California Marine Life Protection Act Initiative
Master Plan Science Advisory Team
Some Key Species Likely to Benefit from Marine Protected Areas
in the Central Coast Study Region
November 28, 2005

Introduction

The Marine Life Protection Act [Fish and Game Code, Section 2856(a)(2)(B)] calls for "An identification of select species or groups of species likely to benefit from MPAs". Well-designed marine protected areas (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

The attached table 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 attached 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.

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Habitat Type	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
Species													
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	

ND = no data

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worms	Both	Intertidal	>600	1	0	0	ND	ND	0	0	1	0	
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 in places like SF Bay since 1850

ND = no data

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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	
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 water column in kelp beds at night.
lingcod	Rock	0	1558	1	1	1	1	ND	0	1	0	0	reproductive aggregations

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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	
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	

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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
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

ND = no data

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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
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

ND = no data

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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, potent'l human disturb. reduction

ND = no data