

California Marine Life Protection Act Initiative Blue Ribbon Task Force

MEMORANDUM

Phil Isenberg, *Chair*
Isenberg/O'Haren, Government Relations

William Anderson
Westrec Marina Management, Inc.

Meg Caldwell
Stanford University Law School

Ann D'Amato
Los Angeles City Attorney's Office

Susan Golding
The Golding Group, Inc.

Dr. Jane Pisano
Natural History Museum of L.A. County

Cathy Reheis-Boyd
Western States Petroleum Association

Douglas P. Wheeler
Hogan & Hartson, LLP

John J. Kirlin, *Executive Director*

To: Ryan Brodrick, Director, California Department of Fish and Game

From: John Kirlin, Executive Director, MLPA Initiative

Subject: Transmission of the Draft Master Plan Framework Approved by the MLPA Blue Ribbon Task Force

Date: April 18, 2005

As you are aware, the MLPA Blue Ribbon Task Force has been engaged in a very public process to develop a draft master plan framework for recommendation to the Department of Fish and Game and ultimately for consideration by the California Fish and Game Commission.

This framework is designed to be the first phase in a multi-phase process to help the State of California develop a Master Plan for guiding the adoption and implementation of a Marine Life Protection Program pursuant to the Marine Life Protection Act.

Two drafts of this document were released for public review and we received a substantial number of comments and suggestions that greatly improved the final product. The Master Plan Science Advisory Team provided guidance regarding the design of networks of marine protected areas, habitats and biogeographical regions. Several of your staff actively participated in developing this document as members of the steering committee for the initiative.

I am pleased to attach the Draft Master Plan Framework approved on April 11 by the MLPA Blue Ribbon Task Force for submission to the department. Please do not hesitate to call on me if you have questions or would like additional assistance as you move through the Fish and Game Commission process.

Enclosures

cc: Phil Isenberg, Chair, MLPA Blue Ribbon Task Force
Members, MLPA Blue Ribbon Task Force
Mike Chrisman, Secretary, California Resources Agency
John Ugoretz, MLPA Policy Advisor, Department of Fish and Game

CALIFORNIA MARINE LIFE PROTECTION ACT INITIATIVE

DRAFT MASTER PLAN FRAMEWORK

**A Recommendation to the
California Department of Fish and Game by the
MLPA Blue Ribbon Task Force**

April 15, 2005

CONTENTS

Executive Summary

Section 1: Introduction

Section 2: Process for Developing Alternative Marine Protected Area Proposals

Section 3: Considerations in the Design of Marine Protected Area Networks

Section 4: Management

Section 5: Enforcement

Section 6: Monitoring and Evaluation

Section 7: Financing

Works Cited

Appendices (a separate document)

- A. The Marine Life Protection Act
- B. The Marine Managed Areas Improvement Act
- C. Implementation of the Marine Life Protection Act: 1999-2004
- D. Strategy for Stakeholder and Interested Public Participation
- E. Social Science Tools and Methods
- F. Outline of Information Required for Proposals for Alternative Networks of Marine Protected Areas
- G. Master List of Species Likely to Benefit from Marine Protected Areas
- H. Summary of Recent and Ongoing Processes Related to the Marine Life Protection Act Initiative
- I. Description of Existing State Marine Protected Areas
- J. Glossary
- K. Suggested Outline for Regional Management Plans of Marine Protected Areas

Executive Summary

Section 1. Introduction

In 1999, the legislature approved and the governor signed the Marine Life Protection Act (MLPA; FGC Section 2851-2863). The MLPA requires that the Department of Fish and Game prepare and present to the Fish and Game Commission a master plan that will guide the adoption and implementation of a Marine Life Protection Program, which includes a statewide network of marine protected areas (MPAs). Other recent related legislation includes the Marine Life Management Act of 1998, Marine Managed Areas Improvement Act of 2000, and California Ocean Protection Act of 2004.

This legislation continues a long tradition of legislation addressing the conservation of California's diverse coastal and marine wildlife and habitats. Since World War II especially, pressures on these resources have grown as fishing effort and capacity have increased and as coastal development has transformed coastal habitats and generated pollutants. In the last 35 years, both federal and state government programs have addressed, if not solved, all of these problems. Marine and coastal wildlife populations also are affected by environmental factors, such as long-term shifts in oceanographic conditions.

Since passage of the Marine Life Management Act (MLMA) in 1998, restrictions on commercial and recreational fishing have grown as fishery managers have sought to maintain sustainable fisheries in the face of uncertainty and of declining fish populations. The MLMA reflects shifts in the goals of fishery management away from a single-species focus on maximum yields toward sustainable yields and an ecosystem perspective.

The MLPA reflects prevailing views regarding the role of MPAs in conserving biological diversity, protect habitats, aiding in the recovery of fisheries, and promoting recreation, study, and education. There remains disagreement whether MPAs, particularly no-take marine reserves, do provide benefits to fisheries.

In August 2004, the California Resources Agency, California Department of Fish and Game, and Resources Legacy Fund Foundation launched an effort to implement the MLPA, after two unsuccessful earlier attempts. The MLPA Initiative established an MLPA Blue Ribbon Task Force, together with a Master Plan Science Advisory Team and stakeholder advisory groups, to oversee the completion of several objectives. The first of these objectives is this master plan framework, which includes guidance, based on the MLPA, for the development of alternative proposals of MPAs in an initial central coast study region. The task force will forward both the master plan framework and, by March 2006, the package of alternative MPA proposals to the Department of Fish and Game for its consideration and submission to the California Fish and Game Commission for its consideration and action.

Section 2. Process for Designing Alternative Marine Protected Area Network Proposals

Rather than attempting to design a single network for the entire state at one time, the MLPA Initiative envisions the assembly of a statewide network by 2011 from a series of regional processes, beginning with an area along the central coast. This master plan framework will

guide that process. The master plan framework describes a series of activities, most of which will be undertaken by a regional stakeholder group and a sub-team of the statewide science advisory team.

The overall aim of this five-step process is developing alternative MPA proposals for consideration by the Department of Fish and Game and the Fish and Game Commission. These five steps are:

1. Regional MPA planning, starting with the identification of a study region and ending with the identification of alternative approaches to networks and potential MPA sites;
2. MPA planning, in which proposals for MPAs are developed at potential MPA sites, after evaluation of existing MPAs and other management activities,
3. Assembling alternative MPA network proposals, in which MPAs developed in the previous stage are assembled into alternative networks, which are evaluated generally;
4. Evaluating the alternative MPA proposals, in which the MLPA Blue Ribbon Task Force evaluates the proposals and forwards a package to the Department of Fish and Game, which sponsors a peer review and develops initial regulatory documents;
5. Fish and Game Commission action on MPA proposals, which includes preparing regulatory analyses (including California Environmental Quality Act review), public testimony, and action by the commission.

Section 3. Considerations in the Design of MPAs

Achieving the MLPA's goals and objectives to improve a statewide network of MPAs will require consideration of a number of issues, each of which is discussed in this section.

Goals of the Marine Life Protection Program

The MLPA identifies a set of goals for the Marine Life Protection Program, of which the principal element is a statewide network of MPAs. The goals include conservation of biological diversity and the health of marine ecosystems, recovery of wildlife populations, provision of recreational and educational opportunities consistent with biodiversity conservation, and protection of representative and unique habitats for their intrinsic value. This section of the MLPA also identifies major deficiencies in the existing array of MPAs.

The MLPA also calls for an "improved marine life reserve component" that protects a representative variety of marine habitat types and communities across a range of depths and conditions, includes replicates of similar types of habitats in each biogeographical region, and avoids activities that upset the natural functions within reserves. The MLPA also acknowledges the value of other, less-restrictive types of MPAs, and requires that they have goals and objectives and be of adequate size, number, type and location.

MPA Networks

The MLPA calls for improving and managing the state's MPAs as a network, to the extent possible. The MLPA itself does not define a network. However, there are two common approaches to MPA networks: MPAs linked biologically and/or oceanographically, and MPAs

linked through administrative function. Biological and oceanographic linkages are described in more detail in this section.

Science Advisory Team Advice on MPA Network Design

Explained in more detail in the master plan framework, the Master Plan Science Advisory Team for the MLPA Initiative developed the following guidelines regarding the design of MPA networks:

- The diversity of species and habitats to be protected, and the diversity of human uses of marine environments, prevents a single optimum network design in all environments.
- To protect the diversity of species that live in different habitats and those that move among different habitats over their lifetime, every 'key' marine habitat should be represented in the MPA network.
- To protect the diversity of species that live at different depths and to accommodate the movement of individuals to and from shallow nursery or spawning grounds to adult habitats offshore, MPAs should extend from the intertidal zone to deep waters offshore.
- To best protect adult populations, based on adult neighborhood sizes and movement patterns, MPAs should have an alongshore extent of at least 5-10 km of coastline, and preferably 10-20km. Larger MPAs would be required to fully protect marine birds, mammals, and migratory fish.
- To facilitate dispersal among MPAs for important bottom-dwelling fish and invertebrate groups, based on currently known scales of larval dispersal, MPAs should be placed within 50-100 km of each other.
- To provide analytical power for management comparisons and to buffer against catastrophic loss of an MPA, at least 3-5 replicate MPAs should be designed for each habitat type within biogeographic regions.
- To lessen negative impact while maintaining value, placement of MPAs should take into account local resource use and stakeholder activities.
- Placement of MPAs should take into account the adjacent terrestrial environment and associated human activities.
- To facilitate adaptive management of the MPA network into the future, and the use of MPAs as natural scientific laboratories, the network design should account for the need to evaluate and monitor biological changes within MPAs.

Consideration of Habitats in the Design of MPAs

The MLPA calls for protecting representative types of habitat in different depth zones and conditions. The science advisory team generally confirmed all but one of the habitats identified in the MLPA: rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, kelp forests, submarine canyons, and seagrass beds. The Master Plan Science Advisory Team noted that rocky reefs, intertidal zones, and kelp forests are actually broad categories that include several types of habitat.

The science advisory team identified five depth zones: intertidal, intertidal to 30 meters, 30 meters to 100 meters, 100 meters to 200 meters, and deeper than 200 meters. The science

team also called for special delineation of estuaries as a critical California coastal habitat. Finally, the science advisory team recommended expanding the habitat definitions to include ocean circulation features, principally upwelling centers, freshwater plumes from rivers, and retention areas.

Species Likely to Benefit from MPAs

The MLPA requires the identification of species likely to benefit from MPAs. Identifying these species may also assist in identifying habitat areas that can contribute to achieving the goals of the MLPA. The Department of Fish and Game prepared a list of such species, which appears in Appendix G. The master plan framework calls for the department to work with the science advisory team in refining this list for each region.

Geographical Regions

The MLPA requires that representative habitats be protected by more than one marine reserve in each biogeographical region. The MLPA identifies the following three biogeographical regions:

- The area extending south from Point Conception,
- The area between Point Conception and Point Arena, and
- The area extending north from Point Arena.

The MLPA also authorizes a master plan science team to modify these regions. A variety of options for the possible definition of biogeographic regions are presented:

- 1) The three biogeographic regions defined in the MLPA;
- 2) The two *biogeographic provinces* recognized by many scientists with a boundary at Point Conception;
- 3) The four *marine regions* identified by the Master Plan Team convened by the Department of Fish and Game in 2000, with boundaries at Pt. Conception, Pt. Año Nuevo, and Pt. Arena; and
- 4) The biogeographic regions recognized by scientists who have identified borders based on species distributional patterns or on abundance and diversity data with boundaries at Pt. Conception, Monterey Bay and/or San Francisco Bay, and Cape Mendocino.

Accepting the strong scientific consensus of a major biogeographic break at Point Conception, the Blue Ribbon Task Force confirms that two biogeographic regions exist along the California coast for purposes of implementing the Marine Life Protection Act. The more refined information on other breaks will be useful in designating study regions and in designing networks of MPAs.

Types of MPAs

The MLPA recognizes the role of different types of MPAs in achieving the objectives of the Marine Life Protection Program. Three types of MPAs are defined by the Marine Managed

Areas Improvement Act: state marine reserve, state marine park, and state marine conservation area. Each designation provides authority for different levels of restriction on human uses and includes various objectives. The MLPA sets other requirements for the use of marine reserves. The master plan framework briefly describes these differences and discusses their use in zoning of areas.

Setting Goals and Objectives for MPAs

The MLPA requires that all MPAs have clearly identified goals and objectives and suggests several possible objectives. The master plan framework calls for beginning the MPA design process by setting regional goals and objectives that are consistent with the MLPA, then identifying goals and objectives for individual MPAs. Once set, goals and objectives will influence crucial decisions regarding size, location and boundaries, as well as management measures and the focus of monitoring and evaluation programs. The master plan framework also calls for consulting the goals and objectives of other complementary programs, such as the nearshore fishery management plan adopted under the Marine Life Management Act.

Enforcement and Public Awareness Considerations in Setting Boundaries

Public acceptance, understanding and compliance with MPAs can be increased if certain criteria are considered in the design of MPAs. First, boundaries should be clear, well-marked, recognizable, measurable and enforceable. Ease of access to MPAs may influence the level of enforcement activity required to ensure compliance and protection. Siting MPAs where there are other special management programs such as national marine sanctuaries may enhance enforceability.

Information Supporting the Design of MPAs

The MLPA calls for the use of the “best readily available science” in designing and managing MPAs. The master plan framework calls for identifying baseline data needs in regional profiles and MPA management plans, and offers several examples of these types of information. The MLPA also calls for soliciting information from local communities and interested parties regarding the marine environment, the history of fishing, water pollution, and the socioeconomic and environmental impacts of MPA alternatives. The master plan framework then describes considerations in evaluating the economic value of marine ecosystems and the economic effects of specific MPAs.

Other Programs and Activities Other than Fishing

The master plan framework calls for describing current and anticipated human activities that may affect representative habitats and focal species in each region and at each MPA site. Where non-fishing activities may have a significant impact, a proposal for an MPA may include recommendations to appropriate agencies for reducing the impacts of those activities. Such recommendations generally should be referred also to the California Ocean Protection Council established under the California Ocean Protection Act of 2004.

Section 4: Management

In several passages, the MLPA requires that California's MPAs have effective management measures. Under the master plan framework, the initial focus for meeting this requirement is the preparation of a regional management plan, a suggested outline of which is found in Appendix K. Besides generally guiding day-to-day management of MPAs, a management plan also distills the reason for key elements of MPAs that should be monitored, evaluated, and revised in response to new information and experience. A management plan should describe the allocation of responsibility to various government agencies, non-governmental organizations and industry groups. Where possible, management of MPAs should rely on collaboration among groups, including volunteer efforts. Finally, advisory committees formed for the purpose of designing MPAs in a region may serve important purposes in the implementation of MPAs. Likewise, the master plan framework suggests the consideration of a statewide MPA advisory committee that can assist with implementation. Much of the material required for a management plan will be developed during the regional design of MPAs.

Section 5: Enforcement

The MLPA identifies the lack of enforcement as one of the chief deficiencies in California's existing MPAs. Therefore, the MLPA requires that the Marine Life Protection Program provides for adequate enforcement and includes enforcement measures for all MPAs, and that the master plan include recommendations for improving enforcement.

The master plan framework includes a general discussion of the capacities of the Department of Fish and Game's enforcement program as well as the programs of other state and federal agencies, with whom the department may collaborate. The master plan framework also identifies a set of enforcement program objectives, including cooperative efforts, community involvement, education and operations.

Section 6: Monitoring and Adaptive Management of MPAs

Like the Marine Life Management Act, the MLPA calls for adaptive management. The MLPA requires that the master plan include recommendations for monitoring and evaluation in selected areas for adaptive management. The MLPA also requires that all MPAs have measurable goals and objectives.

The master plan framework describes a process for developing monitoring and evaluation programs in different regions. The master plan framework also calls for a communications plan that will help ensure that results of monitoring are provided to decision makers and the public in terms that they can understand and act upon. A comprehensive review of monitoring results and performance should be conducted every three to five years. If monitoring results are not consistent with the goals and objectives of an individual MPA, the region, and overall network, recommendations should be developed for altering the MPAs and their management.

The master plan framework discusses general considerations in identifying indicators as part of a monitoring and evaluation program, and provides specific examples of indicators for

biophysical, socioeconomic and governance objectives. The master plan framework also encourages collaborative monitoring efforts with fishermen and other groups.

Section 7. Financing

The MLPA requires that the master plan include recommendations for funding MPA management activities and for implementing the Marine Life Protection Program. The master plan framework briefly discusses inclusion of financing considerations in management plans for regional MPAs and provides examples of various sources of funding. The MLPA Initiative will produce a long-term funding strategy for implementing the MLPA by the end of 2005.

Appendices

A separate volume of the master plan framework includes appendices with more extensive information on a number of issues raised in the master plan framework.

Section 1. Introduction

The rich natural heritage of California has supported commercial and recreational fisheries, which have provided consumers with a healthy source of high-quality protein, recreational anglers with enjoyable experiences, and many coastal communities with sources of employment and revenues. California's nearshore waters are among the top destinations for recreational SCUBA divers from around the world. Whether watching the flight of birds or the graceful forms of dolphins and whales, people also have increasingly sought enjoyment from observing marine wildlife. The dramatic growth of marine aquaria along the coast also serves as evidence of growing public interest in ocean wildlife, while California's century-long renown as a leader in marine science has only grown. California enjoys beautiful and productive marine resources.

In 1999, the State of California adopted the Marine Life Protection Act (MLPA), one in a long history of statutes and regulations designed to protect California's ocean and estuarine waters and the species and habitats found within them (FGC Section 2851-2863). The Department of Fish and Game is required to prepare and present to the Fish and Game Commission a master plan that will guide the adoption and implementation of the Marine Life Protection Program, including a statewide network of MPAs (FGC Section 2855[b]1).

Another relevant law, the Marine Managed Areas Improvement Act (Public Resources Code, Sections 36600 et seq.), was adopted in 2000. The two measures, taken together, represent a declaration that California intends to protect its oceans and the marine species that live there and provide direction on how to proceed.

In 2004 the legislature approved and the Governor signed the California Ocean Protection Act (Public Resources Code, Sections 35500 et seq.). One purpose of this law is to coordinate activities of state agencies that are charged with the protection and conservation of coastal waters and ocean ecosystems, in order to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations. The legislation identifies the following objectives:

- (a) Provide a set of guiding principles for all state agencies to follow, consistent with existing law, in protecting the state's coastal and ocean resources.
- (b) Encourage cooperative management with federal agencies, to protect and conserve representative coastal and ocean habitats and the ecological processes that support those habitats.
- (c) Improve coordination and management of state efforts to protect and conserve the ocean by establishing a cabinet level oversight body responsible for identifying more efficient methods of protecting the ocean at less cost to taxpayers.
- (d) Use California's private and charitable resources more effectively in developing ocean protection and conservation strategies.
- (e) Provide for public access to the ocean and ocean resources, including to marine protected areas, for recreational use, and aesthetic, educational, and scientific purposes, consistent with the sustainable long-term conservation of those resources.

Related to this legislation, on October 18, 2004, Governor Arnold Schwarzenegger released an ocean action plan, *Protecting Our Ocean: California's Action Strategy*, with four primary goals:

- Increase the abundance and diversity of California's oceans, bays, estuaries and coastal wetlands.
- Make water in these bodies cleaner.
- Provide a marine and estuarine environment that Californians can productively and safely enjoy.
- Support ocean dependent economic activities.

Part of this ocean action plan is full implementation of the MLPA. Among other policies, the ocean action plan also addresses the relationship between California's management activities and the Department of Defense as follows:

- Coordinate California ocean and coastal management activities that impact military facilities/operations with the Department of Defense, as well as requesting the Department of Defense to coordinate their activities and operational needs with the State of California to the extent possible without compromising national security objectives.

Early Years

From its very first days as a state in 1850, California has adopted statutes and regulations dealing with the ocean, fisheries, and protection of resources, commerce and industry. In an historic sense, California's history of involvement (as with most other states) has been through early steps to regulate fishing and define health and safety requirements for those who earn a living on the waters, and to protect outstanding areas and features along the California coast and in state waters.

In the early decades of statehood, California's policy toward natural resources reflected the desire of government at all levels to promote economic expansion by bringing natural resources into production (McEvoy 1986). Even so, lawmakers in California, as elsewhere, began becoming concerned that the expansion of fishing might well threaten the long-term economic health of the fishing industry. In 1852, the California State Legislature passed its first fishing statute to regulate the Sacramento River salmon fishery, and continued to do so over the next several decades. In 1870, the legislature responded to the concerns of sport fishermen by establishing a State Board of Fish Commissioners, which later became the Fish and Game Commission. In this and other ways, California led the nation. By the end of the 19th century, the California State Legislature had adopted a body of fisheries management law that was a model for its time.

At the same time, the courts repeatedly upheld the importance of the state's role in protecting its resources. In 1894, for instance, the California State Supreme Court found that "The wild game within a state belongs to the people in their collective, sovereign capacity; it is not the subject of private ownership, except in so far as the people may elect to make it so; and they may, if they see fit, absolutely prohibit the taking of it, or any traffic or commerce in it, if deemed necessary for its protection or preservation, or the public good."

Californians often feel strongly about both available fisheries and regulations on access. Some assert that article 1, section 25, of the California Constitution gives the public a “right to fish.” It states “The people shall have the right to fish upon and from the public lands of the State and in the waters thereof...provided, that the legislature may by statute, provide for the season when and the conditions under which the different species of fish may be taken.”

However, this “right to fish” is not absolute. In 1918, the California Supreme Court considered whether a law providing for the licensing of fishermen was unconstitutional because it violated article 1, section 25. The court rejected the argument, finding that the provision authorizing the legislature to fix the seasons and conditions under which fish are taken was intended to leave the matter under the legislature’s discretion [*Paladini v. Superior Court* (1918) 178 Cal. 369]. As recently as 1995, a court reaffirmed the qualified, not fundamental, right to fish and that the language of the State Constitution was not intended to curtail the ability of the legislature (or the Fish and Game Commission through legislated authority) to regulate fishing [*California Gillnetters Association v. Department of Fish and Game* (1995) 39 Cal.App.4th 1145].

Also, section 25 must be read in connection with article 4, section 20 (formerly section 25½), which states that the California State Legislature may enact appropriate laws for protection of fish and game, and may delegate to the Fish and Game Commission such powers relating to protection and propagation of fish and game [*Ex parte Parra* (1914) 24 Cal.App. 339, 340]. In that respect, the California Supreme Court found it “most apparent” that the purpose of (now) article 4, section 20 “was to clothe the Legislature with ample power to adequately protect the fish and game of the state.” Further, the California Supreme Court has long declared that the power to regulate fishing has always existed as an aspect of the inherent power of the legislature to regulate the terms under which a public resource may be taken by private citizens [*In re Phoedovius* (1918) 177 Cal. 238, 245-246; *People v. Monterey Fish Products Company* (1925) 195 Cal. 548, 563]. This regulatory power clearly includes the regulation of fishing within MPAs [Section 2860, FGC].

Like other economic activities, from agriculture to manufacturing, fishing began expanding rapidly in the first few decades of the 1900s. In 1912, the legislature responded by authorizing staff for the California Fish and Game Commission, which found itself with greater and greater responsibilities for managing industrial fisheries, in particular. In 1927, the legislature created a Department of Natural Resources, within which it housed a Division of Fish and Game.

Post World War II

After World War II, the marine policies of California and other state and federal governments were based largely on several assumptions that reflected the progressive thinking of the time. First, the abundance of marine wildlife was thought to be nearly without practical limits. Second, scientists and fishery managers believed that we possessed enough knowledge to exploit marine populations at very high levels over long periods of time without jeopardizing them. Third, the value of marine wildlife was principally as a commodity to be processed and traded. Finally, the chief challenge in commercial fisheries management was to expand domestic fishing fleets in order to exploit the assumed riches of the sea.

In 1945, the legislature granted the Fish and Game Commission discretionary authority over recreational fisheries. In 1947, the legislature instituted a tax on sardine landings that was used to fund research into causes for the decline in sardine abundance. These activities led to the inauguration of one of the world's longest series of fisheries research cruises, the California Cooperative Oceanic Fisheries Investigations, CalCOFI, a cooperative venture of the California Department of Fish and Game, Scripps Institution of Oceanography and the National Marine Fisheries Service.

Several factors combined to challenge these assumptions. Changing fishing technologies and expanding fleets increased harvests. Poor forestry practices resulted in sediment loading to coastal watersheds that impeded spawning. Development decreased wetlands reducing their important capacities in marine life cycles and in filtering run off.

In the face of disturbing declines in a number of fisheries, state and federal fisheries agencies around the country began an intensive review of prevailing policies in the mid-1960s. In 1967, the California State Legislature passed the California Marine Resources Conservation and Development Act to develop a long-range plan for conservation and development of marine and coastal resources (1967 California Statutes Ch. 1,642). In the same year, Governor Ronald Reagan imposed an emergency two-year moratorium on commercial sardine fishing (1967 California Statutes Ch. 278).

During the 1960s, recreational fishermen convinced the legislature to remove certain species of fish from commercial exploitation, such as Calico bass and striped marlin. Beginning in the 1970s, traditional views of marine fish populations as commodities began shifting more rapidly. Marine wildlife and ecosystems were increasingly valued for themselves and for uses such as tourism, education, and scientific research. Recognition of the need to balance the capacity of fishing fleets with the often limited and uncertain productive capacity of marine species grew. Rather than seeking to extract the maximum yield from marine species, fisheries managers began seeking levels that would be sustainable into the distant future.

Changes also occurred in marine recreational activities. Catch and release programs became important in some fisheries. The value of the experience of fishing was recognized as being greater than just the monetary value of fish caught. Non-consumptive recreation including surfing, diving, sightseeing, and other activities increased dramatically. Additionally, the public became more interested in the value of healthy marine environments for both recreational use and the intrinsic value of the ocean itself.

California's Marine Heritage

For 1,100 miles, the spectacular mass of California's lands meets the Pacific Ocean. In many areas, mountains plunge into the oceans. Elsewhere, ancient shorelines stand as terraces above the surf. Streams and rivers break through the coastal mountains and, in some places, flow into bays and lagoons rimmed with wetlands. Offshore, islands and rocks break the surface.

This is what we can easily see. But beneath the surface of the water offshore, California's dramatic geological formations continue. Unlike the Atlantic or Gulf coasts, California's shallow

continental shelf is quite narrow, generally no wider than 5 miles. At its broadest point off San Francisco, the shelf extends 30 miles offshore before plunging from 600 feet to the abyssal region at 6,000 feet. Beyond state waters, peaks called seamounts rise from the depths to the photic zone where sunlight spurs plant growth and attracts life.

Whether near or far from shore, the ocean bottom may be rocky, sandy, or silty. It may be flat or formed of rocky reefs. In many areas along the coast, great canyons cut into the continental shelf quite close to shore. For example, the Monterey submarine canyon, which is larger than the Grand Canyon of the Colorado, begins within miles of the shoreline. There, as in other submarine canyons, marine life normally found far offshore is drawn close to land by the deep waters. Off southern California, the ocean bottom appears like a piece of crumpled paper, with basins, troughs, canyons, peaks, and cliffs alternating in a checkerboard pattern.

Ocean currents introduce other dimensions to California's coastal waters. For much of the year, the California Current brings colder northern waters southward along the shore as far as southern California. There, where the coastline juts eastward, the California Current moves offshore. In the gap between the California Current and the mainland, the Southern California Countercurrent flows into the Santa Barbara Channel. Around Point Conception, these two currents meet, creating a rich transition zone. Closer to shore and deeper, the California Undercurrent also carries warmer water northward.

Seasonal changes in wind direction commonly create seasonal patterns for these currents. Beginning in March, for instance, northwesterly winds combine with the rotation of the Earth to drive surface waters offshore, triggering the upwelling of cold, nutrient-rich water from the depths. Fueled by sunlight and the nutrients, single-celled algae bloom and create a rich soup that fuels a blossoming of marine life, attracting larger animals from seabirds and swordfish to humpback and blue whales.

By September, as the northwesterly winds die down, the cold water sinks again and warmer waters return to the coast. This oceanic period lasts into October, when the predominant winds move to the southwesterly direction. These winds drive a surface current, called the Davidson Current, which flows north of Point Conception and inside the California Current, generally lasting through February.

Laid over this general pattern are both short-term and long-term changes. Local winds, topography, tidal motions, and discharge from rivers create their own currents in nearshore waters. Less frequently, a massive change in atmospheric pressure off Australia floods the eastern Pacific with warm water, which suppresses the normal pattern of upwelling. These short-term climatic changes, called El Niño, reduce the productivity of coastal waters, causing some fisheries and seabird and marine mammal populations to decline and others to increase. For instance, warm waters that flow north in an El Niño carry the larva of sheephead and lobster from the heart of their geographical range in Mexico into the waters off California.

Other oceanographic changes last for a decade or more and these natural fluctuations can have significant impacts on the health and composition of marine life. In these regime shifts, water temperatures rise or fall significantly, causing dramatic changes in the distribution and abundance of marine life. The collapse of the California sardine fishery occurred when heavy

commercial fishing continued on sardine populations that were greatly reduced by a cooling of offshore waters in the late 1940s and early 1950s. In response to the decline in sardines, California law severely curtailed the catch. In 1977, waters off California began warming and remained relatively warm. The warmer water temperatures were favorable for sardines, whose abundance greatly increased. But the warmer waters also reduced the productivity of other fish, including many rockfishes, lingcod, sablefish, and those flatfishes that favor cold water for successful reproduction.

Currents and other bodies of water may differ dramatically in temperature and chemistry, as well as speed and direction. These factors all influence the kinds of marine life found in different bodies of water. In general terms, geography, oceanography, and biology combine to divide California marine fisheries and other marine life into two major regions north and south of Point Conception. Within each region, other differences emerge. Conservation and use of California's marine life depends partly upon recognizing these differences.

Marine Life of California

The waters off California are host to hundreds of species of fish. Thousands of species of marine invertebrates inhabit the sea floor from tidepools along the shoreline to muddy plains 8,000 feet deep. Dozens of species of coastal and offshore birds spend some part of the year in California's waters, as do 35 species of marine mammals.

This great variety of marine life reflects the different responses of groups of animals and plants to changing environmental conditions over long periods of time. In successfully meeting their needs for growth, survival, and reproduction, individual species have developed a set of characteristics that biologists call life history traits. These traits include age at maturity, maximum age, maximum size, growth rate, natural mortality, and feeding and reproductive strategies.

Differences among species can be dramatic. For instance, California market squid mature within 12 months and die soon after spawning, whereas widow rockfish do not mature until age five at the earliest and may live as long as 59 years. This has profound consequences for managing fisheries so that they are sustainable.

Reproductive strategies also vary. Queenfish, for instance, may spawn 24 times in a season, releasing their body weight in eggs into the open water, where most will be eaten whether or not they are fertilized. In contrast, species such as olive rockfish spawn just once a year, releasing up to 500,000 larvae, which have been fertilized and developed internally. Other species, including sharks and surfperches, bear a small number of fully functional and live young each year.

Amid the variety, the life histories of fish tend to fall into several larger categories. For instance, fish species that have low rates of mortality as adults, such as many species of sharks, bluefin tuna, and billfish, also mature late and reproduce in smaller numbers. Organisms that have high rates of mortality as adults, such as anchovies and squid, grow quickly, mature early, and reproduce in large numbers. Some species spend the first several months of their lives floating as planktonic larvae in ocean currents. Climate and oceanographic changes influence the

abundance of these species more than does the number of spawning adults. Other species, including most sharks and surfperches, give birth to well-developed young which immediately take up residence. Many mollusks and some sharks produce eggs which are physically attached to the substrate until hatching. For these species, local conditions and predation play a major role in abundance.

Species differ also in their movements. For instance, during winter Dover sole move into deep water where they reproduce, then move into shallow water in the summer to feed. Pacific whiting migrate from their summer feeding grounds off Oregon and Washington to their winter spawning grounds off southern California and Baja California. By contrast, kelp bass, which can live to 30 years, venture less than a mile from their home range.

Individual plants and animals are part of larger communities that are linked in many ways. One of the clearest of relationships concerns who eats whom, also known as the food web. Generally, the eating begins with herbivores, who consume plants that have manufactured food through photosynthesis. These herbivores may be as small as the larva of an anchovy or as large as a basking shark. The smaller herbivores pass along much of the food value of the plants when they are eaten by primary carnivores, which in turn may be consumed by higher level carnivores. Humans enter the food web at a variety of levels, removing not only higher level carnivores, but herbivores, and even the lowest level algae.

These relationships among wildlife populations differ considerably among different habitats and communities. A decrease in the abundance of some species, due to fishing, habitat alteration, or climate changes, for instance, can affect species that feed upon them. Healthy habitat can also play an important role in the abundance of marine wildlife. A large percentage of the state's coastal wetlands have been destroyed, causing incalculable losses in coastal wildlife. Pollution of coastal waters can expose marine animals to toxic chemicals and can foster changes in plant communities that wildlife depends upon. A decrease in the abundance of some species, due to habitat alteration, pollution, fishing, or climate changes, can produce a ripple effect throughout the marine environment. Considering these interrelationships when managing fisheries requires an ecosystem perspective. In addition, it is important to consider existing risk-averse fishery management regulations that have, for example, restored species such as sardine to "fully recovered" status, and integrate these considerations into the ecosystem management context.

Factors Affecting Marine Wildlife Populations

The abundance and diversity of populations of marine wildlife are influenced by a wide range of natural and human-caused factors, including short-term and long-term shifts in oceanographic conditions and numerous human activities, which may have direct or indirect effects (Parrish and Tegner 2001; Sheehan and Tasto 2001; NRC 1995). The impact of each factor varies with distance from shore and with individual species.

Some types of natural phenomena, such as El Niño and La Niña fluctuations, in which especially warm or especially cool waters respectively dominate, may have transitory impacts on marine wildlife and their habitats, while other natural phenomena, such as longer-term shifts in oceanographic conditions, may affect the abundance of some types of marine wildlife over

much longer periods (Parrish and Tegner 2001). Increasingly, fisheries managers are attempting to adjust to these natural phenomena.

As in other coastal states, the development and growth of California's population and economy, especially since World War II, introduced additional stresses to coastal ecosystems. Coastal development transformed coastal watersheds, wetlands, and estuaries, and placed greater demands on coastal ecosystems. These stresses include chemical pollution and eutrophication, alteration of physical habitat and the invasion of exotic species (NRC 1995). Intake structures for "once-through" cooling systems at electrical power plants destroy aquatic marine life, and the thermal discharges from these facilities contribute the largest volume of effluent into California's coastal ocean. Chemical pollution and eutrophication can alter the abundance and biodiversity of wildlife in coastal environments, especially bays and estuaries (NRC 1995). Pollution ranges from toxic chemicals to partially treated sewage, and the sources of potential pollution range from point sources, such as sewage treatment plants, to non-point sources, such as runoff from agricultural and urban lands (Sheehan and Tasto 2001). Similarly, estuarine and shoreline habitats have been especially affected by residential, commercial and industrial development (Sheehan and Tasto 2001).

The degree of impact from these stresses on water quality and habitats varies markedly along the state's coastline. Storm-water runoff is a particular problem in major urban areas, while some waters of the central coast are most affected by agricultural runoff (Sheehan and Tasto 2001). San Francisco Bay's waters are affected both by industrial discharges and by dairy farm runoff. In some areas, particularly bays and estuaries, waters are so impaired that certain uses are prohibited or restricted. Many north coastal streams are impaired due to sedimentation, habitat modification, altered temperature and eutrophication. Timber harvest activities in north coast watersheds are a particular concern.

In the last 35 years, both federal and state governments have carried out regulatory and other programs to reduce these threats to coastal ecosystems. At the federal level, the Clean Water Act launched an enormous effort to reduce the flow of sewage and industrial pollutants into coastal waters (Sheehan and Tasto 2001). Since 1990, the federal government, in cooperation with state governments, has encouraged efforts to reduce the flow of non-point source pollution. In July 2000, California was the first state in the nation to receive full federal approval of its Coastal Non-point Source Pollution Control Program by the U.S. Environmental Protection Agency and the National Oceanic and Atmospheric Administration (the lead federal agencies that administer the Clean Water Act and Coastal Zone Management Act, respectively). Storm water runoff from large and medium sized urban areas is now regulated as a point source under the National Pollutant Discharge Elimination System Program. The Governor's ocean action plan outlines many other such programs.

Passage and implementation of the state coastal legislation in the 1970s slowed the rate of loss of sensitive coastal habitats, and in some areas, efforts are underway to restore converted wetlands. In the last several years, the state has devoted more resources to addressing coastal water quality and habitat, including major state bonds. Nonetheless, future population and economic growth will continue to stress on coastal ecosystems.

The Marine Life Management Act

Like these other factors, fishing can have impacts on marine fish populations and other wildlife and has likely been having these effects since humans began to harvest marine species (NRC 1995, Jackson, et al. 2001). California has long sought to manage fisheries in its waters for long-term sustainability. In 1998 the California State Legislature responded to the shifts in understanding and public values as well as declines in some fisheries and nearshore ecosystems by adopting the Marine Life Management Act (MLMA).

Before the MLMA, the responsibility for managing most of California's marine resources harvested by commercial fisheries within state waters lay with the State Legislature, while the Department of Fish and Game and the Fish and Game Commission managed the recreational fisheries and those commercial fisheries with catch quotas that changed periodically. Management of commercial fisheries under this division of responsibility was complicated, piecemeal, and oftentimes untimely, with necessary regulatory changes only occurring after much political deliberation and approval by both the California State Assembly and California State Senate.

The MLMA transferred permanent management authority to the Fish and Game Commission for the nearshore finfish fishery, the white seabass fishery, emerging fisheries, and other fisheries for which the commission had some management authority prior to January 1, 1999. As importantly, the MLMA broadened the focus of fisheries management to include consideration of the ecosystem - the entire community of organisms (both fished and unfished) and the environment and habitats that those species depend on.

Recent Developments

The Marine Life Protection Act (MLPA) was enacted in 1999. (See Appendix A for text of the MLPA, as amended.) In doing so, the California State Legislature recognized the benefits of setting aside some areas under special protection and of ensuring that these marine protected areas (MPAs) were developed in a systematic manner, with clear goals and objectives, and management plans and programs for monitoring and evaluating their effectiveness. Rather than focusing on one use or value for marine protected areas, the MLPA recognized a wide range of values, including the conservation of biological diversity¹.

Between the MLPA's passage in 1999 and the creation of the MLPA Initiative in 2004, there were two other efforts at implementation. Both attempts suffered from a lack of adequate resources to ensure a robust multi-stakeholder involvement and to provide needed information, particularly regarding the potential socioeconomic impacts of potential MPAs. (See Appendix C for a more detailed description of MLPA implementation.)

¹ Biological diversity or "biodiversity" is defined by Public Resources Code Section 12220(b) as: a component and measure of ecosystem health and function. It is the number and genetic richness of different individuals found within the population of a species, of populations found within a species range, of different species found within a natural community or ecosystem, and of different communities and ecosystems found within a region.

The first attempt became problematic when the Department of Fish and Game and the MLPA Master Plan Team developed a set of initial proposals for a statewide network of MPAs without significant stakeholder input, even though the intent was to revise these initial proposals based on public comment as required by the MLPA. The second attempt was more inclusive of stakeholders, but suffered from a lack of staff and funding. After these unsuccessful attempts, state legislators and the department realized that this complex and controversial process required significant resources and time to implement and evaluate successfully.

Since passage of the MLPA in 1999, the Pacific Fishery Management Council established several major recreational and commercial fishery closures to protect lingcod and certain populations of rockfish that were declared overfished by the National Marine Fisheries Service. The closures, which remain in effect today, are generally based on depth and affect certain types of bottom-fishing gear. The closures have changed in both their total area and season several times. The primary closures are the Cowcod Conservation Areas in southern California, which are almost entirely in federal waters, and the Rockfish Conservation Area, which is statewide and encompasses portions of state and federal waters. During 2000 and 2001 additional depth-based seasonal fishing restrictions for certain recreational fisheries were also established outside of the Cowcod Conservation Areas and Rockfish Conservation Area. While portions of the Rockfish Conservation Area are open seasonally to bottom fishing, certain depth zones in certain parts of the state are closed year-round.

Such fishery conservation measures are similar to certain types of limited-take MPAs and can function as *de facto* MPAs. One important distinction between these closures and MPAs is that the former, while potentially of long-term duration, change in area and regulations based on assessments of specific stocks. Once the goal of rebuilding overfished populations is achieved, such closures may be abolished or greatly reduced. In contrast, MPAs are likely to be abolished if they fail to achieve such objectives as biodiversity conservation and habitat protection..

A significant increase in the total amount of state waters included in MPAs occurred in 2003 when the Fish and Game Commission established a system of 12 new MPAs (10 state marine reserves and 2 state marine conservation areas) around the Santa Barbara Channel Islands. The establishment of the 10 Channel Islands state marine reserves increased the area of state waters in marine reserves from 0.2% to 2.5%. This occurred following a stakeholder-based process which lasted approximately 5 years. Monitoring of the new MPAs, and of the effect they are having on local fishing patterns, is now occurring. The details of the Channel Islands monitoring program are available at www.dfg.ca.gov/mrd/channel_islands.

Marine Protected Areas Generally

California is able to take advantage of several decades of experience and study regarding MPAs elsewhere in the United States and abroad, as well as within its own waters. While most of this experience is with no-take reserves, it can be applied generally to other MPAs. In 2001, for instance, a committee of the National Academy of Sciences released its report *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems*. Like other reports of the National Academy of Sciences, this report can be considered an authoritative general review of the science of marine protected areas (OMB 2004). Many of their conclusions, while directed to

marine reserves, may have applicability to other MPAs. Among other things, this expert panel concluded:

- A growing body of literature documents the effectiveness of marine reserves for conserving habitats, fostering the recovery of overexploited species, and maintaining marine communities.
- Networks of marine reserves, where the goal is to protect all components of the ecosystem through spatially defined closures, should be included as an essential element of ecosystem-based management.
- Choosing a location for a marine reserve or protected area requires an understanding of probable socioeconomic impacts as well as the environmental criteria for siting.
- It is essential to involve all potential stakeholders at the outset to develop plans for MPAs that enlist the support of the community and serve local conservation needs.
- Marine reserves and protected areas must be monitored and evaluated to determine if goals are being met and to provide information for refining the design of current and future MPAs and reserves.
- Sufficient scientific information exists on the habitat requirements and life-history traits of many species to support implementation of marine reserves and protected areas to improve management.

Since the National Academy of Sciences report, a vigorous discussion among scientists and decision makers has explored the benefits and costs of MPAs, particularly marine reserves (Nowlis and Friedlander 2004; Hilborn et al. 2004; SSC 2004; NFCC 2004; FAO 2004). Many of these discussions have focused upon the use of marine reserves as a fisheries management tool and on the effect of marine reserve designation on fishing operations, fisheries management, and fish populations outside reserves. There has been virtually no discussion of the value and design of other types of MPAs, such as marine parks and marine conservation areas.

Recent literature supports the potential value of marine reserves for protecting habitat and biodiversity within reserve boundaries (Nowlis and Friedlander 2004; Hilborn et al. 2004; FAO 2004). This same literature cites several potential benefits of marine reserves to fisheries management, including buffering against uncertainty, reducing collateral ecological impacts (e.g., bycatch and habitat damage), managing multi-species fisheries, and improving knowledge. Empirical evidence for increased fish catches outside marine reserves is sparse, although there are strong reasons to believe that if designed properly, marine reserves can contribute to fisheries management in some circumstances (Nowlis and Friedlander 2004; Hilborn et al. 2004). Without experience gained from the establishment of additional marine reserves, assessing the appropriateness of marine reserves for fisheries enhancement purposes will remain difficult.

At the same time, potential problems with marine reserves have been cited, including possible shifts in fishing effort, disruption of stock assessment research, and socioeconomic impacts (Hilborn et al. 2004; FAO 2004; SSC 2004). Empirical evidence for these potential impacts is sparse, as well. These authors urge care in the design of marine reserves so as to minimize losses to fisheries and to increase the opportunity to obtain empirical information on marine reserves by careful experimental design (Hilborn et al. 2004; SSC 2004). These studies also note that for certain species, especially species with highly mobile adults, marine reserves are unlikely to benefit fisheries (Nowlis and Friedlander 2004; Hilborn et al.; SSC 2004; NFCC 2004). When designing marine reserves or other MPAs with a goal of enhancing fisheries, the target species and potential impacts must be considered.

It is important to remember that a primary purpose of the MLPA is to protect and restore marine biodiversity and ecosystems. The MLPA recognizes that MPAs may be a tool to accomplish those purposes, but they are not the only tool. Implementation of the MLPA must consider and respect other efforts, including traditional fishery management, water quality controls and coastal development management, in order to avoid duplication and conflicts in the state's efforts to protect California's ocean environment.

MLPA Initiative Process

In August 2004, a new effort was launched to implement the MLPA. Combining public and private sources of support, the MLPA Initiative has four key objectives to achieve by December 2006, when the initiative expires:

- the development of a draft master plan framework;
- the development of alternative proposals for an MPA network in a central coast study region;
- recommendations on funding sources for MPA implementation and management; and
- recommendations to increase the coordination between state and federal agencies with authority to manage ocean resources.

The first two of these products will be provided to the Department of Fish and Game for its consideration and submission to the Fish and Game Commission, which will take action through the normal commission process. These products are intended to provide a strong foundation for completing the statewide network of MPAs by 2011.

The MLPA Initiative process includes the following groups and organizations:

- MLPA Blue Ribbon Task Force (an oversight body)
- MLPA Initiative staff
- Master Plan Science Advisory Team (an expansion of the former Master Plan Team with additional expertise)
- Science sub-team for the central coast region
- MLPA Statewide Interests Group for providing advice on the initiative process,
- Regional stakeholder group for the central coast region
- Peer review group

- Department of Fish and Game staff
- Fish and Game Commission

Figure 1 portrays the links among the various players in the initiative process. See Appendix D for a description of stakeholder participation strategies.

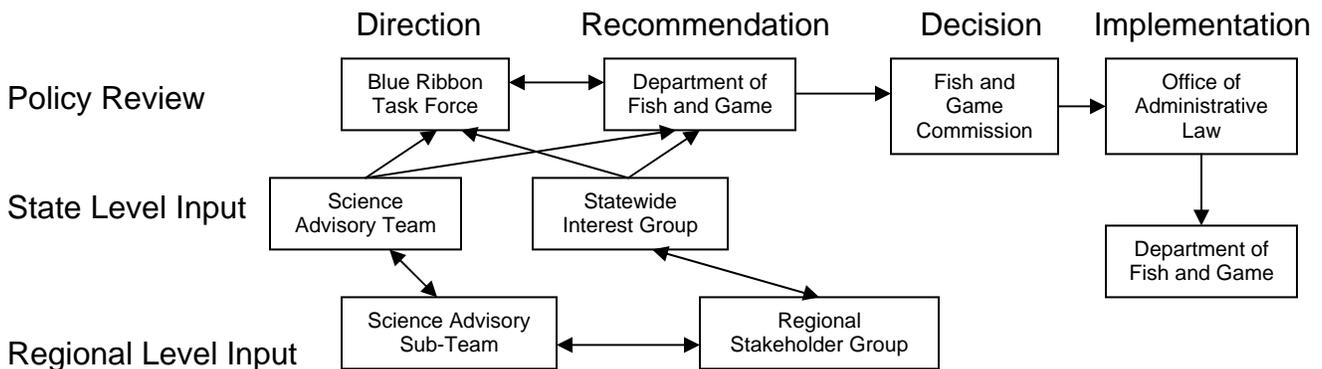
Roles in the Marine Life Protection Act Initiative

Organizational Partners

The Fish and Game Commission is the ultimate decision-making authority for implementation of the MLPA. Specifically, the commission will make all final decisions on the Master Plan, the proposed regional networks of marine protected areas, and supporting CEQA documentation, all after completing its own process of public reviews. The principal mission of the other partners is to support the commission in making sound policy decisions required by the MLPA. Although the commission will not be involved in the day-to-day work of the Initiative, the Initiative will include regular opportunities for informational meetings and strategic consultation with the commission.

The California Resources Agency will provide general oversight and public leadership for the initiative and implementation of the MLPA. Besides providing policy direction for coordinating funding and staffing, the agency will make critical decisions in shaping the initiative. The secretary of the California Resources Agency will select the chair and other members of the MLPA Blue Ribbon Task Force. The secretary will convene and charge the members of the task force with meeting the objectives identified in the task force description below. The California Resources Agency will also seek adequate current and future funding for agency and Department of Fish and Game personnel committed to the initiative and for completing future phases of the MLPA.

Figure 1. Players in the Marine Life Protection Act Initiative



Note: input is solicited from the interested public and stakeholders at each step, until adoption of regulations by the Fish and Game Commission.

The Department of Fish and Game will serve as the lead agency for the design and implementation of the MLPA master plan and networks of marine protected areas. The department will continue its traditional support of the Resources Agency and the Fish and Game Commission. In consultation with the secretary of the agency, the president of the commission, and the chair of the task force, the director of the department will select the members of the Master Plan Science Advisory Team. Through the initiative's Steering Committee (described below), the department will also be involved in developing the draft master plan framework and proposed alternatives for marine protected areas along the central coast, and is ultimately responsible for presenting a final draft master plan and alternatives for marine protected areas to the commission. The department will also provide biological and other relevant information, participate in meetings as appropriate, review working documents, and act as lead agency under the California Environmental Quality Act, among other activities.

The MLPA Blue Ribbon Task Force will be composed of seven to ten distinguished, knowledgeable and highly credible public leaders selected by the secretary of the California Resources Agency. The charge to the task force will be to oversee the preparation of the draft master plan framework, and the proposal for alternative networks of marine protected areas in an area along the central coast for the department to present to the commission; to prepare a comprehensive strategy for long-term funding of planning, management and enforcement of marine protected areas, and to develop recommendations for improved coordination of managing marine protected areas with federal agencies involved in ocean management. The task force will also work to resolve policy disputes and provide direction in the face of uncertainty, while meeting the objectives of the MLPA. The chair of the task force will select the executive director, senior MLPA project manager, operations & communications manager, and central coast MLPA project manager to the initiative; work with the director of the department to convene and direct the science advisory team; and serve as the principal link between the task force and initiative staff. At least one member of the task force will serve as liaison to the central coast project.

The Resources Legacy Fund Foundation will use its best efforts to obtain, coordinate and administer philanthropic investments to supplement public funding for the Initiative, provide strategic advice to the California Resources Agency on public-private funding, and support the operations & communications manager in managing private contracts for staffing the initiative.

Other state and federal agencies will play a variety of roles in the initiative. For instance, federal agencies such as NOAA Fisheries and the National Ocean Service may be sources of valuable information and may have programs that the MLPA Initiative should take into account in designing regional MPAs. State agencies may play a similar role. The California Coastal Commission may review some aspects of establishing MPAs, such as coastal zone access and facilities development.

Committees and Teams

The director of the department, in consultation with the chair of the task force, the secretary of the agency, and the president of the commission, will convene the Master Plan Science Advisory Team. The science advisory team will include the members required by the MLPA, including staff from the Department of Fish and Game, the Department of Parks and

Recreation, the State Water Resources Control Board, one member appointed from a list provided by Sea Grant, and thirteen to fifteen leading scientists knowledgeable in marine ecology, fisheries science, marine protected areas, economics and the social sciences. The role of the science advisory team will be to assist the task force in developing a draft master plan framework by reviewing supporting and draft documents, addressing scientific issues, and framing and referring policy challenges to the task force. The science advisory team will report to the task force and the director of the Department of Fish and Game, and will be supported by the senior MLPA project manager. A sub-team of the science advisory team will also serve the central coast project.

The Central Coast Science Advisory Sub-Team will be composed of three to five members of the science advisory team, and will work with the central coast project manager to develop alternative networks of marine protected areas by reviewing supporting and draft documents, addressing scientific issues and information provided by the central coast stakeholder group, and framing and referring policy challenges to the task force. At least one member of the science sub-team will attend each central coast stakeholder group meeting.

The Central Coast MLPA Stakeholder Group will include key, affected members of the central coast region who are able and willing to provide information that will assist in the development of the proposed alternative networks of marine protected areas along the central coast. The director of the Department of Fish and Game and the central coast liaison of the task force will solicit nominations, and select from the nominees a representative group that will meet regularly over two years to provide input to the central coast project manager, primarily by providing information and other input for framing key scientific questions to be addressed by the science advisory sub-team.

The MLPA Statewide Interests Group will be composed of up to 20 or more members in addition to alternates who will advise the task force and professional staff to the initiative on the overall process to develop a draft master plan framework and network of marine protected areas along the California coast. The group will not vote or otherwise take formal positions on any procedural or substantive issues, but instead will alert the task force to issues and opportunities that may improve public involvement in the process.

The MLPA Steering Committee will be chaired by the executive director, and will include the senior project manager, the operations & communications manager, the central coast project manager, and the Department of Fish and Game's policy advisor, statewide technical advisor, and regional coordinator. The committee will be responsible for coordinating all work necessary to achieve each of the objectives of the initiative.

Master Plan Framework

The MLPA calls for the development of a master plan by the Department of Fish and Game, and its adoption by the Fish and Game Commission². The MLPA Initiative has divided the

² The Fish and Game Code currently requires the Department of Fish and Game to provide a draft master plan to the commission by January 2005 and for the commission to adopt a final master plan with regulations by December 2005 [Section 2859, FGC].

master plan into two principal parts: a section providing guidance in the application of the MLPA to the development of a statewide MPA network (the master plan framework), and a section describing the preferred alternatives for MPA proposals. The MLPA Initiative envisions a focus on portions of the state in a series of regional processes, beginning with the central coast. The requirement for a full master plan and implementing regulations will be met when the commission adopts the final portion of the plan and all regions of the coast have been completed.

It is important to emphasize that the physical, biological, social and economic conditions in each region of the state will affect the specific application of the MLPA and the framework recommended in this document. For example, California coastal waters, especially those in southern California, are critical for our nation's military both for training and testing as well as operations. The United States Department of Defense controls two of the Channel Islands and has installations along significant portions of the coastline. Many of the operational ocean areas are significantly restricted to public access. Based on inputs from the Department of Defense, the designation of MPAs in specified operational areas of the military is not consistent with military readiness. Therefore, in assessing the overall MLPA network, the beneficial effects of military operational areas (as well as other *de facto* MPAs such as long-term closures implemented through fishing regulations), with respect to habitat conservation goals will be considered in the needs assessment.

The central coast effort will provide concrete experience in applying the master plan framework and this more specific guidance to a specific area. This experience may lead to recommendations to adjust the framework regarding specific topics. In this way, the master plan framework will serve as the foundation for an evolution of practice that adapts to new information as well as serve as a blueprint for developing a statewide MPA network.

Section 2. Process for Designing Alternative Marine Protected Area Network Proposals

For practical reasons, the review and improvement of the existing array of MPAs and insuring California's MPAs function as a network mandated by the MLPA cannot be established in a single step. The resources and effort required to design and evaluate MPAs along the state's 1,100-mile coast are beyond the capacity of both governmental and non-governmental resources. In addition, ecological, social and economic conditions differ widely among many regions.

A sound master plan framework based on the requirements of the MLPA should enable application of the MLPA to differing conditions while maintaining a statewide perspective. For these and other reasons, this master plan framework envisions that the statewide network will be assembled through the establishment of MPAs in each of several study regions along the coast by 2011. Once established, management, research, education, and monitoring in each regional can be coordinated statewide.

The master plan framework will be first applied in developing alternative proposals in the central coast study region. Key to understanding this process are several concepts and definitions. First, the "central coast study region" is the general area under consideration for the design of MPAs. By no means will the entire area be designated an MPA. Rather, after review of the circumstances within the region, including existing MPAs, and the setting of regional goals and objectives, alternatives for the region will be developed.

Equally important, this study region will likely include a smaller area than the "biogeographical regions" defined in the MLPA. It is the biogeographical regions that are the basis for determining the number of marine reserves as required by the MLPA for replicates of similar habitats within marine reserves. The biogeographical regions are also the basis for the requirement of a network of MPAs.

Within the study region, existing regulations (including existing MPAs), the status of the resources and habitats, and the requirements of the MLPA will be considered. Regional goals and objectives will then be developed, along with potential goals and objectives for individual MPAs. At this point, possible boundaries and regulations will be identified for individual MPAs in the region, including alternative designs and potential changes to or removal of existing MPAs.

This variety of approaches to configuring MPAs within the region will then be assembled into alternative proposals. It is these alternatives that will be considered by the task force, and recommended, in some form, to the Department of Fish and Game and the Fish and Game Commission.

The Blue Ribbon Task Force MPA Design Process

The MPA design process is composed of five general activities:

1. **Regional MPA planning**, which starts with the identification of a study region along the coast that constitutes a logical locale based on a variety of scientific and socioeconomic

criteria for studying where MPAs might appropriately be placed. This step ends with the identification of regional goals and objectives, an evaluation of existing MPAs, and initial discussion of potential MPA locations.

2. **Individual MPA planning**, in which a regional stakeholder group, in consultation with a sub-team of the science advisory team, develops proposals for potential MPAs. This includes recommendations for changes to existing MPAs and other management activities in the region.
3. **Assembling alternative MPA network proposals**, which involves assembly of the MPAs developed in the previous stage into full network proposals. This stage also includes an initial evaluation of the network proposals, including socioeconomic effects, and preparation of a general management plan for MPAs in the region.
4. **Evaluating alternative MPA proposals**, which begins with an initial evaluation by the task force. The task force then forwards the package of alternative proposals to the department, which reviews the proposals and sponsors a peer review.
5. **Fish and Game Commission consideration and action on MPA proposals**, which includes public hearings, consideration of testimony and action on the proposals.

Figure 2 illustrates these five general activities and the major elements of each. Table 1 provides a summary of the activities and elements of the activities, together with a list of the lead actors and the groups to be consulted. A more detailed description of each activity follows in the text.

The ultimate goal of these activities is compliance with the MLPA and specific elements listed here provide general guidance only. In each regional process, the specific elements undertaken must be selected and adjusted based both on the specifics of that region and adaptations suggested from prior experiences implementing the MLPA.

Figure 2. Process for MPA Planning in Study Regions

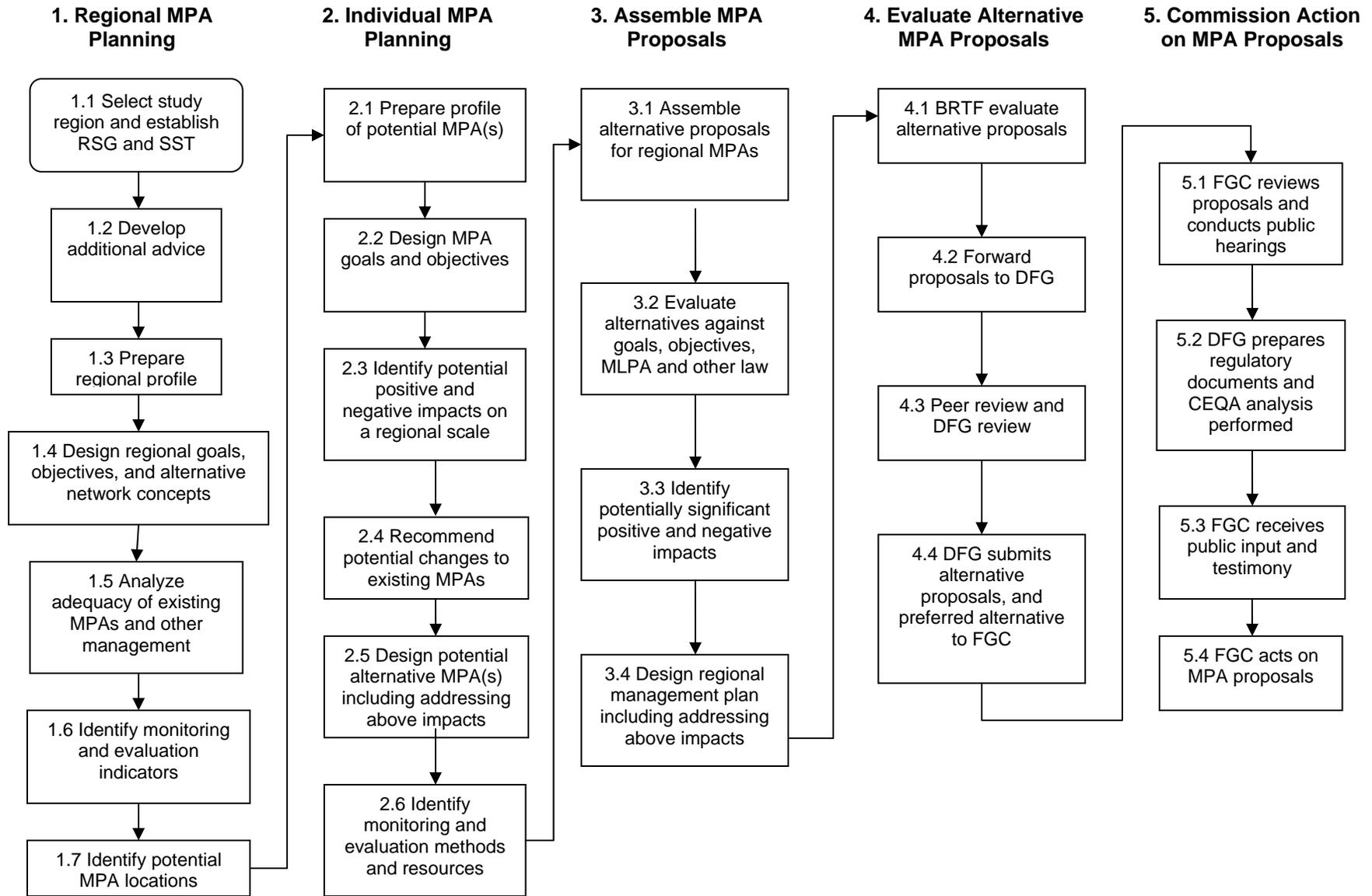


Table 1: Process for MPA Planning in Study Regions

Key to acronyms: BRTF = Blue Ribbon Task Force; CEQA = California Environmental Quality Act; Department = Department of Fish and Game; FGC = Fish and Game Commission; MLPAI = MLPA Initiative including the department; RSG = Regional Stakeholder Group; SAT = Science Advisory Team; SST = Science Advisory sub-team

	TASK	LEAD ACTORS	SUGGEST/COMMENT
REGIONAL MPA PLANNING			
1.1	Establish regional process		
1.1.1	Select a study region	BRTF	
1.1.2	Convene regional stakeholder group (RSG)	Department	Stakeholders
1.1.3	Select science advisory sub-team (SST)	SAT	
1.1.4	Develop workplan and budget for regional effort	BRTF/Department	
1.2	Develop additional advice		
1.2.1	Identify issues requiring additional advice for designing MPAs in the study region	RSG/SST/MLPAI	Stakeholders/SAT
1.2.2	Collect and prepare additional advice for designing MPAs in the study region	MLPAI/SST	RSG/Stakeholders
1.2.3	Review additional advice for designing MPAs in the study region	BRTF/FGC/SAT	RSG/Stakeholders
1.2.4	Adopt additional advice for designing MPAs in the study region	BRTF	
1.3	Prepare regional profile		
1.3.1	Assemble regional information on biological, oceanographic, socioeconomic, and governance aspects of the region	MLPAI	Stakeholders
1.3.2	Review regional information and consider comments from stakeholders	RSG/SST	Stakeholders
1.3.3	Assess needs for additional information and ability to collect that information while meeting the goals of the MLPA.	RSG/SST	SAT/DFG
1.3.4	Evaluate general distribution of representative and unique habitats	RSG/SST	Stakeholders
1.3.5	Identify extent of habitat to be included in MPAs within study region	RSG/SST	Stakeholders
1.3.6	Evaluate wildlife populations, habitats, and uses of concerns	RSG/SST	Stakeholders
1.3.7	Evaluate fishing and non-fishing activities affecting populations, and habitats	RSG/SST	Stakeholders
1.3.8	Identify species generally likely to benefit from MPAs and document their regional distribution	RSG/SST	Stakeholders
1.3.9	Develop, review, and adopt regional profile based on the above	RSG/SST/SAT/ BRTF	Stakeholders

	TASK	LEAD ACTORS	SUGGEST/COMMENT
1.4	<i>Design regional ecological and socioeconomic goals and objectives and alternative network concepts</i>		
1.4.1	Design regional goals and objectives and alternative network concepts consistent with the MLPA and other relevant state law	RSG/SST	Stakeholders
1.4.2	Review regional goals and objectives and alternative network concepts	BRTF/FGC/SAT	Stakeholders
1.4.3	Approve regional goals and objectives and alternative network concepts	BRTF	
1.5	<i>Analyze adequacy of existing MPAs and management</i>		
1.5.1	Evaluate existing MPAs against goals and objectives	RSG/SST	Stakeholders
1.5.3	Evaluate existing fishing and non-fishing management activities against the MLPA, regional goals and objectives, and other relevant state law	RSG/SST	Stakeholders
1.5.4	Identify inadequacies if any in existing MPAs and management	RSG/SST	Stakeholders
1.6	<i>Identify monitoring and evaluation indicators</i>	SST/SAT	DFG
1.7	<i>Identify potential MPAs</i>	RSG/SST	Stakeholders
1.7.1	Based on regional profile, goals, objectives and alternative network concepts, identify potential MPA locations	RSG/SST	Stakeholders
1.7.2	After science advisory team review, select potential MPAs for further evaluation	SAT/RSG	Stakeholders
INDIVIDUAL MPA PLANNING			
2.1	<i>Prepare profile of potential MPAs</i>		
2.1.1	Assemble and review information on biological, oceanographic, socioeconomic, and governance aspects of potential MPAs	MLPAI/RSG/SST	Stakeholders
2.1.2	Evaluate distribution of representative and unique habitats	RSG/SST	Stakeholders
2.1.3	Evaluate wildlife populations, habitats, and uses of concerns	RSG/SST	Stakeholders
2.1.4	Evaluate activities affecting populations, and habitats at each potential MPA site	RSG/SST	Stakeholders
2.1.5	Identify species likely to benefit or not to benefit from MPAs	RSG/SST	Stakeholders
2.1.6	Identify extent of habitat to be included in MPAs	RSG/SST	Stakeholders
2.1.7	Design, review, and adopt MPA profiles	RSG/SST	Stakeholders
2.2	<i>Design MPA goals and objectives (ecological and socioeconomic) for each potential MPA</i>		

	TASK	LEAD ACTORS	SUGGEST/COMMENT
2.2.1	Identify goals and objectives for the potential MPA	RSG/SST	Stakeholders
2.2.2	Review and request revision of goals and objectives for the potential MPA	SAT/BRTF	Stakeholders
2.2.3	Approve goals and objectives for the potential site and forward to FGC for review	BRTF	
2.3	Identify potential positive and negative impacts (ecological and socioeconomic) of the MPA on a regional scale	<i>RSG/SST</i>	<i>DFG/Stakeholder/SAT</i>
2.4	Recommend potential changes to existing MPAs	RSG/SST	DFG/SAT/Stakeholders
2.4.1	Evaluate existing MPAs against the goals and objectives and recommend potential changes	RSG/SST	Stakeholders
2.4.2	Prepare rationale for the recommendation	RSG/SST	Stakeholders
2.5	Design Potential Alternative MPAs		
2.5.1	Evaluate different types of MPAs for meeting goals and objectives of the site, of the MLPA, and of other relevant state law	RSG/SST	Stakeholders
2.5.2	Design boundaries, management and enforcement measures for MPAs, as well as monitoring and budgets	RSG/SST	Stakeholders
2.5.3	Identify likely socioeconomic impacts of the MPAs	RSG/SST	Stakeholders
2.5.4	Identify recommended measures by other authorities regarding activities other than fishing that adversely impact the resources of the proposed MPA	RSG/SST	Stakeholders
2.6	Identify monitoring and evaluation methods and resources	SST/SAT	Department
ASSEMBLE ALTERNATIVE REGIONAL MPAS			
3.1	Assemble MPA proposals into alternative proposals for the region	RSG/SST	Stakeholders
3.2	Evaluate these alternatives against regional goals and objectives, the MLPA, and other relevant state law	RSG/SST	Stakeholders
3.3	Identify potentially significant positive and negative impacts (ecological and socioeconomic)	RSG/SST	Stakeholders
3.4	Design general management plan for MPAs in the region, including monitoring, enforcement, and financing, periodic review of effectiveness	RSG/SST	Stakeholders

	TASK	LEAD ACTORS	SUGGEST/COMMENT
EVALUATE ALTERNATIVE MPA PROPOSALS			
4.1	<i>Evaluate alternative MPA proposals against the MLPA and other relevant state law</i>	BRTF	Stakeholders
4.2	<i>Forward alternative proposals to the Department for consideration and submission to FGC</i>	BRTF	
4.3	<i>Conduct peer review and review proposals and relevant documents, amending as warranted</i>	Department	
4.4	<i>Department submission of alternative proposals, preferred alternative and other documents to FGC</i>	Department	
COMMISSION CONSIDERATION AND ACTION			
5.1	<i>FGC review of alternative proposals and public testimony</i>	FGC	Stakeholders/Department / BRTF
5.2	<i>If FGC requests, the department prepares regulatory documents, and a CEQA analysis is performed</i>	Department	
5.3	<i>FGC accepts public testimony on alternative MPA proposals and supporting documents</i>	FGC	Stakeholders
5.4	<i>FGC acts on MPA proposals</i>	FGC	

The text below describes in greater detail the process for MPA planning in a study region. It is important to note that some of the sub-activities described below may occur simultaneously or may be repeated, such as the design of individual MPAs within a region. Other important activities, such as applying socioeconomic analyses or taking monitoring into account in the design of MPAs, are elements of broader activities throughout the process.

Task 1: Regional MPA Planning

The objective of this task is to develop background information, goals and objectives, and possible MPA network concepts (i.e., how the proposed MPAs within a region may relate to the statewide network) for the study region. Among other products is a regional profile that summarizes available ecological and socioeconomic information. This profile serves as a foundation for setting goals and objectives, developing alternative network concepts, and identifying needs for additional information.

During the MLPA Initiative process, designing MPAs begins with identification of a study region. The study region will focus initial efforts to implement this framework in a discrete area. For the MLPA Initiative process, the MLPA Blue Ribbon Task Force (BRTF) will oversee all

aspects of regional planning in the initial study region. In evaluating possible initial study region alternatives along the central coast from Point Conception to Point Arena, the MLPA Initiative used the following criteria, which may be useful in future evaluations:

- Biophysical boundaries. Species of plants and animals are not distributed continuously along the California coast. Rather, they have distinct north/south boundaries. Many species form natural communities with borders that may assist in determining the central coast study region. Although the borders themselves may be fuzzy, the central coast clearly has two major zones, divided by the outflow from San Francisco Bay. A weaker, but important break occurs at Point Sur, where current gyres cause abrupt changes in the composition of the community of species.
- Area large enough for replicates? Options were reviewed to determine if they were large enough to replicate various habitat types in more than one MPA within the entire region.
- Relative amount of habitat mapped. High-resolution mapping allows determination of bottom type on a finer scale than hard versus soft, and can distinguish relief, complexity, and rugosity, for example, of hard bottom structures. This criterion, rated as either high, moderately-high, moderate, or low, was based on the amount of available, high-resolution, fine-scale, habitat mapping data relative to the potential study region.
- Human activity boundaries. The diversity and intensity of human activities in coastal waters are discontinuous as well. As an example, recreational fishing is more prevalent south of Point Conception than north. The waters around Monterey are among the most popular sites for scuba diving in the United States. Government jurisdictions add another layer of complexity that should also be considered. Several sub-categories were considered within this criterion:
 - Recreational fishing
 - Commercial fishing
 - Scuba diving
 - County jurisdictions
 - Military/security uses
 - State/federal jurisdiction
- Progress of past MLPA and other public discussion groups. Input from outside groups' prior or ongoing discussions were considered. These groups may provide important information that will assist the regional process.
- Potential state, federal and private partners with financial or in-kind services. Potential partners were considered. The assistance provided by these partners can enhance and facilitate regional processes.
- Scientific knowledge of, and research being conducted in, the region. Public and private entities, such as universities, state and federal agencies, and power generating companies (e.g. PG&E's Diablo Canyon) have conducted or are conducting research and monitoring studies in a variety of areas along the coast. Availability of region-specific

information, including information on the distribution of habitats identified in the MLPA, should help determine the final study region.

- Availability of first-hand knowledge of the area. Numerous scientists, fishermen, and other informed individuals collectively provide a wealth of knowledge within specific areas. The level and availability of this type of information should be considered.
- Number of existing MPAs. Availability of scientific data about existing MPAs and how they meet or do not meet both resource protection needs and the requirements of the MLPA are important in determining a study region.
- Existing fishery regulations in the region and how they meet or do not meet both resource protection needs and the requirements of the MLPA. Existing regulations create differences in the need for additional protection in certain areas.
- Number of complete department fishing districts and management areas (related to existing fishery regulations). The selected study region should reflect a consideration of these areas.
- Range or area over which a resource user may be expected to have a working knowledge of the resources. Similar to the range over which resources are utilized by user groups, the geographic range of a user's working knowledge will vary with the resource or resources in question. This also applies to researchers, fishery managers, and other scientists within the region. The selected study region should not be so large as to preclude the ability of individual representatives to provide input on its entire geographic extent.
- Distance members of a regional stakeholder group would need to travel in order to participate in group meetings. Choosing too large a study region could impose logistical problems for those required to, or interested in, participating in the process. This criterion was rated from high to low based on the length of coastline (nautical miles) within the potential study region as follows:
 - High = greater than 200 miles
 - Moderate to high = 151-200 miles
 - Moderate = 100-150 miles
 - Low = less than 100 miles
- Availability of Department of Fish and Game personnel. The same considerations relative to travel that apply to the regional working group would also apply to department staff.

A list of potential study regions was prepared and input was taken from the public both at BRTF meetings and at three public workshops. Specific areas of agreement among the majority of comments were noted. In addition, specific areas of concern became apparent. From this, a set of three potential study regions was developed. The positive and negative aspects of each potential region were presented to the BRTF, which then selected the final study region based on the information provided.

Activity 1.1: Establish regional process

Activity 1.1.1: Based upon advice from the science advisory team, the department, and stakeholders, the task force selects a geographical study region within which to evaluate and design MPAs.

Activity 1.1.2: Once the study region is identified, the director of the department convenes a regional stakeholder group to participate in the evaluation of existing MPAs and the design of any additional MPAs.

Activity 1.1.3: The science advisory team identifies members who will serve on a science sub-team, which will work closely with the regional stakeholder group, and will serve as a link to the science advisory team.

Activity 1.1.4: In collaboration with the regional stakeholder group and the science advisory sub-team, staff develop a work plan and budget for designing alternative MPA proposals in the study region.

Activity 1.2: Develop additional advice

Activity 1.2.1: The regional stakeholder group, the science advisory sub-team, and staff identify issues requiring additional advice for designing MPAs in the study region.

Activity 1.2.2: In consultation with the science advisory sub-team, staff prepares draft advice on these issues.

Activity 1.2.3: the task force, commission and science advisory team review additional advice for designing MPAs in the study region.

Activity 1.2.4: the task force adopts the additional advice.

Activity 1.3: Prepare regional profile

Activity 1.3.1: Staff assemble regional information on biological, oceanographic, socioeconomic and governance aspects and draw upon suggestions and information provided by local communities and other stakeholders. The profile will include governance aspects related to tribal uses in the region. See Appendix E for a description of social science tools and methods. Much of the information that might be included in a regional profile may be found in Appendix F.

Activity 1.3.2: The regional stakeholder group and the science sub-team review regional information and consider comments from stakeholders.

Activity 1.3.3: The regional stakeholder group and the science sub-team assess the needs for additional information and the ability to collect that information while meeting the goals of the MLPA. It should be noted that the MLPA requires the best readily

available information and does not require the process to wait for significant new information to be gathered.

Activity 1.3.4: The regional stakeholder group and the science advisory sub-team evaluate the distribution of representative and unique habitats in the study region and identify any significant gaps in information. The stakeholder group and science sub-team shall use the classifications of representative habitat as recommended by the science advisory team and adopted by the task force.

Activity 1.3.5: Drawing upon the list of habitats that are to be represented in marine reserves in a region, the regional stakeholder group and science advisory sub-team recommend the extent of habitat to be included in MPAs within the study region.

Activity 1.3.6: The regional stakeholder group and the science advisory sub-team identify and evaluate wildlife populations, habitats, and uses of areas in the study region that may be of concern for conservation or other reasons identified in the MLPA.

Activity 1.3.7: The regional stakeholder group and the science advisory sub-team identify fishing and non-fishing activities affecting marine wildlife and habitats in the study region.

Activity 1.3.8: Drawing upon the species list described in Appendix G, the regional stakeholder group and science advisory sub-team develop a list of species likely to benefit from MPAs and document their regional distribution.

Activity 1.3.9: The regional stakeholder group reviews and adopts a regional profile based upon the above activities and submits that profile for review by the science advisory team.

Activity 1.4: Design regional ecological and socioeconomic goals and objectives and alternative network concepts

Activity 1.4.1: Drawing upon the regional profile and the goals and objectives of the MLPA, the regional stakeholder group and the science advisory sub-team design recommended regional goals, objectives and alternative network concepts, consistent with the MLPA and other relevant state law. (See discussion of setting goals and objectives below.)

Activity 1.4.2: The regional goals, objectives, and alternative network concepts designed in the regional effort are reviewed by the science advisory team, whose comments are forwarded to the task force. The task force reviews the proposed regional goals, objectives, and alternative network concepts and provides comments and suggestions to the regional stakeholder group for consideration in revision. The task force subsequently forwards its comments and suggestions, together with the proposed regional goals, objectives, and network concepts, to the department

Activity 1.4.3: The task force approves the regional goals, objectives, and alternative network concepts, when satisfied that they meet the standards of the MLPA.

Activity 1.5: Analyze adequacy of existing MPAs and management activities

Activity 1.5.1: The regional stakeholder group and the science advisory sub-team evaluate existing MPAs in the study region against the regional goals and objectives and the MLPA.

Activity 1.5.3: The regional stakeholder group and the science advisory sub-team evaluate existing management of fishing and non-fishing activities against regional goals and objectives and the MLPA. Where this other management meets regional goals and objectives and the goals and objectives of the MLPA in all or part of the region, it should be incorporated into the final design.

Activity 1.5.4: The regional stakeholder group and the science advisory sub-team identify inadequacies in existing MPAs and management activities in meeting the goals and objectives of the study region and of the MLPA. (See Appendix H for a description of planning processes related to the MLPA.)

Activity 1.6: Identify monitoring and evaluation indicators. The regional stakeholder group and the science advisory sub-team will identify potential monitoring and evaluation indicators used to evaluate progress toward achieving goals and objectives.

Activity 1.7: Identify potential new MPAs

Activity 1.7.1: Based on the regional profile, regional goals and objectives, and alternative network concepts developed above, the regional stakeholder group and the science advisory sub-team identify general areas within the study region within which individual MPAs may be sited.

Activity 1.7.2: Upon review by the science advisory team, the regional stakeholder group selects potential MPAs for further evaluation in the next task.

Task 2: MPA Planning

The objectives of this task are to evaluate conditions in each potential MPA identified in the previous activity, to develop goals and objectives for potential MPAs, and to design boundaries and other management measures for possible MPAs at each potential MPA site. The intent is for the sum of individual MPAs to meet the regional goals and objectives and the sum of the regions to meet the MLPA goals and objectives and network requirements while noting that any individual MPA may not meet all of the goals of the region or network.

Activity 2.1: Prepare profile of each potential MPA site. Note that the following seven steps are carried out for each of the potential MPAs identified in the previous activity.

Activity 2.1.1: Staff assemble and review information on biological, oceanographic, socioeconomic, and governance aspects of the potential MPA site. The regional stakeholder group and the science advisory sub-team review this information and may request additional information.

Activity 2.1.2: The regional stakeholder group and the science advisory sub-team evaluate the distribution of representative and unique habitats in the potential MPA site, based on the information assembled in Activity 2.1.1, and information provided by stakeholders, including local communities and fishermen.

Activity 2.1.3: The regional stakeholder group and the science advisory sub-team identify and evaluate wildlife populations, habitats, and various human uses that may negatively impact the populations and habitats in the study site.

Activity 2.1.4: The regional stakeholder group and the science advisory sub-team identify and evaluate activities that may affect populations and habitats.

Activity 2.1.5: The regional stakeholder group and the science advisory sub-team identify species likely to benefit from the potential MPA with focus on species of concern. Species not likely to benefit should also be considered as prohibition of their take may lead to unnecessary socioeconomic impact. All species should be considered for their ecological interactions, whether the individual species benefit or not.

Activity 2.1.6: The regional stakeholder group and the science advisory sub-team identify the extent of habitat to be included in the potential MPA.

Activity 2.1.7: In consultation with the regional stakeholder group and the science advisory sub-team, staff prepare a profile of the potential MPA based on the information developed in activities 2.1.1 to 2.1.6. The regional stakeholder group and the science advisory sub-team review and adopt the profile as the basis for the next major activity.

Activity 2.2: Design MPA goals and objectives (ecological and socioeconomic) for each potential MPA

Activity 2.2.1: Based on the site planning profile, the regional goals and objectives, and the MLPA, the regional stakeholder group and the science sub-team designs recommended goals and objectives for individual MPA(s) in the region.

Activity 2.2.2: The regional goals and objectives for the potential MPA(s) are reviewed by the science advisory team.

Activity 2.2.3: The department approves the goals and objectives for the potential MPA(s).

Activity 2.3: Identify potential positive and negative impacts (ecological and socioeconomic) of the potential MPA(s) on a regional scale.

Activity 2.4: Recommend potential changes to existing MPAs

Activity 2.4.1: The regional stakeholder group and the science sub-team reviews all the above information and makes initial recommendations for the modification, reduction in size, expansion, or removal of existing MPAs in order to meet regional goals and

objectives consistent with the goals of the MLPA and the network concepts for the region. (See Appendix I for brief descriptions of existing MPAs.)

Activity 2.4.2: The regional stakeholder group and the science team develop a rationale for this recommendation, which is included in the regional options forwarded to the Blue Ribbon Task Force and then to the Department of Fish and Game.

Activity 2.5: Design potential alternative MPA(s)

Activity 2.5.1: The regional stakeholder group and science advisory sub-team evaluate different types of MPAs and combinations of MPAs for meeting the goals and objectives of the MLPA, regional goals and objectives, and goals of the statewide network.

Activity 2.5.2: The regional stakeholder group and science advisory sub-team design boundaries, management and enforcement measures for potential alternative MPA(s), as well as general features of a monitoring plan and budget.

Activity 2.5.3: The regional stakeholder group and science advisory sub-team identify likely direct and indirect socioeconomic effects of the MPA(s) that should be considered in subsequent analyses.

Activity 2.5.4: The regional stakeholder group and science advisory sub-team recommend measures that may be taken by other authorities to mitigate the effects of activities other than fishing that adversely impact the resources of the potential alternative regional MPA(s).

Activity 2.6: Identify monitoring and evaluation methods and resources. The regional stakeholder group and the science advisory sub-team will identify potential monitoring and evaluation methods along with potential resources to complete monitoring. The definitions of reserves, parks and conservation areas creates a gradient in fishing pressure (e.g. zero, little, medium and open fishing) that will be used in the design of the monitoring program to assess the impacts of the MPAs.

Task 3: Assemble alternative regional MPAs

The objectives of this task are to assemble the results of planning regarding each potential MPA into alternative packages, to evaluate these packages against the regional goals and objectives and the MLPA, to identify likely socioeconomic impacts, and to outline a management plan for the region's MPAs.

Activity 3.1: The regional stakeholder group and science advisory sub-team assembles individual MPA proposals into alternative proposals for the study region.

Activity 3.2: The regional stakeholder group and the science advisory sub-team evaluate these alternative proposals against regional goals and objectives, the MLPA and other relevant state law.

Activity 3.3: The regional stakeholder group and the science advisory sub-team identify potentially significant positive and negative impact(s) (both environmental and socioeconomic) from the alternative proposals and attempts to modify the proposals to limit the negative impacts.

Activity 3.4: The regional stakeholder group and the science advisory sub-team designs a general management plan for MPAs in the region, including monitoring, enforcement, costs and financing, and periodic review of effectiveness.

Task 4: Evaluate Alternative MPA proposals

The objectives of this task are to conduct initial reviews of the alternative MPA proposals, to conduct environmental and socioeconomic analyses as required by law, and to submit the alternative proposals and supporting materials to the Fish and Game Commission for its consideration.

Activity 4.1: The regional stakeholder group and the science advisory sub-team forwards the alternative MPA proposals, initial evaluations and general management plan to the task force, which evaluates these proposals against the MLPA's standards and other relevant state law.

Activity 4.2: The task force forwards alternative proposals for MPAs, a preferred alternative, initial evaluations, and the general management plan, together with its own evaluation, to the department for its consideration and submission to the Fish and Game Commission.

Activity 4.3: The department sponsors a peer review of alternative MPA proposals and reviews the alternative proposals, initial evaluations, and general management plans, and amends these documents consistent with its authorities and peer review as well as any recommendations from the task force and the public in response to the peer review.

Activity 4.4: The department submits those alternative proposals that are consistent with the MLPA, a preferred alternative, the submissions of the regional groups and the task force, to the Fish and Game Commission.

Task 5: Commission consideration and action

The objectives of this task are to consider public testimony and other information regarding the MPA proposals submitted by the department and to take action on these proposals.

Activity 5.1: The Fish and Game Commission reviews the alternative regional MPA proposals, takes public testimony, and determines whether to request that the department begin the formal regulatory process.

Activity 5.2: If the Fish and Game Commission does make such a request, the department prepares regulatory language and other documents and analyses required by the California Environmental Quality Act (CEQA) and other relevant law.

Activity 5.3: The Fish and Game Commission then accepts public testimony on the alternative regional MPA proposals and on the analyses conducted under CEQA and other law.

Activity 5.4: The Fish and Game Commission acts on alternative regional MPA proposals.

Section 3. Considerations in the Design of MPAs

Accomplishing MLPA goals and objectives to improve a statewide network of MPAs will require the consideration of a number of issues, some of which are addressed in the MLPA itself. These are as follows:

- Goals of the Marine Life Protection Program
- MPA networks
- Types of MPAs
- Settling goals and objectives for MPAs
- Geographical regions
- Representative and unique habitats
- Species likely to benefit from MPAs
- Enforcement considerations in setting boundaries
- Information used in the design of MPAs
- Monitoring and evaluation strategies and resources
- Other activities affecting resources of concern

Each of these issues is discussed below.

Goals of the Marine Life Protection Program

The foundation for achieving the goals and objectives of the MLPA is a Marine Life Protection Program (MLPP), which must be adopted by the California Fish and Game Commission. The MLPA sets the following goals for the MLPP [FGC subsection 2853(b)]:

- (1) To protect the natural diversity and abundance of marine life, and the structure, function, and integrity of marine ecosystems.
- (2) To help sustain, conserve, and protect marine life populations, including those of economic value, and rebuild those that are depleted.
- (3) To improve recreational, educational, and study opportunities provided by marine ecosystems that are subject to minimal human disturbance, and to manage these uses in a manner consistent with protecting biodiversity.
- (4) To protect marine natural heritage, including protection of representative and unique marine life habitats in California waters for their intrinsic value.
- (5) To ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based on sound scientific guidelines.
- (6) To ensure that the state's MPAs are designed and managed, to the extent possible, as a network.

Meeting the goals of the MLPA requires that an MPA network reflect these goals in its own goals, objectives, management, monitoring and evaluation.

The goals of the MLPP go beyond the scope of traditional management of activities affecting living marine resources, which has focused upon maximizing yield from individual species or groups of species. For example, the first goal emphasizes biological diversity and the health of

marine ecosystems, rather than the abundance of individual species. The second goal recognizes a role for MPAs as a tool in fisheries management. The third recognizes the importance of recreation and education in MPAs, and balances these with the protection of biodiversity. The fourth recognizes the value of protecting representative and unique marine habitats for their own value. The fifth and sixth goals address the deficiencies in California's existing MPAs that the MLPA identifies elsewhere in the law. (See the glossary in Appendix J for definitions of some key terms in this goal statement.)

The MLPA also states that the preferred siting alternative for MPA networks, which the Department of Fish and Game must present to the Fish and Game Commission, must include an "improved marine life reserve³ component" and must be designed according to all of the following guidelines:

- (1) Each MPA shall have identified goals and objectives. Individual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of this chapter.
- (2) Marine Life Reserves in each bioregion shall encompass a representative variety of marine habitat types and communities, across a range of depths and environmental conditions.
- (3) Similar types of marine habitats shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region.
- (4) Marine life reserves shall be designed, to the extent practicable, to ensure that activities that upset the natural functions of the area are avoided.
- (5) The MPA network and individual MPAs shall be of adequate size, number, type of protection, and location to ensure that each MPA meets its objectives and that the network as a whole meets the goals and guidelines of the MLPA.

MPA Networks

One of the goals of the Marine Life Protection Program calls for improving and managing the state's MPAs as a network, to the extent possible. Although neither statute nor legislative history defines "network," the ordinary dictionary usage contemplates *interconnectedness* as a characteristic of the term. The term "reserve network", has been defined as a group of reserves which is designed to meet objectives that single reserves cannot achieve on their own (Roberts and Hawkins, 2000). In general this definition may infer some direct or indirect connection of MPAs through the dispersal of adult and/or larval organisms or other biological interactions. In most cases, larval dispersal rates are not known and oceanography or ocean current patterns may be combined with larval biology to help determine connectivity.

Network components will likely differ in each region of the state. The MLPA also requires that the network as a whole meet the various goals and guidelines set forth by the law and contemplates the adaptive management of that network [Fish and Game Code Section 2857(c)(5)]. In order to meet those goals a strict interpretation of an ecological network across the entire state, based on larval dispersion and connectivity, may not be possible.

³ As noted previously, marine life reserve in the context of the MLPA is synonymous with a state marine reserve.

The MLPA also requires that MPAs be managed as a network, to the extent possible. This implies a coordinated system of MPAs. MPAs might be linked through biological function as in the case of adult movement or larval transport. MPAs managed as a network might also be linked by administrative function, in addition to biological function. The important aspects of this interpretation are that MPAs are linked by common goals and a comprehensive management and monitoring plan, and that they protect areas with a wide variety of representative habitat as required by the MLPA. MPAs should be based on the same guiding principles, design criteria, and processes for implementation. In this case, a statewide network could be one that has connections through design, funding, process, and management. At a minimum, the master plan should insure that the statewide network of MPAs reflects a consistent approach to design, funding and management.

Because of the long-term approach of the MLPA Initiative, the statewide network of MPAs called for by the MLPA will be developed in phases, region by region. Within each region, components of the statewide network will be designed consistent with the MLPA and with regional goals and objectives. Each component ultimately will be presented as a series of options, developed in a regional process involving a regional stakeholder group and a sub-group of the science advisory team. Each will include a preferred alternative identified by the department and delivered to the Fish and Game Commission. Another application of phasing may be an incremental implementation of a portion of the statewide MPA network within a single region. This type of phasing could allow for the completion of baseline surveys or the time necessary to secure additional funding for enforcement and management. Final proposals should include an explanation of the timing of implementation.

Science Advisory Team Advice on MPA Network Design

The MLPA calls for the use of the best readily available science, and establishes a science advisory team as one vehicle for fostering consistency with this standard. The MLPA also requires that the statewide MPA network and individual MPAs be of adequate size, number, type of protection, and location as to ensure that each MPA and the network as a whole meet the objectives of the MLPA. In addition, the MLPA requires that representative habitats in each bioregion be replicated in more than one marine reserve.

The science advisory team provided the following guidance in meeting these standards. This guidance, which is expressed in ranges for some aspects such as size and spacing of MPAs, should be the starting point for regional discussions of alternative MPAs. Although this guidance is not prescriptive, any significant deviation from it should be explained.

Overall MPA and network guidelines:

- The diversity of species and habitats to be protected, and the diversity of human uses of marine environments, prevents a single optimum network design in all environments.
- To protect the diversity of species that live in different habitats and those that move among different habitats over their lifetime, every 'key' marine habitat should be represented in the MPA network.

- To protect the diversity of species that live at different depths and to accommodate the movement of individuals to and from shallow nursery or spawning grounds to adult habitats offshore, MPAs should extend from the intertidal zone to deep waters offshore.
- To best protect adult populations, based on adult neighborhood sizes and movement patterns, MPAs should have an alongshore extent of at least 5-10 km of coastline, and preferably 10-20 km. Larger MPAs would be required to fully protect marine birds, mammals, and migratory fish.
- To facilitate dispersal among MPAs for important bottom-dwelling fish and invertebrate groups, based on currently known scales of larval dispersal, MPAs should be placed within 50-100 km of each other.
- To provide analytical power for management comparisons and to buffer against catastrophic loss of an MPA, at least three to five replicate MPAs should be designed for each habitat type within a biogeographic region.
- To lessen negative impact while maintaining value, placement of MPAs should take into account local resource use and stakeholder activities.
- Placement of MPAs should take into account the adjacent terrestrial environment and associated human activities.
- To facilitate adaptive management of the MPA network into the future, and the use of MPAs as natural scientific laboratories, the network design should account for the need to evaluate and monitor biological changes within MPAs.

1. MPAs should be in different marine habitats, biogeographic regions and upwelling cells

The strong association of most marine species with particular habitat types (e.g., sea grass beds, submarine canyons, shallow and deep rock reefs), and variation in species composition across latitudinal, depth clines and biogeographic regions, implies that habitat types must be represented across each of these larger environmental gradients to capture the breadth of biodiversity in California's waters.

Different species use marine habitats in different ways. As a result, protection of all the key habitats along the California coast is a critical component of network design. A 'key' habitat type is one that provides distinctive benefits by harboring a different set of species or life stages, having special physical characteristics, or being used in ways that differ from the use of other habitats. In addition, many species require different habitats at different stages of their life cycle - for example, nearshore species may occur in offshore open ocean habitats during their larval phase. Thus, protection of these habitats, as well as designs that ensure connections between habitats, is critical to MPA success. Individual MPAs that encompass a diversity of habitats will both ensure the protection of species that move among habitats and protect adjoining habitats that benefit one another (e.g., exchange nutrients, productivity). Habitats with unique features (educationally, ecologically, archeologically, anthropologically,

culturally, spiritually), or those that are rare should be targeted for inclusion. Habitats that are uniquely productive (e.g. upwelling centers or kelp forests) or aggregative (e.g., fronts) or those that sustain distinct use patterns (e.g. dive training centers, fishing or whale watching hot spots) should also get special consideration in design planning

2. Target species are ecologically diverse

MPAs protect a large number of species within their borders, and these species can have dramatically different requirements. As a result, MPA networks cannot be designed for the specific needs of each individual species. Rather, design criteria need to focus on maximizing collective benefits across species by minimizing compromises where possible. Commonly, it is more practical to consider protecting groups of species based on shared functional characteristics that influence MPA function and design (e.g., patterns of adult movement; patterns of larval dispersal; dependence on critical locations such as spawning grounds, mammal haul out areas, bird rookeries). It is also reasonable to emphasize protection of ecologically and economically dominant species groups when siting MPAs. The former play the largest roles in the function of coastal ecosystems, and the latter often experience the greatest impacts from human activities. In addition, knowledge of the distribution of rare, endemic, and endangered species should supplement the use of species groups. Generally, MPAs should not be used solely to enhance single-species management goals.

3. Uses of marine and adjacent terrestrial environments are diverse

The way people use coastal marine environments is highly diversified in method, goals, timing, economic objectives, spatial patterns, etc. The wide spectrum of environmental uses should be a part of decisions comparing alternatives networks of MPAs. The heterogeneity of uses, both between and within consumptive and non-consumptive categories make it unlikely that any one design will satisfy all user groups. The design will need to make some explicit provisions for trading off between the various negative and positive impacts to user groups. Placement of MPAs should also take into account the adjacent terrestrial environment and associated human activities. Freshwater runoff can be an important source of nutrients but also a potential source of contaminants to the adjacent marine environment. Terrestrial protected areas (e.g., preserves, parks) can regulate human access, restrict discharge of contaminants and provide enforcement support to adjoining MPAs.

4. MPA permanence is especially critical for long lived animals

Two clear objectives for establishing self-sustaining MPAs are to protect areas that are important sources of reproduction (nurseries, spawning areas, egg sources) and to protect areas that will receive recruits and thus be future sources of spawning potential. To meet the first objective of protecting areas that serve as sources of young, protection should occur both for areas that historically contained high abundances and for areas that currently contain high abundances. Historically productive fishing areas, which are now depleted, are likely to show a larger, ultimate response to protective measures if critical habitat has not been damaged. Protecting areas where targeted populations were historically abundant alone is insufficient, however, because the pace of recovery may be slow, especially for species with relatively long life spans and sporadic recruitment (for example, top marine predators). Including areas with

currently high abundances in an MPA network helps buffer the network from the inevitable time lag for realizing the responses of some species. The biological characteristics of longevity and sporadic recruitment also suggest that the concept of a rotation of open and closed areas will probably not work well for the diversity of coastal species in California.

5. Size and shape guidelines

To provide any significant protection to a target species, the size of an individual MPA must be large enough to encompass the typical movements of many individuals. Movement patterns vary greatly among species. Some are completely immobile or move only a few meters. Others forage widely. The more mobile the individuals, the larger the individual MPA must be to afford protection. Therefore, minimum MPA size constraints are set by the more mobile target species. Because some of California's coastal species are known to move hundreds of miles, MPAs of any modest size are unlikely to provide real protection for these species. Fortunately, tagging studies indicate that net movements of many of California's nearshore bottom-dwelling fish species, particularly reef-associated species, are on the order of 3-12 miles (5-20 km) or less over the course of a year. These individual adult neighborhood or home range sizes must be combined with knowledge of how individuals are distributed relative to one another (e.g., in exclusive versus overlapping neighborhoods) to determine how many individuals a specific MPA design will protect. Current data suggest that MPAs spanning less than about 3-6 miles (5-10 km) in extent along coastlines will leave many individuals of important species poorly protected. Larger MPAs, spanning 10-20 km of coastline, are probably a better choice given current data on adult fish movement patterns. With MPAs of this size, pelagic species with very large neighborhood sizes will likely receive little protection unless the MPA network as a whole affords significant reductions in mortality during the cumulative periods that individuals spend in different MPAs, or unless other ecological benefits are conferred (e.g., protection of feeding grounds, reduction in bycatch). Protection for highly mobile species will come from other means, such as state and federal fisheries management programs, but MPAs may play a role.

Less is known about the net movements of most of the deeper water sedentary and pelagic fishes, especially those associated with soft-bottom habitat, but it is reasonable to suspect that the range of movements will be similar or greater than those of nearshore species. One cause of migration in demersal fishes is the changing resource/habitat requirements of individuals as they grow. Thus, individual ranges can reflect the gradual movement of an individual among habitats, and MPAs that encompass more diverse habitat types will more likely encompass the movement of an individual over its lifetime. Although fisheries may not target younger fish, offshore MPAs that include inshore nursery habitats increase the likelihood of replenishment of adult populations offshore. Such MPAs would also protect younger fish from incidental take (i.e. by-catch). Fish with moderate movements, especially those in deeper water, will require larger MPA sizes. Because several species also move between shallow and deeper habitat, MPAs that extend offshore (from the coastline to the three-mile offshore boundary of State waters) will accommodate such movement and protect individuals over their lifetime.

Typically, the relative amount of higher relief rocky reef habitat decreases with distance from shore. In such situations, a MPA shape that covers an increasing area with distance offshore (i.e. a wedge shape) may be an effective design. This shape also better accommodates the greater movement ranges of deeper water and soft-bottom associated fishes and the

larval/juvenile stages of nearshore species which may occur offshore during their planktonic phase of life. Therefore, coupling of pelagic and benthic habitats is an important consideration in both offshore and nearshore MPA design. The size of a protected area should also be large enough to facilitate enforcement and to limit deleterious edge effects caused by fishing adjacent to the MPA. MPA shape should ultimately be determined on a case-by-case basis using a combination of information about bathymetry, habitat complexity, and species distribution and relative abundance.

6. Spacing between MPAs

The exchange of larvae among MPAs is the fundamental biological rationale for MPA “networks”. Larval exchange has at least three primary objectives: to assure that populations within MPAs are not jeopardized by their reliance on replenishment from less protected populations outside MPAs; to ensure exchange and persistence of genetic traits of protected populations (e.g., fast growth, longevity); and to enhance the independence of populations and communities within MPAs from those outside MPAs for the use of MPAs as reference sites. For MPAs to act as reference sites for comparison with less protected populations or communities, MPAs must act independently from areas with less protected populations. Independence is enhanced for MPAs whose replenishment is contributed to by other MPAs.

Movement out of, into and between MPAs by juveniles, larvae or spores of marine species depends on their dispersal distance. Important determinants of dispersal distance are the length of the planktonic period, oceanography and current regimes, larval behavior, and environmental conditions (e.g., temperature and sources of entrainment). As with adult movement patterns, the dispersal of juveniles, larvae and spores varies enormously among species. Some barely move from their natal site. Others disperse vast distances. MPAs will only be connected through the dispersal of young if they are close enough together to allow movement from one MPA to another. Any given spacing of MPAs will undoubtedly provide connectivity for some species and not for others. The challenge is minimizing the number of key or threatened species that are left isolated by widely spaced MPAs.

Based on emerging genetic data from species around the world, larval movement of 50-100 km appears common in marine invertebrates. For fishes, larval neighborhoods based on genetic data appear generally larger, ranging up to 100-200 km. For marine birds and mammals, dispersal of juveniles of hundreds of km is not unusual, but for some of these species, return of juveniles to natal areas can maintain fine-scale population structure. For MPAs to be within dispersal range for most commercial or recreational groundfish or invertebrate species, they will need to be on the order of no more than 50-100 km apart. Otherwise, a large fraction of coastal species will gain no benefits from connections between MPAs.

Current patterns, retention features such as fronts, eddies, bays, and the lees of headlands may create “recruitment sinks and sources”. Such spatial variation in recruitment habitat may be predictable - dispersal distances will be shorter where retention is substantial (e.g., lees of headlands). As a result, MPAs may need to be more closely spaced in these settings. Although dispersal data appear to be valid for a wide range of species, there are only a small number of coastal marine species in California that allow these estimates of larval

neighborhoods to be made with confidence. Nonetheless, it is the distribution of dispersal distances across species that really drives network design rather than the specific patterns for any particular species.

7. Minimal replication of MPAs

MPAs in a particular habitat type need to be replicated along the coast. Four major reasons for this are: to provide stepping-stones for dispersal of marine species; to insure against local environmental disaster (e.g. oil spills or other catastrophes) that can destroy an individual, small reserve; to provide independent experimental replicates for scientific study of MPA effects; and for the use of MPAs as reference sites to evaluate the effects of human influences on populations and communities outside MPAs. Ideally at least five replicates (but a minimum of three) containing sufficient representation of each habitat type, should be placed in the MPA network within each biogeographic region and for each habitat to serve these goals. For large biogeographic regions, fulfilling the critical stepping stone role may require even more MPA replicates. The spacing criteria discussed above will drive the number of replicates in this situation. To ensure that the effects of reserves can be quantified, the network should be designed in a way that facilitates comparison of protected and unprotected habitats, and between different degrees of consumptive and non-consumptive uses.

8. Human activities ranges and MPA placement

The geographic extent of human activities is suggestive of size and placement of MPAs. Fishing fleets and other user groups typically have a finite home range from ports and access points along the coast. Many activities, especially in central California, are day-based and conducted from motor, sail or hand powered crafts with ranges between 1 and 29 miles (1 and 25 nautical miles). Historical patterns of fishing activity may have been concentrated much closer to ports than is true today because of declines in abundance from activities in the past. If MPAs are designed to limit consumptive uses, MPAs located farthest away from access points will tend to be associated with lower costs. However, MPAs often become magnets for fishing along their edges. These situations create a net benefit for consumptive users by locating MPAs close to ports and coastal access points. Similarly, MPAs designed to facilitate certain non-consumptive types of activities such as diving may be more effective closer to ports and coastal access points. As a general rule, locating MPAs at the outer reaches of the maximum range of any given user group will tend to minimize the impacts on that group, both negative (loss of opportunity) and positive (creation of opportunity). The balance between these influences must be evaluated for specific locations. In addition, if MPAs restrict transit they will carry higher social, economic and, potentially, safety costs for users seeking access to sites beyond the MPA.

9. Human activity patterns and portfolio effects

Human activities have distinct hotspots where effort is concentrated. For example, in the northern California urchin fishery, economists at the University of California at Davis have documented area based fishing strategies around a dozen fishing locations. It is likely that there are a threshold number of these locations below which the fishery would not be feasible. Because an MPA larger than the typical harvest area could potentially eliminate a fishing

location, these spatial use patterns should be part of design considerations, especially if establishing one particular MPA would spell the end of a particular activity along the entire coastline.

Consideration of Habitats in the Design of MPAs

The first step in assembling alternative proposals for MPAs in a region and in the context of a statewide MPA network, is to use existing information to the extent possible to identify and to map the habitats that should be represented. The MLPA also calls for recommendations regarding the extent and types of habitats that should be represented.

The MLPA identifies the following habitat types: rocky reefs, intertidal zones, sandy or soft ocean bottoms, underwater pinnacles, sea mounts, kelp forests, submarine canyons, and seagrass beds. The Master Plan Team convened in 2000 reduced this basic list by eliminating sea mounts, since there are no sea mounts in state waters. The team also identified four depth zones as follows: intertidal, intertidal to 30 meters, 30 meters to 200 meters, and beyond 200 meters. Several of the seven habitat types occur in only one zone, while others may occur in three or four zones.

The Master Plan Science Advisory Team recommends expanding these habitat definitions in four ways:

1. Based on information about fish depth distributions provided in a new book on the ecology of California marine fishes, the science advisory team recommends dividing the 30-200 m depth zone into a 30-100 m and a 101-200 m zone. This establishes five depth zones for consideration:
 - Intertidal
 - Intertidal to 30 m
 - 30 to 100 m
 - 100 to 200 m
 - 200 m and deeper.
2. The habitats defined in the MLPA implicitly focus on open coast ecosystems and ignore the critical influence of estuaries. California's estuaries contain most of the State's remaining soft bottom and herbaceous wetlands such as salt marshes, sand and mud flats, and eelgrass beds. Ecological communities in estuaries experience unique physical gradients that differ greatly from those in more exposed coastal habitats. They harbor unique suites of species, are highly productive, provide sheltered areas for bird and fish feeding, and are nursery grounds for the young of a wide range of coastal species. Emergent plants filter sediments and nutrients from the watershed, stabilize shorelines, and serve as buffers for flood waters and ocean waves. Given these critical ecological roles and ecosystem functions, estuaries warrant special delineation as a critical California coastal habitat.
3. Three of the habitats defined in the MLPA – rocky reefs, intertidal zones, and kelp forests – are generic habitat descriptions that include distinct habitats that warrant

specific consideration and protection. In the case of rocky reefs and intertidal zones, the type of rock that forms the reef greatly influences the species using the habitat. For example, granitic versus sedimentary rock reefs harbor substantially different ecological assemblages and should not be treated as a single habitat. Similarly, the term kelp forest is a generic term that subsumes two distinct ecological assemblages dominated by different species of kelp. Kelp forests in the southern half of the state are dominated by the giant kelp, *Macrocystis pyrifera*. By contrast, kelp forests in the northern half of the state are dominated by the bull kelp, *Nereocystis luetkeana*. In central California, both types of kelp forests occur. These two types of kelp forests harbor distinct assemblages and should be treated as separate habitats.

4. Habitat definitions in the MLPA should be expanded to include ocean circulation features, because habitat is not simply defined by the substrate. Seawater characteristics are analogous to the climate of habitats on land, and play a critical role in determining the types of species that can thrive in any given setting. Just as features of both the soil and atmosphere characterize habitats on land, features of both the substrate (e.g., rock, sand, mud) and the water that bathes it (e.g., temperature, salinity, nutrients, current speed and direction) characterize habitats in the sea. No one would argue that a sand dune at the beach and a sand dune in the desert are the same habitat. Similarly, rocky reefs in distinct oceanographic settings are different habitats that can differ fundamentally in the species that use the reefs.

The oceanography of the California coastline is dominated by the influence of the California Current System. On the continental shelf and slope this system consists of two primary currents – the California Current, which flows toward the equator, and the California Undercurrent, which flows toward the pole. The undercurrent sometimes occurs beneath the southward flowing California Current. North of Pt. Conception, the undercurrent may outcrop the surface as a nearshore, poleward flowing surface current that is best developed in fall and winter. These currents vary in intensity and location, both seasonally and from year to year.

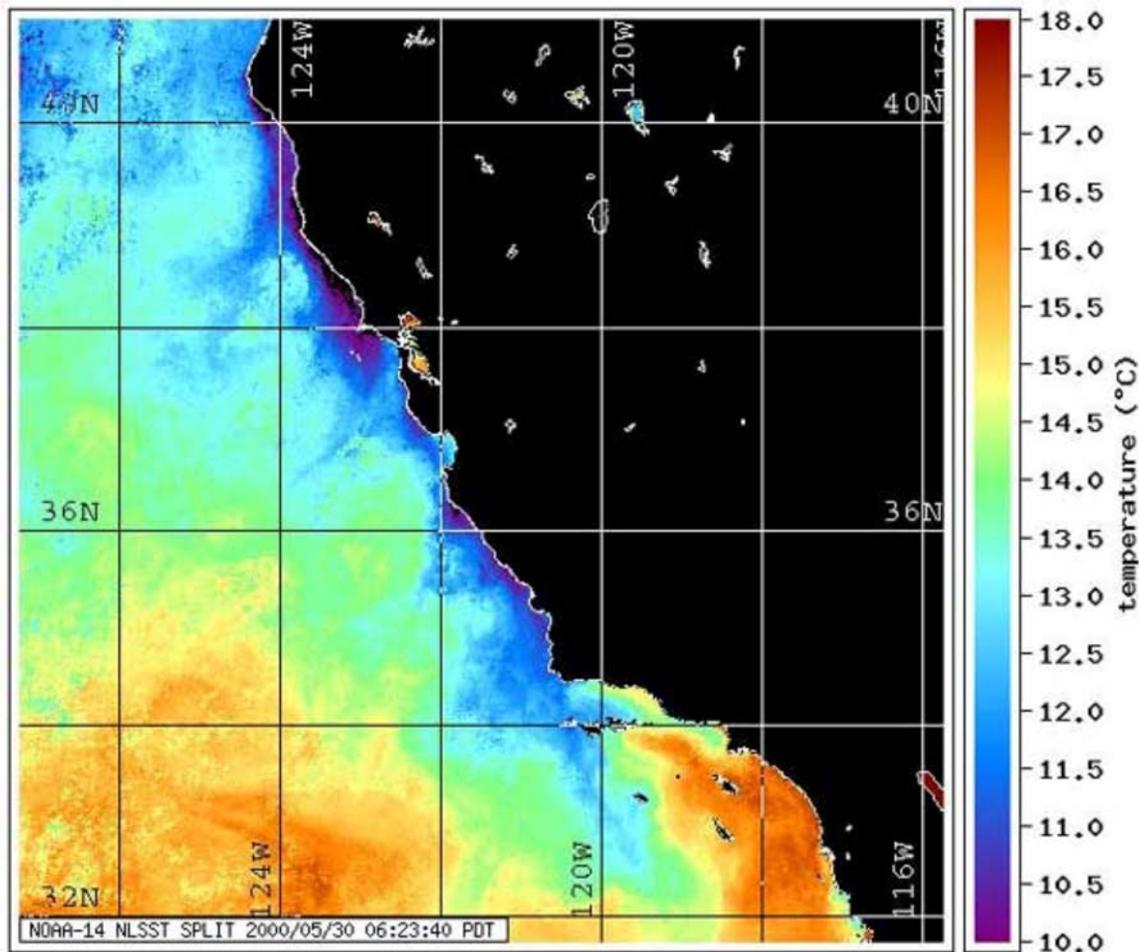
Organisms will also be affected by the circulation induced by tidal currents. For those living in shallow water habitats very close to shore, inshore of the surf zone, the dominant influence on transport of planktonic propagules will be the circulation generated by breaking waves.

As can be seen in a satellite image of ocean temperature along the California coastline (Figure 3), the circulation and physical characteristics of the California Current System are exceedingly complex and variable. This is not the image one would expect if ocean currents were analogous to northward or southward flowing rivers in the sea. Rather, ocean flows are greatly modified by variation in the strength and direction of winds, ocean temperatures and salinity, tides, the topography of the coastline, and the shape of the ocean bottom, among several other factors. The end result is a constantly changing sea of conditions.

The patterns are not completely random, however. Many aspects of ocean climates vary somewhat predictably in space, especially ones that are tied to key features of the coastline – points and headlands, river mouths, etc. Locations that share similar ocean climates are typically more similar in the types of species they harbor. Therefore, defining habitats for the

MLPA and MPA networks must include habitats defined by coastal oceanography as well as the composition of the seafloor.

Figure 3. An example of sea surface temperature in the California coastal waters, May 30, 2000



Although a wide range of oceanographic habitats could be defined for the California coastline, the science advisory team suggests that three prominent habitats stand out because of their demonstrated importance to different suites of coastal species:

- Upwelling centers
- Freshwater plumes
- Retention areas

Upwelling Centers

Upwelling is one of the most biologically important circulation features in the ocean. Upwelling occurs when deep water is brought to the surface. On average deep water is colder and more nutrient rich than surface waters. When upwelling delivers nutrients to the sunlit waters near the surface, it provides the fuel for rapid growth of marine plants, both plankton and seaweeds. Ultimately the added nutrients can energize the productivity of entire marine food webs. Upwelling regions are the most productive ocean ecosystems. The west coast of North America is one of the few major coastal upwelling regions on the entire planet. The major driver of upwelling along the California coastline is wind. Winds that blow from the north parallel to California's generally north-south coastline drive currents at the surface. Because of the complicated effects of friction and the rotation of the earth, surface water is pushed to the right of the direction of the wind (the Coriolis Effect). With winds blowing from the north, this effect pushes surface waters away from shore. As water is pushed offshore, it is replaced by water that is upwelled from below.

The rate of upwelling depends on many features that vary spatially along the coastline – the strength and direction of the wind, the topography of the shoreline, and the shape of the continental shelf are three of the most important. Capes and headlands play a key feature in all of these drivers of upwelling. They accelerate alongshore winds, and they channel coastal currents in such a way that upwelling intensity can increase dramatically in their vicinity. As a result, major headlands and capes from Pt. Conception north are commonly centers of upwelling associated with strong rates of offshore transport of surface waters, greatly elevated nutrient concentrations, and enhanced productivity offshore. Since major capes and headlands tend to be fairly regularly spaced along the California coastline, with an average spacing between 150 and 200 km, these upwelling centers drive cells of ocean circulation with relatively predictable patterns of flow. Enhanced offshore flow emanating from the headlands, versus eddies and locations of more frequent alongshore flow in the regions between headlands. These filaments of upwelled water are readily identified emanating from key headlands in most satellite images of ocean temperature or biomass of phytoplankton. Because the upwelling centers are locations of more frequent and intense offshore flow near the surface, which moves larvae and other plankton away from shore, and elevated nutrients, which fuels much more rapid algal productivity, these locations represent a distinct oceanographically driven coastal habitat with substantially different species composition and dynamics compared to other coastal locations.

Freshwater Plumes

A second coastal habitat driven by features of the water column is generated by the influence of rivers. Freshwater emerging from watersheds alters the physical characteristics of coastal seawater (especially salinity), changes the pattern of circulation (by altering seawater density), and delivers a variety of particles and dissolved elements, such as sediments, nutrients, and microbes. These effects all arise from the land and can have a profound influence on the success of different marine species. The mouths of watersheds set the locations of low salinity plumes, and the size and shape of the plume vary over time as functions of the volume of flow from the watershed, the concentration of particles, and the nature of coastal circulation into which the water is released. The location of California's freshwater plume habitats can be defined by both satellite and ocean-based measurements.

Retention Areas

Since connectivity and movement of larvae, plankton, and nutrients play such an important role in the impact of MPAs on different species, changes in the speed and direction of coastal currents can create very different ecological settings. A number of circulation features can greatly limit the coastal particles. In particular, features characterized by rotational flows, such as eddies, can greatly enhance the length of time that a particle or larval fish stays in a general region of the coastline. Such retentive features have been shown to significantly affect the species composition of coastal ecosystems. Since many retention areas are tied to fixed features of coastal topography (e.g., eddies in the lee of coastal headlands or driven by bottom topography), they define unique regions of coastal habitat that can be predictably defined.

Experience in California and elsewhere demonstrates that individual MPAs generally include several types of habitat in different depth zones, so that the overall number of MPAs required to cover the various habitat types can be smaller than the number of total habitats. The Master Plan Team convened in 2000 also called for considering adjacent lands and habitat types, including seabird and pinniped rookeries. Since marine birds and mammals are protected by federal regulations, they are not a primary focus of the MLPA. Nonetheless, these species can play important ecological roles and their success may be impacted by changes in other components of California's coastal ecosystems that are a primary focus of MLPA. Therefore, MPA planning needs to coordinate with other efforts focused on marine birds and mammals.

As noted regarding the design of MPAs, this guidance should be the starting point for regional discussions regarding representative habitats in a region. Although this guidance is not prescriptive, any significant deviation from it should be explained.

Species Likely to Benefit from MPAs

Recommending the extent of habitat that should be included in an MPA network will require careful analysis and consideration of alternatives. These recommendations may vary with habitat and region, but should be based on the best readily available science. One aspect of determining appropriate levels of habitat coverage is the habitat requirements of species likely to benefit from MPAs in a region. At Fish and Game Code subsection 2856(a)(2)(B), the MLPA requires that the master plan identify "select species or groups of species likely to benefit from MPAs, and the extent of their marine habitat, with special attention to marine breeding and spawning grounds, and available information on oceanographic features, such as current patterns, upwelling zones, and other factors that significantly affect the distribution of those fish or shellfish and their larvae."

The Department of Fish and Game prepared a master list of such species, which appears in Appendix G. This list may serve as a useful starting point for identifying such species in each region during the development of alternative MPA proposals. With the assistance of the science advisory team, the department should develop a list of species specific to each study region of the state, as they are determined, for use by the appropriate regional stakeholder group. This regional list then can assist in evaluating desirable levels of habitat coverage in alternative MPA proposals. Although the statewide list will be all inclusive, it is not likely that all species on the list will benefit from the establishment of new, or the expansion of existing,

MPAs. For example, a species may be in naturally low abundance within this portion of its geographical range.

Geographical Regions

In calling for a statewide network of MPAs, to the extent possible, the MLPA recognizes that the state spans several biogeographical regions, and identified these, initially, as follows [FGC subsection 2852(b)]:

- The area extending south from Point Conception,
- The area between Point Conception and Point Arena, and
- The area extending north from Point Arena.

In the same provision, the MLPA provides authority for the master plan team required by FGC subsection 2855(b)(1) to establish an alternate set of boundaries. The Master Plan Team convened by the Department of Fish and Game in 2000 determined that the three regions identified in the MLPA were not zoogeographic regions; scientists recognize only two zoogeographic regions between Baja California and British Columbia with a boundary at Pt. Conception. Instead of the term “biogeographical region,” the team adopted the term “*marine region*” and identified four *marine regions*:

- North marine region: California-Oregon border to Point Arena (about 210 miles or 183 linear nautical miles of coastline);
- North-central marine region: Point Arena to Point Año Nuevo (about 180 miles or 156 nautical miles of coastline);
- South-central marine region: Point Año Nuevo to Point Conception (about 233 miles or 203 nautical miles of coastline); and
- South marine region: Point Conception to the California-Mexico border, including the islands of the southern California Bight (about 280 miles or 243 nautical miles of coastline).

Three of the above four regions (those north of Pt. Conception) fall within the larger zoogeographic region accepted by scientists. These sub-regions were used more or less as subdivisions of the greater zoogeographic region by the former Master Plan Team. Technically, the requirement of replicate state marine reserves encompassing a representative variety of habitat types and depths would only apply to the two recognized zoogeographic regions within the state. However, based on the concept of a network of MPAs, in whatever way it is defined, and the fact that it would likely require unusually and unacceptably large state marine reserves to incorporate a wide variety of habitat types if only two (the minimum definition of “replicate”) state marine reserves were established in each zoogeographic region, it is likely that a statewide network will contain more than two state marine reserves in each biogeographic region.

MPAs in different biogeographic regions will affect different suites of species. Hence, the rationale for considering replication and network design separately for relatively distinct stretches of coastline. Biogeographic regions can be distinguished based upon data of two

types: 1) the location of species' borders along the coastline; and 2) surveys of species' distribution and abundance. Historically, the locations of species' borders, i.e., places where multiple species terminate their ranges, have been used to define biogeographical regions or provinces. However, regional boundaries typically are set by only small subset of the species distributed up and down coast from these "breakpoints".

The abundances and diversity of species at locations along the coast are much more reflective of differences in biological communities and provide the best evidence of biologically distinct regions from both structural and functional standpoints. Historically, such data on abundance and biological diversity have not been available at enough locations along most coastlines for broad scale, geographic analyses. As a result, definitions of biogeographic regions have been forced to rely on a less meaningful measure of biological differences – the location of species' borders.

Biogeographers have divided all major oceans into large *biogeographic provinces*. California's coastline spans two of these large-scale provinces – the Oregonian and the Californian Provinces – with a boundary in the vicinity of Point Conception. This prominent biogeographic boundary has been recognized for more than half a century. More detailed analyses of species' borders also have led to the identification of regional scale boundaries between biogeographical sub-provinces.

Biogeographers commonly have used distributional data for subgroups of taxonomically related species (e.g., snails, seaweeds, or fish) to set biogeographical boundaries; interestingly, the boundaries for sub-provinces often differ among taxonomic groups because different types of species respond to different physical and biological characteristics in different ways (Airamé *et al.* 2003). Two locations, however, emerge as prominent boundaries for key coastal species. Seaweeds, intertidal invertebrates, and nearshore fishes have comparable numbers of species' borders in the vicinity of Monterey Bay as they do at Point Conception. In addition, coastal fishes have an important sub-province boundary at Cape Mendocino.

Scientific data do not support a significant biological break between biogeographic regions at Point Arena, as identified in earlier MLPA documents. Therefore, on the basis of the distribution of species' borders for key coastal species groups, there are three biogeographic regional boundaries and four regions along the California coast:

1. The Mexican border to Pt. Conception,
2. Point Conception to Monterey Bay,
3. Monterey Bay to Cape Mendocino, and
4. Cape Mendocino to the Oregon border.

In the past decade, detailed data have become available on species abundances and diversity from a large number of locations along California's coast. This wealth of information on actual species assemblages now provides the opportunity to define biogeographic regions on the basis of actual ecosystem compositions, rather than the presumed composition of ecosystems inferred from species' borders. These ecosystem-based data are a better scientific fit with the goals of the MLPA. Summaries of species abundance and diversity data, especially for shallow water species (<30 m depth), suggest that there are four points of transition along the

California coastline that demarcate distinct marine assemblages: Point Conception, Monterey Bay, San Francisco Bay, and Cape Mendocino.

Three of these locations are identical to those defined above solely on the basis of species' borders for prominent groups. The new boundary that emerges from abundance and biodiversity data is San Francisco Bay. The region between Monterey Bay and Cape Mendocino has two distinct biological assemblages on coastal reefs even though this is not a region characterized by large numbers of species' borders. The difference in assemblages on either side of San Francisco Bay appears to be caused by changes in the types of rock that form nearshore reefs. Since the type of rock is used to defined bottom habitats for MPA designation, this transition in species composition could be addressed in MPA designs using habitat considerations or, alternatively by designating the Monterey Bay to San Francisco Bay segment as a distinct biogeographic region.

Based on this review, there are four possible definitions of the biogeographic regions that will serve as the basic structure of the statewide network of MPAs. These options are as follows:

- 1) The three biogeographic regions defined in the MLPA;
- 2) The two *biogeographic provinces* recognized by many scientists with a boundary at Point Conception;
- 3) The four *marine regions* identified by the former Master Plan Team, with boundaries at Pt. Conception, Pt. Año Nuevo, and Pt. Arena; and
- 4) The biogeographic regions recognized by scientists who have identified borders based on species distributional patterns or on abundance and diversity data with boundaries at Pt. Conception, Monterey Bay and/or San Francisco Bay, and Cape Mendocino.

Accepting the strong scientific consensus of a major biogeographic break at Point Conception, the MLPA Blue Ribbon Task Force confirms that two biogeographic regions exist along the California Coast for purposes of implementation of the Marine Life Protection Act. The more refined information on other breaks will be useful in designating study regions and in designing networks of MPAs.

Types of MPAs

The MLPA recognizes the role of different types of MPAs in achieving the objectives of the Marine Life Protection Program [FGC subsection 2853(c)]. While the MLPA does not define the different types, the Marine Managed Areas Improvement Act (MMAIA) does define state marine reserve, state marine park, and state marine conservation area. (See Appendix B for the text of the MMAIA as amended.)

Besides somewhat different purposes, which are described below, each type of MPA represents a different level of restriction on activities within MPA boundaries. These restrictions and purposes suggest how each designation can be used effectively in a network of MPAs.

State Marine Reserve

As defined in the MMAIA, a state marine reserve prohibits injuring, damaging, taking or possessing any living, geological, or cultural resources and must maintain the area “to the extent practicable in an undisturbed and unpolluted state” while allowing “managed enjoyment and study” by the public [PRC subsection 36710(a)]. The responsible agency may permit research, restoration, or monitoring. Such activities as boating, diving, research, and education may be allowed, to the extent feasible, so long as the area is maintained “to the extent practicable in an undisturbed and unpolluted state.” Such activities may be restricted to protect marine resources. It specifically allows the agency to permit scientific activities. The definition of “marine life reserve” in the MLPA is consistent with this definition.

The MLPA and MMAIA thus require striking a balance between protection and access in marine reserves. The form that this balance takes in an individual marine reserve will depend upon the goals and objectives of that reserve. While the MLPA specifically precludes commercial and recreational fishing from marine reserves, it also authorizes restrictions on other activities, including non-extractive activities such as diving, kayaking, snorkeling, or some types of mariculture. Any such restrictions, however, must be based on specific objectives for an individual site and the best readily available science. It is important to note that this statement does not imply that navigation will necessarily be restricted though MPAs, or that other non-extractive activities will be regulated, although in some instances the latter may be necessary. For example, it may necessary to protect populations of sensitive marine birds or mammals in their nesting or breeding areas by prohibiting access to some areas.

The MLPA sets other requirements for the use of marine reserves. At FGC subsection 2857(c)(3), the MLPA requires “[s]imilar types of marine habitats and communities shall be replicated, to the extent possible, in more than one marine life reserve in each biogeographical region.” Consistent with this approach, this Master Plan Framework foresees that in each biogeographic region described above, all habitat types and depth zones must be represented in at least two marine reserves in order to assure the replication of habitats required by the MLPA. It should be noted that several of habitat types occur in only one depth zone, while others may occur in three or four depth zones. Experience demonstrates that individual MPAs generally include several types of habitat in different depth zones, so the overall number of marine reserves required to replicate the various habitat types may be less than the total combination of depth zones and habitats replicated across each region.

State Marine Park

As defined in the MMAIA, a state marine park prohibits injuring, damaging, taking or possessing for commercial use any living or nonliving marine resources. Other uses that would compromise the protection of living resources, habitat, geological, cultural, or recreational features may be restricted. All other uses are allowed, consistent with protecting resources.

State marine parks, hereafter called “marine parks”, differ from marine reserves to different degrees in their purposes as well as the type of restrictions. Unlike marine reserves, marine parks allow some or all types of recreational fishing. The types of restrictions on fishing may vary with the focal species, habitats, and goals and objectives of an individual marine park

within a region. Where the primary goal is biodiversity conservation, restrictions on fishing may be different from those in a marine park where the primary goal is enhancing recreational opportunities.

State Marine Conservation Area

In a state marine conservation area, activities that would compromise the protection of species of interest, the natural community⁴, habitat, or geological features may be restricted. Research, education, and recreational activities, as well as commercial and recreation catches may be permitted.

State marine conservation areas, hereafter called “marine conservation areas”, also differ from marine reserves in their purpose as well as the type of restrictions. This type of MPA allows some level of recreational and/or commercial fishing. The restrictions on fishing may vary with the focal species, habitats, and goals and objectives of an individual MPA within a region, and may, for instance, be in the form of restrictions on the catch of particular species or on the use of certain types of fishing gear. Marine conservation areas may be useful in protecting more sedentary, benthic species, while allowing the harvest of migratory or pelagic species. Another use of a marine conservation area would be to allow the continued use of traps with low bycatch rates while prohibiting the harvest of species of concern by hook-and-line or trawl that may have higher bycatch rates. At present the large fishery closures known as the Cowcod Conservation Areas and the Rockfish Conservation Area may function as *de facto* marine conservation areas in that bottom fishing for finfishes is prohibited but other types of fishing are allowed, though the specific regulations in these areas are subject to change dependent on stock assessments.

Combined use of marine reserves, marine parks and marine conservation areas

The combination of the use of marine reserves, marine parks and marine conservation areas has an especially valuable role to play in designing a network that accommodates a spectrum of uses (NRC 2001; Salm et al. 2000). In the design of MPAs, plans that use all three types of MPAs may allow separation of incompatible uses (NRC 2001). For instance, a marine reserve could be buffered with a marine park in which some types of recreational fishing are regulated but allowed or with a marine conservation area where limited recreation and commercial fishing are allowed. The buffer zone can separate non-MPA areas and MPAs by a limited use area which can allow the full benefit of spillover to be realized.

This approach may, however, prove to be problematic relative to the enforcement and public understanding of different regulations within contiguous areas. Confusing differences in regulations in a small spatial area can lead to unintentional infractions and a degradation of the function of the MPA. Care must be taken to ensure that regulations are understandable and observed by the public and enforced as necessary.

⁴ Natural community is defined in Fish and Game Code section 2702(d) as a distinct, identifiable, and recurring association of plants and animals that are ecologically interrelated.

Setting Goals and Objectives for MPAs

Whether MPAs within a region are reserves, parks, or conservation areas, or some combination of the above, the MLPA specifies that all MPAs have certain features. First, the MLPA requires that the MLPP and each MPA in the preferred alternative have specific identified objectives (FGC subsections 2853[c](2) and 2857[c](1)). FGC subsection 2857(c)1 states: “[I]ndividual MPAs may serve varied primary purposes while collectively achieving the overall goals and guidelines of this chapter.” The MLPA provides some options for what these objectives are. At FGC subsection 2857(b), the MLPA states that the preferred alternative may include MPAs that will achieve either or both of the following objectives:

- (1) Protection of habitat by prohibiting potentially damaging fishing practices or other activities that upset the natural ecological functions of the area.
- (2) Enhancement of a particular species or group of species, by prohibiting or restricting fishing for that species or group within the MPA boundary.

It is important to note that it is damaging fishing practices, not fishing per se, that is addressed in the first objective, and that both the first and second objectives may be achieved outside of the MPLA itself, as a result of other regulatory processes. The California Ocean Protection Act provides a framework for identifying opportunities to meet the objectives of the MLPA through the actions of other state agencies.

Setting goals and objectives for a region and for individual MPAs within a region will be a critical step in developing meaningful alternatives for a statewide MPA network and assembling a recommended network of MPAs, and in the design of monitoring and evaluation. Assembling and evaluating available information on the biological, oceanographic, socioeconomic and governance features of a region, including existing MPAs, and other closures implemented through fishery management regulations, and also including non-fishing impacts, should precede setting regional goals and objectives. Similarly, setting regional goals and objectives should precede setting goals and objectives for individual MPAs as well as designing boundaries and management measures for individual MPAs. Importantly, the process of establishing regional goals and objectives must include stakeholder involvement in the analysis and decision-making process.

Once set, goals and objectives will influence crucial design decisions regarding size, location, and boundaries. For instance, a marine reserve whose primary goal is protection of biological diversity may well have a different configuration than a marine reserve whose goal is enhancement of depleted fisheries (Nowlis and Friedlander 2004).

There are a variety of techniques for setting goals and objectives. No one technique is likely to suit the diverse situations in all regions. Deciding upon a process for setting goals and objectives should be an early focus for regional discussions. In fashioning goals, the following characteristics should be kept in mind (Pomeroy et al. 2004).

A goal is a broad statement of intent that is:

- Brief and clearly defines the desired long-term vision and/or condition that will result from effective management of the MPA;
- Typically phrased as a broad mission statement; and
- Simple to understand and communicate.

An objective is a more specific measurable statement of what must be accomplished to attain a goal. Usually, attaining a goal requires accomplishing two or more objectives. Useful objectives have the following features:

- Specific and easily understood;
- Written in terms of what will be accomplished, not how to go about it;
- Realistically achievable;
- Defined within a limited time period; and
- Can be measured and validated.

In developing regional goals and objectives, attention should be paid to other complementary programs. For instance, like the MLPA, the Marine Life Management Act (MLMA) takes an ecosystem-based approach to management. The Nearshore Fishery Management Plan (NFMP) required by the MLMA identified MPAs as an important tool in achieving its goals and objectives. While the NFMP deferred to the MLPA process in designing and establishing networks of MPAs, it also identified key features of MPA networks that would contribute to the goals and objectives of the NFMP and the MLMA. Other fishery management plans should be reviewed for similar linkages. The features that MPAs should include in order to fulfill the goals of the NFMP are (from NFMP, Section 1, Chapter 3):

- Restrict take in any MPA [intended to meet the NFMP goals] so that the directed fishing or significant bycatch of the 19 NFMP species is prohibited
- Include some areas that have been productive fishing grounds for the 19 NFMP species in the past but are no longer heavily used by the fishery
- Include some areas known to enhance distribution or retain larvae of NFMP species
- Consist of an area large enough to address biological characteristics such as movement patterns and home range. There is an expectation that some portion of NFMP stocks will spend the majority of their life cycle within the boundaries of the MPA
- Consist of areas that replicate various habitat types within each region including areas that exhibit representative productivity

Once developed, regional goals and objectives can be matched with the goals of the different types of MPAs, as defined by the Marine Managed Areas Improvement Act (MMAIA) at PRC Section 36700 and in the MLPA. The MMAIA defines the goals for the three types of MPAs as shown in Table 2.

Table 2: Marine Protected Area Goals

Purpose	State Marine Reserve	State Marine Park	State Marine Conservation Area
Protect or restore rare, threatened, or endangered native plants, animals, or habitats in marine areas.	X		X
Protect or restore outstanding, representative, or imperiled marine species, communities, habitats, and ecosystems.	X	X	X
Protect or restore diverse marine gene pools.	X		X
Contribute to the understanding and management of marine resources and ecosystems by providing the opportunity for scientific research in outstanding, representative, or imperiled marine habitats or ecosystems.	X	X	X
Provide opportunities for spiritual, scientific, educational, and recreational opportunities		X	
Preserve cultural objects of historical, archaeological, and scientific interest in marine areas.		X	
Preserve outstanding or unique geological features.		X	X
Provide for sustainable living marine resource harvest.			X

Although the MLPA does not identify specific goals and objectives for marine parks and marine conservation areas, it does identify possible functions, which may be considered as goals, for marine reserves. At FGC subsection 2851(f), the MLPA says that marine reserves:

- protect habitat and ecosystems,
- conserve biological diversity,
- provide a sanctuary for fish and other sea life,
- enhance recreational and educational opportunities,
- provide a reference point against which scientists can measure changes elsewhere in the marine environment, and
- may help rebuild depleted fisheries.

Some or all of these functions may apply to any particular marine park or marine conservation area. For example, a conservation area which allows fishing for salmon and pelagic species

could address bullets 1-3 and 5-6 by protecting all benthic species. A marine park could address bullet 4 as well as bullet 5.

As mentioned above, the MLPA recognizes that individual MPAs may have several goals and objectives, such as protection of biological diversity and enhancement of recreational opportunities. In these instances, special care should be taken in designing management measures, such as restrictions as well as data collection and monitoring, which will maximize the different objectives and quantify whether different objectives are being met.

Enforcement and Public Awareness Considerations in Setting Boundaries

Regardless of the amount of enforcement funding, personnel or equipment available the enforceability and public acceptance and understanding of marine protected areas will be enhanced if a number of criteria are considered during design and siting. While the complexities of the California coastline and locations and distributions of protected habitats and resources make using the same criteria at each location difficult, an effort should be made to include as many of these considerations as possible.

Marine protected area boundaries should be clear, well-marked, recognizable, measurable and enforceable. Selecting known, easily recognizable landmarks or shoreline features, where possible, as starting points for marine protected area boundaries will provide a common, easily referenced understanding of those boundaries. In general, marine protected area boundaries should be straight lines that follow whole number North-South and East-West coordinates wherever possible. Likewise, any offshore corners or boundary lines should be located at easily determined coordinates. This is especially true if installation and maintenance of boundary marker buoys is not cost effective or feasible. Using depth contours or distances from shore as boundary designations should be avoided, if possible, due to ambiguities in determining exact depths and distances. However, in some cases, depth boundaries may be not only unavoidable but desirable. Many of California's existing MPAs in ocean waters use depth as the offshore boundary. This is a practical concession based on the use by divers who possess depth gauges but no other navigational aids. In the case of a proposed intertidal MPA, for example, depth would be the only practical alternative for an offshore boundary.

There are benefits and disadvantages to siting marine protected areas in locations that are accessible and/or observable, either from the shore or the water. On one hand they can increase the likelihood that potential illegal activities will be observed and reported, thereby discouraging such activities because they might be observed and increase public awareness of the MPA.

Conversely, MPAs sited in areas that are very easily accessed will naturally have higher potential for illegal activities to occur. Additionally, these areas will have the highest level of conflict with existing uses. Siting MPAs in areas close to harbors may raise issues of safety and convenience by requiring extractive users to travel farther to areas open to fishing could be problematic. Siting must be balanced between the ease of enforcement and monitoring and the potential for infractions to occur. If enforceable alternative areas are available farther from easy access points, they should be considered.

Siting marine protected areas within, or near, locations under special management (national marine sanctuaries and parks, state and local parks and beaches, research facilities, museums and aquaria, etc) may provide an added layer of enforcement, observation and public awareness. This is especially true if there are shore-side facilities and personnel based at the site.

Information Supporting the Design of MPAs

Throughout the development of alternative proposals for MPAs, an emphasis must be placed upon using the best readily available science, as required at FGC subsection 2855(a). The MLPA does not require complete or comprehensive science, but rather the level of science that is practicable.

Baseline data needs for MPAs should be drafted for inclusion in the regional profile and MPA management plan described elsewhere in the master plan framework. Examples of such needs are:

- Status of recreational, commercial, and other marine resources in the region;
- Status of species in need of restoration;
- Analysis of consumptive and non-consumptive activities affecting living marine resources in the region, including commercial and recreational fishing, diving, point and non-point discharges, among others;
- Analysis of existing management and regulations;
- Geographical patterns of extractive and non-extractive uses;
- Economic contribution of ocean-dependent activities to local and regional economies.

This process should also draw upon the knowledge, values, and expertise of local communities and other interested parties. At FGC subsection 2855(c)(1)-(2), the MLPA specifically requires that local communities and interested parties be consulted regarding:

- (1) Practical information on the marine environment and the relevant history of fishing and other resources use, areas where fishing is currently prohibited, and water pollution in the state's coastal waters.
- (2) Socioeconomic and environmental impacts of various alternatives.

Understanding the distribution, magnitude, and spatial extent of economic activities and values is important in the design of marine protected areas. Marine protection can both positively and negatively impact the level and sustainability of economic values, taxes and employment. Within each region a varying level of data will exist for determining these values. Additionally, stakeholder groups in each region will help provide informal data on the value of resources in their area. More information on social science tools and methods can be found in Appendix E. The regional MPA process should make every effort to assemble socioeconomic information early and to apply it in the design and evaluation of MPAs.

Other Programs and Activities Other Than Fishing

Regional profiles and profiles of potential MPAs should describe current and anticipated human activities that may affect representative habitats and focal species. Water quality and marine habitats, especially in estuarine areas, may be degraded by any of a wide range of activities (Sheehan and Tasto 2001). For instance, water quality may be undermined by point source discharges from pulp mills, sewage treatment plants, manufacturing facilities, as well as by nonpoint source discharges from agriculture, urban areas, forestry, marinas and boating, mine drainage, on-site sewage systems, and by modification of river flows. Water quality and habitats may be directly affected by dredging and the disposal of dredge spoil, and by catastrophic spills of oil or other substances.

A profile should discuss whether any such non-fishing activities are significantly affecting wildlife or habitats of concern in a potential MPA site. Where the effects of any such activities present a clear threat to resources of concern, a profile should identify current efforts to mitigate those threats. Federal, state, county, and local government agencies carry out a diverse array of programs to manage such activities (Sheehan and Tasto 2001). The Governor's ocean action plan includes a useful survey of such programs (CRA and CEPA 2004). If warranted, a proposal for an MPA may include recommendations to appropriate agencies for reducing impacts of activities that are likely to prevent an MPA from achieving its goals and objectives. Generally, such recommendations should also be referred to California Ocean Protection Council since the California Ocean Protection Act of 2004 created that body to promote coordination of ocean protection efforts across agencies. The council is ideally positioned to insure that MPAs established under the MLPA benefit from the programs and capabilities of agencies with responsibilities beyond those of the Department of Fish and Game.

One significant aspect of the MLPA is its intent to comprehensively identify:

- areas in the ocean uniquely worthy of being reserved for their specific or intrinsic value,
- areas that need the additional protections and attention that may come with being designated as an MPA,
- habitats and species that should be protected within MPAs in each region of the state, and
- areas of the ocean that should be reserved for specific uses.

The MLPA depicts the legislature's intent to make California's existing array of MPAs function as a network. It focuses on sustaining healthy marine ecosystems for their long-term values.

One purpose of the council established by the California Ocean Protection Act of 2004 (COPA) is to coordinate the activities of state agencies related to the protection and conservation of the coastal waters and ocean ecosystems to improve effectiveness of all these efforts within limited resources. COPA and the Council may serve as the vehicle for addressing non-fishing impacts that are not under the regulatory authority of the Fish and Game Commission.

Efforts are being undertaken by many state and federal agencies that contribute to and support the overall goals of the MLPA. These efforts include the following:

- the Department of Fish and Game's work to implement the Marine Life Management Act with its broader ecosystem considerations in fishery management;
- the State Water Resources Control Board recent updates to its California Ocean Plan to ensure that it establishes appropriate water quality standards and lays out a workable implementation plan;
- the work of the California Coastal Commission in monitoring local coastal programs, establishing a Critical Coastal Areas Program, permitting coastal development, and ensuring coastal zone access;
- the Resource Agency and California Environmental Protection Agency in their agreement to strengthen an MOU regarding watershed planning to give renewed support to collaborative efforts to ensure land-based activities avoid harming the marine environment in general, and bays and estuaries in particular,
- the National Marine Sanctuary Program's sponsorship of research and community discussions regarding special marine protected areas in the Monterey Bay National Marine Sanctuary.

Likewise, there are numerous similar efforts being undertaken by federal agencies including the Water Quality Protection Program of the Monterey Bay National Marine Sanctuary; the Army Corps of Engineers, Coastal Sediment Management Master Plan; and the continuing efforts of NOAA Fisheries to confront ocean impacts derived from upstream pollution, sand and gravel mining, over-drafting water rights, and invasive species.

While not all of these programs will have a significant effect on regional implementation of the MLPA and the designation of MPAs, coordination of the regional planning efforts will help identify ways that various efforts can be integrated and made supplementary to each other to avoid overlap and conflict. Identifying goals for individual MPAs and a network of MPAs in the context of the goals and objectives of these other agencies and programs will help ensure consistency. Management, research, and monitoring plans for MPAs should also be coordinated with these other agencies and programs to increase the likelihood that MPAs will successfully meet the MLPA goals for the least cost and disruption to the public benefits derived from the ocean.

Section 4. Management

Without effective management, MPAs and MPA networks become “paper parks,” and their goals, objectives, and benefits are not achieved (Kelleher et al. 1995). As a result, the array of MPAs creates the illusion of protection while falling far short of its potential to protect and conserve living marine life and habitat “[FGC Section 2851(a)]. In several passages, the MLPA requires that California's MPAs have effective management measures [FGC subsection 2853(b)(5); 2853(c)(2); 2856(a)(2)(H) and (K)].

The initial focus for meeting the management requirements of the MLPA should be the preparation of a management plan for MPAs in each region. An outline that may serve as the basis for a regional MPA management plan may be found in Appendix K. Besides generally guiding day-to-day management, research, education, enforcement, monitoring, and budgeting, a management plan also distills the reasoning for key elements of the network that should be monitored, evaluated, and revised in response to new information and experience. Much of the material required to complete a management plan will be developed in the course of designing, evaluating, and establishing a regional proposal. Some elements of management, such as monitoring and evaluation, enforcement, and financing, are described in more detail in other areas of this document.

Management plans should not dwell upon detail, but should provide a foundation for developing more specific action plans, as necessary, and for adapting management measures to new information. Management plans should include a schedule for review and possible revision at least every five years, and a mechanism for revisions in the interim in response to significant events, such as unexpected monitoring results, budget shifts, or changes in the status of the populations of focal species or of habitats or in the character or effectiveness of management outside individual MPAs.

A management plan should describe the allocation of responsibility to various government agencies and non-government organizations and industry groups for carrying out specific management activities including those partnerships that could result in more effective and economical management of the MPA. While the California Department of Fish and Game, and in some circumstances the California Department of Parks and Recreation, exercise primary authority for the management of California's MPAs, these agencies can draw upon the capacity of other agencies and organizations in carrying out critical management activities. MPAs located adjacent to facilities such as marine labs, onshore protected areas, or similar such institutions may be effectively co-managed by those entities.

In meeting needs for research, monitoring, enforcement, and public education activities, MPA proposals should look to collaboration with other agencies and non-governmental groups. An example is the Department of Fish and Game's collaboration with the Channel Island's National Marine Sanctuary and the National Park Service at the MPAs established in 2003 around the Channel Islands. In some cases, such collaboration will benefit from a formal memorandum of understanding, while in other cases collaboration can be most effectively pursued at more informal levels.

Another example of government partnerships is the California Coastal Commission and State Water Resources Control Board's critical coastal areas partnership (for more information see <http://www.coastal.ca.gov/nps/cca-nps.html>). California's Critical Coastal Areas (CCA) Program is an innovative program to foster collaboration among local stakeholders and government agencies, to better coordinate resources and focus efforts on coastal-zone watershed areas in critical need of protection from polluted runoff. A CCA Committee is focusing its efforts on preventing runoff into sensitive and important marine habitats, in particular areas of special biological significance. This program is a good example of a coordinated effort to link land and sea.

In addition, collaboration with non-governmental organizations, including non-profit conservation and education organizations, yacht clubs, and fishermen's or recreational divers' groups, can enhance implementation of important management activities, such as education, research, and monitoring. At the Monterey Bay National Marine Sanctuary, for instance, the Citizen Watershed Monitoring Network, a volunteer-based group, conducts monitoring according to U.S. Environmental Protection Agency standards. While this data is voluntarily collected and therefore may not be used for enforcement purposes, it does provide several benefits to the sanctuary, which would otherwise not have the staff or funding to support such data collection.

Stakeholder advisory committees should continue to play a role in the management of MPAs in a region after completion of the design process, although other methods for engaging the public may be used. The management plan for a regional MPA proposal should provide for continuing engagement of stakeholders through a regional advisory committee or other means (Salm et al. 2000). Some form of state-wide MPA advisory committee may also serve a valuable function to help ensure a continuing linkage between public and governmental participants as the MLPA is implemented throughout the state. Such committees can fulfill a number of important roles, such as those stated in the recent National Report of the National Marine Sanctuary Program's Advisory Councils (NMSP 2004):

- Serve as a link between an MPA and its community, disseminating information about the MPA to the various constituencies of members and bringing the concerns of constituents and the public to sanctuary staff;
- Assist in creating a dialogue to examine various sides of an issue and a place for mediation;
- Identify potential partners and constituent groups with which the MPA should be working and forge relationships;
- Review and provide input on plans, proposals, and products, including prioritizing issues;
- Provide technical and background information on issues facing the MPA; and
- Validate the accuracy and quality of information used for decision making.

Key issues in convening an effective advisory committee include size and structure, such as whether to convene an overall committee within which sub-groups of the committee or working groups of non-committee members operate. As is the case with stakeholder committees advising on the design and evaluation of proposed MPAs, the charter of the

stakeholder committees convened after establishment of MPAs must be clear. The role of such committees may range from simply advising the Department of Fish and Game to conducting specific management tasks under the general guidance of the department (Pomeroy and Goetze 2003). In any event, the establishment and possible roles of such standing committees should be discussed in a draft management plan, so that they can be considered by the department and Fish and Game Commission.

Section 5. Enforcement

The MLPA identified the lack of enforcement as one of the chief deficiencies in California's existing MPAs (FGC Section 2851[a]). To remedy this deficiency, the MLPA requires that the Marine Life Protection Program provide for adequate enforcement [FGC Section 2853(b)(5)] and include enforcement measures for all MPAs in the system [FGC Section 2853(c)(2)].

This section of the master plan framework addresses these requirements by responding to two requirements for the master plan identified at FGC Section 2856(a)(2):

- (I) Recommendations for management and enforcement measures for the preferred alternative that apply system wide or to specific types of sites and that would achieve the goals of this chapter.
- (J) Recommendations for improving the effectiveness of enforcement practices, including, to the extent practicable, the increased use of advanced technology surveillance systems.

Any new, modified or existing marine protected areas will only be effective if their regulations are widely accepted, understood and adhered to by the public. To that end, the first requirement of effective enforcement of restrictions in the network of marine protected areas is solicit the input and participation of stakeholders in the first stages of MPA design. Where possible, it will also be important to enlist user communities in protecting the designated protected areas. In some contexts, such as specialized fisheries or recreational fishermen allowed access to marine conservation areas and/or parks, or non-consumptive users allowed access to marine reserves, enlisting those users in enforcement of their protected status will be important.

The Department of Fish and Game's enforcement staff is charged with enforcing marine resource management laws and regulations over an area encompassing approximately 1,100 miles of coastline and out to sea for 200 miles. The department currently deploys 50 law enforcement officers statewide (still well below the staffing level of the 1980's) who focus on the marine environment. Of these 50 officers, 21 are dedicated to on-water patrols utilizing patrol vessels as enforcement platforms. The department has two 65-foot patrol vessels, five new 54-foot vessels and two 40-foot vessels, all of which can patrol wide areas including offshore waters and islands. These large patrol vessels are equipped with 18-foot rigid hull inflatable skiffs. The department also has 21 skiffs (13-32 feet) for local patrols. Patrol vessels and skiffs are strategically stationed at various ports and other locations to provide the most effective coverage of California's marine waters. The department also maintains patrol aircraft that are available when needed to assist with marine enforcement activities.

The department shares jurisdiction for the Magnuson Fishery Conservation and Management Act, the Endangered Species Act, and the Lacey Act, all of which apply to resources residing within or transiting through the MPAs. How effectively these laws are enforced within and around the MPAs will affect the success of MPA management in conserving and protecting the resources. The department's enforcement program also works closely with the enforcement programs of a number of other governmental agencies (California Department of Parks and Recreation, NOAA Fisheries, National Marine Sanctuary Program, National Park Service, U.S.

Coast Guard, local harbor patrols and local police and sheriffs departments) on matters of mutual enforcement interest. During the regional MPA planning process the enforcement resources available in that area and any gaps or limitations to effective enforcement in that area will be identified. This will not only make planning for MPAs in the region more realistic, but also provide a basis for seeking more enforcement resources, if needed.

Enforcement of current marine protected area regulations is one of many responsibilities for the department's enforcement program. A new system of marine protected areas is likely to require additional enforcement effort; however, it is uncertain whether significant new sources of funding, personnel and equipment will be available to provide dedicated enforcement for those areas. If additional resources become available, they will most likely provide for increased attention to marine protected areas as part of the overall marine resources enforcement effort.

Marine Protected Area Enforcement Requirements

The law enforcement program is an essential component of resource protection within MPAs. A goal of MPA enforcement is to prevent adverse resource impacts. This preventive enforcement is best achieved by maintaining sufficient patrol presence within the MPAs to deter violations of the law. Successful enforcement relies on frequent on-water patrols and routine vessel boarding inspections. On-water patrols will ensure that users of the MPAs are familiar with the regulations and deter willful or inadvertent violations and/or emergencies.

Officers working within the MPAs should practice *interpretive enforcement*. This style of enforcement seeks voluntary compliance primarily through education of users. Interpretive law enforcement emphasizes informing the public through educational messages, literature and other programs about responsible behavior, before the resources in the MPAs are adversely impacted. For example, officers working within MPAs talk with users and distribute brochures in the field. These contacts allow officers to make direct, informative encounters with visitors, while conducting routine enforcement activity. Officers should also conduct interpretive programs throughout the local communities.

Federal, state and local agencies are increasingly joining forces and targeting whole coastal ecosystems including rivers, bays, estuaries and coastlines for comprehensive management and enforcement actions. Federal, state and local laws provide government with a variety of tools to protect coastal resources. In so doing, these laws strengthen law enforcement capabilities by allowing agencies to build on each other's expertise and share physical resources. This example can readily be seen in the cooperative enforcement efforts in the Channel Island Marine Protected Areas Network. In addition, local residents and frequent MPA users can help by detecting and reporting various violations and groundings. Table 3 lists the various assets available for enforcement of natural resource laws and regulations in California.

Table 3. Natural Resource Enforcement Assets in California

Agency	Assets and Activities
<i>U.S. Coast Guard</i>	The U.S. Coast Guard has a primary role in protecting natural resources under the Oil Pollution Act of 1990, the Rivers and Harbors Act of 1899, and the Marine Plastic Pollution and Control Act. The U.S. Coast Guard works directly with the Department of Fish and Game's Office of Spill Prevention and Response (OSPR) on oil pollution incidents.
<i>U.S. Fish and Wildlife Service</i>	U.S. Fish and Wildlife Service agents and officers have the statutory authority to enforce the Marine Mammal Protection Act, Endangered Species Act and Lacey Act.
<i>NOAA Fisheries</i>	The Department of Fish and Game has a Joint Enforcement Agreement with NOAA Fisheries. NOAA Fisheries provides funding to the state to enforce federal regulations in state waters, federal offshore waters and in bays, estuaries, rivers and streams.
<i>National Marine Sanctuaries</i>	Currently, there are several sanctuary officers within the central coast area, patrolling both the Monterey Bay and the Channel Islands National Marine sanctuaries. Boats and aircraft available for law enforcement patrols. Law enforcement agreements coordinate enforcement efforts, share physical resources, cross deputize state officers and provide federal funds for state operations.
<i>National Park Service</i>	The National Park Service has enforcement personnel stationed at various federal parks along the California coast and at some of the off-shore islands.
<i>California Department of Fish and Game</i>	Seven large patrol boats and over twenty smaller craft dedicated to marine patrol efforts. One large patrol boat dedicated to the Channel Islands Marine Protected Areas law enforcement patrols. Two other large patrol boats are within the central coast area.
<i>California Department of Parks and Recreation</i>	The Department of Parks and Recreation has law enforcement personnel stationed in park units throughout California, many with on water patrol capability. These officers have the authority to enforce Fish and Game statutes.
<i>Harbor Police, City Police, and Sheriffs</i>	Local harbor districts, sheriff and police departments often employ peace officers to conduct on-water patrols within their jurisdictions.

Enforcement Program Objectives

Agreements/cooperative efforts

- Strengthen and develop partnerships with other agencies
- Develop partnerships with federal, state and local agencies in order to provide strong enforcement presence throughout the MPAs
- Maintain an active relationship with federal, state and local enforcement agencies to identify areas of mutual concern, and to develop cooperative responses to enforcement issues

- Develop and maintain an active relationship with stakeholders
- Explore cooperative relationships with stakeholders
- Enter into memoranda of understanding, cooperative enforcement agreements and joint operations plans with other enforcement agencies
- Facilitate communication among enforcement agencies to avoid duplication of effort
- Promote cooperation, standardization of gear, and coordination of limited resources such as vessels, radios, aircraft, etc.
- Promote training and cross deputization among enforcement agencies

Community involvement

- Encourage public involvement by encouraging site-specific interpretive patrols by volunteer groups
- Use volunteers for interpretive efforts
- Involve USCG, Civil Air patrols, power squadrons, charter boats and fishing organizations in promoting compliance
- Conduct a community outreach program to encourage compliance with marine reserve regulations and citizen involvement in reporting violations through CALTIP

Education

- Emphasize education as a tool to achieve compliance with regulations in conjunction with the department's Office of Natural Resource Education and Office of Communications
- Promote voluntary compliance and stewardship of the general public through specific outreach programs regarding enforcement of marine reserve regulations
- Train user groups about regulations and how to report violations
- Identify major user groups and disseminate specific materials through workshops

Operations

- Maintain an investigative capability to ensure quick response to purposeful unlawful acts
- Develop and maintain the capability to effectively respond to violations
- Establish an *Enforcement Advisory Committee* consisting of relevant regional law enforcement organizations
- Develop enforcement operation plans that identify specific enforcement strategies and priorities and outline the best means to achieve them; use the incident command system format
- Develop regulations that are understandable to the general public and are easily enforced

Section 5: Monitoring and Adaptive Management of MPAs

In the last several decades, monitoring and evaluation have become important features of management approaches to living marine resources and the environment (NRC 1990, NRC 2001). More recently, they have become central elements in management programs intended to adapt as understanding of the managed ecosystems – both the biophysical and social systems – improves and circumstances change. In California, the legislature incorporated this adaptive approach into the Marine Life Management Act (MLMA) in 1998. Besides defining adaptive management, the MLMA requires the development of research and monitoring activities within fishery management plans [FGC Sections 90.1, 7073(b)(3), and 7081].

A year later, the legislature incorporated the principle of adaptive management as well as monitoring and evaluation of MPAs and a statewide MPA network into the MLPA in several passages. At FGC Section 2856(a)2(H), for instance, the MLPA requires that the master plan include “[R]ecommendations for monitoring, research, and evaluation in selected areas of the preferred alternative, including existing and long-established MPAs, to assist in adaptive management of the MPA network, taking into account existing and planned research and evaluation efforts.”

In these and other ways, the MLPA emphasizes the role of monitoring and evaluation in adapting individual MPAs and MPA network in response to new knowledge and circumstances. The adaptive management approach of the MLPA provides for future proposals to add, modify, or eliminate MPAs based on information gained from monitoring and evaluation activities, the development of new scientific information, and input from interested parties.

It is worth noting that the MLPA calls for monitoring and evaluation of selected areas within the preferred alternative to assist with adaptive management of the MPA network. This does not mean that other MPAs should not also be monitored and evaluated in accordance with their own goals and objectives, but that the performance of selected MPAs might be used to guide future decisions over a wider area.

Monitoring and evaluation should not be done for its own sake, but to gauge the performance of an MPA in relation to its goals and objectives. A cost effective approach in many areas may be to link these activities to other ongoing monitoring activities. Similarly there may be many opportunities to involve stakeholders and members of the general public in monitoring and evaluation activities as well, thus leveraging further the resources available.

Since MPAs will be phased in individual regions through 2011 rather than adopted all at once statewide, the initial focus must be on developing effective monitoring programs in individual regions, including monitoring in areas both inside and outside MPAs. The final phase in developing monitoring and evaluation programs will be to evaluate and adjust these programs in individual regions to reflect a coherent program statewide.

Clear and measurable objectives should, in turn, form the basis for the design of systems to monitor and evaluate the impacts of management actions. Monitoring and evaluation systems should explicitly address five principles (Pomeroy et al. 2004). Such programs should be:

- Useful to managers and stakeholders for improving MPA management;
- Practical in use and cost;
- Balanced to seek and include scientific input and stakeholder participation;
- Flexible for use at different sites and in varying conditions; and
- Holistic through a focus on both natural and human perspectives.

Developing a Monitoring and Evaluation Program for MPAs and Network Components

To promote consistency among monitoring and evaluation programs in different regions, developers of regional MPAs should follow the sequential process outlined below. Many of the recommendations that follow largely come from a 2004 guidebook to natural and social indicators for evaluating MPA management effectiveness (Pomeroy *et al.* 2004). This discussion relies heavily on this guidebook because it is comprehensive, reflects the experience of MPAs around the world, has been field tested, and relies principally upon techniques that are simple rather than complex, and therefore more likely to be implemented and sustained over the long-term.

The discussion below presents only the more general features of the approach presented in the guidebook; much more detail is available in the guidebook itself. In addition, monitoring and evaluation programs should reflect local conditions, constraints and opportunities.

- Identify MPA goals and objectives.
 - Identify any overlapping goals and objectives.
- Select indicators to evaluate biophysical, socioeconomic and governance patterns and processes
 - Review and prioritize indicators,
 - Develop quantifiable benchmarks of progress on indicators that will measure progress toward goals and objectives, and
 - Identify how selected indicators and benchmarks relate to one another.
- Plan the evaluation.
 - Assess existing data;
 - Assess resource needs for measuring selected indicators;
 - Determine the audiences to receive the evaluation results;
 - Review relevant monitoring and evaluation programs at existing MPAs, such as at the Channel Islands;
 - Identify participants in the evaluation; and
 - Develop a timeline and work plan for the evaluation.
- Review and revise planned monitoring and evaluation program.
 - Conduct structured peer and public review processes, and
 - Make modifications in response to review.
- Implement the evaluation work plan.
 - Select methods and approach and collect data;
 - Manage collected data, includes identifying the data manager, providing for the long-term archiving and access to the data, and making the data available for analysis and sharing;

- Analyze collected data; and
- Conduct peer review and independent evaluation to ensure robustness and credibility of results.
- Communicate results and adapt management.
 - Share results with target audiences, and
 - Use results to adapt management strategies.

To achieve the purpose of informing adaptive management, the results of monitoring and evaluation must be communicated to decision makers and the public in terms that they can understand and act upon (NRC 1990). Moreover, in addition to aiding in MPA management, measuring, analyzing and communicating indicators can promote learning, sharing of knowledge and better understanding of MPA natural and social systems among scientists, resource managers, stakeholders, members of the public, and other interested parties (Pomeroy *et al.* 2004). To these ends, monitoring and evaluation programs for MPAs should include a communications plan that identifies the target audiences and specifies the timing, methods, and resources to regularly synthesize and present monitoring and evaluation results.

Though the results from ongoing monitoring and evaluation should be reviewed periodically, a comprehensive analysis of monitoring results should be conducted every three to five years. The longer time-frame for review takes into account the fact that biological changes are slow to occur and trends are more likely to become apparent on this time scale. These reviews should be transparent, include peer review, and make results available to the public. Besides evaluating monitoring methods and results, the review should evaluate whether or not the monitoring results are consistent with the goals and objectives of the individual MPA, the region, and the MLPA. If the results are not consistent, the review should develop recommendations for adjustments in the management of the MPA network.

Within the above set of required components, the master plan framework does not prescribe specific monitoring methods. For example, monitoring and evaluation programs may be effective within a range of levels in intensity and sampling frequencies. They also may rely on different indicators, depending on the MPA goals and objectives. Useful guidance on the selection of indicators can be found in Pomeroy *et al.* (2004).

General Considerations in Identifying Indicators

An indicator measures the success of a management action, such as the specific design of an MPA. It is a unit of information measured over time that will make it possible to document changes in specific attributes of the MPA (Pomeroy *et al.* 2004). General considerations in selecting or designing an indicator include:

- Measurable - able to be recorded and analyzed in quantitative or qualitative terms.
- Precise - clear meaning, with any differences in meaning well understood OR measured the same way by different people.
- Consistent - not changing over time, but always measuring the same thing.
- Sensitive - changing proportionately in response to actual changes in the variables measured.

- Simple - rather than complex.
- Independence defined - correlation with other indicators examined.

In selecting indicators, a monitoring and evaluation plan for an MPA or portion of the MPA network should (Pomeroy *et al.* 2004):

- Define and provide a brief description of the indicator;
- Explain the purpose and rationale for measuring the indicator;
- Consider difficulty and utility—that is, how difficult it is to measure and the relative usefulness of information provided by the indicator;
- Evaluate the required resources including people, equipment, and funding;
- Specify the method and approach to collecting, analyzing, and presenting information on the indicator, including sample size, spatial and temporal variation;
- Identify reference points or benchmarks against which results will be measured and timelines within which changes are expected;
- Explain how results from measuring the indicator can be used to better understand and adaptively manage the MPA;
- Provide references on methods and previous uses of the indicator.

Prior knowledge of the variability in the indicators selected should be incorporated into the monitoring and evaluation design where possible. If no prior knowledge exists variation in indicators must be identified within the monitoring and evaluation program. Multiple independent indicators are required for complex systems such as in the marine environment. Consideration also should be given to the timescale within which changes in an indicator might reasonably be expected. For instance, recovery of populations of long-lived species, such as some rockfish, may require many years; performance measures or other types of benchmarks for such indicators should reflect this longer timescale.

MPA monitoring and evaluation programs should measure biophysical, socioeconomic, and governance indicators, since these dimensions of marine ecosystems are inextricably linked (Pomeroy *et al.* 2004). Text below provides examples of possible indicators.

Biophysical. One common focus of MPAs is the conservation of living marine resources and habitats of California's coastal waters. Likely biophysical goals of individual MPAs and MPA networks established under the MLPA include sustaining the abundance and diversity of marine wildlife, protecting vulnerable species and habitats, and restoring depleted populations and degraded habitats. Thus, potential biophysical indicators might include (Pomeroy *et al.* 2004):

- Abundance and population structure of species of high ecological or human use value;
- Composition and structure of a community of organisms;
- Survival of young;
- Measures of ecosystem condition;
- Type and level of return on fishing effort;
- Water quality; and
- Areas whose habitat or wildlife populations are showing signs of recovery.

Socioeconomic. Socioeconomic indicators make it possible to understand and incorporate the concerns and interests of stakeholders, to determine the impacts of management measures on stakeholders, and to document the value of an MPA to the public and to decision makers (Pomeroy *et al.* 2004).

Possible socioeconomic indicators include (Pomeroy *et al.* 2004):

- Use data (and values of those uses) for consumptive and non-consumptive purposes, including:
 - Numbers of participants
 - Economic effects on local communities and to supporting industry
 - Measures of perceived value and level of satisfaction derived from consumptive and non-consumptive activities
 - Changes in geographic and other patterns of use in and around MPAs within the region;
- Level of understanding of human impacts on resources;
- Perceptions of non-market and non-use value;
- Community infrastructure and business;
- Number and nature of markets; and
- Shareholder knowledge of natural history and current use patterns and intensity.

All of these indicators would be tailored and specifically defined to reflect the conditions, resources present, use patterns and goals and objectives of each MPA or region.

Governance. By definition, MPAs are a governance tool since they limit, forbid, or otherwise control how people use marine areas and wildlife through rights and rules (Pomeroy and others 2004). Governance may include enforcement, use rights, and regulations. Goals for governance of MPAs include the following (Pomeroy *et al.* 2004):

- Legal certainty as indicated by legal challenges or reported failure to act because of legal uncertainty;
- Effective management structures and strategies maintained;
- Effective legal structures and strategies for management maintained;
- Effective stakeholder participation and representation ensured;
- Management plan compliance by resource users enhanced; and
- Resource use conflicts managed and reduced.

Possible governance indicators include the following:

- Local understanding of MPA rules and regulations;
- Availability of MPA administrative resources;
- Existence and activity level of community organizations;
- Level of stakeholder involvement; and
- Clearly defined enforcement procedures.

In addition, it is important to recognize the role that volunteer monitoring activities can play in evaluation. As mentioned earlier, there may be many opportunities to leverage with existing monitoring activities in the region and to make very productive use of stakeholder, other members of the public and educational and research entities to form partnerships in conducting monitoring and management programs. For example, the Citizen Watershed Monitoring Network in the Monterey Bay National Marine Sanctuary has used a monitoring protocol developed by the U.S. Environmental Protection Agency in collecting information on water quality in the sanctuary. Information from this program has helped in determining where education and outreach efforts should be targeted how successful specific pollution reduction activities have been, and in identifying problem areas for further investigation.

Finally, monitoring and evaluation programs can benefit from engaging commercial and recreational fishermen. At the Channel Islands, in Morro Bay, Fort Bragg, and elsewhere along the California coast, fishermen, research scientists, and federal and state biologists are carrying out field projects of mutual interest, including tag-and-recapture studies that provide critical information on the movement of fish and growth rates. Similarly, recreational fishermen have recently participated in collecting information on their catches as part of the Coastside Fishing Club's Recreational Catch Estimation Project. The Channel Islands National Marine Sanctuary supports a Cooperative Marine Research Program which helps coordinate and fund fisheries/science cooperative monitoring projects. These initiatives are in the early stages of development, and offer important opportunities for collaboration.

Section 7. Financing

Achieving the goals and objectives of individual MPAs, the statewide system of MPAs, and of the MLPA itself will depend upon sufficient short and long-term funding for carrying out key management activities, including public education, research, monitoring and evaluation, and enforcement. At FGC Section 2856(a)2(K), the MLPA requires that the master plan include “[R]ecommendations for funding sources to ensure all MPA management activities are carried out and the Marine Life Protection Program is implemented.” One of the products of the MLPA Initiative will be the development of a comprehensive funding strategy by December 2005, which will address these needs.

For many types of management activity, including monitoring, public education, and enforcement, estimates of costs will vary depending on the intensity of the activity, which may range between essential or critical levels to optimal levels. As a result, overall costs for carrying out management activities will be a range of estimates for any one year. Estimates and actual costs will also vary from year to year, particularly in the early years as initial start-up costs are absorbed. An effective management plan will map these potential costs over several years.

Although some funds for management may be raised from local fees or from the private sector profit and non-profit communities, the primary source of funding for the management of MPAs will be state government and perhaps the federal government (Salm *et al.* 2000). It is also possible to reduce the need for government funding through effective partnerships in carrying out management or research activities.

Other sources of funds may indirectly contribute to achieving the goals and objectives of MPAs in a region by mitigating threats to species and habitats of concern from pollution and poor water quality. For instance, the State Water Resources Control Board has the authority to designate an MPA area as an area of special biological significance. Recent legislation places a high priority on using available pollution control funds on improving water quality in such areas.

Funding the management of a statewide MPA network should also be viewed within a broader context that includes the funding of other new and continuing efforts to maintain and enhance the living marine heritage of California, including legislation such as the Marine Life Management Act and other, older legislation on fisheries, coastal and marine habitat, and water quality.

Because available state funds fluctuate with changes in the overall economic health and priorities of California and the nation, marine and coastal programs of all types have to constantly adjust to these changes.⁵ Management plans are an important tool for protecting MPAs and their benefits during times of limited funding. Sound management plans can help ensure that realistic cost estimates are taken into account when such features as boundaries

⁵ Currently, the state budget includes little funding explicitly devoted to implementation of the MLPA.

are decided. They also can help prioritize the most vital activities at times of low financial resources, and allocate funds efficiently and effectively when more generous funding is available.

Financing an effective system of MPAs in California will depend upon this good planning as well as tapping into a diverse array of non-governmental and governmental funding sources. A detailed approach to doing so awaits adoption of a long-term funding strategy that is being prepared by the MLPA Initiative, as well as the development of management plans for the regional components of the MPA network.

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