California MLPA Master Plan Science Advisory Team
Draft Work Group Responses to Science Questions Posed by the NCCRSG at its July 10-11, 2007 Meeting
Revised September 28, 2007

The following are draft responses of the MLPA Master Plan Science Advisory Team (SAT) to questions posed by the MLPA North Central Coast Regional Stakeholder Group (NCCRSG) at its July 10-11, 2007 meeting. These draft responses have been prepared by work groups of the SAT; most responses were provided in a provisional form to the NCCRSG at its August 22-23, 2007 meeting.

1. **Review of the measurability of the draft regional objectives** (John Ugoretz, Mark Carr, Sarah Allen, Karina Nielson)

   Measurability of the draft regional goals and objectives was reviewed by the SAT and approved at its September 17, 2007 meeting.

2. **What are the key and/or unique habitats for this region?** (in relation to Goal 4, Objective 1)

   This response was adopted by the SAT at its September 17, 2007 meeting.

   Response: For Goal 4, Objective1, the NCCRSG asked the SAT to identify "unique habitats" in the study region. For purposes of representing unique habitats with important marine resources in the region, the stakeholders should include estuaries and the intertidal/subtidal waters around the Farallon islands.

   While estuaries are found along the California coast, the north central coast study region has about 20 square miles of estuaries of several different types. Tomales Bay, for example, is relatively unique due to its long narrow shape (originating along a fault zone), protected waters and varied habitats (deep waters, extensive eelgrass, and mudflats).

   The Farallons are truly unique as offshore islands surrounded by deepwater habitat, located offshore of the outlet of San Francisco Bay, and in an area bathed by nutrient-rich upwelled water from the Point Arena-Point Reyes upwelling system. They contain a globally significant and unique combination of marine mammal and seabird breeding colonies and have intertidal communities that are distinctly different than on the mainland.

   In addition to these two habitats identified as unique and warranting representation in marine protected areas, there are two other features of the region worth considering during MPA planning. First, it should be recognized that intertidal and subtidal habitats north and south of Point Reyes have different biological assemblages (there's a biogeographic break at Point Reyes). Secondly, the freshwater plumes in the region are important for their influence on nearshore communities and for their role as migratory corridors for anadromous fish (salmon, steelhead, sturgeon). The output of San Francisco Bay at the Golden Gate is the largest outflow of estuarine freshwater in the entire state, draining 40% of the California including the Sacramento and San Joaquin Rivers.

References

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3. **What are the species most likely to benefit in the MLPA North Central Coast Study Region**? (Mark Carr, John Ugoretz, Gerry McChesney, Pete Raimondi)

   Draft response: This is an agenda item; a discussion on the provisional list (a handout to the draft agenda) will be covered under the specific agenda item.

4. **Do the existing depth zones need to be split up or revised (esp. 30-100 meters) given that we have only minimal area >100m?** (Stakeholders noted that there's a little area as deep as 116m). **Do they need to represent depths >100m?** (Mark Carr, John Ugoretz, Pete Raimondi)

   This response was adopted by the SAT at its September 17, 2007 meeting.

   Response: The SAT recommends that the depths between 30 and 100 meters be considered one depth zone in terms of replication and spacing analyses for this study region. This reaffirms the SAT guideline that MPAs should be designed to extend from shallow to deep water to encompass the full range of depth related migrations many species make throughout their life cycle. Ideally, most MPAs would span across the full 30-100 m range, but in certain locations and to meet other goals, individual MPAs may only encompass on portion of this range. Given the differences in preferred depth ranges of various species, analyses of benefits to individual species or species groups should take into account these preferred depths. As with other habitats that are not present or very rare in the region, depths greater than 100 meters would not be considered in habitat analyses.

Background: Presumably, consideration for splitting the 30-100 meter depth range into finer depth strata is motivated by a concern that MPAs located within that depth range, but not across the entire depth range, would fail to represent some species within the range. For example, if the depth distribution of one or more species ranged from 30-60 m depth and an MPA was proposed that extended from 60 m and deeper, than that MPA would not include and provide protection for those shallower distributed species. There are two components to the response to this question:

1. Are there species whose depth distribution includes some but not all of the 30-100m range? And, if so,
2. What are the implications for redefining depth strata on the design of MPAs?

The SAT reviewed literature on the depth distribution of some species that occur in the 30-100m depth range of the MLPA North Central Coast Study Region to determine if there is evidence of ranges that span only a portion of the 30-100m range. This review focused on marine fishes and was generated from two key resources. The depth distribution of fish assemblages illustrated in Figure 1 is from NOAA's National Center for Coastal Monitoring and Assessment (CMA) biogeographic assessment of the three central coast national marine sanctuaries[1]. The depth distributions of hard-bottom fishes illustrated in Figure 2 is largely based on rockfishes from species accounts in The Rockfishes of the Northeast Pacific[2]. A parallel synthesis of soft-bottom fish depth distributions was also conducted and largely reinforced the results and conclusions generated from the other syntheses (Figure 3).

[1] Information on how these assemblages were defined is available at: http://ccmaserver.nos.noaa.gov/products/biogeography/canms_cd/htm/fish/assemblage.htm.
[2] Love, M.S., M. Yoklavich, and L. Thorsteinson. 2002. University of California Press, Berkeley, California, USA 405 pages

Figure 1. Depth ranges of finfish species

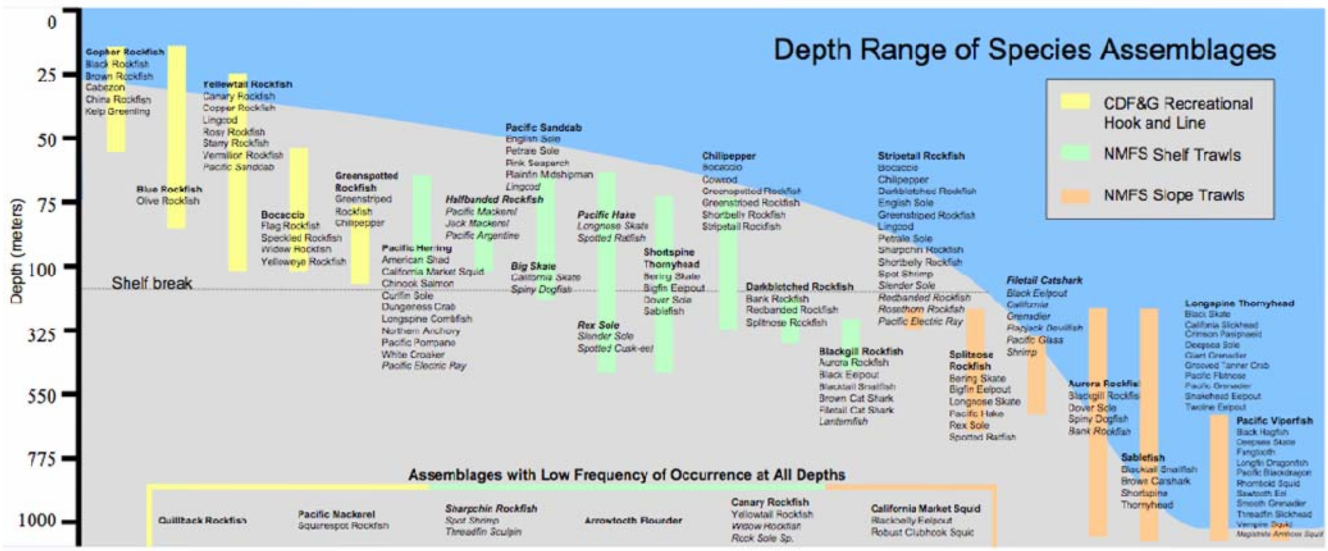


Figure 2. Depth distributions of hard-bottom fish species.

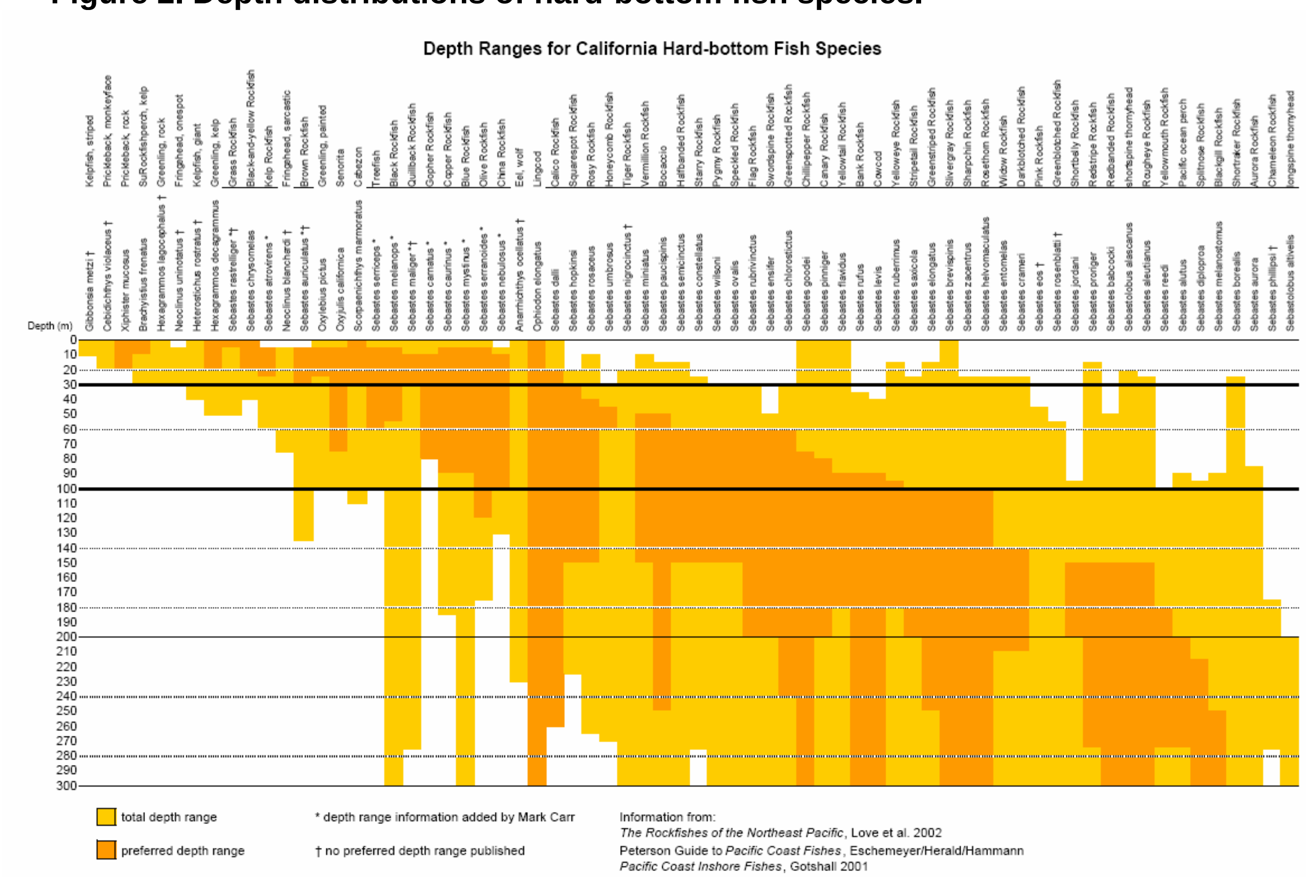
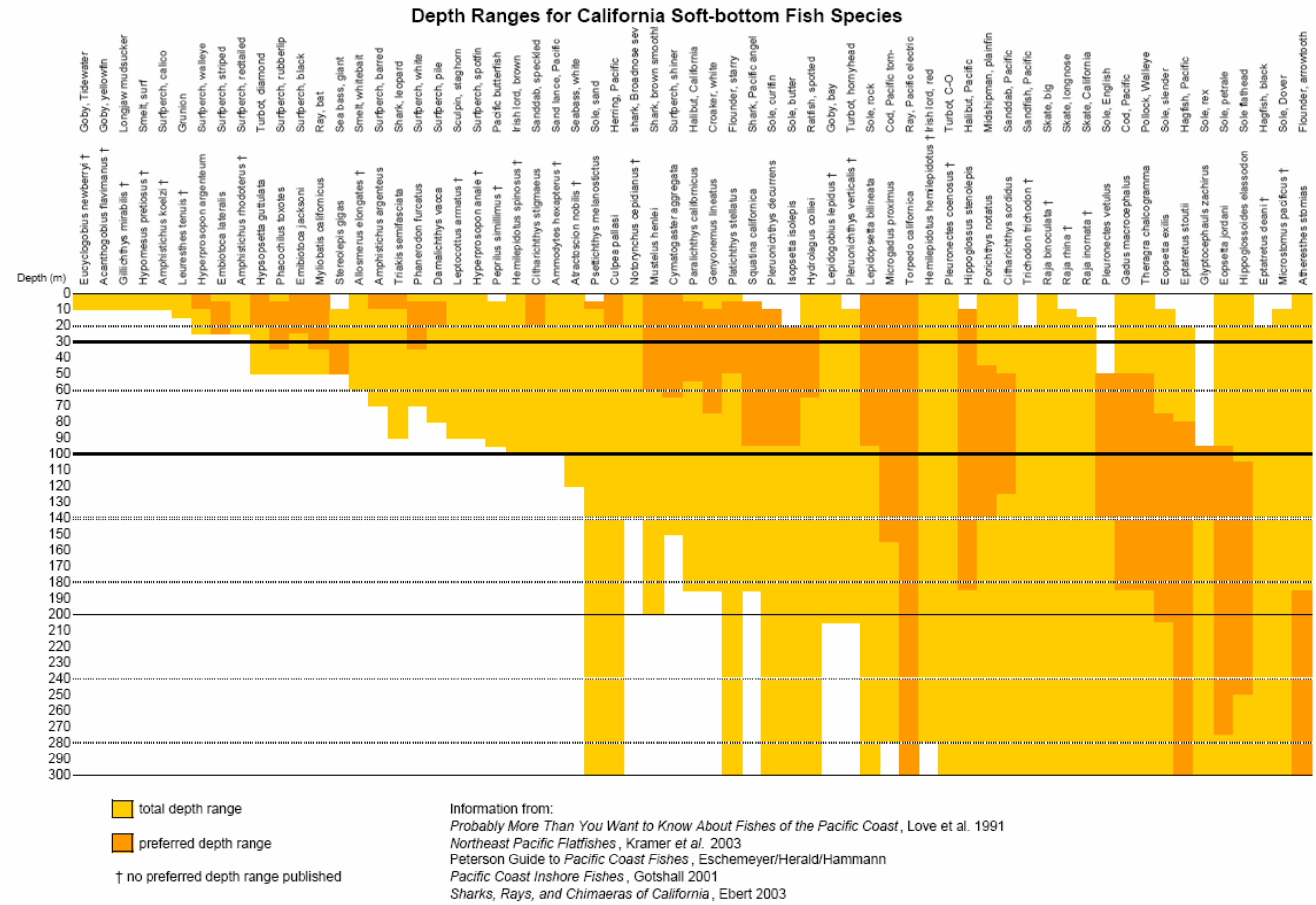


Figure 3. Depth distributions of soft-bottom fish species.



It is clear from depth distributions of entire fish assemblages (Figure 1; bocaccio, greenspotted rockfish, Pacific herring, halfbanded rockfish, Pacific sanddab, and big skate) and the *preferred* (dark orange) depth range of rockfishes (Figure 2; *Sebastes serriceps, S. melanops, S. carnatus*, and many species including and to the right of *S. miniatus*) that certain species and assemblages occur within only a portion of the 30-100 m depth range. Thus, an MPA that includes only a portion of the 30-100 m depth range may not include species that otherwise occur within the depth range. This analysis did not consider benthic invertebrates, which may exhibit similar discontinuous distributions across this depth range. It is also notable that the upper and lower depth ranges of many of these species occurs around 60 m depth.

There are two implications of these results. First, the 30-100 m depth range could be divided into separate 30-60 and 60-100 m depth strata, thereby assuring that each of these strata and their corresponding species and assemblages are represented in MPAs. Alternatively, MPAs could be designed to encompass the entire 30-100m depth range. Both guidelines would help meet the goal of representative biodiversity within this range. Of the two alternatives, the latter is the most scientifically sound for the following reason. Separate from including representative species, the design of MPAs needs to consider depth-related movement patterns of marine species. There are a number of marine fishes that move across broad depth ranges during their adult phase, especially in relation to annual reproductive migrations into shallower depths (e.g., lingcod). Other species known to move across depth ranges as adults include olive, yellowtail, canary and vermillion rockfishes (Rick Starr, pers. comm.). Indeed, recognition of this behavior led the central coast SAT to recommend the guideline that MPAs be designed to extend from the intertidal to the boundary of state waters to encompass the depth-related movements of various species across the range of depths in state waters. Overall, the SAT would interpret these data to recommend that MPAs in the 30-100 m depth range encompass as much of this depth range as possible, thereby protecting the collective number of species that occur there and accommodate their depth-related migrations.

There is very little area in state waters that is deeper than 100m and it extends only a small range of depth (100-116m depth). This indicates that waters deeper than 100 m within state waters would be such an insignificant portion of the range of most species that it would not be an important guiding criterion for MPA location.

5. **What is the influence of offshore habitats (e.g. Bodega canyon) on state waters?** (Sarah Allen, Mark Carr, Dominic Gregorio)

   Draft response: A draft response to this question is still being formulated.

6. **What is the appropriate size/seasonality for buffers to prevent disturbance to bird/mammal colonies?** (Sarah Allen, Gerry McChesney)

   This response was adopted by the SAT at its September 17, 2007 meeting.

   Response: BUFFER DISTANCES TO PREVENT BOAT DISTURBANCE TO SEABIRD AND MARINE MAMMAL COLONIES

   <u>Seabirds</u>

   Species of seabirds differ in how prone they are to disturbance by boats. Those that nest and roost on the surface are more sensitive to disturbance than those nesting in underground burrows. In particular, species nesting or roosting in dense aggregations tend to most sensitive to disturbance because disturbance events can affect larger numbers of birds. The species most sensitive to disturbance include the Common Murre, Brandt's Cormorant, Double-crested Cormorant, and Pelagic Cormorant. Pigeon Guillemots, which nests underground, congregate in large numbers on the water and in intertidal areas adjacent to nesting areas and are highly prone to flush (fly away) when boats approach too closely.

Few studies have examined boat disturbance distances at seabird colonies. In a study on seabird disturbance at the Three Arch Rocks National Wildlife in coastal Oregon, 98% of boat disturbances occurred within 500 feet of the colony (Riemer and Brown 1997). Using data from that study, a 500 foot closure was established around the nesting rocks. This closure resulted in a significant decrease in disturbance to wildlife.

At certain colonies along the central California coast, the U.S. Fish and Wildlife Service records boat and other disturbances to seabirds with a focus on the Common Murre. Observations are separated into events causing birds to become visibly frightened or agitated and those causing birds to move or flush from the colony. From these observations, 80% of events causing alarm and 90% of events causing flushing occurred within 200 meters (about 650 feet) of nesting colonies (Table 1). Ninety percent of agitation and 100% of flushing events occurred within 400 meters (1,300 feet). However, other observations have shown birds flushing at distances over 400 meters, especially outside the breeding season when birds are more prone to flush.

Based on these data, the 500 foot closure used at Three Arch Rocks in Oregon would not alleviate all disturbances to seabirds. A buffer zone about 400 meters would be needed to nearly eliminate flushing events, and about 500 meters would be needed to nearly eliminate all detectable disturbance events.

NOTE: These data do not include other factors that could cause substantial disturbance to seabirds, such as bright lights used on some boats on night, or loud noises.

Table 1. Cumulative percentages in 50 meter (164 ft.) distance zones of boat disturbances to seabird breeding colonies along the central California coast, 1996-2006 (N = 102 events). Data are shown separately for events causing alarm behaviors and those causing flushing behaviors. (U.S. Fish and Wildlife Service, unpublished data).

Distance (m)	*Distance (ft.)*	*Alarm Behaviors Cumulative %*	*Flushing Behaviors Cumulative %*
0-50	0-164	46.9	66.7
50-100	164-328	65.4	76.2
100-150	328-492	67.9	76.2
150-200	492-656	80.2	90.5
200-250	656-820	85.2	95.2
250-300	820-984	91.4	95.2
300-350	984-1148	91.4	95.2
350-400	1148-1312	95.1	100.0
400-450	1312-1476	95.1	100.0
450-500	1476-1640	97.5	100.0
>500	>1640	100.0	100.0

Marine Mammals

The National Marine Fisheries Service recommends a buffer zone of 300 feet around marine mammal colonies to prevent disturbance; these recommendations are on the NMFS website: http://www.oceanservice.noaa.gov/outreach/pdfs/wildlife_watching_handbook.pdf

Additionally, in a study of harbor seals in Bolinas Lagoon in the 1970s, most seals were disturbed at around 300 feet (Allen et al. 1985). At Three Arch Rocks National Wildlife Refuge, Oregon, Riemer and Brown (1997) reported that nearly all disturbances to wildlife occurred within 500 feet of the colony.

Literature Cited

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U.S. Fish and Wildlife Service, unpublished data. San Francisco Bay National Wildlife Refuge Complex, Common Murre Restoration Project. Contact: Gerry McChesney

7. **Can the SAT review and comment on the list of important features in the draft regional profile (section 3.3)?** (Steve Morgan and John Largier)

Draft response: Spatial data are available to begin identifying specific locations in the study region that have high biodiversity significance based on the guidelines provided in the Master Plan Framework (CDFG 2005a) and results of regional scientific research and mapping efforts. Specific locations can be identified using existing maps, by overlaying relevant data layers in the Internet Mapping Service site, or conducting more sophisticated GIS analysis. The following is a partial list of types of areas that have regional biodiversity significance:

- Areas where numerous habitats are found in close proximity and areas with unique combinations of habitats
- Large open estuaries (e.g. Tomales Bay, Drakes Estero, Bolinas Lagoon) with eelgrass beds, tidal flats, and coastal marsh (Maps 2a-2f)
- Stream outlets and estuaries with presence of coho, chinook, or steelhead populations (Maps 6a and 6b)
- Marine areas off headlands, especially those with kelp forests.

- Marine areas which offer residence adjacent to upwelling centers, especially those with kelp forests and rocky reefs.
- ~~with adjacent upwelling centers, especially those with kelp forests and rocky reefs in retention areas in the lee of the upwelling center~~
- Large kelp beds (Maps 2a-2f) and nearshore rocky reefs (Maps 3a-3f).
- Areas of high bathymetric complexity which provide topographic relief and a variety of habitats in close proximity
- Rocky subtrata in all depth zones, since rocky habitat is much less common than soft-bottom habitat and is important for depleted rockfish species (Maps 3a-3f)
- Rocky intertidal shores, especially wave-cut rocky platforms (which provide habitat at diverse tidal elevations), boulder fields, and rare sheltered rocky shores (Maps 2a-2f)
- Seabird colonies and marine mammal rookeries and haulouts (Maps 5a-5f)
- Areas of high fish or seabird diversity and/or density (Maps 5a-5f, 6a-6b, and 7a-7e).
- Offshore islands

8. Are there biological breaks in species distribution with in the study region if so where and which are important to consider? (Steve Gaines, Pete Raimondi, Mark Carr)

This response was adopted by the SAT at its September 17, 2007 meeting.

Response: There are two levels of biogeographic patterns of species and biological communities relevant to the MLPA process; major "biogeographic regions" and smaller "bioregions". Biogeographic regions are largely defined by species range boundaries common to many species. For example, Point Conception is a well recognized biogeographic boundary that separates two biogeographic regions to the south and north. These biogeographic regions are described in detail in the previous SAT's description provided in the MLPA master plan. Biologically-based subregions within these biogeographic regions are referred to as "bioregions". These are regions that are characterized by differences in species composition and community structure within habitat types or ecosystems (e.g., within the rocky intertidal, within shallow hard-bottom habitats). For example, in the MLPA Central Coast Study Region, the SAT recognized differences in community structure of rocky intertidal and shallow rocky reef communities to the north and south of Monterey Bay. Often, these subregions and the variation in communities they are based upon are closely related to differences in habitat structure. For example, the different shallow reef communities north and south of Monterey Bay correspond with sedimentary and granitic substrata, respectively. The purpose for defining these subregions is to recognize that MPAs in one subregion may not include the species composition and community structure of an ecosystem in other subregions.

Within the MLPA North Central Coast Study Region, there are largely three subregions. First, rocky intertidal communities along the mainland from Pigeon Point to Point Reyes are different from those at and north of the Point Reyes headland. Specifically, the boundary between these two bioregions generally corresponds with a change in substratum type that occurs midway between Point Reyes and Tomales Point. These differences reflect, in part, differences in substratum type (sedimentary rock to the south and granitic rock to the north), but also the markedly different oceanographic environment north and south of Point Reyes. The third subregion is defined by the unique environment at the Farallon Islands as described in the "unique habitats" response by the SAT. There is an additional change in substratum types in the northern portion of the study region, but there are not data indicating corresponding changes in biological communities. It is reasonable to expect patterns in subtidal habitats to be similar to those of the more well studied intertidal habitats described here; such correspondence is common elsewhere in the state.