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Rocky Intertidal Resource Dynamics at Point Loma, San Diego County, California
1996-1998 Report

Final Technical Summary

Final Study Report

U.S. Department of the Interior
Minerals Management Service
Pacific OCS Region

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Final Technical Summary

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FINAL TECHNICAL SUMMARY

STUDY TITLE: Inventory of Rocky Intertidal Resources in San Diego County

REPORT TITLE: Rocky Intertidal Resource Dynamics at Point Loma, San Diego County, California, 1996-1998 Report

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COOPERATING AGENCIES: U.S. National Park Service, U.S. Navy

BACKGROUND: This is the final report of a study monitoring key rocky intertidal resources along the coast of Point Loma, San Diego County. The original work period was from November 15, 1996 through February 14, 1998; this period was subsequently extended to September 30, 1998.

This project was carried out with cooperative assistance from the U.S. National Park Service and the U.S. Navy. Both agencies supported previous monitoring at the Point Loma sites. The National Park Service funded surveys at the 3 Cabrillo National Monument sites from 1990 to 1995. The Navy funded surveys at Navy North and Navy South in 1995. Both agencies will continue the monitoring surveys upon conclusion of this project.

This final project report provides the results of 4 biannual baseline monitoring surveys conducted from Fall 1996 through Spring 1998 at 5 rocky intertidal sites along the outer coast of Point Loma Peninsula in San Diego, California. The primary project objective was to increase regional understanding of population dynamics of important rocky intertidal species in order to help assess and reduce human impacts, including possible effects of oil transport accidents and public visitation. The work was carried out with cooperative assistance from the U.S. National Park Service and the U.S. Navy, who sponsored prior monitoring at the sites and will continue the monitoring upon conclusion of this project. The National Park Service funded surveys at 3 contiguous sites along a visitor use gradient at the Cabrillo National Monument at the southern end of Point Loma from 1990 to 1995. The Navy funded surveys farther north on the Fort Rosecrans Military Reservation at sites designated Navy North and Navy South in 1995 to provide baseline information for minimizing impacts from nearby Navy facilities.

DESCRIPTION: The baseline monitoring for this study utilized the same key species protocol that has been employed at over 50 sites ranging from San Luis Obispo County to the Mexican Border, thus ensuring compatibility with ongoing studies in southern California that comprise a recently-formed Multi-Agency Rocky Intertidal Monitoring Network. Abundances of 13 index species plus higher taxa were monitored in fixed plots or transects at the 5 sites during fall and spring oceanic seasons. In addition, habitat assessments, species reconnaissance observations, overview photographs, and videotapes were taken whenever possible.

STUDY RESULTS: The Fall 1996 and Spring 1997 surveys were relatively uneventful; however, the next 2 seasonal samples occurred during a major El Niño event that included above normal water temperatures, heavy rainfall, and large storm swells. Fall 1997 surveys took place shortly after a period of heavy surf. Spring 1998 surveys occurred after a winter characterized by record rainfall, major erosion of seacliffs, and numerous storms generating large swells. Site-wide storm effects observed during the El Niño period included large quantities of kelp wrack and drift debris, overturned rocks, cobble scoured surfaces, and breakouts of sedimentary rock strata.

Despite variability in key species cover dynamics among plots/transects and sites during 1996-1998, overall patterns of change were fairly consistent at the 5 Point Loma rocky intertidal stations. This can be attributed to their proximity along 3.5 km of the peninsula, comparable exposure to west-facing sea conditions, and generally similar habitat structure composed of gently-sloping wave-cut benches and scattered boulders backed by sedimentary cliffs. Of the 13 key species monitored at the 3 contiguous Cabrillo National Monument sites from F96 to S98, 2 species (black abalone, ochre seastar) were not found and 2 species (sargassum weed, aggregating anemone) occurred only in minor amounts. Historically, black abalone and ochre seastars were common at Point Loma, but timed searches conducted during each sampling since 1990 revealed no black abalone and only 1 ochre seastar. Sargassum weed and aggregating anemones were common at the sites, but rare in the sampling because they were not primarily targeted in the fixed plots and transects.

Of the 9 other target species, 5 (pink thatched barnacle, goose barnacle, mussel, red turf, boa kelp) remained essentially unchanged, 2 (acorn barnacle, owl limpet) declined slightly, and 2 (rockweed, surfgrass) declined moderately. Trends mostly were the same for species monitored at the 2 Navy sites farther north on Point Loma except that acorn barnacle and surfgrass declines here were less, and owl limpet numbers increased substantially. The declines in acorn barnacle, rockweed, and surfgrass cover at the Point Loma sites since 1995 were noteworthy because nearly all occurred after S97, during the strong El Niño event. Other key species coverages appeared largely unaffected by El Niño, except for storm-induced rock breakouts in a few owl limpet, mussel, and goose barnacle plots.

Trends in key species abundances at the Cabrillo National Monument sites during previous monitoring from 1990 to 1995 included major increases in surfgrass, minor declines in goose barnacles and owl limpets, and greatly reduced thatched barnacles, mussels, and boa kelp. Since 1995, goose barnacles, thatched barnacles, and boa kelp have not recovered to prior levels. Mussels have increased to the highest levels ever in Cabrillo I, but have not recovered elsewhere. The few remaining mussels throughout Cabrillo II and III areas are older individuals, with practically no recruitment. Long-term declines in such species as black abalone, ochre seastars, mussels, and boa kelp prior to or since monitoring began in 1990 may be related to a 22-year warming trend in southern California waters.

Since 1995, owl limpet numbers generally have increased to 1990 levels, though variability was high due to observer differences in sampling. Acorn barnacle, rockweed, and surfgrass cover have now dropped below 1990 values, apparently as a result of "thinning" by the 1997-1998 El Niño storms. Over past and present surveys, minor seasonal cycles generally were evident for 5 key species. Rockweed and surfgrass tended to be less abundant in spring periods, while sargassum weed, red algal turf, and goose barnacles (in band transects) tended toward lower cover in fall surveys.

Impacts from human activities at Point Loma may be caused by various types of pollution from point and non-point sources, and visitor activities. Contamination from oil was limited to scattered tar blobs that were less common than occur at Santa Barbara County monitoring sites. Localized impacts from public visitation in Cabrillo I and II were observed during the project sampling, but changes in key species abundances associated with visitor use were not evident. Some human impacts may be widespread and chronic. Throughout all past and current surveys, owl limpets were larger in the protected Cabrillo sites than in the Navy sites where collecting may have occurred. The extent of most possible impacts is difficult to separate from natural environmental variation without continued long-term monitoring coupled with detailed experimental studies.

FINAL STUDY REPORT

INTRODUCTION

Bedrock intertidal reefs comprise 14% of the coastline of San Diego County, with the remaining 86% consisting of sand, gravel, or cobble beaches (Smith et al. 1976). Most rocky intertidal shores in the county occur on the Point Loma and La Jolla peninsulas, with relatively few isolated reefs farther north. Rocky intertidal communities along the ocean-facing side of Point Loma are the most extensive and diverse in San Diego County. With the majority of the peninsula owned by the U.S. Navy, restrictions on public visitation, except at the Cabrillo National Monument, have preserved this coast as one of the few remote stretches of mainland rocky shoreline in southern California. Visitors at the Cabrillo tidepools are fortunate to be able to see fascinating assemblages of plants and animals where the marine life is protected from collecting activities. However, the rich communities found in these tidepools and rocky reef habitats are subject to influences from a multitude of human activities associated with the large metropolitan area of San Diego, including harbor commerce, nearshore shipping of oil and other products, wastewater runoff and outfalls, onshore development, and direct disturbance or illegal collecting by beach explorers. Effective management of increasingly-valued intertidal resources requires dynamic baseline surveys to determine what is there and to understand how key components of this land/water interface ecosystem respond to natural environmental variations and human impacts.

Federal, state and local agencies have recognized the importance of baseline information for coastal ecological resources by funding the establishment of regional rocky intertidal monitoring stations in central and southern California. The goals of shoreline resource monitoring include the following:

- To maintain permanent representative monitoring sites to help assess and reduce human impacts and document long-term climatic changes.
- To increase understanding of population dynamics of important rocky intertidal species by comparing key species abundance changes among plots, seasons, years, and sites (to the extent possible) throughout central and southern California.
- To provide relevant information to resource agencies that will lead to more effective management of rocky intertidal ecosystems.

Assessing ecological conditions is a complex and often expensive undertaking. During the 1980's, Channel Islands National Park developed a cost-effective intertidal monitoring program that has become a model for rocky shore surveys throughout the Southern California Bight (Richards & Davis 1988; Davis & Engle 1991; Ambrose et al. 1995; Engle & Davis 1996a,b,c; Dunaway et al. 1997; Engle et al. 1997; Engle et al. 1998a,b). Instead of detailed surveys of all species at many sites, ecological conditions at representative locations are evaluated by concentrating on selected key species assemblages that are monitored seasonally in fixed plots. Qualitative reconnaissance surveys yield inventory data and provide ecosystem perspective for the key species monitoring. The baseline surveys for this study utilized this key species monitoring approach, thus ensuring compatibility with other ongoing studies in central and southern California. Following a workshop last year (Engle et al. 1997), a Multi-Agency Rocky Intertidal Monitoring Network was established to coordinate related projects at over 50 sites ranging from San Luis Obispo County to the Mexican Border (Dunaway et al. 1997).

In 1990, the Cabrillo National Monument in San Diego County began long-term rocky intertidal monitoring at three sites on the southern tip of Point Loma (Davis & Engle 1991; Engle & Davis 1996a,b). In 1995 the U.S. Navy sponsored the establishment of two additional sites along central Point Loma (Engle & Davis 1996c). However, funding ceased for Monument and Navy surveys by the end of 1995. After a gap in sampling in Spring 1996, the current MMS-sponsored project has continued the monitoring from Fall 1996 through Spring 1998. The Cabrillo National Monument and U.S. Navy will continue the surveys in Fall 1998 and thereafter.

METHODS

Resource monitoring sites

The locations of the 5 rocky intertidal sites surveyed for this project along the outer coast of Point Loma are shown in Figure 1. The 3 sites in the Cabrillo National Monument were established in 1990 to assess effects of public use. Public access to the monument's intertidal zone was restricted to a single point approximately 800 m north of the peninsula tip. From this point, visitors could explore about 1 km of exposed shoreline without crossing deep channels that extend to the base of steep cliffs, or moving around the southern end of the Point into San Diego Bay. This situation created a gradient of diminishing public use extending from the access location downcoast to the Point. The resource monitoring stations were stratified into 3 contiguous areas (Cabrillo I, II, and III) along this human use gradient, with each area encompassing roughly 330 m of shoreline. In 1996, Cabrillo III was closed to the public to further protect resources and to provide a control site for public use effects.

The 2 sites north of the Cabrillo National Monument on the Point Loma Peninsula were established for the U.S. Navy in 1995 to provide baseline information to aid in minimizing impacts from nearby Navy facilities. Conditions evaluated in choosing the 2 survey sites included reasonable and safe access, regional representation of stable (bedrock or large boulder) habitats, sufficient abundances of the same key species monitored at the Cabrillo National Monument, and adequate bedrock surfaces for establishing fixed plots. The physical and biological characteristics of the Navy and Monument sites are summarized below. More detailed information is available in Engle and Davis (1996a,b,c).

<u>Physical Characteristics at the Point Loma Sites</u>

The Navy North (NN) site encompasses approximately 300 m of rocky shore along the base of sheer 25-30 m high sedimentary cliffs in the central portion of the Fort Rosecrans Military Reservation on Point Loma (32.693 N Lat, 117.253 W Lon). A prominent landmark for this site is the centrally-located pinnacle rock (10 m high; 30 m in diameter). This chimney rock is about 20 m offshore from the main promontory such that it is surrounded by water at high tide. The NN site extends from roughly 200 m upcoast of the chimney rock to 100 m downcoast. The rocky intertidal zone at this site consists primarily of broad, gently-sloping wave-cut benches composed of many horizontal layers of poorly-consolidated sandstone. There are numerous crevices, channels, and pools on the mostly low-medium relief features. There is little sand on this headland shore. The gradual beach slope at NN creates extensive intertidal reef area, extending 30-100 m offshore. The site is fully exposed to ocean swells, but the outer reef margin dissipates some of the wave energy, especially at low tide. Access to this site requires hiking about 1 km upcoast from the shore trail at Navy South.

The Navy South (NS) site encompasses approximately 250 m of rocky shore along the base of 25 m high cliffs at the southern end of the Fort Rosecrans Military Reservation (32.683 N Lat, 117.250 W Lon), 0.25 km north of the northern boundary of the Point Loma Wastewater Treatment Facility. A prominent landmark for this site is the narrow promontory separating the broad cove to the south from the narrow access inlet to the north. The NS site extends from about 100 m upcoast of the promontory tip to about 150 m downcoast. Like NN, NS intertidal shore consists primarily of wave-cut benches composed of many horizontal layers of poorly-consolidated sandstone. However, NS has a more irregular shoreline, resulting in greater diversity of physical habitats, and narrower intertidal reefs (5-20 m wide, except for the southern cove where rockweed plots are located), resulting in greater wave shock for benches not protected by headlands.

The 3 Cabrillo National Monument monitoring sites have generally similar features, with poorly-consolidated, sedimentary reefs projecting out from eroding sandstone cliffs. The relatively flat, gently-sloping reefs are topped with scattered rocks and boulders. Reef width varies from 20-40 m in Cabrillo I to >50 m in Cabrillo II to >70 m in Cabrillo III, resulting in a moderate gradient in wave exposure conditions from highest wave shock in Cabrillo I to calmest conditions in Cabrillo III. Cabrillo I (32.669 N Lat, 117.245 W Lon) extends from ~220 m north to ~110 m south of the access point. The northern portion is backed by fractured low cliffs with small caves and pockets of cobble and boulders. The offshore region is composed of pools, surge channels, and numerous boulders. The southern part of the site is in a cove backed by higher cliffs and a small sand beach. Cabrillo II (32.668 N Lat, 117.245 W Lon) extends downcoast approximately 330 m from the boundary of Cabrillo I, with the central portion located offshore from the old Navy dolphin training compound. The northern section of Cabrillo II has sloping rock slabs and low-relief reefs, mixed with various-sized boulder/bedrock outcrops. The central and southern parts of the site are backed by an irregular low sandstone cliff with caves and pockets of boulders and cobbles. The lower intertidal zone encompasses extensive pools and flat reefs topped with occasional boulders. Cabrillo III (32.665 N Lat, 117.243 W Lon) extends another 330 m from Cabrillo II (at the Radio Tower) south to the tip of Point Loma, including a prominent line of boulders that extend offshore southwest of the lighthouse. The site is backed by large riprap boulders and a low cliff. Except for the south end boulders, the offshore portion of Cabrillo III has extensive, broad, flat reefs with shallow pools and small rocks.

Biological Characteristics at the Point Loma Sites

Overall, the biological communities at the Navy and Cabrillo sites are quite comparable. All sites contain extensive reefs, with a range of wave exposures and a variety of microhabitats, that support diverse plant and animal species. The same key species assemblages are found at the 5 sites. Upper intertidal zones typically occur as relatively narrow bands on steeply-sloping walls at cliff bases or on projecting rocks or uplifted benches farther out on the shore. Slippery algal films and hard crusts predominate, along with sessile invertebrates (especially barnacles) and numerous motile grazers (i.e., periwinkles, limpets, chitons) that nestle in damp pits and crevices. Opportunistic algae are locally abundant where fresh-water seeps occur and where layers of rock break out, creating fresh bare surfaces. The Navy sites have greater numbers of periwinkles and chitons compared to the Cabrillo sites, probably because higher wave exposures at NN and NS provide more moisture to the upper intertidal zone. White acorn barnacles are present but not dense at Navy and Cabrillo locations. The larger, longer-lived pink thatched barnacles are more common at the Cabrillo sites, where high densities can occur on harder rocks that are less subject to erosion. Owl limpets are common at all the Point Loma sites, with highest densities in the most exposed subareas, but the Monument limpets tend to be larger than those at the Navy sites.

Other ecologically important species occurring slightly lower in the high intertidal zone at Point Loma include rockweed, California mussels, and goose barnacles. Overall rockweed is not common at the Navy and Cabrillo sites; it is present in patches on the sides of harder projecting rocks, or in partially protected habitats, such as the downcoast lees of headlands. Mussels now are rare throughout the peninsula, including at the Navy and Cabrillo sites where the few present were targeted for fixed plot monitoring. Only scattered small patches occur in narrow bands along cliff bases or on the sides of higher rock outcrops in areas with direct wave exposure. Goose barnacles also are less common than expected at Point Loma. Overall, they are rare at the Navy sites where they mingle with the few mussels. They are present in slightly greater numbers at the Cabrillo locations. Here they were not only found with mussels, but also as a spotty narrow band higher up along the cliff base or on riprap.

The middle intertidal zones at Point Loma are relatively flat benches covered by low-growing red algal turf. Previous work (Stewart 1982) has shown that a few low-growing plants, primarily the coralline algae *Corallina vancouveriensis* and *C. pinnatifolia*, dominate, but many other algae (>67 species) occur as epiphytes on the anchor taxa, and numerous small invertebrates (>45 species) inhabit the carpet-like thicket. Red turf assemblages are abundant at all Navy and Cabrillo areas, but are more extensive in Cabrillo II and III where the broadest mid-tidal reef flats occur. Two key species, aggregating anemones and sargassum weed occur in low depressions within the algal turf zone and in tidepools and surge channels at Point Loma. Anemones are more common at the Cabrillo sites where the larger flats drain more slowly. In addition to the larger solitary anemones inhabiting wet microhabitats, smaller clonal forms are present just above the turf zone, usually on the inshore sides of outcrops near sand pockets. These shelly-sand covered aggregations also are more common at Cabrillo, where sand influence is slightly higher. The non-native sargassum weed is present at all Point Loma sites. Some dense patches occur in sheltered pools and on wet surfaces where breakout of rock slabs or overturned rocks expose bare substrate.

Extensive meadows of surfgrass drape much of the low intertidal zones at the Navy and Cabrillo sites. Surfgrass is particularly dense on the flat offshore benches at the Navy sites, where waves splash over the grass habitat even at low tide. At the Cabrillo sites, the grass beds are generally less dense, more broken up by cobble and boulders overlying the outer reefs, and contain greater amounts of sand than those at NN and NS. The inshoremost grass patches at all areas are confined to tidepools, where the plants are shorter and often partially bleached. Boa kelp previously was common at the reef fringes at Point Loma, but is mostly subtidal now. Intertidal boa kelp is rare at the Navy sites, where only the occasional weathered adult or fresh juvenile can be seen. It is found more often at the Cabrillo sites, but far below the abundances recorded in the early 1990's.

Target species assemblages

Ideally one would like to monitor the abundances of all species in an area; however, limited resources require that a subset of the resident species be targeted. Intertidal zonation is frequently characterized by distributions of dominant attached plants and sessile animals (Ricketts et al. 1985). Therefore, a representative group of important taxa (species or species groups), also referred to as "target" or "key" species assemblages, can provide an accurate index of ecological conditions (see Ambrose et al. 1995 for discussion). Thirteen index taxa have been monitored at the 3 Cabrillo National Monument sites since 1990 (Davis & Engle 1991; Engle & Davis 1996a,b) and at the 2 Navy sites since 1995 (Engle & Davis 1996c). Criteria used for selecting these target species assemblages include the following:

- Species ecologically important in structuring intertidal communities
- Species characteristic of discrete intertidal heights
- Species that have been well-studied
- Species that are especially vulnerable to human impacts
- Species practical for long-term monitoring

The index taxa surveyed at the NN, NS, and Cabrillo intertidal sites are listed in Table 1. In addition to the key species, broad categories (other plants, other animals, other biota) were scored, as well as the amount of tar and bare substrate (rock or sand). The natural history and ecology for each of the key species are summarized in Engle and Davis (1996b).

Survey procedures

The sampling techniques used to survey NN, NS, and the 3 Cabrillo sites were similar to those employed elsewhere in the Multiagency Rocky Intertidal Monitoring Network to ensure optimum compatibility among studies (Richards & Davis 1988; Ambrose et al. 1995; Engle et al. 1994a,b; Dunaway et al. 1997; Engle et al. 1997). These include qualitative species inventories combined with quantitative cover (for sessile species) or count (for mobile species) data for the index taxa within fixed plots or along fixed transects. Fixed sampling units reduce the variability that would result from random sampling, and thus give more statistical power to detect changes in cover or density over time (see Ambrose et al. 1995 for discussion of advantages and limitations of fixed plot sampling). Each site was sampled in

Spring and Fall, to evaluate seasonal population changes during the periods when maximum differences were expected.

Table 1 summarizes the sampling techniques and number of replicate fixed plots for each key species at the 5 monitoring sites. Rectangular (50 x 75 cm; 0.375 m^2) photoquadrats were used to monitor the population dynamics of 5 relatively small, densely-spaced target species, rockweed (*Pelvetia fastigiata*), acorn barnacles (*Chthamalus* spp.), pink-thatched barnacles (*Tetraclita rubescens*), mussels (*Mytilus californianus*), and goose barnacles (*Pollicipes polymerus*). Bolts or epoxy mark 3-4 corners of each plot. The upper left bolts or epoxy were marked for plot identification. Still photos were taken during each seasonal survey using a quadripod apparatus, which holds a camera and strobe in a fixed orientation over each quadrat. Five replicate photoquadrats were surveyed for each target species (except for goose barnacles; these have 6 replicates because the Cabrillo sites had 3 band transects that were converted to photoplots in 1995, with 2 plots per transect). Species abundance was scored from the slides in the laboratory as percentage cover by the point contact method. The slide was projected onto a grid of 100 uniformly-distributed points. The number of points occupied by key species, higher taxa, tar, and bare substrate were recorded to determine percentage cover of each taxon.

The number and size distribution of owl limpets (*Lottia gigantea*) were monitored within permanent circular plots at all 5 intertidal sites. There were 6 replicate plots because each Cabrillo site was established with 3 plots on boulder and 3 on cliff face habitats). Plots were marked with a center bolt, marked to indicate the plot number. All limpets ≥15 mm found within a 1 m radius circle (3.14 m^2 area) around each bolt were counted and measured (maximum length in millimeters).

Red algal turf (*Corallina* spp. and other tufted algae), surfgrass (*Phyllospadix* spp.), boa kelp (*Egregia menziezii*), sargassum weed *(Sargassum muticum)*, and aggregating anemones (*Anthopleura elegantissima*) were sampled by line-intercepts along 10 m long permanent transects. Six replicate transects were used at each site. Two transects each were employed for red algal turf and surfgrass. At Cabrillo, 2 additional transects originally targeted boa kelp, but by 1995 this lowest zone became dominated by surfgrass. At NN and NS, with boa kelp rare in 1995, the 2 “boa kelp zone” transects were placed in the lowest surfgrass level. Each transect was marked at both ends and the center with stainless steel bolts. Bolts at the start (north end) of each transect were notched for identification. The abundance and distribution of the key species, other biota, tar, and bare substrate were recorded as distances (to the nearest centimeter) along the edge of a meter tape laid out between the bolts.

Historically, ochre sea stars (*Pisaster ochraceus*) and black abalone (*Haliotis cracherodii*) were important components of Point Loma intertidal shores (Zedler 1976, 1978). However, these key species have been rare or absent here in recent years. Timed searches (30 person minutes) of likely habitats throughout each survey site were conducted during each sampling period in order to document possible occurrences of any species of abalone or sea stars.

Reconnaissance observations were made during the surveys whenever possible after key species monitoring was completed. Physical conditions were characterized at each site, including weather conditions, sea state, substrate changes, presence of tar, and other unusual occurrences such as debris or pollutants. Biological features were noted, including habitat types and zonation, distribution and abundance of species, condition of individuals and populations (e.g., size-structure, color pattern, epiphyte load), and animal behavior. The presence and activities of birds, marine mammals, and humans were recorded. Representative habitats and microhabitats (e.g., crevices, tidepools, under-rock, under-plant) were explored and species composition noted. Overview photos and/or videos were taken as necessary to document site-wide physical and biological conditions. Navy personnel C. Berdzar and E. Steenblock used a Trimble Global Positioning System (GPS) during Spring 1998 to acquire latitude and longitude coordinate values for plots, transects, and reference bolts.

RESULTS

Field Activities and Observations

Table 2 lists the schedule of field activities for the rocky intertidal baseline surveys at the 5 Point Loma sites. For efficiency, we concentrated the work during periods in when good low tides occurred during midday hours. Project biologists, cooperating scientists from the National Park Service and California Department of Fish and Game, U.S. Navy personnel, and numerous volunteers participated in the field surveys (Table 3). Results from Spring and Fall reconnaissance and key species surveys at the 2 Navy and 3 Cabrillo National Monument sites are reported below. For ease of presentation, the sampling seasons are abbreviated, for example, as F97 for Fall 1997 and S98 for Spring 1998. The Navy sites are abbreviated as NN (Navy North) and NS (Navy South). The Cabrillo National Monument sites from north to south are abbreviated as Cabrillo I, Cabrillo II, and Cabrillo III.

During each visit to the Point Loma sites, qualitative physical and biological observations were recorded on Field Log data sheets, videotape, and/or photographs. The F96 and S97 surveys were relatively uneventful in terms of observed conditions at the 5 sites. There was evidence of typical storm activity, including some bent or missing bolt markers, a few breakouts of sedimentary rock, occasional overturned rocks, and several smashed lobster traps high on the beach.

The F97 and S98 samples occurred during a major El Niño event that included above normal water temperatures, heavy rainfall, and large storm swells. F97 surveys took place shortly after a period of heavy surf. Large amounts of kelp wrack and drift debris were observed at all Point Loma sites, with some piles 1.5 m high. The wrack included giant kelp, sea palms, various algae, and surfgrass. A moderate number of overturned rocks were seen and some scour marks noted on outer reef margins in the surfgrass zone. S98 surveys occurred after a winter characterized by record rainfall, major erosion of seacliffs, and numerous storms generating large swells. S98 conditions at the Point Loma sites after winter storms included additional damaged markers in mussel and goose barnacle plots and surfgrass transects, a greater number of overturned rocks and cobble scoured surfaces, and various breakouts on the sedimentary cliff faces. Some landslides were evident. There was less drift debris and kelp wrack than in F97. Sand levels were low on nearby beaches. Freshwater seeps from bluffs were prevalent, with blooms of ephemeral algae evident in the vicinity of the seeps.

Visitors were most common at Cabrillo I and II during the monitoring surveys. Cabrillo III has been closed to the public since 1996. No people were seen at NN or NS during F96-S98 sampling, not surprising due to the difficult access and military restrictions. At Cabrillo I and II, visitor activities involved walking over the reef, turning over rocks, and picking up shells or animals. Collecting was prohibited. A few spots of weathered tar were seen at the San Diego sites, but no major concentrations or fresh material.

Key Species Survey Data

The results of monitoring rocky intertidal species assemblages in fixed plots/transects at the 5 Point Loma, San Diego County sites from Fall 1996 through Spring 1998 are presented below for each key species. Summary data from prior monitoring (starting Spring 1995 for the Navy sites and Spring 1990 for the Cabrillo sites) are provided for longer-term perspective. The earlier data were reported in Engle and Davis (1996b,c). This section will focus on mean abundances for replicate plots or transects at each site. Changes in percentage cover are presented as differences between sampling seasons, not as percent of change from previous values.

Rockweed (*Pelvetia fastigiata*)

Plots emphasizing rockweed were monitored at each of the 5 Point Loma sites (Tables 4-15; Fig. 2). Rockweed cover declined substantially from F96 to S98 at all sites, with most of the losses occurring after S97. Declines ranged from 11% at NS to 38% at NN, with Cabrillo sites intermediate (23%, 33%, 34%). Other plant cover typically increased where *Pelvetia* declined. Rockweed declines at the 5 sites generally were consistent among plots, except a few plots, especially at NS, changed little from F96 to S98. Rockweed did not occur in other key species plots at Point Loma, except for mostly minor amounts in a few barnacle plots. Of the 2 barnacle zone plots with F96 rockweed cover >10%, plot 3 in Cabrillo II was unchanged by S98, while plot 3 in Cabrillo III declined 10%.

Since establishment of the Navy sites in S95, *Pelvetia* has declined by 50% cover at NN, but only decreased 7% at NS. Initial survey cover values for rockweed at the Cabrillo sites in S90 were less than or similar to the values in F96, thus most of the declines were recent. S98 abundances at Cabrillo I, II, and III were the lowest in the 8 y of monitoring. Over the years, there was a tendency for rockweed cover to be less in Spring than in Fall, but this pattern was not always evident.

Acorn Barnacle (*Chthamalus* spp.)

None of the Point Loma sites had plots specifically targeting acorn barnacles; however, these barnacles occurred in varying abundances within thatched barnacle plots, and in some goose barnacle, mussel, and rockweed plots (Tables 4-15; Figs. 2-3). *Chthamalus* cover varied considerably between samplings, but there was a trend of declining abundance from F96 to S98, with most losses occurring after S97. NN and NS thatched barnacle plots had low cover of acorn barnacles initially in F96, which declined slightly by S98. The 3 Cabrillo sites had 10-22% cover of *Chthamalus* in F96, which decreased by 10-18% cover, thus few acorn barnacles remained by S98. At Cabrillo III, *Chthamalus* in mussel plots plummeted from 48% cover in F96 to 9% in S98, but those in goose barnacle plots remained essentially unchanged. Other plants and/or bare rock increased wherever barnacles decreased. The cover of acorn barnacles in thatched barnacle plots at the Cabrillo sites during the 6 y of sampling prior to F96 often was unstable, with no obvious seasonal or annual pattern, although some changes were comparable between areas (e.g., declines between S92 and F92).

Pink Thatched Barnacle (*Tetraclita rubescens*)

Plots targeting the relatively large thatched barnacles were surveyed at all the Point Loma sites (Tables 4-15; Fig. 3). A few *Tetraclita* occurred on rock or atop mussels in several mussel and goose barnacle plots. Even in the targeted barnacle plots, *Tetraclita* abundance typically was <10% during F96-S98, except at NN where cover ranged from 21-32%. Bare rock, other plants, and acorn barnacles dominated most of these plots. Thatched barnacle cover remained fairly stable at all sites during the past 2 y of sampling, although a few plots varied considerably between surveys. Since S95, *Tetraclita* cover has remained fairly stable at NN, and declined from 15% to 7% cover at NS. Greater losses were evident at the Cabrillo sites since S90 (-16%, -23%, -12%). Cover values prior to F91 were the highest recorded during the 8 y of monitoring at all 3 sites. There has been a tendency toward higher cover in Spring than in Fall.

Goose Barnacle (*Pollicipes polymerus*)

Goose barnacles were monitored at all 5 sites in their targeted plots and in mussel plots (Tables 4-15; Figs. 4-5). Six replicate plots were surveyed instead of 5 in order to maintain consistency after 3 band transects were converted into 2 photoplots each at the Cabrillo National Monument in S95. *Pollicipes* cover has typically been <15% at the Point Loma sites, with bare rock, other plants, and mussels comprising most of the plot cover. From F96-S98, goose barnacle cover remained essentially unchanged among the sites, with the greatest differences reflecting a 7% loss within the mussel zone plots at NS and a 6% gain within the goose barnacle zone plots at Cabrillo I. *Pollicipes* did not occur in the mussel zone plots at Cabrillo II or III. Goose barnacle cover at NS, Cabrillo II, and Cabrillo III have been stable since S95, but NN cover declined 5% in goose barnacle zone plots and 7% in mussel zone plots, and Cabrillo I cover increased 8%. The only plots with sufficient *Pollicipes* cover for analysis since S90 were in the mussel zone in Cabrillo I. Individual plots there varied; however, collectively they exhibited remarkable stability over the 8 y period.

Mussel (*Mytilus californianus*)

Mussel assemblages were surveyed at all Point Loma sites in mussel zone plots and in some goose barnacle plots, notably at NS (Tables 4-15; Figs. 4-5). From F96 to S98, *Mytilus* cover increased by 12% at NN and Cabrillo I, but showed relatively little change elsewhere

(±0-5%). Individual plots changed in a highly variable manner, with some increasing and others decreasing even at the same site. The NN and NS patterns were similar back to S95 as well, but cover at the Cabrillo sites changed markedly since S90. Mussels at Cabrillo I varied from 6-16% cover during S90-F95, then increased to a high of 34% cover in S98. Cabrillo II and III *Mytilus* cover declined from highs of 55% and 47% to <5% levels from S90 to S94, after which they exhibited near zero cover. Mussels in these plots were replaced by other plants, bare rock, and acorn barnacles.

Owl Limpet (*Lottia gigantea*)

Owl limpets ≥15 mm length were counted and measured in 6 plots each at the Point Loma sites (Tables 16-27; Figs. 6-12). Total numbers of limpets increased slightly (by 4-14) at NS, Cabrillo I, and Cabrillo III, increased more at NN (by 72), and decreased at Cabrillo II (by 55), between F96 and S98. All plots contributed to the increases at NN, but interplot dynamics were mixed at the other sites. Most of the decline at Cabrillo II was due to losses in 2 plots where the counts were highly variable. Small limpets (<30 mm) contributed more to the gains at NN and losses at Cabrillo II than larger limpets. Overall, mean sizes decreased by 1-2 mm at 2 sites (NN and Cabrillo III) and increased by 2-5 mm at 3 sites (NS, Cabrillo I, and Cabrillo II). Mean sizes during the F96-S98 period were larger at the Cabrillo sites (39-49 mm) than at the Navy sites (31-38 mm). All sites had limpets as small as 15 mm, with the largest limpets found at Cabrillo I (75-84 mm), followed by Cabrillo II (77-79 mm), Cabrillo III (66-70 mm), NS (64-69 mm), and NN (58-69 mm).

Since S95, the total number of *Lottia* at NN increased by 72 and those at NS by 94. Most of the change came from higher numbers of small limpets (<30 mm) at NN, but both large and small limpets became more common at NS. Since S90, owl limpets at Cabrillo I increased by 64, while those at Cabrillo II and III declined by 19 and 39. The gains in Cabrillo I were primarily due to additional small limpets, while the losses in Cabrillo II and III were due to losses of larger individuals. Neither numbers nor sizes of *Lottia* appeared to show seasonal patterns.

Red Algal Turf (*Corallina* spp., et al.)

Red turf is a mixed species assemblage of low-growing algae that carpet the middle intertidal zones of low-relief reefs. In San Diego County, this turf can contain as many as 67 types of plants, but often 2 species of erect coralline algae (*Corallina vancouveriensis* and *C. pinnatifolia*) dominate (Stewart & Myers 1980; Stewart 1982; Stewart 1989b). Turf cover was measured in line-intercept transects at all Point Loma sites (Tables 28-39; Figs. 13-15). It also was common in the surfgrass and boa kelp transects at the Cabrillo sites, but was overlain with grass to such an extent at NN and NS that it received low primary cover scores there. During F96-S98, red turf covered 90-100% of the turf zone transects at NN and NS and 66-90% of the transects at Cabrillo I, II, and III. The turf assemblage was remarkably stable at all Point Loma sites, not only during the past 2 y, but also back to S95 for the Navy sites and back to S90 for the Cabrillo sites. Inter-transect dynamics were generally minimal and consistent as well at the sites, except at Cabrillo III where 1 transect gained 18% in turf cover and the other transect lost 13% cover during the F96-S98 period.

Red turf cover in the surfgrass zone increased at all sites where surfgrass declined during F96-S98, except in Cabrillo III where turf remained stable. The reduction in surfgrass allowed the already existing understory turf to be exposed as the primary cover. Red turf cover increases were 15% and 4% for NN and NS offshore surfgrass transects, and 22% and 8% for Cabrillo I and II surfgrass transects. Similar increases in turf cover occurred where surfgrass declined in the boa kelp zone at Cabrillo I and II (11% and 20% gains). Since S90, red turf cover in the surfgrass and boa kelp transects generally varied inversely with the surfgrass and boa kelp cover due to the fact that only the top biotic layer was scored.

Surfgrass (*Phyllospadix* spp.)

Surfgrass was targeted at all 5 sites, with 2 line-intercept transects each at the Cabrillo sites, and 2 inshore and 2 offshore transects each at NN and NS (Tables 28-39; Figs. 13-15). It also occurred in variable amounts in the turf transects everywhere, and was prominent in the boa kelp transects at Cabrillo I, II, and III. *Phyllospadix* covered 79-100% of the surfgrass zone transects at NN and NS, and 39-90% of those transects at the Cabrillo sites during the past 2 y. Surfgrass cover remained stable from F96 to F97, then declined markedly at all sites by S98. These decreases ranged from minor losses (3-4%) at NN and NS inshore transects to moderate decreases (13-17%) at NN and NS offshore transects as well as those at Cabrillo I, to major declines (37-50%) at Cabrillo II and III. Grass declines were matched by increases in bare rock and/or red turf. Trends were fairly consistent among all transects. At NN and NS, inshore *Phyllospadix* cover remained essentially unchanged since S95, while offshore grass cover declined by 10-11%, mostly since F97. Surfgrass cover in S98 was 5% higher than the S90 condition at Cabrillo I, but Cabrillo II and III sites were 18% and 12% lower. Overall, there was a pattern, especially evident at Cabrillo III, of lower surfgrass cover in Spring compared to Fall.

Surfgrass in red turf and boa kelp zones at the Cabrillo sites followed similar trends as that in the targeted surfgrass zone. Grass losses between F96 and S98 in red turf transects were minor (3% at Cabrillo I, 10% at Cabrillo II, 0% at Cabrillo III). *Phyllospadix* declines in boa kelp transects were considerable (16% at Cabrillo I, 22% at Cabrillo II, 32% at Cabrillo III). In S90, when boa kelp was common in the boa kelp zone, surfgrass cover there ranged only from 4-11%. In later years, grass cover increased as boa kelp declined, with peak *Phyllospadix* abundance ranging from 41-81% cover in F96.

Other Transect Species

Boa Kelp (*Egregia menziezii*), initially common in low intertidal transects at the Cabrillo National Monument, did not occur in any transects at NN, or NS (Tables 28-39; Fig. 15). Major declines occurred at all 3 Cabrillo sites prior to F96, after which boa kelp was minimally present or absent from the transects. Surfgrass was the principal replacement cover on the *Egregia* transects, except at Cabrillo III in S98 when bare rock accounted for 43% of the coverage.

Sargassum weed (*Sargassum muticum*) was absent in NN and NS transects. At the Cabrillo National Monument since S90, it occurred occasionally in the turf transects (1-3%), grass transects (1-26%), and kelp transects (1-18%) (Tables 28-39; Fig. 14). Clearly this weedy species was quite variable in its occurrence; however, whenever found, *Sargassum* was consistently more common in Spring compared to Fall seasons.

Aggregating anemones (*Anthopleura elegantissima*) were absent in transects at the Navy sites; they occurred in small amounts in the Cabrillo transects, primarily in the turf zone (Tables 28-39). Anemone cover ranged from 0-2% throughout the 8 y of monitoring at Cabrillo I, II, and III. Though low, anemone cover appeared stable, with no seasonal or annual trends.

Black Abalone (*Haliotis cracherodii*) and **Ochre Seastar** (*Pisaster ochraceus*)

Black abalone and ochre seastars once were common in San Diego County, but now are absent or rare, to the extent that it was not possible to survey for them in fixed plots. Instead, haphazard timed searches at each site were carried out to document their absence/rarity or possible recovery. No black abalone or ochre seastars were found at any site in the 8 y of surveys since S90, except for 1 ochre seastar observed at Cabrillo I in S94. Occasional individuals of the typically subtidal green abalone (*Haliotis fulgens*), blue knobby stars (*Pisaster giganteus*), and bat stars (*Asterina miniata*) were noted at the Cabrillo and Navy sites.

DISCUSSION

This section synthesizes information acquired during the Point Loma, San Diego rocky intertidal monitoring surveys with respect to the temporal variability of index species populations. The natural history and ecology of the index species are summarized in Engle and Davis (1996b). It is important to note that determination of the causes for any abundance changes is a difficult process. Much can be inferred from the data and observations during the monitoring, combined with knowledge gained from previous intertidal ecology and impact studies; nevertheless, carefully designed experiments would be necessary to attribute specific causality with confidence. At Navy North and Navy South, monitoring now includes 3 samples for each season from S95 to S98 (no S96 sample). Navy data for 1995 are discussed in Engle and Davis (1996c). Navy North and South results for 1997-1998 are compared with 2 recently added monitoring sites in San Diego County (Cardiff Reef and Scripps Reef) in Engle et al. (1998b). At Cabrillo I, II, and III, monitoring now includes 8 samples for each season from S90 to S98 (no S96 sample). Cabrillo data from 1990 through 1995, including possible effects of human activities, are discussed in Engle and Davis (1996b).

Despite variability in key species cover dynamics among plots/transects and sites (not unexpected in complex intertidal systems) during F96-S98, overall patterns of change were fairly consistent at the 5 Point Loma stations. This can be attributed to their proximity along 3.5 km of the peninsula, comparable exposure to west-facing sea conditions, and generally similar habitat structure composed of gently-sloping wave-cut benches and scattered boulders backed by sedimentary cliffs. Of the 13 key species monitored at the 3 contiguous Cabrillo National Monument rocky intertidal sites from F96 to S98, 2 species (black abalone, ochre seastar) were not found and 2 species (sargassum weed, aggregating anemone) occurred only in minor amounts. Of the 9 other target species, 5 (pink thatched barnacle, goose barnacle, mussel, red turf, boa kelp) remained essentially unchanged, 2 (acorn barnacle, owl limpet) declined slightly, and 2 (rockweed, surfgrass) declined moderately. Trends mostly were the same for species monitored at the 2 Navy sites farther north on Point Loma except that acorn barnacle and surfgrass declines here were less, and owl limpet numbers increased substantially.

Historically black abalone and ochre sea stars were present at Point Loma (Zedler 1976, 1978). No black abalone and only 1 ochre seastar have been found during the biannual timed searches at the Cabrillo sites (since 1990) and none were found at the Navy sites (since 1995). Abalone losses prior to initiation of Cabrillo monitoring may have been associated with a “withering” syndrome that has caused widespread declines at the Channel Islands (Lafferty & Kuris 1993; Richards & Davis 1993) and along other mainland shores in southern California (Miller & Lawrenze-Miller 1993; Altstatt et al. 1996). Similarly, sea star populations in this region have been decimated by a “wasting” disease, apparently caused by a warm-water bacterium of the genus *Vibrio* (Schroeter & Dixon pers. comm.).

Sargassum weed and aggregating anemones occurred at the monitoring stations, but were not primarily targeted in fixed plots or transects, hence their recorded absence at the Navy sites and low abundances at the Cabrillo sites. With scant data, little can be revealed about population trends. However, limited records and observations since 1990 at the Cabrillo sites indicated that sargassum weed cover was variable, yet consistently more common in spring compared to fall seasons. This is because sargassum weed undergoes post-reproductive declines each summer (Gunnill 1980a,b, 1983; Deysher & Norton 1982). On the other hand, aggregating anemone cover, though low in the transects, appeared stable throughout the 8 y of surveys at the Cabrillo sites.

Pink thatched barnacle, goose barnacle, mussel, red turf, and boa kelp abundances at the Point Loma sites changed relatively little overall from S96-F98, though moderate variation occurred among plots and sites. Pink thatched barnacles exhibited substantial losses at the 3 Cabrillo sites from 1990-1995, with no recovery evident by 1998. Goose barnacle cover in the photoplots was remarkably stable, (not only over the past 2 y, but also over 8 y at Cabrillo I), despite observed recruitment events and occasional losses from rock break-outs. More extensive band transect monitoring of goose barnacles at the Cabrillo sites revealed moderate declines from 1990 through 1994.

Mussels had declined drastically at the Cabrillo sites from 1990 through 1995. They remained at low levels since 1995, except at Cabrillo I. There, mussel cover increased substantially in 3 of the 5 plots to the highest levels since monitoring began. Cabrillo II and III plots remained nearly devoid of mussels. The few remaining mussels throughout Cabrillo II and III areas are older individuals, with practically no sign of recruitment. Obviously, mussels settled and grew successfully in the 3 plots at Cabrillo I during recent years, yet mussels still are rare throughout this site. Perhaps the greater wave exposure at Cabrillo I provided marginally better conditions for mussel settlement and survival than at the slightly calmer downcoast sites. Since mussel plots were established in the few Navy locations with adequate cover in S95, abundances increased slightly at NN and remained unchanged at NS.

Red turf was remarkably stable in its targeted transects at all Point Loma stations during the present study and all past monitoring. This mixed species assemblage dominated the middle intertidal flats and occurred as an understory layer lower down the shore in surfgrass and boa kelp zones. Red turf is highly resistant to disturbance, including abrasion and sand burial (Stewart 1983, 1989a). Unlike red turf, boa kelp underwent catastrophic declines during 1990-1995 at the Cabrillo sites. No recovery from near total losses occurred by 1998. Boa kelp still occurs commonly in the shallow subtidal zone and is capable of recovery within a few years if intertidal conditions become favorable for its re-establishment (Vesco & Gillard 1980).

Owl limpet numbers were quite variable within and among plots over time, reflecting not only actual population changes, but also observer differences in locating cryptic individuals and distinguishing this species from close relatives (especially for small limpets). The overall slight declines at the Cabrillo sites from F96-S98 were due to losses only at Cabrillo II, where 2 of the cliff habitat plots showed substantial declines. Both plots incurred occasional rock breakouts and partial sand coverage in recent years. In addition, the high numbers for one of these plots (#242) in F96 and F97 samples apparently resulted from the inclusion of a second similar-appearing limpet species. Overall, owl limpet abundances at the Cabrillo sites declined slightly during 1990-1995, then increased about the same amount from 1995-1998; the net result was relatively little change over the period from 1990-1998. Navy South owl limpet counts were generally similar during F96-S98, but reflected an increase in both small and large limpets since S95. Navy North counts were consistent from S95-F96, then increased substantially by S98. Most of this increase was due to additional small limpets. The plots at NN have numerous tiny crevices with cryptic limpets, thus it is unclear to what extent the changes in limpet counts here reflect actual population shifts.

The declines in acorn barnacle, rockweed, and surfgrass cover at the Point Loma sites since 1995 were noteworthy because nearly all occurred after S97, during the strong El Niño event. Both F97 and S98 samplings took place after periods of heavy surf. Storms can tear out patches of plants, cause breakage of blades/leaves, dislodge organisms struck by moving rocks and debris, and flake off or break out sedimentary rock layers. Notably large accumulations of kelp wrack and drift debris were observed on the shore at all sites in F97. More than usual amounts of overturned rocks, cobble scoured surfaces, breakouts of sedimentary slabs, and damaged plot/transect markers were found during F97 and S98. Disturbance from El Niño storms likely “thinned out” acorn barnacles, rockweed, and surfgrass, as has been observed in previous studies (Gunnill 1983; Stewart 1989a; Ambrose et al. 1995; Engle & Davis 1996b). Both rockweed and surfgrass declined at all 5 Point Loma sites. Plants were observed to be not only less dense, but also shorter. Interestingly, the more exposed offshore surfgrass transects at NN and NS experienced greater declines than the more sheltered inshore transects. Both rockweed and surfgrass can recover quickly via regrowth if holdfasts or rhizomes remain intact. Other key species coverages appeared largely unaffected by these storms, except that rock breakouts in a few owl limpet, mussel, and goose barnacle plots were noted. Rocky intertidal monitoring sites established in F97 for the Navy at Cardiff and Scripps Reefs in central San Diego County sustained greater storm damage than at Point Loma, including losses of rockweed, surfgrass, acorn barnacles, sand castle worms, goose barnacles, and mussels (Engle et al. 1998b).

Other possible El Niño effects include increases in sea level, rainfall, and water temperature. The sea level rise was relatively small (perhaps 8-12 cm), and therefore unlikely to have a major effect. Heavy rains resulted in increased freshwater runoff, erosion, landslides, sedimentation, and floating debris, all of which likely caused at least localized disturbances to rocky shore life. Warmer water may particularly stress organisms adapted to cool conditions, yet intertidal biota are adapted to withstanding considerable variation in air and water temperatures. More significant is the fact that sea surface temperatures have been consistently warmer than the long-term mean since 1976, as documented by measurements taken at the Scripps pier from 1920-1997 (Figs. 16-17). Long-term warming has been associated with northward shifts in the ranges of southern species (Barry et al. 1995) and with dramatic declines in the abundance of zooplankton in southern California (Roemmich & McGowan 1995). Thus, the species assemblages monitored at the Point Loma sites in 1996-1998 and earlier years likely reflect the cumulative effects of this 22-year warming pattern. Long-term declines in such species as black abalone, ochre seastars, mussels, and boa kelp may be related to this climate shift.

In addition to El Niño related changes, the lengthening time series of key species monitoring, especially at the Cabrillo sites, has revealed various periodic, irregular, or multi-year abundance patterns. For example, minor seasonal cycles generally were evident for 5 key species. Rockweed and surfgrass tended to be less abundant in spring periods, while sargassum weed, red algal turf, and goose barnacles (in band transects) tended toward lower cover in fall surveys. The cover of acorn barnacles was quite variable (likely reflecting irregular recruitment events), while that for the multi-species red turf assemblage exhibited considerable stability from year to year. Surfgrass replaced boa kelp as the dominant species in the boa kelp transects. Owl limpets and goose barnacles on layered sedimentary rocks occasionally disappeared when sections of the soft rock broke out. Mussel recruitment eventually enhanced the mussel plots at the more exposed Cabrillo I site, while mussel losses in Cabrillo II and III have not been compensated for by new settlement. These examples of dynamic patterns and trends in Point Loma key species populations clearly demonstrate the importance of long-term monitoring in assessing the changing “baseline” condition of intertidal resources.

Impacts from human activities on rocky intertidal ecosystems may be caused by various types of pollution from point sources (e.g., outfalls, vessel spills) and non-point sources (e.g., storm runoff, aerial fallout), and visitor activities (see Ghazanshahi et al. 1983; Foster et al. 1988; Anderson et al. 1993 for reviews). Impacts may range from single events affecting one location (e.g., a shipwreck on the beach) to chronic (but often low level), widespread conditions (e.g., trace metal contamination) that may show little short-term effect, but cause significant cumulative effects over many years or decades. Twenty-two years ago, Zedler (1976) compared areas varying in degree of human use at the Cabrillo National Monument tidepools and found lower abundances of certain coralline algae, sand castle worms, and limpets in more heavily-visited habitats. In experiments with turning over rocks, species diversity of exposed invertebrates declined rapidly after 2 weeks, and opportunistic green algae invaded by 4 weeks (Zedler 1978). In trampled algal turf mats, the more brittle species of erect coralline algae were most impacted, with recovery estimated to take 1-2 yr (Zedler 1978). Human use issues for the Point Loma sites were emphasised in Engle and Davis (1996b,c), so only a brief update follows.

Heavy visitor use of Cabrillo I and II sites continued through the F96-S98 project period; however, unlike previous monitoring during 1990-1995, Cabrillo III has been off limits to the public since 1996. Visitor and bird count records for the Cabrillo sites have been collected by Cabrillo National Monument personnel. Continued evidence of human impacts at Cabrillo I and II during the 1996-1998 surveys included frightened marine birds, beach debris, trampled habitats, overturned rocks, displaced marine life, and disturbed organisms. No specimen collecting was observed because this activity is prohibited in the Monument. No visitors were seen at the remote Navy sites or in the closed Cabrillo III area. The only obvious sign of human influence at these locations was scattered beach debris. The occasional explorer could reach the Navy sites by hiking south along the shore at low tide and collect marine life legally with a license.

Although specific effects of visitor activities at Cabrillo I and II were observed as noted above, people effects were not obvious from the results of the key species monitoring during F96-S98. In general, population changes occurred similarly in public and restricted/remote areas, or appeared to reflect physical differences among the sites (e.g., mussel increases in Cabrillo I possibly associated with greater surf exposure). This should not lead to the conclusion that impacts are not occurring. An important consideration is that decades of visitor use took place prior to this study (Zedler 1976, 1978), so initial (1990) survey conditions were not pristine. Thus rocky shore ecosystems may be in a continuously disturbed state. For example, throughout all surveys, the mean and maximum sizes of owl limpets have been larger in the protected Cabrillo sites than in the Navy sites where collecting might occur. Similarly smaller owl limpets have been sampled farther upcoast at the often-visited Scripps and Cardiff Reefs (Engle et al. 1998). Another major consideration is that other (non-visitor) impacts, such as water and air pollution, are widespread, affecting all 5 survey areas. Possible contamination sources include shoreside runoff, the San Diego Harbor, the Tijuana River, offshore shipping, and the Point Loma municipal outfall. With regard to oil pollution, scattered tar blobs were observed at all sites, but were much less common than at monitoring stations in Santa Barbara County (Ambrose et al. 1995).

In summary, trends in key species abundances at the Cabrillo National Monument sites during previous monitoring from 1990 to 1995 included major increases in surfgrass, minor declines in goose barnacles and owl limpets, and greatly reduced thatched barnacles, mussels, and boa kelp. Since 1995, goose barnacles, thatched barnacles, and boa kelp have not recovered to prior levels. Mussels have increased substantially in Cabrillo I, but have not recovered elsewhere. Owl limpet numbers generally have increased to former amounts. Also since 1995, acorn barnacle cover declined slightly, and rockweed and surfgrass showed moderate losses, apparently as a result of 1997/1998 El Niño storms. Trends at the more recently-established Navy sites farther north on Point Loma generally were the same except that acorn barnacle and surfgrass declines here were less, and owl limpet numbers increased substantially. Localized impacts from public visitation in Cabrillo I and II were observed during the project sampling, but changes in key species abundances associated with visitor use were not evident. Some human impacts may be widespread and chronic. The extent of possible impacts is difficult to separate from natural environmental variation without continued long-term monitoring coupled with detailed experimental studies.

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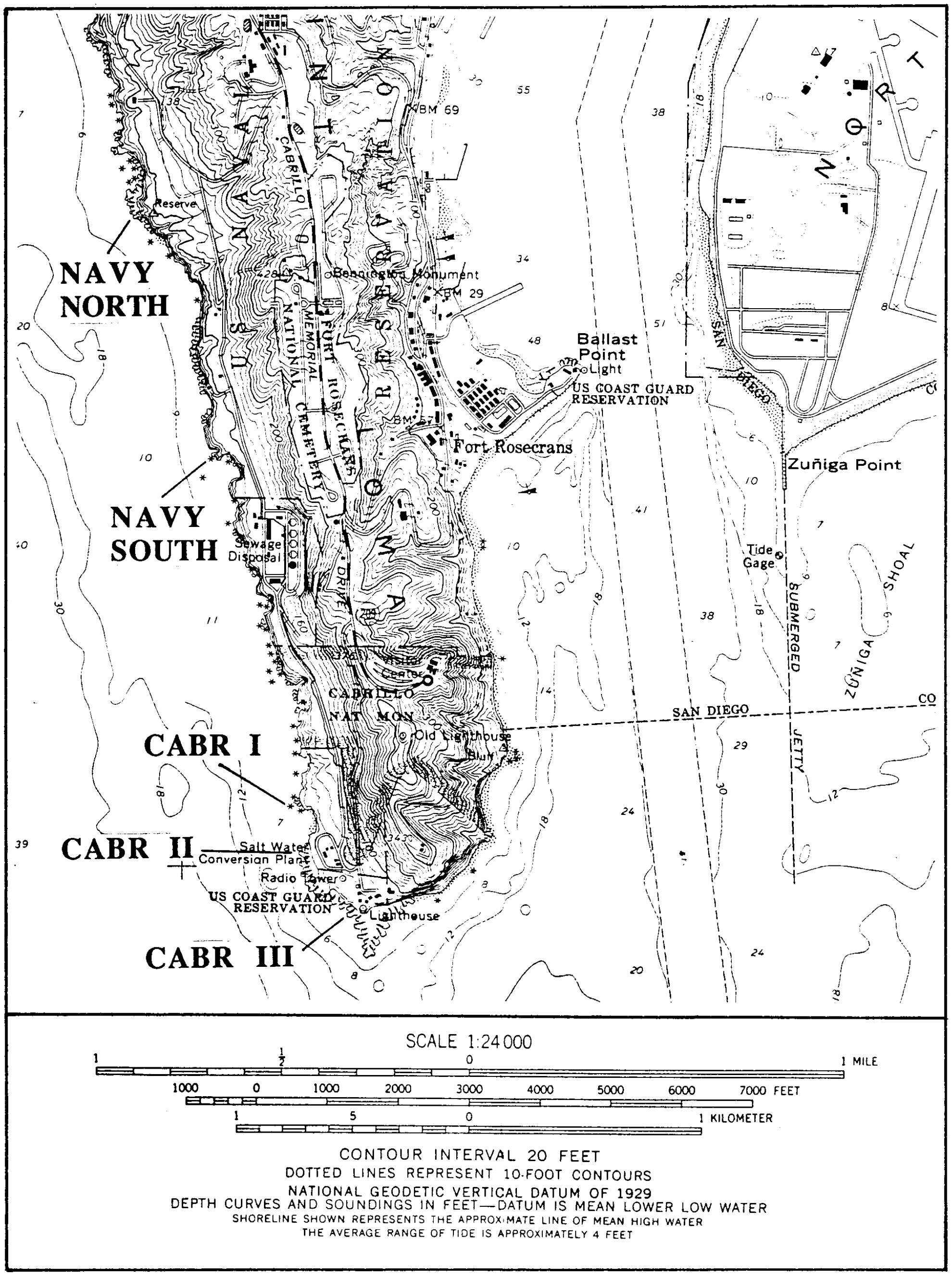

Figure 1. Point Loma rocky intertidal monitoring sites.

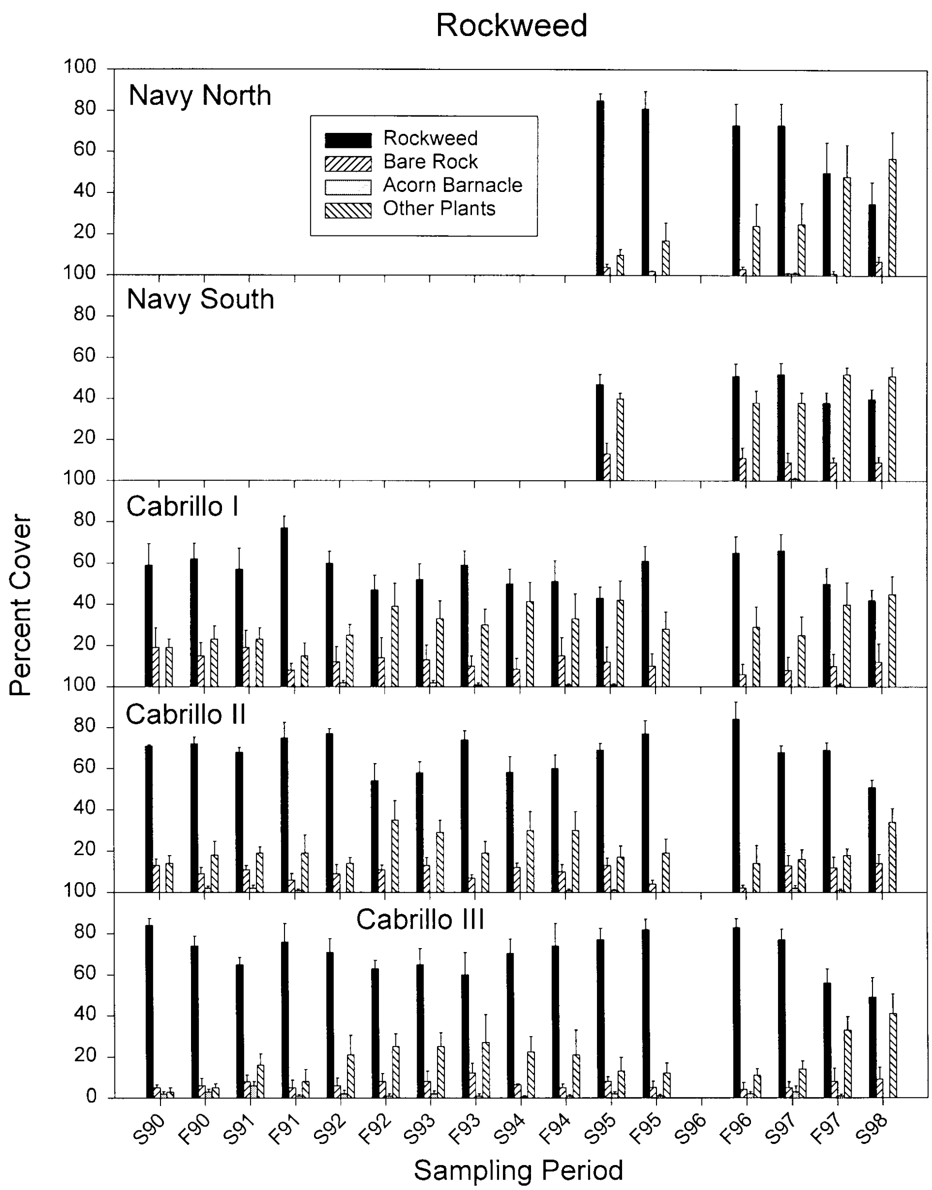

Fig. 2. Species abundances in Rockweed plots at 5 Pt. Loma sites.

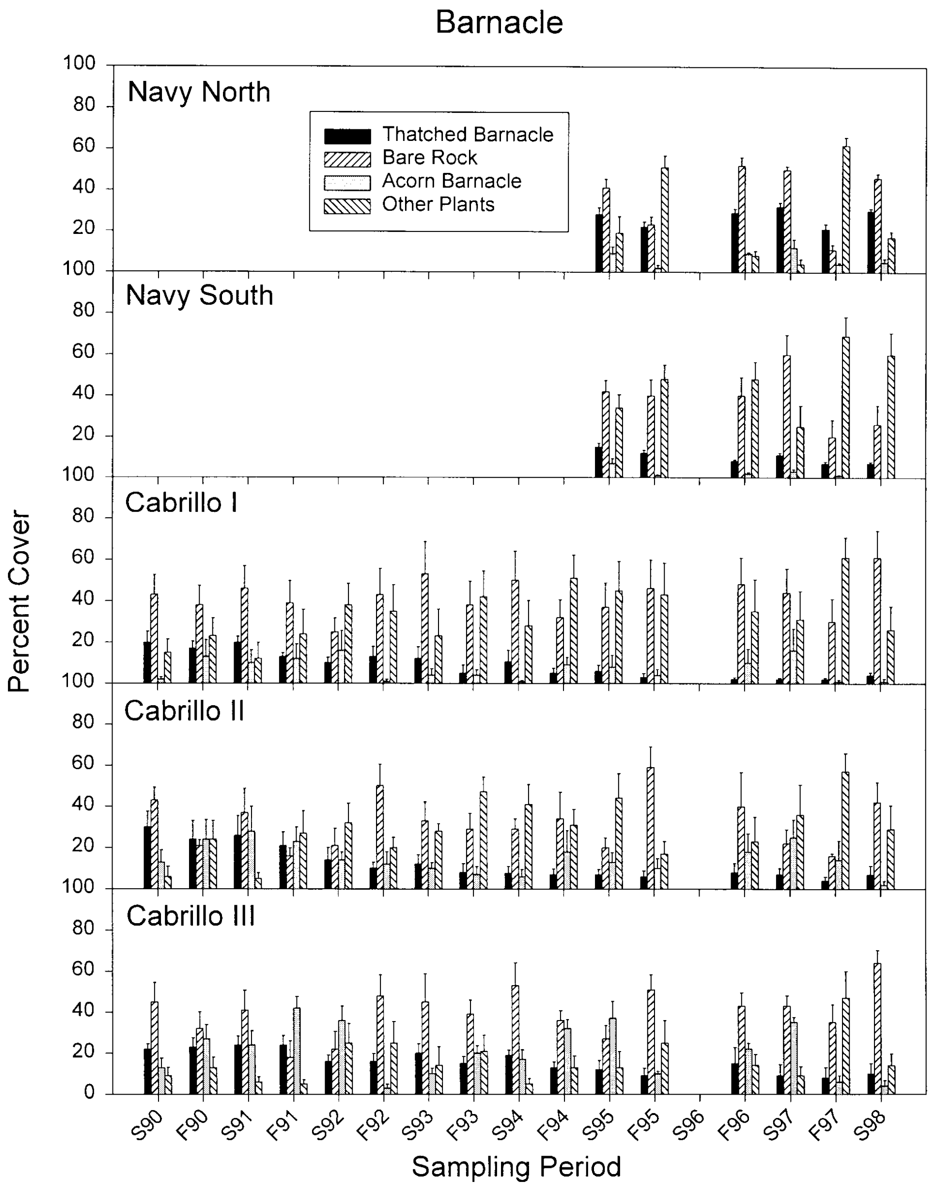

Fig. 3. Species abundances in Barnacle plots at 5 Pt. Loma sites.

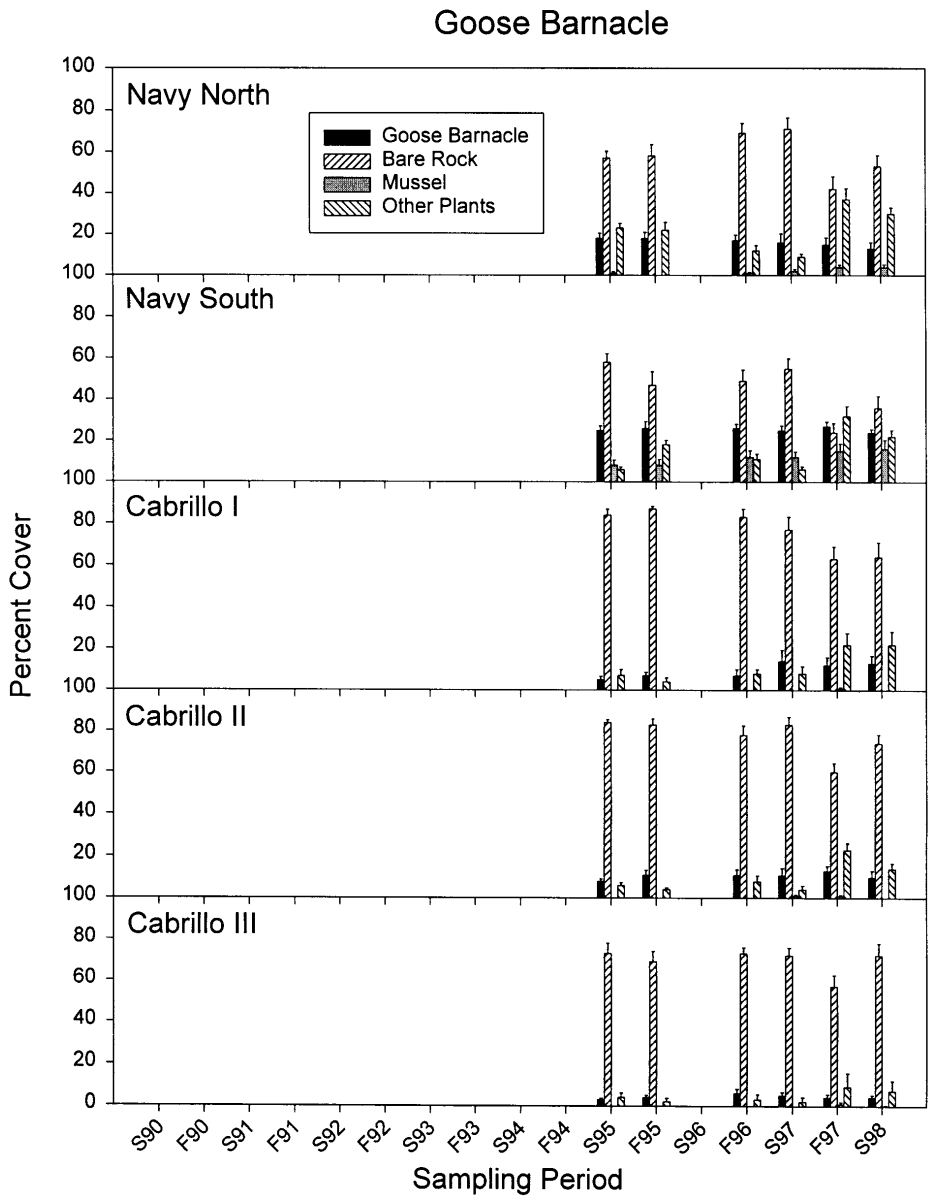

Fig. 4. Species abundances in Goose Barnacle plots at 5 Pt. Loma sites.

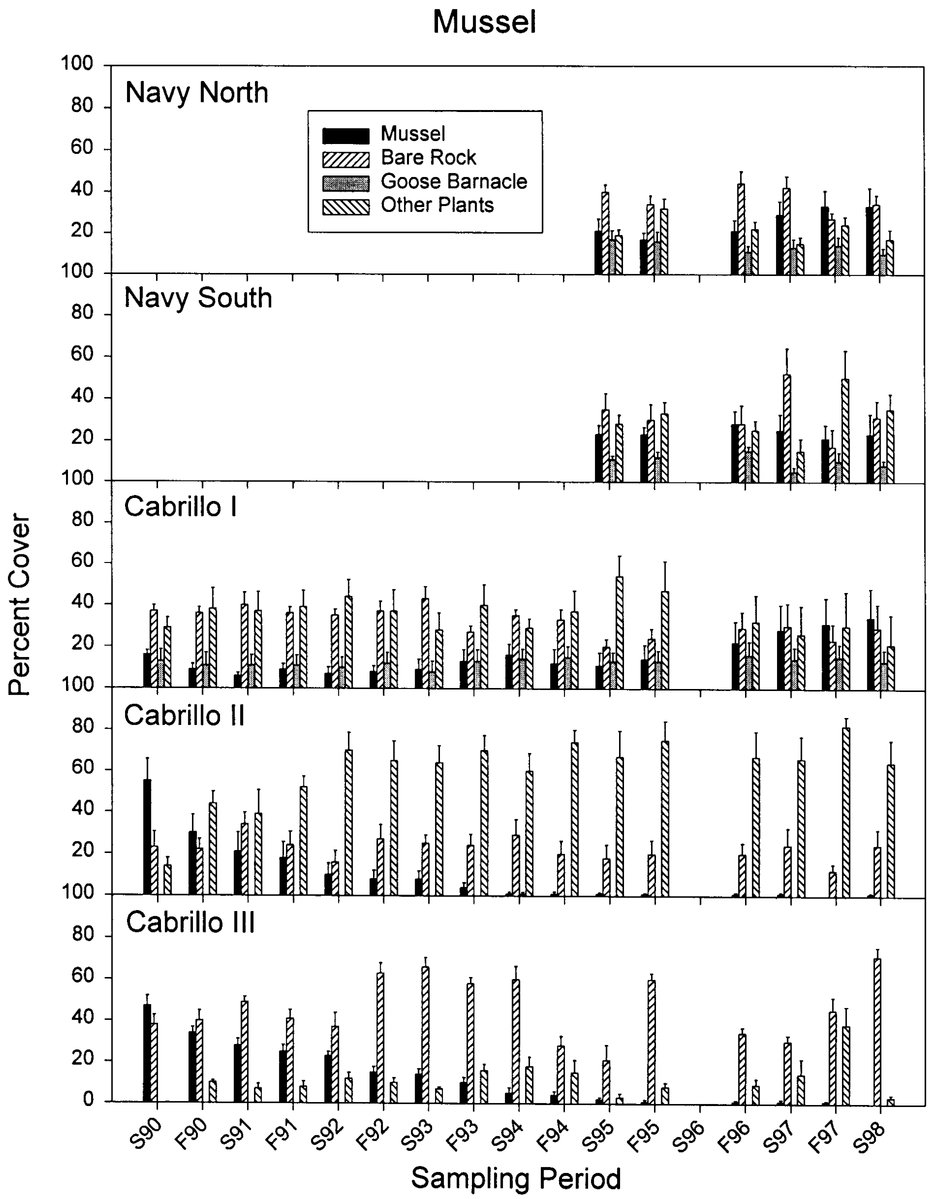

Fig. 5. Species abundances in Mussel plots at 5 Pt. Loma sites.

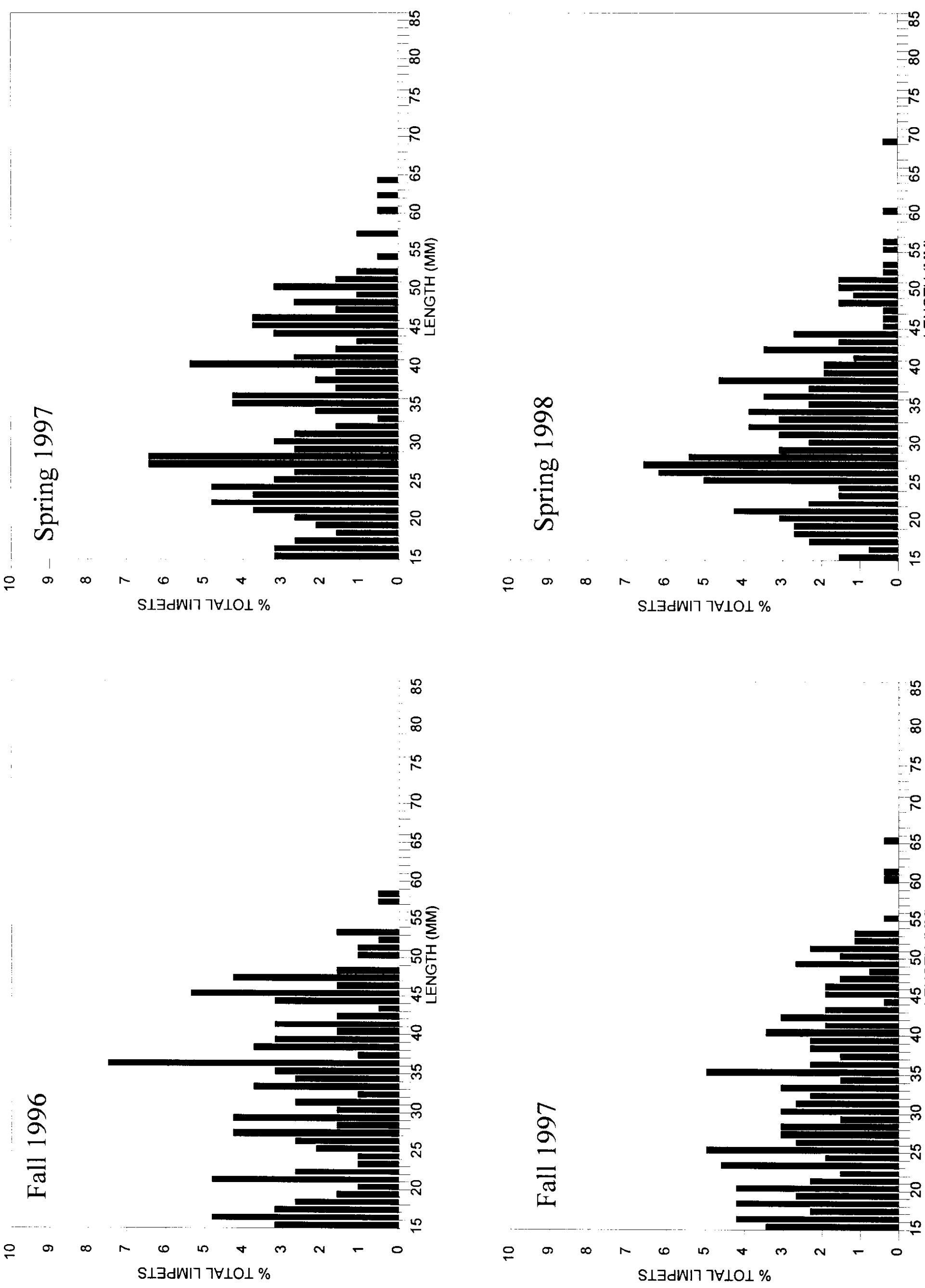

Fig. 6. Owl Limpet Length Frequencies at Navy North (Fall 1996-Spring 1998).

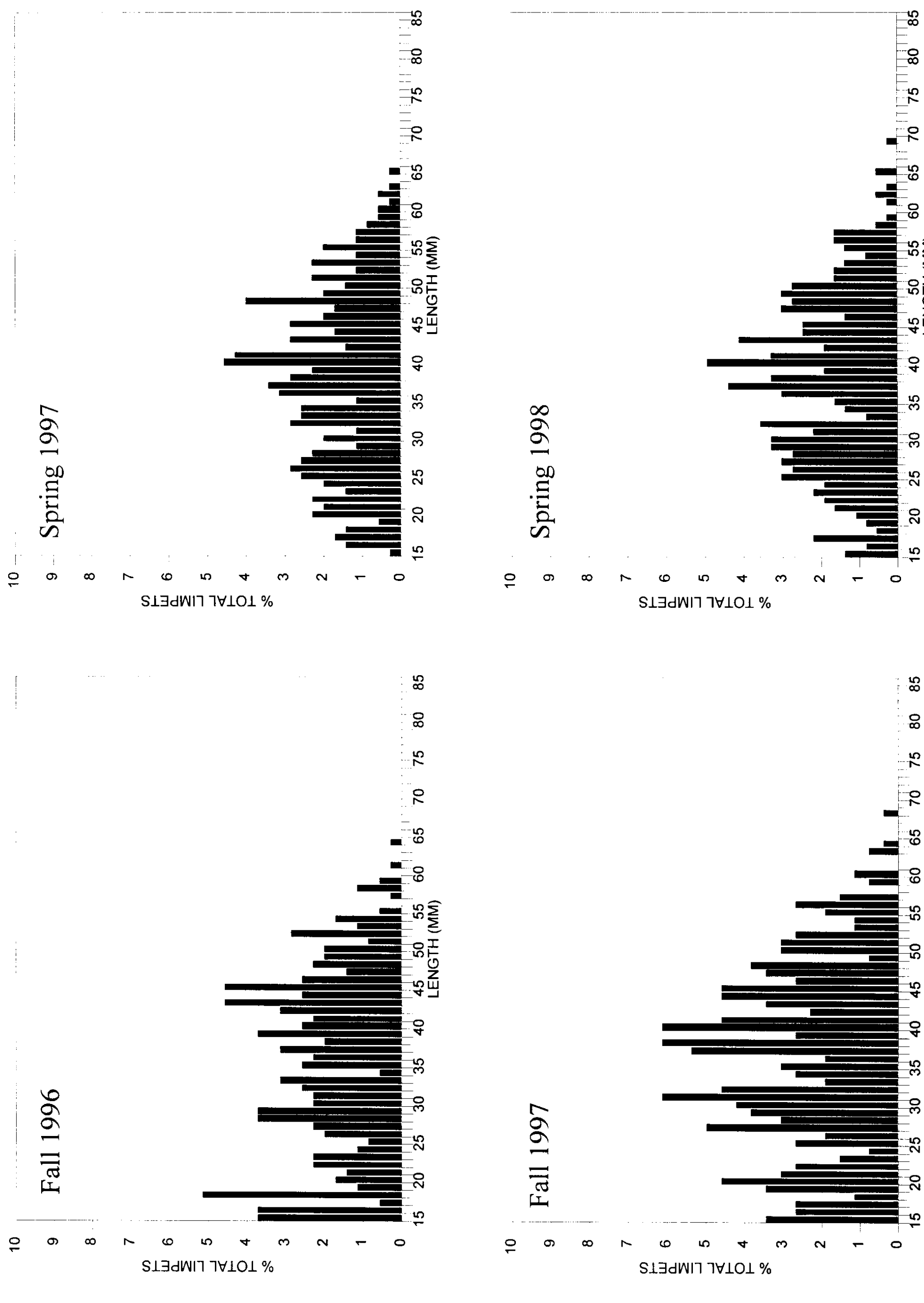

Fig. 7. Owl Limpet Length Frequencies at Navy South (Fall 1996-Spring 1998).

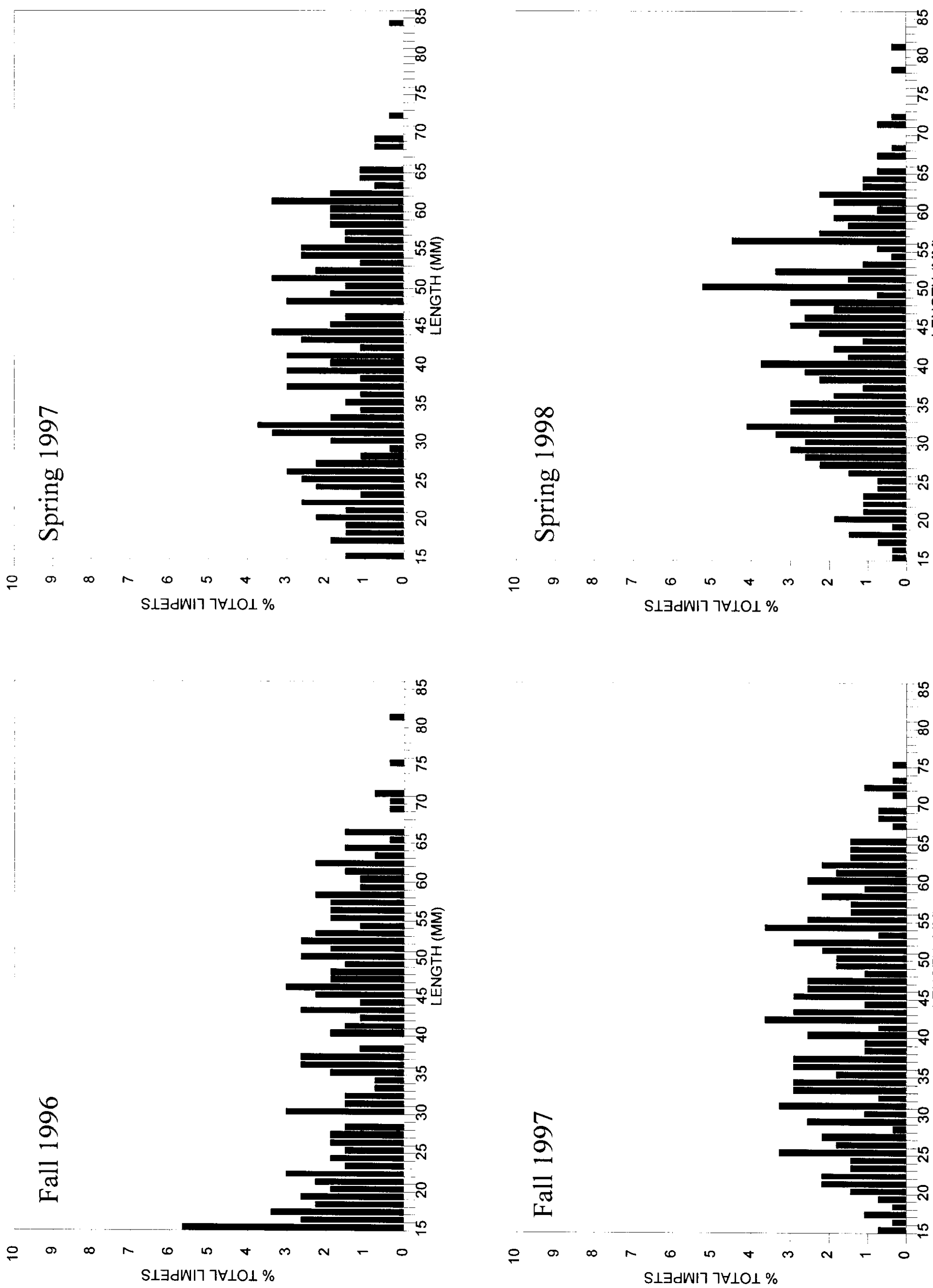

Fig. 8. Owl Limpet Length Frequencies at Cabrillo I (Fall 1996-Spring 1998).

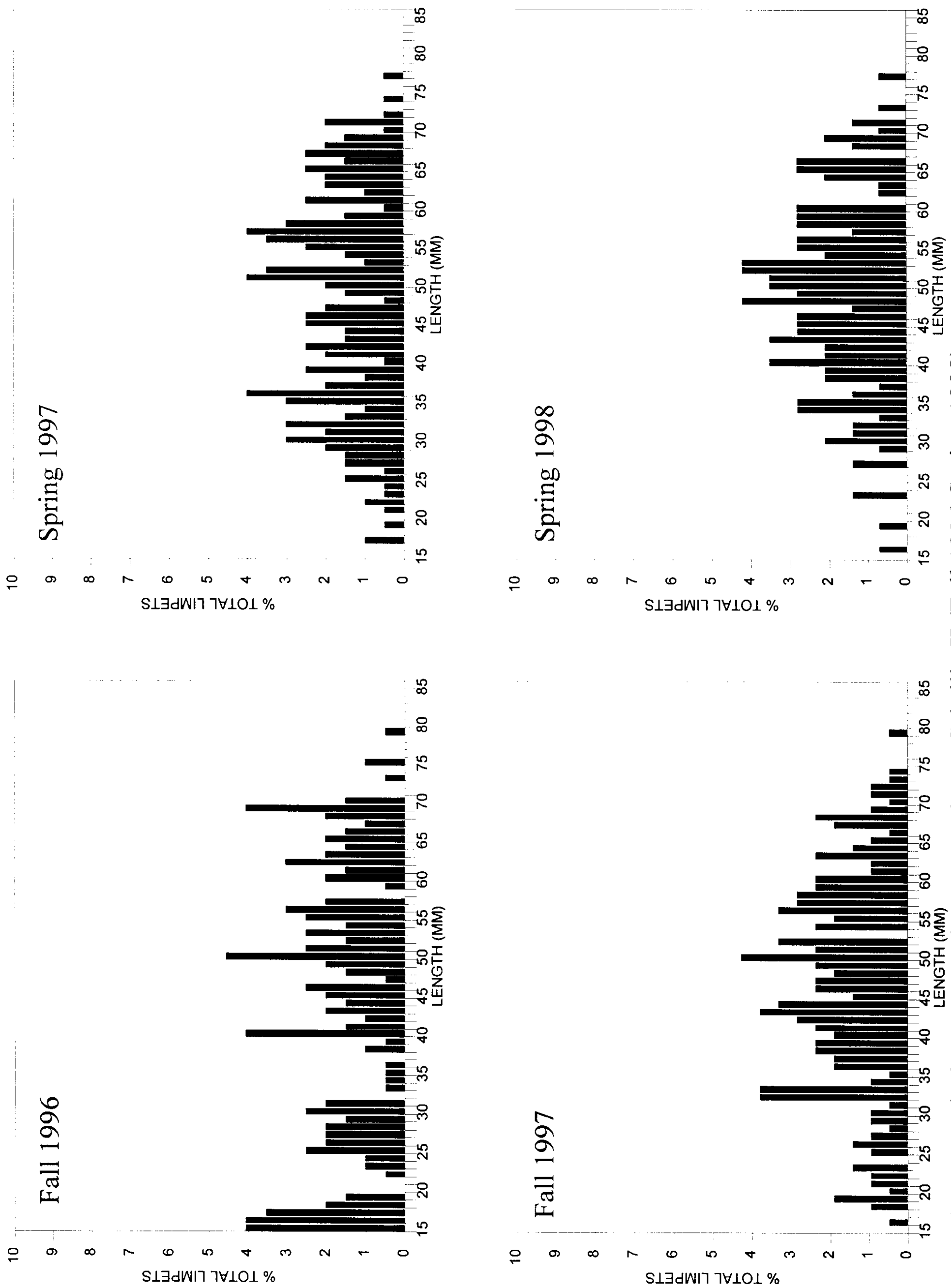

Fig. 9. Owl Limpet Length Frequencies at Cabrillo II (Fall 1996-Spring 1998).

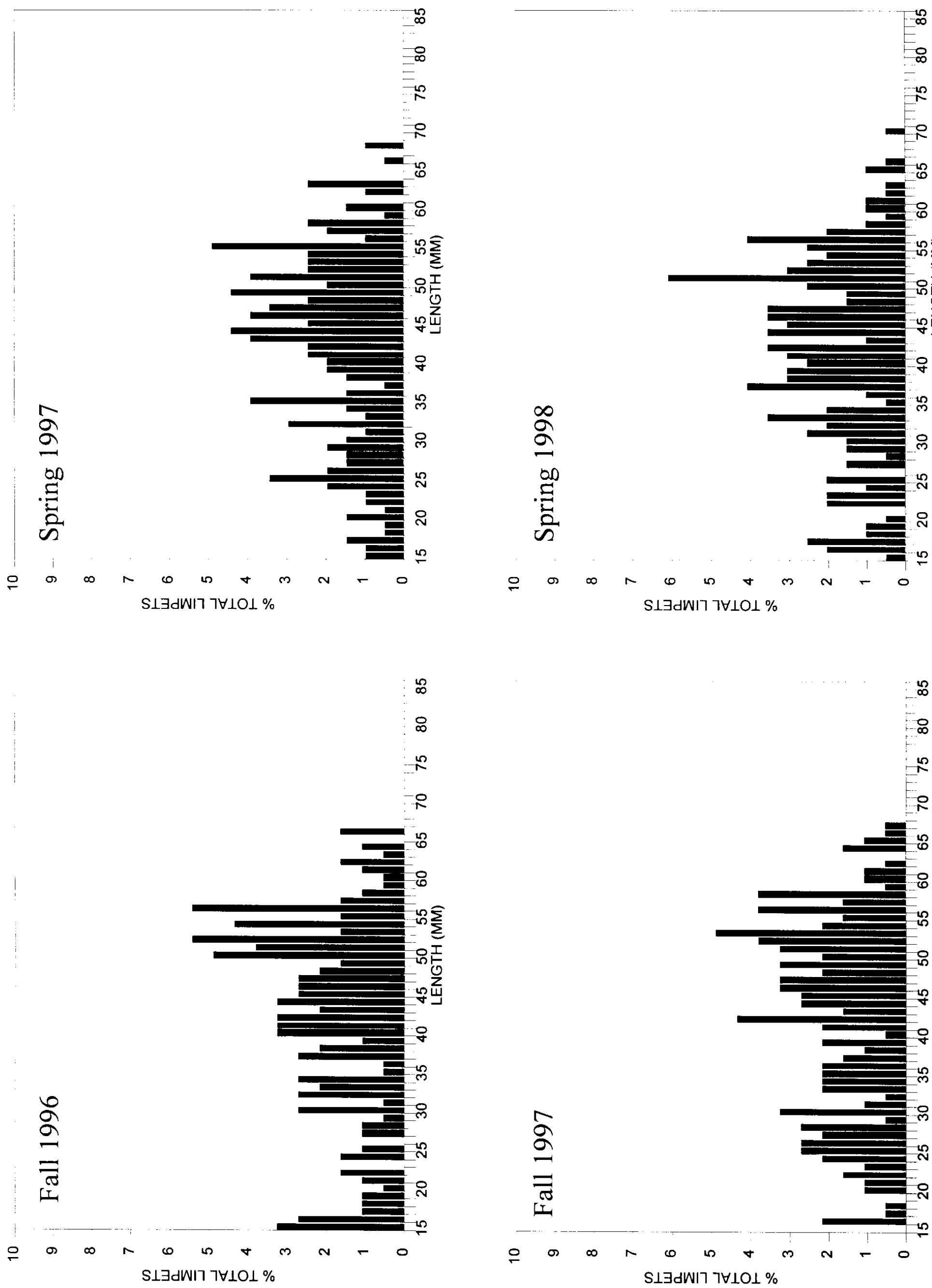

Fig. 10. Owl Limpet Length Frequencies at Cabrillo III (Fall 1996-Spring 1998).

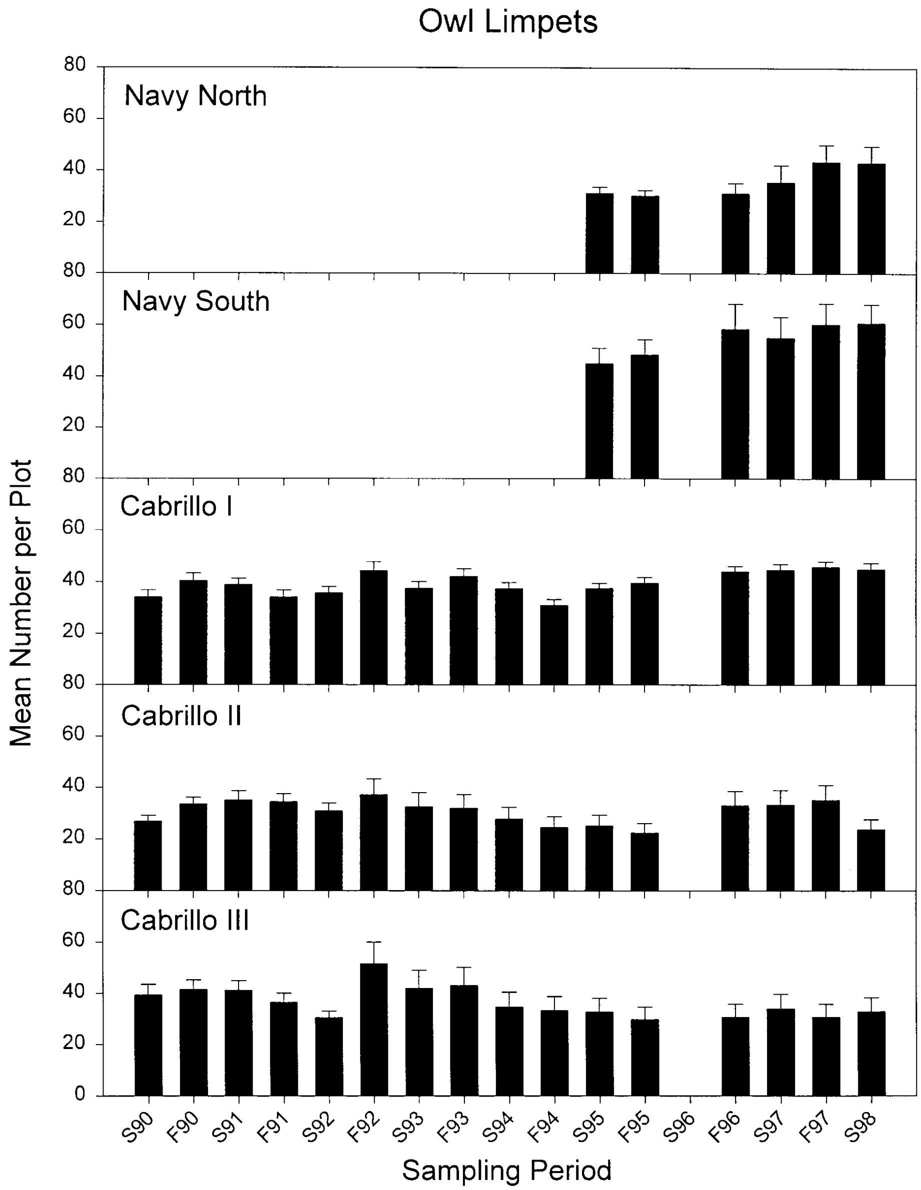

Fig. 11. Owl limpet abundances at 5 Pt. Loma sites.

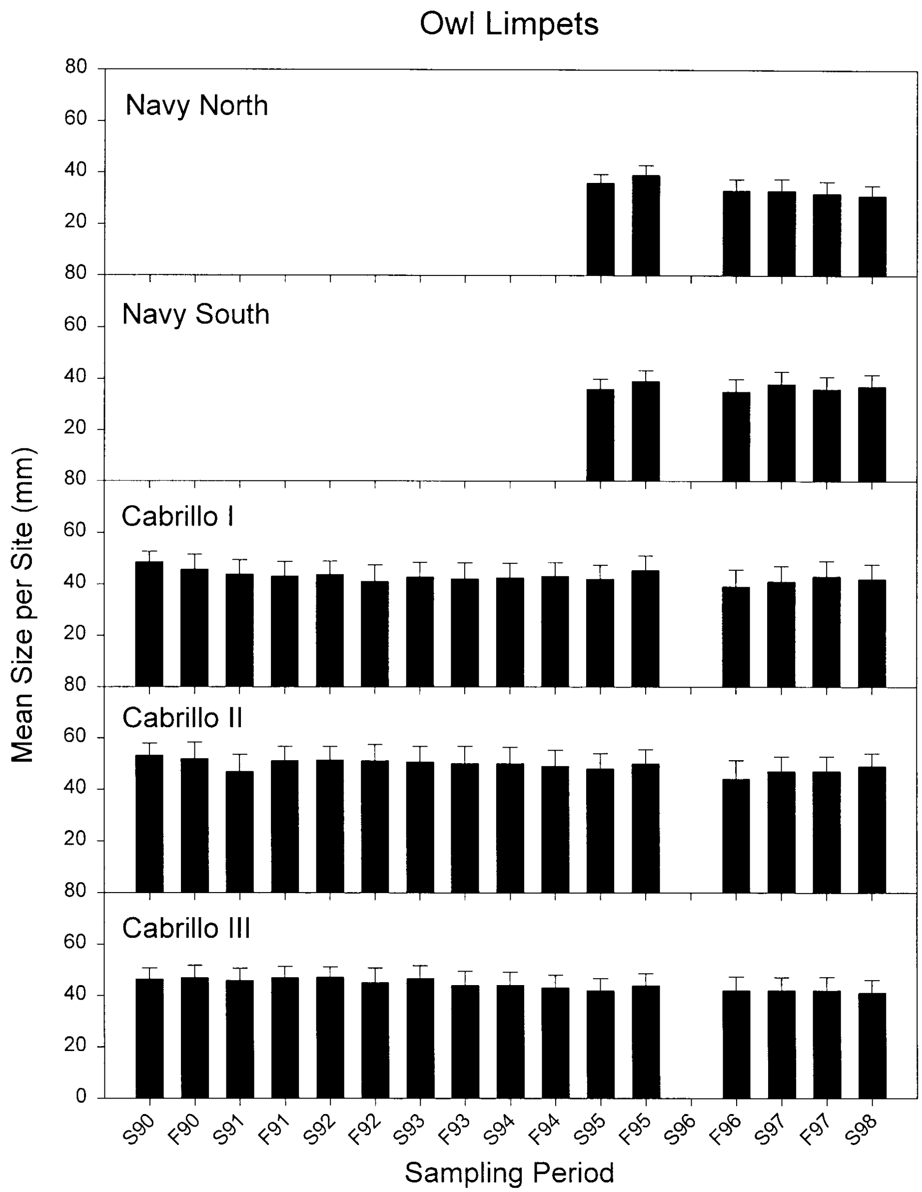

Fig. 12. Owl limpet sizes from 6 plots (combined) at 5 Pt. Loma sites.

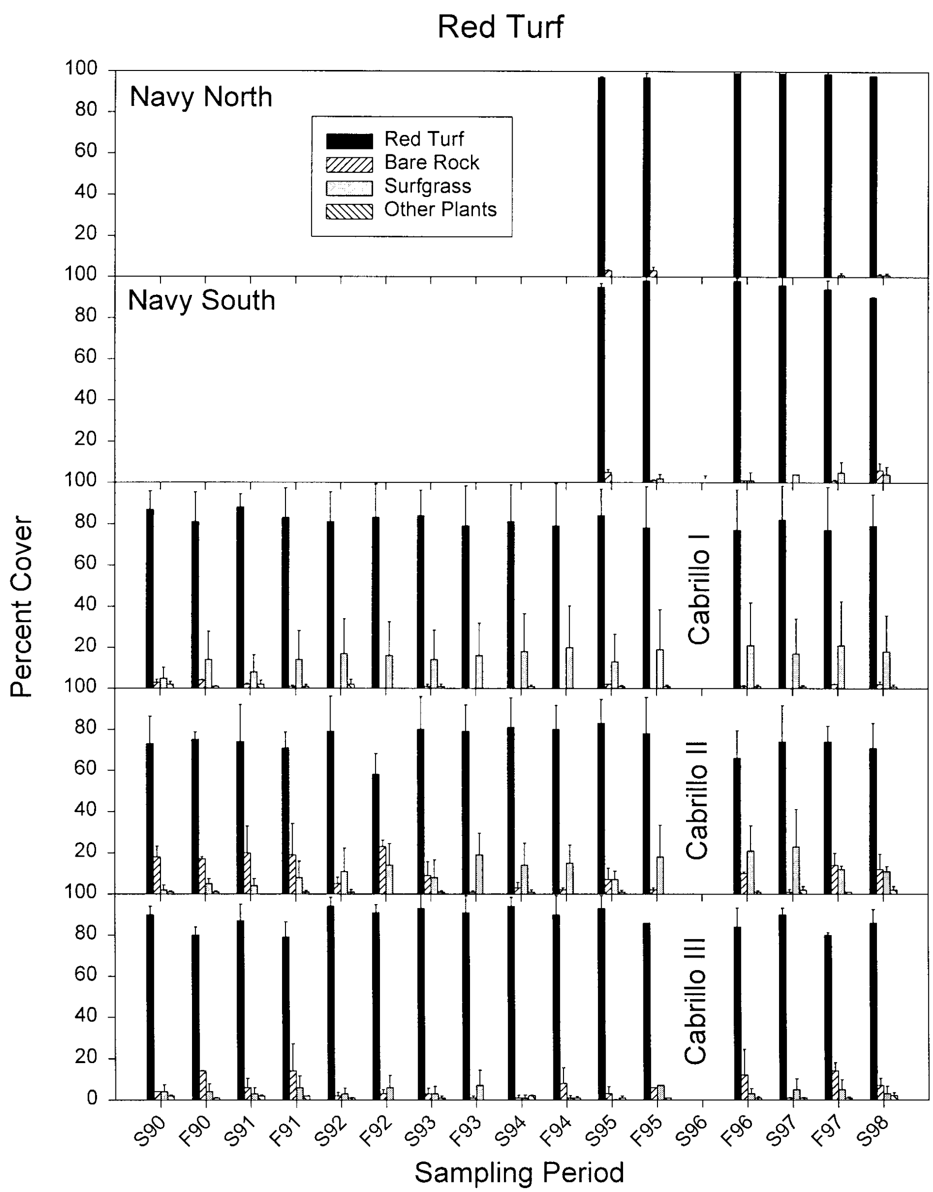

Fig. 13. Species abundances in Turf transects at 5 Pt. Loma sites.

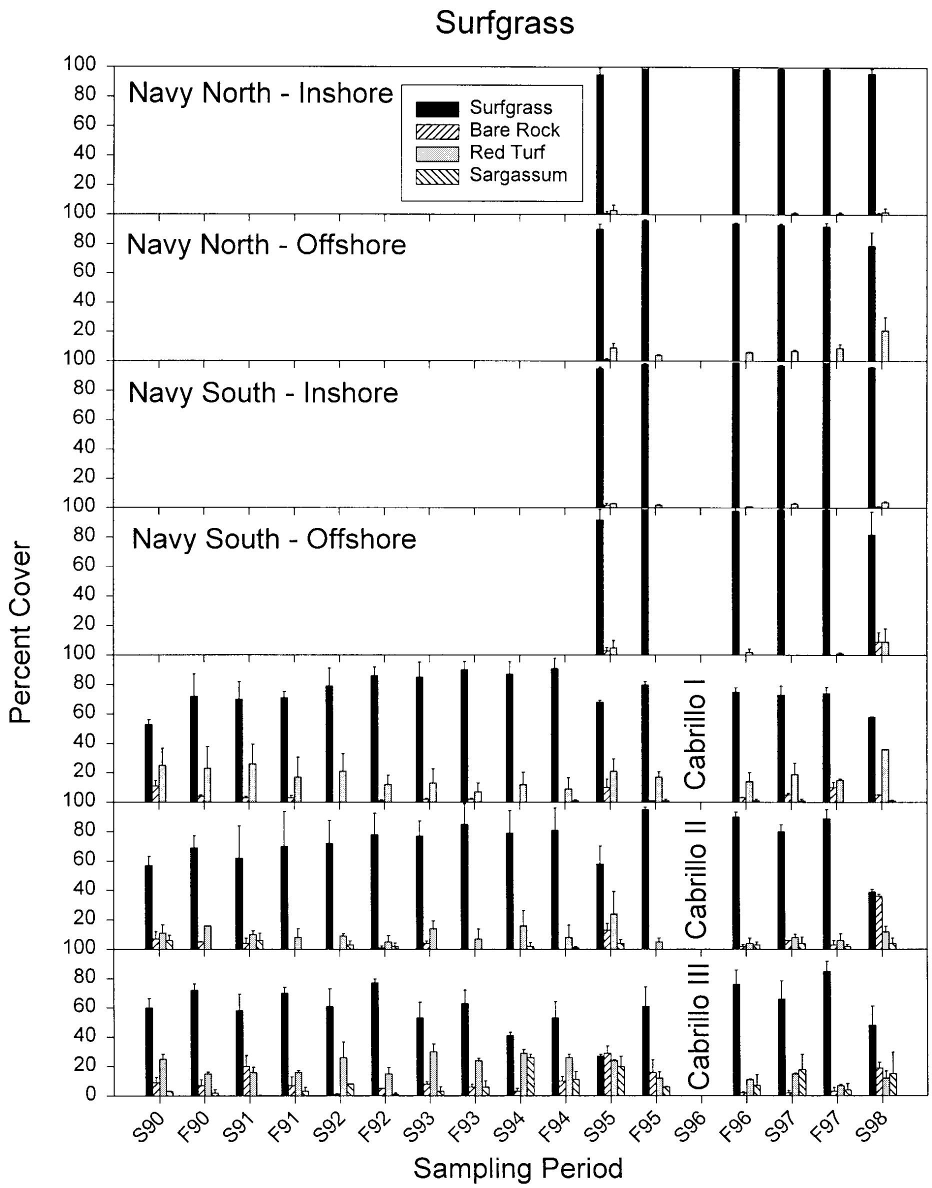

Fig. 14. Species abundances in Surfgrass transects at 5 Pt. Loma sites.

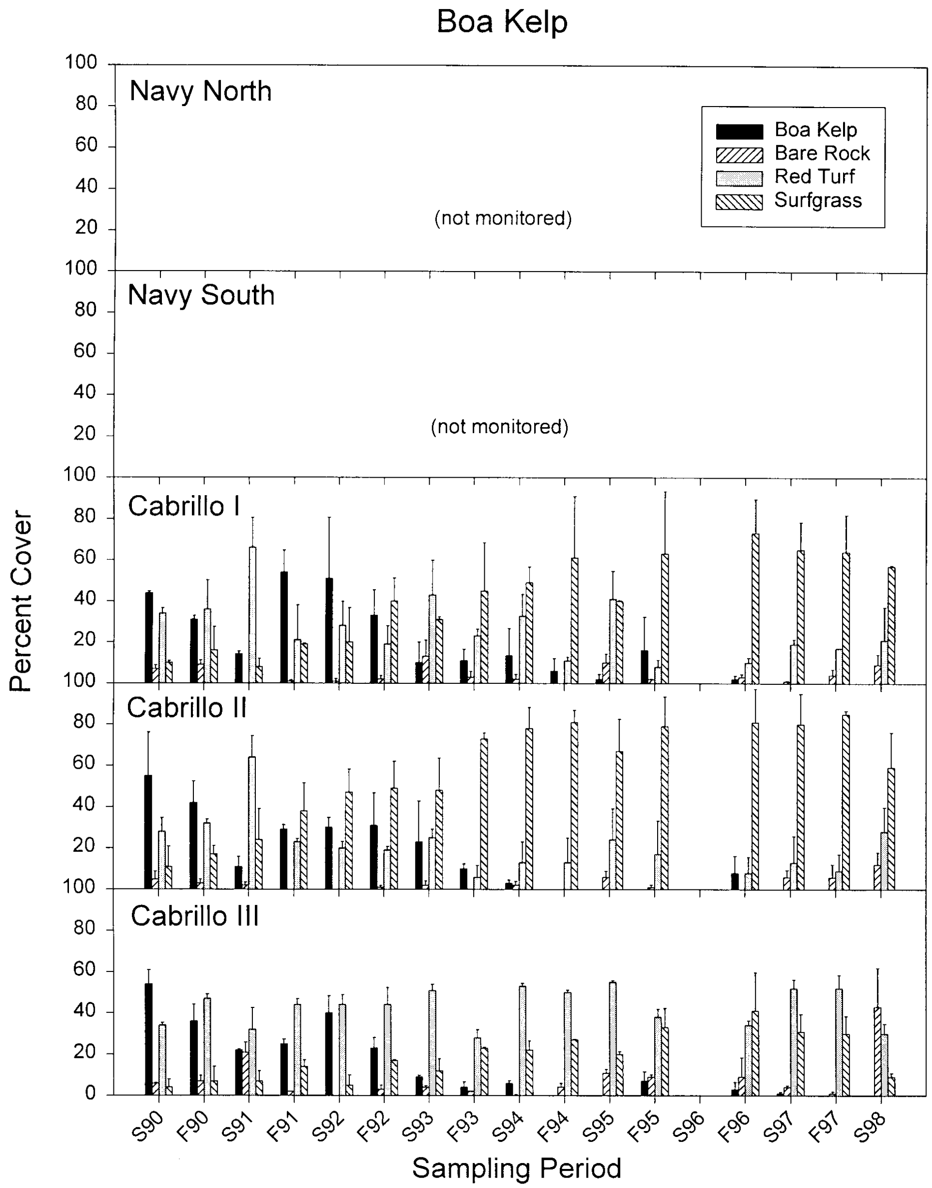

Fig. 15. Species abundances in Boa Kelp transects at 3 Pt. Loma sites.

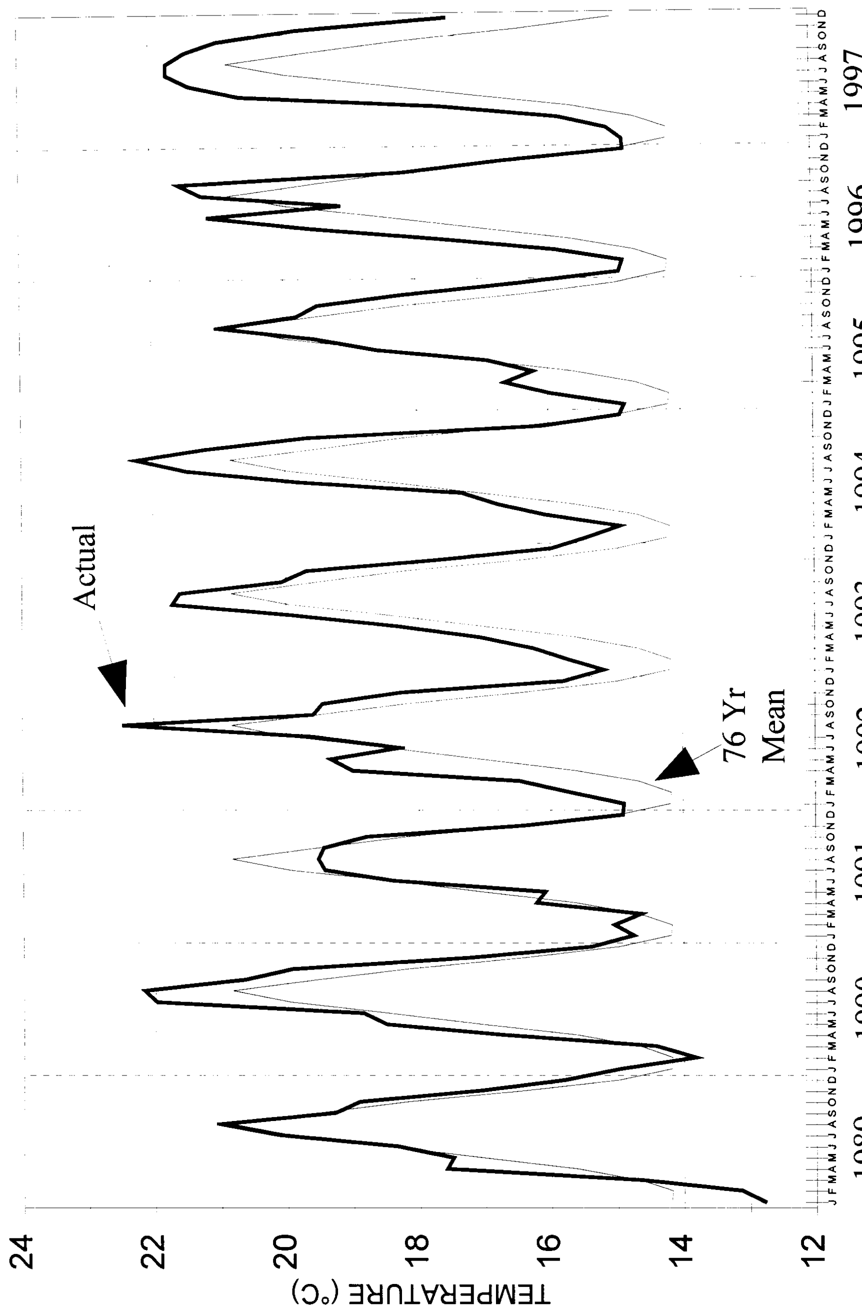

Fig. 16. Scripps Pier Seawater Temperatures (1989 to 1997).

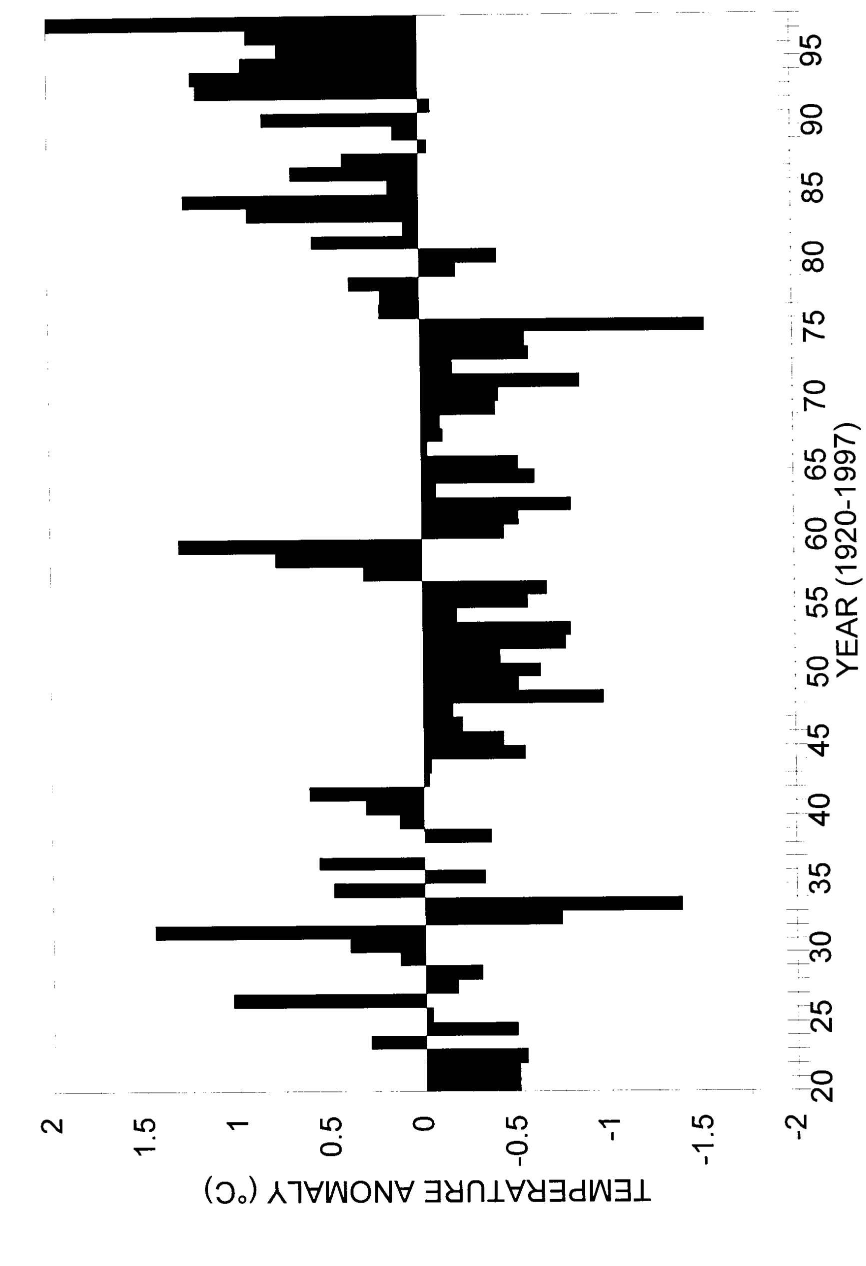

Fig. 17. Scripps Pier Seawater Temperature Anomalies (1920 to 1997).

Table 1. Summary of Key Species Assemblages Monitored at the Five Point Loma Sites.
In addition to the targeted key species (indicated by bullets), other species or higher taxa sampled within plots/transects are listed. Black abalone (*Haliotis cracherodii*) and ochre sea stars (*Pisaster ochraceus*), though not currently present at the sites, are searched for in case they reappear.

Technique/Taxa	Navy North	Navy South	CABR I	CABR II	CABR III	Total Sites
Photoplot **Dimensions** (50 X 75 cm)						
• Rockweed (*Pelvetia fastigiata*)	5	5	5	5	5	5
• Acorn Barnacle (*Chthamalus spp.*)						
• Pink Thatched Barnacle (*Tetraclita rubescens*)	5	5	5	5	5	5
• California Mussel (*Mytilus californianus*) Inshore	5	5	5	5	5	5
• Goose Barnacle (*Pollicepis polymerus*)	6	6	6	6	6	5
Other Plants						
Other Animals						
Tar						
Bare Substrate						
Circular Plot **Dimensions** (1 m radius)*						
• Owl Limpet (*Lottia gigantea*)	6	6	6	6	6	5
Line Transect **Dimensions** (10 m)						
• Red Algal Turf (*Corallina spp. et al.*)	2	2	2	2	2	5
• Surfgrass (*Phyllospadix spp.*) Inshore	2	2	2	2	2	5
• Surfgrass (*Phyllospadix spp.*) Offshore	2	2				2
• Boa Kelp (*Egregia menziesii*)			2	2	2	3
Sargassum Weed (*Sargassum muticum*)						
Aggregating Anemone (*Anthopleura elegantissima*)						
Other Biota						
Tar						
Bare Substrate						
Timed Search **Dimensions** (30 person-minutes)						
• Black Abalone (*Haliotis cracherodii*)	1	1	1	1	1	5
• Ochre Sea Star (*Pisaster ochraceus*)	1	1	1	1	1	5
Total Key Species Per Site	9	9	11	11	11	

Table 2. Field Activities for the Point Loma, San Diego County Rocky Intertidal Monitoring Project.

Season	Date	Site	Activity
Fall 1996	November 22	Cabrillo I	Rocky intertidal fall sample
	November 23	Cabrillo I, II, and III	Rocky intertidal fall sample
	November 24	Cabrillo I, II, and III	Rocky intertidal fall sample
	December 8	Cabrillo I, II, and III	Rocky intertidal fall sample
	December 9	Navy North	Rocky intertidal fall sample
	December 10	Navy South	Rocky intertidal fall sample
Spring 1997	April 2	Cabrillo I and II	Rocky intertidal spring sample
	April 3	Navy North and South	Rocky intertidal spring sample
	April 4	Navy South	Rocky intertidal spring sample
	April 4	Cabrillo I, II, and III	Rocky intertidal spring sample
	April 5	Cabrillo II and III	Rocky intertidal spring sample
	April 6	La Jolla Rocky Shores	Scouting other rocky intertidal sites
Fall 1997	October 14	Navy South	Rocky intertidal fall sample
	October 14	Cabrillo I, II, and III	Rocky intertidal fall sample
	October 15	Navy North and South	Rocky intertidal fall sample
	October 15	Cabrillo I, II, and III	Rocky intertidal fall sample
	October 17	Cabrillo I, II, and III	Rocky intertidal fall sample
	October 18	Cabrillo I, II, and III	Rocky intertidal fall sample
Spring 1998	February 22	Cabrillo I, II, and III	Rocky intertidal spring sample
	February 23	Navy South	Rocky intertidal spring sample
	February 24	Cabrillo I, II, and III	Rocky intertidal spring sample
	February 27	Navy North	Rocky intertidal spring sample
	March 24	Cabrillo I	Rocky intertidal spring sample
	March 25	Cabrillo I, II, and III	Rocky intertidal spring sample
	March 26	Cabrillo III	Rocky intertidal spring sample
	March 27	Cabrillo I, II, and III	Rocky intertidal spring sample

Table 3. Personnel Participating in Point Loma, San Diego County Rocky Intertidal Surveys.

Participants	Affiliation	Status	F96	S97	F97	S98
Jack Engle	University of California, Santa Barbara	Employee	X	X	X	X
Dan Martin	University of California, Santa Barbara	Employee			X	X
Dave Hubbard	University of California, Santa Barbara	Employee	X	X	X	
Jessie Altstatt	University of California, Santa Barbara	Employee			X	
Melissa Wilson	University of California, Santa Barbara	Employee	X			
Cindy Taylor	Scripps Institution of Oceanography	Employee	X	X	X	
Alan Anzak	United States Navy	Cooperator		X	X	
Cleave Berdzar	United States Navy	Cooperator				X
Gary Davis	Channel Islands National Park	Cooperator	X	X	X	
Robin Lewis	California Department of Fish and Game	Cooperator	X			X
Erik Steenblock	United States Navy	Cooperator				X
Samantha Weber	Cabrillo National Monument	Cooperator	X	X	X	X
Nancy Aguilar	Scripps Institution of Oceanography	Volunteer		X	X	X
Shane Bagnall	Cabrillo National Monument	Volunteer	X			
John Ball	Cabrillo National Monument	Volunteer				X
Chris Brown	Cabrillo National Monument	Volunteer			X	X
Anna Burgans	Cabrillo National Monument	Volunteer		X	X	
Anita Burkett	Cabrillo National Monument	Volunteer			X	X
George Cantrell	Cabrillo National Monument	Volunteer	X			
Pam Villa Clay	Cabrillo National Monument	Volunteer	X			
Andrea Compton	Cabrillo National Monument	Volunteer	X		X	X
Robert Compton	Cabrillo National Monument	Volunteer	X		X	X
Kai Craig	Cabrillo National Monument	Volunteer				X
Rya Currie	Cabrillo National Monument	Volunteer	X			
Dave Dillon	Cabrillo National Monument	Volunteer	X			
Debra Dillon	Cabrillo National Monument	Volunteer	X			
Timothy Downey	Cabrillo National Monument	Volunteer		X		
Heather Elbert	Cabrillo National Monument	Volunteer			X	
Cliff Engle	Ellwood School	Volunteer		X		
Bob Gladden	San Diego Underwater Photographic Society	Volunteer	X	X	X	X
Pierce Harris	Cabrillo National Monument	Volunteer	X	X	X	X
George Herring	Cabrillo National Monument	Volunteer				X
Cynthia Kangas	Cabrillo National Monument	Volunteer	X			
Sandy Kay	Cabrillo National Monument	Volunteer	X			
Katherine Kim	Cabrillo National Monument	Volunteer		X		
Susan Kranz	Cabrillo National Monument	Volunteer	X			
Marty Lane	Cabrillo National Monument	Volunteer	X			
R. McCollough	Cabrillo National Monument	Volunteer		X		
Will Miller	Cabrillo National Monument	Volunteer	X			
Jenny Noble	Cabrillo National Monument	Volunteer		X		
Heather O'Brien	Cabrillo National Monument	Volunteer			X	
Todd Partridge	Cabrillo National Monument	Volunteer	X		X	X
Mary Platter-Reiger	Cabrillo National Monument	Volunteer	X			
Jane Rodgers	Cabrillo National Monument	Volunteer	X			
Jennifer Rodgers	Cabrillo National Monument	Volunteer	X	X	X	
Terry Rodgers	Cabrillo National Monument	Volunteer			X	
Camille Rothenburg	Cabrillo National Monument	Volunteer	X		X	
Patricia Rutledge	Cabrillo National Monument	Volunteer	X			
Molly Sanford	Cabrillo National Monument	Volunteer		X		
Debbie Stein	Cabrillo National Monument	Volunteer	X	X		
Bill Van Bonn	Cabrillo National Monument	Volunteer		X	X	
Carol Vandenberg	University of California, Santa Barbara	Volunteer		X		
Valerie Vucich	San Diego State University	Volunteer		X		
Debbie Younkin	Cabrillo National Monument	Volunteer				X

Table 4. Photoplot Cover at Navy North and Navy South in Fall 1996.

NAVY NORTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M0	M1	M2	M3	M4	AVG	M5	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	102	100	100		100	100	100	100	100	100	
ACORN BARNACLE	10	8	7	10	10	9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	3	1
THATCHED BARNACLE	28	31	33	22	31	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCKWEED	0	1	0	1	6	2	73	86	88	84	32	73	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	13	10	24	40	16	21	0	2	0	3	0	1	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	10	13	17	0	14	11	22	17	7	12	25	17	17
OTHER PLANTS	7	16	7	2	10	8	23	6	11	15	66	24	29	23	9	28	21	22	9	17	7	5	22	13	12
OTHER ANIMALS	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	11	0	3	2	1	0	0	0	0	1
BARE SUBSTRATE	55	44	53	64	43	52	4	8	1	1	2	3	48	52	51	21	49	44	67	62	85	80	52	66	69

NAVY SOUTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M5	M1	M2	M3	M4	AVG	M0	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	1	1	2	4	3	2	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0
THATCHED BARNACLE	7	9	6	10	9	8	0	0	0	0	0	0	1	0	0	0	0	0	1	0	4	0	0	0	1
ROCKWEED	0	0	0	0	0	0	68	37	61	38	51	51	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	18	41	17	45	18	28	4	20	18	3	19	7	12
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	11	10	22	17	16	15	21	27	29	27	34	19	26
OTHER PLANTS	37	35	32	61	75	48	28	61	34	33	32	38	35	36	14	21	19	25	22	10	6	10	15	5	11
OTHER ANIMALS	0	2	4	0	0	1	1	0	0	0	0	0	1	12	0	2	2	3	2	0	0	0	0	0	0
BARE SUBSTRATE	55	53	56	25	13	40	2	2	5	28	17	11	34	1	47	14	44	28	49	43	43	60	32	69	49

Table 5. Photoplot Cover at Cabrillo I, II, and III in Fall 1996.

CABR AREA I	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% C				
PHOTOPLOT #	286	299	294	292	293	AVG	291	290	295	288	287	AVG	298	297	296	289	285	AVG	P1	P2	P3	P4	P5
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	0	100	100	100
ACORN BARNACLE	19	33	0	0	0	10	0	0	0	0	1	0	0	0	0	0	0	0	5		0	0	1
THATCHED BARNACLE	6	2	0	3	1	2	0	0	0	0	0	0	1	0	0	1	0	0	0		0	0	0
ROCKWEED	0	0	0	0	0	0	38	80	80	60	66	65	0	0	0	0	0	0	0		0	0	0
CALIFORNIA MUSSEL	0	0	8	0	0	2	0	0	0	0	0	0	17	29	57	0	6	22	0		0	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	30	26	25	0	1	16	0		16	4	1
OTHER PLANTS	16	9	89	49	12	35	62	15	20	40	7	29	17	20	7	79	36	32	14		11	2	5
OTHER ANIMALS	0	0	1	4	7	2	0	0	0	0	0	0	0	1	0	0	1	0	1		0	1	0
BARE SUBSTRATE	59	56	2	44	80	48	0	5	0	0	26	6	35	24	11	20	56	29	80		73	93	93

CABR AREA II	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% C				
PHOTOPLOT #	247	248	256	259	260	AVG	249	251	252	258	265	AVG	245	246	253	254	255	AVG	P1	P2	P3	P4	P5
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100
ACORN BARNACLE	0	30	5	10	47	18	0	0	0	1	0	0	0	0	8	0	0	2	1	0	1	0	0
THATCHED BARNACLE	3	3	5	5	26	8	0	0	0	0	0	0	0	0	37	3	0	8	0	0	0	0	0
ROCKWEED	0	0	27	3	4	7	91	50	96	88	94	84	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	11	0	0	2	0	0	0	0	0	0	3	0	0	0	2	1	0	0	0	0	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	14	3	17	18
OTHER PLANTS	1	8	41	60	4	23	1	48	4	11	6	14	68	71	23	77	98	67	3	4	14	10	18
OTHER ANIMALS	0	0	0	2	5	1	0	0	0	0	0	0	2	1	8	0	0	2	0	3	4	1	2
BARE SUBSTRATE	96	59	11	20	14	40	8	2	0	0	0	2	27	28	24	20	0	20	92	79	78	72	61

CABR AREA III	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% C				
PHOTOPLOT #	3	16	29	30	20	AVG	9	10	28	27	25	AVG	24	15	14	17	12	AVG	P1	P2	P3	P4	P5
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100
ACORN BARNACLE	27	19	30	15	19	22	5	0	0	4	0	2	50	51	27	65	46	48	3	17	20	3	29
THATCHED BARNACLE	1	0	22	42	10	15	0	0	0	0	0	0	9	12	8	2	2	7	0	0	0	0	0
ROCKWEED	0	0	16	1	0	3	70	90	77	92	87	83	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	1	1	0	0	0	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	6	4	6	0
OTHER PLANTS	25	28	0	11	6	14	7	9	22	3	13	11	5	9	14	0	16	9	0	0	0	15	0
OTHER ANIMALS	1	4	1	4	2	2	0	0	0	1	0	0	2	0	8	0	1	2	0	1	2	1	0
BARE SUBSTRATE	46	49	31	27	63	43	18	1	1	0	0	4	34	25	42	33	34	34	82	76	74	75	71

Table 6. Photoplot Cover at Navy North and Navy South in Spring 1997.

NAVY NORTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M0	M1	M2	M3	M4	AVG	M5	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	26	6	4	16	10	12	3	0	0	0	0	1	0	0	0	0	1	0	3	0	2	2	1	1	2
THATCHED BARNACLE	27	31	39	30	35	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCKWEED	0	3	0	1	0	1	65	94	97	71	39	73	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	2	0	0	0	0	0	0	0	0	0	23	26	29	53	15	29	3	1	0	6	0	0	2
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	12	13	15	0	26	13	21	21	8	8	33	6	16
OTHER PLANTS	0	12	0	1	7	4	30	5	3	27	60	25	13	15	6	25	16	15	12	13	5	5	11	7	9
OTHER ANIMALS	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	1
BARE SUBSTRATE	46	47	55	52	48	50	2	1	0	2	1	1	52	46	50	22	42	42	59	65	85	77	55	86	71

NAVY SOUTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M5	M1	M2	M3	M4	AVG	M0	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	4	4	1	7	1	3	0	0	1	3	1	1	0	0	2	0	1	1	0	0	2	1	0	1	1
THATCHED BARNACLE	11	14	8	14	9	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	1
ROCKWEED	0	0	0	0	0	0	71	48	51	37	54	52	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	1	0	0	0	0	0	0	0	0	0	0	19	53	23	7	22	25	9	17	16	6	21	5	12
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	3	6	12	1	3	5	14	25	27	28	32	25	25
OTHER PLANTS	1	14	20	30	61	25	29	52	43	41	24	38	8	30	3	29	6	15	6	12	3	8	6	2	6
OTHER ANIMALS	0	0	0	0	1	0	0	0	0	0	0	0	1	7	1	0	2	2	0	0	0	0	0	0	0
BARE SUBSTRATE	84	67	71	49	28	60	0	0	5	19	21	9	69	4	59	63	66	52	71	46	46	57	41	67	55

Table 7. Photoplot Cover at Cabrillo I, II, and III in Spring 1997.

CABR AREA I	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	286	299	294	292	293	AVG	291	290	295	288	287	AVG	298	297	296	289	285	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	30	52	0	0	0	16	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	0	1
THATCHED BARNACLE	4	4	2	0	2	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
ROCKWEED	0	0	0	0	1	0	40	85	74	76	57	66	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	21	0	0	4	0	0	0	0	0	0	24	36	70	0	11	28	0	0	0	0	0	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	25	24	20	0	0	14	0	37	14	7	5	18	14
OTHER PLANTS	14	1	70	58	13	31	59	11	25	23	9	25	18	16	1	79	16	26	21	8	3	0	1	16	8
OTHER ANIMALS	2	1	0	2	4	2	0	0	0	0	0	0	1	3	0	1	1	1	0	1	0	0	2	0	1
BARE SUBSTRATE	50	42	7	40	80	44	1	4	1	1	34	8	32	21	9	19	71	30	76	54	83	93	92	66	77

CABR AREA II	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	247	248	256	259	260	AVG	249	251	252	258	265	AVG	245	246	253	254	255	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	41	8	39	36	25	0	0	0	7	3	2	0	0	9	0	0	2	0	0	0	0	0	1	0
THATCHED BARNACLE	6	1	7	2	18	7	0	0	0	0	0	0	0	0	35	0	0	7	0	0	0	0	0	0	0
ROCKWEED	0	0	10	6	2	4	70	66	78	59	68	68	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	17	0	3	4	0	0	0	0	0	0	2	0	0	0	3	1	0	1	0	0	3	0	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	2	23	15	13	11
OTHER PLANTS	84	1	45	36	13	36	10	11	22	32	7	16	72	47	37	77	97	66	6	1	2	1	12	0	4
OTHER ANIMALS	0	10	0	3	0	3	0	0	0	0	1	0	1	1	0	1	0	1	0	1	4	0	2	0	1
BARE SUBSTRATE	10	47	13	14	28	22	20	23	0	2	21	13	25	52	19	22	0	24	93	84	92	76	68	86	83

CABR AREA III	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	3	16	29	30	20	AVG	9	10	28	27	25	AVG	24	15	14	17	12	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	35	28	42	31	38	35	14	0	0	0	0	3	49	47	13	65	48	44	7	17	21	8	26	42	20
THATCHED BARNACLE	2	1	0	29	12	9	0	0	0	0	0	0	15	14	13	2	1	9	0	0	0	0	0	0	0
ROCKWEED	0	0	11	3	0	3	64	87	67	90	78	77	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	1	0	0	0	0	0	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	6	6	7	0	1	5
OTHER PLANTS	6	25	0	13	3	9	7	12	25	6	22	14	12	5	42	0	10	14	0	1	0	13	0	0	2
OTHER ANIMALS	3	0	0	0	2	1	0	1	0	0	0	0	0	5	5	0	0	2	0	0	3	0	0	2	1
BARE SUBSTRATE	54	46	47	24	45	43	15	0	8	4	0	5	24	25	27	33	39	30	83	76	70	72	74	55	72

Table 8. Photoplot Cover at Navy North and Navy South in Fall 1997.

NAVY NORTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M0	M1	M2	M3	M4	AVG	M5	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	6	2	3	5	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	0	1
THATCHED BARNACLE	20	25	26	12	21	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROCKWEED	0	0	0	2	5	1	34	84	80	48	5	50	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	1	0	0	0	0	0	0	0	0	0	22	32	34	61	18	33	8	5	0	2	5	1	4
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	15	17	14	0	25	14	25	20	7	8	23	8	15
OTHER PLANTS	59	68	53	74	58	62	66	16	13	52	95	48	33	22	13	19	33	24	34	26	31	27	44	61	37
OTHER ANIMALS	0	0	0	0	0	0	0	0	0	0	0	0	3	4	2	0	0	2	3	0	0	3	1	0	1
BARE SUBSTRATE	15	5	17	7	11	11	0	0	7	0	0	1	27	25	37	20	24	27	30	49	61	57	27	30	42

NAVY SOUTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M5	M1	M2	M3	M4	AVG	M0	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	1	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1
THATCHED BARNACLE	10	9	7	6	5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
ROCKWEED	0	0	0	0	0	0	54	32	45	30	28	38	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	17	45	17	7	17	21	7	22	22	5	25	9	15
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	6	5	25	0	13	10	19	26	32	28	33	21	27
OTHER PLANTS	74	36	64	89	83	69	39	54	53	57	56	52	67	39	20	93	32	50	23	34	21	44	23	48	32
OTHER ANIMALS	5	5	1	2	1	3	0	6	0	0	0	1	0	11	1	0	1	3	1	1	2	3	0	0	1
BARE SUBSTRATE	10	48	28	3	11	20	7	8	2	13	16	9	10	0	37	0	37	17	47	17	21	20	19	22	24

Table 9. Photoplot Cover at Cabrillo I, II, and III in Fall 1997.

CABR AREA I	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	286	299	294	292	293	AVG	291	290	295	288	287	AVG	298	297	296	289	285	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	4	1	0	0	1	0	0	0	0	3	1	0	0	0	0	0	0	2	1	3	0	1	0	1
THATCHED BARNACLE	4	4	0	2	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
ROCKWEED	0	0	0	0	1	0	24	58	70	44	54	50	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	18	0	0	4	0	0	0	0	0	0	26	37	75	0	19	31	0	3	0	0	0	0	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	28	26	19	0	1	15	0	29	13	8	8	11	12
OTHER PLANTS	70	62	80	71	24	61	72	31	30	54	11	40	13	12	1	93	30	30	45	19	21	8	10	30	22
OTHER ANIMALS	1	0	0	3	4	2	0	1	0	0	0	0	2	1	0	0	1	1	0	0	3	2	1	4	2
BARE SUBSTRATE	25	30	1	24	69	30	4	10	0	2	32	10	31	24	5	7	47	23	53	48	60	82	80	55	63

CABR AREA II	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	247	248	256	259	260	AVG	249	251	252	258	265	AVG	245	246	253	254	255	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	50	1	5	16	14	2	0	0	2	3	1	0	0	4	0	0	1	0	1	0	1	0	4	1
THATCHED BARNACLE	3	0	3	3	12	4	0	0	0	0	0	0	0	0	11	7	0	4	0	0	0	0	0	0	0
ROCKWEED	0	0	16	0	5	4	57	75	77	66	69	69	1	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	18	0	2	4	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	3	0	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	16	6	19	17	13	13
OTHER PLANTS	78	32	48	77	52	57	14	25	23	19	7	18	87	80	71	76	97	82	32	27	20	21	30	10	23
OTHER ANIMALS	0	0	0	0	0	0	3	0	0	0	0	1	0	0	2	0	0	0	1	2	2	3	5	2	3
BARE SUBSTRATE	19	18	14	15	13	16	24	0	0	13	21	12	11	20	12	17	2	12	63	53	72	56	45	71	60

CABR AREA III	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	3	16	29	30	20	AVG	9	10	28	27	25	AVG	24	15	14	17	12	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	1	3	16	1	11	6	4	0	0	0	0	1	9	2	10	2	2	5	7	25	24	10	37	58	27
THATCHED BARNACLE	1	0	7	27	7	8	0	0	0	0	0	0	8	10	15	8	4	9	0	0	0	0	0	0	0
ROCKWEED	0	0	9	3	0	2	38	80	55	52	56	56	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	5	0	0	0	0	0	1
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	5	5	6	0	0	4
OTHER PLANTS	76	74	10	49	26	47	24	12	42	44	42	33	14	35	25	62	54	38	2	7	0	41	1	0	9
OTHER ANIMALS	0	0	0	1	1	0	0	7	1	1	0	2	3	5	1	0	1	2	1	4	5	2	1	0	2
BARE SUBSTRATE	22	23	58	19	55	35	34	1	2	3	2	8	66	46	49	28	38	45	75	59	66	41	61	42	57

Table 10. Photoplot Cover at Navy North and Navy South in Spring 1998.

NAVY NORTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M0	M1	M2	M3	M4	AVG	M5	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	10	2	1	7	3	5	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
THATCHED BARNACLE	27	31	34	30	30	30	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
ROCKWEED	0	0	0	2	4	1	20	57	57	36	4	35	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	27	32	26	66	14	33	7	8	0	5	2	0	4
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	11	8	10	1	18	10	15	15	4	10	26	8	13
OTHER PLANTS	13	20	21	9	23	17	78	28	29	59	92	57	16	24	6	8	30	17	25	32	22	43	31	26	30
OTHER ANIMALS	0	4	0	1	0	1	0	0	1	0	0	0	7	7	10	4	2	6	1	0	3	1	0	0	1
BARE SUBSTRATE	50	43	44	51	40	46	2	14	13	5	3	7	39	29	47	21	36	34	51	45	71	41	41	66	53

NAVY SOUTH	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLES (% COVER)						
PHOTOPLOT #	B1	B2	B3	B4	B5	AVG	Pe1	Pe2	Pe3	Pe4	Pe5	AVG	M5	M1	M2	M3	M4	AVG	M0	M6	M7	M8	M9	M10	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
THATCHED BARNACLE	5	5	8	9	7	7	0	1	0	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0	0
ROCKWEED	0	0	0	0	0	0	54	36	30	33	49	40	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	1	0	0	0	0	0	0	0	0	0	0	10	60	23	4	19	23	5	31	18	9	27	8	16
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	10	6	14	0	8	8	22	20	27	21	30	21	24
OTHER PLANTS	70	32	36	79	81	60	44	61	58	54	37	51	48	21	26	57	22	35	31	20	14	12	29	28	22
OTHER ANIMALS	11	9	13	2	4	8	0	0	0	0	0	0	4	10	2	0	1	3	1	0	6	2	0	1	2
BARE SUBSTRATE	14	53	43	10	8	26	2	2	12	13	14	9	28	2	35	38	50	31	41	29	33	56	14	41	36

Table 11. Photoplot Cover at Cabrillo I, II, and III in Spring 1998.

CABR AREA I	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	286	299	294	292	293	AVG	291	290	295	288	287	AVG	298	297	296	289	285	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	1	6	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1
THATCHED BARNACLE	9	3	0	4	3	4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
ROCKWEED	0	0	0	0	0	0	31	54	55	37	34	42	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	21	0	0	4	0	0	0	0	0	0	37	43	79	0	9	34	0	1	0	0	0	0	0
GOOSE BARNACLE	0	0	0	1	0	0	0	0	0	0	0	0	24	26	15	0	2	13	1	28	15	9	8	14	13
OTHER PLANTS	20	9	67	33	3	26	68	37	44	59	19	45	12	4	2	78	11	21	48	25	19	6	6	25	22
OTHER ANIMALS	1	3	0	3	8	3	0	1	0	0	0	0	3	0	0	2	5	2	3	0	2	2	3	1	2
BARE SUBSTRATE	69	79	12	59	86	61	1	8	1	4	47	12	24	27	4	19	72	29	48	44	63	83	83	60	64

CABR AREA II	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	247	248	256	259	260	AVG	249	251	252	258	265	AVG	245	246	253	254	255	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	0	2	0	10	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
THATCHED BARNACLE	2	1	7	3	23	7	0	0	0	0	0	0	0	0	15	5	0	4	0	0	0	0	0	0	0
ROCKWEED	0	0	27	0	4	6	57	46	40	53	57	51	0	0	0	1	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	15	0	2	3	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	1	1	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	16	0	19	14	11	10
OTHER PLANTS	67	6	15	43	13	29	26	52	41	39	13	34	70	48	33	72	98	64	20	10	10	9	23	9	14
OTHER ANIMALS	2	14	4	24	8	10	2	1	0	0	1	1	2	2	30	3	0	7	0	2	1	2	4	1	2
BARE SUBSTRATE	29	79	30	30	40	42	15	1	19	8	27	14	26	50	21	19	2	24	79	72	89	69	58	79	74

CABR AREA III	BARNACLES (% COVER)						ROCKWEED (% COVER)						MUSSELS (% COVER)						GOOSE BARNACLE (% COVER)						
PHOTOPLOT #	3	16	29	30	20	AVG	9	10	28	27	25	AVG	24	15	14	17	12	AVG	P1	P2	P3	P4	P5	P6	AVG
# POINTS SCORED	100	100	100	100	100		100	100	100	100	100		100	100	100	100	100		100	100	100	100	100	100	
ACORN BARNACLE	0	0	14	4	3	4	0	0	0	0	0	0	10	2	8	15	8	9	3	12	7	0	22	50	16
THATCHED BARNACLE	1	2	9	29	11	10	0	0	0	0	0	0	13	14	15	4	5	10	0	0	0	0	0	0	0
ROCKWEED	0	0	6	0	0	1	34	87	38	40	44	49	0	0	0	0	0	0	0	0	0	0	0	0	0
CALIFORNIA MUSSEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
GOOSE BARNACLE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	5	4	4	1	2	4
OTHER PLANTS	31	23	2	10	4	14	33	8	60	50	54	41	5	2	6	0	3	3	1	5	1	31	5	0	7
OTHER ANIMALS	4	6	2	15	2	6	2	5	0	0	0	1	10	9	12	0	5	7	1	0	4	0	0	0	1
BARE SUBSTRATE	64	69	67	42	80	64	31	0	2	10	2	9	62	73	59	81	79	71	86	78	84	63	72	48	72

Table 12. Photoplot Summary Data for Navy North and Navy South.

Mean % cover data for 8 taxa in 4 intertidal zones. N = 5, except N = 6 for goose barnacles.

	NAVY NORTH BARNACLE								NAVY NORTH ROCKWEED								NAVY NORTH MUSSEL								NAVY NORTH GOOSE BARNACLE							
DATE	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS
SPRING 95	9	28	1	1	0	19	0	41	0	0	85	0	0	10	0	4	0	0	0	21	17	19	2	40	1	0	0	1	18	23	1	57
FALL 95	2	22	2	0	0	51	0	23	0	0	81	0	0	17	0	2	1	0	0	17	16	32	1	34	2	0	0	0	18	22	1	58
SPRING 96																																
FALL 96	9	29	2	0	0	8	0	52	0	0	73	0	0	24	0	3	0	0	0	21	11	22	3	44	1	0	0	1	17	12	1	69
SPRING 97	12	32	1	0	0	4	0	50	1	0	73	0	0	25	0	1	0	0	0	29	13	15	0	42	2	0	0	2	16	9	1	71
FALL 97	4	21	1	0	0	62	0	11	0	0	50	0	0	48	0	1	0	0	0	33	14	24	2	27	1	0	0	4	15	37	1	42
SPRING 98	5	30	1	0	0	17	1	46	0	0	35	0	0	57	0	7	0	0	0	33	10	17	6	34	0	0	0	4	13	30	1	53

	NAVY SOUTH BARNACLE								NAVY SOUTH ROCKWEED								NAVY SOUTH MUSSEL								NAVY SOUTH GOOSE BARNACLE							
DATE	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS
SPRING 95	7	15	0	0	0	34	2	42	0	0	47	0	0	40	0	13	1	1	0	23	11	28	1	35	4	0	0	8	25	6	0	58
FALL 95	1	12	0	0	0	48	0	40									0	1	0	23	12	33	1	30	1	0	0	8	26	18	0	47
SPRING 96																																
FALL 96	2	8	0	0	0	48	1	40	0	0	51	0	0	38	0	11	0	0	0	28	15	25	3	28	0	1	0	12	26	11	0	49
SPRING 97	3	11	0	0	0	25	0	60	1	0	52	0	0	38	0	9	1	0	0	25	5	15	2	52	1	1	0	12	25	6	0	55
FALL 97	1	7	0	0	0	69	3	20	0	0	38	0	0	52	1	9	0	0	0	21	10	50	3	17	1	0	0	15	27	32	1	24
SPRING 98	0	7	0	0	0	60	8	26	0	0	40	0	0	51	0	9	0	0	0	23	8	35	3	31	0	0	0	16	24	22	2	36

AB=ACORN BARNACLE TB=THATCHED BARNACLE RW=ROCKWEED GB=GOOSE BARNACLE
CM=CALIFORNIA MUSSEL OP=OTHER PLANTS OA=OTHER ANIMALS BS=BARE SUBSTRATE

Table 13. Photoplot Summary Data for Cabrillo I, II, and III.

Mean % cover data for 8 taxa in 4 intertidal zones. N = 5, except N = 6 for goose barnacles.

AREA I	BARNACLE								ROCKWEED								MUSSEL								GOOSE BARNACLE							
DATE	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS
SPRING 90	2	20	0	0	4	15	15	43	0	0	59	0	0	19	2	19	0	2	0	16	13	29	4	37								
FALL 90	13	17	0	1	4	23	5	38	0	0	62	0	0	23	0	15	0	1	0	9	11	38	5	36								
SPRING 91	10	20	0	0	4	12	9	46	0	0	57	0	0	23	1	19	1	2	0	6	11	37	4	40								
FALL 91	12	13	0	1	3	24	7	39	0	0	77	0	0	15	0	8	0	1	0	9	11	39	4	36								
SPRING 92	16	10	0	1	3	38	6	25	2	0	60	0	0	25	0	12	0	0	0	7	10	44	4	35								
JUNE 92	18	11	0	0	4	23	11	32	0	0	66	0	0	21	0	13	0	0	0	10	13	28	7	42								
FALL 92	1	13	0	2	2	35	4	43	0	0	47	0	0	39	0	14	0	0	0	8	12	37	6	37								
SPRING 93	4	12	0	3	2	23	5	53	2	0	52	0	0	33	0	13	1	0	0	9	8	28	11	43								
FALL 93	4	5	3	3	1	42	2	38	1	0	59	0	0	30	0	10	1	0	0	13	13	40	7	27								
SPRING 94	1	10	0	4	0	28	8	50	0	0	50	0	0	41	0	8	0	0	0	16	14	29	6	35								
FALL94	9	5	0	2	0	51	1	32	1	0	51	0	0	33	0	15	2	0	0	12	15	37	1	33								
SPRING 95	8	6	0	2	0	45	2	37	1	1	43	0	0	42	0	12	1	0	0	11	13	54	1	20	3	0	0	0	5	7	1	84
FALL 95	4	3	0	2	0	43	1	46	0	0	61	0	0	28	0	10	1	0	0	14	13	47	1	24	1	0	0	0	7	4	1	87
SPRING 96																																
FALL 96	10	2	0	2	0	35	2	48	0	0	65	0	0	29	0	6	0	0	0	22	16	32	0	29	1	0	0	0	7	8	0	83
SPRING 97	16	2	0	4	0	31	2	44	0	0	66	0	0	25	0	8	0	0	0	28	14	26	1	30	1	0	0	0	14	8	1	77
FALL 97	1	2	0	4	0	61	2	30	1	0	50	0	0	40	0	10	0	0	0	31	15	30	1	23	1	0	0	1	12	22	2	63
SPRING 98	1	4	0	4	0	26	3	61	0	0	42	0	0	45	0	12	0	0	0	34	13	21	2	29	1	0	0	0	13	22	2	64

AREA II	BARNACLE								ROCKWEED								MUSSEL								GOOSE BARNACLE							
DATE	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS
SPRING 90	13	30	1	2	0	6	5	43	0	0	71	0	0	14	2	13	2	2	0	55	0	14	4	23								
FALL 90	24	24	2	1	0	24	4	21	2	0	72	0	0	18	0	9	0	1	0	30	0	44	3	22								
SPRING 91	28	26	1	1	0	5	2	37	2	0	68	0	0	19	0	11	2	1	0	21	0	39	4	34								
FALL 91	23	21	1	1	0	27	11	16	1	0	75	0	0	19	0	6	1	1	0	18	0	52	3	24								
SPRING 92	14	14	1	1	0	32	17	21	0	0	77	0	0	14	0	9	0	0	0	10	0	70	3	16								
JUNE 92	18	13	2	3	0	13	21	31	0	0	71	0	0	20	0	9	0	0	0	8	0	71	1	20								
FALL 92	12	10	1	3	0	20	5	50	0	0	54	0	0	35	0	11	0	0	0	8	0	65	0	27								
SPRING 93	10	12	0	3	0	28	15	33	0	0	58	0	0	29	0	13	3	0	0	8	0	64	0	25								
FALL 93	7	8	1	1	0	47	6	29	0	0	74	0	0	19	0	7	1	0	0	4	0	70	1	24								
SPRING 94	6	8	1	2	0	41	13	29	0	0	58	0	0	30	0	12	4	0	0	1	1	60	4	29								
FALL94	18	7	5	2	0	31	2	34	1	0	60	0	0	30	0	10	5	0	0	1	0	74	1	20								
SPRING 95	13	7	5	2	0	44	9	20	1	0	69	0	0	17	0	13	12	0	0	1	0	67	1	18	1	0	0	0	8	6	1	84
FALL 95	10	6	5	2	0	17	1	59	0	0	77	0	0	19	0	4	0	4	0	1	0	75	1	20	0	0	0	0	11	4	2	83
SPRING 96																																
FALL 96	18	8	7	2	0	23	1	40	0	0	84	0	0	14	0	2	2	8	0	1	0	67	2	20	1	0	0	0	11	8	2	78
SPRING 97	25	7	4	4	0	36	3	22	2	0	68	0	0	16	0	13	2	7	0	1	0	66	1	24	0	0	0	1	11	4	1	83
FALL 97	14	4	4	4	0	57	0	16	1	0	69	0	0	18	1	12	1	4	0	0	0	82	0	12	1	0	0	1	13	23	3	60
SPRING 98	2	7	6	3	0	29	10	42	0	0	51	0	0	34	1	14	0	4	0	1	0	64	7	24	0	0	0	0	10	14	2	74

AREA III	BARNACLE								ROCKWEED								MUSSEL								GOOSE BARNACLE							
DATE	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS	AB	TB	RW	CM	GB	OP	OA	BS
SPRING 90	13	22	1	0	0	9	10	45	2	0	84	0	0	3	6	5	5	5	0	47	0	0	4	38								
FALL 90	27	23	2	0	0	13	3	32	3	1	74	0	0	5	11	6	8	4	0	34	0	10	4	40								
SPRING 91	24	24	1	0	0	6	4	41	6	1	65	0	0	16	4	8	6	3	0	28	0	7	7	49								
FALL 91	42	24	3	0	0	5	8	18	1	1	76	0	0	8	8	5	17	4	0	25	0	8	5	41								
SPRING 92	36	16	1	0	0	25	1	22	2	0	71	0	0	21	0	6	24	1	0	23	0	12	3	37								
JUNE 92	35	14	3	0	0	11	13	24	1	0	86	0	0	9	0	4	0	1	0	23	0	21	8	47								
FALL 92	3	16	4	0	0	25	3	48	1	0	63	0	0	25	2	8	3	3	0	15	0	10	6	63								
SPRING 93	10	20	2	0	0	14	8	45	2	0	65	0	0	25	0	8	4	2	0	14	0	7	7	66								
FALL 93	20	15	4	0	0	21	1	39	1	0	60	0	0	27	0	12	7	4	1	10	0	16	4	58								
SPRING 94	17	19	4	0	0	5	2	53	1	0	70	0	0	22	0	6	10	2	0	5	0	18	5	60								
FALL94	32	13	3	0	0	13	3	36	1	0	74	0	0	21	0	5	48	4	0	4	0	15	1	28								
SPRING 95	37	12	4	0	0	13	7	27	2	0	77	0	0	13	0	8	68	4	1	2	0	3	2	21	19	0	0	0	3	4	1	73
FALL 95	10	9	6	0	0	25	0	51	1	0	82	0	0	12	0	5	23	7	1	1	0	8	1	60	24	0	0	0	4	2	1	69
SPRING 96																																
FALL 96	22	15	3	0	0	14	2	43	2	0	83	0	0	11	0	4	48	7	0	1	0	9	2	34	18	0	0	0	6	3	1	73
SPRING 97	35	9	3	0	0	9	1	43	3	0	77	0	0	14	0	5	44	9	0	1	0	14	2	30	20	0	0	0	5	2	1	72
FALL 97	6	8	2	0	0	47	0	35	1	0	56	0	0	33	2	8	5	9	0	1	0	38	2	45	27	0	0	1	4	9	2	57
SPRING 98	4	10	1	0	0	14	6	64	0	0	49	0	0	41	1	9	9	10	0	0	0	3	7	71	16	0	0	0	4	7	1	72

AB=ACORN BARNACLE TB=THATCHED BARNACLE RW=ROCKWEED GB=GOOSE BARNACLE
CM=CALIFORNIA MUSSEL OP=OTHER PLANTS OA=OTHER ANIMALS BS=BARE SUBSTRATE

Table 14. Photoplot Primary Taxa Data for Navy North and Navy South.
Percent cover data for 5 index taxa (acorn barnacles, thatched barnacles, rockweed, mussels, goose barnacles).

NORTH	ACORN					THATCHED					ROCKWEED					MUSSEL											GOOSE BARNACLE										
DATE	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5	Pe1	Pe2	Pe3	Pe4	Pe5	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
S95	8	1	4	20	12	31	24	29	18	38	86	97	82	77	85	8	14	21	44	19	0	1	0	5	0	1	16	21	23	1	26	25	16	15	11	25	13
F95	3	0	0	7	2	24	20	25	14	28	96	90	94	72	51		11	16	27	14	0	0	0	1	0	0		18	19	1	25	26	14	13	14	28	14
S96																																					
F96	10	8	7	10	10	28	31	33	22	31	73	86	88	84	32	13	10	24	40	16	0	2	0	3	0	1	10	13	17	0	14	22	17	7	12	25	17
S97	26	6	4	16	10	27	31	39	30	35	65	94	97	71	39	23	26	29	53	15	3	1	0	6	0	0	12	13	15	0	26	21	21	8	8	33	6
F97	6	2	3	5	5	20	25	26	12	21	34	84	80	48	5	22	32	34	61	18	8	5	0	2	5	1	15	17	14	0	25	25	20	7	8	23	8
S98	10	2	1	7	3	27	31	34	30	30	20	57	57	36	4	27	32	26	66	14	7	8	0	5	2	0	11	8	10	1	18	15	15	4	10	26	8

SOUTH	ACORN					THATCHED					ROCKWEED					MUSSEL											GOOSE BARNACLE										
DATE	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5	Pe1	Pe2	Pe3	Pe4	Pe5	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
S95	15	9	3	6	3	14	12	14	22	13	59	51	51	30	45	2	37	21	30	14	14	14	14	1	11	3	19	8	14	16	10	8	26	28	28	31	18
F95	1	2	0	0		12	10	9	16							1	30	22	31	18	13	13	15	0	13	3	17	4	16	20	10	12	27	28	25	40	19
S96																																					
F96	1	1	2	4	3	7	9	6	10	9	68	37	61	38	51	4	41	17	45	18	18	20	18	3	19	7	21	10	22	17	16	11	27	29	27	34	19
S97	4	4	1	7	1	11	14	8	14	9	71	48	51	37	54	9	53	23	7	22	19	17	16	6	21	5	14	6	12	1	3	3	25	27	28	32	25
F97	1	2	0	0	0	10	9	7	6	5	54	32	45	30	28	7	45	17	7	17	17	22	22	5	25	9	19	5	25	0	13	6	26	32	28	33	21
S98	0	0	0	0	0	5	5	8	9	7	54	36	30	33	49	5	60	23	4	19	10	31	18	9	27	8	22	6	14	0	8	10	20	27	21	30	21

Table 15. Photoplot Primary Taxa Data for Cabrillo I, II, and III.

Percent cover data for 5 index taxa (acorn barnacles, thatched barnacles, rockweed, mussels, goose barnacles).

AREA I	ACORN					THATCHED					ROCKWEED					MUSSEL					GOOSE BARNACLE (M)					GOOSE BARNACLE (GB)					
DATE	286	299	294	292	293	286	299	294	292	293	291	290	295	288	287	298	297	296	289	285	298	297	296	289	285	P1	P2	P3	P4	P5	P6
S90	5	4	0	2	0	11	21	37	26	7	72	48	88	60	27	16	23	17	13	10	19	16	28	0	17						
F90	39	24	0	0	0	18	21	25	17	5	69	70	82	45	44	7	14	17	2	6	9	18	36	0	14						
S91	33	13	0	4	0	23	18	23	26	10	79	56	80	42	29	6	5	11	2	7	14	18	26	0	13						
F91	29	29	0	0	0	16	10	16	17	7	73	84	93	58	78	7	13	15	0	9	15	17	25	0	13						
S92	25	50	1	2	3	18	5	3	11	4	62	63	76	60	41	5	8	18	0	2	13	20	27	0	10						
J92	31	48	6	5	1	19	3	19	8	6	78	72	80	63	37	9	10	21	3	5	21	32	27	0	16						
F92	5	0	2	0	0	32	5	13	8	8	27		65	52	44	6	10	18	1	7	24	28	22	0	13						
S93	1	14	0		0	29	2	15		2	37	70	70	50	34	7	9	28	0	2	23	27	24	0	18						
F93	10	9	0	0	0	21	2	13	1	3	40	71	72	68	46	9	12	34	1	7	26	30	24	0	15						
S94	3	1	0	0	0	32	3	11	0	6	30	74	52	46	48	10	11	33		8	21	20	24		11						
F94	5	20	0	4	5	14	2	0	5	4	28	79	59		38	4	13	38	0	6	29	18	21	0	7						
S95	4	30	0	4	0	17	3	6	0	5	25	52	41	56	42	4	12	34	0	3	19	17	23	0	6	1	3	8	3	4	12
F95	6	14	0	0	0	11	2	1	1	2	35	69	71	74	56	8	15	39	0	6	21	19	22	0	1	1	5	10	11	7	
S96																															
F96	19	33	0	0	0	6	2	0	3	1	38	80	80	60	66	17	29	57	0	6	30	26	25	0	1	0		16	4	1	14
S97	30	52	0	0	0	4	4	2	0	2	40	85	74	76	57	24	36	70	0	11	25	24	20	0	0	0	37	14	7	5	18
F97	0	4	1	0	0	4	4	0	2	2	24	58	70	44	54	26	37	75	0	19	28	26	19	0	1	0	29	13	8	8	11
S98	1	6	0	0	0	9	3	0	4	3	31	54	55	37	34	37	43	79	0	9	24	26	15	0	2	1	28	15	9	8	14

AREA II	ACORN					THATCHED					ROCKWEED					MUSSEL					GOOSE BARNACLE					GOOSE BARNACLE					
DATE	247	248	256	259	260	247	248	256	259	260	249	251	252	258	265	245	246	253	254	255	245	246	253	254	255	P1	P2	P3	P4	P5	P6
S90	0	25	4	29	6	15	12	43	29	52	72	71	72	69	73	65	74	46	18	74	0	0	0	0	0						
F90	1	44	8	49	17	9	7	39	12	52	73	62	66	77	80	44	53	17	6	31	0	0	0	0	0						
S91	0	43	8	66	23	10	5	41	19	54	66	62	71	75	68	41	43	3	0	18	0	0	0	0	0						
F91	4	45	14	30	21	8	7	41	18	31	90	47	83	82	72	36	36	5	0	15	0	0	0	0	0						
S92	0	14	18	22	17	0	5	34	10	20	76	77	81	82	68	20	27	0	0	5	0	0	0	0	0						
J92	9	20	20	18	22	4	2	24	12	23	75	36	87	72	83	16	23	0	0	2	0	0	0	0	0						
F92	0	34	11	8	0	5	1	17	11	15	44	27	66	57	74	18	18	0	1	3	0	0	0	0	0						
S93	0	15	14	9	10	0	3	19	11	25	44	50	56	65	74	19	14	0	1	4	0	0	0	0	0						
F93	0	21	0	8	8	3	0	12	1	22	58	69	79	83	79	9	10	0	0	1	0	0	0	0	0						
S94	0	18	0	3	7	0	6	10	3	19	59	29	65	65	73	4	0	0	0	0	0	0	0	0	0						
F94	0	23	1	12	56	2	3	6	5	17	70	38		68	63	5	0	0	0	0	0	0	0	0	0						
S95	2	21	6	9	26	1	4	14	4	12	65	59	70	78	72	4	1	0	0	2	0	0	0	0	0	3	10	7	9	8	10
F95	0	18	2	6	24	1	4	2	9	16	79	54	92	77	82	2	0	0	0	1	0	0	0	0	0	4	9	5	16	17	13
S96																															
F96	0	30	5	10	47	3	3	5	5	26	91	50	96	88	94	3	0	0	0	2	0	0	0	0	0	4	14	3	17	18	8
S97	0	41	8	39	36	6	1	7	2	18	70	66	78	59	68	2	0	0	0	3	0	0	0	0	0	1	13	2	23	15	13
F97	0	50	1	5	16	3	0	3	3	12	57	75	77	66	69	1	0	0	0	1	0	0	0	0	0	4	16	6	19	17	13
S98	0	0	2	0	10	2	1	7	3	23	57	46	40	53	57	2	0	1	0	0	0	0	0	0	0	1	16	0	19	14	11

AREA III	ACORN					THATCHED					ROCKWEED					MUSSEL					GOOSE BARNACLE					GOOSE BARNACLE					
DATE	3	16	29	30	20	3	16	29	30	20	9	10	28	27	25	24	15	14	17	12	24	15	14	17	12	P1	P2	P3	P4	P5	P6
S90	11	14	13	29	0	22	15	30	25	0	77	90	84	76	92	39	39	40	55	64	0	0	40	0	64						
F90	11	26	44	42	14	34	18	19	32	14	64	79	69	66	90	28	32	30	44	36	0	0	30	0	36						
S91	13	19	33	47	9	38	23	25	22	9	56	60	74	72	62	20	27	24	33	37	0	0	24	0	37						
F91	25	53	52	48	32	37	19	21	31	32	67	89	47	78	99	22	19	28	37	20	0	0	28	0	20						
S92	17	40	59	27	36	26	17	16	11	36	72	81	46	83	74	16	21	25	28	24	0	0	25	0	24						
J92	25	29	53	34	32	20	12	14	17	32	85	77	92	84	94	21	22	25	26	23	0	0	25	0	23						
F92	10	1	2	0	0	12	14	17	31	0	58	60	53	75	70	8	15	24	12	18	0	0	24	0	18						
S93	14	14	13	11	0	15	17	25	35	0	54	93	62	49	69	9	19	22	11	11	0	0	22	0	11						
F93	19	12	31	26	14	12	10	19	27	14	62	86	20	67	63	7	17	16	8	4	0	0	16	0	4						
S94	13	9	35	19	11	16	15	22	27	11	78	67	45	80	82	0	11	11	0	2	0	0	11	0	2						
F94	26	19	43	37	37	5	11	13	22	37	81	90	31	90	76	0	7	9	0	4	0	0	9	0	4						
S95	11	27	42	47	59	3	1	18	25	59	67	88	83	86	60	0	4	4	0	0	0	0	4	0	0	3	3	6	4	2	2
F95	8	12	12	10	6	0	1	13	20	6	75	92	67	93	84	0	3	4	0	0	0	0	4	0	0	6	5	6		1	1
S96																															
F96	27	19	30	15	19	1	0	22	42	19	70	90	77	92	87	0	3	1	0	1	0	0	1	0	1	15	6	4	6	0	2
S97	35	28	42	31	38	2	1	0	29	38	64	87	67	90	78	0	4	0	0	2	0	0	0	0	0	10	6	6	7	0	1
F97	1	3	16	1	11	1	0	7	27	7	38	80	55	52	56	0	2	0	0	1	0	0	0	0	0	10	5	5	6	0	0
S98	0	0	14	4	3	1	2	9	29	11	34	87	38	40	44	0	0	0	0	0	0	0	0	0	0	9	5	4	4	1	2

Table 16. Density and Size of Owl Limpets at Navy North and Navy South in Fall 1996.

LENGTH (MM)	NAVY NORTH PLOTS (# OF LIMPETS)								NAVY SOUTH PLOTS (# OF LIMPETS)							
	1	2	3	4	5	6	ALL	%	1	2	3	4	5	6	ALL	%
15	2	1	0	1	0	2	6	3	0	0	1	6	3	3	13	4
16	3	2	2	2	0	0	9	5	2	0	3	5	0	3	13	4
17	0	1	0	2	1	2	6	3	0	0	0	2	0	0	2	1
18	1	1	0	1	1	1	5	3	2	0	1	8	4	3	18	5
19	0	0	1	1	1	0	3	2	0	0	2	2	0	0	4	1
20	0	0	0	0	1	1	2	1	1	0	2	2	1	0	6	2
21	1	1	1	2	3	1	9	5	0	0	1	2	0	2	5	1
22	0	0	0	3	1	1	5	3	0	0	2	1	3	2	8	2
23	0	0	0	1	1	0	2	1	1	0	4	3	0	0	8	2
24	0	0	0	0	1	1	2	1	1	0	0	2	1	0	4	1
25	2	0	0	0	0	2	4	2	1	0	0	1	0	1	3	1
26	0	0	0	3	0	2	5	3	1	0	2	2	1	1	7	2
27	2	0	1	1	4	0	8	4	1	1	1	2	1	2	8	2
28	0	0	0	2	0	1	3	2	1	2	2	2	2	4	13	4
29	0	0	1	3	2	2	8	4	1	2	2	2	4	2	13	4
30	2	0	0	0	1	0	3	2	4	1	1	2	0	0	8	2
31	1	0	0	1	3	0	5	3	1	1	1	1	1	3	8	2
32	2	0	0	0	0	0	2	1	2	1	2	0	2	2	9	3
33	2	0	0	1	3	1	7	4	0	1	1	5	2	2	11	3
34	0	2	1	0	2	0	5	3	0	0	1	1	0	0	2	1
35	1	1	1	3	0	0	6	3	4	0	0	3	0	2	9	3
36	3	1	3	1	5	1	14	7	2	0	1	3	1	1	8	2
37	1	0	0	0	0	1	2	1	1	2	1	2	0	5	11	3
38	1	1	2	2	0	1	7	4	0	0	1	2	2	2	7	2
39	0	0	1	0	1	4	6	3	5	0	0	3	2	3	13	4
40	1	0	1	0	1	0	3	2	1	3	2	0	2	1	9	3
41	2	1	0	1	2	0	6	3	0	2	2	1	1	2	8	2
42	0	1	0	0	2	0	3	2	2	2	1	1	2	3	11	3
43	0	0	0	0	1	0	1	1	3	0	1	5	5	2	16	5
44	1	0	2	0	1	2	6	3	3	0	1	1	3	1	9	3
45	2	3	0	1	1	3	10	5	1	1	2	5	1	6	16	5
46	0	0	1	2	0	0	3	2	1	3	0	1	1	3	9	3
47	1	2	0	2	0	3	8	4	1	1	1	1	0	1	5	1
48	0	1	1	1	0	0	3	2	3	0	1	1	0	3	8	2
49	0	0	0	0	0	0	0	0	1	0	2	3	0	1	7	2
50	0	0	0	0	1	1	2	1	2	2	1	1	0	1	7	2
51	0	0	0	0	0	2	2	1	2	0	1	0	0	0	3	1
52	1	0	0	0	0	0	1	1	2	1	0	2	2	3	10	3
53	0	1	1	0	1	0	3	2	0	0	0	1	0	3	4	1
54	0	0	0	0	0	0	0	0	0	1	0	1	1	3	6	2
55	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	1	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0
58	0	0	0	0	0	1	1	1	0	0	0	0	2	2	4	1
59	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	33	20	20	37	41	36	187	100	54	29	47	89	52	79	350	100
MIN SIZE	15	15	16	15	17	15	15		16	27	15	15	15	15	15	
MAX SIZE	57	53	53	48	53	58	58		55	64	51	59	61	59	64	
AVG SIZE	32	35	35	30	32	34	33		37	41	32	31	35	37	35	
ST DEV	11	13	11	10	9	12	11		10	10	11	12	12	12	12	

Table 17. Density and Size of Owl Limpets at Cabrillo I, II, and III in Fall 1996.

LENGTH	AREA I PLOTS (# OF LIMPETS)								AREA II PLOTS (# OF LIMPETS)								AREA III PLOTS (# OF LIMPETS)							
	BOULDER			CLIFF					BOULDER			CLIFF					BOULDER					CLIFF		
(MM)	282	283	284	277	279	280	ALL	%	239	240	241	242	243	266	ALL	%	11	18	19	21	26	13	ALL	%
15	2	0	0	1	5	7	15	6	0	0	0	8	0	0	8	4	0	0	0	0	0	6	6	3
16	1	1	0	2	1	2	7	3	0	0	0	8	0	0	8	4	0	4	0	0	0	1	5	3
17	3	1	0	3	2	0	9	3	1	0	0	6	0	0	7	4	0	0	0	0	0	2	2	1
18	2	0	0	2	1	1	6	2	0	1	0	1	2	0	4	2	0	0	0	0	0	2	2	1
19	2	0	1	1	1	2	7	3	3	0	0	0	0	0	3	2	0	1	0	0	0	1	2	1
20	1	0	4	0	0	0	5	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1
21	2	0	3	1	0	0	6	2	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1
22	0	0	3	2	1	2	8	3	1	0	0	0	0	0	1	1	2	1	0	0	0	0	3	2
23	1	0	0	1	1	1	4	2	0	0	0	2	0	0	2	1	0	0	0	0	0	0	0	0
24	2	0	1	1	0	1	5	2	0	0	0	2	0	0	2	1	0	1	0	0	0	2	3	2
25	1	0	0	2	0	1	4	2	1	1	0	2	1	0	5	3	0	2	0	0	0	0	2	1
26	2	1	1	1	0	0	5	2	0	0	0	2	0	2	4	2	0	0	0	0	0	0	0	0
27	1	0	0	2	2	0	5	2	0	1	0	1	1	1	4	2	0	2	0	0	0	0	2	1
28	0	1	1	1	0	1	4	2	0	0	0	0	0	4	4	2	1	1	0	0	0	0	2	1
29	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3	2	0	1	0	0	0	0	1	1
30	1	1	3	1	2	0	8	3	2	1	0	1	1	0	5	3	0	4	1	0	0	0	5	3
31	1	0	0	1	1	1	4	2	3	1	0	0	0	0	4	2	0	1	0	0	0	0	1	1
32	1	0	1	1	1	0	4	2	0	0	0	0	0	0	0	0	0	2	1	0	0	2	5	3
33	0	0	1	0	1	0	2	1	0	0	0	0	0	1	1	1	0	1	0	0	0	3	4	2
34	0	0	0	2	0	0	2	1	0	1	0	0	0	0	1	1	2	3	0	0	0	0	5	3
35	0	0	3	2	0	0	5	2	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1	1
36	0	0	0	3	2	2	7	3	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1
37	1	0	3	2	1	0	7	3	0	0	0	0	0	0	0	0	1	1	0	0	0	3	5	3
38	0	0	1	2	0	0	3	1	1	1	0	0	0	0	2	1	0	2	0	0	0	2	4	2
39	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	1	2	1
40	0	0	0	3	2	0	5	2	1	1	0	0	1	5	8	4	3	3	0	0	0	0	6	3
41	1	0	1	0	2	0	4	2	0	1	1	0	1	0	3	2	2	2	0	0	0	2	6	3
42	0	0	1	1	1	0	3	1	1	1	0	0	0	0	2	1	2	2	0	0	0	2	6	3
43	3	0	2	0	1	1	7	3	3	0	0	0	1	0	4	2	3	1	0	0	0	0	4	2
44	1	0	1	0	1	0	3	1	1	0	0	0	0	2	3	2	0	4	0	0	1	1	6	3
45	0	3	0	0	2	1	6	2	2	0	0	0	1	1	4	2	1	2	0	0	1	1	5	3
46	0	0	2	2	4	0	8	3	1	1	0	0	1	2	5	3	0	2	2	0	0	1	5	3
47	0	0	1	2	2	0	5	2	1	0	0	0	0	0	1	1	2	3	0	0	0	0	5	3
48	0	0	2	0	2	1	5	2	0	1	0	0	1	1	3	2	2	1	0	0	1	0	4	2
49	2	0	2	0	0	0	4	2	1	2	0	0	1	0	4	2	1	1	0	0	0	1	3	2
50	0	1	2	1	3	0	7	3	5	0	1	0	1	2	9	5	3	4	0	1	0	1	9	5
51	1	1	3	0	0	0	5	2	2	0	1	0	0	2	5	3	3	1	1	1	0	1	7	4
52	1	0	3	2	0	1	7	3	0	1	0	0	0	2	3	2	4	2	1	1	1	1	10	5
53	1	3	1	0	0	1	6	2	1	3	0	0	1	0	5	3	0	1	1	0	1	0	3	2
54	1	1	0	0	0	1	3	1	1	0	0	0	0	2	3	2	3	2	1	2	0	0	8	4
55	3	1	0	0	0	1	5	2	2	1	0	0	0	2	5	3	1	0	0	0	1	1	3	2
56	2	0	1	0	1	1	5	2	1	0	0	0	0	5	6	3	1	1	3	2	0	3	10	5
57	0	1	1	0	1	2	5	2	0	0	0	2	0	2	4	2	0	0	0	2	0	1	3	2
58	0	3	0	0	1	2	6	2	0	0	0	0	0	0	0	0	0	1	0	0	1	0	2	1
59	1	0	0	0	0	2	3	1	0	1	0	0	0	0	1	1	0	0	1	0	0	0	1	1
60	2	1	0	0	0	0	3	1	1	1	0	0	0	2	4	2	0	0	1	0	0	0	1	1
61	2	1	0	0	0	1	4	2	0	0	0	0	0	3	3	2	0	0	1	0	1	0	2	1
62	1	2	0	1	0	2	6	2	0	3	0	0	3	0	6	3	1	0	2	0	0	0	3	2
63	2	0	0	0	0	0	2	1	1	2	0	0	1	0	4	2	0	0	0	1	0	0	1	1
64	2	0	0	0	0	2	4	2	0	0	2	0	0	1	3	2	0	0	0	1	0	1	2	1
65	1	0	0	0	0	0	1	0	0	0	1	1	1	1	4	2	0	0	0	0	0	0	0	0
66	2	0	0	0	0	2	4	2	0	0	2	0	0	1	3	2	0	0	2	1	0	0	3	2
67	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	1	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	2	0	1	1	4	2	0	0	0	0	0	0	0	0
69	1	0	0	0	0	0	1	0	0	2	4	1	0	1	8	4	0	0	0	0	0	0	0	0
70	0	0	0	0	0	1	1	0	0	0	2	0	0	1	3	2	0	0	0	0	0	0	0	0
71	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	1	0	0	0	0	0	1	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	58	23	49	46	45	43	264	100	38	30	18	37	23	51	197	100	39	62	19	12	9	43	184	100
MIN SIZE	15	16	19	15	15	15	15		17	18	41	15	18	26	15		21	16	20	50	39	15	15	
MAX SIZE	81	62	57	62	58	70	81		63	73	79	69	68	75	79		62	58	66	66	61	64	66	
AVG SIZE	43	48	37	32	36	40	39		41	49	65	23	44	50	44		45	38	52	57	51	35	42	
ST DEV	20	14	12	12	13	20	16		13	14	9	14	15	13	18		10	11	13	5	7	15	13	

Table 18. Density and Size of Owl Limpets at Navy North and Navy South in Spring 1997.

LENGTH	NAVY NORTH PLOTS (# OF LIMPETS)								NAVY SOUTH PLOTS (# OF LIMPETS)							
(MM)	1	2	3	4	5	6	ALL	%	1	2	3	4	5	6	ALL	%
15	1	0	0	1	2	2	6	3	0	0	0	1	0	0	1	0
16	1	0	0	4	1	0	6	3	2	0	0	3	0	0	5	2
17	0	0	0	2	1	2	5	2	2	0	2	2	0	0	6	2
18	0	0	0	1	1	1	3	1	0	0	1	1	1	2	5	2
19	0	0	0	1	2	1	4	2	1	0	1	0	0	0	2	1
20	0	0	1	1	3	0	5	2	3	0	0	2	2	1	8	2
21	2	0	1	0	2	2	7	3	1	0	4	2	0	0	7	2
22	1	0	2	3	2	1	9	4	2	0	2	2	1	1	8	2
23	0	0	0	3	2	2	7	3	0	0	1	1	1	2	5	2
24	4	0	2	1	1	1	9	4	0	1	0	3	2	1	7	2
25	1	1	2	1	0	1	6	3	0	0	3	3	2	1	9	3
26	1	2	0	2	0	0	5	2	2	1	2	2	1	2	10	3
27	2	0	0	4	5	1	12	6	2	0	0	5	1	1	9	3
28	2	1	0	1	5	3	12	6	0	0	4	1	2	1	8	2
29	1	0	0	2	1	1	5	2	1	0	2	1	0	0	4	1
30	2	0	0	2	1	1	6	3	0	1	2	2	0	2	7	2
31	0	0	0	0	3	2	5	2	1	0	0	2	1	0	4	1
32	0	0	0	0	1	2	3	1	3	1	2	1	1	2	10	3
33	0	0	0	0	1	0	1	0	2	0	1	3	1	2	9	3
34	1	1	1	1	0	0	4	2	0	2	0	2	4	1	9	3
35	1	1	1	0	4	1	8	4	0	0	1	3	0	0	4	1
36	1	0	1	3	2	1	8	4	0	2	0	4	1	4	11	3
37	1	1	0	0	1	0	3	1	2	0	3	4	1	2	12	4
38	1	0	0	1	0	2	4	2	4	1	1	2	1	1	10	3
39	0	0	0	1	1	1	3	1	1	0	3	0	3	1	8	2
40	0	0	0	2	4	4	10	5	5	1	2	3	2	3	16	5
41	1	1	0	1	2	0	5	2	3	1	3	3	1	4	15	5
42	0	0	1	0	1	1	3	1	0	0	0	1	1	3	5	2
43	0	0	0	1	1	0	2	1	1	1	0	3	1	4	10	3
44	2	1	1	0	2	0	6	3	1	0	1	0	3	1	6	2
45	3	2	1	1	0	0	7	3	2	0	1	1	4	2	10	3
46	3	1	2	0	1	0	7	3	2	0	0	2	0	3	7	2
47	0	1	0	0	1	1	3	1	0	1	0	3	1	1	6	2
48	0	1	2	0	0	2	5	2	3	2	2	3	0	4	14	4
49	1	0	1	0	0	0	2	1	1	0	2	0	4	0	7	2
50	1	0	1	1	2	1	6	3	2	1	1	0	0	1	5	2
51	0	0	1	1	0	1	3	1	1	2	1	4	0	0	8	2
52	0	0	0	0	0	2	2	1	2	2	0	0	0	0	4	1
53	0	0	0	0	0	0	0	0	3	1	2	1	0	1	8	2
54	1	0	0	0	0	0	1	0	1	0	1	0	2	0	4	1
55	0	0	0	0	0	0	0	0	2	1	0	1	1	2	7	2
56	0	0	0	0	0	0	0	0	0	1	0	1	0	2	4	1
57	2	0	0	0	0	0	2	1	1	1	0	0	0	2	4	1
58	0	0	0	0	0	0	0	0	1	0	0	0	0	2	3	1
59	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	1
60	0	1	0	0	0	0	1	0	0	0	1	0	0	1	2	1
61	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
62	0	0	0	0	0	1	1	0	0	0	0	0	1	1	2	1
63	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
64	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	38	15	21	42	56	41	213	100	61	25	52	79	49	64	330	100
MIN SIZE	15	25	20	15	15	15	15		16	24	17	15	18	18	15	
MAX SIZE	64	60	51	51	50	62	64		59	65	60	59	63	62	65	
AVG SIZE	36	39	36	28	31	33	33		38	44	34	34	38	40	38	
ST DEV	12	10	12	10	10	12	11		12	11	11	11	12	11	12	

Table 19. Density and Size of Owl Limpets at Cabrillo I, II, and III in Spring 1997.

LENGTH	AREA I PLOTS (# OF LIMPETS)								AREA II PLOTS (# OF LIMPETS)								AREA III PLOTS (# OF LIMPETS)							
	BOULDER			CLIFF					BOULDER			CLIFF					BOULDER					CLIFF		
(MM)	282	283	284	277	279	280	ALL	%	239	240	241	242	243	266	ALL	%	11	18	19	21	26	13	ALL	%
15	0	0	0	2	2	0	4	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	1
17	1	0	1	2	1	0	5	2	1	0	0	0	1	0	2	1	0	0	0	2	0	1	3	1
18	1	1	0	1	1	0	4	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
19	0	1	1	2	0	0	4	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0
20	0	1	1	3	1	0	6	2	0	0	0	0	0	0	0	0	2	0	0	0	0	1	3	1
21	1	0	0	2	1	0	4	1	0	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0
22	0	0	1	4	2	0	7	3	0	0	1	0	0	1	2	1	0	1	0	0	0	1	2	1
23	0	0	0	3	0	0	3	1	0	1	0	0	0	0	1	1	1	0	0	1	0	0	2	1
24	1	0	0	3	2	0	6	2	1	0	0	0	0	0	1	1	2	0	0	0	1	1	4	2
25	0	0	1	4	0	2	7	3	2	0	1	0	0	0	3	2	4	2	0	0	1	0	7	3
26	0	0	3	1	2	2	8	3	0	0	0	0	1	0	1	1	1	3	0	0	0	0	4	2
27	1	1	1	2	0	1	6	2	2	1	0	0	0	0	3	2	2	1	0	0	0	0	3	1
28	0	0	1	1	1	0	3	1	0	0	1	0	1	1	3	2	3	0	0	0	0	0	3	1
29	0	0	0	0	1	0	1	0	1	1	0	0	0	2	4	2	1	3	0	0	0	0	4	2
30	0	0	4	0	1	0	5	2	1	0	0	2	1	2	6	3	0	1	0	1	0	1	3	1
31	3	1	2	1	2	0	9	3	3	0	0	0	0	1	4	2	0	1	0	0	0	1	2	1
32	3	2	2	3	0	0	10	4	2	1	0	0	1	2	6	3	0	6	0	0	0	0	6	3
33	1	1	0	3	0	0	5	2	0	0	0	1	1	1	3	2	1	1	0	0	0	0	2	1
34	0	0	0	3	0	0	3	1	0	0	0	0	1	1	2	1	0	1	0	0	0	2	3	1
35	1	0	1	0	2	0	4	1	1	2	0	0	1	2	6	3	1	0	2	0	0	5	8	4
36	0	0	1	1	1	0	3	1	2	2	1	0	0	3	8	4	0	2	0	0	0	1	3	1
37	1	0	2	1	2	2	8	3	1	0	0	1	1	1	4	2	0	1	0	0	0	0	1	0
38	0	1	0	2	0	0	3	1	0	0	0	0	1	1	2	1	1	1	0	0	0	1	3	1
39	1	0	2	1	3	1	8	3	0	1	0	0	1	3	5	3	1	2	0	0	1	0	4	2
40	0	1	2	2	0	0	5	2	1	0	0	0	0	0	1	1	3	0	0	0	0	1	4	2
41	2	0	3	0	2	1	8	3	0	1	0	0	2	1	4	2	0	2	0	1	0	2	5	2
42	0	0	1	1	1	0	3	1	2	0	0	1	0	2	5	3	0	1	0	0	0	4	5	2
43	0	0	3	1	3	0	7	3	0	1	0	0	0	2	3	2	6	2	0	0	0	0	8	4
44	2	0	2	1	4	0	9	3	0	1	0	0	0	2	3	2	3	5	0	0	1	0	9	4
45	0	1	1	0	3	0	5	2	3	1	0	0	0	1	5	3	1	3	0	0	0	1	5	2
46	0	1	0	0	3	0	4	1	1	1	0	0	0	3	5	3	1	4	0	1	1	1	8	4
47	0	0	0	0	0	0	0	0	1	0	0	0	1	2	4	2	0	4	2	0	0	1	7	3
48	2	0	2	2	2	0	8	3	1	0	0	0	0	0	1	1	3	1	0	0	0	1	5	2
49	0	1	1	0	3	0	5	2	1	1	1	0	0	0	3	2	3	4	1	1	0	0	9	4
50	0	0	1	0	3	0	4	1	1	0	0	0	1	2	4	2	1	1	0	1	0	1	4	2
51	1	0	6	0	2	0	9	3	3	2	0	0	1	2	8	4	3	3	0	0	1	1	8	4
52	1	2	2	0	0	1	6	2	2	0	0	0	1	4	7	4	2	1	1	0	0	1	5	2
53	2	1	0	0	0	0	3	1	1	0	0	0	0	1	2	1	2	1	1	0	1	0	5	2
54	3	1	0	0	1	2	7	3	0	1	0	0	2	0	3	2	1	1	1	2	0	0	5	2
55	2	2	0	0	1	2	7	3	2	0	1	0	0	2	5	3	2	1	3	1	2	1	10	5
56	0	2	1	0	0	1	4	1	3	0	1	0	0	3	7	4	1	0	0	1	0	0	2	1
57	2	1	0	0	1	0	4	1	0	1	0	0	3	4	8	4	1	2	0	1	0	0	4	2
58	2	1	0	0	1	1	5	2	1	2	0	0	1	2	6	3	0	0	0	2	1	2	5	2
59	1	1	1	0	1	1	5	2	0	1	0	0	1	1	3	2	1	0	0	0	0	0	1	0
60	0	1	1	0	0	3	5	2	0	0	0	0	0	1	1	1	0	0	2	1	0	0	3	1
61	4	2	1	0	1	1	9	3	0	1	0	0	0	4	5	3	0	0	0	0	0	0	0	0
62	2	1	0	1	0	1	5	2	0	2	0	0	0	0	2	1	0	0	2	0	0	0	2	1
63	1	0	0	0	0	1	2	1	0	0	0	0	1	3	4	2	1	0	2	1	1	0	5	2
64	1	0	0	0	0	2	3	1	0	0	0	0	1	3	4	2	0	0	0	0	0	0	0	0
65	3	0	0	0	0	0	3	1	0	2	3	0	0	0	5	3	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	1	2	0	0	0	3	2	0	0	0	1	0	0	1	0
67	0	0	0	0	0	0	0	0	0	1	3	0	0	1	5	3	0	0	0	0	0	0	0	0
68	2	0	0	0	0	0	2	1	0	0	0	2	1	1	4	2	0	0	1	1	0	0	2	1
69	1	0	0	0	0	1	2	1	0	0	3	0	0	0	3	2	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	1	2	1	0	0	4	2	0	0	0	0	0	0	0	0
72	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	51	28	52	53	57	26	267	100	40	31	23	8	29	68	199	100	57	66	18	19	11	33	204	100
MIN SIZE	17	18	17	15	15	25	15		17	23	22	30	17	22	17		15	15	35	17	24	16	15	
MAX SIZE	84	62	61	62	61	69	84		58	74	77	71	68	68	77		63	57	68	68	63	58	68	
AVG SIZE	50	46	39	29	39	50	41		41	50	59	47	44	48	47		40	39	54	49	47	39	42	
ST DEV	16	14	11	10	12	14	15		11	14	16	18	14	12	14		12	11	9	16	13	11	13	

Table 20. Density and Size of Owl Limpets at Navy North and Navy South in Fall 1997.

LENGTH	NAVY NORTH PLOTS (# OF LIMPETS)								NAVY SOUTH PLOTS (# OF LIMPETS)							
(MM)	1	2	3	4	5	6	ALL	%	1	2	3	4	5	6	ALL	%
15	3	1	1	1	3	0	9	3	1	0	2	1	3	2	9	2
16	3	0	0	2	3	3	11	4	1	1	1	1	0	3	7	2
17	1	0	1	1	1	2	6	2	0	2	2	1	1	1	7	2
18	3	2	0	2	3	1	11	4	0	0	1	0	1	1	3	1
19	2	0	0	1	3	1	7	3	1	1	3	1	2	1	9	2
20	2	1	1	2	2	3	11	4	1	1	0	5	3	2	12	3
21	1	0	2	2	1	0	6	2	0	2	2	2	1	1	8	2
22	0	0	1	3	0	0	4	2	2	2	1	1	0	1	7	2
23	2	2	0	2	4	2	12	5	0	0	2	1	0	1	4	1
24	0	1	1	2	1	0	5	2	0	1	0	0	0	1	2	1
25	0	1	0	5	5	2	13	5	2	0	1	2	0	2	7	2
26	3	0	0	2	1	1	7	3	1	0	1	0	2	1	5	1
27	1	1	1	2	2	1	8	3	3	2	1	3	2	2	13	4
28	2	0	2	2	2	0	8	3	2	0	0	2	1	3	8	2
29	1	0	0	1	2	0	4	2	0	0	2	3	1	4	10	3
30	2	2	0	1	0	3	8	3	1	0	2	3	2	3	11	3
31	1	0	3	2	0	1	7	3	1	1	7	4	0	3	16	4
32	1	1	0	2	0	2	6	2	2	1	0	4	4	1	12	3
33	1	2	1	2	1	1	8	3	0	0	0	2	1	2	5	1
34	0	0	1	0	0	3	4	2	2	0	2	2	1	0	7	2
35	1	0	1	4	6	1	13	5	0	0	3	2	0	3	8	2
36	0	2	0	1	2	1	6	2	0	1	0	3	0	1	5	1
37	1	0	0	1	2	0	4	2	3	1	0	6	3	1	14	4
38	1	0	1	0	2	2	6	2	3	0	4	5	1	3	16	4
39	0	1	1	1	2	1	6	2	3	0	0	0	3	1	7	2
40	4	1	0	1	2	1	9	3	0	2	1	3	5	5	16	4
41	1	0	0	1	2	1	5	2	2	0	0	4	2	4	12	3
42	4	1	1	2	0	0	8	3	0	1	1	0	1	3	6	2
43	0	0	1	0	4	0	5	2	3	0	0	2	2	2	9	2
44	1	0	0	0	0	0	1	0	2	2	0	3	3	2	12	3
45	2	0	1	1	1	0	5	2	1	0	2	1	3	5	12	3
46	3	0	1	0	0	1	5	2	1	0	1	2	0	3	7	2
47	0	1	0	1	1	1	4	2	3	2	2	1	0	1	9	2
48	1	0	0	0	1	0	2	1	3	1	2	0	1	3	10	3
49	1	1	2	0	1	2	7	3	0	1	0	0	0	1	2	1
50	0	1	1	2	0	0	4	2	0	0	1	3	1	3	8	2
51	0	1	1	0	1	3	6	2	0	2	3	2	1	0	8	2
52	1	0	1	0	0	1	3	1	2	1	1	1	2	0	7	2
53	0	0	0	1	1	1	3	1	1	1	0	1	0	0	3	1
54	0	0	0	0	0	0	0	0	2	1	0	0	0	0	3	1
55	0	0	1	0	0	0	1	0	2	1	0	0	1	1	5	1
56	0	0	0	0	0	0	0	0	3	1	0	0	1	2	7	2
57	0	0	0	0	0	0	0	0	0	2	0	0	0	2	4	1
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	1
60	0	0	1	0	0	0	1	0	0	0	0	1	0	2	3	1
61	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1
64	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
65	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	52	23	29	53	62	42	261	100	55	35	51	78	57	85	361	100
MIN SIZE	15	15	15	15	15	16	15		15	16	15	15	15	15	15	
MAX SIZE	65	51	60	53	53	53	65		59	68	52	60	63	64	68	
AVG SIZE	32	32	36	29	30	32	32		39	38	33	35	36	37	36	
ST DEV	13	11	13	10	11	12	11		12	15	11	10	12	12	12	

Table 21. Density and Size of Owl Limpets at Cabrillo I, II, and III in Fall 1997.

LENGTH	AREA I PLOTS (# OF LIMPETS)								AREA II PLOTS (# OF LIMPETS)								AREA III PLOTS (# OF LIMPETS)							
	BOULDER			CLIFF					BOULDER			CLIFF					BOULDER					CLIFF		
(MM)	282	283	284	277	279	280	ALL	%	239	240	241	242	243	266	ALL	%	11	18	19	21	26	13	ALL	%
15	0	0	0	2	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	4	4	2
17	1	0	1	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
18	0	0	0	1	0	0	1	0	0	0	0	0	0	2	2	1	0	0	0	0	0	1	1	1
19	0	0	1	0	0	1	2	1	1	0	0	0	0	3	4	2	0	0	0	0	0	0	0	0
20	0	0	1	0	0	3	4	1	0	0	0	0	0	1	1	0	2	0	0	0	0	0	2	1
21	0	0	3	0	1	2	6	2	0	0	0	1	0	1	2	1	0	1	0	1	0	0	2	1
22	2	1	1	0	0	2	6	2	0	0	0	0	0	2	2	1	0	0	0	0	0	3	3	2
23	1	1	0	0	1	1	4	1	0	1	0	2	0	0	3	1	1	0	0	0	0	1	2	1
24	1	0	2	0	0	1	4	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3	4	2
25	2	0	1	4	0	2	9	3	0	0	0	0	0	2	2	1	2	1	1	1	0	0	5	3
26	1	0	2	0	0	2	5	2	2	1	0	0	0	0	3	1	1	1	0	0	0	3	5	3
27	0	0	1	3	1	1	6	2	1	0	0	1	0	0	2	1	0	1	0	0	0	3	4	2
28	0	0	0	0	1	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	3	5	3
29	0	2	0	2	2	1	7	3	2	0	0	0	0	0	2	1	0	0	0	0	0	1	1	1
30	0	0	1	1	0	1	3	1	0	0	0	0	0	2	2	1	2	1	0	0	0	3	6	3
31	1	1	0	4	3	0	9	3	0	0	0	0	0	1	1	0	2	0	0	0	0	0	2	1
32	1	0	0	0	1	0	2	1	5	0	0	1	0	2	8	4	1	0	0	0	0	0	1	1
33	1	0	1	1	5	0	8	3	4	0	2	0	0	2	8	4	1	0	0	1	0	2	4	2
34	1	1	1	3	2	0	8	3	1	0	0	0	0	1	2	1	0	2	0	0	0	2	4	2
35	2	0	2	0	0	1	5	2	0	0	0	0	0	1	1	0	2	2	0	0	0	0	4	2
36	0	0	3	3	2	0	8	3	0	1	0	1	0	2	4	2	0	2	1	1	0	0	4	2
37	0	0	1	2	3	2	8	3	1	2	0	0	0	1	4	2	0	3	0	0	0	0	3	2
38	0	0	1	0	1	1	3	1	1	0	0	2	1	1	5	2	0	1	0	0	0	1	2	1
39	0	0	1	0	2	0	3	1	1	1	1	0	0	2	5	2	0	3	0	0	1	0	4	2
40	0	0	2	3	0	2	7	3	0	1	1	0	1	1	4	2	1	0	0	0	0	0	1	1
41	1	0	0	0	0	1	2	1	1	1	0	0	0	3	5	2	2	2	0	0	0	0	4	2
42	2	2	0	2	4	0	10	4	0	0	0	1	1	4	6	3	0	5	0	0	1	2	8	4
43	1	0	1	2	2	2	8	3	1	0	0	2	0	5	8	4	1	0	0	0	0	2	3	2
44	1	0	1	1	0	0	3	1	0	1	0	0	1	5	7	3	1	1	0	0	0	3	5	3
45	1	0	1	1	4	1	8	3	2	1	0	0	0	0	3	1	1	0	1	0	1	2	5	3
46	0	0	2	0	4	1	7	3	0	2	0	1	1	1	5	2	3	3	0	0	0	0	6	3
47	1	0	0	2	3	1	7	3	2	0	0	2	0	1	5	2	1	2	0	0	0	3	6	3
48	0	0	2	0	0	1	3	1	1	0	0	2	0	1	4	2	0	1	0	1	0	2	4	2
49	0	2	1	0	2	0	5	2	2	0	0	1	0	2	5	2	0	4	0	1	0	1	6	3
50	1	0	3	0	1	0	5	2	3	0	0	1	2	3	9	4	2	0	0	0	1	1	4	2
51	0	1	2	0	3	0	6	2	1	0	1	0	0	3	5	2	3	1	0	1	0	1	6	3
52	1	2	4	1	0	0	8	3	2	1	0	0	0	4	7	3	4	2	0	0	1	0	7	4
53	0	1	0	0	1	0	2	1	0	0	0	0	0	0	0	0	2	2	2	2	0	1	9	5
54	3	2	3	0	1	1	10	4	2	0	1	1	0	1	5	2	0	0	3	0	0	1	4	2
55	2	1	1	0	2	1	7	3	2	0	1	1	0	0	4	2	0	1	1	0	1	0	3	2
56	3	0	0	0	1	0	4	1	1	2	0	1	0	3	7	3	2	2	1	1	0	1	7	4
57	2	1	0	0	0	1	4	1	0	1	0	1	0	4	6	3	2	0	0	0	1	0	3	2
58	2	3	0	0	0	1	6	2	1	1	1	1	2	0	6	3	2	3	1	1	0	0	7	4
59	0	1	1	0	1	0	3	1	0	1	0	1	0	3	5	2	0	0	1	0	0	0	1	1
60	1	1	2	0	0	3	7	3	0	1	0	0	1	3	5	2	1	0	0	1	0	0	2	1
61	2	1	0	0	1	1	5	2	0	0	0	1	0	1	2	1	0	0	1	1	0	0	2	1
62	3	0	0	0	1	2	6	2	0	1	0	0	0	1	2	1	0	0	1	0	0	0	1	1
63	2	0	1	0	0	1	4	1	0	2	1	2	0	0	5	2	0	0	0	0	0	0	0	0
64	0	0	1	1	0	2	4	1	0	0	0	0	2	1	3	1	0	1	1	0	1	0	3	2
65	3	0	0	0	0	1	4	1	0	1	1	0	0	0	2	1	0	0	1	1	0	0	2	1
66	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	1
67	1	0	0	0	0	0	1	0	0	1	1	2	0	0	4	2	0	0	0	1	0	0	1	1
68	2	0	0	0	0	0	2	1	0	0	3	1	1	0	5	2	0	0	0	0	0	0	0	0
69	1	0	0	0	0	1	2	1	0	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
71	1	0	0	0	0	0	1	0	0	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0
72	0	0	2	0	0	1	3	1	0	0	1	0	1	0	2	1	0	0	0	0	0	0	0	0
73	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
75	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	52	24	56	39	57	46	274	100	40	26	20	32	14	78	210	100	43	51	16	16	8	50	184	100
MIN SIZE	17	22	16	15	17	19	15		19	23	33	21	38	16	16		20	21	25	17	39	16	16	
MAX SIZE	75	61	73	64	62	72	75		58	74	79	69	72	70	79		60	66	65	67	64	56	67	
AVG SIZE	49	47	42	35	41	42	43		41	51	60	48	54	43	47		43	43	53	47	51	34	42	
ST DEV	16	12	15	10	10	17	14		10	13	14	14	11	13	14		12	10	10	16	8	12	13	

Table 22. Density and Size of Owl Limpets at Navy North and Navy South in Spring 1998.

LENGTH	NAVY NORTH PLOTS (# OF LIMPETS)								NAVY SOUTH PLOTS (# OF LIMPETS)							
(MM)	1	2	3	4	5	6	ALL	%	1	2	3	4	5	6	ALL	%
15	0	0	1	1	0	2	4	2	0	0	3	1	1	0	5	1
16	0	0	0	0	0	2	2	1	0	0	1	1	1	0	3	1
17	2	1	1	1	0	1	6	2	3	0	3	0	0	2	8	2
18	2	0	1	1	0	3	7	3	0	0	0	1	1	0	2	1
19	0	1	2	1	1	2	7	3	0	0	1	1	1	0	3	1
20	2	0	2	1	3	0	8	3	0	1	3	0	0	0	4	1
21	4	0	0	0	3	4	11	4	0	1	0	0	1	4	6	2
22	0	1	2	1	0	2	6	2	1	0	3	2	0	1	7	2
23	0	0	0	2	2	0	4	2	2	2	1	2	0	1	8	2
24	0	0	0	0	3	1	4	2	0	1	0	2	0	4	7	2
25	3	0	0	3	4	3	13	5	3	0	1	4	1	2	11	3
26	3	1	2	3	5	2	16	6	3	2	1	0	2	2	10	3
27	5	1	1	7	2	1	17	7	1	3	1	3	2	1	11	3
28	1	2	1	2	6	2	14	5	2	1	1	2	0	4	10	3
29	0	2	0	3	0	3	8	3	0	1	3	2	4	2	12	3
30	1	2	0	0	1	2	6	2	1	0	2	2	4	3	12	3
31	1	0	1	2	3	1	8	3	2	1	3	1	1	0	8	2
32	1	0	0	5	2	2	10	4	2	0	2	2	4	3	13	4
33	0	1	1	2	2	2	8	3	0	1	0	1	1	0	3	1
34	0	0	1	5	3	1	10	4	1	1	1	0	0	2	5	1
35	0	0	1	2	0	3	6	2	0	0	1	3	0	2	6	2
36	2	0	0	0	1	6	9	3	1	0	1	2	3	4	11	3
37	0	2	1	0	1	2	6	2	1	1	4	3	2	5	16	4
38	3	2	1	4	1	1	12	5	3	1	1	4	1	2	12	3
39	1	0	1	1	1	1	5	2	1	0	1	2	2	1	7	2
40	1	2	1	0	1	0	5	2	4	0	3	6	2	3	18	5
41	0	0	0	0	3	0	3	1	3	1	1	3	1	3	12	3
42	1	0	1	1	5	1	9	3	0	0	1	2	1	3	7	2
43	1	0	1	0	2	0	4	2	2	2	1	4	4	2	15	4
44	1	3	1	0	2	0	7	3	3	0	0	3	1	2	9	2
45	0	0	0	1	0	0	1	0	0	2	0	1	2	4	9	2
46	1	0	0	0	0	0	1	0	0	1	0	1	2	1	5	1
47	0	0	1	0	0	0	1	0	2	2	1	2	2	2	11	3
48	0	0	0	2	0	2	4	2	2	2	2	1	1	2	10	3
49	0	0	2	0	1	0	3	1	0	0	3	4	0	4	11	3
50	1	1	0	2	0	0	4	2	2	3	1	3	0	1	10	3
51	0	1	1	0	1	1	4	2	2	0	1	2	0	1	6	2
52	0	0	0	0	0	1	1	0	0	2	1	1	0	2	6	2
53	0	0	1	0	0	0	1	0	3	0	0	0	1	1	5	1
54	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3	1
55	0	0	1	0	0	0	1	0	1	2	0	0	1	1	5	1
56	0	1	0	0	0	0	1	0	1	2	0	0	1	2	6	2
57	0	0	0	0	0	0	0	0	3	0	0	1	1	1	6	2
58	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2	1
59	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
60	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
62	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	1
63	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	1	1	0	0	1	0	0	0	0	1	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	38	24	30	53	59	55	259	100	58	38	53	76	56	83	364	100
MIN SIZE	17	17	15	15	19	15	15		17	20	15	15	15	17	15	
MAX SIZE	60	56	55	50	51	69	69		62	69	52	62	65	65	69	
AVG SIZE	30	35	33	31	32	30	31		39	40	32	37	38	38	37	
ST DEV	10	10	12	8	8	11	10		12	13	11	10	12	11	11	

Table 23. Density and Size of Owl Limpets at Cabrillo I, II, and III in Spring 1998.

	AREA I PLOTS (# OF LIMPETS)								AREA II PLOTS (# OF LIMPETS)								AREA III PLOTS (# OF LIMPETS)							
LENGTH	BOULDER			CLIFF					BOULDER			CLIFF					BOULDER					CLIFF		
(MM)	282	283	284	277	279	280	ALL	%	239	240	241	242	243	266	ALL	%	11	18	19	21	26	13	ALL	%
15	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
16	0	0	0	0	1	0	1	0	0	0	1	0	0	0	1	1	1	0	0	0	1	2	4	2
17	2	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	2	2	0	0	0	1	5	3
18	1	0	0	1	2	0	4	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	1
19	0	1	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	2	1
20	0	1	0	3	0	1	5	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
21	0	0	1	2	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	2	1	0	3	1	0	0	0	0	0	0	0	0	1	2	0	0	0	1	4	2
23	1	0	0	0	2	0	3	1	1	0	1	0	0	0	2	1	0	1	0	2	0	1	4	2
24	0	1	1	0	0	0	2	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	2	1
25	0	1	0	1	0	0	2	1	0	0	0	0	0	0	0	0	1	1	0	0	0	2	4	2
26	0	0	0	2	2	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	3	0	1	2	0	0	6	2	1	1	0	0	0	0	2	1	2	0	0	0	0	1	3	2
28	3	0	1	3	0	0	7	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
29	1	0	1	3	0	3	8	3	0	0	0	1	0	0	1	1	1	1	0	0	0	1	3	2
30	1	0	1	3	2	0	7	3	0	0	0	1	2	0	3	2	1	0	0	0	0	2	3	2
31	2	0	3	2	2	0	9	3	0	0	1	0	0	1	2	1	0	1	0	1	0	3	5	3
32	1	1	3	3	1	2	11	4	0	0	0	0	1	1	2	1	0	1	0	0	0	3	4	2
33	0	0	1	2	1	1	5	2	0	0	0	0	0	1	1	1	2	1	0	0	0	4	7	4
34	1	1	1	1	1	3	8	3	3	1	0	0	0	0	4	3	1	2	0	0	0	1	4	2
35	0	1	1	0	5	1	8	3	1	0	0	0	0	3	4	3	0	0	0	0	0	1	1	1
36	0	0	2	1	2	0	5	2	1	0	0	0	1	0	2	1	0	0	1	0	0	1	2	1
37	0	0	0	1	2	0	3	1	0	0	0	0	0	1	1	1	3	1	1	0	0	3	8	4
38	1	0	0	4	1	0	6	2	1	1	0	0	0	1	3	2	1	1	0	0	0	4	6	3
39	2	1	1	2	1	0	7	3	1	1	0	0	0	1	3	2	2	1	1	0	0	2	6	3
40	4	0	0	1	4	1	10	4	3	0	0	0	1	1	5	4	2	1	0	0	0	2	5	3
41	0	0	0	2	2	0	4	1	1	0	1	0	0	1	3	2	0	2	0	1	0	3	6	3
42	2	1	1	1	0	0	5	2	0	0	0	0	1	2	3	2	1	3	0	1	0	2	7	4
43	0	0	0	0	1	2	3	1	1	2	0	0	0	2	5	4	0	0	1	0	0	1	2	1
44	0	0	4	1	1	0	6	2	2	0	0	0	1	1	4	3	2	2	0	1	0	2	7	4
45	1	2	0	1	4	0	8	3	1	0	1	2	0	0	4	3	1	2	1	0	1	1	6	3
46	2	1	0	0	4	0	7	3	1	1	1	0	0	1	4	3	1	4	0	2	0	0	7	4
47	0	0	1	1	2	1	5	2	0	2	0	0	0	0	2	1	2	2	0	0	1	2	7	4
48	1	0	2	2	1	2	8	3	3	1	0	0	0	2	6	4	1	1	0	0	0	1	3	2
49	0	0	0	0	2	0	2	1	2	1	0	0	0	1	4	3	1	1	0	0	1	0	3	2
50	4	1	3	1	5	0	14	5	3	0	0	1	0	1	5	4	2	2	0	0	0	1	5	3
51	0	1	2	0	0	1	4	1	1	1	0	0	0	3	5	4	5	6	0	1	0	0	12	6
52	2	2	2	0	2	1	9	3	2	2	1	0	1	0	6	4	1	1	0	1	0	3	6	3
53	0	2	1	0	0	0	3	1	1	2	0	0	0	3	6	4	1	1	0	0	1	2	5	3
54	0	1	0	0	0	0	1	0	2	0	0	0	1	0	3	2	0	1	2	0	1	0	4	2
55	1	0	0	0	1	0	2	1	0	1	0	0	1	2	4	3	1	1	0	1	0	2	5	3
56	5	3	1	0	3	0	12	4	1	0	0	0	1	2	4	3	3	2	1	0	0	2	8	4
57	4	1	1	0	0	0	6	2	0	1	0	0	1	0	2	1	1	0	2	1	0	0	4	2
58	0	2	2	0	0	0	4	1	0	0	0	1	0	3	4	3	0	0	1	1	0	0	2	1
59	2	0	0	0	0	3	5	2	0	0	2	1	1	0	4	3	0	0	1	0	0	0	1	1
60	1	0	0	1	0	0	2	1	1	0	1	0	1	1	4	3	0	0	1	0	0	1	2	1
61	3	1	0	0	0	1	5	2	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	1
62	4	1	1	0	0	0	6	2	0	1	0	0	0	0	1	1	0	0	0	0	1	0	1	1
63	2	1	0	0	0	0	3	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1
64	1	0	1	0	0	1	3	1	0	1	1	1	0	0	3	2	0	0	0	0	0	0	0	0
65	0	0	0	0	0	2	2	1	1	1	1	0	1	0	4	3	0	0	1	1	0	0	2	1
66	0	0	0	0	0	0	0	0	0	2	1	1	0	0	4	3	0	0	0	1	0	0	1	1
67	1	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	1	0	0	0	0	0	1	0	0	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	2	0	1	0	3	2	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1
71	1	0	0	0	0	1	2	1	0	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0
72	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
78	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL #	63	28	41	50	58	28	268	100	35	24	20	9	19	35	142	100	46	49	15	16	7	64	197	100
MIN SIZE	17	19	21	15	16	20	15		23	27	16	29	19	31	16		16	17	36	23	16	15	15	
MAX SIZE	81	63	72	60	56	71	81		65	77	73	66	70	60	77		57	56	65	66	62	70	70	
AVG SIZE	48	46	43	33	40	46	14		45	51	56	50	49	46	49		40	41	52	48	47	38	13	
ST DEV	15	13	12	9	10	14	42		9	12	17	14	15	9	12		12	11	9	13	15	12	41	

Table 24. Owl Limpet Summary Data for Navy North and Navy South.
Number of limpets and shell length statistics for 6 circular plots.

NAVY NORTH

DATE	NUM	#S	#L	MIN	MAX	AVG	SD
SPRING 95	187	41	146	15	54	36	8
FALL 95	181	32	149	16	55	39	9
SPRING 96							
FALL 96	187	77	110	15	58	33	11
SPRING 97	213	101	112	15	64	33	11
FALL 97	261	122	139	15	65	32	11
SPRING 98	259	127	132	15	69	31	10

NAVY SOUTH

DATE	NUM	#S	#L	MIN	MAX	AVG	SD
SPRING 95	270	70	200	16	63	36	9
FALL 95	290	48	242	15	66	39	11
SPRING 96							
FALL 96	350	125	225	15	64	35	12
SPRING 97	330	94	236	15	65	38	12
FALL 97	361	111	250	15	68	36	12
SPRING 98	364	107	257	15	69	37	11

#S = # LIMPETS < 30 mm   #L = # LIMPETS >= 30 mm

Table 25. Owl Limpet Summary Data for Cabrillo I, II, and III.
Number of limpets and shell length (mm) statistics for 6 circular plots divided among boulder and cliff habitats.

AREA I	BOULDER							CLIFF							ALL						
DATE	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD
SPRING 90	106	1	105	22	81	50	12	98	1	97	28	64	47	7	204	2	202	22	81	48	10
FALL 90	118	23	95	19	85	49	15	124	27	97	18	64	43	12	242	50	192	18	85	46	14
SPRING 91	113	13	100	22	83	48	14	120	33	87	18	63	40	12	233	46	187	18	83	44	13
FALL 91	115	25	90	17	84	45	16	89	12	77	18	65	41	10	204	37	167	17	84	43	14
SPRING 92	107	15	92	21	79	47	14	106	14	92	18	59	41	10	213	29	184	18	79	44	12
JUNE 92	105	13	92	15	79	47	14	127	24	103	17	62	40	11	232	37	195	15	79	43	13
FALL 92	129	28	101	15	84	47	17	136	49	87	15	64	36	13	265	77	188	15	84	41	16
SPRING 93	102	9	93	20	82	48	15	122	32	90	15	66	38	12	224	41	183	15	82	43	14
FALL 93	132	36	96	15	85	43	17	120	20	100	16	71	41	12	252	56	196	15	85	42	17
SPRING 94	110	22	88	18	84	45	15	113	16	97	15	70	40	12	223	38	185	15	84	42	14
FALL 94	98	16	82	16	82	45	15	87	10	77	17	69	40	10	185	26	159	16	82	43	13
SPRING 95	115	21	94	18	82	44	14	109	22	87	17	65	40	12	224	43	181	17	82	42	13
FALL 95	122	19	103	17	85	47	15	114	13	101	19	64	43	12	236	32	204	17	85	45	14
SPRING 96																					
FALL 96	130	38	92	15	81	42	17	134	52	82	15	70	32	15	264	90	174	15	81	39	16
SPRING 97	131	19	112	17	84	45	14	136	49	87	15	69	37	14	267	68	199	15	84	41	15
FALL 97	132	26	106	16	75	46	15	142	35	107	15	72	40	13	274	61	213	15	75	43	14
SPRING 98	132	20	112	17	81	46	14	136	32	104	15	71	38	12	268	52	216	15	81	42	14

AREA II	BOULDER							CLIFF							ALL						
DATE	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD
SPRING 90	79	1	78	25	81	54	13	82	0	82	32	87	52	10	161	1	160	25	87	53	11
FALL 90	93	18	75	18	82	52	17	108	14	94	23	83	52	14	201	32	169	18	83	52	16
SPRING 91	92	18	74	20	78	51	17	118	29	89	19	81	44	15	210	47	163	19	81	47	16
FALL 91	83	5	78	19	78	54	15	123	10	113	19	80	49	13	206	15	191	19	80	51	14
SPRING 92	83	7	76	16	79	52	16	102	4	98	27	79	50	11	185	11	174	16	79	51	13
JUNE 92	80	4	76	17	80	54	16	103	7	96	18	71	49	12	183	12	171	17	80	51	14
FALL 92	96	12	84	16	82	51	18	126	14	112	19	74	50	14	222	26	196	16	82	51	16
SPRING 93	85	6	79	26	81	54	15	110	11	99	17	74	48	14	195	17	178	17	81	51	15
FALL 93	99	17	82	15	83	51	19	92	7	85	16	75	50	17	191	24	167	15	83	50	17
SPRING 94	91	10	81	19	85	52	17	75	9	66	20	72	47	14	166	19	174	19	85	50	16
FALL 94	76	3	73	26	84	52	15	71	11	60	16	75	45	14	147	14	133	16	84	49	15
SPRING 95	75	8	67	20	84	50	16	75	12	63	15	73	45	13	150	20	130	15	84	48	15
FALL 95	70	4	66	17	81	52	14	64	3	61	19	72	48	12	134	7	127	17	81	50	14
SPRING 96																					
FALL 96	86	10	76	17	79	49	15	111	45	66	15	75	40	19	197	55	142	15	79	44	18
SPRING 97	94	13	81	17	77	49	15	105	9	96	17	71	47	13	199	22	177	17	77	47	14
FALL 97	86	8	78	19	79	48	14	124	17	107	16	72	45	14	210	25	185	16	79	47	14
SPRING 98	79	5	74	16	77	50	13	63	2	61	19	70	48	11	142	7	135	16	77	49	12

AREA III	BOULDER							CLIFF							ALL						
DATE	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD	NUM	#S	#L	MIN	MAX	AVG	SD
SPRING 90	210	9	201	16	74	46	10	26	0	26	35	82	48	12	236	9	227	16	82	46	11
FALL 90	217	20	197	19	73	47	11	32	5	27	24	81	45	14	249	25	224	19	81	47	12
SPRING 91	216	27	189	20	73	46	12	31	5	26	24	80	45	13	247	32	215	20	80	46	12
FALL 91	197	8	189	23	74	48	11	22	1	21	26	78	45	11	219	9	210	23	78	47	11
SPRING 92	155	3	152	21	70	48	9	28	1	27	26	69	43	11	183	4	179	21	70	47	10
JUNE 92	221	7	214	22	76	48	10	39	6	33	15	77	43	14	260	13	247	15	77	47	11
FALL 92	255	45	210	17	74	45	14	54	13	41	15	77	41	15	309	58	251	15	77	45	14
SPRING 93	209	21	188	17	73	47	12	43	7	36	19	75	43	14	252	28	224	17	75	47	12
FALL 93	222	37	185	15	74	44	14	36	5	31	22	75	43	14	258	42	216	15	75	44	14
SPRING 94	186	26	160	15	71	44	13	22	0	22	32	74	45	10	208	26	182	15	74	44	13
FALL 94	162	21	141	15	69	43	12	37	8	29	17	61	37	11	199	29	170	15	69	43	12
SPRING 95	171	23	148	17	68	42	12	25	3	22	15	56	39	11	196	20	176	15	68	42	12
FALL 95	143	10	133	16	68	45	11	32	8	24	16	62	39	12	175	18	157	16	68	44	11
SPRING 96																					
FALL 96	141	19	122	16	66	44	12	43	14	29	15	64	35	15	184	33	151	15	66	42	13
SPRING 97	171	37	134	15	68	42	13	33	5	28	16	58	39	11	204	42	162	15	68	42	13
FALL 97	134	17	117	17	67	45	12	50	22	28	16	56	34	12	184	39	145	16	67	42	13
SPRING 98	133	23	110	16	66	43	12	64	13	51	15	70	38	12	197	36	161	15	70	41	13

NOTE: DATA FOR 3 PLOTS COMBINED FOR EACH HABITAT EXCEPT AREA III (5 BOULDER, 1 CLIFF).
#S = # LIMPETS < 30 mm   #L = # LIMPETS >= 30 mm

Table 26. Owl Limpet Density and Size Data by Plot at Navy North and Navy South.

Number of limpets and shell length (mm) statistics for 6 circular plots at each site.

	NAVY NORTH 1					NAVY NORTH 2					NAVY NORTH 3					NAVY NORTH 4					NAVY NORTH 5					NAVY NORTH 6				
DATE	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD
SPR 95	35	20	50	36	8	34	18	48	35	8	25	15	49	37	9	24	23	54	34	7	36	15	50	36	9	33	18	47	36	8
FALL 95	35	17	55	39	10	27	16	50	39	8	28	16	55	41	11	32	21	53	36	8	36	17	52	37	10	23	26	55	42	8
SPR 96																														
FALL 96	33	15	57	32	11	20	15	53	35	13	20	16	53	35	11	37	15	48	30	10	41	17	53	32	9	36	15	58	34	12
SPR 97	38	15	64	36	12	15	25	60	39	10	21	20	51	36	12	42	15	51	28	10	56	15	50	31	10	41	15	62	33	12
FALL 97	52	15	65	32	13	23	15	51	32	11	29	15	60	36	13	53	15	53	29	10	62	15	53	30	11	42	16	53	32	12
SPR 98	38	17	60	30	10	24	17	56	35	10	30	15	55	33	12	53	15	50	31	8	59	19	51	32	8	55	15	69	30	11

	NAVY SOUTH 1					NAVY SOUTH 2					NAVY SOUTH 3					NAVY SOUTH 4					NAVY SOUTH 5					NAVY SOUTH 6				
DATE	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD
SPR 95	51	18	60	37	10	27	19	52	38	8	34	16	54	35	10	54	16	52	35	9	42	20	63	37	10	62	18	60	37	9
FALL 95	46	17	56	40	8	36	27	57	42	7	41	15	62	36	12	70	15	60	36	11	38	20	66	42	11	59	15	63	43	10
SPR 96																														
FALL 96	54	16	55	37	10	29	27	64	41	10	47	15	51	32	11	89	15	59	31	12	52	15	61	35	12	79	15	59	37	12
SPR 97	61	16	59	38	12	25	24	65	44	11	52	17	60	34	11	79	15	59	34	11	49	18	63	38	12	64	18	62	40	11
FALL 97	55	15	59	39	12	35	16	68	38	15	51	15	52	33	11	78	15	60	35	10	57	15	63	36	12	85	15	64	37	12
SPR 98	58	17	62	39	12	38	20	69	40	13	53	15	52	32	11	76	15	62	37	10	56	15	65	38	12	83	17	65	38	11

Table 27. Owl Limpet Density and Size Data by Plot at Cabrillo I, II, and III (# limpets and shell length (mm) statistics).

AREA I	282 Boulder					283 Boulder					284 Boulder					277 Cliff					279 Cliff					280 Cliff				
DATE	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD
SPRING 90	27	33	81	56	14	25	39	68	50	7	54	22	70	46	10	16	36	59	50	7	28	37	58	47	6	54	28	64	47	8
FALL 90	40	23	85	58	15	19	26	64	50	10	59	19	67	42	13	42	19	63	37	10	22	22	61	47	12	60	18	64	45	12
SPRING 91	39	22	83	54	16	18	30	63	49	10	56	22	69	44	12	39	18	61	34	9	28	23	58	41	12	53	19	63	43	11
FALL 91	33	19	84	51	19	17	25	66	52	11	65	17	63	39	13	29	18	46	34	9	28	21	56	41	10	32	28	65	46	8
SPRING 92	32	26	79	52	16	15	38	66	54	8	60	21	70	42	12	38	20	50	35	8	35	18	56	42	11	33	29	59	45	8
JUNE 92	37	15	79	47	19	14	40	64	54	8	54	15	72	44	12	63	17	62	37	10	32	17	58	41	13	32	24	62	45	9
FALL 92	43	15	84	52	19	17	22	66	54	12	69	17	75	41	15	67	15	60	32	12	42	19	64	39	13	27	23	61	43	12
SPRING 93	37	22	82	53	16	11	30	66	51	14	54	20	74	45	13	49	18	60	35	10	45	15	63	37	12	28	22	66	44	11
FALL 93	47	19	85	50	19	17	18	69	38	17	68	15	76	40	16	41	19	56	36	9	51	16	65	40	12	28	25	71	49	12
SPRING 94	39	20	84	50	17	16	24	69	44	14	55	18	74	41	13	37	15	62	33	9	49	21	60	40	10	27	30	70	52	10
FALL 94	32	19	82	53	15	14	23	63	48	11	52	16	75	40	14	24	20	59	39	9	39	22	61	39	9	24	17	69	44	11
SPRING 95	43	22	82	47	15	22	18	64	43	13	50	20	75	41	12	44	17	58	33	8	40	23	62	41	10	25	18	65	50	11
FALL 95	48	17	85	51	17	19	22	65	49	11	55	18	74	43	14	41	19	62	34	8	47	24	64	44	9	26	42	79	56	8
SPRING 96																														
FALL 96	58	15	81	43	20	23	16	62	48	14	49	19	57	37	12	46	15	62	32	12	45	15	58	36	13	43	15	70	40	20
SPRING 97	51	17	84	50	16	28	18	62	46	14	52	17	61	39	11	53	15	62	29	10	57	15	61	39	12	26	25	69	50	14
FALL 97	52	17	75	49	16	24	22	61	47	12	56	16	73	42	15	39	15	64	35	10	57	17	62	41	10	46	19	72	42	17
SPRING 98	63	17	81	48	15	28	19	63	46	13	41	21	72	43	12	50	15	60	33	9	58	16	56	40	10	28	20	71	46	14

AREA II	239 Boulder					240 Boulder					241 Boulder					242 Cliff					243 Cliff					266 Cliff				
DATE	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD
SPRING 90	26	25	64	46	10	17	34	81	57	12	36	34	77	58	13	11	32	70	54	11	22	33	59	49	7	49	33	87	54	11
FALL 90	34	18	62	41	13	24	20	82	50	20	35	26	76	64	10	17	25	69	49	17	29	29	72	55	12	62	23	83	52	15
SPRING 91	34	[illegible]	[illegible]	39	[illegible]	23	25	78	49	17	35	28	76	62	12	14	29	70	46	14	28	24	66	45	13	76	19	81	44	15
FALL 91	24	[illegible]	[illegible]	45	[illegible]	22	19	77	50	15	37	20	78	62	15	21	27	67	48	12	32	24	71	54	12	70	19	80	46	13
SPRING 92	26	[illegible]	[illegible]	42	[illegible]	24	22	78	48	16	33	16	79	64	14	17	29	66	49	11	18	30	68	54	9	67	27	79	50	11
JUNE 92	25	[illegible]	[illegible]	45	[illegible]	23	17	72	48	15	32	17	80	64	14	18	18	68	51	12	14	18	71	49	14	71	22	66	49	11
FALL 92	41	16	66	41	13	24	17	79	49	17	31	31	82	66	12	24	32	73	58	11	25	19	71	40	16	77	21	74	52	13
SPRING 93	32	26	61	43	10	21	27	77	53	14	32	39	81	67	10	12	17	72	52	14	30	23	70	43	12	68	23	74	49	14
FALL 93	44	15	61	40	14	24	16	79	49	20	31	24	83	67	12	13	21	75	59	14	27	16	73	45	14	52	27	73	50	12
SPRING 94	36	21	60	42	10	26	19	78	51	17	29	19	85	64	16	10	30	72	58	13	22	21	66	44	13	43	20	72	46	14
FALL 94	29	29	62	43	9	24	26	79	51	15	23	34	84	66	12	7	38	75	54	14	24	35	63	48	9	40	16	75	42	16
SPRING 95	28	20	59	40	10	23	24	80	53	13	24	25	84	60	16	6	36	57	45	8	20	18	62	48	11	49	15	73	44	15
FALL 95	27	17	62	44	11	23	29	74	51	14	20	36	81	64	11	3	54	60	56	3	21	30	65	49	9	40	19	72	46	14
SPRING 96																														
FALL 96	38	17	63	41	13	30	18	73	49	14	18	41	79	65	9	37	15	69	23	14	23	18	68	44	15	51	26	75	50	13
SPRING 97	40	17	58	41	11	31	23	74	50	14	23	22	77	59	16	8	30	71	47	18	29	17	68	44	14	68	22	68	48	12
FALL 97	40	19	58	41	10	26	23	74	51	13	20	33	79	60	14	32	21	69	48	14	14	38	72	54	11	78	16	70	43	13
SPRING 98	35	23	65	45	9	24	27	77	51	12	20	16	73	56	17	9	29	66	50	14	19	19	70	49	15	35	31	60	46	9

AREA III	11 Boulder					18 Boulder					19 Boulder					21 Boulder					26 Boulder					13 Cliff				
DATE	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD	NUM	MIN	MAX	AVG	SD
SPRING 90	56	27	64	45	8	82	16	56	41	8	19	27	67	52	12	30	30	72	50	10	23	33	74	57	10	26	35	82	48	12
FALL 90	62	19	65	44	9	76	20	60	43	9	28	21	73	54	15	29	37	71	52	8	22	27	72	58	9	32	24	81	45	14
SPRING 91	60	20	64	44	9	78	20	60	40	10	27	26	73	54	15	28	27	66	50	9	23	28	71	56	10	31	24	80	45	13
FALL 91	55	23	66	44	8	71	23	64	43	9	30	32	74	55	13	21	41	61	53	5	20	30	71	56	9	22	26	78	45	11
SPRING 92	36	31	57	46	5	58	28	56	44	7	24	35	69	53	12	19	39	64	53	7	18	21	70	54	11	28	26	69	43	11
JUNE 92	55	24	62	46	8	86	24	63	44	8	33	22	76	53	14	27	37	64	54	8	20	33	72	55	12	39	15	77	43	14
FALL 92	75	17	65	43	13	88	18	57	41	10	39	17	74	49	17	28	24	68	54	12	25	17	72	50	16	54	15	77	41	15
SPRING 93	52	24	62	47	9	76	20	60	43	9	31	17	73	52	16	28	27	66	52	12	22	17	71	51	16	43	19	75	43	14
FALL 93	73	15	65	40	13	65	15	58	39	10	33	17	74	53	14	25	21	66	54	11	26	18	68	48	15	36	22	75	43	14
SPRING 94	47	15	63	39	12	56	24	57	40	8	26	27	71	53	13	30	15	69	51	14	27	17	69	47	17	22	32	74	45	10
FALL 94	54	15	62	41	11	50	15	55	38	9	21	35	69	53	9	20	29	67	54	9	17	22	68	46	17	37	17	61	37	11
SPRING 95	51	17	57	40	10	66	17	54	37	9	22	25	65	50	13	20	30	66	53	9	12	30	68	50	12	25	15	56	39	11
FALL 95	42	16	59	43	9	55	17	57	41	9	22	17	67	51	13	15	47	68	57	7	12	25	60	47	11	32	16	62	38	12
SPRING 96																														
FALL 96	39	21	62	45	10	62	16	58	38	11	19	20	66	52	13	12	50	66	57	5	9	39	61	51	7	43	15	64	35	15
SPRING 97	57	15	63	40	12	66	15	57	39	11	18	35	68	54	9	19	17	68	49	16	11	24	63	47	13	33	16	58	39	11
FALL 97	43	20	60	43	12	51	21	66	43	10	16	25	65	53	10	16	17	67	47	16	8	39	64	51	8	50	16	56	34	12
SPRING 98	46	16	57	40	12	49	17	56	41	11	15	36	65	52	9	16	23	66	48	13	7	16	62	47	15	64	15	70	38	12

Table 28. Line Transect Cover at Navy North and Navy South in Fall 1996.

NAVY NORTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	3	6	AVG	4	5	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	100	100	100	0	0	0	5	6	6
SURF GRASS	0	0	0	100	100	100	95	94	94
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	0	0	0	0	0	0	0	0	0

NAVY SOUTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	5	6	AVG	3	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	97	100	98	1	1	1	4	0	2
SURF GRASS	3	0	1	99	99	99	96	100	98
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	1	1	1	0	0	0	0	0	0

Table 29. Line Transect Cover at Cabrillo I, II, and III in Fall 1996.

CABR AREA I	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	210	237	AVG	211	238	AVG	212	236	AVG
FEATHER BOA KELP	1	0	0	0	0	0	3	0	2
SARGASSUM WEED	0	0	0	2	0	1	0	0	0
RED ALGAL TURF	58	97	77	7	20	14	12	8	10
SURF GRASS	42	0	21	78	72	75	57	90	73
AGGREGATING ANEMONE	0	1	1	0	0	0	0	0	0
OTHER BIOTA	0	1	0	10	5	7	22	1	11
BARE SUBSTRATE	0	1	1	3	4	3	4	2	3

CABR AREA II	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	244	270	AVG	267	271	AVG	268	272	AVG
FEATHER BOA KELP	0	4	2	0	1	0	0	16	8
SARGASSUM WEED	0	0	0	5	2	3	2	2	2
RED ALGAL TURF	80	53	66	1	8	4	1	16	8
SURF GRASS	9	33	21	94	87	90	97	64	81
AGGREGATING ANEMONE	1	0	1	0	0	0	0	1	0
OTHER BIOTA	2	0	1	0	0	0	1	1	1
BARE SUBSTRATE	9	10	10	0	3	2	0	1	0

CABR AREA III	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	1	8	AVG	5	7	AVG	2	4	AVG
FEATHER BOA KELP	0	0	0	0	5	3	7	0	3
SARGASSUM WEED	0	0	0	0	15	7	0	0	0
RED ALGAL TURF	93	75	84	11	12	11	31	36	34
SURF GRASS	5	0	3	86	66	76	22	60	41
AGGREGATING ANEMONE	1	0	1	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	20	5	12
BARE SUBSTRATE	0	25	12	3	2	2	19	0	9

Table 30. Line Transect Cover at Navy North and Navy South in Spring 1997.

NAVY NORTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	3	6	AVG	4	5	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	100	99	100	0	2	1	7	8	7
SURF GRASS	0	0	0	100	99	99	93	92	93
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	0	1	0	0	0	0	0	0	0

NAVY SOUTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	5	6	AVG	3	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	91	100	96	3	2	3	1	0	0
SURF GRASS	8	0	4	97	98	97	99	100	99
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	0	0	0	0	0	0	0	0	0

Table 31. Line Transect Cover at Cabrillo I, II, and III in Spring 1997.

CABR AREA I	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	210	237	AVG	211	238	AVG	212	236	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	2	0	1	1	0	1
RED ALGAL TURF	66	98	82	11	26	19	16	21	19
SURF GRASS	34	0	17	79	67	73	52	79	65
AGGREGATING ANEMONE	1	2	1	0	0	0	0	0	0
OTHER BIOTA	0	0	0	1	3	2	29	0	15
BARE SUBSTRATE	0	0	0	7	4	5	1	1	1

CABR AREA II	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	244	270	AVG	267	271	AVG	268	272	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	8	4	0	0	0
RED ALGAL TURF	92	56	74	5	10	8	0	25	13
SURF GRASS	5	42	23	85	76	80	95	66	80
AGGREGATING ANEMONE	3	0	2	0	0	0	0	0	0
OTHER BIOTA	0	0	0	3	0	2	2	0	1
BARE SUBSTRATE	0	2	1	6	6	6	2	9	6

CABR AREA III	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	1	8	AVG	5	7	AVG	2	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	1	0	1
SARGASSUM WEED	0	0	0	8	28	18	5	0	3
RED ALGAL TURF	87	94	90	14	16	15	56	48	52
SURF GRASS	10	0	5	78	53	66	23	39	31
AGGREGATING ANEMONE	1	1	1	0	0	0	0	0	0
OTHER BIOTA	0	5	2	0	0	0	10	10	10
BARE SUBSTRATE	1	1	1	0	3	2	5	3	4

Table 32. Line Transect Cover at Navy North and Navy South in Fall 1997.

NAVY NORTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	3	6	AVG	4	5	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
SAND TURF	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	97	100	99	0	1	1	6	11	9
SURF GRASS	2	0	1	100	99	99	94	89	92
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
SAND TUBE WORM	0	0	0	0	0	0	0	0	0
MUSSEL	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	1	0	0	0	0	0	0	0	0

NAVY SOUTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	5	6	AVG	3	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
SAND TURF	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	90	99	94	0	0	0	2	0	1
SURF GRASS	10	0	5	100	99	100	99	100	99
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
SAND TUBE WORM	0	0	0	0	0	0	0	0	0
MUSSEL	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	1	2	1	0	1	0	0	0	0

Table 33. Line Intercept Cover at Cabrillo I, II, and III in Fall 1997.

CABR AREA I	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	210	237	AVG	211	238	AVG	212	236	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	56	98	77	15	16	15	17	17	17
SURF GRASS	43	0	21	78	70	74	46	82	64
AGGREGATING ANEMONE	0	1	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	31	0	15
BARE SUBSTRATE	2	2	2	7	14	10	7	1	4

CABR AREA II	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	244	270	AVG	267	271	AVG	268	272	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	3	0	2	0	0	0
RED ALGAL TURF	66	81	74	2	11	6	1	17	9
SURF GRASS	13	10	12	95	83	89	86	83	85
AGGREGATING ANEMONE	1	1	1	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	20	8	14	0	6	3	12	0	6

CABR AREA III	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	1	8	AVG	5	7	AVG	2	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	9	4	7	0	4
RED ALGAL TURF	79	81	80	6	8	7	46	58	52
SURF GRASS	10	0	5	92	78	85	22	39	30
AGGREGATING ANEMONE	1	0	1	0	0	0	0	0	0
OTHER BIOTA	0	0	0	2	0	1	24	3	13
BARE SUBSTRATE	10	18	14	1	6	3	2	0	1

Table 34. LineTransect Cover at Navy North and Navy South in Spring 1998.

NAVY NORTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	3	6	AVG	4	5	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
SAND TURF	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	98	98	98	0	5	2	12	30	21
SURF GRASS	2	0	1	99	93	96	88	70	79
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
SAND TUBE WORM	0	0	0	0	0	0	0	0	0
MUSSEL	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	0	2	1	1	2	1	0	0	0

NAVY SOUTH	LINE TRANSECTS (% COVER)								
	TURF ZONE			INSHORE GRASS ZONE			OFFSHORE GRASS ZONE		
TAXA	1	2	AVG	5	6	AVG	3	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	0	0	0	0	0
SAND TURF	0	0	0	0	0	0	0	0	0
RED ALGAL TURF	90	90	90	4	3	4	18	1	9
SURF GRASS	7	0	4	96	96	96	67	97	82
AGGREGATING ANEMONE	0	0	0	0	0	0	0	0	0
SAND TUBE WORM	0	0	0	0	0	0	0	0	0
MUSSEL	0	0	0	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	0	0	0	0	0
BARE SUBSTRATE	3	10	6	0	1	1	15	2	9

Table 35. Line Intercept Cover at Cabrillo I, II, and III in Spring 1998.

CABR AREA I	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	210	237	AVG	211	238	AVG	212	236	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	1	0	1	0	0	0
RED ALGAL TURF	64	95	79	36	36	36	5	37	21
SURF GRASS	35	0	18	58	58	58	56	57	57
AGGREGATING ANEMONE	1	2	1	0	0	0	0	0	0
OTHER BIOTA	0	0	0	0	1	0	24	1	13
BARE SUBSTRATE	0	3	2	5	5	5	14	5	9

CABR AREA II	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	244	270	AVG	267	271	AVG	268	272	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	7	4	0	0	0
RED ALGAL TURF	84	59	71	9	16	12	16	40	28
SURF GRASS	8	13	11	37	40	39	76	42	59
AGGREGATING ANEMONE	3	0	2	0	0	0	0	0	0
OTHER BIOTA	0	8	4	16	2	9	1	0	1
BARE SUBSTRATE	5	20	12	38	35	36	7	18	12

CABR AREA III	LINE TRANSECTS (% COVER)								
	TURF ZONE			GRASS ZONE			KELP ZONE		
TAXA	1	8	AVG	5	7	AVG	2	4	AVG
FEATHER BOA KELP	0	0	0	0	0	0	0	0	0
SARGASSUM WEED	0	0	0	0	29	15	4	0	2
RED ALGAL TURF	80	93	86	17	7	12	35	25	30
SURF GRASS	7	0	3	61	35	48	11	7	9
AGGREGATING ANEMONE	3	0	2	0	0	0	0	0	0
OTHER BIOTA	0	4	2	6	5	5	26	6	16
BARE SUBSTRATE	10	3	7	16	23	19	24	62	43

Table 36. Line Transect Summary Data for Navy North and Navy South.
Mean % cover data (n=2) for 7 taxa in 3 intertidal zones.

	NAVY NORTH TURF							NAVY NORTH INSHORE GRASS							NAVY NORTH OFFSHORE GRASS						
DATE	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS
SPRING 95	0	0	97	0	0	0	3	0	0	3	95	0	0	1	0	0	9	90	0	0	1
FALL 95	0	0	97	0	0	0	3	0	0	0	100	0	0	0	0	0	4	96	0	0	0
SPRING 96																					
FALL 96	0	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	6	94	0	0	0
SPRING 97	0	0	100	0	0	0	0	0	0	1	99	0	0	0	0	0	7	93	0	0	0
FALL 97	0	0	99	1	0	0	0	0	0	1	99	0	0	0	0	0	9	92	0	0	0
SPRING 98	0	0	98	1	0	0	1	0	0	2	96	0	0	1	0	0	21	79	0	0	0

	NAVY SOUTH TURF							NAVY SOUTH INSHORE GRASS							NAVY SOUTH OFFSHORE GRASS						
DATE	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS
SPRING 95	0	0	95	0	0	0	5	0	0	3	95	0	0	2	0	0	5	92	0	0	3
FALL 95	0	0	98	2	0	0	1	0	0	2	98	0	0	0	0	0	0	100	0	0	0
SPRING 96																					
FALL 96	0	0	98	1	0	0	1	0	0	1	99	0	0	0	0	0	2	98	0	0	0
SPRING 97	0	0	96	4	0	0	0	0	0	3	97	0	0	0	0	0	0	99	0	0	0
FALL 97	0	0	94	5	0	0	1	0	0	0	100	0	0	0	0	0	1	99	0	0	0
SPRING 98	0	0	90	4	0	0	6	0	0	4	96	0	0	1	0	0	9	82	0	0	9

BK=BOA KELP SW=SARGASSUM WEED RT=RED ALGAL TURF SG=SURF GRASS
AA=AGGREGATING ANEMONE OB=OTHER BIOTA BS=BARE SUBSTRATE

Table 37. Line Transect Summary Data for Cabrillo I, II, and III.
Mean % cover data (n=2) for 7 taxa in 3 intertidal zones.

	AREA I TURF							AREA I GRASS							AREA I KELP						
DATE	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS
SPRING 90	3	0	87	5	2	0	3	10	0	25	53	0	1	11	44	0	34	10	0	5	7
FALL 90	0	0	81	14	1	0	4	1	0	23	72	0	0	4	31	0	36	16	0	8	9
SPRING 91	0	0	88	8	2	0	2	1	0	26	70	0	0	3	14	0	66	8	0	12	0
FALL 91	1	0	83	14	1	0	1	10	0	17	71	0	0	3	54	2	21	19	0	4	1
SPRING 92	0	0	81	17	2	0	0	0	0	21	79	0	0	0	51	0	28	20	0	0	1
JUNE 92	5	0	81	13	1	0	0	6	0	17	77	0	0	0	43	0	23	20	0	14	0
FALL 92	0	0	83	16	0	0	0	1	0	12	86	0	0	1	33	0	19	40	0	6	2
SPRING 93	0	0	84	14	1	0	1	0	0	13	85	0	0	2	10	0	43•	31	0	4	13
FALL 93	4	1	79	16	0	0	0	0	0	7	90	0	0	2	11	11	23	45	0	7	3
SPRING 94	0	0	81	18	1	0	0	0	0	12	87	0	0	0	13	0	33	49	0	3	2
FALL 94	0	0	79	20	0	0	0	0	1	9	91	0	0	0	6	0	11	61	0	22	0
SPRING 95	0	0	84	13	1	0	2	0	0	21	68	0	1	10	2	0	41	40	0	8	10
FALL 95	2	0	78	19	1	0	0	1	1	17	80	0	0	1	16	0	8	63	0	11	2
SPRING 96																					
FALL 96	0	0	77	21	1	0	1	0	1	14	75	0	7	3	2	0	10	73	0	11	3
SPRING 97	0	0	82	17	1	0	0	0	1	19	73	0	2	5	0	1	19	65	0	15	1
FALL97	0	0	77	21	0	0	2	0	0	15	74	0	0	10	0	0	17	64	0	15	4
SPRING 98	0	0	79	18	1	0	2	0	1	36	58	0	0	5	0	0	21	57	0	13	9

	AREA II TURF							AREA II GRASS							AREA II KELP						
DATE	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS
SPRING 90	6	0	73	2	1	0	18	18	6	11	57	0	1	7	55	0	28	11	0	1	5
FALL 90	3	0	75	5	1	0	17	8	0	16	69	0	2	5	42	0	32	17	3	3	3
SPRING 91	0	0	74	4	0	2	20	10	6	10	62	0	8	4	11	0	64	24	0	0	2
FALL 91	1	1	71	8	1	0	19	17	0	8	70	0	5	0	29	6	23	38	0	4	0
SPRING 92	1	3	79	11	1	0	5	13	3	9	72	0	4	0	30	0	20	47	0	3	0
JUNE 92	8	3	72	12	2	1	2	16	3	6	74	0	1	1	48	0	11	29	0	12	0
FALL 92	4	0	58	14	0	1	23	13	2	5	78	0	0	1	31	0	19	49	0	0	1
SPRING 93	2	0	80	8	1	0	9	1	0	14	77	0	4	4	23	0	25	48	0	2	2
FALL 93	2	0	79	19	0	0	1	3	0	7	85	0	5	0	10	0	6	73	0	11	0
SPRING 94	1	1	81	14	1	0	3	3	2	16	79	0	0	0	3	0	13	78	0	3	2
FALL 94	0	2	80	15	0	0	2	2	1	8	81	0	8	0	0	0	13	81	0	6	0
SPRING 95	0	3	83	7	1	0	7	0	4	24	58	0	2	13	0	0	24	67	0	2	6
FALL 95	2	0	78	18	0	0	2	0	0	5	95	0	1	0	0	0	17	79	0	3	1
SPRING 96																					
FALL 96	2	0	66	21	1	1	10	0	3	4	90	0	0	2	8	2	8	81	0	1	0
SPRING 97	0	0	74	23	2	0	1	0	4	8	80	0	2	6	0	0	13	80	0	1	6
FALL 97	0	0	74	12	1	0	14	0	2	6	89	0	0	3	0	0	9	85	0	0	6
SPRING 98	0	0	71	11	2	4	12	0	4	12	39	0	9	36	0	0	28	59	0	1	12

	AREA III TURF							AREA III GRASS							AREA III KELP						
DATE	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS	BK	SW	RT	SG	AA	OB	BS
SPRING 90	0	0	90	4	2	0	4	2	3	25	60	0	1	9	54	0	34	4	0	2	6
FALL 90	0	0	80	4	1	1	14	4	2	15	72	0	0	7	36	0	47	7	0	3	7
SPRING 91	0	1	87	3	2	0	6	6	0	16	58	0	0	20	22	14	32	7	0	5	21
FALL 91	0	0	79	6	2	0	14	4	3	16	70	0	0	7	25	4	44	14	0	11	2
SPRING 92	0	0	94	3	1	0	2	4	8	26	61	0	0	1	40	8	44	5	0	3	0
JUNE 92	0	0	94	4	2	0	0	2	2	19	76	0	0	0	50	7	24	11	0	6	2
FALL 92	0	0	91	6	0	0	3	2	1	15	77	0	0	5	23	4	44	17	0	9	3
SPRING 93	0	0	93	3	1	0	3	4	3	30	53	0	2	8	9	14	51	12	0	10	4
FALL 93	0	0	91	7	0	0	1	0	6	24	63	0	1	6	4	1	28	23	0	16	2
SPRING 94	0	1	94	1	2	0	1	0	26	29	41	0	0	3	6	18	53	22	0	2	0
FALL 94	0	0	90	1	1	0	8	0	11	26	53	0	0	10	0	1	50	27	0	19	4
SPRING 95	0	2	93	0	1	0	3	0	20	24	27	0	0	29	0	8	55	20	0	5	11
FALL 95	0	0	86	7	1	0	6	5	6	12	61	0	0	16	7	0	38	33	0	12	9
SPRING 96																					
FALL 96	0	0	84	3	1	0	12	3	7	11	76	0	0	2	3	0	34	41	0	12	9
SPRING 97	0	0	90	5	1	2	1	0	18	15	66	0	0	2	1	3	52	31	0	10	4
FALL 97	0	0	80	5	1	0	14	0	4	7	85	0	1	3	0	4	52	30	0	13	1
SPRING 98	0	0	86	3	2	2	7	0	15	12	48	0	5	19	0	2	30	9	0	16	43

BK=BOA KELP SW=SARGASSUM WEED RT=RED ALGAL TURF SG=SURF GRASS
AA=AGGREGATING ANEMONE OB=OTHER BIOTA BS=BARE SUBSTRATE

Table 38. Transect Primary Taxa Data for Navy North and South.
% cover data for 2 index taxa (red algal turf and surf grass).

NAVY NORTH	TURF ZONE		INSHORE GRASS ZONE		OFFSHORE GRASS ZONE	
DATE	1	2	3	6	4	5
S95	96	97	100	91	94	87
F95	95	99	100	99	96	95
S96						
F96	100	100	100	100	95	94
S97	100	99	100	99	93	92
F97	97	100	100	99	94	89
S98	98	98	99	93	88	70

NAVY SOUTH	TURF ZONE		INSHORE GRASS ZONE		OFFSHORE GRASS ZONE	
DATE	1	2	5	6	3	4
S95	93	97	96	95	85	99
F95	95	100	97	98	100	100
S96						
F96	97	100	99	99	96	100
S97	91	100	97	98	99	100
F97	90	99	100	99	99	100
S98	90	90	96	96	67	97

Table 39. Transect Primary Taxa Data for Cabrillo I, II, and III.
% cover data for 3 index taxa (red algal turf, surf grass, boa kelp).

AREA I	TURF ZONE		GRASS ZONE		KELP ZONE	
DATE	210	237	211	238	212	236
S90	78	96	50	56	43	44
F90	67	96	88	57	29	33
S91	81	94	82	58	13	16
F91	69	97	75	67	64	43
S92	66	95	91	67	81	21
J92	65	98	85	69	54	33
F92	67	99	92	80	45	20
S93	71	96	95	75	20	0
F93	60	99	96	85	17	6
S94	63	99	96	79	27	0
F94	59	100	97	84	12	0
S95	71	97	69	66	5	0
F95	58	98	82	78	33	0
S96						
F96	58	97	78	72	3	0
S97	66	98	79	67	0	0
F97	56	98	78	70	0	0
S98	64	95	58	58	0	0

AREA II	TURF ZONE		GRASS ZONE		KELP ZONE	
DATE	244	270	267	271	268	272
S90	86	59	64	51	76	34
F90	79	71	78	61	52	32
S91	92	56	84	40	16	6
F91	63	79	94	47	31	27
S92	96	62	87	56	35	25
J92	93	51	93	55	48	47
F92	68	47	92	63	47	15
S93	96	64	87	66	43	3
F93	92	66	99	71	8	12
S94	95	66	94	63	2	5
F94	92	69	96	66	0	0
S95	95	71	70	46	0	0
F95	96	60	96	93	1	0
S96						
F96	80	53	94	87	0	16
S97	92	56	85	76	0	0
F97	66	81	95	83	0	0
S98	84	59	37	40	0	0

AREA III	TURF ZONE		GRASS ZONE		KELP ZONE	
DATE	1	8	5	7	2	4
S90	86	94	66	54	47	61
F90	76	84	76	67	28	44
S91	79	95	69	46	22	21
F91	86	71	74	66	23	28
S92	90	99	73	49	32	48
J92	89	99	85	68	42	58
F92	87	95	80	75	17	28
S93	86	100	63	42	10	8
F93	83	99	54	72	7	2
S94	90	99	39	43	7	5
F94	81	99	42	64	0	0
S95	87	100	26	28	0	0
F95	86		75	48	12	3
S96						
F96	93	75	86	66	7	0
S97	87	94	78	53	1	0
F97	79	81	92	78	0	0
S98	80	93	61	35	0	0

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Royalty Management Program** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.