3. Protection Levels (Goals 1, 2, 4 and 6)

Status of this chapter: The SAT has approved of the approach presented as the conceptual model in Figure 3-1 and the level of protection designations for the activities included in this chapter. The SAT has not reviewed or discussed in detail the supporting text in this chapter.

Summary of the MLPA Guidelines Regarding Level of Protection

The MLPA calls for an improved network of MPAs which includes a "marine life reserve component," and may include "areas with various levels of protection." To facilitate comparison between MPA proposals allowing various uses, the SAT has developed a framework for assessing the level of protection provided by a proposed MPA.

The level of protection (LOP) concept is simple: the more permissive an MPA, the lower its LOP. Permissiveness, as used here, means the degree to which the MPA's regulations permit impacts to habitat or community structure. If a proposed MPA permits activities having high impact on habitat or community structure, then that MPA is said to have a low LOP. An MPA which permitted no human activity at all would on the other hand be said to have a high LOP.

Why Categorize MPAs by Protection Levels?

The SAT needs a method by which to evaluate the overall conservation value of entire proposed arrays of MPAs. Each MPA in a proposal will be designated as one of three types of marine protected areas: state marine reserve (SMR), state marine conservation area (SMCA), or state marine park (SMP). While the SMR, where no appreciable take of any species is allowed, is clearly the most protective of the MPA types, the relationship between the SMCA and the SMP is less clear. There is great variation in the type and magnitude of activities that may be permitted within these MPAs. It is expected that proposals will, in addition to naming each of its MPAs with one of these types, also specify what activities are to be permitted in each MPA. This gives designers of MPA proposals flexibility in crafting MPAs that either individually or collectively fulfill the various goals and objectives specified in the MLPA. However, this flexibility may mean that to evaluate an array of MPAs only by their type designations may lead to deceptive results. For this reason, the SAT looks beyond the MPA type to the proposed permitted activities to determine the LOP an MPA will afford.

Marine Protected Area (MPA) Designations

State marine reserves (SMR) provide the greatest level of protection to species and to ecosystems by prohibiting take of any kind (with the exception of permitted scientific take for research, restoration, or monitoring). The high level of protection attributed to an SMR is based on the assumption that no other appreciable level of take or alteration of the ecosystem will be allowed. Thus, of the three types of MPAs, SMRs provide the greatest likelihood of achieving MLPA goals 1, 2, and 4.

State marine parks (SMP) are designed to provide recreational opportunities and therefore can allow some or all types of recreational take of a wide variety of fish and invertebrate species by various means (e.g. hook and line, spear fishing). Because of the variety of species that potentially can be taken and the potential magnitude of recreational fishing pressure, SMPs that allow recreational fishing provide lower protection and conservation value relative to other, more restrictive MPAs (e.g. SMRs and some SMCAs). Although SMPs may have lower value for achieving MLPA goals 1 and 2, they may assist in achieving other MLPA goals.

State marine conservation areas (SMCA) potentially have the most variable levels of protection and conservation of the three MPA designations because they may allow any combination of commercial and recreational fishing, as well as other extractive activities (e.g. kelp harvest).

Conceptual Framework for Assigning Levels of Protection

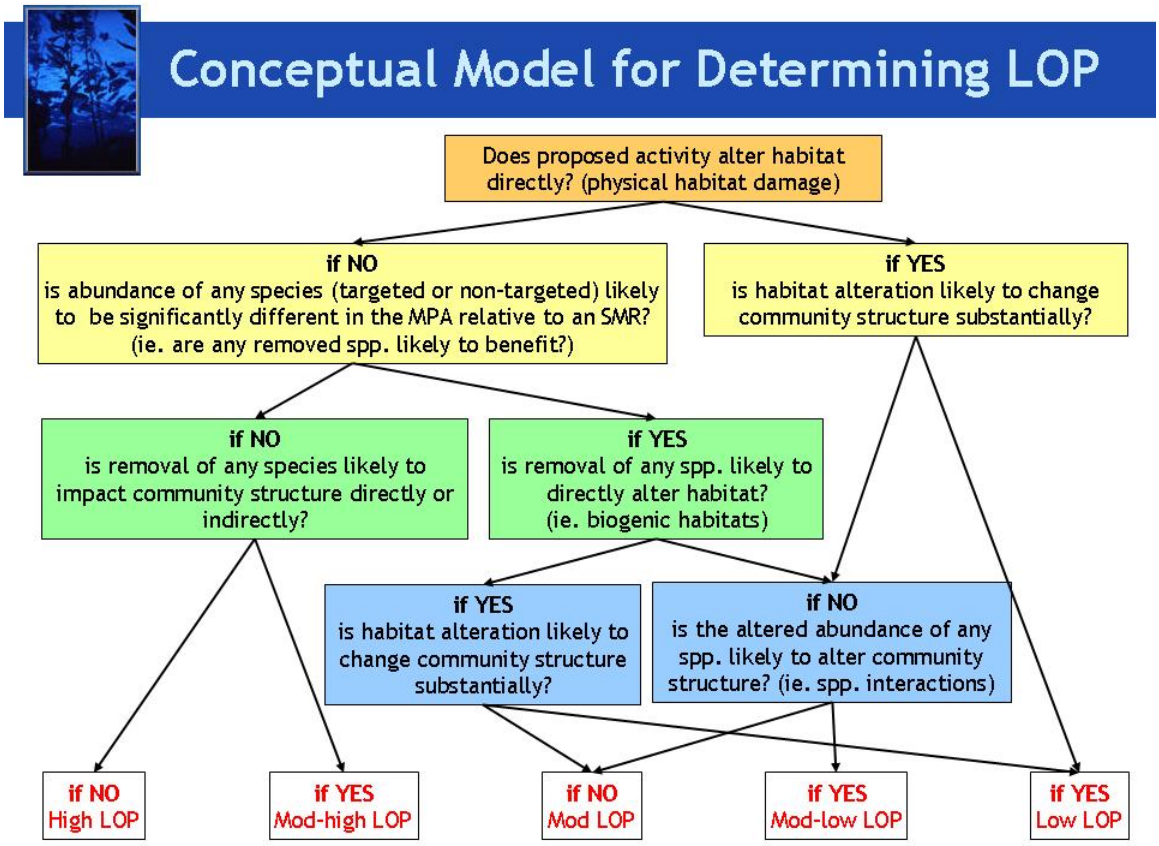
Levels of protection are based upon the likely impacts of proposed activities to the ecosystems within the MPA. Conceptually, the SAT seeks to answer the following question in assigning levels of protection: “How much will an ecosystem differ from an unfished ecosystem if one or more proposed activities are allowed?” To arrive at answer, the SAT will evaluate each activity that is proposed to be permitted in an MPA, asking “How much will this ecosystem differ from an unfished system if this one activity is allowed?” Where multiple permitted activities are proposed, the one with the greatest impact is the one that will “win,” meaning that the LOP ascribed to the MPA will be the LOP that would result if that single, highest-impact activity were the only one allowed.

Marine reserves (SMRs) are, by definition, unfished ecosystems, therefore we ascribe to them the highest protection level, “very high.” To MPAs that allow extractive activities are ascribed 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. Figure 3-1 presents the decision flow for determining the level of protection of a proposed MPA based on one permitted activity. It asks questions about the activity so as to result in a LOP designation for the MPA where that activity will be allowed. This same decision flow will be used for every activity that is proposed to be permitted, so that the one resulting in the lowest LOP designation for a particular MPA is the one that will determine the LOP designation actually assigned.

As the term is used here, “activity” refers to:

- take of a particular species,
- by a particular method,
- at a particular range of depths.

Figure 3-1. Conceptual Model for Determining the Level of Protection in an MPA Based on an Extractive Activity Permitted There



In applying the conceptual model presented in Figure 3-1 the SAT makes three important assumptions:

- Any extractive activity can occur at high intensity.
- For the purpose of comparison, an unfished system is a marine reserve that is successful in protecting that ecosystem from all effects of fishing and other extractive uses within the MPA.
- The proposed activity is occurring in isolation (i.e. without cumulative effects of multiple allowed activities).

The SAT identifies the impacts of a proposed activity by considering two main categories of impacts: (1) direct impacts of the activity, and (2) indirect impacts of the activity on community structure and ecosystem dynamics. In the case of fishing, direct impacts may include habitat disturbance and removal of target and non-target species caused by the fishing gear or method. Indirect impacts may include any change in the ecosystem caused by removal of target and non-target species. In general, removal of resident species that are likely to benefit from MPAs are considered to have impacts on species interactions, especially if those species play an integral role in the food web or perform a key ecosystem function (e.g. biogenic structure).

Associated Catch

To consider the catch associated with specific gear types and target species, the SAT examined five sources of data in the analysis: 1) California Recreational Fisheries Survey angler interviews (CRFS interviews), 2) CRFS onboard observer data (CRFS observer data), 3) DFG commercial landing receipt data, 4) DFG log book data from recreational commercial passenger fishing vessels (CPFVs), and, where adequate scientific information was lacking, 5) input from stakeholders familiar with relevant species or fisheries.

The CRFS data, commercial landing receipt data, and CPFV log book data are all limited in their ability to accurately reflect 'bycatch' because catch information is not clearly linked to a specific target species. Bycatch, in this document, means fish or other marine life that are taken (both landed and discarded) in a fishery but which are not the target of the fishery. CRFS angler interviews, commercial landing receipt data, and CPFV log book data all report catch at the trip level, with a single target per trip. Anglers may switch target species during a trip and retain a mixed species catch but this shift in effort to a different target species is not always captured in the data. For example, an interviewed angler or CPFV logbook may report yellowtail as the primary target but may have switched fishing effort to target kelp bass during the trip. Both yellowtail and kelp bass may have been retained, but at the trip level there is insufficient resolution in the data to determine if those kelp bass were caught incidentally while fishing for yellowtail, or were caught cleanly in a separate fishing event on the same trip. In the case of CRFS onboard observer data, the fishing target is not indicated, only the catch is recorded, which further complicates efforts to identify incidental catch. Due to the inability of these data to accurately reflect 'bycatch,' the term 'associated catch' is used in reference to data where it can not be determined if the reported catch was incidental to fishing for the target species. Associated catch is defined in this document as the removal or mortality of species other than the declared target species and includes any organisms that are: 1) captured incidentally in a fishery whether they are discarded (either dead or alive), kept for personal use, or sold; or 2) captured as a secondary target species where it could not be determined if effort shifted to a secondary target species.

The CRFS data used in this analysis may provide a better estimate of associated catch than commercial landing receipt data because it includes both landed and discarded catch. However, the CRFS data only reflect sampled trips, and are not expanded for total effort. CRFS observer data consist of observations of landed and returned catch by a trained CRFS observer sampling a sub-set of anglers fishing at each location on sampled trips. CRFS interview data include both examined catch and catch that was not examined by a sampler but reported by anglers as discarded either dead or alive. CRFS data are reported as numbers of fish.

Commercial landing receipts only provide data for species that were landed and brought to market. Discarded catch is not reported on landing receipts and was not available for this analysis. Thus, the commercial landing receipt data are likely to provide a reasonable estimate of associated catch only for marketable species that are legal to retain in conjunction with the primary target species. Again, commercial fishermen may switch target species during a trip and report those on a single landing receipt. For each trip in which a given species made up

the largest proportion of the catch, those species and all other species reported on the same landing receipts using similar gear are represented as a percent of the landed catch. Ecological impacts may result from removal of all of the species considered here as "associated catch."

Logbook data from CPFV recreational fishing trips in the study region report the number of landed and discarded target species as well as incidental catch and, in many cases, the depth where the majority of the catch was taken. However, in some cases it may be possible that a single target species was recorded for a trip where effort shifted to a secondary target species that was not recorded as a target. The data from those trips would be considered "associated catch" rather than "bycatch."

Throughout this analysis, the associated catch for a fishery was only one consideration of the ecological consequences of that activity. As described above, in determining the level of protection to assign to an activity, the SAT considered both direct and indirect impacts, such as habitat disturbance or removal of individuals from the ecosystem, and the consequences those individuals may have on the ecosystem or community dynamics.

Levels of Protection for the South Coast Study Region

The levels of protection as they apply to the south coast study region are presented below. For an MPA that allows multiple activities, the lowest LOP designation resulting from any allowed activity is the one assigned to that MPA. The SAT acknowledges that multiple uses within an MPA may have cumulative impacts on the ecosystem that exceed those of the individual activities. Such cumulative impacts are difficult to predict and the SAT has not addressed this concern in assigning levels of protection.

Very High – no take of any kind allowed. This designation applies only to SMRs.

High – Proposed activities were assigned this level of protection if the SAT concluded that the activity: 1) does not directly alter habitat, 2) is unlikely to significantly alter the abundance of any species relative to an SMR, and 3) is unlikely to have an impact on community structure relative to an SMR. The mobility of removed species (both target and associated catch) was an important factor in determining the activity's impact on abundance and community structure. Individuals of highly mobile species are expected to move frequently between MPAs and unprotected waters, so local abundance of these species is unlikely to be different in a fished area relative to an SMR. Altered abundance of a species, and the associated changes in ecological interactions (e.g. predator/prey, competitive, or mutualistic relationships) are what drives changes in community structure. If the proposed activity is unlikely to alter the abundance of *any* species relative to an SMR, community structure is expected to be unaltered as well and the activity is expected to have little impact on the ecosystem.

~~*High* – MPAs were assigned this level of protection if the SAT concluded that the allowed fishing activity has a very low associated-catch of resident species, causes minimal habitat damage, and is likely to have little impact on ecosystems in the MPA. The mobility of the target species was an important factor in determining ecosystem impacts. Individuals of highly mobile species are expected to move frequently between MPAs and unprotected waters, so local~~

~~abundance of these species is unlikely to be enhanced by MPAs. Because the fishing activity is likely to have little impact on populations of target or any other species (low associated catch), the activity is expected to have little impact on the ecosystem. For example, fishing activities that received a high level of protection include hook and line fishing for pelagic finfish near the surface in deep-water (>50m depth), and pelagic seine fishing for coastal pelagic finfish in deep water (>50m depth).~~

Moderate-high – Activities were assigned this level of protection if the SAT concluded that the activity: 1) does not directly alter habitat, 2) is unlikely to significantly alter the abundance of any species relative to an SMR, but 3) has some potential to alter community structure relative to an SMR. Activities assigned this level of protection are generally characterized by substantial uncertainty regarding ecosystem impacts. This uncertainty arises in one of three ways: 1) the movement range of the target species is either uncertain or short enough that reserve effects are possible, yielding uncertainty as to whether the abundance of this species will be altered relative to an SMR, 2) the level or composition of incidental catch is uncertain making it unclear whether the abundance of any non-target species will be altered relative to an SMR, or 3) the ecological role of any removed species is unclear, leading to uncertainty about how removal may alter community structure relative to an SMR.

~~*Moderate-high* – Fishing activities assigned to this level of protection cause minimal habitat damage, but have either more associated catch or a greater likelihood of ecosystem impacts than those in the high protection category. For example, MPAs that allow hook and line fishing for pelagic finfish in waters shallower than 50m depth were assigned to this level of protection because: 1) The likelihood of increased associated catch of resident benthic species such as sea bass or rockfish is higher; and 2) there is a potential impact to the MPA ecosystem if a pelagic predator is removed at this depth. Similarly, MPAs that allow crab fishing with traps/pots were assigned this level of protection because crabs are only moderately mobile and interact directly with the resident ecosystem. It is difficult to predict whether local populations of crabs will be affected by MPAs, but if they are, a reduction in the crab population in fished areas could have ecosystem-wide impacts.~~

Moderate – Activities were assigned to this level of protection if the SAT concluded that the activity was likely to alter either habitat or species abundance in the area relative to an SMR, but that these changes were unlikely to impact community structure substantially. Activities that are likely to cause minor habitat perturbations or alter the abundance of species that play a minor ecological role (e.g. one of many prey items) received this level of protection.

~~*Moderate* – Fishing activities assigned to this level of protection have higher associated catches of resident species or a greater likelihood of ecosystem impacts than those assigned to the mod-high category. Examples of fishing activities that received a moderate level of protection include hook and line fishing for halibut and other flatfish, diving for abalone, shore-based fishing with hook and line gear in larger MPAs, and hand harvest of giant kelp.~~

Moderate-low – Activities were assigned to this level of protection if the SAT concluded the activity was likely to: 1) alter species abundance relative to an SMR, and 2) alter community structure significantly through the change in abundance of a species that plays an important

ecological role (e.g. top predator) but does not form biogenic habitat. Activities assigned this level of protection may also alter habitat if that habitat alteration is unlikely to have a significant impact on community structure.

~~*Moderate-low* – Fishing activities assigned to this level of protection either directly target resident species, have significant associated catch of resident species, or target species whose removal is expected to have an impact on the resident ecosystem. Examples of fishing activities that received a low-mod level of protection include harvest of urchin, kelp bass, barred sand bass, rockfish, lingcod, cabezon, and surfperches.~~

Low – Only activities that alter habitat in a way that is likely to significantly alter community structure were assigned to this level of protection. Activities with the potential to alter habitat substantially either through direct contact with fishing gear or removal of habitat-forming organisms received this low level of protection.

~~*Low* – Only fishing activities that alter habitat were assigned to this category. Harvest of mussels, and other habitat-forming organisms received a low level of protection, as did all forms of trawl fishing, mechanical harvest of giant kelp and mariculture.~~

Table 3-1. 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	
	Moderate-high	SMCA	
	Moderate	SMCA SMP	spot prawn (trap); sea cucumber (scuba/hookah); grunion (hand harvest)
	Moderate-low	SMCA SMP	Kelp bass, barred sand bass, sheephead(H&L, spear, trap); spotted sand bass (H&L); lobster (trap, hoop net, diving)
	Low	SMCA SMP	

Only SAT-approved designations are included in this table, blank cells are still under review

Coastal MPAs are most effective at protecting species with limited range of movement and close associations to seafloor habitats. Less protection is afforded to more wide-ranging, transient species like salmon and other pelagics (e.g. albacore, swordfish, pelagic sharks).

This has led to proposals of SMCAs that prohibit take of bottom-dwelling species, while allowing the take of transient pelagic species. However, fishing for some pelagic species, near the sea floor or over rocky substrate in relatively shallow water, may increase the likelihood of inadvertently catching resident species that are likely to otherwise receive protection within the MPA. Although depth- and habitat-related bycatch information for specific fisheries are not readily available, it is likely that bycatch is highest in shallow water where bottom fish move close to the surface and become susceptible to the fishing gear.

Participants at a national conference[11] on benthic-pelagic coupling considered the nature and magnitude of interactions among benthic (bottom-dwelling) and pelagic species, and the implications of these interactions for the design of marine protected areas. At this meeting, scientists, managers, and recreational fishing representatives concluded that bycatch is higher in depths where seafloor is <50m (27 fathoms,164 ft) and is lower in depths where seafloor is >50m. This information, along with associated-catch information provided by DFG, contributed to SAT's categorization of MPAs into levels of protection.

In applying the conceptual model presented above in Figure 3-1, Table 3-2 provides a decision matrix for each activity and the corresponding level of protection designated in Table 3-1. Table 3-2 and Figure 3-1 should be viewed together to follow the decision pathway.

[11] Benthic-pelagic linkages in MPA design: a workshop to explore the application of science to vertical zoning approaches. November 2005. Sponsored by NOAA National Marine Protected Area Center, Science Institute, Monterey, CA.

Table 3-2. Level of Protection Decision Matrix

(Colors across the top row correspond to the question level in the conceptual model in Figure 3-2, gray 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
lobster (trap, hoop net, scuba)	mod-low	NO - gear contacts bottom but habitat damage unlikely	YES - target species has low movement & MPA effect has been shown			NO		YES - important urchin predator and thus may have indirect effects on kelp and associated community	SAT approved
barred sand bass (H&L or spear)	mod-low	NO	YES - target species has low movement & MPA effect has been shown			NO		YES - important predator	SAT approved
kelp bass (H&L or spear)	mod-low	NO	YES - target species has low movement & MPA effect has been shown			NO		YES - impt predator	SAT approved
sheephead (H&L, spear, trap)	mod-low	NO - traps contact bottom but habitat damage unlikely	YES - target species has low movement & MPA effect has been shown			NO		YES - impt urchin predator	SAT approved
spotted sand bass (H&L)	mod-low	NO	YES - target species has low movement, restricted to estuaries			NO		YES - impt predator in estuarine embayments	SAT approved
spot prawn (trap)	moderate	NO - traps contact bottom but habitat damage unlikely	YES - genetics and parasites suggest low movement in BC, no studies from CA			NO		NO - predator and prey	SAT approved
sea cucumber (scuba/hookah)	moderate	NO	YES - target species abundance and size shown to decrease where not protected			NO		NO - detritivore and prey	SAT approved
grunion (hand take)	moderate	NO	YES - genetics suggest highly mobile, but likely breeding site fidelity			NO		NO - eggs are a source of food on breeding beaches	SAT approved

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

Spot prawn (trap):

Direct impacts – Take of California spot prawn (*Pandalus platyceros*) with traps involves bottom contact but is unlikely to alter habitat.

Spot prawn are a moderately mobile species (Boutillier and Bond, 2000) which may benefit directly from MPAs within state waters. Tagging studies of spot prawn from British Columbia show that individuals remain within a mile or two of their release location over several months (Boutillier, unpublished data). This finding is supported by a study that found significant differences in parasite loads between populations separated by only 10s of kilometers (Bower and Boutillier, 1990). The moderate adult movement of spot prawn indicates that the abundance of spot prawn is likely to be lower in a fished area as compared to a no-take marine reserve. No data on associated catch for the spot prawn fishery were examined, but data from other trap fisheries (Dungeness crab in the north central coast) indicates that bycatch in the trap fishery is likely to be low, thus the fishing activity is unlikely to alter the abundance of any non-target species.

Indirect impacts – Spot prawn are micro-predators, feeding on other shrimp, plankton, small mollusks, worms, sponges, and fish carcasses. In turn, spot prawn are one of many available prey items for fishes and marine mammals. Any change to ecological interactions

caused by reduced abundance of spot prawn is likely to have only minor impacts on community structure within an MPA.

Level of protection: **Moderate**

Sea cucumber (scuba/hookah hand collection):

Direct impacts – Hand collection of sea cucumber (*Parastichopus parvimensis*) has the potential to alter habitat (anchoring and search activities can disturb both rock and kelp as habitat), but habitat alterations are unlikely to have a significant impact on community structure.

Sea cucumber are relatively sedentary bottom-dwelling species that are likely to benefit directly from MPAs within state waters. A study conducted in the northern Channel Islands before and after the onset of the sea cucumber dive fishery showed a significant decline in sea cucumber abundance at fished sites after the onset of fishing, relative to two no-take marine reserves on Anacapa Island (Schroeder et. al. 2001). The low adult movement of sea cucumber indicates that the abundance of sea cucumber is likely to be lower in a fished area as compared to a no-take marine reserve. Because divers harvest selectively, there is little or no catch of non-target species, thus the fishing activity is unlikely to alter the abundance of any non-target species.

Indirect impacts – Sea cucumbers are detritivores and prey for sea stars (especially Pycnopodia) in the nearshore rocky environment. Any change to ecological interactions caused by reduced abundance of sea cucumber is likely to have only minor impacts on community structure within an MPA.

Level of protection: **Moderate**

Grunion (hand collection):

Direct impacts – Collecting grunion (*Leuresthes tenuis*) by hand from beaches is unlikely to alter habitat.

Grunion are a highly mobile species that is unlikely to benefit from MPAs constrained within state waters unless those MPAs protect spawning sites. Genetic studies of grunion indicate panmixia within the Southern California Bight (Gaida et al, 2003) and high genetic similarity between populations in San Francisco Bay and Los Angeles (Johnson et al, 2009). These genetic studies support the conclusion that grunion are highly mobile. However, collecting grunion by hand on spawning beaches targets this species during the vulnerable spawning period. Unlike squid, which also form spawning aggregations, grunion spawn multiple times in a single season, and may display natal homing, returning to breed at the beach where they were spawned (Martin, K., personal communication). Due to natal homing and spawning aggregations, the abundance of spawning grunion may be altered by hand collection relative to an SMR. Because collectors harvest selectively, there is little or no catch of non-target species, thus the fishing activity is unlikely to alter the abundance of any non-target species.

Indirect impacts – Although grunion are a highly mobile pelagic species they form spawning aggregations and deposit large numbers of eggs on sandy shores. Spawning grunion and their eggs are important, if sporadic, prey in the nearshore ecosystem, thus an altered abundance of grunion may have some minor impacts on the beach community but is unlikely to change community structure significantly.

Level of protection: **Moderate**

Kelp bass (hook and line or spear):

Direct impacts – Take of kelp bass (*Paralabrax clathratus*) by hook and line or spear is unlikely to alter habitat as gear rarely touches the seafloor.

Kelp bass are demersal fish that occur on nearshore rocky reefs and kelp forests. Several studies have shown kelp bass to have small home range sizes. Tag recapture studies conducted by the California DFG in the 1940s and 50s showed that 80% of fish move on the order of 1-2 km although some individuals moved hundreds of kilometers, possibly in search of better habitat (Collyer & Young 1953) (Young 1963) (Quast 1968). More recent studies using acoustic telemetry have confirmed these results, indicating that most kelp bass utilize a small core area (average 0.003 km^2), although some individuals made excursions from this core of one km or more (Lowe et al 2003). Using passive acoustic telemetry methods, Mason (2008) found that kelp bass tagged in the small (0.06 sq mile) Catalina Marine Science Center Reserve were detected within the reserve 317 days out of the subsequent year. Increases in the size and abundance of kelp bass have been demonstrated in a number of small MPAs in Southern California (Tetreault and Ambrose 2007) (Froeschke et al 2006). Tetreault and Ambrose examined kelp bass populations in five small (all < 2 km^2) marine reserves and found that on average, kelp bass were 2.8 times more abundant and 1.4 times larger inside the reserves as compared to nearby control sites. Additionally, Froeschke et al. found kelp bass densities were significantly higher inside the Catalina reserve as compared to control sites outside the reserve. These studies support the conclusion that kelp bass are relatively sedentary and that their abundance is likely to be altered by take relative to an SMR.

CRFS observer and interview data indicate that kelp bass catch using hook and line gear is often associated with catch of other resident reef species including barred sand bass, sheephead, halfmoon, blacksmith, and several nearshore rockfish species. This indicates that the abundance of non-target species may also be altered by hook and line fishing for kelp bass. No data was examined to determine associated catch using spear gear, but a targeted spear fishery is unlikely to produce incidental catch of non-target species.

Indirect impacts – Kelp bass are top predators on nearshore rocky reefs, so that their removal of this species is likely to have impacts on community structure within an MPA. Kelp bass are carnivorous ambush predators, feeding on a variety of small fish and invertebrates including other kelp bass, pipefishes, flatfishes, blacksmith, surfperch, crabs, squid, polychaetes, tunicates, and hydrozoans. Kelp bass also scavenge urchins from sheephead attacks.

Level of protection: **Moderate-low**

Barred sand bass (hook and line or spear):

Direct impacts – Take of barred sand bass (*Paralabrax nebulifer*) by hook and line or spear is unlikely to alter habitat as gear rarely touches the seafloor.

Barred sand bass are demersal fish which occur in mixed sandy and rocky habitat and are often associated with kelp and seagrass beds or artificial reefs. The movements of barred sand bass are not well known. DFG (1982) tagging studies from the 1980s indicate movements from five to 40 miles but more recent acoustic tagging studies from a small marine reserve on Catalina Island show that at least some barred sand bass stay within a small area most of the year (Mason 2008). In this study, eight barred sand bass were tagged within the small (0.06 sq mile) Catalina Marine Science Center Reserve. These tagged fish were detected inside the reserve an average of 314 days out of the subsequent year. Another study showed a significant increase in the density of barred sand bass inside the small (0.04 sq mile) Heisler Park Reserve as compared to nearby control sites (Tetreault & Ambrose 2007), indicating that barred sand bass may be sufficiently sedentary to benefit directly from MPAs. During the breeding season (May-August), barred sand bass are known to form breeding aggregations in soft-bottom habitats ranging from 20-30m depth (Baca Hovey et al 2002) but it is unclear how far they move to reach these breeding sites. The locations of many barred sand bass breeding sites are known and the aggregations are often targeted by the recreational fishery; thus barred sand bass are likely to benefit from MPAs that protect their breeding sites. Due to breeding aggregations and likely low adult movement, catch of barred sand bass is likely to alter their abundance relative to an SMR.

Indirect impacts – Barred sand bass are important predators in the nearshore environment, so removal of this species is likely to have impacts on community structure within an MPA. Barred sand bass are carnivorous ambush predators, feeding on a variety of small fish and invertebrates including surfperch, sardines, anchovies, midshipman, crabs, clams, and squid.

Level of protection: **Moderate-low**

California sheephead (hook and line, spear, or trap):

Direct impacts – Take of California sheephead (*Semicossyphus pulcher*) by hook and line or spear is unlikely to alter habitat as gear rarely touches the seafloor. Use of trap gear involves bottom contact but is also unlikely to alter habitat significantly.

Sheephead are demersal fish which occur on nearshore rocky reefs and kelp forests. The movements of sheephead have not been studied extensively, but existing studies indicate that they have high site fidelity and a small home range. Topping et al (2005) used acoustic tags to monitor the movement of sheephead within the small (0.06 sq mile) Catalina Marine Science Center Reserve. The 16 sheephead in this study used a small core area (average 0.015 km^2) and were detected within the reserve 266 days over the subsequent year.

Increases in the size and abundance of sheephead have been demonstrated in a number of small MPAs in southern California. Tetreault and Ambrose (2007) examined sheephead populations in five small (all < 2 km^2) marine reserves and found that on average, male sheephead were 3.7 times more abundant and 1.2 times larger inside the reserves as compared to nearby control sites. Female sheephead were 1.6 times more abundant and 1.3 times larger inside reserves as compared to control sites. Additionally Froeschke et al. (2006) found that sheephead densities were significantly higher inside the Catalina reserve as compared to control sites outside the reserve. These studies support the conclusion that sheephead abundance is likely to be altered by take relative to an SMR.

Indirect impacts – Sheephead are important predators on nearshore rocky reefs, so removal of this species is likely to have impacts on community structure within an MPA. Sheephead are carnivores with powerful crushing jaws. They feed mainly on invertebrates including urchins and other echinoderms, mussels, clams, gastropods, crabs, spiny lobster, barnacles, squid, bryzoans, and polychaetes. Importantly, sheephead predation on urchins may act as an ecosystem driver by reducing and stabilizing urchin populations (Tegner & Dayton 1981) (Cowen 1983). Throughout their range, urchin populations can decrease kelp abundance, thereby altering the relative abundance of macroalgae in a kelp forest.

Level of protection: **Moderate-low**

Spotted sand bass (hook and line):

Direct impacts – Take of spotted sand bass (*Paralabrax maculatofasciatus*) by hook and line is unlikely to alter habitat as gear rarely touches the seafloor.

Spotted sand bass occur over sand or mud habitat in shallow bays, harbors, and coastal lagoons that contain eelgrass and surfgrass. Spotted sand bass are predominantly a warm water species and their distribution in the Southern California Bight is restricted to warm-water embayments. The movements of spotted sand bass are not well known, but tagging studies have shown that adults rarely range beyond the embayment where they settled as juveniles (Allen, unpublished data). Spotted sand bass form breeding aggregations just near the entrances of embayments between May and September (Allen et al 1995). One study in southern California showed that different populations of spotted sand bass display varied mating strategies (Hovey & Allen 2000), which further supports the conclusion that spotted sand bass are relatively sedentary and thus their abundance is likely to be altered by take relative to an SMR.

Indirect impacts – Spotted sand bass are important predators in coastal embayments, so removal of this species is likely to have impacts on community structure within an MPA. Spotted sand bass are carnivores and feed mainly on demersal invertebrates including clams, crabs, squid, and polychaetes.

Level of protection: **Moderate-low**

Spiny lobster (traps, hoop nets, or hand take by scuba):

Direct impacts – In the SCSR, spiny lobster (*Panulirus interruptus*) are taken using three main methods: recreational hand collection by scuba- or free-divers, recreational take using hoop nets, and commercial take using traps or pots. All three of these methods may cause some habitat disturbance (anchoring and placement of traps which can disturb rock and kelp habitat), but these habitat effects are unlikely to alter community structure significantly.

The movement habits of spiny lobster are not well known. Some reports indicate that adult lobster migrate offshore into deeper waters during the winter months (DFG 2001) but the distance and prevalence of this migration are not well documented. Recent studies have shown that the home range and habits of spiny lobster may vary markedly from site to site and may be related to predator abundance and habitat quality (Hovel & Lowe, in prep). A study conducted in a small MPA (0.6 sq mi) on Catalina Island where lobster take had been prohibited for 23 years showed that legal-sized lobsters were significantly more abundant inside the no-take area than in nearby fished areas (Iacchei 2005). This suggests that at least some portion of the lobster population is relatively sedentary and likely to benefit directly from MPAs within state waters. Thus the abundance of lobsters in an area that allows lobster fishing is likely to be lower than that in a no-take marine reserve.

Bycatch in the lobster fishery, while not well quantified, is likely low and unlikely to alter the abundance of any other species relative to an SMR. Anecdotal reports from the recreational hoop-net fishery indicate that sheephead, nearshore rockfish, sand bass, California scorpionfish, octopus, rock crab, sheep crab, miscellaneous invertebrates, sharks, skates, and rays make up the most common invaders of recreational hoop nets.

Indirect impacts – Lobsters are important predators in the nearshore rocky environment, therefore removal of this species is likely to have impacts on community structure within an MPA. Adult lobsters feed on a variety of algae and invertebrates including urchins, snails, mussels, and clams. Importantly, lobster predation on urchins may act as an important ecosystem driver by reducing and stabilizing urchin populations (Tegner & Levin 1983) (Lafferty 2004) (Behrens & Lafferty 2004). Throughout their range, urchin populations can impact (decrease) kelp abundance, thereby altering the relative abundance of macroalgae in a kelp forest.

Level of protection: **Moderate-low**

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