Marine Sanctuaries Conservation Series ONMS-05-05

Channel Islands Deep Water Monitoring Plan Development Workshop Report April 26-27, 2005 University of California, Santa Barbara

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Ocean and Coastal Resource Management
Office of National Marine Sanctuaries

September 2005

About the Marine Sanctuaries Conservation Series

The National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries (ONMS) administers the National Marine Sanctuary Program. Its mission is to identify, designate, protect and manage the ecological, recreational, research, educational, historical, and aesthetic resources and qualities of nationally significant coastal and marine areas. The existing marine sanctuaries differ widely in their natural and historical resources and include nearshore and open ocean areas ranging in size from less than one to over 5,000 square miles. Protected habitats include rocky coasts, kelp forests, coral reefs, sea grass beds, estuarine habitats, hard and soft bottom habitats, segments of whale migration routes, and shipwrecks.

Because of considerable differences in settings, resources, and threats, each marine sanctuary has a tailored management plan. Conservation, education, research, monitoring and enforcement programs vary accordingly. The integration of these programs is fundamental to marine protected area management. The Marine Sanctuaries Conservation Series reflects and supports this integration by providing a forum for publication and discussion of the complex issues currently facing the National Marine Sanctuary Program. Topics of published reports vary substantially and may include descriptions of educational programs, discussions on resource management issues, and results of scientific research and monitoring projects. The series facilitates integration of natural sciences, socioeconomic and cultural sciences, education, and policy development to accomplish the diverse needs of NOAA's resource protection mandate.

Channel Islands
Deep Water Monitoring Plan Development
Workshop Report
April 26-27, 2005
University of California, Santa Barbara

Sarah Fangman[1], Steve Gittings[2], Kathy Dalton[2], Greg McFall[3], Dave Lott[2]

[1]NOAA/Channel Islands National Marine Sanctuary
113 Harbor Way, Suite 150
Santa Barbara, CA 93109

[2]NOAA/National Marine Sanctuary Program
1305 East West Highway
Silver Spring, MD 20910

[3]NOAA/Gray's Reef National Marine Sanctuary
10 Ocean Science Circle
Savannah, GA 31411

U.S. Department of Commerce
Carlos M. Gutierrez, Secretary

National Oceanic and Atmospheric Administration
VADM Conrad C. Lautenbacher, Jr. (USN-ret.)
Under Secretary of Commerce for Oceans and Atmosphere

National Ocean Service
Richard W. Spinrad, Ph.D., Assistant Administrator

Office of National Marine Sanctuaries
Daniel J. Basta, Director

Silver Spring, Maryland
September 2005

DISCLAIMER

REPORT AVAILABILITY

Electronic copies of this report may be downloaded from the National Marine Sanctuaries Program web site at www.sanctuaries.nos.noaa.gov. Hard copies may be available from the following address:

National Oceanic and Atmospheric Administration
Office of National Marine Sanctuaries
SSMC4, N/ORM62
1305 East-West Highway
Silver Spring, MD 20910

COVER

Satellite image illustrating the temperature variation in the Northern Channel Islands. Temperature ranges are represented as follows: blue = 44-52º F, green-yellow = 56-64º F, and orange-red = 65-72º F. Photo credit: Channel Islands National Marine Sanctuary.

SUGGESTED CITATION

Fangman, S., S. Gittings, K. Dalton, G. McFall, D. Lott. 2005. Channel Islands Deep Water Monitoring Plan Development Workshop Report. Marine Sanctuaries Conservation Series ONMS-05-05. U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 38 pp.

CONTACT

Dr. Steve Gittings
Science Program Manager
Office of National Marine Sanctuaries
1305 East West Highway, 11th Floor
Silver Spring, MD 20910
(301) 713-7274
Steve.Gittings@noaa.gov

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

FIGURE/TABLE **PAGE**

ABSTRACT

In 2003, twelve marine protected areas were established in state waters (0-3 nmi) surrounding the Channel Islands. NOAA is considering extending this network (3-6 nmi) into deeper waters of the Channel Islands National Marine Sanctuary (CINMS). In order for effective long-term management of the deep water reserves to occur, a well-structured monitoring program is required to assess effectiveness. The CINMS and the National Marine Sanctuary Program (NMSP) hosted a 2-day workshop in April 2005 to develop a monitoring plan for the proposed federal marine reserves in that sanctuary. Conducted at the University of California at Santa Barbara, participants included scientists from academic, state, federal, and private research institutions. Workshop participants developed project ideas that could answer priority questions posed by the NMSP. This workshop report will be used to develop a monitoring plan for the reserves.

KEY WORDS

Channel Islands National Marine Sanctuary, monitoring plan, deep water reserves

BACKGROUND

In 2003 twelve Marine Protected Areas (MPAs) were established in California state waters (0-3 nautical miles) surrounding the northern Channel Islands. NOAA is considering extending this network of marine reserves into deeper waters of the Channel Islands National Marine Sanctuary (roughly 3-6 nautical miles) (Figure 1). The goals of the proposed reserves are to:

- Provide long-term protection of the Channel Islands National Marine Sanctuary (CINMS) resources including natural habitats, populations of interest and ecological processes
- Restore and enhance natural habitats and the abundance, density, population age structure and diversity of natural biological communities in the CINMS
- Provide, for research and education, undisturbed reference areas that include the full spectrum of CINMS habitats where local populations exhibit a more natural abundance, density, and age structure
- Set aside for intrinsic and heritage value, representative habitats and natural biological communities
- Create models of and incentives for ways to conserve and manage the resources of the CINMS

In order for effective long-term management of the deep-water marine reserves to occur, a well-structured biological monitoring plan is required that identifies specific programs to assess effectiveness.

In the spring of 2003 NOAA's Channel Islands National Marine Sanctuary (CINMS), the California Department of Fish and Game (CDFG) and the Channel Islands National Park (CINP) hosted a workshop to develop preliminary socioeconomic and biological monitoring plans for the shallower MPAs. The result of the workshop was a draft comprehensive monitoring plan that details programs (both existing and proposed activities) for both biological and socioeconomic monitoring. Subsequent meetings and workshops held by Sea Grant and the CINMS Research Activities Panel continued to refine the draft monitoring plan.

On April 26-27, 2005 the National Marine Sanctuary Program (NMSP) and the CINMS hosted a Focus Group Meeting to develop the monitoring plan for the deep-water reserves. The goal of the workshop was to identify and prioritize requirements for monitoring the proposed reserves. During the workshop, invited experts discussed the key questions that would be used to evaluate reserve effectiveness. The group then identified projects and implementation strategies for monitoring the proposed reserves.

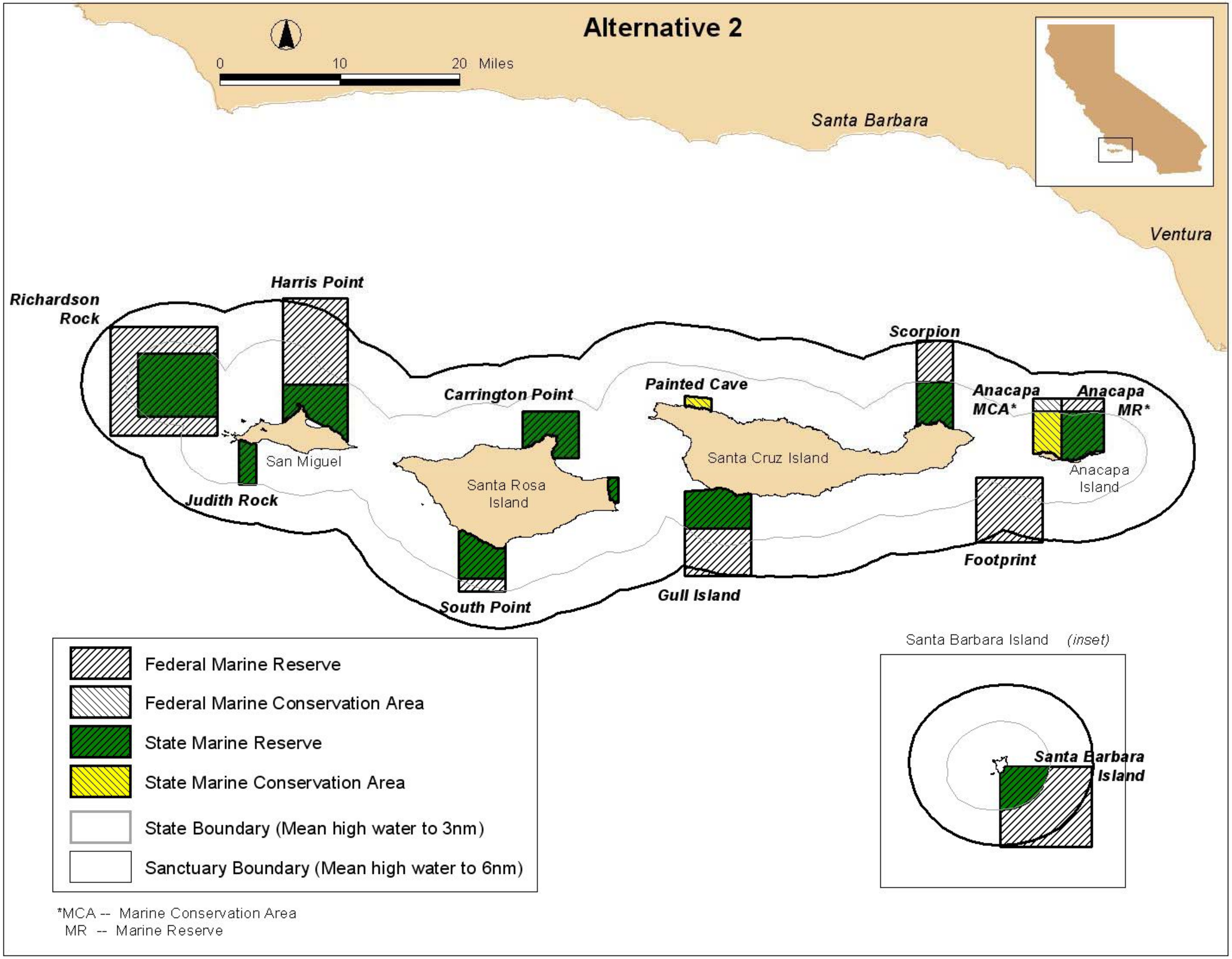

Figure 1. Map of the Channel Islands National Marine Sanctuary, including both the state marine protected area (MPA) network and the proposed, federal extensions.

PROCESS

Workshop participants consisted of sanctuary staff from the National Marine Sanctuary Program, the Channel Islands National Marine Sanctuary, and invited scientists from other marine sanctuaries, academic, federal, state, and private research institutions. All had experience or expertise with reserve establishment and monitoring (see Appendix II for list of participants and their affiliations). The group included scientists experienced with deep surveys of benthic invertebrates and fish, shallow diving survey techniques and technologies, intertidal, marine mammal, physical oceanography, contaminant chemistry, seafloor mapping, and information management. Each was asked to participate in breakout groups in which their knowledge and experience could best be applied.

The goal of the workshop was to identify natural resource monitoring activities that could be used to determine whether the goals of the reserves are being reached. Five goals have been identified for the proposed reserves (see above). The two primary goals that relate to natural resources are 1) to ensure the long-term protection of the CINMS resources and 2) to restore natural habitats, populations and diversity in the sanctuary.

Two major steps were used in the workshop, both of which are consistent with the process defined in the document "A Monitoring Framework for the National Marine Sanctuary System" (NMSP, 2004). The first step was to identify the requirements for monitoring, that is, the key resources to be assessed and the associated priority measurements (called "metrics" in this report). The second was to select or develop protocols to allow for the collection of data or information related to priority metrics. Each step is described in more detail below, in the sections titled "Requirements" and "Protocols."

In the introductory plenary session, participants first discussed the scope of the workshop with respect to depth and its relation to the shallow water reserve monitoring program already in place. The group agreed to focus on resources in depths greater than 20 m, because this is the maximum depth that the majority of current reserve effectiveness studies ends. Focusing on depths greater than 20 m will overlap with areas inside the boundaries of the proposed federal reserves. However, the group felt it important to monitor those areas at depths likely to respond to changes in fishing pressure, namely the seaward portion of kelp-dominated habitats, where considerable fishing occurs.

Before the workshop, a series of general questions and more specific sub-questions were developed. They were derived from discussions and documents prepared during prior reserve design workshops. A draft set of questions was prepared by the planning committee for this workshop and modified by participants. The final list of questions was intended to focus the discussions, and is presented below:

QUESTIONS ADDRESSED DURING WORKSHOP

Changes Within MPAs

1. **Do populations, communities and species distributions change within, adjacent to, and distant from reserves?**
    a. Is community structure in reserves different from that in otherwise equivalent non-protected areas?
    b. What changes occur among selected species?
    c. Do high-level carnivores change patterns of predation?

Spillover

2. **Does migration of adults and young enhance populations outside reserves, and if so, how far outside?**
    a. What is the rate and magnitude of movement by selected species and size classes between MPAs and surrounding areas?
    b. Does spillover enhance adjacent populations?

3. **Do populations outside reserves increase as a result of increased larval recruitment?**
    a. Are larvae produced inside MPAs transported into areas outside MPAs?

Habitat and Ecosystem Effects

4. **Do MPAs affect ecosystem structure and function, including trophic cascades?**
    a. How does trophic structure change as a result of establishment of MPAs?

5. **Do changes in fishing effort affect habitats within and/or close to MPAs?**
    a. Does the cessation of fishing effort in reserves alter natural biotic habitats?
    b. Does the cessation of fishing effort in reserves alter natural abiotic habitats?
    c. Does the cessation of prawn trapping alter biotic and abiotic habitats?

6. **Can observed changes within CINMS (and/or reserves) be attributed to large scale forcing and other factors independent of reserve establishment?**
    a. Can observed changes in MPAs be attributed to sediment quality, water quality and other independent (uncontrolled) factors?
    b. Can observed changes within reserves be attributed to climate and oceanographic forcing?

Participants split into two breakout groups to consider different but often overlapping questions. One group discussed the first three questions, which addressed information needs and monitoring related to changes that might occur with reserves (primarily at the population and community level), the issues of spillover (juvenile and adult movement out of reserves) and export of biomass produced within reserves. The other group discussed Questions 4 through 6, which related to potential changes to habitats and ecosystems, as well as the need to understand environmental impacts caused by uncontrolled factors, such as large-scale oceanographic features and climate change.

Figure 2. Workshop participants address key questions during a breakout session.

REQUIREMENTS

On the first day, the groups were asked to consider each question separately, and identify the resources that would have to be assessed, and the specific metrics that would have to be measured to address each question. They first identified the key resources or environmental attributes most relevant to the questions. For each resource, the potential responses stemming from the establishment of reserves were identified, as were the metrics (measurement variables) required to determine whether a response actually occurred. The groups also noted, to the extent possible, existing projects that might address each of the topics. It should be noted, however, that representatives were not completely familiar with some of the projects, and more work will be needed to determine if a project can in fact address a given topic. Finally, the groups listed, for each question, prospective projects or types of projects that could be part of a comprehensive monitoring program to assess the effectiveness of deep-water marine reserves.

At the end of the first day, a "requirements matrix" was assembled based on the day's discussions. This is a matrix of priority resources and metrics, with the information in the cells representing the question(s) to which each combination applies (Tables 1a and 1b). The matrix allows participants to see the entire list of resources considered relevant to each question, and associated measurement requirements. Decisions can then be made about which combinations are the most important based on the resources themselves or the number of questions addressed by a specific resource-metric combination.

Table 1a. Part 1 of the Requirements Matrix containing all species and measurements considered potentially important to document change caused by the establishment of reserves within the Channel Islands National Marine sanctuary. Numbers in each cell correspond to questions addressed by that resource-metric combination. Questions are listed in the text above.

Requirements Matrix

Metrics

Resources		Anthro	Anthro	Anthro	Anthro	Anthro	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Chem	Geol	Habitat	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	
		% Area w/ Anthro Debris	% Area w/ Trawl Marks	Fishing Effort	Fishing Gear	Fishing Location	# of trophic levels	% Live	Area Covered by	Biomass	Change in abund w/in trophic levels	CPUE	Density at sea	Density on land	Dietary Data (4a?)	Distribution at sea	Distribution on land	Emigration	Fecundity (length/size)	Growth Rates	Immigration	Injury	Larval Duration in WC	Larval Mortality in WC	Mean height and density	Percent cover	Sex Ratio	Size Frequency	Size/Mean Size	Species composition	Tag Recovery	Timing/Duration	Stable Isotopes (4a?)	Sediment Trap Loads	Rugosity	Current Direction @ Depth	Current Speed @ Depth	Dispersion (Movement?)	El Nino Indices	North Pacific Index	Sea Surface Temperature	Upwelling Indices	Concentration of contaminants	Sediment contaminants	Tissue contaminants	Dissolved Oxygen	rdgp Line
Algae	Drift kelp												5a, 4a																									5a									
Algae	Kelp												1a												1a					1a																	
Algae	Red algae																																														
Cnidaria	Black coral									1b			1b						1b	1b								1b	1b																		
Cnidaria	Deep coral (soft)							5a					1a									5a			1a, 5a					1a, 5a																	
Cnidaria	Gorgonian corals							5a					5a									5a			5a					5a																	
Cnidaria	Hard corals							5a, 5c					5a, 5c									5a, 5c							5a	5a																	
Crustacea	Cancer crabs						1a				1a	1b	4a																																		
Crustacea	King crabs												4a																																		
Crustacea	Lobster					2a						1b, 2a	4a					2a			2a							2b			2b																
Crustacea	Ridgeback prawns			5a									5a						5a																												
Crustacea	Spot prawns			5a									5a						5a																												
Echinoderm	Basketstars												1a, 1b												1a																						
Echinoderm	Brittle stars								1b				1a, 1b																																		
Echinoderm	Crinoid												1a, 1b												1a																						
Echinoderm	Cucumaria (sea cucumber)								1b																																						
Echinoderm	Fragile sea urchin												4a																																		
Echinoderm	Purple sea urchin									1b			1b						1b	1b								1b	1b																		
Echinoderm	Red sea urchin									1b			1b, 4a						1b	1b								1b	1b																		
Echinoderm	Sea urchins												5a						5a											5a																	
Echinoderm	White sea urchin									1b			1b						1b	1b								1b	1b																		
Fish	Angel sharks					2a	1a				1a	2a	1a					2a			2a							1a, 2b			2b																
Fish	Blue rockfish									1b			1b, 6b						1b	1b								1b	1b																		
Fish	Bocaccio					2a				1b		2a	1b, 4a, 6b					2a	1b	1b	2a							1b, 2b	1b		2b																
Fish	Cabezon					2a						2a	2a					2a			2a							2b			2b																
Fish	Canary rockfish									1b			1b						1b	1b								1b	1b																		
Fish	Cold water rockfish												6b																																		
Fish	Cowcod					2a				1b		2a	1b, 4a					2a	1b	1b	2a							1b, 2b	1b		2b																
Fish	Giant black seabass									1b			1b, 4a						1b	1b								1b	1b																		
Fish	Greenspotted rockfish												4a																																		
Fish	Halibut					2a	1a					2a	1a, 4a					2a			2a							1a, 2a			2b																
Fish	Kelp bass					2a						2a	2a					2a			2a							2b			2b																
Fish	Lingcod					2a				1b		2a	1b, 4a					2a	1b	1b	2a							1b, 2b	1b		2b																
Fish	Migratory fish												1c			1c																															
Fish	Non-fished species												1b																																		
Fish	Olive rockfish												6b																																		

Table 1b. Part 2 of the Requirements Matrix containing all species and measurements considered potentially important to document change caused by the establishment of reserves within the Channel Islands National Marine sanctuary. Numbers in each cell correspond to questions addressed by that resource-metric combination. Questions are listed in the text above.

Requirements Matrix	Metrics	Anthro	Anthro	Anthro	Anthro	Anthro	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Biol	Chem	Geol	Habitat	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	Phys	
Resources		% Area w/ Anthro Debris	% Area w/ Trawl Marks	Fishing Effort	Fishing Gear	Fishing Location	# of trophic levels	% Live	Area Covered by	Biomass	Change in abund w/in trophic levels	CPUE	Density at sea	Density on land	Dietary Data (4a?)	Distribution at sea	Distribution on land	Emigration	Fecundity (length/size)	Growth Rates	Immigration	Injury	Larval Duration in WC	Larval Mortality in WC	Mean height and density	Percent cover	Sex Ratio	Size Frequency	Size/Mean Size	Species composition	Tag Recovery	Timing/Duration	Stable Isotopes (4a?)	Sediment Trap Loads	Rugosity	Current Direction @ Depth	Current Speed @ Depth	Dispersion (Movement?)	El Nino Indices	North Pacific Index	Sea Surface Temperature	Upwelling Indices	Concentration of contaminants	Sediment contaminants	Tissue contaminants	Dissolved Oxygen	rdgp Line
Fish	Pacific sanddab									6a			6a																																6a		
Fish	Sablefish												4a																																		
Fish	Seabass					2a						2a	2a					2a			2a							2b			2b																
Fish	Selected larvae (spp.)																						3a	3a																							
Fish	Sheephead					2a				1b		2a	1b					2a	1b	1b	2a						1b	1b, 2b	1b		2b																
Fish	Shortspine												4a																																		
Fish	Sixgill shark												4a																																		
Fish	Skates												4a																																		
Fish	Slendersole sanddabs									6a			6a																																6a		
Fish	Speckled sanddabs									6a			6a																																6a		
Fish	Thornyhead												4a																																		
Fish	Torpedo rays												4a																																		
Fish	Vermillion rockfish									1b			1b, 4a						1b	1b								1b	1b																		
Fish	White seabass						1a				1a		1a																																		
Fish	Widow rockfish									1b			1b						1b	1b								1b	1b																		
Fish	Yelloweye rockfish									1b			1b						1b	1b								1b	1b																		
Food Web	Food web complexity						1a				1a		1a															1a																			
Habitat	Canyon edges	5b	5b		5b																													5b	5b												
Habitat	Gravel habitat	5b	5b		5b																													5b	5b												
Habitat	Rugose habitat	5b	5b		5b																													5b	5b												
Habitat	Soft sediment habitat	5b	5b		5b																													5b	5b												
Invert	Benthic siphonophores												4a																																		
Invert	Benthic space competitors																									1a				1a																	
Invert	Sea pens												5a																	5a																	
Invert	Tube forming amphipods												5a																	5a																	
Invert	Tube forming brachiopods												5a																	5a																	
Mammal	CA sealions												1c	1c		1c	1c															1c															
Mammal	Harbor seals												1c	1c		1c	1c															1c															
Mammal	Sea otters												1c, 4a			1c																1c															
Mollusca	Pink abalone									1b			1b						1b	1b								1b	1b																		
Mollusca	Red abalone									1b			1b						1b	1b								1b	1b																		
Mollusca	Squid																																														
Mollusca	Squid spawning grounds															1a																															
Mollusca	White abalone									1b			1b						1b	1b								1b	1b																		
Ocng	Currents/Transport																																			3a	3a										
Ocng	Upwelling areas															6b																							6b	6b	6b	6b					
Ocng	Water quality																																											6a		6a	
Porifera	Sponges												1a, 5a									5a, 5c			1a	5a, 5c			5a	1a, 5a, 5b																	
Seabird	12 seabird spp												1c	1c		1c	1c															1c															

PROTOCOLS

On the second day of the workshop, participants were asked to build out project ideas. They prioritized the list of prospective projects generated in Day 1, and then used templates to indicate specific objectives, approaches, field requirements, potential partners and roles, likely costs, and other information (see Appendix IV).

At the end of the second day, participants convened again in plenary to discuss each of the proposed projects. They prioritized the projects based on prior group discussions, comments raised in plenary, and a list of criteria that will be used by the CINMS to determine the ultimate program components. These selection criteria included:

- Cost
- Logistical feasibility
- Duration
- Stakeholder involvement
- Urgency
- Breadth (the number of questions addressed)
- Geography (the number of reserves involved)
- Effectiveness of ecosystem indicators
- Availability of historical data
- Integration of other site-specific needs
- Integration with state reserve monitoring plan
- Application to other national marine sanctuaries

The list of prioritized projects recommended by the participants is in Table 2. Though a show-of-hands vote for three categories (high, medium, or low priority) was used during the workshop, the table presents five categories based on the number of votes received by each project. Note that the voting was based on prioritization in the context of monitoring reserve effectiveness, not on scientific merit alone. Thus, projects that might actually be very important to other sanctuary characterization or management needs may be ranked as lower priorities with regard to monitoring reserve effectiveness. It must also be noted that the group was not asked to apply the selection criteria in a consistent or rigorous manner in ranking process. This will happen during planning sessions conducted after the workshop and could result in changes in the order of prioritized projects. Finally, some projects were ranked low not because of their scientific merit or importance relative to monitoring reserve effectiveness, but simply because participants felt that the work was already being conducted.

Table 2. List of projects proposed to address information needs related to deep-water reserve effectiveness in the Channel Islands and their ranking by workshop participants.

Priority	Project	Description	Approaches
High	Deep visual surveys	Benthic and fish fauna surveys 30-340m	Subs, ROV, camera sleds
	Shallow visual surveys	Benthic and fish fauna surveys 20-30m	Divers, ROV
	Trap Surveys	Trapping, tagging (acoustic and visual) to assess movement	Commercial fishermen
High-Medium	Impacts of prawn traps	Assess impacts of one of the only active fisheries	ROV, subs
Medium	Acoustic tracking	Directly tracking the movement of individual fish	Implanted transmitters and downloadable seabed receivers
	Model food web interactions	Develop models of changing food webs	Use data from other studies to produce models
	Foraging	Document changes in feeding patterns and locations of top level carnivores	Vessel, aircraft and land-based observations; pinnipeds and seabirds
	Deep slope surveys	Collections and observations below 340m	NMFS? Trawling and deep subs
	Water quality – sample and data collection	Document changes in uncontrolled water quality variables	Collections during other surveys, but not analysis
	Sediment quality – sample and data collection	Document changes in uncontrolled sediment quality variables	Collections during other surveys, but not analysis
Medium-Low	Large Scale Physical Influences	Correlate changes in reserves with large scale patterns in the ocean and climate	Use existing information
Low	Trawl surveys	Collections of primary consumers for population and contaminants	Trawling
	Modeling larval transport	Predicting larval transport	Existing data on currents and larval duration for selected species
	Water quality - data analysis	Document changes in uncontrolled water quality variables	Analysis of archived samples
	Sediment quality - data analysis	Document changes in uncontrolled sediment quality variables	Analysis of archived samples

WORKSHOP RECOMMENDATIONS

Participants in the Deep Water Monitoring Plan Development Workshop developed a prioritized list of projects that they recommended for implementation to assess reserve effectiveness. This list of prioritized projects is provided in Table 2. This section briefly describes each project that was recommended. Further details for each project can be found in the Project Templates provided in Appendix IV.

Three projects were ranked “High” by workshop participants: deep visual surveys, shallow visual surveys and trap surveys. Deep visual surveys were recommended to address the question: “How do deepwater (30 – 340m) marine populations, communities and trophic structure respond to marine protected area implementation?” The objectives of deep visual surveys are to quantify changes in community structure for conspicuous fishes and invertebrates inside and outside MPAs; quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside of MPAs; and to quantify changes in trophic structure inside and outside MPAs. Deep visual surveys would be conducted using submersibles, remotely operated vehicles (ROVs), towed cameras and/or drop cameras.

The second high priority project proposed by workshop participants was shallow visual surveys. The group recommended these surveys to address the question: “How do shallow water (20-30m) marine populations, communities and trophic structure respond to MPA implementation?” The objectives of shallow visual surveys are to quantify changes in community structure for conspicuous fishes and invertebrates inside and outside of MPAs; quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside of MPAs; and to quantify changes in trophic structure inside and outside of MPAs. Shallow visual surveys would be conducted by SCUBA divers.

The final project ranked as a high priority for deep water monitoring was trap surveys. Trap surveys were recommended to address the questions: “How does catch per unit effort (CPUE) and size change inside and outside reserves?” and “Is there a spillover effect?” The objectives of trap surveys in a deep water monitoring plan are to quantify changes in CPUE for rock crabs and lobsters inside and outside reserves; quantify changes in mean size and size frequency for rock crabs and lobster inside and outside reserves; and to discern if there is spillover of rock crabs and lobster. Workshop participants recommended that lobster and crab fishermen be partners in conducting these trap surveys.

One project was ranked “High-medium” priority by the group. Conducting a study to assess the impacts of prawn traps on habitats was recommended in response to observations made during deep visual surveys that suggest prawn traps may be damaging deep water habitats. Observations of tangled ropes and derelict traps intertwined with diseased and broken coral and sponges suggest that prawn trap fishing may damage essential fish habitat (EFH) in the CINMS. There are two related questions this project seeks to address: (1) Are there historical patterns in sponge/coral density and health between areas of high and low fishing intensity? (2) Are there changes in time in sponge/coral density, recruitment, growth and health inside and outside

MPAs? Undertaking this study would involve the use of a manned submersible to visually survey populations of sponges and corals inside and outside of MPAs and in areas of historically low and high fishing intensity.

Six deep water monitoring projects were recommended as “Medium” priority. The first of these (ranking within categories was not conducted) was an acoustic tracking study. Acoustically tracking fishes was proposed to answer the question: “How is the movement of ecologically and commercially important fish and invertebrate species mediated by seafloor habitats?” The objectives of this type of project are to quantify the movement of fish and invertebrates species at multiple islands, inside and outside MPAs at Anacapa, Santa Barbara, Santa Cruz and Santa Rosa islands. The Pfleger Institute of Environmental Studies (PIER) has an acoustic array in place at these islands, and has been tracking fishes at the Channel Islands since 1999. Workshop participants recommended continuing, and possibly expanding, this activity.

A second project proposed as medium priority involved modeling food web interactions. Participants proposed this project to provide information on how trophic structure is changing as a result of marine protected area establishment. The group recommended that classification should involve taking densities of species, putting them in functional feeding groups/trophic analysis, and looking for changes in relative abundance over time. Participants recommended that for species that are fished, the responses of prey should be examined. And for species that are primary consumers, the changes in input (e.g. kelp) should be examined.

The workshop participants recommended a high level carnivore foraging study as a medium priority project for the reserves monitoring program. Such a study would provide information on the changes in abundance in prey resources over time within MPAs and whether this leads to changes in foraging patterns of high level carnivores. The objectives of this project would be to look at foraging patterns of carnivores throughout the Channel Islands and at changes in seabird nesting or pinniped haul out locations.

Deep slope surveys were recommended as another medium priority project during the workshop. The goal of this project would be to determine how deep water (>340m) marine populations, communities and trophic structure respond to MPA implementation. The objectives of deep slope survey are to quantify changes in community structure for conspicuous fishes and invertebrates inside and outside MPAs; quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside MPAs; and to quantify changes in trophic structure inside and outside of MPAs. Conducting deep slope surveys would require deep trawls, larger ROVs, deep water submersible and perhaps laser line scanning.

Participants in the monitoring workshop recognized that water quality issues may impact reserve effectiveness and recommended that a water quality monitoring project be a medium priority component of the implementation plan. This project could answer the question: “Do changes in water quality affect benthic communities inside and around MPAs?” The objective of a water quality monitoring program would be to evaluate contaminants, oxygen level and other parameters in the water column.

The final medium priority project recommended by workshop participants was a sediment quality project, which could determine if contaminated sediments affect benthic communities. The objectives of such a study would be to determine the level of contamination (PCBs, DDTs, metals, etc.) in sediments.

One project was identified as "Medium-Low" priority. A large scale physical influences project was recommended to consider whether there are changes in reserves that are attributable to large scale forcing. The objectives of such study would be to determine large scale factors that change benthic communities.

Finally, four projects were identified as "Low" priority by participants. The first of these was trawl surveys, which were proposed to determine if there are changes in the trophic structure of the deepwater community and if contaminants affect benthic organisms. The objectives of trawl surveys would be to determine the community composition of benthic primary and secondary consumers; the contaminant levels in tissues of sanddabs; collect baseline inventory of the deepwater marine community; and determine recruitment of benthic communities. The advantages of trawl surveys were that scientists can make accurate species identifications and collect length and weight information. Samples collected by trawl can be examined for anomalies and sampled for contaminants, gut contents, and otoliths. Finally, small individuals are not identified well using visual surveys.

A second project identified as low priority involved modeling larval transport. Recognizing that there is little knowledge about the extent of larval transport out of reserves, the objective of this project would be to model larval transport pathways.

Water quality and sediment quality data analysis was also identified as a low priority project for a deep water marine reserves monitoring program. The proposed goal of such an effort would be to document changes in uncontrolled water and sediment quality variables. Conducting such a study would involve the analysis of archived samples.

One project that the group recommended was not ranked. Workshop participants proposed a project to evaluate the recovery of seafloor habitat and associated taxa following the cessation of physical, anthropogenic disturbance. The purpose of such a study would be to answer the question: "What is the rate and direction of recovery of seafloor habitats and associated taxa in the CINMS, inside and outside of reserves, following the cessation of physical anthropogenic disturbance?" Conducting such a study would require ROV, AUV or towed cameras to conduct visual transects at control and impacted sites to quantify the recovery of seafloor habitats and associated taxa across a spectrum of habitat types inside and outside of marine reserves.

NEXT STEPS

The National Marine Sanctuary Program (NMSP) and the Channel Islands National Marine Sanctuary, in collaboration with appropriate partners, will use the information provided at this Deep Water Monitoring Plan Development Workshop to draft a more detailed and complete reserves monitoring plan. In addition to providing further details on the monitoring projects themselves, the draft plan will include information on staffing, funding, information management and delivery, and implementation, including a timeline. The plan will incorporate ongoing investigations that can address portions of the identified priorities. The NMSP and CINMS will work with the State of California to coordinate with the plan already in existence for the State Marine Reserves. The Draft Deep Water Monitoring Plan will be made available for review and comment, updated based on those comments, and then finalized for implementation.

LITERATURE CITED

National Marine Sanctuary Program. 2004. A Monitoring Framework for the National Marine Sanctuary System. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service. Silver Spring, MD. 22p.

Appendix I Workshop agenda

Channel Islands Deep Water Monitoring Plan Development

April 26-27, 2005

University of California, Santa Barbara

Meeting Agenda

Day 1: April 26
Goals: Background material, identify requirements

8:30 – 9:00 am	Registration and light breakfast/coffee
9:00 – 9:30 am	Introductory Remarks *Chris Mobley, CINMS Manager*
9:30 – 10:30 am	Deep water monitoring design process and requirements templates *Steve Gittings, NMSP Science Program Manager*
10:30 – 10:45 am	Break
10:45 – 11:15 am	Review and verify questions *Steve Gittings*
11:15-12:00	Breakout sessions – Begin Questions Tables ➢ Habitat and Ecosystem Effects *Satie Airamé, PISCO Policy Coordinator* ➢ Changes Within MPAs and Spillover *Greg McFall, GRNMS Research Coordinator*
12:00 – 1:00 pm	Lunch (provided)
1:00 – 2:30 pm	Breakout sessions - Continue with Questions Tables
2:30 – 2:45 pm	Break
2:45 – 4:30	Breakout sessions - Continue with Questions Tables
4:30 – 5:00 pm	Progress report *Steve Gittings*

Channel Islands Deep Water Monitoring Plan Development
April 26-27, 2005
University of California, Santa Barbara

Day 2: April 27
Goals: Short-listing; requirements matrix; project designs

8:30 – 9:00 am	Bagels/coffee
9:00 – 9:30 am	Day 1 Output Review (requirements matrix and prioritization) *Steve Gittings*
9:30 – 10:30 am	Breakout sessions – Begin Project Templates ➢ Habitat and Ecosystem Effects *Satie Airamé, PISCO Policy Coordinator* ➢ Changes Within MPAs and Spillover *Greg McFall, GRNMS Research Coordinator*
10:30-10:45	Break
10:45-12:00	Breakout sessions – Continue Project Templates
12:00 – 1:00 pm	Lunch (provided)
1:00 – 2:00 pm	Breakout sessions – Finish Project Templates
2:00 – 2:15 pm	Break
2:15 – 3:30 pm	Plenary Prioritization Discussion *Steve Gittings*
3:30 – 4:00 pm	Wrap up

Appendix II List of workshop participants and roles

Name		Institution	Working Group	Role
Satie	Airame	UCSB	Habitat and Ecosystem Effects/Spillover	Facilitator
Jim	Allen	SCCWRP	Habitat and Ecosystem Effects/Spillover	Participant
Dennis	Bedford	DFG	Habitat and Ecosystem Effects/Spillover	Participant
Jackie	Buhl	CINMS	Habitat and Ecosystem Effects/Spillover	Participant
Kathy	Dalton	NMSP HQ	Habitat and Ecosystem Effects/Spillover	Note taker
Gary	Davis	NPS	Changes Within MPAs	Participant
Sarah	Fangman	CINMS	Habitat and Ecosystem Effects/Spillover	Note taker
Steve	Gittings	NMSP HQ	Changes Within MPAs	Participant
John	Hunter	NOAA	Changes Within MPAs	Participant
Jeff	Hyland	NOAA	Changes Within MPAs	Participant
Brian	Keller	FKNMS	Changes Within MPAs	Participant
James	Lindholm	PIER	Habitat and Ecosystem Effects/Spillover	Participant
Steve	Lonhart	MBNMS	Habitat and Ecosystem Effects/Spillover	Participant
Dave	Lott	NMSP HQ	Changes Within MPAs	Note taker
Milton	Love	UCSB	Changes Within MPAs	Participant
Greg	McFall	GRNMS	Changes Within MPAs	Facilitator
Chris	Mobley	CINMS	Habitat and Ecosystem Effects/Spillover	Participant
Dan	Richards	NPS	Changes Within MPAs	Participant
Dirk	Rosen	Marine Applied Research	Changes Within MPAs	Participant
Donna	Schroeder	UCSB	Habitat and Ecosystem Effects/Spillover	Participant
Natalie	Senyk	NOAA	Changes Within MPAs	Note taker
Chuck	Valle	DFG	Changes Within MPAs	Participant
Robert	Warner	UCSB	Habitat and Ecosystem Effects/Spillover	Participant
Doug	Weaver	NOAA	Habitat and Ecosystem Effects/Spillover	Participant

Appendix III Question tables: Question 1

Changes within MPAs	**Do populations, communities and species distributions change within, adjacent to, and distant from reserves?**				
Sub-questions	**Key Resources**	**Potential Responses**	**Metrics**	**Potential Sources of Data**	**Prospective Projects**
1a Is community structure in reserves different from that in otherwise equivalent non-protected areas?	crabs, kelp, sponges, deep coral, benthic cover, food web complexity, white seabass, angel shark, squid spawning grounds, halibut	1) food web complexity 2) change in kelp height 3) change in coral height 4) change in sponge height 5) change in cover 6) change in density (kelp, coral, sponge) 7) increased densities of apex predators 8) changes in size frequency distribution of apex pred. 9) change in distribution of squid spawning in time and space	1a) number of trophic levels 1b) changes in abundance within trophic guilds 2a, 3a, 4a) average height and density 5a) species composition 5b) percent cover 6a) density of kelp, coral and sponge 7a) density of apex pred. 8a) size frequency of apex pred. 9) changes in benthic juvenile survivorship (derived info need)	CDFG ROV Surveys Love Lab Submersible Survey CDFG Aerial Kelp Survey NMFS SWFC Butler and Demer CALCOFI SCCWRP Grab sampling SCCWRP Trawl sampling USGS Towed Video	1) Soft bottom faunal characterization 2) Data mining of existing video transects (sub, rov) for hard bottom faunal assembledges 3) Comparison sites for existing hard bottom surveys 4) Conceptual diagrams for hard and soft bottom communities
1b What changes occur among selected species?	Lingcod, cowcod, boccacio, widow rockfish, yelloweye rock, canary, white abalone, pink abalone, red urchin, purple urchin, white urchin, sheephead, vermillion, blue rock, giant black seabass, black coral, red algae, lobster, squid, certain non-fished species, crab	1) change in density 2) changes in mean size 3) changes in size frequency 4) changes in biomass 5) growth rates 6) reproductive potential 7) sex ratio 8) changes in non-fished species 9) changes in benthic juvenile survivorship	1a) fish density 1b) CPUE for crabs and lobsters (indirect density) 2) mean size 3) size frequency 4) biomass 5) growth rates 6) fecundity at length and size frequency by species 7) sex ratio 8a) density of non-fished species (with the exception of 8b) 8b) area cover of brittle star, white urchin, squid eggs and sea cucumber 9) size frequency (1a, 2, 3)	CDFG ROV Surveys Love Lab Submersible Survey USGS Towed Video NMFS SWFC Butler and Demer CDFG Landings Logs MRFSS/CRFS Observer Data CDFG Creel Census (Milton)	1) Trap study for lobster and crab 2) Data mining of existing video transects (sub, rov) for hard bottom faunal assembledges 3) Comparison sites for existing hard bottom surveys
1c Do high-level carnivores change patterns of predation?	seabirds (12 species in CINMS), migratory fish, California sea lions, harbor seals, otter	1) Changes in foraging location 2) Changes in foraging duration 3) Change in haulout/nesting 4) Reduced prey species abundance	1a) density 1b) distribution 2a) time 3a) density (land) 3b) distribution (land) 4) inferred from question 1b	NMFS aerial surveys/demographics - Delong FWS seabird surveys USGS seabird surveys CINMS SAMSAP NPS seabird monitoring	1) At-sea surveys 2) Tagging

Appendix III Question tables: Question 2

Spillover Effects	Does migration of adults and young enhance populations outside reserves, and if so, how far outside?				
Sub-questions	**Key Resources**	**Potential Responses**	**Metrics**	**Potential Sources of Data**	**Prospective Projects**
2a What is the rate and magnitude of movement by selected species and size classes between MPAs and surrounding areas?	sheephead, cabezon, kelp bass, sea bass, lobster, bocaccio, lingcod, cow cod, halibut, angel shark	1) net movement from reserves 2) increase in edge fishing	1a) rates of immigration 1b) rates of emigration 2a) patterns of fishing 2b) CPUE/size	PIER Acoustic Tracking CMRP Tagging (Casselle) MRFSS/CRFSS Surveys	1) Additional tagging for key species 2) More observer surveys of private/party boats
2b Does spillover enhance adjacent populations?	sheephead, cabezon, kelp bass, sea bass, lobster, bocaccio, lingcod, cow cod, halibut, angel shark	1) persistent changes in abundance outside of reserves 2) increase reproductive capacity in populations outside reserves	1a, 2a) abundance of tagged fish 1b, 2b) size frequency of tagged fish	PIER Acoustic Tracking CMRP Tagging (Casselle) Hannon and assoc. tagging	1) Tagging for key species acoustic/traditional

Appendix III Question tables: Question 3

Spillover Effects	**Do populations outside reserves increase as a result of increased larval recruitment?**				
Sub-questions	**Key Resources**	**Potential Responses**	**Metrics**	**Potential Sources of Data**	**Prospective Projects**
3a Are larvae produced inside MPAs transported into areas outside MPAs?	larvae	1) extent of larval transport	1a) current direction @ depth 1b) current speed @ depth 2) duration of larvae in water column 3) mortality	PISCO/Warner (?) SB Channel CODAR - Washburn Scripps Buoys ADCP - LTER Dan Reed (?) Historical Data CINMS West Coast Obs (?)	1) Small scale current & oceanographic modeling

Appendix III Question tables: Question 4

Habitat & Ecosystem Effects	Do MPAs affect ecosystem structure and function, including trophic cascades?				
Sub-questions	**Key Resources/Processes**	**Potential Responses**	**Metrics**	**Potential Sources of Data**	**Prospective Projects**
4a How does trophic structure change as a result of establishment of MPAs?	kelp debris, 14 fish species, 6 invert species (DFG list) and their prey and the things that eat them, euphausids, big piscivores, marine mammals and seabirds, previously fished, associated prey, primary producers, sharks (cat shark/deep water coral & sponges relationship)	1) change in prey of large piscivores 2) changes in previously fished top predators 3) changes in associated prey 4) changes in detrital kelp	1) amount of kelp debris 2) dietary data 3) stable isotopes 4) abundance	LTER NPS Kelp Forest Monitoring CDFG Aerial monitoring (kelp)	1) Investigate origin of kelp debris 2) Abundance and distribution data collected for MPA effects questions 3) Monitor keystone prey and predators not being considered above 4) Model food web interactions and changes (can use historic information)// 5) Primary predators and input can be monitored by video 6) Secondary predators may require other techniques possibly video and trawl

Appendix III Question tables: Question 5

Habitat & Ecosystem Effects	**Do changes in fishing effort affect habitats within and/or close to MPAs?**				
Sub-questions	**Key Resources**	**Potential Responses**	**Metrics**	**Potential Sources of Data**	**Prospective Projects**
5a Does the cessation of fishing effort in reserves alter natural biotic habitats?	Sponges, Soft corals, Gorgonians, Hard corals, Tube forming brachiopods, Tube forming amphipods, Sea pens, Drift kelp, Urchins, Ridgeback prawns (targeted), Spot prawns (targeted), Sea cucumbers (targeted)	1) change in percent cover 2) diversity 3) density 4) abundance 5) proportion injured 6) mean size 7) cover 8) persistence or age 9) evenness	1) size 2) cover 3) density 4) fishing effort 5) injury 6) species composition 7) dispersion 8) fecundity 9) percent live 10) fishing debris 11) trawl marks	USGS Towed Video CDFG ROV Surveys Love Lab Submersible Surveys SCCWRP Trawl surveys (baseline) NMFS Trawl surveys (baseline) MMS OCS Studies	1) Review exsiting video 2) 20 minute video transect w/ 20 still photos 1 minute apart, sediment sample at each transect at multiple sites stratified randomly done anually (occupy same stations each year); sediment profile camera to measure the complexity of the sediment water interface.
5b Does the cessation of fishing effort in reserves alter natural abiotic habitats?	rugose habitat, gravel, soft sediment, existence of bioturbation, canyon edges	1) changes in relief 2) cessation of degradation 3) less siltation and sedimentation 4) exposed hard substrata 5) increased bioturbation in the soft sediment 6) reduction of trawl marks 7) less abandoned gear 8) recovery of sand ripple	1) rugosity 2) distribution and abundance of habitat types 3) fishing efforts and gear 4) sediment trap loads 5) percent area of anthropogenic debris 6) percent area of trawl marks 7) deposition of a rdgp line	USGS Towed Video CDFG ROV Surveys Love Lab Submersible Surveys USGS Sidescan Sonar Surveys	1) Review exsiting video 2) 20 minute video transect w/ 20 still photos 1 minute apart, sediment sample at each transect at multiple sites stratified randomly done anually (occupy same stations each year); sediment profile camera to measure the complexity of the sediment water interface.
5c Does the cessation of prawn trapping alter biotic and abiotic habitats?	sessile habitat-forming macroinvertebrates, e.g. sponges, corals	1) reduction of injury to colony 2) changes in cover and diversity of habitats (e.g. habitats formed by sponges or corals)	1) percent of colony alive 2) percent of population injured	Love Lab Submersibles	1) Submersible survey inside and outside reserve at Gull Island (in Santa Cruz Canyon), possible ROV, video and verbal annotation, sampling 1-5 year interval

Appendix III Question tables: Question 6

Habitat & Ecosystem Effects	**Can observed changes within CINMS (and/or reserves) be attributed to large scale forcing and other factors independent of reserve establishment?**					
Sub-questions	**Key Resources**	**Potential Responses**	**Metrics**	**Potential sources of data**	**Prospective Projects**	**Additional Comments**
6a Can observed changes in MPAs be attributed to sediment quality, water quality and other independent (uncontrolled) factors?	infauna, epifauna, benthically associated fauna (demersal fishes e.g. speckled sanddab, slender sole, pacific sanddab), sessile invertebrates, sediments, seawater	1) changes in biodiversity, abundance and biomass 2) changes in populations and chemical body burdens 3) presence of contaminents in sediments 4) presence of contaminents in water 5) changes in oxygen content in water	1) concentrations of dissolved oxygen 2) concentration of contaminants in sediments and water 3) sediment chemistry 4) diversity and abundance of infauna (look at correlations with independent factors) 5) measure contaminant loads (NOAA's NS&T contam. List plus emergent contaminant lists) in sanddab guild 6) parasite load 7) fluctuating assymetry	SCCWRP Bight 98/03 (08) Love Lab targeted surveys of animal tissue for heavy metals (rigs)	1) Sediment grabs & water samples to evaluate contam. load in water, sediment and infauna, 3-5 year intervals; build on historical data; targeted monitoring program using sediment sampling trawling or hook and line for the sanddabs (analyze tissues for contaminants)	Inside and outside reserves at multiple sites throughout the islands; this needs to be an ongoing monitoring program to form a baseline linked to program wide priorities (as stated this is a yes/no question)... must also accommodate new sources (e.g. point sources)
6b Can observed changes within reserves be attributed to climate and oceanographic forcing?	bocaccio, cold water rockfish, blue and olive rockfish, invertebrates?	1) population changes 2) associating w/ areas of upwelling 3) spatial changes	1) sea surface temperature 2) North Pacific Index 3) El Nino Indices 4) Upwelling indices	CalCOFI ICESS PISCO	1) Harness existing data	

Appendix IV Project Templates – Deep Visual Surveys

Project Template - CINMS Deep-Water Monitoring
Deep Visual Surveys

(shaded cell) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Visual surveys of very deep communities and habitats 340+ m

	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)	1a, 1b		5a, 4a

Problem Statement & Hypothesis	How do deepwater (34 - 340m) marine populations, communities, and trophic structure respond to MPA implementation?
Objectives	Quantify changes in community structure for conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in trophic structure inside and outside of MPAs
Info Requirement (types of data)	1a) number of trophic levels 1b) changes in relative abundance within trophic guilds 2a, 3a, 4a) average height and density 5a) species composition 5b) percent cover 6a) density of kelp, coral and sponge 7a) density of apex predators 8a) size frequency of apex predators 9a) distribution of squid spawning 1a) fish density 2) mean size 3) size frequency 4) biomass 6) fecundity at length and size frequency by species 7) sex ratio (for obvious species only) 8a) density of non-fished species (with the exception of 8b) 8b) area cover of brittle star and sea cucumber habitat characteristics: substrate type, relief, slope, depth, temperature, relative rugosity kelp debris

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island	Footprint
Geography (locations)	X	X		X	X			X	X	X	X	X	X

	Days	Weeks	Months
Annual Field Needs (time & interval)	10		

	Type	Where	Time Period	Collector	Availability
Existing Information	Delta and ROV species and habitat characteristics	number of sites	1995-2004 for Delta, 2004 for ROV	Love lab delta, CDFG ROV	Yes

	Partner	Roles (e.g., on-going, field surveys, data analysis)
Partners and Roles	UCSB	Field collection, post-processing
	NURP	Funding
	SWFSC	Field collection, post-processing
	NGOs (Packard)	Funding
	USGS (NMSP sled)	Field collection, post-processing
	CDFG	Field collection, post-processing

Support Requirements (e.g., equipment types, vessels)	Sub (Delta), towed camera (NMSO), drop camera, ROB (NMSP, CFG, MBARI)

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K) - Delta or Aquarius			240			
Annual Cost (K) - ROV Heavy 100+ m				X		
Annual Cost (K) - ROV light 30-100 m		X				
Annual Cost (K) - Towed camera	X					
Annual Cost (K) - Drop camera	X					

	1	2	3	4	5	>5
Time to Complete (years)						X
Interval at any one site		X				

Additional Comments (incl. links to shallow monitoring)	Cost is per site with inside-outside comparison for a 10-day field project with some post-processing. Quality of the products is platform dependent. Data mining is possible with existing video archive.

Appendix IV Project Templates – Shallow Visual Surveys

Project Template - CINMS Deep-Water Monitoring
Shallow Visual Surveys

(shaded)	= key criteria for evaluation as an element of the Deep-Water Monitoring Plan
Title	Surveys of shallow water communities and habitats 20 - 30 m

	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)	1a, 1b		5a, 4a

Problem Statement & Hypothesis	How do shallow water (20-30m) marine populations, communities, and trophic structure respond to MPA implementation?
Objectives	Quantify changes in community structure for conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in trophic structure inside and outside of MPAs
Info Requirement (types of data)	1a) number of trophic levels 1b) changes in relative abundance within trophic guilds 2a, 3a, 4a) average height and density 5a) species composition 5b) percent cover 6a) density of kelp, coral and sponge 7a) density of apex predators 8a) size frequency of apex predators 1a) fish density 2) mean size 3) size frequency 4) biomass 6) fecundity at length and size frequency by species 7) sex ratio (for obvious species only) 8a) density of non-fished species (with the exception of 8b) 8b) area cover of brittle star, white urchin, squid eggs and sea cucumber habitat characteristics: substrate type, relief, slope, depth, temperature, rugosity kelp debris

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	X	X	X	X	X	X	X	X	X	X	X	X

	Days	Weeks	Months
Annual Field Needs (time & interval)		8 days per pair of sites x 12 reserves	

	Type	Where	Time Period	Collector	Availability
Existing Information	CRANE data & methodology				

	Partner	Roles (e.g., on-going, field surveys, data analysis)
Partners and Roles	UCSB & CDFG	Field collection, post-processing
	NPS	Field collection, post-processing

Support Requirements (e.g., equipment types, vessels)	6 divers hired for a 8-month period. Assumes use of Shearwater equivalent.

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K) - Divers				320		
Annual Cost (K) - ROV	ROV costs needed from Dirk					

	1	2	3	4	5	>5
Time to Complete (years)						X
Interval at any one site		X				

Additional Comments (incl. links to shallow monitoring)	This is the minimum survey requirement. ROV for no-kelp areas. Volunteers for relative abundance. Approximately $13,000 per site ($26K per pair). Does not include boat days - increased cost if Shearwater is not available. Includes 26% overhead. Database only - does not include write up.

Appendix IV Project Templates – Trap Survey

Project Template - CINMS Deep-Water Monitoring
Trap Survey

(shaded cell) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Rock crab and lobster collaborative monitoring using trap fishermen

	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)	1b	2a, 2b	

Problem Statement & Hypothesis	1) How does CPUE and size change inside and outside reserves 2) Is there a spillover effect?
Objectives	Quantify changes in CPUE for rock crabs and lobsters inside and outside reserves Quantify changes in mean size and size frequency for rock crabs and lobsters inside and outside reserves Is there spillover of rock crab and lobsters
Info Requirement (types of data)	1b) CPUE (number and weight) for crabs and lobsters (indirect density) 2) mean size 3) size frequency 4) growth rates 6) fecundity at length and size frequency by species 7) sex ratio 8) movement rates and distance Fishing effort

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations) rock crab	X	X	X	X	X	X	X	X	X	X	X	X
Geography (locations) lobster				X	X		X	X	X	X	X	X

	Days	Weeks	Months
Annual Field Needs (time & interval)			6 months

	Type	Where	Time Period	Collector	Availability
Existing Information	Hunter Lenihan	UCSB	2004	unk	unk

	Partner	Roles (e.g., on-going, field surveys, data analysis)
Partners and Roles	Lenihan	
	Lobster and crab fishermen	
	CIMSF CMRP	

Support Requirements (e.g., equipment types, vessels)	Fishing vessel and gear; tags.

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K) - Traditional Tag/CPUE		75				
Annual Cost (K) - Acoustic	Use Lindholm template					

	1	2	3	4	5	>5
Time to Complete (years)			X			

Additional Comments (incl. links to shallow monitoring)	Approximately $75K per paired site traditional tagging/CPUE; includes post-processing; incidental species may be caught

Appendix IV Project Templates – Prawn Traps

Project Template - CINMS Deep-Water Monitoring
Prawn Trap Surveys

(shaded cell) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Deepwater MPAs: the prawn trap fishery and its effect on essential fish habitat										
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects				
Question(s) addressed (e.g. 1b, 7a)	yes						yes				
Problem Statement & Hypothesis	Does prawn trap fishing damage essential fish habitat (EFH) in the CINMS? Observations of tangled ropes and derelict traps intertwined with diseased and broken coral and sponges suggest it does. This question is important because large corals and sponges may be EFH and federal portions of proposed MPAs seek to protect EFH. There are two related questions this project seeks to address: (1) Are there historical patterns in sponge/coral density and health between areas of high and low fishing intensity? (2) Are there changes in time in sponge/coral density, recruitment, growth and health inside and oustide MPAs?										
Objectives	Use a manned submersible to visually survey populations of sponges and corals inside and outside of MPAs and in areas of historically low and high fishing intensity.										
Info Requirement (types of data)	Data collected from video transects would reveal current status and subsequent changes in: species composition of sessile macroinvertebrates, density, size, health (signs of disease and proportion of animal affected), amount of derelict fishing gear (prawn traps and ropes).										
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)								X				
	Days			Weeks			Months				
Annual Field Needs (time & interval)	minimum 3 consecutive days										
	Type			Where			Time Period		Collector		Availability
Existing Information	Some information exists at CINMS			Gull Island MPA			2002		CINMS, Sarah		available
	Partner				Roles (e.g., on-going, field surveys, data analysis)						
Partners and Roles	Donna Schroeder, UCSB and Channel Islands				chief scientist						
Support Requirements (e.g., equipment types, vessels)	Field work and some salary for data analysis and reports										
	0-50	<100	<250	<500	<750	<1M					
Annual Cost (K)		X									
	1	2	3	4	5	>5					
Time to Complete (years)	X					X					
Additional Comments (incl. links to shallow monitoring)	One year of surveys can provide information on historical patterns. Multiple years (annually or every 3 years) are strongly preferred and can give information on effectiveness of MPAs.										

Appendix IV Project Templates – Acoustic Tracking of Fish Movement and Spillover

Project Template - CINMS Deep-Water Monitoring
Acoustic Tracking of Fish Movement and Spillover

= key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Acoustic tracking of fish movement and spillover in California's Channel Islands											
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects					
Question(s) addressed (e.g. 1b, 7a)				2a								
Problem Statement & Hypothesis	How is the movement of ecologically and commercially important fish and invertebrate species mediated by seafloor habitats in Channel Islands?											
Objectives	Quantify the movement of fish and invertebrate species at multiple islands, inside and out, of State Marine Reserves, focusing in particular on Anacapa, but also including reserves at SBI, Santa Cruz, and Santa Rosa.											
Info Requirement (types of data)	Location and depth of individual fish within the range of acoustic receivers.											
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)					X			X	X	X	X	X
	Days			Weeks			Months					
Annual Field Needs (time & interval)				2-3 weeks every quarter								
	Type			Where			Time Period		Collector		Availability	
Existing Information	Black sea bass data			Pfleger Institute of Environmental Research - PIER			Data collected since 1999				Limited until completed	
	White sea bass data			Pfleger Institute of Environmental Research - PIER			Data collected since 2003				Limited until completed	
	CA Sheephead data			Pfleger Institute of Environmental Research - PIER			Data collected since 2004				Limited until completed	
	Kelp Bass			Pfleger Institute of Environmental Research - PIER			Data collected since 2004				Limited until completed	
	Partner				Roles (e.g., on-going, field surveys, data analysis)							
Partners and Roles	PIER				On-going field operations and data analysis							
Support Requirements (e.g., equipment types, vessels)	From CINMS: Vessel support for 3-4 days of SCUBA operations on quarterly basis											
	0-50	<100	<250	<500	<750	<1M						
Annual Cost (K) - total project cost			< $250K annually									
Requested support from CINMS	$50K annually											
	1	2	3	4	5	>5						
Time to Complete (years)		2-5 years per transmitter										
Additional Comments (incl. links to shallow monitoring)												

Appendix IV Project Templates – Model Food Web Interactions

Project Template - CINMS Deep-Water Monitoring
Model Food Web Interactions

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Model Food Web Interactions											
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects					
Question(s) addressed (e.g. 1b, 7a)							4a					
Problem Statement & Hypothesis	How is trophic structure changing as a result of MPA establishment.											
Objectives	Classification should involved taking densities of species, put them in functional feeding groups/trophic analysis, look for changes in relative abundance over time; for species that are fished, look at responses of their prey (longer term), for species that are primary consumers look at chances in input (e.g., kelp) - shorter term											
Info Requirement (types of data)	Species densities; requires data from shallow and deep monitoring programs to accomplish this; develop food web model; identify changes in model over time											
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	Depends on data sources											
	Days			Weeks			Months					
Annual Field Needs (time & interval)	7 days for food web analysis						6 months to develop food web model					
	Type			Where			Time Period		Collector		Availability	
Existing Information	Requires data (minimum five years of information) from shallow and deep monitoring programs; scientific literature on diet											
	Partner				Roles (e.g., on-going, field surveys, data analysis)							
Partners and Roles	PISCO				Data collection and analysis							
	NCEAS?				Data analysis							
Support Requirements (e.g., equipment types, vessels)	Data requirements as part of funding; database management needed, but not directed at this level											
	0-50	<100	<250	<500	<750	<1M						
Annual Cost (K)	X (level 1)	X (level 2)										
	1	2	3	4	5	>5						
Time to Complete (years)	To do the initial analysis				To get the >>5-10: start initial analysis in year 5, subsequent analysis in year ten would potentially be cheaper							
Additional Comments (incl. links to shallow monitoring)												

Appendix IV Project Templates – Foraging

Project Template - CINMS Deep-Water Monitoring
Foraging

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	High level carnivore foraging										
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects				
Question(s) addressed (e.g. 1b, 7a)	1c										
Problem Statement & Hypothesis	Changes in abundance in prey resources over time within MPAs can lead to changes in foraging patterns of high level carnivores										
Objectives	1) To look at foraging patterns of carnivores throughout the Channel Islands 2) Look at changes in nesting or haul out locations										
Info Requirement (types of data)	Seabirds: Quantifying foraging location and duration; locate and quantify nesting locations quantify fledgling success Pinnipeds: Quantifying foraging location and duration; locate and quantify haul out locations										
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	A subset of locations may be reasonable - follow-up needed											
	Days			Weeks			Months				
Annual Field Needs (time & interval)	Consult experts										
	Type			Where			Time Period		Collector		Availability
Existing Information	NMFS aerial surveys/demographics - DeLong FWS seabird surveys USGS seabird surveys CINMS SAMSAP NPS seabird monitoring										
	Partner				Roles (e.g., on-going, field surveys, data analysis)						
Partners and Roles											
Support Requirements (e.g., equipment types, vessels)	Depends on levels of partner activity										
	0-50	<100	<250	<500	<750	<1M					
Annual Cost (K)											
	1	2	3	4	5	>5					
Time to Complete (years)											
Additional Comments (incl. links to shallow monitoring)	Experts needed										

Appendix IV Project Templates – Deep Slope Surveys

Project Template - CINMS Deep-Water Monitoring
Deep Slope Surveys

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Visual surveys of very deep communities and habitats 340+ m

	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)	1a, 1b		5a, 4a

Problem Statement & Hypothesis	How do deepwater (340+ m) marine populations, communities, and trophic structure respond to MPA implementation?
Objectives	Quantify changes in community structure for conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in population density and relative abundance for selected conspicuous fishes and invertebrates inside and outside of MPAs Quantify changes in trophic structure inside and outside of MPAs
Info Requirement (types of data)	1a) number of trophic levels 1b) changes in relative abundance within trophic guilds 2a, 3a, 4a) average height and density 5a) species composition 5b) percent cover 6a) density of kelp, coral and sponge 7a) density of apex predators 8a) size frequency of apex predators 1a) fish density 2) mean size 3) size frequency 4) biomass 6) fecundity at length and size frequency by species 7) sex ratio (for obvious species only) 8a) density of non-fished species (with the exception of 8b) 8b) area cover of brittle star and sea cucumber habitat characteristics: substrate type, relief, slope, depth, temperature, relative rugosity kelp debris

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island	Footprint
Geography (locations)			X	X				X				X	X

	Days	Weeks	Months
Annual Field Needs (time & interval)	10		

	Type	Where	Time Period	Collector	Availability
Existing Information					

Partners and Roles	Partner	Roles (e.g., on-going, field surveys, data analysis)
	UCSB	Field collection, post-processing
	NURP, Ocean Exploration	Funding
	NWFSC	Field collection, post-processing
	NGOs (Packard)	Funding
	MBARI, Woods Hole, Can Dive	

Support Requirements (e.g., equipment types, vessels)	Laser line scan, deep trawls commercial, heavy ROV, deep subs

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K) - Subs					X	
Annual Cost (K) - ROV Heavy 100+ m				X		
Annual Cost (K) - Laser line				X		
Annual Cost (K) - Deep trawls	X					

	1	2	3	4	5	>5
Time to Complete (years)						X
Interval at any one site			trawls			

Additional Comments (incl. links to shallow monitoring)	Cost is per site with inside-outside comparison for a 10 day field project with some post-processing. Quality of the products is platform dependent. Invertebrate sampling is poor from trawls. Extractive sampling.

Appendix IV Project Templates – Water Quality (sample and data collection)

Project Template - CINMS Deep-Water Monitoring
Water Quality - sample and data collection

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Water Quality Monitoring											
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects					
Question(s) addressed (e.g. 1b, 7a)							6a					
Problem Statement & Hypothesis	Do changes in water quality affect benthic communities inside and around MPAs?											
Objectives	Evaluate contaminants, oxygen level, etc. in water column											
Info Requirement (types of data)	Transmissivity, chlorophyll a, oxygen levels, contaminants, bacteria, HABs, pseudonitzchia, opportunistically piggyback on other projects (e.g., Lindholm protocol); minimum 16-24 transects per site per day - 10-14 days to complete 2 major sites											
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)				X						X	X	
	Days			Weeks			Months					
Annual Field Needs (time & interval)	10 to 14 days											
	Type			Where			Time Period		Collector		Availability	
Existing Information	Plumes and Blooms			7 stations in SB Channel from SRI			Monthly since 1996		ICESS			
	Partner				Roles (e.g., on-going, field surveys, data analysis)							
Partners and Roles	SCCWRP, EPA?											
Support Requirements (e.g., equipment types, vessels)	Vessel time											
	0-50	<100	<250	<500	<750	<1M						
Annual Cost (K)												
	1	2	3	4	5	>5						
Time to Complete (years)	Ongoing monitoring											
Additional Comments (incl. links to shallow monitoring)												

Appendix IV Project Templates – Sediment Quality (sample and data collection)

Project Template - CINMS Deep-Water Monitoring
Sediment Quality - sample and data collection

(key colour) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Sediment Sampling											
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects					
Question(s) addressed (e.g. 1b, 7a)							6a					
Problem Statement & Hypothesis	Do contaminated sediments affect benthic communities?											
Objectives	Contamination of sediments (PCBs, DDTs, NS&T list, metals - copper, zinc, mercury, lead, chromium, arsenic)											
Info Requirement (types of data)	Sediment grab samples - sample at all depth ranges and biogeographic ranges inside/outside reserves 0 same sites as trawl surveys; van veen grab; three grabs per stations (one each for: infauna, chemistry and toxicity); toxicity samples must be processed right away, taxonomy can be deferred. Survey frequency same as trawling.											
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	See above											
	Days			Weeks			Months					
Annual Field Needs (time & interval)	10											
	Type			Where			Time Period		Collector		Availability	
Existing Information	Chemistry, infauna and toxicity			Throughout southern California			30 years of data in So.		SCCWRP			
	Partner				Roles (e.g., on-going, field surveys, data analysis)							
Partners and Roles	SCCWRP											
Support Requirements (e.g., equipment types, vessels)	CINMS vessel and staff time											
	0-50	<100	<250	<500	<750	<1M						
Annual Cost (K)		X										
	1	2	3	4	5	>5						
Time to Complete (years)						X						
Additional Comments (incl. links to shallow monitoring)												

Appendix IV Project Templates – Large Scale Physical Influences

Project Template - CINMS Deep-Water Monitoring
Large Scale Physical Influences

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Large scale physical influences											
	Changes Within MPAs			Spillover			Habitat and Ecosystem Effects					
Question(s) addressed (e.g. 1b, 7a)							6b					
Problem Statement & Hypothesis	Are changes in reserves attributable to large scale forcing											
Objectives	To determine large scale factors that change benthic communities											
Info Requirement (types of data)	SST, PDO index, upwelling and circulation; need data on abundance of adults of targeted species as well as recruitment information if available; physical characterization including bottom temperature											
	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)												
	Days			Weeks			Months					
Annual Field Needs (time & interval)	None if surveys include physical data						12 for full analysis of physical patterns overtime and correlate with abundance data (starting with adequate (5 years) survey data)					
	Type			Where			Time Period		Collector		Availability	
Existing Information	SSCWRP - report on 30 year			SCCWRP website			30 years		SCCWRP		SCCWRP website	
	Partner				Roles (e.g., on-going, field surveys, data analysis)							
Partners and Roles	ICESS				Sea surface temperature data							
	PISCO				CODAR, circulation patterns							
	OOS's				Temperature, circulation and possible productivity							
Support Requirements (e.g., equipment types, vessels)	N/A											
	0-50	<100	<250	<500	<750	<1M						
Annual Cost (K)		X										
	1	2	3	4	5	>5						
Time to Complete (years)	X (once data collected)											
Additional Comments (incl. links to shallow monitoring)												

Appendix IV Project Templates – Trawl Surveys

Project Template - CINMS Deep-Water Monitoring
Trawl Surveys

= key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Trawl surveys		
	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)			4a, 6a
Problem Statement & Hypothesis	Are there changes in the trophic structure of the deepwater community? Do contaminants affect benthic organisms?		
Objectives	Composition of benthic primary and secondary consumers; contaminant levels in tissues of sanddabs; baseline inventory of the deepwater marine community; recruitment of benthic communities; trawl surveys advantages; accurate id's; length measurements; weight; anomalies; samples for contaminants; gut contents; otoliths; cryptic species and small individuals are not identified well with visual surveys.		
Info Requirement (types of data)	Every year (same season) or semi-annually; sample in four depth zones: 0-30, 31-100, 101-200, 201-500m; trawl size: 7.6 m wide net, 1.3 cm cod end mesh, 10 minute trawls along isobaths, minimum one trawl per depth; ideally survey inside/outside all reserves; minimum: one inside/outside pair in each biogeographic zone and each depth zone for each pair; north/south comparison if resources allow; video and trawl surveys should overlap in some areas.		

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	See above											

	Days	Weeks	Months
Annual Field Needs (time & interval)	For 24 trawls = 12 days		

	Type	Where	Time Period	Collector	Availability
Existing Information	6000+ trawl surveys; standard	SCCWRP	40 year period	SCCWRP & others	Contact Jim Allen
	NMFS	200m and deeper	Recent	NMFS	

	Partner	Roles (e.g., on-going, field surveys, data analysis)
Partners and Roles	SCCWRP	Tissue analysis, data analysis, field surveys
	NMFS	Field surveys, data analysis

Support Requirements (e.g., equipment types, vessels)	Vessel and staff support from CINMS

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K)	X (labor, travel, data analysis for 12 days of fieldwork)					

	1	2	3	4	5	>5
Time to Complete (years)						X

Additional Comments (incl. links to shallow monitoring)	

Appendix IV Project Templates – Modeling Larval Transport

Project Template - CINMS Deep-Water Monitoring
Modeling Larval Transport

(shaded) = key criteria for evaluation as an element of the Deep-Water Monitoring Plan

Title	Larval transport modeling

	Changes Within MPAs	Spillover	Habitat and Ecosystem Effects
Question(s) addressed (e.g. 1b, 7a)		3a	

Problem Statement & Hypothesis	There is little knowledge about the extent of larval transport out of reserves
Objectives	Model larval transport pathways
Info Requirement (types of data)	Data mining from existing oceanographic data Life history information on target larval species (e.g., timing of settlement)

	Rich Rk	HarrisPt	Judith Rk	South Pt	Carr Pt	Skunk Pt	Paint Cave	Gull Isl	Scorp Rk	N Ani I SMCA	N Ani I SMR	SB Island
Geography (locations)	Any - but may look at places where existing data is more complete									X	X	

	Days	Weeks	Months
Annual Field Needs (time & interval)			Target species specific

	Type	Where	Time Period	Collector	Availability
Existing Information	PISCO/SMRFS SB Channel CODAR - Washburn Scripps Buoys ADCP - LTER Dan Reed (?) Historical data CINMS West Coast Obs (?) CALCOFI				

	Partner	Roles (e.g., on-going, field surveys, data analysis)
Partners and Roles	F3 - Dave Siegel	modeler?

Support Requirements (e.g., equipment types, vessels)	Potential for additional field work (e.g., CTD, ADCP), salary for modeler

	0-50	<100	<250	<500	<750	<1M
Annual Cost (K)		X				

	1	2	3	4	5	>5
Time to Complete (years)		X				

Additional Comments (incl. links to shallow monitoring)	Need info from circulation modelers to determine if existing circulation info is of fine enough scale. Cost will drop to add additional species. Depending on species selected, could overlap with shallow water monitoring. May be important to keep MMS/NDBC buoys in service - need to ask modelers. Talk to regional IOOS.

Appendix V Comments received from the CINMS Sanctuary Advisory Council Research Activities Panel

Research Activities Panel

A Working Group of the Channel Islands National Marine Sanctuary Advisory Council

Submitted September 21, 2005

Review of the Channel Islands Monitoring Plan Development Workshop Report

Assembled by Robert Warner (Chair) from comments electronically contributed by RAP members.

Background: The CINMS and the National Marine Sanctuary Program hosted a 2-day workshop in April 2005 to develop a monitoring program for the proposed federal marine reserves in the CINMS. The RAP received a draft of the report of the workshop in early September 2005, with a request from CINMS staff for the RAP to consider if the workshop participants missed anything, whether they agreed with the prioritization, and if they have thoughts on how to move the recommendations into a plan. This is timely, because the next step is to develop the monitoring plan itself.

The workshop considered many different projects that might address information needed for monitoring, and placed them into several different categories according to their priority. We are in general agreement with the ranking of projects. Given the current economic climate, the RAP considers it very unlikely that any of the projects ranked as medium or low priority will be part of a monitoring plan unless they can be included in the top-ranked programs with little or no extra cost. Because of that, we review here only the top-ranked programs.

As a general comment, it is important to remember that the species expected to show the greatest changes as a result of reserve establishment are those that are currently affected by human activity (through extraction or habitat alteration). A survey of such activities currently occurring in the deep-water zones would suggest a list of species and areas of particular concern, and such a list could be used to focus particular monitoring projects.

There were three projects ranked as high priority by the workshop:

1. *Deep visual surveys* (we assume these occur between 30 and 340m, despite the occasional reference to >340m). Certainly, these will be the primary source of information on changes in deep water MPAs. We note that there is no recommendation as to the method by which these surveys will be carried out: submersibles, ROVs, towed cameras, and drop cameras are all mentioned. This overlap of methods and lack of resolution has hampered progress in the monitoring plan for deeper portions of the State reserves, and appears likely to do the same here. There is a limited amount of information comparing the accuracy, efficiency, and repeatability of these methods, but no decision can be made without some idea of the details of the monitoring plan itself. What species are the primary focus of monitoring? Will transects be fixed or

randomly placed? Even if several methods end up being used, great care should be exercised to develop protocols that can yield comparable data emerging from these different techniques.

The number of surveys suggested per year is probably adequate, but is also extremely expensive.

2. *Shallow visual surveys* (SCUBA surveys conducted between 20 and 30m). The protocols for these surveys is well developed, and we see no major problems with this project. However, diver bottom time will be limited for work at these depths, which may increase the cost.

The number of surveys suggested per year is impressive, far in excess of what is currently taking place in shallow water (<20m) for State reserve monitoring.

3. *Trap surveys*. This aspect of monitoring is a good complement to the visual surveys, since it covers two groups of organisms (lobsters and crabs) that are not counted well visually. It also has the advantage of being a collaborative program. Preliminary usage surveys (see RAP comments above) are especially relevant here, because the greatest changes are expected in the areas of heavy impact prior to reserve establishment.

One project was rated as “high-medium”: a study to assess the impacts of prawn traps on habitats (particularly sponges and corals), to be conducted by a manned submersible comparing areas of high and low use. While this is an important project, much of it lays outside the strict definition of monitoring. Given that deep visual surveys are likely to be part of a monitoring scheme, we suggest that (1) these surveys include assessments of sponges and corals, and (2) some surveys be targeted in areas that have received historically high prawn trap fishing intensity.

Overall, the RAP was impressed with the thoroughness of the Deep Water Workshop process, and endorses the report as an important first step towards a comprehensive monitoring program.

ONMS CONSERVATION SERIES PUBLICATIONS

To date, the following reports have been published in the Marine Sanctuaries Conservation Series. All publications are available on the Office of National Marine Sanctuaries website (http://www.sanctuaries.noaa.gov/).

Movement of yellowtail snapper (*Ocyurus chrysurus* Block 1790) and black grouper (*Mycteroperca bonaci* Poey 1860) in the northern Florida Keys National Marine Sanctuary as determined by acoustic telemetry (MSD-05-4)

The Impacts of Coastal Protection Structures in California's Monterey Bay National Marine Sanctuary (MSD-05-3)

An annotated bibliography of diet studies of fish of the southeast United States and Gray's Reef National Marine Sanctuary (MSD-05-2)

Noise Levels and Sources in the Stellwagen Bank National Marine Sanctuary and the St. Lawrence River Estuary (MSD-05-1)

Biogeographic Analysis of the Tortugas Ecological Reserve (MSD-04-1)

A Review of the Ecological Effectiveness of Subtidal Marine Reserves in Central California (MSD-04-2, MSD-04-3)

Pre-Construction Coral Survey of the M/V Wellwood Grounding Site (MSD-03-1)

Olympic Coast National Marine Sanctuary: Proceedings of the 1998 Research Workshop, Seattle, Washington (MSD-01-04)

Workshop on Marine Mammal Research & Monitoring in the National Marine Sanctuaries (MSD-01-03)

A Review of Marine Zones in the Monterey Bay National Marine Sanctuary (MSD-01-2)

Distribution and Sighting Frequency of Reef Fishes in the Florida Keys National Marine Sanctuary (MSD-01-1)

Flower Garden Banks National Marine Sanctuary: A Rapid Assessment of Coral, Fish, and Algae Using the AGRRA Protocol (MSD-00-3)

The Economic Contribution of Whalewatching to Regional Economies: Perspectives From Two National Marine Sanctuaries (MSD-00-2)

Olympic Coast National Marine Sanctuary Area to be Avoided Education and Monitoring Program (MSD-00-1)

Multi-species and Multi-interest Management: an Ecosystem Approach to Market Squid (*Loligo opalescens*) Harvest in California (MSD-99-1)