California MLPA Master Plan Science Advisory Team

Methods Used to Evaluate MPA Proposals in the North Coast Study Region (DRAFT)
Chapter 6 – MPA Size

February 4, 2010

6. Size (Goals 2 and 6)

Status of this chapter: Pending approval by the SAT. Note that the only change to this chapter from the January 18, 2010 version is that (1) the size and spacing portions have been divided into two separate documents and (2) "perch" in Table 2 has been changed to "surfperch."

The Master Plan Guidelines Regarding Size Analyses

Size guidelines were developed to provide for the persistence of important bottom-dwelling fish and invertebrate groups within marine protected areas (MPAs); (MLPA goals 2 and 6).

Guidance on size in the *California Marine Life Protection Act Master Plan for Marine Protected Areas* (Master Plan) states:

1. "For an objective of protecting adult populations, based on adult neighborhood sizes and movement patterns. MPAs should have an alongshore span of five to ten kilometers (3-6 miles or 2.5-5.4 nautical miles) of coastline, and preferably 10-20 kilometers (6-12.5 miles or 5.4-11 nautical miles). Larger MPAs would be required to fully protect marine birds, mammals and migratory fish."

2. "For an objective of protecting the diversity of species that live at different depths and to accommodate the movement of individuals to and from shallow nursery or spawning grounds to adult habitats offshore, MPAs should extend from the intertidal zone to deep waters offshore."

The first guideline for MPA size arises primarily from data on the movement of adult and juvenile fish and invertebrates. Since MPAs will be most effective if they are substantially larger than the distance that individuals move within their home ranges, larger MPAs provide benefit to a wider diversity of species.

A summary of existing scientific studies of adult movement shows that adult movement varies greatly among California's marine species (Table 6-1). A recent synthesis and analysis of movement information for west coast rocky reef fishes indicates that the range of movement for 75 percent of individuals of a species (the 75th percentile movement range) was three kilometers (km) or less for 85% of the 26 species for which data are available[1]. However, the majority of movement data are from shallow dwelling reef fishes (depth < 30-50 meters). This synthesis also shows that movement distance was not correlated with days at liberty for eleven

[1] Jan Freiwald, unpublished dissertation.

species for which data are available, indicating that movement of these species was unlikely a diffusive process (i.e. increasing range with time). The analysis also showed that movement distances for deeper dwelling species (n= 6, 75th percentile = 35 km) were significantly greater than for shallower dwelling species (n= 18, 75th percentile = 2 km).

Therefore, the choice of any MPA size determines the subset of species that could potentially benefit. For species with average movement distances of 100s to 1000s of miles, MPAs are unlikely to be a source of significant protection (except when they protect critical locations, e.g. spawning or nesting grounds). As a result, the *Master Plan* guidelines focus on species in the first three movement categories in Table 6.1. The minimum size guideline of five to 10 km (three to six miles) targets species in the first two categories. The preferred size range of 10 to 20 km (six to 12.5 miles) provides substantially more benefit to the important group of species in the third category (10 - 100 km movement). This group includes a number of important rockfishes from the California coast. Therefore, MPAs that meet the preferred size guideline should protect more biological diversity than MPAs that meet the less stringent minimum guideline.

Table 6-1. Scales of Adult Movement for California Coastal Marine Species

	0-1 km	1-10 km	10-100 km	100-1000 km	>1000 km
Invertebrates	abalone, mussel, octopus, sea star, snail, urchin		Dungeness crab**		jumbo squid**
Rockfishes	black & yellow, brown, copper, gopher, grass*, kelp, quillback, starry, treefish, vermilion	black, China, greenspotted*, olive, yelloweye	blue, bocaccio, yellowtail	canary	
Other Fishes	cabezon, eels, greenlings, giant seabass, black, striped, and pile surfperches, pricklebacks	walleye surfperch*	California halibut, lingcod, starry flounder	anchovy, big skate, herring, Pacific halibut, sablefish**, salmonids**, sole, sturgeon	sardine, shark**, tunas**, whiting**
Reptiles					turtles**
Birds			gulls, cormorants	gulls**	albatross**, pelican**, shearwater**, shorebirds**,terns**
Mammals			harbor seal, otter	porpoise, sea lion**	dolphins, sea lion**, whales**

**Studies of this species included fewer than 10 individuals*

***Seasonal migration*

The second size guideline above arises from the consideration of ecological connections between habitats across depth ranges. Many marine species spend different parts of their life cycle in different habitats that may span a range of depths; if these different habitats are connected in a single MPA, species that move among contiguous habitats likely will benefit.

This guideline reflects the SAT's recommendation that MPAs extend from the shore to the boundary of state waters (three nautical miles offshore). Extending MPA boundaries to the edge of state waters has the added benefit of allowing for connections with any potential future MPA designations in federal waters. The combination of these two guidelines forms the basis for SAT evaluation of MPA size.

In evaluating the size of MPAs, the SAT considers both the area of individual MPAs and clusters of contiguous MPAs. The MPA size guidelines in the *Master Plan* specify that MPAs should cover an alongshore span of at least three to six statute miles (preferably six to 12 statute miles) and extend from the coast to deep waters offshore. Because state waters extend only three nautical miles (3.45 statute miles) offshore, the SAT considers an MPA or cluster of MPAs that extend to the offshore limit of state waters to meet the offshore size guideline. The SAT combines and simplifies alongshore and offshore guidelines from the *Master Plan* by using a minimum size threshold of nine square statute miles, while recognizing that the state waters extend three nautical miles offshore rather than three statute miles as used in the area calculations. No MPA that is smaller than nine square miles could meet both the alongshore and onshore-offshore size guidelines mentioned above. Thus, for the purpose of SAT analyses, MPA clusters with areas nine to 18 square miles are considered to fall within the minimum size range, and those 18 to 36 square miles fall within the preferred size range. The guidelines for minimum and preferred areas of proposed MPAs will receive priority above the individual guidelines for alongshore and offshore spans. Additionally, the SAT recommends consideration of the configuration of proposed MPAs. Configurations with maximum area-to-perimeter ratios (e.g., three by three statute miles) are more likely to achieve greater protection for a variety of adjacent habitats and associated species than particularly narrow or long MPAs (e.g., one by nine statute miles).

In evaluating the size of MPAs, the SAT:

- combines contiguous MPAs at or above a given level of protection into "MPA clusters," with size analyses conducted at three different levels of protection: "moderate-high," "high," and "very high"; and
- tabulates the number of MPA clusters in each size range (below minimum, minimum size range, preferred size range).

Note that estuarine MPAs are not evaluated with respect to size. Because species and life stages that inhabit estuaries rarely stray from the favorable estuarine habitat, the overall size of the MPA is less important than protecting the entire estuarine system. Thus, the SAT recommends that MPAs encompass entire estuaries, if feasible, but does not evaluate the size of estuarine MPAs relative to the size guidelines.