DONALD BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT
MASTER OF ENVIRONMENTAL SCIENCE & MANAGEMENT
CLASS of 2004
GROUP PROJECT BRIEF
ON THE WEB AT HTTP://WWW.BREN.UCSB.EDU SPRING 2004

Evaluation and Augmentation of the Shallow Subtidal Monitoring Plan for the Channel Island Marine Protected Areas

By: Adina Abeles, Kevin Afflerbaugh, Larry Chiang, Ben Pitterle, and Matt Stadler[1]

Problem Statement

A network of 12 Marine Protected Areas (MPAs) was officially implemented within the Channel Islands National Marine Sanctuary (CINMS) on April 9th, 2003 (Figure 1). MPAs are a relatively new and controversial marine management tool in the United States where sections of the ocean are given varying degrees of protection, ranging from limited extraction of some resources to the prohibition of all extractive activities.

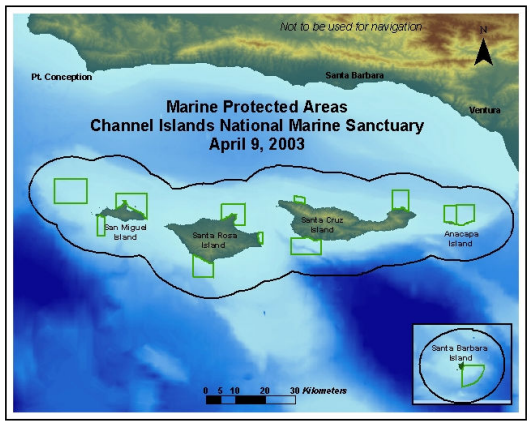

Figure 1: Marine Protected Areas in the Channel Islands National Marine Sanctuary

MPA designation within CINMS was prompted by both a public desire for ecosystem protection and by increased emphasis on MPAs as a marine management tool, as mandated by the California Marine Life Protection Act of 1999. However, the network of MPAs within CINMS is also characterized by debate and uncertainty. The CINMS MPAs restrict extractive commercial and recreational uses within their boundaries. Many stakeholders believe that the access restrictions imposed by the MPAs result in unnecessary hardships that are disproportionate to any resulting benefits. Although MPAs have been shown to be an effective management tool for increasing the abundance and size-frequency of organisms within their boundaries, the effects that MPAs have outside of their boundaries, including the possible regional enhancement of fisheries, are less well known. MPA implementation, therefore, has resulted in a heated political climate in which California Department of Fish and Game (CDFG), the agency responsible for managing the MPAs, is obligated to provide evidence through monitoring that justifies the decision to use MPAs in the CINMS. This effort is further complicated by political pressure to demonstrate significant effects of the MPA network within a short time period, using minimal resources.

Project Importance

Assessment of the CINMS MPAs relies on an effective biological monitoring program. The CINMS MPAs provide a unique opportunity to examine the impacts of fishing and other direct human-induced disturbance on marine populations, communities, and ecosystem. Monitoring this ecosystem experiment will provide a large-scale test of alternative and integrative management approaches.

Project Objectives

Our project assisted in developing, evaluating, and augmenting CDFG's biological monitoring program for the CINMS MPAs. Our objectives included: (1) to summarize expert monitoring recommendations and existing research programs within the CINMS; (2) to evaluate the CDFG's proposed biological monitoring framework; and (3) to develop and implement projects that help fill critical gaps found in the monitoring framework.

Summary of Current Programs and Recommendations

An initial component of our project was to assist with the compilation of an official CDFG document that summarizes the existing biological and ecological research programs within CINMS (Figure 2). This summary served two purposes: (1) to determine if existing research throughout CINMS

[1] Advisor: Dr. Hunter Lenihan
Clients: California Department of Fish and Game
Channel Islands National Marine Sanctuary

could be used to evaluate the MPAs and (2) to help plan the Channel Islands Marine Protected Areas Monitoring Workshop.

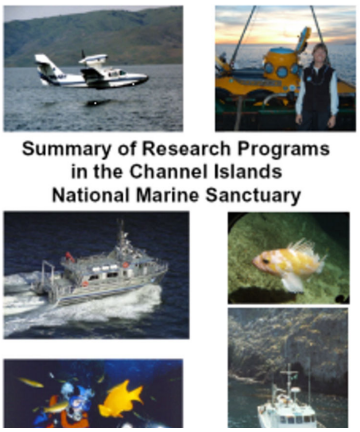

Figure 2: Official CDFG summary of research programs

The workshop was held at the Bren School of Environmental Science and Management from 14th-16th March 2003. More than 60 researchers, regulatory officials, environmental group representatives, and stakeholders participated to help develop preliminary MPA monitoring plans for the CINMS. Our group recorded recommendations from this workshop and worked with CDFG to produce the Summary of Monitoring Worksheet Results. Five major monitoring recommendations were chosen by our group for further consideration. These recommendations were: to focus on a monitoring design that used paired sites (inside vs. outside MPAS) in the shallow subtidal ecosystem; to address fishery monitoring; to incorporate local ecological knowledge in the monitoring process; to address database management concerns; and to improve public outreach.

Evaluation of Draft Monitoring Framework

Analysis of Proposed Monitoring Plan

Our group analyzed CDFG's Draft Monitoring Framework from the monitoring workshop. Due to limited state funding, CDFG is relying primarily on existing (and on-going) research programs within CINMS for biological monitoring data. One type of biological monitoring consists of measuring the density of benthic organisms that inhabit communities on shallow subtidal seafloor. CDFG selected the National Park Service Kelp Forest Monitoring Program (NPS) and the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) as the two primary benthic community monitoring programs from which data will be combined and used to assess the CINMS-MPAs. Sampling locations from these programs are shown in the map above. Our objective was to test whether data from the two programs were statistically similar, thereby providing a robust, flexible, and geographically broad baseline data set. Using ANOVA, we determined that NPS and PISCO sampling programs are sufficiently comparable for use by CDFG.

We also performed a statistical power analysis to determine whether the NPS and PISCO benthic community sampling data will provide a means of detecting statistical differences in the density of benthic organisms inside and outside the MPAs if they occur. CDFG plans to assess the impact of the MPAs after a 5-year period. Statistical power is a function of sample size, variation in the data, and the size of effect of the experimental treatment, in this case, the implementation of the reserves. Results from our analysis indicate that sufficient power to detect change in benthic communities could be a challenge for CDFG using these protocols and the proposed number of samples.

Further analysis, based on the workshop recommendations, found several shortcomings in the Draft Framework. Our group worked to augment CDFG's plan by addressing the following four issues:

- Fishery monitoring
- Incorporation of public input
- Data management
- Public outreach

Augmentation of Shallow Subtidal MPA Monitoring

Fishery Monitoring

The existing monitoring programs within CINMS are being used to evaluate impacts of the MPAs on communities of organisms, thereby providing an assessment of whether the MPAs are conserving and protecting ecosystem structure and function *(1)*. The impact of the MPAs on local and regional fishery-related processes is not well addressed by the ecosystem monitoring effort. To address this gap and to help integrate MPAs into existing fisheries management, our project created a cooperative MPA monitoring plan for an economically and ecologically

important harvested species: the California spiny lobster (*Panulirus interruptus*).

Spiny lobster monitoring is particularly important, considering the lack of fishery-dependent and independent research about this species in California over the past 25 years and because of potential spillover effects to the lobster fishery from the MPAs. The monitoring plan uses trapping and tagging techniques to evaluate the effects of the MPAs as a refuge to lobster, while providing essential fishery information on the biological and ecological dimensions of the California lobster fishery. The plan will promote the continued effort to facilitate collaboration and cooperation between the lobster fishery, governmental agencies, and the scientific community.

Figure 3: Lobster traps to be used in the lobster monitoring program (photo courtesy Miller *et al. (2)*.)

Incorporation of Local Ecological Knowledge

A breadth of ecological knowledge exists among fishers and divers that work at CINMS. This knowledge is very important to the monitoring effort. We conducted interviews with local fishers and divers who were willing to assist in the development of CDFG's monitoring plan. Information collected during these interviews was incorporated into the monitoring plan in two ways. First, to aid in the selection of new monitoring sites, information was collected regarding the locations of comparable habitats within the MPA network. This information was then provided in GIS format to researchers. The effort required in locating potential new monitoring sites is expensive and time consuming for researchers. The information our project collected regarding comparable habitat minimized this effort by directing CDFG and researchers directly to potentially comparable sites. Second, discussions with local commercial and recreational fishers improved the design and applicability of the cooperative fishery based monitoring plan for spiny lobster. This dialogue was successful both in gathering information and in forming relationships for potential collaboration and participation in the monitoring program.

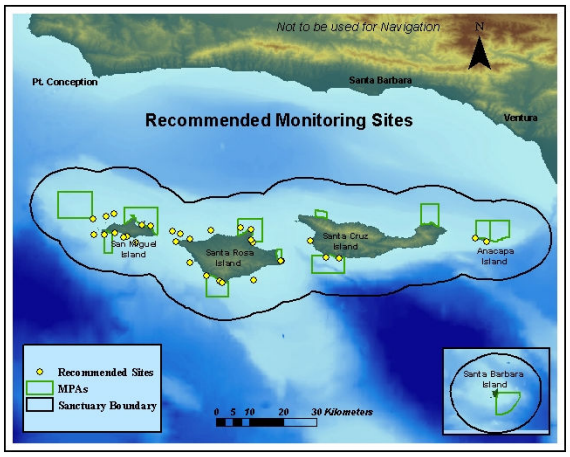

Figure 4: Potential monitoring site locations recommended during interviews with local fishers

Database concerns

Throughout the ecological and policy realm, data acquisition and management is an essential aspect to ecological analyses (3). CDFG is relying on the various agencies already monitoring and researching the shallow subtidal ecosystem of CINMS because its limited budget prohibits the initiation its own monitoring program. It is important to be able to store data from these multiple, existing monitoring programs so that scientists can examine monitoring data in a broader regional context, allowing for more comprehensive evaluations. The CDFG requires a means to store monitoring data from multiple programs so that these evaluations can be made. Our group created an MPA monitoring database for CDFG that allows it to access and analyze monitoring data to evaluate the performance of the MPAs.

Public Outreach

Public outreach and involvement has been integral throughout the MPA implementation process. To continue to inform and educate the public about the MPAs and monitoring efforts in CINMS, our project created a website that is available on CDFG's server: (http://www.dfg.ca.gov/mrd/channel_islands/sse_monitoring/index.html). This

website contains information regarding the various components of the monitoring program: experimental protocols, lists and descriptions of focal species, and the locations of MPA monitoring sites throughout the MPA network. The website provides information in a format that is useful, appealing to the public, and readily accessible (Figure 5). In addition to making this information accessible to the public, the website assists in the coordination of future monitoring efforts by potentially minimizing overlap in MPA research.

Figure 5: CDFG shallow subtidal monitoring website

Conclusion

The general objective of our group project was to assist CDFG and CINMS in implementing, monitoring, and managing the MPAs established within CINMS. We worked to meet this objective by filling experimental and administrative gaps in CDFG's Draft Monitoring Framework based upon the recommendations of experts and stakeholders. Our statistical analysis confirms that CDFG has the ability to compare NPS and PISCO monitoring data to expand coverage, but also forewarns of the possibility of poor statistical power. The addition of a monitoring database and a subtidal monitoring website eliminates critical shortcomings in CDFG's ability to monitor while keeping the public informed. The creation of a lobster monitoring program significantly augments CDFG's efforts to address issues important to local fishery stakeholders, while incorporating them in the process. Although more effort will be required in order for the monitoring program to be truly comprehensive, the tasks our group performed significantly enhance CDFG's MPA monitoring program.

At its core, our project was undertaken to further incorporate the needs and interests of the public while improving governmental management of marine resources. The challenges CDFG will face in accomplishing this goal are great and indicative of the broad nature of the public's interest. The CDFG is charged with the task of managing resources that are of economic, ecological, and aesthetic value. Although stakeholders may differ in the nature of their concern, all are united in their desire that the management of marine resources be efficient, effective, and accountable.

References:

[1] California Department of Fish and Game and the Channel Islands National Marine Sanctuary (2003). Summary of research programs in the Channel Islands National Marine Sanctuary. February 20, 2003.Assembled by: Abeles, A., Chiang, L., Stadler, M., Pitterle, B.: Donald Bren School of Environmental Science and Management, University of California, Santa Barbara. Airamé, S and Fangman, S.: Channel Islands National Marine Sanctuary. Bergen, M. and Ugoretz, J. : California Department of Fish and Game. http://www.cinms.nos.noaa.gov/marineres/PDF/sum_research.pdf

[2] Miller, K. A., Iacchei, M. and Robinson, P. Wrigley Marine Science Center, University of Southern California. Contact kam@usc.edu

[3] Reichman, O., Schildhauer, M., and Jones, M. (1999). Integrating marine ecology data for scientific analysis and resource management: a community database prototype. National Science Foundation proposal. http://www.nceas.ucsb.edu