

Using Marine Reserves to Protect Highly Migratory Species: Scientists Discuss Potential Strategies, Including Mobile MPAs

One commonly held belief on no-take marine reserves is that although they can be effective in protecting relatively stationary organisms, they are ineffective for highly mobile ones. Oceanic species — including tunas, billfishes, sea turtles, cetaceans, and sea birds — often range over thousands of kilometers in their lifetimes, crossing into and out of protected areas along their seasonal migrations. When outside of the protected areas, they are exposed to fishing impacts, either as the targeted species or as bycatch.

However, there are ways that marine reserves could, theoretically, be effective in protecting such species. Reserves could be made very large, for example, to encompass these species' movements throughout their entire lives. Alternatively, no-take zones could be placed around the most critical habitats for these species, such as feeding and breeding grounds, or migration corridors. The entire spawning stock for eastern Atlantic bluefin tuna, for example, gathers each year to spawn in a small area of the Mediterranean, at which point the species becomes highly vulnerable to overfishing.

Another option is more revolutionary: that is, reserves could have flexible, "dynamic" boundaries that would follow certain highly migratory species throughout their migrations. In other words, wherever that species was at any point in time, it would be protected by a moving no-take zone. Boundaries for these dynamic reserves would be continually adjusted — monthly, weekly, or even daily — based on satellite transmission of various data, such as the location of frontal areas on ocean currents. (These frontal areas have a tendency to concentrate oceanic predators and their prey, and are already targeted by pelagic fishing fleets using satellite imagery.) Management agencies would regularly report the adjusted boundaries of dynamic reserves to fishing vessels at sea. The dynamic reserve concept was described by Elliott Norse in "Protecting the Least-Protected Places on Earth: The Open Oceans", *MPA News* 7:7.

Each of these design options carries substantial challenges, the foremost being that there is no established framework for designating broadly recognized MPAs on the high seas, where many highly migratory species spend much of their lives (see "At World Parks

Congress, Target Is Set for High Seas MPAs", *MPA News* 5:4, and "Recent Developments Toward a System of High-Seas MPAs", *MPA News* 8:1). Setting that roadblock aside for the time being, these MPA options provide possibilities for the conservation of highly migratory species in the future. This month, *MPA News* asked several scientists for their views on MPA options for pelagic resources. Their replies are posted below.

Firm believer in dynamic MPAs: David Hyrenbach

[David Hyrenbach, a biological oceanographer at Duke University in the US, has published on the subject of high-seas MPAs, including dynamic marine reserves. His current research, funded by a 2007 Pew Fellowship in Marine Conservation, is assessing the extent to which distributions of marine birds, mammals, and turtles in the Alborán Sea (Western Mediterranean) are predictable enough to warrant the designation of MPAs.]

"MPAs will not work in every place and every time. We may fail, for example, to find predictable habitat associations for some species. Other species may cue on highly dynamic or ephemeral features, which managers cannot map and enforce effectively in real-time. Thus, MPAs are one of the many tools in the management toolbox, which includes a broad range of diffuse and focused actions. The modification of fishing gears and practices (e.g., use of 'tori' lines or pingers to avoid seabird and cetacean bycatch), and the regulation of human activities to specific regions of the ocean (e.g., shifting a shipping lane to avoid whale strikes or oil spills close to a seabird colony) are other examples of spatially explicit conservation measures.

"I am a firm believer in the use of dynamic MPAs — designed to change their location and size as they track a specific habitat feature associated with species movement or concentration. Resource managers currently have at their disposal the technology to map oceanic habitats (e.g., surface temperature isotherms identifying the position of fronts), to communicate this information to vessels at sea, and to monitor and enforce spatially-explicit management measures in real-time. Moreover, in those instances where the political will exists, the high-tech enforcement of large and remote

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areas has proven feasible — such as with toothfish fisheries enforcement by Australia and France in their respective EEZs in the sub-Antarctic (<http://www.ens-newswire.com/ens/nov2003/2003-11-24-03.asp>).

“Dynamic management measures are already widely used, suggesting that real-time ocean management is, in fact, attainable. Two examples from the US illustrate the use of real-time data on oceanography and species distributions to reduce impacts on protected species. Time-area closures to avoid sea turtle bycatch off southern California are triggered by warm-water conditions in the tropical Pacific Ocean. On a smaller scale, a mandatory ship reporting system is used to avoid ship-strikes of northern right whales off Massachusetts. The use of dynamic MPAs and time-area closures will increase in the future, fueled by the development of predictive habitat models and remote-sensing capabilities.

“Increasingly, real-time habitat models and remote sensing are helping to identify critical bycatch habitats and to monitor fisheries. While dynamic MPAs will require new design concepts (e.g., extensive buffers or real-time monitoring), they will surely become more widely used in the future.

“Nevertheless, MPAs implemented without buy-in from the resource users often end up as ineffective ‘paper parks’. Thus, due to their controversial nature, dynamic MPAs will require vigorous public education and outreach efforts to convey the rationale of their design. Moreover, the formulation of clear and tangible objectives — within the context of a larger marine zoning framework — will be critical to ensure the success of this novel approach to marine conservation.”

to prominent habitat features like reefs, shelf breaks, or seamounts (*MPA News* 5:3). He has shown that protection of these predator hotspots could potentially benefit multiple threatened species.]

“The size of large pelagic reserves to protect highly migratory species would clearly depend on the pattern of habitat use by different species. The analogy would be to migratory birds on land: often only a tiny proportion of their total range has been effectively protected [such as resting sites along their migratory corridor], but this has often been very successful in reversing population declines of these species. Breeding and feeding grounds where the species aggregate and spend much of their time are also important targets for conservation.

“It is important to ask whether the MPA objective is protection of target species (yellowfin tuna or swordfish, for example) or whether it aims to protect vulnerable bycatch species such as sharks or turtles. Our 2003 research showed that hotspots of species diversity (most of them bycatch species) were often not associated with large catch rates of target species. This means that the bycatch species could be protected without displacing a large proportion of the target catch. If the objective is to protect target species, however, other areas may be chosen, and (by definition) more target catch would be displaced. Yet sometimes the two objectives can be matched: for example, time-area closures off Florida to protect juvenile swordfish [designated by the US National Marine Fisheries Service] are also located within a diversity hotspot. Further progress on this question relies on understanding patterns of habitat use for multiple species as well as fishermen.

“Ecologically, the idea of using dynamic MPAs to protect highly migratory species is a good one. The association of highly migratory species with oceanographic features is very well documented. I wonder, however, whether these mobile MPAs would create an enforcement problem and confusion among resource users. A scenario is possible whereby somebody is setting a longline legally in the evening, and in the morning that same line is illegal because the MPA boundary has shifted. Such a scenario is not entirely unlikely since fishing effort often concentrates around MPA boundaries. As an alternative to dynamic MPAs, I would suggest fixed areas that encompass the known variability in the location of those oceanographic features.”

No hope for dynamic reserves as management tool: Alain Fonteneau

[Alain Fonteneau is a tropical tuna fisheries scientist with France's Institute for Research and Development. He has advised regional tuna commissions on the use of temporarily or permanently closed areas as a management tool.]

“Dynamic MPAs are definitely an interesting scientific concept, but I have absolutely no hope of seeing them as

More information on dynamic reserves and/or conservation of pelagic species

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MPAs around diversity hotspots: Boris Worm

[Boris Worm, a biologist at Dalhousie University (Canada), identified in 2003 that large oceanic predator species concentrate in distinct diversity hotspots, often found close

a management tool for offshore pelagic fisheries, even in the remote future. My negative point of view is based on practical and legal reasons.

“On the practical side: offshore tuna fisheries are conducted by hundreds of vessels belonging to dozens of flag states, with multiple sizes of vessels. It would be impossible to handle and to efficiently apply such mobile MPAs — impossible to inform all vessels, very difficult for fishermen to follow these unpredictable forbidden areas, and impossible to enforce these mobile oceanic zones.

“On the legal side: any closed area designated within the international framework of a regional tuna commission must have boundaries dictated by points and lines on a map, with those boundaries designated under national law by each of the member states. The mobile MPAs, with constantly varying boundaries, would never fit in this basic legal framework.

“My recommendation instead would be to choose quite large and well-selected fixed areas. These MPAs would be based around areas of significant biomass, in spawning zones (where predators are highly vulnerable to fisheries), and in hotspot areas of high biodiversity.”


Initially, closures may need to avoid key parts of fishing grounds: Eric Gilman

[Eric Gilman is director of the Fisheries Bycatch Program for the Blue Ocean Institute, a US-based NGO. He has published several papers on bycatch in pelagic fisheries.]

“I am optimistic that a representative system of protected area networks on the high seas will eventually be achieved to help manage interactions between marine capture fisheries and highly migratory, sensitive species groups (e.g., seabirds, sea turtles, and cetaceans).

“High-seas MPAs to protect highly migratory species will require extensive and dynamic boundaries and large buffer zones. Hence, an obstacle to overcome is the development of the scientific basis for designing such MPAs. The state of knowledge is improving to identify topographic and oceanographic features where sensitive species groups tend to be abundant. Marine reserves can contribute to reducing fisheries bycatch of sensitive highly migratory species groups only where the location and time-of-occurrence of hotspots for these species are known and predictable.

“The political reality is that, to get key fishing nations to be a party to high-seas MPA networks, sufficient portions of key productive fishing grounds might need to be left out of international protected status — at least initially. This would allow for gradual introduction of adverse economic and social effects on pelagic marine capture fisheries. It would be better to start with small, modest conservation gains than to lose participation by key fishing nations.

“One consideration in employing high-seas MPAs to manage bycatch is whether regulations will apply to all nations or just to parties that agree to them. If the closures apply only to party States, this could result in increased effort in the area by fleets from non-party States with fewer or no controls to manage bycatch — exacerbating the problem that the MPA was established to address. Measures adopted by regional fisheries management organizations (RFMOs) are binding only upon parties to the Convention that established the RFMO. Illegal, unreported, and unregulated fishing activities will also pose a challenge to the efficacy of high-seas MPAs if resources for surveillance and legally binding measures and resources for enforcement are not in place.” 

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Letter to the Editor

Recreational angling and the Skomer Marine Nature Reserve

Dear MPA News:

I am writing to correct a statement in the essay by Leon Roskilly (“Aligning the Interests of Anglers and Conservation Groups on MPAs”) that appeared in the February 2007 *MPA News*.

The proposal by the UK's conservation agency in Wales in 2005 to the South Wales Sea Fisheries Committee (SWSFC) to ban most taking of commercial species in Skomer Marine Nature Reserve was not “scuppered” by anglers, as Roskilly suggests, but rather by the commercial fishing industry. Local anglers were content that the proposal would hardly affect them. In fact, there were only three objections to the proposal from anglers: two from people unfamiliar with the area and another from an individual who misunderstood the location of the

reserve. (In contrast, 30 objections to the proposal were received from commercial fishermen. The SWSFC rejected the proposal.) The proposal was even cited in *Sea Angler* magazine (February 2005) as “covering waters that do not form a key angling area” along with a mention that local anglers were in regular contact with those making the proposal.

Skomer Marine Nature Reserve is Wales' only statutory marine nature reserve. The site currently has prohibitions on dredging, beam trawling, and the taking of scallops, but any species under the regulatory remit of the SWSFC — finfish, crustaceans, and mollusks — can otherwise be exploited there.

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On the Importance of Educating Park Visitors: An Interview with Phil Dearden

Last month's *MPA News* examined how practitioners are using a variety of approaches to educate MPA stakeholders and build public support for conservation. Among the most powerful educational tools can be the protected area itself. The experience of visiting an MPA and seeing first-hand the benefits of conservation has the potential to deliver a strong, memorable education message — stronger than any brochures or other media could deliver. If management handles this potential poorly, however, visitors can be left with little insight and an indifferent opinion on the MPA's importance.

This month, Phil Dearden of the University of Victoria (Canada) discusses with *MPA News* why visitor education is important and how managers can best achieve it. Dearden is leader of the MPA Working Group for Canada's Ocean Management Research Network, and heads the Marine Protected Areas Research Group at the University of Victoria. He has published extensively on the subjects of marine park planning and ecotourism, including on the need for park managers to engage visitors with conservation messages.

MPA News: Why is it important for protected areas to educate their visitors?

Dearden: There are several reasons:

- Parks are a political entity: they are created by politicians and can be un-created by politicians. Encouraging people to visit parks, exposing them to park values, and explaining the roles that parks play helps build a constituency in favor of parks. This constituency can be a powerful political force in encouraging politicians to create more parks and provide adequate funding for management.
- There are serious environmental challenges facing the world that have been caused by human impacts. Parks represent the antithesis of these impacts. They show us another world, and provide an outdoor classroom that people visit not because they have to, but because they want to. We need to capitalize on this to catalyze the changes people need to make for a more sustainable future, including in their own lives.
- In general, visitors who are educated about park values are much less likely to violate park regulations because they will have greater understanding of the reasons behind them.
- The un-practiced eye of the novice visitor is often a bored eye. As global society becomes increasingly urbanized, we suffer from a deficit of nature: people are no longer exposed to the rhythms of nature nor

understand the complexities that science has revealed. Skilled interpretation re-awakens a sense of wonder and reverence for nature that forms the platform for its preservation in parks.

MPA News: You have spoken elsewhere about the need for managers to create "teachable moments" for park visitors. What is a teachable moment?

Dearden: In general, people enter parks to have an enjoyable experience. Managers should determine how the value of that experience can be improved by skillful interpretation. The idea of the "teachable moment" is to create opportunities in which visitors will welcome educational input that will enhance the value of their visit.

A teachable moment occurs when the interest of visitors is piqued by something they see, hear, touch, or are otherwise curious about. The key to effective park education programs is to seed and take advantage of this natural curiosity. In all too many instances, we try to cram information into visitors when they are not particularly receptive to receiving information — we give them information when we feel they ought to have it (our schedule) rather than when they want it. A common example that I have seen is when, on park entry, a marine biologist decides to show how many names of fish he knows, complete with slides. This might work well with an audience of specialist fish watchers, but for most people it becomes a blur of Latin from which they will remember little.


It is much more effective to select a few species that illustrate different facets of life in the ecosystem and make an interesting story based on these facets. In a coral reef MPA, for example, who would not be entertained by the story of the monogamous, territorial anemone fishes and their symbiotic relationship with the anemone? The story is not only entertaining — which is necessary — but also a vehicle for teaching about co-evolution, ecological complexity, and conservation. The anemone fishes become a window into environmental consciousness, just as do whales, turtles, and many other species.

When the visitor actually experiences these creatures, his curiosity is raised. This is when the information should be delivered. The skilled interpreter hitches her story to such moments as they occur: a breaching whale, a feeding parrotfish, a surfacing shark, a sleeping crocodile. The list is endless, but the essence is the same — a stimulation of visitors' curiosity that the interpreter uses to convey a message. The most important messages revolve around the splendor of nature, the impacts that human activities are having on species and ecosystems, and what the visitor can do to help.

MPA News: What are some common mistakes in managers' efforts to educate park visitors, and how can these be avoided?

Dearden: Teachable moments do not come often, and the emphasis needs to be on quality rather than quantity of information. Don't overload people with details. Managers should identify the three most important messages they would like visitors to receive, and design programs to ensure that these messages are conveyed in an enjoyable way.

MPA News: How would an MPA's visitor education program be different from a program designed to educate its community stakeholders?

Dearden: The two target audiences are quite different and require distinct approaches. The first step in both cases is for management to assess these constituencies' perceptions of the park, then prioritize the messaging for each audience and methods of delivery. However, one common factor that I have often found is the value of face-to-face contacts: that is, having a skilled interpretive force rather than relying upon written materials. It may not be the most cost-effective way over the short term, but over the long term — and in terms of effectiveness of conveying message — nothing beats personal contact for both visitors and local audiences. 

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Notes & News

Error

Due to an editorial error in our February 2007 issue, the feature "Informing stakeholders during a public planning process" misidentified the work affiliation of Tim Allen. He works for the Australian Government in its Natural Resource Management Division.

Report proposes MPA network for Colombia's Caribbean waters

A new report proposes that Colombia designate a network of MPAs around priority areas in its Caribbean waters and include this network in the country's system of National Natural Parks. Available in Spanish, the publication uses the planning software MARXAN to identify the priority areas for conservation, based on ecological criteria. The report is published by INVEMAR (Instituto de Investigaciones Marinas y Costeras) — a research organization that provides guidance to the Colombian Ministry of the Environment on coastal and marine issues — in association with the National Natural Parks authority, national environmental authorities, and two international NGOs (The Nature Conservancy and Environmental Defense). The 12-page *Una Red de Áreas Marinas Protegidas para del Norte del Caribe Continental Colombiano* is available in PDF format at <http://www.invemar.org.co/redcostera1/invemar/docs/CartillaRedAMP.pdf>.

Report proposes priority areas for marine conservation in Fiji

A new report from WWF South Pacific identifies 35 priority conservation areas in the Fiji Islands Marine Ecoregion as identified by a team of scientists, community stakeholders, and representatives of NGOs and government agencies. The priority areas attempt to capture the ecoregion's full range of marine biodiversity and habitats, including more than one-third of the

world's coral species and the third-longest barrier reef system in the world, the Great Sea Reef. "If conserved, [these priority areas] will contribute to the maintenance of integrity of Fiji's marine systems," states the report. The 79-page *Setting Priorities for Marine Conservation in the Fiji Islands Marine Ecoregion* also describes threats to the ecoregion's biodiversity, and is available in PDF format at http://www.wwfpacific.org.fj/publications/fiji/FIME_rpt.pdf.

Newsletter features article on ocean zoning

The February 2007 edition of the *W2O Observer* newsletter features an article on ocean zoning, including zoning efforts by several MPAs worldwide. The article "Ocean Zoning Is Coming! Ocean Zoning Is Coming! Music to Some Ears, a Fearsome Sound to Others", authored by Tundi Agardy, is available online at <http://thew2o.net/newsletter.html>. The *W2O Observer* is a publication of the World Ocean Observatory, an institution that serves as a clearinghouse for ocean-related information on the Web.

Course available on Caribbean MPAs

Students and practitioners interested in MPAs in the Caribbean region are invited to enroll in an international course to be held at the Academic Unit of Puerto Morelos, Quintana Roo, Mexico, from 1-8 July 2007. The course "Marine Protected Areas for the South Florida, Mexican Caribbean, and Mesoamerican Region" will analyze ecological and socioeconomic aspects of MPA design and management, and will be co-led by researchers from the National University of Mexico and Florida International University. The same institutions will offer a course on tropical marine botany during the preceding week (23-30 June 2007). Fellowships for the MPA course are available for Latin American students. For more information, e-mail Ligia Collado Vides at colladol@fiu.edu.

Grants available to develop software tools for marine EBM

A new fund is offering grants to develop and distribute creative software tools for marine ecosystem-based management (EBM). The Marine Ecosystem-based Management Tool Innovation Fund is now seeking letters of intent, due 30 March 2007. Based at Duke University in the US, the initiative will provide a total of US\$1,000,000 in small grants to a broad range of organizations and developers. For more information or to apply, visit the program website at <http://mgel.env.duke.edu/mebm>.

Update on implementation of California's Marine Life Protection Act

The initiative to plan and designate a network of MPAs along the coast of the US state of California has entered its second phase, following the announcement in February 2007 of a task force to oversee planning for the state's north central coast.

The initiative's first phase, which addressed the central coast, resulted in a proposal last August to designate 29 MPAs, covering 528 km² (*MPA News* 8:3). Under that proposal, nearly half of the total MPA area on the central coast (46%) would be no-take; the remainder would allow limited recreational or commercial fishing. The California Fish and Game Commission is scheduled to adopt regulations for the central coast MPAs on 13 April. Those MPAs will be the first product of the state's eight-year process so far to build a system of marine reserves along its entire coast. The California state legislature passed the Marine Life Protection Act (MLPA) in 1999 with a goal of redesigning and strengthening the state's fragmented system of MPAs (*MPA News* 1:3).

One benefit of taking a region-by-region approach to this planning is being able to improve the process for subsequent regions, says John Ugoretz, habitat conservation program manager (marine region) for the California Department of Fish and Game. In fact, several documents describing lessons learned from the first phase are available on the MLPA website (http://www.dfg.ca.gov/mrd/mlpa/lessonslearned_phase1.html). Lessons cover a variety of subjects — from the roles that agencies and scientific advisors should play in the planning process, to gauging how much information on socioeconomic impacts is required for decision-making on MPA network design. "Future regions will certainly benefit from the information developed during the first regional process," says Ugoretz.

Public comments on the MLPA process in general or the north central coast planning phase in particular may be submitted via the Web, at <http://www.dfg.ca.gov/mrd/mlpa/publiccomments.html>.

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**As ocean warms, will Great Barrier Reef migrate southward?
(And if so, should the Great Barrier Reef Marine Park follow it?)**

In discussions on the effects of climate change on coral reefs, the talk often turns to Australia's Great Barrier Reef (GBR), the world's largest barrier reef system. Some high-profile reports have forecast that, due to coral bleaching caused by climate change, the GBR could be severely threatened in coming decades. Most recently, a draft report by the Intergovernmental Panel on Climate Change — leaked to the media in January 2007 — said the GBR would become "functionally extinct" by 2050. (The leaked report was co-authored by Ove Hoegh-Guldberg at the University of Queensland, who has written other, similarly bleak forecasts concerning the GBR and climate change [see *MPA News* 6:8]).


Not all scientists agree with such forecasts for the GBR. Some people, in fact, have suggested that the GBR ecosystem might migrate southward along the coast of Australia, away from the warming waters. If such were the case, this could theoretically raise issues for the Great Barrier Reef Marine Park. If its habitats moved outside the current park boundaries, should the boundaries be moved in pursuit?

For insights on how the Great Barrier Reef Marine Park Authority (GBRMPA) views these scenarios, *MPA News* asked Johanna Johnson, project manager of the Climate Change Response Program for GBRMPA.

MPA News: Some scientists have forecast that, due to climate change, the Great Barrier Reef could be largely dead within the next few decades. Other people have suggested that the GBR will migrate southward as a result of climate change. Which of these scenarios do you expect is more likely?

Johanna Johnson: Impacts from climate change on the Great Barrier Reef, such as coral bleaching, are causing a decline in reef quality. Therefore the reef is likely to be very different in the next few decades, but not dead. This change will have implications for ecosystem function, how people perceive the reef, and the industries and communities that depend on it.

It is unlikely that reefs in general will migrate southward, as there is a decrease in shallow-water areas and an increase in siliceous sediments further from the equator, creating conditions that are less suitable for reef development. Although changes in climate may result in more suitable temperatures for coral growth away from the tropics, higher latitude marine environments tend to have substrata that are much less suited to development of carbonate reef structures. This means there is limited potential for a significant increase in reef development at higher latitudes. (Furthermore, the carbonate structures that provide the physical foundations for the Great Barrier Reef ecosystem have taken thousands of years to build. While some species may shift their distribution southward, it is unlikely that there would be any observable migration of GBR bioregions over human timeframes.)

The Great Barrier Reef Marine Park Authority expects its bioregions — reef and non-reef — to be increasingly challenged by climate-related stressors. The result will be a tendency for community dynamics to be increasingly dominated by recovery processes and an associated decrease in ecosystem quality, rather than to shift location. For these reasons, the GBRMPA is focusing its efforts on restoring and maintaining the ability of the ecosystem to cope with change — its resilience — rather than considering boundary changes. 

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