Executive Summary

This document provides the guidelines for design and methods used to evaluate alternative marine protected area (MPA) proposals for the California Marine Life Protection Act (MLPA) South Coast Study Region (SCSR). The MPA proposals are being developed through California's MLPA Initiative, a public/private partnership designed to assist the State of California in implementing the MLPA [California Fish and Game Code, Section 2853]. Developing and evaluating alternative MPA proposals is one component of an iterative process designed to "reexamine and redesign California's MPA system to increase its coherence and its effectiveness at protecting the state's marine life habitat, and ecosystems", as mandated by the MLPA.

The MLPA South Coast Regional Stakeholder Group (SCRSG) creates alternative MPA designs that integrate a variety of scientific and personal knowledge. The California Fish and Game Commission, the lead decision-making authority under the MLPA, has requested that the SCRSG not consider changes to the boundaries and regulations of the existing northern Channel Islands and Santa Barbara Island MPAs, but that these existing MPAs (using current boundaries, regulations and classifications) be included within, and evaluated as part of, the alternative MPA proposals developed for the SCSR.

Evaluations of alternative MPA proposals are conducted relative to the MLPA goals (Table 1-1 in Chapter 1), scientific guidelines described in the *California Marine Life Protection Act Master Plan for Marine Protected Areas* (hereafter called the *Master Plan*) and developed by the MLPA Master Plan Science Advisory Team (SAT), California Department of Fish and Game (DFG) feasibility criteria and California Department of Parks and Recreation guidelines. Potential impacts to commercial and recreational consumptive users also are evaluated. Evaluations are conducted by the SAT, MLPA Initiative staff, and contractors to the MLPA Initiative.

In addition to the guidelines for MPA design and associated evaluation methods, a discussion of the analysis and identification of bioregions in the SCSR are also included in this document. Bioregions are areas of the ocean where due to specific conditions such as ocean circulation and habitat, distinct species assemblages and communities occur. The consideration of bioregions in the design and evaluation of a network of MPAs is critical in ensuring that adequate representation of marine communities are included in MPAs.

Evaluations conducted by the SAT to address the scientific guidelines in the *Master Plan* include levels of protection, habitat representation and replication, size, and spacing. Additional analyses conducted by the SAT include birds and mammals, bio-economic modeling, and water quality. MLPA staff evaluate recreational, education and study opportunities while an MLPA contractor, Ecotrust, conducts an analysis of potential commercial and recreational fishery impacts.

The California Department of Fish and Game (DFG) conducts a feasibility analysis where alternative MPA proposals are evaluated against a set of feasibility criteria developed by DFG.

The California Department of Parks and Recreation (State Parks) conducts an analysis where alternative MPA proposals are evaluated against a set of guidelines for MPA proposals developed by State Parks.

Bioregions

To help ensure that MPAs established under the MLPA include adequate representation of the marine communities and species diversity representative of California, MPAs must be distributed across biogeographically distinct areas. Both the MLPA and the *Master Plan* identify two biogeographic regions: 1) Point Conception north to the California-Oregon border and 2) Point Conception south to the U.S.-Mexico border (which includes the entire SCSR).

The SCSR refers to state waters off the mainland coast extending from Point Conception to the U.S.-Mexico border, and state waters surrounding all eight Channel Islands in the Southern California Bight. Southern California is characterized by strong gradients in environmental conditions (e.g., water temperature) and species abundances across the study region. Some parts of the study region (e.g., the western Channel Islands) contain biotic assemblages highly similar to central California, while others support quite different species communities that resemble those found in Mexican waters to the south. As has been done in previous study regions, the SAT conducted analyses to identify biogeographically relevant subregions (hereafter referred to as “bioregions”) within the large-scale biogeographic region to help ensure that distinct species assemblages within the study region are adequately represented in MPAs.

The SAT identified five bioregions that characterize the MLPA South Coast Study Region:

- North Mainland (Point Conception to Marina Del Rey)
- South Mainland (Marina Del Rey to U.S.-Mexico border)
- West Channel Islands (San Miguel, Santa Rosa and San Nicolas islands)
- Mid-Channel Islands (Santa Cruz, Anacapa and Santa Barbara islands)
- East Channel Islands (Santa Catalina and San Clemente islands)

The SAT recommends including representation of all key habitats in each bioregion (see habitat representation). Representation of key habitats in each of the five bioregions of the SCSR will be considered as part of the habitat representation evaluation for alternative MPA proposals. Replication of habitats will also be evaluated for each bioregion and the entire SCSR.

Levels of Protection

Types of activities that may be allowed within the three types of marine protected areas (state marine conservation area, state marine park, and state marine reserve) differ in the level of protection they provide to marine ecosystems. To facilitate comparison across alternative MPA proposals, the SAT assigns a “level of protection” to each MPA based on the uses allowed within its boundaries.

Levels of protection are based upon the likely impacts of proposed activities to the ecosystems within a MPA. Conceptually, the SAT seeks to answer the following question in assigning levels of protection: "How much will an ecosystem differ from an unfished ecosystem if one or more proposed activities are allowed?"

State marine reserves (SMRs) are, by definition, unfished ecosystems, therefore they receive the highest protection level, "very high". MPAs that allow extractive activities receive levels of protection ranging from "high" for low-impact activities, to "low" for activities that alter habitat and thus are likely to have a large impact on the ecosystem. Both direct impacts (those resulting directly from the gear used or removal of target or non-target species) and indirect impacts (ecosystem-level effects of species removal) are considered in the levels of protection analysis. Table 1 summarizes levels of protection assigned to various targeted species and gear types. As the need arises, the SAT will evaluate additional targeted species and gear types.

Table ES-1. Level of protection and the activities associated with levels of protection in the MLPA South Coast Study Region

	Level of Protection	MPA Type	Activities Associated with a Protection Level
	Very high	SMR	No take
	High	SMCA	pelagic finfish, white seabass and bonito (spear, H&L >50m)
	Moderate-high	SMCA	pelagic finfish, white seabass and bonito (H&L surface gear on mainland, 30m-50m)
	Moderate	SMCA SMP	spot prawn (trap); sea cucumber (scuba/hookah); grunion (hand harvest)
	Moderate-low	SMCA SMP	Kelp bass, barred sand bass (H&L, spear), sheephead (H&L, spear, trap); spotted sand bass (H&L); lobster (trap, hoop net, scuba); pelagic finfish, white seabass and bonito (H&L <30m on mainland, H&L<50m on islands); urchin (hand take)
	Low	SMCA SMP	rock scallop (scuba)

H&L = hook and line. The SAT is currently reviewing the level of protection for numerous activities, this table will be updated as activities are reviewed and approved by the SAT.

The level of protection assigned to an MPA that allows multiple uses is the lowest level of protection designated for any of the uses. The SAT's "level of protection" analysis does not currently account for the cumulative impacts of multiple activities within a single MPA, but the SAT is working to address this issue.

The levels of protection assigned by the SAT are used in all subsequent SAT analyses. Only MPAs at the three highest levels of protection, "moderate-high," "high," and "very high," contribute toward replication and are considered as part of the size and spacing analysis.

Habitat Representation

The SAT recommended that "For an objective of protecting 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[1]." California's key marine habitats are described in the MLPA and have been further subdivided by the SAT to reflect important ecological differences at different depths. This habitat classification yields a total of 22 key habitats for which habitat representation is assessed contingent upon habitat map quality: rocky shore, sandy beach, surfgrass, coastal marsh, tidal flats, estuarine waters, eelgrass, kelp, hard and soft substrates in four depth zones (0-30 meters, 30-100 meters, 100-200 meters, and greater than 200 meters), submarine canyons, pinnacles, upwelling centers, retention zones, river plumes, and oceanographic fronts.

In evaluating habitat representation the SAT considers:

- The availability of habitats across the entire SCSR
- The availability of habitats within the five bioregions of the SCSR
- The percentage of available habitat protected in MPAs across six levels of protection
- The distribution of habitat protection across the five bioregions

The SAT also identified unique habitats in southern California, including oil seeps (concentrated in the Santa Barbara Channel) and shallow hydrothermal vents (off White Point on the Palos Verdes Peninsula). The unique habitats will be noted if they occur within an alternative MPA proposal but no minimum size threshold will be estimated for unique habitats and they will not be evaluated for habitat representation or replication.

Habitat Replication

Habitat replication within broad biogeographic regions is required by the *Master Plan*. The *Master Plan* identifies just two biogeographic regions in California: 1) Point Conception north to the California-Oregon border and 2) Point Conception south to the U.S.-Mexico border. The SAT recommended three to five replicates of each key habitat type within marine reserves in each biogeographic region. The entire SCSR lies within a single biogeographic region so the guideline for replication should be applied at this scale. Considering the strong physical and biological gradients across the SCSR, the SAT has additionally recommended at least one replicate of each key habitat be included in each of the five bioregions of the SCSR.

To count as a replicate of any given habitat, a MPA must contain enough habitat to encompass 90% of the biodiversity associated with that habitat. The minimum area to encompass 90% of the associated biodiversity varies by habitat and is determined from biological surveys. A summary of the minimum areas for replicates of key habitats in the SCSR is in Chapter 5 (and in Table ES-2.).

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[1]*California Marine Life Protection Act Master Plan for Marine Protected Areas*

Table ES-2. Amount of habitat in an MPA necessary to encompass 90% of local biodiversity given in linear statute miles and square statute miles.

Habitat	Representation needed to encompass 90% of biodiversity	Data Source
Rocky Intertidal	~0.48 linear miles	PISCO Biodiversity
Shallow Rocky Reefs/Kelp Forests (0-30 m)	~1.14 linear miles	CRANE Subtidal Surveys
Deep Rocky Reefs (30-100 m)	~0.20 square miles	Love Surveys
Deep Rocky Reefs (100-3000 m)	~0.22 square miles	Love Surveys
Sandy Beaches[1]	~1.14 linear miles	See below
Soft Bottom Habitat (0-30 m)	~1.14 linear miles	See below
Soft Bottom Habitat (30-100 m)	~2.24 square miles	SCCWRP (BIGHT '98 & '03)
Soft Bottom Habitat (100-200 m)	~1.10 square miles	SCCWRP (BIGHT '98 & '03)
Soft Bottom Habitat (>200 m)	~0.46 square miles	SCCWRP (BIGHT '98 & '03)
All Soft Bottom Habitat (>0 meters)	***~8 square miles***	***Preferred option - see Chapter 5***
Estuarine Habitats	0.12 square miles (77 acres)	SONGS sampling

[1] Sandy beaches are often linked to shallow soft bottom areas, therefore linear extent for sandy beaches is tied to linear extent of soft bottom habitat, see below for further explanation.

In order for estuarine habitats to be considered present, a minimum of 77 acres of estuarine habitats must be included within an MPA. For the three sub-habitats eelgrass, tidal flats, and coastal marsh to be considered present, a minimum of 25 acres of each must be included within an MPA. The SAT recommends that wherever possible, a mixture of estuarine sub-habitats be protected in close proximity to one another to allow for the movement of species among sub-habitats.

In evaluating replication of key habitats, the SAT:

- combines contiguous MPAs at or above the three highest levels of protection into "MPA clusters." Replication analyses are conducted at three different levels of protection:

"moderate-high," "high," and "very high" and include all MPAs at or above the stated level of protection.

- considers whether there is a minimum amount of each key habitat present within an MPA cluster, and whether the MPA cluster meets the minimum size threshold, as described below.
- tabulates the number of replicate MPA clusters for each habitat within the biogeographic region (Point Conception to the U.S.-Mexico border) relative to the guideline of three to five replicates per biogeographic region tabulates the number of replicate MPA clusters for each habitat within each of the five bioregions (north and south mainland, and west, mid- and east Channel Islands) relative to SAT guidance to include at least one replicate of each habitat per bioregion.

MPA Size

The SAT recommended "For an objective of protecting adult populations, based on adult neighborhood sizes and movement patterns, MPAs should have an alongshore span of five to ten kilometers (3-6 miles) of coastline, and preferably 10-20 km (6-12.5 miles). Larger MPAs would be required to fully protect marine birds, mammals, and migratory fish[2]."

The SAT recommended that MPAs extend from intertidal to offshore areas for an objective of protecting 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. The recommended offshore span is from the mean high tide line to the offshore state waters boundary, generally a distance of 3.45 miles (3 nautical miles), except in some areas (e.g., offshore rocks) where state boundaries may extend further.

Taking into account these two guidelines, the SAT recommended a minimum area of 9 – 18 square miles for each MPA, and preferably 18 – 36 square miles. The recommendation of a minimum area of 9 square miles is a simplified combination of the along-shore and offshore size guidelines and allows for the possibility that the alongshore span may be less (or greater) than three miles or the offshore span may be less than 3.45 miles. The guidelines for minimum and preferred areas of proposed MPAs will receive priority above the individual guidelines for alongshore and offshore spans. Additionally, the SAT recommends consideration of the configuration of proposed MPAs. Configurations with maximum area-to-perimeter ratios (e.g., 3 x 3 statute miles) are more likely to achieve greater protection for a variety of adjacent habitats and associated species than narrow and long MPAs (e.g.,1 x 9 statute miles).

In evaluating the size of MPAs, the SAT:

- combines contiguous MPAs at or above the three highest levels of protection into "MPA clusters." Size analyses are conducted at three different levels of protection: "moderate-high," "high," and "very high" and include all MPAs at or above the stated level of protection.

[2] California Marine Life Protection Act Master Plan for Marine Protected Areas

- tabulates the number of MPA clusters in each size range (below minimum, minimum size range, preferred size range).

MPAs containing estuarine habitat are not evaluated against the general rule that replication of habitat needs to be within an MPA cluster that is at least nine square miles.

MPA Spacing: Mainland Coast

The SAT recommended "For an objective of facilitating dispersal of important bottom-dwelling fish and invertebrate groups among MPAs, based on currently known scales of larval dispersal, MPAs should be placed within 50-100 km (31-62 miles) of each other" along the mainland coast of southern California. Neighboring MPAs placed closer than 50 km (31 miles) apart also meet the guideline for spacing for the goal of designing a network of MPAs.

In evaluating the spacing of MPAs for the mainland coast, the SAT:

- combines contiguous MPAs at or above the three highest levels of protection ("moderate-high," "high," and "very high") into "MPA clusters" and include all MPAs at or above the stated level of protection.
- considers MPA clusters of sufficient size (minimum MPA cluster size of nine square miles), with sufficient amounts of key habitats included, and given at least a moderate-high level of protection.
- determines the distance between replicates of key habitats within MPAs relative to the minimum spacing guideline of 31-62 miles of one another along the mainland coast of southern California.
- estimates the distance between protected patches of the same key habitat.
- analyzes distances between neighboring MPAs separately for each key habitat.

MPA Spacing: Channel Islands

Connectivity between Channel Islands (and between islands and mainland) is influenced and limited by their complex geography and ocean circulation. A simple guideline for MPA spacing does not account for these complex variables. The SAT recommended that guidelines other than spacing should serve as a starting point for design of MPAs at the Channel Islands. Those guidelines include bioregions, habitat representation, habitat replication, and MPA size.

Modeling

Spatially-explicit bioeconomic models use data on habitat, fishery effort and proposed MPA locations and regulations to estimate biomass and larval supply (estimates of conservation value) and fishery yield and profits (estimates of economic impacts) for a suite of about 10 representative species. The modeling is an additional and complementary tool to other SAT evaluations.

Two models emerged from earlier efforts to apply modeling to evaluating alternative MPA proposals. A model developed by researchers at University of California, Davis (UCD model)

considers each fished species separately, and focuses on sustainability of fished populations under each alternative MPA proposal, using current estimates of fishery stock status to help predict future management success. A model developed by scientists at the University of California, Santa Barbara (UCSB model), and based on previous work by members of the north central coast SAT[3], focuses on the tradeoffs between fisheries performance (profits) and fish abundance. Both models incorporate spatially explicit fishery regulations and predicted behavioral shifts of fishers in response to changes in the regulations (e.g., after MPAs are established).

Model outputs are not expressed in terms of minimum or maximum threshold values, so outputs from the evaluation of alternative MPA proposals must be compared to each other to understand the potential impacts of changes to the design. For the modeling evaluation of alternative MPA proposals, the SAT will provide:

- maps of biomass and larval supply[4] for a suite of about 10 representative species and a map that shows the weighted average biomass of all species
- figures that summarize the study region-wide effects of all MPA proposals on biomass and larval supply[5]
- maps of fishery yield and profits[6] of the suite of about 10 representative species and a map that shows the weighted average biomass of all species
- figures that summarize the study region-wide effects of all MPA proposals on fishery yield and profits[7]
- maps of spatial fishing intensity for the suite of about 10 representative species and a map that shows the weighted average of spatial fishing intensity for all species
- diagrams that illustrate the level of connectivity between different places in the SCSR for the suite of about 10 representative species
- figures that show tradeoffs between the conservation value (estimated as biomass and larval supply[8]) and economic return (estimated as fishery yield and profits[9])

Birds and Mammals

MPAs may benefit marine birds and mammals by protecting their forage base and by potentially reducing human disturbance to roosting and haul-out sites, and breeding colonies

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[3] The UCSB model adopts many of the key assumptions of the Equilibrium Delay Difference Optimization Model (EDOM), developed by C. Walters, R. Hilborn, and C. Costello in the North Central Coast Study Region.

[4] The UCD model estimates larval supply, in addition to biomass and fishery yield.

[5] The UCD model estimates larval supply, in addition to biomass and fishery yield.

[6] The UCSB model estimates fishery profits, in addition to biomass and fishery yield.

[7] The UCSB model estimates fishery profits, in addition to biomass and fishery yield.

[8] The UCD model estimates larval supply, in addition to biomass and fishery yield.

[9] The UCSB model estimates fishery profits, in addition to biomass and fishery yield.

or rookeries. To evaluate the protection afforded by alternative MPA proposals to birds and mammals, the SAT:

- Identifies proposed MPAs or special closures that contribute to protection of birds and mammals.
- Identifies focal species likely to benefit from MPAs and for which data are available.
- Estimates the proportion (of total numbers of individuals) of breeding bird/mammal at colonies and rookeries potentially benefiting by proposed MPAs.
- Estimates the proportion of nearby foraging areas protected by MPAs, defined by evaluating protection of buffered areas around colonies.
- Estimates the number of neritic foraging 'hot spots' protected by MPAs, defined by at-sea densities of marine birds and mammals.
- Estimates the proportion of marine birds and mammals that inhabit estuaries and coastal beaches protected by MPAs.

Water Quality

While water quality is not subject to management under the MLPA, it may be important in designing alternative MPA proposals. Where water quality is significantly compromised, marine life may be affected. Impaired water quality may lead to changes to population rates (growth, reproduction, and mortality), population abundance and ecological community composition through a variety of interactions (e.g., decreased diversity, loss of sensitive species and abundance of tolerant species).

For MPA network design, the SAT recommends including areas already designated as areas of special biological significance (ASBSs) because these areas benefit from protection beyond that offered by standard waste discharge restrictions. The SAT recommends avoiding locations of poor or threatened water quality, including

- major cooling water intake sites for power plants
- municipal sewage or industrial outfalls
- areas that are significantly impacted by a variety of pollutants from large industrial or developed watersheds

The SAT determined that MPAs may be placed in or near areas of impaired water quality (e.g. Santa Monica Bay) if there are other reasons to place MPAs in such areas.

Since water quality evaluations are not mandated by the MLPA, these guidelines based on consideration of water quality are secondary to other MPA network design guidelines. Other guidelines (including bioregions, habitat representation and replication, and MPA size and spacing) should be used to drive design of alternative MPA proposals. Water quality considerations may be incorporated if other guidelines have been met. The SAT has not yet completed a methodology for evaluating alternative MPA proposals. Details about the evaluation of MPA proposals for water quality will be updated pending SAT discussions and recommendations.

Recreational, Education and Study Opportunities (Goal 3)

MLPA Initiative staff evaluates the potential recreational, educational, and study opportunities provided by each MPA proposal in terms of the MPAs' overall accessibility, proximity to educational institutions, inclusion of existing monitoring sites, and consideration of replication in design.

In evaluating the alternative MPA proposals, MLPA Initiative staff considers:

- Access points within and near MPAs, including proximity to boat launches and ports. Proximity to MPAs that allow many uses versus MPAs that allow few uses may have different effects on different users.
- Inclusion of existing monitoring sites and close proximity to research institutions, which may increase study opportunities.
- Replication of habitats within MPAs, which may offer research opportunities.

Recreational and Commercial Fishery Impacts

While fishery impacts are not the focus of the MLPA, they are considered in designing an MPA network. The evaluation of maximum potential recreational and commercial fishery impacts utilizes region-specific data on areas of importance collected by MLPA contractor, Ecotrust.

To evaluate the potential recreational and commercial fishery impacts, MLPA Initiative staff and contractors:

- Conduct interviews with recreational and commercial fishermen, using an interactive, custom computer interface, to collect geo-referenced information about the extent and relative importance of study region commercial and recreational fisheries.
- Organize impact analyses by port, fishery and/or user group.
- Evaluate and summarize the maximum potential impacts[10] on commercial and recreational fishing grounds, both in terms of total area and value affected. Results are summarized for both study region fishing grounds and total fishing grounds.
- Conduct a socioeconomic impact analysis for commercial fisheries.
- Consider or identify "outliers" (i.e. fishermen likely to experience disproportional impacts).

Assess the effect of existing fishery management area closures and other constraints on fishing opportunities.

[10] Impact analyses represent a "worst case" scenario where fisherman cannot fish in a different location.