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# Selecting Sites for MPAs: How Practitioners Have Used Different Methods in Planning MPA Networks

In designing MPA networks, planners must decide how they will choose which sites to include. There are a variety of ways to select sites, from simple ones (having experts make a list based on their best judgment) to complex (using advanced software to consider an array of ecological and socioeconomic factors). There are also questions on how best to classify the area you seek to protect. After all, if you aim to have a representative network of MPAs, you need to know what characteristics or habitats you want *represented* within it, and how to include samples of each in the network.

This month, *MPA News* briefly examines methods that practitioners have used in planning representative MPA networks, and offers cases in which planners explain how they chose their methods.

### Site-selection methods

Among the most basic ways of selecting sites is to convene a panel of experts to do it. Often called the Delphic method, it normally involves experts answering a questionnaire — in this case, on which sites to include in an MPA network — then discussing the answers. The goal is consensus. In 2002, for example, a panel of 62 scientists and conservationists met in Vietnam to develop a global list of "areas of outstanding universal value for marine biodiversity" for potential future inclusion in the UNESCO World Heritage program. The panel identified 79 areas of importance that merited World Heritage status, based on the knowledge and expertise of the panelists. A report on the meeting ("The Hanoi Statement") including the list of sites is at http://whc.unesco.org/en/events/501.

Another method of selecting sites involves using relatively simple scoring systems. These systems assign a rank of relative importance to candidate sites based on various user-defined criteria. An example of this was the ranking system devised for the Bahamas in 1999-2000 when that country anticipated designating a network of MPAs. The system ranked candidate sites on a scale of 1 to 3 for each of several socioeconomic criteria (fishing impact, community management, community benefits) and ecological criteria (habitat diversity, regional importance). The system was described in our February 2000 edition (*MPA News* 1:5), and is revisited below.

> For a more detailed comparison of various site selection methods, see *Evaluation of Site Selection Methodologies for Use in Marine Protected Area Network Design*, a 2004 report prepared for the Canadian Science Advisory Secretariat. It is available at www.dfo-mpo.gc.ca/csas/Csas/DocREC/2004/RES2004_082_e.pdf.

The most complex method of site selection — but also the one that promises an "optimal" network design — involves using software tools to process large amounts of information. The software Marxan, for example, allows practitioners to account for multiple species, habitats, oceanographic factors, resource uses, and other considerations across a wide geographic area. It has been used in multiple MPA-planning processes in recent years, including for Australia's Great Barrier Reef Marine Park and in British Columbia, Canada ("Using Computer Software to Design Marine Reserve Networks", *MPA News* 6:4).

Each system has its advantages and disadvantages. A major advantage to the Delphic method, for example, is its ease. It relies simply on the knowledge of the participants, and requires no significant scoring system or computing expertise. However, its clear basis on human judgment can be limiting. Although no site-selection system is free from human biases, the biases are particularly apparent in the Delphic method, where "experts" wield the decision-making power and stakeholders may potentially feel alienated from the process (unless stakeholders are included as experts). In contrast, Marxan-based planning processes have been opened to the public in some cases, where stakeholders have been able to suggest potential MPA sites and see on a computer screen how well they would fit in a network. This was done in the process to plan no-take reserves within the Channel Islands National Marine Sanctuary in the US ("Science as a Central Tool in Planning Marine Reserves", *MPA News* 2:10).

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Direct correspondence to:
MPA News, School of Marine Affairs, University of Washington, 3707 Brooklyn Ave. NE, Seattle, WA 98105, USA. Tel: +1 206 685 1582; Fax: +1 206 543 1417; E-mail: *mpanews@u.washington.edu*

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In practice, these methods are often not exclusive. A scoring system, for example, may be applied to candidate sites that were originally selected by a Delphic panel of experts. And nearly all selection systems are influenced by political considerations before the final designation of sites.

### Bahamas: Revisiting the site-ranking system for a national MPA network

In 1999, the government of the Bahamas sought to designate a network of no-take marine reserves in its waters, and asked US scientists Craig Dahlgren, Mark Hixon, and Allan Stoner to devise a system for selecting the sites. There was time pressure: the team was given just a few weeks to create the ranking system and recommend areas. The team first listed 30 candidate sites, then applied the ranking system and recommended the five highest-scoring sites. Since then, the five sites have undergone extensive stakeholder consultation and been modified; the designation process is ongoing. (Delays in designation have been partly due to changes in the Bahamian government between then and now.)

The Bahamas site-ranking system remains a model of conciseness in MPA planning, especially as compared to more recent Marxan-based methods. The impact of various sites on fishing activity, for example, was scored as 1 point for major displacement, 2 points for minor displacement, and 3 points for negligible displacement. Similarly, sites scored highly if they had a supportive community nearby, if they contained both reef and seagrass habitats (as opposed to one or the other), and if they were thought to serve as a major source of fish larvae to the rest of the Bahamas.

Dahlgren, who is now at the Perry Institute of Marine Science in the US, says the emphasis in creating the system was on speed and simplicity. "The system was simple out of necessity," he says. "To take advantage of a narrow political time window, our ranking criteria were created very quickly and with minimal information. There were not many site-specific data available to us, we had no time to collect new data, and more advanced tools were not available. Marxan, for example, was just being developed at the time."

Dahlgren says the main benefit of the ranking system was that it allowed his team to provide policy-makers with the information they needed to move forward with MPA planning rapidly and at minimal cost. "While the level of detail and accuracy that our system provided may make many scientists cringe, the simplicity of the system and amount of information provided was actually well-suited to the political decision-making process at the time," he says. "The tradeoff was that our simple system, and how it was used, provided only very basic information to decision-makers.

"If we were to evaluate the same sites today, we would probably be able to improve upon our earlier system," says Dahlgren, noting an increase in available information about general ecological processes, the distribution of key species, and socioeconomic factors in the Bahamas, as well as improved data on site-specific conditions. "We would be able to evaluate various criteria in greater detail and make more accurate assessments of conditions. Having said that, I am not sure an improved ranking system would change site rankings considerably."

Dan Brumbaugh directs the Bahamas Biocomplexity Project (BBP), an interdisciplinary initiative to improve the design of MPA networks for biodiversity conservation, fisheries sustainability, and other uses (http://bbp.amnh.org/website/home.html). He cites the effort by Dahlgren (who is also a BBP collaborator), Stoner, and Hixon as an important forerunner to BBP's work in that it included both ecological and social criteria in its rankings. "Given their limited resources and timeframe, it was probably the best approach available, although time and further study have understandably revealed various shortcomings in the analysis," says Brumbaugh. "Proposed reserve areas that were initially judged to be socially acceptable turned out to be more controversial once a wider set of stakeholders became aware and involved in the actual planning discussions. This underscores some of the risks inherent in both misidentifying affected communities as well as over-generalizing about community-level responses (vs. subsets of stakeholder interests) to MPA proposals. To the extent that we should always try to use the best available science for policy considerations, after years of multidisciplinary investigation, we simply have far more to consider now than what they had at their disposal."

If a site-selection process for the Bahamas were to be conducted today, Brumbaugh describes how he would do it. "Given the growing number of site-selection tools, including new data layers and algorithms, we have the means to more explicitly define many more types of objectives for a system of MPAs in the Bahamas," he says. "My approach therefore — given the luxuries of hindsight, new information and tools, and enough time and money to implement them appropriately — would be to avoid an expert-driven analysis. Rather, an integrated natural-social science research team would assist the Department of Marine Resources, the Bahamas National Trust, and other relevant agencies in their work with as many local settlements as possible. Consensus would be sought on what set of features are most valued; what important datasets are still missing but feasible; how much of each feature Bahamians want to conserve; and, ultimately, what Bahamian MPA networks incorporating as many of these objectives as possible could look like. Deepening the interaction with and among stakeholders to make new scientific tools accessible for planning is an excellent way to facilitate as much science-based planning as possible. It also helps to generate the kind of community buy-in that new MPAs ultimately need to be effective."

### Site selection in Australia: Great Barrier Reef Marine Park and South Australia

Selecting sites for a representative system of MPAs requires a way to classify the biogeography of the area, such as into "ecoregions", "bioregions", habitats, or other classifications. Graeme Kelleher wrote in *Guidelines for Marine Protected Areas* (IUCN, 1999, www.iucn.org/dbtw-wpd/edocs/PAG-003.pdf):

> "The biogeographic classification system used by a country in developing such a representative system need not be universally applicable. Indeed, if the world were to wait for general scientific agreement on the 'best' such classification system, it would probably be a long time before a start was made in establishing many MPAs. The important thing is that the biogeographic system used in a particular country suits that country's existing scientific and information base."

In Australia alone, different classification systems have been used for different MPA-planning initiatives. The Representative Areas Program (RAP) of the Great Barrier Reef Marine Park, in which no-take zones in the park were expanded, involved subdividing the park into 70 bioregions, then setting aside at least 20% of each bioregion in no-take zones (*MPA News* 5:10). In contrast, the state of South Australia, which has roughly the same length of coastline as the Great Barrier Reef Marine Park, subdivides its marine waters into just eight bioregions, and is engaged in designing MPAs within those bioregions.

Deciding what constitutes a "bioregion" is obviously open to interpretation, and dependent on the level of available information. It also affects the ultimate design of a representative MPA network if you are taking a bioregional approach.

Leanne Fernandes, who managed RAP and now runs Earth to Ocean Consulting, says the term *bioregion* as used by RAP was not technically correct but represented a compromise between a biologically appropriate description and a socially meaningful one. "Bioregions, as used in biogeography, are at a far larger scale than those defined for the Great Barrier Reef (GBR) ecosystem," says Fernandes. "Some global bioregionalizations have the entire GBR ecosystem as one 'bioregion', for example; likewise the Interim Marine and Coastal Regionalisation of Australia (IMCRA) had the GBR encompassed within nine regions (www.environment.gov.au/coasts/mbp/imcra/index.html). For the RAP's planning and management purposes, this was too broad a scale. Given the available knowledge on the GBR, our experts were able to define 70 bioregions for the GBR ecosystem, including 30 reef bioregions and 40 non-reef bioregions." She notes that datasets for the IMCRA process were each required to cover the entirety of Australia's waters, which limited the number of usable datasets. In contrast, because GBR in particular is so heavily studied, far more datasets were available to RAP than the IMCRA process could use.

"The term *bioregion* is an abbreviation of 'biological region', which was something we could talk to the community about," says Fernandes. "People understood that 'bio' referred in some way to plants and animals. To many people, the term *bioregion* made sense to describe a region within which plants and animals were more similar to each other than they were to plants and animals in another region."

If the scale of classification had been broader, says Fernandes, the zoning outcome might have been different. Namely, it might have missed protecting ecosystem elements about which little is currently known. "There was not perfect information for all the habitats and species that comprise the GBR ecosystem," she says. "By defining bioregions at the scale we used, we ensured a comprehensive description of the biodiversity of the entire system. The likelihood of failing to protect some part of the ecosystem about which little is known would have been greater if a broader-scale bioregionalization had been applied in the RAP."

To help guide its site selection, the RAP established a list of 11 biophysical operating principles, including that whole reefs must be included in no-take zones, and that most no-take zones be at least 20 km along their smallest dimension. Fernandes says the latter principle was a challenge to follow. "Complying with the minimum-size principle was the most difficult one, as we were also trying to comply with socioeconomic, cultural and management feasibility principles — one of which was to aim to minimize conflict with human uses," she says. She notes that prior to the rezoning, just one no-take zone in the park measured 20 km or more across its smallest dimension. The RAP website is at www.gbrmpa.gov.au/corp_site/management/representative_areas_program.

South Australia has also established design principles to guide its MPA-planning process. Released in June 2008, the 14 principles include ones to ensure the system is representative ("The system must reflect the variety of our marine life") and does not discriminate against certain groups ("Give consideration to the full diversity of marine users" and "Respect indigenous interests and culture"). South Australian Minister for the Environment Jay Weatherill said, "The design principles reflect the latest thinking and international

### For more information

**Craig Dahlgren**, Perry Institute for Marine Science, Jupiter, Florida, US. E-mail: cdahlgren@perryinstitute.org

**Dan Brumbaugh**, American Museum of Natural History, New York City, US. E-mail: dbrumbaugh@amnh.org

**Leanne Fernandes**, Earth to Ocean Consulting, Queensland, Australia. E-mail: leannef@earth2ocean.com

**Angela Gray**, Department for Environment & Heritage, South Australia, Australia. E-mail: Gray.Angela@saugov.sa.gov.au

best practice in designing and selecting marine parks." A document describing the design principles is available at www.environment.sa.gov.au/coasts/marineparks.html.

Prior to setting the principles, however, South Australia decided roughly where its marine parks would be sited — what planners have called "focus locations". There are 19 focus locations, representing island groups, gulfs, peninsulas, and other noteworthy features (www.environment.sa.gov.au/coasts/marineparks/locations.html). One marine park will eventually be sited in each focus location, and boundaries for those MPAs will be set in the coming months. "Decisions on the boundaries of the marine parks in each of the focus locations will be guided by the design principles," says Bryan McDonald of South Australia's Department for Environment & Heritage.

Although the South Australia process is underpinned by bioregional considerations, the 19 focus locations are not evenly distributed across all bioregions. One relatively homogeneous bioregion contains just a single focus location, whereas another, more-complex bioregion contains ten. The South Australian government says the 19 focus locations will ensure a representative network of MPAs "that will collectively conserve and protect all known types of habitats and communities within South Australia."

## Future directions in MPA site selection

**By Dan Brumbaugh**

Collectively, stakeholders in most MPA processes are interested in science-based network designs that provide confidence in the long-term persistence of biological diversity and the maintenance of important ecosystem processes and services. Therefore, a big challenge for marine conservation scientists and planners is to utilize features (i.e., what people want to conserve), target levels (how much is needed or how much can be afforded), and new algorithms that fully achieve stakeholder visions for their seascapes.

Since systematic conservation planning is data-intensive, planners have traditionally chosen features such as sets of species or habitats for which data are readily available. There is a growing appreciation, however, that we can also address other ecological and social interests by transforming these species and habitat data to more explicitly represent key ecosystem processes and services, and then use these estimated functions and services as new features with site-selection software.

In addition, since stakeholders and planners are often interested in management goals that extend beyond MPAs — such as how protected areas can complement other types of management outside of protected areas or across a more complex zoned seascape — it is important to move beyond simplistic protected/non-protected dichotomies where all contributions to management targets come exclusively from reserved areas. Instead, we need algorithms that allow us to assess the contributions of ecosystem functions and services across whole seascapes.

Finally, another important extension into MPA network planning is the incorporation of true seascape processes into site-selection algorithms. Ecological connections among different habitat types, such as those caused by developmental migrations of species from a nursery habitat to an adult habitat, may make certain nearby combinations of different habitats more valuable to management targets than the same habitats when farther apart. Population connectivity, if known for management targets, should also influence the selection of "upstream" (e.g., larval release) and "downstream" (e.g., larval recruitment) sites that are especially well-connected. By looking at these processes across the whole seascape, both inside and outside of protected areas, or even across a wider range of use zones, we can develop a more realistic view of how MPAs may work for different objectives.

### For more information

**Dan Brumbaugh**, American Museum of Natural History, New York City, US. E-mail: dbrumbaugh@amnh.org

**MPA Perspective** 

# Building Networks of MPAs for Sustainable Reef Fisheries in Indonesia - The COREMAP Experience

**By Peter J. Mous, Agus Dermawan, Cherryta Yunia**

The Coral Reef Management and Rehabilitation Program (COREMAP) represents a major effort by the Government of Indonesia, The World Bank, and the Asian Development Bank toward better management of coral reefs in Indonesia. Although biodiversity conservation remains a welcome side effect, COREMAP is really about people who make a living from the sea. COREMAP is designed with an expectation that catch-per-unit-effort (CPUE) in waters of participating districts will increase by 35% for fish species that mature in 1-2 years, and by 10% for fish species that mature in 5-6 years. COREMAP is also explicit about the way that this goal is to be achieved: by setting aside 10% of reefs in participating districts as no-take areas. One can argue whether setting aside 10% of reefs is sufficient to achieve the expected increase in CPUE, but that is beside the point. What matters is that COREMAP, and therefore the Government of Indonesia, is giving no-take areas a chance to prove their value as a fisheries management tool *at scale*.

COREMAP aspires to influence nearly half a million hectares (ha) of reef habitat, so going to scale is an essential consideration. In this respect, COREMAP is an innovative program. Various projects and studies demonstrate fishery benefits at individual pilot sites, but COREMAP will show us which approaches toward implementation of no-take areas still work after scaling up by a factor of 10,000 or more. Factors that are often overlooked in pilot projects, such as management costs per ha per year and availability of human resources for development and management, emerge as overriding design criteria.

## Challenges in achieving 10% protection

Building on concepts from the Philippines, COREMAP had high expectations for community-managed reserves as a tool to achieve scale. Eight years into the project, these expectations have yet to be fulfilled. Whereas COREMAP established nearly 200 community-managed reserves, most of them are simply too small to achieve scale. The total surface area of COREMAP community-managed reserves approaches some 3500 ha, which is less than 1% of reefs in COREMAP districts. Even if they would all be effectively managed, this would clearly be insufficient to achieve sustainable reef fisheries in each district.

The small average size of community-managed reserves cannot be completely blamed on weaknesses in facilitation. Rather, it appears to be a common trait of this management model, which is partly due to the area of influence of each village. In eastern Indonesia, the median reef area controlled by coastal villages amounts to some 100 ha. Since few villages are inclined to set aside most of their reefs as a no-take area, tiny and small reserves become generally accepted outcomes of village reserve planning. Scale would still have been achievable if reserves could be easily replicated, and if neighboring communities who do not participate in COREMAP would copy the concept from their neighbors. However, independent establishment of village reserves rarely happens, and it has become clear that communities do expect external resources to cover costs for establishment and management. Finally, even if community-managed reserves would achieve 10% coverage, they would generally be too small to protect mid- and large-size commercial fishes such as groupers and snappers from over-exploitation. Scientists recommend a minimum size of 1000 ha for networked no-take areas, which only one COREMAP community-managed reserve ("Mursika" of Mutus village in Raja Ampat, West Papua) approaches. Currently the COREMAP policy is to aim for an average reserve size of 100 ha and a minimum reserve size of 10 ha, but it appears that most COREMAP districts will not achieve this.

Marine protected areas established by the Ministry of Marine Affairs and Fisheries and the Ministry of Forestry are generally much bigger than village reserves (thousands of ha), and those that are zoned and effectively managed could contribute to sustainable fisheries. Therefore, COREMAP supports these two government-managed systems as well. The challenge here is to put management systems in place. The fledgling network of the Ministry of Marine Affairs and Fisheries and some of the smaller areas managed by the Ministry of Forestry lack operational capacity, even though their legal basis is strong.

Another important issue is that local electorates in Indonesia do not yet accept large no-take areas as a tool for fisheries management. *Orang harus makan* or "Man has to eat" is the prevailing mindset. Few people are ready to accept that conservation of fisheries resources will require hard choices, and therefore local policy makers cannot, and perhaps should not, wholeheartedly support the establishment and enforcement of large no-take areas. Breaking this pattern requires working examples and awareness campaigns that go beyond "Save the Reefs" boilerplate. COREMAP's slogan "Healthy coral reefs — thriving fish" makes a first attempt at helping the public to connect the dots, but it will take more to raise genuine concern among voters in Indonesia.

## The future

Achieving sustainable fisheries management is not only about hectares, efficient zoning plans, and political will. It is also about local availability of human resources for management. It is in this respect that COREMAP holds a major promise for

**Editor's note**

Peter Mous is MPA Advisor for the Coral Reef Management and Rehabilitation Program (COREMAP) in Indonesia. Agus Dermawan is Deputy Director for Aquatic Conservation Areas and Marine National Parks (Directorate-General of Marine, Coastal, and Small Islands) in Indonesia's Ministry of Marine Affairs and Fisheries. Cherryta Yunia is Deputy Director for Conservation Areas, Wetlands, and Essential Ecosystems (Directorate-General of Forest Protection and Nature Conservation) in Indonesia's Ministry of Forestry.

**For more information**

**Peter Mous**, COREMAP Phase II, Jakarta Selatan, Indonesia. E-mail: pjmous@gmail.com

further development of large marine protected areas that are collaboratively managed by professionals from diverse backgrounds. Currently, COREMAP involves hundreds of government officials and thousands of villagers in some aspect of MPA management. If Indonesia is to deliver on international commitments under the Convention on Biological Diversity and on its policy to establish 20 million ha of effectively managed marine protected areas by 2020, it will need every hand in this pool of expertise to make a difference at sea.

# Notes & News

## Program to build MPA management capacity

A six-day program to train managers, stakeholders, and government officials in the planning and management of MPAs will be held 8-13 September 2008 in Suva, Fiji. Offered by the University of the South Pacific, the International Ocean Institute-*OceanLearn*, USAID, and the US National Oceanic and Atmospheric Administration, the training program is tailored to meet the management training needs of newly designated MPAs in the South Pacific region. To view the course announcement, go to www.oceanlearn.net/Flyers/MPACourse08.pdf.

## MPA Tip: Making technical language accessible for public planning processes

"MPA Tip" is a recurring feature that presents advice for MPA planning and management from practitioners and publications. Below are suggestions for resource managers on how to communicate technical information effectively to the public, such as during MPA planning processes that involve stakeholders. The advice is from the draft *Handbook on Public Participation in International Waters Management*, being produced by the International Waters Learning Exchange and Resource Network (IW:LEARN). The draft publication is available in Word format at www.iwlearn.net/abt_iwlearn/events/p2/p2-handbook.en.

**Tip:** It is important to communicate with the public in terms that they understand. To make technical language accessible, use the following checklist:

- Use examples and analogies;
- Use vocabulary familiar to the target audience;
- Clearly state why the information is relevant to the target audience;
- Use visuals;
- Use short sentences;
- Avoid jargon and acronyms. When they must be used, define them in simple language;
- Use language similar to what you would in a conversation with stakeholders; and
- Do not "dumb down" the language. The purpose of creating accessible information is to educate and inform, not to disadvantage stakeholders with oversimplified versions of concepts that are inherently complex.

## Endowment created for Malpelo MPA

A US $5-million endowment has been established to help fund the Malpelo Fauna and Flora Sanctuary and World Heritage Site, in the eastern Pacific. Proceeds from the endowment will cover annual operating expenses of the Malpelo management plan, including monitoring and education. To create the endowment a Colombian foundation, *Fondo para la Acción Ambiental y la Niñez*, partnered with Conservation International; each institution provided $2.5 million. **For more information: José Luis Gómez**, Fondo Acción, Colombia. E-mail: joselgomez@accionambiental.org

## Expedition for educators in Papahānaumokuākea

From 13-24 July 2008, educators from eight countries in Oceania gathered for an expedition through Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian Islands. The expedition aboard the US research vessel *Hi'ialakai* aimed to bring together marine educators in support of the 2008 International Year of the Reef, as well as build an educator network throughout the region. The educators were joined by cultural practitioners from Hawai'i, resource managers, archeologists, and deep sea researchers. "The ultimate goal [was] to learn how we can work together to better protect the coral reefs and marine environments in our island nations, using Papahānaumokuākea and its nearly pristine resources as an inspirational learning environment," said Andy Collins, education coordinator for Papahānaumokuākea. A blog of the expedition is available at http://educatorexpedition.honadvblogs.com/page/7.

## Economic valuation of fishery closures

A new report from the Fisheries Centre at the University of British Columbia (Canada) estimates the cost to fisheries of closing areas, using a spatial model of fleet operations. Focusing on protected sea lion habitat in the eastern North Pacific, the report links spatial variability of fisheries biomass and profitability over time to environmental variables. It also develops estimates of opportunity costs of time and area closures to the fishing industry at various scales. The authors suggest that their findings have direct applications to evaluating boundary changes to existing MPAs and other spatial management decisions. *Economic Valuation of Critical Habitat Closures* is available at www.fisheries.ubc.ca/publications/reports/report16_8.php.