California MLPA Master Plan Science Advisory Team
Draft Responses to Science Questions Posed by
Santi Roberts/Oceana in a Letter Dated September 10, 2007
(revised November 5, 2007)

The following are draft responses of the MLPA Master Plan Science Advisory Team (SAT) to questions posed by Santi Roberts, representing Oceana and a member of the MLPA North Central Coast Regional Stakeholder Group (NCCRSG), in a letter dated September 10, 2007. These draft responses have been prepared by work groups of the SAT.

1. How large do MPAs need to be to accomplish the objective of enhancing local populations of forage species (including squid, sardines, anchovies, and herring)?

This response still requires review by the full SAT before adoption.

Draft response: Particulars about the movements of squid, sardines, anchovies, and herring are not well known; however, all these species are believed to move hundreds of miles within their lifetime and known to range well beyond the boundary of state waters. Given the wide-ranging nature of these coastal pelagic species, it is unlikely that any MPA or network of MPAs designed within the limits of state waters could contain and protect a population of any of these species throughout their life cycle.

For coastal pelagic species, a consideration of the timing and location of spawning may be the best approach to MPA enhancement of local populations. For instance, market squid spend the majority of their lives offshore, moving inshore only for reproduction, to spawning grounds at depths of 3-180m (Hixon 1983).

In the case of Northern anchovy, most spawning occurs south of the MLPA North Central Coast Study Region. Most anchovy live within 100 miles of shore, occasionally entering estuarine waters; tagging studies reveal movements from San Francisco to Monterey, central California to southern California, and visa versa, and southern California to northern Baja (Love 1996).

Herring are usually found along the open coast (Love 1996), frequently off-shore (Eschmeyer et al. 1983). These fish move inshore to harbors, bays, and large estuaries for spawning (Eschmeyer et al. 1983, Love 1996), especially during the peak spawning months of January and February. Spawning, usually a night-time occurrence, takes place from San Diego Bay northward, with major runs beginning in San Francisco Bay. Most spawning occurs in very shallow, and sometimes intertidal, waters down to 11m (Love 1996).

Sardine are found very close to shore, as well as hundreds of miles off the coast (Love 1996). On average, about 10 percent of the sardine population migrates into Canada each year (Department of Fisheries and Oceans Canada). Much sardine spawning occurs near shore, but it is likely that some takes place at least 90m out to sea (Love 1996).

References:

Dept of Fisheries and Oceans Canada:
www.dfo-mpo.gc.ca/csas/Csas/status/2004/SSR2004_037_E.pdf

Eschmeyer, WN, Herald, ES, and H Hammann 1983. A Field Guide to Pacific Coast Fishes of North America. Houghton Mifflin Company, Boston.

Hixon, RF 1983. Loligo opalescens. In: Boyle P.R. (Ed.), Cephalopod Life Cycles, Vol. 10. Academic Press, London, pp. 95–114

Love, Milton 1996. Probably More Than You Want to Know About the Fishes of the Pacific Coast. Really Big Press, Santa Barbara.

2. Which seafloor habitat types in the study area are most sensitive to physical disturbance and which fishing gear types have the potential to damage the seafloor?

This response still requires review by the full SAT before adoption.

Draft response: A review of available literature on habitat disturbance by fishing gear shows that biogenic habitats (e.g. kelp forests, sea grass beds, deep coral communities) are the most sensitive to physical disturbance. Hard bottom habitats (e.g. rocky reefs) are generally less sensitive to disturbance than biogenic habitats, but are still more vulnerable than soft bottom habitats.

Dredges are the fishing gear most likely to cause extensive habitat damage. Bottom trawl gear (especially over hard bottom habitat) can also cause extensive habitat disturbance. Nets (e.g. seine, gill, dip, trammel and salmon reef nets) that are not dragged over the bottom cause less disturbance than trawl gear. Trap and hook and line fishing (including longline fishing) are the least impacting fishing methods.

References:

Auster, PJ and RW Langton. 1999. The effects of fishing on fish habitat. In: Fish Habitat: Essential Fish Habitat and Rehabilitation. LE Benaka (ed). American Fisheries Society Symposium 22, Bethesda, Maryland. pp 150-187.

Johnson, KA. 2002. A Review of National and International Literature on the Effects of Fishing on Benthic Habitats. NOAA Tech. Memo. NMFS-F/SPO-57. 72 p.

MRAG Americas. 2004. Essential Fish Habitat EIS: Risk Assessment for the Pacific Groundfish FMP. Prepared for Pacific Council EIS Oversight Committee August 2004 Meeting Briefing Book. August 2004.

Watling, L and EA Norse. 1998. Disturbance of the seabed by mobile fishing gear: a comparison to forest clearcutting. Conservation Biology 12: 1180-1197.

3. How can MPAs most effectively protect corridors and hotspots for migratory species (including white sharks)?

This response was adopted by the SAT at its October 1, 2007 meeting.

Response: Thoughtful placement of MPAs can be useful for protecting migratory species. MPAs placed at migration bottlenecks and in areas that are critical to certain life stages of migratory species will enable better protection for the target species. A good example of a migration bottleneck is when salmon return to their natal rivers to spawn. Placing a protected area in the coastal waters offshore of the river mouth will protect salmon during a crucial life stage. Other species also form spawning aggregations in certain areas, which can frequently, but not always, be identified as areas with the highest catch per unit effort (if the species is fished). Closure of these areas would protect the species during a sensitive life stage, but could have significant fishery impacts.

Since little is known about the breeding locations of white sharks, protecting forage species in areas where white sharks aggregate (e.g. the Farallones, Tomales Point) would likely benefit them.

References:
Roberts, C.M. 2000. Selecting marine reserve locations: optimality versus opportunism. Bull. Mar. Sci. 66: 581-592.

Taylor Chapple, personal communication.

4. For the purpose of enhancing populations of groundfish and other benthic species, is it more effective to design MPAs that encompass entire reefs or fractions of reefs?

This response still requires review by the full SAT before adoption.

Draft response: An MPA that encompasses an entire reef is likely to be more effective in protecting populations of reef fishes than an MPA that encompasses only a fraction of the reef because reef species with small home ranges are more likely to move within the confines of a single reef than to move outside of the reef into less desirable habitat.

Benthic reef fish species show preferences for rocky reef type habitat and are less often found over sandy bottom type habitat. Two studies that looked at movement away from rocky reefs for copper and quillback rockfishes have shown that individuals do not move off high relief reefs and even return to these reefs when displaced (Matthews 1990a, b). Ongoing studies on kelp rockfish and kelp greenling have shown that these species have small home ranges that are located on the reef and individuals do not venture far from these reefs and rarely cross extensive areas of sandy bottom (Freiwald, unpublished data).

California sheephead and kelp bass have been shown to prefer kelp forest habitat over mud/sand bottom type habitat. Even when these species move outside of the hard bottom

reef areas, they always return to reefs where they spent most of their time (Lowe et al. 2003, Topping et al. 2006).

For species that are less associated with the benthic habitat and with greater movement range, the inclusion of entire reefs is probably less important because these species move on scales that are often larger then individual reefs.

In conclusion, the above studies show that including entire reefs that are surrounded by other habitat types will protect species that have limited movement of adult individuals away from reefs. Placing MPA boundaries off the reefs in other habitat types will help to contain individuals within the boundaries of an MPA and reduce their level of exposure to exploitation, even in smaller MPAs.

References:

Lowe, C. G., D. T. Topping, D. P. Cartamil, and Y. P. Papastamatiou. 2003. Movement patterns, home ranges and habitat utilization of adult kelp bass Paralabrax clathratus in a temperate no-take marine reserve. Marine Ecology Progress Series 256:205-216.

Matthews, K. R. 1990a. An Experimental Study of the Habitat Preferences and Movement Patterns of Copper Quillback and Brown Rockfishes Sebastes-Spp. Environmental Biology of Fishes 29:161-178.

Matthews, K. R. 1990b. A Telemetric Study of the Home Ranges and Homing Routes of Copper and Quillback Rockfishes on Shallow Rocky Reefs. Canadian Journal of Zoology 68:2243-2250.

Topping, D. T., C. G. Lowe, and J. E. Caselle. 2006. Site fidelity and seasonal movement patterns of adult California sheephead Semicossyphus pulcher (Labridae): an acoustic monitoring study. Marine Ecology-Progress Series 326:257-267.

5. How can MPAs benefit species by protecting them during critical/sensitive life stages, behaviors, or biological processes (e.g. spawning, feeding, resting)?

This response was discussed by the SAT at its October 1, 2007 meeting but requires further discussion and clarification before adoption.

Draft response: MPAs can benefit species by reducing mortality during sensitive life stages or behaviors; this is only feasible when the behaviors or life stages occur in specific habitats or locations. For example, bat rays congregate in estuaries to breed in the fall. By eliminating fishing mortality in an estuary, you would protect rays during this vulnerable period and potentially benefit the population as a whole. The SAT notes that protecting spawning and other aggregations of marine life often has benefits, but can also scatter fishing effort, leading to increased bycatch, increased catch of non-reproductive juveniles, or increased habitat disturbance as the fishing effort is spread over a broader area. Reduced fishing efficiency may also have socioeconomic impacts.

6. The central coast SAT [reference is to the 2005-2007 SAT] recognized the need to protect the different assemblages associated with granitic versus sedimentary substrate. Are there similar differences in assemblages associated with different hard-bottom substrates in the NCC [north central coast] region, and can the SAT help identify or predict them?

Draft response: Please refer to the response to Question 9 from the list of questions from the MLPA North Central Coast Regional Stakeholder Group's August 22-23, 2007 meeting.