

ECOSYSTEM MANAGEMENT

## Science Meets Politics Off California's Coast

Protecting marine resources involves a mix of cutting-edge science and political compromise, as California officials have learned

Just offshore from San Diego, California, the largest kelp forest on the West Coast shelters rockfish, sculpin, and many other species. Anglers and sea urchin divers have plied those waters for decades, but not for much longer. The Department of Fish and Game is drafting regulations that would put 18 square kilometers off-limits to any fishing or harvesting. As a result, fish, lobsters, and urchins should start getting larger and more abundant, says Edward Parnell, a marine ecologist with Scripps Institution of Oceanography in San Diego. “They’re going to fulfill their more historical ecological role,” he predicts.

The reserve is just one of 48 marine protected areas (MPAs) designated by a new plan, approved in December, that would safeguard 15% of the state waters off Southern California. Under an ambitious \$38 million program that began in 2004, the state has already protected an even larger fraction of the Central Coast. Next up is the far northern reach of the coast. When the process is complete, California will have set aside more of its waters as no-take reserves than any other state, and perhaps as much as any country save Australia. “We’ve created an historic advance in marine conservation,” says Gregory Helms of the advocacy group Ocean Conservancy in Santa Barbara, California. Other countries are beginning to emulate the approach.

But as the California experiment has shown, it’s not easy. The process was authorized by a 1999 state law, the Marine Life Protection Act (MLPA), that called for a network

of protected areas to rebuild and protect marine ecosystems. From the outset, scientists were heavily involved in figuring out the most effective locations for MPAs. After their initial efforts met with heated opposition, it became clear that the needs of the fishers had to be accommodated, too. So a political dance ensued and compromises were struck—especially in Southern California, where controversy has been most intense. The recently approved plan there is “not predicated on making the best network but on making the best possible bargain,” says Joel Greenberg of the Recreational Fishing Alliance.

Not surprisingly, fishers are still worried about the economic impacts, and conservationists have been upset about the failure to protect the very best habitat in Southern California. But the disagreement among these warring camps has been eased by a new bioeconomic computer model for designing MPAs in a way that is most likely to maximize biological benefits while minimizing economic pain. It should be a useful tool, its creators say, for other nations that are setting out to protect their coastal waters.

### Networking

During the 1980s, California’s waters were generating worrisome headlines. Populations of rockfish and other fisheries were crashing, raising larger concerns about the condition of marine ecosystems. The state already had more than 100 MPAs before the passage of MLPA, but they were not carefully planned, says Satie Airamé of the MLPA Initiative, the public-private partner-

**Battleground.** Productive kelp forests are prized by ecologists, fishers, and others.

ship that is running the process. The new law called for rigorous science to design MPAs that would function as a network to conserve marine life more effectively.

The first attempt to implement the act failed miserably. In 2001, the Department of Fish and Game asked a team of eight scientists to create a draft map of proposed MPAs. When it was released for public comment, communities near the proposed reserves howled. “If you showed up wearing a tie or looking like a scientist, guys would throw shrimp at you,” recalls Christopher Weible, a public policy expert at the University of Colorado, Denver, who says it can take a decade to develop trust and work out details in designing an MPA. By the end of the year, the plan was shelved. A second attempt the next year included stakeholders but ran out of money.

The process didn’t really get going until newly elected governor Arnold Schwarzenegger added his considerable political momentum to marine conservation. Five foundations pledged \$20 million to boost the state’s funding, and the MLPA Initiative resumed work. The staff, drawn from various state agencies and nonprofit groups, divided the coast into four regions plus San Francisco Bay—a good move to reduce complexity, Weible says. The idea was to start in the Central Coast, learn from the experience, and then proceed to the next region.

First, however, a team of scientists created guidelines for the size and spacing of the protected areas. In a conceptual change from past efforts, the guidelines aimed to ensure that larvae could float from one MPA to another, based on estimates of how far they can travel. This would allow the populations in individual reserves to boost each other, creating a network of protected areas more resilient than if they were isolated. Another goal was to make sure that each kind of habitat was protected by more than one MPA. To meet these goals, 18% to 20% of state waters would need to be protected, says marine ecologist Steven Gaines of the University of California, Santa Barbara (UCSB), who helped craft the guidelines.

Next, the stakeholders got their turn. Anyone with an interest in coastal waters could participate: commercial and recreational fishing groups, for example, as well as marina operators and preservationists. Beginning in 2005, more than 50 representatives were charged to propose a set of networks in the Central Coast region. The proposals were

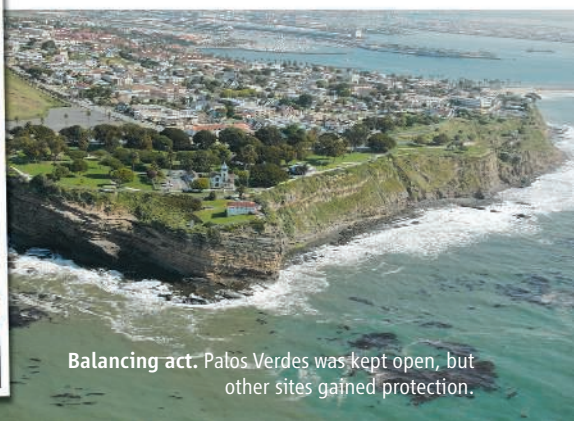
reviewed by the science advisory team to check whether the networks met the guidelines for size, spacing, and habitat coverage. Then a Blue Ribbon Task Force, appointed by Schwarzenegger, forwarded the plans, along with a preferred alternative, to state officials for a final decision.

During the meetings on the Central Coast reserves, fishing groups had complained that the scientific advisory team didn't have an adequate number of fisheries scientists. So for the next section of coast, to the north, the MLPA Initiative recruited Ray Hilborn, a fisheries scientist at the University of Washington, Seattle, and others. Once involved, Hilborn expressed several concerns. Most fundamentally, he argued that there is no need to locate MPAs so that larvae can travel from one MPA to another, because plenty of larvae exist in between them. By establishing what he views as arbitrary guidelines based on larvae dispersal, the science advisory team had "manipulated the system to get a certain amount of state [waters] put in reserves," he claims. Other members of the science advisory team disagreed, and the guidelines remained.

To help move past the debate, Christopher Costello, a UCSB economist on the science advisory team, and others wanted to focus on evaluating proposed MPA networks better. Costello, Hilborn, and Carl Walters of the University of British Columbia, Vancouver, in Canada developed a bioeconomic model that incorporates the habitat, ocean currents, and the biology of species, as well as fishing patterns. Another group, from UC Davis and headed by fisheries scientist Louis Botsford, adapted another model for the same purpose.

Rather than just pointing to guidelines, the models allowed the science advisory team to give much more explicit advice to stakeholders about the relative impact on conservation and fishing of placing MPAs in various locations. They could also project the costs and benefits of making a particular reserve bigger or smaller. The model was "worth its weight in gold," says Helms of the Ocean Conservancy.

On the South Coast, the model helped negotiate the toughest point of contention: the Palos Verdes Peninsula just west of Long Beach. With the best rocky habitat in much of Southern California, the site was a top priority



Balancing act. Palos Verdes was kept open, but other sites gained protection.

for preservationists. But creating a no-take zone there would cause big economic losses for charter fishing operations and restrict access by other users. When the political appointees on the Blue Ribbon Task Force decided not to protect the site, the model pointed to a second-best approach to conservation, emphasizing the need for MPAs around Malibu and Catalina Island, which had similar habitats. "The clearer you can be about what is at risk and why you're opting for one

dock," he says, and ignores the larger effects on the community, such as businesses that cater to fishers.

Preliminary research raises the possibility of a better outcome. The bioeconomic model suggests that MPAs, if designed properly and coordinated with fishery management, could boost fishery profits. Costello and colleagues took data from the South Coast region and compared the outcome of fishery management with and without MPAs. The value of

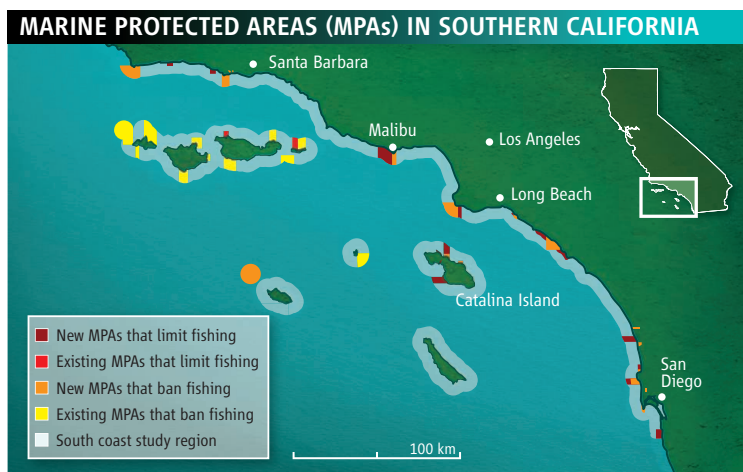
the fishery doubled for kelp rockfish, for example, when MPAs were located in places that produce a lot of larvae, they reported online 22 February in the *Proceedings of the National Academy of Sciences*. Hilborn and others are skeptical. "I think they're a long way from convincing people in the fishery management community," Hilborn says.

Another unknown is whether the network of connected MPAs will perform better than a set of isolated protected areas would have. Marine ecologist Mark Carr of UC Santa Cruz says the only way to answer that ques-

tion will be to use computer simulations, and it could take 10 years to get enough data. To help figure all this out, the California Ocean Science Trust, a nonprofit foundation, has pledged \$16 million for monitoring the MPAs.

Even before the California process is done and its effects tallied, other countries are taking note. "It's been watched globally," says Jason Hall-Spencer of the University of Plymouth in the United Kingdom, a member of a scientific advisory panel now drafting ecological guidelines for a set of U.K. protected areas. "We're adopting many of the ideas."

—ERIK STOKSTAD



**Connect the dots.** Dozens of new reserves were located to boost the dispersal of organisms while attempting to minimize economic pain to human users.

solution over another, the more acceptable the decision is," says Margaret Caldwell of Stanford University Law School in Palo Alto, California, a member of the task force.

### Win-win?

The model hasn't eliminated controversy by a long stretch. Bob Bertelli, president of the California Sea Urchin Commission, thinks that the Costello model—as well as a social science survey commissioned by the MLPA Initiative—underestimates the economic impact of designating MPAs, noting that they only estimate the lost value from smaller catches. "All the information stops right at the