California Marine Life Protection Act Initiative
Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region
ADDITIONS TO Chapter 3 – Protection Levels

Revised February 23, 2009

In applying the conceptual model presented as Figure 3-1 in Chapter 3 of the *Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA South Coast Study Region,* the 'Updates to Table 3-2' at the end of this document provides a decision matrix for each newly proposed activity and the recommended corresponding level of protection.

Various fishing activities and associated levels of protection are described below.

Pelagic finfish,[1] Pacific bonito, and white sea bass (hook and line or spear):

Direct impacts – Take of pelagic finfish by hook and line is unlikely to alter habitat directly as gear rarely touches the seafloor.

Pelagic finfish targeted in the study region, include yellowtail, barracuda, dorado, mackerel, marlin, swordfish, mako and thresher sharks, and albacore, yellowfin, bluefin, and skipjack tunas. Pacific bonito (*Sarda chiliensis*) and white seabass (*Atractoscion nobilis*) are not defined as pelagic finfish in CDFG regulations, but they share many characteristics with the above species and are often caught in conjunction with other pelagics. Pelagic finfish are highly mobile species that are unlikely to benefit directly from MPAs constrained within state waters, thus the abundance of these species is unlikely to be altered in an area that allows take relative to an SMR.

Fishing for pelagic finfish with spear gear requires visual contact with the target, thus the incidental catch in this fishery is likely to be minimal. Data on associated catch of pelagic finfish using hook and line gear were extracted from CPFV observer data collected by DFG, but were difficult to interpret because they do not resolve the targeted species. Observer catch records for bonito, mackerel, yellowtail, white seabass, and barracuda all indicate a high associated catch of basses (kelp bass and barred sand bass) and other reef-associated fishes, including rockfish, halfmoon, scorpionfish, and sheephead. CPFV angler interview data (which resolves catch by target but does not account for target switching within a trip) confirms the associated catch relationship between pelagic finfish and nearshore resident species. If associated catch of resident species is substantial, the abundance of these species may be altered by take of pelagic finfish relative to an SMR.

Catch information was insufficient to assess the magnitude of incidental catch, or how it correlates with gear type, depth, or habitat. However, the primary gear and methods used to take pelagic finfish are virtually identical to those used when targeting nearshore resident species, such as kelp bass and barred sandbass. Thus the SAT concluded that avoidance of shallow nearshore habitats was the only way to reliably reduce incidental catch of

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[1] Pelagic finfish: northern anchovy (*Engraulis mordax*), barracudas (*Sphyraena* spp.), billfishes* (family Istiophoridae), dolphinfish (*Coryphaena hippurus*), Pacific herring (*Clupea pallasi*), jack mackerel (*Trachurus symmetricus*), Pacific mackerel (*Scomber japonicus*), salmon (*Oncorhynchus* spp.), Pacific sardine (*Sardinops sagax*), blue shark (*Prionace glauca*), salmon shark (*Lamna ditropis*), shortfin mako shark (*Isurus oxyrinchus*), thresher sharks (*Alopias* spp.), swordfish (*Xiphias gladius*), tunas (family Scombridae), and yellowtail (*Seriola lalandi*). *Marlin is not allowed for commercial take.

resident species. The SAT used the depth distribution of kelp forests and sandbass breeding aggregations to delineate depth zones where incidental catch of resident species was more or less likely.

Indirect impacts – Pelagic finfish generally feed on mobile forage species such as small schooling fishes, crab larvae, squid, shrimps and planktonic organisms. As both pelagic finfish and their prey are highly mobile, MPAs are likely to have little impact on the local abundance of these species. Thus, the indirect ecosystem impacts of pelagic finfish take are predicted to be low.

Level of protection:

High – spear, any depth
High – hook and line, if water depth in MPA is greater than 50m
Mod-high – hook and line surface gear on mainland if water depth in MPA is less than 50m but greater than 30m due to potential increase in associated catch of resident species
Mod-low – hook and line if water depth is less than 30m on the mainland or 50m at the islands

Rock scallop (scuba hand collection):

Direct impacts – Hand collection of rock scallops (*Crassadoma gigantea*) is done in one of two ways: either the diver cuts the scallop from it's shell underwater, leaving the shell attached to the rock, or the diver pries the scallop, shell and all, from the rock. Either method causes some habitat disturbance, but prying the shell from the rock causes damage to the reef as well as removing the habitat formed by the scallop shell. The removal of rock scallops is likely to have an impact on community structure by altering reef structure and habitat for benthic invertebrates.

Rock scallops are a sessile bivalve that inhabits rocky reefs. Due to their sessile nature rock scallops are likely to benefit directly from MPAs within state waters, therefore harvest of rock scallops is likely to alter their abundance relative to an SMR.

Because divers harvest selectively, there is little or no catch of non-target species.

Indirect impacts – Rock scallops are planktivores and prey to sea stars and shell borers in the nearshore rocky environment. Removal of this species is likely to have moderate impacts on community structure within an MPA.

Level of protection:

Low

Urchin hand collection:

Direct impacts – Hand collection of urchins causes some habitat disturbance (divers may move rocks to better remove the urchins) but these habitat effects are unlikely to alter community structure significantly.

Several species of sea urchins inhabit shallow rocky reefs along the coast of California. The two most abundant species on shallow rocky reefs throughtout the coast of California are the red and purple sea urchin (*Strongylocentrotus franciscanus* and *purpuratus*, respectively). In southern California, two other species can be locally abundant on rocky reefs, the crowned sea urchin, *Centrostephanus coronatus* and the white sea urchin, *Lytechinus anamesus*. The red urchin is the only species taken commercially in California waters. All but the white sea urchin are relatively sedentary species. Thus, the abundance of red sea urchins within an area may be altered by harvest relative to a no-take marine reserve, depending on the level of protection and rates of predation by other sea urchin predators. However divers harvest selectively, so there is little or no catch of non-target species.

Indirect impacts – Urchins are ecologically important species in most shallow rocky ecosystems (Lawrence 1975, Harrold and Pearse 1987). They can be important herbivores, prey, competitors and facilitators of other species in nearshore rocky habitats. Throughout their range, populations of sea urchins can impact (decrease) the abundance of macroalgae, thereby altering both the total abundance of macroalgae, the relative abundance of species of macroalgae in a kelp forest, and the abundance of invertebrates and fishes associated with habitats created by macroalgae (Graham 2004, Graham et al 2008). Sea urchins feed on both drift (i.e. detached) and attached growing macroalgae. Their impact on the local abundance of drift and attached algae is a function of their local abundance, food availability and abundance of their predators. In low abundance, with sufficient drift availability and the presence of predators, red sea urchins restrict their distribution to crack and crevices and feed on drift. With insufficient drift abundance (Ebeling et al 1985, Harrold and Reed, 1985, Tegner and Dayton 1991) or reduced predator abundance (Cowen 1983), red sea urchins emerge from cracks and crevices and form “feeding fronts” that remove all macroalgae where they travel (see Table 2 in Harrold and Pearse, 1987). Other triggers of destructive grazing events include episodes of strong recruitment of sea urchins and loss of abundant drift caused by reduction of kelp by other factors (storms, El Nino events, grazing amphipods).

Adult sea urchins are eaten by several predators in shallow rocky reefs, including the sea otter, *Enhydra lutris*, wolf eel, *Anarrhichthys ocellatus*, California spiny lobster, *Panulirus interruptus* (Tegner and Levin 1983, Berhens and Lafferty 2004), California sheephead, *Semicossyphus pulcher* (Cowen 1983), sunflower sea star, *Pycnopodia helianthodes*, and other species. Small sea urchins are eaten by other predators (e.g., other sea stars, crabs and other species). Three lines of evidence from the MLPA South Coast Study Region suggest that these predators, when they occur in sufficient abundance, can control/suppress the abundance of their sea urchin prey. In one marine reserve in the northern Channel Islands (Anacapa Island), spiny lobster and California sheephead were more numerous, sea urchin density was lower and the abundance of giant kelp, *Macrocystis pyrifera*, was higher than areas outside the reserve (Behrens and Lafferty 2004). Similarly, after five years of protection, an increase in kelp abundance has been observed within the Channel Islands MPAs compared to adjacent areas, though there is no direct evidence for a trophic basis for this response (B. Kinlan pers Comm., The First Five Years of Monitoring the Channel Islands Marine Protected Area Network) Thirdly, between the extirpation of sea otters and the advent of the sea urchin fishery, kelp forests were extensive in southern California demonstrating that other factors besides fishermen controlled sea urchins (Crandall 1912). These interactions between multiple predators (including man) and their prey, suggest that these predators may compete for sea urchins. Thus, the local impacts of human take may diminish the local growth, reproduction and abundance of the other predators of sea urchins in a marine protected area. In addition, at high densities, sea urchins experience high mortality from disease (Lafferty 2004) reducing the local abundance of sea urchin populations.

Sea urchins compete with other herbivores for both drift and intact algae. They also compete with other species for refuge from predators in cracks and crevices. In particular, sea urchins compete with abalone for both drift algae and refuge space (Karpov et al. 2001). In contrast, red sea urchins serve as nursery sites for other small invertebrates, protecting them from predators during their vulnerable life stages. Young abalone seek shelter beneath the spines of red sea urchins and the density of abalone recruits can be greater in northern California MPAs where red sea urchins are protected from take[2].

Based on the various species interactions described above, removal of urchins by urchin harvest is likely to have impacts on community structure, especially the total and relative abundance of other sea urchin predators, within an MPA.

Level of protection:
Moderate-low – due to indirect ecosystem effects

Literature cited:

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Updates to Table 3-2. Level of protection decision matrix. *(Colors across the top row correspond to the question level in the conceptual model in Figure 3-1, grey cells indicate that question was not addressed following the decision flow.)*

	Question level	1	2		3		4		
Allowed Use	**Level of Protection Designation**	**Does proposed activity alter habitat directly?**	**Is abundance of any species likely to be significantly different in the MPA relative to an SMR?**	**Is habitat alteration likely to change community structure substantially?**	**Is removal of any species likely to impact community structure directly or indirectly?**	**Is removal of any species likely to directly alter habitat?**	**Is habitat alteration caused by species removal likely to change community structure substantially?**	**Is the altered abundance of any species likely to alter community structure substantially?**	**Status of LOP designation**
pelagic finfish*, white seabass, and bonito (spear)	high (proposed)	NO	NO - target species are highly mobile, selective harvest by spear should result in little or no incidental catch		NO - target species are highly mobile and low incidental catch				Discussed within workgroup
pelagic finfish*, white seabass, and bonito (H&L) >50m depth	**high (proposed)**	NO	NO - target species are highly mobile, incidental catch of resident species is likely to be low deeper than 50m where no kelp occurs		NO - target species are highly mobile and low incidental catch				Discussed within workgroup
pelagic finfish*, white seabass, and bonito (H&L) 50>30m depth using surface gear on mainland	mod-high (proposed)	NO	NO - target species are highly mobile, incidental catch of resident species is likely to be moderate as you fish closer to kelp beds		YES - incidental catch of resident benthic species could change community structure				Discussed within workgroup
pelagic finfish*, white seabass, and bonito (H&L) <30m depth	mod-low (proposed)	NO	YES - target species are highly mobile, incidental catch of resident benthic species (kelp bass on rocky reef and barred sand bass on soft bottom) is very likely in shallow water			NO		YES - incidentally caught resident species play an important predatory role in the nearshore environment	Discussed within workgroup
rock scallop (scuba)	low (proposed)	YES		YES - rock scallop removal modifies rugosity of reef and local diversity of benthic species					Revisited based upon questions from SAT members
urchin	mod-low (proposed)	NO	YES - target species has low movement			NO		YES - impt grazer of kelp which can change the entire structure of ecosystem	Discussed within workgroup