



Section III

Ecosystem Protection

- **Big Sur Coastal Ecosystem Action Plan**
- **Bottom Trawling Effects on Benthic Habitats Action Plan**
- **Davidson Seamount Action Plan**
- **Emerging Issues Action Plan**
- **Introduced Species Action Plan**
- **Sanctuary Integrated Monitoring Network (SIMoN) Action Plan**
- **Marine Protected Areas Action Plan**

Ecosystem Protection Action Plans

Background

Several issues under the theme of Ecosystem Protection involve how NOAA addresses the impacts of fishing on the ecosystem in the MBNMS. Members of the public and the science community raised several issues during the scoping phase of management plan review. Certain recommendations during the JMPR involved regulatory action and coordination with other agencies as part of the rulemaking process. The MBNMS Advisory Council also discussed and recommended MBNMS take certain actions at the present time and for the MBNMS to implement certain action plans that may involve fishing regulations. Other action plans involved further analysis and work with stakeholders prior to identifying a specific action. Following is a description of some of the issues that relate to fishing and their potential outcomes regarding fishing related regulations.

Development of Fishing Regulations in National Marine Sanctuaries

The regulation of fishing in a national marine sanctuary requires certain steps to be taken that are different from regulation of other activities. Specifically, NOAA must consult the regional fishery management council (i.e., Pacific Fishery Management Council) and provide the council with the opportunity to prepare draft NMSA regulations in the Exclusive Economic Zone. Section 304(a) (5) of the NMSA requires this step in the rulemaking process. Following this consideration by the appropriate Fishery Management Council, NOAA determines whether to address the issue with certain statutory authorities. In these areas, NOAA has two statutory authorities, the NMSA and the Magnuson-Stevens Fishery Conservation and Management Act (MSA) that can be used to regulate fishing. NOAA uses two regulatory tools, either exclusively or in conjunction with one another, to manage fishing in the national marine sanctuaries to meet the various goals and objectives identified to fulfill the resource protection mandates of the NMSA. It is NOAA policy to consider, on a case-by-case basis, the appropriate authorities for issuing fishing regulations, including establishing no-take marine reserves, in national marine sanctuaries.

Krill Harvesting Recommendations from Sanctuary Advisory Council

Krill are a critical component of the marine ecosystem and fundamental to the trophic structure of the marine life within the Sanctuary. These species are preyed upon by many commercially important species within Sanctuary waters including salmon, rockfish, squid, sardine, mackerel and flatfish. Blue whales, humpbacks, and numerous seabirds including sooty shearwaters, marbled murrelets, and common murre are dependent on krill as forage. Reliable regional estimates of biomass and prey requirements do not exist. However, it has been estimated that krill makes up between 15 and 60 percent of the diet of commercially significant fish in ecosystems with comparable trophic structures.

Krill are currently not harvested within the Sanctuary; however the potential exists for this fishery to develop in the future due to an increasing need for aquaculture feed. A krill fishery could not only severely impact the integrity of the marine ecosystem but could adversely affect

commercial and recreational fisheries of all kinds as most target species are directly or indirectly dependent on the resource. A krill fishery may have serious adverse impacts on many of the local commercially important fish populations including salmon, rockfish, sardine and squid as these species are heavily dependent on krill as a food source.

To address this issue, MBNMS, as part of the JMPR, explored the potential for the future harvest of krill, outlined the current regulatory framework, and presented the recommendations from the working group to the Sanctuary Advisory Council. The Monterey Bay Sanctuary Advisory Council recommended that MBNMS provide a presentation to the Pacific Fishery Management Council and recommend permanent restrictions in the Sanctuary. This concluded the necessary actions in this case and, therefore, the Krill Harvesting Action Plan was not included in this management plan. If krill harvesting were to evolve as a fishery in the MBNMS, the MBNMS would revisit the recommendations of the working group, Advisory Council, and actions taken to protect the ecosystem.

Davidson Seamount Recommendations

The Davidson Seamount working group and Sanctuary Advisory Council recommend that the Davidson Seamount met standards for designation as a national marine sanctuary after consideration of the resources and qualities of the area. The Advisory Council also recommended that if existing fishing practices within the area around Davidson Seamount would not be affected, then the MBNMS should restrict all potential forms of disturbance to the seabed and those activities above the seabed that may have the potential to harm the fragile coral and sponge communities should also be restricted. One activity with the potential to disturb the area is fishing with a bottom trawl. The peak of Davidson Seamount is approximately 3,700 feet below the ocean's surface. The MBNMS therefore proposed a regulation to restrict any disturbance, collection, or harvest, including by fishing, below 3,000 feet in these areas. While currently there is no fishing that takes place at that depth range, the MBNMS provided the Pacific Fishery Management Council with the opportunity to draft fishing regulations. The Pacific Fishery Management Council, while unanimously supporting the goals and objectives of the MBNMS proposal, recommended changes to the Groundfish Management Plan to address the MBNMS proposal to restrict fishing below 3,000 feet in that area. To address other types of disturbance, collection, or harvest in the area, the MBNMS proposed a regulation that reflects the restrictions found in the Groundfish Management Plan as well as the in the MBNMS regulations. With both regulations in place, no disturbance, including by fishing may occur below 3,000 feet in the area.

Marine Protected Areas Action Plan Implementation

The Marine Protected Areas Action Plan, as implemented, will look to determine if additional MPAs are to be created in the MBNMS. The action plan provides a framework for the investigation and outlines how the MBNMS will work with the State of California during its implementation of the Marine Life Protection Act (MLPA). For federal waters of the MBNMS, NOAA may propose MPAs to complement the State's network component to ensure an appropriate range of habitats and ecosystems are protected.

As stated above, it is NOAA's policy to consider, on a case-by-case basis, the appropriate authority for issuing fishing regulations including establishing no-take marine reserves, for national marine sanctuaries. NOAA will include a range of spatial and regulatory alternatives in the Environmental documents for fishing actions in California national marine sanctuaries and does not preclude use of either the NMSA or MSA to implement the goals and objectives of those sanctuaries. For example, in the Channel Islands National Marine Sanctuary and NOAA used the authority of both the NMSA and MSA to implement marine reserves and marine conservation areas.

Bottom Trawling Effects on Benthic Habitats Action Plan Implementation

The Bottom Trawling Effects on Benthic Habitats Action Plan, when implemented, will assess current trawling activity in the MBNMS, identify the habitats vulnerable to trawling, and identify protection measures. In this case, the MBNMS will present potential management measures to the relevant fishery management agency.

Big Sur Coastal Ecosystem Action Plan

Goal

The MBNMS will lead an effort to design and facilitate a program to enhance communication between the public and agencies with jurisdiction in the Big Sur coastal region while improving resource agency coordination and providing enhanced protection and management of coastal and marine resources.

Introduction

Presently, there are several local, state and federal agencies producing new or revised management plans affecting the Big Sur coast. Public groups and individuals have raised a concern that all these agencies will develop separate plans for pieces of the Big Sur coastal ecosystem, rather than a single plan that identifies the related roles and interconnectedness among agencies and components of the ecosystem. MBNMS is working to identify a framework for a comprehensive, multi-agency “Big Sur Coastal Ecosystem Plan,” integrating resource protection, education and outreach, and research and monitoring activities specifically for the Big Sur area. Many of these agencies currently coordinate on several of these issues. However, no formal plan or guidelines exists that offers the agencies clear guidance on existing programs, contact information and resource collaboration opportunities.

Figure BSP -1: RV Shearwater Surveys Big Sur Coast



Specific planning efforts underway or in the early stages of development include:

- A. Joint Management Plan Review, MBNMS (United States Department of Commerce (DOC) / National Oceanic and Atmospheric Administration (NOAA) / Monterey Bay National Marine Sanctuary)
- B. Monterey County Periodic Review (California Coastal Commission)
- C. Monterey County General Plan Update (Monterey County)
- D. Los Padres National Forest, Forest Plan Update (USDA/LPNF) – United States Department of Agriculture / Los Padres National Forest
- E. Caltrans Big Sur Coast Highway Management Plan (California Dept. of Transportation)
- F. California Coastal National Monument Management Plan (United States Department of the Interior (DOI)/Bureau of Land Management)
- G. Regional General Plan Updates (California State Parks)

Multi-agency coordination of programs and projects can be difficult. At the same time, most agencies lack adequate resources to fully implement all of their mandates, and expectations often exceed capabilities. Partnerships between agencies, the public and/or nonprofit groups help ease the lack of resources and extend an agency’s capabilities to meet its mandates. Along the Big Sur coast, the timing of all seven agencies updating or producing management plans enhances the ability of the coordinating efforts of these agencies. More effective coordination in the

development and implementation of programs along the Big Sur coast should help the public understand agency roles and ensure more efficient management and protection of natural resources.

Implementation Overview

Three strategies have been developed to meet the goals of the Big Sur Coastal Ecosystem Coordination Plan. First, before attempting to integrate the programs and policies of all agency management systems for the Big Sur area, MBNMS will facilitate coordination of agency actions on priority resource issues. The first strategy integrates the relevant data and mapping information for the public and provides access to all of the plans and documents for the various agencies. As this information is developed and made available and usable online, this will form the foundation for an online integrated management plan that integrates the plans, policies, and programs for the public agencies involved in resource management in the Big Sur area. The second strategy lays out the framework for each of the agencies and stakeholders to coordinate on producing action plans for priority issues as identified in this plan. The third strategy is the integration of these issue action plans. The MBNMS offers to facilitate this process in order to meet the goals. However, MBNMS implementation priorities will focus on the following products as they best address the mission of the MBNMS. The following specific outcomes or products should result from this effort:

- A. Coordinated online access to planning documents
- B. Increased understanding of watershed resource protection, research, and monitoring needs
- C. Coordinated coastal and marine resource education programs
- D. Coordinated enforcement programs
- E. Provide a forum to address resource issues among and between agencies
- F. Integrated management planning document

Strategy BSP-1: Provide Integrated Data and Information to the Public

The purpose of this strategy is to provide a simple way for the public to access all of the various agencies, plans, programs, notices, documents, and contact information for the main resources agencies with jurisdiction in the Big Sur Region.

Activity 1.1: Create Multi-Agency Website for Big Sur Region

MBNMS staff will work with the multiple government agencies to provide an initial “one-stop-shop” online portal allowing access to the multiple agencies with jurisdiction, programs, policies and operations in the Big Sur region. This will be a first step towards making access easier and less confusing. The website will have an internet domain name that will be easily recognizable and intuitive such as www.bigsur.gov or www.bigsur.ca.us; this will be determined after exploration of availability of domain names.

Activity 1.2: Provide Online Access for Planning Documents

MBNMS staff will work with other agency staff to provide links to public agency management processes such as Draft and Final Management Plans, agency contact information, public notice information and a meeting calendar. Other suggested information includes emergency

information and the public mapping and database information such as geographic information system data. This website and users' manuals will be available for public access at the Big Sur Library, Big Sur Station, and the Henry Miller Library.

Activity 1.3: Develop Integrated Geographic Information System (GIS) Database for Big Sur Coastal and Marine Resource Management

The website will provide many layers of information related to resource data for the Big Sur region. MBNMS GIS staff will facilitate meetings of agencies with information related to the Big Sur area to compile one integrated GIS Database for Big Sur Coastal and Marine Resource Management. Additional layers can be added through "live" portals to the various agency servers and as information is updated by individual agencies, the integrated Big Sur Database would also be updated.

Activity 1.4: Update Website as Agencies Update Plans and Programs

The website described in Activity 1.2 will need to be updated as plans and programs are adopted or updated. While the update of the plans will be accomplished by the individual agencies, a group of agency representatives must meet to ensure that the website is accurate and up to date. This should be accomplished through the portal system of linking to the agency website, however the quarterly meetings of stakeholders described in Strategy BSP-2 must discuss the status of the updates and "enforce" the updates as agencies take actions or make modifications to plans or programs.

Activity 1.5: Develop and Implement Process to Keep Public Informed About Website

MBNMS staff will work with agencies to provide links on other agency websites as well as commercial or informational websites that involve the Big Sur area. MBNMS staff will work with the Big Sur Multi-Agency Advisory Council to ensure that the public is aware of updates and has the ability to comment or provide suggested modifications in order to better attain the program goals. This could include a bulletin board or an email address to provide suggestions or public input on various issues.

Activity 1.6: Attend and Participate in the Big Sur Multi-Agency Advisory Council (MAAC)

The Big Sur Multi-Agency Advisory Council is administered by the 5th Supervisorial District Office of Monterey County. Members include representatives from the 5th District Supervisor, 17th Congressional District, State Assembly 27th District, California State Senate, Monterey County Planning and Building, California Coastal Commission, Monterey Regional Parks District, California Department of Transportation, local residents, the Coast Property Owners Association, Big Sur Chamber of Commerce, California State Parks, and the MBNMS. The Big Sur MAAC provides a forum for agencies to coordinate and interact with the Big Sur residents. The meetings occur four times per year.

Strategy BSP-2: Develop an Interagency Coordination Program

This second strategy identifies the framework for each of the agencies and stakeholders to coordinate in addressing priority issues as identified in this plan. Overlapping jurisdictions, different agency mandates and limited resources necessitate the development of a relationship bringing together multiple agencies for the common purpose of ecosystem management. The long-term goal will be one ecosystem plan, identifying all agency responsibilities and programs

with identified areas of common management mandates and opportunities for coordination. This plan would live “online” at a website maintained by NOAA, but controlled by the Agency Coordination Team.

Activity 2.1: Facilitate an Ad Hoc Agency Coordination Team

The MBNMS will facilitate regular coordination sessions for agency planning staff and stakeholders to address agency coordination needs and implementation progress. Agency representatives will identify technical representatives for coordination meetings to address specific priority issues. All agencies must commit to implementation of the plan and participation in the Coordination Team. Reporting of progress should be brought to the Big Sur Multi-Agency Advisory Council. Advice from the Council would be provided to the Coordination Team.

Activity 2.2: Facilitate Priority Issue Coordination Task Forces

The MBNMS will facilitate certain agency coordination task forces charged with addressing coastal and marine resource management issues. Other agencies will likely facilitate as “lead agencies” on certain issues, depending on agency mandates and responsibilities. Task forces composed of agencies, stakeholders, experts, and partners would address all priority issues by developing action plans to address specific priority issues. Each agency with relevant programs or policies must bring their relevant sections of management plans, programs and policies to the table and work with other agencies and stakeholders to identify the coordination objectives, potential overlapping programs, complementary policies, mutual needs, and potential policy or program conflicts. Depending on the outcome of issue discussions, an agency may need to modify regulations and policies.

A. Big Sur Coastal Oil Spill Response Plan

The Big Sur coast remains one of the most exposed and vulnerable coastlines in central California for a major oil spill given the extensive vessel traffic between San Francisco and Los Angeles and the relative distance of oil spill response vessels and equipment. Adding to the risk and lack of immediate responders, many areas of the coastline are inaccessible to typical shore-based clean up response equipment. In addition to the MBNMS, a major oil spill in the area would directly impact lands managed by U.S. Forest Service, State Parks, the California Coastal National Monument, and Caltrans, as well as private landowners. Strategies and activities that should be undertaken by the MBNMS to address this issue would include:

1. Coordinate with NOAA’s Office of Response and Restoration, U.S. Coast Guard and California Department of Fish and Game Office of Spill Prevention and Response (DFG OSPR) to assess current response capabilities and equipment resource gaps in the Area Contingency Plan;
2. Assess available research, characterization and monitoring of the intertidal and nearshore subtidal resources, and seabird and marine mammal aggregation areas to identify the most sensitive areas of the coastline;
3. Determine need and location for immediate contingency measures planning;

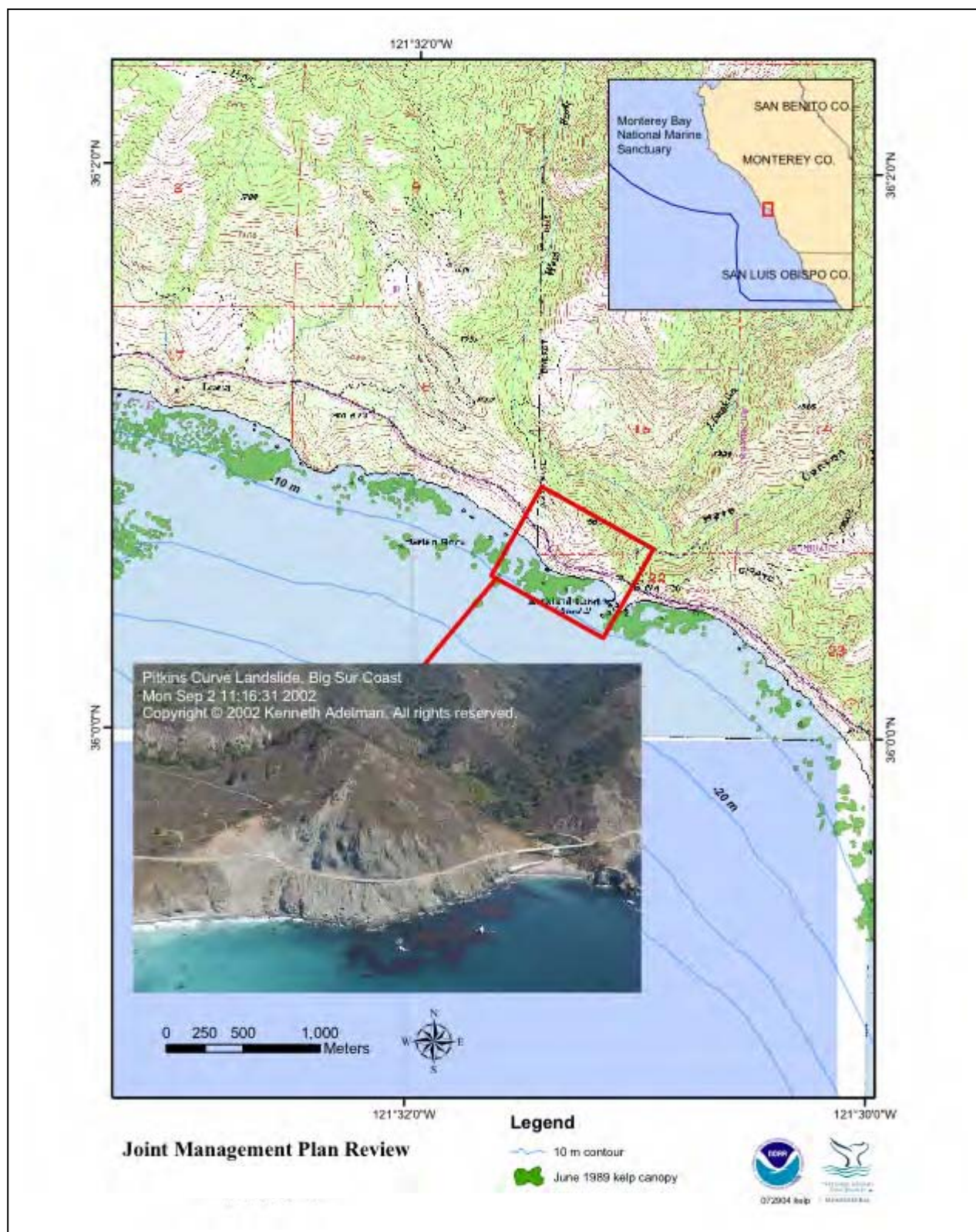
4. Determine if a specific subsection of the U.S. Coast Guard’s Area Contingency Plan could be identified to allow for additional coordination with MBNMS, Caltrans and U.S. Forest Service, California Coastal National Monument, State Parks, County OES, and local experts;
5. Based on above assessments, update Area Contingency Plan subsection to clearly articulate the resource protection and management responsibilities of the MBNMS and other agencies, as well as the necessary additional equipment, training, and storage locations; and
6. Work with U.S. Coast Guard and DFG OSPR to conduct a major oil spill drill involving all agencies to ensure readiness and identify additional resource or contingency needs.

B. Potential Offshore Disposal of Landslide Material

As portions of the Big Sur coast are highly erosive, Highway 1 along the Big Sur coast is subject to landslides from above the highway that bury it, and from below the highway that undercut it. Caltrans *Coast Highway Management Plan* (CHMP) identifies strategies for prevention and handling landslides. The CHMP identifies the need to consider offshore disposal of excess landslide debris into the marine environment. Strategies and activities that must be undertaken by the MBNMS include:

1. Conduct research, characterization and monitoring of the intertidal and nearshore subtidal resources, and seabird and marine mammal aggregation areas below the highway;
2. Assess sensitivity of various habitat types and locations to landslide disposal;
3. Integrate above data with GIS data layers from Caltrans and U.S. Forest Service, California Coastal National Monument, and State Parks to map all sensitive resource areas;
4. With best data available, determine offshore sediment transport along Big Sur coast, including estimating natural inflows and outputs, and physical characteristics of sediment;
5. With California Coastal National Monument, Coastal Commission, U.S. Forest Service, State Parks and possibly other resource management agencies, consider natural resource constraints, and work with Caltrans to develop a proposal to address Caltrans’ disposal needs, while protecting MBNMS resources and qualities; and
6. Facilitate appropriate interagency environmental review of proposals.

Figure BSP-2: Landslide Area and Kelp Mapping in Big Sur



The MBNMS will work with other agencies, residents, NGO's, stakeholders and constituents to address other issues requiring coordination. Implementation of this management plan will involve addressing many issues identified that require interagency coordination and public involvement.

Activity 2.3: Integrate Priority Action Plans

The Agency Coordination Team will compile the completed action plans to form a coordinated and integrated plan identifying agency responsibilities, stakeholders, and partners in implementation of the plans to address the individual natural resource issues.

Activity 2.4: Maintain Plan with Agency Coordination Team and Task Force Representatives

The MBNMS will work with partners to update action plans' program actions or as new priorities are identified.

Activity 2.5: Conduct Workshops to Facilitate Public Comment on Integrated Comprehensive Plan

The Agency Coordination Team will conduct public workshops to facilitate public comment and input on the Integrated Plan and individual action plans as they are developed. These workshops may serve to provide input to agencies as they relate to individual agency programs or policies. This input would then be provided to decision makers at the appropriate agencies.

Action Plan Partners: Monterey County, Caltrans, State Parks, U.S. Forest Service, Coastal Commission, Big Sur Volunteer Fire Department, U.S. Coast Guard, California Department of Fish and Game (Office of) Oil Spill and Prevention and Response, California Department of Forestry, California Highway Patrol, Fire Departments, Pacific Valley School, Bureau of Land Management, U.S. Fish and Wildlife Service, volunteer groups (BAY NET, Friends of the Elephant Seal), fishing community, (Monterey, Morro Bay, Port San Luis Harbors), NOAA OR&R, Clean Seas, Clean Bay, Bureau of Land Management/California Coastal National Monument

Table BSP.1: Measuring Performance of the Big Sur Coastal Ecosystem Coordination Action Plan

Desired Outcome(s) For This Action Plan:	
Protection of the Big Sur coastal ecosystem through increased agency coordination and public involvement to address resource protection issues in the coastal watersheds and nearshore marine environment.	
Performance Measure	Explanation
By 2007, complete and implement a landslide disposal policy for the Big Sur Coast.	MBNMS will track the implementation of this plan by first developing a landslide disposal policy. If the outcome is successful on this initiative, MBNMS will initiate other activities for agency coordination in the plan.

Table BSP.2: Estimated Timelines for the Big Sur Coastal Ecosystem Coordination Action Plan

Big Sur Ecosystem Protection Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy BSP-1: Provide Integrated Data and Information to the Public			●—————●	●·····→	
Strategy BSP-2: Develop an Interagency Coordination Program	●·····	·····●	—————●	—————→	
Legend					
Year Beginning/Ending:	●—————●	Major Level of Implementation: —————			
Ongoing Strategy:	●————→	Minor Level of Implementation: ······			

Table BSP.3: Estimated Costs for the Big Sur Coastal Ecosystem Coordination Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy BSP-1: Provide Integrated Data and Information to the Public	\$84	\$52	\$32	\$32	\$28
Strategy BSP-2: Develop an Interagency Coordination Program	\$307	\$255	\$259	\$251	\$231
Total Estimated Annual Cost	\$391	\$307	\$291	\$283	\$259
* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.					
** Contributions from outside funding sources also anticipated.					

Bottom Trawling Effects on Benthic Habitats Action Plan

Goal

To maintain the natural biological communities and ecological processes in the MBNMS by evaluating and minimizing adverse impacts of bottom trawling in benthic habitats while allowing the long-term continuation of sustainable local fisheries in the MBNMS.

Introduction

International studies have examined the direct effects of bottom trawling, including the incidental killing of benthic and demersal species, and mortality caused by increased vulnerability to predation. Increased food availability is another direct effect as trawling creates fish offal, discarded fish, and dead benthic organisms that provide food for scavenging species. As in any fishery, indirect effects include reductions in the total biomass of non-target fish, which could be expected to affect predators, prey, competitors of a target species, and overall seafloor community structure. These downstream consequences also encompass potential changes in the flow of materials and energy through ecosystems and shifts in the balance of production and consumption.

Figure BH-1: Bottom trawling involves towing a net along the seafloor



Bottom trawling is widely believed to adversely affect benthic habitats based on numerous scientific studies. In other marine protected areas such as the Great Barrier Reef Marine Park in Australia as well as others in New Zealand, Canada and Italy, managers have banned benthic trawling while allowing for other fishing activities within protected areas because of the indiscriminate damage to seafloor habitats and the associated bycatch. In the MBNMS, there is an incomplete picture about the extent of these impacts and the potential need for local protective action. In a 1994 report, the National Research Council stated, “Habitat alteration by fishing activities is perhaps the least understood of the important environmental effects of fishing.” Since that report was published, there has been extensive research on the effects of trawl gear on the seafloor. However, the inherent difficulty in studying offshore habitats, and the problems associated with determining causation under shifting environmental conditions (current, temperature variation, natural migration, storm activity), have left many questions unanswered.

Both despite and because of the uncertainty that remains, the use of trawl gear is a source of concern for the MBNMS. This is due in part to the potential modification of the substrate, the possible disturbance of benthic communities, and the removal of non-target species. There has been little research conducted within the MBNMS boundaries; however, a 1998 study indicated the occurrence of many of these suspected impacts. There is also a perception that declines in many traditional fisheries could lead to increased efforts to find under-exploited fish populations

in more remote and lightly fished areas. These efforts would be facilitated by the development of new types of gear and navigational aids, possibly exposing new regions of the continental shelf, slope, submarine canyons, and seamounts to the effects of bottom trawling.

The Sustainable Fisheries Act of 1996 required that fishery management plans describe and identify essential fish habitat (EFH) and address how it is affected by fishing activities. The seafloor has thus become an area of acute environmental concern and a focus of scientific research. Legal challenges have been brought alleging that the Fishery Management Councils, who help implement the Sustainable Fisheries Act, have not adequately addressed this issue. However, in 2006, the Pacific Fishery Management Council and NOAA Fisheries took a major step by designating and protecting Essential Fish Habitat for Pacific groundfish. This initiative created large trawl closures that in essence, froze the existing trawling effort patterns.

The EFH measures will likely soon be complemented by a Individual Trawl Quota (ITQ) program which will allow trawlers to fish at their own pace instead of rushing to try to catch their share of the sector's quota. This may also lead to trawlers taking the time to fish in areas where they know there is likely to be less bycatch. There are also efforts underway to purchase local trawl vessels and their permits with private funding. These efforts have been successful in Morro Bay and are proceeding within the Sanctuary with an eye towards maintaining local fishing communities and infrastructure.

The MBNMS is concerned not only with the nexus between habitat and the health of a particular species or assemblage, but with the role the benthic habitat plays in the health of the ecosystem. Therefore, the MBNMS is looking to address both the direct and indirect effects on seafloor habitat that can result from the fishing practice of bottom trawling.

Strategy BH-1: Develop Partnerships with Fishermen

Fishermen have a wealth of knowledge not only about their fishery but also about the physical and biological environment. The MBNMS recognizes that tapping into this knowledge base is critical to obtain quality information regarding the extent and potential impacts of bottom trawling. Working cooperatively with fishermen is critical to effectively accomplish this goal.

Activity 1.1: Engage Fishermen to Work with the MBNMS to Address Impacts from Bottom Trawling

The MBNMS will work with fishermen to help identify potential impacts from bottom trawling and find workable solutions. This type of coordination will in part be conducted through implementation of the Fishing Related Research and Education Action Plan. Given recent regulatory actions, fishermen may be reluctant to engage in a discussion on this issue. However, the MBNMS has worked to create partnerships with fishermen in the past and would continue to draw from and build on these relationships.

Strategy BH-2: Assess Trawl Activity

In order to determine when and where trawling is taking place, the MBNMS will need to examine a number of existing indicators. The MBNMS and its partners will evaluate the need for recommending measures that would improve the quality of the data available. Existing tools will be utilized to determine where and when trawling is taking place, including landing receipts,

logbooks, and anecdotal information. The MBNMS realizes many of these activities may require additional work from partners, in particular California Department of Fish and Game staff, which may be limited by resource availability. In addition, some data collection may be limited by confidentiality. The Sanctuary will work with partners to ensure that the confidentiality is protected.

Activity 2.1: Compile Fishing Data

Building off existing databases, MBNMS staff will work with California Department of Fish and Game, National Marine Fisheries Service, and fishermen to agree on an appropriate level of resolution for existing trawl data. This will involve the consideration of logbook, landing receipt, and anecdotal information regarding where, when, and what kind of trawling has been taking place in the MBNMS.

Activity 2.2: Evaluate Effect of Current and Projected Regulations on Future Fishing Effort

The MBNMS will facilitate the assessment of the capabilities and potential impacts of a full-scale fishery, including potential displacement from other areas. Determining the number of potential participants will help establish the spectrum of effort that can be applied in MBNMS waters. This will affect the range of potential impacts on benthic habitats. This analysis will also evaluate the potential for a shift to factory vessels, the impact of buy-back programs, retiring permits, individual trade quotas, individual fishing quotas, and the potential revision of existing regulations.

Activity 2.3: Improve Data Gathering

MBNMS staff will encourage the continued development of a more refined system of gathering data, as this has been initiated by federal fishery agencies. The MBNMS will examine the data collected by fishery management agencies and will assess the need for recommending measures that could produce more refined or reliable data that would help managers to effectively manage and protect resources.

Strategy BH-3: Identify Habitats Vulnerable to Trawling

The level of adverse impacts to benthic habitats from trawling depends on the vulnerability of the specific habitat. The MBNMS will examine what habitats are particularly susceptible and identify these locations within its jurisdiction.

Activity 3.1: Consult Literature and Scientists to Develop Criteria for Selecting and Prioritizing Habitats Vulnerable to Effects of Bottom Trawling

The MBNMS will work to identify what makes a given habitat vulnerable to trawling, and it will address them in the order of this susceptibility. Initially defining habitat vulnerability is a critical first step of this process. Vulnerability will be established in part by reference to stressed local species. The MBNMS's partners will help establish criteria for this assessment.

Activity 3.2: Consult with Local Scientists, Fishermen, and Primary Literature to Determine What and Where Vulnerable Habitats are Located

There is an extensive amount of international research focused on the effects of trawling in benthic habitats. The MBNMS in partnership with local scientists and fishermen will seek to

identify what habitats within the MBNMS are vulnerable (as defined in 3.1) and what the specific impacts are likely to be.

Activity 3.3: Gather Existing Data on Habitat Distribution and Incorporate into Geographic Information System (GIS) Format

There are several existing mapping projects that have focused on portions of the MBNMS. These include work by United States Geological Survey, Moss Landing Marine Laboratories, California Department of Fish and Game, and California State University Monterey Bay. Using the Sanctuary Integrated Monitoring Network (SIMoN) program, the MBNMS will generate a series of habitat maps that depict where vulnerable habitats are located and the level of threat posed by trawling activity.

Activity 3.4: Evaluate the Need for and Develop Strategy to Obtain Additional Habitat Distribution Data if Necessary

The MBNMS will determine the availability of habitat information in areas where trawling is occurring. It will identify data gaps and will work with local scientists to design research projects that target these needs.

Strategy BH-4: Develop a Management Tracking Program

Trawlers are heavily regulated by existing laws and regulations. In order to assess the risk of adverse impacts to benthic habitats and identify appropriate management strategies, the MBNMS and community members helping with this action plan must have a comprehensive understanding of the current regime. Additionally, given that laws and regulations are subject to alteration, the MBNMS must be able to stay abreast of regulatory and statutory changes.

Activity 4.1: Compile Database of Regulations and Restrictions

The MBNMS will work with fishery management agencies to compile the relevant regulations and restrictions and incorporate this information into a series of GIS maps. Having an easily accessible and updateable database is critical to making informed decisions and in identifying important issues. The National Marine Fisheries Service and California Department of Fish and Game have done much of this work. The MBNMS will offer its support to these agencies in its continued evolution. Additionally, the MBNMS will incorporate the information into its own GIS program and update information as needed.

Activity 4.2: Track Changes in Regulatory Environment

The MBNMS will seek to partner with fishery management agencies to address mutual concerns and interests, and will create a means for staying apprised of the current and pending regulatory environment. Developing a relationship with fishery management agencies early in this process will be critical to forming an effective partnership and will help the MBNMS stay apprised of the current regulatory setting. Staying up to date will require that the MBNMS allocate sufficient staff resources to the issue and maintain relationships with fishery managers who can keep the MBNMS current with regard to regulation changes and pending management action.

Strategy BH-5: Develop an Impact Identification and Research Program

This strategy recognizes the need to articulate what the potential impacts are to benthic habitats from trawling. Being as specific as possible in this regard will help ensure that any remedial action recommended will be narrowly tailored and as effective as possible at addressing MBNMS concerns. Additionally, clearly identifying impacts will help design specific solutions that have as little impact as possible on the economic viability of commercial fishing within the MBNMS. Information gaps will be identified and research projects to address data needs will be pursued with MBNMS partners.

Activity 5.1: Identify Impacts from Bottom Trawling in MBNMS

The MBNMS will draw on the local scientific expertise to create an inventory of local impacts from trawling. Identifying the extent of some of these impacts will be the subject of additional activities focusing on research needs. However, it is important to generate a preliminary list of known impacts in order to guide plan development and to allow the MBNMS to address issues while data needs are identified and more information is obtained. The following is an initial list of direct and indirect impacts from trawling that will be augmented by future discussion and research.

Direct Impacts:

- Altered ecosystem function due to removal of target species
- Incidental mortality of non-target species
- Alteration or damage to habitat
- Increased short-term food availability for scavengers from discards, offal, and dead benthic organisms
- Shift towards smaller organisms

Indirect Impacts:

- Alteration of the seafloor community structure
- Shift in the flow of materials and energy in the ecosystem
- Shift in production and balance between non-human consumers
- Alteration of biodiversity
- Increased vulnerability to other natural or anthropogenic stressors

Activity 5.2: Identify and Conduct Necessary Research on Trawling Impacts

Conducting, supporting, and coordinating research in benthic habitats is a critical aspect of the MBNMS's role in protecting this resource. Further study should be performed on the impacts of trawling on benthic habitats, particularly at a local level. Once MBNMS identifies what areas are most at risk, it will be able to determine what the research needs are for that habitat. Initial efforts will be to promote study that addresses the recovery rates and dynamics of community structures through post-regulatory monitoring. In order to discern the severity of trawling impacts, it is necessary to examine the rate at which a trawled site recovers and the ecological dynamics of that recovery over time. Evaluating these on a local, habitat specific level can help identify the severity of impacts and the need for and design of tailored remedial action. This

study would also examine the impact on the physical structure of these habitats as it relates to benthic ecology.

Strategy BH-6: Identify and Implement Potential Ecosystem Protection Measures

After assessing the location and extent of impacts from trawling and consulting with fishermen, the MBNMS will present potential management measures to the relevant fishery management agency.

Activity 6.1: Generate Socio-economic Profile of Local Trawl Fishery

A socio-economic profile of the trawl fishery needs to be created and considered in any management action or recommendation. Understanding the socio-economic characteristics of the trawl fishery and fishermen is critical in the ability to appropriately consider the economic effects of regulation and impact mitigation measures. Fisheries within the MBNMS are a critical component of the region's economy and culture. The study would consider potential future impacts, and the spatial and temporal distribution of markets and the relative value/impact of the market vs. regulations. The MBNMS will also work with economists and fishermen to describe the effects that recent regulatory changes such as the groundfish closure have had on markets and employment.

Activity 6.2: Develop Considerations For Potential Ecosystem Protection Measures

After defining the benthic habitats in need of protection, the MBNMS will consider the type of protection needed, and the expected costs and benefits of that protection. The MBNMS will develop considerations, including the impact of trawling on vulnerable habitats in the MBNMS, the socio-economics of the local trawl fishery, protection afforded by existing management, and costs and benefits of increased protection.

Activity 6.3: Explore Regulatory Modifications with Fishermen, Other Stakeholders, and Fishery Managers

The MBNMS will consult with fishermen, researchers, and agencies to evaluate the potential benefits, effectiveness, and costs of different management options, including marine protected areas.

Activity 6.4: Consider Socioeconomic Impacts of Proposed Management Actions

Any proposed restrictions on trawling activities should consider the impact on the fishery participants and the community.

Activity 6.5: Identify Proposed Ecosystem Protection Measures

The Sanctuary may recommend management changes with input from stakeholders and agencies. Action may involve coordination with the MBNMS marine protected areas working group.

Activity 6.6: Evaluate Utility of Economic Mitigation Measures

The MBNMS recognizes that the trawling industry has been subject to regulation that has made it economically challenging for many participants. These fishermen are frequently heavily invested in the fishery and may find it difficult to find other employment. Mitigation measures

such as buy-out programs, money required for gear changes, and re-education programs that are designed to ameliorate the economic condition of these fishermen are options that the MBNMS will evaluate and consider endorsing.

Strategy BH-7: Develop Education and Outreach Program

Fishermen, managers, and researchers must be able to effectively communicate and share information with one another. All three of these groups have valuable information to share with the public at large. The MBNMS has a separate action plan for incorporating fisheries' issues into research and education. Activities specifically identified for this plan will likely fit into broader strategies identified by that group, and efforts will therefore be closely coordinated. The goal of this strategy is to educate the public regarding the impacts of bottom trawling and to facilitate and encourage information exchange between managers, researchers, and fishermen.

Activity 7.1: Define Educational Needs and Develop Outreach Program

MBNMS staff will conduct a needs assessment based on determined target audiences and synthesize and package the results of research, analysis, and recommendations into an educational and outreach program.

Action Plan Partners: Alliance of Communities for Sustainable Fisheries, Pacific Coast Federation of Fisherman's Associations, UC Sea Grant, Fisherman's Marketing Association, California Department of Fish and Game, National Marine Fisheries Service, Pacific Fishery Management Council, Pacific States Marine Fisheries Commission, regional research institutions, fishermen, local trawlers, California State University Monterey Bay, UCSB - Bren School, Sea Studios, Monterey Bay Aquarium, Sanctuary Education Panel, United States Geological Survey, NOAA's National Undersea Research Program, Maritime Museum of Monterey, The Nature Conservancy, Environmental Defense

Table BH.1: Measuring Performance of the Bottom Trawling Effects on Benthic Habitats Action Plan

Desired Outcome(s) For This Action Plan:	
Maintain the natural biological communities and ecological processes in the MBNMS and evaluate and minimize impacts of bottom trawling in benthic habitats.	
Performance Measure	Explanation
By 2012, spatial identification of 100% vulnerable areas in the MBNMS and identification of protective measures under a range of potential authorities.	MBNMS staff will measure its performance in implementing the action plan by developing habitat vulnerability criteria; assessing the progress in engaging the fishery management agencies, scientists and fishermen in identifying the areas that have been trawled in the MBNMS and assessing impacts and recovery.

Table BH.2: Estimated Timelines for the Bottom Trawling Effects on Benthic Habitats Action Plan

Bottom Trawling Effects on Benthic Habitats Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy BH-1: Develop Partnerships with Fisherman	●	●			▶
Strategy BH-2: Assess Trawl Activity	●		●		
Strategy BH-3: Identify Habitats Vulnerable to Trawling	●		●		
Strategy BH-4: Develop a Management Tracking Program	●		●		▶
Strategy BH-5: Develop an Impact Identification and Research Program		●	●		
Strategy BH-6: Identify and Implement Potential Ecosystem Protection Measures				●	●
Strategy BH-7: Develop Education and Outreach Program		●			▶
Legend					
Year Beginning/Ending	: ● — ●	Major Level of Implementation: —			
Ongoing Strategy	: ● — ▶	Minor Level of Implementation:			

Table BH.3: Estimated Costs for the Bottom Trawling Effects on Benthic Habitats Action Plan

Strategy	Estimated Annual Cost (in thousands)*
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Monterey Bay National Marine Sanctuary – Final Management Plan
Section III – Ecosystem Protection: Bottom Trawling Effects on Benthic Habitats Action Plan

	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy BH-1: Develop Partnerships with Fishermen	\$16	\$12	\$12	\$0	\$0
Strategy BH-2: Assess Trawl Activity	\$125	\$15.5	\$0	\$0	\$0
Strategy BH-3: Identify Habitats Vulnerable to Trawling	\$152	\$128	\$128	\$128	\$0
Strategy BH-4: Develop a Management Tracking Program	\$4	\$4	\$0	\$0	\$0
Strategy BH-5: Develop an Impact Identification and Research Program	\$12	\$298	\$298	\$16	\$0
Strategy BH-6: Identify and Implement Potential Ecosystem Protection Measures	\$0	\$0	\$5	\$13	\$47
Strategy BH-7: Develop Education and Outreach Program	\$8	\$26.5	\$70	\$8	\$18
Total Estimated Annual Cost	<i>\$317</i>	<i>\$484</i>	<i>\$513</i>	<i>\$165</i>	<i>\$65</i>

* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.

Davidson Seamount Action Plan

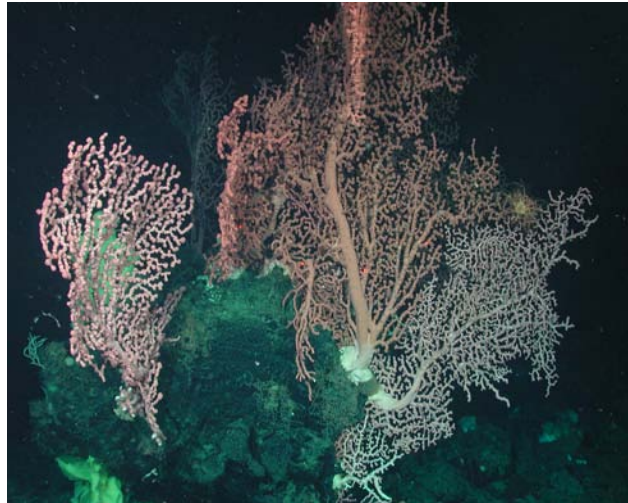
Goal

Develop and implement a resource protection plan for the Davidson Seamount, increase understanding of the seamount through characterization and ecological process studies, and develop education programs for the seamount and other seamounts throughout the nation.

Introduction

Less than 0.1 percent of the world's seamounts have been explored for what species live on them, and many species found on seamounts are new to science. Seamounts are often dominated by suspension feeders, like corals, that grow on rock in an otherwise flat, low biomass, sediment-covered abyssal plain. In addition, seamounts create complex current patterns that can influence sea life above them. Commercially valuable fish species often concentrate around relatively shallow seamounts due to enhanced upwelling caused by current deflection. Conservation issues relevant to seamounts revolve around endemism, harvest, and the low resilience of species. A survey in the southwest Pacific suggests that up to one-third of the species on seamounts can be endemics.

Figure DS-1: Fragile cold-water corals (*Paragorgia arborea*) at Davidson Seamount



Davidson Seamount is located seventy-five miles to the southwest of Monterey, due west of San Simeon, and is one of the largest known seamounts in U.S. waters. It is twenty-six miles long and eight miles wide. From base to crest, Davidson Seamount is 7,480 feet tall; yet, it is still 4,101 feet below the sea surface at its highest point. Davidson Seamount has an atypical seamount shape, having northeast-trending ridges created by a type of volcanism only recently described, and it last erupted about 9.8 million years ago. This large geographic feature was the first underwater formation to be characterized as a “seamount” and was named after the Coast and Geodetic Survey (forerunner to the National Ocean Service) scientist George Davidson.

Species associated with Davidson Seamount can be divided into habitats including: the sea surface habitat (birds in flight and on the sea surface), the midwater habitat (0 – 4,100 feet below sea surface), the seamount crest habitat (4,100 – 4,900 feet), the seamount slope habitat (4,900 – 8,200 feet), and the seamount base habitat (8,200 – 11,500 feet). The surface habitat hosts a variety of seabirds, marine mammals, and surface fishes, including albatross, shearwaters, jaegers, sperm whales, killer whales, albacore tuna, and ocean sunfish. At this time, there is no published evidence that the species composition in this surface habitat is different than adjacent areas without a seamount below, although in some years Davidson Seamount may enhance albacore fishing. Organisms in the midwater habitat have a patchy distribution with marine snow, organic matter that continually “rains” down from the sea surface, most likely providing

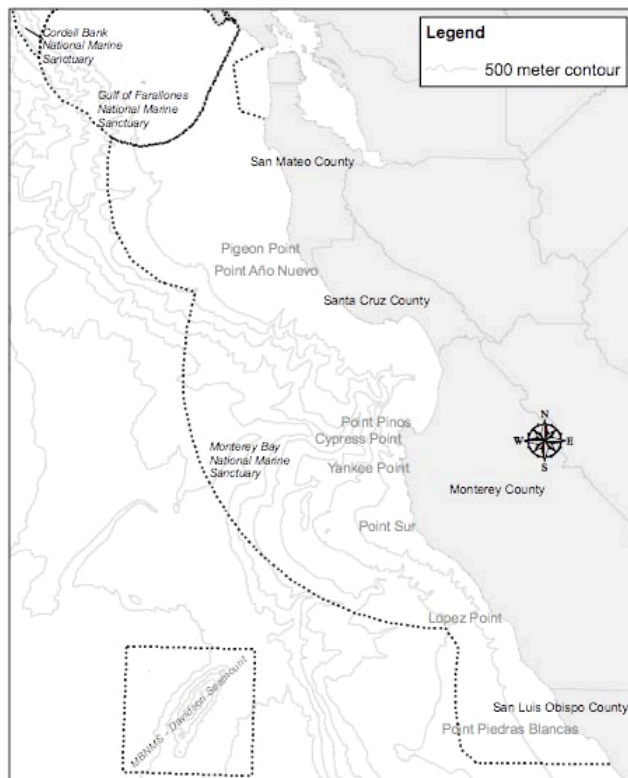
an important food source for deep-sea animals. Swimming worms, and an undescribed mollusk have been seen above Davidson Seamount.

The seamount crest habitat is the most diverse, including *Paragorgia arborea* (a large gorgonian coral) forests, vast sponge fields (consisting of both described and undescribed species), crabs, deep-sea fishes, shrimp, and basket stars. The seamount slope habitat is composed of cobble and rocky areas interspersed with areas of ash and sediment that host a diverse assemblage of sessile invertebrates and rare deep-sea fishes. The seamount base habitat is the interface between rocky outcrops and the deep soft bottom. Species here are similar looking to their relatives in the nearshore, including sea cucumbers, urchins, anemones, and sea stars.

Anthropogenic influence on Davidson Seamount has been detected in the form of DDT in sediments near its base, and trash (e.g., bottles, cans, brooms, newspapers, buckets, curtains) discarded from the sea surface.

However, because of the abundance of large, fragile species (e.g., corals greater than eight feet tall, some at least 200 years old, as well as vast fields of sponges) and an apparently, physically undisturbed seafloor, the area appears relatively pristine. The top of the seamount is too deep for most fish trawling technology; moreover, fish density is very low, and the species seen to date are not commercially desirable. The existing albacore tuna and swordfish/shark fisheries operate in the top 150 feet of water, thousands of feet above the summit of the seamount.

Figure DS-1: Davidson Seamount Management Zone within the Monterey Bay National Marine Sanctuary.



Davidson Seamount is important for science to study how the seamount is ecologically linked with the coastal waters, nearshore canyons, and species currently protected in the MBNMS. Protecting it will help facilitate research to

understand how the Monterey Bay and Big Sur Canyon complexes have an effect on Davidson Seamount and what the migration pattern of species is between the seamount and nearshore.

Threats to the Davidson Seamount

Conservation issues related to seamounts revolve around endemism (species only found on a specific seamount), harvest, and low resilience of species. Existing and potential threats to Davidson Seamount include bio-prospecting, cumulative impacts from research collecting of

long-lived species, new or unknown forms of seafloor disturbance, new technologies to harvest from the seabed, “exploratory” benthic fishing which could destroy habitat and long-lived species, and marine debris/dumping. Although management agencies are responsible for some activities that may occur at the seamount, there is currently no comprehensive protection and management of organisms on the seamount or the surrounding ecosystem, and coordinated education or research programs addressing Davidson Seamount issues are in their infancy. By incorporating the seamount into the MBNMS, its resources will be protected and opportunities will be provided for a better understanding of the seamount.

Expansion of the MBNMS to Include Davidson Seamount Management Zone

The Davidson Seamount Management Zone (DSMZ) is a recent addition to the MBNMS, as part of the adoption of this management plan. This area encompasses approximately 585 square nautical miles of ocean waters and the submerged lands there under. The boundary resembles a square box, approximately twenty-five nautical miles per side, centered on the summit of Davidson Seamount. The uniform lines and symmetry of the boundary configuration offer easy navigation by longitude and latitude even though the seamount is physically disconnected from the MBNMS boundaries contiguous with the shoreline (See Figure DS-1). Standard MBNMS regulations apply within the DSMZ, without the exceptions for seabed alteration. Below 3,000 feet, in addition to a general prohibition by the MBNMS, a prohibition on fishing was implemented by NMFS in June of 2006 to address potential threats to the seamount and natural resources.

Strategy DS-1: Conduct Site Characterization

The purpose of this strategy is to complete a number of already initiated studies on the DSMZ ranging from geological and biological characterization to zoological and oceanographic surveys, while further initiating a socioeconomic survey. The strategy will also result in a complete cultural history analysis and site characterization document for Davidson Seamount.

Activity 1.1: Complete Geologic and Biological Characterization of the Seamount

In addition to initiated studies, a complete analysis of existing video transects from the Davidson Seamount Management Zone (DSMZ) of species and habitat types from past NOAA and the Monterey Bay Aquarium Research Institute (MBARI) research cruises will be completed. In 2006, a collaborative research cruise with MBARI and the British Broadcasting Corporation (BBC) successfully obtained information from other unvisited areas of Davidson Seamount to produce an education video.

Activity 1.2: Identify Taxonomy and Natural History of Rare or New Species

Seamounts are known to have a high percentage of endemism. This creates many taxonomic questions concerning the possible discovery of new deep-water corals. Past surveys of Davidson Seamount indicate species that are rare or new to science altogether.

Activity 1.3: Conduct Zoological Survey of Surface and Midwater Areas Above the Seamount

Additional cruises from the NOAA ships are necessary to describe surface and mid-water species, sea turtles, birds, and mammals. The Sanctuary Aerial Monitoring and Spatial Analysis Program (SAMSAP) has been established within the area using local NOAA aircraft and has

been incorporated into the MBNMS's monitoring program. The SAMSAP program is designed to monitor the locations of different kinds of commercial and recreational vessels as well as distributions of some species of interest, including cetaceans (whales and dolphins), and some physical conditions, such as spilled oil. During aerial surveys, observers document the precise locations of the vessels, animals and physical characteristics using a Global Positioning System (GPS). Observers distinguish between commercial and recreational vessels, and between consumptive and non-consumptive activities. When observers see fishing gear in the water, the type of fishing activity is noted.

Activity 1.4: Initiate Oceanographic Surveys of Seamount Region

Oceanographic surveys will be conducted using the NOAA ships and satellite imagery. The data from the surveys will be linked with national coastal observatories (i.e., Central and Northern California Ocean Observing System) resulting in a better understanding of ocean current patterns on and around Davidson Seamount. This will also enable researchers to determine how the ocean current patterns affect life on and around Davidson Seamount and generally, how Davidson Seamount has an influence on the regional ecology.

Activity 1.5: Complete Socioeconomic (Commercial, Recreational, Research Uses) Analysis

In comparison to the rest of the MBNMS, there are relatively few user groups in the Davidson Seamount region. However, a comprehensive understanding of key users of the seamount region is needed. Learning more about who uses the seamount region over a period of time is critical to effective education and protection.

Activity 1.6: Characterize Cultural History of Davidson Seamount

Throughout history Davidson Seamount has played a role in mapping, fishing, whaling, and research. By working with the Monterey History and Art Association/Maritime Museum of Monterey, the MBNMS can characterize and further highlight the role of the seamount in the region's rich maritime past, and the history of the seamount's namesake, George Davidson. His many contributions to maritime history and his personality as a maritime figure are important and have heritage value. Additionally, a history concerning the types of seamounts nationally and worldwide will be included. Among the results of this activity will be reports. A video for visitor centers was created and disseminated among the public, stimulating interest that has heuristic value.

Activity 1.7: Incorporate Site Characterization Document in MBNMS Websites

All relevant data from above activities (1.1-1.6) will be incorporated into the MBNMS websites, updating all physical and biological information. A Davidson Seamount chapter will be added to the MBNMS Site Characterization, while incorporating all seamount information into the geology chapter.

Strategy DS-2: Conduct Ecological Processes Investigations

In addition to characterizing the seamount region, Strategy DS-2 will result in the description of process studies to determine the causes of distribution and abundance of species. Several hypotheses to be tested include the role of seamounts as either: 1) islands, where seamounts serve as a sink for larval recruits originating in adjacent habitats; or 2) oases, where seamounts serve as a source of larvae integral to the surrounding areas. Another proposed hypothesis is

seamounts may acquire heightened biodiversity through the presence of coral and sponge fields, which promote local species coexistence by offering increased habitat complexity. High biodiversity of seamounts may also reflect rapid habitat turnover associated with substrate type, currents, temperature, oxygen concentration, and other abiotic/biotic parameters encountered across the flanks and summits of the seamount. Currently, we are assessing these hypotheses, and other ecological process studies, utilizing data collected from Remotely Operated Vehicle (ROV) dives at Davidson Seamount conducted in 2000, 2002, 2006, and 2007 through a collaboration of MBARI, MBNMS, and other NOAA partners.

Activity 2.1: Conduct Regular Benthic Surveys of Davidson Seamount

The DSMZ benthos must be monitored. Based on information from early site characterization and preliminary studies, a benthic monitoring plan will be developed for Davidson Seamount. Data from this monitoring program will be made available through the Sanctuary Integrated Monitoring Network (SIMoN) website.

Activity 2.2: Conduct Deep-water Coral Age Determination and Restoration Studies

Cold-water corals are receiving increased attention in terms of scientific studies and conservation. The relatively pristine nature of Davidson Seamount and its diverse coral populations provide for a number of opportunities for age determination, and restoration efforts to historical locations of corals in impacted areas of the MBNMS. A research plan for deep-water coral studies will be developed, linking the activities to the resource protection portion of Davidson Seamount action plan.

Activity 2.3: Perform Research on Seamount to Expand Understanding Distribution and Abundance of Species

Designation of Davidson Seamount as a managed area provides the status and opportunity for advancing the basic ecological understanding of seamounts. One such example would be to determine causes of high diversity and patchiness of Davidson Seamount corals and sponges.

Activity 2.4: Understand Links with Coastal Area of Sanctuary

It is important to understand how the seamount is linked ecologically with the coastal area of the Sanctuary. For effective ecosystem management, we should understand questions, such as how the Monterey Bay and Big Sur Canyon complexes have an effect on the DSMZ, or what the migration and dispersal patterns of species are among these diverse systems.

Activity 2.5: Initiate up-to-date faunal inventory for Davidson Seamount

A single cohesive database of existing biota will be created including information on the species' biogeography (known distribution of the species on Davidson, Eastern Pacific Seamounts, seamounts globally, and non-seamount habitats), habitat preference, trophic level, and range of densities.

Activity 2.6: Development of long-term monitoring plan through analyses of faunal database

Analyses of a faunal database will enable a long-term monitoring plan to be developed to understand ecological processes at the seamount, and the sensitivity and resilience of seamount biological communities to anthropogenic perturbations.

Strategy DS-3: Develop Resource Protection Program

MBNMS regulations will protect and enhance understanding of Davidson Seamount. Two modifications to standard MBNMS regulations were established to address resource threats: (1) because of the depth of the seamount, there is no need to have exceptions to the regulation prohibiting drilling into, dredging or otherwise altering the seabed that allow for anchoring vessels, aquaculture, kelp harvesting or lawful fishing operations, harbor maintenance, or collection of jade, therefore these exceptions will not apply in the DSMZ; and (2) an additional regulation has been issued to prohibit the disturbance, collection or harvesting of any sanctuary resources in areas below 3,000 feet of the sea surface (unless a permit is obtained for this activity).

Activity 3.1: Continuously Characterize the Potential Threats to Davidson Seamount

A threats and protection plan will be developed based on a thorough literature review, workshops with experts, and a socioeconomic and biological characterization. Initial research has enabled the identification of potential threats to Davidson Seamount and associated resources, including the following.

A. *Bio-prospecting*

Some groups of organisms found on Davidson Seamount have been targeted for collection in other areas of the world for developing medicine. Discovering medicinal uses for natural products is important for enhancing human health services, however over-collection of rare or sensitive species can disrupt natural habitats.

B. *Cumulative research collecting of long-lived species*

Where there are limited populations of slow growing species, research collection can be detrimental. Over the last two years, there has been increased worldwide interest in studying deep-sea corals such as the large pink gorgonian coral, *Paragorgia arborea*, found on Davidson Seamount, and they are often collected. This problem is exacerbated on seamounts that have a high degree of endemism, and Davidson Seamount has several other taxa that are slow growing and rare. Research is critical to understanding and managing ecosystems, so appropriate scientific collecting is often encouraged with permits to ensure minimal impacts.

C. *New or unknown forms of seafloor disturbance, including exploratory fishing / new technologies to harvest from the seabed*

Harvesting from Davidson Seamount is not a currently known commercial activity. With new discoveries of precious corals or other commercial species, in concert with more effective harvest technologies being explored at depths of greater than 4,000 feet, commercial harvest at Davidson Seamount could quickly cause severe impacts before protective regulations could be issued. The concerns relative to impacts to Davidson Seamount are largely for protecting a fragile area before it is severely impacted.

D. *Marine debris / dumping*

The Davidson Seamount area should be excluded from targeted dumping, and education about the site's significance could augment existing federal regulations regarding at-sea dumping.

E. *Ocean acidification*

Although changes in ocean chemistry due to anthropogenic release of CO₂ are relatively well established, what needs more attention is determining what impact this drop in pH will have on deep-sea organisms.

Activity 3.2: Initiate Resource Protection Measures as Necessary

Characterization of the potential threats to Davidson Seamount may require initiation of additional protective measures or enhanced enforcement of existing regulatory measures to ensure adequate protection. Integration of the SAMSAP program will enable enhanced monitoring abilities for the DSMZ including vessel traffic monitoring and fishing use that currently occurs in the DSMZ. In addition SAMSAP will provide biological monitoring capabilities to the MBNMS to establish potential conflicts between the surface use of marine organisms such as cetaceans and vessels.

Activity 3.3: Develop and Implement Enforcement Plan for DSMZ

Based on Activities 3.1 and 3.2, a threats management plan will be developed. Incorporated into this plan will be the identification of collaborative agencies to develop enforcement partnerships. Enforcement of Sanctuary regulations relevant to Davidson Seamount will be integrated into the MBNMS enforcement program. The distance of Davidson Seamount from the coastline will require coordination of the U.S. Coast Guard, NOAA Office of Law Enforcement, and the California Department of Fish and Game to establish surveillance and response capabilities for the area. Aerial surveys, such as SAMSAP, will be incorporated into the enforcement effort as well as patrols on USCG and NOAA ships.

Activity 3.4: Develop Permitting Considerations to Facilitate Continued Appropriate Research and Education

This permit process should facilitate the continuation of appropriate research and education while minimizing impacts to the benthic habitat of the seamount, to accompany extending the regulations and the MBNMS permit program into this new habitat.

Strategy DS-4: Conduct Seamount Education and Outreach Initiatives

Davidson Seamount has captivated the public through numerous media reports (including the CBS Nightly News and American Airlines in-flight news) and through NOAA's Ocean Explorer web site (<http://oceanexplorer.noaa.gov/explorations/06davidson/welcome.html>). A recent survey of the public, related to developing a visitor center for the MBNMS, found that one of their top interests was in "seafloor topography" of which canyons and seamounts are dramatic examples. Proximity to the Monterey Bay Aquarium and other education institutions provides excellent education opportunities (e.g., displays on seamounts). The proximity of education and research institutions in the Monterey Bay region facilitates interdisciplinary collaborations that enhance research and education. Davidson Seamount and MBNMS's research efforts have generated significant interest in the Cambria and San Simeon area and will be prominently featured in the San Simeon Visitor Center.

Activity 4.1: Conduct an Educational Needs Assessment

The MBNMS will actively work with the Sanctuary Education Panel to identify target audiences. Subsequently, an educational needs assessment will be completed. Finally, relevant information regarding the DSMZ will be synthesized.

Activity 4.2: Develop and Implement Davidson Seamount Education and Outreach Program

Information on the DSMZ will be incorporated into educational material and interpretive centers. These will include items such as CD-ROMs, a website, and print material. Building on the opportunity that the DSMZ is the only seamount in the National Marine Sanctuaries Program, educational information on seamount biological diversity, habitats, and species of related interest, such as cold-water corals and sponges will be provided to all relevant NOAA programs.

Activity 4.3: Explore the Potential Use of Davidson Seamount Footage within the MBNMS Interpretive Center and Other Virtual Experiences

Incorporate Davidson Seamount video and still photos into the exhibits of the San Simeon Coastal Discovery Center. Creating a narrative of selected footage will encourage use of the video footage obtained beyond the MBNMS. As the National Marine Sanctuary Program (NMSP) telepresence program develops, the potential for use of this high quality footage is very likely; creating prepared footage for use will be key to its use across the nation.

Activity 4.4: Involve MBNMS Education Staff in Davidson Seamount Research

Involvement by the education staff in research on Davidson Seamount will increase public knowledge of the seamount, expose the uniqueness of the region, and ensure necessary outreach pieces are created for use in resource management decision making.

Activity 4.5: Involve the Education and Outreach Mechanisms within NOAA to Promote the Existing and New Research on Davidson Seamount

The 2002 mission to the seamount, in conjunction with NOAA's Office of Exploration and Research (OER), was hugely successful due to the combined efforts of the MBNMS, NMSP, and OER. This relationship and others should always be considered when new cruises and campaigns are considered.

Activity 4.6: Expand Outreach and Education Efforts in San Simeon / Cambria Region

MBNMS will develop outreach materials and displays for the San Simeon Coastal Discovery Center to address the increased interest in the region regarding the natural resources of Davidson Seamount. MBNMS staff will also incorporate discussion of Davidson Seamount into local presentations and outreach events.

<p><i>Action Plan Partners:</i> Monterey History and Art Association / Maritime Museum of Monterey, Monterey Bay Aquarium Research Institute, Moss Landing Marine Labs, Monterey Bay Aquarium, Save The Earth, United States Coast Guard, National Marine Fisheries Service, UC Sea Grant, fishermen, The Ocean Conservancy, California Department of Fish and Game</p>

Table DS.1: Measuring Performance of Davidson Seamount Action Plan

Desired Outcome(s) For This Action Plan:	
Protect Davidson Seamount from potential threats while increasing understanding of the seamount through characterization, public education efforts and ecological process studies.	
Performance Measure	Explanation
By 2012, Davidson Seamount is adequately characterized.	Implementation of this action plan will result in protection of the seamount, but more importantly, an understanding of the fragile communities and habitat associated with Davidson Seamount. The 2006 research cruise to Davidson Seamount created a valuable addition to the body of knowledge in the site characterization, which must be built upon through further research and monitoring. Performance will be measured for this action plan through an annual assessment of our understanding of the habitats and species of Davidson Seamount.
Develop education and outreach opportunities about the seamount at visitor centers by 2010 and a series of media products related to its incorporation into MBNMS by 2009.	NMSP will incorporate awareness of Davidson Seamount into surveys related to national marine sanctuaries and the sanctuary system.

Table DS.2: Estimated Timelines for Davidson Seamount Action Plan

Davidson Seamount Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy D S-1: Conduct Site Characterization			●————→		
Strategy DS-2: Conduct Ecological Processes Investigations		●————→			
Strategy DS-3: Develop Resource Protection Program	●.....●————→				
Strategy DS-4: Conduct Seamount Education and Outreach Initiatives			●————→		
Legend					
Year Beginning/Ending : ●————●			Major Level of Implementation: —————		
Ongoing Strategy : ●————→			Minor Level of Implementation:		

Table DS.3: Estimated Costs for Davidson Seamount Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy DS-1: Conduct Site Characterization	\$24	\$28	\$16	\$8	\$12
Strategy DS-2: Conduct Ecological Processes Investigations	\$285	\$0	\$33.5	\$10	\$6
Strategy DS-3: Develop Resource Protection Program	\$36	\$40	\$40	\$72	\$76
Strategy DS-4: Conduct Seamount Education and Outreach Initiatives	\$30	\$70	\$14.5	\$8	\$14
Total Estimated Annual Cost	\$375	\$138	\$104	\$98	\$108

* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.

Emerging Issues Action Plan

Goal

Develop a system to identify, track and appropriately respond to emerging issues that present potential threats to Monterey Bay National Marine Sanctuary (MBNMS) resources.

Introduction

The goals and objectives set forth by the NMSA direct each of the sanctuaries to take an ecosystem-based approach to managing marine areas. The ecosystems include habitat structure, species assemblages and ecological processes, as well as the many interactions with humans and their activities. The MBNMS needs to develop a system to look ahead to emerging issues that should be addressed to meet the priority goal of resource protection.

Although a wide range of issues have been included in the existing management plan, many other issues are not addressed. These include issues that are currently considered to have relatively small impacts, but which may grow to have large impacts in the future, as well as issues that have arisen in other coastal areas but have not yet appeared in the MBNMS. They also include unforeseen issues that may emerge in the future due to technological advances, changes in operations, growing population sizes, etc. This plan focuses on development of a framework to identify and address future resource protection issues.

The following constitutes a partial list of potential issues that may emerge more fully in future years. However, there are undoubtedly many other issues, either partly known or wholly unforeseen, that are not listed here. Examples of recent or potential issues that may emerge for future consideration include:

- A. Coastal and Offshore Energy Development
 - Wave or tidal powered energy generators
 - Wind powered energy generators
 - Offshore oil development – slant drilling
 - Deep-sea mineral development
- B. Commercial/Private Activities
 - Rapid ferry service between MBNMS harbors (e.g., hydrofoils)
 - Increase in private airports along the coast for helicopters, fixed-wing and vertical takeoff planes
 - Importation of fresh water via large floating bags from Oregon or Washington (Spragg Bags)
 - Pyrotechnic disposal of cremation remains
 - Aquaculture net pens in nearshore and offshore (>3 miles) coastal regions

C. Recreational Activities

- One-man submersibles and hydro-boats
- Remotely operated ski sleds
- Surf kites/parachutes and water skiing in Elkhorn Slough

D. Military/Coast Guard/NASA Activities

- New marine acoustic technologies
- Discharges of fuel from aircraft
- Live weapons firing/training
- Expanding military overflights/at-sea activities

E. Research Activities

- Impacts of Automated Underwater Vehicles on marine wildlife
- Monitoring to detect responses to climate change
- Bioengineering and potential release of organisms

F. Coastal Development and Access

- Human population growth issues and pressures
- Increased erosion and runoff from expanding development
- Artificial reefs to prevent coastal erosion of developments, or for other purposes
- Numerous human access sites to the coast, reducing number of wild areas left
- California Coastal Trail development and expansion
- Significant expansion of elephant seal populations and human/marine mammal interactions (new conflicts between haul out sites and human access)

G. Water Quality

- Micro pollutants (e.g., contaminants that can't be tested for or are not tested for, like antibiotics, caffeine, sun tan lotion derivatives, etc.)
- High levels of small plastic debris in the marine environment

H. Threats From Well Beyond MBNMS Boundaries (but which affect Sanctuary resources)

- Many possibilities, e.g. a serious poaching problem in Papua New Guinea threatening small remaining population of highly migratory leatherback sea turtles

Strategy EI-1: Identify and Track Emerging Issues

The MBNMS will identify and track emerging issues as they arise. The following activities provide a framework for the MBNMS to understand and track emerging coastal and marine management issues in order to prevent harm to the resources of the MBNMS.

Activity 1.1: Drawing on Existing Knowledge, Develop a List of Potential Emerging Issues, Building on the List Provided Above

Activity 1.2: Prioritize the List to Identify Those Issues That Currently Warrant Some Level of Additional Tracking

Activity 1.3: Consider Development of an “Early Warning” System, Which Would Assist MBNMS in Receiving Early Information on New and Unforeseen Issues, Including Efficient Pathways and Processes for Receiving This Information

Strategy EI-2: Develop Process to Address Emerging Issues

The MBNMS must use a process to determine the importance and priority of issues as they arise. This management plan is based on addressing the top priority resources issues as they have been identified in a public process of scoping, prioritization and selection with the Sanctuary Advisory Council (SAC). However, the MBNMS recognizes that certain unforeseen issues may pose a threat, and must be understood and addressed in a timely manner.

Activity 2.1: Identify and Define Criteria for Assessing the Importance of Emerging Issues, Including Consideration of:

- A. Intensity, duration and geographic extent of threat to MBNMS resources or qualities
- B. Whether the issue falls within the MBNMS’s mandate
- C. Rate at which the issue or threat is growing or emerging
- D. Degree of public or SAC interest in MBNMS involvement in issue
- E. Priority ranking relative to other MBNMS initiatives

Activity 2.2: Outline Alternative Categories and Processes to Address Emerging Issues, Including:

- A. Issues that are new, but are relatively small issues which staff address internally
- B. Issues that appear to be large or significant, but where we lack adequate information and need additional research to determine
- C. Issues that appear to be large or significant, but are actually relatively small, and should be addressed by an effective communication plan
- D. Large issues that are deferred due to lack of time and resources to address
- E. Large issues that are short-term and can be addressed with no formal action plan
- F. Large, complex, long-term issues with multiple interested parties that require an action plan developed by either staff or a multistakeholder working group of the SAC

Strategy EI-3: Develop Emerging Issues Staffing and Operations Structure

Activity 3.1: Evaluate and Develop Staff Options for Tracking Emerging Issues, Including Consideration of Utilizing one Designated Staff Member, or Distributing Responsibility Among Various Staff Working on Related Issues

Activity 3.2: Identify Process for Bringing Emerging Issues Forward to the Sanctuary Advisory Council Where Necessary

Activity 3.3: Coordinate with the National Marine Sanctuary Program (NMSP) on Issues That Are Not Site Specific and May Require Action for Other Sanctuaries in Region or System

Table EI.1: Measuring Performance of the Emerging Issues Action Plan

Desired Outcome(s) For This Action Plan:	
Address emerging resource issues per process outlined in issue identification, tracking, and response system	
Performance Measure	Explanation
By 2008, develop and implement a system to identify, track and appropriately respond to emerging issues that threaten the resources and qualities of the MBNMS.	MBNMS will measure the performance toward meeting this goal by first, in the short-term, developing a system to identify, track and respond to issues and second ensuring that as issues arise, they are tracked and routed through the process. Each issue should have an identified outcome whether it is addressed or deferred.

Table EI.2: Estimated Timelines for the Emerging Issues Action Plan

Emerging Issues Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy EI-1: Identify and Track Emerging Issues	● ————— ●				
Strategy EI-2: Develop Process to Address Emerging Issues	● ————— ●				
Strategy EI-3: Develop Emerging Issues Staffing and Operations Structure		● ————— ●			
Legend					
Year Beginning/Ending : ● ————— ●		Major Level of Implementation: —————			
Ongoing Strategy : ● ————— ➔		Minor Level of Implementation:			

Table EI.3: Estimated Costs for the Emerging Issues Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy EI-1: Identify and Track Emerging Issues	\$27	\$27	\$22	\$27	\$27
Strategy EI-2: Develop Process to Address Emerging Issues	\$9	\$0	\$0	\$0	\$0
Strategy EI-3: Develop Emerging Issues Staffing and Operations Structure	\$9	\$0	\$0	\$0	\$0
Total Estimated Annual Cost	\$45	\$27	\$22	\$27	\$27
* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.					

Introduced Species Action Plan

Goal

To maintain the natural biological communities and ecological processes in the MBNMS and protect them from the potentially adverse impacts of introduced species by preventing new introduced species from establishing in the MBNMS; and detecting, controlling (limiting the spread) and where feasible, eradicating environmentally harmful species that are introduced to the MBNMS waters.

Introduction

Introduced species are a major economic and environmental threat to the living resources and habitats of the MBNMS and to the commercial and recreational uses that depend on these resources. Once established, introduced species are extremely difficult if not impossible to eradicate. Introduced species are an increasingly common global threat, and the rate of invasions continues to accelerate at a rapid pace. Although the open coast is resistant to invasions, estuaries are particularly vulnerable to invasion. Large ports, such as San Francisco Bay, can support hundreds of introduced species, many of which significantly impact native ecosystems.

Figure IS-1: MBNMS Divers work to remove Undaria at Monterey Harbor



There are a variety of terms used to describe introduced species. Some of the more common terms are exotic, invasive, alien, nuisance and non-indigenous species. This action plan generally uses the term “introduced” except when citing other authorities or when specifically referring to introduced species that are known to have “invasive” characteristics (i.e., spread rapidly, out-compete native species and are likely to cause environmental harm). In using the term “introduced,” this action plan refers to species that have been moved dramatically beyond their original distribution by human activities. This plan is not intended to address gradual changes in species composition caused by climate change.

In general, introduced species in the marine and estuarine environment alter species composition, threaten the abundance and/or diversity of native marine species, especially threatened and endangered species, interfere with ecosystem function and disrupt commercial and recreational activities. Introduced species may cause local extinction of native species either by preying upon them directly or through competing for prey. For example, the European green crab, now found in Elkhorn Slough, both preys on the young of valuable species such as oysters and Dungeness crab and competes with them for resources. Introduced species may cause changes in physical habitat structure. For example, burrows caused by the isopod *Sphaeroma quoyanum*, originally

from New Zealand and Australia, are found in banks throughout Elkhorn Slough and may exacerbate the high rate of tidal erosion in the Slough. Introduced species pose a significant threat to the natural biological communities and ecological processes in the MBNMS and may significantly impact threatened and endangered species. Introduced species also pose significant economic costs to industries such as water and power utilities, commercial and recreational fishing, and agriculture.

Strategy IS-1: Address Known Pathways of Introduction

There are multiple pathways that can lead to introductions of species within the MBNMS.

Activity 1.1: Develop and Implement Action Plans to Address Pathways, Threats, and Effective Prevention/Management

MBNMS will identify and characterize each of the following known pathways with an assessment of the severity of the threat. The severity of the threat will be based on:

Likelihood of the pathway leading to introductions

Feasibility of the MBNMS addressing the pathway

Severity of the threat posed by the pathway (or the likelihood of a species being introduced by a particular pathway)

Effectiveness of prevention or management efforts

An action plan focusing on most likely pathways of introduction will then be developed with strategies to prevent new introductions. The following represents a list of the most likely pathways for introduced species entering the MBNMS.

A. Aquaculture

Aquaculture has been a historic pathway for both intentional and unintentional introductions of non-native species. Cultured non-native species can escape from captivity. Aquaculture operations can also result in the unintended introduction of species associated with the cultivated species.

B. Aquarium Trade

Wholesale importers, culture facilities and retail pet stores transport and sell non-native fresh and saltwater plants, fishes and invertebrates. The release or escape of specimens into the environment by the industry and the hobbyist aquarium owner has led to introductions in the United States. There are numerous pet store and aquarium supply stores in communities adjacent to the MBNMS.

C. Ballast Water

Ballast water can contain aquatic plants, animals, pathogens, and other contaminants. Marine vessels take on and discharge millions of tons of ballast water daily in ports and harbors around the world. The discharge of ballast water is considered the single largest pathway for coastal aquatic introductions because of the huge volume of water carried as ballast. Although few large vessels visit ports within the MBNMS, the Ports of San Francisco and Oakland have been subject to invasions of introduced species due to ballast water discharge. The San Francisco Bay's proximity to the MBNMS makes it a likely source of past and future introductions within the MBNMS, as species first introduced to San Francisco Bay through ballast waste discharge can then be transported to the

MBNMS through coastal ballast transport, vessel fouling, and natural spread via currents, swimming and ingestion by other organisms such as migratory birds.

D. *Biological Control*

In terrestrial and freshwater environments, selected non-native species, usually specialist predators, have been intentionally introduced in an effort to control the growth and spread of other introduced species. However, the specificity and selective abilities of these predators are often poorly known. For example, grass carp introduced to control unwanted aquatic plants in inland lakes resulted in native plant species being decimated.

E. *Fisheries Enhancement*

U.S. federal and state agencies imported nineteen game fish species into Washington State between 1890 and 1980 to enhance recreational fishing. Accidental release and unplanned spread of some species was a by-product of this activity. Private citizens may also transport and release their favorite fish or shellfish species into a body of water, hoping to establish a harvestable population.

F. *Hull Fouling and other Non-Ballast Vessel Introductions*

Once introduced to a neighboring area, introduced species can spread within a region due to local small boat traffic. It is likely that many of the introduced species found in Elkhorn Slough were transported via frequent boat traffic between Moss Landing and other regional harbors, such as San Francisco Bay. Fishing vessels in MBNMS harbors can regularly travel from as far as Baja, California and Alaska, potentially transporting species that have been introduced in other areas along the West Coast back to the MBNMS.

Recreational boaters transport introduced species in bait buckets or boat wells, often without realizing it. Fouling of vessel hulls by encrusting organisms also provides a mechanism for transfer of species. Aquatic plants, in particular, are easily transported when plant fragments get tangled on boat propellers, anchors, trailers and fishing gear of recreational boats. Once a new species is introduced into one MBNMS harbor, it becomes more likely that adjacent harbors will also become invaded as the species can be transported by local boat traffic.

G. *Other Intentional Introduction*

In some cases, non-natives species have been introduced to areas deliberately. For example, three invasive *Spartina* species were introduced into the San Francisco Bay in the 1970's as part of marsh restoration projects. *Spartina alterniflora* readily hybridizes with and out-competes the native California cord grass and threatens this native cord grass and other native plants with local extinction. All California estuaries are considered threatened by invasive *Spartina* species. The Chinese mitten crab (*Eriocheir sinensis*) may have been introduced to the San Francisco Estuary through deliberate release to establish a fishery. Mitten crabs pose several threats to the ecosystem and local communities, including burrowing activity that accelerates the erosion of banks and levees, and may imperil salmon populations due to their appetite for juvenile salmon. The mitten crab is also the secondary intermediate host for the Oriental lung fluke, with mammals, including humans, as the final host.

H. *Live Bait*

Recreational fishers buy commercially sold live worms and other aquatic organisms for use as bait. Both the bait species and its packing material (frequently invertebrate-laden seaweeds) can result in introductions through intentional and accidental release.

- I. *Restaurants, Seafood Retail, Seafood Wholesaling and Processing*
Packing materials for live seafood such as seaweed and seawater contain a number of living organisms and provide an opportunity for species introductions when the unused product, packing materials and shipping containers are disposed of improperly. Live organisms either in or on live seafood may pose an additional threat. There are numerous seafood restaurants and fish markets located on the waterfront or wharves in MBNMS communities, especially Santa Cruz and Monterey, presenting a very direct means of potential introduction through seafood or packing material discards.
- J. *Scientific Research Institutions, Schools and Public Aquariums*
Private and public research laboratories, schools and aquariums use non-native species for testing, teaching, research and display. Accidental release of specimens can occur when strict protocols for animal management are not followed or when protocols do not exist. Many of these institutions rely on seawater intake and discharge systems that can provide a direct means of accidentally transporting introduced species from the lab or aquarium to the ocean.
- K. *Dispersal of Adults, Eggs, and Larvae*
Once introduced to a particular site, introduced species can spread within a region due to dispersal of adults, eggs, and larvae on currents.

Strategy IS-2: Develop Prevention and Response Programs for Introduced Species

Introduced species can become established very quickly and once established are costly and difficult, if not impossible, to eradicate. Therefore, it is critical that resource managers focus efforts on the prevention of new introductions by addressing known pathways of introduction. When new introductions do occur, it is important to be able to quickly assess the threat posed by a newly introduced or newly identified species. Ideally, resource protection agencies would be able to quickly identify a newly introduced species and respond with effective eradication efforts.

PREVENTION:

Activity 2.1: Develop and Implement Introduced Species Outreach and Prevention Program

An outreach program should include components to address targeted audiences most likely to introduce non-native species. Targeted audiences may include the shipping industry, harbors, boaters, fishermen, research and teaching institutions, aquaculture facilities, private aquarium shops, etc. Potential audiences should be assessed to determine the most effective way to reach them, including the best message and tools to communicate the message.

Activity 2.2: Identify Incentives and Necessary Infrastructure and Training to Reduce Risk of Introduction

The MBNMS will work with partners to develop an outreach program to encourage businesses to implement precautionary practices. The MBNMS will also evaluate implementing programs to provide financial incentives for hull cleaning and help find funding for sewerage boat yards or installing filters. The MBNMS will also investigate whether areas where hull cleaning occurs drain directly to the ocean, and whether the likelihood of introductions could be reduced by having wash down areas for boats and boatyards that drain to sewer systems. The MBNMS will

coordinate with partners in providing technical training for boat yards, underwater hull cleaners, and aquaculture operations. The MBNMS will also conduct regulatory agency coordination for discharge permits.

Activity 2.3: Coordinate Use of Regulations/Permits/Enforcement and Inspect Discharge Logs

MBNMS will coordinate with its partners and support state and federal efforts to address introductions through regulatory promulgation, permitting, and interpretive and regulatory enforcement. The MBNMS will coordinate with the Coast Guard to inspect vessel discharge logs for evidence of unauthorized ballast discharges and take appropriate enforcement action. The MBNMS will coordinate with the California State Lands Commission (CSLC) ballast water program. The MBNMS will also continue to review and comment on National Pollutant Discharge Elimination System (NPDES) applications and coordinate with Regional Water Quality Control Boards to ensure that all dischargers adequately address introduced species prevention.

RESPONSE:

Activity 2.4: Develop and Conduct an Early Detection Training Program

The MBNMS will continue to work with the Elkhorn Slough National Estuarine Research Reserve (ESNERR) to implement and expand the Early Detection program and develop enhanced detection capabilities, such as training dive volunteers. Area researchers and others who spend a significant amount of time in and adjacent to the water should be targeted for detection training.

Activity 2.5: Develop and Implement Response Plan

The MBNMS will work with partners to identify species already introduced to MBNMS waters, or the harbors and evaluate the feasibility and efficacy of eradication efforts or other management measures designed to limit their spread. The MBNMS will also work with appropriate partner agencies to develop a decision-making framework to help guide response to detection of an introduced species. The plan will identify eradication and treatment methods, restoration and long-term monitoring.

Strategy IS-3: Develop Baseline Information, Research & Monitoring Program

Over the past five years, a few studies have attempted to determine the extent of established introductions in portions of the MBNMS. To date, these studies have focused largely on Elkhorn Slough, which is part of the MBNMS, and to a lesser degree, harbors adjacent to the MBNMS. The overall goal of Strategy IS-3 is to improve the knowledge of existing introduced species in the MBNMS, including possible prevention and remediation responses.

Activity 3.1: Increase Baseline Research

MBNMS staff and partners will assist with additional baseline research, especially expansion of surveys to uninvestigated areas such as Santa Cruz and Pillar Point harbors and the outer coast, and uninvestigated habitats such as pier pilings. MBNMS will also coordinate with the California Department of Fish and Game on its biological surveys currently underway.

Activity 3.2: Develop Monitoring Plan for New Invasions Through SIMoN

MBNMS will develop a monitoring plan targeted at detecting new introductions. This plan will identify how to coordinate monitoring efforts conducted by other agencies, the frequency of the monitoring and who will be conducting the monitoring in which areas. The monitoring plan should also identify the role of volunteers and any necessary training for identification and removal of introduced species.

Activity 3.3: Synthesize Research Results and Make Results Publicly Available

Research and monitoring data will be integrated and made available via the SIMoN website.

Activity 3.4: Assess Ecological and Economic Impacts of Introduced Species in the MBNMS

MBNMS staff will coordinate with partners in facilitating analysis of the impacts of introduced species in the MBNMS. Results of these efforts will be used to focus prevention efforts and to block the pathways of introduction.

Action Plan Partners: Scientific institutions, Regional Water Quality Control Board, California Department of Boating and Waterways, UC Sea Grant, California Department of Fish and Game (Marine Region - Office of Spill Prevention and Response), Marine Pollution Control Studies Lab, Office of Spill Prevention and Response, Elkhorn Slough National Estuarine Research Reserve (ESNERR), Smithsonian Environmental Research Center (SERC), California State Lands Commission, local researchers, divers, boaters, municipalities, harbor masters

Table IS.1: Measuring Performance of the Introduced Species Action Plan

Desired Outcome(s) For This Action Plan:	
Prevent new introduced species from becoming established as well as detect, control and eradicate harmful introduced species that may already be established in the MBNMS.	
Performance Measure	Explanation
By 2012, develop and implement action plans to address four key known pathways to prevent introduction of non-native species.	MBNMS will measure progress and performance by evaluating progress in the development and implementation of the action plans for key pathways. Implementation of each of the pathway strategies will also require further identification of performance measures including numbers or tonnage of introduced species removed, monitoring of rates of introduction, and comprehensiveness of monitoring programs.

Table IS.2: Estimated Timelines for the Introduced Species Action Plan

Introduced Species Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy IS-1: Address Known Pathways of Introduction	●.....●		●.....●		→
Strategy IS-2: Develop Prevention Program for Known Pathways of Introduction		●.....●	●.....●		→
Strategy IS-3: Develop Baseline Information, Research & Monitoring Program	●.....●		●.....●	●.....●	→
Legend					
Year Beginning/Ending : ●.....●			Major Level of Implementation: ————		
Ongoing Strategy : ●.....→			Minor Level of Implementation:		

Table IS.3: Estimated Costs for the Introduced Species Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy IS-1: Address Known Pathways of Introduction	\$24	\$24	\$8	\$18	\$18
Strategy IS-2: Develop Prevention Program for Known Pathways of Introduction	\$89.5	\$104	\$133	\$300	\$318
Strategy IS-3: Develop Baseline Information, Research & Monitoring Program	\$20	\$204	\$162	\$27	\$0
Total Estimated Annual Cost	<i>\$133.5</i>	<i>\$332</i>	<i>\$303</i>	<i>\$345</i>	<i>\$336</i>
* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.					
** Contributions from outside funding sources also anticipated.					

Sanctuary Integrated Monitoring Network (SIMoN) Action Plan

Goal

Provide an ecosystem-wide monitoring program within MBNMS to determine human induced and natural changes and to disseminate information to the public and agencies.

Introduction

Comprehensive, long-term monitoring is a fundamental element of resource management and conservation. Numerous reviews and studies recognize that coordinated, standardized approaches to monitoring are essential for effectively determining temporal and spatial trends. However, despite the substantial efforts by private and government organizations, monitoring programs are typically incomplete, inconsistent, fragmented, and inaccessible. This is commonly a result of insufficient infrastructure, minimal funding from too few sources, slow and focused dissemination of information, and limited interpretation of data. A comprehensive, integrated and long-term perspective to marine protected areas is difficult to achieve. To assure the effective and continuous evaluation of a region and its resources, particularly large areas on the scale of the MBNMS, a commitment towards a stable network of flexible ecosystem and issue-based monitoring programs is needed.

Figure SIMoN-1: SIMoN scientists prepare launch for subtidal surveys



The management plans for all national marine Sanctuaries mandate implementation of a monitoring program. When the MBNMS was designated in 1992, its original management plan specifically included a requirement that the NOAA monitor ecosystem change, determine those adverse changes that are due to human actions, and take steps to eliminate or lessen adverse changes through education and possibly new regulation. Given the size and complexity of this national marine sanctuary, and number of potential human impacts, this is not a trivial task. The Joint Management Plan Review (JMPR) process to update the MBNMS Management Plan identified the priority issues that must be addressed. The issue-related action plans identified in the management plan each identify research and monitoring needs. These will be the focus of integration efforts for existing data and new monitoring efforts by Sanctuary Integrated Monitoring Network (SIMoN).

The MBNMS, in collaboration with the regional science and management community, designed SIMoN to identify and track natural and human induced changes to the MBNMS. SIMoN's

integration of high quality scientific research and long-term monitoring data furnishes the information needed for effective management and provides a greater basic understanding of the MBNMS, its resources, and natural processes.

SIMoN utilizes existing data sets, supports and augments current research and monitoring efforts, and initiates new efforts to address important gaps in our knowledge of the MBNMS. The strength of this program is that SIMoN serves as the hub for regional ecosystem monitoring as requested by the science community. Local scientists continue to collect the large majority of monitoring data, but the MBNMS helps generate funds required to maintain or expand some existing efforts and to initiate new studies. The funds secured by the MBNMS allow SIMoN to contract with researchers and institutions for specific monitoring efforts through annual SIMoN requests for proposals (RFPs). RFP topics are decided on by a committee of scientists and managers working from a list of priority areas of need, developed largely from Management Plan issues, whereas experts from around the nation rigorously review proposals.

Through SIMoN, the MBNMS also integrates and interprets results of individual efforts in a large ecosystem-wide context and continuously updates and disseminates data summaries to facilitate communication between researchers, managers, educators, and the public. Timely and pertinent information is provided to all parties through tools such as a SIMoN web site, an annual symposium, and a series of technical and public reports.

Strategy SI-1: Implement Monitoring Programs Needed to Support Management Priorities

Activity 1.1: Identify and Compile Priorities as Identified in Management Plan

Activity 1.2: Use the SIMoN Process to Address Priorities from Management Plan

Activity 1.3: Solicit Outside Funds and Partners to Address New Priorities

Strategy SI-2: New Monitoring Efforts for Basic MBNMS Characterization and Understanding of Changes in Natural Resources

Although the central California marine environment is well studied, resource managers lack critical information on many locations, resources, and processes within the MBNMS. In particular, there is very little basic information on remote areas such as the Big Sur Coast and critical management concerns such as the population dynamics and trophic interactions of key prey species (e.g., krill and squid). For effective resource management and conservation, and for a comprehensive, integrated ecosystem understanding of the entire MBNMS, additional work is imperative.

To identify where new efforts should be focused, the MBNMS held a two-day workshop with over eighty regional academic scientists and resource managers in April 2000. The workshop produced a series of priority questions that are being addressed for effective monitoring of the MBNMS, its resources, and its processes. These results were then evaluated for common themes, compared with information on historic data sets and existing monitoring efforts to identify gaps, and synthesized into MBNMS-wide “areas of need” by a scientific advisory committee and MBNMS staff.

All new SIMoN monitoring efforts to address these areas of need are either detailed surveys or characterizations, specific question-driven monitoring with fixed durations, or essential long-term monitoring efforts focused on key indicators of resource or ecosystem change and health.

Some examples of new monitoring efforts SIMoN has initiated are:

- A. *Characterization of the Benthic and Planktonic Communities of Elkhorn Slough*
An ecosystem description of Elkhorn Slough that compares current data to baseline data and also collects new data that will serve as a baseline for future assessments of rapid changes in this coastal habitat.
- B. *Coastal Ocean Mammal & Bird Education and Research Surveys*
A beach survey program called Coastal Ocean Mammal and Bird Education and Research Surveys (Beach COMBERS), using trained volunteers to survey beached marine birds and mammals, monthly, at selected sections of beaches from the Santa Cruz/San Mateo County line through Cambria.
- C. *Midwater and Benthic Trawl Surveys on Moss Landing Marine Laboratories Class Cruises in Monterey Bay*
Developing a database of historic and current information from marine ecology, invertebrate zoology, and ichthyology field cruises at Moss Landing Marine Laboratories. Class data from several research vessels' programs to survey the fishes and invertebrates in both shallow- and deep-benthic and midwater habitats in Monterey Bay.
- D. *Ecological Effects of the Moss Landing Thermal Discharge*
A quantitative evaluation of the impacts of the thermal discharge into the MBNMS from the Moss Landing Power Plant.
- E. *Monitoring and Management of the Invasive Alga Undaria pinnatifida*
Monitoring the spread of the invasive seaweed *Undaria pinnatifida* within the Monterey Harbor, studying the effectiveness of manual removal of *Undaria* from harbor docks and pier pilings, and describing the phenology of this alga in its new environment.

While the SIMoN program selects and coordinates new monitoring efforts, data collection is largely conducted by outside scientific experts under contract. This includes basic surveys, maps, and characterizations of all areas of the MBNMS, and long-term monitoring of key indicators of status and trends.

Activity 2.1: Initiate New and Continue Existing Monitoring Efforts to Distinguish Natural Versus Human Caused Changes Through Time

A formal SIMoN Science Committee meets with SIMoN staff a minimum of two times per year. The SIMoN Science Committee provides guidance on the specific topics covered by the RFPs, reviews full proposals, and makes recommendations to the SIMoN staff on proposal finalists.

To determine topics for the RFP process, SIMoN staff presents to the Science Committee a working list of focused priority topics for characterizing and monitoring the MBNMS and proposes funding levels given the total budget available for that particular year. This list is based on areas of need, which are updated as needed, and coordinated with other MBNMS staff. A final list of topics to be addressed is selected and prioritized by SIMoN staff and the Science Committee based on the following criteria:

- A. Consistency with the overall goals of the MBNMS and SIMoN
- B. Urgency and ability to address identified resource management priorities
- C. Fundamental nature relative to the understanding of resources or processes
- D. Unique or limited opportunities
- E. Significance of threat to the ecosystem or human health (relevance to needs identified in the action plans addressing priority issues)
- F. Importance beyond the MBNMS boundaries and to other national marine sanctuaries
- G. Ability to gather sufficient information with the funds and technology available
- H. Availability of matching funds; complementary nature to existing studies

For each topic on the final priority list, SIMoN staff, with aid from the Science Committee, drafts requests for pre-proposals for each new monitoring effort to be funded. Pre-proposals are then evaluated for their ability to address specific monitoring and management needs, and those that qualify are asked to submit a full proposal. All full proposals are first sent out for thorough and objective review by two to four scientists, not affiliated with the MBNMS office, who are experts in the particular fields represented by the proposal. The Science Committee and SIMoN staff evaluate proposals and external reviews to grade them on: (1) ability to provide the specific information needed for resource management decisions; (2) feasibility and scientific merit; (3) ability to link with other ongoing efforts and existing data sets; and (4) ability to supply a broader, long-term understanding of the MBNMS.

Activity 2.2: Continue Rapid Response Programs to Address Monitoring Related Questions

In the event of a major catastrophe or unforeseen natural event, the rapid response program can be used to initiate monitoring identify cause, impacts, and extent of unforeseen extraordinary changes (e.g., oil spills, harmful algal blooms) facilitating swift and appropriate management responses. This will be limited by availability of contingency funds.

Activity 2.3: Continue Review of Internal MBNMS Proposals

In some cases, MBNMS staff and closely affiliated programs may submit pre-proposals for review by SIMoN staff and the Science Committee. These proposals can be submitted at any time.

Activity 2.4: Continue Review of Unsolicited Proposals

Twice each year (May and November), SIMoN staff will accept unsolicited pre-proposals. These proposals have no limitations on topic, but generally do not exceed \$15,000 per year and will be evaluated using the criteria listed in Activity 2.1.

Activity 2.5: Solicit Outside Funds and Partners to Address Priorities

Strategy SI-3: Integrate Regional Monitoring Efforts

There are multiple on-going research and monitoring efforts that provide valuable insight into how resources and processes of the MBNMS are changing through time. Providing summary information on a large portion of these is a “value-added” process that has already been completed as part of SIMoN’s development. However, bringing together, interpreting, and disseminating information on the various ongoing but disconnected regional efforts will continue

throughout the life of this program by the SIMoN staff. There is enormous value to resource management, education, and research in simply integrating and interpreting the large body of existing information for a long-term, ecosystem understanding of the MBNMS.

Activity 3.1: Coordinate and Synthesize Historic Data Sets with Information from the Various Regional Research Institutions Working within the MBNMS

Activity 3.2: Integrate Existing Data Sets into the SIMoN Database

Activity 3.3: Create and Disseminate Synthetic Products Based on Data from Various Monitoring and Research Efforts

Activity 3.4: Expand the Metadata Database to Include all On-going Monitoring Projects, Add New Projects, and Periodically Update and Review all Projects in the Database

Activity 3.5: Expand the SIMoN Database (i.e., PDERM) to Include Research (Non-monitoring) Projects That Complement Historic and Current Monitoring Efforts

Activity 3.6: Participate in the Development of Regional Ocean Observatory Programs

Strategy SI-4: Integrate, Synthesize, and Analyze New and Existing Data

A central objective of SIMoN is to produce an integrated analysis of the state of the resources and qualities of the MBNMS. Marine research conducted in the Sanctuary includes long-term monitoring programs that are essential to furthering our understanding and to determining the health, of the marine ecosystem. The MBNMS will develop the methods and tools to analyze the multiple data sources that comprise SIMoN.

Activity 4.1: Identify Valuation Tools (e.g., Ecosystem Models) and Indicators for Species, Habitat, and Ecosystem Change

Activity 4.2: Analyze Selected Indicators for Species, Habitats, Ecosystem Change

Activity 4.3: Produce a “SIMoN Says” Report, Annually Reporting on the State of the Sanctuary

Activity 4.4: Develop a Framework for Regional Water Quality Data Integration and Analysis that will be Useful for Evaluating the Overall Status of Water Quality in the Sanctuary and its Watersheds.

Strategy SI-5: Increase Outreach and Information Dissemination

Monitoring data are most useful if they are readily available and provide timely and pertinent information to managers and decision makers, the research community, and the general public. SIMoN, therefore, is not only a hub for initiating and integrating data collecting efforts, but also for disseminating information through a data sharing “network.” Information dissemination must package and interpret data relevant to the management plan’s action plans and present or discuss data with MBNMS resource protection staff and management, as well as coordinate with education staff to incorporate data results into education programs and products.

Activity 5.1: Continue Development and Maintenance of Monitoring Database and Mapping Tools on SIMoN Website

Activity 5.2: Produce State of the Sanctuary Report and Other Technical Reports

Activity 5.3: Conduct Annual Monitoring Symposia and Workshop

Activity 5.4: Provide Timely Information for Management Decisions

As part of all funding contracts, each new SIMoN effort is responsible for providing the following to allow rapid information dissemination by SIMoN staff:

- A. Detailed materials, methods, and maps of study area(s) within two months of receiving initial funding and all protocol updates as they occur
- B. Continuous access to all data in a standardized format
- C. Periodic site visits and personal contact with SIMoN staff
- D. Statistical summaries, progress reports, and budget updates every six months
- E. A comprehensive final report with literature review
- F. Publication of results in a peer-reviewed journal when possible

Activity 5.5 Continue to Create Geographic Information Systems (GIS) Products to Support Monitoring Efforts

Activity 5.6: Produce Periodic Reports on the State of Sanctuary Water Quality that will be Useful for management Decisions and Accessible to a General Audience

Strategy SI-6: Expand SIMoN as a Model for the National Marine Sanctuary System

SIMoN has received backing from the National Marine Sanctuary Program (NMSP). Besides their aid in the development of SIMoN and providing financial and personnel support for its operation, the NMSP is now using SIMoN as a model for how integrated monitoring programs should be developed and operated at all other sanctuary sites nation-wide. Using a phased approach, all national marine sanctuaries will implement monitoring in the future with the assistance of SIMoN staff.

As a part of a national system of marine sanctuaries, staff from SIMoN will aid the national effort to produce ecosystem monitoring and observatory programs at all sanctuaries. The national program has fully embraced the concept behind SIMoN – involving local researchers along with agency staff to share existing monitoring data and identify and collect new, critical monitoring data.

Activity 6.1: Establish SIMoN Programs at all Sites

Establishing a SIMoN program will allow concentration on producing programs that, like in Monterey Bay, have local support from marine scientists and agencies. The NMSP has prepared a schedule for creating new SIMoN or SIMoN-like programs at other national marine sanctuaries in the following order: Gulf of Farallones and Cordell Bank; Channel Islands and Olympic Coast; Fagatele Bay, Hawaiian Humpback Whale, Northwestern Hawaiian Islands; Grays Reef and Stellwagen Bank; Florida Keys and Flower Garden Banks.

Activity 6.2: Involve Local Researchers Along with Agency Staff to Share Existing Monitoring and Identify and Collect New, Critical Monitoring Data

Activity 6.3: Identify “Sentinel” Locations for Long-term Monitoring Locations at all Sanctuaries in the Development of Ocean Observatories

Activity 6.4: Develop Indicators, or Metrics, for each Site to Assess, to the Extent Possible, the Health of the MBNMS’s Ecosystem

Action Plan Partners: University of California, Stanford University, Moss Landing Marine Laboratories, Elkhorn Slough National Estuarine Research Reserve, Naval Postgraduate School, National Marine Fisheries Service, US Geologic Survey, Monterey Bay Aquarium, National Undersea Research Program, UC Sea Grant, National Oceanographic Data Center, Center for Marine Integrated Technologies, Central and Northern California Ocean Observing System, Center for Integrative Coastal Observation, California Department of Fish and Game , Research and Education, Other National Marine Sanctuaries, Other Research Institutions

Table SIMoN.1: Measuring Performance of the Sanctuary Integrated Monitoring Network (SIMoN) Action Plan

Desired Outcome(s) For This Action Plan:	
Provide ecosystem-wide monitoring program within MBNMS to determine human induced and natural changes and to disseminate information to public and agencies.	
Performance Measure	Explanation
By 2012, adequately characterize 100% of MBNMS habitats and species in a web-enabled database with identified monitoring system for each habitat type.	MBNMS will measure the number of habitats that have been characterized and monitored in the MBNMS to determine whether performance of the SIMoN program is effective.

Table SIMoN.2: Estimated Timelines for the Sanctuary Integrated Monitoring Network (SIMoN) Action Plan

Introduced Species Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy SI-1: Implement Monitoring Programs Needed to Support Management Priorities	●				→
Strategy SI-2: New Monitoring Efforts for Basic MBNMS Characterization and Understanding of Changes in Natural Resources	●				→
Strategy SI-3: Integrate Regional Monitoring Efforts	●				→
Strategy SI-4: Integrate, Synthesize, and Analyze New and Existing Data	●				→
Strategy SI-5: Increase Outreach and Information Dissemination	●				→
Strategy SI-6: Expand SIMoN as a Model for the National Marine Sanctuary System	●	●			→
Legend					
Year Beginning/Ending	: ● — ●		Major Level of Implementation: _____		
Ongoing Strategy	: ● —→		Minor Level of Implementation:		

Table SIMoN.3: Estimated Costs for the Sanctuary Integrated Monitoring Network (SIMoN) Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy SI-1: Implement Monitoring Programs Needed to Support Management Priorities	\$40	\$40	\$40	\$40	\$40
Strategy SI-2: New Monitoring Efforts for Basic MBNMS Characterization and Understanding of Changes in Natural Balances	\$80	\$80	\$80	\$80	\$80
Strategy SI-3: Integrate Regional Monitoring Efforts	\$80	\$80	\$80	\$80	\$80
Strategy SI-4: Integrate, Synthesize, and Analyze New and Existing Data	\$40	\$40	\$40	\$40	\$40
Strategy SI-5: Increase Outreach and Information Dissemination	\$40	\$40	\$40	\$40	\$40
Strategy SI-6: Expand SIMoN as a Model for the National Marine Sanctuary System	\$40	\$20	\$0	\$0	\$0
Total Estimated Annual Cost	<i>\$320</i>	<i>\$300</i>	<i>\$280</i>	<i>\$280</i>	<i>\$280</i>
* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.					

Marine Protected Areas Action Plan

Goal

To determine the role, if any, of additional marine protected areas (MPAs) in maintaining the integrity of biological communities in the MBNMS, and to protect, and, where appropriate, restore and enhance natural habitats, populations and ecological processes. If additional MPAs are to be created, design and ensure implementation of MPAs that meet the Sanctuary's goals and are compatible with the continuation of long-term sustainable fishing in the region.

Introduction

The action plan outlines the framework for coordinating with and providing input to appropriate state and federal agencies on the need for, purpose, design and implementation of MPAs within the MBNMS region, whether initiated or coordinated by the MBNMS or other agencies. A multi-stakeholder workgroup will work together to implement the components of the action plan.

MPAs are a management tool that may fully restrict take of marine life within a designated geographic area or may allow take of selected species. Scientific research has indicated that carefully crafted MPAs can be effective tools for conservation of biodiversity and habitats. MPAs may be used as a means to restore degraded areas and as a precautionary tool to conserve a range of representative habitats and biodiversity. Well-designed MPAs generally contain higher species diversity, more abundant species, and larger fish within their boundaries relative to impacted areas of similar habitat outside the reserve. These larger fish produce many more young than do smaller fish and for some species larger females produce healthier young that survive better. MPAs are one of several useful tools that can be used to prevent, slow, or reverse negative habitat and ecosystem changes within the MBNMS. MPAs may also have positive or negative ecological, social or economic consequences. As the science of MPAs is evolving, care must be given to actively look to emerging MPA studies to assess both the positive or negative impacts of MPAs. The MBNMS will also consider other management tools that may enable the program to meet its goals.

Consideration of MPAs will be a joint effort with the participation of many diverse stakeholders, and as fishing is a key cultural and economic component of the region, this will include strong participation of the fishing community to tap into their extensive knowledge and to consider socioeconomic impacts of alternative MPA designs. It will also involve participation from other agencies, scientists, environmental organizations and the public. Strong interagency collaboration with the National Marine Fisheries Service, the Pacific Fishery Management Council, and the California Department of Fish and Game will be an essential component of this process.

Regarding state waters (within 3 nautical miles of shore with some exceptions), in early 2005 the California Resources Agency reinitiated a process pursuant to the 1999 Marine Life Protection Act (MLPA) to develop an improved network of MPAs. While the MBNMS will be an active participant in the MLPA process, the Resources Agency will be the lead agency for the consideration and implementation of MPAs in state waters within the MBNMS. The Sanctuary plans to continue to defer to the MLPA process for consideration of MPAs in state waters as long

as the process is actively progressing. In addition to providing its perspective during the MPA designation phase under MLPA, MBNMS staff will also seek to be active partners in research, enforcement, and education as state MPAs are implemented.

To consider MPAs in federal waters, the MBNMS will facilitate continuation of a multi-stakeholder workgroup representing agencies, the fishing community, environmental organizations, scientists and other stakeholders to carry out the evaluations outlined in the plan below. If the workgroup ultimately recommends the establishment and locations of specific MPAs in federal waters, they could be implemented by a variety of mechanisms. Depending on the final design of MPAs, their implementation could draw on the authorities of the NMSA, or the Magnuson Stevens Fishery Conservation and Management Act.

Workgroup Planning

To address the issue of the role, if any, of MPAs in protecting MBNMS resources, the MBNMS developed a workgroup of the Sanctuary Advisory Council in January 2003 to provide guidance on several aspects of MPAs. The workgroup was asked to outline the framework for the need for, purpose, design and implementation of MPAs within federal waters the MBNMS region. The framework describes the process, goals and criteria for effective MPAs and provides recommendations for future steps to evaluate the issue. Although the revised management plan itself does not specify exact locations for MPAs, the MBNMS will continue the planning effort in the future with the workgroup using the framework document as a guide in developing MPA alternatives and assessing their role in achieving Sanctuary mandates. To conduct a thorough evaluation of the issue, much detailed work remains, including a more detailed assessment of the need for MPAs; identification of specific habitats and ecological processes to be protected; identification of potential and existing threats; development of site-specific goals; consideration of design criteria that incorporate biological and socioeconomic issues; integration with other management efforts; development of alternative MPA designs, and articulation of monitoring, education and enforcement needs.

The workgroup refined a draft list of future work topics that address these and other issues in the MPA plan. This list, shown below, will provide the basis for a longer-term work program for implementation, with continued involvement by the Workgroup. The Workgroup identified the strategies below as necessary steps to achieving the objectives laid out in the goal statement. Strategy one addresses the need to form working partnerships with stakeholders and other agencies that will facilitate the implementation of the plan. Strategy two focuses on the evaluation of the need for MPAs and identification of the resources to be protected. Strategies three through six focus on effective design of MPAs, considering biological issues, patterns of use, socioeconomics and potential for integration with other management measures. Strategies seven through nine focus on considering education, enforcement and research programs during both MPA design and implementation phases. Strategies ten and eleven focus on implementation issues related to phasing of MPAs and to coordination of interagency designation processes, assuming a decision is reached in the future regarding the need for MPAs and on their locations.

Strategy MPA-1: Develop Partnerships

Activity 1.1: Develop Partners During Evaluation, Goal Setting, and Design Phases

- A. Continue multi-stakeholder workgroup for evaluation and design, and allow for continued involvement of local communities
- B. Ensure constituent involvement and adequate notification for public involvement
- C. Outline roles and steps for involvement of MBNMS, National Marine Fisheries Service, Pacific Fishery Management Council, and California Department of Fish and Game, and identify common goals
- D. Develop partnerships with California Department of Fish and Game, National Marine Fisheries Service, Pacific Fishery Management Council and consider joint staffing during evaluation and design phases
- E. Evaluate linking to and coordination with potential Pacific Fishery Management Council evaluation of MPAs
- F. Ensure coordination with MLPA process in state waters
- G. Marine Reserve issues in the Northern Management Area first go to the GFNMS Advisory Council for action. Their recommendations are then forwarded to the MBNMS Advisory Council for comment and action.

Strategy MPA-2: Define Goals and Objectives and Habitats and Resources to be Protected

This strategy outlines activities the working group must address in defining more specific objectives for MPAs, considering the range of habitats and ecological interactions, which may warrant protection, and the threats to those resources.

Activity 2.1: Develop Specific Conservation, Education, Research, and Compatible Use Goals and Objectives for MPAs Program, Building on General Goal Statement Above as Part of Ongoing Multi-stakeholder Process

Activity 2.2: Consider Range of Representative Habitat Type- e.g. Hard Bottom, Soft Bottom, Pelagic, etc.

Activity 2.3: Identify Key Ecological Interactions, Including Predator-Prey Relationships, Migratory Patterns, Life History Stages, and the Role of Biogenic Habitat (e.g. corals)

Activity 2.4: Identify Emerging or Existing Threats to These Habitats, Resources or Interactions

Activity 2.5: Identify Resource or Habitat-specific Objectives for MPAs and/or Network/Collection of MPAs

Activity 2.6: Include Mix of Degrees of Habitat Health Ranging from Areas that are Minimally Disturbed and Set Aside for Protection, to Historically Productive, Currently Underused Habitats Set Aside to Allow Recovery

Strategy MPA-3: Develop General Design Criteria and Incorporate into MPA Siting Alternatives

This strategy outlines the various criteria the working group must describe and evaluate in designing MPAs, including biological issues, human use patterns, questions of scale and size, and practical implementation issues.

Activity 3.1: Consider Biological and Physical Factors

- A. Consider biological factors identified above in Strategy MPA-2
- B. Consider proximity to ecological “hotspots”
- C. Evaluate physical oceanographic factors such as currents, upwelling, etc.
- D. Consider biological relationships between state and federal waters for a network/collection of MPAs

Activity 3.2: Consider Human Use Patterns

- A. Evaluate distribution of human activities on the water
- B. Evaluate how locations and distances may impact different user groups and local communities
- C. Consider distances from port and safety issues
- D. Evaluate potential impacts of displacement of fishing effort to other areas
- E. Consider access by other target users, such as researchers
- F. Map location of existing small reserves, areas closed to certain types of fishing, and other types of MPAs
- G. Consider locations of other types of human threats—e.g. water quality and vessel traffic,

Activity 3.3: Address Considerations of MPA Size and Scale

- A. Ensure that MPAs are sized appropriately to meet objectives, considering biological and socioeconomic factors
- B. Consider distances between MPAs and between types of MPAs
- C. Evaluate the need for a network of MPAs as opposed to individually sited MPAs
- D. Determine appropriate scale of a network
- E. Incorporate variability in MPA design to improve effectiveness evaluations

Activity 3.4: Consider Design Issues Specific to Federal Waters

- A. Define conditions where it is beneficial to extend state MPAs to federal waters, and when separate MPAs may be more appropriate
- B. Evaluate type and orientation of extension that may be appropriate across state and federal waters, and consider the benefits and disadvantages of doing so
- C. Evaluate potential for separate offshore MPAs focused on biological hotspots correlated with persistent physical and oceanographic features
- D. Evaluate the persistence of pelagic hotspots over time
- E. Consider practical feasibility of pelagic restrictions, including possibility for temporary closures

Activity 3.5: Consider Practical Implementation Issues

- A. Consider proximity and ability to enforce
- B. Consider ability to monitor for effectiveness evaluation

Activity 3.6: Design MPA alternatives in the working group setting that incorporate and reflect the criteria and considerations developed in this strategy.

- A. Utilize a decision support tool in the working group to look at different spatial alternatives,
how they help achieve Sanctuary mandates, and their associated costs and benefits

Strategy MPA-4: Determine Types of Use

MPAs may vary from full no-take reserves that allow no harvest to areas that allow some levels of harvest, and areas that allow varying types of non-extractive uses. This strategy outlines the need for the working group to evaluate options for varying types of use in designing MPAs.

Activity 4.1: Consider Mix of Options that May Restrict Certain Human Activities at Selected Sites in a MPA or MPA Network

Activity 4.2: Consider Relationship Between State of California's Marine Managed Areas Improvement Act (MMAIA) Classifications and MBNMS Designations

Strategy MPA-5: Develop Integrated Management System

This strategy outlines issues the working group must consider in coordinating the development of MPAs with other types of management measures.

Activity 5.1: Identify and Evaluate Other Existing or Planned Ecosystem, Fishery, or Land-based Management Tools as Feasible Within Staff Limitations

Activity 5.2: Identify and Evaluate Gaps, Limits and Constraints of Existing Tools, as Feasible Within Staff Limitations

Activity 5.3: Evaluate Means to Effectively Integrate and Coordinate MPAs With the Efforts Identified in 5.1 to Leverage and Strengthen Efforts and Avoid Duplication

Activity 5.4: Use MPAs to Help Leverage Agency Resources to Address Multiple Threats to Key Sites

Strategy MPA-6: Conduct Socioeconomic Impact Analysis and Identify Mitigation

This strategy outlines activities to assess potential negative and positive socioeconomic impacts of MPAs during the design and post-design stages, and steps to mitigate potential negative effects and maximize potential positive effects.

Activity 6.1: Identify Types of Socioeconomic Analyses to Assist in the Design and Evaluation of Biologically Effective MPAs That Will Allow Continuation of Sustainable Fishing Practices and Sustainable Communities

- A. Evaluate how the community is affected, including cultural and economic sustainability of both consumptive and nonconsumptive factors and values
- B. Evaluate user groups and ports affected, short- and long-term effects, and potential for buffering or reducing negative effects
- C. Consider economic uses that may be improved by designation of MPAs
- D. Consider social values of a wide variety of different people in evaluating MPAs

Activity 6.2: Prioritize Studies Needed and Ensure Their Implementation, Including Those Required by the National Environmental Policy Act (NEPA)

Activity 6.3: Work with the NOAA and Department of Commerce to Expand/Develop Potential Economic Mitigation Programs for Users That May be Impacted

Strategy MPA-7: Develop Enforcement and Compliance Program

This strategy outlines activities needed to design an effective enforcement program.

Activity 7.1: Identify Components of an Effective Enforcement Program and Implementation Mechanisms to Provide Adequate Surveillance on the Water and in the Air

Activity 7.2: Develop Partnerships and Cooperative Interagency Enforcement Plans

Activity 7.3: Ensure Adequate Training of Enforcement Officers in MPA Management and Regulations

Activity 7.4: Work to Facilitate Compliance via Tools such as GPS Systems

Activity 7.5: Enlist Community Participation in MPA Management and Enforcement to Maximize Cost-effectiveness of Enforcement Program and Enhance Compliance

Strategy MPA-8: Develop Education and Outreach Program

This strategy outlines outreach and education needs during both the design and post-design phases.

Activity 8.1: Identify Target Audiences and Develop Components of an Effective Education and Outreach Program

Activity 8.2: Conduct Regional Workshops to Share Information and Gather Input From Fishing Leaders and the Community After MPA Design Criteria are Suggested by Multi-stakeholder Groups

Activity 8.3: Consider Ongoing Education Potential of Individual Reserve Locations

Activity 8.4: Link Efforts to Strategies in the Fishing Related Research and Education Action and to MBNMS Regional Education and Outreach Plans

Activity 8.5: Integrate Education with Enforcement and Research

Strategy MPA-9: Build Research and Monitoring Program

This strategy outlines activities needed to develop a research and monitoring program that will assess and disseminate information on the biological effectiveness of the MPAs and their impacts on patterns of human use.

Activity 9.1: Design and Conduct Biological Effectiveness Evaluations Linked to Specific Goals of MPAs

- A. Evaluate biological changes within and outside of MPAs
- B. Include comparisons to adequate control sites
- C. Distinguish between natural and anthropogenic changes
- D. Evaluate potential spillover effect to local populations

Activity 9.2: Evaluate Human Activities and Changes Relative to Specific Goals of MPAs

- A. Assess consumptive and non-consumptive use patterns inside and outside MPAs
- B. Determine effects of scientific monitoring
- C. Include observer program on research and fishing vessels
- D. Monitor socioeconomic changes in user groups after MPAs are established

Activity 9.3: Coordinate Monitoring and Data Distribution

- A. Coordinate MPA monitoring with other biological monitoring in the region and link to Sanctuary Integrated Monitoring Network (SIMoN)
- B. Involve fishermen and recreational divers in monitoring activities
- C. Coordinate with other sanctuaries conducting MPA monitoring
- D. Package and distribute readily understood monitoring information and effectiveness evaluations to decision makers, fishermen and public

Strategy MPA-10: Determine Timing Strategies and Phasing / Effectiveness Evaluations

This strategy outlines activities for evaluating the potential for phasing in the implementation of MPAs over time, as well as development of a defined process for adaptive management.

Activity 10.1: Evaluate Potential Benefits and Disadvantages of Phasing

Activity 10.2: If Phasing is Considered Appropriate, Develop Criteria for Establishing a Reasonable First Phase

Activity 10.3: Determine Criteria for Frequency of Effectiveness Evaluation of MPAs, Linking Criteria to Site-specific Goals

Activity 10.4: Establish Criteria for When Evaluations Should Lead to Adaptive Management or Changes in MPAs Based on Improved Knowledge

Strategy MPA-11: Develop Interagency Coordination and Implementation Mechanisms in Federal and State Waters

This strategy outlines the procedures and coordination for MPA implementation and for ensuring interagency coordination in the process.

Activity 11.1: After Identification of MPA Needs, Feasibility, Site-specific Goals, and Designs as Outlined Above, Identify and Recommend the Most Appropriate Process and Agency to Implement

<p>Note: The MBNMS MPA working group did not try to reach consensus on the options for implementing MPAs and did not recommend which of these options or others may be appropriate once strategies one through ten are completed. The group recommended further legal review of the current and future options. The MBNMS has chosen to present these options essentially verbatim as outlined in the MPA working group.</p>
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A. For federal waters, options and considerations include:

- Drawing on the authorities on the NMSA, the Pacific Fishery Management Council would be given the opportunity to prepare draft Sanctuary regulations.
- If the Pacific Fishery Management Council declines to prepare draft Sanctuary regulations under the NMSA or drafts regulations that fail to meet the goals and objectives of the Sanctuary, NOAA could prepare the draft regulations drawing on the authority of the NMSA.
- Promulgation of regulations under the NMSA requires amendment of the MBNMS Designation Document since fishing is currently not an activity subject to regulation. As outlined in the Designation Document, amendment of the Designation Document to

regulate fishing would occur in consultation with fishery management agencies, the fishing community, and the public, and would be subject to public hearings, preparation of environmental review, and government notification requirements. Revision of the Designation Document could be constrained to focus only on MPA designation and not on fishery regulations in general.

- The Pacific Fishery Management Council could adopt MPAs under its own statutory authority under Magnuson-Stevens, provided the species covered are addressed by a Fishery Management Plan (FMP) and state landing laws could be used to restrict landings of non-FMP species.

B. For state waters, options and considerations include:

- The State of California (through the Fish and Game Commission, California Department of Fish and Game, and the Parks Commission) could adopt MPAs pursuant to its authorities under the Marine Life Protection Act or under the Marine Managed Areas Improvement Act. The MBNMS plans to defer to the MLPA process for the consideration of MPAs in state waters so long as it is actively progressing. MBNMS staff will participate in and will coordinate with that process.

Activity 11.2: Ensure Coordination between State and Federal Implementation Measures and Timelines

Since state and federal implementation may occur via different agencies, ensure adequate coordination of implementation outcomes related to design and phasing.

Action Plan Partners: National Marine Fisheries Service, California Department of Fish and Game, fishermen, MPA working group members, Pacific Fishery Management Council, United States Coast Guard, harbor masters, California Department of Boating and Waterways, fishing clubs, California Resources Agency, dive shops, whale watchers, kayak companies, yacht associations, MPA Center, divers, researchers, local research institutions, socioeconomists, user groups, California Department of Parks and Recreation, community groups, NOAA OLE, Sanctuary Education Panel, fishing interest organizations, other stakeholders, NOAA General Counsel, Sea Grant

Table MPA.1: Measuring Performance of the Marine Protected Areas Action Plan

Desired Outcome(s) For This Action Plan:	
Collaborate with regional stakeholders and agencies in the designation of marine protected areas, which limit extraction to ensure the protection of natural biological communities and, where appropriate, restore and enhance habitats, populations, and processes.	
Performance Measures	Explanation
Complete description of the compositions, structure and function of the various habitats and ecosystems in the MBNMS.	Protection of the natural biological communities and the need to restore and enhance those habitats, population, and processes begins with an understanding of what change is occurring with the ecosystem and how the removal of certain species affects the various processes. A common goal of the many stakeholders and agencies is to understand and describe the many habitats and then to examine the methods and effects of extraction on the various habitats and ecosystem. Various legal mandates and planning processes are underway by several agencies to examine the manner in which to designate MPAs as one tool in ensuring the protection of ecosystems, habitats, and resources. To understand the need and effect of management actions, the MBNMS must begin with descriptions and mapping of the various habitats and ecosystems. MBNMS will measure the number and development of the habitats described and mapped as part of this action plan.

Table MPA.2: Estimated Timelines for the Marine Protected Areas Action Plan

Marine Protected Areas Action Plan	YR 1	YR 2	YR 3	YR 4	YR 5
Strategy MPA-1: Develop Partnerships	● — ●				
Strategy MPA-2: Define Conservation Goals and Objectives and Habitats and Resources to be Protected	● — ●				
Strategy MPA-3: Develop General Design Criteria	● ● — ●				
Strategy MPA-4: Determine Types of Use	● ● — ●				
Strategy MPA-5: Develop Integrated Management System	● ● — ● ▶				
Strategy MPA-6: Conduct Socioeconomic Impact Analysis and Identify Mitigation	● — ●				
Strategy MPA-7: Develop Enforcement and Compliance Program				● — ▶	
Strategy MPA-8: Develop Education and Outreach Program				● — ▶	
Strategy MPA-9: Build Research and Monitoring Program		● — ▶			
Strategy MPA-10: Determine Timing Strategies and Phasing/ Effectiveness Evaluations			● — ●		
Strategy MPA-11: Develop Interagency Coordination and Implementation Mechanisms in Federal and State Waters	● — ▶				
Legend					
Year Beginning/Ending :	● — ●	Major Level of Implementation: —			
Ongoing Strategy :	● — ▶	Minor Level of Implementation:			

Table MPA.3: Estimated Costs for the Marine Protected Areas Action Plan

Strategy	Estimated Annual Cost (in thousands)*				
	YR 1	YR 2	YR 3	YR 4	YR 5**
Strategy MPA-1: Develop Partnerships	\$37	\$29	\$29	\$25	\$0
Strategy MPA-2: Define Conservation Goals and Objectives and Habitats and Resources to be Protected	\$153	\$48	\$28	\$60	\$0
Strategy MPA-3: Develop General Design Criteria	\$67	\$257	\$57	\$37	\$0
Strategy MPA-4: Determine Types of Use	\$0	\$83	\$8	\$0	\$0
Strategy MPA-5: Develop Integrated Management System	\$16	\$20	\$16	\$16	\$0
Strategy MPA-6: Conduct Socioeconomic Impact Analysis and Identify Mitigation	\$67	\$166	\$17	\$16	\$0
Strategy MPA-7: Develop Enforcement and Compliance Program	\$0	\$0	\$16	\$16	\$0
Strategy MPA-8: Develop Education and Outreach Program	\$67	\$72	\$39	\$43	\$0
Strategy MPA-9: Build Research and Monitoring Program	\$0	\$8	\$24	\$641	\$0
Strategy MPA-10: Determine Timing Strategies and Phasing/ Effectiveness Evaluations	\$0	\$0	\$16	\$16	\$0
Strategy MPA-11: Develop Interagency Coordination and Implementation Mechanisms in Federal and State Waters	\$0	\$0	\$20	\$20	\$0
Total Estimated Annual Cost	\$407	\$683	\$270	\$890	\$0

* Cost estimates are for both “programmatic” and “base” (salaries and overhead) expenses.

** Costs for year five will depend on the what implementing authority is used to establish any MPAs