

Science as a Central Tool in Planning Marine Reserves: Case Study of the Channel Islands

A marine protected area based wholly upon ecological science may represent the ideal MPA for conservation biologists. Seldom, however, are MPAs designated on a purely ecological basis. More often, MPA designations represent the desire of decisionmakers to protect an area for aesthetic or political reasons. Or they incorporate a range of social and economic considerations — like minimizing economic impacts on fishers — that can compromise an MPA’s “ideal” ecological design, often for the purpose of gaining support from stakeholders.

Frequently this results in disagreement about the role of science in stakeholder processes.

In the state of California (USA), a process is ongoing to designate a series of marine reserves around the Channel Islands archipelago. The process, designed by a multistakeholder group, has been advised by two panels: a science advisory panel, made up of natural scientists, and a socioeconomic advisory panel, consisting of economists and other social scientists. Set to conclude this month (May), the process has been intended to heed ecological and socioeconomic concerns in generating a consensus plan.

The process has been particularly noteworthy for the primary recommendation of the science panel — that 30% or more of the waters around the islands be set aside as no-take areas. MPA News examines the roles that science and scientists have played in the Channel Islands process, and how stakeholders, particularly the fishing community, have responded.

Background

The marine ecosystems surrounding the Channel Islands are unique for their interactions among species. The islands form the boundary between two vast biogeographical regions: one of cold water, the other warm. Fish species found as far north as the Bering Sea interact in the Channel Islands with species found in Baja California (Mexico).

The US federal government designated the 4,294-sq. km Channel Islands National Marine Sanctuary (CINMS) in 1980 to protect the waters around the islands. At the time, such protection had little to do

with protection from the effects of fishing; in fact, it was protection from the threat of increased oil drilling in the vicinity that initiated the designation. Nonetheless, in 1999, impelled in part by community calls to protect dwindling fish stocks, the sanctuary and the California Department of Fish and Game developed a joint process to consider no-take marine reserves in the sanctuary for the first time. (For the sanctuary, the reserve process has represented one element in a broader effort to update all aspects of the sanctuary management plan.)

The multistakeholder Sanctuary Advisory Council for CINMS, which serves to provide a range of advice to the sanctuary’s management, was assigned oversight of the joint reserve-planning process. To study the possibility of reserves in greater detail, the council formed a marine reserves working group (MRWG) of managers, fishers, conservationists, and other stakeholders. Based on its study, the MRWG would recommend a plan to the council, which would evaluate and forward the plan to the sanctuary manager. Final implementation would rest on approval from state and federal fisheries management agencies.

To ensure that any decision it made on reserves weighed ecological and socioeconomic considerations, the MRWG set a number of goals. Among these were:

- protection of representative and unique habitats
- achievement of sustainable fisheries in the Channel Islands
- minimization of short-term socioeconomic losses to all resource users

Note from the editor

This issue of MPA News focuses on the science of marine protected areas and how it translates into practice. Through the eyes of experts in the field, we examine some recent developments in MPA research, whether science is getting to practitioners who need it, and what stakeholders think of the role of science — and scientists — in planning. As always, we look forward to hearing from readers with comments and contributions.

Kind regards,
John B. Davis
Editor-in-Chief

Table of Contents

Science as a Central Tool in Planning Marine Reserves: Case Study of the Channel Islands	1
Interview: Channel Islands Scientists Discuss their Work	3
MPA Practitioners Face Challenges in Accessing Science	4
The State of MPA Science: What Have We Learned Lately?	6

MPA News

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MPA News is produced
monthly as an independent
study initiative at the School
of Marine Affairs, Univ. of
Washington. The MPA News
staff is solely responsible for
content.

This publication was funded
in part by Washington Sea
Grant Program, Univ. of
Washington, pursuant to
National Oceanic and
Atmospheric Administration
Award No. NA76RG0119.
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Channel Islands

continued from page 1

The MRWG agreed to operate by consensus, and established the aforementioned two advisory panels — on science and socioeconomics — to inform its decisionmaking.

The science panel and its recommendation

One criterion for serving on the science panel was that members had no prior published views on marine reserves. Satie Airame, who has served as sanctuary liaison to the science panel, says such a restriction was necessary in order to represent the variety of interests involved in the reserve process, including commercial and recreational fishers.

"The Sanctuary Advisory Council required a neutral science advisory panel to review the existing literature on marine reserves and the status of resources in the Channel Islands," said Airame. The eventual science panel included oceanographers, biologists, fishery managers, statisticians, and others.

The panel adopted a habitat-based approach, particularly in its mapping of resources. Its GIS database — used in analyzing proposed reserve sites — identified habitat types accurate to fractions of 1 square nautical mile (3.43 sq. km). Based on this habitat information, the panel projected the distribution of area fish stocks and identified areas of high habitat heterogeneity with potential for meeting the MRWG goals.

Ideally, said Airame, the panel would like to have had more information on which to base its models. Available catch data, however, were judged by the panel as being insufficiently detailed in quantity and quality, and the state could offer little additional data. The state of California has only recently begun developing fishery management plans for stocks in its waters, and as a result, there were few stock studies for the panel to consult. The panel appealed to fishers to help by supplying proprietary stock information to the panel — essentially telling the panel where the fish were — but the fishing community was reluctant to do so. Fishers feared such sharing would draw more fishers or, worse, reserves to the best fishing sites. (The fishing community eventually supplied such data to the socioeconomic advisory panel under an agreement that strictly controlled how the data would be used and protected.)

In September 2000, the science panel released its recommendation to the MRWG. Given the status of marine resources in the sanctuary and the current levels of fishing, the science panel advised that at least 30% of each of the habitats of the sanctuary be set aside as no-take reserves. Furthermore, given environmental variability and the uncertainties associated with fisheries management, the science panel recommended setting

aside as much as 50% of the sanctuary to minimize the risk of population collapse. The panel said such set-asides were necessary to protect the majority of the fish species of concern in the Channel Islands.

Criticism of the science process

The reaction from fishers, including those on the MRWG, was shock and outrage. The idea of giving away one-third to one-half of their fishing grounds threatened economic disaster to the regional fishing industry. Analysis by the socioeconomic advisory panel indicated that a closure of 50% of the sanctuary would result in a maximum potential loss of about 50% in fishing industry revenue (commercial and recreational), according to Bob Leeworthy, lead economist on the socioeconomic panel. "If you're a user group, you're scared that size of closure will put you out of business," said Leeworthy.

MRWG member Bob Fletcher, president of the Sportfishing Association of California, says the science panel was skewed in favor of reserves from the beginning. "I think many of the panel members believe that traditional fisheries management has been a failure, and that marine reserves are going to be the savior of fisheries management," said Fletcher.

Aniello Guglielmo, a squid fisherman and MRWG member, suggests that other management tools could be just as effective as reserves in protecting stocks, while allowing fishing to continue. The California squid industry, for example, has voluntarily stopped fishing for two days each week; incidentally, 75% of its catch comes from the Channel Islands. Such temporal closures could be instituted for other industry segments, said Guglielmo. "A one-day closure for sportfishers seems like it would be reasonable," he said.

"A lot of fishermen here feel the scientists have acted as stakeholders, trying to set policy," said Chris Miller, a lobster fisherman and MRWG member. To simply argue against the panel's recommendation, however, is reactionary, he said. "What we need to ask is how it would be applied to, and integrated with, existing fisheries management," he said. "Fishermen are always portrayed as malcontents for attacking scientific data. It's a trap that's easy to fall into. We have to stay constructive."

Deadline for consensus

The MRWG must now weigh the ecological and socioeconomic advice of the panels in forming a consensus plan for reserve placement in the sanctuary. The deadline for such a plan is this month — 16 May. In recent weeks, public meetings of the MRWG have drawn hundreds of vocal fishers and conservationists. Many conservationists have adopted the 30-50%

closure range of the science panel as their preferred target.

Fishers are doubtful that a MRWG consensus on the science panel's recommendation will be possible soon. "A 30% closure will not be reached by consensus by the [16 May] meeting," said Guglielmo.

However, say some fishers, consensus on a smaller closure figure — perhaps 20% — appears possible. In fact, fishers, managers, and conservationists have been meeting privately to devise alternative reserve sites, analyzing them with a GIS-based model created by the science and socioeconomic panels. Running the model for 10 minutes generates output to analyze the economic impact of a proposed reserve on particular segments of the fishing industry.

"If everyone believes that marine reserves are as valuable as they think, then they should be willing to accept a smaller closure now with the understanding that we'll reconvene in five years or so to evaluate," said Fletcher. "If the supporters can show that a smaller closure has increased stock abundance and catch per unit effort around the reserves, then it would be a lot easier to get support for the bigger closure."

The willingness of fishers to support any closure in the Channel Islands has been the result of recognizing political realities, said Fletcher. California is starting its own review of the need for resource protection throughout the state's marine waters; presumably, the state could implement its own reserve network in the Channel Islands if it saw fit. "My fishermen know this," said Fletcher. "If they're willing to give up a little now, maybe the future processes will take less."

Lobster fisherman Miller added that although the science panel's percentage approach has been controversial, it shouldn't overshadow the other elements of reserve theory and design that the panel has contributed to the process. These elements — including considerations for connectivity, edge effects, representative habitat, and habitat quality — have been essential to the reserve-siting negotiations among fishers, conservationists, and managers, he said.

"We've utilized all the ecological process information that the science panel gave us," he said. "In spite of the problems we have encountered, we will come up with a good reserve design." 

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Interview: Channel Islands Scientists Discuss their Work

MPA News spoke with two members of the Channel Islands science advisory panel about the roles of science and scientists in the reserve-planning process there. Satie Airame, a postdoctoral researcher with the Channel Islands National Marine Sanctuary, has served as the panel's sanctuary liaison; Robert Warner is a biologist at the University of California, Santa Barbara.

MPA News: Given similar goals for protection of ecosystem biodiversity and fisheries sustainability, would you expect that the same percentage set-aside recommended for the Channel Islands would apply to other marine areas?

Robert Warner: I would. The arguments for percent set-aside were generic, based mostly on fisheries data and models, and not on the specifics of the Channel Islands ecosystem.

Satie Airame: The size of individual reserves depends on many factors, including the purpose of the reserve, and social, administrative, and enforcement constraints. In the Channel Islands, the marine reserves working group and the science advisory panel identified over 100 species of interest with a diversity of life-history strategies and varying levels of dispersal. No single reserve size would be optimal for all species. Given the variety of habitats and species characteristics in the Channel Islands, the science panel recommended at

least one reserve — but not more than four — comprising between 30-50% of the representative habitats in each of three biogeographical regions in the sanctuary. The fraction of habitat required to sustain populations will vary with species.

MPA News: How might a phase-in of the designation of reserve areas over a number of years — as suggested by some fishers — affect the efficacy of the reserves in the Channel Islands?

Warner: There has been major concern in this process for establishing a monitoring and evaluation program that could lead to adaptive changes in reserve design in the future. Since the indications are that small set-asides will have correspondingly small effects, we would be unable to evaluate reserve efficacy until after we achieved full implementation. A slow phase-in may mitigate short-term costs, but it also delays the onset of long-term benefits that are central to the sustainable fisheries goal.

Airame: The impacts of marine reserves depend on the current and historical levels of fishing, life-history characteristics of the fished species, and environmental conditions. Fast-growing animals and plants with low dispersal are likely to increase rapidly in no-take marine reserves located in areas [currently] under high fishing pressure; the same animals and plants may not show the

Channel Islands reserve documents online

The website below serves as a repository for all official documents of the Channel Islands reserve process:

<http://www.cinms.nos.noaa.gov/nmpreserves.html>

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same response if reserves are located in areas [currently] under lower fishing pressure. Phasing in reserves will diminish and delay the benefits of the reserve for conservation and fisheries management, particularly in areas of [currently] high fishing pressure, or under extreme environmental conditions (e.g. El Niño), or for species that are severely depleted (e.g. cowcod and bocaccio).

MPA News: Each scientist was appointed to the panel, in part, because he or she did not have a written track record on marine reserves (particularly in support of reserves), and therefore could be viewed as an objective arbiter. Was this necessary?

Warner: I think it is necessary to avoid mindless advocacy and to support objectivity. A scientific paper reporting the effects of reserve establishment is not, in my opinion, advocacy. It simply reflects expertise, which is valuable.

MPA News: Has the NCEAS consensus statement on marine reserves,* signed by several members of the Panel, affected the panelists' reputation of objectivity?

Warner: To me, the NCEAS consensus statement was a direct answer to claims that there is not enough

existing science to make any statements about reserve function. In the opinion of the scientists that signed, there in fact is enough science: we know enough now to predict the effects of reserve establishment. Thus, to me, the statement is an objective clarification, not an act of advocacy. Reputation is a matter of personal perspective, and it depends on whom you ask.

Airame: Since the Science Panel was formed, members of the panel have become involved in other processes and activities related to marine reserves, including courses for students on marine policy and reserve design and conferences on the design and effectiveness of marine reserves. In general, participation in these outside processes has been viewed as a positive step toward increasing the quality of scientific research and advice in public policy. 

* Editor's note: A statement in support of the wider use of marine reserves to replenish fish stocks was released in February at a meeting of the American Association for the Advancement of Science. The statement was chiefly informed by the work of a research panel at the National Center for Ecological Applications and Synthesis (NCEAS), at the University of California, Santa Barbara (MPA News 2:8).

MPA Practitioners Face Challenges in Accessing Science

The heightened interest in MPAs among resource managers has spurred a wave of related scientific research and a growing library of academic articles and reports. But how much of this scientific discovery is reaching MPA practitioners — the people who need this information to plan and manage their MPAs effectively? MPA News asked two practitioners about the availability of scientific information and explored what others are doing to help translate science into action.

Viet Nam: Available science is inadequate

Many obstacles can exist on the route between MPA science and MPA practice, and Nick Cox has experienced several of them first-hand. A British volunteer for Voluntary Services Overseas, or VSO (a UK-based international development charity), Cox advises the director of Viet Nam's coastal Con Dao National Park on management issues. Marine conservation is still a very new concept in Viet Nam, he said, and gathering the information necessary to manage MPAs is difficult.

"Out of more than 100 protected areas [in Viet Nam], only two have officially recognized marine components with protected status," said Cox. "As one might expect, information sharing and networking are pretty much non-existent."

International organizations, including the United Nations Development Programme and the Australian Institute for Marine Science, have organized training courses for managers in the region. Nonetheless, Cox says Viet Nam's overall level of marine conservation training is poor. "The [Vietnamese] government does not have the funds or experience to offer full-time education courses in marine conservation, and so the education system continues to churn out an excess of foresters," he said.

Even something as mundane as language can present a major barrier to science dissemination. "Other than the fact that scientific marine research with the national park is increasing and there is a growing amount of research being undertaken in the country as a whole, generally the amount of scientific information available — particularly in Vietnamese — is grossly inadequate," said Cox. Notably, most major international journals that regularly publish MPA-related research are available only in English.

Even for English-speaking practitioners, it can be difficult to stay informed. Money is a factor: the cost of subscribing to the relevant journals is usually prohibitive to anyone but universities and well-funded agencies. In Viet Nam, said Cox, the internet currently offers the best hope for managers needing information, though he

still finds it lacking. "We have tried to find a definitive website where we can access up-to-date information, or a good e-mail listserv, but to no avail," he said.

Australia: Lack of socioeconomic data

Grahame Byron manages Jervis Bay Marine Park, a 220-sq. km MPA along the coast of New South Wales, Australia. Unlike Cox in Viet Nam, Byron is reasonably satisfied with the biological and geophysical data available to him. Much of this may relate to where he works: Australia has been a global leader in marine protected areas for decades, establishing some of the world's largest MPAs and generating long-term marine biological research.

Science is more than studying the natural world, however. It also includes sociology, economics, and other social sciences, and Byron says it is in these disciplines that information is still lacking for the MPA manager. Locally for his park and around the world, he says, there is a shortage of socioeconomic data necessary for MPA practitioners to do their job effectively.

"The role of managing a park comes down to managing people, and while generally most people are concerned about the natural environment, they still have a strong commitment to their personal situation," said Byron. "We need to be able to gain information about social and economic issues. Our community support quite often depends upon our ability to maintain social harmony and economic viability."

Byron has conducted MPA training courses for managers in Australia and Asia, and observes that most managers confront similar issues, despite dissimilar environments. He adds, however, that although many managers may believe they hold a broad perspective on MPA management, they in fact work mostly in exile in their parks, due either to geographic or resource constraints. He'd prefer that there be more networking of managers to share information and data.

"I would like to see mechanisms introduced to bring these managers together, either physically or through technology," he said. Like Cox, Byron recommends the establishment of an internet-based discussion network on MPAs. For a more formal source of scientific information, Byron would like there to be a high-quality journal of marine protected area management to encourage development of management-support mechanisms and further the science of MPA management.

Although such mechanisms are necessary, said Byron, they will encounter their own obstacles. Managers in many locations already have full schedules and lack the time and resources needed to report on their management. Also, he added, managers in developing countries often lack confidence in their techniques, and are therefore sometimes reluctant to provide detailed information to others.

Getting science to practitioners

Several experts and organizations around the world are working to improve the dissemination of MPA science. Here are two efforts:

Sharing regional information: In the Caribbean Sea, fisheries scientists and managers have teamed to share information of regional interest through the Gulf and Caribbean Fisheries Institute (GCFI). Founded in 1947, GCFI holds an annual meeting devoted to technical presentations and workshops on Caribbean marine resource issues. As an independent not-for-profit corporation, GCFI generates its support through member contributions and subscriptions to the conference proceedings, distributed to more than 80 countries.

The institute began holding special workshops on MPAs four years ago, says Leroy Creswell, executive secretary of GCFI. "With MPAs, most of what we talk about is related to fisheries biology, such as spawning aggregations, larval dispersion, and migration into and out of protected areas," said Creswell. "But GCFI is every bit as manager-oriented as science-oriented. In the islands, practitioners often wear both hats." The GCFI website is <http://www.gcfi.org>.

Bridging the gap: Kathy Kohm is dedicated to bridging what she considers a gap between conservation science and practice. As editor of *Conservation Biology in Practice* (CBIP), a new quarterly publication of the US-based Society for Conservation Biology, Kohm wants to serve conservation practitioners and policy makers who are short on time but long on information needs. She describes CBIP as a mix between a magazine and journal.

"Scientists and practitioners speak wholly different languages, with entirely different jargon," said Kohm. "We can't bridge the gap through grand scientific theories, but we can do it by telling good stories, such as through case studies." CBIP features such case studies, along with reviews of tools, notes on resources, and other information. The next issue of CBIP will cover the topic of marine reserve networks. Individual subscriptions range from \$US 30-40. The CBIP website is <http://cbinpractice.com/CBIP>. 

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Workshop on MPA Science and Management

There will be an international workshop on the role of science in the management of marine protected areas on 14-16 July 2001 in Cleveland, Ohio, USA. The workshop will examine how science contributes to the effective management of various types of MPA, and is designed for MPA and coastal-management practitioners to share their experience and knowledge.

Some limited financial support is available for attendees from developing nations to cover the workshop registration fee. The workshop will be co-sponsored by the US National Oceanic and Atmospheric Administration (NOAA), UNESCO, and other organizations.

For more information or to register, visit the workshop website: <http://www.csc.noaa.gov/cz2001/workshops.html>.

The State of MPA Science: What Have We Learned Lately?

In October 1999, MPA News surveyed a dozen MPA experts from around the world on what scientific question intrigued them most (MPA News 1:2). Reflecting the relative newness of MPA science, respondents viewed some of the most basic questions — such as whether no-take areas increase stock biomass, both within and outside their borders — as unanswered.

Since then, several academic papers, reports, and consensus statements have cited “compelling” scientific evidence for marine reserves’ use as a central tool in fisheries management. A committee of the US National Research Council has argued in favor of the expanded use of marine reserves for protecting and rebuilding depleted fish stocks (see note, left). A separate group of 160 marine-science academics voiced a similar opinion (MPA 2:8).

This month, MPA News again surveyed scientists, this time to see what recent research has done the most to improve our understanding of the science of MPAs. We asked them a single question:

What has been the most noteworthy contribution to the science of marine protected areas in the past three years, and why?

Below are three responses (more responses will appear in next month’s MPA News):

Austin Bowden-Kerby, Scientific Director, Coral Gardens Initiative, Fdn. for the Peoples of the South Pacific/Counterpart International, Suva, Fiji

“The most noteworthy contribution in recent years has been a major advance in community-based processes for the establishment of MPAs in coral reef environments (led in part by the Biodiversity Conservation Network project and World Resources Institute and evidenced by increased funding for MPAs from private foundations like Packard and MacArthur, etc.).

“It is noteworthy because roughly some 70+% of coral reefs on the planet are owned or controlled in part by rural fishing communities — ‘customary fishing rights owners’ — and these communities and their fishing activities are a major force of destruction. Therefore they MUST be involved. This involvement can only happen when scientists and managers respect the knowledge of the fishers, encourage local and new knowledge to express itself, and facilitate involvement in a participatory process, leading to the development of community-based resource management plans and MPAs for restoring local resources. The process is in itself a big step toward any long-lasting solution involving MPAs in areas with customary fishing rights owners — nay, it is the very foundation itself.”

Rod Fujita, Marine Ecologist, Environmental Defense, Oakland, CA, USA

“Ben Halpern’s survey of scientific research on marine reserves (Halpern, B. ‘The impact of marine reserves: do reserves work and does reserve size matter?’ in press, *Ecological Applications*) is having an especially important impact on policymakers, because it summarizes a lot of empirical work on marine reserves and confirms the scientific consensus on marine reserves in quantitative terms as a result of a detailed analysis.

“The work of Swearer, Warner, and others on larval transport and dispersion has also been particularly instructive because it challenges the conventional wisdom that marine reserves have to be quite large to be sustainable.”

[Editor’s note: The abstract of Halpern’s paper is available online at <http://depts.washington.edu/mpanews/halpern.html>]

Fabian Pina Amargss, Marine Biologist, Centro de Investigaciones de Ecosistemas Costeros (CIEC), Cayo Coco, Morón, Cuba

“The most noteworthy contribution to the science of marine protected areas in the past three years has been the technical report *Marine Protected Areas and the Management of Coral Reef Fisheries* prepared by J.L. Munro from ICLARM Caribbean/Eastern Pacific Office, Suite 158, Inland Messenger Service, Road Town, Tortola, British Virgin Islands and executed in collaboration with the Centre for Marine Sciences, University of the West Indies, Jamaica with funding provided by the Inter-American Development Bank. This report is remarkably important because it provides this science with new knowledge for the management of coral reef fish such as:

- Heavily exploited fish stocks have drastically reduced settlement and recruitment rates when compared with the moderately exploited fish stocks.
- Some species remain resident in the reserve for extended periods; other species move out of the reserve with increasing size and few move substantial distances.
- Estimates of growth parameters were obtained for 15 species of reef fish. Most of these parameters were previously unknown.
- Marine fisheries reserves delay recruitment to the fishery and reduce growth overfishing by increasing the average size of the catch.

“This report also suggests the creation of reserves which encompass all depths, and that reserves should ideally cover 10 km of coastline.”

National Research Council book now available

The book *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems* has just become available for purchase. As reported earlier in MPA News (MPA 2:5), the book is the product of a committee of the US National Research Council; the committee examined the potential role of marine reserves in protecting and rebuilding depleted fish stocks. To order: National Academy Press, 2101 Constitution Avenue, NW, Lockbox 285, Washington, DC 20055, USA. Tel: +1 800 624 6242 (US) or +1 202 334 3313 (outside US); Web: www.nap.edu. The listed price of the book is US \$42.95 (US orders) or \$51.75 (international orders), although discounted prices are available for online orders.