CALIFORNIA MARINE LIFE PROTECTION ACT

MASTER PLAN
for
Marine Protected Areas

California Department of Fish & Game

Revised Draft
~~April 23,~~August 2007

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Section 5. Enforcement

The MLPA identifies 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.

A general discussion of the capacities of the Department's enforcement program as well as the programs of other state and federal agencies, with which the Department may collaborate is included. A set of enforcement program objectives, including cooperative efforts, community involvement, education and operations is identified.

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.

A process for developing monitoring and evaluation programs in different regions is described. 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 should be developed. 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. In addition to these planned comprehensive reviews, preliminary monitoring results and updates on monitoring progress will be provided to the Commission annually. At least every three years, the Commission is required to receive and act upon proposals to add, delete, or modify MPAs. A long-term schedule incorporating these annual updates and triennial reviews will be established.

General considerations in identifying indicators as part of a monitoring and evaluation program, and specific examples of indicators for biophysical, socioeconomic and governance objectives are discussed. Collaborative monitoring efforts with fishermen and other groups are encouraged.

Section 7. Funding

The MLPA requires that the master plan include recommendations for funding MPA management activities and for implementing the Marine Life Protection Program. The inclusion of financing considerations in management plans for regional MPAs is discussed and examples of various sources of funding are provided. Contractors to the MLPA Initiative also produced a report on long-term costs and funding options for implementing the MLPA (Appendix L and N).

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.~~It is important to note that this group defined "marine reserves" more broadly than the State of California definition, using a definition more closely aligned with California's definition of "marine protected areas". References from the report below have been changed to reflect the broad definition. Among other things, this expert panel concluded:

- A growing body of literature documents the effectiveness of ~~marine reserves~~ MPAs for conserving habitats, fostering the recovery of overexploited species, and maintaining marine communities.

- Networks of ~~marine reserves~~ MPAs, 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~~ an MPA 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~~ MPAs 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 MPAs 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~~ MPAs as a fisheries management tool and on the effect of ~~marine reserve~~MPA designation on fishing operations, fisheries management, and fish populations outside ~~reserves.~~MPAs. There has been ~~virtually no discussion~~little direct comparison of the ~~value and design~~relative benefits of ~~other types of MPAs, such as~~no-take reserves compared to marine parks and marine conservation areas. Much of the existing research has focused on either no-take reserves alone or broader classes of MPAs and fisheries management measures but has not directly compared the two.

Recent literature supports the potential value of ~~marine reserves~~MPAs 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~~MPAs 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~~MPAs is sparse, although there are strong reasons to believe that if designed properly, ~~marine reserves~~MPAs 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~~MPAs, assessing the appropriateness of ~~marine reserves~~MPAs for fisheries enhancement purposes will remain difficult.

At the same time, potential problems with ~~marine reserves~~ MPAs 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~~MPAs 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~~MPAs 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 develop a plan and implement a program that will 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 had four key objectives to achieve by December 2006:

- the development of a draft master plan framework;
- the development of alternative proposals for an MPA network component 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 were provided to the Department for its consideration and submission to the Commission, which will take action through its normal process. These products are intended to provide a strong foundation for completing the statewide network of MPAs by 2011.

The MLPA Initiative process included the following groups and organizations:

- MLPA Blue Ribbon Task Force (an oversight body)
- MLPA Initiative staff

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). In passing the MLPA, the California State Legislature cited a lack of clearly defined purposes and effective management for MPAs previously established in state waters. As a result, the Legislature found, "…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 sub-section 2851(a)]. To remedy this, the Legislature called for an overall program that will "ensure that California's MPAs have clearly defined objectives, effective management measures, and adequate enforcement, and are based upon sound scientific guidelines…" and that MPAs have "specific identified objectives, and management and enforcement measures" [FGC sub-sections 2853(b)(5) and 2853(c)(2)].

The initial focus for meeting the management requirements of the MLPA should be the preparation of regional management plans. 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.

Regional management plans will not contain specific details for methodology, protocol or activities, but will provide a foundation for developing more specific action plans, as necessary, and for adapting management measures to new information. ~~Management plans will 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, habitats, or the character or effectiveness of management outside individual MPAs.~~

While the Department, 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 onshore protected areas, marine labs, or similar such institutions may be effectively co-managed by the local management entities. A management plan should describe the potential management partners including various government agencies and non-government organizations and industry groups. Collaboration with non-governmental organizations, including among others 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.

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. 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.

Primary review of MPA regulations and effectiveness towards achieving stated goals will occur within the Fish and Game Commission's established regulatory process. The MLPA requires that the Commission "…at least every three years, receive, consider, and promptly act upon petitions from any interested party to add, delete, or modify MPAs, favoring those petitions that are compatible with the goals and guidelines of (the MLPA)" [FGC subsection2861(a)]. As such, at a minimum a triennial review of MPAs adopted by the Commission must occur. It is, however, likely that biological changes in response to the establishment of MPAs will take longer than three years to initially occur and to subsequently change (see discussion in Section 6 below). Additionally, it is important to consider monitoring on an ongoing basis, to ensure Commission concerns, scientific needs, and stakeholder input are being incorporated into ongoing planning. Thus, the following schedule of review and decision-making in regards to monitoring and adaptive management are recommended:

- **Annual Monitoring Reports and Updates** - Provided to the Commission at its December meeting
- **Triennial MPA Proposal Hearings** - Scheduled by the Commission not later than three years subsequent to the completion of the statewide MLPA implementation process and every third year thereafter.
- **Comprehensive Reviews of Monitoring Results** - Provided to the Commission five years after first implementation of MPAs within each study region. Upon completion of statewide implementation, a schedule will be developed to provide a comprehensive review of monitoring results for each study region on a rotating basis. This may be scheduled at the same hearing as the annual reports, with an emphasis on results from the study region reaching its five-year timeframe.

Structure of the Regional MPA Management Plans

Management plans typically have multiple objectives. Management plans:

1. summarize programs and regulations;
2. guide preparation of annual operating plans;
3. articulate visions, goals, objectives and priorities;
4. guide management decision-making;
5. guide future project planning (including funding needs);
6. ensure public involvement in management processes; and
7. contribute to the attainment of system goals and objectives (adapted from NOAA, 2002, p. 5).

Regional MPA management plans are envisioned to be working documents; plans should be readily accessible for reference and alteration. Retaining the plans' usefulness requires regular updates to incorporate new information from actual implementation, consistent with goals of adaptive management. To accomplish this, processes for review and revision when necessary are included.

Section 8. Regional MPA Management Plans

NOTE: This section has been removed from the body of the draft Master Plan and inserted as a new Appendix O without change.

CALIFORNIA MARINE LIFE PROTECTION ACT

APPENDICES TO THE MASTER PLAN

California Department of Fish & Game

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- General description of preferred proposal (and alternatives)
    - Spacing of MPAs and overall level of protection
    - Proposed management measures
    - Proposed monitoring for evaluating the effectiveness of the site in achieving its goals
    - Proposed research programs
    - Proposed education programs
    - Enforcement needs and means of meeting those needs
    - Funding requirements and sources
    - Proposed mechanisms for coordinating existing regulatory and management authority
    - Opportunities for cooperative state, federal, and local management,
    - Name

- Evaluation of the proposal:
    - How does the proposal emphasize:
        - areas where habitat quality does (or potentially can) support diverse and high-density populations
        - benthic habitats and non-pelagic species
        - ~~hard bottom as opposed to soft bottom, because fishing activities within state waters have had the greatest impact on fishes associated with hard bottom, and because soft bottom habitat is interspersed within areas containing rocky habitat~~
        - habitats associated with those species that are officially designated as overfished, with threatened or endangered species, and productive habitats such as kelp forests and seagrass beds
    - How does the proposal include:
        - unique habitats
        - a variety of ocean conditions such as upwelling centers, upwelling shadows, bays, estuaries, and exposed and semi-protected coastlines
    - How does the proposal address existing MPAs?
    - How does the proposal include a variety of sizes and types of MPAs that:
        - Provide enough space within individual MPAs for the movement of juveniles and adults of many species
        - Achieve beneficial ratios of edge to area
        - Help to include a variety of habitats
        - Facilitate analysis of the effects of different-sized MPAs
        - Facilitate analysis of the effects of different types of MPAs
        - Provide for biological connectivity
        - Enable the use of MPAs as reference sites to evaluate the effects of climate change and other factors on marine ecosystems, without the effects of fishing
        - Enable the use of MPAs as reference sites for fisheries management,
        - Minimize the likelihood that catastrophic events will impact all replicate MPAs within a biogeographic region
        - If an MPA is less restrictive than a reserve, how do different uses and restrictions affect achieving the objectives immediately above?

Some Key Species Likely to Benefit from Marine Protected Areas in the Central Coast Study Region

Introduction:

The Marine Life Protection Act [Section 2856(a)(2)(B)] calls for "An identification of select species or groups of species likely to benefit from MPAs". Well-designed MPAs could result in population-level effects, deemed to be beneficial to certain species or groups of species. These might include: 1) increases in abundance, 2) changes in population size structure resulting from increases in the number of individuals living to achieve larger body sizes and older ages, 3) increases in reproductive output due to the increased abundance of larger, older individuals. At the multi-species community level, well-designed MPAs could result in changes in community-level parameters over time, such as diversity and structure (defined as the result of species present in the community and their abundances), which can be distinguished from those occurring in non-MPAs. These changes might result in differences in community functions among MPAs and other areas.

It is important to note that not all MPAs in all areas will necessarily have all of these results. The overall benefit to any individual species will necessarily depend upon the final MPA design. Additionally, not all individual MPAs or groups of MPAs will necessarily lead to benefits for all species. A variety of design considerations must be taken into account when developing MPAs in order to maximize the potential benefits to the broadest range of species.

In this section, the criteria, discussion, and resultant list focus on some individual species that may benefit from MPAs. While this discussion and criteria consider the current status of species, they are not intended to explain how MPAs might be used as a fisheries management tool. Although MPAs may assist with rebuilding of depleted populations, current fisheries management strategies and rebuilding plans may achieve the same results with regards to single stock management. The goals and objectives of the Marine Life Protection Act primarily address protection of habitats, natural heritage, diversity, and abundance, and do not specifically consider fisheries management.

Discussion:

This list of some key species likely to benefit may be useful for designing MPAs and in the evaluation of MPAs. It is expected that the development of such a list be a dynamic process and subject to change as new information on the effects of MPAs and on species status becomes available. By definition, the primary change due to the establishment of an MPA (whether a reserve, park, or conservation area) is a reduction in take. Those species likely to benefit **directly** by a decrease in the level of harvest are those that are targeted by fisheries, as well as those that are caught incidentally to fishing for the target species (i.e., bycatch) and cannot be successfully returned to the water following capture. It is expected that species likely to benefit will be afforded some degree of reduced mortality within the MPAs and that the local population within an MPA will experience increased survivorship, increased growth, and/or larval production within the MPAs. These benefits may or may not transfer to this species in other areas, depending on the amount of spill over (transport of new recruits or adults beyond

the range of the MPA) and on existence of nearby sinks (that is, loss of individuals due to increased mortality in certain areas).

Direct benefits of MPAs may also accrue for seabirds, turtles, and marine mammals (pinnipeds and whales). For instance, aside from fish species, bycatch in some fisheries also includes species of turtles, marine mammals, and seabirds. Other human impacts include vessel activities (e.g., noise, motion, lights) in areas surrounding seabird breeding colonies and marine mammal rookeries, and inadvertent entanglement in associated gear. Decreasing or eliminating such disturbance, harassment, and other negative interactions within an MPA will reduce mortality of these species.

Besides impacting particular species, fishing **indirectly** can cause changes to the function of communities and ecosystems. For example, because large predators (e.g., yelloweye rockfish, bocaccio) often are the targets of fisheries, restricting harvest within an MPA likely will change the trophic dynamics (both predator and competitive interactions) of the system. Similarly, the abundance of macroalgae and sea grasses can be strongly affected by **indirect** species interactions that differ between MPAs and non-MPAs. In addition, species that already are fully protected (e.g., Marine Mammal Protection Act, Endangered Species Act, etc.) could be afforded additional **indirect** benefit from MPAs. For example, sea otters, pinnipeds, and some seabirds prey on some of those species (e.g., abalone, urchins, rock crabs, squid, and young rockfish) that could be expected to increase in size and abundance with increased protection of an MPA. It should be noted, however, that some of these top predators (i.e., sea otters) may locally reduce or prevent any realized gain in their prey species within an MPA.

Foraging seabirds and marine mammals can congregate at prey aggregations that are associated with hydrographic (e.g., fronts and eddies) and topographic features (e.g., seamounts, submarine canyons, promontories). These areas have been suggested to serve as "refugia" for top predators during periods of reduced food due to climate variability (e.g., El Niño). Parts of the Monterey Canyon, for example, are persistent foraging sites for many seabird and marine mammal assemblages. Some seabirds and mammals persistently forage near and downstream from upwelling centers, many located near coastal promontories along the California coastline. Affording MPA status to such areas could benefit all such predators.

Reduction in fishing effort by some specific gears within an MPA can also reduce or eliminate disturbance or destruction of the biological and physical structural components of benthic habitats, thereby **indirectly** benefiting those organisms associated with such habitats. Because change to ecosystem function can be complex, usually is not well documented, and therefore is not entirely understood, it is difficult to surmise all species that may **indirectly** benefit (or alternately suffer loss) from increased protection within MPAs. In addition, the species likely to benefit (and the magnitude of those benefits) will vary from place to place and will be dependent on local conditions.

Proposed List:

Table G1 includes a draft list of some key central coast species most likely to benefit from MPAs. Species that occur in the central coast study region were included on this list primarily based on the extent of their adult mobility or dispersal, on their persistent use of specific sites to forage, grow, or breed, on certain life history characteristics that contribute to a species vulnerability to depletion, and on the status and trend of their population size.

The extent of movement of individual species generally changes among larval, juvenile, and adult life stages, and can influence how much protection that species receives from an MPA network. Many species in the central coast area have pelagic larval stages that disperse during several weeks to months, potentially over broad geographic areas, before settling to benthic habitats. Some of these species move from shallow water as juveniles to deeper depths as adults. Some species, such as squid, leopard sharks, and lingcod, exhibit seasonal patterns in movement that often are related to reproduction and/or feeding. MPAs are likely to have their greatest direct benefits on residential species. In general, MPAs offer direct protection to less mobile or sedentary species that locally aggregate in specific habitats (e.g., many of the rockfish species); these species can be especially vulnerable to local depletion by fisheries that target their specific habitats.

Mobile seabird and marine mammal species that breed and/or forage persistently in specific areas along the central coast also are included on this list. Mobile pelagic species (e.g., northern anchovy, Pacific sardine, salmon, herring etc.) represent a critical forage component in the central California coastal ecosystem, and protection afforded such species in an MPA could affect local ecosystem function. However, these pelagic species are less likely to benefit directly from the establishment of MPAs unless the size of the MPA encompasses their range of movement or the MPA is located to protect critical life stages (i.e., spawning or feeding aggregations, nursery grounds). For example, some salmon stocks can benefit from protection as they aggregate to spawn in areas near river mouths, and the herring fishery is highly regulated in their spawning areas in California bays.

Direct benefits of MPAs are expected to be much reduced for highly migratory species (e.g., swordfish, tunas, some sharks) that likely spend relatively little time inside local coastal MPAs. Protection of these mobile species and their contributions to local marine ecosystems may best be addressed by larger-scale regulatory measures.

Summary:

One or more of the following criteria were used in identifying some key species most likely to benefit in the central coast region. Note that this list is not exhaustive and other criteria may be appropriate. The individual criteria in the attached table are not additive within each species; that is, all criteria are not equally weighted in importance when considering potential MPA benefits for these species:

- Species occurs on the central coast
- Species is either directly or indirectly affected by take

- Species has small-to-moderate adult neighborhood size (e.g., small = 0-5 km; moderate = 10-20 km) and moderate-to-large take (either current or historic take).
- Species population trend, stock size, or status is known to have declined or been reduced.
- Species has unknown population size or status, but shares life history traits and/or co-occurs with species of low or declining status.
- Species has particular life stage (e.g., uses persistent breeding, foraging, or nursery areas) amenable to spatial management
- Species size structure has shifted towards smaller individuals.
- Species habitat is vulnerable to disturbance
- Species of particular ecological significance (e.g. kelp, sea otter, etc.)

For each of the above, a “1” in the following table means that species meets the criterion, a “0” means it does not meet the criterion, and “ND” means there is no data available. Comments about particular criteria or data sources are included where appropriate.

Species	Primary Bottom type (Rock/Sand)	Shallow Depth (ft.)	Deepest Depth (ft.)	sm-mod adult home range (sm 0-5 km mod 10-20 km)	Currently mod-large take	Historically mod-large take	Low Pop. Estimate (<40% unfished)	Size structure shifted toward sm indiv	life history trait vulnerable	life stage to benefit (e.g., spawning activity, nursery area)	habitat impacted (by human activity)	Ecologically Important (keystone or habitat forming)	Comments
				"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	"ND" = No data	
Invertebrates													
black abalone	Rock	Intertidal	20	1	0	1	1	1	1	0	1	0	Only benefit in areas absent of sea otters
brown rock crab	Both	0	>330	1	1	1	ND	ND	0	0	0	0	Only benefit in areas absent of sea otters
corals	Rock	40	>500	1	0	0	ND	ND	1	0	1	1	Possible impacts from trawling or other bottom contact
Dungeness crab	Sand	0	755	0	1	1	ND	0	0	0	0	0	Due to management regime, no size shift
ghost shrimp	Sand	Intertidal	1	1	1	0	ND	ND	0	0	1	0	fish bait
gorgonians	Rock	40	>500	1	0	0	ND	ND	1	0	1	1	Possible impacts from trawling or other bottom contact
limpets	Rock	Intertidal	98	1	0	0	ND	1	0	0	1	1	removal impacts other species
littleneck clams	Coarse Sand	Intertidal	Intertidal	1	0	0	ND	ND	0	0	1	0	
market squid	Pelagic/Sand			0	1	1	0	ND	0	0	0	1	Both forage species and predators on small fishes
moon snail	Sand	Intertidal	499	1	0	0	ND	ND	0	0	1	0	
mud shrimp	Sand	Intertidal	1	1	0	0	ND	ND	0	0	1	0	
mussels	Rock	Intertidal	131	1	0	0	ND	ND	0	0	1	1	removal impacts other species
Pismo clam	Sand	0	82	1	0	1	0	1	1	0	0	0	very slow growing adults, long lived, 50 years, Only benefit in areas absent of sea otters
purple urchin	Both	0	302	1	0	0	ND	ND	0	0	0	1	Only benefit in areas absent of sea otters, removal impacts other species
red abalone	Rock	Intertidal	200	1	0	1	1	1	1	0	0	0	short-lived, non-feeding larval stage, Only benefit in areas absent of sea otters
red rock crab	Both	0	750	1	1	1	ND	ND	0	0	0	0	Only benefit in areas absent of sea otters
red urchin	Both	Intertidal	295	1	1	1	0	ND	0	0	0	1	Only benefit in areas absent of sea otters, removal impacts other species
rock scallop	Rock	0	98	1	ND	ND	ND	ND	1	0	0	0	Evidence of positive impact in So. Cal reserves
sand crab	Sand	Intertidal	1	1	0	0	ND	ND	0	0	0	0	
sea hares	Both	0	59	1	0	0	ND	ND	0	0	0	0	
sea pens	Sand	25	>300	1	0	0	ND	ND	1	0	1	1	Possible impacts from trawling or other bottom contact
sea stars	Both	Intertidal	>600	1	0	0	ND	ND	0	0	1	1	Keystone species in intertidal
sponges	Rock	Intertidal	>2000	1	0	0	ND	ND	1	0	1	1	Possible impacts from trawling or other bottom contact
spot prawn	Sand/Interface	150	1600	1	1	1	ND	ND	0	0	0	0	
turban snail	Rock	Intertidal	249	1	0	0	ND	ND	0	0	1	0	
worms	Both	Intertidal	>600	1	0	0	ND	ND	0	0	1	0	

Species	Primary Bottom type (Rock/Sand)	Shallow Depth (ft.)	Deepest Depth (ft.)	sm-mod adult home range (sm 0-5 km mod 10-20 km)	Currently mod-large take	Historically mod-large take	Low Pop. Estimate (<40% unfished)	Size structure shifted toward sm indiv	life history trait vulnerable	life stage to benefit (e.g., spawning activity, nursery area)	habitat impacted (by human activity)	Ecologically Important (keystone or habitat forming)	Comments
Plant and Algae													
bull kelp	Rock	1	59	1	0	0	0	0	0	0	0	1	
eel grass	Sand	1	10	1	0	0	1	0	1	0	1	1	
giant kelp	Rock	20	121	1	0	0	0	0	0	0	0	1	
other intertidal algal species	Rock	Intertidal	Intertidal	1	0	0	0	0	1	0	1	1	
rock weeds	Rock	Intertidal	Intertidal	1	0	0	0	0	1	0	1	1	
sea palm	Rock	Intertidal	Intertidal	1	0	0	0	0	1	0	1	0	
Fishes													
aurora rockfish	Sand/Rock	266	2930	ND	1	1	ND	ND	1	0	0	0	
bank rockfish	Rock	102	1489	ND	1	1	ND	1	1	0	0	0	declines in pop size and age/length in fishery
barred surfperch	Sand	0	240	1	1	1	ND	ND	1	0	0	0	piers;jetties;sandy beaches
bat ray	Sand/Rock	0	354	0	1	0	ND	ND	1	1	1	1	aggregate to spawn and breed inshore. Very often in the sandy areas in kelp beds, between the rocks. Top predator. Digging in sand has profound impact on invertebrate community.
big skate	Sand	7	2624	0	0	0	ND	ND	1	0	0	0	low fecundity
black rockfish	Rock	0	1200	1	1	1	1	1	1	0	0	0	Per Steve Ralston, CA population likely below 40%
black surfperch	Rock	0	150	1	1	1	ND	ND	1	0	1	0	piers; jetties; estuaries; kelp; low fecundity
black-and-yellow rockfish	Rock	0	120	1	1	1	ND	ND	1	0	0	0	
blackgill rockfish	Rock	289	2520	ND	1	1	0	ND	1	0	0	0	
blue rockfish	Rock	0	1800	0	1	1	0	1	1	0	0	1	filter barnacle larvae (Gaines and Roughgarden)
bocaccio	Rock	0	1578	0	1	1	1	1	1	0	0	1	Top predator; adults with low movement. declining lengths in central CA CPFV (Mason 1998)
bronzespotted rockfish	rock	246	1354	1	1	1	ND	ND	1	0	0	0	
brown rockfish	Rock	0	480	1	1	1	ND	0	1	0	0	0	locally important species in places like SF Bay since 1850
brown smoothhound	Sand	0	922	0	1	0	ND	ND	1	1	1	0	inshore nursery
cabezon	Rock	0	360	1	1	1	0	ND	0	0	0	0	
calico rockfish	Rock	0	1000	1	0	0	ND	ND	1	0	0	0	

Species	Primary Bottom type (Rock/Sand)	Shallow Depth (ft.)	Deepest Depth (ft.)	sm-mod adult home range (sm 0-5 km mod 10-20 km)	Currently mod-large take	Historically mod-large take	Low Pop. Estimate (<40% unfished)	Size structure shifted toward sm indiv	life history trait vulnerable	life stage to benefit (e.g., spawning activity, nursery area)	habitat impacted (by human activity)	Ecologically Important (keystone or habitat forming)	Comments
California halibut	Sand	1	922	0	1	1	0	ND	0	1	0	0	nursery and spawning aggregations
California skate	Sand	43	5248	0	0	0	ND	ND	1	0	0	0	
canary rockfish	Rock	0	1440	0	0	1	1	1	1	0	0	0	declining lengths in central CA CPFV (Mason 1998)
chilipepper rockfish	rock	0	1611	0	1	1	0	1	1	0	0	0	declining lengths in central CA CPFV (Mason 1998)
china rockfish	rock	10	420	1	1	1	ND	ND	1	0	0	0	
copper rockfish	Rock	0	607	1	1	1	ND	1	1	0	0	0	
cowcod	Rock	132	1610	1	0	1	1	ND	1	0	0	1	
darkblotched rockfish	Both	95	2985	1	1	1	1	ND	1	0	0	0	
Dover sole	Sand	7	4500	0	1	1	0	ND	0	0	0	0	
English sole	Sand	0	1800	0	1	1	0	ND	0	0	0	0	
flag rockfish	Rock	100	1371	1	1	1	ND	ND	1	0	0	0	
gopher rockfish	Rock	0	282	1	1	1	0	ND	1	0	0	0	
grass rockfish	Rock	0	150	1	1	1	ND	ND	1	0	0	0	
greenblotched rockfish	Rock	180	1610	1	1	1	ND	ND	1	0	0	0	
greenspotted rockfish	Both	98	1243	1	1	1	ND	ND	1	0	0	0	
greenstriped rockfish	Sand/Interface	39	3756	1	1	1	ND	ND	1	0	0	0	
kelp greenling	Rock	0	426	1	1	1	ND	ND	0	0	0	0	
kelp rockfish	Rock	0	190	1	1	1	ND	ND	1	0	0	0	
leopard shark	Sand	0	515	0	1	0	ND	ND	1	1	1	0	estuarine pupping and nursery grounds. Very common in kelp beds, often up in the water column in kelp beds at night.
lingcod	Rock	0	1558	1	1	1	1	ND	0	1	0	0	reproductive aggregations
longnose skate	Sand	30	3506	0	0	0	ND	ND	1	0	0	0	low fecundity
longspine thornyhead	Sand	660	5760	0	1	1	0	ND	0	0	0	0	
monkeyface prickleback	Rock	0	80	1	1	1	ND	ND	1	0	1	0	homing; tidepools; large TL; potential local depletion
olive rockfish	Rock	0	564	1	1	1	ND	1	1	0	0	0	
Pacific hagfish	Sand/Rock	53	3168	0	0	1	ND	ND	0	0	0	0	
petrale sole	Sand	0	1800	0	1	1	1	ND	0	0	0	0	

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pile surfperch	Rock	0	295	1	1	1	ND	ND	1	0	0	0	piers; jetties; estuaries; kelp. Low fecundity
pink rockfish	Rock	150	1200	1	0	0	ND	ND	1	0	0	0	
quillback rockfish	rock	16	899	1	1	1	ND	ND	1	0	0	0	
rainbow surfperch	Rock	0	165	ND	0	0	ND	ND	1	0	1	0	harbors; eelgrass. some evidence they move inshore and offshore, movements are not known; low fecundity.
redbanded rockfish	Rock	161	3756	ND	1	1	ND	ND	1	0	0	0	
rex sole	Sand	0	3756	0	1	1	0	ND	0	0	0	0	
rosethorn rockfish	Both	194	3756	1	1	1	ND	ND	1	0	0	0	
rosy rockfish	Rock	24	864	1	1	1	ND	ND	1	0	0	0	
rubberlip surfperch	Rock	0	165	ND	1	1	ND	ND	1	0	1	0	piers; jetties; kelp. Low fecundity
sand sole	Sand	0	1066	ND	1	1	ND	ND	0	0	0	0	
sanddab, Pacific	Sand	0	1800	0	1	1	0	ND	0	0	0	0	
shiner surfperch	Both	0	480	ND	1	1	ND	ND	0	0	1	0	estuaries; kelpbeds
shortspine thornyhead	Sand/Rock	56	5000	0	1	1	0	ND	0	0	0	0	Juveniles, in particular, are often found on rocks.
slender sole	Sand	30	3756	0	0	0	ND	ND	0	0	0	0	
speckled rockfish	Rock	100	1200	1	1	1	ND	ND	1	0	0	0	
splitnose rockfish	sand	262	2932	0	1	1	ND	ND	1	0	0	0	
squarespot rockfish	Rock	60	1000	1	1	0	0	ND	1	0	0	0	
starry flounder	Sand	0	1968	ND	1	1	0	ND	0	0	1	0	estuarine nurseries
starry rockfish	Rock	50	900	1	1	1	ND	ND	1	0	0	0	
striped surfperch	Rock	0	165	0	1	1	ND	ND	0	0	1	0	piers; jetties; estuaries; kelp
surf smelt	Sand	0	30	0	1	1	ND	ND	0	1	1	0	spawn in surfzone
topsmelt	Sand	0	85	ND	1	1	ND	ND	0	1	1	0	eggs laid on plants in backwater
treefish	Rock	0	320	1	1	1	ND	ND	1	0	0	0	
vermilion rockfish	Rock	0	1440	1	1	1	0	1	1	0	0	0	southern CA declines in length (Love et al.)
walleye surfperch	Both	0	597	1	1	1	ND	ND	0	0	0	0	sandy beaches; piers

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white croaker	Sand	0	781	0	0	0	ND	ND	0	0	0	0	
white surfperch	Both	0	230	1	1	1	ND	ND	0	0	1	0	estuaries
widow rockfish	Rock	0	2625	0	0	1	1	ND	1	1	0	0	known to aggregate around pinnacles/seamounts
wolf eel	Rock	0	740	1	0	0	ND	ND	0	1	0	0	sedentary;mate-for-life? Large size
yelloweye rockfish	Rock	49	1800	1	0	1	1	ND	1	0	0	1	Top predator.
yellowtail rockfish	rock	0	1801	0	1	1	0	1	1	0	0	0	declining lengths in central CA CPFV (Mason 1998)
Seabirds (breeding)	-	-	-	-	-	-	-	-	-	-	-	-	-
Brandt's Cormorant		surface	50	0	0	0	0	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Brown Pelican		surface	10	0	0	0	1	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction, downlisting under consideration
Common Murre		surface	600	0	0	0	0	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Double-crested Cormorant		surface	50	0	0	0	0	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Least Tern		surface	surface	0	0	0	1	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Marbled Murrelet		surface	100	0	0	0	1	0	1	1	1	0	Significant decline in California population (Only found in northern part of central coast),potential for forage base increase, potential human disturbance reduction
Pelagic Cormorant		surface	50	0	0	0	0	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Pigeon Guillemot		surface	100	0	0	0	0	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Rhinoceros Auklet		surface	300	0	0	0	1	0	1	1	1	0	potential for forage base increase, potential human disturbance reduction
Seabird (Migrant)	-	-	-	-	-	-	-	-	-	-	-	-	-
Grebe spp. (Western, Clark's)		surface	30	0	0	0	0	0	1	0	0	0	potential for forage base increase

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Loon spp. (Pacific and Red-necked)		surface	50	0	0	0	0	0	1	0	0	0	potential for forage base increase
Northern Fulmar		surface	5	0	0	0	0	0	1	0	0	0	potential for forage base increase
Red-necked Phalarope		surface	surface	0	0	0	0	0	1	0	0	0	potential for forage base increase
Scoter spp. (Surf, White-winged)		surface	10	0	0	0	0	0	1	0	0	0	potential for forage base increase
Shearwater spp. (Sooty, Black-vented)		surface	30	0	0	0	0	0	1	0	0	0	potential for forage base increase
Marine mammals	-	-	-	-	-	-	-	-	-	-	-	-	-
Gray whale		surface		0	0	1	0	0	0	0	0	0	potential for forage base increase
Harbor porpoise		surface		1	0	1	0	0	0	0	0	0	potential for forage base increase
Harbor seal		surface		0	0	1	0	0	0	1	1	1	potential for forage base increase, potential human disturbance reduction
Short-beaked common dolphin		surface		0	0	0	0	0	0	0	0	0	potential for forage base increase
Southern Sea Otter		surface		0	0	1	1	0	0	0	0	1	potential for forage base increase
Steller's sea lion		surface		0	0	1	1	0	0	0	1	1	Ano Nuevo population has declined, potential for forage base increase, potential human disturbance reduction

Appendix O. Regional MPA Management Plans

This Appendix was added from Section 8 of the April 2007 version of the Revised Draft Master Plan. No changes have been made to the text of the section.