, based on interest and comprehension, advance into more sophisticated concepts (e.g., start explaining climate change mitigation and then advance into Blue Carbon).

Trust is also earned by:

- demonstrating long-term commitment to an area;
- being available for informal or spontaneous discussions; and
- showing appreciation and understanding of the cultural and political context of decisions.

These attributes demonstrate why local scientists play a critical role in linking science with decision-making. It is, therefore, highly recommended that foreign scientists partner with in-country scientists. Doing so will better ensure there is someone available to articulate the findings when relevant policy decisions arise, which could be months or even years later. Engaging in-country senior or junior scientists also facilitates access to informal knowledge and strengthens in-country capacity.

Scientists: portals to knowledge

Scientists play a critical role in policy-making, not only in collecting and analyzing data to answer science questions, but perhaps more importantly, by providing expert insight into a breadth of issues. Viewed as objective critical thinkers, scientists are often called upon to speak on a wide range of issues which may, in some cases, be only marginally related to their area of expertise. As a result, scientists often serve as portals to the latest knowledge and, therefore, play important roles in drawing in other experts on key issues.

Trust leads to action

Phoenix Islands, Kiribati

When Greg Stone and David Obura first visited the Phoenix Islands in 2000, their purpose was research. However, their roles quickly shifted to advisors to the Kiribati Government on the status and significance of the nation's vast marine resources. A trusting relationship emerged with the Environment Permanent Secretary, Tukabu Teroroko, who hosted numerous presentations, meetings, and receptions, and introduced the scientists to all levels of government to share their insights regarding the uniqueness of the marine ecosystems and how these resources could be conserved. With connections to other expertise including legal and financial experts, Stone and Obura brought additional knowledge to the Government, which ultimately led President Tong declaring the Phoenix Islands Protected Area—the largest marine managed area in the world at the time.

The decision-making process

A decision-maker is someone who selects a course of action among several choices. Decision-makers occur at all scales. The owner of a global supermarket may decide to only sell sustainable seafood. However, the family member responsible for food decides which stores to patronize and which products to buy. A nation's parliament may endorse an international convention calling for more marine managed areas (MMAs) while a village chief may set the timeline and boundaries for a MMA in his community. All these individuals make decisions that affect the sustainability of marine resources.

The decision-making process varies depending on the context, but the key components include:

- **issue identification** (e.g., fish stock depletion);
- **assessment of impacts** of alternative solutions (political, social, economic, and environmental); and,
- **implementation** of the chosen alternative (e.g., establishment of fishing regulation).

These components are the first steps in the adaptive management cycle. The cycle continues into monitoring and evaluation of the impacts of the decision. These steps provide for improved understanding, which will then feed into further issue identification creating a cyclical process.

Science is only one consideration in decision-making

California, USA

When the state of California committed to establishing a network of ecologically significant MMAs as part of the Marine Life Protection Act, a team of scientists was asked to develop a proposal. The resulting concept was strongly opposed by ocean user groups, particularly fishermen, who were concerned about the impacts on their economic and social well-being. In order to balance these concerns, the decision-making process was redesigned to solicit plans from all stakeholders, which were then vetted by scientific panels, according to scientific guidelines. By enabling greater stakeholder engagement, social and economic considerations were perceived to be better balanced with ecological priorities. Due to this shift in process and, consequently, perceptions, a network of MMAs is now being implemented.

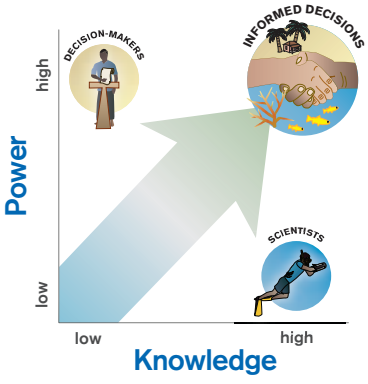
Social science provides basis for focusing conservation

Birds Head Seascape, Indonesia

When CI began working in the Birds Head Seascape, a few scoping studies were conducted, including an analysis of tenurial rights and people's perceptions of resources. CI decided to focus initially on two villages that were identified as owning a large, remote, and pristine area covering 155,000 square kilometers. The villagers were not using the area due to its remoteness, and they were concerned that their resources were being poached by outsiders. CI discussed with the village leaders the idea of making this area into a *sasi* (no-take area) with the empowering benefit to the communities of overseeing their own resources. The resulting conservation agreement provides a means of employment, capacity building, engagement of community members through a rotating patrol system, and a boat that the community could not have otherwise afforded.

Why work with decision-makers?

Creating social change and solving environmental problems requires both knowledge and power. Scientists have knowledge, but typically limited authority to change behavior. Decision-makers have power, but may lack in-depth knowledge of particular problems. Linking these two groups brings knowledge together with power to make informed decisions that can drive social change.



Why is feeding science into decision-making so difficult?

Scientists and decision-makers come from two different worlds with varying objectives, languages, and processes. While scientists are motivated by discovery and often judged by their peers based on their publication rates and journal status, decision-makers are under pressure to make immediate decisions and are accountable to their constituents on numerous issues.

In order to examine questions critically, scientists typically have a particular area of expertise, such as the carbon storage rates of mangroves or the economic cost-benefits of tourism. In contrast, decision-makers are responsible for numerous issues ranging from health care to climate change and are, therefore, typically generalists who have to consider not only the latest science on a particular issue, but also the economic, cultural, health, and political impacts of their decisions.

While scientists typically conduct research over a period of years, decision-makers often need answers within one hour to one week.

Both scientists and decision-makers are accustomed to being sought after—scientists for their expert knowledge and decision-makers for their decision-making power. As a result of their differing objectives, expertise, and timelines, scientists and decision-makers have limited capacity and time to seek each other out, understand each other, and collaborate.

Science communication leads to conservation action

Abrolhos, Brazil

When a fish farming company proposed constructing the nation's largest facility along the Abrolhos coastline, an advocacy coalition was created consisting of 21 NGOs, fishermen, community groups, and research institutions. Their concerns were regarding the ecological impacts on the mangroves. Meanwhile, a series of ecological and socioeconomic studies were under way in the region. Due to many consultations between the scientists and local stakeholders, including many of the coalition members, they were familiar with the key messages emerging, which included that 1000 families depended on the mangroves and that the mangroves played a key role in the life cycles of commercially valuable fish species. These insights were incorporated into the campaign, which succeeded in halting the farm proposal and ultimately led to President Lula declaring the mangroves the Cassurubá Extractive Reserve.

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Purpose of this guidebook

Recognizing the importance of informed decisions and the differences between the scientific and decision-making processes, this guidebook provides practical tips on how to best bring these worlds together. In doing so, this guidebook emphasizes the roles of facilitating, synthesizing, translating, and communicating science to inform conservation action. It is geared toward the perspective of scientists and decision-makers working in tropical developing nations and focusing on marine resource management issues. However, the concepts are applicable to a broad range of scientists and decision-makers worldwide.

SCIENCETOACTION

What is a scientist?

A scientist—whether an anthropologist, economist, biologist or physical oceanographer—systematically tests hypotheses. Scientists may conduct research to address specific questions, such as the resilience of a population to disturbance, or conduct monitoring to determine the effects of decisions on nature and human well-being. The concept of a scientist has expanded from someone who collects new data to someone who synthesizes existing data sets from varying sources. Scientists exist in universities, government agencies, non-government organizations and the private sector. The concepts in this guidebook apply to all these scientists.

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CONSERVATION INTERNATIONAL

a scientist's guide
to influencing decision-making

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