# The Status of Nearshore Rocky Reefs in Santa Monica Bay

## For Surveys Completed in the 2007-2008 Sampling Seasons

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## EXECUTIVE SUMMARY

- The Vantuna Research Group has taken the lead in establishing a long-term collaborative research study of the nearshore rocky reefs in Santa Monica Bay and the Southern California Bight. This research program has been integrated over two spatial scales. First, it encompasses the entirety of the bay through a partnership with Santa Monica Baykeeper and the Sanitation Districts of Los Angeles County. Second, this program has taken the lead for the continued CRANE (Cooperative Research and Assessment of Nearshore Ecosystems) statewide research program established by the California Department of Fish and Game. It is also directly comparable to the scientific monitoring and research efforts throughout California conducted by PISCO (Partnership for the Interdisciplinary Studies of Coastal Oceans) conducted through the University of California. A standardized survey protocol has been established that addresses all the various interests and metrics necessary for studying these reefs.

- A novel technique for mapping nearshore rocky reefs habitat in GIS was developed. The nearshore rocky reefs of Santa Monica Bay were completely mapped and there are approximately 22,461,807 $m^2$ (5551 acres) of nearshore reef in the Santa Monica Bay study region.

- All potential Marine Protected Areas and the Malibu ASBS were extensively surveyed during this study. This study provides a unique opportunity to quantify the effect of marine reserves in the future with pre-reserve data. In addition, this research program has integrated the research in the bay with the biological assessment of reefs in the states ASBSs. A monitoring plan for these areas has been established.

- There is significant variation among reef habitats within Santa Monica Bay and the Southern California Bight due to a variety of biotic and anthropogenic factors. An integrative model was developed to evaluate the habitat quality of the mainland reefs in the Southern California Bight. In a survey of 29 mainland reefs, 8 of the 10 highest in quality were in Santa Monica Bay. This habitat valuation model was useful in identifying areas where reef quality is significantly degraded.

- The major sources of reef degradation were identified: overfishing, sedimentation and turbidity. Reefs easily accessible to anglers originating from King Harbor had significantly reduced sportfish populations (especially kelp bass). Sedimentation and associated turbidity continues to devastate and in many instances continues to bury reefs in the region.

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**ACKNOWLEDGEMENTS**

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## INTRODUCTION

The Vantuna Research Group (VRG) at Occidental College and Santa Monica Baykeeper (SMBK) with the assistance of the Los Angeles County Sanitation District (LACSD) quantitatively assessed the nearshore rocky reef resources of Santa Monica Bay during the 2007-2008 sampling seasons. This report addresses the following information gaps: 1) provide critical pre-reserve subtidal data necessary for the establishment Marine Protected Areas in coastal southern California as dictated by the Department of Fish and Game; 2) use this assessment to establish the subtidal rocky-reef monitoring program identified as a need by the Santa Monica Bay Restoration Commission's (SMBRC) Comprehensive Monitoring Program (SMBRC 2007); and 3) integrate and coordinate the bay's rocky-reef monitoring program with the rest of the Southern California Bight and the rest of the California coastline.

In this region, the coastline consists of long stretches of sandy beach broken up by rocky headlands, deep submarine canyons and deep reefs. There are also gravel beds extending from Ballona Creek to the Redondo Canyon and surfgrass off Topanga Canyon, distinctive habitat types specific to Santa Monica Bay (Emery 1960; personal communication DFG). The primary limiting resource in this arena is hard bottom habitats, comprising approximately 25% of the total nearshore habitat (Appendix IX). The major reef areas, the headlands at Palos Verdes and reefs along the Malibu coast, are intensively fished by both commercial and recreational fishers. Fortuitously, the resources of the region have been studied intensively over the past few decades by the VRG, SMBK and LACSD. The hallmark of this research effort has been the long-term quarterly monitoring (1974-present) of the reef fishes at Palos Verdes Point, Rancho Palos Verdes and King Harbor, Redondo Beach representing the longest continually monitored rocky reefs in the world (Terry and Stephens 1976; Stephens and Zerba 1981; Stephens et al., 1986; Stephens et al. 1994, Pondella and Stephens 2002). In addition to this long-term monitoring program, in 2000 we began a spatial assessment of reef fish assemblages throughout the Southern California Bight (Pondella et al. 2005), the most integrative reef assessment of this area to date. It includes the only scientific research studies of the fishes of Horseshoe Kelp (Froeschke and Pondella 2006), Catalina Island, San Clemente Island, San Nicolas Island and Santa Barbara Island (Pondella and Allen 2000; Pondella et al. 2005; Froeschke et al. 2007), and the most intensive monitoring programs of the Palos Verdes Peninsula (Pondella et al. 1996, Stephens et al. 1996, Pondella and Stephens 1998), Santa Monica Bay (Stephens et al. 1992), and the Malibu coast (Coastkeeper 2005, Pondella and Allen 2000). Further, the VRG was instrumental and principal investigator for the development and implementation of Department of Fish and Game's Cooperative Resource Assessment of Nearshore Ecosystems (CRANE; Tenera 2006). This bight-wide program was reimplemented in 2008 by the VRG (under support of this program) in collaboration with Southern California Coastal Water Research Project (SCCWRP) Bight '08 program (referred to as Bight '08 Rocky Reefs).

The state's 1999 Marine Life Protection Act (MLPA) mandated an ecosystem approach to not only establish MPAs dedicated to protecting and preserving our delicate marine ecosystems, but also to improve the resources in this arena. While MPAs can be used for a variety of purposes, we implemented a research program that addressed all of these goals and their long-term valuation. This timing allowed a unique window in

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which pre-reserve placement studies were conducted to allow both the appropriate 'before and after' and spatial design features (Claudet et al. 2006), as well as provided quantitative fisheries independent information for the optimization of reserve placement and design, which has already been completed.

In addition to the timeliness with respect to the MLPA, we also addressed the objectives set out for Hard Benthos in the Comprehensive Monitoring Program (SMBRC 2007), which were to determine the spatial extent of the subtidal hard substrate organisms, and track changes in this ecosystem over time and space across the Southern California Bight. Specifically, these objectives were to:

1) Determine the status of algal, invertebrate, and fish communities throughout the Bay within the shallow water (< 90 feet) portion of the habitat
2) Track changes over time in the status of algal, invertebrate and fish communities throughout the Bay within shallow water (< 90 feet) high relief and low relief habitat types
3) Conduct reconnaissance of conditions in deep-water (> 90 feet) habitat, including banks, canyons, and rocky outcrops along the shelf edge
4) Track changes over time at a set of fixed reefs in shallow water
5) Estimate changes in abundance of key commercial and recreational rocky subtidal fishes
6) Assess the effectiveness of the current ASBS and any future marine protected areas at protecting and/or restoring algal, invertebrate, and fish communities

With the exception of objective three, this report addresses all of these goals in the following ways:

- Fine scale maps of all subtidal rocky reefs and organisms' distribution and associated statistics (richness, diversity, density, biomass etc.) were created in a GIS matrix. The MLPA's Master Plan Science Advisory Team for the South Coast Study Region and Regional Stakeholder Groups used these data layers for the MLPA process.
- A description of a standard methodology/design for fixed long term monitoring sites that will allow trend analyses of algal, inverts and fishes to be conducted throughout this region is provided.
- Meta-analyses on the data collected were completed to provide a basis for the establishment of spatial scale surveys necessary to meet the goals of the Comprehensive Monitoring Program.
- Baseline information for evaluating the effectiveness of ASBS's and MPA's through pre- and post-protection studies is provided.
- This research program took the lead in organizing subtidal monitoring in the rest of the Southern California region and coordinated these efforts with the study of ASBS's as part of SCCWRP's Bight '08 program.

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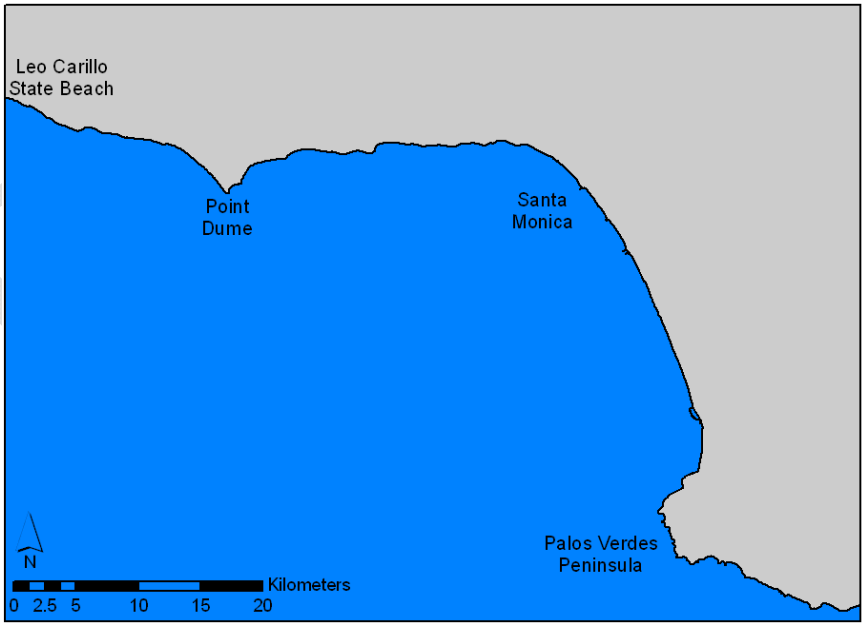
## 1. MAPPING AND GIS ANALYSES

The geographic extent and character of marine hard bottom/reef was mapped by combining several different spatial datasets into a preliminary habitat data layer. This layer was then verified and corrected using underwater field observations and analyses of aerial and satellite photography. All mapping and spatial analysis was done using ArcGIS software. Spatial data layers were created and maintained in the shapefile format, using the UTM Zone 11 North, WGS84 projection to minimize distortion in both area and length measurements. These data layers are included with this report as ESRI format shapefiles and Google Earth compatible .kml files on the included data CD, and are also available for download from the Vantuna Research Group website.

The study area was defined as that bounded by the coastline extending from Point Fermin northwest to the Los Angeles County line near Leo Carillo State Beach, and seaward to the 30 meter isobath. For geographic context and to provide a landward boundary to the mapping and spatial analysis, a shoreline spatial data layer was constructed by combining the two shoreline data layers from the US Geological Survey Coastal and Marine Geology Program Internet Map Server[1]. The shoreline layer for 1998 comprises most of the shoreline for the study area but contains gaps, which were filled using data from the 1971-76 shoreline data layer. The 30 meter isobaths was mapped by extracting this feature from the bathymetric contour spatial dataset of Kellner et al. (2005). These geographic boundaries are shown in Figure 1.1.

Figure 1.1. Location of Study.




[1] http://coastalmap.marine.usgs.gov/regional/contusa/westcoast/pacificcoast/data.html
The National Assessment of Shoreline Change: A GIS Compilation of Vector Shorelines and Associated Shoreline Change Data for the Sandy Shorelines of the California Coast By Cheryl Hapke and David Reid U.S. Geological Survey Open-File Report 2006-1251 Version 1.1 – I used this for shoreline position (combined both 1998 and 1971-76 data to get shoreline in LBLA Harbor area; defaulted to 98

Initial mapping of reef extent to create the preliminary habitat map was accomplished by combining three existing vector polygon spatial data sets

- Kelp canopy (shapefile, polygon): a highly precise polygon spatial layer created by using a 2-meter rectangular grid to classify georeferenced aerial photography[2]. As this data layer depicts the kelp canopy, the use of the data here to map marine hard bottom capable of supporting kelp holdfasts introduces some error into the analysis.

- Habitat classification (shapefile, polygon) derived from side scan sonar surveys[3]. There is no coverage for this data in the portion of the study area from Point Dume northwest to the study area boundary, or in the central portion of the study area from Pacific Palisades south to Torrance Beach. From this data layer, only those habitat types that correspond to or function as "reef" (see list below) were selected .

    - Deformed hummocky bedrock
    - Differentially eroded deformed bedrock
    - Hard anthropogenic mounds
    - Hummocky bedrock
    - Hummocky sediment covered deformed bedrock
    - Mixed bimodal sediment over bedrock
    - Mixed sediment and flat bedrock
    - Scoured boulders and pinnacles
    - Volcanic rock

- Coarse-scale mapping of hard bottom[4] (shapefile, polygon) between the 10 and 30m isobaths. This layer only discriminates between soft sediment and hard bottom, and lacks spatial resolution in identifying boundaries between these two bottom types. It was used primarily to verify bottom type in areas not covered by the above two datasets.

Together, these data layers represent all mapped rocky bottom and reef within the study area. The layers were merged using a GIS union to create a single spatial data layer, the preliminary habitat map, retaining reference to the source data in the attribute table of the resulting data layers derived from this data layer. The geographic extent of this data layer is shown in Figure 1.2.

[2] Need reference for this dataset – kvitek lab?

[3] Data from Sea Floor Mapping Lab at California State University Monterey Bay (http://seafloor.csumb.edu/SFMLwebDATA.htm).

[4] From Kellner et al. 2005

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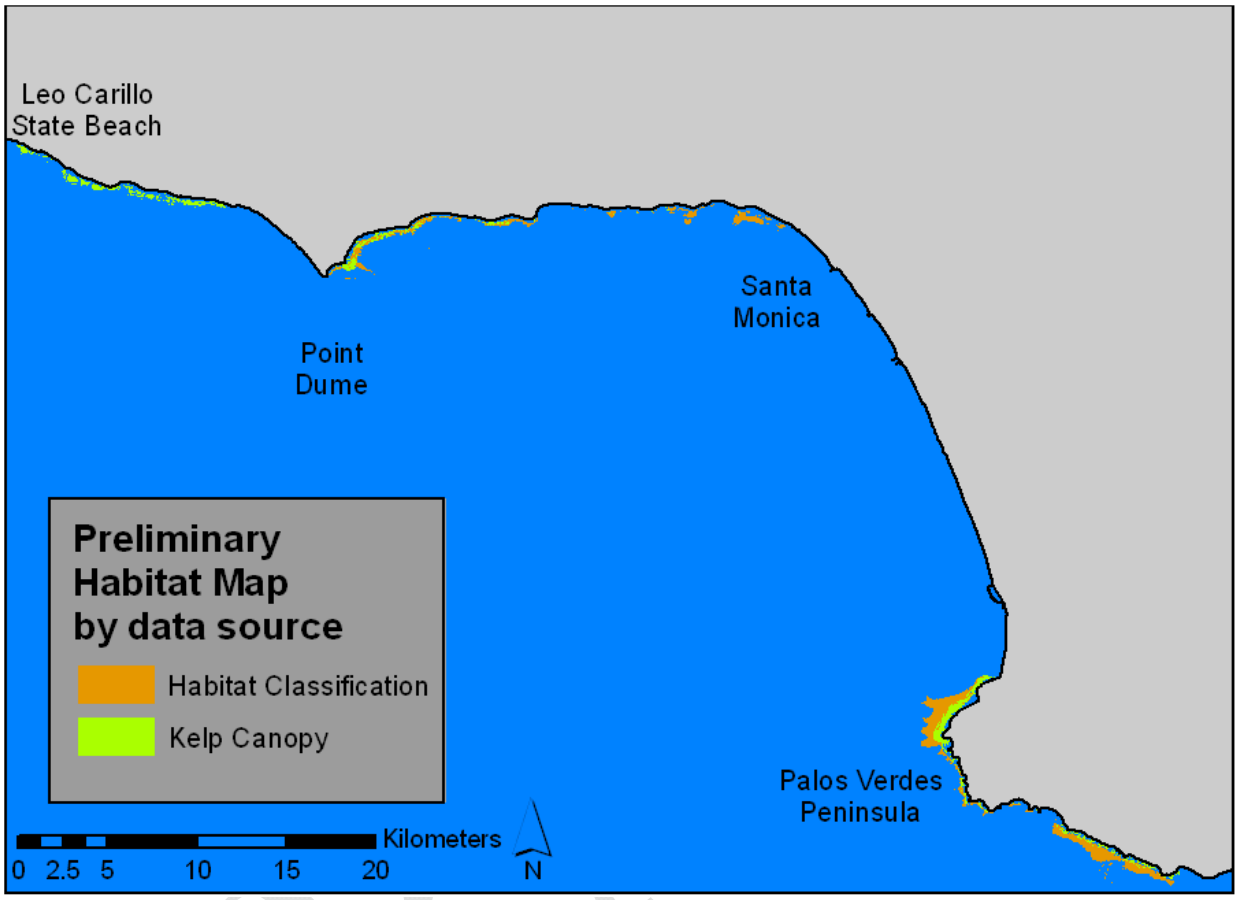
Figure 1.2. Preliminary habitat classification of reef areas inside of the 30 m isobath.




As the preliminary habitat map was constructed of spatial data that does not cover the entire study area, mapping was completed and validated by a variety of techniques. To validate the accuracy and coverage of the spatial data layer, two methods were used. The first was to transform the spatial data layer into the Google Earth .kml format, and examine the mapped habitat against the georeferenced aerial imagery that serves as a back coverage in the Google Earth application. The aerial photo coverage used to augment and correct the GIS union spatial data layer is the TeleAtlas March 2007 imagery available for use with Google Earth and Google Earth Pro. This technique was also used to map bottom habitat directly for the nearshore zone in areas where the side scan sonar survey did not collect data, and the water was shallow and clear enough to see habitat variation in the aerial photographs. The aerial imagery showed numerous additional nearshore areas were composed of hard bottom, and that the kelp canopy was more extensive than depicted in the kelp canopy data. This technique also allowed habitat mapping in the area northwest of Point Dume to Leo Carillo, and in the vicinity of Redondo Harbor and the Santa Monica breakwater anchorage, which are not covered in the original habitat classification data layer. These additional marine hard bottom/reef areas were mapped by hand-digitizing polygons from the Google Earth imagery registered to the GIS spatial data. These data corrections were added to the preliminary

habitat spatial data layer, again retaining data source information using the polygon attributes.

In addition to verification using aerial imagery, the point locations of field sampling sites were plotted on the preliminary habitat map to verify that the observed bottom characteristics matched the GIS data layer. All field sample sites (Figure 1.3; Table 1.1) matched the map data, but a very small number of minor anomalies were noted in the preliminary habitat map in offshore areas that represent missing data, probably due to the way in which this data was produced. The bottom characteristics of these areas were interpreted using diver observations and experience to fill in these areas as appropriate. Not only was this step a final check of habitat mapping accuracy, it also was used to determine how effectively the network of field sites sample and characterize the different reef habitats present the study area, and their geographic distribution. All maps were then reviewed and checked for accuracy by scientific divers who have extensive experience in the area. The final habitat map with sampling stations (Table 1.1) is shown in Figure 1.3. In the ArcGIS, we then were able to calculate the total area of habitat for 21 reefs in the region (Table 1.2). There are approximately 22,220,911 $m^2$ (5491 acres) of nearshore (<30 m) natural rock habitat in the study region. The largest reef is Rocky Point comprising 2,400,014 $m^2$ (594 acres) of habitat. The smallest reefs are the relatively isolated Big Rock and Pt. Dume, which comprised 25,948 $m^2$ (6 acres) and 17,372 $m^2$ (4 acres), respectively.

Figure 1.3. Locations of field sampling (in red) sites in the 2007-2008 survey.

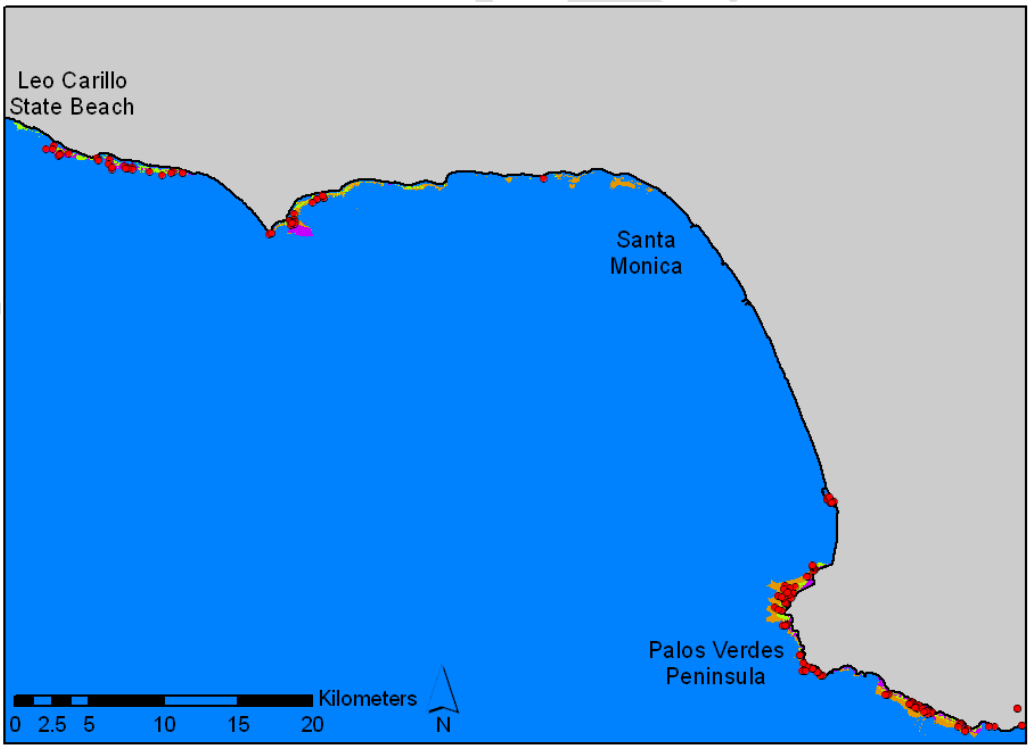


Figure 1.4. The final rocky reef habitat map incorporates all available data layers.

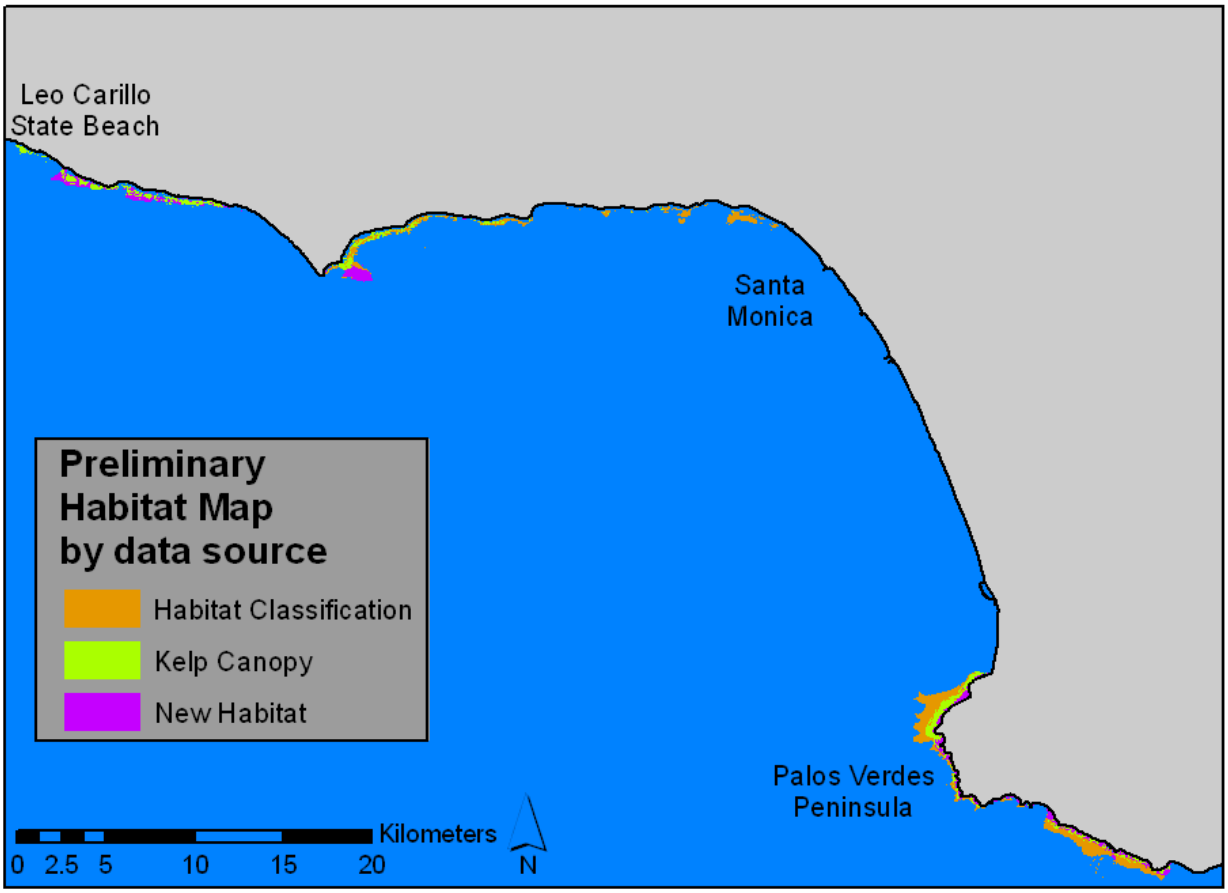


Table 1.1. Locations of 126 natural reef zones surveyed in Santa Monica Bay, 2007-2008. Reef zones are discussed in section 2.

| Station | Zone | Latitude | Longitude | Station | Zone | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| 3 Palms | Inner | 33.71870 | -118.33548 | Long Point West | Inner | 33.73845 | -118.40320 |
| 3 Palms | Middle | 33.71757 | -118.33272 | Long Point West | Middle | 33.73803 | -118.40398 |
| 3 Palms East | Inner | 33.71868 | -118.33003 | Nicholas Canyon | Middle | 34.03803 | -118.91168 |
| 3 Palms East | Middle | 33.71790 | -118.33098 | Nicholas Canyon | Outer | 34.03735 | -118.91130 |
| 3 Palms East | Outer | 33.71712 | -118.33145 | Nicholas Canyon East | Middle | 34.03787 | -118.90758 |
| 3 Palms West | Inner | 33.72083 | -118.33555 | Nicholas Canyon East | Outer | 34.03685 | -118.90747 |
| 3 Palms West | Middle | 33.72025 | -118.33623 | Nicholas Canyon West | Middle | 34.03837 | -118.91345 |
| 3 Palms West | Outer | 33.71990 | -118.33653 | Nicholas Canyon West | Outer | 34.03752 | -118.91232 |
| Big Rock | Inner | 34.03537 | -118.60777 | Point Dume | Inner | 33.99935 | -118.80550 |
| Bunker Point | Inner | 33.72540 | -118.35205 | Point Dume | Middle | 33.99852 | -118.80725 |
| Bunker Point | Middle | 33.72502 | -118.35285 | Point Dume | Outer | 33.99935 | -118.80550 |
| Bunker Point | Outer | 33.72505 | -118.35403 | Point Fermin | Inner | 33.70460 | -118.29465 |
| Carp Reef | Inner | 34.41762 | -118.27443 | Point Fermin | Middle | 33.70418 | -118.29597 |
| Deep Hole | Middle | 34.04573 | -119.60512 | Point Fermin | Outer | 33.70355 | -118.29658 |
| Deep Hole | Outer | 34.04468 | -118.95992 | Point Fermin West | Inner | 33.70840 | -118.29962 |
| Deep Hole East | Inner | 34.04538 | -118.96090 | Point Fermin West | Middle | 33.70730 | -118.30015 |
| Deep Hole East | Middle | 34.04572 | -118.95417 | Point Fermin West | Outer | 33.70615 | -118.30078 |
| Deep Hole East | Outer | 34.04430 | -118.96097 | Point Vicente | Inner | 33.74130 | -118.41208 |
| Deep Hole West | Inner | 34.05005 | -118.96160 | Point Vicente | Middle | 33.73967 | -118.41348 |
| Deep Hole West | Middle | 34.04818 | -118.96520 | Point Vicente | Outer | 33.73857 | -118.41443 |
| Deep Hole West | Outer | 34.04788 | -118.96553 | Point Vicente East | Inner | 33.74063 | -118.40822 |
| El Matador East | Middle | 34.03388 | -118.97073 | Point Vicente East | Middle | 33.74042 | -118.40745 |
| El Matador West | Middle | 34.03570 | -118.88587 | Point Vicente East | Outer | 33.74013 | -118.40748 |
| Encinal Canyon East | Inner | 34.03543 | -118.89495 | Point Vicente West | Deep | 33.73857 | -118.41477 |
| Encinal Canyon East | Middle | 34.03483 | -118.87088 | Point Vicente West | Inner | 33.74178 | -118.41192 |
| Encinal Canyon West | Inner | 34.03573 | -118.87105 | Point Vicente West | Middle | 33.74355 | -118.41447 |
| Encinal Canyon West | Middle | 34.03470 | -118.87792 | Point Vicente West | Outer | 33.73902 | -118.41250 |
| Escondido | Inner | 34.02042 | -118.87920 | Resort Point | Deep | 33.76653 | -118.42908 |
| Escondido | Middle | 34.02042 | -118.77245 | Resort Point | Inner | 33.76673 | -118.42590 |
| Escondido East | Inner | 34.02145 | -118.77245 | Resort Point | Middle | 33.76637 | -118.42675 |
| Escondido East | Middle | 34.02145 | -118.76817 | Resort Point | Outer | 33.76630 | -118.42792 |
| Escondido West | Inner | 34.02252 | -118.76817 | Ridges | Deep | 33.78860 | -118.42870 |
| Escondido West | Middle | 34.01892 | -118.76915 | Ridges | Inner | 33.78392 | -118.42337 |
| Flat Rock | Inner | 33.80053 | -118.77613 | Ridges | Middle | 33.78443 | -118.42430 |
| Flat Rock | Middle | 33.80098 | -118.40680 | Ridges | Outer | 33.78678 | -118.42645 |
| Flat Rock | Outer | 33.80323 | -118.40725 | Ridges North | Deep | 33.79070 | -118.42837 |
| Flat Rock North | Inner | 33.79957 | -118.40855 | Ridges North | Inner | 33.78632 | -118.42210 |
| Flat Rock North | Middle | 33.80175 | -118.40778 | Ridges North | Middle | 33.78995 | -118.42057 |
| Flat Rock North | Outer | 33.80233 | -118.40770 | Ridges North | Outer | 33.78938 | -118.42453 |
| Flat Rock South | Inner | 33.79595 | -118.40867 | Ridges South | Deep | 33.78860 | -118.42870 |
| Flat Rock South | Middle | 33.79595 | -118.41105 | Ridges South | Inner | 33.78305 | -118.42410 |
| Lead Better Beach | Inner | 34.39713 | -118.41222 | Ridges South | Middle | 33.78497 | -118.42545 |
| Lead Better Beach | Middle | 34.39637 | -119.69868 | Ridges South | Outer | 33.78658 | -118.42675 |
| Leo Carillo | Inner | 34.04330 | -119.69787 | Rocky Point | Deep | 33.78413 | -118.43268 |
| Leo Carillo | Middle | 34.04238 | -118.93347 | Rocky Point | Inner | 33.77993 | -118.42720 |
| Leo Carillo | Outer | 34.03802 | -118.92225 | Rocky Point | Middle | 33.78037 | -118.42823 |

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Table 1.1. Study sites, continued.

| Station | Zone | Latitude | Longitude | Station | Zone | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| Leo Carillo East | Inner | 34.04278 | -118.92463 | Rocky Point | Outer | 33.78352 | -118.43057 |
| Leo Carillo East | Middle | 34.04003 | -118.92497 | Rocky Point North | Deep | 33.78420 | -118.43263 |
| Leo Carillo East | Outer | 34.03662 | -118.92238 | Rocky Point North | Inner | 33.77942 | -118.42742 |
| Leo Carillo West | Inner | 34.04295 | -118.93355 | Rocky Point North | Middle | 33.77975 | -118.42775 |
| Leo Carillo West | Middle | 34.04207 | -118.93217 | Rocky Point North | Outer | 33.78253 | -118.42957 |
| Little Dume | Inner | 34.00727 | -118.79267 | Rocky Point South | Deep | 33.77703 | -118.43545 |
| Little Dume | Middle | 34.00660 | -118.79123 | Rocky Point South | Inner | 33.77502 | -118.43058 |
| Little Dume | Outer | 34.00510 | -118.78908 | Rocky Point South | Middle | 33.77502 | -118.43058 |
| Little Dume East | Inner | 34.01138 | -118.78908 | Rocky Point South | Outer | 33.77563 | -118.43262 |
| Little Dume East | Middle | 34.00783 | -118.78887 | Hawthorne Reef East | Middle | 33.74858 | -118.41715 |
| Little Dume East | Outer | 34.00680 | -118.78800 | Hawthorne Reef East | Outer | 33.74858 | -118.41715 |
| Little Dume West | Inner | 34.00492 | -118.79172 | Whites Point | Inner | 33.71512 | -118.32048 |
| Little Dume West | Middle | 34.00643 | -118.79057 | Whites Point | Middle | 33.71413 | -118.32138 |
| Little Dume West | Outer | 34.00572 | -118.79053 | Whites Point | Outer | 33.71363 | -118.32353 |
| Long Point East | Inner | 33.73620 | -118.39983 | Whites Point West | Inner | 33.71728 | -118.32662 |
| Long Point East | Middle | 33.73588 | -118.40040 | Whites Point West | Middle | 33.71537 | -118.32485 |
| Long Point East | Outer | 33.73588 | -118.40128 | Whites Point West | Outer | 33.71467 | -118.32587 |

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Table 1.2. The total area of rocky habitat and perimeter of nearshore rocky reefs from north to south in the study area.

| Reef | AREA ($m^{2)}$ | ACRES | PERIMETER (m) |
|---|---|---|---|
| Deer Creek* | 240,896 | 60 | 16,421 |
| Deep Hole* | 1,133,601 | 280 | 6,178 |
| Leo Carrillo | 954,077 | 236 | 17,417 |
| Nicholas Canyon | 492,424 | 122 | 12,257 |
| Encinal Canyon | 961,695 | 238 | 34,892 |
| Point Dume | 17,372 | 4 | 3,544 |
| Little Dume | 2,149,296 | 531 | 43,744 |
| Escondido | 755,522 | 187 | 26,910 |
| Malibu Point | 612,425 | 151 | 10,957 |
| Big Rock | 25,948 | 6 | 2,494 |
| Topanga | 2,234,355 | 552 | 58,080 |
| Flat Rock | 807,769 | 200 | 7,795 |
| Ridges | 2,129,633 | 526 | 8,519 |
| Rocky Point | 2,400,014 | 593 | 8,657 |
| Resort Point | 1,160,789 | 287 | 12,477 |
| Point Vicente | 358,074 | 88 | 4,624 |
| Long Point | 300,192 | 74 | 5,047 |
| Abalone Cove | 875,941 | 216 | 16,325 |
| Bunker Point | 556,995 | 138 | 3,629 |
| Three Palms | 1,616,273 | 399 | 6,388 |
| White's Point | 1,243,546 | 307 | 16,891 |
| Point Fermin | 1,434,970 | 355 | 7,936 |
| | 22,461,807 | 5,551 | |

*above Los Angeles/Ventura County Line

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## 2. BIOLOGICAL AND HABITAT SURVEYS

The following section describes the standardized habitat and biological survey methodology. This methodology was established during the 2003-2004 California Department of Fish and Game's CRANE (Cooperative Research and Assessment of Nearshore Ecosystems) program (Tenera 2006). These survey techniques were adapted from the PISCO (Partnership for the Interdisciplinary Studies of Coastal Oceans). In addition, these techniques were also used in the Southern California Coastal Water Research Program's (SCCWRP) Bight '08 Rocky Reef Program (Appendix IX). In the current CRANE program, the sampling design is one line or sampling cell per reef. In the previous program, two sampling cells were completed. This was done to increase the spatial aspect of the program by spreading the work effort over a wider spatial scale. Further, CRANE now includes a 'deep' depth zone for reefs that occupy habitat from the 20-30 m isobaths as well as canopy transects for fishes.

Continuation of this program allows for both regional spatial comparisons and time series analyses. For long-term trend design, this sampling design should be conducted at least annually at fixed sites throughout the Bay chosen from the major natural reef areas (Table 1.2). Of these reefs, Point Vicente, Rocky Point, and Little Dume were surveyed in the 2003-2004 sampling season; thus, offering the best long-term time series. For marine protected areas the standard monitoring protocol is to conduct a 'full' CRANE method (i.e. two sampling cells) annually. Appropriate outside reserve monitoring with the same effort will need to be completed.

### 2.1 Sampling Unit

A sampling unit in this program was the equivalent of one-half of a PISCO or CRANE study site (Tenera 2006), which will be referred to as a sampling cell. Within each cell four depth zones (if present) were sampled (Figure 2.1). The core sampling unit for a PISCO/CRANE cell is three depth zones based upon the natural contours of a reef. These zones are the inner (~5m), middle (~10m) and outer (~15m) portions of a natural reef or kelp bed. In this program we added a deep zone (~25m) where this habitat was available. Thus, the sampled target depths for sites are the 5 m, 10 m, 15 m and 25 m contours.

Within each depth zone, two benthic sampling protocols –Unified Point Contact (UPC) and macro invertebrate and algae (Swath) – were completed. For fishes, four benthic, mid-depth and canopy (when present) 30 m belt transects were completed in each depth zone. Thus for a reef containing four depth zones, 16 benthic fish transects, 16 midwater fish transects, 16 canopy (when present) fish transects, 8 UPC and 8 Swath transects were completed. In addition, 100 red and 100 purple urchins were size classed at each site.

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Figure 2.1. Example of the four sampling depth zones on a natural reef.

**2.2 Fish Sampling**

The purpose of the fish sampling is to estimate fish density and length frequency distributions by species at each site. Good visibility is critical and a minimum of 3 m is necessary to conduct these transects. Within each depth zone, a total of four benthic, four midwater and four canopy (when present) 30 m x 2 m replicate transects were sampled. The height of the 'mid-water' transect varies as a function of bottom depth and is approximately half way up the water column. Canopy transects are conducted immediately below the kelp canopy where present.

Observers began the transects by loosely clipping the end of the transect measuring tape to a kelp stipe or attaching it to a rock. The pair of divers swam in the pre-arranged compass direction for a distance of 30 m while counting and estimating the sizes of all fishes. All fishes (Table 2.1) encountered along the transects were recorded. Divers counted and estimated total length (TL) of small fish (< 15 cm [5.9 in] TL) to the nearest cm, and larger fish (> 15 cm) to the nearest 5 cm (2.0 in) interval. If a school of fish (>10 fish) was encountered, the number of fish is estimated within each size group. The observer censused fishes within the boundaries of an imaginary observation "box" slightly ahead of them as they swim along, sometimes stopping, scanning and searching within discrete areas of the "box" that is delimited by the 2 m transect width and natural

features such as kelp plants or large boulders. The diver held the data board in front of them and records data periodically so that they could maintain fish counts and size estimates with minimal distraction. If there was an intervening obstacle, the transect continued over it so long as the depth change was less than 2.5 m. If the obstacle was greater than 2.5 m in height, the transect circumvented it. Transects were completed even if sand is encountered. When there was sand for more than 5 m and it appeared that the habitat continued primarily as sand, the transect direction was changed to the minimum necessary to remain on rocky habitat. Physical data collected on each transect included observation depth (m), water temperature (Cº), horizontal visibility (m), surge (0-4 relative scale), and kelp canopy cover (%).

Transects were completed in 3-6 minutes depending on the number of fishes and the complexity of the habitat. Upon completing a transect, the divers then swam to the starting point of their next replicate transect within the same zone by choosing a haphazard direction along the same isobath. The preferred distance between transects was at least 10 m.

**2.3 Swath Sampling**

The purpose of the swath sampling was to estimate the density of conspicuous, solitary and mobile invertebrates (Table 2.2) as well as specific macroalgae. Individual invertebrates and plants were counted along the entire 30 m x 2 m transect. Transects were completed even if sand is encountered but when there was sand for more than 5 m, the direction of the transect was changed to the minimum necessary to remain on rocky habitat. Divers slowly swam one direction counting targeted invertebrates (from a pre-printed list on the data sheet) and then swam back along the transect counting targeted macroalgae. Cracks and crevices were searched and understory algae pushed aside. No organisms were removed. Any organism with more than half of its body inside the swath area was counted.

The following size criteria applied to counting macroalgal species:

- *Macrocystis* taller than 1 m (3.3 ft), and number of stipes per frond were counted at 1 m above the substrate. *Macrocystis* was not subsampled.
- *Nereocystis*, *Pterygophora*, *Laminaria setchellii* and *Eisenia arborea* taller than 30 cm (11.8 in)
- *Laminaria farlowii* with blade greater than 10 cm (3.9 in) wide
- *Cystoseira osmundacea* greater than 6 cm (2.4 in) wide
- *Costaria* and *Alaria* – no size restrictions

Transects were divided into three, 10-meter segments. Species that occurred in high densities (e.g., purple urchins) were sub-sampled if greater than 30 individuals occurred within any of the three 10 m segments on a transect. *Macrocystis* was not subsampled. Normally a diver counted all target species within each 10 m segment, but when 30 individuals of one species were counted, the diver recorded the meter mark at which the threshold abundance was reached and then stopped counting that species for the remainder of that segment. The species continued to be counted at the start of each following segment and the same threshold abundance rule was applied. The subsampled

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abundances were then extrapolated per segment to calculate an estimated total abundance per transect. Considering their paucity and critical status, the size and species of any abalone was recorded.

**2.4 Uniform Point Contact Benthos Sampling**

Percent cover of substrate type, substrate relief and benthic organisms (Table 2.3) were recorded at each meter mark along the 30 m transect tape. Substrate percentages in the following categories were estimated within each 10 m segment: bedrock ($\geq$ 1 m), boulder (<1 m, but >10 cm), cobble ($\leq$10 cm), and sand. Substrate relief is the maximum relief within a rectangle centered on the point that is 0.5 meter along the tape and 1 meter wide. To contact benthic organisms, the line was pushed down and the species under the tape is recorded. If the line would not contact the substrate, the diver's finger was used to mark the spot. Epiphytes, epizooids and mobile organisms were not recorded. If the contact point was on a blade of *Laminaria*, brittlestars or a sea cucumber, the organism under the point was recorded and it was noted that the point was under one of these organisms. The superlayer was also recorded. In addition to quantifying benthic organisms, the following types of bare substrate were recorded, if contacted: rock, sand, shell debris, and mud.

**2.5 Sea Urchin Sampling**

In order to gain a more accurate estimate of the size frequency distribution of local sea urchins populations, specimens were collected and measured in the areas on and around each transect. In areas where urchins are abundant at least 100 red (*Strongylocentrotus franciscanus*) and 100 purple urchins (*S. purpuratus*) were collected and their test diameters measured to the nearest centimeter. Specimens were collected from each depth zone and multiple areas of the site, if possible. To avoid bias in size measurements, all emergent urchins are collected from each patch unless the patch was very large, in which case only a representative portion of the patch was collected. Urchins were measured on the boat. Very small urchins (< 1 cm) under the spine canopy of larger urchins were not measured. If it was not possible to collect 100 of each species within a total dive time of one hour, the search for urchins was suspended.

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Table 2.1. Fishes observed on SCB mainland reefs during the 2007-2008.

| Scientific Name | Common Name |
|---|---|
| *Alloclinus holderi* | island kelpfish |
| *Anisotremus davidsonii* | sargo |
| *Artedius corallinus* | coralline sculpin |
| *Atherinops affinis* | topsmelt |
| Atherinopsidae | silverside |
| *Atherinopsis californiensis* | jack smelt |
| *Aulorhynchus flavidus* | tubesnout |
| *Balistes polylepis* | finescale triggerfish |
| *Brachyistius frenatus* | kelp perch |
| *Caulolatilus princeps* | ocean whitefish* |
| *Cephaloscyllium ventriosum* | swell shark |
| *Cheilotrema saturnum* | black croaker |
| *Chromis punctipinnis* | blacksmith |
| Clinidae | kelpfish |
| *Clinocottus analis* | wooly sculpin |
| *Cymatogaster aggregata* | shiner perch |
| *Embiotoca jacksoni* | black perch* |
| *Embiotoca lateralis* | striped seaperch |
| *Engraulis mordax* | northern anchovy |
| *Galeorhinus galeus* | soupfin* |
| *Gibbonsia elegans* | spotted kelpfish |
| *Gibbonsia sp.* | kelpfish |
| *Girella nigricans* | opaleye |
| Gobiidae | unidentified goby |
| *Gymnothorax mordax* | California moray |
| *Halichoeres semicinctus* | rock wrasse |
| *Hermosilla azurea* | zebraperch |
| *Heterodontus francisci* | horn shark |
| *Heterostichus rostratus* | giant kelpfish |
| *Hexagrammos decagrammus* | kelp greenling* |
| *Hyperprosopon argenteum* | walleye surfperch |
| *Hypsurus caryi* | rainbow seaperch |
| *Hypsypops rubicundus* | garibaldi |
| *Leiocottus hirundo* | lavender sculpin |
| *Lethops connectens* | halfblind goby |
| *Lythrypnus dalli* | bluebanded goby* |
| *Medialuna californiensis* | halfmoon |
| *Micrometrus minimus* | dwarf surfperch |
| *Myliobatis californica* | bat ray |
| *Ophiodon elongatus* | lingcod* |
| *Orthonopias triacis* | snubnose sculpin |
| *Oxyjulis californica* | senorita |
| *Oxylebius pictus* | painted greenling |

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Table 2.1. Fishes, continued.

| Scientific Name | Common Name |
|---|---|
| *Paralabrax clathratus* | kelp bass* |
| *Paralabrax nebulifer* | barred sandbass* |
| *Paralichthys californicus* | California halibut* |
| *Phanerodon atripes* | sharpnose seaperch |
| *Phanerodon furcatus* | white seaperch |
| *Rathbunella alleni* | stripefin ronquil |
| *Rhacochilus toxotes* | rubberlip seaperch |
| *Rhacochilus vacca* | pile perch |
| *Rhinogobiops nicholsii* | blackeye goby |
| *Sarda chiliensis* | bonito* |
| *Sardinops sagax* | Pacific sardine* |
| *Scomber japonicus* | Pacific chub mackerel* |
| *Scorpaena guttata* | California scorpionfish* |
| *Scorpaenichthys marmoratus* | cabezon* |
| *Scorpaenodes xyris* | rainbow scorpionfish |
| *Sebastes atrovirens* | kelp rockfish* |
| *Sebastes auriculatus* | brown rockfish* |
| *Sebastes carnatus* | gopher rockfish* |
| *Sebastes caurinus* | copper rockfish* |
| *Sebastes chrysomelas* | black-and-yellow rockfish* |
| *Sebastes dallii* | calico rockfish |
| *Sebastes juv-brown complex* | juvenile brown rockfish |
| *Sebastes miniatus* | vermillion rockfish* |
| *Sebastes mystinus* | blue rockfish* |
| *Sebastes paucispinus* | bocaccio* |
| *Sebastes rastrelliger* | grass rockfish* |
| *Sebastes serranoides* | olive rockfish* |
| *Sebastes serranoides/flavidus* | olive/yellowtail rockfish* |
| *Sebastes serriceps* | treefish |
| *Sebastes* sp. | rockfish |
| *Sebastes umbrosus* | honeycomb rockfish |
| *Semicossyphus pulcher* | California sheephead* |
| *Sphyraena argentea* | Pacific barracuda* |
| *Squatina californica* | angel shark* |
| *Stereolepis gigas* | giant sea bass* |
| *Trachurus symmetricus* | jack mackerel* |
| *Triakis semifasciata* | leopard shark* |
| *Urobatis halleri* | round stingray |
| *Xenistius californiensis* | salema |

*commercial or recreational species

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Table 2.2. Organisms observed on SWATH transects in Santa Monica Bay, 2007-2008.

| Taxa | Common Name |
|---|---|
| **Phaeophyta** | **Brown Algae** |
| *Cystoseira osmundacea* | chain-bladder kelp |
| *Desmarestia ligulata* | acid kelp |
| *Egregia menziesii* | feather boa kelp |
| *Eisenia arborea* | southern sea palm |
| *Laminaria farlowii* | oarweed |
| *Laminaria setchellii* | southern stiff stiped kelp |
| *Macrocystis pyrifera* | giant kelp |
| *Pterygophora californica* | pom pom kelp |
| *Sargassum sp.* (*S. muticum and S. filicinium*)* | wireweed |
| *Undaria pinnatifida* | wakame |
| **Rhodophyta** | **Red Algae** |
| *Mastocarpus papillatus* | Turkish towel |
| **Anthozoa** | **Anemones and gorgonians** |
| *Anthopleura elegantissima* | aggregating anemone |
| *Anthopleura sola* | solitary anemone |
| *Anthopleura xanthogrammica* | giant green anemone |
| cup coral | brown or orange cup corals |
| *Eugorgia rubens* | purple gorgonian |
| *Lophogorgia chilensis* | red gorgonian |
| *Muricea californica* | golden gorgonian |
| *Muricea fruticosa* | brown gorgonian |
| *Pachycerianthus fimbratus* | tube-dwelling anemone |
| *Urticina mcpeaki* | McPeak's urticina |
| *Urticina lofotensis* | white-spotted rose anemone |
| *Hydrozoa* | corals |
| *Polyorchis pencillatus* | bell medusa |
| *Stylaster californicus* | California hydrocoral |
| **Crustacea** | **Shrimps, crabs and barnacles** |
| Barnacle | unidentified barnacle |
| *Cancer antennarius* | brown rock crab |
| *Cancer* sp. | unidentified rock crab |
| *Loxorhyncus grandis* | sheep crab** |
| *Pandalus gurneyi* | coonstriped shrimp |
| *Panulirus interruptus* | California spiny lobster** |
| *Pugettia producta* | northern kelp crab |
| *Pugettia richii* | cryptic kelp crab |

*invasive species
**commercial or recreational species

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Table 2.2. SWATH organisms, continued.

| Taxa | Common Name |
|---|---|
| **Asteroidea** | **Sea Stars** |
| *Asterina miniata* | bat star |
| *Astrometis sertulifera* | fragile rainbow star |
| *Astropectin armatus* | spiny sand star |
| *Ceramaster patogonicus* | cookie star |
| *Dermasterias imbricata* | leather star |
| *Henricia leviuscula* | blood star |
| *Linckia columbianus* | fragile star |
| *Orthasterias koehleri* | rainbow star |
| *Pisaster brevispinus* | short-spined sea star |
| *Pisaster giganteus* | giant-spined sea star |
| *Pisaster ochraceus* | ochre star |
| *Pycnopodia helianthoides* | sunflower star |
| *Stylasterias forreri* | fish-eating star |
| **Echinoidea** | **Sea urchins** |
| *Centrostephanus coronatus* | black sea urchin |
| *Lytechinus anamesus* | white urchin |
| *Strongylocentrotus franciscanus* | red sea urchin** |
| *Strongylocentrotus purpuratus* | purple sea urchin |
| **Holothuroidea** | **Sea cucumber** |
| *Cucumaria piperata* | salt-and-pepper sea cucumber |
| *Parastichopus californicus* | California sea cucumber** |
| *Parastichopus parvimensis* | warty sea cucumber |
| **Ophiuroidea** | **Brittle star** |
| *Ophioplocus esmarki* | smooth brittle star |
| **Bivalvia** | **Bivalves** |
| *Chaceia ovoidea* | wart-necked piddock |
| *Crassedoma giganteum* | rock scallop** |
| *Parapholas californica* | scaleside piddock |
| **Cephalopoda** | **Octopi** |
| *Octopus bimaculoides* | two-spot octopus |
| **Gastropoda** | **Snails and Slugs** |
| *Aplysia californica* | California sea hare** |
| *Cadlina leuteomarginata* | yellow-edged cadlina |
| *Ceratostoma foliatum* | leafy hornmouth |
| *Cypraea spadicea* | chestnut cowry |
| *Dendrodoris* sp. | dendrodorid nudibranch |
| *Diaulula sandiegensis* | San Diego dorid |
| *Dirona albolineata* | white-lined dirona |
| *Doris montereyensis* | Monterey dorid |

**commercial or recreational species

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Table 2.2. SWATH organisms, continued.

| Taxa | Common Name |
|---|---|
| **Gastropoda** | **Snails and Slugs** |
| *Flabellina iodinea* | Spanish shawl |
| *Haliotis corrugata* | pink abalone** |
| *Haliotis fulgens* | green abalone** |
| *Haliotis rufescens* | red abalone** |
| *Kelletia kelletii* | Kellet's whelk** |
| *Lithopoma undosum* | turban snail |
| *Megathura crenulata* | giant keyhole limpet** |
| *Mexichromis porterae* | Porter's chromodorid |
| *Norrisia norrisi* | Norris's topsnail |
| *Peltodoris nobilis* | sea lemon |
| **Porifera** | **Sponge** |
| *Craniella arb* | gray puffball sponge |
| *Tethya aurantia* | orange puffball sponge |
| *Toxadocia* sp. | white finger sponge |
| **Asidiacea** | **Tunicate** |
| *Styela montereyensis* | stalked tunicate |

**commercial or recreational species

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Table 2.3. Unified Point Contact (UPC) taxonomic categories for Santa Monica Bay 2007-2008.

| UPC Taxa | Common Name |
|---|---|
| **Phaeophyta** | **Brown Algae** |
| Brown algae | erect brown algae (other) |
| *Cystoseira osmundacea* | chain-bladder kelp |
| *Egregia menziesii* | feather boa kelp |
| *Eisenia arborea* | southern sea palm |
| Laminariales holdfast (alive) | *Laminaria* holdfast |
| *Macrocystis* holdfast (alive) | giant kelp holdfast |
| Other holdfast | other holdfast (most likely *Pterygophora*) |
| *Pterygophora* holdfast | Pom holdfast |
| *Sargassum* sp. | wire weed |
| **Chlorophyta** | **Green Algae** |
| Green algae | erect green algae |
| **Rhodophyta** | **Red Algae** |
| Coralline algae -Crustose | crustose coralline algae |
| Coralline algae -Erect/Articulated | erect coralline algae |
| Red algae -Erect | erect red algae |
| Red algae -Turf | red turf algae |
| **Anthophyta** | **Flowering Plant** |
| *Phyllospadix* sp. | surfgrass |
| *Zostera marina* | eelgrass |
| **Polychaeta** | **Segmented worms** |
| *Diopatra/Chaetopterus* sp. | ornate tube worm |
| *Phragmatopoma* californica | sand castle worm |
| Sabellid/Serpulid/*Spirobranchus*/*Eudistylia* | tubeworm (*e.g.* feather duster or Christmas tree worms) |
| *Salmacina tribranchiata* | fragile tube worm |
| Tubeworm | solitary tubeworm |
| Tubeworm mat | colonial tubeworm (e.g. *Phragmatopoma* or *Salmacina*) |
| **Anthozoa** | **Anemones and Gorgonians** |
| Anemone | anemone (*Urticina* sp. or *Anthopleura* sp.) |
| *Anthopleura elegantissima* | aggregating anemone |
| *Anthopleura sola* | solitary anemone |
| *Corynactis californica* | strawberry anemone |
| Cup Coral | brown or orange cup corals |
| *Lophogorgia chilensis* | red gorgonian |
| *Muricea californica* | golden gorgonian |
| *Muricea fruticosa* | brown gorgonian |
| *Pachycerianthus fimbratus* | tube-dwelling anemone |

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Table 2.3. UPC categories, continued.

| UPC Taxa | Common Name |
|---|---|
| **Echinodermata** | **Stars, Urchins and Cucumbers** |
| *Asterina miniata* | bat star |
| *Pisaster giganteus* | giant-spined sea star |
| *Centrostephanus coronatus* | black sea urchin |
| *Strongylocentrotus franciscanus* | red sea urchin |
| *Strongylocentrotus purpuratus* | purple sea urchin |
| *Parastichopus parvimensis* | California sea cucumber |
| Brittlestars | brittle star (e.g. *Ophiothrix* or *Ophiopsilla)* |
| **Mollusca** | **Bivalves and Snails** |
| *Chaceia ovoidea* | wart-necked piddock |
| *Crassedoma giganteum* | rock scallop |
| *Parapholas californica* | scaleside piddock |
| *Serpulorbis squamigerous* | scaled worm shell |
| **Others** | |
| Sponge | sponge |
| Tethya aurantia | orange puffball sponge |
| Tunicate –Colonial compound social | colonial tunicate (*Pycnoclavella* or *Didemnum*?) |
| Tunicate -Solitary | unidentified solitary tunicate |
| Hydroid | unidentified hydroid (Plumularia sp. 1 or 2) |
| Bryozoan | unidentified bryozoan |
| Barnacle | unidentified barnacle |

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## 2.6 Density and Habitat Metric Calculations

By dividing the number of individuals (N) by the surface area covered on a transect (60 $m^2$) the density of fishes, macroinvertebrates and algae were calculated for each depth zone and reef (Appendices I, II, III, VII; Figure 2.2). Fish density was calculated for benthic, midwater and canopy transects. In addition, for fishes the length (TL) estimates were converted to biomass using species-specific length-weight conversion power equations of the form:

$$Wt = a\mathrm{TL}^{b}$$

Where weight (g) is calculated from the total length (TL) estimate and ***a*** and ***b*** are species-specific constants. These constants were obtained from the literature, calculated in the laboratory or, when these two avenues were not available, adapted from the most similar morphological or proxy species (Table 2.4). For some species only standard length (SL) to weight conversion equations were available. In these cases, TL was converted to SL using the linear function:

$$\mathrm{TL} = a\mathrm{SL} + b$$

Where ***a*** and ***b*** are species-specific parameters of the line. Angel sharks and round stingrays lengths were converted to weight using species-specific equations (Table 2.4). After the length-to-weight conversions were made, biomass density was calculated in a similar fashion (Appendices IV-VI; Figure 2.2 and 2.3).

In order to describe the benthic habitat, the unified point contact (UPC) method was used. In the UPC data set, a transect starts begins at zero and a measurement is made every meter for 30 m. Thus, there are 31 points taken on a transect. From this data the percent cover for each benthic organism and habitat characteristic were calculated by dividing the frequency by 31. For relief, the average of all measurements for a depth zone or the entire reef was reported. Species richness was also calculated from the swath and fish transects individually (Table 2.6;. Urchin measures were summarized in 10 mm size class bins by site and year (Tables 2.7 and 2.8).

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Table 2.4. Length to weight conversion coefficients and proxy species.

| Species | a (TL) | b (TL) | a (SL) | b (SL) | TL-SL (a) | TL-SL (b) | Reference/proxy |
|---|---|---|---|---|---|---|---|
| *Alloclinus holderi* | | | 0.00001 | 3.0512 | 0.8747 | 1.9854 | VRG |
| *Anisotremus davidsonii* | 1.9649E-06 | 3.3922 | | | | | Recfin |
| *Artedius corallinus* | | | 0.00004 | 2.7971 | 0.8414 | 1.0798 | VRG |
| *Atherinops affinis* | 0.00005566 | 2.59 | | | | | Recfin |
| Atherinopsidae | 0.00005566 | 2.59 | | | | | *Atherinops affinis* |
| *Atherinopsis californiensis* | 9.882E-07 | 3.3536 | | | | | Recfin |
| *Aulorhynchus flavidus* | 1.64E-08 | 3.95516 | | | | | *Syngnathus leptorhynchus** |
| bait ball | 0.0000032 | 3.15 | | | | | *Sardinops sagax* |
| *Balistes polylepis* | 0.00000926 | 3.099 | | | | | *Rhacochilus vacca* |
| *Brachyistius frenatus* | | | 0.000005 | 3.3596 | 0.7823 | 5.3443 | Miller et al. 2008 |
| *Caulolatilus princeps* | 0.00000304 | 3.22 | | | | | Recfin |
| *Cephaloscyllium ventriosum* | 0.05 | 2.6825 | | | | | VRG |
| *Cheilotrema saturnum* | 0.00001 | 3.056 | | | | | Miller et al. 2008 |
| *Chromis punctipinnis* | 0.000291 | 2.4964 | | | | | Recfin |
| Clinidae | | | 0.000005 | 3.2228 | 0.8937 | 2.2527 | *Gibbonsia elegans* |
| *Clinocottus analis* | | | 0.00002 | 2.9805 | 0.828 | 1.2904 | VRG |
| *Cymatogaster aggregata* | 0.000006 | 3.1813 | | | | | VRG |
| *Embiotoca jacksoni* | 0.000291 | 2.4964 | | | | | Recfin |
| *Embiotoca lateralis* | 0.0000154 | 3.01 | | | | | Recfin |
| *Engraulis mordax* | 0.0000056 | 2.984 | | | | | Recfin |
| *Galeorhinus galeus* | 0.002673 | 3.29654 | | | | | Ripley 1946 females |
| *Gibbonsia elegans* | | | 0.000005 | 3.2228 | 0.8937 | 2.2527 | VRG |
| *Gibbonsia sp.* | | | 0.000005 | 3.2228 | 0.8937 | 2.2527 | *Gibbonsia elegans* |
| *Girella nigricans* | 0.0000145 | 3.0492 | | | | | Recfin |
| *Gobiidae sp* | 0.0000032 | 3.15 | | | | | Recfin-*Lepidogobius lepidus* |
| *Gymnothorax mordax* | 1.12E-07 | 3.42744 | | | | | Quast 1968 |
| *Halichoeres semicinctus* | 0.0000045 | 3.16 | | | | | Recfin |
| *Hermosilla azurea* | 0.0000107 | 3.1025 | | | | | Recfin |
| *Heterodontus francisci* | 0.00000855 | 3 | | | | | Recfin |
| *Heterostichus rostratus* | 2.16E-07 | 3.62125 | | | | | Recfin |
| *Hexagrammos decagrammus* | 0.000026 | 2.8928 | | | | | Recfin |
| *Hyperprosopon argenteum* | 3.56E-07 | 3.717 | | | | | Recfin |
| *Hypsurus caryi* | 0.0000154 | 3.007 | | | | | Recfin |
| *Hypsypops rubicundus* | | | 0.000036 | 3.1 | 0.8556 | 1.6037 | Quast 1968; TL-SL VRG |
| *Leiocottus hirundo* | 0.0000358 | 2.9 | | | | | Recfin |
| *Lethops connectens* | | | 0.000006 | 3.2822 | 0.8355 | 0.725 | *Rhinogobiops nicholsii* |
| *Lythrypnus dalli* | | | 0.00002 | 2.9624 | 0.8744 | 1.379 | VRG |
| *Medialuna californiensis* | 0.0000737 | 2.7338 | | | | | Recfin |
| *Micrometrus minimus* | 0.000004 | 3.3527 | | | | | VRG |
| *Myliobatis californica* | 0.0000082 | 3.096 | | | | | Martin and Cailliet, 1988 |
| *Ophiodon elongatus* | 0.0000116 | 2.99 | | | | | Recfin |
| *Orthonopias triacis* | | | 0.00007 | 2.6479 | 0.8081 | 0.0774 | VRG |
| *Oxyjulis californica* | 0.0000045 | 3.16 | | | | | Recfin |
| *Oxylebius pictus* | 1.8155E-06 | 3.384 | | | | | DeMartini and Anderson, 1980 |
| *Paralabrax clathratus* | 0.00000272 | 3.27 | | | | | Recfin |

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Table 2.4. Length-weight coefficients, continued.

| Species | a (TL) | b (TL) | a (SL) | b (SL) | TL-SL (a) | TL-SL (b) | Reference/proxy |
|---|---|---|---|---|---|---|---|
| *Paralabrax nebulifer* | 0.00000684 | 3.1128 | | | | | Recfin |
| *Paralichthys californicus* | 0.00000849 | 3.033 | | | | | Recfin |
| *Phanerodon atripes* | 0.0000137 | 2.98 | | | | | Recfin |
| *Phanerodon furcatus* | 0.0000137 | 2.978 | | | | | Recfin |
| *Rathbunella alleni* | | | 0.00003 | 2.7544 | 0.9105 | 3.9959 | VRG |
| *Rhacochilus toxotes* | 0.0000322 | 2.9084 | | | | | Recfin |
| *Rhacochilus vacca* | 0.00000926 | 3.099 | | | | | Recfin |
| *Rhinogobiops nicholsii* | | | 0.000006 | 3.2822 | 0.8355 | 0.725 | VRG |
| *Sarda chiliensis* | 0.00000763 | 3.0896 | | | | | Recfin |
| *Sardinops sagax* | 0.0000032 | 3.15 | | | | | Recfin |
| *Scomber japonicus* | 0.00000137 | 3.3936 | | | | | Recfin |
| *Scorpaena guttata* | 0.0000141 | 3.063 | | | | | Recfin |
| *Scorpaenichthys marmoratus* | 0.0000882 | 2.7203 | | | | | Recfin |
| *Scorpaenodes xyris* | 0.0000141 | 3.063 | | | | | Recfin |
| *Sebastes atrovirens* | 0.0000328 | 2.862 | | | | | Recfin |
| *Sebastes auriculatus* | 0.000026 | 2.9336 | | | | | Recfin |
| *Sebastes carnatus* | 0.0000205 | 2.9573 | | | | | Recfin |
| *Sebastes caurinus* | 0.0000165 | 3.018 | | | | | Recfin |
| *Sebastes chrysomelas* | 0.00000446 | 3.2565 | | | | | Recfin |
| *Sebastes dalli* | 0.00000443 | 3.182 | | | | | Recfin |
| Sebastes juv.-brown complex | 0.0000328 | 2.862 | | | | | *Sebastes atrovirens* |
| *Sebastes miniatus* | 0.0000268 | 2.9165 | | | | | Recfin |
| *Sebastes mystinus* | 0.0000162 | 2.9884 | | | | | Recfin |
| *Sebastes paucispinus* | 0.00000583 | 3.0941 | | | | | Recfin |
| *Sebastes rastrelliger* | 0.00000576 | 3.235 | | | | | Recfin |
| *Sebastes serranoides* | 0.00000521 | 3.1541 | | | | | Recfin |
| *Sebastes serranoides flavidus* | 0.00000521 | 3.1541 | | | | | *Sebastes serranoides* |
| *Sebastes serriceps* | 0.012404 | 1.89 | | | | | Recfin |
| *Sebastes* sp. | 0.00000443 | 3.182 | | | | | *Sebastes semicinctus* |
| *Sebastes umbrosus* | 0.0000058 | 3.1969 | | | | | Recfin |
| *Semicossyphus pulcher* | 0.0000295 | 2.9066 | | | | | Recfin |
| *Sphyraena argentea* | 0.00000412 | 2.983 | | | | | Recfin |
| *Squatina californica* | 1.33-0.00831*TL+0.0000152*TL^2 | | | | | | Natanson 1984 |
| *Stereolepis gigas* | 0.0000259 | 2.9616 | | | | | Recfin |
| *Trachurus symmetricus* | 0.00000331 | 3.2232 | | | | | Recfin |
| *Triakis semifasciata* | 0.0000209 | 2.88 | | | | | Recfin |
| *Urobatis halleri* | 10^(3.0754*LOG(DW)-4.385 | | | | | | Hoisington and Lowe 2005 |
| *Xenistius californiensis* | 0.0000107 | 2.91 | | | | | Recfin |

*used two decimal place adjustment *Syngnathus leptorhynchus* from Quast 1968

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Table 2.5. Abundance, species richness (R), Shannon Wiener Diversity (H'), density (#/100 $m^2$), biomass (g/100 $m^2$) for fishes by transect depth (bottom, midwater or canopy) and invertebrates and algae (SWATH) by major reef area for Santa Monica Bay (2007-2008). Fish metrics from Bight '08 for reefs outside of the study area are also provided (# = replicates).

| | Fish | | | | | | | | | | | | Inverts and algae | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | | Bottom | | | Midwater | | | Canopy | | | | | |
| **station** | **Abund** | **R** | **H'** | **Density** | **Bio** | **#** | **Density** | **Bio** | **#** | **Density** | **Bio** | **#** | **Abund** | **R** | **H'** |
| Cojo | 179 | 11 | 1.83 | 4.38 | 3.61 | 24 | 0 | 0 | 24 | 10.28 | 0.11 | 24 | | | |
| Naples | 464 | 23 | 1.93 | 23.14 | 87.91 | 24 | 4.79 | 1.65 | 24 | 5.42 | 0.16 | 4 | | | |
| Lead Better Beach | 109 | 5 | 0.63 | 19.73 | 1.37 | 8 | 4.25 | 0.99 | 8 | 0 | 0 | 8 | | | |
| Carp Reef | 93 | 3 | 0.12 | 29.58 | 0.61 | 4 | 4.58 | 0.41 | 4 | 0 | 0 | 4 | | | |
| Deep Hole | 3047 | 30 | 1.91 | 32.32 | 10.26 | 32 | 79.95 | 4.78 | 28 | 41.22 | 0.88 | 24 | 815 | 19 | 1.84 |
| Leo Carillo | 2194 | 33 | 2.19 | 30.46 | 11.85 | 33 | 27.15 | 4.20 | 28 | 52.92 | 0.63 | 31 | 2774 | 34 | 2.46 |
| Nicholas Canyon | 3333 | 29 | 2.23 | 52.20 | 24.42 | 24 | 49.68 | 6.95 | 24 | 57.18 | 1.66 | 24 | 1777 | 28 | 2.38 |
| Encinal Canyon | 1210 | 27 | 2.05 | 40.19 | 11.97 | 24 | 14.61 | 7.91 | 16 | 19.24 | 0.44 | 24 | 1340 | 26 | 2.27 |
| Point Dume | 3612 | 30 | 1.78 | 180.13 | 34.00 | 24 | 52.94 | 1.30 | 12 | | | | 984 | 23 | 2.00 |
| Little Dume | 2182 | 28 | 1.40 | 58.26 | 13.20 | 36 | 32.04 | 3.37 | 32 | 17.67 | 0.10 | 20 | 3076 | 36 | 2.70 |
| Escondido | 1087 | 16 | 1.55 | 16.31 | 7.26 | 24 | 19.38 | 1.74 | 24 | 36.25 | 0.22 | 24 | 1504 | 24 | 2.43 |
| Big Rock | 982 | 15 | 1.65 | 134.83 | 52.81 | 4 | 142.92 | 3.56 | 4 | 92.08 | 0.54 | 4 | 425 | 12 | 1.64 |
| Flat Rock | 1823 | 23 | 1.99 | 29.99 | 9.65 | 32 | 10.41 | 3.90 | 24 | 43.01 | 1.59 | 32 | 1446 | 38 | 2.49 |
| Ridges | 1959 | 31 | 2.05 | 23.79 | 12.65 | 48 | 22.65 | 4.12 | 48 | 41.22 | 0.08 | 16 | 3261 | 35 | 2.26 |
| Rocky Point | 3453 | 34 | 1.85 | 71.05 | 19.62 | 48 | 27.83 | 2.87 | 48 | 14.57 | 11.87 | 16 | 2794 | 40 | 2.59 |
| Resort Point | 1374 | 24 | 2.10 | 19.90 | 7.97 | 24 | 25.06 | 7.93 | 24 | 61.33 | 4.35 | 20 | 1272 | 32 | 2.20 |
| Point Vicente | 3079 | 30 | 1.67 | 54.56 | 12.24 | 40 | 48.04 | 6.66 | 36 | 3.75 | 0.06 | 4 | 7247 | 34 | 1.76 |
| Long Point | 1161 | 18 | 1.04 | 38.00 | 9.43 | 20 | 44.58 | 2.70 | 20 | | | | 2417 | 25 | 2.44 |
| Bunker Point | 1412 | 19 | 1.63 | 113.69 | 15.74 | 12 | 28.84 | 2.10 | 8 | 9.31 | 0.17 | 12 | 1281 | 26 | 2.18 |
| 3 Palms | 1314 | 23 | 1.59 | 22.87 | 9.14 | 32 | 42.16 | 2.80 | 24 | 11.03 | 0.34 | 26 | 2466 | 26 | 2.14 |
| Whites Point | 1353 | 22 | 1.63 | 41.74 | 12.47 | 24 | 39.87 | 2.55 | 24 | 10.97 | 0.10 | 12 | 2319 | 33 | 2.47 |
| Point Fermin | 795 | 22 | 2.38 | 22.20 | 8.15 | 24 | 12.02 | 1.75 | 24 | 37.50 | 0.16 | 12 | 2261 | 31 | 2.70 |
| Horseshoe Kelp | 2537 | 15 | 0.94 | 345.64 | 27.83 | 8 | | | | | | | | | |
| Crystal Cove | 582 | 9 | 1.47 | 69.20 | 40.28 | 8 | 15.57 | 1.07 | 8 | | | | | | |
| Little Corona | 662 | 12 | 1.61 | 36.54 | 19.51 | 9 | 10.37 | 2.71 | 9 | | | | | | |
| Laguna | 768 | 8 | 1.14 | 124.92 | 14.44 | 9 | 3.33 | 1.10 | 9 | | | | | | |
| Barn Kelp | 87 | 9 | 1.33 | 11.30 | 6.60 | 9 | 1.11 | 0.72 | 9 | | | | | | |
| Point La Jolla | 121 | 11 | 1.47 | 10.39 | 7.30 | 11 | 1.52 | 2.55 | 11 | | | | | | |
| Point Loma | 290 | 11 | 1.39 | 13.90 | 4.41 | 22 | 4.02 | 1.04 | 21 | | | | | | |
| **total:** | **41262** | **69** | **2.28** | | | | | | | | | | **39459** | **78** | **2.82** |

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Table 2.6. Reef classification characteristics (UPC) including average relief (m) and percent cover.

| **Reef** | **Relief** | **Bare rock** | **sand** | **no biota** | **algal coverage** | **Invertebrate cover** | ***Phyllospadix*** | ***Zostera marina*** |
|---|---|---|---|---|---|---|---|---|
| Deep Hole | 0.10 | 0.00% | 5.65% | 24.19% | 54.84% | 15.32% | 0.00% | 0.00% |
| Leo Carillo | 0.70 | 1.81% | 23.99% | 2.82% | 38.71% | 32.26% | 0.40% | 0.00% |
| Nicholas Canyon | 0.67 | 11.02% | 15.59% | 2.15% | 33.60% | 37.63% | 0.00% | 0.00% |
| Encinal Canyon | 0.56 | 1.34% | 32.80% | 2.42% | 30.65% | 32.53% | 0.00% | 0.27% |
| Point Dume | 0.51 | 4.03% | 19.35% | 7.26% | 54.03% | 15.32% | 0.00% | 0.00% |
| Little Dume | 0.65 | 4.30% | 23.66% | 2.51% | 49.64% | 19.89% | 0.00% | 0.00% |
| Escondido | 0.75 | 5.38% | 13.71% | 17.20% | 36.02% | 27.69% | 0.00% | 0.00% |
| Big Rock | 1.00 | 0.00% | 19.35% | 1.61% | 25.81% | 53.23% | 0.00% | 0.00% |
| Flat Rock | 0.59 | 4.84% | 26.41% | 2.82% | 56.85% | 9.07% | 0.00% | 0.00% |
| Ridges | 0.71 | 4.30% | 18.01% | 4.17% | 65.46% | 8.06% | 0.00% | 0.00% |
| Rocky Point | 0.51 | 9.81% | 13.17% | 6.45% | 64.78% | 5.78% | 0.00% | 0.00% |
| Resort Point | 0.79 | 2.82% | 7.66% | 4.44% | 70.56% | 14.52% | 0.00% | 0.00% |
| Point Vicente | 1.25 | 8.23% | 3.71% | 4.35% | 60.00% | 23.71% | 0.00% | 0.00% |
| Long Point | 1.65 | 1.29% | 6.45% | 7.42% | 63.87% | 20.97% | 0.00% | 0.00% |
| Bunker Point | 1.20 | 8.06% | 8.60% | 9.68% | 53.76% | 19.89% | 0.00% | 0.00% |
| Three Palms | 0.62 | 10.69% | 11.49% | 7.66% | 61.69% | 8.47% | 0.00% | 0.00% |
| Whites Point | 0.72 | 12.63% | 18.82% | 0.81% | 58.60% | 9.14% | 0.00% | 0.00% |
| Point Fermin | 0.94 | 5.38% | 11.83% | 7.53% | 54.57% | 20.70% | 0.00% | 0.00% |

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Table 2.7. Frequency of red urchin test diameters (mm) for Santa Monica Bay 2007-2008.

| **Red Urchins** | **Test Diameter (mm)** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Site** | **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** | **90** | **100** | **110** | **120** |
| 3 Palms 2007 | | | 1 | | 1 | 4 | 8 | 15 | 25 | 16 | 1 | |
| 3 Palms 2008 | | | | | | | | | | 1 | | |
| Big Rock 2008 | 2 | | 1 | 1 | | 4 | 5 | 8 | 20 | 16 | 5 | 1 |
| Bunker Point 2007 | | 1 | | | 4 | 7 | 8 | 13 | 16 | 4 | | |
| Cabrillo Breakwater 2008 | | | | 1 | 8 | 11 | 33 | 14 | 3 | 1 | | |
| Cabrillo Jetty 2008 | | | | 1 | | 2 | 9 | 7 | 13 | 4 | 4 | |
| Deep Hole 2007 | | | 1 | 11 | 24 | 29 | 19 | 10 | 6 | | | |
| Deep Hole 2008 | 1 | 7 | 17 | 3 | 29 | 30 | 9 | 3 | | 1 | | |
| El Matador 2007 | | | 4 | 7 | 7 | 11 | 15 | 25 | 29 | 2 | | |
| Escondido 2007 | | | 3 | 6 | 18 | 34 | 25 | 13 | 1 | | | |
| Escondido 2008 | 1 | 3 | 15 | 12 | 6 | 12 | 22 | 14 | 3 | 1 | | |
| Flat Rock 2007 | | | 2 | 7 | 6 | 14 | 12 | 15 | 25 | 10 | 2 | |
| Leo Carillo 2007 | | | 7 | 8 | 9 | 19 | 21 | 14 | 12 | 7 | 2 | 1 |
| Leo Carillo 2008 | | 4 | 9 | 12 | 20 | 24 | 15 | 9 | 4 | 2 | 1 | |
| Little Dume 2007 | | | 2 | 17 | 12 | 16 | 26 | 20 | 6 | 1 | | |
| Little Dume 2008 | 2 | 7 | 2 | | 2 | 5 | 12 | 18 | 2 | | | |
| Long Point 2007 | | 1 | 13 | 12 | 17 | 17 | 15 | 14 | 10 | 1 | | |
| Nicholas Canyon 2007 | | 2 | 2 | 5 | 13 | 8 | 15 | 21 | 20 | 11 | 1 | |
| Nicholas Canyon 2008 | 1 | | 4 | 3 | 2 | 3 | 11 | 16 | 5 | 1 | | |
| Point Dume 2007 | | | | 1 | 11 | 35 | 28 | 10 | 9 | 1 | | |
| Point Fermin 2008 | 3 | 7 | 4 | 2 | 2 | 5 | 6 | 6 | 9 | 4 | 1 | |
| Point Vicente 2007 | | 2 | 6 | 22 | 12 | 7 | 14 | 26 | 10 | 1 | | |
| Resort Point 2008 | | 12 | 11 | 13 | 31 | 41 | 26 | 16 | 12 | 7 | 2 | |
| Ridges 2007 | | | | | | 4 | 27 | 49 | 14 | 5 | | |
| Ridges 2008 | | | 3 | 5 | 5 | 11 | 19 | 29 | 17 | 17 | 10 | 2 |
| Rocky Point 2007 | | | | | | 6 | 46 | 36 | 8 | 3 | 1 | |
| Whites Point 2008 | | 1 | 3 | | 1 | 2 | 4 | 10 | 6 | 5 | | |

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Table 2.8. Frequency of purple urchin test diameters (mm) for Santa Monica Bay 2007-2008.

| **Purple Urchins** | **Test Diameter (mm)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Site** | **0** | **10** | **20** | **30** | **40** | **50** | **60** | **70** | **80** |
| 3 Palms 2007 | | | | 2 | 6 | 7 | 5 | 2 | |
| 3 Palms 2008 | | | | | 1 | 3 | 1 | | |
| Big Rock 2008 | | | | 2 | 3 | 2 | 2 | | |
| Bunker Point 2007 | | | | 4 | 17 | 31 | 20 | 5 | 1 |
| Deep Hole 2007 | | | 6 | 54 | 32 | 8 | | | |
| Deep Hole 2008 | 2 | 22 | 27 | 31 | 17 | 2 | | | |
| El Matador 2007 | | 1 | 1 | 5 | 18 | 37 | 11 | | |
| Escondido 2007 | | | 6 | 36 | 30 | 8 | 1 | | |
| Escondido 2008 | | 2 | 14 | 34 | 21 | 9 | 8 | | |
| Flat Rock 2007 | | | | 1 | 6 | 5 | 1 | | |
| Leo Carillo 2007 | | | 7 | 24 | 28 | 29 | 10 | 2 | |
| Leo Carillo 2008 | | 6 | 17 | 46 | 20 | 8 | 2 | | |
| Little Dume 2007 | | | 3 | 20 | 39 | 31 | 7 | | |
| Little Dume 2008 | | | | | 1 | | | | |
| Long Point 2007 | | | 2 | 46 | 46 | 5 | 1 | | |
| Nicholas Canyon 2007 | | | | 3 | 14 | 18 | 3 | | |
| Nicholas Canyon 2008 | | | 16 | 14 | 22 | 27 | 14 | 5 | |
| Point Dume 2007 | | | 2 | 7 | 41 | 42 | 8 | | |
| Point Fermin 2008 | | 1 | 4 | 12 | 5 | 19 | 26 | 8 | |
| Point Vicente 2007 | | 2 | 64 | 31 | 3 | | | | |
| Resort Point 2008 | | | 4 | 69 | 156 | 9 | | | |
| Ridges 2007 | | | | 1 | 1 | | | | |
| Ridges 2008 | | 9 | 15 | 21 | 18 | 34 | 9 | 2 | |
| Rocky Point 2007 | | | 1 | 5 | 52 | 39 | 3 | | |
| Whites Point 2008 | | | 2 | 5 | 7 | 14 | 11 | 3 | |

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Figure 2.2 Fish Density (#/100 $m^2$) and biomass (g/100$m^2$) for reefs in Santa Monica Bay.

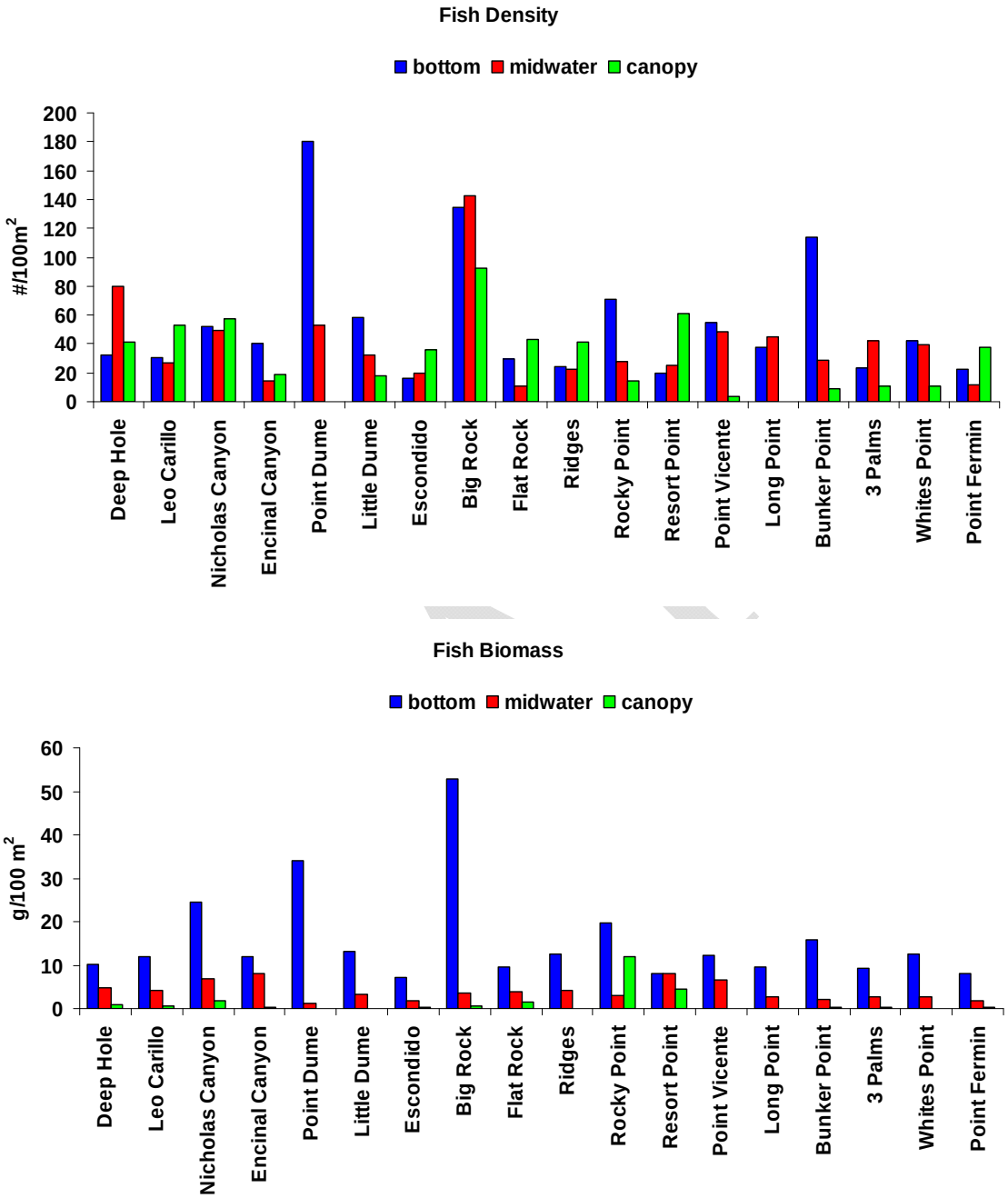
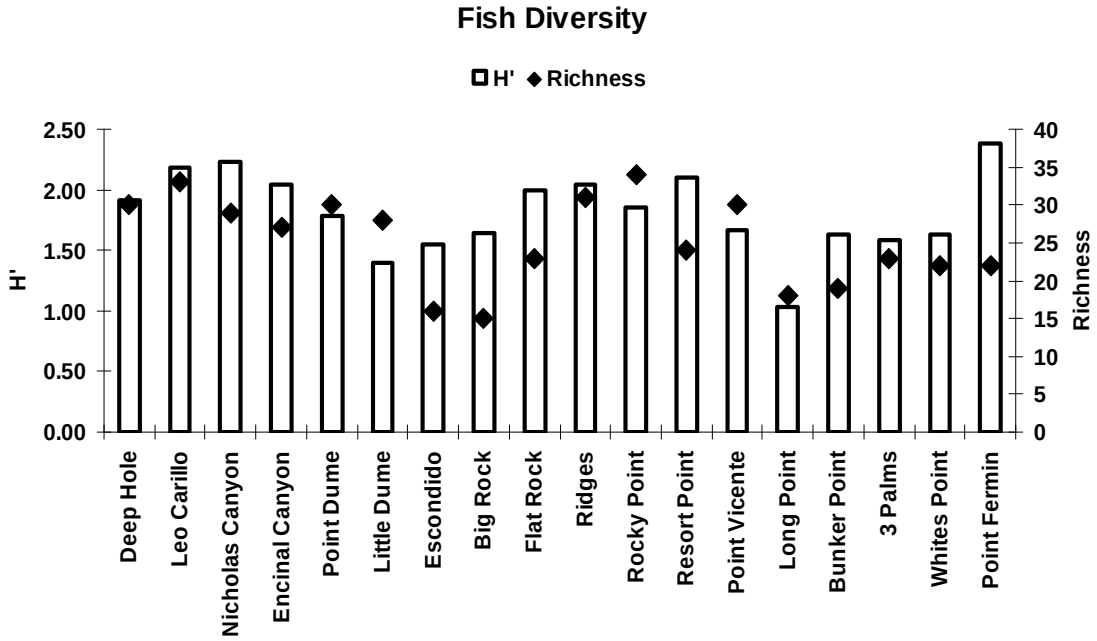
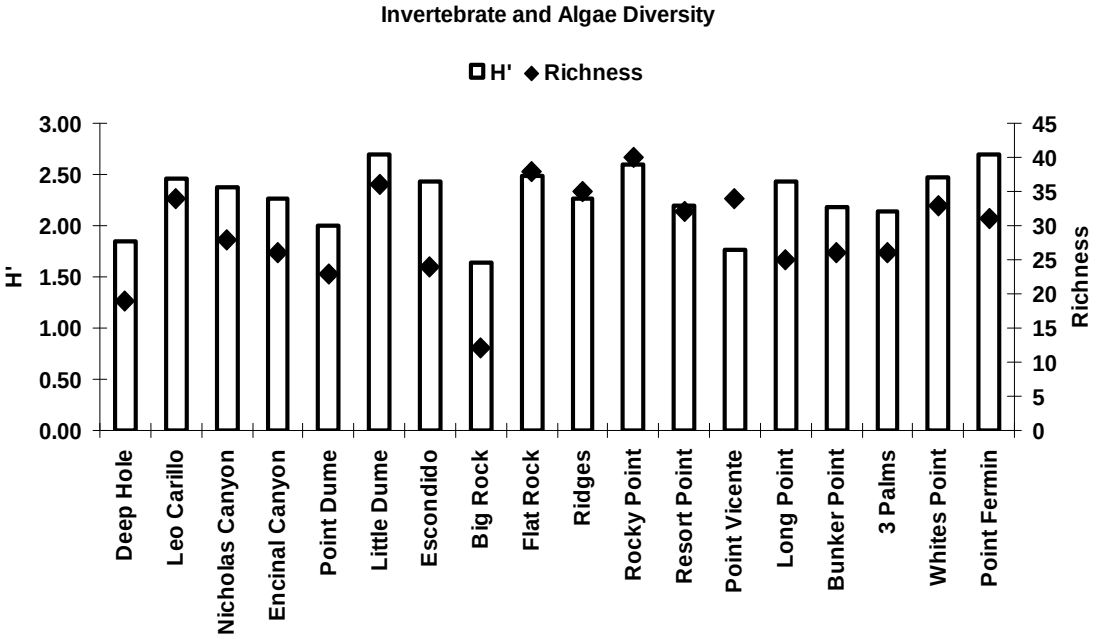


Figure 2.3. Fish and Invertebrate/Algal diversity metrics, Shannon Wiener H' and Species Richness for the reefs of Santa Monica Bay.



## 3. Areas of Special Biological Significance (ASBS's) and proposed Marine Protected Areas (MPAs) baseline studies

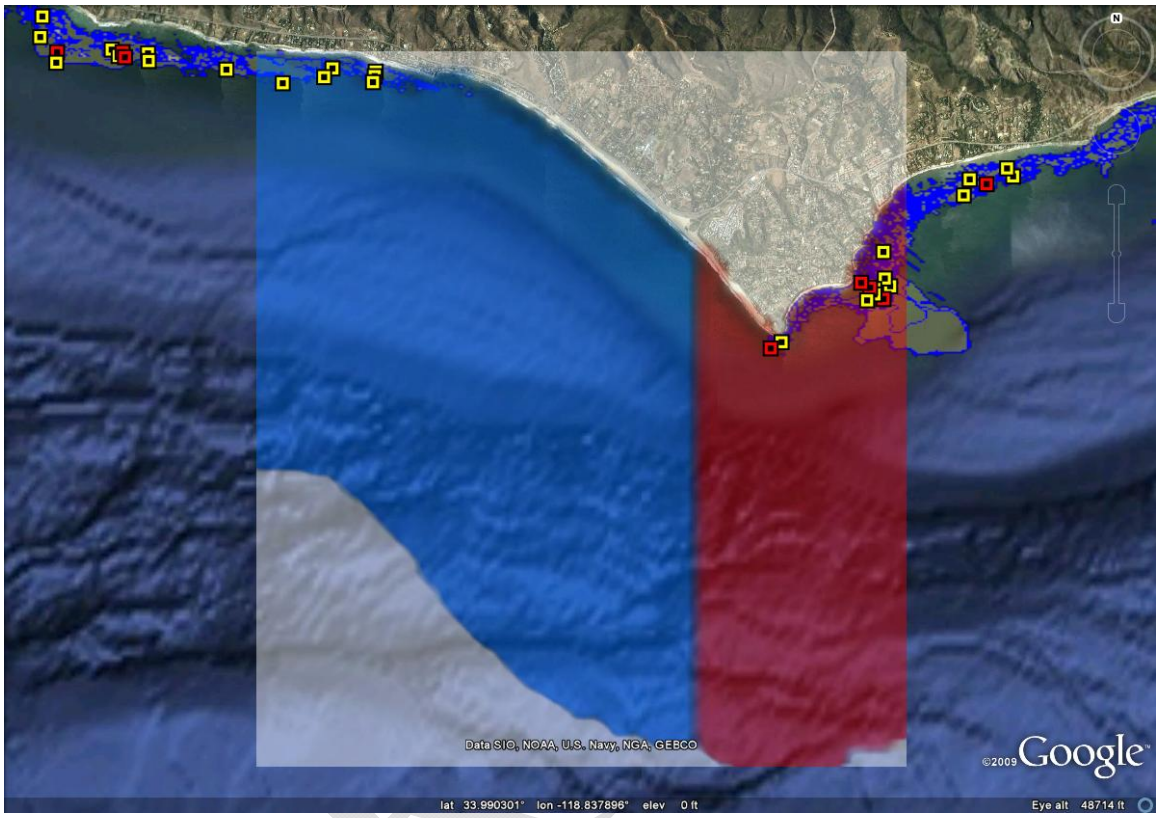
There is a single Area of Special Biological Significance in the study region; it extends from Point Mugu to Escondido (Figure 3.1). We completed 32 surveys within the Malibu ASBS. Sampling locations included Deep Hole, El Matador, Leo Carillo, Encinal Canyon, Nicholas Canyon, Lechuza, Point Dume, Little Dume, and Escondido Beach. The majority of reef habitat (in blue outline) in this ASBS (in yellow outline) is in Santa Monica Bay and was extensively sampled. Data for these station and depth zones are contained in Appendices (I-VIII). The status of all ASBS for the region is being evaluated in the SCCWRP' Bight '08 Rocky Reef Program (see Appendix IX).

The Marine Life Protection Act's Blue Ribbon task forced has forwarded two marine protected areas for the South Coast Integrated preferred alternative in this study region (Figures 3.2 and 3.3). Each of these includes a State Marine Reserve coupled with a State Marine Conservation Area. The Point Vicente State Marine Reserve and the Abalone Cove State Marine Conservation Area (15 surveys) are found at the center of the Palos Verdes Peninsula. For the Malibu coastline, these are the Point Dume State Marine Reserve and the Lechuza State Marine Conservation (15 surveys). The final ruling on these reserves will take place in 2010. At that point, an integrative evaluation and monitoring plan needs to be developed. This should include, at a minimum, the continued time series monitoring and identification of the appropriate reference sites.

Figure 3.1. Locations of stations completed within the Malibu ASBS during the 2007 (yellow)-2008 (red) field seasons. Nearshore reefs are in are outlined in blue.

Figure 3.2. Overlain on the South Coast Integrated preferred alternative for the Palos Verdes Peninsula are the 2007 (yellow) and 2008 (red) field seasons sampling stations. Kelp beds and nearshore reefs are in green. The Point Vicente State Marine Reserve is in pink and the Abalone Cove State Marine Conservation Area is in blue.

Figure 3.3 Overlain on the South Coast Integrated preferred alternative for the Malibu Coast are the 2007 (yellow) and 2008 (red) field seasons sampling stations. Nearshore reefs are in are outlined in blue. The Point Dume State Marine Reserve is in red and the Lechuza State Marine Conservation Area is in blue.



## 4.1 Commercial and Recreation Fishing

Eight of the reef invertebrates are of economic importance. Pink, green and red abalone are completely protected due to the fisheries closure from overfishing. These abalones are extremely rare in Santa Monica Bay. Similarly, rock scallops are found in low numbers, but they are still taken recreationally. Giant keyhole limpets, studied for medicinal properties, are taken by scientific collectors, and are an emerging fishery in Southern California. Scientific collectors also collect sea hares for neurological studies. The two most important invertebrate fisheries for these nearshore reefs are spiny lobster and red urchin (Table 2.5). Both of these fisheries appear quite viable at this time. We have observed a marked increase in hoopnetters targeting lobster in the past few years. This could be a significant problem, most of Santa Monica Bay is already closed to commercial lobstering, but recreational fishing remains allowed. This huge commercial closure likely provides a significant contribution to the continued success of this fishery. Theoretically, reducing this stock could have deleterious consequences to the commercial and recreational fishery.

Nearly half of the fishes surveyed (Table 2.1) are important components of the commercial and recreational fisheries. While a number of the others are taken when conditions are poor (i.e. blacksmith) and/or are taken extensively by pier fishers (ex. topsmelt, jacksmelt, shiner perch etc.) Nearly every large fish is targeted at some level. Fishes are targeted in every conceivable mode (from piers, beaches, jetties, bluffs, kayakers, recreational boaters, commercial traps, spearfishers, and commercial passenger fishing vessels [CPFVs]). The recreational boaters and CPFVs originate primarily at King Harbor and Marina del Rey. Recreational and CPFVs also originate from the Port of Los Angeles and Long Beach to the south, and Port Hueneme to the north. Clearly, the most fished stretch of coastline is from Malaga to Rocky Point, the northwest portion of the Palos Verdes Peninsula. The reason for this is the proximity to port (King Harbor), and the abundant reef and kelp habitat. Rocky Point is the largest reef and has the most persistent kelp in the Bay. Fishing regulations are by species and usually are in the form of daily bag limits with some seasonal closures. However, there are no quotas on any species landed in the Bay; as such, there is no overall limit to the take of reef fishes (or invertebrates) in Santa Monica Bay.

Considering the scale and magnitude of these various fishing modes, it is difficult to imagine that fishing does not influence fish populations on all of the reefs in the Bay. Some effects appear to be localized, as the most targeted nearshore rocky reef fish, kelp bass, shows an appreciable reduction in density with proximity to King Harbor (Figure 4.2). California sheephead, which are targeted by both recreational and commercial fishers, have a variable yet low density (~2 per $100m^2$). This variation appears to be best explained by the presence of high relief reefs (Table 2.6). These types of reefs offer optimal spawning and refuge habitat. With the exception of Rocky Point, Ridges and Whites Point, all the 'points' harbor the highest densities of sheephead (Figure 4.1). Finally, barred sand bass have significantly depressed numbers throughout the region, with the exception of the distant stretches of Malibu (Figure 4.3). Recreational fishing needs to be better managed in Santa Monica Bay.

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Figure 4.1. California sheephead density (#/100m$^2$) in Santa Monica Bay.

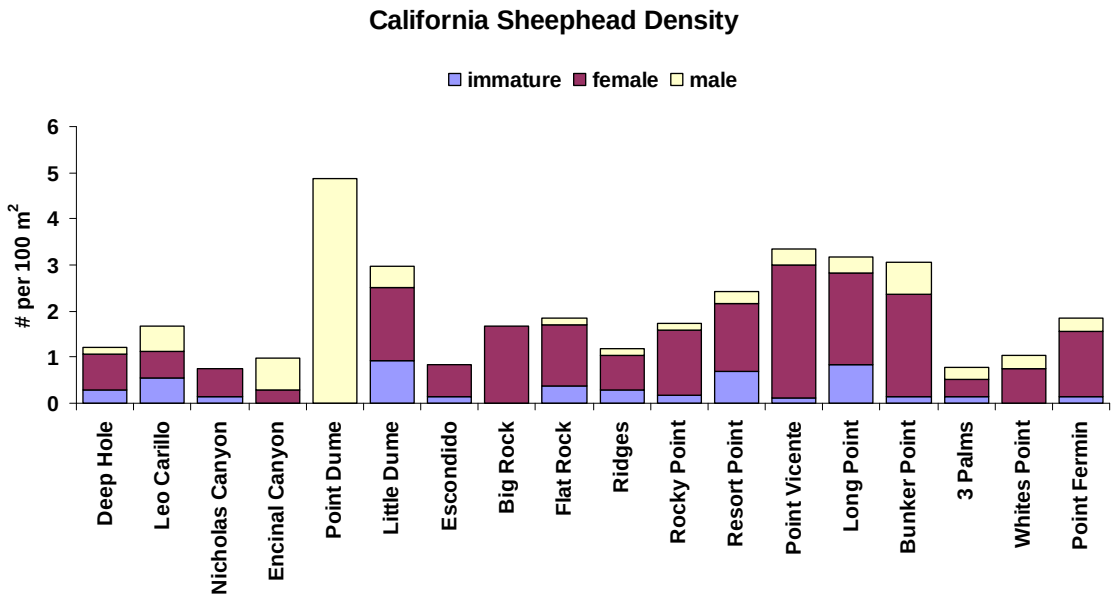


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Figure 4.2. Kelp bass density (#/100 $m^2$; ± 1 S.E.) by reef. Reefs easily accessible to King Harbor are circled in red.

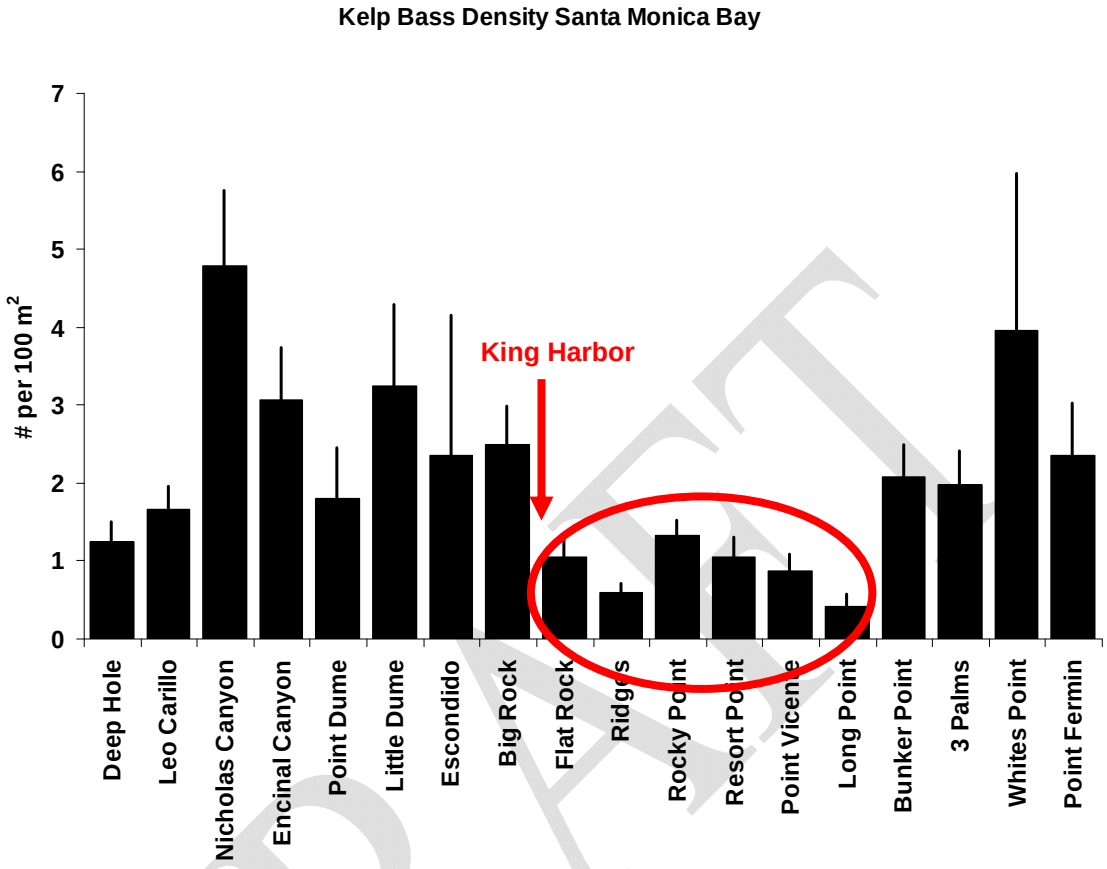


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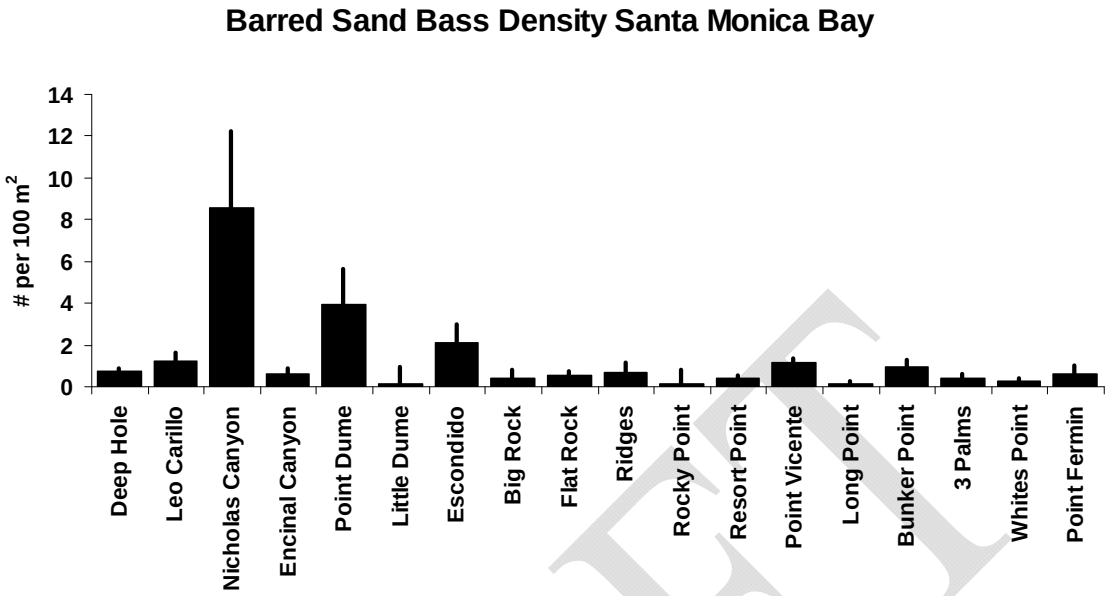
Figure 4.3. Barred Sand Bass density (#/100 m2; ± 1 S.E.) by reef.

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**5. Habitat quality of the San Monica Bay reefs, with comparisons to mainland reefs throughout the Southern California Bight**

This is an extremely complex question as various anthropogenic stressors factors affect reefs along the coast of the Southern California Bight. These include: pollution, consequences of sedimentation (turbidity, scour and burial), overfishing, and in some instances urchin barrens. Further complicating any assessment of reefs is the natural variation among reefs. Reefs vary based upon biogeographic region (Oregonian vs San Diegan), size, depth strata, sources of production, presence of giant kelp, relief and complexity. In addition, positive anthropogenic factors are acting in concert with these stressors. These include: restoration projects, marine protected areas (MPAs), fishing closures, reduction of point source pollution and Areas of Special Biological Significance (ASBS's). There is a consensus among stakeholders that an assessment of reef health would enable stronger management of this critical nearshore ecosystem.

In order to begin to address this problem, we surveyed 29 mainland reefs spanning the entire Southern California Bight (Pt. Loma to Cojo); 18 of these reefs were in Santa Monica Bay (Deep Hole to Pt. Fermin). At all sites the CRANE protocol was used (Section II, Appendix IX). While the Bight '08 Rocky Reef project is still in progress, all of the reef fish data for the mainland were synthesized. The biological and habitat characteristics of these reefs are presented in Tables 5.1 and 5.2.

Considering the great amount of variation in reef communities within this region, a habitat value model (Bond et al. 1999) was used to complete this comparison. This is a three parameter model where fish assemblages are quantified based upon feeding guilds (Table 4.1) using mean size (TL) (as a surrogate for biomass), density (*D*: per hectare), and fidelity (*F*). Fidelity is defined as the frequency of occurrence of a guild on a reef per sampling period scaled as a proportion from 0-1. The three parameters are treated equally such that for each guild, the guild value is the square root of the product of the three parameters. The habitat value (*HV*) is the sum of the guild values as follows:

$$HV = \sum_{24}^{1} \sqrt{mean(TL) * F * D}$$

Thus, the model incorporates trophic levels (feeding guilds), a diversity factor (# of guilds), density, size and fidelity. One new guild was added to the model for Giant Seabass, *Stereolepis gigas* (macrocarnivore; Guild 24; Table 4.1).

A habitat value was calculated for each CRANE depth zone sampled in the survey and then summed across all depth zones for each site. Bottom transects were completed at all reef strata, middepth densities were scaled to the depth of the water, and canopy transects were included when the canopy was present. Total lengths of fishes were those estimated in the field. Density was calculated as an area estimate of fishes by summing the density at the three sampling levels (bottom, middepth and canopy) per depth zone (inner, middle, outer, deep). A fidelity was calculated as the frequency of occurrence of a guild in each CRANE depth zone overall all sampling occasions.

The habitat values ranged considerably throughout the bight (Table 4.2) from a low of 348 at Carp Reef, Santa Barbara to a high at Point Dume, Malibu (10,076). Eight of the top ten reefs were in the Santa Monica Bay. These habitat values were then scaled to color and integrated as a layer in GIS for the Bay (Figures 5.1-5.3). There was

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considerable variation in habitat quality in the Bay. The most informative region, only because it is the most studied, is the Palos Verdes Peninsula (Figure 5.3). Point Fermin to 3 Palms has the poorest habitat quality in spite of persistent kelp in this area. There is adequate light to support kelp, which gives a false sense that the ecosystem below is healthy. This area is still under the chronic stress of sedimentation, scour and turbidity historically from the Portuguese Landslide (Kayen et al. 2002; Figure 5.4) and more recently from the Trump National Golf Course landslide on Bunker Point in 1999. There is also significant sedimentation and turbidity proximate to the large storm drains. This stretch of coastline has the highest percentage of bare rock (Table 5.2); this may be a consequence of scour, but is certainly an indication of deleterious effects of the turbidity. Of greater concern is the ongoing burial of rocky reefs in this region (Figure 5.5). Similar processes are ongoing along the Malibu coastline. Buried algae were observed at Little Dume and a significant amount of bare rock was observed at Nicholas Canyon (Table 5.2). The loss and degradation of our nearshore reefs due to sedimentation and turbidity appears to be the most significant anthropogenic problem at this time.

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Table 5.3. Fish guilds found along the Southern California Mainland Reefs 2007-2008.

| guild | Description and Species |
|---|---|
| **1** | **water column foragers, schooling, filter feeding** |
| | *Sardinops sagax* |
| **3** | **water column, nocturnal** |
| | *Hyperprosopon argenteum* |
| **4** | **water column, benthic foragers, schooling, diurnal herbivores** |
| | *Atherinops affinis* |
| | Atherinopsidae |
| **5** | **substrate associated, water column foragers, selective feeding, usually benthic refugers, diurnal** |
| | *Aulorhynchus flavidus* |
| | *Chromis punctipinnis* |
| | *Sebastes* juv-brown complex |
| | *Sebastes miniatus* |
| | *Sebastes mystinus* |
| | *Sebastes umbrosus* |
| **6** | **Substrate associated, nocturnal visual** |
| | *Sebastes serranoides* |
| | *Sebastes serranoides/flavidus* |
| **8** | **substrate associated, water column foragers, benthic foragers, schooling, often benthic refuging, diurnal, pickers** |
| | *Brachyistius frenatus* |
| | *Cymatogaster aggregata* |
| | *Oxyjulis californica* |
| **9** | **substrate associated, non-schooling, diurnal, engulfers** |
| | *Caulolatilus princeps* |
| | *Heterostichus rostratus* |
| | *Paralabrax clathratus* |
| | *Paralabrax nebulifer* |
| **10** | **substrate associated, nocturnal** |
| | *Cephaloscyllium ventriosum* |
| | *Gymnothorax mordax* |
| | *Scorpaena guttata* |
| | *Sebastes atrovirens* |
| | *Sebastes auriculatus* |
| | *Sebastes carnatus* |
| | *Sebastes chrysomelas* |
| | *Sebastes dalli* |
| | *Sebastes rastrelliger* |
| | *Sebastes serriceps* |
| **11** | **substrate associated, benthic foragers, schooling/nonscholloing, diurnal generalists** |
| | *Embiotoca jacksoni* |
| | *Hypsurus caryi* |
| | *Hypsypops rubicundus* |
| | *Micrometrus minimus* |
| | *Phanerodon atripes* |
| | *Phanerodon furcatus* |
| | *Sebastes caurinus* |

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Table 5.3. Fish guilds, continued.

| | |
|---|---|
| **12** | **substrate associated crushers** |
| | *Balistes polylepis* |
| | *Halichoeres semicinctus* |
| | *Heterodontus francisci* |
| | *Myliobatis californica* |
| | *Rhacochilus vacca* |
| | *Semicossyphus pulcher* |
| **13** | **substrate associated herbivores** |
| | *Girella nigricans* |
| | *Hermosilla azurea* |
| | *Medialuna californiensis* |
| **14** | **substrate associated, nocturnal generalists** |
| | *Anisotremus davidsonii* |
| | *Cheilotrema saturnum* |
| | *Rhacochilus toxotes* |
| **16** | **substrate associated, water column/benthic foragers, mesocarnivores** |
| | *Ophiodon elongatus* |
| | *Paralichthys californicus* |
| | *Scorpaenichthys marmoratus* |
| | *Squatina californica* |
| **17** | **substrate associated, substrate sitters, microcarnivores, diurnal** |
| | *Hexagrammos decagrammus* |
| | *Oxylebius pictus* |
| **19** | **substrate associated, hiders (in holes and crevices), diurnal** |
| | *Clinocottus analis* |
| | Gobiidae |
| | *Lythrypnus dalli* |
| | *Rhinogobiops nicholsii* |
| **20** | **substrate associated, benthic foragers, pickers and scrapers, diurnal** |
| | *Alloclinus holderi* |
| | *Gibbonsia elegans* |
| | *Rathbunella alleni* |
| **22** | **substrate associated, diggers and extractors** |
| | *Leiocottus hirundo* |
| | *Urobatis halleri* |
| **23** | **water column, pelagic mesocarnivores** |
| | *Atherinopsis californiensis* |
| | *Galeorhinus galeus* |
| | *Sebastes paucispinus* |
| | *Sphyraena argentea* |
| | *Trachurus symmetricus* |
| **24** | **macrocarnivore** |
| | *Stereolepis gigas* |

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Table 5.4. Habitat values based on fish guilds for the mainland reefs of Southern California Bight.

| guild | Cojo | Naples | Carp Reef | Lead Better Beach | Deep Hole | Leo Carillo | Nicholas Canyon | Encinal Canyon | Point Dume | Little Dume | Escondido | Big Rock | Flat Rock | Ridges | Rocky Point |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 754 | | 373 | | 1658 | | | | | | |
| 2 | | | | | 75 | 173 | 190 | 11 | | 87 | 257 | | 216 | 224 | 53 |
| 3 | 252 | | | | | | | | 661 | | 17 | | | | |
| 4 | 179 | 142 | | | 404 | 289 | 392 | | 1625 | | | | 127 | | |
| 5 | | 23 | 50 | 211 | 483 | 297 | 566 | 127 | 95 | 258 | | 224 | 554 | 335 | 1083 |
| 6 | 175 | 709 | | | 84 | 108 | 49 | 20 | 887 | 58 | | | | 18 | 50 |
| 8 | | 294 | 298 | 254 | 970 | 1082 | 1165 | 810 | 807 | 810 | 520 | 537 | 863 | 454 | 1415 |
| 9 | 43 | 152 | | | 445 | 633 | 1010 | 545 | 364 | 453 | 453 | 253 | 351 | 249 | 601 |
| 10 | 186 | 301 | | | 196 | 285 | 282 | 212 | 870 | 170 | 30 | 102 | | 107 | 126 |
| 11 | 49 | 335 | | | 412 | 532 | 446 | 449 | 883 | 323 | 130 | 478 | 506 | 268 | 393 |
| 12 | | | | 52 | 356 | 346 | 283 | 341 | 1019 | 428 | 142 | 299 | 438 | 421 | 706 |
| 13 | | | | | 169 | 137 | 33 | 145 | 512 | 213 | | 941 | 176 | 257 | 615 |
| 14 | | 42 | | | 147 | 36 | 49 | 160 | 155 | 202 | | 822 | 78 | 37 | 302 |
| 16 | 52 | 206 | | | 32 | 47 | | | 300 | 29 | | | | | |
| 17 | | | | | 89 | 38 | 50 | 40 | 71 | 18 | | 54 | 19 | 137 | 134 |
| 19 | | | | | 76 | 40 | 56 | | | 20 | | | 31 | 253 | 301 |
| 20 | | 27 | | | | | | | | | | | 88 | | 47 |
| 22 | | 35 | | | | | | | | 32 | | | | | |
| 23 | | | | | 327 | 556 | 381 | 363 | | 147 | 65 | | 260 | 891 | 314 |
| 24 | | | | | | | 57 | | 171 | | | | | | |
| **Total** | **936** | **2266** | **348** | **517** | **5020** | **4601** | **5383** | **3223** | **10076** | **3249** | **1614** | **3709** | **3707** | **3650** | **6140** |

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Table 5.4. Habitat values, continued.

| guild | Resort Point | Point Vicente | Long Point | Bunker Point | 3 Palms | Whites Point | Point Fermin | Horseshoe Kelp | Little Corona | Crystal Cove | Laguna | Barn Kelp | Point La Jolla | Point Loma |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | |
| 2 | 2 | | | 102 | 157 | | 298 | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | 4 | | | | | | 41 | | | | | | | |
| 5 | 316 | 1872 | 1428 | 948 | 300 | 30 | 382 | 1239 | 1296 | 1262 | 1118 | 167 | 91 | |
| 6 | | | | | | 28 | | | | | | | | |
| 8 | 762 | 1220 | 1866 | 1292 | 1155 | 880 | 480 | 1391 | 1242 | 613 | 586 | 450 | 515 | 656 |
| 9 | 489 | 529 | 1237 | 559 | 595 | 486 | 498 | 183 | 857 | 845 | 655 | 484 | 896 | 436 |
| 10 | 171 | 113 | 76 | 102 | 70 | 42 | 49 | 196 | | 122 | | 129 | | 77 |
| 11 | 230 | 658 | 729 | 646 | 424 | 745 | 308 | 174 | 1178 | 901 | 622 | 271 | 362 | 241 |
| 12 | 378 | 1038 | 923 | 512 | 459 | 215 | 354 | 675 | 945 | 1145 | 810 | 451 | 448 | 327 |
| 13 | 1183 | 498 | 405 | 102 | 199 | 300 | 450 | 51 | 547 | | | | | |
| 14 | | 175 | 195 | 169 | | 70 | 46 | 209 | | | | | | |
| 16 | | 268 | 175 | | 59 | 65 | | 166 | | | | | | |
| 17 | 144 | 267 | 135 | 66 | 46 | | 30 | 103 | | | | | | |
| 19 | 171 | 308 | 70 | 54 | | | 93 | 103 | | | | | | |
| 20 | | | | | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | |
| 23 | 335 | 132 | | 1243 | 46 | 19 | 118 | | | | | | | |
| 24 | | | | | | | | | | | | | | |
| **Total** | **4185** | **7078** | **7238** | **5795** | **3511** | **2878** | **3147** | **4490** | **6064** | **4888** | **3792** | **1952** | **2312** | **1738** |

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Figure 5.1. Guild values for Pt. Dume-Escondido.

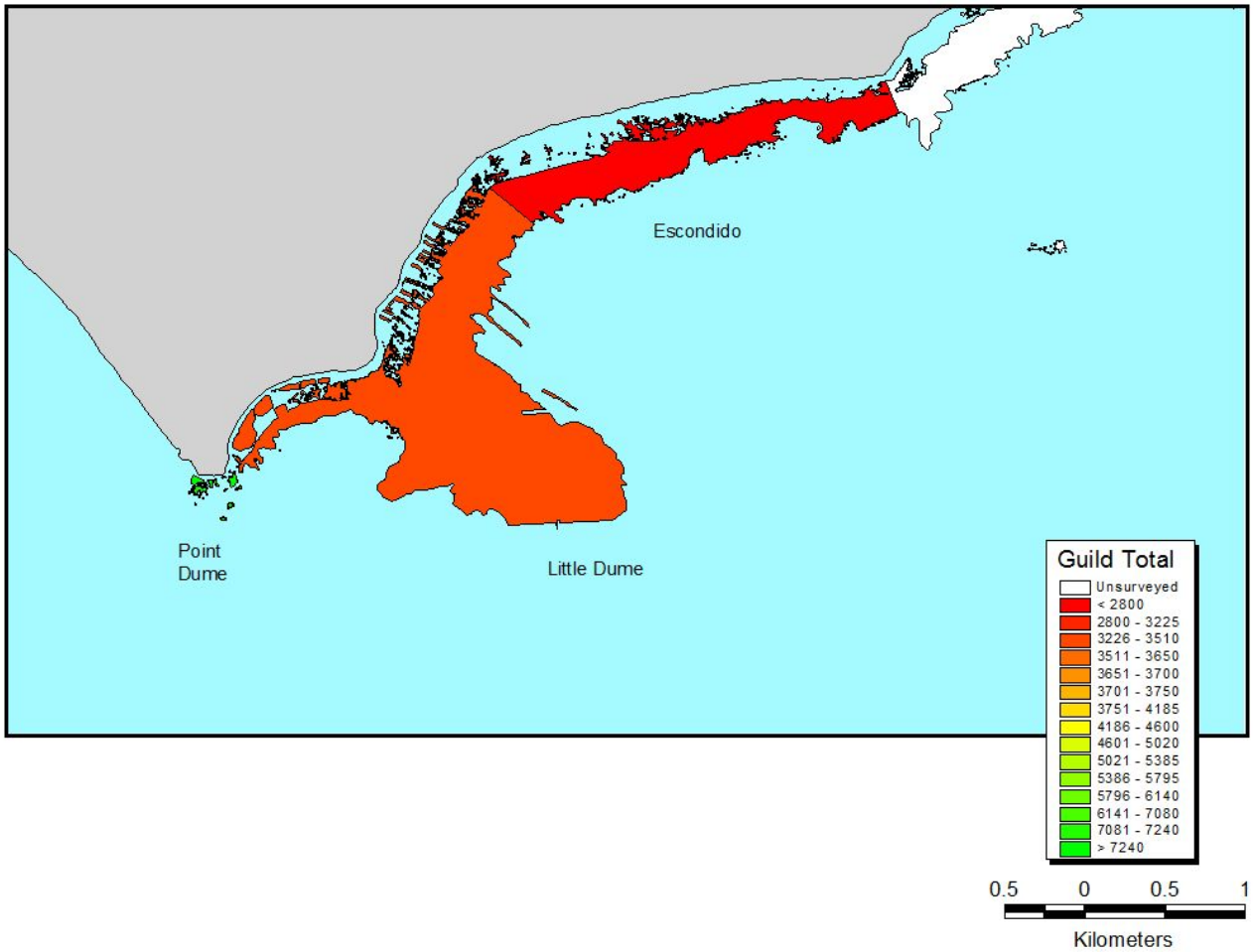

Figure 5.2. Guild Values for Malibu, Deep Hole to Zuma Beach.

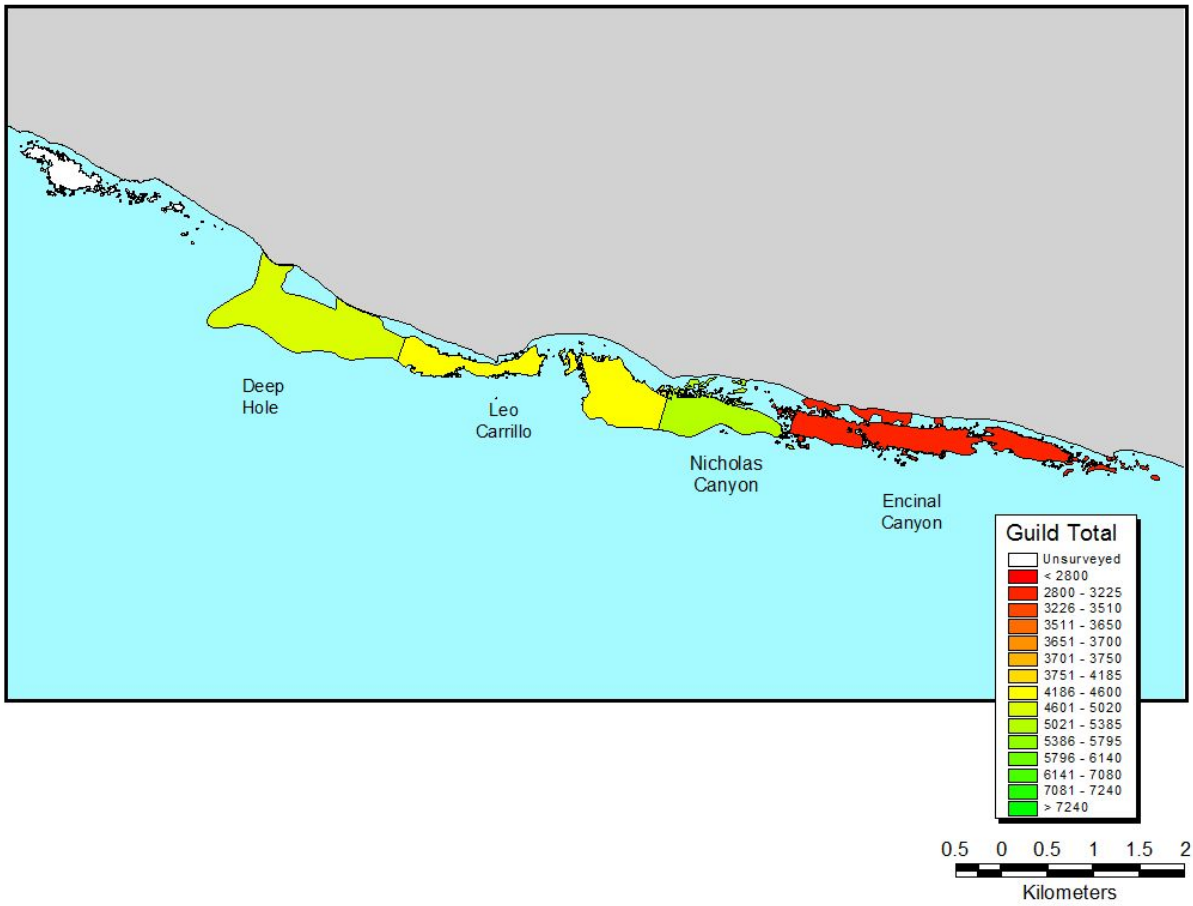

Figure 5.3. Guild values for the Palos Verdes Peninsula.

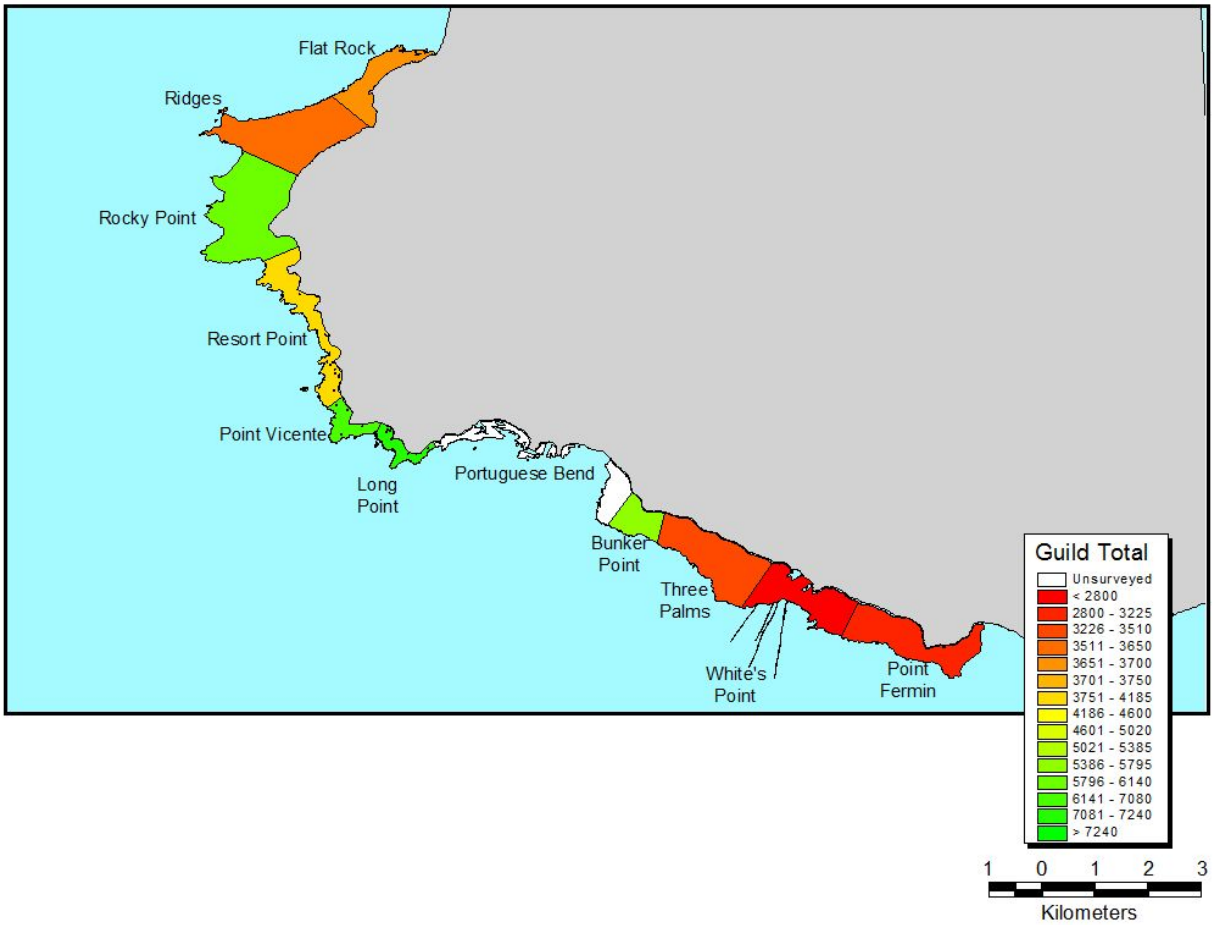

Figure 5.4. Example of turbidity plume from the Portuguese Bend Landslide.

Figure 5.5. Examples of buried reef at Bunker Point (above), October 22, 2008 and Whites Point (below), June 3, 2009.

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Appendix I. Mean fish density (#/100m$^2$) and standard error for bottom transects 2007-2008 on natural reefs on the mainland of the Southern California Bight. The number of replicates is in parentheses.

| | 3 Palms (32) | | Barn Kelp (9) | | Big Rock (4) | | Bunker Point (12) | | Carp Reef (4) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | | | 45.00 | 28.92 | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | 0.42 | 0.15 |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.52 | 0.20 | 0.37 | 0.24 | | | 0.14 | 0.14 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 4.53 | 3.66 | 0.19 | 0.19 | 8.33 | 8.33 | 30.14 | 14.22 | | |
| *Clinocottus analis* | 0.05 | 0.05 | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 1.41 | 0.32 | 0.19 | 0.19 | 17.08 | 11.59 | 1.94 | 0.57 | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.63 | 0.37 | | | 42.08 | 31.52 | 0.14 | 0.14 | | |
| Gobiidae | 0.05 | 0.05 | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 1.20 | 0.54 | | | 0.83 | 0.83 | 1.39 | 0.45 | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterodontus francisci* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.52 | 0.19 | | | | | 2.78 | 1.24 | | |
| *Hypsypops rubicundus* | 0.99 | 0.32 | 0.37 | 0.24 | 1.67 | 0.68 | 3.06 | 1.49 | | |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Micrometrus minimus* | 0.05 | 0.05 | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Ophiodon elongatus* | | | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | 3 Palms (32) | | Barn Kelp (9) | | Big Rock (4) | | Bunker Point (12) | | Carp Reef (4) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 6.67 | 2.06 | 6.67 | 3.77 | 9.17 | 3.50 | 28.47 | 8.20 | 29.17 | 8.21 |
| *Oxylebius pictus* | 0.10 | 0.07 | | | 0.42 | 0.42 | 0.28 | 0.19 | | |
| *Paralabrax clathratus* | 1.98 | 0.44 | 1.11 | 0.39 | 2.50 | 0.48 | 2.08 | 0.42 | | |
| *Paralabrax nebulifer* | 0.42 | 0.17 | 0.56 | 0.28 | 0.42 | 0.42 | 0.97 | 0.32 | | |
| *Paralichthys californicus* | | | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 0.14 | 0.14 | | |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.56 | 0.31 | | |
| *Rhacochilus vacca* | 0.63 | 0.42 | | | 3.33 | 3.33 | | | | |
| *Rhinogobiops nicholsii* | | | | | | | 0.14 | 0.14 | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | | |
| *Scorpaenichthys marmoratus* | 0.05 | 0.05 | | | | | | | | |
| *Sebastes atrovirens* | | | 0.19 | 0.19 | 0.83 | 0.83 | 0.28 | 0.19 | | |
| *Sebastes auriculatus* | 0.21 | 0.21 | | | | | | | | |
| *Sebastes carnatus* | | | | | | | | | | |
| *Sebastes caurinus* | | | | | | | | | | |
| *Sebastes chrysomelas* | | | | | | | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Sebastes serranoides/flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.16 | 0.09 | | | | | 0.14 | 0.14 | | |
| *Semicossyphus pulcher*-Female | 0.36 | 0.12 | 1.11 | 0.39 | 1.67 | 0.68 | 2.22 | 0.63 | | |
| *Semicossyphus pulcher*-Male | 0.26 | 0.11 | 0.56 | 0.28 | | | 0.69 | 0.32 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | 63.89 | 55.42 | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$) continued.

| | Cojo (24) | | Crystal Cove (8) | | Deep Hole (32) | | Encinal Canyon (24) | | Escondido (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | | | | | 0.07 | 0.07 | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | 0.68 | 0.68 | 1.74 | 1.74 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.07 | 0.07 | | | | | | | | |
| *Caulolatilus princeps* | | | | | 0.05 | 0.05 | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | | | 31.25 | 8.97 | 8.39 | 3.07 | 2.64 | 1.27 | | |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.56 | 0.19 | 1.25 | 0.61 | 0.89 | 0.22 | 2.29 | 0.59 | 0.49 | 0.16 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | 0.36 | 0.27 | 0.28 | 0.13 | | |
| Gobiidae | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | 1.04 | 0.44 | 0.21 | 0.12 | 0.76 | 0.22 | 0.28 | 0.13 |
| *Hermosilla azurea* | | | | | 0.05 | 0.05 | | | | |
| *Heterodontus francisci* | | | | | | | 0.21 | 0.11 | | |
| *Heterostichus rostratus* | | | | | 0.05 | 0.05 | 0.42 | 0.21 | | |
| *Hexagrammos decagrammus* | 0.21 | 0.11 | | | | | | | | |
| *Hypsurus caryi* | 0.76 | 0.25 | | | 1.30 | 0.51 | 2.22 | 0.48 | 0.21 | 0.11 |
| *Hypsypops rubicundus* | | | 6.67 | 1.89 | 0.36 | 0.21 | 0.28 | 0.13 | | |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | 1.20 | 1.04 | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | 0.05 | 0.05 | | | 0.14 | 0.14 |
| *Ophiodon elongatus* | | | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Cojo (24) | | Crystal Cove (8) | | Deep Hole (32) | | Encinal Canyon (24) | | Escondido (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.28 | 0.16 | 8.96 | 1.75 | 9.95 | 2.93 | 15.90 | 5.23 | 9.65 | 7.03 |
| *Oxylebius pictus* | 0.14 | 0.10 | | | 0.26 | 0.11 | 0.07 | 0.07 | | |
| *Paralabrax clathratus* | | | 4.79 | 0.91 | 1.25 | 0.25 | 3.06 | 0.68 | 2.36 | 1.80 |
| *Paralabrax nebulifer* | | | 2.29 | 0.63 | 0.73 | 0.18 | 0.63 | 0.24 | 2.01 | 0.82 |
| *Paralichthys californicus* | | | | | 0.05 | 0.05 | | | | |
| *Phanerodon atripes* | | | | | | | 0.07 | 0.07 | | |
| *Phanerodon furcatus* | 0.28 | 0.16 | | | 0.57 | 0.38 | 2.43 | 2.08 | 0.14 | 0.14 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | 0.16 | 0.09 | 0.42 | 0.23 | | |
| *Rhacochilus vacca* | 0.07 | 0.07 | | | 0.52 | 0.16 | 0.76 | 0.44 | | |
| *Rhinogobiops nicholsii* | | | | | 0.42 | 0.15 | | | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | | |
| *Scorpaenichthys marmoratus* | | | | | | | | | | |
| *Sebastes atrovirens* | 0.07 | 0.07 | 0.21 | 0.21 | 0.26 | 0.15 | 0.42 | 0.21 | | |
| *Sebastes auriculatus* | | | | | | | 0.07 | 0.07 | | |
| *Sebastes carnatus* | | | | | 0.16 | 0.11 | | | | |
| *Sebastes caurinus* | | | | | | | 0.07 | 0.07 | | |
| *Sebastes chrysomelas* | | | | | 0.05 | 0.05 | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | 0.16 | 0.09 | 0.07 | 0.07 | | |
| *Sebastes serranoides/flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | | | 0.42 | 0.42 | 0.21 | 0.10 | | | 0.14 | 0.14 |
| *Semicossyphus pulcher*-Female | | | 8.75 | 2.35 | 0.78 | 0.25 | 0.28 | 0.13 | 0.07 | 0.07 |
| *Semicossyphus pulcher*-Male | | | 3.13 | 1.46 | 0.16 | 0.09 | 0.07 | 0.07 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Flat Rock (32) | | Horseshoe Kelp (8) | | Laguna (9) | | Lead Better Beach (8) | | Leo Carillo (33) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | 0.05 | 0.05 | | | | | | | | |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | 0.10 | 0.10 | | | | | 0.42 | 0.27 | 2.07 | 2.02 |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | | | | | | | | | 0.10 | 0.10 |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 8.23 | 3.03 | 127.08 | 42.01 | 78.33 | 53.68 | | | 1.92 | 0.64 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 1.20 | 0.38 | 1.04 | 0.44 | 0.19 | 0.19 | | | 2.98 | 1.12 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.73 | 0.47 | 0.21 | 0.21 | | | | | 0.15 | 0.15 |
| Gobiidae | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 1.67 | 0.37 | | | 1.30 | 0.72 | 0.21 | 0.21 | 0.40 | 0.15 |
| *Hermosilla azurea* | 0.16 | 0.16 | | | | | | | | |
| *Heterodontus francisci* | | | | | | | | | 0.05 | 0.05 |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.42 | 0.21 | | | | | | | 3.48 | 2.01 |
| *Hypsypops rubicundus* | 2.97 | 0.66 | | | 2.41 | 0.74 | | | 0.15 | 0.08 |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Ophiodon elongatus* | | | 0.42 | 0.27 | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Flat Rock (32) | | Horseshoe Kelp (8) | | Laguna (9) | | Lead Better Beach (8) | | Leo Carillo (33) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 8.75 | 2.98 | 198.13 | 54.30 | 28.15 | 14.01 | 18.75 | 18.75 | 7.42 | 2.67 |
| *Oxylebius pictus* | 0.05 | 0.05 | 0.83 | 0.31 | | | | | 0.15 | 0.08 |
| *Paralabrax clathratus* | 1.04 | 0.26 | 1.25 | 0.61 | 1.30 | 0.72 | | | 1.67 | 0.30 |
| *Paralabrax nebulifer* | 0.57 | 0.18 | | | 8.70 | 7.28 | | | 1.21 | 0.39 |
| *Paralichthys californicus* | | | | | | | | | | |
| *Phanerodon atripes* | | | 0.83 | 0.45 | | | | | 0.20 | 0.20 |
| *Phanerodon furcatus* | | | | | | | | | 0.81 | 0.47 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | 0.21 | 0.12 | 1.04 | 0.44 | | | | | 0.05 | 0.05 |
| *Rhacochilus vacca* | 0.42 | 0.21 | 3.96 | 2.56 | | | | | 1.01 | 0.26 |
| *Rhinogobiops nicholsii* | 0.16 | 0.09 | 1.25 | 0.42 | | | | | 0.10 | 0.07 |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | 0.05 | 0.05 |
| *Scorpaenichthys marmoratus* | | | 0.21 | 0.21 | | | | | | |
| *Sebastes atrovirens* | | | 0.63 | 0.44 | | | | | 0.51 | 0.36 |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes carnatus* | | | 0.83 | 0.31 | | | | | 0.15 | 0.11 |
| *Sebastes caurinus* | | | | | | | | | 0.15 | 0.15 |
| *Sebastes chrysomelas* | | | | | | | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | 0.21 | 0.21 | 0.05 | 0.05 |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | 0.35 | 0.16 |
| *Sebastes serranoides/flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.36 | 0.14 | 0.21 | 0.21 | 0.93 | 0.74 | | | 0.05 | 0.05 |
| *Semicossyphus pulcher*-Female | 1.30 | 0.38 | 4.58 | 1.96 | 2.59 | 0.74 | | | 0.56 | 0.19 |
| *Semicossyphus pulcher*-Male | 0.10 | 0.07 | 1.04 | 0.44 | 0.93 | 0.29 | | | 0.05 | 0.05 |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | 0.05 | 0.05 |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Little Corona (9) | | Little Dume (36) | | Long Point (20) | | Naples (24) | | Nicholas Canyon (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | 0.28 | 0.10 | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | 1.16 | 1.16 | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | 0.07 | 0.07 | | |
| *Brachyistius frenatus* | | | 0.05 | 0.05 | | | 2.36 | 1.52 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | 0.07 | 0.07 | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 30.93 | 9.90 | 3.89 | 2.30 | 17.33 | 5.90 | 0.97 | 0.67 | 17.50 | 5.85 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | 0.07 | 0.07 | | |
| *Embiotoca jacksoni* | 1.48 | 0.43 | 1.57 | 0.51 | 1.83 | 0.36 | 1.81 | 0.57 | 1.11 | 0.22 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 2.41 | 1.82 | 0.83 | 0.51 | 0.58 | 0.30 | | | | |
| Gobiidae | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 2.22 | 0.28 | 0.83 | 0.25 | 0.25 | 0.14 | 0.07 | 0.07 | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterodontus francisci* | | | 0.05 | 0.05 | | | 0.07 | 0.07 | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.37 | 0.16 | 0.08 | 0.08 | 1.53 | 0.51 | 6.94 | 2.38 |
| *Hypsypops rubicundus* | 6.30 | 2.06 | 0.37 | 0.15 | 1.00 | 0.28 | | | 0.14 | 0.10 |
| *Leiocottus hirundo* | | | | | | | 0.07 | 0.07 | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.46 | 0.46 | 0.42 | 0.29 | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | 0.37 | 0.37 | 0.05 | 0.05 | | | | | | |
| *Ophiodon elongatus* | | | | | | | 0.07 | 0.07 | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Little Corona (9) | | Little Dume (36) | | Long Point (20) | | Naples (24) | | Nicholas Canyon (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 12.41 | 1.82 | 36.34 | 15.73 | 7.75 | 2.56 | 4.86 | 1.25 | 20.35 | 8.29 |
| *Oxylebius pictus* | | | 0.05 | 0.05 | 0.42 | 0.21 | 1.32 | 0.20 | 0.42 | 0.23 |
| *Paralabrax clathratus* | 2.96 | 0.61 | 3.24 | 1.05 | 0.42 | 0.17 | 1.04 | 0.22 | 4.79 | 0.97 |
| *Paralabrax nebulifer* | 1.11 | 0.28 | 0.14 | 0.08 | 0.17 | 0.11 | | | 8.54 | 3.69 |
| *Paralichthys californicus* | | | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | 0.65 | 0.28 | | | | | 0.97 | 0.40 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | 0.19 | 0.11 | 0.08 | 0.08 | | | 0.07 | 0.07 |
| *Rhacochilus vacca* | 0.19 | 0.19 | 0.23 | 0.12 | 0.33 | 0.15 | 0.35 | 0.14 | 2.36 | 1.38 |
| *Rhinogobiops nicholsii* | | | 0.09 | 0.06 | 0.17 | 0.11 | | | 0.21 | 0.15 |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | 0.08 | 0.08 | | | | |
| *Scorpaenichthys marmoratus* | | | 0.05 | 0.05 | 0.08 | 0.08 | | | | |
| *Sebastes atrovirens* | | | 0.37 | 0.21 | | | 0.28 | 0.13 | 0.83 | 0.45 |
| *Sebastes auriculatus* | | | 0.05 | 0.05 | | | 0.14 | 0.10 | | |
| *Sebastes carnatus* | | | | | | | 0.35 | 0.14 | | |
| *Sebastes caurinus* | | | | | | | 0.21 | 0.11 | 0.07 | 0.07 |
| *Sebastes chrysomelas* | | | | | | | 0.07 | 0.07 | 0.14 | 0.14 |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | 0.14 | 0.10 |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | 0.19 | 0.09 | | | | | 1.04 | 1.04 |
| *Sebastes serranoides/flavidus* | | | | | | | 0.07 | 0.07 | | |
| *Sebastes serriceps* | | | | | 0.08 | 0.08 | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | | | 0.09 | 0.06 | 0.08 | 0.08 | | | 0.14 | 0.10 |
| *Semicossyphus pulcher*-Female | 2.41 | 0.84 | 1.57 | 0.74 | 2.00 | 0.31 | 0.83 | 0.17 | 0.63 | 0.30 |
| *Semicossyphus pulcher*-Male | 0.56 | 0.28 | 0.46 | 0.13 | 0.33 | 0.15 | 0.35 | 0.14 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | 0.07 | 0.07 |
| *Trachurus symmetricus* | | | | | | | | | 1.04 | 1.04 |
| *Urobatis halleri* | | | 0.05 | 0.05 | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Point Dume (24) | | Point Fermin (24) | | Point La Jolla (11) | | Point Loma (22) | | Point Vicente (40) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | 1.81 | 1.47 | 0.07 | 0.07 | | | | | 0.13 | 0.07 |
| *Atherinops affinis* | 0.69 | 0.69 | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | | | 1.46 | 1.39 | | | 0.38 | 0.27 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | 0.14 | 0.10 | | | | | | | | |
| *Chromis punctipinnis* | 86.74 | 18.45 | 0.21 | 0.15 | | | | | 12.92 | 4.76 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 3.06 | 0.64 | 1.18 | 0.50 | 0.45 | 0.23 | 0.45 | 0.31 | 1.42 | 0.24 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 8.82 | 3.09 | 2.64 | 1.47 | | | | | 3.04 | 1.09 |
| Gobiidae | | | | | | | | | | |
| *Gymnothorax mordax* | 0.07 | 0.07 | | | | | | | | |
| *Halichoeres semicinctus* | 0.69 | 0.17 | 0.35 | 0.14 | 0.15 | 0.15 | | | 2.50 | 0.64 |
| *Hermosilla azurea* | 0.07 | 0.07 | | | | | | | 0.04 | 0.04 |
| *Heterodontus francisci* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.07 | 0.07 | 0.49 | 0.23 | 0.30 | 0.20 | 0.76 | 0.42 | 0.50 | 0.19 |
| *Hypsypops rubicundus* | 5.07 | 1.07 | 0.63 | 0.34 | 0.45 | 0.32 | 0.30 | 0.14 | 1.96 | 0.31 |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | 0.28 | 0.13 | 2.71 | 2.42 | | | | | 0.21 | 0.09 |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | 0.15 | 0.15 | 1.14 | 1.14 | | |
| *Ophiodon elongatus* | | | | | | | | | 0.13 | 0.07 |
| *Orthonopias triacis* | 0.07 | 0.07 | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Point Dume (24) | | Point Fermin (24) | | Point La Jolla (11) | | Point Loma (22) | | Point Vicente (40) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | | | 5.49 | 2.44 | 5.15 | 2.03 | 6.59 | 2.19 | 17.67 | 3.84 |
| *Oxylebius pictus* | 17.36 | 5.02 | 0.07 | 0.07 | | | | | 0.75 | 0.21 |
| *Paralabrax clathratus* | 1.81 | 0.64 | 2.36 | 0.66 | 2.88 | 0.81 | 1.97 | 0.53 | 0.88 | 0.21 |
| *Paralabrax nebulifer* | 3.96 | 1.68 | 0.63 | 0.42 | 0.15 | 0.15 | 0.45 | 0.16 | 1.13 | 0.24 |
| *Paralichthys californicus* | 1.11 | 0.34 | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | 0.14 | 0.14 | | | | | 0.04 | 0.04 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | | | 0.21 | 0.11 |
| *Rhacochilus vacca* | 0.42 | 0.21 | 0.14 | 0.10 | | | | | 0.92 | 0.26 |
| *Rhinogobiops nicholsii* | 0.35 | 0.14 | 0.28 | 0.16 | | | | | 1.67 | 0.50 |
| *Sardinops sagax* | 0.21 | 0.11 | | | | | | | | |
| *Scorpaena guttata* | 34.72 | 34.72 | | | | | 0.08 | 0.08 | 0.04 | 0.04 |
| *Scorpaenichthys marmoratus* | | | | | | | | | 0.08 | 0.06 |
| *Sebastes atrovirens* | | | 0.14 | 0.10 | | | | | | |
| *Sebastes auriculatus* | 0.69 | 0.28 | | | | | | | | |
| *Sebastes carnatus* | 0.35 | 0.28 | | | | | 0.08 | 0.08 | 0.04 | 0.04 |
| *Sebastes caurinus* | 0.07 | 0.07 | | | | | | | | |
| *Sebastes chrysomelas* | | | | | | | | | 0.08 | 0.06 |
| *Sebastes dalli* | 0.07 | 0.07 | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | 0.04 | 0.04 |
| *Sebastes mystinus* | | | | | | | | | 0.25 | 0.14 |
| *Sebastes rastrelliger* | 0.07 | 0.07 | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Sebastes serranoides/flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | 0.21 | 0.15 | | | | | | | 0.04 | 0.04 |
| *Sebastes umbrosus* | 0.14 | 0.10 | | | | | | | 0.21 | 0.14 |
| *Semicossyphus pulcher* | | | 0.14 | 0.10 | | | | | 0.13 | 0.07 |
| *Semicossyphus pulcher*-Female | | | 1.04 | 0.44 | 0.61 | 0.34 | 0.15 | 0.10 | 2.88 | 0.70 |
| *Semicossyphus pulcher*-Male | 4.86 | 1.42 | 0.21 | 0.11 | | | 0.15 | 0.15 | 0.33 | 0.12 |
| *Sphyraena argentea* | 0.42 | 0.21 | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Resort Point (24) | | Ridges (48) | | Rocky Point (48) | | Whites Point (24) | |
|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | 0.03 | 0.03 | | |
| *Anisotremus davidsonii* | | | | | 0.42 | 0.35 | | |
| *Atherinops affinis* | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | 0.07 | 0.07 |
| *Aulorhynchus flavidus* | | | | | | | | |
| *Balistes polylepis* | | | | | | | | |
| *Brachyistius frenatus* | | | | | 0.03 | 0.03 | 0.63 | 0.24 |
| *Caulolatilus princeps* | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | |
| *Cheilotrema saturnum* | | | | | 1.32 | 1.06 | | |
| *Chromis punctipinnis* | 1.94 | 1.34 | 3.19 | 1.84 | 28.75 | 7.56 | 1.60 | 1.38 |
| *Clinocottus analis* | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | |
| *Embiotoca jacksoni* | 0.90 | 0.20 | 0.73 | 0.19 | 1.39 | 0.46 | 4.65 | 1.95 |
| *Gibbonsia elegans* | | | | | | | | |
| *Girella nigricans* | 0.90 | 0.40 | 0.49 | 0.16 | 2.88 | 1.23 | 0.76 | 0.50 |
| Gobiidae | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | |
| *Halichoeres semicinctus* | 0.49 | 0.19 | 0.63 | 0.17 | 2.33 | 0.86 | 0.14 | 0.10 |
| *Hermosilla azurea* | | | | | | | | |
| *Heterodontus francisci* | | | 0.07 | 0.05 | | | | |
| *Heterostichus rostratus* | 0.07 | 0.07 | | | 1.39 | 1.39 | | |
| *Hexagrammos decagrammus* | | | | | | | | |
| *Hypsurus caryi* | 0.42 | 0.18 | 0.35 | 0.13 | 0.45 | 0.19 | 4.65 | 4.16 |
| *Hypsypops rubicundus* | 0.69 | 0.20 | 0.49 | 0.15 | 0.73 | 0.16 | 1.25 | 0.40 |
| *Leiocottus hirundo* | | | | | | | | |
| *Lythrypnus dalli* | 0.07 | 0.07 | | | | | | |
| *Medialuna californiensis* | | | 0.31 | 0.25 | | | 0.83 | 0.83 |
| *Micrometrus minimus* | | | | | | | | |
| *Myliobatis californica* | | | | | 0.03 | 0.03 | | |
| *Ophiodon elongatus* | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | |

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Appendix I. Benthic mean fish density (#/100m$^2$), continued.

| | Resort Point (24) | | Ridges (48) | | Rocky Point (48) | | Whites Point (24) | |
|---|---|---|---|---|---|---|---|---|
| Species | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 5.49 | 1.84 | 6.42 | 3.51 | 19.69 | 7.81 | 9.79 | 6.97 |
| *Oxylebius pictus* | 0.28 | 0.13 | 0.45 | 0.11 | 0.42 | 0.15 | | |
| *Paralabrax clathratus* | 1.04 | 0.26 | 0.59 | 0.12 | 1.32 | 0.20 | 3.96 | 2.01 |
| *Paralabrax nebulifer* | 0.42 | 0.15 | 0.07 | 0.05 | 0.14 | 0.07 | 0.21 | 0.11 |
| *Paralichthys californicus* | | | | | | | 0.07 | 0.07 |
| *Phanerodon atripes* | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 7.08 | 6.94 |
| *Rathbunella alleni* | | | 0.07 | 0.05 | 0.03 | 0.03 | | |
| *Rhacochilus toxotes* | | | 0.10 | 0.06 | 0.38 | 0.19 | 0.21 | 0.15 |
| *Rhacochilus vacca* | 1.04 | 0.83 | 0.42 | 0.19 | 0.73 | 0.52 | 0.21 | 0.15 |
| *Rhinogobiops nicholsii* | 0.56 | 0.19 | 1.46 | 0.35 | 1.63 | 0.35 | 0.28 | 0.13 |
| *Sardinops sagax* | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | |
| *Scorpaenichthys marmoratus* | | | | | | | | |
| *Sebastes atrovirens* | 0.14 | 0.10 | 0.07 | 0.05 | 0.03 | 0.03 | 0.07 | 0.07 |
| *Sebastes auriculatus* | | | | | 0.56 | 0.46 | | |
| *Sebastes carnatus* | | | | | | | | |
| *Sebastes caurinus* | | | 0.03 | 0.03 | 0.03 | 0.03 | | |
| *Sebastes chrysomelas* | | | | | | | 0.07 | 0.07 |
| *Sebastes dalli* | | | 0.07 | 0.05 | 0.21 | 0.08 | | |
| *Sebastes miniatus* | 0.14 | 0.10 | 0.03 | 0.03 | 0.03 | 0.03 | | |
| *Sebastes mystinus* | | | | | 0.10 | 0.08 | | |
| *Sebastes rastrelliger* | | | | | 0.03 | 0.03 | | |
| *Sebastes serranoides* | | | 0.03 | 0.03 | 0.03 | 0.03 | 0.07 | 0.07 |
| *Sebastes serranoides/flavidus* | | | | | | | | |
| *Sebastes serriceps* | 0.07 | 0.07 | 0.07 | 0.05 | | | | |
| *Sebastes umbrosus* | | | 0.31 | 0.25 | 0.28 | 0.12 | | |
| *Semicossyphus pulcher* | 0.07 | 0.07 | 0.28 | 0.10 | 0.17 | 0.07 | | |
| *Semicossyphus pulcher*-Female | 1.46 | 0.34 | 0.76 | 0.16 | 1.04 | 0.17 | 0.76 | 0.22 |
| *Semicossyphus pulcher*-Male | 0.21 | 0.11 | 0.10 | 0.06 | 0.14 | 0.07 | 0.28 | 0.13 |
| *Sphyraena argentea* | | | | | 0.69 | 0.69 | | |
| *Squatina californica* | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | |
| *Trachurus symmetricus* | 0.14 | 0.14 | 10.42 | 10.42 | 0.21 | 0.21 | | |
| *Urobatis halleri* | | | | | | | | |

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Appendix II. Mean fish density (#/100m$^2$) and standard error for midwater transects 2007-2008 on natural reefs on the mainland of the Southern California Bight. The number of replicates is in parentheses.

| | 3 Palms (24) | | Barn Kelp (9) | | Big Rock (4) | | Bunker Point (8) | | Carp Reef (4) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | 2.43 | 2.43 | | | | | | | | |
| *Brachyistius frenatus* | 0.07 | 0.07 | | | | | | | 0.42 | 0.42 |
| *Chromis punctipinnis* | | | 0.37 | 0.37 | 29.17 | 29.17 | 2.29 | 2.06 | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | 8.33 | 8.33 | 0.21 | 0.21 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | 8.33 | 8.33 | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | 0.21 | 0.21 | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | 0.07 | 0.07 | | | | | 0.21 | 0.21 | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 37.22 | 11.48 | 0.56 | 0.39 | 96.25 | 60.02 | 21.25 | 7.01 | 4.17 | 4.17 |
| *Paralabrax clathratus* | 0.21 | 0.11 | | | 0.83 | 0.48 | | | | |
| *Paralabrax nebulifer* | | | 0.19 | 0.19 | | | | | | |
| *Phanerodon furcatus* | 0.07 | 0.07 | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.21 | 0.21 | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.14 | 0.14 | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | 4.17 | 4.17 | | |

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Appendix II. Mean midwater fish density (#/100m$^2$), continued.

| | Cojo (24) | | Crystal Cove (8) | | Deep Hole (28) | | Encinal Canyon (16) | | Escondido (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | 6.60 | 3.72 |
| *Atherinopsis californiensis* | | | | | 2.44 | 1.82 | 6.77 | 3.97 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | | | | | 0.06 | 0.06 | 0.10 | 0.10 | | |
| *Chromis punctipinnis* | | | 15.21 | 8.65 | 1.19 | 0.45 | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | | | 0.21 | 0.21 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | 0.10 | 0.10 | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | 0.12 | 0.08 | 0.63 | 0.34 | | |
| *Hyperprosopon argenteum* | | | | | | | | | 0.07 | 0.07 |
| *Hypsurus caryi* | | | | | | | 0.10 | 0.10 | | |
| *Hypsypops rubicundus* | | | | | | | 0.10 | 0.10 | | |
| *Medialuna californiensis* | | | | | 0.12 | 0.12 | 0.21 | 0.21 | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | | | 0.21 | 0.21 | 12.92 | 4.46 | 10.63 | 3.75 | 11.11 | 6.30 |
| *Paralabrax clathratus* | | | | | 0.18 | 0.10 | 1.04 | 0.34 | 0.28 | 0.13 |
| *Paralabrax nebulifer* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | 0.36 | 0.16 | 0.73 | 0.43 | | |
| *Rhacochilus toxotes* | | | | | 1.19 | 1.13 | 0.10 | 0.10 | | |
| *Rhacochilus vacca* | | | | | 0.06 | 0.06 | | | 0.07 | 0.07 |
| *Sardinops sagax* | | | | | 59.52 | 59.52 | | | | |
| *Sebastes atrovirens* | | | | | 0.06 | 0.06 | 0.73 | 0.40 | | |
| *Sebastes auriculatus* | | | | | | | 0.83 | 0.63 | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | 0.12 | 0.08 | | | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | 0.21 | 0.14 | | |
| *Semicossyphus pulcher*-Male | | | | | | | 0.31 | 0.17 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix II. Mean midwater fish density (#/100m$^2$), continued.

| | Flat Rock (24) | | Laguna (9) | | Lead Better Beach (8) | | Leo Carillo (28) | | Little Corona (9) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | 2.86 | 2.02 | | |
| *Aulorhynchus flavidus* | | | | | 2.08 | 2.08 | | | | |
| *Brachyistius frenatus* | 0.07 | 0.07 | | | 1.04 | 1.04 | 0.36 | 0.18 | | |
| *Chromis punctipinnis* | 10.90 | 5.09 | 3.15 | 1.43 | | | 0.24 | 0.24 | 3.33 | 1.15 |
| *Cymatogaster aggregata* | | | | | | | 0.60 | 0.60 | | |
| *Embiotoca jacksoni* | | | | | | | 0.12 | 0.08 | 0.19 | 0.19 |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | 0.42 | 0.35 | | | | | | | | |
| *Girella nigricans* | | | | | | | | | 0.93 | 0.74 |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | 0.07 | 0.07 | | | | | | | | |
| *Hermosilla azurea* | | | | | | | 0.12 | 0.12 | | |
| *Heterostichus rostratus* | 0.07 | 0.07 | | | | | | | 0.19 | 0.19 |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | | | | | | | | |
| *Hypsypops rubicundus* | 0.21 | 0.15 | | | | | | | | |
| *Medialuna californiensis* | | | | | | | 0.60 | 0.54 | | |
| *Myliobatis californica* | | | | | | | | | 1.11 | 0.73 |
| *Oxyjulis californica* | 3.82 | 1.15 | 0.19 | 0.19 | | | 18.39 | 7.80 | 4.63 | 1.73 |
| *Paralabrax clathratus* | 0.49 | 0.16 | | | | | 1.43 | 0.44 | | |
| *Paralabrax nebulifer* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 0.48 | 0.36 | | |
| *Rhacochilus toxotes* | 0.07 | 0.07 | | | | | | | | |
| *Rhacochilus vacca* | | | | | | | 0.06 | 0.06 | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | 1.25 | 0.65 | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | 0.12 | 0.08 | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | 0.07 | 0.07 | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix II. Mean midwater fish density (#/100m$^2$), continued.

| | Little Dume (32) | | Long Point (20) | | Naples (24) | | Nicholas Canyon (24) | | Point Dume (12) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | 0.36 | 0.32 | | | | | | | | |
| *Atherinops affinis* | | | | | | | 4.17 | 2.75 | 10.42 | 7.48 |
| *Atherinopsis californiensis* | | | | | | | 0.63 | 0.56 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.52 | 0.43 | | | 0.56 | 0.56 | 3.82 | 1.72 | | |
| *Chromis punctipinnis* | 0.10 | 0.10 | 34.92 | 12.50 | 0.07 | 0.07 | 1.25 | 0.86 | 9.72 | 5.87 |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.05 | 0.05 | 0.08 | 0.08 | | | 0.07 | 0.07 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.52 | 0.52 | | | | | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.08 | 0.08 | | | | | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.08 | 0.08 | | | 0.07 | 0.07 | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 28.80 | 18.49 | 7.17 | 2.63 | 3.54 | 2.34 | 27.78 | 7.70 | | |
| *Paralabrax clathratus* | 0.31 | 0.14 | | | | | 4.03 | 1.46 | 0.14 | 0.14 |
| *Paralabrax nebulifer* | | | | | | | 0.07 | 0.07 | | |
| *Phanerodon furcatus* | | | | | | | 0.49 | 0.19 | | |
| *Rhacochilus toxotes* | | | | | | | 0.07 | 0.07 | | |
| *Rhacochilus vacca* | | | | | | | 0.07 | 0.07 | | |
| *Sardinops sagax* | | | | | | | 20.83 | 20.83 | 41.67 | 41.67 |
| *Sebastes atrovirens* | 0.21 | 0.16 | | | | | 0.97 | 0.90 | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | 0.05 | 0.05 | | | | | | | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix II. Mean midwater fish density (#/100m$^2$), continued.

| | Point Fermin (24) | | Point La Jolla (11) | | Point Loma (21) | | Point Vicente (36) | | Resort Point (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | 1.16 | 1.16 | | |
| *Atherinopsis californiensis* | | | | | | | 0.69 | 0.69 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.07 | 0.07 | | | 1.03 | 0.42 | 0.09 | 0.06 | 0.14 | 0.10 |
| *Chromis punctipinnis* | 5.21 | 3.61 | 0.15 | 0.15 | | | 39.68 | 19.46 | 4.44 | 2.92 |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | | | 0.05 | 0.05 | | |
| *Galeorhinus galeus* | | | | | | | | | 0.07 | 0.07 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | 0.46 | 0.42 | 12.01 | 8.29 |
| *Gobiidae sp* | 0.69 | 0.69 | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.07 | 0.07 | | | | | | | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.15 | 0.15 | | | | | | |
| *Hypsypops rubicundus* | | | | | | | 0.09 | 0.09 | | |
| *Medialuna californiensis* | | | | | | | 0.14 | 0.08 | 0.07 | 0.07 |
| *Myliobatis californica* | | | 0.15 | 0.15 | | | | | | |
| *Oxyjulis californica* | 3.13 | 2.15 | 0.76 | 0.76 | 2.38 | 1.29 | 10.19 | 3.30 | 3.89 | 0.95 |
| *Paralabrax clathratus* | 0.14 | 0.10 | 0.15 | 0.15 | 0.32 | 0.19 | 0.28 | 0.12 | 1.39 | 0.51 |
| *Paralabrax nebulifer* | 0.07 | 0.07 | | | | | 0.09 | 0.09 | 0.07 | 0.07 |
| *Phanerodon furcatus* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.05 | 0.05 | | |
| *Rhacochilus vacca* | | | 0.15 | 0.15 | | | 0.28 | 0.28 | 0.21 | 0.21 |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.07 | 0.07 | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | 0.07 | 0.07 |
| *Semicossyphus pulcher*-Male | | | | | | | 0.05 | 0.05 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix II. Mean midwater fish density (#/100m$^2$), continued.

| | Ridges (48) | | Rocky Point (48) | | Whites Point (24) | |
|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | 0.69 | 0.69 | | |
| *Atherinops affinis* | | | | | | |
| *Atherinopsis californiensis* | | | | | | |
| *Aulorhynchus flavidus* | | | | | | |
| *Brachyistius frenatus* | | | | | 0.21 | 0.21 |
| *Chromis punctipinnis* | 1.77 | 1.40 | 4.44 | 3.51 | 2.78 | 2.78 |
| *Cymatogaster aggregata* | | | | | | |
| *Embiotoca jacksoni* | | | | | | |
| *Galeorhinus galeus* | | | | | | |
| *Gibbonsia elegans* | | | | | | |
| *Girella nigricans* | | | 0.87 | 0.87 | 0.14 | 0.14 |
| *Gobiidae sp* | | | | | | |
| *Halichoeres semicinctus* | | | | | | |
| *Hermosilla azurea* | | | | | | |
| *Heterostichus rostratus* | | | 0.07 | 0.07 | 1.39 | 1.39 |
| *Hyperprosopon argenteum* | | | | | | |
| *Hypsurus caryi* | | | | | | |
| *Hypsypops rubicundus* | 0.03 | 0.03 | | | | |
| *Medialuna californiensis* | | | | | | |
| *Myliobatis californica* | | | | | | |
| *Oxyjulis californica* | 2.67 | 1.28 | 18.30 | 8.05 | 34.93 | 11.98 |
| *Paralabrax clathratus* | 0.10 | 0.06 | 1.91 | 1.18 | 0.35 | 0.35 |
| *Paralabrax nebulifer* | | | 0.07 | 0.07 | | |
| *Phanerodon furcatus* | | | | | | |
| *Rhacochilus toxotes* | | | | | | |
| *Rhacochilus vacca* | 0.03 | 0.03 | | | | |
| *Sardinops sagax* | | | | | | |
| *Sebastes atrovirens* | | | | | | |
| *Sebastes auriculatus* | | | | | | |
| *Sebastes mystinus* | 0.35 | 0.35 | | | | |
| *Sebastes paucispinus* | 0.35 | 0.35 | | | | |
| *Sebastes serranoides* | | | 0.10 | 0.08 | | |
| *Semicossyphus pulcher* | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | |
| *Sphyraena argentea* | 2.78 | 1.96 | | | | |
| *Trachurus symmetricus* | 13.89 | 13.89 | | | | |

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Appendix III – Mean fish density (#/100m$^2$) and standard error for canopy transects 2007-2008 on natural reefs on the mainland of the Southern California Bight. The number of replicates is in parentheses.

| | 3 Palms (26) | | Big Rock (4) | | Bunker Point (12) | | Carp Reef (4) | | Cojo (24) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 2.56 | 2.56 | 12.50 | 7.98 | 0.28 | 0.28 | | | | |
| Atherinopsidae | | | | | | | | | 4.17 | 2.52 |
| *Atherinopsis californiensis* | 0.90 | 0.90 | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | 2.85 | 1.40 |
| *Brachyistius frenatus* | 0.58 | 0.24 | 1.25 | 1.25 | | | | | 2.15 | 0.70 |
| *Chromis punctipinnis* | | | 5.00 | 3.91 | | | | | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | 0.06 | 0.06 | | | | | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 1.47 | 1.03 | | | | | | | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 4.55 | 2.57 | 73.33 | 59.77 | 8.89 | 5.65 | | | 0.21 | 0.21 |
| *Paralabrax clathratus* | 0.32 | 0.19 | | | 0.14 | 0.14 | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | | | 0.07 | 0.07 |
| *Rhacochilus vacca* | | | | | | | | | 0.14 | 0.14 |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix III. Mean canopy fish density (#/100m$^2$), continued.

| | Deep Hole (24) | | Encinal Canyon (24) | | Escondido (24) | | Flat Rock (32) | | Lead Better Beach (8) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 20.97 | 8.90 | 0.07 | 0.07 | | | 13.85 | 8.83 | | |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | 2.64 | 2.64 | 6.39 | 4.91 | 0.83 | 0.83 | 4.84 | 2.35 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 2.08 | 1.07 | 0.83 | 0.33 | 2.99 | 1.58 | 1.09 | 0.73 | | |
| *Chromis punctipinnis* | 6.18 | 4.86 | 0.14 | 0.14 | | | 0.16 | 0.16 | | |
| *Embiotoca jacksoni* | | | 0.07 | 0.07 | | | 0.05 | 0.05 | | |
| *Girella nigricans* | | | | | | | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.35 | 0.17 | 1.25 | 0.70 | 17.36 | 10.16 | 1.09 | 0.78 | | |
| *Hypsypops rubicundus* | | | | | | | 0.05 | 0.05 | | |
| *Medialuna californiensis* | | | 0.07 | 0.07 | | | | | | |
| *Myliobatis californica* | | | | | | | 0.05 | 0.05 | | |
| *Oxyjulis californica* | 22.15 | 6.82 | 5.07 | 1.76 | 13.75 | 4.81 | 18.70 | 9.48 | | |
| *Paralabrax clathratus* | 0.07 | 0.07 | 0.07 | 0.07 | 0.49 | 0.21 | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | 0.21 | 0.11 | | | 0.07 | 0.07 | | | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | 0.28 | 0.22 | 1.74 | 1.18 | 0.14 | 0.10 | | | | |
| *Sebastes auriculatus* | 2.08 | 1.74 | 0.42 | 0.35 | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix III. Mean canopy fish density (#/100m$^2$), continued.

| | Leo Carillo (31) | | Little Dume (20) | | Naples (4) | | Nicholas Canyon (24) | | Point Fermin (12) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 8.28 | 4.88 | 2.50 | 2.50 | | | 14.58 | 9.98 | 26.39 | 20.57 |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | 9.46 | 7.68 | | | | | 6.53 | 3.87 | 1.39 | 1.39 |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 4.52 | 1.76 | 1.25 | 0.66 | 1.25 | 1.25 | 10.63 | 3.34 | 5.00 | 4.13 |
| *Chromis punctipinnis* | 5.97 | 3.83 | 1.92 | 1.83 | 0.83 | 0.83 | 2.08 | 2.08 | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | | | | |
| *Gobiidae sp* | | | | | | | 2.78 | 2.78 | 3.47 | 3.47 |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.59 | 0.54 | 1.83 | 1.83 | | | 0.21 | 0.11 | 0.56 | 0.43 |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 18.39 | 7.57 | 8.17 | 5.81 | 1.67 | 1.67 | 22.64 | 8.31 | 0.69 | 0.56 |
| *Paralabrax clathratus* | 0.11 | 0.11 | | | | | 0.42 | 0.21 | | |
| *Phanerodon atripes* | | | | | | | 0.21 | 0.21 | | |
| *Phanerodon furcatus* | 0.05 | 0.05 | 0.50 | 0.50 | | | 0.14 | 0.14 | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | 5.00 | 2.47 | 1.50 | 1.41 | | | 4.51 | 1.90 | | |
| *Sebastes auriculatus* | | | | | | | 0.56 | 0.56 | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | 1.67 | 1.67 | | | | |

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Appendix III. Mean canopy fish density (#/100m$^2$), continued.

| | Point Vicente (4) | | Resort Point (20) | | Ridges (16) | | Rocky Point (16) | | Whites Point (12) | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | | | 18.67 | 9.56 | 31.25 | 31.25 | 4.17 | 4.17 | | |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | | | 12.17 | 10.07 | | | | | 0.14 | 0.14 |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 1.67 | 1.18 | 2.08 | 0.69 | 0.31 | 0.23 | 0.21 | 0.14 | 0.83 | 0.83 |
| *Chromis punctipinnis* | 1.25 | 0.42 | 0.25 | 0.18 | | | 2.60 | 2.60 | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | | | 12.67 | 10.89 | 0.10 | 0.10 | 0.10 | 0.10 | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | 0.17 | 0.17 | | | | | | |
| *Heterostichus rostratus* | | | 0.08 | 0.08 | 0.10 | 0.10 | 5.31 | 2.88 | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.33 | 0.19 | | | | | | |
| *Myliobatis californica* | | | | | | | 0.21 | 0.21 | | |
| *Oxyjulis californica* | 0.83 | 0.83 | 12.67 | 4.63 | 9.38 | 5.69 | 1.15 | 0.52 | 9.86 | 6.94 |
| *Paralabrax clathratus* | | | 0.50 | 0.42 | | | 0.31 | 0.23 | 0.14 | 0.14 |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | | | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | | | 0.25 | 0.18 | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | 0.21 | 0.21 | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix IV. Mean fish biomass density (g/100m$^2$) and standard error for bottom transects 2007-2008 on natural reefs on the mainland of the Southern California Bight.

| | 3 Palms | | Barn Kelp | | Big Rock | | Bunker Point | | Carp Reef | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | | | 22.36 | 14.37 | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | 0.001 | 0.001 |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.002 | 0.001 | 0.01 | 0.01 | | | 0.004 | 0.004 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 0.05 | 0.02 | 0.02 | 0.02 | 0.004 | 0.004 | 1.10 | 0.50 | | |
| *Clinocottus analis* | 0.0005 | 0.0005 | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.45 | 0.14 | 0.06 | 0.06 | 2.36 | 1.92 | 0.77 | 0.21 | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.37 | 0.23 | | | 22.03 | 20.31 | 0.34 | 0.34 | | |
| Gobiidae | 0.003 | 0.003 | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 0.17 | 0.09 | | | 0.06 | 0.06 | 0.16 | 0.05 | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterodontus francisci* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.01 | 0.01 | | | | | 0.17 | 0.08 | | |
| *Hypsypops rubicundus* | 0.49 | 0.19 | 0.96 | 0.67 | 1.15 | 0.43 | 1.78 | 0.98 | | |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Micrometrus minimus* | 0.0005 | 0.0005 | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Ophiodon elongatus* | | | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | 3 Palms | | Barn Kelp | | Big Rock | | Bunker Point | | Carp Reef | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.18 | 0.06 | 0.09 | 0.04 | 0.35 | 0.16 | 0.77 | 0.16 | 0.05 | 0.02 |
| *Oxylebius pictus* | 0.004 | 0.003 | | | 0.01 | 0.01 | 0.004 | 0.004 | | |
| *Paralabrax clathratus* | 1.15 | 0.35 | 0.50 | 0.18 | 0.72 | 0.44 | 1.41 | 0.57 | | |
| *Paralabrax nebulifer* | 0.25 | 0.11 | 0.98 | 0.50 | 0.15 | 0.15 | 0.36 | 0.16 | | |
| *Paralichthys californica* | | | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 0.003 | 0.003 | | |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.12 | 0.08 | | |
| *Rhacochilus vacca* | 0.01 | 0.005 | | | 0.83 | 0.83 | | | | |
| *Rhinogobiops nicholsii* | | | | | | | 0.0005 | 0.0005 | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | | |
| *Scorpaenichthys marmoratus* | 0.10 | 0.10 | | | | | | | | |
| *Sebastes atrovirens* | | | 0.07 | 0.07 | 0.20 | 0.20 | 0.07 | 0.04 | | |
| *Sebastes auriculatus* | 0.05 | 0.05 | | | | | | | | |
| *Sebastes carnatus* | | | | | | | | | | |
| *Sebastes caurinus* | | | | | | | | | | |
| *Sebastes chrysomelas* | | | | | | | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Sebastes serranoides flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.08 | 0.05 | | | | | 0.06 | 0.06 | | |
| *Semicossyphus pulcher*-Female | 0.50 | 0.26 | 0.88 | 0.31 | 1.23 | 0.72 | 0.71 | 0.28 | | |
| *Semicossyphus pulcher*-Male | 0.78 | 0.34 | 0.74 | 0.39 | | | 1.74 | 0.89 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | 2.04 | 1.89 | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Cojo | | Crystal Cove | | Deep Hole | | Encinal Canyon | | Escondido | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | | | | | 0.05 | 0.05 | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | 0.07 | 0.07 | 0.09 | 0.09 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.0001 | 0.0001 | | | | | | | | |
| *Caulolatilus princeps* | | | | | 0.01 | 0.01 | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | | | 2.36 | 0.66 | 0.36 | 0.12 | 0.17 | 0.09 | | |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.02 | 0.01 | 0.25 | 0.14 | 0.18 | 0.05 | 0.63 | 0.18 | 0.05 | 0.02 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | 0.13 | 0.08 | 0.27 | 0.14 | | |
| Gobiidae sp. | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | 0.24 | 0.10 | 0.03 | 0.02 | 0.05 | 0.01 | 0.04 | 0.02 |
| *Hermosilla azurea* | | | | | 0.02 | 0.02 | | | | |
| *Heterodontus francisci* | | | | | | | 0.51 | 0.35 | | |
| *Heterostichus rostratus* | | | | | 0.0007 | 0.0007 | 0.01 | 0.01 | | |
| *Hexagrammos decagrammus* | 0.01 | 0.01 | | | | | | | | |
| *Hypsurus caryi* | 0.06 | 0.03 | | | 0.23 | 0.08 | 0.20 | 0.08 | 0.01 | 0.01 |
| *Hypsypops rubicundus* | | | 17.56 | 6.16 | 0.15 | 0.10 | 0.23 | 0.11 | | |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | 0.19 | 0.15 | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | 0.34 | 0.34 | | | 2.21 | 2.21 |
| *Ophiodon elongatus* | | | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Cojo | | Crystal Cove | | Deep Hole | | Encinal Canyon | | Escondido | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.01 | 0.00 | 0.36 | 0.06 | 0.26 | 0.05 | 0.57 | 0.21 | 0.06 | 0.03 |
| *Oxylebius pictus* | 0.002 | 0.001 | | | 0.008 | 0.004 | 0.003 | 0.003 | | |
| *Paralabrax clathratus* | | | 3.54 | 0.87 | 0.53 | 0.17 | 2.18 | 0.65 | 0.63 | 0.47 |
| *Paralabrax nebulifer* | | | 2.48 | 0.77 | 0.63 | 0.24 | 0.74 | 0.34 | 1.45 | 0.51 |
| *Paralichthys californica* | | | | | 0.01 | 0.01 | | | | |
| *Phanerodon atripes* | | | | | | | 0.01 | 0.01 | | |
| *Phanerodon furcatus* | 0.02 | 0.02 | | | 0.04 | 0.02 | 0.03 | 0.02 | 0.01 | 0.01 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | 0.09 | 0.06 | 0.15 | 0.08 | | |
| *Rhacochilus vacca* | 0.002 | 0.002 | | | 0.12 | 0.05 | 0.11 | 0.09 | | |
| *Rhinogobiops nicholsii* | | | | | 0.003 | 0.002 | | | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | | |
| *Scorpaenichthys marmoratus* | | | | | | | | | | |
| *Sebastes atrovirens* | 0.02 | 0.02 | 0.14 | 0.14 | 0.06 | 0.03 | 0.14 | 0.08 | | |
| *Sebastes auriculatus* | | | | | | | 0.05 | 0.05 | | |
| *Sebastes carnatus* | | | | | 0.04 | 0.03 | | | | |
| *Sebastes caurinus* | | | | | | | 0.02 | 0.02 | | |
| *Sebastes chrysomelas* | | | | | 0.02 | 0.02 | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | 0.02 | 0.02 | 0.03 | 0.03 | | |
| *Sebastes serranoides flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | | | 0.39 | 0.39 | 0.04 | 0.02 | | | 0.06 | 0.06 |
| *Semicossyphus pulcher*-Female | | | 7.12 | 1.81 | 0.45 | 0.20 | 0.20 | 0.10 | 0.05 | 0.05 |
| *Semicossyphus pulcher*-Male | | | 5.83 | 3.04 | 0.33 | 0.25 | 0.07 | 0.07 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Flat Rock | | Horseshoe Kelp | | Laguna | | Lead Better Beach | | Leo Carillo | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | 0.0001 | 0.0001 | | | | | | | | |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | 0.0007 | 0.0007 | | | | | 0.0004 | 0.0004 | 0.01 | 0.01 |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | | | | | | | | | 0.0001 | 0.0001 |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 0.23 | 0.10 | 4.88 | 2.20 | 0.48 | 0.15 | | | 0.17 | 0.07 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.24 | 0.10 | 0.18 | 0.11 | 0.04 | 0.04 | | | 0.36 | 0.11 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.40 | 0.34 | 0.06 | 0.06 | | | | | 0.04 | 0.04 |
| *Gobiidae sp* | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 0.14 | 0.04 | | | 0.04 | 0.02 | 0.004 | 0.004 | 0.03 | 0.01 |
| *Hermosilla azurea* | 0.004 | 0.004 | | | | | | | | |
| *Heterodontus francisci* | | | | | | | | | 0.07 | 0.07 |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.02 | 0.02 | | | | | | | 0.19 | 0.07 |
| *Hypsypops rubicundus* | 1.98 | 0.49 | | | 5.42 | 1.93 | | | 0.06 | 0.04 |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Ophiodon elongatus* | | | 2.63 | 2.23 | | | | | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Flat Rock | | Horseshoe Kelp | | Laguna | | Lead Better Beach | | Leo Carillo | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.11 | 0.04 | 2.17 | 1.05 | 0.11 | 0.06 | 0.004 | 0.004 | 0.24 | 0.07 |
| *Oxylebius pictus* | 0.002 | 0.002 | 0.02 | 0.01 | | | | | 0.01 | 0.00 |
| *Paralabrax clathratus* | 0.18 | 0.06 | 1.72 | 0.77 | 0.84 | 0.77 | | | 0.73 | 0.20 |
| *Paralabrax nebulifer* | 0.41 | 0.22 | | | 1.48 | 0.86 | | | 1.13 | 0.49 |
| *Paralichthys californica* | | | | | | | | | | |
| *Phanerodon atripes* | | | 0.01 | 0.01 | | | | | 0.02 | 0.02 |
| *Phanerodon furcatus* | | | | | | | | | 0.07 | 0.05 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | 0.08 | 0.05 | 1.03 | 0.47 | | | | | 0.02 | 0.02 |
| *Rhacochilus vacca* | 0.01 | 0.01 | 1.80 | 1.41 | | | | | 0.32 | 0.12 |
| *Rhinogobiops nicholsii* | 0.001 | 0.0005 | 0.01 | 0.003 | | | | | 0.0005 | 0.0003 |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | | 0.03 | 0.03 |
| *Scorpaenichthys marmoratus* | | | 1.07 | 1.07 | | | | | | |
| *Sebastes atrovirens* | | | 0.15 | 0.10 | | | | | 0.04 | 0.03 |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes carnatus* | | | 0.25 | 0.12 | | | | | 0.04 | 0.03 |
| *Sebastes caurinus* | | | | | | | | | 0.04 | 0.04 |
| *Sebastes chrysomelas* | | | | | | | | | | |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | 0.0001 | 0.0001 | 0.04 | 0.04 |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | 0.12 | 0.07 |
| *Sebastes serranoides flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | | | | | | | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.28 | 0.14 | 0.22 | 0.22 | 0.33 | 0.24 | | | 0.01 | 0.01 |
| *Semicossyphus pulcher*-Female | 0.73 | 0.26 | 4.71 | 1.97 | 3.10 | 1.06 | | | 0.24 | 0.09 |
| *Semicossyphus pulcher*-Male | 0.14 | 0.10 | 3.45 | 1.73 | 0.99 | 0.34 | | | 0.08 | 0.08 |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | 0.42 | 0.42 |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Little Corona | | Little Dume | | Long Point | | Naples | | Nicholas Canyon | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | | | 0.09 | 0.05 | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | 0.13 | 0.13 | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | 0.03 | 0.03 | | |
| *Brachyistius frenatus* | | | 0.0002 | 0.0002 | | | 0.01 | 0.01 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | 77.92 | 77.92 | | |
| *Cheilotrema saturnum* | | | | | | | | | | |
| *Chromis punctipinnis* | 2.13 | 0.45 | 0.25 | 0.17 | 1.16 | 0.47 | 0.002 | 0.001 | 1.30 | 0.50 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | 0.001 | 0.001 | | |
| *Embiotoca jacksoni* | 0.45 | 0.15 | 0.22 | 0.08 | 0.63 | 0.15 | 0.19 | 0.06 | 0.23 | 0.07 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 1.38 | 1.15 | 0.45 | 0.27 | 0.34 | 0.24 | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | | | |
| *Halichoeres semicinctus* | 0.23 | 0.04 | 0.08 | 0.02 | 0.04 | 0.02 | 0.003 | 0.003 | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterodontus francisci* | | | 0.01 | 0.01 | | | 0.10 | 0.10 | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.02 | 0.01 | 0.02 | 0.02 | 0.06 | 0.02 | 0.45 | 0.21 |
| *Hypsypops rubicundus* | 20.05 | 6.47 | 0.22 | 0.09 | 0.61 | 0.21 | | | 0.08 | 0.06 |
| *Leiocottus hirundo* | | | | | | | 0.01 | 0.01 | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.20 | 0.20 | 0.06 | 0.04 | | | | |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | 0.09 | 0.09 | 0.74 | 0.74 | | | | | | |
| *Ophiodon elongatus* | | | | | | | 0.10 | 0.10 | | |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Little Corona | | Little Dume | | Long Point | | Naples | | Nicholas Canyon | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 1.15 | 0.25 | 0.21 | 0.10 | 0.16 | 0.05 | 0.39 | 0.13 | 0.44 | 0.16 |
| *Oxylebius pictus* | | | 0.001 | 0.001 | 0.008 | 0.004 | 0.06 | 0.02 | 0.02 | 0.01 |
| *Paralabrax clathratus* | 3.00 | 0.73 | 1.04 | 0.40 | 0.07 | 0.04 | 0.55 | 0.18 | 3.80 | 0.77 |
| *Paralabrax nebulifer* | 1.03 | 0.45 | 0.10 | 0.06 | 0.14 | 0.10 | | | 8.08 | 3.28 |
| *Paralichthys californica* | | | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | 0.02 | 0.01 | | | | | 0.06 | 0.03 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | 0.13 | 0.08 | 0.04 | 0.04 | | | 0.04 | 0.04 |
| *Rhacochilus vacca* | 0.17 | 0.17 | 0.04 | 0.03 | 0.07 | 0.03 | 0.14 | 0.07 | 0.26 | 0.15 |
| *Rhinogobiops nicholsii* | | | 0.0003 | 0.0002 | 0.002 | 0.001 | | | 0.002 | 0.002 |
| *Sardinops sagax* | | | | | | | | | | |
| *Scorpaena guttata* | | | | | 0.05 | 0.05 | | | | |
| *Scorpaenichthys marmoratus* | | | 0.02 | 0.02 | 0.12 | 0.12 | | | | |
| *Sebastes atrovirens* | | | 0.08 | 0.05 | | | 0.07 | 0.03 | 0.20 | 0.11 |
| *Sebastes auriculatus* | | | 0.02 | 0.02 | | | 0.02 | 0.02 | | |
| *Sebastes carnatus* | | | | | | | 0.04 | 0.03 | | |
| *Sebastes caurinus* | | | | | | | 0.02 | 0.01 | 0.02 | 0.02 |
| *Sebastes chrysomelas* | | | | | | | 0.02 | 0.02 | 0.04 | 0.04 |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | 0.002 | 0.002 |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | | | 0.01 | 0.003 | | | | | 0.004 | 0.004 |
| *Sebastes serranoides flavidus* | | | | | | | 0.001 | 0.001 | | |
| *Sebastes serriceps* | | | | | 0.04 | 0.04 | | | | |
| *Sebastes umbrosus* | | | | | | | | | | |
| *Semicossyphus pulcher* | | | 0.06 | 0.06 | 0.02 | 0.02 | | | 0.04 | 0.03 |
| *Semicossyphus pulcher*-Female | 3.09 | 1.36 | 1.14 | 0.47 | 0.83 | 0.17 | 0.68 | 0.17 | 0.56 | 0.25 |
| *Semicossyphus pulcher*-Male | 2.31 | 1.52 | 0.74 | 0.32 | 0.23 | 0.12 | 0.62 | 0.28 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | 3.74 | 3.74 |
| *Trachurus symmetricus* | | | | | | | | | 0.09 | 0.09 |
| *Urobatis halleri* | | | 0.08 | 0.08 | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Point Dume | | Point Fermin | | Point La Jolla | | Point Loma | | Point Vicente | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | | | | | | |
| *Anisotremus davidsonii* | 2.08 | 1.92 | 0.03 | 0.03 | | | | | 0.05 | 0.03 |
| *Atherinops affinis* | 0.01 | 0.01 | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Balistes polylepis* | | | | | | | | | | |
| *Brachyistius frenatus* | | | 0.03 | 0.03 | | | 0.001 | 0.001 | | |
| *Caulolatilus princeps* | | | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | | | |
| *Cheilotrema saturnum* | 0.05 | 0.04 | | | | | | | | |
| *Chromis punctipinnis* | 1.90 | 0.50 | 0.01 | 0.01 | | | | | 0.36 | 0.14 |
| *Clinocottus analis* | | | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.98 | 0.16 | 0.20 | 0.10 | 0.14 | 0.08 | 0.11 | 0.09 | 0.55 | 0.16 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 7.75 | 3.42 | 1.21 | 0.54 | | | | | 1.11 | 0.41 |
| Gobiidae | | | | | | | | | | |
| *Gymnothorax mordax* | 0.15 | 0.15 | | | | | | | | |
| *Halichoeres semicinctus* | 0.17 | 0.06 | 0.02 | 0.01 | 0.01 | 0.01 | | | 0.29 | 0.08 |
| *Hermosilla azurea* | 0.02 | 0.02 | | | | | | | 0.02 | 0.02 |
| *Heterodontus francisci* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hexagrammos decagrammus* | | | | | | | | | | |
| *Hypsurus caryi* | 0.02 | 0.02 | 0.01 | 0.004 | 0.02 | 0.01 | 0.01 | 0.004 | 0.05 | 0.03 |
| *Hypsypops rubicundus* | 4.21 | 1.08 | 0.37 | 0.20 | 1.07 | 0.81 | 0.15 | 0.09 | 1.14 | 0.20 |
| *Leiocottus hirundo* | | | | | | | | | | |
| *Lythrypnus dalli* | | | | | | | | | | |
| *Medialuna californiensis* | 0.07 | 0.03 | 0.58 | 0.53 | | | | | 0.05 | 0.03 |
| *Micrometrus minimus* | | | | | | | | | | |
| *Myliobatis californica* | | | | | 0.01 | 0.01 | 0.25 | 0.25 | | |
| *Ophiodon elongatus* | 0.07 | 0.07 | | | | | | | 0.65 | 0.47 |
| *Orthonopias triacis* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Point Dume | | Point Fermin | | Point La Jolla | | Point Loma | | Point Vicente | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.42 | 0.13 | 0.12 | 0.05 | 0.16 | 0.06 | 0.11 | 0.04 | 0.49 | 0.11 |
| *Oxylebius pictus* | 0.06 | 0.03 | 0.002 | 0.002 | | | | | 0.02 | 0.01 |
| *Paralabrax clathratus* | 2.40 | 1.15 | 0.82 | 0.18 | 3.82 | 1.61 | 0.17 | 0.07 | 0.31 | 0.09 |
| *Paralabrax nebulifer* | 1.35 | 0.77 | 0.40 | 0.24 | 0.13 | 0.13 | 0.17 | 0.09 | 0.48 | 0.14 |
| *Paralichthys californica* | | | | | | | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | 0.0004 | 0.0004 | | | | | 0.002 | 0.002 |
| *Rathbunella alleni* | | | | | | | | | | |
| *Rhacochilus toxotes* | 0.25 | 0.14 | | | | | | | 0.13 | 0.08 |
| *Rhacochilus vacca* | 0.12 | 0.06 | 0.05 | 0.05 | | | | | 0.14 | 0.06 |
| *Rhinogobiops nicholsii* | 0.001 | 0.000 | 0.001 | 0.001 | | | | | 0.01 | 0.00 |
| *Sardinops sagax* | 0.39 | 0.39 | | | | | | | | |
| *Scorpaena guttata* | | | | | | | 0.0002 | 0.0002 | 0.01 | 0.01 |
| *Scorpaenichthys marmoratus* | 0.11 | 0.08 | | | | | | | 0.05 | 0.04 |
| *Sebastes atrovirens* | 0.22 | 0.10 | 0.02 | 0.02 | | | | | | |
| *Sebastes auriculatus* | 0.15 | 0.13 | | | | | | | | |
| *Sebastes carnatus* | 0.02 | 0.02 | | | | | 0.01 | 0.01 | 0.01 | 0.01 |
| *Sebastes caurinus* | | | | | | | | | | |
| *Sebastes chrysomelas* | 0.02 | 0.02 | | | | | | | 0.00 | 0.00 |
| *Sebastes dalli* | | | | | | | | | | |
| *Sebastes miniatus* | | | | | | | | | 0.02 | 0.02 |
| *Sebastes mystinus* | 0.001 | 0.001 | | | | | | | 0.02 | 0.02 |
| *Sebastes rastrelliger* | | | | | | | | | | |
| *Sebastes serranoides* | 0.01 | 0.01 | | | | | | | | |
| *Sebastes serranoides flavidus* | | | | | | | | | | |
| *Sebastes serriceps* | 0.06 | 0.04 | | | | | | | 0.01 | 0.01 |
| *Sebastes umbrosus* | | | | | | | | | 0.01 | 0.01 |
| *Semicossyphus pulcher* | | | 0.02 | 0.02 | | | | | 0.02 | 0.02 |
| *Semicossyphus pulcher*-Female | 2.69 | 0.87 | 0.42 | 0.16 | 0.94 | 0.55 | 0.05 | 0.04 | 1.24 | 0.34 |
| *Semicossyphus pulcher*-Male | 0.80 | 0.48 | 0.48 | 0.28 | | | 0.04 | 0.04 | 0.50 | 0.20 |
| *Sphyraena argentea* | | | | | | | | | | |
| *Squatina californica* | | | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |
| *Urobatis halleri* | | | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Resort Point | | Ridges | | Rocky Point | | Whites Point | |
|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Alloclinus holderi* | | | | | 0.0005 | 0.0005 | | |
| *Anisotremus davidsonii* | | | | | 0.34 | 0.29 | | |
| *Atherinops affinis* | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | 0.00003 | 0.00003 |
| *Aulorhynchus flavidus* | | | | | | | | |
| *Balistes polylepis* | | | | | | | | |
| *Brachyistius frenatus* | | | | | 0.001 | 0.001 | 0.01 | 0.00 |
| *Caulolatilus princeps* | | | | | | | | |
| *Cephaloscyllium ventriosum* | | | | | | | | |
| *Cheilotrema saturnum* | | | | | 0.12 | 0.09 | | |
| *Chromis punctipinnis* | 0.04 | 0.03 | 0.06 | 0.03 | 1.00 | 0.27 | 0.13 | 0.12 |
| *Clinocottus analis* | | | | | | | | |
| *Cymatogaster aggregata* | | | | | | | | |
| *Embiotoca jacksoni* | 0.13 | 0.04 | 0.08 | 0.03 | 0.24 | 0.07 | 0.74 | 0.28 |
| *Gibsonia elegans* | | | | | | | | |
| *Girella nigricans* | 0.16 | 0.07 | 0.25 | 0.09 | 2.37 | 1.07 | 0.42 | 0.26 |
| *Gobiidae sp* | | | | | | | | |
| *Gymnothorax mordax* | | | | | | | | |
| *Halichoeres semicinctus* | 0.06 | 0.03 | 0.06 | 0.02 | 0.31 | 0.11 | 0.02 | 0.02 |
| *Hermosilla azurea* | | | | | | | | |
| *Heterodontus francisci* | | | 0.07 | 0.05 | | | | |
| *Heterostichus rostratus* | 0.002 | 0.002 | | | 0.000001 | 0.000001 | | |
| *Hexagrammos decagrammus* | | | | | | | | |
| *Hypsurus caryi* | 0.04 | 0.02 | 0.01 | 0.01 | 0.03 | 0.01 | 0.58 | 0.57 |
| *Hypsypops rubicundus* | 0.29 | 0.09 | 0.29 | 0.09 | 0.44 | 0.10 | 0.73 | 0.23 |
| *Leiocottus hirundo* | | | | | | | | |
| *Lythrypnus dalli* | 0.00001 | 0.00001 | | | | | | |
| *Medialuna californiensis* | | | 0.08 | 0.06 | | | 0.22 | 0.22 |
| *Micrometrus minimus* | | | | | | | | |
| *Myliobatis californica* | | | | | 1.25 | 1.25 | | |
| *Ophiodon elongatus* | | | | | | | | |
| *Orthonopias triacis* | | | | | | | | |

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Appendix IV. Benthic mean fish biomass density (g/100m$^2$), continued.

| | Resort Point | | Ridges | | Rocky Point | | Whites Point | |
|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Oxyjulis californica* | 0.28 | 0.13 | 0.13 | 0.05 | 0.57 | 0.13 | 0.29 | 0.24 |
| *Oxylebius pictus* | 0.01 | 0.01 | 0.01 | 0.004 | 0.01 | 0.01 | | |
| *Paralabrax clathratus* | 0.43 | 0.16 | 0.14 | 0.03 | 0.78 | 0.14 | 2.02 | 1.08 |
| *Paralabrax nebulifer* | 0.26 | 0.13 | 0.03 | 0.02 | 0.10 | 0.05 | 0.09 | 0.06 |
| *Paralichthys californica* | | | | | | | 0.16 | 0.16 |
| *Phanerodon atripes* | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 0.09 | 0.09 |
| *Rathbunella alleni* | | | 0.0003 | 0.0002 | 0.0004 | 0.0004 | | |
| *Rhacochilus toxotes* | | | 0.03 | 0.02 | 0.41 | 0.24 | 0.06 | 0.04 |
| *Rhacochilus vacca* | 0.05 | 0.03 | 0.01 | 0.00 | 0.24 | 0.23 | 0.02 | 0.02 |
| *Rhinogobiops nicholsii* | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| *Sardinops sagax* | | | | | | | | |
| *Scorpaena guttata* | | | | | | | | |
| *Scorpaenichthys marmoratus* | | | | | | | | |
| *Sebastes atrovirens* | 0.04 | 0.03 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| *Sebastes auriculatus* | | | | | 0.0008 | 0.0007 | | |
| *Sebastes carnatus* | | | | | | | | |
| *Sebastes caurinus* | | | 0.00 | 0.00 | 0.01 | 0.01 | | |
| *Sebastes chrysomelas* | | | | | | | 0.01 | 0.01 |
| *Sebastes dalli* | | | 0.001 | 0.0007 | 0.004 | 0.002 | | |
| *Sebastes miniatus* | 0.01 | 0.004 | 0.0006 | 0.0006 | 0.0002 | 0.0002 | | |
| *Sebastes mystinus* | | | | | 0.002 | 0.002 | | |
| *Sebastes rastrelliger* | | | | | 0.01 | 0.01 | | |
| *Sebastes serranoides* | | | 0.0003 | 0.0003 | 0.0004 | 0.0004 | 0.0010 | 0.0010 |
| *Sebastes serranoides flavidus* | | | | | | | | |
| *Sebastes serriceps* | 0.02 | 0.02 | 0.02 | 0.02 | | | | |
| *Sebastes umbrosus* | | | 0.002 | 0.002 | 0.01 | 0.00 | | |
| *Semicossyphus pulcher* | 0.0007 | 0.0007 | 0.08 | 0.03 | 0.05 | 0.03 | | |
| *Semicossyphus pulcher*-Female | 0.82 | 0.29 | 0.31 | 0.08 | 0.50 | 0.10 | 0.58 | 0.23 |
| *Semicossyphus pulcher*-Male | 0.18 | 0.12 | 0.10 | 0.06 | 0.30 | 0.18 | 0.46 | 0.24 |
| *Sphyraena argentea* | | | | | 2.54 | 2.54 | | |
| *Squatina californica* | | | | | | | | |
| *Stereolepis gigas* | | | | | | | | |
| *Trachurus symmetricus* | 0.01 | 0.01 | 0.10 | 0.10 | 0.07 | 0.07 | | |
| *Urobatis halleri* | | | | | | | | |

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Appendix V. Mean fish biomass (g/100m$^2$) and standard error for midwater transects 2007-2008 on natural reefs on the mainland of the Southern California Bight.

| | 3 Palms | | Barn Kelp | | Big Rock | | Bunker Point | | Carp Reef | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | | | | |
| *Aulorhynchus flavidus* | 0.02 | 0.02 | | | | | | | | |
| *Brachyistius frenatus* | 0.0009 | 0.0009 | | | | | | | 0.0003 | 0.0003 |
| *Chromis punctipinnis* | | | 0.04 | 0.04 | 0.02 | 0.02 | 0.18 | 0.16 | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | 0.66 | 0.66 | 0.03 | 0.03 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | 2.48 | 2.48 | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | 0.0004 | 0.0004 | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | 0.0001 | 0.0001 | | | | | 0.01 | 0.01 | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 0.45 | 0.19 | 0.02 | 0.01 | 0.01 | 0.00 | 0.58 | 0.23 | 0.01 | 0.01 |
| *Paralabrax clathratus* | 0.07 | 0.04 | | | 0.16 | 0.09 | | | | |
| *Paralabrax nebulifer* | | | 0.01 | 0.01 | | | | | | |
| *Phanerodon furcatus* | 0.003 | 0.003 | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.11 | 0.11 | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.02 | 0.02 | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | 0.36 | 0.36 | | |

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Appendix V. Midwater mean fish biomass density (g/100m$^2$), continued.

| | Cojo | | Crystal Cove | | Deep Hole | | Encinal Canyon | | Escondido | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | 0.40 | 0.24 |
| *Atherinopsis californiensis* | | | | | 0.05 | 0.04 | 0.83 | 0.46 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | | | | | 0.0001 | 0.0001 | 0.003 | 0.003 | | |
| *Chromis punctipinnis* | | | 0.91 | 0.41 | 0.07 | 0.03 | | | | |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | | | 0.03 | 0.03 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | 0.13 | 0.13 | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | 0.0004 | 0.0003 | 0.003 | 0.002 | | |
| *Hyperprosopon argenteum* | | | | | | | | | 0.0001 | 0.0001 |
| *Hypsurus caryi* | | | | | | | 0.003 | 0.003 | | |
| *Hypsypops rubicundus* | | | | | | | 0.06 | 0.06 | | |
| *Medialuna californiensis* | | | | | 0.03 | 0.03 | 0.06 | 0.06 | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | | | 0.02 | 0.02 | 0.33 | 0.09 | 0.34 | 0.19 | 0.12 | 0.09 |
| *Paralabrax clathratus* | | | | | 0.04 | 0.03 | 1.43 | 0.71 | 0.08 | 0.05 |
| *Paralabrax nebulifer* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | 0.05 | 0.02 | 0.07 | 0.04 | | |
| *Rhacochilus toxotes* | | | | | 0.20 | 0.18 | 0.08 | 0.08 | | |
| *Rhacochilus vacca* | | | | | 0.01 | 0.01 | | | 0.02 | 0.02 |
| *Sardinops sagax* | | | | | 0.67 | 0.67 | | | | |
| *Sebastes atrovirens* | | | | | 0.02 | 0.02 | 0.17 | 0.10 | | |
| *Sebastes auriculatus* | | | | | | | 0.13 | 0.12 | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | 0.01 | 0.01 | | | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | 0.03 | 0.02 | | |
| *Semicossyphus pulcher*-Male | | | | | | | 0.66 | 0.41 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix V. Midwater mean fish biomass density (g/100m$^2$), continued.

| | Flat Rock | | Laguna | | Lead Better Beach | | Leo Carillo | | Little Corona | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | | | | |
| *Atherinopsis californiensis* | | | | | | | 0.16 | 0.10 | | |
| *Aulorhynchus flavidus* | | | | | 0.003 | 0.003 | | | | |
| *Brachyistius frenatus* | 0.0003 | 0.0003 | | | 0.0007 | 0.0007 | 0.005 | 0.003 | | |
| *Chromis punctipinnis* | 0.22 | 0.11 | 0.56 | 0.27 | | | 0.01 | 0.01 | 0.24 | 0.07 |
| *Cymatogaster aggregata* | | | | | | | 0.0004 | 0.0004 | | |
| *Embiotoca jacksoni* | | | | | | | 0.03 | 0.02 | 0.05 | 0.05 |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | 0.01 | 0.01 | | | | | | | | |
| *Girella nigricans* | | | | | | | | | 0.34 | 0.24 |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | 0.01 | 0.01 | | | | | | | | |
| *Hermosilla azurea* | | | | | | | 0.02 | 0.02 | | |
| *Heterostichus rostratus* | 0.001 | 0.001 | | | | | | | 0.01 | 0.01 |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | | | | | | | | |
| *Hypsypops rubicundus* | 0.04 | 0.03 | | | | | | | | |
| *Medialuna californiensis* | | | | | | | 0.17 | 0.14 | | |
| *Myliobatis californica* | | | | | | | | | 0.42 | 0.32 |
| *Oxyjulis californica* | 0.06 | 0.02 | 0.01 | 0.01 | | | 0.31 | 0.12 | 0.33 | 0.15 |
| *Paralabrax clathratus* | 0.07 | 0.03 | | | | | 0.53 | 0.22 | | |
| *Paralabrax nebulifer* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | 0.08 | 0.07 | | |
| *Rhacochilus toxotes* | 0.005 | 0.005 | | | | | | | | |
| *Rhacochilus vacca* | | | | | | | 0.02 | 0.02 | | |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | 0.25 | 0.18 | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | 0.01 | 0.01 | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | 0.004 | 0.004 | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix V. Midwater mean fish biomass density (g/100m$^2$), continued.

| | Little Dume | | Long Point | | Naples | | Nicholas Canyon | | Point Dume | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | 0.25 | 0.22 | | | | | | | | |
| *Atherinops affinis* | | | | | | | 0.11 | 0.07 | 0.13 | 0.09 |
| *Atherinopsis californiensis* | | | | | | | 0.28 | 0.27 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.0008 | 0.0007 | | | 0.0009 | 0.0009 | 0.03 | 0.01 | | |
| *Chromis punctipinnis* | 0.002 | 0.002 | 1.65 | 0.62 | 0.01 | 0.01 | 0.04 | 0.03 | 0.43 | 0.28 |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | 0.004 | 0.004 | 0.01 | 0.01 | | | 0.03 | 0.03 | | |
| *Galeorhinus galeus* | | | | | | | | | | |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | 0.27 | 0.27 | | | | | | | | |
| *Gobiidae sp* | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | | | | | | | | | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.002 | 0.002 | | | | | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.01 | 0.01 | | | 0.02 | 0.02 | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 0.01 | 0.01 | 0.14 | 0.05 | 0.15 | 0.09 | 1.03 | 0.33 | | |
| *Paralabrax clathratus* | 0.06 | 0.03 | | | | | 1.18 | 0.47 | 0.03 | 0.03 |
| *Paralabrax nebulifer* | | | | | | | 0.02 | 0.02 | | |
| *Phanerodon furcatus* | | | | | | | 0.05 | 0.02 | | |
| *Rhacochilus toxotes* | | | | | | | 0.08 | 0.08 | | |
| *Rhacochilus vacca* | | | | | | | 0.01 | 0.01 | | |
| *Sardinops sagax* | | | | | | | 0.13 | 0.13 | 0.47 | 0.47 |
| *Sebastes atrovirens* | 0.05 | 0.04 | | | | | 0.02 | 0.02 | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | 0.002 | 0.002 | | | | | | | | |
| *Semicossyphus pulcher* | | | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | | | | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix V. Midwater mean fish biomass density (g/100m$^2$), continued.

| | Point Fermin | | Point La Jolla | | Point Loma | | Point Vicente | | Resort Point | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | | | | | | | | |
| *Atherinops affinis* | | | | | | | 0.02 | 0.02 | | |
| *Atherinopsis californiensis* | | | | | | | 0.08 | 0.08 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.001 | 0.001 | | | 0.01 | 0.002 | 0.0004 | 0.0003 | 0.001 | 0.001 |
| *Chromis punctipinnis* | 0.34 | 0.25 | 0.01 | 0.01 | | | 1.56 | 0.85 | 0.26 | 0.19 |
| *Cymatogaster aggregata* | | | | | | | | | | |
| *Embiotoca jacksoni* | | | | | | | 0.01 | 0.01 | | |
| *Galeorhinus galeus* | | | | | | | | | 0.73 | 0.73 |
| *Gibbonsia elegans* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | 0.03 | 0.03 | 3.82 | 3.00 |
| *Gobiidae sp* | 3E-06 | 3E-06 | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Hermosilla azurea* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.01 | 0.01 | | | | | | | | |
| *Hyperprosopon argenteum* | | | | | | | | | | |
| *Hypsurus caryi* | | | 0.01 | 0.01 | | | | | | |
| *Hypsypops rubicundus* | | | | | | | 0.03 | 0.03 | | |
| *Medialuna californiensis* | | | | | | | 0.02 | 0.01 | 0.02 | 0.02 |
| *Myliobatis californica* | | | 0.14 | 0.14 | | | | | | |
| *Oxyjulis californica* | 0.03 | 0.02 | 0.03 | 0.03 | 0.04 | 0.02 | 0.15 | 0.05 | 0.15 | 0.04 |
| *Paralabrax clathratus* | 0.001 | 0.001 | 0.01 | 0.01 | 0.01 | 0.01 | 0.05 | 0.03 | 0.33 | 0.15 |
| *Paralabrax nebulifer* | 0.01 | 0.01 | | | | | 0.004 | 0.004 | 0.04 | 0.04 |
| *Phanerodon furcatus* | | | | | | | | | | |
| *Rhacochilus toxotes* | | | | | | | 0.01 | 0.01 | | |
| *Rhacochilus vacca* | | | 0.04 | 0.04 | | | 0.07 | 0.07 | 0.09 | 0.09 |
| *Sardinops sagax* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes mystinus* | | | | | | | | | | |
| *Sebastes paucispinus* | | | | | | | | | | |
| *Sebastes serranoides* | | | | | | | | | | |
| *Semicossyphus pulcher* | 0.02 | 0.02 | | | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | | | | 0.01 | 0.01 |
| *Semicossyphus pulcher*-Male | | | | | | | 0.05 | 0.05 | | |
| *Sphyraena argentea* | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix V. Midwater mean fish biomass density (g/100m$^2$), continued.

| | Ridges | | Rocky Point | | Whites Point | |
|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Anisotremus davidsonii* | | | 0.58 | 0.58 | | |
| *Atherinops affinis* | | | | | | |
| *Atherinopsis californiensis* | | | | | | |
| *Aulorhynchus flavidus* | | | | | | |
| *Brachyistius frenatus* | | | | | 0.01 | 0.01 |
| *Chromis punctipinnis* | 0.09 | 0.07 | 0.22 | 0.18 | 0.10 | 0.10 |
| *Cymatogaster aggregata* | | | | | | |
| *Embiotoca jacksoni* | | | | | | |
| *Galeorhinus galeus* | | | | | | |
| *Gibbonsia elegans* | | | | | | |
| *Girella nigricans* | | | 0.003 | 0.003 | 0.07 | 0.07 |
| *Gobiidae sp* | | | | | | |
| *Halichoeres semicinctus* | | | | | | |
| *Hermosilla azurea* | | | | | | |
| *Heterostichus rostratus* | | | 8.E-07 | 8.E-07 | 1.E-06 | 1.E-06 |
| *Hyperprosopon argenteum* | | | | | | |
| *Hypsurus caryi* | | | | | | |
| *Hypsypops rubicundus* | 0.01 | 0.01 | | | | |
| *Medialuna californiensis* | | | | | | |
| *Myliobatis californica* | | | | | | |
| *Oxyjulis californica* | 0.05 | 0.03 | 0.31 | 0.13 | 0.30 | 0.13 |
| *Paralabrax clathratus* | 0.02 | 0.01 | 0.58 | 0.31 | 0.07 | 0.07 |
| *Paralabrax nebulifer* | | | 0.01 | 0.01 | | |
| *Phanerodon furcatus* | | | | | | |
| *Rhacochilus toxotes* | | | | | | |
| *Rhacochilus vacca* | 0.004 | 0.004 | | | | |
| *Sardinops sagax* | | | | | | |
| *Sebastes atrovirens* | | | | | | |
| *Sebastes auriculatus* | | | | | | |
| *Sebastes mystinus* | 0.01 | 0.01 | | | | |
| *Sebastes paucispinus* | 0.003 | 0.003 | | | | |
| *Sebastes serranoides* | | | 0.01 | 0.01 | | |
| *Semicossyphus pulcher* | | | | | | |
| *Semicossyphus pulcher*-Female | | | | | | |
| *Semicossyphus pulcher*-Male | | | | | | |
| *Sphyraena argentea* | 0.94 | 0.66 | | | | |
| *Trachurus symmetricus* | 0.13 | 0.13 | | | | |

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Appendix VI. Mean fish biomass (g/100m$^2$) and standard error for canopy transects 2007-2008 on natural reefs on the mainland of the Southern California Bight.

| | 3 Palms | | Big Rock | | Bunker Point | | Carp Reef | | Cojo | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 0.009 | 0.009 | 0.089 | 0.053 | 0.025 | 0.025 | | | | |
| Atherinopsidae | | | | | | | | | 0.086 | 0.049 |
| *Atherinopsis californiensis* | 0.0001 | 0.0001 | | | | | | | | |
| *Aulorhynchus flavidus* | | | | | | | | | 0.007 | 0.004 |
| *Brachyistius frenatus* | 0.002 | 0.001 | 0.003 | 0.003 | | | | | 0.010 | 0.003 |
| *Chromis punctipinnis* | | | 0.182 | 0.142 | | | | | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | 0.053 | 0.053 | | | | | | | | |
| Gobiidae | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.005 | 0.004 | | | | | | | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 0.084 | 0.051 | 0.269 | 0.216 | 0.145 | 0.113 | | | 0.00004 | 0.00004 |
| *Paralabrax clathratus* | 0.191 | 0.113 | | | 0.001 | 0.001 | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | | | 0.001 | 0.001 |
| *Rhacochilus vacca* | | | | | | | | | 0.006 | 0.006 |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix VI. Canopy mean fish biomass density (g/100m$^2$), continued.

| | Deep Hole | | Encinal Canyon | | Escondido | | Flat Rock | | Lead Better Beach | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 0.408 | 0.151 | 0.001 | 0.001 | | | 0.053 | 0.032 | | |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | 0.130 | 0.130 | 0.222 | 0.131 | 0.016 | 0.016 | 0.321 | 0.264 | | |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.008 | 0.004 | 0.004 | 0.002 | 0.006 | 0.003 | 0.003 | 0.001 | | |
| *Chromis punctipinnis* | 0.051 | 0.023 | 0.006 | 0.006 | | | 0.012 | 0.012 | | |
| *Embiotoca jacksoni* | | | 0.020 | 0.020 | | | 0.008 | 0.008 | | |
| *Girella nigricans* | | | | | | | | | | |
| Gobiidae | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.001 | 0.0004 | 0.005 | 0.002 | | | 0.003 | 0.002 | | |
| *Hypsypops rubicundus* | | | | | | | 0.031 | 0.031 | | |
| *Medialuna californiensis* | | | 0.010 | 0.010 | | | | | | |
| *Myliobatis californica* | | | | | | | 0.829 | 0.829 | | |
| *Oxyjulis californica* | 0.249 | 0.112 | 0.085 | 0.037 | 0.110 | 0.061 | 0.328 | 0.194 | | |
| *Paralabrax clathratus* | 0.013 | 0.013 | 0.061 | 0.061 | 0.068 | 0.049 | | | | |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | 0.016 | 0.013 | | | 0.002 | 0.002 | | | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | | | 0.021 | 0.017 | 0.018 | 0.012 | | | | |
| *Sebastes auriculatus* | 0.003 | 0.003 | 0.004 | 0.003 | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix VI. Canopy mean fish biomass density (g/100m$^2$), continued.

| | Leo Carillo | | Little Dume | | Naples | | Nicholas Canyon | | Point Fermin | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | 0.138 | 0.092 | 0.016 | 0.016 | | | 0.161 | 0.151 | 0.086 | 0.069 |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | 0.208 | 0.174 | | | | | 1.085 | 0.682 | 0.071 | 0.071 |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.039 | 0.023 | 0.003 | 0.003 | 0.022 | 0.022 | 0.057 | 0.021 | 0.004 | 0.003 |
| *Chromis punctipinnis* | 0.001 | 0.0003 | 0.034 | 0.034 | 0.090 | 0.090 | | | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | | | | | | | | | | |
| Gobiidae | | | | | | | | | | |
| *Halichoeres semicinctus* | | | | | | | | | | |
| *Heterostichus rostratus* | 0.011 | 0.011 | | | | | 0.001 | 0.001 | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | | | | | | | | |
| *Myliobatis californica* | | | | | | | | | | |
| *Oxyjulis californica* | 0.198 | 0.117 | 0.017 | 0.009 | 0.038 | 0.038 | 0.227 | 0.088 | 0.002 | 0.002 |
| *Paralabrax clathratus* | 0.020 | 0.020 | | | | | 0.079 | 0.047 | | |
| *Phanerodon atripes* | | | | | | | 0.009 | 0.009 | | |
| *Phanerodon furcatus* | 0.002 | 0.002 | 0.021 | 0.021 | | | 0.004 | 0.004 | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | 0.016 | 0.007 | 0.013 | 0.013 | | | 0.038 | 0.021 | | |
| *Sebastes auriculatus* | | | | | | | 0.001 | 0.001 | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | 0.011 | 0.011 | | | | |

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Appendix VI. Canopy mean fish biomass density (g/100m$^2$), continued.

| | Point Vicente | | Resort Point | | Ridges | | Rocky Point | | Whites Point | |
|---|---|---|---|---|---|---|---|---|---|---|
| Taxa | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. | Mean | S.E. |
| *Atherinops affinis* | | | 0.196 | 0.122 | 0.070 | 0.070 | 0.002 | 0.002 | | |
| Atherinopsidae | | | | | | | | | | |
| *Atherinopsis californiensis* | | | 0.050 | 0.029 | | | | | 0.015 | 0.015 |
| *Aulorhynchus flavidus* | | | | | | | | | | |
| *Brachyistius frenatus* | 0.001 | 0.001 | 0.009 | 0.004 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| *Chromis punctipinnis* | 0.038 | 0.016 | 0.016 | 0.011 | | | | | | |
| *Embiotoca jacksoni* | | | | | | | | | | |
| *Girella nigricans* | | | 3.766 | 3.238 | 0.007 | 0.007 | 0.054 | 0.054 | | |
| Gobiidae | | | | | | | | | | |
| *Halichoeres semicinctus* | | | 0.002 | 0.002 | | | | | | |
| *Heterostichus rostratus* | | | | | | | 0.004 | 0.003 | | |
| *Hypsypops rubicundus* | | | | | | | | | | |
| *Medialuna californiensis* | | | 0.061 | 0.035 | | | | | | |
| *Myliobatis californica* | | | | | | | 11.635 | 11.635 | | |
| *Oxyjulis californica* | 0.018 | 0.018 | 0.206 | 0.138 | 0.007 | 0.005 | 0.010 | 0.009 | 0.005 | 0.005 |
| *Paralabrax clathratus* | | | 0.049 | 0.046 | | | 0.170 | 0.150 | 0.079 | 0.079 |
| *Phanerodon atripes* | | | | | | | | | | |
| *Phanerodon furcatus* | | | | | | | | | | |
| *Rhacochilus vacca* | | | | | | | | | | |
| *Sebastes atrovirens* | | | | | | | | | | |
| *Sebastes auriculatus* | | | | | | | | | | |
| *Sebastes* juv-brown complex | | | | | | | | | | |
| *Trachurus symmetricus* | | | | | | | | | | |

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Appendix VII. Density (100m$^2$) of invertebrates and algae by depth zone in Santa Monica Bay, 2007-2008.

| Station | Zone | *Anthopleura elegantissima* | *Anthopleura sola* | *Anthopleura xanthogrammica* | *Aplysia californica* | *Asterina miniata* | *Astrometis sertulifera* | *Astropectin armatus* | Barnacle | *Cadlina leuteomarginata* | *Cancer antennarius* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | 2.5 | | | | | |
| Bunker Point | Inner | 27.5 | | | | | | | | | |
| Bunker Point | Middle | 1.7 | | | | | | 1.7 | | | |
| Bunker Point | Outer | | | | | | | 7.5 | | | |
| Deep Hole | Middle | | | | 0.8 | 11.7 | | | | | |
| Deep Hole | Outer | | 4.2 | | 0.8 | 38.3 | | | | | |
| El Matador East | Middle | 0.8 | | | | | | 6.7 | | | |
| El Matador West | Middle | 8.3 | | | | | | 25.0 | | | |
| Encinal Canyon East | Inner | | 4.2 | | 3.3 | | | 16.7 | | | |
| Encinal Canyon East | Middle | | 0.8 | | | | | 10.0 | | | |
| Encinal Canyon West | Inner | | 9.2 | | | | | 0.8 | | | |
| Encinal Canyon West | Middle | 0.8 | | | | | | 63.3 | | | |
| Escondido | Inner | | | | | 0.8 | | | | | |
| Escondido | Middle | | 1.7 | | | 2.5 | | 0.8 | | | |
| Escondido East | Inner | | 5.0 | | 0.8 | | | 3.3 | | | |
| Escondido East | Middle | | 6.7 | | | | | 5.0 | | | |
| Escondido West | Inner | | | | | | | | | | |
| Escondido West | Middle | | | | | | | 2.5 | | | |
| Flat Rock | Inner | | | | | | | | | | |
| Flat Rock | Middle | | | | | 5.0 | | | | | |
| Flat Rock | Outer | | 1.7 | | | 5.8 | | 1.7 | | | |
| Flat Rock North | Inner | | | | 5.8 | | | 0.8 | | | |
| Flat Rock North | Middle | | | | | | | | | | |
| Flat Rock North | Outer | | | | 13.3 | | | 0.8 | | | |
| Flat Rock South | Inner | 5.0 | | | | | | 0.8 | | | |
| Flat Rock South | Middle | 0.8 | | | | | | 9.2 | | | |
| Leo Carillo | Inner | | 23.3 | | | 27.5 | | | | | |
| Leo Carillo | Middle | | 11.7 | | | 53.3 | | 0.8 | | | |
| Leo Carillo | Outer | 0.8 | | | | 66.7 | | | | | |
| Leo Carillo East | Inner | | | | | | | 0.8 | | | |
| Leo Carillo East | Middle | | 14.2 | | | | | 9.2 | | | |
| Leo Carillo East | Outer | | | | | | | 26.7 | | | |
| Leo Carillo West | Inner | | 11.7 | | | | | 30.8 | | | |
| Leo Carillo West | Middle | 4.2 | | | 0.8 | | | 20.0 | | | |
| Little Dume | Inner | | 5.8 | | | 0.8 | | | | | |
| Little Dume | Middle | | | | | | | | | | |
| Little Dume | Outer | | 1.7 | | | 58.3 | | | | | |
| Little Dume East | Inner | 1.7 | 0.8 | | 0.8 | | | 2.5 | | | |
| Little Dume East | Middle | | 3.3 | | | | | 5.0 | | | |
| Little Dume East | Outer | | | | 2.5 | | | 15.0 | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Anthopleura elegantissima* | *Anthopleura sola* | *Anthopleura xanthogrammica* | *Aplysia californica* | *Asterina miniata* | *Astrometis sertulifera* | *Astropectin armatus* | Barnacle | *Cadlina leuteomarginata* | *Cancer antennarius* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Inner | 6.7 | | | 0.8 | | | 0.8 | | | |
| Little Dume West | Middle | | 6.7 | | 7.5 | | | 10.8 | | | 1.7 |
| Little Dume West | Outer | | | | | | | 35.0 | | | |
| Long Point East | Inner | | 11.7 | | 7.5 | | | 22.5 | | | |
| Long Point East | Middle | | 5.0 | | 10.8 | | | 60.0 | | | |
| Long Point East | Outer | | 7.5 | | | | | 49.2 | | | |
| Long Point West | Inner | | 78.3 | | 2.5 | | | 30.0 | | | |
| Long Point West | Middle | | 7.5 | | | | | 46.7 | | | |
| Nicholas Canyon | Middle | 1.7 | | | | 30.8 | | | | | |
| Nicholas Canyon | Outer | | | | | 58.3 | | | | | |
| Nicholas Canyon East | Middle | 1.7 | | | | | | 15.8 | | | |
| Nicholas Canyon East | Outer | | | | | | | 57.5 | | | |
| Nicholas Canyon West | Middle | 0.8 | 1.7 | | | | | 6.7 | | | |
| Nicholas Canyon West | Outer | 10.0 | | | | | | 123.3 | | | |
| Point Dume '08 | Middle | | 55.0 | 1.7 | | 18.3 | | | | | |
| Point Dume '07 | Middle | | 0.8 | | 0.8 | | | 6.7 | | | |
| Point Fermin | Inner | 13.3 | 4.2 | | | 3.3 | | 1.7 | | | |
| Point Fermin | Middle | 19.2 | 5.0 | | | | | 26.7 | | | |
| Point Fermin | Outer | 1.7 | | | | | | 10.8 | | | |
| Point Fermin West | Inner | | 13.3 | | | | | | | | |
| Point Fermin West | Middle | | 3.3 | | | 8.3 | | | | | |
| Point Fermin West | Outer | | | | | 16.7 | | | | | |
| Point Vicente | Inner | | 68.3 | | | 10.0 | | | | | |
| Point Vicente | Middle | | 14.2 | | | 55.8 | | | | | |
| Point Vicente | Outer | | 20.0 | | | 18.3 | | | | | |
| Point Vicente East | Inner | 0.8 | | | 1.7 | | | 21.7 | | | |
| Point Vicente East | Middle | | 10.0 | | 7.5 | | | 29.2 | | | |
| Point Vicente East | Outer | | 5.0 | | 4.2 | | | 33.3 | | | |
| Point Vicente West | Deep | 0.8 | | | | | | 60.8 | | | |
| Point Vicente West | Inner | 29.2 | 13.3 | | 0.8 | | | 22.5 | | | |
| Point Vicente West | Middle | 21.7 | 2.5 | | 4.2 | | | 39.2 | | | |
| Point Vicente West | Outer | 5.8 | | | | | | 110.0 | | | |
| Resort Point | Deep | | | | | 51.7 | | 0.8 | | 0.8 | |
| Resort Point | Inner | | 3.3 | | | 19.2 | | | | | |
| Resort Point | Middle | | | | | 29.2 | | | | | |
| Resort Point | Outer | | 0.8 | | | 10.8 | | | | | |
| Ridges | Deep | | | | | | | | | | |
| Ridges | Inner | | 0.8 | | | | | | | | |
| Ridges | Middle | | | | | 4.2 | | | | | |
| Ridges | Outer | | | | | | | | | | |
| Ridges North | Deep | | | | | | | 23.3 | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Anthopleura elegantissima* | *Anthopleura sola* | *Anthopleura xanthogrammica* | *Aplysia californica* | *Asterina miniata* | *Astrometis sertulifera* | *Astropectin armatus* | Barnacle | *Cadlina leuteomarginata* | *Cancer antennarius* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | | | | | | | | |
| Ridges North | Middle | | | | | | | 1.7 | | | |
| Ridges North | Outer | | | | | | | 3.3 | | | |
| Ridges South | Deep | | | | | | | 2.5 | | | |
| Ridges South | Inner | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | | |
| Ridges South | Outer | | | | | | | | | | |
| Rocky Point | Deep | | | | | 15.8 | | | | | |
| Rocky Point | Inner | | | | | | | | | | |
| Rocky Point | Middle | | | | | | | | | | |
| Rocky Point | Outer | | | | | 0.8 | | | | | |
| Rocky Point North | Deep | | | | | | | 13.3 | | | |
| Rocky Point North | Inner | | | | | | | | | | |
| Rocky Point North | Middle | | | | | | | | | | |
| Rocky Point North | Outer | | | | | | | | | | |
| Rocky Point South | Deep | | | | | | 0.8 | 37.5 | | | |
| Rocky Point South | Inner | | 0.8 | | | | | 15.0 | | | |
| Rocky Point South | Middle | | | | | | | | | | |
| Rocky Point South | Outer | | | | | | | 0.8 | | | |
| 3 Palms | Inner | | | | | | | | | | |
| 3 Palms | Middle | | | | | 1.7 | | | | | |
| 3 Palms East | Inner | | 5.0 | | | | | 0.8 | 5.8 | | |
| 3 Palms East | Middle | | 2.5 | | | | | 3.3 | | | |
| 3 Palms East | Outer | | | 2.5 | | | | 11.7 | | | |
| 3 Palms West | Inner | | | | | | | | | | |
| 3 Palms West | Middle | | | 0.8 | | | | 13.3 | | | |
| 3 Palms West | Outer | | 0.8 | | | | | 7.5 | | | |
| Whites Point | Inner | 9.2 | 9.2 | | | | | 5.8 | | | |
| Whites Point | Middle | 9.2 | 9.2 | | | | | 1.7 | | | |
| Whites Point | Outer | 13.3 | 5.0 | | | | | 7.5 | | | |
| Whites Point West | Inner | 6.7 | | | | 0.8 | | | | | |
| Whites Point West | Middle | 2.5 | 1.7 | | | 24.2 | | | | | |
| Whites Point West | Outer | | | | | 1.7 | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cancer* sp. | *Centrostephanus coronatus* | *Ceramaster patogonicus* | *Ceratostoma foliatum* | *Chaceia ovoidea* | *Craniella arb* | *Crassedoma giganteum* | *Cucumaria piperata* | Cup Coral | *Cypraea spadicea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | | 0.8 | | | | 0.8 |
| Bunker Point | Inner | | | | | | | | | | 17.5 |
| Bunker Point | Middle | | | | | | | | | | 2.5 |
| Bunker Point | Outer | 1.7 | | | | | | | | | 1.7 |
| Deep Hole | Middle | | | | | | | | | | |
| Deep Hole | Outer | | | | | | | | | | |
| El Matador East | Middle | | | | | | | | | | |
| El Matador West | Middle | | | | | | | | | | |
| Encinal Canyon East | Inner | | | | | | | | | | 9.2 |
| Encinal Canyon East | Middle | | | | | | | | | | |
| Encinal Canyon West | Inner | | | | | | | | | | |
| Encinal Canyon West | Middle | | | | | | | | | | |
| Escondido | Inner | | | | | | | | | | |
| Escondido | Middle | | | | | | | | | | |
| Escondido East | Inner | | | | | | | | | | 0.8 |
| Escondido East | Middle | | | | | | | | | | |
| Escondido West | Inner | | | | | | | | | | |
| Escondido West | Middle | | | | | | | | | | |
| Flat Rock | Inner | | | | | | | | | | 16.7 |
| Flat Rock | Middle | | | | | | | | | | 0.8 |
| Flat Rock | Outer | | | | | | 7.5 | | | | |
| Flat Rock North | Inner | | | | | | 1.7 | | 11.7 | | |
| Flat Rock North | Middle | | | | | | | | | | |
| Flat Rock North | Outer | | | | | | | | 5.0 | | |
| Flat Rock South | Inner | | | | | | | | | | 7.5 |
| Flat Rock South | Middle | | | | | | | | | | |
| Leo Carillo | Inner | | | | | | | | | | 66.7 |
| Leo Carillo | Middle | 1.7 | | | | | | | | | 8.3 |
| Leo Carillo | Outer | | | | | | | | | | 1.7 |
| Leo Carillo East | Inner | | | | | | | | | | |
| Leo Carillo East | Middle | | | | | | | | | | |
| Leo Carillo East | Outer | | | | | 1.7 | | | | | |
| Leo Carillo West | Inner | | | | | | | | | | |
| Leo Carillo West | Middle | | | | | | | | | | |
| Little Dume | Inner | | | | | | | | | | 5.8 |
| Little Dume | Middle | | | | | | | | | | |
| Little Dume | Outer | | | | | | | | | | |
| Little Dume East | Inner | | | | | | | | | | 5.0 |
| Little Dume East | Middle | | | | | | | | | | 4.2 |
| Little Dume East | Outer | | | | | | | | | | 2.5 |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cancer* sp. | *Centrostephanus coronatus* | *Ceramaster patogonicus* | *Ceratostoma foliatum* | *Chaceia ovoidea* | *Craniella arb* | *Crassedoma giganteum* | *Cucumaria piperata* | Cup Coral | *Cypraea spadicea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Inner | 0.8 | | | 70.8 | | | | | | |
| Little Dume West | Middle | 0.8 | | | 1.7 | | | | | | |
| Little Dume West | Outer | | | | 22.5 | | | | | | |
| Long Point East | Inner | | | | | | | | | | 60.8 |
| Long Point East | Middle | | | | | | 1.7 | | | | 17.5 |
| Long Point East | Outer | | | | | | 1.7 | | | | |
| Long Point West | Inner | | | | | | | | | | |
| Long Point West | Middle | | | | | | 0.8 | | | | |
| Nicholas Canyon | Middle | | | | | | | | | | 4.2 |
| Nicholas Canyon | Outer | | | | | | 1.7 | | | | |
| Nicholas Canyon East | Middle | | | | | | | | | | |
| Nicholas Canyon East | Outer | | | | | | | | | | |
| Nicholas Canyon West | Middle | | | | | | | | | | |
| Nicholas Canyon West | Outer | | | | | | | | | | |
| Point Dume '08 | Middle | | | | | | | | | | |
| Point Dume '07 | Middle | | | | | | | | | | 12.5 |
| Point Fermin | Inner | 10.8 | | | 18.3 | | | | | | 125.0 |
| Point Fermin | Middle | 14.2 | | | | | | | | 0.8 | |
| Point Fermin | Outer | | | | | 0.8 | 0.8 | | | 2.5 | |
| Point Fermin West | Inner | | | | | | | | | | 110.0 |
| Point Fermin West | Middle | | | | | | | | | | |
| Point Fermin West | Outer | | | | | | | | | | 4.2 |
| Point Vicente | Inner | | | | | | | | | | |
| Point Vicente | Middle | | | | | | 3.3 | | | | 1.7 |
| Point Vicente | Outer | | | | | | 7.5 | | | | |
| Point Vicente East | Inner | 3.3 | | | 0.8 | | | | | | |
| Point Vicente East | Middle | | | | | | | | | | |
| Point Vicente East | Outer | | | | | | | | | | |
| Point Vicente West | Deep | | | | | | | | | 2.5 | |
| Point Vicente West | Inner | | | | | | | | | | |
| Point Vicente West | Middle | | | | | | | | | | 6.7 |
| Point Vicente West | Outer | 49.2 | | | | | 0.8 | | | | |
| Resort Point | Deep | | | | | 0.8 | | | | | |
| Resort Point | Inner | | | | | | | | | | 10.0 |
| Resort Point | Middle | | | | | | | | | | 32.5 |
| Resort Point | Outer | | | | | | | | | | 0.8 |
| Ridges | Deep | | | | | | | | | | |
| Ridges | Inner | | | | | | | | | | 14.2 |
| Ridges | Middle | | | | | | | | | | 22.5 |
| Ridges | Outer | 0.8 | | | | | | | | | 1.7 |
| Ridges North | Deep | 0.8 | | | 1.7 | | | | 55.8 | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cancer* sp. | *Centrostephanus coronatus* | *Ceramaster patogonicus* | *Ceratostoma foliatum* | *Chaceia ovoidea* | *Craniella arb* | *Crassedoma giganteum* | *Cucumaria piperata* | Cup Coral | *Cypraea spadicea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | 0.8 | | | | | | | 5.0 |
| Ridges North | Middle | | | | | | | | | | |
| Ridges North | Outer | 2.5 | | | | | | | 3.3 | | |
| Ridges South | Deep | | | | | | | | 35.8 | | |
| Ridges South | Inner | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | 0.8 | |
| Ridges South | Outer | | | | | | | | | | 4.2 |
| Rocky Point | Deep | | | | | | | | | 0.8 | |
| Rocky Point | Inner | | | | | | | | | | 3.3 |
| Rocky Point | Middle | | | | | | | | | | 66.7 |
| Rocky Point | Outer | | | | | | | | | | |
| Rocky Point North | Deep | 0.8 | | | | | | 0.8 | | 0.8 | |
| Rocky Point North | Inner | 12.5 | | | | | 0.8 | | | 0.8 | 47.5 |
| Rocky Point North | Middle | | | | | | | | | | |
| Rocky Point North | Outer | 17.5 | | | | | | | | | |
| Rocky Point South | Deep | | 0.8 | | | | | | | 0.8 | |
| Rocky Point South | Inner | | | | | | | | | | |
| Rocky Point South | Middle | | | | | | | | | | 23.3 |
| Rocky Point South | Outer | 1.7 | | | | | | | | | 6.7 |
| 3 Palms | Inner | | | | | | | | | | 40.8 |
| 3 Palms | Middle | | | | | | | | | | 12.5 |
| 3 Palms East | Inner | | | | | | | | | | |
| 3 Palms East | Middle | | | | | | | | | | 50.0 |
| 3 Palms East | Outer | | | | | | | | | | 39.2 |
| 3 Palms West | Inner | | | | | | | | | | |
| 3 Palms West | Middle | | | | | | 1.7 | | | | 11.7 |
| 3 Palms West | Outer | | | | | | | | | | |
| Whites Point | Inner | 0.8 | | | | | | | | | 56.7 |
| Whites Point | Middle | | | | | | | | | | 56.7 |
| Whites Point | Outer | 10.0 | | | 3.3 | | | | | 6.7 | 9.2 |
| Whites Point West | Inner | | | | | | | | | | 98.3 |
| Whites Point West | Middle | | | | | | | | | | 56.7 |
| Whites Point West | Outer | | | | | | | | | | 32.5 |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cystoseira osmundacea* | *Dendrodoris* sp. | *Dermasterias imbricata* | *Desmarestia ligulata* | *Diaulula sandiegensis* | *Dirona albolineata* | *Egregia menziesii* | *Eisenia arborea* | *Eugorgia rubens* | *Flabellina iodinea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | | 4.2 | 16.7 | | | |
| Bunker Point | Inner | | | | | | 36.7 | | | | |
| Bunker Point | Middle | | | | | | | | | | |
| Bunker Point | Outer | | | | | | | | | | |
| Deep Hole | Middle | | | | | | | | | | |
| Deep Hole | Outer | | | | | | | | | | |
| El Matador East | Middle | | | | | | | | | | |
| El Matador West | Middle | | 0.8 | | 3.3 | | | | | | |
| Encinal Canyon East | Inner | | | | | | | | | | |
| Encinal Canyon East | Middle | | | | | | 0.8 | | | | |
| Encinal Canyon West | Inner | | | | | | | | | | |
| Encinal Canyon West | Middle | | | | | | | | | | |
| Escondido | Inner | | | | | | | | | | |
| Escondido | Middle | | 3.3 | | | | | | | | |
| Escondido East | Inner | | | | | | | | | | |
| Escondido East | Middle | | | | | | | | | | |
| Escondido West | Inner | | | | | | | | | | |
| Escondido West | Middle | | | | | | | | | | |
| Flat Rock | Inner | | | | | | | | | | |
| Flat Rock | Middle | | | | | | 0.8 | | | | |
| Flat Rock | Outer | | | | 1.7 | | | | | | |
| Flat Rock North | Inner | | | | | | | | | | |
| Flat Rock North | Middle | | | | | | | | | | |
| Flat Rock North | Outer | | | | | | | | | | |
| Flat Rock South | Inner | | | | | | | | | | |
| Flat Rock South | Middle | | | | | | | | | | |
| Leo Carillo | Inner | | | | | | | | | | |
| Leo Carillo | Middle | | | | | | | | | | |
| Leo Carillo | Outer | | | | | | | | | | |
| Leo Carillo East | Inner | | | | 0.8 | | 0.8 | | | | |
| Leo Carillo East | Middle | | | | | | | | | | |
| Leo Carillo East | Outer | | 2.5 | | | | | | | | |
| Leo Carillo West | Inner | | | | 2.5 | | 0.8 | | | | |
| Leo Carillo West | Middle | | | | | | | | | | |
| Little Dume | Inner | | | | | | 1.7 | | | | |
| Little Dume | Middle | | | | | | | | | | |
| Little Dume | Outer | | | | | | | | | | |
| Little Dume East | Inner | | | | | | 2.5 | | | | |
| Little Dume East | Middle | | | | | | | 1.7 | | | |
| Little Dume East | Outer | | | | | | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cystoseira osmundacea* | *Dendrodoris* sp. | *Dermasterias imbricata* | *Desmarestia ligulata* | *Diaulula sandiegensis* | *Dirona albolineata* | *Egregia menziesii* | *Eisenia arborea* | *Eugorgia rubens* | *Flabellina iodinea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Inner | | | | | | 10.8 | | | | |
| Little Dume West | Middle | | | | | | | | | | |
| Little Dume West | Outer | | | | | | | | | | |
| Long Point East | Inner | | | | | | 29.2 | 35.0 | | | |
| Long Point East | Middle | | | | | | 6.7 | 2.5 | | | |
| Long Point East | Outer | | | | | | | | | | |
| Long Point West | Inner | | | | | | | 5.8 | | | |
| Long Point West | Middle | | | | | | | | | | |
| Nicholas Canyon | Middle | | | | | | | | | | |
| Nicholas Canyon | Outer | | | | | | | | | | |
| Nicholas Canyon East | Middle | | | | | | | | | | |
| Nicholas Canyon East | Outer | | 0.8 | | | | | | | | |
| Nicholas Canyon West | Middle | | 1.7 | | | | | | | | |
| Nicholas Canyon West | Outer | | | | | | | | | | |
| Point Dume '08 | Middle | | | | | | | 10.0 | | 0.8 | |
| Point Dume '07 | Middle | | | | | | 2.5 | 0.8 | | | |
| Point Fermin | Inner | | | | | | | | | | |
| Point Fermin | Middle | | | | | | | | | | |
| Point Fermin | Outer | | | | | | | | | | |
| Point Fermin West | Inner | | | | | | 89.2 | | | | |
| Point Fermin West | Middle | | | | | | | | | | |
| Point Fermin West | Outer | | | | | | | | | | |
| Point Vicente | Inner | | | | | | 7.5 | 24.2 | | | |
| Point Vicente | Middle | | | | | | | | | 4.2 | |
| Point Vicente | Outer | | | | | | 0.8 | 0.8 | | 8.3 | |
| Point Vicente East | Inner | | | | | | | | | | |
| Point Vicente East | Middle | | | | | | | 0.8 | | | |
| Point Vicente East | Outer | | | | | | | | | | |
| Point Vicente West | Deep | | | | | | | | | 2.5 | |
| Point Vicente West | Inner | | | | | | | | | | |
| Point Vicente West | Middle | | | | | | | 0.8 | | | |
| Point Vicente West | Outer | | | | | | | | | 1.7 | |
| Resort Point | Deep | | | | | | | | 0.8 | 1.7 | |
| Resort Point | Inner | | | | | | 2.5 | 0.8 | | | |
| Resort Point | Middle | | | | | | | | | | |
| Resort Point | Outer | | | | | | 2.5 | 3.3 | | | |
| Ridges | Deep | | | | | | | | | | |
| Ridges | Inner | | | | | | 0.8 | 0.8 | | | |
| Ridges | Middle | | | 16.7 | | | | | | | |
| Ridges | Outer | | | | | | 0.8 | | | | 0.8 |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Cystoseira osmundacea* | *Dendrodoris* sp. | *Dermasterias imbricata* | *Desmarestia ligulata* | *Diaulula sandiegensis* | *Dirona albolineata* | *Egregia menziesii* | *Eisenia arborea* | *Eugorgia rubens* | *Flabellina iodinea* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Deep | | | | | | | | | | |
| Ridges North | Inner | | | | | | | 0.8 | | | |
| Ridges North | Middle | | | | | | | | | | |
| Ridges North | Outer | | | | | | | | | | |
| Ridges South | Deep | | | | | | | | | | |
| Ridges South | Inner | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | | |
| Ridges South | Outer | | | | | | | | | | |
| Rocky Point | Deep | | | | | | | | | 0.8 | |
| Rocky Point | Inner | | | | | | | | | | |
| Rocky Point | Middle | | | | | | | | | | |
| Rocky Point | Outer | | | | | | | | | | |
| Rocky Point North | Deep | | | | | 0.8 | | | | 2.5 | |
| Rocky Point North | Inner | | | | | | | 16.7 | | | |
| Rocky Point North | Middle | | | | | | 0.8 | | | | |
| Rocky Point North | Outer | | | | | | | | | | |
| Rocky Point South | Deep | 7.5 | | | | | | | | | |
| Rocky Point South | Inner | | | | | | 0.8 | 5.8 | | | |
| Rocky Point South | Middle | | | | | | | | | | |
| Rocky Point South | Outer | | | | | | | | | | |
| 3 Palms | Inner | | | | | | 26.7 | | | | |
| 3 Palms | Middle | | | | | | | | | | |
| 3 Palms East | Inner | | | | | | | | | | |
| 3 Palms East | Middle | | | | | | | | | | |
| 3 Palms East | Outer | | | | | | | | | | |
| 3 Palms West | Inner | | | | | | 0.8 | | | | |
| 3 Palms West | Middle | | | | | | | | | | |
| 3 Palms West | Outer | | | | | | | | | | |
| Whites Point | Inner | | | | | | 4.2 | | | | |
| Whites Point | Middle | | 0.8 | | | | | | | | |
| Whites Point | Outer | | | | | | | | | | |
| Whites Point West | Inner | | | | | | 4.2 | | | | |
| Whites Point West | Middle | | | | | | | | | | |
| Whites Point West | Outer | | | | | | | 78.3 | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Haliotis corrugata* | *Haliotis rufescens* | *Henricia leviuscula* | *Kelletia kelletii* | *Laminaria farlowii* | *Laminaria setchellii* | *Linckia columbianus* | *Lithopoma undosum* | *Lophogorgia chilensis* | *Loxorhyncus grandis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | | | | | | |
| Bunker Point | Inner | | | 6.7 | | | | | | | |
| Bunker Point | Middle | | | 14.2 | | | | | | | |
| Bunker Point | Outer | | | 5.8 | | | | | | | |
| Deep Hole | Middle | | | | | | | | | | |
| Deep Hole | Outer | | | 2.5 | | | | | 2.5 | | 4.2 |
| El Matador East | Middle | | | 5.0 | | | | | | | |
| El Matador West | Middle | | | 15.8 | | | | | | | |
| Encinal Canyon East | Inner | | | | | | | | | | |
| Encinal Canyon East | Middle | | | | | | | | | | |
| Encinal Canyon West | Inner | | | | | | | | | | |
| Encinal Canyon West | Middle | | | 1.7 | | | | | | | |
| Escondido | Inner | | | | | | | | | | |
| Escondido | Middle | | | 0.8 | | | | | | | |
| Escondido East | Inner | | | | | | | | | | |
| Escondido East | Middle | | | | | | | | 1.7 | | |
| Escondido West | Inner | | | | | | | | | | |
| Escondido West | Middle | | | 1.7 | | | | | 0.8 | | 7.5 |
| Flat Rock | Inner | | | | | | | 7.5 | | | |
| Flat Rock | Middle | | | 4.2 | | | | 5.0 | | | |
| Flat Rock | Outer | | | 21.7 | | | 0.8 | 2.5 | | | |
| Flat Rock North | Inner | | | | | 0.8 | | 74.2 | | | |
| Flat Rock North | Middle | | | 1.7 | | | | 7.5 | | | |
| Flat Rock North | Outer | | | 4.2 | | | | 0.8 | 1.7 | 0.8 | |
| Flat Rock South | Inner | | | 6.7 | | | | 21.7 | | | |
| Flat Rock South | Middle | | | 16.7 | | | | 25.8 | | | |
| Leo Carillo | Inner | | | | | | | | | | |
| Leo Carillo | Middle | | | | | | | | 0.8 | | |
| Leo Carillo | Outer | | 0.8 | 13.3 | 0.8 | | | 0.8 | 5.0 | | 1.7 |
| Leo Carillo East | Inner | | | 0.8 | | | | | | | |
| Leo Carillo East | Middle | | | 4.2 | | | | | | | |
| Leo Carillo East | Outer | | 0.8 | | | | | | | | |
| Leo Carillo West | Inner | | | 2.5 | | | | 0.8 | | | |
| Leo Carillo West | Middle | | | 3.3 | | | | | 0.8 | | |
| Little Dume | Inner | | | | 10.0 | | | 0.8 | | | |
| Little Dume | Middle | | | | 20.8 | | | | | | |
| Little Dume | Outer | | | 12.5 | 0.8 | | | | | | |
| Little Dume East | Inner | | | 4.2 | | | | | | | |
| Little Dume East | Middle | | | 11.7 | 5.0 | | | | | 0.8 | |
| Little Dume East | Outer | | | 13.3 | 4.2 | | | | | 0.8 | |
| Little Dume West | Inner | | | 0.8 | 7.5 | 9.2 | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Haliotis corrugata* | *Haliotis rufescens* | *Henricia leviuscula* | *Kelletia kelletii* | *Laminaria farlowii* | *Laminaria setchellii* | *Linckia columbianus* | *Lithopoma undosum* | *Lophogorgia chilensis* | *Loxorhyncus grandis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Middle | | | 12.5 | | | | | | | |
| Little Dume West | Outer | | | 17.5 | | | | | | 0.8 | 16.7 |
| Long Point East | Inner | | | 14.2 | | | | 3.3 | | | |
| Long Point East | Middle | | | 11.7 | | | | 3.3 | | | |
| Long Point East | Outer | | | 5.0 | | | | 4.2 | | | 36.7 |
| Long Point West | Inner | | | 7.5 | | | | 1.7 | | | |
| Long Point West | Middle | | | 25.8 | | | | 0.8 | 1.7 | | |
| Nicholas Canyon | Middle | | | 4.2 | 2.5 | | | | | | |
| Nicholas Canyon | Outer | | | 0.8 | | | | | 6.7 | | |
| Nicholas Canyon East | Middle | | | 3.3 | | | | | | 0.8 | |
| Nicholas Canyon East | Outer | | | 13.3 | | | | | 8.3 | | |
| Nicholas Canyon West | Middle | | | 5.0 | | | | | | | |
| Nicholas Canyon West | Outer | | | 13.3 | | | | 3.3 | 1.7 | 1.7 | |
| Point Dume '08 | Middle | | | | | | | | | | |
| Point Dume '07 | Middle | | | | | | | | | | |
| Point Fermin | Inner | | | 52.5 | | | | | | | |
| Point Fermin | Middle | | | 14.2 | | | | | | | |
| Point Fermin | Outer | | | 2.5 | | | | | | | |
| Point Fermin West | Inner | | | 5.8 | | | | 4.2 | | | |
| Point Fermin West | Middle | | | 0.8 | | | | | | | |
| Point Fermin West | Outer | | | 0.8 | | | | | | | |
| Point Vicente | Inner | | | 20.8 | | | | | | | |
| Point Vicente | Middle | | | 0.8 | | | | | | | |
| Point Vicente | Outer | | | 2.5 | | | | | | | |
| Point Vicente East | Inner | | | 2.5 | | | | 6.7 | | | |
| Point Vicente East | Middle | | | 31.7 | | | | 1.7 | 17.5 | | |
| Point Vicente East | Outer | | | 24.2 | | | | 1.7 | 24.2 | | |
| Point Vicente West | Deep | | | 2.5 | | | | 0.8 | | | |
| Point Vicente West | Inner | | | 17.5 | | | | 1.7 | | | |
| Point Vicente West | Middle | | | 10.8 | | | | 1.7 | | | |
| Point Vicente West | Outer | | | 3.3 | | | | 2.5 | | | |
| Resort Point | Deep | | 0.8 | 16.7 | 3.3 | | | 2.5 | 20.8 | | 1.7 |
| Resort Point | Inner | | | 15.0 | 2.5 | | | 1.7 | | | |
| Resort Point | Middle | | | 4.2 | | | | 1.7 | | | |
| Resort Point | Outer | | | 3.3 | | | | | | | |
| Ridges | Deep | | 6.7 | 5.8 | 143.3 | | | 8.3 | 5.0 | | |
| Ridges | Inner | | | | | | | 9.2 | | | |
| Ridges | Middle | | | 4.2 | | | | 11.7 | | | |
| Ridges | Outer | | 1.7 | 0.8 | 32.5 | 5.0 | | 0.8 | | | |
| Ridges North | Deep | | 1.7 | 9.2 | 54.2 | | | 4.2 | 16.7 | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Haliotis corrugata* | *Haliotis rufescens* | *Henricia leviuscula* | *Kelletia kelletii* | *Laminaria farlowii* | *Laminaria setchellii* | *Linckia columbianus* | *Lithopoma undosum* | *Lophogorgia chilensis* | *Loxorhyncus grandis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | 10.8 | | | | 21.7 | | | |
| Ridges North | Middle | | | 1.7 | | | | 11.7 | | | |
| Ridges North | Outer | | 1.7 | 11.7 | 2.5 | | | | | | |
| Ridges South | Deep | | 2.5 | 0.8 | 95.8 | | | | 7.5 | | |
| Ridges South | Inner | | | | | | | 2.5 | | | |
| Ridges South | Middle | | | | | | | 50.0 | | | |
| Ridges South | Outer | | | 1.7 | 25.0 | 3.3 | | 0.8 | | | |
| Rocky Point | Deep | | 2.5 | 5.0 | | | | 3.3 | 2.5 | | |
| Rocky Point | Inner | | | | | | | | | | |
| Rocky Point | Middle | | | | | 120.8 | | 13.3 | | | |
| Rocky Point | Outer | | | | | | 1.7 | 10.0 | | | |
| Rocky Point North | Deep | 10.0 | 6.7 | 4.2 | 34.2 | | | 4.2 | 1.7 | | |
| Rocky Point North | Inner | | | 7.5 | | | | 10.0 | | | |
| Rocky Point North | Middle | | | | | 30.8 | | 7.5 | | | |
| Rocky Point North | Outer | | 2.5 | | 72.5 | 70.0 | | 1.7 | | | |
| Rocky Point South | Deep | | 0.8 | 6.7 | 5.8 | | | 3.3 | 5.0 | | |
| Rocky Point South | Inner | | | 4.2 | | | | | | | |
| Rocky Point South | Middle | | | 2.5 | | | | 17.5 | | | |
| Rocky Point South | Outer | | | 3.3 | | | | 5.8 | | | |
| 3 Palms | Inner | | | | | 4.2 | | | | | |
| 3 Palms | Middle | | | 8.3 | | | | | | | |
| 3 Palms East | Inner | | | | | 105.8 | | 17.5 | | | |
| 3 Palms East | Middle | | | | 8.3 | 28.3 | | | | | |
| 3 Palms East | Outer | | | 2.5 | | | | | | | |
| 3 Palms West | Inner | | | | | 120.0 | | | | | |
| 3 Palms West | Middle | | | 16.7 | | 150.0 | | | | | |
| 3 Palms West | Outer | | | | | 137.5 | | | | | |
| Whites Point | Inner | | | 14.2 | | | | | | 0.8 | |
| Whites Point | Middle | | | 3.3 | | 13.3 | | | | | |
| Whites Point | Outer | | | 13.3 | | 22.5 | | | | | |
| Whites Point West | Inner | | | 14.2 | | | | 5.0 | | | |
| Whites Point West | Middle | | | | | | | | | | |
| Whites Point West | Outer | | | 15.0 | | 2.5 | | | | | 1.7 |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Lytechinus anamesus* | *Macrocystis pyrifera* | *Mastocarpus papillatus* | *Megathura crenulata* | *Mexichromis porterae* | *Muricea californica* | *Muricea fruticosa* | *Norrisia norrisi* | *Octopus bimaculoides* | *Ophioplocus esmarki* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | 51.7 | | | | 135.0 | 6.7 | | | | |
| Bunker Point | Inner | 24.2 | | 6.7 | | | | | | | |
| Bunker Point | Middle | 26.7 | | | | 3.3 | | 1.7 | | 0.8 | |
| Bunker Point | Outer | 35.8 | | | | 55.0 | 4.2 | | | | |
| Deep Hole | Middle | 19.2 | | 3.3 | | 11.7 | 0.8 | | | | |
| Deep Hole | Outer | 5.0 | | 0.8 | | 36.7 | 3.3 | | | | |
| El Matador East | Middle | 25.8 | | | | | | | | | |
| El Matador West | Middle | 16.7 | | 0.8 | | 5.0 | 2.5 | | | 0.8 | |
| Encinal Canyon East | Inner | 22.5 | | | | 2.5 | | | | | |
| Encinal Canyon East | Middle | 15.0 | | | | | | | | | |
| Encinal Canyon West | Inner | 22.5 | | 0.8 | | 26.7 | | | | | |
| Encinal Canyon West | Middle | 15.8 | | | | 61.7 | | | | | |
| Escondido | Inner | 30.0 | | | | 1.7 | 1.7 | | | | |
| Escondido | Middle | 25.8 | | | | 20.8 | 6.7 | | | | |
| Escondido East | Inner | 17.5 | | 0.8 | | 38.3 | 10.0 | | | | |
| Escondido East | Middle | 33.3 | | | | 85.8 | 75.8 | | | | |
| Escondido West | Inner | 21.7 | | | | | | | | | |
| Escondido West | Middle | 60.0 | | | | 39.2 | 13.3 | | | | |
| Flat Rock | Inner | 57.5 | | 0.8 | | | | | | | |
| Flat Rock | Middle | 31.7 | | | | | | | | | |
| Flat Rock | Outer | 21.7 | | | 1.7 | 18.3 | 0.8 | | | | |
| Flat Rock North | Inner | 45.8 | | 1.7 | | | | | | | |
| Flat Rock North | Middle | 34.2 | | | | 9.2 | 2.5 | | | | |
| Flat Rock North | Outer | 28.3 | | | | 52.5 | 1.7 | | | 2.5 | |
| Flat Rock South | Inner | 43.3 | | | | | | | 0.8 | | |
| Flat Rock South | Middle | 26.7 | | | | 26.7 | 1.7 | | | | |
| Leo Carillo | Inner | 15.0 | | 5.0 | | 0.8 | 12.5 | | | | |
| Leo Carillo | Middle | 22.5 | | 2.5 | | 49.2 | 0.8 | | | | |
| Leo Carillo | Outer | 29.2 | | | | 24.2 | 3.3 | | | | |
| Leo Carillo East | Inner | 6.7 | | | | | | | | | |
| Leo Carillo East | Middle | 19.2 | | | | 3.3 | 1.7 | | | | |
| Leo Carillo East | Outer | 20.8 | | | | 6.7 | | | | | |
| Leo Carillo West | Inner | 25.8 | | 9.2 | | 45.8 | 3.3 | | | | |
| Leo Carillo West | Middle | 7.5 | | 1.7 | | 58.3 | 65.0 | | | 1.7 | |
| Little Dume | Inner | 24.2 | | | | 11.7 | 10.0 | | | | |
| Little Dume | Middle | 15.0 | | 1.7 | | 2.5 | | | | | |
| Little Dume | Outer | 32.5 | 2.5 | 9.2 | | 33.3 | 7.5 | | | | |
| Little Dume East | Inner | 13.3 | | | | 65.8 | 25.0 | | | | |
| Little Dume East | Middle | 11.7 | | | | 12.5 | 10.0 | | | | |
| Little Dume East | Outer | 39.2 | | | | 18.3 | 7.5 | | | | |
| Little Dume West | Inner | 15.0 | | | | | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Lytechinus anamesus* | *Macrocystis pyrifera* | *Mastocarpus papillatus* | *Megathura crenulata* | *Mexichromis porterae* | *Muricea californica* | *Muricea fruticosa* | *Norrisia norrisi* | *Octopus bimaculoides* | *Ophioplocus esmarki* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Middle | 29.2 | | 0.8 | | 12.5 | | | | | |
| Little Dume West | Outer | 2.5 | | | | 19.2 | | | | | |
| Long Point East | Inner | 35.8 | | 41.7 | | 0.8 | | | | | |
| Long Point East | Middle | 10.0 | | 8.3 | | 15.0 | 0.8 | | | | |
| Long Point East | Outer | | | 10.0 | | 34.2 | 3.3 | | | | |
| Long Point West | Inner | | | 13.3 | | | | | | | |
| Long Point West | Middle | | | 5.0 | | 14.2 | 1.7 | | | | |
| Nicholas Canyon | Middle | 19.2 | | | | 5.8 | 0.8 | | | | |
| Nicholas Canyon | Outer | 45.0 | | | | 60.8 | 0.8 | | | | |
| Nicholas Canyon East | Middle | 21.7 | | | | 0.8 | 0.8 | | | | |
| Nicholas Canyon East | Outer | 19.2 | | | | 55.8 | 0.8 | | | | |
| Nicholas Canyon West | Middle | 16.7 | | | | 25.0 | | | | | |
| Nicholas Canyon West | Outer | 30.0 | | | | 46.7 | 6.7 | | | | |
| Point Dume '08 | Middle | 6.7 | 0.8 | 8.3 | | 100.0 | 2.5 | | | 0.8 | |
| Point Dume '07 | Middle | 5.0 | | | | 100.8 | | | | | |
| Point Fermin | Inner | 0.8 | | 16.7 | | | 3.3 | | | | |
| Point Fermin | Middle | 10.0 | | 0.8 | | 25.0 | | | | 3.3 | |
| Point Fermin | Outer | | | | | 26.7 | 4.2 | | | | |
| Point Fermin West | Inner | 26.7 | | 5.8 | | | | | | | |
| Point Fermin West | Middle | 30.0 | | 5.8 | | 23.3 | 5.0 | | | | |
| Point Fermin West | Outer | 147.5 | | | | 57.5 | 1.7 | | | | |
| Point Vicente | Inner | 57.5 | | 8.3 | | | | | | | |
| Point Vicente | Middle | 25.8 | | 1.7 | | | | | | | |
| Point Vicente | Outer | 36.7 | | 5.8 | | 0.8 | | | | | |
| Point Vicente East | Inner | | | | | | | | | | |
| Point Vicente East | Middle | | | 0.8 | | 27.5 | 3.3 | | | | |
| Point Vicente East | Outer | 1.7 | | | | 52.5 | 8.3 | | | | |
| Point Vicente West | Deep | | | 2.5 | | 9.2 | 0.8 | | | | |
| Point Vicente West | Inner | 1.7 | | 1.7 | | | | | | | |
| Point Vicente West | Middle | 12.5 | | 4.2 | | 9.2 | 1.7 | | | | |
| Point Vicente West | Outer | | | 3.3 | | 9.2 | | | | | |
| Resort Point | Deep | 11.7 | | | | 26.7 | | | | | 0.8 |
| Resort Point | Inner | 68.3 | | | | | | | 1.7 | | |
| Resort Point | Middle | 94.2 | | | | | | | | | |
| Resort Point | Outer | 130.8 | | 3.3 | | 2.5 | | | | | |
| Ridges | Deep | | | | | 18.3 | 8.3 | | | | |
| Ridges | Inner | 128.3 | | 0.8 | | | | | | | |
| Ridges | Middle | 72.5 | | | | | | | | | |
| Ridges | Outer | 16.7 | | | | 2.5 | 1.7 | | | | |
| Ridges North | Deep | | | | | 50.0 | 0.8 | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Lytechinus anamesus* | *Macrocystis pyrifera* | *Mastocarpus papillatus* | *Megathura crenulata* | *Mexichromis porterae* | *Muricea californica* | *Muricea fruticosa* | *Norrisia norrisi* | *Octopus bimaculoides* | *Ophioplocus esmarki* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | 35.0 | | | | | | 4.2 | | | |
| Ridges North | Middle | 22.5 | | 0.8 | | 3.3 | | | | | |
| Ridges North | Outer | 2.5 | | 3.3 | | 19.2 | | | | | |
| Ridges South | Deep | | | | | 42.5 | 5.0 | | | | |
| Ridges South | Inner | 4.2 | | | | | | | | | |
| Ridges South | Middle | 12.5 | | | | 0.8 | | 0.8 | | | |
| Ridges South | Outer | 40.0 | | | | 1.7 | | | | | |
| Rocky Point | Deep | | | | | 10.0 | | | | | 0.8 |
| Rocky Point | Inner | 101.7 | | | | | | | | | |
| Rocky Point | Middle | 1.7 | | 0.8 | | | | | | | |
| Rocky Point | Outer | 19.2 | | | | 5.0 | | | | | |
| Rocky Point North | Deep | | | | | 3.3 | 2.5 | | | | |
| Rocky Point North | Inner | 41.7 | | 2.5 | | | | | | | |
| Rocky Point North | Middle | | | | | | | | | | |
| Rocky Point North | Outer | | | | | | | | | | |
| Rocky Point South | Deep | | | 0.8 | | 0.8 | | | | | |
| Rocky Point South | Inner | 12.5 | | 6.7 | | | | | | | |
| Rocky Point South | Middle | 23.3 | | | | 1.7 | | | | | |
| Rocky Point South | Outer | 25.0 | | 0.8 | | 0.8 | | | | | |
| 3 Palms | Inner | 50.0 | | | | | | 0.8 | | | |
| 3 Palms | Middle | 20.0 | | 0.8 | | | | 1.7 | | | |
| 3 Palms East | Inner | 5.0 | | 4.2 | | | | | | | |
| 3 Palms East | Middle | 5.8 | | 0.8 | | | | | | | |
| 3 Palms East | Outer | 19.2 | | 0.8 | | 2.5 | | | | | |
| 3 Palms West | Inner | 16.7 | | 9.2 | | | | 5.8 | | | |
| 3 Palms West | Middle | 12.5 | | 5.0 | | | | 3.3 | | | |
| 3 Palms West | Outer | 15.0 | | | | | | | | | |
| Whites Point | Inner | 3.3 | | 2.5 | | | | 2.5 | | | |
| Whites Point | Middle | 13.3 | | | | 69.2 | 1.7 | 0.8 | | | |
| Whites Point | Outer | 20.8 | | | | 25.8 | | | | | |
| Whites Point West | Inner | 31.7 | | 9.2 | | | | | | | |
| Whites Point West | Middle | 34.2 | | | | 0.8 | | | | | |
| Whites Point West | Outer | 37.5 | | 0.8 | | 33.3 | 3.3 | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Orthasterias koehleri* | *Pachycerianthus fimbratus* | *Panulirus interruptus* | *Parapholas californica* | *Parastichopus californicus* | *Parastichopus parvimensis* | *Pisaster brevispinus* | *Pisaster giganteus* | *Polyorchis pencillatus* | *Pterygophora californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | | | | | 20.8 | |
| Bunker Point | Inner | | 0.8 | | | 9.2 | | 26.7 | | 21.7 | |
| Bunker Point | Middle | 1.7 | | | | 4.2 | 1.7 | 11.7 | | 59.2 | |
| Bunker Point | Outer | 5.0 | | | | 9.2 | | 8.3 | | 6.7 | |
| Deep Hole | Middle | | | | | | 2.5 | 22.5 | | 10.0 | |
| Deep Hole | Outer | | | | | 3.3 | | 15.0 | | 10.8 | |
| El Matador East | Middle | 14.2 | | | | 6.7 | 1.7 | 15.8 | | 3.3 | |
| El Matador West | Middle | 1.7 | | | | 11.7 | | 12.5 | | | |
| Encinal Canyon East | Inner | | | | | 0.8 | | 6.7 | | 7.5 | |
| Encinal Canyon East | Middle | | | | | | | 0.8 | 5.0 | 2.5 | |
| Encinal Canyon West | Inner | | 0.8 | | | 1.7 | | 6.7 | | | |
| Encinal Canyon West | Middle | | | | | 4.2 | | 51.7 | | | |
| Escondido | Inner | | | | | | 20.8 | 12.5 | | | |
| Escondido | Middle | 16.7 | | | | | 15.8 | 6.7 | | | |
| Escondido East | Inner | | 0.8 | | | 0.8 | | 8.3 | | 83.3 | |
| Escondido East | Middle | | 0.8 | | | 1.7 | 5.8 | 8.3 | | 1.7 | |
| Escondido West | Inner | | | | | | 13.3 | 3.3 | | 1.7 | |
| Escondido West | Middle | | | | | 2.5 | 13.3 | 16.7 | | 19.2 | |
| Flat Rock | Inner | | | | | | | 7.5 | | | |
| Flat Rock | Middle | | | | | | | 18.3 | | | |
| Flat Rock | Outer | 0.8 | | | | | | 5.0 | | | 0.8 |
| Flat Rock North | Inner | | 1.7 | | | | | 10.8 | | | |
| Flat Rock North | Middle | | | | | | | 5.0 | | | |
| Flat Rock North | Outer | | | | | | | 4.2 | | | |
| Flat Rock South | Inner | | 2.5 | | | | | 2.5 | | 10.0 | |
| Flat Rock South | Middle | 0.8 | | | | 0.8 | 0.8 | 6.7 | | 143.3 | |
| Leo Carillo | Inner | | | | | | | 30.8 | | | |
| Leo Carillo | Middle | | | | 2.5 | | | 11.7 | | | |
| Leo Carillo | Outer | | | | | | | 25.0 | | | |
| Leo Carillo East | Inner | | | | | | | | | 0.8 | |
| Leo Carillo East | Middle | | | | | 0.8 | | 13.3 | | 0.8 | |
| Leo Carillo East | Outer | 1.7 | | | | | | 10.8 | | | |
| Leo Carillo West | Inner | | | | | | | 25.8 | | | |
| Leo Carillo West | Middle | | | | | 1.7 | | 5.8 | | | |
| Little Dume | Inner | | | | | | | 10.8 | | 120.0 | |
| Little Dume | Middle | | | | | | | 6.7 | | 115.8 | |
| Little Dume | Outer | | | | | | 3.3 | 36.7 | | 14.2 | |
| Little Dume East | Inner | | | | | | 0.8 | 2.5 | | 28.3 | |
| Little Dume East | Middle | | | | | 1.7 | | 9.2 | | 97.5 | |
| Little Dume East | Outer | | | | | 2.5 | | 6.7 | | 44.2 | |
| Little Dume West | Inner | | | | | | | 10.0 | | 40.0 | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Orthasterias koehleri* | *Pachycerianthus fimbratus* | *Panulirus interruptus* | *Parapholas californica* | *Parastichopus californicus* | *Parastichopus parvimensis* | *Pisaster brevispinus* | *Pisaster giganteus* | *Polyorchis pencillatus* | *Pterygophora californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Middle | | | | 0.8 | | 0.8 | 13.3 | | 110.0 | |
| Little Dume West | Outer | 50.8 | | 5.8 | | | 16.7 | 0.8 | | | |
| Long Point East | Inner | | 0.8 | | | 5.0 | | 20.0 | | | |
| Long Point East | Middle | | | | | 5.8 | | 24.2 | | | |
| Long Point East | Outer | | | | | | 0.8 | 16.7 | | | |
| Long Point West | Inner | | | | | 1.7 | 0.8 | 28.3 | | | |
| Long Point West | Middle | | | | | | | 22.5 | | | |
| Nicholas Canyon | Middle | | | | | | 0.8 | 17.5 | | 16.7 | |
| Nicholas Canyon | Outer | | | | | | | 11.7 | | 0.8 | |
| Nicholas Canyon East | Middle | 0.8 | | | | 0.8 | | 9.2 | | 4.2 | |
| Nicholas Canyon East | Outer | 4.2 | | | | 5.8 | | 13.3 | | | |
| Nicholas Canyon West | Middle | 0.8 | | | | 0.8 | | 10.8 | | 1.7 | |
| Nicholas Canyon West | Outer | 10.0 | 1.7 | | | 5.0 | 8.3 | 11.7 | | | |
| Point Dume '08 | Middle | | | | | 0.8 | | 11.7 | | | |
| Point Dume '07 | Middle | | | | | 4.2 | | 2.5 | | | |
| Point Fermin | Inner | | | | | 3.3 | | 21.7 | | 71.7 | |
| Point Fermin | Middle | 10.8 | | | 0.8 | 12.5 | 6.7 | 26.7 | | | |
| Point Fermin | Outer | 3.3 | | | | 1.7 | 4.2 | 15.8 | | | |
| Point Fermin West | Inner | | 0.8 | | | | | 6.7 | | 115.8 | |
| Point Fermin West | Middle | | | | | 0.8 | 2.5 | 22.5 | | 57.5 | |
| Point Fermin West | Outer | | | | | | 2.5 | 14.2 | | 31.7 | |
| Point Vicente | Inner | | | | | 3.3 | | 25.0 | | | |
| Point Vicente | Middle | | | | | 1.7 | | 55.8 | | | |
| Point Vicente | Outer | | | | | 32.5 | 0.8 | 129.2 | | | |
| Point Vicente East | Inner | | 0.8 | | | 2.5 | | 10.0 | | | |
| Point Vicente East | Middle | | | | 0.8 | 1.7 | | 33.3 | | | |
| Point Vicente East | Outer | | | | 0.8 | 3.3 | 1.7 | 11.7 | | | |
| Point Vicente West | Deep | | | | | 1.7 | 0.8 | 17.5 | | 0.8 | |
| Point Vicente West | Inner | | | | | 6.7 | | 5.8 | | 0.8 | |
| Point Vicente West | Middle | | | | | 0.8 | 0.8 | 23.3 | | | |
| Point Vicente West | Outer | | | | | 6.7 | | 67.5 | | | |
| Resort Point | Deep | | | | | 2.5 | | 12.5 | | 1.7 | |
| Resort Point | Inner | | | | | | | 13.3 | | | |
| Resort Point | Middle | | | | 0.8 | 0.8 | | 2.5 | | | |
| Resort Point | Outer | | | | | | 1.7 | 15.8 | | 15.0 | |
| Ridges | Deep | | | | | | | 7.5 | | | |
| Ridges | Inner | | 5.8 | | | | | 2.5 | | 85.0 | |
| Ridges | Middle | | 0.8 | | | | | 6.7 | | 150.0 | |
| Ridges | Outer | | | | | | | 5.0 | | 47.5 | |
| Ridges North | Deep | | 2.5 | | | 0.8 | | 4.2 | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Orthasterias koehleri* | *Pachycerianthus fimbratus* | *Panulirus interruptus* | *Parapholas californica* | *Parastichopus californicus* | *Parastichopus parvimensis* | *Pisaster brevispinus* | *Pisaster giganteus* | *Polyorchis pencillatus* | *Pterygophora californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | | | | | 3.3 | | 5.8 | |
| Ridges North | Middle | | | | | | | 20.8 | | 170.0 | |
| Ridges North | Outer | | 0.8 | | | | | 25.0 | | 4.2 | |
| Ridges South | Deep | | | | | | | 3.3 | | | |
| Ridges South | Inner | | | | | | | 12.5 | | 78.3 | |
| Ridges South | Middle | | 1.7 | | | | | 1.7 | | 305.0 | |
| Ridges South | Outer | | | | | | | 0.8 | | 97.5 | |
| Rocky Point | Deep | | | | | 0.8 | | 3.3 | | 100.0 | |
| Rocky Point | Inner | | | | | | | | | 70.0 | |
| Rocky Point | Middle | | | | | 2.5 | | 5.0 | | 15.0 | |
| Rocky Point | Outer | | | | | 0.8 | | 10.8 | | 65.0 | |
| Rocky Point North | Deep | | | | 1.7 | 2.5 | | 2.5 | | | |
| Rocky Point North | Inner | | 3.3 | | | | | | | 52.5 | |
| Rocky Point North | Middle | | | | | | | 0.8 | | 31.7 | |
| Rocky Point North | Outer | | | | | | | 50.8 | | | |
| Rocky Point South | Deep | | | | 0.8 | 5.8 | 0.8 | 4.2 | | | |
| Rocky Point South | Inner | | 0.8 | | | | | | | | |
| Rocky Point South | Middle | | | | | 2.5 | | 3.3 | | 179.2 | |
| Rocky Point South | Outer | | | | | 5.0 | | 0.8 | | 120.0 | |
| 3 Palms | Inner | | 1.7 | | | | | | | 87.5 | |
| 3 Palms | Middle | | | | | 4.2 | 3.3 | 47.5 | | 34.2 | |
| 3 Palms East | Inner | | | | | | | 5.0 | | | |
| 3 Palms East | Middle | | | | | 0.8 | | 7.5 | | 150.0 | |
| 3 Palms East | Outer | | 0.8 | | | 1.7 | 2.5 | 15.0 | | 126.7 | |
| 3 Palms West | Inner | | | | | | | 7.5 | | 101.7 | |
| 3 Palms West | Middle | | 0.8 | | | 7.5 | | 5.8 | | | |
| 3 Palms West | Outer | | | | | | 1.7 | 6.7 | | 56.7 | |
| Whites Point | Inner | | | | | 0.8 | | 9.2 | | 48.3 | |
| Whites Point | Middle | | | | | 1.7 | 2.5 | 5.8 | | 135.0 | |
| Whites Point | Outer | 0.8 | | | | 10.0 | 2.5 | 8.3 | | 11.7 | |
| Whites Point West | Inner | | 3.3 | | | | 10.8 | 15.8 | | 140.0 | |
| Whites Point West | Middle | | 0.8 | | | 0.8 | | 20.8 | | 139.2 | |
| Whites Point West | Outer | | 1.7 | | | | 5.8 | 25.8 | | 130.0 | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Pugettia producta* | *Pugettia richii* | *Pycnopodia helianthoides* | *Sargassum* sp. | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Styela montereyensis* | *Stylaster californicus* | *Stylasterias forreri* | *Stylela monteryensis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | 13.3 | | 100.8 | | | | |
| Bunker Point | Inner | | | 5.8 | 35.0 | 339.2 | | | | | |
| Bunker Point | Middle | | | | 181.7 | 20.8 | | | | | 0.8 |
| Bunker Point | Outer | | | | 12.5 | | | | | 0.8 | 7.5 |
| Deep Hole | Middle | | | | 48.3 | 135.0 | 0.8 | | | | 5.0 |
| Deep Hole | Outer | | 0.8 | | 126.7 | 138.3 | 8.3 | | | | 5.8 |
| El Matador East | Middle | | | | 60.0 | 15.8 | | | | 38.3 | 0.8 |
| El Matador West | Middle | | | | 30.8 | 65.0 | | | | 35.0 | 6.7 |
| Encinal Canyon East | Inner | | | | 9.2 | 3.3 | | | | 150.0 | |
| Encinal Canyon East | Middle | | | | | | | | | 23.3 | |
| Encinal Canyon West | Inner | | | | | 5.8 | | | | 50.0 | |
| Encinal Canyon West | Middle | | | | 3.3 | 2.5 | | | | 50.8 | 3.3 |
| Escondido | Inner | | | | 25.0 | 15.8 | 7.5 | | | | 3.3 |
| Escondido | Middle | | | | 0.8 | 2.5 | 4.2 | | | | 0.8 |
| Escondido East | Inner | | | | 18.3 | 31.7 | | | | 57.5 | |
| Escondido East | Middle | | | | 61.7 | 29.2 | | | | 20.8 | 8.3 |
| Escondido West | Inner | | | | | 45.8 | | | | 1.7 | 2.5 |
| Escondido West | Middle | | | | 35.8 | 44.2 | | | | 48.3 | 5.0 |
| Flat Rock | Inner | | | | 10.0 | 5.0 | | | | | |
| Flat Rock | Middle | | | | 28.3 | 1.7 | | | | | |
| Flat Rock | Outer | | | | 6.7 | | | | | | 15.8 |
| Flat Rock North | Inner | | | | 18.3 | 42.5 | | | | | |
| Flat Rock North | Middle | | | | 3.3 | 0.8 | | 0.8 | | | |
| Flat Rock North | Outer | | | | 7.5 | | | 2.5 | | | 20.8 |
| Flat Rock South | Inner | | | 4.2 | 46.7 | 27.5 | | | | | 0.8 |
| Flat Rock South | Middle | | | | 11.7 | 1.7 | | | | | |
| Leo Carillo | Inner | | | | 48.3 | 111.7 | 88.3 | | | | |
| Leo Carillo | Middle | | | | 53.3 | 84.2 | 44.2 | | | | 3.3 |
| Leo Carillo | Outer | | | | 113.3 | 105.8 | 3.3 | | | | 20.0 |
| Leo Carillo East | Inner | | | 0.8 | | | | | | 5.8 | |
| Leo Carillo East | Middle | | | | 95.0 | 95.0 | | | | 13.3 | |
| Leo Carillo East | Outer | | | | 58.3 | 23.3 | | | | 2.5 | 11.7 |
| Leo Carillo West | Inner | | | | 33.3 | 90.8 | | | | 75.0 | 5.0 |
| Leo Carillo West | Middle | | | | 41.7 | 33.3 | | | | 36.7 | 7.5 |
| Little Dume | Inner | | | | 31.7 | 51.7 | 96.7 | | | | |
| Little Dume | Middle | | | | 6.7 | 0.8 | 30.8 | | | | |
| Little Dume | Outer | | | | 101.7 | 0.8 | 8.3 | | | | 1.7 |
| Little Dume East | Inner | | | | 49.2 | 23.3 | | | | 46.7 | |
| Little Dume East | Middle | | | | 55.0 | 19.2 | | | | 105.8 | |
| Little Dume East | Outer | | | | 15.8 | | | | | 15.8 | 1.7 |
| Little Dume West | Inner | | | | 0.8 | 8.3 | | | | 5.0 | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Pugettia producta* | *Pugettia richii* | *Pycnopodia helianthoides* | *Sargassum* sp. | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Styela montereyensis* | *Stylaster californicus* | *Stylasterias forreri* | *Stylela monteryensis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Middle | | | | 51.7 | 10.8 | | | | 116.7 | |
| Little Dume West | Outer | | 1.7 | | 12.5 | | | | | 3.3 | 0.8 |
| Long Point East | Inner | | | 15.0 | 145.8 | 134.2 | | | | | 0.8 |
| Long Point East | Middle | | | | 109.2 | 81.7 | | | | | 22.5 |
| Long Point East | Outer | | | | 50.0 | 41.7 | | | | | 20.8 |
| Long Point West | Inner | | | | 115.8 | 150.0 | | | | | |
| Long Point West | Middle | | 1.7 | | 50.0 | 50.0 | | | | | 1.7 |
| Nicholas Canyon | Middle | 0.8 | | | 2.5 | 3.3 | 27.5 | | | | 2.5 |
| Nicholas Canyon | Outer | | | | 100.0 | 78.3 | 10.8 | | | | 6.7 |
| Nicholas Canyon East | Middle | | | | 110.0 | 51.7 | | | | 5.8 | 15.8 |
| Nicholas Canyon East | Outer | | | | 55.0 | 20.8 | | | | 10.8 | 27.5 |
| Nicholas Canyon West | Middle | | | | 51.7 | 61.7 | | | | 4.2 | 9.2 |
| Nicholas Canyon West | Outer | | | | 118.3 | 18.3 | | | | 1.7 | 28.3 |
| Point Dume '08 | Middle | | | | 102.5 | 125.0 | 7.5 | | | | |
| Point Dume '07 | Middle | | | 18.3 | 92.5 | 91.7 | | | | 2.5 | |
| Point Fermin | Inner | | | | 50.0 | 116.7 | | | | 1.7 | |
| Point Fermin | Middle | | | | 2.5 | 7.5 | | | | | 20.8 |
| Point Fermin | Outer | | | | 13.3 | | | | | | 10.0 |
| Point Fermin West | Inner | | | | 5.0 | 59.2 | | | | | |
| Point Fermin West | Middle | | | | 45.8 | 21.7 | 0.8 | | | | |
| Point Fermin West | Outer | | | | 65.8 | 10.8 | | | | | 1.7 |
| Point Vicente | Inner | | | | 30.0 | 1066.7 | | | | | |
| Point Vicente | Middle | | 0.8 | | 52.5 | 362.5 | | | | | |
| Point Vicente | Outer | | | | 132.5 | 90.8 | | | | | |
| Point Vicente East | Inner | | | | 16.7 | 741.7 | | | | | |
| Point Vicente East | Middle | | 0.8 | | 90.8 | 56.7 | | | | | 49.2 |
| Point Vicente East | Outer | | | | 44.2 | 78.3 | | | | | 55.0 |
| Point Vicente West | Deep | | 1.7 | | 81.7 | 63.3 | | | 0.8 | | 4.2 |
| Point Vicente West | Inner | | 0.8 | 15.8 | 25.8 | 185.0 | | | | | |
| Point Vicente West | Middle | | 0.8 | | 35.8 | 804.2 | | | | | 11.7 |
| Point Vicente West | Outer | | | | 60.8 | 79.2 | | | | | 2.5 |
| Resort Point | Deep | | | | 16.7 | 1.7 | 0.8 | | | | 16.7 |
| Resort Point | Inner | | | | 72.5 | 150.0 | | | | | |
| Resort Point | Middle | | | | 64.2 | 53.3 | | | | | |
| Resort Point | Outer | | | | 9.2 | 8.3 | | | | | 2.5 |
| Ridges | Deep | | | | 3.3 | | | | | | 6.7 |
| Ridges | Inner | | | | 28.3 | 62.5 | | | | | |
| Ridges | Middle | | | | 28.3 | 15.0 | | | | | |
| Ridges | Outer | | | | 10.8 | 0.8 | | | | | |
| Ridges North | Deep | | | | 8.3 | | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Pugettia producta* | *Pugettia richii* | *Pycnopodia helianthoides* | *Sargassum* sp. | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Styela montereyensis* | *Stylaster californicus* | *Stylasterias forreri* | *Stylela monteryensis* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | | 11.7 | 43.3 | | | | | |
| Ridges North | Middle | | | | 43.3 | | | | | | |
| Ridges North | Outer | | | | 21.7 | | | | | | 1.7 |
| Ridges South | Deep | | | | | | | | | | 5.0 |
| Ridges South | Inner | | | | 29.2 | 32.5 | | | | | |
| Ridges South | Middle | | | | 28.3 | 0.8 | | | | | |
| Ridges South | Outer | | | | 3.3 | 0.8 | | | | 0.8 | |
| Rocky Point | Deep | | | | 2.5 | 0.8 | | | | | 0.8 |
| Rocky Point | Inner | | | 8.3 | 5.0 | 11.7 | | | | | |
| Rocky Point | Middle | | | | 37.5 | 15.8 | | | | | |
| Rocky Point | Outer | | | | 5.0 | | | | | | 23.3 |
| Rocky Point North | Deep | | | | | | | | | | |
| Rocky Point North | Inner | | | | 3.3 | 72.5 | | | | | |
| Rocky Point North | Middle | | | | | | | | | | 3.3 |
| Rocky Point North | Outer | | | | | | | | | | 9.2 |
| Rocky Point South | Deep | | | | 2.5 | | | | | | 1.7 |
| Rocky Point South | Inner | | | 3.3 | 8.3 | 111.7 | | | | | |
| Rocky Point South | Middle | | | | 34.2 | 29.2 | | | | | |
| Rocky Point South | Outer | | | | 4.2 | 2.5 | | | | | 1.7 |
| 3 Palms | Inner | | | | 0.8 | 27.5 | | | | | |
| 3 Palms | Middle | | | | 115.8 | 0.8 | | | | | 0.8 |
| 3 Palms East | Inner | | | | 39.2 | 19.2 | | | | | |
| 3 Palms East | Middle | | | | | 6.7 | | | | | 1.7 |
| 3 Palms East | Outer | | | | 10.8 | 8.3 | | | | 0.8 | 0.8 |
| 3 Palms West | Inner | | | | 5.0 | 15.0 | | | | | |
| 3 Palms West | Middle | | | | 55.8 | 38.3 | | | | | 1.7 |
| 3 Palms West | Outer | | | | 2.5 | 0.8 | | | | | |
| Whites Point | Inner | | | | 4.2 | 50.8 | | | | 1.7 | |
| Whites Point | Middle | | | | | 5.0 | | | | 11.7 | 10.8 |
| Whites Point | Outer | | | | | | | | | 0.8 | 9.2 |
| Whites Point West | Inner | | | | 10.0 | 32.5 | | | | | |
| Whites Point West | Middle | | | | 55.8 | 36.7 | 0.8 | | | | |
| Whites Point West | Outer | | | | 6.7 | 1.7 | 1.7 | | | | 5.8 |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Tethya aurantia* | *Toxadocia* sp. | *Undaria pinnatifida* | *Urticina lofotensis* | *Pisaster ochraceus* | *Peltodoris nobilis* | *Urticina mcpeaki* | *Pandalus gurneyi* | *Doris montereyensis* |
|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | 0.8 | | | | | |
| Bunker Point | Inner | | | | 4.2 | | | | | |
| Bunker Point | Middle | | | 3.3 | | | | | | |
| Bunker Point | Outer | | | | 4.2 | 2.5 | | | | |
| Deep Hole | Middle | | | | | | | | | |
| Deep Hole | Outer | | | | | | | | | |
| El Matador East | Middle | | | | | | | | | |
| El Matador West | Middle | | | | | | | | | |
| Encinal Canyon East | Inner | | | | 0.8 | | | | | |
| Encinal Canyon East | Middle | | | | | | | | | |
| Encinal Canyon West | Inner | | | | | | | | | |
| Encinal Canyon West | Middle | | | | | | | | | |
| Escondido | Inner | | | | | | | | | |
| Escondido | Middle | | | | | | | | | |
| Escondido East | Inner | | | | | | | | | |
| Escondido East | Middle | | | | | | | | | |
| Escondido West | Inner | | | | | | | | | |
| Escondido West | Middle | | | | | | | | | |
| Flat Rock | Inner | | | | | | | | | |
| Flat Rock | Middle | | | | | | | | | |
| Flat Rock | Outer | 1.7 | | | | 4.2 | | | | |
| Flat Rock North | Inner | | | | | | | | | |
| Flat Rock North | Middle | | | | | | | | | |
| Flat Rock North | Outer | | | | | | | | | |
| Flat Rock South | Inner | | | | 2.5 | | | | | |
| Flat Rock South | Middle | | | | | | | | | |
| Leo Carillo | Inner | | | | 4.2 | | | | | |
| Leo Carillo | Middle | | | | | | | | | |
| Leo Carillo | Outer | | | | | | | | | |
| Leo Carillo East | Inner | | | | | | | | | |
| Leo Carillo East | Middle | | | | | | | | | |
| Leo Carillo East | Outer | | | | | | | | | |
| Leo Carillo West | Inner | | | | 2.5 | | | | | |
| Leo Carillo West | Middle | | | | | | | | | |
| Little Dume | Inner | | | | 50.0 | | | | | |
| Little Dume | Middle | | | | | | | | | |
| Little Dume | Outer | | | | | | | | | |
| Little Dume East | Inner | | | | 0.8 | | | | | |
| Little Dume East | Middle | | | | | | | | | |
| Little Dume East | Outer | | | | 0.8 | | | | | |
| Little Dume West | Inner | | | | 5.0 | | | | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Tethya aurantia* | *Toxadocia* sp. | *Undaria pinnatifida* | *Urticina lofotensis* | *Pisaster ochraceus* | *Peltodoris nobilis* | *Urticina mcpeaki* | *Pandalus gurneyi* | *Doris montereyensis* |
|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume West | Middle | | | | | | | | | |
| Little Dume West | Outer | | | | | | | | | |
| Long Point East | Inner | | | | 35.8 | | | | | |
| Long Point East | Middle | | | | 12.5 | | | | | |
| Long Point East | Outer | | | | 0.8 | | | | | |
| Long Point West | Inner | | | | 32.5 | | | | | |
| Long Point West | Middle | | | | 4.2 | | | | | |
| Nicholas Canyon | Middle | | | | | | | | | |
| Nicholas Canyon | Outer | | | | | | | | | |
| Nicholas Canyon East | Middle | | | | | | | | | |
| Nicholas Canyon East | Outer | | | | | | | | | |
| Nicholas Canyon West | Middle | | | | | 1.7 | | | | |
| Nicholas Canyon West | Outer | | | | | 1.7 | | | | |
| Point Dume '08 | Middle | | | | 25.8 | | | | | |
| Point Dume '07 | Middle | | | | | | | | | |
| Point Fermin | Inner | | | | 31.7 | | | | | |
| Point Fermin | Middle | | | | 1.7 | | | | | |
| Point Fermin | Outer | | | | | | | | | |
| Point Fermin West | Inner | | | | 1.7 | | | | | |
| Point Fermin West | Middle | | | | 2.5 | | | | | |
| Point Fermin West | Outer | | | | | | | | | |
| Point Vicente | Inner | | | | 37.5 | | | | | |
| Point Vicente | Middle | | | | 18.3 | | | | | |
| Point Vicente | Outer | | | | 6.7 | | | | | |
| Point Vicente East | Inner | | | | 29.2 | | | | | |
| Point Vicente East | Middle | | | | 7.5 | | | | | |
| Point Vicente East | Outer | | | | 1.7 | | | | | |
| Point Vicente West | Deep | | | | 5.8 | | 1.7 | | | |
| Point Vicente West | Inner | | | | 27.5 | | | | | |
| Point Vicente West | Middle | | | | 7.5 | | | | | |
| Point Vicente West | Outer | | | | 4.2 | | | | | |
| Resort Point | Deep | | | | | 0.8 | | | | |
| Resort Point | Inner | | | | 6.7 | | | | | |
| Resort Point | Middle | | | | 2.5 | | | | | |
| Resort Point | Outer | | | | 0.8 | | | | | |
| Ridges | Deep | | | | | 0.8 | | | | |
| Ridges | Inner | | | | | | | | | |
| Ridges | Middle | | | | | | | | | |
| Ridges | Outer | | | | | | | | | |
| Ridges North | Deep | | | | | | | 0.8 | | |

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Appendix VII. Invertebrate and algal densities.

| Station | Zone | *Tethya aurantia* | *Toxadocia* sp. | *Undaria pinnatifida* | *Urticina lofotensis* | *Pisaster ochraceus* | *Peltodoris nobilis* | *Urticina mcpeaki* | *Pandalus gurneyi* | *Doris montereyensis* |
|---|---|---|---|---|---|---|---|---|---|---|
| Ridges North | Inner | | | | 0.8 | | | | | |
| Ridges North | Outer | | | | | | | | | |
| Ridges South | Deep | | | | | | | | | |
| Ridges South | Inner | | | | 1.7 | | | | | |
| Ridges South | Middle | | | | | | | | | |
| Ridges South | Outer | | | | | | | | | |
| Rocky Point | Deep | | | | | | | | | |
| Rocky Point | Inner | | | | | | | | | |
| Rocky Point | Middle | | | | | | | | | |
| Rocky Point | Outer | | 92.5 | | | | | | | |
| Rocky Point North | Deep | | 39.2 | | | | | | 7.5 | |
| Rocky Point North | Inner | | | | | | | | | |
| Rocky Point North | Middle | | | | | | | | | |
| Rocky Point North | Outer | | | | | | | | | 7.5 |
| Rocky Point South | Deep | | 2.5 | | | | | | | |
| Rocky Point South | Inner | | | | | | | | | |
| Rocky Point South | Middle | | | | | | | | | |
| Rocky Point South | Outer | | | | | | | | | |
| 3 Palms | Inner | | | | | | | | | |
| 3 Palms | Middle | | | | 2.5 | | | | | |
| 3 Palms East | Inner | | | | 3.3 | | | | | |
| 3 Palms East | Middle | | | | | | | | | |
| 3 Palms East | Outer | | | | 0.8 | | | | | |
| 3 Palms West | Inner | | | | | | | | | |
| 3 Palms West | Middle | | | | 1.7 | | | | | |
| 3 Palms West | Outer | | | | | | | | | |
| Whites Point | Inner | | | | 26.7 | | | | | |
| Whites Point | Middle | | | | 4.2 | | | | | |
| Whites Point | Outer | | | | | | | | | |
| Whites Point West | Inner | | | | 0.8 | | | | | |
| Whites Point West | Middle | | | | 0.8 | | | | | |
| Whites Point West | Outer | | | | | | | | | |

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Appendix VIII. UPC % cover by depth zone in Santa Monica Bay, 2007-2008.

| Station | Zone | Brown algae | Coralline algae -Crustose | Coralline algae -Erect/Articulated | *Cystoseira osmundacea* | *Egregia menziesii* | *Eisenia arborea* | Green algae | Laminariales holdfast (alive) | *Macrocystis* holdfast (alive) | Other holdfast | *Phyllospadix* sp | *Pterygophora* holdfast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | 2% | | | 3% | | | 2% | | | 2% |
| Bunker Point | Inner | 3% | 16% | | | | | | | 2% | | | 5% |
| Bunker Point | Middle | 3% | 11% | | | | | | | 3% | 5% | | |
| Bunker Point | Outer | 13% | 10% | | | | | | 2% | 5% | | | |
| Deep Hole | Middle | 10% | 37% | 2% | | | | | | 3% | | | |
| Deep Hole | Outer | | 55% | | | | | | | 2% | | | 2% |
| El Matador East | Middle | 6% | 5% | 3% | | | | | | 11% | | | |
| El Matador West | Middle | | | 8% | | | | | | 11% | | | |
| Encinal Canyon East | Inner | 2% | | 3% | | | | 3% | | 2% | | | |
| Encinal Canyon East | Middle | | | | | | | | | 2% | | | |
| Encinal Canyon West | Inner | 6% | | 11% | | | | | | 5% | | | |
| Encinal Canyon West | Middle | | | | | | | | 6% | 11% | | | |
| Escondido | Inner | | | | | | | | | 13% | | | |
| Escondido | Middle | | 6% | 2% | | | | | | 24% | | | |
| Escondido East | Inner | | 2% | 6% | | | | | | 2% | | | |
| Escondido East | Middle | | 2% | | | | | | | 5% | | | |
| Escondido West | Inner | | | | | | | | | 6% | | | |
| Escondido West | Middle | | | | | | | | | | | | |
| Flat Rock | Inner | 16% | 31% | 31% | | | | | | | | | |
| Flat Rock | Middle | | 13% | | | | | | | 11% | | | |
| Flat Rock | Outer | 2% | | 5% | | | | | | 8% | | | 2% |
| Flat Rock North | Inner | 19% | 50% | | | | | | | 5% | | | |
| Flat Rock North | Middle | 3% | 10% | 11% | | | | 2% | | 5% | | | |
| Flat Rock North | Outer | | 5% | | | | | | | 3% | 3% | | |
| Flat Rock South | Inner | 6% | 6% | 3% | | | | | | 15% | | | 5% |
| Flat Rock South | Middle | 2% | 18% | 27% | | | | | | 6% | | | 6% |
| Lead Better Beach | Inner | 19% | 8% | | | | | | 2% | 5% | | | |
| Lead Better Beach | Middle | | 11% | | | | | | 15% | 6% | | | 2% |
| Leo Carillo | Inner | 11% | 13% | 10% | 3% | | | | | 8% | | | |
| Leo Carillo | Middle | | 8% | | | | | | | 8% | | 3% | |
| Leo Carillo | Outer | | 3% | | | | | | | 10% | | | |
| Leo Carillo East | Inner | 3% | | | | | | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Brown algae | Coralline algae -Crustose | Coralline algae -Erect/Articulated | *Cystoseira osmundacea* | *Egregia menziesii* | *Eisenia arborea* | Green algae | Laminariales holdfast (alive) | Macrocystis holdfast (alive) | Other holdfast | *Phyllospadix* sp | *Pterygophora* holdfast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Leo Carillo East | Middle | | 6% | | | | | | | 3% | | | |
| Leo Carillo East | Outer | | | | | | | | | 10% | | | |
| Leo Carillo West | Inner | | 11% | | | | | | | 2% | | | |
| Leo Carillo West | Middle | | | | | | | | | 2% | | | |
| Little Dume | Inner | 2% | 2% | 5% | | | | | 3% | 11% | | | 5% |
| Little Dume | Middle | | 10% | 13% | | | | | | 8% | | | 11% |
| Little Dume | Outer | 26% | 18% | | | 5% | | | | | | | |
| Little Dume East | Inner | 8% | 5% | 3% | | | | 3% | | 10% | | | |
| Little Dume East | Middle | | 5% | | | | | | | 5% | 2% | | |
| Little Dume East | Outer | 3% | 21% | | | | | | | 8% | 2% | | 2% |
| Little Dume West | Inner | 10% | 8% | 3% | 11% | 3% | | | | 5% | | | |
| Little Dume West | Middle | 3% | 2% | | | | | | | 3% | | | |
| Little Dume West | Outer | | 53% | | | | | | | | | | |
| Long Point East | Inner | 3% | 40% | 2% | 2% | | | | | 3% | 2% | | |
| Long Point East | Middle | | 45% | 3% | | | | | | | | | |
| Long Point East | Outer | | 32% | | | | | | | | | | |
| Long Point West | Inner | 2% | 50% | 3% | | | | | | | | | |
| Long Point West | Middle | | 35% | | | | | | | | | | |
| Nicholas Canyon | Middle | 2% | | 5% | 2% | | | | | 5% | | | |
| Nicholas Canyon | Outer | | 6% | | | | | | | 15% | | | |
| Nicholas Canyon East | Middle | 2% | 3% | | | | | | | 5% | | | |
| Nicholas Canyon East | Outer | | 15% | | | | | | | 6% | | | |
| Nicholas Canyon West | Middle | | | | | | | | | 8% | | | |
| Nicholas Canyon West | Outer | | 2% | 2% | | | | | | 6% | | | |
| Point Dume '08 | Middle | 37% | 18% | | | | | | | 3% | | | 3% |
| Point Dume '07 | Middle | 2% | | | | | | 16% | | 5% | | | |
| Point Fermin | Inner | 2% | 11% | 3% | 5% | | | | | 2% | | | 2% |
| Point Fermin | Middle | | 13% | | | | | | | | | | |
| Point Fermin | Outer | | 15% | | | | | | | | | | |
| Point Fermin West | Inner | | 2% | 42% | 19% | 3% | | | | 6% | | | 11% |
| Point Fermin West | Middle | | | | | | | | 3% | 16% | | | |
| Point Fermin West | Outer | 2% | 11% | | | | | | | 13% | | | 18% |
| Point Vicente | Inner | | 42% | 2% | | | | | | 15% | | | |
| Point Vicente | Middle | 6% | 5% | 10% | | | | 6% | | | | | 5% |
| Point Vicente | Outer | | 15% | 2% | | | | | | 2% | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Brown algae | Coralline algae -Crustose | Coralline algae -Erect/Articulated | *Cystoseira osmundacea* | *Egregia menziesii* | *Eisenia arborea* | Green algae | Laminariales holdfast (alive) | Macrocystis holdfast (alive) | Other holdfast | *Phyllospadix* sp | *Pterygophora* holdfast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point Vicente East | Inner | | 58% | | | | | | | | | | |
| Point Vicente East | Middle | 5% | 32% | | | | | | | | | | |
| Point Vicente East | Outer | 2% | 21% | | | | | | | | | | |
| Point Vicente West | Deep | 2% | 44% | | | | | | | | | | |
| Point Vicente West | Inner | 3% | 24% | 2% | 3% | | | | | 15% | | | |
| Point Vicente West | Middle | 2% | 31% | | | | | | | | | | |
| Point Vicente West | Outer | | 47% | | | | | | | | | | |
| Resort Point | Deep | 5% | 6% | 15% | | | | | | 5% | | | |
| Resort Point | Inner | 3% | 52% | 10% | | | | | | | | | |
| Resort Point | Middle | | 37% | 5% | 2% | | | | | 32% | | | |
| Resort Point | Outer | 10% | 2% | 16% | | | | 2% | | 18% | 5% | | 2% |
| Ridges | Deep | 2% | 31% | 6% | | | | | 8% | | | | |
| Ridges | Inner | 8% | 32% | 19% | | | | | | 6% | 2% | | 3% |
| Ridges | Middle | | 18% | 24% | 3% | | | | | 6% | | | 29% |
| Ridges | Outer | 5% | 8% | 6% | | | | | | 3% | | | 3% |
| Ridges North | Deep | 6% | | 15% | | | | | | | | | |
| Ridges North | Inner | 10% | 47% | 26% | | | | | | | | | |
| Ridges North | Middle | 8% | 15% | | | | | | | 11% | | | 10% |
| Ridges North | Outer | 21% | 10% | 19% | | | | | | | | | 2% |
| Ridges South | Deep | 2% | | 31% | | | | | | | | | |
| Ridges South | Inner | 13% | 5% | 16% | | | | | | 3% | | | 10% |
| Ridges South | Middle | | 13% | 26% | | | | | | 5% | | | 24% |
| Ridges South | Outer | | | 8% | | | | | | | | | |
| Rocky Point | Deep | 3% | 2% | 23% | | | | | | | | | 2% |
| Rocky Point | Inner | 16% | 5% | 15% | | | | | | 5% | | | 8% |
| Rocky Point | Middle | 11% | | 13% | | | | | | 2% | | | 11% |
| Rocky Point | Outer | 2% | 31% | 2% | | | | | | 2% | | | |
| Rocky Point North | Deep | 3% | 5% | 6% | | | | | | | | | 2% |
| Rocky Point North | Inner | 5% | | 16% | 2% | | | 3% | | 2% | | | 2% |
| Rocky Point North | Middle | 3% | 8% | | | | | | | 6% | 26% | | |
| Rocky Point North | Outer | 6% | 10% | 10% | | | | | | 2% | 10% | | |
| Rocky Point South | Deep | | 8% | 13% | | | | 6% | | | | | |
| Rocky Point South | Inner | 15% | 32% | 29% | | | | | | 3% | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Brown algae | Coralline algae -Crustose | Coralline algae -Erect/Articulated | Cystoseira osmundacea | Egregia menziesii | Eisenia arborea | Green algae | Laminariales holdfast (alive) | Macrocystis holdfast (alive) | Other holdfast | Phyllospadix sp | Pterygophora holdfast |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rocky Point South | Middle | 2% | 31% | 18% | | | | | | | | | 29% |
| Rocky Point South | Outer | | 34% | 5% | | | | | | 5% | | | 3% |
| 3 Palms | Inner | 2% | 5% | 19% | 18% | 3% | | | 5% | 11% | | | 6% |
| 3 Palms | Middle | 11% | 11% | 8% | | | | | | 5% | | | |
| 3 Palms East | Inner | | 10% | 10% | 5% | 2% | | | | 3% | | | 3% |
| 3 Palms East | Middle | | 6% | 10% | 3% | | | | | 5% | | | 6% |
| 3 Palms East | Outer | 10% | 10% | 24% | | | | | | 3% | | | 6% |
| 3 Palms West | Inner | 2% | 16% | | 19% | | | | | 6% | | | 2% |
| 3 Palms West | Middle | 2% | | 15% | 2% | | | 3% | | 8% | | | |
| 3 Palms West | Outer | | 3% | | | | | | | 10% | 6% | | |
| Whites Point | Inner | 3% | 5% | 5% | 2% | | | | | | | | 3% |
| Whites Point | Middle | 8% | 8% | 3% | | | | | | | | | 3% |
| Whites Point | Outer | 2% | 13% | | | | | | | | | | |
| Whites Point West | Inner | | 5% | 21% | 15% | | | | | 6% | | | 11% |
| Whites Point West | Middle | 8% | 10% | 5% | 3% | | | | | 2% | | | 13% |
| Whites Point West | Outer | 13% | 31% | 5% | 8% | | | | | 3% | | | 3% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Red algae -Erect | Red algae -Turf | *Sargassum* sp | Anemone | *Anthopleura elegantissima* | *Anthopleura sola* | *Asterina miniata* | Barnacle | Brittlestars | Bryozoan | *Centrostephanus coronatus* | *Chaceia ovoidea* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | 15% | 3% | | | | | | | | 5% | | |
| Bunker Point | Inner | 26% | 15% | | 2% | | | | | | 6% | | |
| Bunker Point | Middle | 11% | 15% | | 2% | | | | | | 10% | | |
| Bunker Point | Outer | 8% | 10% | | | | | | | | | | |
| Deep Hole | Middle | | | | | | | | | | | | |
| Deep Hole | Outer | | | | | | | | | | | | |
| El Matador East | Middle | 15% | 15% | | 2% | | | | | | 10% | | |
| El Matador West | Middle | | 2% | | | | | | | | 3% | | |
| Encinal Canyon East | Inner | 18% | | | 3% | | | | | | 8% | | |
| Encinal Canyon East | Middle | 3% | 3% | | 3% | | | 2% | | | | | |
| Encinal Canyon West | Inner | 11% | | | 2% | | | | | | 2% | | |
| Encinal Canyon West | Middle | 13% | 8% | | | | | | | | 16% | | |
| Escondido | Inner | 2% | 37% | | | | | | | | 8% | | |
| Escondido | Middle | | | | | | 2% | | | | | | |
| Escondido East | Inner | 19% | 10% | | | | | | | | 3% | | |
| Escondido East | Middle | 11% | 21% | | | | | | | | 11% | | |
| Escondido West | Inner | 10% | 15% | | | | | | | | | | |
| Escondido West | Middle | 10% | 15% | | 3% | | | | | | | | |
| Flat Rock | Inner | 6% | | | | | | | | | | | |
| Flat Rock | Middle | 26% | | | | | | | | | | | |
| Flat Rock | Outer | 11% | 2% | | | | | | | | 3% | | |
| Flat Rock North | Inner | 5% | | | | | | | | | | | |
| Flat Rock North | Middle | 10% | 3% | | | | | | | | 2% | | |
| Flat Rock North | Outer | 23% | | | | | | | | | | | |
| Flat Rock South | Inner | 13% | 19% | | | | | | | | | | |
| Flat Rock South | Middle | 3% | 5% | | | | | | 2% | | | | |
| Lead Better Beach | Inner | 10% | | | | | | | | | 3% | | |
| Lead Better Beach | Middle | 10% | | | | | | | | | | | |
| Leo Carillo | Inner | 10% | 3% | | | | | | | | | | |
| Leo Carillo | Middle | 5% | 6% | | | | | | | | 8% | | |
| Leo Carillo | Outer | 6% | 13% | | | | | | | | 5% | | |
| Leo Carillo East | Inner | | 81% | | | | | | | | 6% | | |
| Leo Carillo East | Middle | 2% | 32% | | 2% | | | | | | 3% | | |
| Leo Carillo East | Outer | 3% | | | 5% | | | | | | 3% | | |
| Leo Carillo West | Inner | 10% | 26% | | | | | | | | | | |
| Leo Carillo West | Middle | | 2% | | | | | | | | 5% | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Red algae -Erect | Red algae -Turf | *Sargassum* sp | Anemone | *Anthopleura elegantissima* | *Anthopleura sola* | *Asterina miniata* | Barnacle | Brittlestars | Bryozoan | *Centrostephanus coronatus* | *Chaceia ovoidea* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume | Inner | 8% | 5% | | | | | | | | | | |
| Little Dume | Middle | | 10% | | | | | | | | | | 5% |
| Little Dume | Outer | 16% | | | | | | | | | | | 2% |
| Little Dume East | Inner | 15% | 10% | | 5% | | | | | | 3% | | |
| Little Dume East | Middle | 8% | 11% | | 5% | | | | | | 2% | | |
| Little Dume East | Outer | 3% | 19% | | 2% | | | | | | | | |
| Little Dume West | Inner | 10% | 5% | | | | | | | | | | 2% |
| Little Dume West | Middle | 10% | 13% | | 5% | | | | | | 5% | | |
| Little Dume West | Outer | | 10% | | | | | | | | | | |
| Long Point East | Inner | 2% | 21% | | | | | | | | 2% | | 5% |
| Long Point East | Middle | 2% | 31% | | | | | | | | | | 5% |
| Long Point East | Outer | 5% | 19% | | | | | | | | 2% | | |
| Long Point West | Inner | 2% | 3% | | 6% | | | | | | 2% | | 3% |
| Long Point West | Middle | 3% | 10% | | 2% | | | | | | | | |
| Nicholas Canyon | Middle | 8% | 35% | | | | | | | | | | |
| Nicholas Canyon | Outer | | 3% | | | | | | | | | | |
| Nicholas Canyon East | Middle | 5% | 6% | | | | | 5% | | | | | |
| Nicholas Canyon East | Outer | 8% | | | | | | 5% | | | | | |
| Nicholas Canyon West | Middle | 5% | 26% | | 2% | | | | | | 6% | | |
| Nicholas Canyon West | Outer | 3% | 19% | | | | | | | | 15% | | |
| Point Dume '08 | Middle | | | | | | | | | | | | 3% |
| Point Dume '07 | Middle | 24% | | | | | | | 2% | | | | |
| Point Fermin | Inner | 11% | 44% | | 2% | | | | | | 6% | | |
| Point Fermin | Middle | | 37% | | 2% | | | | | | | | |
| Point Fermin | Outer | | | | | | | | | | | | |
| Point Fermin West | Inner | 15% | | | | | | | | | | | |
| Point Fermin West | Middle | 8% | 5% | | | | | | | | 6% | | |
| Point Fermin West | Outer | | 10% | | | | | | | | 8% | | |
| Point Vicente | Inner | 2% | 29% | | | 2% | 3% | | | | | | |
| Point Vicente | Middle | 24% | 2% | | 3% | | | | | | | | |
| Point Vicente | Outer | 11% | 24% | | | | | | | | 19% | | |
| Point Vicente East | Inner | | | | | | | | | | | | |
| Point Vicente East | Middle | | 13% | | | | | | | | | | 8% |
| Point Vicente East | Outer | 2% | 37% | | 3% | | | | | | | | 2% |
| Point Vicente West | Deep | 2% | 13% | | | | | | | | | | |
| Point Vicente West | Inner | 3% | 5% | 2% | | | | | | | 2% | | 5% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Red algae -Erect | Red algae -Turf | *Sargassum* sp | Anemone | *Anthopleura elegantissima* | *Anthopleura sola* | *Asterina miniata* | Barnacle | Brittlestars | Bryozoan | *Centrostephanus coronatus* | *Chaceia ovoidea* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point Vicente West | Middle | | 23% | 5% | 5% | | | | | | | | |
| Point Vicente West | Outer | | 8% | | | | | | | | 2% | | |
| Resort Point | Deep | 11% | 3% | | | 8% | | | | | | | |
| Resort Point | Inner | 2% | 15% | | 2% | | | | | | | | 2% |
| Resort Point | Middle | | 3% | | | | | | | | | | |
| Resort Point | Outer | 21% | 3% | | | | | | 2% | | | | |
| Ridges | Deep | 11% | 11% | | | | | | | | | | |
| Ridges | Inner | 2% | 13% | | | | | | | | | | |
| Ridges | Middle | | | | | | | | | | | | |
| Ridges | Outer | 6% | 21% | | | | | | | 2% | | | |
| Ridges North | Deep | 26% | 6% | | | | | | | | 2% | | |
| Ridges North | Inner | | 5% | | | | | | | | | | |
| Ridges North | Middle | 5% | | | | | | | | | | | |
| Ridges North | Outer | 5% | | | | | | | | | 2% | 2% | |
| Ridges South | Deep | 24% | | | | | | | | | 6% | | |
| Ridges South | Inner | 19% | 16% | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | | | | |
| Ridges South | Outer | 32% | 5% | | | | | | | | 3% | | |
| Rocky Point | Deep | 24% | 6% | | 2% | | | | | | 6% | | |
| Rocky Point | Inner | 5% | 27% | | | | | | | | | | |
| Rocky Point | Middle | 3% | 32% | | 2% | | | | | | 2% | | |
| Rocky Point | Outer | | 50% | | | | | | | | | | |
| Rocky Point North | Deep | 23% | 3% | | | | | | | | | | |
| Rocky Point North | Inner | 18% | 2% | | | | | | | | 2% | | |
| Rocky Point North | Middle | | 13% | | | | | | | | | | |
| Rocky Point North | Outer | | 27% | | | | | | | | | 5% | |
| Rocky Point South | Deep | 16% | | | | | | | | | | | |
| Rocky Point South | Inner | | | | | | | | | | | | |
| Rocky Point South | Middle | 5% | 5% | | | | | | | | | | |
| Rocky Point South | Outer | | 10% | | | | | | | | 2% | | |
| 3 Palms | Inner | 6% | 2% | | | | | | | | | | |
| 3 Palms | Middle | 8% | 29% | | | | | | | | | | |
| 3 Palms East | Inner | 16% | 19% | | | | | | | | | | 6% |
| 3 Palms East | Middle | 5% | 19% | | | | | | | | 2% | | |
| 3 Palms East | Outer | 8% | 23% | | | | | | | | | | |
| 3 Palms West | Inner | 23% | | | | | | | | | 10% | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Red algae -Erect | Red algae -Turf | *Sargassum* sp | Anemone | *Anthopleura elegantissima* | *Anthopleura sola* | *Asterina miniata* | Barnacle | Brittlestars | Bryozoan | *Centrostephanus coronatus* | *Chaceia ovoidea* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 Palms West | Middle | 15% | 5% | | 5% | | | | | | 3% | | |
| 3 Palms West | Outer | 2% | | | | | | 2% | | | | | |
| Whites Point | Inner | 10% | 24% | | 2% | | | | | | | | |
| Whites Point | Middle | 10% | 21% | | 6% | | | | | | | | |
| Whites Point | Outer | 3% | 18% | | | | | | | | | | |
| Whites Point West | Inner | 29% | | | | | | | | | | | |
| Whites Point West | Middle | 3% | 13% | | | | | | | | 6% | | |
| Whites Point West | Outer | 2% | 3% | | | | | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Corynactis californica* | *Crassedoma giganteum* | Cup Coral | *Diopatra/Chaetopterus* sp | Hydroid | *Lophogorgia chilensis* | *Muricea californica* | *Muricea fruticosa* | *Pachycerianthus fimbratus* | *Parapholas californica* | *Parastichopus parvimensis* | *Phragmatopoma californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | 2% | 5% | | | 16% | | | | | 26% |
| Bunker Point | Inner | | | | 2% | | | | | | | | 10% |
| Bunker Point | Middle | | | | 15% | | | | | | | | 5% |
| Bunker Point | Outer | 2% | | 2% | 6% | | | | | | | | |
| Deep Hole | Middle | 16% | | | | | | 3% | | | | | |
| Deep Hole | Outer | | | | | | | 6% | 2% | | | | |
| El Matador East | Middle | | | 3% | 3% | | | | | | | | |
| El Matador West | Middle | | | | 34% | 5% | | | | | | | |
| Encinal Canyon East | Inner | | | 2% | | 13% | | | | | | | |
| Encinal Canyon East | Middle | | | | 15% | | | | | | | | 2% |
| Encinal Canyon West | Inner | | | 2% | | 5% | | | | | | | |
| Encinal Canyon West | Middle | | | 2% | 24% | | | | | | | | |
| Escondido | Inner | | | | 16% | | | | | | | | |
| Escondido | Middle | | | | 15% | 3% | | 2% | | | | | |
| Escondido East | Inner | | | | 13% | | | | | | | | 2% |
| Escondido East | Middle | | | | 16% | | | | | | | | |
| Escondido West | Inner | | | | 19% | | | | | | | | |
| Escondido West | Middle | | | | 29% | 2% | | | | | | | |
| Flat Rock | Inner | | | | | | | | | | | | |
| Flat Rock | Middle | | | | 2% | | | | | | | | |
| Flat Rock | Outer | | | 5% | 2% | | | | | | | | |
| Flat Rock North | Inner | | | 2% | | | | | | | | | 2% |
| Flat Rock North | Middle | | | | | 3% | | | | | | | |
| Flat Rock North | Outer | | | | | | | 3% | | | | | |
| Flat Rock South | Inner | | | 2% | 2% | | | | | | | | |
| Flat Rock South | Middle | | | 2% | | | | 2% | | | | | 6% |
| Lead Better Beach | Inner | | | | 2% | | | | | | | | |
| Lead Better Beach | Middle | | | | 3% | 15% | | | | | 2% | | |
| Leo Carillo | Inner | | | | | | | | 2% | | | | 8% |
| Leo Carillo | Middle | 8% | | 2% | 10% | | | | | | | | 5% |
| Leo Carillo | Outer | 6% | | 5% | 27% | | | 3% | | | | | |
| Leo Carillo East | Inner | | | | | | | | | | | | |
| Leo Carillo East | Middle | | | | 10% | | | | | | | | |
| Leo Carillo East | Outer | 2% | | | 34% | | | | | | | | |
| Leo Carillo West | Inner | | | 2% | 3% | 2% | | | | | | | 5% |
| Leo Carillo West | Middle | | | | 6% | | | | | | | | 5% |
| Little Dume | Inner | | | | | | | 2% | | | | | 13% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Corynactis californica* | *Crassedoma giganteum* | Cup Coral | *Diopatra/Chaetopterus* sp | Hydroid | *Lophogorgia chilensis* | *Muricea californica* | *Muricea fruticosa* | *Pachycerianthus fimbratus* | *Parapholas californica* | *Parastichopus parvimensis* | *Phragmatopoma californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Little Dume | Middle | | | | | | | | | | | | 19% |
| Little Dume | Outer | | | 3% | | | | 3% | | | | | |
| Little Dume East | Inner | | | | | | | | | | | | |
| Little Dume East | Middle | | | | 5% | 2% | | | | | | | 3% |
| Little Dume East | Outer | | | | 3% | 5% | | | | | | | |
| Little Dume West | Inner | | | | 5% | 2% | | | | | | | 2% |
| Little Dume West | Middle | | | | 2% | 3% | | | | | | | 21% |
| Little Dume West | Outer | | | | | 3% | | | | | | | |
| Long Point East | Inner | 5% | | 3% | 3% | | | | | | | | |
| Long Point East | Middle | 2% | | 2% | 2% | 2% | | | | | | | |
| Long Point East | Outer | 5% | | 2% | | | | | | | | | |
| Long Point West | Inner | 2% | | 10% | 2% | | | | | | | | |
| Long Point West | Middle | 10% | | 11% | 6% | | | | | | | | |
| Nicholas Canyon | Middle | | | | 16% | 2% | | | | | | | |
| Nicholas Canyon | Outer | 3% | | 2% | 47% | | | | | 2% | | | |
| Nicholas Canyon East | Middle | | | | 6% | | | | | | | | |
| Nicholas Canyon East | Outer | | | | 15% | | | 3% | | | | 2% | |
| Nicholas Canyon West | Middle | | | | 19% | 2% | | | | | | | |
| Nicholas Canyon West | Outer | 3% | | 13% | 19% | | | | | | | | |
| Point Dume '08 | Middle | | | | | | | 3% | 5% | | | | 3% |
| Point Dume '07 | Middle | 3% | | 3% | | 3% | | | | | | | |
| Point Fermin | Inner | | | 3% | 2% | | | | | | | | 2% |
| Point Fermin | Middle | 2% | | 2% | 13% | | | | | | | | |
| Point Fermin | Outer | 5% | | | | | | | | | | | |
| Point Fermin West | Inner | | | | | | | | | | | | |
| Point Fermin West | Middle | 3% | | | 24% | 2% | | | | | | | |
| Point Fermin West | Outer | 2% | | | | | | 2% | | | | | |
| Point Vicente | Inner | 2% | | | | | | | | | | | 2% |
| Point Vicente | Middle | | | 24% | | 5% | | | | | | | |
| Point Vicente | Outer | 21% | | | | | | | | | | | |
| Point Vicente East | Inner | | | | | | | | | | | | |
| Point Vicente East | Middle | 2% | | 3% | 5% | | | | | | | | |
| Point Vicente East | Outer | 2% | | 2% | | | | | | | | | |
| Point Vicente West | Deep | 5% | | 11% | | | | 2% | 2% | | | | 2% |
| Point Vicente West | Inner | 26% | | 6% | 2% | | | | | | | | |
| Point Vicente West | Middle | 5% | | 3% | 3% | | | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Corynactis californica* | *Crassedoma giganteum* | Cup Coral | *Diopatra/Chaetopterus* sp | Hydroid | *Lophogorgia chilensis* | *Muricea californica* | *Muricea fruticosa* | *Pachycerianthus fimbratus* | *Parapholas californica* | *Parastichopus parvimensis* | *Phragmatopoma californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point Vicente West | Outer | 19% | | | | | | | | | | | |
| Resort Point | Deep | | | 6% | | | 6% | 6% | 2% | | | | |
| Resort Point | Inner | | | | 3% | | | | | | | | |
| Resort Point | Middle | | | | | | | | | | | | |
| Resort Point | Outer | | | | | | | 3% | | | | | |
| Ridges | Deep | 2% | | 2% | 2% | 2% | 5% | | | | | | |
| Ridges | Inner | | | | | | | | | | | | |
| Ridges | Middle | | | | | | | | | | | | |
| Ridges | Outer | 2% | | | | | | | | | | | |
| Ridges North | Deep | | | 2% | | | | 10% | | | | | |
| Ridges North | Inner | | | | | | | | | | | | |
| Ridges North | Middle | 6% | | | | | | | | | | | |
| Ridges North | Outer | 8% | | | | 6% | | | | | | | |
| Ridges South | Deep | | | | | | | | | | | | |
| Ridges South | Inner | | | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | | | | |
| Ridges South | Outer | | | | | 3% | | | | | | | |
| Rocky Point | Deep | | | | | | | | | | | | |
| Rocky Point | Inner | | | | | | | | | | | | |
| Rocky Point | Middle | | | | | | | | | | | | 3% |
| Rocky Point | Outer | | | | | | | | | | | | |
| Rocky Point North | Deep | | | | | 5% | | | | | | | 2% |
| Rocky Point North | Inner | 3% | | 3% | | 5% | | | | | | | |
| Rocky Point North | Middle | | | | | | | | | | | | |
| Rocky Point North | Outer | | | | | 6% | | | | | | | |
| Rocky Point South | Deep | | | 3% | | | | | | | | | |
| Rocky Point South | Inner | | | | | | | | | | | | |
| Rocky Point South | Middle | | 2% | | | | | | | | | | |
| Rocky Point South | Outer | 3% | | | | 2% | | | | | | | |
| 3 Palms | Inner | | | | | | | | | | | | |
| 3 Palms | Middle | | | | | | | | | | | | |
| 3 Palms East | Inner | | | | 6% | | | | | | | | |
| 3 Palms East | Middle | | | | 8% | | | | | | | | 2% |
| 3 Palms East | Outer | | | | 3% | | | | | | | | |
| 3 Palms West | Inner | | | | | | | | | | | | |
| 3 Palms West | Middle | | | | | | | | | | | | |
| 3 Palms West | Outer | | | | | | | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Corynactis californica* | *Crassedoma giganteum* | Cup Coral | *Diopatra/Chaetopterus* sp | Hydroid | *Lophogorgia chilensis* | *Muricea californica* | *Muricea fruticosa* | *Pachycerianthus fimbratus* | *Parapholas californica* | *Parastichopus parvimensis* | *Phragmatopoma californica* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Whites Point | Inner | | | | 2% | | | | | | | | 2% |
| Whites Point | Middle | | | | 2% | 2% | | | | | | | 5% |
| Whites Point | Outer | | | 2% | 2% | | | | | | | | |
| Whites Point West | Inner | | | | | | | | | | | | |
| Whites Point West | Middle | | | | | | | | | | | | |
| Whites Point West | Outer | | | | | | | | 2% | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Pisaster giganteus* | Sabellid/Serpulid group | *Salmacina tribranchiata* | Sediment/Mud | *Serpulorbis squamigerous* | Sponge | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Tethya aurantia* | Tubeworm | Tubeworm mat. | Tunicate –Colonial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | | | | | | | | | |
| Bunker Point | Inner | | | | | | | | | | | | |
| Bunker Point | Middle | | | | | | | | | | | | |
| Bunker Point | Outer | | | | | | | | | | | | |
| Deep Hole | Middle | | | 2% | | | 2% | | | | | | |
| Deep Hole | Outer | | | | | | | | | | | | |
| El Matador East | Middle | | | | 2% | | | | | | | | 3% |
| El Matador West | Middle | | | 6% | | | 6% | | | | | | 5% |
| Encinal Canyon East | Inner | | | | | | | | | | 3% | | |
| Encinal Canyon East | Middle | | | | | | | | | | | | |
| Encinal Canyon West | Inner | | | | | | 2% | | | | 2% | | |
| Encinal Canyon West | Middle | | | | | | | | | | | | |
| Escondido | Inner | | | | 16% | | | | | | | | 2% |
| Escondido | Middle | | | 2% | 8% | | 5% | | | | | | 2% |
| Escondido East | Inner | | | | 2% | | | | | | 2% | 3% | |
| Escondido East | Middle | | | | | | 3% | | | | | | |
| Escondido West | Inner | | | | 23% | | | | | | | | |
| Escondido West | Middle | | | | 10% | | | | | | | 2% | 2% |
| Flat Rock | Inner | | | | | | | | | | | | |
| Flat Rock | Middle | | | | | | | | | | | | |
| Flat Rock | Outer | | 3% | | | | 3% | | | | | | |
| Flat Rock North | Inner | | 2% | | | | | | | | | | |
| Flat Rock North | Middle | | | | 2% | | | | | | 2% | | |
| Flat Rock North | Outer | | | | | | 5% | | | 5% | 2% | | |
| Flat Rock South | Inner | | | | | | 2% | | 2% | | | | |
| Flat Rock South | Middle | | | 2% | | | 3% | | | | | | |
| Lead Better Beach | Inner | | | | | | 3% | | | | | | |
| Lead Better Beach | Middle | | | | 3% | | 2% | | | | | | |
| Leo Carillo | Inner | | | | | | | | | | | | |
| Leo Carillo | Middle | | | | | | | | | | | | 3% |
| Leo Carillo | Outer | | | | | | | | | 3% | | | 6% |
| Leo Carillo East | Inner | | | | | | | | | | | | |
| Leo Carillo East | Middle | | | | | | 3% | | | | | | |
| Leo Carillo East | Outer | | | | 2% | | 29% | | | | | | 10% |
| Leo Carillo West | Inner | | | | | | 5% | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Pisaster giganteus* | Sabellid/Serpulid group | *Salmacina tribranchiata* | Sediment/Mud | *Serpulorbis squamigerous* | Sponge | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Tethya aurantia* | Tubeworm | Tubeworm mat. | Tunicate –Colonial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Leo Carillo West | Middle | | | | | | | | | | | | |
| Little Dume | Inner | | | | | | | | | | | | |
| Little Dume | Middle | | | | | | 3% | | | | | | |
| Little Dume | Outer | | | | | | 3% | | | | | | |
| Little Dume East | Inner | | | | | | 2% | | | | 2% | | 2% |
| Little Dume East | Middle | | | | | | 2% | | | | | | 3% |
| Little Dume East | Outer | | | | | | | | | | 2% | | |
| Little Dume West | Inner | | | | | | | | | | | | 2% |
| Little Dume West | Middle | | | | | | | | | | | | 23% |
| Little Dume West | Outer | | | | | | | | | | | | 3% |
| Long Point East | Inner | | | | | | 2% | | | | | | |
| Long Point East | Middle | | | | | | | | | | | | |
| Long Point East | Outer | | | | | | | | | | | 2% | |
| Long Point West | Inner | | 3% | | | | | | | | 2% | | |
| Long Point West | Middle | | | 2% | | | | | | | 2% | 3% | |
| Nicholas Canyon | Middle | | | | | | 2% | | | | | | 3% |
| Nicholas Canyon | Outer | | | | | | 6% | | | | | | 2% |
| Nicholas Canyon East | Middle | | 2% | | | | | 5% | 2% | 2% | | | |
| Nicholas Canyon East | Outer | | | | | | 2% | 2% | | 2% | | | |
| Nicholas Canyon West | Middle | | | | | | 2% | | | | | | 2% |
| Nicholas Canyon West | Outer | | | | | | 5% | | | | | | 3% |
| Point Dume '08 | Middle | | | | | | | | | | | | |
| Point Dume '07 | Middle | | | | | | | | | | 5% | | |
| Point Fermin | Inner | | | | | | | | | | | | 2% |
| Point Fermin | Middle | | | | | | | | | | | | 3% |
| Point Fermin | Outer | | | 3% | | | 10% | | | | | | |
| Point Fermin West | Inner | | | | | | | | | | | | |
| Point Fermin West | Middle | | 2% | 8% | | | | | | | | | 10% |
| Point Fermin West | Outer | | | | | | | | | | | | 3% |
| Point Vicente | Inner | | | | | | | | | | | | |
| Point Vicente | Middle | | | | | | 6% | | | | | | |
| Point Vicente | Outer | | | | | | 5% | | | | 2% | | |
| Point Vicente East | Inner | | | | | | | | | | | | |
| Point Vicente East | Middle | | | | 15% | | 2% | | | | | | |
| Point Vicente East | Outer | | | | 6% | | | | | | 3% | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Pisaster giganteus* | Sabellid/Serpulid group | *Salmacina tribranchiata* | Sediment/Mud | *Serpulorbis squamigerous* | Sponge | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Tethya aurantia* | Tubeworm | Tubeworm mat. | Tunicate –Colonial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Point Vicente West | Deep | | | | | | 3% | | | | | | |
| Point Vicente West | Inner | | | | | | | | | | | | |
| Point Vicente West | Middle | | | | 2% | | 6% | | | | | | |
| Point Vicente West | Outer | | | | | | 2% | | | | | | 3% |
| Resort Point | Deep | | | | | | 6% | | | | 3% | | |
| Resort Point | Inner | | 2% | | | | | | | | | | |
| Resort Point | Middle | | | | | | | | | | 3% | | |
| Resort Point | Outer | | | | | | 3% | | | | | | |
| Ridges | Deep | | | | | | 6% | | | | | | |
| Ridges | Inner | | | | | 2% | | | | | 2% | | |
| Ridges | Middle | | | | | | | | | | | | |
| Ridges | Outer | | | | | | 3% | | | | | | 2% |
| Ridges North | Deep | | | | | | 2% | | | | 2% | | |
| Ridges North | Inner | | | | | | | | | | | | |
| Ridges North | Middle | | 2% | | | | 2% | | | | | | |
| Ridges North | Outer | 2% | | | | | 5% | | | | 2% | | |
| Ridges South | Deep | | | | | | | | | | 3% | | |
| Ridges South | Inner | | | | | | | | | | | | |
| Ridges South | Middle | | | | | | | | | | | | |
| Ridges South | Outer | | | | | | | | | | | | |
| Rocky Point | Deep | | | | | | 2% | | | | 3% | | |
| Rocky Point | Inner | | | | | | | | | | | | |
| Rocky Point | Middle | | | | | | | | | | | | |
| Rocky Point | Outer | | | | | | | | | | | | |
| Rocky Point North | Deep | | | | | | | | | | | | |
| Rocky Point North | Inner | | | | | | | | | | | | |
| Rocky Point North | Middle | | | | | | | | | | | | |
| Rocky Point North | Outer | 2% | | | | | | | | 2% | | | |
| Rocky Point South | Deep | | | | 2% | | | | | | | | |
| Rocky Point South | Inner | | | | | | | | | | | | |
| Rocky Point South | Middle | | | | | 2% | | | | | | | |
| Rocky Point South | Outer | | | | | | | | | | | | 3% |
| 3 Palms | Inner | | | | | | | | | | | | |
| 3 Palms | Middle | | | | | | | | | | | | |
| 3 Palms East | Inner | | | | | | 2% | | | | | | |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | *Pisaster giganteus* | Sabellid/Serpulid group | *Salmacina tribranchiata* | Sediment/Mud | *Serpulorbis squamigerous* | Sponge | *Strongylocentrotus franciscanus* | *Strongylocentrotus purpuratus* | *Tethya aurantia* | Tubeworm | Tubeworm mat. | Tunicate –Colonial |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 Palms East | Middle | | | 2% | | | 2% | | | | | | |
| 3 Palms East | Outer | | | | | | | | | | | | |
| 3 Palms West | Inner | | | | | | | | | | | | |
| 3 Palms West | Middle | | | | | | | | | | | | |
| 3 Palms West | Outer | 2% | | | | | | | | | 8% | 3% | |
| Whites Point | Inner | | | | | | | | | | | | 6% |
| Whites Point | Middle | | | | | | | | | | 2% | | 6% |
| Whites Point | Outer | | | | | | | | | | | | |
| Whites Point West | Inner | | | | | | | | | | | | |
| Whites Point West | Middle | | | | | | | | | | | | |
| Whites Point West | Outer | | 2% | | | | 2% | | | | | | 2% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Tunicate -Solitary | *Zostera marina* | Detritus | Shell debris | Bare rock | Bare sand |
|---|---|---|---|---|---|---|---|
| Big Rock | Inner | | | | 2% | | 19% |
| Bunker Point | Inner | | | 6% | | 6% | 2% |
| Bunker Point | Middle | | | 6% | 6% | 3% | 5% |
| Bunker Point | Outer | | | 6% | 3% | 15% | 19% |
| Deep Hole | Middle | | | 18% | 6% | | 2% |
| Deep Hole | Outer | | | 10% | 15% | | 10% |
| El Matador East | Middle | 5% | | | 5% | | 13% |
| El Matador West | Middle | | | 2% | | | 18% |
| Encinal Canyon East | Inner | | | 2% | | | 42% |
| Encinal Canyon East | Middle | 2% | | | | 6% | 63% |
| Encinal Canyon West | Inner | 2% | | 3% | 2% | 2% | 45% |
| Encinal Canyon West | Middle | 2% | 2% | | | | 16% |
| Escondido | Inner | | | | 5% | 2% | |
| Escondido | Middle | | | | 15% | 8% | 8% |
| Escondido East | Inner | | | | | | 37% |
| Escondido East | Middle | | | | 6% | 3% | 21% |
| Escondido West | Inner | 2% | | 5% | 6% | 11% | 3% |
| Escondido West | Middle | | | 5% | 3% | 8% | 13% |
| Flat Rock | Inner | | | | | 2% | 15% |
| Flat Rock | Middle | | | 15% | 2% | 21% | 11% |
| Flat Rock | Outer | | | | | 3% | 52% |
| Flat Rock North | Inner | | | | | | 16% |
| Flat Rock North | Middle | 3% | | 2% | | | 44% |
| Flat Rock North | Outer | 2% | | | | | 50% |
| Flat Rock South | Inner | | | 3% | | 11% | 11% |
| Flat Rock South | Middle | 2% | | | | 2% | 13% |
| Lead Better Beach | Inner | | | 3% | 34% | 5% | 6% |
| Lead Better Beach | Middle | | | | 10% | 21% | 2% |
| Leo Carillo | Inner | 3% | | | | | 29% |
| Leo Carillo | Middle | | | | | | 34% |
| Leo Carillo | Outer | | | | | 2% | 10% |
| Leo Carillo East | Inner | | | | | | 10% |
| Leo Carillo East | Middle | 5% | | 3% | 3% | 3% | 24% |
| Leo Carillo East | Outer | | | | | 3% | |
| Leo Carillo West | Inner | 10% | | | | | 26% |
| Leo Carillo West | Middle | | | 15% | | 6% | 60% |
| Little Dume | Inner | 3% | | 3% | 5% | | 34% |
| Little Dume | Middle | | | | 3% | 3% | 15% |
| Little Dume | Outer | | | 2% | 3% | 3% | 16% |
| Little Dume East | Inner | | | | 2% | 2% | 31% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Tunicate -Solitary | *Zostera marina* | Detritus | Shell debris | Bare rock | Bare sand |
|---|---|---|---|---|---|---|---|
| Little Dume East | Middle | | | | | 10% | 39% |
| Little Dume East | Outer | | | | 2% | 13% | 16% |
| Little Dume West | Inner | | | | | | 34% |
| Little Dume West | Middle | | | | | 5% | 6% |
| Little Dume West | Outer | 2% | | | 3% | 3% | 23% |
| Long Point East | Inner | | | 3% | | | 3% |
| Long Point East | Middle | | | | | 2% | 6% |
| Long Point East | Outer | | | 10% | 8% | 3% | 13% |
| Long Point West | Inner | | | 6% | 2% | | 3% |
| Long Point West | Middle | | | 5% | 3% | 2% | 6% |
| Nicholas Canyon | Middle | | | | 2% | 3% | 16% |
| Nicholas Canyon | Outer | | | | 5% | | 10% |
| Nicholas Canyon East | Middle | | | 2% | | 35% | 21% |
| Nicholas Canyon East | Outer | | | 3% | | 21% | 18% |
| Nicholas Canyon West | Middle | 2% | | 2% | | 6% | 19% |
| Nicholas Canyon West | Outer | | | | | | 10% |
| Point Dume '08 | Middle | | | | 11% | 8% | 5% |
| Point Dume '07 | Middle | | | 3% | | | 34% |
| Point Fermin | Inner | | | 5% | | | |
| Point Fermin | Middle | | | 2% | 2% | 10% | 16% |
| Point Fermin | Outer | | | 31% | | 6% | 31% |
| Point Fermin West | Inner | | | | | 2% | |
| Point Fermin West | Middle | | | 5% | 2% | | 6% |
| Point Fermin West | Outer | | | | | 15% | 18% |
| Point Vicente | Inner | | | | | | 3% |
| Point Vicente | Middle | | | 3% | | | |
| Point Vicente | Outer | | | | | | |
| Point Vicente East | Inner | | | | | 40% | 2% |
| Point Vicente East | Middle | | | 6% | 3% | 2% | 5% |
| Point Vicente East | Outer | | | 2% | 2% | | 18% |
| Point Vicente West | Deep | | | | | 16% | |
| Point Vicente West | Inner | | | | 2% | | 2% |
| Point Vicente West | Middle | | | 2% | | 6% | 8% |
| Point Vicente West | Outer | | | | 2% | 18% | |
| Resort Point | Deep | | | 8% | | | 8% |
| Resort Point | Inner | | | | | 3% | 8% |
| Resort Point | Middle | | | | 10% | | 8% |
| Resort Point | Outer | | | | | 8% | 6% |
| Ridges | Deep | | | 2% | | 2% | 10% |
| Ridges | Inner | | | | | | 11% |
| Ridges | Middle | | | | | | 19% |

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Appendix VIII. UPC % cover, continued.

| Station | Zone | Tunicate -Solitary | *Zostera marina* | Detritus | Shell debris | Bare rock | Bare sand |
|---|---|---|---|---|---|---|---|
| Ridges | Outer | | | | 2% | 2% | 35% |
| Ridges North | Deep | | | 3% | | 24% | 3% |
| Ridges North | Inner | | | | | 11% | 2% |
| Ridges North | Middle | | | | | 3% | 39% |
| Ridges North | Outer | | | 13% | | | 5% |
| Ridges South | Deep | | | 24% | | | 10% |
| Ridges South | Inner | | | 2% | | 10% | 6% |
| Ridges South | Middle | | | | | | 32% |
| Ridges South | Outer | | | 5% | | | 44% |
| Rocky Point | Deep | | | 2% | | 16% | 10% |
| Rocky Point | Inner | | | 2% | | | 18% |
| Rocky Point | Middle | | | 5% | | 11% | 5% |
| Rocky Point | Outer | | | | | 13% | 2% |
| Rocky Point North | Deep | | | 21% | | 15% | 16% |
| Rocky Point North | Inner | | | 8% | | 19% | 11% |
| Rocky Point North | Middle | | | | | | 44% |
| Rocky Point North | Outer | | | | | | 21% |
| Rocky Point South | Deep | | | 26% | | 15% | 11% |
| Rocky Point South | Inner | | | | | 19% | 2% |
| Rocky Point South | Middle | | | | | 5% | 3% |
| Rocky Point South | Outer | | | 13% | | 5% | 16% |
| 3 Palms | Inner | | | | 3% | 2% | 18% |
| 3 Palms | Middle | | | | | 16% | 11% |
| 3 Palms East | Inner | | | 2% | | 8% | 8% |
| 3 Palms East | Middle | | | 5% | | 16% | 10% |
| 3 Palms East | Outer | | | 10% | | 3% | |
| 3 Palms West | Inner | | | | | 13% | 10% |
| 3 Palms West | Middle | 2% | | 18% | | 5% | 19% |
| 3 Palms West | Outer | 2% | | 24% | | 23% | 16% |
| Whites Point | Inner | | | | | 6% | 31% |
| Whites Point | Middle | | | | | 3% | 21% |
| Whites Point | Outer | | | | | 15% | 47% |
| Whites Point West | Inner | 2% | | | | 11% | |
| Whites Point West | Middle | | | | 2% | 26% | 10% |
| Whites Point West | Outer | 3% | | | 3% | 15% | 5% |

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**APPENDIX IX**

# Southern California Bight 2008 Regional Marine Monitoring Survey (Bight'08)

# Rocky Reef Workplan

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Prepared by:

Bight'08 Rocky Reef Committee

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# I. INTRODUCTION

The Southern California Bight (SCB) a transitional zone between the cool temperate (Oregonian) fauna fueled by the California Current to the north and the warm temperate (San Diegan) fauna from the south is a unique and increasingly critical stretch of the California coastline. With its eight channel islands, the linear coastline of the SCB is roughly equal to the rest of the state. Irrespective of the biogeographic intricacies, the physical constitution of the coastline along the mainland SCB is dominated by sandy beaches, with approximately 15% rocky-headlands, a stark contrast to the remainder of the state. The southern California islands, however, support a greater proportion of reefs to soft substrate communities. Due to accessibility and increasing stress by a growing population, these reefs are under a variety of anthropogenic stressors (e.g. turbidity, river plumes, sedimentation, overfishing, pollution etc.) and harmful algal blooms, which in many instances are not well understood and in all cases necessitate a Bight-wide perspective and coordination to contextualize and manage these effects.

Recently it has been demonstrated that significant management actions can have significant positive effects on this complex ecosystem (Pondella and Allen 2008). Currently, potential positive measures to aid this ecosystem has been the creation of Marine Protected Areas (MPAs) in the northern Channel Islands and kelp bed restoration along the mainland. It has been recently announced the California Department of Fish and Game (CDFG) will continue its Marine Life Protection Act (MLPA) process to the SCB in 2009. Thus, there is a great deal of impetus and pressure to generate physical and biological data that can lead to informed decisions concerning this process in the SCB.

While the subtidal reefs in the SCB have been highly studied for decades, quantitative large scale spatial and temporal studies have been relatively limited, with the exceptions of the Channel Islands National Park Service's Kelp Forest Monitoring Program, the Packard Foundation's Partnership for the Interdisciplinary Study of Coastal Oceans (PISCO), the Vantuna Research Group at Occidental College and more recently Reef Check California. In 2003-04 the CDFG supported a cooperative research program referred to as the Cooperative Research Assessment of Nearshore Ecosystems (CRANE) that sampled 88 reefs with standardized protocol from Santa Cruz to the Mexico Border including the southern California islands.

The first quantitative assessment of many of the southern California and Baja Islands (Pondella et al. 2005) found that for fishes, island fauna are generally distinct from each other and that their similarities are not a function of distance, but rather reflect the physical oceanographic regime where they are found. Due to the unique physical oceanographic conditions in the SCB, we do not find a latitutidinal clinal variation in these populations. PISCO and the VRG combined their data for NOAA's (2005) Biogeographic Assessment of the Channel Islands National Marine Sanctuary (CINMS) and found that for the islands (San Miguel and Santa Rosa were not included) there were essentially three groups. A warm group (San Clemente, Santa Catalina, Santa Barbara Anacapa and the east end of Santa Cruz) a transitional fauna (Santa Cruz and San Nicolas) and cold group (Pt. Conception) (Clark et al. 2005). In an analysis of the CRANE data set, San Miguel and Santa Rosa fall into the cold temperate fauna (Tenera 2006). Analyses of the CRANE data found essentially a cool temperate, warm temperate and a transitional fauna in the SCB (Tenera 2006). This survey was completed five

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years ago and reef sites were not selected in a probabilistic design, thus the integration with the bight program constitutes a critical and timely coordination.

What is necessary is a cohesive collaborative plan that incorporates the entire SCB to address both spatial and temporal concerns within this region. As a result the first next step in continuing to develop this long-term collaborative rocky reef program is participation in Bight'08 under the coordination of SCCWRP. The view of the planning committee is that it is critical to integrate the Bight-wide reef studies with the other regional studies coordinated by SCCWRP in order to place this research into the appropriate context and allowing resource managers to make informed decisions with this unique regional and global perspective. Currently 25 local, state and federal agencies, universities and NGOs and consulting groups are participating in this committee (Table 1).

Table 1. Current Participants in Bight'08 Rocky Reef Program

| |
|---|
| California State University, Long Beach (CSULB) |
| Channel Islands National Marine Sanctuary (CINMS) |
| Heal the Bay |
| Los Angeles County Sanitation Districts (LACSD) |
| Los Angeles Regional Water Quality Control Board (LARWQCB) |
| Marine Science Institute, UCSB (MSI) |
| MBC Applied Environmental Sciences (MBC) |
| Merkel and Associates, Inc. |
| Minerals Management Service (MMS) |
| Montrose Settlements Restoration Program (MSRP) |
| National Marine Fisheries Service (NMFS) |
| National Park Service (NPS) |
| Ocean Science Trust (OST) |
| Partnership for the Interdisciplinary Study of Coastal Oceans (PISCO) |
| Port of Los Angeles |
| Reef Check California (RCCA) |
| San Diego Coastkeeper |
| San Diego State University (SDSU) |
| Santa Monica Bay Restoration Commission (SMBRC) |
| Santa Monica Baykeeper (SMBK) |
| Scripps Institute of Oceanography (SIO) |
| Southern California Edison (SCE) |
| Southern California Coastal Water Research Project (SCCWRP) |
| United State Geological Survey (USGS) |
| US Navy |
| Vantuna Research Group, Occidental College (VRG) |

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# II. STUDY DESIGN

## A. Study Objectives

The overall goal of the rocky reef program is to determine the status of rocky reef resources in the southern California bight (SCB). In this study we are striving to achieve a collaborative rocky reef study that will address the following study questions on both the appropriate spatial and temporal scales:

1. What is the distribution of hard bottom (non-trawlable) habitats in the southern California bight?

2. What is the range of natural biological conditions in these reef assemblages?

3. How do these conditions overlay or correlate with anthropogenic factors?

## B. Mapping Efforts and Station Assignments

The primary data layer needed for all associated questions is a map of hard bottom habitats in the Southern California Bight. Not all rocky reefs have been mapped and previous mapping efforts are of various resolutions and scales. Currently, mapping efforts in the SCB are ongoing to fill in these data gaps and will not be completed prior to the beginning of this study effort. Thus, we have acquired what we believe to be the best compilations of rocky reef habitat in the SCB. These include the following maps of hard bottom habitats and kelp canopy (Figures 1 and 2). GIS spatial analysis techniques were used to integrate existing spatial data that characterizes bottom type, kelp cover, and bathymetry to create a preliminary habitat map. Using this data in GIS, we met with experts who have conducted multiple subtidal scuba research projects on various geographic areas of the SCB. These working groups delineated and categorized all reefs in the SCB (Figure 3, Table 2). In this assessment, reefs were characterized as artificial reefs, cobble, major reef complexes, offshore reefs and pinnacles, and patchy reefs. Reefs were also coded as island or mainland within each biogeographic realm, San Diegan (warm temperate) or Oregonian (cold temperate). At the islands biogeographic realm was determined by assessment of benthic fish assemblages studied during the previous CRANE survey (Figure 4). In this biogeographic analysis, young-of-year (YOY) fishes whose density is seasonal and highly abundant pelagic species (*Engraulis mordax* and *Sardinops sagax*) that were only present at two sites were trimmed from the data set. All statistics were run using PRIMER (version 6). The number of fishes observed by station were Lox (x+1) transformed. A Bray-Curtis similarity matrix was then calculated and a hierarchical cluster analysis was performed. Using the similarity matrix, non-metric multi-dimensional scaling was performed and presented graphically using 45% similarity ellipses calculated from the Bray-Curtis cluster.

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Table 2. Identified hectares and number of natural reefs in the SCB organized by biogeographic region.

| | Oregonian | San Diegan | Total |
|---|---|---|---|
| Island | 21587 (33) | 8430 (44) | 30017 (77) |
| Mainland | 8214 (20) | 10750 (21) | 18964 (41) |
| Total: | 29801 (53) | 19180 (65) | 48982 (118) |

Oil platforms, artificial reefs, breakwaters and jetties were not included in this mapping effort because they are well mapped and not part of the random station draw. For the spatial scale aspect of this program, 60 natural rocky reefs (Figure 5; Table 4) from this map were randomly selected weighted proportionally to biogeographic region and reef size using EPA's Environmental Monitoring and Assessment Program (EMAP) (Stevens 1997). These sites and the polygons they represent can be observed as a layer in the attached file (Bight 08' Rocky Reefs.kmz). If a fixed monitoring site is included coincidentally in the random draw it will be used. When more than one monitoring site is included in a designated reef, the site to be used in the probabilistic design will be randomly selected. The final site sampling plan has a tiered design. The first layer is the 60 sites determined in the EMAP routine. The second layer is any CRANE site (Table 5). The final layer is any additional reef (Table 3).

Special studies are underway to enrich our understanding of additional rocky reef habitats in this nearshore region. These special studies are primarily focused on determining the role of artificial substrates (jetties, breakwaters, oil platforms, and artificial reefs) with respect to the natural reefs in the region. Artificial structures such as these comprise a large amount of additional and some cases critical reef habitat in the southern California Bight. As an example, the Federal Breakwater of the Port of Los Angeles and Port of Long Beach, spans seven miles and is one of the largest rocky reefs in the Bight. We are also conducting a intercalibration experiment between the CRANE protocols and Reef Check California methods.

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Figure 1. Location of hard substrate from NMFS and MMS databases. Gray line indicates Channel Islands National Marine Sanctuary boundary (source Kellner et al. 2005).

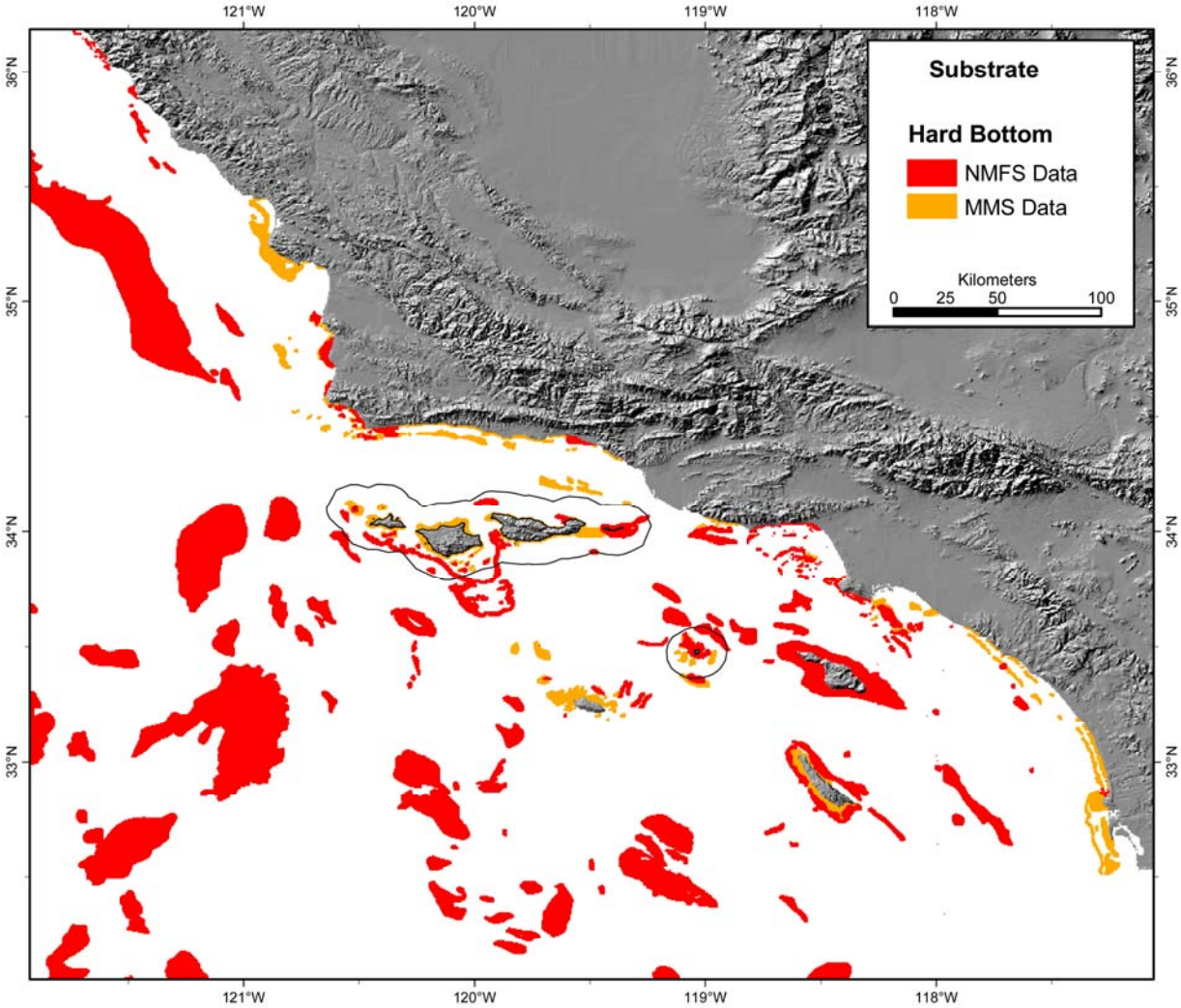

Figure 2. Kelp distribution off southern California. Black line indicates Channel Islands National Marine Sanctuary boundary (source Kellner et al. 2005).

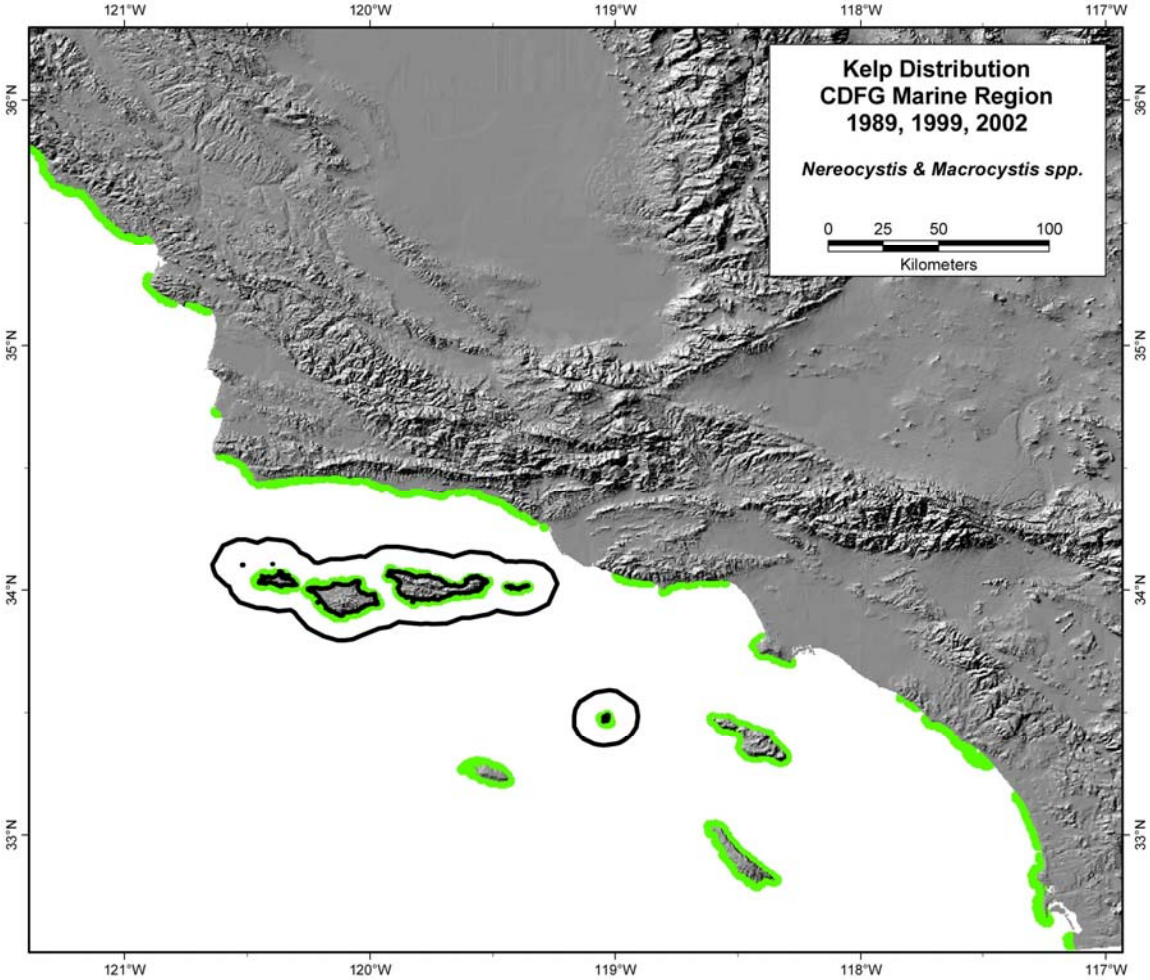

Figure 3. Rocky reefs of the SCB. Reefs are color coded by biogeographic province (cold vs. warm).

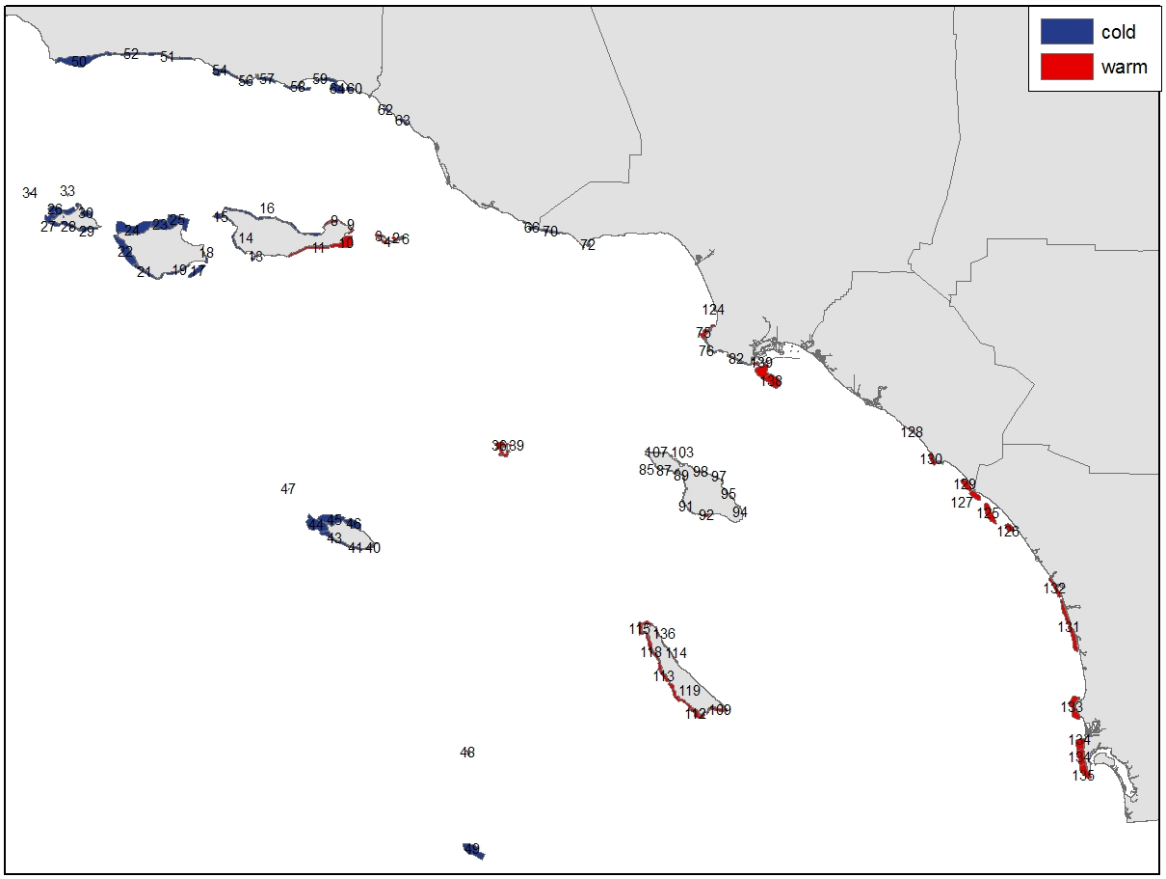

Figure 4. Bray Curtis similarity and MDS plot of the 44 sites sampled in the 2003 CRANE survey. Elipses in the MDS plot represent 45% similarity from the cluster analysis. Abbreviations are in Table 5.

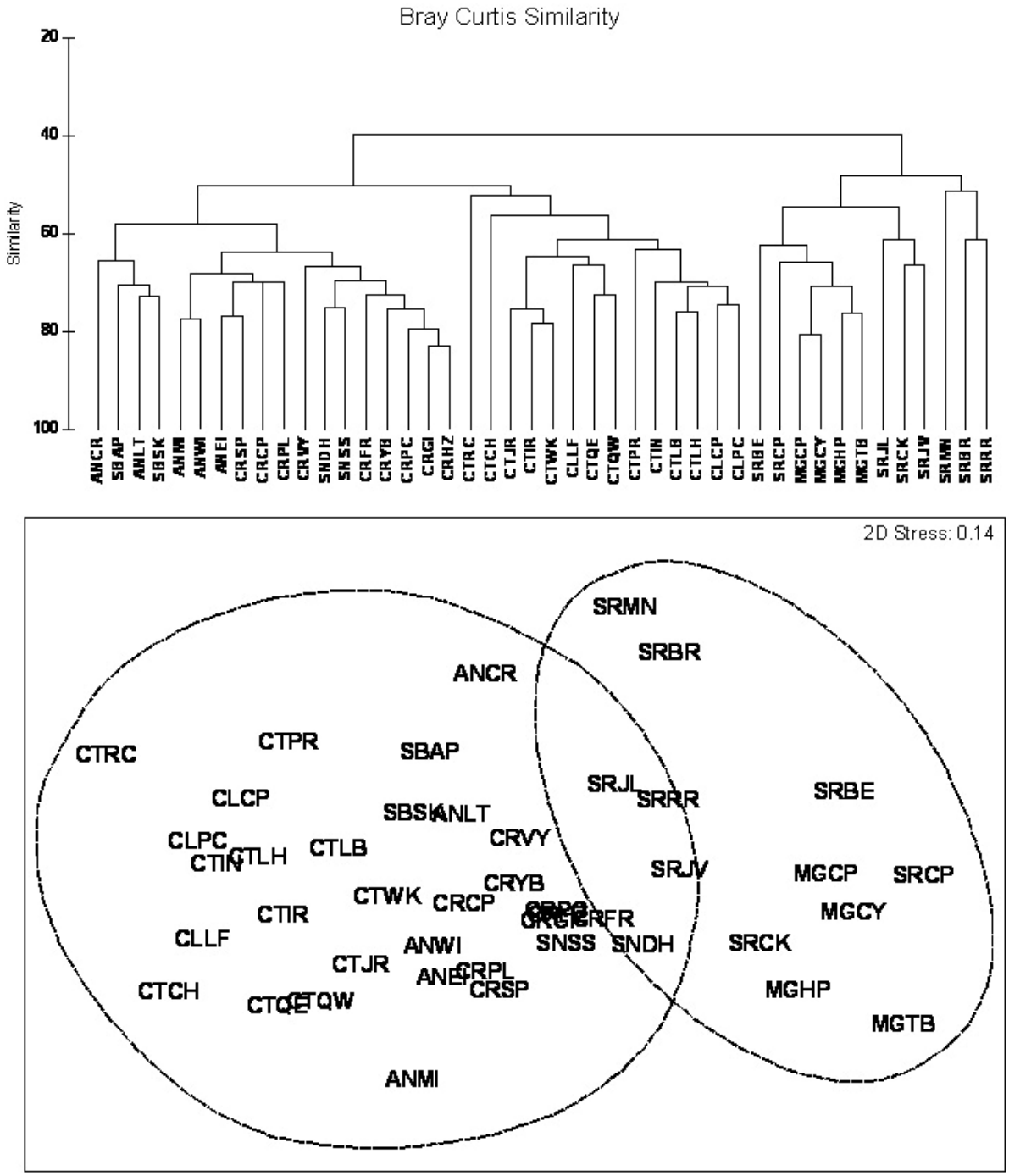

Figure 5. Reef sites (n = 60) identified for the spatial scale assessment in the Bight'08 rocky reef program.

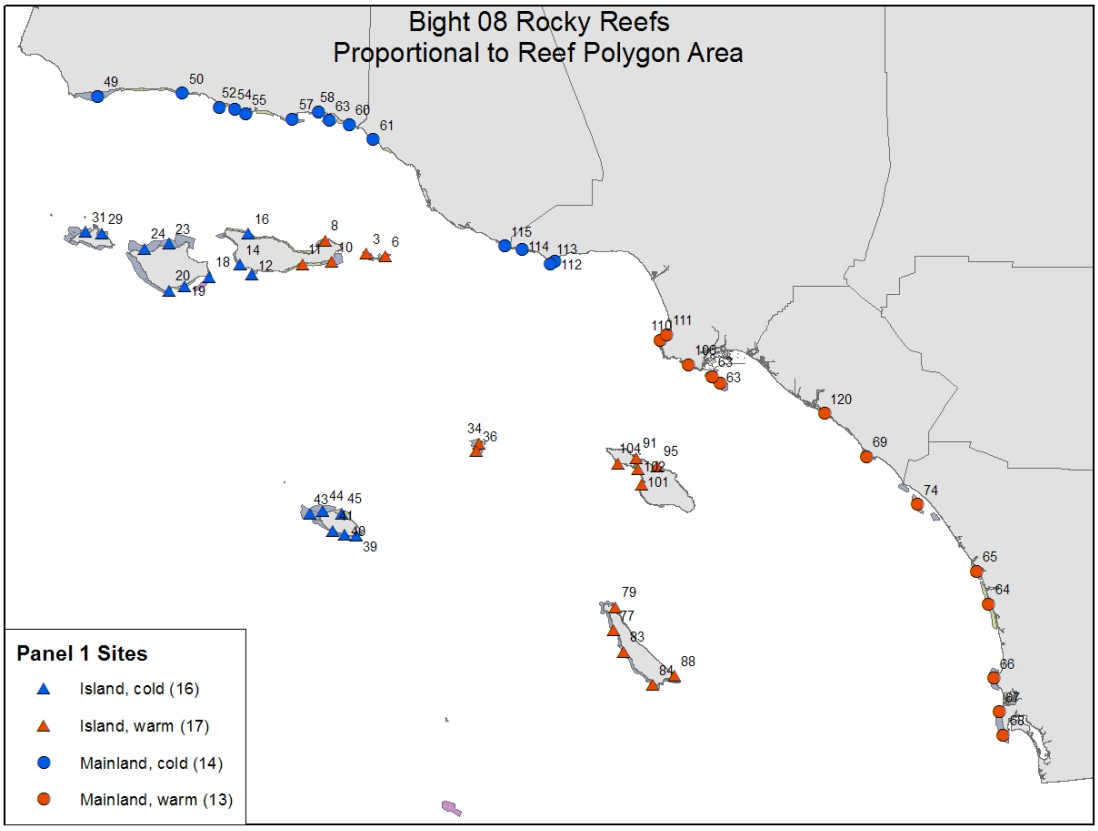

Table 3. Identified rocky reefs in the SCB. Types 1 = major reef complex, 2 = patchy reef, 3 = cobble, 4 = offshore or pinnacle reef, 5 = artificial reef.

| Id# | Region | Site | Bioregion | Temp | type | Longitude | Latitude |
|---|---|---|---|---|---|---|---|
| 1 | Anacapa | Landing Cove | Island | warm | 1 | 119.369627 | 34.017134 |
| 2 | Anacapa | The Hump | Island | warm | 1 | 119.389852 | 34.012069 |
| 3 | Anacapa | Port Rock | Island | warm | 2 | 119.434176 | 34.018309 |
| 4 | Anacapa | Cat Rock | Island | warm | 1 | 119.419339 | 34.002545 |
| 5 | Anacapa | Coral Reef | Island | warm | 1 | 119.435770 | 34.008907 |
| 6 | Anacapa | Lighthouse | Island | warm | 2 | 119.368555 | 34.011497 |
| 7 | Anacapa | East Fish Camp | Island | warm | 2 | 119.386138 | 34.004564 |
| 8 | Santa Cruz | Scorpions | Island | warm | 1 | 119.577385 | 34.053269 |
| 9 | Santa Cruz | San Pedro Point | Island | warm | 1 | 119.526028 | 34.026019 |
| 10 | Santa Cruz | Yellow Banks | Island | warm | 1 | 119.553621 | 33.992587 |
| 11 | Santa Cruz | Blue Banks | Island | warm | 2 | 119.652433 | 33.984221 |
| 12 | Santa Cruz | Gull Island | Island | warm | 1 | 119.823857 | 33.950703 |
| 13 | Santa Cruz | Malva Real | Island | warm | 1 | 119.814399 | 33.958198 |
| 14 | Santa Cruz | Morris to Kenton | Island | warm | 1 | 119.867576 | 33.977131 |
| 15 | Santa Cruz | Forneys | Island | warm | 1 | 119.915993 | 34.056102 |
| 16 | Santa Cruz | Painted Cave | Island | warm | 2 | 119.768711 | 34.057342 |
| 17 | Santa Rosa | Rosa Pinnacles | Island | cold | 4 | 119.995417 | 33.916005 |
| 18 | Santa Rosa | East Point | Island | cold | 1 | 119.970487 | 33.940028 |
| 19 | Santa Rosa | Ford Point | Island | cold | 2 | 120.054263 | 33.911759 |
| 20 | Santa Rosa | Johnson's Lee | Island | cold | 1 | 120.105338 | 33.898383 |
| 21 | Santa Rosa | Chickasaw | Island | cold | 1 | 120.155571 | 33.908710 |
| 22 | Santa Rosa | Bee Rock | Island | cold | 1 | 120.219422 | 33.962372 |
| 23 | Santa Rosa | Carrington Point | Island | cold | 1 | 120.111106 | 34.031983 |
| 24 | Santa Rosa | Rodes | Island | cold | 1 | 120.194510 | 34.014893 |
| 25 | Santa Rosa | Talcot | Island | cold | 1 | 120.057656 | 34.046221 |
| 26 | San Miguel | Castle Rock | Island | cold | 1 | 120.438027 | 34.049591 |
| 27 | San Miguel | Judith Rock | Island | cold | 1 | 120.444870 | 34.025975 |
| 28 | San Miguel | Miracle Mile | Island | cold | 1 | 120.392388 | 34.022156 |
| 29 | San Miguel | Crook Point | Island | cold | 1 | 120.335717 | 34.017362 |
| 30 | San Miguel | Cuyler Harbor | Island | cold | 1 | 120.342381 | 34.053673 |
| 31 | San Miguel | Harris Point | Island | cold | 1 | 120.364167 | 34.075961 |
| 32 | San Miguel | Simonton Cove | Island | cold | 1 | 120.396255 | 34.057399 |
| 33 | San Miguel | Wilson Rock | Island | cold | 4 | 120.402706 | 34.099588 |
| 34 | San Miguel | Richardson's Rock | Island | cold | 4 | 120.517911 | 34.101563 |
| 35 | Santa Barbara | Santa Barbara north | Island | warm | 1 | 119.035702 | 33.485468 |
| 36 | Santa Barbara | Websters | Island | warm | 1 | 119.053295 | 33.485825 |
| 37 | Santa Barbara | Sutil | Island | warm | 1 | 119.046474 | 33.462764 |
| 38 | Santa Barbara | Southeast Sealion | Island | warm | 1 | 119.031438 | 33.462940 |
| 39 | Santa Barbara | S. Barbara offshore | Island | warm | 4 | 119.018756 | 33.486777 |
| 40 | San Nicolas | Daytona Beach | Island | cold | 1 | 119.447355 | 33.216755 |
| 41 | San Nicolas | Dutch Harbor | Island | cold | 1 | 119.486060 | 33.216562 |
| 42 | San Nicolas | Station 2 | Island | cold | 1 | 119.526073 | 33.227707 |
| 43 | San Nicolas | Unnamed reef | Island | cold | 1 | 119.572095 | 33.249066 |
| 44 | San Nicolas | Boilers | Island | cold | 1 | 119.606241 | 33.273616 |
| 45 | San Nicolas | Station 3 | Island | cold | 1 | 119.562481 | 33.284383 |
| 46 | San Nicolas | Alpha Foul | Island | cold | 2 | 119.499252 | 33.277894 |

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Table 3. continued

| Id# | Region | Site | Bioregion | Temp | type | Longitude | Latitude |
|---|---|---|---|---|---|---|---|
| 47 | San Nicolas | Begg Rock | Island | cold | 4 | 119.695590 | 33.362290 |
| 48 | Tanner Bank | Tanner Bank | Island | cold | 4 | 119.129956 | 32.696057 |
| 49 | Cortez Bank | Cortez Bank | Island | warm | 4 | 119.106164 | 32.447142 |
| 50 | Mainland North | Cojo Anchorage | Mainland | cold | 1 | 120.374059 | 34.442885 |
| 51 | Mainland North | Refugio | Mainland | cold | 1 | 120.081962 | 34.458965 |
| 52 | Mainland North | Gaviota | Mainland | cold | 2 | 120.216357 | 34.467947 |
| 53 | Mainland North | Naples Reef | Mainland | cold | 1 | 119.952646 | 34.422569 |
| 54 | Mainland North | Inshore Naples | Mainland | cold | 3 | 119.937859 | 34.430907 |
| 55 | Mainland North | Ellwood | Mainland | cold | 1 | 119.899818 | 34.418317 |
| 56 | Mainland North | Isly Reef | Mainland | cold | 1 | 119.861498 | 34.405226 |
| 57 | Mainland North | More Mesa | Mainland | cold | 2 | 119.797321 | 34.413186 |
| 58 | Mainland North | Mohawk | Mainland | cold | 1 | 119.701730 | 34.395016 |
| 59 | Mainland North | Carp Reef | Mainland | cold | 1 | 119.612974 | 34.416802 |
| 60 | Mainland North | Rincon | Mainland | cold | 2 | 119.538869 | 34.392798 |
| 61 | Mainland North | La Conchita Banana | Mainland | cold | 0 | 119.505327 | 34.383204 |
| 62 | Mainland North | Soledad | Mainland | cold | 1 | 119.422241 | 34.342284 |
| 63 | Mainland North | Pitas | Mainland | cold | 2 | 119.372461 | 34.315649 |
| 64 | Mainland North | Horseshoe Kelp | Mainland | cold | 4 | 119.575412 | 34.393578 |
| 64 | Mainland North | Horseshoe Kelp | Mainland | warm | 4 | 118.233455 | 33.672677 |
| 65 | Mainland North | Deer Creek | Mainland | cold | 1 | 118.985003 | 34.059537 |
| 66 | Mainland North | Deep Hole | Mainland | cold | 1 | 118.963695 | 34.047706 |
| 67 | Mainland North | Leo Carrillo | Mainland | cold | 1 | 118.932455 | 34.042628 |
| 68 | Mainland North | Nicholas Canyon | Mainland | cold | 1 | 118.906695 | 34.037954 |
| 69 | Mainland North | El Matador | Mainland | cold | 1 | 118.889132 | 34.035605 |
| 70 | Mainland North | Encinal Canyon | Mainland | cold | 1 | 118.870112 | 34.034865 |
| 71 | Mainland North | Point Dume | Mainland | cold | 4 | 118.805859 | 33.999287 |
| 72 | Mainland North | Little Dume | Mainland | cold | 1 | 118.791930 | 34.005724 |
| 73 | Mainland South | Flat Rock | Mainland | warm | 1 | 118.405531 | 33.802309 |
| 74 | Mainland South | Ridges | Mainland | warm | 1 | 118.422430 | 33.789442 |
| 75 | Mainland South | Rocky Point | Mainland | warm | 1 | 118.432109 | 33.777127 |
| 76 | Mainland South | R. Palos Verdes | Mainland | warm | 1 | 118.422034 | 33.760970 |
| 77 | Mainland South | Point Vicente | Mainland | warm | 1 | 118.410031 | 33.739506 |
| 78 | Mainland South | Long Point | Mainland | warm | 1 | 118.397642 | 33.734580 |
| 79 | Mainland South | Abalone Cove | Mainland | warm | 2 | 118.377185 | 33.738297 |
| 80 | Mainland South | Bunker Point | Mainland | warm | 1 | 118.350807 | 33.724947 |
| 81 | Mainland South | Three Palms | Mainland | warm | 1 | 118.331725 | 33.719135 |
| 82 | Mainland South | Whites Point | Mainland | warm | 1 | 118.308558 | 33.710263 |
| 83 | Mainland South | Point Fermin Reef | Mainland | warm | 1 | 118.289713 | 33.703674 |
| 84 | Santa Catalina | Ironbound | Island | warm | 1 | 118.576783 | 33.447395 |
| 85 | Santa Catalina | Ribbon Rock | Island | warm | 1 | 118.564284 | 33.434804 |
| 86 | Santa Catalina | Cape Cortez | Island | warm | 1 | 118.539646 | 33.433961 |
| 87 | Santa Catalina | Lobster Bay | Island | warm | 1 | 118.521935 | 33.428962 |
| 88 | Santa Catalina | Pin Rock | Island | warm | 1 | 118.503963 | 33.423253 |
| 89 | Santa Catalina | Banana Rock | Island | warm | 1 | 118.482481 | 33.389641 |
| 90 | Santa Catalina | Little Harbor | Island | warm | 1 | 118.482517 | 33.374831 |
| 91 | Santa Catalina | Ben Weston | Island | warm | 2 | 118.469013 | 33.328719 |
| 92 | Santa Catalina | Salte Verde | Island | warm | 1 | 118.424588 | 33.315527 |

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Table 3. continued

| Id# | Region | Site | Bioregion | Temp | type | Longitude | Latitude |
|---|---|---|---|---|---|---|---|
| 93 | Santa Catalina | East Quarry | Island | warm | 1 | 118.304767 | 33.322821 |
| 94 | Santa Catalina | Lovers Cove | Island | warm | 1 | 118.317440 | 33.343604 |
| 95 | Santa Catalina | Torqua | Island | warm | 1 | 118.345908 | 33.370571 |
| 96 | Santa Catalina | Hen Rock | Island | warm | 1 | 118.367292 | 33.398468 |
| 97 | Santa Catalina | Italian Gardens | Island | warm | 1 | 118.377457 | 33.410770 |
| 98 | Santa Catalina | Rippers Cove | Island | warm | 1 | 118.429385 | 33.428534 |
| 99 | Santa Catalina | West Quarry | Island | warm | 1 | 118.465005 | 33.441274 |
| 100 | Santa Catalina | Blue Cavern | Island | warm | 1 | 118.477783 | 33.448763 |
| 101 | Santa Catalina | Wrigley | Island | warm | 1 | 118.487414 | 33.445887 |
| 102 | Santa Catalina | Ship Rock | Island | warm | 4 | 118.491654 | 33.463217 |
| 103 | Santa Catalina | Eagle Reef | Island | warm | 4 | 118.509774 | 33.459972 |
| 104 | Santa Catalina | Lionhead | Island | warm | 1 | 118.502080 | 33.451246 |
| 105 | Santa Catalina | Indian Rock | Island | warm | 1 | 118.529283 | 33.469253 |
| 106 | Santa Catalina | Parson's Landing | Island | warm | 1 | 118.546926 | 33.475941 |
| 107 | Santa Catalina | Black Point | Island | warm | 1 | 118.578625 | 33.476201 |
| 108 | San Clemente | Lil Flower | Island | warm | 1 | 118.361860 | 32.832279 |
| 109 | San Clemente | Pyramid Cove | Island | warm | 1 | 118.375970 | 32.818270 |
| 111 | Santa Catalina | West Kelp | Island | warm | 1 | 118.599881 | 33.468636 |
| 112 | San Clemente | China Point | Island | warm | 1 | 118.435938 | 32.805559 |
| 113 | San Clemente | Eel Point | Island | warm | 1 | 118.536149 | 32.900018 |
| 114 | San Clemente | Navy Reef | Island | warm | 1 | 118.516641 | 32.960678 |
| 115 | San Clemente | Target Rock | Island | warm | 1 | 118.606079 | 33.010859 |
| 116 | San Clemente | Northwest Harbor | Island | warm | 1 | 118.590482 | 33.038714 |
| 117 | San Clemente | Reflector Reef | Island | warm | 1 | 118.565862 | 33.025713 |
| 118 | San Clemente | West Clemente | Island | warm | 1 | 118.569627 | 32.959319 |
| 119 | San Clemente | East Clemente | Island | warm | 1 | 118.488347 | 32.841186 |
| 120 | Mainland South | Port of LA 1 | Mainland | warm | 5 | 118.271413 | 33.704050 |
| 121 | Mainland South | Port of LA 2 | Mainland | warm | 5 | 118.257011 | 33.706796 |
| 122 | Mainland South | Port of LA 3 | Mainland | warm | 5 | 118.254147 | 33.715719 |
| 123 | Mainland South | Port of LA 4 | Mainland | warm | 5 | 118.266841 | 33.708359 |
| 124 | Mainland South | King Harbor | Mainland | warm | 5 | 118.398731 | 33.843268 |
| 125 | Mainland South | San Onofre | Mainland | warm | 3 | 117.545777 | 33.325690 |
| 126 | Mainland South | Barn Kelp | Mainland | warm | 1 | 117.486872 | 33.291764 |
| 127 | Mainland South | San Mateo Kelp | Mainland | warm | 1 | 117.593397 | 33.373749 |
| 128 | Mainland South | Laguna Beach | Mainland | warm | 1 | 117.784118 | 33.535041 |
| 129 | Mainland South | San Clemente Reef | Mainland | warm | 5 | 117.620651 | 33.402724 |
| 130 | Mainland South | Dana Point | Mainland | warm | 1 | 117.721284 | 33.461371 |
| 131 | Mainland South | Cardiff-Encinitas | Mainland | warm | 2 | 117.303287 | 33.043031 |
| 132 | Mainland South | Carlsbad | Mainland | warm | 1 | 117.345303 | 33.136072 |
| 133 | Mainland South | La Jolla | Mainland | warm | 1 | 117.285702 | 32.831748 |
| 134 | Mainland South | Point Loma north | Mainland | warm | 1 | 117.267481 | 32.724302 |
| 135 | Mainland South | Point Loma south | Mainland | warm | 1 | 117.254668 | 32.676597 |
| 136 | San Clemente | Wilson Cove | Island | warm | 1 | 118.551681 | 33.005913 |
| 137 | Mainland South | Port of LA 5 | Mainland | Warm | 5 | 118.23185 | 33.714348 |

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Table 4. The 60 sites randomly chosen for the probabilistic design, current research sites and CRANE sites within them.

| Id# | Region | Site | Agency-Current Study Site | CRANE 2003 |
|---|---|---|---|---|
| 3 | Anacapa | Port Rock | PISCO-West Isle | Anacapa West Isle |
| 6 | Anacapa | Lighthouse | PISCO-Lighthouse | Southwest Lighthouse |
| 79 | San Clemente | Reflector Reef | | |
| 77 | San Clemente | West Clemente | | |
| 83 | San Clemente | Eel Point | | |
| 88 | San Clemente | Lil Flower | | Little Flower |
| 84 | San Clemente | China Point | | China Point |
| 31 | San Miguel | Simonton Cove | | |
| 29 | San Miguel | Cuyler Harbor | PISCO- Cuyler and Harris Pt. | Cuyler and Harris Pt. |
| 44 | San Nicolas | Station 3 | | |
| 45 | San Nicolas | Alpha Foul | | |
| 43 | San Nicolas | Boilers | | |
| 41 | San Nicolas | Station 2 | | |
| 39 | San Nicolas | Daytona Beach | | Sand Spit |
| 40 | San Nicolas | Dutch Harbor | | Daytona Beach |
| 34 | Santa Barbara Island | Santa Barbara north | | |
| 36 | Santa Barbara Island | Sutil | | |
| 91 | Santa Catalina | Lionhead | VRG/LACSD | |
| 104 | Santa Catalina | Ironbound and Ribbon Rock | VRG/LACSD | |
| 95 | Santa Catalina | Rippers Cove | VRG/LACSD | |
| 102 | Santa Catalina | Pin Rock to Banana Rock | VRG/LACSD | Ripper's Cove |
| 101 | Santa Catalina | Little Harbor | VRG/LACSD | |
| 16 | Santa Cruz | Painted Cave | PISCO-Painted Cave and Hazards | Painted Cave and Hazards |
| 8 | Santa Cruz | Scorpions | PISCO-Scorpion Anchorage, Scorpion Point, Cavern Point, Potato Pasture, Coche Point | Coche Point and Scorpion |
| 10 | Santa Cruz | Yellow Banks | PISCO-Yellowbanks | Yellowbanks |
| 14 | Santa Cruz | Morris to Kenton | | |
| 11 | Santa Cruz | Blue Banks | PISCO-Valley | Blue Banks |
| 12 | Santa Cruz | Gull Island | PISCO-Gull Island | Gull Island |
| 23 | Santa Rosa | Rodes | PISCO-Beacon Reef | Beacon Reef |
| 24 | Santa Rosa | Talcott | PISCO-Rodes Reef | Rodes Reef |
| 18 | Santa Rosa | East Point | | |
| 19 | Santa Rosa | Ford Point | PISCO-Jolla Vieja | Jolla Vieja |

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| Id# | Region | Site | Agency-Current Study Site | CRANE 2003 |
|---|---|---|---|---|
| 20 | Santa Rosa | Johnson's Lee | PISCO-Johnson's Lee South, Johnson's Lee North | Johnson's Lee |
| 50 | Mainland North | Refugio | | |
| 49 | Mainland North | Cojo Anchorage | PISCO-Cojo Anchorage | Cojo |
| 52 | Mainland North | Naples Reef | PISCO-Naples Reef | Naples Reef |
| 54 | Mainland North | Ellwood | | |
| 58 | Mainland North | Carp Reef | | |
| 55 | Mainland North | Isly Reef | | |
| 63 | Mainland North | Horseshoe Kelp | | |
| 57 | Mainland North | Mohawk | | |
| 60 | Mainland North | La Conchita Banana | | |
| 61 | Mainland North | Soledad | | |
| 115 | Mainland North | Deep Hole | VRG/SMBK | |
| 114 | Mainland North | Leo Carrillo to Encinal | VRG/SMBK | |
| 112 | Mainland North | Little Dume | VRG/SMBK | |
| 113 | Mainland North | Point Dume | VRG/SMBK | |
| 63 | Mainland North | Horseshoe Kelp SP | VRG/LACSD | |
| 63 | Mainland North | Horseshoe Kelp SP | VRG/LACSD | |
| 111 | Mainland South | Flat Rock | VRG/LACSD | |
| 110 | Mainland South | Rocky Point and Ridges | VRG/LACSD | Rocky Point |
| 106 | Mainland South | Bunker Point to Whites Point | VRG/LACSD | |
| 120 | Mainland South | Little Corona | | |
| 69 | Mainland South | Dana Point | | Dana Point |
| 74 | Mainland South | San Onofre | | San Onofre |
| 65 | Mainland South | Carlsbad | | Carlsbad |
| 64 | Mainland South | Cardiff-Encinitas | | Encinitas |
| 66 | Mainland South | La Jolla | SDSU | La Jolla |
| 67 | Mainland South | Point Loma north | SDSU | Point Loma North |
| 68 | Mainland South | Point Loma south | SDSU | |

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Table 5. CRANE survey sites in the SCB and current commitment (occupied) in 2008 program.

| Site Name | Code | County or Island | Latitude (N) | Longitude (W) | Occupied |
|---|---|---|---|---|---|
| Cojo | CJ | Santa Barbara | 34.44508 | 120.41583 | x |
| Naples[2] | NP | Santa Barbara | 34.42218 | 119.95187 | x |
| Cuyler | MGCY | San Miguel Island | 34.05027 | 120.34587 | x |
| Harris Point | MGHP | San Miguel Island | 34.05278 | 120.33738 | x |
| Tyler Bight | MGTB | San Miguel Island | 34.02653 | 120.4067 | x |
| Crook Point | MGCP | San Miguel Island | 34.01718 | 120.32888 | x |
| Rodes Reef | SRRR | Santa Rosa Island | 34.0325 | 120.1072 | x |
| Beacon Reef | SRBR | Santa Rosa Island | 34.0492 | 120.0432 | x |
| Monacos[2] | SRMN | Santa Rosa Island | 33.9845 | 120.0087 | x |
| Bee Rock | SRBE | Santa Rosa Island | 33.9539 | 120.2119 | x |
| Cluster Point | SRCP | Santa Rosa Island | 33.9238 | 120.18945 | x |
| Chickasaw | SRCK | Santa Rosa Island | 33.8999 | 120.1361 | x |
| Johnson's Lee | SRJL | Santa Rosa Island | 33.8941 | 120.1079 | x |
| Jolla Vieja | SRJV | Santa Rosa Island | 33.9092 | 120.0677 | x |
| Forney | CRFR | Santa Cruz Island | 34.05303 | 119.90693 | x |
| Painted Cave | CRPC | Santa Cruz Island | 34.07287 | 119.87098 | x |
| Hazards | CRHZ | Santa Cruz Island | 34.05658 | 119.82117 | x |
| Pelican | CRPL | Santa Cruz Island | 34.03065 | 119.69665 | x |
| Coche Point | CRCP | Santa Cruz Island | 34.04497 | 119.60153 | x |
| Scorpion | CRSP | Santa Cruz Island | 34.04847 | 119.54637 | x |
| Gull Isle | CRGI | Santa Cruz Island | 33.9499 | 119.8236 | x |
| Valley | CRVY | Santa Cruz Island | 33.98433 | 119.64148 | x |
| Yellowbanks | CRYB | Santa Cruz Island | 33.99037 | 119.5545 | x |
| Anacapa West Isle | ANWI | Anacapa Island | 34.01698 | 119.43292 | x |
| Anacapa Middle Isle | ANMI | Anacapa Island | 34.00932 | 119.38877 | x |
| Anacapa East Isle | ANEI | Anacapa Island | 34.01767 | 119.36368 | x |
| Cat Rock | ANCR | Anacapa Island | 34.0035 | 119.4241 | x |
| Southwest Lighthouse | ANLT | Anacapa Island | 34.0116 | 119.3661 | x |
| Malibu[2] | MB | Los Angeles | 34.02785 | 118.69552 | x |
| King Harbor | KH | Los Angeles | 33.84143 | 118.39492 | x |
| Rocky Point | RK | Los Angeles | 33.78053 | 118.42793 | x |
| Point Vicente | PV | Los Angeles | 33.7441 | 118.41962 | x |
| Dana Point | DP | Orange | 33.47962 | 117.7257 | |
| San Mateo | MT | Orange | 33.38842 | 117.6008 | |
| San Onofre | SO | San Diego | 33.34445 | 117.55735 | |
| Barn Kelp | BK | San Diego | 33.28935 | 117.4898 | |
| Carlsbad | CB | San Diego | 33.12792 | 117.33693 | |
| Encinitas | EN | San Diego | 33.03408 | 117.29655 | |
| Cardiff | CF | San Diego | 32.9954 | 117.27813 | |
| La Jolla | LJ | San Diego | 32.8209 | 117.28505 | x |
| Point Loma North | PLN | San Diego | 32.72382 | 117.25965 | x |
| Point Loma South | PLS | San Diego | 32.68668 | 117.26618 | x |
| Sand Spit | SNSS | San Nicolas Island | 33.21622 | 119.44362 | |
| Dutch Harbor | SNDH | San Nicolas Island | 33.21288 | 119.47053 | |
| Arch Point | SBAP | Santa Barbara Island | 33.48633 | 119.02793 | x |

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Table 5. Continued

| Site Name | Code | County or Island | Latitude (N) | Longitude (W) | Occupied |
|---|---|---|---|---|---|
| South Kelp | SBSK | Santa Barbara Island | 33.47085 | 119.02932 | x |
| West Kelp[2] | CTWK | Santa Catalina Island | 33.4718 | 118.60447 | |
| Johnson's Rocks[2] | CTJR | Santa Catalina Island | 33.47673 | 118.58887 | |
| Isthmus Reef | CTIR | Santa Catalina Island | 33.44782 | 118.48932 | x |
| Intakes | CTIN | Santa Catalina Island | 33.44708 | 118.4851 | x |
| West Quarry[2] | CTQW | Santa Catalina Island | 33.44245 | 118.47143 | |
| Ripper's Cove | CTRC | Santa Catalina Island | 33.42857 | 118.42992 | x |
| East Quarry | CTQE | Santa Catalina Island | 33.3157 | 118.30333 | |
| Lobster Bay | CTLB | Santa Catalina Island | 33.4276 | 118.52032 | |
| Catalina Harbor[2] | CTCH | Santa Catalina Island | 33.4262 | 118.51145 | |
| Pin Rock[2] | CTPR | Santa Catalina Island | 33.42352 | 118.50433 | x |
| Little Harbor | CTLH | Santa Catalina Island | 33.38925 | 118.48088 | x |
| Little Flower | CLLF | San Clemente Island | 32.84023 | 118.36855 | |
| Pyramid Cove | CLPC | San Clemente Island | 32.80873 | 118.43772 | |
| China Point | CLCP | San Clemente Island | 32.80873 | 118.43772 | x |

## C. Quality Assurance and Quality Control

The rocky reef field leaders met on May 29, 2008 to review all field protocols in dry lab setting. Field audits and coordination are overseen by three regional QA/QC officers, each a principal investigator from CRANE, and will follow the format used during CRANE (Tenera 2006). QA/QC officers oversee the training of all personnel in their study region. This training first includes the oversight of the testing of field technicians with various types of training materials which includes techniques and taxonomic materials. In addition all field technicians are trained for fish size class estimations prior to commencing field work. After the oversight of the dry lab training, the QA/QC officers are responsible for auditing the field crews throughout the sampling season. The QA/QC officers and field leaders conduct at least one intercalibration field sampling event to insure consistency among the various field programs, with the objective of consistency in sampling techniques.

<u>QA/QC OFFICERS</u>

Northern Region-Dr. Jennifer Caselle (caselle@msi.cusb.edu)
Central Region-Dr. Dan Pondella (Pondella@oxy.edu)
Southern Region-Dr. Matt Edwards (Edwards@sciences.sdsu.edu)

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## D. Field Program

### D.1 Sampling Unit

A sampling unit in this program is the equivalent of one-half of a PISCO or CRANE study site, which will be referred to as a sampling cell. A cell will consist of a fixed stretch of coastline, occupying at least 250 m of reef habitat. Within each cell four depth zones (if present) will be sampled. Each depth zone needs to be geo referenced. The core sampling unit for a PISCO/CRANE cell is three depth zones based upon the natural contours of a reef. These strata are the inner (~5m), middle (~10m) and outer (~15m) portions of a natural reef or kelp bed. In the Bight '08 program we have added a deep zone (~25m) when this habitat is available. Thus, the sampled target depths for sites are 5 m, 10 m, 15 m and 25 m contours (or equivalent inshore, middle, and outer and deep portions of a reef; Figure 6). Within each depth zone two benthic sampling protocols, Unified Point Contact (UPC) and macro invertebrate and algae (Swath), will be completed. For fishes, in each depth zone four benthic, mid-depth and canopy (when present) 30 m belt transects will be completed. If kelp reaches the surface, then the canopy transects are completed. The minimum sampling effort for a reef is the core sampling unit from PISCO/CRANE cell, which includes 12 benthic fish transects, 12 midwater fish transects, 12 canopy (when present) fish transects, 6 UPC and 6 Swath transects. 100 red and 100 purple urchins are size classed at each site. A team of four divers can sample a cell within a sampling day. Other sampling configurations are used depending on the specific distributions of rock reefs and depth profiles at a site as determined by the principal investigator. However, the same number of replicates for the core sampling unit would need to be completed.

Figure 6. Example of the four sampling depth zone on a natural reef.

**D.2 Fish Sampling**

The purpose of the fish sampling is to estimate fish density and length frequency distributions by species at each site. Good visibility is critical and a minimum of 3 m is necessary to conduct these transects. Within each cell, a total of four benthic, four middepth and four canopy (when present) 30 m x 2 m replicate transects are sampled. The sampled target depths for sites with three zones were approximately the 25m, 15 m, 10 m, and 5 m depths (or equivalent reef zones, deep, outer-edge, middle, and inshore portion), respectively. The height of the 'mid-water' transect varies as a function of bottom depth and is approximately half way up the water column. Canopy transects are conducted immediately below the kelp canopy when present.

Observers begin the transects by loosely clipping the end of the transect measuring tape to a kelp frond or placing it beneath a rock. The pair of divers swim in the pre-arranged compass direction for a distance of 30 m while counting and estimating the sizes of the fish. All conspicuous fishes encountered along the transects are recorded. Divers count and estimated total length (TL) of small fish (< 15 cm [5.9 in] TL ) to the nearest cm, and larger fish (> 15 cm) to the nearest 5 cm (2.0 in) interval. If a school of fish (>10 fish) is encountered, the number of fish is estimated within each size group. The observer censuses fishes within the boundaries of an imaginary observation "box" slightly ahead of them as they swim along, sometimes stopping, scanning and searching within discrete areas of the "box" that is delimited by the 2 m transect width and natural features such as kelp plants or large boulders. The diver holds the data board in front of them and records data periodically so that they could maintain fish counts and size estimates with minimal distraction. If there is an intervening obstacle, the transect continued over it so long as the depth change was less than 2.5 m. If the obstacle is greater than 2.5 m in height, the transect circumvented it. Transects are completed even if sand is encountered. When there was sand for more than 5 m and it appeared that the habitat continued primarily as sand, the transect direction is changed to the minimum necessary to remain on rocky habitat. Physical data collected on each transect included observation depth (m), water temperature (Cº), horizontal visibility (m), surge (0-4 relative scale), and kelp canopy cover (%).

Transects are completed in 3-6 minutes depending on the number of fishes and the complexity of the habitat. Upon completing a transect, the divers then swim to the starting point of their next replicate transect within the same zone by choosing a haphazard direction along a similar depth contour. The preferred distance between transects is at least 10 m.

Canopy transects can be completed at two levels of expertise. 1) a fully trained scientist who is familiar with young-of-year (YOY) fishes. At this level fishes of all sizes are enumerated and size classed. 2) a normal scientific diver who is proficient in identifying and sizing fishes on benthic and midwater transects. These divers would record all adult and subadults by species and YOY's could be recorded at higher taxonomic levels.

**D.3 Invertebrate and Macroalgae sampling**

Swath, sea urchin sampling and uniform point contact (UPC) are conducted within each depth zone, a total of eight 30 m x 2 m replicate transects are sampled. Transects are deployed beforehand parallel to the bathymetry and maintained within a ±

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2.5 m depth range. As with the fish transects, if there is an intervening obstacle, the transect is continued over it unless it was greater than 2.5 m in height, in which case the transect circumvented it. Visibility of at least 3 m is necessary.

**D.4 Swath Sampling**

The purpose of the swath sampling is to estimate the density of conspicuous, solitary and mobile invertebrates as well as specific macroalgae. Individual invertebrates and plants are counted along the entire 30 m x 2 m transect. Transects are completed even if sand is encountered but when there was sand for more than 5 m, the direction of the transect was changed to the minimum necessary to remain on rocky habitat. Divers slowly swim one direction counting targeted invertebrates (from a pre-printed list on the data sheet) and then swim back along the transect counting targeted macroalgae. Cracks and crevices were searched and understory algae pushed aside. No organisms are removed. Any organism with more than half of its body inside the swath area is counted. The following size criteria applied to counting macroalgal species:

- *Macrocystis* plants taller than 1 m (3.3 ft), and number of stipes per plant at 1 m above the substrate. *Macrocystis* is not subsampled.
- *Nereocystis*, *Pterygophora*, *Laminaria setchellii* and *Eisenia arborea* taller than 30 cm (11.8 in)
- *Laminaria farlowii* with blade greater than 10 cm (3.9 in) wide
- *Cystoseira osmundacea* greater than 6 cm (2.4 in) wide
- *Costaria* and *Alaria* no size restrictions

Transects are divided into three, 10-meter segments. Species that occurred in high densities (e.g., purple urchins) are sub-sampled if greater than 30 individuals occurred within any of the three 10 m segments on a transect. *Macrocystis* is not subsampled. Normally a diver counts all target species within each 10 m segment, but when 30 individuals of one species are counted, the diver records the meter mark at which the threshold abundance is reached and then stopped counting that species for the remainder of that segment. The species continued to be counted at the start of each following segment and the same threshold abundance rule was applied. The subsampled abundances are then extrapolated per segment to calculate an estimated total abundance per transect. Considering their paucity for the majority of the SCB the size and species of any abalone is recorded.

**D.5 Uniform Point Contact Benthos Sampling**

Percent cover of substrate type, substrate relief and benthic organisms are recorded at each meter mark along the 30 m transect tape. Substrate percentages in the following categories are estimated within each 10 m segment: bedrock ($\geq$ 1 m), boulder (1 m), cobble ($\leq$10 cm), and sand. Substrate relief is the maximum relief within a rectangle centered on the point that is 0.5 meter along the tape and 1 meter wide (Figure 2-4). To contact benthic organisms, the line is pushed down and the species under the tape is recorded. If the line could not contact the substrate, the diver's finger was used to mark the spot. Epiphytes, epizooids and mobile organisms are not recorded. If the contact point was on a blade of *Laminaria*, brittlestars or the sea cucumber *Pachythione rubra*, the organism under the point is recorded and it is noted that the point was under one of

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these organisms. The superlayer is also recorded. In addition to quantifying benthic organisms, the following types of bare substrate are recorded, if contacted: rock, sand, shell debris, and mud. Considering their paucity for the majority of the SCB the size and species of any abalone is recorded.

### D.6 Sea Urchin Sampling

In order to gain a more accurate estimate of the size frequency distribution of local sea urchins populations, specimens are collected and measured in the areas on and around each transect. In areas where urchins are abundant at least 100 red and 100 purple urchins are collected and their test diameters measured to the nearest centimeter. Specimens were collected from each depth zone and multiple areas of the site, if possible. To avoid bias in size measurements, all emergent urchins are collected from each patch unless the patch is very large, in which case only a portion of the patch is completely collected. Urchins are measured either underwater or on the boat. Very small urchins (< 1 cm) under the spine canopy of larger urchins are not measured. If it is not possible to collect 100 of each species within a total dive time of one hour, the search for urchins is suspended. Considering their paucity for the majority of the SCB the size and species of any abalone is recorded.

## E. Special Studies

### E.1 Oil Rig Surveys

Oil rigs have a previously determined optimal sampling strategy due to their configuration. Midwater community surveys will be conducted via SCUBA transects at six of the seven petroleum platforms on the San Pedro Shelf (Edith, Eureka, Eva, Esther, and the Ellen-Elly complex and five in the Santa Barbara Channel (Gilda, Grace B, Platform B, Holly, and Irene. Conspicuous fish counts will be collected via fish transecting methods described by Love et al. (2003). A dive team descended to the first crossbeam above 31 m and followed a rectangular transect pattern along the major horizontal crossbeams. Upon completion at the 30m level, divers ascended to the next crossbeam and repeat the same transect pattern. Every major horizontal crossmemeber was surveyed from three major depth zones: Level 1, range 1 to 10 m; Level 2, range 11 to 20m; Level 3, range 21 to 32 m (Love et al. 2003). Survey divers identified, counted and estimated the size for all fish encountered in a standardized volume along the structure. Fish size estimation was done using five centimeter bin units. The second diver functioned as a safety diver, as well as periodically operating a digital video camera. The video footage was used for groundtruthing fish identification and as a method of controlling for observer variability.

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**E.2 Port of Los Angeles Surveys**

Studying the reefs of the Port of Los Angeles, situated at the center of the SCB, is important for a variety of reasons. First, the Federal Breakwater and associate rocky groins constitute the largest reef complex in the SCB. What percentage of the total reef habitat in SCB this represents is currently unknown. From the data products generated under the first study question, we will be able to determine the contribution of these structures to amount of hard substrate in the Bight. Secondly, there is limited data on the biological resources associated with these reef structures (Froeschke et al. 2005). Due to the high relief reefs and continual kelp coverage, these structures contribute significant amounts of resources (biomass and species diversity) to the region. The Port of Los Angeles has long been a focus of pier, shore and jetty fishing. These activities are likely to increase in scope and magnitude in and around the Port. There is the long term potential to increase these nearshore-fishing opportunities and creating a research program that will generate data to evaluate these opportunities is timely and necessary. Thus, there is a necessity to collect and interpret data about the organisms, which are being extracted by these activities. In addition, this research effort will augment the current biological baseline survey being conducted in the Port.

Five sites (Figure 7) in the Port during the 2008 sampling season will be surveyed by the Southern California Marine Institute.. The first is the Federal Breakwater proximate to Cabrillo Beach. This site will be particularly important for generating data that can be used in the development of a fishing pier at that location. The second and third sites are Federal Breakwater around Angel's Gate. These sites are intensively fished and due to a variety of physical factors, (i.e. depth, relief, currents) support a diverse kelp and rocky reef ecosystem that is highly productive. The fourth site is the rocky groin on the perimeter of the shallow water habitat. These types of habitats were shown to be highly productive in San Diego Bay (Pondella et al. 2006). The fifth site is the rocky perimeter of Pier 400.

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Figure 7. Study sites in the Port of Los Angles for the  Bight 08' Rocky Reef study.

**E.3 Artificial Reef Surveys**

Known artificial reefs in the SCB have been mapped and are included as their own GIS layer. Surveys of artificial reefs will follow the same protocols as the natural reefs. The principal investigator based upon reef configuration will determine the allocation of replicates. In addition to the five sites in the Port of Los Angeles and the breakwaters of King Harbor, Redondo Beach we are targeting all of the artificial reefs in Los Angeles and Orange Counties.

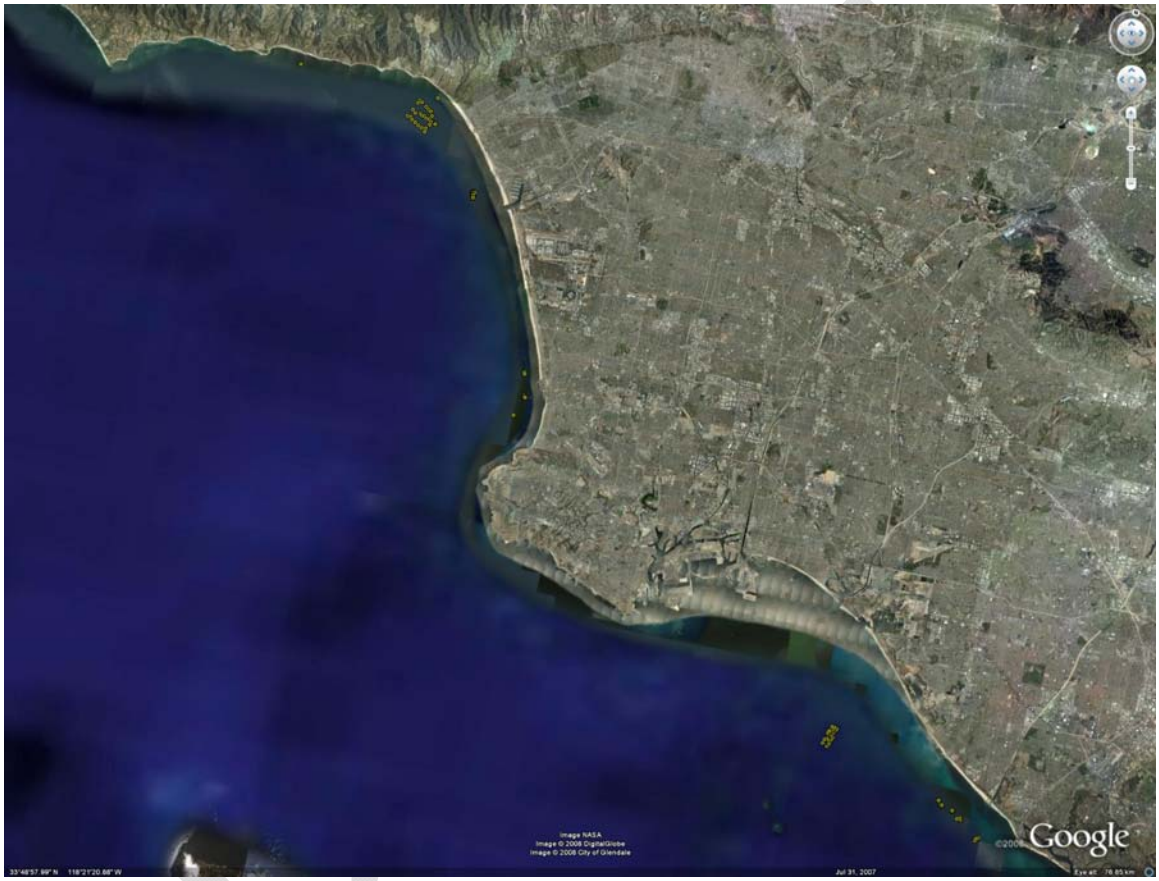


Figure 8. Locations of artificial reefs in Los Angeles and Orange Counties.

**E.4 Reef Check California (RCCA) Surveys**

RCCA protocol has been modeled after the CRANE and PISCO methods. The sampling unit is identical to CRANE/PISCO methods, 30 x 2 m (x 2 m for fish). An RCCA site is 250 m of linear coastline while CRANE/PISCO sites are 500 m split into 2 areas of approximately 250 m. When compared to half, either the upcoast or downcoast area, of a CRANE/PISCO site RCCA has the same sample size for benthic surveys (n = 6) and a slightly higher replicate count, 18 instead of 12 replicate transects, for fish surveys. When designing a monitoring protocol, it is important to match the scientific skills of the intended users with the scientific requirements of the program. By selecting a subset of key indicators and requiring rigorous training, testing and certification, the

RCCA monitoring protocol has been specifically designed to suit the State's management needs at a level that can effectively utilize the vast resources of community-based RCCA trained divers. The RCCA protocol indicator species list is smaller overall than the PISCO/CRANE list in order to ensure the data quality of RCCA surveys, while still providing key information needed to improve nearshore marine management in California. All the RCCA indicator species are also surveyed by PISCO/CRANE. All comparable metrics from the RCCA surveys will be used.

In Bight 08' we will conduct a calibration experiment between the RCCA and those being conducted by volunteers and scientific divers. These will be blind comparisons conducted this fall. The remaining RCCA surveys and dates are listed in Table 6. The regional coordinators of the scientific dive teams will coordinate with Colleen Wisniewski RCCA's Southern California Program Manager (colleen@reefcheck.org; 619.255.9706) to survey the remaining unoccupied sites in the reef draw so that they may be as temporally close to the RCCA surveys as possible. SCCWRP and the rocky reef committee in coordination with RCCA will examine all common metrics from the two programs in the calibration study.

Table 6. Remaining RCCA sites that overlap with Bight 08' stations in the SCB and potential sampling dates.

| **Site_Name** | **Latitude** | **Longitude** | **Fall 2008 (Sept-Nov)** |
|---|---|---|---|
| Naples Reef | 34.4219 | -119.9515 | 10/4/2008-potential date |
| IV Reef | 34.4031 | -119.8661 | 10/11/2008-potential date |
| Cueva Valdez | 34.055 | -119.81 | 10/29/2008 |
| Malaga Cove | 33.8037 | -118.3984 | begin 0ct 12 |
| Little Corona Del Mar | 33.5898 | -117.8687 | oct 25 begin |
| Heisler Park - (LBAOP) | 33.5423 | -117.7950 | oct/nov |
| Crystal Cove-(LBAOP) | 33.5714 | -117.8412 | oct/nov |
| Salt Creek (LBAOP) | | | oct/nov |
| Torqua | 33.3830 | -118.35 | late sept |
| Del Mar | 32.9714 | -117.2722 | Oct LG boat?? |
| S. Solana Beach | | | maybe late October?? |
| North Hill Street (N Point Loma) | 32.7286 | -117.2650 | start sept 13 |
| BroomtailReef (S Point Loma ) | 32.6942 | -117.2681 | start Oct 18 |

## F. Anthropogenic Effects

Critical to various resource managers concerns and needs is the development of a reef index of health. The data generated under the second study question will include all parameters necessary for the evaluation of this index. We will form a subcommittee to oversee this process study. The initial index development will begin with at least two datasets (CRANE and VRG SMBRC reef study) and optimally then be applied to the Bight 08' data.

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We currently recognize that there are various natural and anthropogenic factors affecting reef communities on localized scales. These include harmful algal blooms (HAB), turbidity, river plumes, sedimentation, overfishing, pollution, marine protected areas (MPA's), and kelp bed restoration. Our goal is to overlay the natural biological conditions determined in this program with the various data layers generated in the other Bight 08' programs enabling the beginning of a understanding of how these various factors may relate to each other. This will facilitate perhaps more detailed process studies of these potential effects.

**G. Liability and Diver Safety**

Divers must adhere to the "scientific diving" guidelines of the American Academy of Underwater Sciences (AAUS) or equivalent dive programs. "Scientific diving" gives the researcher much more regulatory flexibility for complex tasks than "commercial" divers. Scientific diving is defined in Cal/OSHA regulations in Title 8 of the California Code of Regulations (8CCR) in section 6051 et. seq. The parallel Federal OSHA reference is 29 CFR 1910.402. Federal and Cal/OSHA have granted an exemption from the rigid commercial diving standard/regulations, for scientific diving. This exemption is allowed ONLY if the diving operations are performed solely as a necessary part of a scientific, research, or educational activity by employees and students whose sole purpose for diving is to perform scientific research tasks. In addition to this mandate, the following elements of a scientific diving program must be established and maintained to qualify as a scientific diving program. Strictly adhering to safe scientific diving practices under the guidelines of AAUS allows the Cal/OSHA exemption to be enacted. In addition participating institutions must carry a minimum of $1,000,000 general liability insurance.

Reef Check California (RCCA) utilizes volunteer divers. They use very specific language when divers go through the training course emphasizing that divers conduct RCCA survey dives at their "own will" and they use "the safe diving practices they were taught in their scuba certification course". When divers go through a RCCA Training Course the RCCA staff who teach the course are covered by a group professional liability insurance policy with a $2 million aggregate which they purchase through NAUI. The policy provides the typical coverage all scuba instructors carry in California. The divers sign NAUI releases, an RCCA release, and a release for whatever dive charter boat we use for the training.

For this reason, the vast majority of RCCA surveys are NOT conducted under a home institution's AAUS auspices, however, basic scientific guidelines outlined by AAUS are followed (e.g. alternate air souce, buddy system, etc.). RCCA does have divers that are AAUS affiliated from university and agency partners (i.e. UCSB, HSU, CDFG and MLML) that do conduct RCCA dives under AAUS auspice of their home institution when we use boats that require that, such as CDFG or Sanctuary/NOAA boats for surveys. The home institution writes the LOR and they assume the liability for that diver. For the actual surveys volunteer divers conduct them at their "own will" meaning that they were going diving anyway and chose to conduct a RCCA survey when they are

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underwater. They often charter boats for surveys and these operate just like any dive charter in that the vessel operator assumes the liability for all divers on the boat.

**H. Timeline and Report Chapters**

Timeline

Field Sampling: 6/1/2008-12/31/2008
Data Submittal: 3/31/2009
QA/QC: 5/30/2009
Analysis>Oral Report: 12/31/2009
Written Report: 6/30/2010

Chapters

Marine Protected Areas
Time Series Assessment
Assessment Index Development
Reef Mapping
Biological Assemblages
Artificial reef vs natural reef comparison
Rigs vs natural reef comparison
Utilization of RCCA data
Integration with other Bight 08' components

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