

# Alolkooy

**Marine Reserves in CINMS**



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## *Inside*

*Frequently Asked  
Questions*

*The Marine Reserves  
Process*

*Marine Reserves  
Legislation: A Review*

*Social Economics  
of Marine Reserves*

*Integrating Science  
and Policy*

*Designing Reserves  
for Conservation  
and Fisheries  
Management*

*GIS Spatial  
Technology*

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**CINMS' rich underwater ecosystem would be protected by marine reserves.**

**Cover photo:**  
An underwater photographer in CINMS explores a kelp forest.  
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## From the Bridge

# Marine Reserves

By Matthew Pickett, Sanctuary Manager

Over the past few years, the concept of marine reserves has gained attention as a viable tool in marine resource management. This issue of *Alolkoy* is focused on the benefits and challenges of marine reserves, and how the Channel Islands National Marine Sanctuary (CINMS) is moving towards effective implementation of marine reserves.

The Sanctuary, in partnership with the State of California, is engaged in a community-based process that has the potential to lead the nation in a new direction for marine resource protection. A recent consensus statement presented by over 160 marine scientists has added even more validation to the Sanctuary and State's efforts. Worldwide scientific studies support utilization of marine reserves as a method for protecting the ecosystem and sustaining marine economies.

CINMS brings unprecedented public involvement, the latest science and technological tools, strong economic analysis and community knowledge to the local process. This will be a year of important decisions. The establishment of marine reserves within CINMS will be a triumph for all who enjoy and utilize our offshore waters. The hard work necessary to establish marine reserves is sometimes challenging, but invaluable and of lasting benefit.

## Editor's Watch

# Concept to Reality

By Cynthia Anderson, Alolkoy Editor

The concept of marine reserves in CINMS has captured considerable media attention. Never before have marine reserves been proposed for such a heavily populated coastal region of the United States.

The marine reserves process has brought together scientists, policy-makers, fishers and many others in a thorough exploration of the threats to the local marine environment and the viability of "no take" zones as a solution. This issue of the *Alolkoy* contains an overview of the process.

You'll find the Problem Statement adopted by MRWG on page 3, along with frequently asked questions. Patricia Wolf and Matthew Pickett detail the marine reserves process, while Sean Hastings provides an overview of existing state and federal legislation.

Bob Leeworthy and Peter Wiley cover the social economics of marine reserves. Matthew Cahn comments on the integration of science and policy. Satie Airame reviews the benefits of marine reserves, effective reserve size and the methodology of locating marine reserves.

Ben Waltenberger explains how a new GIS tool aids in the marine reserves process. See "Things to Do" for an update on upcoming MRWG meetings; the public is welcome.

# Marine Reserves: Frequently Asked Questions

## What are marine reserves?

Marine reserves, or “no take” zones, are a specific type of Marine Protected Area (MPA) that prohibits all extraction or harvesting of marine resources. Marine reserves are not intended to limit access or anchoring.

## Why are marine reserves being considered?

The answer to this question is found in the official Problem Statement adopted by consensus of the Marine Reserves Working Group (MRWG), the entity charged by the Sanctuary Advisory Council with developing a preliminary recommendation for marine reserves (see page 4):

“The urbanization of Southern California has significantly increased the number of people visiting the coastal zone and using its resources. This has increased human demands on the ocean, including commercial and recreational fishing, as well as wildlife viewing and other activities. A burgeoning coastal population has also greatly increased the use of our coastal waters as receiving areas for human, industrial and agricultural wastes. In addition, new technologies have increased the efficiency, effectiveness and yield of sport and commercial fisheries. Concurrently, there have been wide-scale natural phenomena such as El Niño weather patterns, oceanographic regime shifts and dramatic fluctuations in pin-niped populations.

“In recognizing the scarcity of many marine organisms relative to past abundance, any of the above factors could play a role. Everyone concerned desires to better understand the effects of the individual factors and their interactions, to reverse or stop trends of resource decline and to restore the integrity and resilience of impaired ecosystems.

“To protect, maintain, restore and enhance living marine resources, it is necessary to develop new management strat-

egies that encompass an ecosystem perspective and promote collaboration between competing interests. One strategy is to develop reserves where all harvest is prohibited. Reserves provide a precautionary measure against the possible impacts of an expanding human population and management uncertainties, offer education and research opportunities and provide reference areas to measure non-harvesting impacts.”

## Which species will marine reserves try to protect?

While marine reserves offer protection to the whole ecosystem, MRWG is also interested in protecting specific species. MRWG generated a list of over 100 species in CINMS to consider in designing reserves utilizing the following criteria: species that are economically or recreationally important; species that are candidates for, or listed as, endangered; species that have exhibited long-term or

rapid declines in harvest; habitat-forming and dominant species; and species that are sensitive and/or important as prey. The species list includes marine plants, such as kelp; invertebrates, such as urchins; over 80 species of fish; marine birds, such as brown pelicans; and marine mammals, such as harbor seals.

## Where are marine reserves being considered?

Marine reserves are being considered within the boundaries of CINMS, a federally designated MPA that encompasses 1,252 square nautical miles, from the shoreline out six nautical miles around San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara islands. Sanctuary waters overlap state waters (shoreline out three miles) and Channel Islands National Park (shoreline out one mile). Reserves are only being considered within the current boundaries of CINMS.

## Marine Reserves Working Group Members

For additional information visit the Sanctuary website,  
<http://cinms.nos.noaa.gov/nmpreserves.html>.

Patricia Wolf, Co-Chair  
Greg Helms  
Dr. Michael McGinnis  
Steve Roberson  
Shawn Kelly  
Chris Miller  
Neil Guglielmo  
Dale Glanz  
Tom Raftican  
Marla Daily  
Dr. Craig Fusaro  
Gary Davis  
Mark Helvey  
Deborah McArdle  
Locky Brown  
Robert Fletcher  
Matt Pickett, Co-Chair

California Department of Fish and Game  
Center for Marine Conservation  
UCSB, Ocean Coastal Policy Center  
Channel Islands Marine Resource Restoration  
Surfrider Foundation, Ventura Chapter  
Lobster Trappers Association  
Squid Seiner and Processor  
ISP Alginates (Kelp Harvesting Company)  
United Anglers  
Sanctuary Advisory Council  
Sanctuary Advisory Council  
National Park Service  
National Marine Fisheries Service  
California Sea Grant  
Diving Interests  
Sportfishing Association of California  
Sanctuary Manager

# The Marine Reserves Process

By Patricia Wolf and Matt Pickett

Marine reserves have been at the forefront of state and local politics for many years. A specific proposal for new reserves in the Channel Islands was made to the California Fish and Game Commission (FGC) in 1999 by a local conservation group of recreational fishermen. At the request of the FGC, and with the support of diverse interest groups, the Department of Fish and Game (DFG) and the Channel Islands National Marine Sanctuary (CINMS) developed a joint federal and state process to consider marine reserves.

At the core of this process is a panel of representatives formed by the Sanctuary Advisory Council (SAC). The panel is known as the Marine Reserves Working Group (MRWG) and represents many interest groups, experts and community members not represented on the SAC (See MRWG membership, page 3).

Two advisory panels support MRWG by providing additional expertise: a Science Advisory Panel and Socio-economic Advisory Panel (see related articles). These panels give advice and information to MRWG and analyze MRWG's proposals.



©CINMS  
A meeting of the Marine Reserves Working Group (MRWG).

MRWG has already defined a problem statement, mission statement, and goals and objectives to guide the discussions. The mission statement gives the panel a clear direction: *Using the best ecological, socio-economic, and other available information, MRWG will collaborate to seek agreement on a recommendation to the Sanctuary Advisory Council regarding the potential establishment of marine reserves within the Channel Islands National Marine Sanctuary area.*

The MRWG recommendation will be consensus-based. The consensus approach requires that the legitimate concerns of all members be satisfactorily addressed before the group as a whole can reach agreement on a recommendation. The SAC will evaluate and forward this recommendation as formal advice to the Sanctuary Manager, who will then provide the recommendation to the FGC.

The power in the marine reserves process lies in the partnership among the agencies and the community. Through collective learning and communication, each panel member has become familiar not only with the problems at hand, but with the views and needs of other constituencies as well.

This multidisciplinary approach should lead to a recommendation that is more acceptable to all concerned parties. MRWG is using the best available science, socio-economics and local knowledge. The group forms a bridge linking ecology, economics and policy with the concerns of the marine community.

Because the recommendation will not be a majority vote and any member can stop the group from moving forward, everyone's needs must be met. This does not mean that a member can simply "veto" the recommendation. Concerns must be voiced along with constructive ways to meet them, without compromising the concerns of others.

The final recommendation will be stronger because it will represent the wide array of views and needs of the community-at-large. As MRWG nears the final steps in the negotiation, it is essential that we hear from all interested parties. You can track our progress and get involved by visiting the CINMS website: <http://cinms.nos.noaa.gov/nmpreserves.html>.

*Patricia Wolf is Regional Manager of the Marine Region for the California Department of Fish and Game, the DFG Representative on the Sanctuary Advisory Council and Co-Chair of the Channel Islands marine reserves process. Matt Pickett, Sanctuary Manager, is also Co-Chair of the process.*

## Goals for Marine Reserves

MRWG is designing marine reserves to achieve and balance the following goals:

**Biodiversity:** To protect representative and unique marine habitats, ecological processes and populations of interest.

**Socio-economics:** To maintain long-term socio-economic viability while minimizing short-term socio-economic losses to all users and dependent parties.

**Sustainable Fisheries:** To achieve sustainable fisheries by integrating marine reserves into fisheries management.

**Natural and Cultural Heritage:** To maintain areas for visitor, spiritual and recreational opportunities which include cultural and ecological features and their associated values.

**Education:** To foster awareness, promote stewardship and encourage responsible use of marine resources.

# Marine Reserves Legislation: A Review

By Sean Hastings

Marine protected areas and marine managed areas (MPAs and MMAs) are used increasingly by state and federal agencies as resource management tools. The purpose of MPAs and MMAs is to protect and/or enhance living marine resources, cultural heritage, water quality and recreational opportunities.

CINMS is an example of a federally designated MPA. When marine reserves are designated here, they will form a specific MPA within the Sanctuary. Taken together, MPAs and MMAs at the state and federal levels form a complex regulatory system. A key question is: how will Channel Islands marine reserves fit into this system?

This article attempts to answer this question by providing a brief outline of key legislation and agency activities at the state and federal levels since 1998.

## State Legislation

### **State Interagency Marine Managed Areas Workgroup, 1998-2000**

The Resources Agency of California established the State Interagency Marine Managed Areas Workgroup to evaluate MMA classifications and recommend improvements. The following agencies were involved: Coastal Commission, Department of Fish and Game (DFG), Department of Parks and Recreation, San Francisco Bay Conservation and Development Commission, State Lands Commission, State Water Resources Control Board and the University of California.

### **Marine Life Management Act (MLMA), 1998**

The MLMA states that fishery management plans will form the primary basis for managing the state's sport and commercial fisheries. By September 2001, the DFG must prepare a status report on state-managed fisheries and a master plan for developing fishery management plans. The act stresses using the best available science and an adaptive approach to decision-making, including collaboration from a wide array of perspectives and ex-

pertise—as does the CINMS marine reserves process.

### **Marine Life Protection Act (MLPA), Assembly Bill 993, 2000**

The MLPA sets goals for a comprehensive MPA program in California's marine waters; establishes criteria for selecting MPA sites, including fully protected marine reserves; requires development by 2002 of a statewide MPA master plan; and creates processes that require a sound scientific basis for the master plan and involvement by interested parties.

### **MMAs Improvement Act, Assembly Bill 2800, 2001**

Based on the work of the State Interagency Work Group, this act establishes a new classification system for MMAs that consolidates over a dozen classifications into six and simplifies terminology. The act incorporates existing MMAs into the new system, without changing existing resource protection, in a manner consistent with the MLPA; eliminates the use of existing classifications by January 2002; and establishes a consistent designation process to be used by all state entities for MMAs.

The six new classifications are: State Marine Reserve, State Marine Park, State Marine Conservation Area, State Marine Cultural Preservation Area, State Marine Recreational Management Area and State Water Quality Protection Area. For more information, see: <http://caselaw.lp.findlaw.com/cacodes/prc/36700-36900.html>

## Federal Legislation

### **President's Executive Order 13158 on Marine Protected Areas, 2000**

President Clinton issued this Executive Order to develop, strengthen and expand a national system of marine protected areas. The order calls on federal agencies with an interest in MPAs to use their authorities to establish and recommend new MPAs, increase protection of existing MPAs and develop/share scientific information.

The order creates a National MPA

Center in Santa Cruz, sponsored by NOAA and the Department of Interior, to provide scientific resources for establishing and managing MPAs. In California's ocean waters, the order particularly affects the activities of national marine sanctuaries, national parks, the Pacific Fisheries Management Council and the U.S. Environmental Protection Agency.

### **Pacific Fisheries Management Council (PFMC), 2000**

The PFMC is one of eight regional fishery management councils established under the Magnuson-Stevens Fishery Conservation and Management Act. The PFMC recently adopted a technical report identifying options for using marine reserves as a management tool for species under its jurisdiction. Currently under way, Phase II of the PFMC reserve process will designate marine reserves for groundfish along the West Coast.

## Bringing It All Together

The Channel Islands marine reserves process is a year ahead of other reserve designation processes under way at the state and federal level. Therefore, it will be crucial to integrate Channel Islands reserves into the larger framework of reserves in California.

CINMS and DFG staff, and local community representatives, participate in several of the state and federal processes listed above to ensure that the Channel Islands marine reserves process and eventual designation are consistent with the MMA Improvement Act, exceed MLPA requirements, satisfy the President's Executive Order and are nested in fisheries management plans required under the MLMA and the PFMC.

Ultimately, the California Fish and Game Commission, PFMC and NOAA will be responsible for integrating CINMS marine reserves into the existing marine resource management system.

*Sean Hastings, CINMS Resource Protection Coordinator, is lead staff for the marine reserves process. The California Resources Agency contributed substantially to this article.*

# Social Economics of Marine Reserves

By Bob Leeworthy and Peter Wiley

Commercial and recreational uses of the Channel Islands National Marine Sanctuary generate \$197.9 million of total income annually and support 5,491 jobs in the region. An effective marine reserve network will provide a sustainable resource base on which this economy can prosper over the long term.

A Socio-economic Advisory Panel was created to research the economic impacts of marine reserves and present a comprehensive analysis to the Marine Reserves Working Group (MRWG). Comprised of nine representatives from regulatory agencies, the research community and the community-at-large, the Socio-economic Advisory Panel mounted a vast data collection effort.

Given the lack of socio-economic data in CINMS when the analysis began two years ago, this analysis is arguably the most comprehensive to date. The panel's analysis focuses on consumptive uses such as private boat fishing/diving and commercial fishing/diving; and non-consumptive uses such as wildlife viewing, non-consumptive diving and kayaking. The analysis will assist in crafting a balanced marine reserve recommendation that maximizes ecological benefits while minimizing socio-economic impacts.

## Recreation Industry

Researching the recreation industry involved collecting data from existing sources such as regional and county economic reports, identifying current activities and exploring patterns of recreational use. To perform a detailed and fine scale analysis, data were compiled at a 1 x 1 nautical mile resolution.

The team created a database of recreation charter/party boat operators for consumptive and non-consumptive activities. The data included geo-referenced data and business-related data of 18 operators.

Distribution of private boat activity was compiled from sources such as the Channel Islands National Park, The Nature Conservancy and yacht clubs/marinas.

## Commercial Fishing Industry

Commercial fishing data were compiled from numerous sources. The California Department of Fish and Game (DFG) divides the ocean into 10 x 10 nautical mile blocks to record catch. Twenty-two DFG blocks encompass CINMS, and information was compiled for 1988-1999 by species caught and by each of the 22 blocks. Individual species, such as shrimp, shark and rockfish, were aggregated into 27 groups.

Information was collected on the distribution of catch at 1 x 1 nautical mile resolution for most of the 27 species groups. Thirteen species groups were mapped at 1 x 1

## Socio-economic Advisory Panel Members

Dr. Vernon R. (Bob) Leeworthy, Chair, NOAA's National Ocean Service, Special Projects Office

Peter C. Wiley, NOAA's National Ocean Service, Special Projects Office

Dr. Cynthia Thomson, NOAA's National Marine Fisheries Service

Dr. James Lima, U.S. Department of Interior, Minerals Management Service

Marija Vojkovich, California Department of Fish and Game

Dr. Charles Kolstad, UC Santa Barbara

Dr. Craig Barilotti, Sea Foam Enterprises, San Diego

Dr. Caroline Pomeroy, UC Santa Cruz

nautical mile resolution and placed in an Arc View geographic information system for analysis. These 13 groups account for 98.5 percent of the ex vessel value in CINMS, and include squid, urchin, spiny lobster and prawns. ("Ex vessel value" indicates the amount of money received by fishermen for their catch.) Nine maps for species groups that account for the other 1.5 percent were developed at 10 x 10 nautical mile resolution.

## Socio-economic Impacts

Economic models were constructed for both the recreation industry and commercial fishing industry to translate the mapped measurements into economic measures. The recreation industry model estimates the spending impacts of recreational users in CINMS. The commercial fishing model estimates the impacts on revenue (ex vessel value) of commercial fishing operations and translates this into total income and employment impacts. Socio-economic profiles of commercial fishermen show who might be impacted by marine reserves.

The socio-economic data and models will assist MRWG in designing boundary alternatives and allow the Socio-economic Advisory Panel to analyze their impacts. The models can estimate the "maximum potential loss" to users displaced from marine reserve areas. With the data distributions and models, and with local information on other factors, a complete socio-economic assessment will be produced for review by decision-makers and the general public.

*Bob Leeworthy is Chief Economist of the National Ocean Service, Special Projects Office and the leader of the Socio-economic Advisory Panel. Peter Wiley is a staff economist of the National Ocean Service, Special Projects Office and the Panel's project lead for the recreation industry.*

# Integrating Science and Policy in Marine Reserves

By Matthew Cahn

CINMS is currently engaged in a fascinating decision-making process regarding the establishment of marine reserves, or no-take zones. As a federal agency, CINMS is required to solicit public input into any regulatory decision it makes. The marine reserves process, however, goes well beyond any required public participation. In fact, CINMS may be ahead of most other federal agencies in giving the public a seat at the table.

The challenge before the agency is significant. On one hand, CINMS must balance competing mandates established by the National Marine Sanctuaries Act in 1972: conservation of marine resources versus protection of public and commercial access to the Sanctuary. On the other hand, the agency takes its partnership with the public seriously.

There is a consensus among marine scientists that a network of marine reserves is a powerful tool for enhancing biodiversity and mitigating damage to marine ecosystems. Yet, marine reserves may seriously impact consumptive users of Sanctuary resources.

To meet this challenge, CINMS has constructed a unique stakeholder process for evaluating the marine reserve question. A stakeholder working group—the Marine Reserves Working Group (MRWG)—and two advisory panels (scientific and socio-economic) were convened to better review science and policy preferences. The Science Advisory Panel reviewed those aspects of the working group's discussion that relied upon science-based information. The Socio-economic Advisory Panel collected economic data and made those data available to MRWG.

The process represents the best ideal of civic science, where stakeholders are integrated into the scientific process of evaluation in areas including: a) framing

the problem in partnership with scientists; b) defining goals and objectives, in consultation with scientists; c) and applying final ecological data to stakeholder reserve recommendations.

Scientists evaluated the best available information on marine reserves, assembled appropriate datasets and analyzed those data using theoretical modeling, case study analysis and computer-based annealing (see page 9).

Many observers have noted that the assumptions of science and policy are fundamentally different. Science is empirical; it assumes a high degree of training and expertise. There is a narrow protocol of acceptable methodologies, and outcomes are empirically justified according to these methodologies. By definition, access is limited.

In contrast, policy is normative, defining what we ought to do. Policy assumes multiple interests and stakeholders. There is no established protocol; instead, multiple methodologies are utilized. Policy outcomes are not empirically justifiable. And, policy access is, at best, unlimited. Stated another way, if science is rational and democracy is non-rational, there is bound to be conflict. It is no surprise, then, that bringing effective science into the policy process has been extremely challenging.

Integrating science into effective resource management has been attempted by federal agencies for many years. NOAA's national marine

sanctuaries have developed an innovative approach that may provide a model across the nation. CINMS is at the forefront of this trend. The CINMS process is not yet complete; however, it is possible to make some preliminary assessments. It is clear that this evolving model is closer to resolving the paradigmatic conflicts that have long kept science and policy at arm's length.

When interest-based stakeholders and scientists are successful at linking their analytic approaches, a truly civic-science based rulemaking process will emerge. Although practical issues may limit its application, the CINMS process is a model of a policy-science partnership.

*Dr. Matthew Cahn is a Professor of Public Policy at California State University Northridge and a Visiting Professor of Public Policy at the Bren School of Environmental Science and Management.*

## Science Advisory Panel Members

Dr. Matthew Cahn, Chair, CSU Northridge

Dr. Mark Carr, UC Santa Cruz

Dr. Ed Dever, Scripps Institute

Dr. Steve Gaines, UC Santa Barbara,

Marine Science Institute

Peter Haaker, California Department of

Fish and Game

Dr. Bruce Kendall, UC Santa Barbara

Dr. Steve Murray, CSU Fullerton

Dr. Daniel Reed, UC Santa Barbara,

Marine Science Institute

Dan Richards, Channel Islands National Park

Dr. Joan Roughgarden, Stanford University

Dr. Steve Schroeter, UC Santa Barbara

Dr. Dave Siegel, UC Santa Barbara, ICES

Dr. Allan Stewart-Oaten, UC Santa Barbara

Dr. Robert Warner, UC Santa Barbara

Dr. Libe Washburn, UC Santa Barbara, ICES

Dr. Russ Vetter, National Marine Fisheries Service

# Designing Marine Reserves for Conservation

By Satie Airame

Marine reserves are important tools for marine conservation and fisheries management, with the potential to protect ecosystems, improve fisheries yields and enhance recreational opportunities. Non-consumptive users, such as recreational divers and photographers, enjoy increased diversity and abundance of animals in and around reserves. Sport fishermen and divers may benefit from spillover of sport fish from reserves into non-reserve areas. Commercial fishermen may benefit from larval export of economically important species from reserves into non-reserve areas. All users benefit from sustainable use of resources over the long term.

There is substantial evidence that protecting areas from fishing leads to rapid increases in abundance, size, biomass and diversity of animals. Halpern (in press) reviewed 76 studies of reserves that were protected from at least one form of fishing. Across all reserves, abundance approximately doubled, biomass increased 2.5 times that in fished areas, average body size increased by approximately one third and the number of species present per sample increased by one third.

Marine scientists and state and federal agencies that manage fisheries have recognized the potential role of marine reserves in conservation and fisheries management. In 2000, the Pacific Fisheries Management Council specified a process to consider marine reserves as part of an integrated scheme to sustain a healthy ecosystem and more effectively manage the West Coast groundfish. In 2001, the National Research Council released an evaluation of marine reserves, identifying reserves as a tool for conservation and fisheries management where conventional approaches to management have failed to sustain fisheries. A

consensus statement strongly favoring marine reserves, signed by 161 top marine scientists from the United States and 10 other countries, was released at the 2001 annual meeting of the American Association of the Advancement of Science.

Agencies and scientists agree that marine reserves should be implemented around the world for long-term fishery and conservation benefits.

## Effective Reserve Size

One of the most important questions in conservation and fisheries management is how large reserves must be to provide specific benefits. Reserve size depends on goals for marine reserves and the level of fishing intensity in a particular region.

For example, Ballantine (1997) recommends a minimum size of 10 percent of representative marine habitats to meet humankind's ethical obligation to protect natural areas. DeMartini (1993) cautions that small reserves (e.g., 10 percent) may protect species with rapid growth, high reproduction and low dispersal, but larger reserves (e.g., 30 percent or more) may be necessary to protect species with slow growth and lower reproduction (such as rockfish). Sladek-Nowlis and Roberts (1997) recommend reserve sizes of 75-80 percent of the geographical distribution of populations to sustain species that suffer from extremely high fishing mortality.

In general, the benefit of a reserve for conservation increases with size. Larger reserves protect more habitats and populations, providing a buffer against losses from environmental fluctuations and other natural factors that may increase death rates or reduce population growth rates.

For fisheries management, the benefit of a reserve does not increase directly with size. The maximum benefit of no-take reserves for fisheries, in terms of sustainability and yield, occurs when the reserve is large enough to export sufficient larvae and adults, and small enough to minimize the initial economic impact to fisheries.

The Science Advisory Panel evaluated the status of fishery resources around the Channel Islands and goals established by the Marine Reserves Working Group for conservation and fisheries management. One of the goals for marine reserves is to protect representative and unique marine habitats. Another goal is to achieve sustainable fisheries by integrating marine reserves into fisheries management.

The Science Advisory Panel determined that setting aside no less than 30 percent, and possibly 50 percent, of CINMS for marine reserves would achieve some measure of protection for both conservation and fisheries goals.



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Marine reserves would help currently depleted populations of canary rockfish (left), and bocaccio (right) to recover.



# and Fisheries Management

## Locating Marine Reserves

CINMS is located in a region of tremendous biological and physical complexity. The Science Advisory Panel divided the study area (CINMS) into three bioregions (the Oregonian Bioregion, the Californian Bioregion and the transition zone between the two) based on species distributions and physical characteristics. Each of the regions exhibits distinct oceanographic patterns that influence species composition.

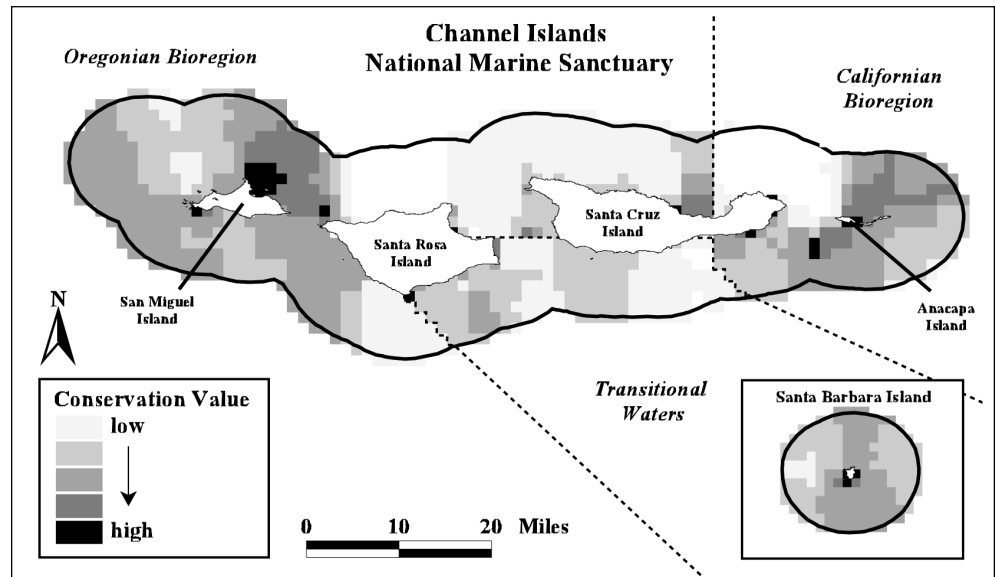
For planning purposes, the regions were subdivided into “planning units” of 1 x 1 minute (approximately 1 x 1 square nautical mile). Each planning unit was assigned a set of values based on habitat and species diversity. For example, scientists described the depth and the percentage cover of soft sediments (mud, sand, gravel) and hard sediments (rock, boulder, bedrock) in each planning unit. Submerged rocky features, such as pinnacles, seamounts and submarine canyons, were located using bathymetric maps, and the percent cover of each feature was estimated in each planning unit.

The areas covered by dominant algae and plant species, such as giant kelp, eelgrass and surfgrass, were identified from aerial photographs and habitat maps of the Channel Islands region. In addition, each planning unit was scored for the presence of bird colonies (16 species) and pinniped haul-outs (5 species).

## Computer Analysis

Conservation priority areas were located using “Sites v. 1.” This computer program was developed to help The Nature Conservancy locate potential reserve areas on land, and the program was modified to help conservation planners evaluate marine environments.

The program randomly generates an initial reserve system that includes the target percentage of each habitat and feature. The program then calculates the conservation value of the reserve system



**Figure 1. Conservation priority areas in the Channel Islands National Marine Sanctuary. Darker colors indicate areas of high conservation value in terms of a variety of habitats and species of interest.**

(based on the goals of the reserve system) and the cost of the reserve system (in this study, based on the boundary length of each planning unit).

After evaluating the initial reserve system, the program randomly selects a planning unit that might or might not already be included. The program evaluates the change to the value (and cost) that would occur if this planning unit were added or removed. At each step, the new solution is compared to the previous solution, and the best one is accepted. In this study, the program evaluated 1 million iterations during a single run, and over 300 runs for each analysis.

A large number of good solutions may satisfy a single set of goals. The Science Advisory Panel provided a map demonstrating the number of times each planning unit was selected for a final solution out of the total number of runs (Figure 1). This map was used to locate a set of core conservation areas. The Science Advisory Panel also selected five solutions that meet all ecological goals at targets of both 30 percent and 50 percent set-aside (for a total of 10 possible solutions). These solutions

were chosen because of their high conservation value and because they were distinctly different from one another, allowing flexibility on the part of the conservation planners.

Flexibility to explore alternative solutions is critically important for conservation planners because optimal solutions may not be possible given practical problems. This approach provides resource managers with the tools necessary to develop acceptable and effective solutions to complex, multi-objective conservation problems.

*Dr. Satie Airame is Scientific Advisor at CINMS. She currently works with the Science Advisory Panel and the Marine Reserves Working Group on conservation and fisheries management issues in the California Channel Islands.*

## References

- Ballantine W. J. 1997. In *The Design and Monitoring of Marine Reserves*. Fisheries Centre, University of British Columbia, Canada.
- DeMartini, E. E. 1993. *Fishery Bulletin* 91:414-427.
- Halpern, B. In press. *Ecological Applications*.
- Roberts, C. M. and J. P. Hawkins. 1997. *Coral Reefs* 16:150.
- Sladek-Nowlis, J. J., and C. M. Roberts. 1999. *Fisheries Bulletin US* 67:604-616.

# Spatial Technology in the Marine Reserves Process

By Ben Waltenberger

An important part of the marine reserves siting process is efficiently conveying relevant information to the Marine Reserves Working Group (MRWG) and to the public. Much of the scientific and socio-economic information gathered is complex, and in its native format not easily interpreted by someone who is not an expert in a particular field.

Also, because information is linked to specific “places in space” (i.e., potential marine reserve sites), complex datasets must be “anchored” to geographic locations. One of the best tools for doing this is a Geographic Information System (GIS). A GIS allows users not only to intuitively visualize potential reserve sites relative to themselves and external landmarks, but also to “mine” them for scientific and socio-economic data related to their locations.

CINMS has partnered with NOAA’s Coastal Services Center to create an enhanced GIS interface called the Channel Islands Spatial Support and Analysis Tool (CI-SSAT). CI-SSAT is more than a GIS; it is a “decision support system,” a term linked to the new and growing field of Public Participation GIS.

The idea behind Public Participation GIS is to create computer interfaces that allow stakeholders to query data contained in the GIS, and to “weight” those data relative to their importance to a particular stakeholder or group. This allows stakeholders to view and understand how community

processes may affect them and gives them an informed voice in those processes.

To illustrate this idea, let’s walk through a simple example of using CI-SSAT in a marine reserve siting process. The first screen in CI-SSAT is the criteria screen, where users can weight criteria (i.e., assign relative importance of one criterion to another) within an area they wish to analyze as a potential site.

In the Channel Islands marine reserves process, for instance, MRWG has two criteria: ecological and socio-economic. A fisherman would probably decide that the socio-economic criterion has a higher degree of relative importance than the ecological criterion (a reserve in Area X may curtail or end a particular type of fishing activity). An environmentalist concerned with protecting a rare species that only occurs in Area X would probably give the ecological criterion a higher relative weight.

Once weights are assigned, CI-SSAT analyzes the criteria comparatively using a simple suitability algorithm. It then creates a map with the chosen analysis area in color shades going from dark to light. The darker the shade, the more likely the area meets a stakeholder’s goals based on the weights they chose. The lighter the area, the less likely it will meet their goals.

Once this “results” map is made, users can dig into the

data associated with it. For instance, users can perform a socio-economic analysis that shows dollar amounts of particular fish species taken out of the area and the percentage of commercial use in that area relative to the entire CINMS. Users can analyze the data for ecological resources (e.g., percentage of kelp, percentage of rocky shoreline, number of bird species) that are found in the area. Users can also query and display ancillary datasets that show information such as historical use patterns, bathymetry (water depth) and geology, to name a few.

The ability to analyze and compare all these data in an intuitive map environment is a powerful tool to help citizens become informed and involved in the marine reserves process.

*Ben Waltenberger is Spatial Data Analyst for the Channel Islands National Marine Sanctuary.*



**A custom-designed GIS tool, the Channel Islands Spatial Support and Analysis Tool (CI-SSAT), helps stakeholders query data regarding the marine reserves process.**

# Sanctuary Waves

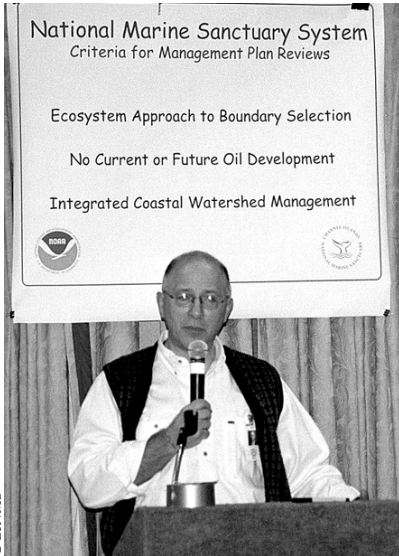
## Management Plan Revision Update

On February 9, 2001 Dan Basta, Director of NOAA's Office of National Marine Sanctuaries, met with the Sanctuary Advisory Council to discuss CINMS boundary options. The SAC and the community advised Mr. Basta and CINMS staff on a wide range of concerns and ideas, and this information has been taken into consideration to help guide an agency decision on this challenging issue.

Late this spring or early summer, look for public release of the Draft Environmental Impact Statement (DEIS) and Draft Management Plan (DMP). These documents will compare a series of boundary options, identify the agency's preferred alternative and present a suite of management programs proposed for the next five years.

Following the DEIS/DMP release, public hearings will be scheduled, and CINMS will welcome and respond to public comments. Later in the year, watch for release of the Final Environmental Impact Statement and Final Management Plan.

For ongoing updates on the management plan process, access the CINMS website at: [www.cinms.nos.noaa.gov/nmpintro.html](http://www.cinms.nos.noaa.gov/nmpintro.html) or contact Anne Walton at (805) 884-1470.



**Dan Basta, Director of NOAA's Office of National Marine Sanctuaries.**

## Cultural Resources Program Highlights

Conference presentations, a series of public lectures, an Internet chat and an online curriculum have been the focus of the CINMS cultural resources program.

Robert Schwemmer, CINMS Cultural Resources Coordinator, presented a paper at the Society for Historical Archaeology meeting in January 2001 that discussed the educational aspects of the cultural resources program. Deborah Marx of East Carolina University presented her survey work at the CINMS shipwreck site *Winfield Scott*, a California Gold Rush-era passenger steamer. Members of CMAR (Coastal Maritime Archaeology Resources), an avocational archaeological organization, presented papers on their partnership role in recording shipwreck sites in CINMS and Channel Islands National Park.

Lectures on shipwrecks of the Channel Islands were presented at the Santa Barbara Maritime Museum's Munger Theater to audiences that included the general public and community schools. Robert Schwemmer and Laura Francis, CINMS Educational Coordinator, participated in a two-hour Internet chat hosted by Rain Camp that reached students and teachers throughout Southern California.

In December 2000, BRIDGE, an online Ocean Science Teacher Resources Center, provided teachers and students with a lesson plan featuring historic shipwrecks of the five West Coast sanctuaries. The curriculum is available on the CINMS website at [www.cinms.nos.noaa.gov](http://www.cinms.nos.noaa.gov).

## CINMS Foundation Initiates Collaborative Marine Research

The Channel Islands Marine Sanctuary Foundation has created a program to involve stakeholders in cooperative research, resource assessment and protection. The program is based on a partnership (facilitated by CINMS) of local marine researchers, commercial fishers and resource management agencies (National Marine Fisheries Service and California Department of Fish and Game).

This partnership will investigate resource management questions with commercial fishers in a variety of roles, including as participants in project selection and planning and as paid research assistants. The program is designed to collect resource management information in a cost-effective manner and build positive relations between marine stakeholders.

The program's pilot project will be "Movement Patterns of Nearshore Marine Fishes in the Channel Islands National Marine Sanctuary." Led by Dr. Jennifer Caselle of UC Santa Barbara, this project will investigate patterns of fish movement and stock structure of reef fishes (including California sheephead, rockfish, cabezon and kelp bass) associated with the premium/live finfish fishery. The project will involve trapping and tagging fish, combined with recapture and resighting surveys, in order to:

- Determine stock structure and population differences among sites for targeted and non-targeted species caught in live traps.
- Determine movement patterns and mobility scales for several stages and sexes (e.g. juveniles, adults, males and females) of species caught in live traps.
- Determine the catch composition of live traps in CINMS boundaries.
- Develop methods for efficient and effective fisher-scientist collaboration.



**Robert Schwemmer, CINMS Cultural Resources Coordinator, spoke to audiences at the Maritime Museum's Munger Theater on Sanctuary shipwrecks.**



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Address Correction Requested

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## Things to Do, Places to Go

### Marine Reserve Working Group (MRWG) Meetings

MRWG meetings are open to the public and all are encouraged to attend. On May 23, the Sanctuary Advisory Council will meet to receive the MRWG recommendation. There will also be a public forum in May, date to be announced.

On **June 19** at Chase Palm Park Center, there will be a Sanctuary Advisory Council meeting to discuss the MRWG recommendation. For more information, contact Sean Hastings at (805) 884-1472.

### Whale Watch Trips

Join the Sanctuary Naturalist Corps for educational whale watch trips departing from Santa Barbara Harbor, Ventura Harbor and Channel Islands Harbor. SNC volunteers will be available for blue and humpback whale watch trips. For more information, visit the CINMS website or call Shauna Bingham at (805) 382-6151.

### Dive into Fish Counting

If you would like to participate in the Great American Fish Count this July, plan to attend a free Fish Identification Seminar. Reserve your place by contacting Laura Francis at [laura.francis@noaa.gov](mailto:laura.francis@noaa.gov) or (805) 884-1463. **June 12, 2001**, 7 p.m.-9 p.m. Channel Islands National Park Visitor Center, 1901 Spinnaker Dr., Ventura; **June 19, 2001**, 7 p.m.-9 p.m. Munger Theater, Santa Barbara

Maritime Museum, Santa Barbara Harbor; **July 7, 2001**, 7 p.m.-9 p.m. Waterfront Classroom, 125 Harbor Way (2<sup>nd</sup> floor), Santa Barbara Harbor.

### Geographic Information Systems (GIS) Workshops

CINMS will host two GIS workshops for teachers this summer, one at UCSB from **June 16-19** and one at Ventura College from **August 8-11**. The \$75 fee includes all curriculum materials and a field trip. Contact Laura Francis at [laura.francis@noaa.gov](mailto:laura.francis@noaa.gov) or (805) 884-1463.

### Fish Survey Trip

Join CINMS and REEF for a fish survey trip aboard the Truth Aquatics boat *Conception* on **July 8-9**. The fee is \$175. Contact Shauna Bingham at [shauna.bingham@noaa.gov](mailto:shauna.bingham@noaa.gov) or (805) 382-6151.

