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KELP FOREST MONITORING
1996 ANNUAL REPORT

David J. Kushner
Jennifer Morgan
Jeff Mondragon
and
Derek Lerma

Channel Islands National Park
1901 Spinnaker Drive

Ventura, California 93001

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ABSTRACT

The 1996 results of Channel Islands National Park Kelp Forest Monitoring Project are described. Population dynamics of 68 taxa, or categories, of algae, fish and invertebrates were measured at 16 permanent sites around the five islands within the Park. Survey techniques utilized SCUBA and surface-supplied-air, and included quadrats, $5m^2$-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, video transects, size frequency measurements, artificial recruitment modules, and species list surveys. Temperature data was collected using remote temperature loggers. Size frequency measurements were taken from artificial recruitment modules at ten sites. In 1996, seven sites had *Macrocystis pyrifera* (giant kelp) forests, one site was a open area with a moderate amount of red algae, and eight sites were dominated by echinoderms. Of the eight sites dominated by echinoderms, one was dominated by *Pachythyone rubra* (aggregated red sea cucumbers), one by *Strongylocentrotus franciscanus* (red sea urchins), one by both *Strongylocentrotus purpuratus* (purple sea urchins) and *Ophiothrix spiculata* (brittle stars), and five by *Strongylocentrotus purpuratus*. Changes to existing monitoring protocols, and the addition of two new protocols are described.

FOREWORD

During the 1996 field season we implemented changes to existing protocols and added two new ones. Changes were made as a result of statistical analysis of our sampling design (Schroeter et al., 1994) and a kelp forest monitoring review workshop (Davis et al., 1996). The changes included, the reduction of 25 Random Point Contacts to 15, the reduction of 20 1m X 2m quadrats to 12, and the modification of fish transects so that divers swim along both sides of the main transect, dividing it into four 50m x 2m x 3m transects where one diver counts the "midwater" fish and the other counts the "benthic" fish. The two new protocols that were added were a $5m^2$-quadrat method, and a Roving Diver Fish Count method with a timed count and estimated abundance measurement.

Schroeter et al. (1994) indicate that there is only small increases in precision when the number of quadrats and random point contacts are greater than 10. We decided to decrease the number of quadrats to 12 and the number of random point contacts to 15. We chose these sample sizes because at most sites these techniques could be completed during one dive. In addition to decreasing the number of quadrats we added "adult" and "juvenile" groupings for *Laminaria farlowii*, *Eisenia arborea*, and *Pterygophora californica*. This will be helpful in identifying recent recruits from more established plants. The fish transects were changed so that the transect size is halved, and each transect now covers unique area, thus it is thought that each of the four transects is a sample.

In addition to the changes to fish transects we added a new fish sampling technique consisting of two components. The new technique, Roving Diver Fish Count, has two components a timed count and estimated abundance. At each site this technique is conducted at least once with a minimum of four divers. We are hoping that this new method will provide us with a less variable estimate of fish populations at the sites.

The new $5m^2$-quadrat method was added to the protocol to acquire better density estimates of adult and subadult *Macrocystis pyrifera* and *Pisaster giganteus*. Schroeter et.al. (1994) indicate that a larger survey area is needed to acquire better density estimates of adult *M. pyrifera* and to better distinguish young-of-the-year from older individuals. We felt that adding subadult and adult *M. pyrifera* categories to band transects would have been too complicated for samplers, so the $5m^2$-quadrat method was developed. In this new sampling protocol, a diver swims along each side of the transect and out one meter while enumerating the number of adult (greater than one meter and haptera present above the primary dichotomy), and subadult (less than one meter with no haptera present at or above the primary dichotomy) *M. pyrifera*, and *Pisaster*

giganteus in 5m X 1m quadrats. Since each of these 5m X 1m segments are continuous and adjacent they can not be looked at as independent samples. However, by separating the transect into five meter segments we will be able to look at patchiness.

The number of individuals of a particular species measured for natural habitat size frequencies was formally increased. This change, however, will have little effect as we have gradually done this over the past several years. We also prioritized species for size frequencies, so that if not enough time is available at a particular site, we may skip size frequency measurements for particular species.

The changes to our sampling design and the new sampling protocols are described in detail in an updated Kelp Forest Monitoring Handbook (Davis et al., in prep.).

EXECUTIVE SUMMARY

Channel Islands National Park has conducted long-term ecological monitoring of the kelp forests around Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel Islands since 1982. Permanent transects were established at 16 sites between 1981 and 1986. In 1996, the sites were monitored during seven five-day cruises between June and October. The 1996 kelp forest monitoring was completed at all 16 monitoring sites by 32 National Park Service (NPS) and volunteer divers completing a total of 756 dives. This annual report contains a summary of the methods used to conduct the monitoring in 1996 and a brief description of the sites along with the results. All of the data collected during 1996 can be found in the Appendices.

Divers using SCUBA or surface-supply-air completed all quadrats, $5m^2$-quadrats, band transects, random point contacts, fish transects, roving diver fish counts, size frequencies, artificial recruitment modules (ARMs) and video transects. Transect lead line repair was completed as necessary at all locations, and new thread rods and eyebolts were installed at Rodes Reef , Santa Rosa Island. Temperature loggers were retrieved and deployed at all sites.

In 1996, *Macrocystis pyrifera* (giant kelp) forests were present at seven of the 16 sites. Sites with *M. pyrifera* included, Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, Yellowbanks at Santa Cruz Island, Cathedral Cove and Landing Cove at Anacapa Island, and Cat Canyon at Santa Barbara Island. One site, Rodes Reef at Santa Rosa Island was an open area with a moderate amount of red algae. Eight sites were dominated by echinoderms. Gull Island South, Pelican Bay, and Scorpion Anchorage at Santa Cruz Island, Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus* (purple sea urchins). Hare Rock, San Miguel Island was dominated by *Strongylocentrotus franciscanus* (Red sea urchins). Admiral's Reef, Anacapa Island was dominated by both *S. purpuratus* and *Ophiothrix spiculata* (brittle stars), however, some *M. pyrifera* was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra* (aggregating red sea cucumbers), and had a moderate density of *S. purpuratus*.

Seven sites had high *S. purpuratus* densities this year compared to five sites with high densities in 1995. On Santa Cruz, Anacapa, and Santa Barbara Islands *Strongylocentrotus purpuratus* (purple sea urchins) are abundant and dominating many of the areas that would probably be kelp forests if *S. purpuratus* densities were lower. Much of the subtidal habitat at Santa Barbara Island appeared to be sea urchin barrens with high densities of *S. purpuratus* and occasionally high densities of *S. franciscanus*. These observations are similar to what was seen in 1995. There were few canopy forming plants at Santa Barbara except for some remnant kelp forests around Sutil Island and Cat Canyon and some very small patches of kelp close to

shore scattered around the island. At middle and west Anacapa Islands, much of the south side and parts of the islands have high densities of *S. purpuratus* and little *Macrocystis pyrifera* (giant kelp). However, the two kelp forest monitoring sites within the Ecological Refuge on Anacapa Island have healthy *M. pyrifera* forests, with low densities of *S. purpuratus*. Four of the five sites at Santa Cruz Island have high densities of *S. purpuratus*.

Sea urchin wasting syndrome (Richards and Kushner, 1994) was observed at eight sites this year, compared to five in 1995. The three sites where this syndrome was observed this year and not in 1995 were all on Santa Cruz island. The syndrome was most common in *Strongylocentrotus purpuratus* (purple sea urchins) populations. At all eight sites where this syndrome was seen, sick *S. purpuratus* were observed. *S. franciscanus* (red sea urchins) were observed with wasting syndrome at four sites and sick *Lytechinus anamesus* (white sea urchins) were seen at three sites. Sea star wasting disease was observed at two sites this year, both on Santa Cruz Island.

We continue to observe and receive reports of the brittle star, *Ophiothrix spiculata*, dominating areas around the islands. *O. spiculata* continued to be abundant at Admiral's Reef, Anacapa Island, and appears to be increasing in abundance at Fry's Harbor, Santa Cruz Island. During survey dives, and from "word of mouth" reports it appears that *O. spiculata* is continuing to increase in abundance around Santa Barbara, Anacapa, and Santa Cruz Islands.

In 1996, we modified some of the existing monitoring protocols and added two new ones. These changes and additions are results of a Kelp Forest Monitoring Review Workshop that was held in 1995 (Davis et al., 1996) and statistical review of our sampling design (Schroeter et al. 1994). Preliminary results indicate that the new changes have maintained sampling precision and have enables us to better and more efficiently monitor kelp forest species.

INTRODUCTION

The waters of Channel Islands National Park and Channel Islands National Marine Sanctuary contain one-third of southern California's kelp forests (Davies, 1968). Giant kelp, *Macrocystis pyrifera*, is the primary constituent of a southern California kelp forest , and over 1,000 species of macro flora and fauna live in this community (Woodhouse 1981, Engle pers. comm.). The kelp forest serves as food, shelter, substrate, and a nursery to resident as well as migratory species. Many species, while not residents of the kelp forest, are dependent upon the existence and productivity of kelp forests; detrital flux from kelp forests provides an important source of nutrients to nearby rocky shore, sandy beach, and estuary communities. The kelp forests are essential to California's commercial and sport fisheries as well as the recreation and tourist industries.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the islands. The Channel Islands National Marine Sanctuary overlaps the subtidal portions of the park, and its boundary extends six miles seaward from the Park Islands. Channel Islands National Park also bears the designation of International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the resources within the Park and manages them through the California Department of Fish and Game.

The federal law which established Channel Islands National Park (16-USC-410) mandated the development of inventories and monitoring of natural resources in the Park. Kelp Forest Monitoring is part of the long-term ecological monitoring program at the Park which is designed to measure the health of the ecosystems. By determining the limits of normal variation and diagnosing abnormal conditions we hope to prescribe remedial action through management recommendations.

Following a five year design study that began in 1982, the Kelp Forest Monitoring Program was implemented in 1987 by the Park's resource management division, using the protocol established during the design phase (Davis and Halvorson, 1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). Richards et al. (in prep.), describe monitoring efforts and results for 1982-1989. Richards et al. (1993a), Richards et al. (1993b), Richards and Kushner (1994), Kushner et. al. (1995a), Kushner et al., (1995b), and Kushner et al. (1997) describe the 1990, 1991, 1992, 1993, 1994, and 1995 monitoring efforts and results respectively. A review of the kelp forest Monitoring program was conducted in 1995 (Davis et al., 1996).

This report summarizes the monitoring efforts and results from 1996, our fifteenth year of monitoring. It is hoped that these reports well provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in this near-shore ecosystem. We have highlighted some of the most important observations, and tried to provide a characterization for each site. Organisms are referred to by genus and species, except in the abstract and executive summary where both scientific and common names are used. Common names are cross referenced to their scientific names in Table 1. Since the design of the kelp forest monitoring project, several genera and species names have been changed. For the most part, the new and the old genus together are listed in this text. The new names are cross referenced in Table 1.

METHODS

Abundances and in some cases age structure of 68 taxa or categories of algae, fish, and invertebrates (Table 1) were measured at 16 permanent sites (Table 2) around the five Park islands (Figure 1). Site and species selection criteria, and sampling protocol are described in the Kelp Forest Monitoring Handbook (Davis et al., in prep.). Sites were monitored between June and October of 1996.

Each site is marked by a 100 m long transect affixed to the seabed. The sampling techniques employed to gather patterns of abundance and age structure are summarized in Table 3. At each station, 24 paired 1 m x 1 m quadrats that are systematically arranged along the transect with a random start, 40 continuous and adjacent 1m x 5m quadrats, and 24 paired 3 m x 10 m band transects that are systematically arranged along the transect with a random start, were used to determine densities and distribution of discrete benthic organisms; 600 random non-adjacent points (random point contacts - RPCs) were used to determine percent cover of encrusting invertebrates, algae and substrate composition; four 2 m x 3 m x 50 m fixed transects were used to determine fish abundance; roving diver fish count with a timed count and estimated abundance; video taped transects provide a record of the site appearance; and size frequency measurements were collected to determine age structure and recruitment cohorts. A general species list was established for each site, noting presence/absence and relative abundance for all recognizable species. Artificial recruitment modules (ARMs) were used at ten of the sites to measure recruitment and population structure of indicator species within the ARMs. A complete description of the monitoring protocols can be found in Davis et. al, (in prep.).

Animals measured for the natural size frequency distributions were located using a band transect type search method (Davis et al., in prep.) except in the following cases: *Strongylocentrotus purpuratus* were located using 0.5m^2 quadrats at Gull Island South, Fry's Harbor, Pelican Bay, and Scorpion Anchorage at Santa Cruz Island, and 1.0 m^2 quadrats at Admiral's Reef at Anacapa Island, Southeast Sea Lion, and Arch Point at Santa Barbara Island because of their high densities at these sites.

STOWAWAY$^{TM.}$ temperature loggers were deployed at all sites. Loggers were encased in underwater housings that were attached to stainless steel thread rods cemented to the bottom at each site. HOBOTEMP$^{TM.}$ temperature loggers were also deployed at each site as a backup in case of unit failure. The HOBOTEMP$^{TM.}$ loggers were programmed to record temperature every 4.8 hours, and the STOWAWAY$^{TM.}$ loggers were programmed to record the mean temperature of 100 temperature readings per hour.

STATION RESULTS

Sampling was completed at all 16 monitoring sites and a summary of the 1996 status of each site is presented in Table 4. Thirty-two divers (Table 5) collected data on seven five-day cruises between June and October. A total of 756 dives with 578 hours of bottom time were completed.

A brief description of each site is included with the station results below. Complete data summaries from the sampling protocol are listed in the appendices. Means for 1-m^2 quadrats (Appendix A) represent average counts obtained from 24 paired 1 m x 1 m quadrats that are systematically arranged along the transect with a random start. Means for 5m^2-quadrats (Appendix B) represent average counts obtained from 40 continuous and adjacent 1m x 5m quadrats. Note that when adult, subadult and juvenile densities for *Macrocystis pyrifera* are listed in the station descriptions, the adult and subadult densities come from the 5m^2-quadrats, and the juvenile densities come from the quadrat data unless otherwise noted.

Means for band transects (Appendix C) represent average counts obtained from 24 paired 3 m X 10 m transects that are systematically arranged along the transect with a random start. Means for random point contacts (Appendix D) represent average percent cover for a given organism or substrate at 15 quadrats that are systematic along the transect with a random start. Forty points from each quadrat (600 points total) are used to determine percent cover of selected organisms and substrate within one meter of the bottom. Percent cover may total more than 100% due to layering.

Means for fish transects (Appendix E) represent the average of four 2 m X 3 m X 50 m transects along the line. It should be noted that this is different from previous years when fish transects were 2m x 3m x 100m. Cases listed refer to the total number of passes over the transect made during sampling. All counts were conducted between 0900 and 1500 hours unless otherwise noted.

The Roving Diver Fish Count data are presented in Appendix F. The first page of this Appendix contains the number of observers that sampled and the total number of species that were observed for each sampling date and site. The following pages contain the average timed score and estimated abundance of each sampling date and site.

Natural habitat size frequency distributions for invertebrates other than gorgonians and *Stylaster (Allopora) californica* are in Appendix G. *Macrocystis pyrifera* size frequency distributions are in Appendix H. Gorgonian and *Allopora (Stylaster) californica* size frequency distributions are in Appendix I. Size frequency measurements taken from the Artificial Recruitment Modules were kept separate from the natural habitat

measurements and their distributions are in Appendix J. Species lists for all locations are in Appendix K. Video transects were completed for all locations.

Temperature data were collected at all 16 sites using STOWAWAY^{TM} and HOBOTEMP^{TM} temperature loggers. One of each type of logger was deployed at each site, but only the data from the STOWAWAY^{TM} was used, unless the unit failed, then the data from the HOBOTEMP^{TM} was used. Because our sampling is conducted June - September we will present 12 months of temperature data from June 1, 1995 to May 31, 1996 (Appendix L). Data are missing for the first three weeks in June at Fry's Harbor, and from June 1 to September 13, 1996 at Yellowbanks, Santa Cruz Island. The temperature loggers appear to have recorded times about 2 hours ahead of the actual time. This appears to be a result of a incorrect time in the computer that was used to launch the temperature loggers.

Starting on Cruise #4 of this year we began using a 50°F mercury thermometer to calibrate the temperature loggers. The thermometer is encased in a protective PVC housing, and the water temperature is recorded in situ at the location of the temperature logger when it is retrieved. This recorded temperature is then compared to the last recorded temperature on the logger. If the temperatures were very different, it will be noted as such.

This year as with previous years, sampling at the monitoring sites usually occurs over at least two separate dates, often several months apart. This occurs because we attempt to conduct fish transects at two different dates that are at least two weeks apart. During our first visit we attempt to conduct all of the abundance estimate techniques (quadrats, 5m2-quadrats, band transects, random point contacts, fish transects, and roving diver fish count). During the second visit, fish transects and any remaining size frequencies are conducted. Occasionally we do not finish one of the abundance techniques during our first visit, and subsequently finish it during our second visit. If it appears that this may have had an impact on the abundances taken, we make note of this in the results below. We sometimes observed large changes in the abundances of species over the course of the summer. When this occurs we have written up notes below.

Location: Wyckoff Ledge, San Miguel Island

1996 sampling dates: 7/22, 7/23, 9/18.
1996 status: Mature kelp forest with dense understory of red and brown algae.

On July 22nd canopy cover of *Macrocystis pyrifera* was estimated at 60%, and was predominately on the east and west ends of the transect, with little canopy over the center of the transect. We estimated that

75% of the adult *M. pyrifera* had tattered fronds that were covered with hydroids (*Obelia* sp. and another hydroid that grew in small clumps/tufts) and were harboring high numbers and often very large caprellid amphipods, the kelp isopod, *Idotea resecata*, and the kelp curler amphipods, *Amphithoe humeralis*. The other 25% of the kelp fronds appeared healthy with little epiphytic growth. During our second visit on September 18th, canopy cover was estimated at only 15%. This decrease in canopy cover appeared evident over the entire area of Wyckoff Ledge. Most of the kelp plants that reached the surface had few stipes, and these stipes had few blades. Stipes with only bladders attached and with no blades were common. Along the transect, small subadult and juvenile plants were moderately abundant. The "giant" caprellid amphipods, and *Amphithoe humeralis* that were present on July 23rd, were still moderately abundant, however their numbers seemed to have decreased with available substrate (canopy forming kelp plants). It is possible that the *A. humeralis* are responsible for the loss of *M. pyrifera*. Kelp crabs, *Pugettia producta* were moderately abundant during both visits on to the kelp stipes. The decrease in *M. pyrifera* around Wyckoff Ledge appeared to be a localized phenomena because further west towards Tyler Bight there appeared to be an abundance of healthy *M. pyrifera* plants.

Overall, this site appeared similar to last year. Adult, subadult and juvenile *M. pyrifera* were abundant along most of the transect with densities of 0.22/m^2, 0.41/m^2, and 2.2/m^2,respectively. Understory algae was abundant and diverse as usual for this site. Brown algae, mostly *Desmarestia* sp. was abundant covering 34% of the bottom. *Pterygophora californica* was common and several *Eisenia arborea* were observed; their coverage's were 7.0% and 0.67% respectively, however, none were observed on quadrat counts. *Cystoseira* spp. was common covering 11% of the bottom. Red algae was also abundant and diverse. *Gigartina* spp. (mostly *G. corymbifera*) was less abundant this year. *Gigartina* spp. covered 2.7% of the bottom compared to 19% in 1995. Miscellaneous red algae covered 79% of the bottom and consisted mostly of *Cryptopleura violacea* and several other species. Articulated and encrusting coralline algae covered 13% and 43% of the bottom respectively. Bare substrate coverage was similar to the past four years and covered 23% of the bottom.

The hydroid, *Aglaophenia latirostris*, was the most common miscellaneous invertebrate on RPCs and this Category covered 7.5% of the bottom. Ornate tube worms were common covering 14% of the bottom. *Phragmatopoma californica* covered 1.8% of the bottom and old/loose sand tubes from this worm were common in the low/sandy areas of the transect, but were not as abundant as in 1995. Miscellaneous bryozoans were common covering 6.7% of the bottom. Tunicates and sponges covered 2.0% and 0.5% of the bottom respectively. White spotted rose anemones were abundant on the tops of rocks, their density was 0.34/m^2. *Tethya aurantia* were moderately abundant with a density of 0.13/m^2. Gorgonians are uncommon at this site, and none were observed on band transects.

Mysids were abundant in the kelp canopy as well as on the bottom. As mentioned above, kelp isopods, *Idotea resecata*, were abundant among the *Macrocystis pyrifera* stipes near the surface. Very large caprellid amphipods, and kelp curler amphipods, *Amphithoe humeralis*, were also abundant in the upper parts of the *Macrocystis pyrifera* plants. Several large rock crabs, *Cancer* spp. (C. *productus* and/or *C. antenarius*), were observed along the transect. This area of San Miguel is actively fished for crab. There were several crab traps within several hundred meters on both sides of the transect.

Kelletia kelletii were counted on both quadrats and band transects, and their densities (with both techniques) were 0.21/m^2 . *Lithopoma (Astraea) gibberosum* were common with a density of 0.29/m^2. Olive snails, *Olivella biplicata*, were observed in the sandy areas on the west end of the transect. *Haliotis rufescens* density was 0.024/m^2.

Asterina (Patiria) miniata were common with a density of 1.2/m^2. Leather stars, *Dermasterias imbricata*, were relatively abundant, and the red sea star, *Mediaster aequalis*, were common. *Pisaster giganteus* were common on the rocky outcrops along the transect, however they were uncommon directly along the transect where they are counted on quadrats. *P. giganteus* was counted in both quadrats and 5m^2-quadrats, and densities were low, 0/m^2 and 0.015/m^2 respectively. Most of the *Pycnopodia helianthoides* observed were small and they were relatively uncommon; none were observed on band transects. *Strongylocentrotus franciscanus* and *S. purpuratus* were common, but confined to crevices which is usual for this site. None of either species of urchin were observed on quadrats this year. The lack of urchins in quadrats is unusual and is probably due to a combination of sea urchins patchiness at this site, and the decrease in the number of quadrats we are conducting (12 quadrats instead of 20).

On July 22, 1996 fish did not appear as abundant as previous years. Adult and juvenile *Embiotoca lateralis* were abundant. Juvenile *Embiotoca jacksoni* were common. S*ebastes atrovirens* were moderately abundant. S*ebastes mystinus*, S*ebastes chrysomelas* (black and yellow rockfish), and S*ebastes carnatus* (copper rockfish) were all common. One *Ophiodon elongatus* (lingcod) was observed as were several S*ebastes* s*erriceps* (treefish), S*ebastes miniatus* (vermilion rockfish), male and female S*emicossyphus pulcher* were observed. *Aulorhynchus flavidus* (Tubesnouts) were abundant and a large school was present during the roving diver fish count. Two large S*ebastes flavidus* (yellowtail rockfish) were also observed. *Coryphopterus nicholsii* were uncommon and none were observed on quadrats. Roving diver fish counts were conducted on July 22 with six divers and on September 19th with four divers; 28 and 23 species of fish were observed respectively.

Both the Stowaway and Hobotemp temperature loggers were retrieved. It appears that the Stowaway logger was recording temperatures that were 4-7° F lower than the actual temperature. The day the temperature

loggers were retrieved, an Edge dive computer was recording temperatures between 56-58° F on the bottom, the Hobotemp was recording similar temperatures, while the Stowaway was recording temperatures several degrees lower. However, the Stowaway temperature logger was checked in a ice bath with another Stowaway logger back in the office, and both checked out within specifications.

Location: Hare Rock, San Miguel Island

1996 sampling dates: 7/23, 8/7, 9/19.
1996 status: S*trongylocentrotus franciscanus* Barrens.

The condition of this site was similar to previous years, and it continues to be dominated by *Strongylocentrotus franciscanus*. The only macroalgae along the transect was some *Laurencia pacifica* on the tops of rocks. Near the transect, on top of large rocks were two juvenile *Macrocystis pyrifera*, and one adult and two juvenile *Eisenia arborea* were observed. *Gigartina corymbifera* and *Desmarestia* sp. was also observed nearby. Excluding coralline algae, algae combined covered only 2.5% of the transect. Articulated coralline algae was uncommon covering 0.17% of the bottom. Most of the bottom was either bare or covered with encrusting coralline algae; their coverage's were 26% and 42% respectively. There were many large breaks in the line, and about 35 meters of lead line was replaced.

Miscellaneous invertebrates covered 19% of the bottom and the most common animals were terebellid worms and the worm *Dodecaceria fewkesi*. The terebellid worms were abundant in the low lying cobble areas along the transect, and their tentacles covered the majority of the bottom in some areas. *Corynactis californica*, and *Balanophyllia elegans* were moderately abundant with coverage's of 9.7% and 2.0% respectively. *Astrangia lajollaensis* were common with a density of 1.1%. While replacing some of the lead line, we removed a piece that was buried and uncovered a *Sipunculus nudus*.

Strongylocentrotus franciscanus were abundant and dominated the site with a density of 10/m^2. Both adult and juvenile *S. franciscanus* were abundant and found out in the open, however juveniles had a more patchy distribution. *S. franciscanus* had notably long and brittle spines that were easily broken off. Adult and juvenile *S. purpuratus* were common but also had a patchy distribution; their density was 0.21/m^2 along the transect. Many of the juvenile *S. franciscanus* and *S. purpuratus* had pieces of rock or shell attached to them. *Asterina* (*Patiria) miniata* were abundant with a density of 2.3/m^2. *Pisaster giganteus* were also abundant and counted on both quadrats (0.5/m^2) and 5m^2-quadrats (0.42/m^2). Small and large *Pycnopodia helianthoides* were moderately abundant along the transect with a density of 0.038/m^2. *Parastichopus parvimensis* were very large, but were not very abundant and had a density of 0.13/m^2.

During our August visit, mysids were extremely abundant on the bottom. Both small and large mysids were present, and their shear numbers combined with green water, greatly reduced visibility at this site. Although barnacles were not noticeably abundant this year, the temperature logger housing was almost completely covered with *Megabalanus califonicus*. Most of these barnacles were large (17mm wide, by 35mm long), however many were dead. The temperature logger housings are cleaned before they are deployed, which means the barnacle growth occurred during the past year.

Small (10-20mm) *Haliotis rufescens* were common under small rocks, and fresh shells ranging from 12-64mm were common along the bottom. It appears that there was an increase in the number of both shells and live *Haliotis rufescens* that were less than 20mm this year, indicating recent recruitment. It should be noted, however, that none of these abalone were observed during band transects because invasive sampling is not conducted. *Kelletia kelletii* were uncommon and none were observed during band transects. *Aplysia californica* were uncommon this year with a density of 0.0056/m^2. *Cypraea spadicea* were common as usual for this site with a density of 0.58/m^2.

Overall, fish were common at this site. *Sebastes mystinus*, and *S. serranoides* were the most common. *Chromis punctipinnis*, *Damalichthys vacca*, *Embiotoca jacksoni*, and *E. lateralis* were all common. Female *Semicossyphus pulcher* were also common and several males were observed. *Coryphopterus nicholsii* were common with a density of 0.71/m^2. The roving diver fish counts were conducted on September 19th with 5 divers who observed 17 species of fish.

Location: Cuyler Harbor, San Miguel Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Sampling date: 7/23
Status: Mature kelp forest on the rocky bottom, with intermittent patches of sand.

Several divers made a recreational dive here. Adult and juvenile *Macrocystis pyrifera* was moderately abundant and healthy on the low lying rocky substrate. These areas had an abundance of understory brown (mostly *Desmarestia* spp.) and red algae. Most of the high relief rocks in this area were *Strongylocentrotus franciscanus* barrens. Large *Haliotis rufescens* were rare, only one was observed by the four divers. Small (approximately 25mm) *Haliotis rufescens* were common under rocks. Large rock crabs (*Cancer productus* and/or *C. antenarius*) were common.

Location: Tyler Bight, San Miguel Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Loran #s: 27861.9 ; 41647.6/7
Sampling date: 9/18
Status: Kelp forest.

We conducted a brief survey dive, and collected *Coryphopterus nicholsii* for Dr. Milton Love. *Macrocystis pyrifera* was moderately abundant and healthy on the rocky substrate. Understory red and brown algae was also abundant and similar to Wyckoff Ledge. We collected six *C. nicholsii* at this site. *C. nicholsii* were relatively uncommon, and it took a little while to learn what habitats they were easy to collect in. In short, they were much easier to net on sandy substrate. Peter Haaker searched for and measured *Haliotis rufescens*, however the area where he was searching had few abalone. The area about 100m from where he was, had an abundance of *H. rufescens* that were observed by other divers. In this area, *H. rufescens* shells were also relatively abundant, and many were fresh.

Location: Offshore of Otter Harbor, San Miguel Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Latitude: N 34:02.92 Longitude: W 120:24.66
Sampling date: 7/19
Status: Mature kelp forest.

We conducted a survey dive offshore, not too far from the intertidal monitoring site at Otter Harbor. The depth of this reef ranged from 13 - 22 meters, and there was a lot of relief. This area had a thick, healthy canopy cover of *Macrocystis pyrifera*. On the bottom, most of the plants were mature, large, and widely spaced. Overall, there was little understory algae, except for an occasional patch of *Dictyota/Pachydictyon*, occasional *Laminaria farlowii*, and an abundance of encrusting and articulated coralline algae. The area reminded us of Northern California. *Strongylocentrotus franciscanus* were common, but the area looked picked over for commercially legal urchins. Although the area appeared to be good habitat for adult *Haliotis rufescens*, none were observed. Small fresh *H. rufescens* shells were common, but large shells were relatively rare. *Tethya aurantia* and various other sponges were notably abundant. We collected 14 *Coryphopterus nicholsii* for Dr. Milton Love at UCSB.

Location: Harris Point, San Miguel Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.

Sampling date: 9/19
Status: Kelp forest.

A brief survey dive was conducted here to look at the *Haliotis rufescens* population. Size frequency measurements were conducted for *H. rufescens*, and Peter Haaker from the California Dept. of fish and Game recorded the data. Adult and juvenile *H. rufescens* were relatively abundant, however there were few commercially legal abalone. This area consisted of a dense kelp forest down to a depth of about 10m, however, at depths greater than 10m the area was mostly *Strongylocentrotus franciscanus* barrens. We collected 10 *Coryphopterus nicholsii* for Dr. Milton Love at UCSB.

Location: Johnson's Lee North, Santa Rosa Island

1996 sampling dates: 8/5, 8/6, 9/17.
1996 status: Kelp forest.

There was notably less large *Macrocystis pyrifera* plants and less canopy along the transect this year. Canopy cover was estimated at 30%, and was thin. On August 5th, adult, subadult and juvenile *M. pyrifera* densities were 0.24/m^2, 0.77/m^2, and 4.0/m^2 respectively, and covered 37% of the bottom. Most of the *M. pyrifera* appeared healthy. During our second visit on September 17th, the most notable difference at the site was an increase in subadult *M. pyrifera*. We decided to conduct 5m^2-quadrats for a second time to see if there was a significant change: adult and subadult densities were recorded at 0.15/m^2 and 1.8/m^2, respectively. On September 17th, the *M. pyrifera* plants still appeared healthy with few epiphytes growing on the blades. At this site we noted that the *M. pyrifera* plants on the inshore side of the transect appeared to be larger than the offshore side of the transect, and feel this is most likely due to the difference in substrate type. The inshore side of the transect has more relief which is better substrate for kelp attachment than the offshore side which consists mostly of flat shale type rock.

Understory algae was moderately abundant along the bottom and diverse. Adult and juvenile *Pterygophora californica* were common with densities of 0.25/m^2 and 0.17/m^2 respectively, and covered 17.0% of the bottom. Adult and juvenile *Laminaria farlowii* densities were 0.13/m^2 and 0.21/m^2 respectively, and covered 2.7% of the bottom. *Cystoseira* spp. was common covering 6.8% of the bottom. Miscellaneous red algae (mostly *Rhodymenia* sp., *Callophyllis violacea*, and *C. flabellulata*) and *Gigartina* spp. (mostly *Gigartina corymbifera*) were relatively abundant with coverage's of 51% and 11% respectively. Articulated coralline algae covered 4.2% of the bottom. Encrusting coralline algae was relatively uncommon covering 7.5% of the bottom. Bare substrate was abundant, covering 40% of the bottom, its highest recorded coverage for this site. Much of the bottom appeared scoured, and may have been due to the large south swell that was

experienced several weeks prior to our visit. This may have been a factor in the relatively low canopy cover as well. Percent cover of sand continued to increase this year, covering 13% of the bottom, also its highest recorded coverage for this site. Much of the bare substrate recorded was several cm of sand over rock.

The most common miscellaneous invertebrates on RPCs were hydroids. This category covered 10% of the bottom. Tunicates and sponges were less abundant than the previous several years, and covered 3.3% and 0.83% of the bottom this year. The tunicate, *Pycnoclavella stanleyi*, was notably less abundant than last year. *Phragmatopoma californica* were common in kelp holdfasts, but not as abundant as the previous several years This years coverage was 1.2%. Bryozoans were common, combined they covered 18% of the bottom. *Tethya aurantia* were common with a density of 0.047/m^2.

Strongylocentrotus franciscanus were common in crevices, their overall density along the transect was 0.42/m^2. *S. purpuratus* were uncommon, and only one was observed on quadrats (0.042/m^2). The two divers who collected the size frequency data for *S. franciscanus* and *S. purpuratus* kept track of the number of sea urchins that they observed, but could not measure because the sea urchins were in crevices. One diver measured 34 *S. franciscanus* and 17 *S. purpuratus*, and saw an additional 108 *S. franciscanus* and 38 *S. purpuratus* that could not be measured. The second diver measured 27 *S. franciscanus* and 20 *S. purpuratus*, and saw an additional 13 *S. franciscanus* and 14 *S. purpuratus* that could not be measured. Because the sea urchins are often in crevices it is difficult to conduct size frequency measurements at this site.

Patiria miniata were and *Pycnopodia helianthoides* were common with densities of 0.50/m^2 and 0.036/m^2 respectively. Leather stars, *Dermasterias imbricata*, were also common. *Pisaster giganteus* were common and counted on both quadrats and 5m^2-quadrats. Their respective densities were 0.21/m^2 and 0.22/m^2. We counted *P. giganteus* a second time when 5m^2-quadrats were again sampled on September 17th, on this date the density was 0.11/ m^2 (again, these data were not entered in the database). *Parastichopus parvimensis* density was 0.33/m^2. On September 17th, whole fresh sea urchin tests were common, and were most likely from predation by *Pycnopodia helianthoides*. *Pycnopodia helianthoides* appeared more abundant on this visit, and size frequencies were conducted for a second time. On September 17th, we located and measured 34 *Pycnopodia helianthoides*, while on August 5th only seven stars were located for size frequency measurements. Since we are unable to tell if we measured the same animals on the two sampling dates, only the larger sample size was entered in the database.

One *Panulirus interruptus* was observed on band transects. *Cypraea spadicea* were common with a density of 0.54/m^2. Several very large *Lithopoma (Astraea) undosum* were observed, but were rare and none were observed on quadrats. *Kelletia kelletii* were uncommon as usual for this site. *Megathura crenulata* were

common on the rocky outcrops with a density of 0.014/m^2. *Haliotis rufescens* were present under ledges and in crevices, but were patchy. Their density was 0.013/m^2. Only one large abalone was found in the area about one meter east of the 73 m mark that was mentioned last year. One small *H. rufescens* measuring 25mm was found under a S*trongylocentrotus franciscanus* during size frequency measurements. Abalone shells were collected, measured and disposed of off the transect. One old *H. corrugata* shell measuring 62mm was found.

Fish were relatively abundant and diverse along the transect on August 5th. Adult and juvenile *Embiotoca jacksoni* and *E. lateralis*, small olive rockfish, S*ebastes atrovirens*, *S. chrysomelas* (black and yellow rockfish), *Chromis punctipinnis*, *Girella nigricans*, *Damalichthys vacca*, and small *Heterostichus rostratus* (giant kelpfish) were all common. *Atherinops affinis* (top smelt), and *Trachurus symetricas* (jack mackerel) were present at the site. *Oxyjulis californica* were common and juveniles were abundant in small schools along the transect. No fish were observed on quadrats this year. The resident *Hypsypops rubicundus* at 73 m along the transect was present as usual with a nest, but with no eggs. On September 17th, adult and juvenile *Embiotoca jacksoni* were notably abundant. Roving diver fish counts were conducted on August 5th with seven six divers and on September 18th with four divers. On the fish counts, 27 and 20 species of fish were observed respectively.

All but one of the 13 ARMs were intact, and appeared not to have moved. It seems that if the ARMs are placed in strategic areas, near large rocks, they are protected from large swells. ARM # 2392 of the south group of ARMs moved inshore about 10 meters, and the first two layers of bricks were broken in half. This ARM was found upright and was sampled for all indicator species before it was moved back with the rest of the ARMs from this group. The remaining ARMs were sampled for all indicator species. Several of the new stainless steel tags that replaced the old brass tags last year had fallen off. This has happened from the apparent corrosion of the stainless steel wire we used. We reattached all of the stainless steel tags that were still present with cable ties, and renumbered the ARMs that didn't have tags.

In the 13 ARMs, four native *Haliotis rufescens* were found, measuring 61, 102, 150, and 156mm. A total of 25 small (all less than 68mm) *Crassedoma (Hinnites) giganteum* were found, more than the past several years. *Asterina (Patiria) miniata* were common (3.5/ARM) with about the same number as last year. *Pisaster giganteus* and *Pycnopodia helianthoides* were common. All of the stars mentioned above were much smaller than the ones located for the natural habitat size frequencies. The number of *Strongylocentrotus franciscanus* (18/ARM) and *S. purpuratus* (9.8/ARM) per ARM decreased since last year. This is the first year these have decreased since monitoring began for them in the ARMs at this site in 1992.

Location: Johnson's Lee South, Santa Rosa Island

1996 sampling dates: 8/6, 8/7, 9/17, 9/18.

1996 status: Mature kelp forest with a dense understory of red algae.

Overall, this site has changed little during the past several years. *Macrocystis pyrifera* canopy cover was thin and estimated at 20%. The *M. pyrifera* plants were healthy with few epiphytes growing on the blades. There were few large adult *M. pyrifera* plants, but subadults and juveniles were common. Their densities were 0.13/m^2, 0.54/m^2 and 1.2/m^2 respectively. Similar to Johnson's Lee North, small subadult *M. pyrifera* plants appeared to be more abundant during our September visit to this site. Adult and juvenile *Laminaria farlowii* were common with densities of 0.38/m^2 and 1.4/m^2 respectively. No adult *Pterygophora californica* or *Eisenia arborea* were observed on quadrats, but several were present along the transect. Juvenile density of these algae were 0.25/m^2 and 0.83 respectively. On RPCs, *M. pyrifera*, *L. farlowii*, *E. arborea* and *P. californica* covered 29%, 7.3%, 1.2%, and 2.7% of the bottom respectively. Understory red algae was abundant and covered almost the entire bottom along the transect. Abundant understory red algae made finding the transect difficult, as only several meters of the transect line were visible. Miscellaneous red algae covered 89%, and *Gigartina* spp. covered 9.8% of the bottom. Articulated and encrusting coralline algae were common covering 10% and 18% of the bottom respectively. Bare substratum was recorded at its highest level for this site (30% cover). Sandy substratum was common and covered 30% of the bottom.

Hydroids (mostly *Aglaophenia latirostris)* were the most common miscellaneous invertebrate on RPCs. This category covered 18% of the bottom. Tunicates and sponges were common covering 6.3% and 1.3% of the bottom respectively. *Balanophyllia elegans* were abundant and covered 6.3% of the bottom. *Diopatra ornata* were abundant in patches in the low lying, sandy areas around the transect, their coverage was 13%. Bryozoans were abundant and covered 19% of the bottom. *Styela montereyensis* were common (0.25/m^2), but have decreased in density over the past several years. *Tethya aurantia* were abundant with a density of 0.13/m^2, and many small ones were present but they were difficult to see. *Urticina (Telia) lofotensis* were common with a density of 0.067/m^2. *Lophogorgia chilensis* were moderately abundant with a density of 0.14/m^2.

Strongylocentrotus franciscanus and *S. purpuratus* were common in crevices, but their overall densities were low at 0.75/m^2 and 1.4/m^2 respectively. *S. franciscanus* and *S. purpuratus* were found exclusively in crevices, making measurements of size frequencies difficult. Therefore we enumerated all sea urchins that we were unable to measure. Only 96 of the 139 *S. franciscanus* and 36 of the 73 *S. purpuratus* were able to be measured. Juvenile *Strongylocentrotus* spp. were uncommon, only one *S. purpuratus* less than 20mm and no *S. franciscanus* less than 20mm were observed. *Pycnopodia helianthoides* were relatively uncommon for this site with a density of 0.018/m^2. Whole sea urchin tests were also uncommon this year

probably indicating low mortality due to predation by *P. helianthoides*. *Asterina* (*Patiria) miniata* were abundant as is usual for this site, with a density of 3.2/m^2. *Pisaster giganteus* were common and were counted on both quadrats (0.17 /m^2) and 5m^2-quadrats (0.16/m^2). *Parastichopus parvimensis* were relatively uncommon as is usual for this site, only two (0.083/m^2) were observed on quadrats.

Cypraea spadicea were common with a density of 0.25/m^2. *Haliotis rufescens* were present in small aggregations in crevices. Six (0.0083/m^2) *H. rufescens* were observed on band transects. No one observed the large *H. rufescens,* near the north end of the transect under a small ledge, that had been present for the past several years. Abalone shells were collected, measured and disposed of off the transect. One fresh *H. corrugata* shell measuring 46mm was found.

Adult *Chromis punctipinnis*, *Oxyjulis californica*, female *Semicossyphus pulcher*, and *Sebastes atrovirens* were common. Adult and juvenile *Embiotoca jacksoni* and *Damalichthys vacca* were moderately abundant. *Coryphopterus nicholsii* were uncommon with a density of 0.083/m^2. Roving diver fish counts were only conducted once at this site, on August 6th, and six divers observed 23 species of fish.

The four ARMs present at this site were sampled for all indicator species. Two of the ARMs were missing number tags (# 2335, 2336) and they were replaced with new stainless steel tags (#2420 and #2421). The ARMs that are placed next to large rocks appeared to in stable positions, one ARM, however, was found on its side but had not moved very far. Three new ARMs were deployed (#2417, #2418, and #2419) to replace the three ARMs that were lost in 1995.

No *Haliotis rufescens* were found in the ARMs. *Asterina* (*Patiria) miniata* were abundant with a mean of 15/ARM. In the four ARMs, four *Pycnopodia helianthoides* and four *Pisaster giganteus* were found, all were small. *Strongylocentrotus franciscanus* were common and *S. purpuratus* were rare. Mean number per ARM were 19 and 1, respectively.

The Stowaway temperature logger stopped taking data on 6/19/96 due to battery failure. The Hobotemp temperature logger stopped taking data on 7/19/96 because the unit reached data capacity, therefore there is a 18 day gap in the temperature data.

Location: Rodes Reef, Santa Rosa Island

1996 sampling dates: 7/10, 9/20.

1996 status: Open area with a moderate amount of understory red algae.

Overall, this site appeared similar to last year. *Macrocystis pyrifera* canopy was estimated to cover less than five percent of the transect. Although there was more *M. pyrifera* than in 1995, it was still relatively uncommon. Most of the adult *M. pyrifera* plants were small, and few reached the surface. No adult *M. pyrifera* plants were within one meter of the transect, but seven subadults were counted on the $5m^2$-quadrats ($0.035/m^2$). Juvenile *M. pyrifera* were common along the transect with a density of $0.42/m^2$. On RPCs, *M. pyrifera* covered 5.7% of the bottom. During our second visit on September 20th, several small adult *M. pyrifera* plants were present along the transect around the 30m mark, and several plants were present just west of the west end of the transect. All of the *M. pyrifera* plants had tattered fronds, and most didn't reach the surface. Many of the longer stipes had bladders but no blades attached to them.

Adult and juvenile *Laminaria farlowii* densities were $0.083/m^2$ and $0.042/m^2$ respectively, and together they covered 5.3% of the bottom on RPCs. One juvenile *Eisenia arborea* was observed. *Cystoseira* sp. (most likely *Cystoseira neglecta*) was common, however no plants were present directly along the transect line, resulting in a 0% coverage on RPCs. Several plants were up to 10m tall and south of the east end of the transect the plants created a small, but dense forest. Miscellaneous brown algae covered 8.8% of the bottom and consisted mostly of *Dictyota/Pachydictyon* and a filamentous brown alga. This is the highest coverage for this category since 1983. *Desmarestia* sp. was common and covered 23% of the bottom, this was the highest coverage of this species since 1986. Miscellaneous red algae was abundant and diverse and covered 72% of the bottom. The most abundant red algae were *Acrosorium uncinatum*, *Fauchea lacinata*, and *Callophyllis* sp.. Articulated coralline was uncommon, and encrusting coralline algae covered 43% of the bottom. Bare substrate covered 5.5% of the bottom, a decrease from 13.4% cover in 1995.

The most common miscellaneous invertebrates on RPCs were *Chaetopterus variopedatus*, *Pista elongata*, hydroids and *Cucumaria piperata*. This category covered 17% of the bottom. *C. variopedatus* were notably less abundant than the last two years. *Diopatra ornata* were also less abundant covering 2.2% of the bottom. Miscellaneous red algae was common growing on the top of *D. ornata*. *Astrangia lajollaensis* and *Balanophyllia elegans* were moderately abundant on the rocky/western half of the transect, and they covered 6.7% and 1.3% of the bottom, respectively. Bryozoans were common and covered 6.5% of the bottom. *Urticina (Telia) lofotensis* were common ($0.036/m^2$) on the tops of rocks. *U. coriacea* and *U. colombiana* were also common. *Lophogorgia chilensis* were uncommon, only one was observed on band transects. *Styela montereyensis* were common ($0.29/m^2$), but have been gradually decreasing in density since 1993.

Echinoderms, especially sea stars, were abundant and diverse at this site. *Strongylocentrotus franciscanus* and *S. purpuratus* were common along the western/rocky half of the, and their overall densities were 3.8/m^2 and 0.75/m^2 respectively. It appeared that most of the *Strongylocentrotus* spp. were confined to crevices this year as opposed to 1995 when they were mostly out in the open. While measuring *S. franciscanus* for size frequencies we noticed that juvenile conspecifics were moderately abundant under the large *S. franciscanus* that were present along the middle part of the transect, but the juveniles were uncommon on the west end of the transects. Juvenile *S. purpuratus* were uncommon. No *Lytechinus anamesus* were observed this year. *Parastichopus parvimensis* were common on the western/rocky half of the transect, however none were observed on quadrats. The sea cucumber, *Cucumaria piperata*, was notably abundant.

Sea stars were abundant and appeared to dominate this site. *Asterina (Patiria) miniata* were abundant with a density of 2.2/m^2. *Pisaster giganteus* were common and were counted on both quadrats (0.25/m^2) and 5m^2-quadrats (0.16/m^2). *Pycnopodia helianthoides* were common with a density of 0.018/m^2. *Dermasterias imbricata* (leather star), *Henricia leviuscula* (blood stars), *Henricia* sp., *Mediaster aequalis* (red sea star), *Pisaster brevispinus* (short spined sea star) were all common. *Orthasterias koehleri* (rainbow stars) were rare.

Kelletia kelletii were less common than the last two years, and were counted on both band transects and quadrats. Their densities using these procedures were 0.049/m^2 and 0.15/m^2 respectively. Several *Astraea undosa* were observed along the transect, but none were observed in quadrats. No *Haliotis* spp. were observed this year. *Aplysia californica* were common with a density of 0.019/m^2. Caprellid amphipods were abundant on some of the *Cystoseira* sp. plants. Mysids were abundant on the bottom.

Fish were moderately abundant. Most notable were numerous male *Semicossyphus pulcher* of moderate size. Female *S. pulcher* were common. *Sebastes atrovirens* were moderately abundant. *S. serranoides*, *S. caurinus*, *S. mystinus*, *Chromis punctipinnis*, *Embiotoca jacksoni* and *E. lateralis* were all common. Several *S. chrysomelas*, *Paralabrax clathratus*, and *Caulolatilus princeps* (ocean whitefish) were observed. A large school of small *Aulorhynchus flavidus* (tubesnouts), and only one *Oxyjulis californica* were observed. Parasitic copepods were abundant on the male *S. pulcher*. On September 20th, fish were notably less abundant than on July 10. However, *Oxylebius pictus* (painted greenlings) were moderately abundant. Roving diver fish counts were conducted on July 10 with seven divers and on September 20th with only two divers. On the fish counts, 22 and 13 species of fish were observed respectively. The low number of fish species observed on the later count may be an artifact of the low sample size (number of divers/observers).

On July 8th we observed fish and birds feeding on what appeared to be bait on the surface. A small school of these "bait" came close to the boat, and we were able to take a sample of them with a dip net. The net was full of krill (hundreds of animals), *Euphausia pacifica*. The krill were around the boat for about 30 minutes.

We observed the sport fishing boat "Island Tak" fishing approximately 250 meters southwest of the transect on July 10, 1996.

On July 10th, four new thread rods were installed for transect stakes. These were placed at meters 50, 80, 90, and 100. On September 20th, two additional thread-rods were installed at 20 and 30m along the transect New stakes are still needed at 60, and 70 meter marks.

Location: Offshore of Jolla Vieja Canyon, Santa Rosa Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Latitude: N 33:53.82 Longitude: W 120:04.73
1996 sampling dates: 9/17.
Status: Mature kelp forest, some small patches of *Pachythyone rubra* barrens.

We conducted a survey dive of the area, and searched for abalone. The five divers were only able to find four live *Haliotis rufescens* (178, 181, ~145, and ~150mm). Some *H. rufescens* shells were observed. Overall, *Haliotis* spp. were uncommon, and there were few shells.

This area appeared similar to the Johnson's Lee area, except that there was less topographical relief and a little more sand. This area was typical of a mature kelp forest with large widely spaced *Macrocystis pyrifera* plants. Some *Eisenia arborea* was present and an occasional dense patch of *Pterygophora californica* were observed. *M. pyrifera* plants were more sparse than at the Johnson's Lee sites. The brown alga, *Pachydictyon/Dictyota* was common.

Fish were abundant and notably large in the area. Large (probably up to 15 pounds) male and female *Semicossyphus pulcher* were abundant, as were large *Paralabrax clathratus*, *Sebastes serranoides*, and *Girella nigricans*. Adult and especially juvenile *Embiotoca jacksoni* and *S. atrovirens* were also abundant.

Location: Gull Island South, Santa Cruz Island

1996 sampling dates: 7/11, 9/30, 10/1.
1996 status: *Strongylocentrotus purpuratus* barrens.

This site was more barren than it has been in many years. Excluding encrusting coralline algae, all other algae combined covered only 6.2% of the bottom on RPCs. This is the lowest combined algal coverage for this site since monitoring began. There was only one adult *Macrocystis pyrifera* plant present along the transect; this plant was on top of the reef at the south end of the transect. On September 10th, our second visit to this site, this plant had been reduced to just a holdfast. Several small juvenile *M. pyrifera* plants were observed along the transect, and were all attached to the lead line. No *M. pyrifera* was observed using the quadrat, $5m^2$-quadrat or random point contact sampling methods, but there were several small patches of canopy forming *M. pyrifera* that were visible around Gull Island. Adult and juvenile *Eisenia arborea* were rare along the transect, and none were observed in quadrats or RPCs. *Cystoseira* sp. and *Laminaria farlowii* were absent along the transect. Miscellaneous red algae and articulated coralline algae were relatively uncommon and both had record low coverage for this site, 3.5% and 0.33% cover, respectively. Miscellaneous plants, consisting mostly of diatom film covered 2.7% of the bottom. Encrusting coralline algae was abundant covering 62% of the bottom and bare substrate covered 10%. The area just inshore of the transect was also *Strongylocentrotus purpuratus* barrens

On RPCs, the most common miscellaneous invertebrates were hydroids and the Christmas tree worm, *Spirobranchus spinosus*. This category covered 5.7% of the bottom, and is the lowest coverage since 1983. *Corynactis californica* covered 3.8% of the bottom. Balanophyllia elegans and *Astrangia lajollaensis* were moderately abundant covering 6.5% and 4.2% of the bottom respectively. *Diopatra ornata* were abundant in the low-lying sandy areas of the transect. Along the line they covered 1.8% of the bottom. Bryozoans combined covered 5.3% of the bottom, a decrease in coverage from the past several years. Sponges and tunicates covered 0.17% and 1.5% of the bottom respectively. *Stylaster (Allopora) californica* density was similar to previous years, $0.06/m^2$. As usual, *Lophogorgia chilensis* were abundant ($0.18/m^2$).

Strongylocentrotus franciscanus and *S. purpuratus* densities were relatively high ($5.7/m^2$ and $28/m^2$ respectively). These densities were similar to 1995. As is usual for this site, *S. purpuratus* were more abundant and small on the northern end of the transect. Juvenile *S. franciscanus* and *S. purpuratus* were rare. Only one *Lytechinus anamesus* was observed at the site on July 11, and none were observed during band transects. One square meter quadrats were used to measure the *S. purpuratus* and some of the *S. franciscanus* for size frequencies. Additional *S. franciscanus* were located using the band transect search method. Out of 410 *S. purpuratus* collected for size frequencies, seven were observed with wasting syndrome. Most of the *S. franciscanus* and *S. purpuratus* were out in the open, however, some were seen in crevices. Whole *S. franciscanus* and *S. purpuratus* tests were common and often in small piles, possibly a result of predation by *Pycnopodia helianthoides*.

Asterina (Patiria) miniata were common with a density of 1.1/m^2. *Pisaster giganteus* were also common and counted on both quadrats and 5m^2-quadrats. The densities were the same on both techniques, 0.25/m^2. *Pycnopodia helianthoides* were common with a density of 0.013/m^2. *Parastichopus parvimensis* were moderately abundant for this site, 1.2/m^2.

Cypraea spadicea were common with a density of 0.63/m^2. *Lithopoma (Astraea) undosum* were rare (0.083/m^2). *Kelletia kelletii* and *Megathura crenulata* were common with densities of 0.036/m^2 and 0.071/m^2 respectively. *Aplysia californica* were relatively common for this site with a density of 0.029/m^2. During our second visit on September 30th fresh shells from two *Haliotis corrugata* (41 and 46mm), and one flat abalone, *Haliotis walallensis*, (31mm) shells were found.

Small *Sebastes serranoides* were common and several large ones were observed. *Chromis punctipinnis*, small female and large male *Semicossyphus pulcher* were common. *Oxyjulis californica* were relatively uncommon, and several *Halichoeres semicinctus* were observed. One California scorpionfish, *Scorpaena guttata* was observed. *Coryphopterus nicholsii* were common with a density of 0.67/m^2. One California moray eel, *Gymnothorax mordax*, was observed on the south end of the transect. One juvenile *Sebastes mystinus* was observed. Roving diver fish counts were conducted on July 11th by six divers and on September 30th by five divers. Twenty-four and 21 species of fish were observed on the fish counts, respectively.

There are three groups of five ARMs at this site. Seven ARMs were monitored for all indicator species: two from the north and middle groups, and three from the south group. The remaining eight ARMs were sampled for all indicator species except sea urchins. The only abalone found was a 28mm flat abalone, *Haliotis walallensis. Cypraea spadicea* were common and about the same number were seen as last year. Small *Megathura crenulata* were relatively common with 10 being found in the 15 ARMs. Asterina (*Patiria) miniata* were moderately abundant; 91 were found in the ARMs. *A. miniata* has gradually increased in abundance in the ARMs over the last three years. *Pisaster giganteus* were common and one *Pycnopodia helianthoides* was found. The number and size of *Strongylocentrotus franciscanus* remained similar to last year. The number and mean size of *S. purpuratus* declined since last year. Several of the ARMs in the north group had one or two layers of bricks buried in the sand. Many of the ARM cages were starting to rust and will need to be replaced.

Location: Fry's Harbor, Santa Cruz Island

1996 sampling dates: 7/24, 10/2

1996 status: Open area with high densities of aggregating red sea cucumbers, *Pachythyone rubra* and *Astrangia lajollaensis*. S*trongylocentrotus purpuratus* density is also increasing.

Except for a notable increase of brittle stars, *Ophiothrix spiculata*, this site has changed little since 1995. *Macrocystis pyrifera* was absent and there was little other foliose algae along the transect. There were several adult *Laminaria farlowii* and *Eisenia arborea* on top of the large boulders along the north end of the transect, but none were observed in the quadrats. Excluding coralline algae, all other algae combined covered only 1.8% of the bottom and consisted mostly a filamentous red alga. Articulated coralline algae were uncommon and none were observed on RPCs. Encrusting coralline algae covered 33% of the bottom. Bare substrate covered 17% of the bottom.

The most common miscellaneous invertebrates on RPCs were the brittle star, *Ophiothrix* s*piculata*, hydroids and a small unidentified anemone. *O.* s*piculata* was counted separately and then added to the miscellaneous invertebrate category. Combined miscellaneous invertebrates covered 24% of the bottom, and *O.* s*piculata* was responsible for 16%. *Astrangia lajollaensis* were abundant covering 21% of the bottom. *Balanophyllia* elegans, and *Corynactis californica* were common. *Lophogorgia chilensis* were abundant on the deeper side of the transect, their overall density was 0.14/m^2. *Diaperoecia californica* were more common than last year and covered 6.0% of the bottom. The bryozoan, *Thalamoporella californica* was less abundant than last year. Miscellaneous bryozoans covered only 1.8% of the bottom, a relatively low percent cover for this site. *Tethya aurantia* density was 0.0069/m^2, its lowest recorded coverage. Many of the *T. aurantia* were discolored by abundant silt that covered them, thus the low density could be an artifact of the silt making *T. aurantia* being more difficult to see.

Pachythyone rubra continued to dominate this site, and covered 30% of the bottom. *P. rubra* are easily disturbed, and we were careful not to disturb the bottom before conducting RPCs along the transect. As mentioned above, *Ophiothrix spiculata* were moderately abundant covering 16% of the bottom. *Parastichopus parvimensis* density (0.71/m^2) was higher than last year; during 1993 to 1995 the numbers had been declining. However, densities of *P. parvimensis* are still relatively low for this site.

Strongylocentrotus franciscanus were common with a density of 2.0/m^2. Densities of *S. purpuratus* have continued to increase, and were recorded at the highest density ever observed at this site, 24/m^2. *S. purpuratus* were collected in 13 0.5/m^2 quadrats for the size frequency measurements. Seventeen of the 261 *S. purpuratus* measured for size frequencies were positively identified with signs of wasting syndrome. No *S. franciscanus* were observed with wasting syndrome. *Lytechinus anamesus* were common on the

deeper/offshore side of the transect, and more abundant towards the southern end. *L. anamesus* densities have continued to decline since 1992 and were counted on both quadrats (0.21/m^2) and band transects(0.77/m^2). *Pisaster giganteus* were common and counted on both quadrats (0.21/m^2) and 5m^2-quadrats (0.17/m^2). *Asterina* (*Patiria) miniata* were common with a density of 0.89/m^2. The blood star, *Henricia leviuscula*, was also common.

At 1830 hours on July 24, we noticed many of the *Asterina* (*Patiria) miniata* along the middle part of the transect were spawning. The *A. miniata* were often paired, male and female next to each other, some were also solitary and a threesome with 2 males and a female was observed. One could tell the sexes by the secretion of sperm (white) and eggs (orange) into the water column. Most of the spawning *A. miniata* were "standing" on the tips of their arms.

Cypraea spadicea and *Lithopoma (Astraea) undosum* were common with densities of 0.71/m^2 and 0.83/m^2 respectively. *Megathura crenulata* were less common than in previous years and densities were lower than ever seen at this site, 0.049/m^2. No *Aplysia californica* were observed on band transects nor during the species list survey. The nudibranch, *Hermissenda crassicornis* was moderately abundant and the animals observed were large. One small (29 mm) fresh *Haliotis corrugata* shell, and one small (19 mm) fresh black abalone shell were found.

When we first arrived on the site, *Paralabrax clathratus* were abundant, but quickly disappeared. A school of jack mackerel, *Trachurus symmetricus*, was observed. *Girella nigricans*, *Embiotoca jacksoni*, adult *Chromis punctipinnis*, *Paralabrax clathratus*, male and female *Halichoeres semicinctus*, and female *Semicossyphus pulcher* were all common. Several male *S. pulcher* and a juvenile were observed. On July 24, several *Chromis punctipinnis* egg masses were found in the ARMs and the eggs were almost ready to hatch. Several *Cephaloscyllium ventriosum* and a *Heterodontus francisci* were observed. *Coryphopterus nicholsii* were abundant (1.9/m^2) and many were small. *Alloclinus holderi* were uncommon with a density of 0.083/m^2. Stripefin ronquils, *Rathbunella hypoplecta*, were common. *Lythrypnus dalli* were common with a density of 0.17/m^2. During our second visit on October 2nd we observed tiny (juvenile) *L. dalli* along the transect. During this visit we also observed small schools of small juvenile *Chromis punctipinnis* at the northern half of the transect. This was the first time we observed YOY (young of year) *C. punctipinnis* this summer. Roving diver fish counts were conducted on July 24 by five divers and on October 2nd by four divers. On the fish counts, 22 and 27 species of fish were observed, respectively.

All seven ARMs were intact and sampled for all indicator species. No *Haliotis* spp. were observed in the ARMs this year. The number of *Crassedoma (Hinnites) giganteuum* (14) found in the ARMs was higher than last year, but relatively low. Small *Pisaster giganteus* were common in the ARMs. *Asterina (Patiria)*

miniata were abundant, and the number per ARM has gradually increased over the last three years. The mean number this year was 15/ARM. The number of *Strongylocentrotus franciscanus* continued to decrease, as did their mean size. The number per ARM was 21 with a mean size of 21. The number of *S. purpuratus* also decreased this year with a mean of 59/ARM. Two of the new stainless steel tags that were placed on the ARMs in 1995 were missing, however the brass tags were still attached (#181, and #182).

Temperature data was not collected during the first three weeks of June, 1995 because the unit was removed by a diver (Kushner et al., 1995).

Location: Pelican Bay, Santa Cruz Island

1996 sampling dates: 7/25, 10/2.
1996 status: *Strongylocentrotus purpuratus* barren.

This site, similar to last year, was an urchin barren dominated by *Strongylocentrotus purpuratus*. The only algae observed along the transect was some *Laurencia pacifica*, *Colpomenia* sp., and a small amount of *Dictyota/Pachydictyon*. The only algae recorded on RPCs was miscellaneous red algae, articulated and encrusting coralline algae. Their coverage's were all low, 0.5%, 0.67% and 17% respectively. Bare substrate was abundant and covered 63% of the bottom. The lead line and many of the eyebolts at this site needed repairs.

Miscellaneous invertebrates covered 19% of the bottom. Of these invertebrates, terebellid worms were the most common and we estimate that the worms/their tentacles made up 80% of the miscellaneous invertebrate category. *Astrangia lajollaensis* were moderately abundant covering 12% of the bottom. *Serpulorbis squamigerus* were common on the tops of large rocks, however their coverage directly along the transect was only 0.67%. Bryozoans covered 1.7% of the bottom. *Lophogorgia chilensis* was mostly present on the deeper/offshore side of the transect, and small individuals were common. Overall their density was 0.085/m^2. *Crassedoma (Hinnites) giganteum* were common with a density of 0.092/m^2.

The density of *Strongylocentrotus purpuratus* (43/m^2) were about the same as last year. *S. franciscanus* and *Lytechinus anamesus* densities were 1.8/m^2 and 0.27/m^2, respectively. When conducting size frequency measurements *S. purpuratus* were collected using 0.5/m^2 quadrats. Juvenile *Strongylocentrotus* spp. were rare. *Parastichopus parvimensis* were relatively uncommon and only two were counted in quadrats (0.083/m^2). *Asterina (Patiria) miniata* were relatively uncommon (0.17/m^2). *Pisaster giganteus* were also uncommon, and were counted on both quadrats (0.083/m^2) and 5m^2-quadrats (0.030/m^2). Large *Centrostephanus coronatus* were present along the transect but none were observed in quadrats.

During our first visit on July 25th wasting syndrome was more common in *Strongylocentrotus purpuratus* and *L. anamesus* than in *S. franciscanus*. Out of the 369 *S. purpuratus* that were observed, 6 had wasting syndrome. One *S. franciscanus* out of 115, and five *L. anamesus* out of 128 were sick. During our second visit, on October 2nd we observed *S. franciscanus*, *S. purpuratus*, and *Lytechinus anamesus* with wasting syndrome in moderate numbers. *L. anamesus* were observed feeding on sick *S. franciscanus*. One *Parastichopus parvimensis*, one *Pisaster giganteus*, and many *Asterina (Patiria) miniata* were observed with sea star wasting disease. We estimated that 50% of the *A. miniata* were diseased. Piles of ossicles with pieces of *A. miniata* arms, indicating recent mortality, were common along and near the transect.

Crassedoma (Hinnites) giganteum were common with a density of 0.091/m^2. *Aplysia californica* were rare and none were observed on band transects. *Astraea undosa* were common with a density of 1.7/m^2. No live *Haliotis* spp. were found in the natural habitat, but four small *H. corrugata* shells were found; two were fresh (32mm, 33mm) and two were old (31mm, 32mm). Two live *Pecten diegensis* were found.

Fish were relatively uncommon. Several small *Paralabrax clathratus*, *Damalichthys vacca*, *Embiotoca jacksoni* and *Hypsypops rubicundus* were observed. *Chromis punctipinnis* were common. Several female *Semicossyphus pulcher* and two males were seen. *Halichoeres semicinctus* were rare and only two were observed. *Coryphopterus nicholsii*, and *Lythrypnus dalli* were common with densities of 0.63/m^2 and 0.78/m^2, respectively. *Alloclinus holderi* density was 0.13/m^2. Roving diver fish counts were conducted on July 24th by seven divers, and on October 2nd by five divers. On the fish counts, 23 and 24 species of fish were observed, respectively.

Only six ARMs remained intact at this site. ARM #2313 was found crushed, underneath a boulder about the size of a small automobile. The top of one ARM was pried open. Overall, the ARMs were very bare and had little growing on, or in, them. One live *Haliotis corrugata* (29mm) was found. *Cypraea spadicea* were less common than in the past two years. *Crassedoma (Hinnites) giganteum* were uncommon and only two were seen in the six ARMs. *Asterina (Patiria) miniata* were common and many were small. *Pisaster giganteus* were noticeably fewer in number than in 1995. The number of *Strongylocentrotus franciscanus* continued to decline; the mean, 12/ARM, was about half what was found in 1995. *S. purpuratus* followed a similar trend with a mean of 36/ARM. There were only a few *S. purpuratus* that were less than 14mm this year, indicating little recruitment No *Centrostephanus coronatus* were found. One new ARM needed to be installed to replace the one that was crushed.

Location: Scorpion Anchorage, Santa Cruz Island

1996 sampling dates: 7/25, 10/2.

1996 status: *Strongylocentrotus purpuratus* barrens.

The transect did not change very much since 1995 and it continues to be a barren dominated by *Strongylocentrotus purpuratus*, in addition, the area around the transect that was kelp forest in 1995 is now an *S. purpuratus* barren as well. There are, however, a few *Macrocystis pyrifera* plants on top of the large rock at the east end of the transect. Aside from coralline algae, the only algae recorded along the transect was miscellaneous red algae and other plants (diatoms). Their coverage was 1.8% and 0.33%, respectively. Articulated and encrusting coralline algae covered 1.2% and 53% of the bottom, respectively. Bare substrate covered 29% of the bottom.

On our second visit to the site on October 2nd, the only notable change was on a large rock at the west end of the transect where there was notably less *M. pyrifera* and other macroalgae than was seen on the rock on July 25th. The decrease in algae is probably due to the *Strongylocentrotus purpuratus* that had worked their way up to the top of the rock. During $5m^2$-quadrats, there were four subadult *M.*

Miscellaneous invertebrates covered 10% of the bottom. The most common invertebrates were Christmas tree worm, *Spirobranchus spinosus*. *Serpulorbis squamigerus* were common and covered 4.5% of the bottom.

Strongylocentrotus purpuratus were abundant with a density of $54/m^2$. *S. franciscanus* were common with a density of $1.3/m^2$. *Lytechinus anamesus* were present, but not very abundant, and were counted on both quadrats ($0.083/m^2$) and band transects($0.035/m^2$). Sea urchins were out in the open and not confined to crevices, including in the area where the ARMs are located. Last year all the sea urchins in this area were confined to crevices. *S. purpuratus* measured for size frequencies were located using $0.5/m^2$ quadrats. *Asterina (Patiria) miniata* were common ($0.13/m^2$) and often very large. *Pisaster giganteus* were uncommon and were counted on quadrats ($0.0/m^2$) and $5m^2$-quadrats ($0.005/m^2$). *Parastichopus parvimensis* were uncommon with a density of $0.13/m^2$.

During our July 25th visit, sea urchin wasting syndrome was common in *S. purpuratus*, and uncommon in *S. franciscanus*. Out of the 475 *S. purpuratus* measured for size frequencies, 25 were diagnosed with the syndrome. On October 2nd, *Asterina (Patiria) miniata* were commonly observed with sea star wasting disease. We observed only two *Pisaster giganteus* along the transect, but both had a terminal case wasting disease.

Aplysia californica were much less common than last year, with a density was $0.0056/m^2$. *Megathura crenulata* density was $0.054/m^2$. *Astraea undosa* were abundant with a density of $3.7/m^2$. On July 25th, no

Panulirus interruptus were observed during band transects, but several molts were observed within the transect. On October 2nd, we observed several *P. interruptus*, as well as several large (at least legal size, 3 1/4 ") molts along the transect.

Overall, fish were uncommon at this site. *Chromis punctipinnis*, *Oxyjulis californica*, *Paralabrax clathratus*, *Halichoeres semicinctus*, and *Hypsypops rubicundus* were relatively uncommon. *Coryphopterus nicholsii* were moderately abundant (1.4/m^2) but many were small. No *Lythrypnus dalli* were observed at this site. *Alloclinus holderi* were uncommon with a density of 0.042/m^2. A Roving diver fish count was performed on October 2nd by five divers; 21 species of fish were observed.

The seven ARMs were monitored for all indicator species. We were only able to find one stainless steel tag (#2382) which was detached and on the bottom of the ARM. All of the other stainless steel tags were missing. One brass tag (#194) was still intact, but corroding. We have no idea how the stainless steel tags disappeared, as the stainless steel wire to which they were attached with was completely intact on most of the ARMs. New stainless steel tags were installed with plastic cable ties. The new numbers are 2422, 2423, 2424, 2425, 2426, and 2427. Brass tag #194 was replaced by the new stainless steel tag 2427.

Cypraea spadicea were abundant with a mean of 11/ARM. The mean number of *Asterina* (*Patiria) miniata* was relatively low (1.1/ARM), and the stars were relatively large for the ARMs. No *Pisaster giganteus* or *Crassedoma (Hinnites) giganteus* were found. The number of *Strongylocentrotus franciscanus* (6.6/ARM) and *S. purpuratus* (42/ARM) per ARM was lower than the last two years. In 1995, the ARMs were located in an area of abundant *Macrocystis pyrifera*, this area was barren and had no kelp and very little other algae.

In the area off the transect there were several small patches of *Macrocystis pyrifera* present. A dense kelp forest, just southwest of the transect contained an abundance of all sizes of *M. pyrifera* and a moderate understory of *Laminaria farlowii*. Within this area, *Strongylocentrotus purpuratus* were much less abundant than along the transect, and *S. franciscanus* had a similar abundance. All of the *Strongylocentrotus* spp. were confined to crevices, unlike along the transect. Large *Panulirus interruptus* molts were common in the kelp forest. One small (juvenile) California moray, *Gymnothorax mordax*, was observed in this area.

The temperature units were retrieved. Upon retrieval both units were not operating due to battery failure. We were only able to retrieve data through May, 1996.

Location: Yellowbanks, Santa Cruz Island

1996 sampling dates: 8/21, 8/22, 9/16.

1996 status: Mature kelp forest.

In general, the entire Yellowbanks area appeared to have less *Macrocystis pyrifera* than the previous several years. The area where the transect is located appeared to have more *M. pyrifera* than the surrounding area. From the surface, *M. pyrifera* canopy cover was qualitatively estimated at 15% and it was thin at slack tide. On the bottom, adult and subadult *M. pyrifera* plants were common, however there were few plants directly along the transect. Juvenile *M. pyrifera* were common along the transect. Adult, subadult, and juvenile densities were 0.045/m^2, 0.09/m^2 and 0.88/m^2 respectively. *M. pyrifera* coverage on RPCs was 13%. Most of the *M. pyrifera* plants appeared healthy, but had a moderate amount of the hydroid, *Obelia* sp., growing on the blades. Overall, understory brown macroalgae were abundant along the transect. *Eisenia arborea* density was 0.083/m^2, and no juveniles were observed along the transect. Adult *Pterygophora californica* were abundant with a density of 1.7/m^2, also with no juveniles being observed. Adult and juvenile *Laminaria farlowii* were common with densities of 0.67/m^2, and 1.3/m^2 respectively. On RPCs, *L. farlowii*, *Cystoseira* spp., *P. californica,* and *E. arborea* covered 11%, 20%, 27%, and 6.0% of the bottom, respectively. Miscellaneous red algae was common but patchy, covering 12% of the bottom. Articulated and encrusting coralline algae covered 29% and 42% of the bottom, respectively. Bare substrate covered 22% of the bottom. Compared to 1995, there didn't appear to be as much silt this year.

The most common miscellaneous invertebrates on RPCs were hydroids, mostly *Aglaophenia latirostris* and *Obelia* sp. This category covered 12% of the bottom. Bryozoans were common, but patchy, mostly occurring on the areas of higher relief. Combined, they covered 10% of the bottom. Only four (0.0056/m^2) *Tethya aurantia* were observed on band transects. Both small and large *Lophogorgia chilensis* were common with a density of 0.028/m^2. *Muricea californica* and *M. fruticosa* were less common and were very large. Only one *Panulirus interruptus* was found around the entire transect, and it was also counted during band transects.

Strongylocentrotus franciscanus were common, but were confined to crevices. Few crevices are present directly along the transect, thus *S. franciscanus* densities were low (0.38/m^2). *S. purpuratus* were also often in crevices there were, however, several high density patches were found in the open. The density of *S. purpuratus* was 9.5/m^2. *Lytechinus anamesus* were common, and were counted on band transects. Their density was 0.64/m^2 and many of them were difficult to see because they were small (mean size 18mm) and often completely covered with debris. Several *S. purpuratus* and *L. anamesus* were observed with wasting syndrome. One large *Pycnopodia helianthoides* was observed. *Pisaster giganteus* were uncommon, and were counted on quadrats (0.0/m^2) and 5m^2-quadrats (0.02/m^2). More Asterina (*Patiria) miniata* were counted at this site than ever before (0.17/m^2), but they were still relatively uncommon. The

brittle star, *Ophiothrix spiculata*, was common. *Parastichopus parvimensis* were common with a density of 1.1/m^2.

Lithopoma (Astraea) undosum were common (0.83/m^2). *Kelletia kelletii* were also common with a density of 0.046/m^2, and several small (less than 40mm) ones were observed during band transects, but these were unable to be located again for size frequencies. *Megathura crenulata* and *Crassedoma* (*Hinnites) giganteus* were relatively uncommon. For the second year, no *Haliotis corrugata* were observed on band transects. We did, however, count two *H. rufescens*. One *H. rufescens* shell was found that appeared to be a introduced/hatchery reared abalone. It appears from the shell coloration and "rings" that the abalone was introduced at a size of 79mm, and grew to 141mm in 3.5-4.5 years (depending how one interprets the "rings"). Unfortunately, we did not get a good look at the two *H. rufescens* observed on band transects to see if they were also introduced/hatchery reared. We did relocate one of these during size frequencies, and it measured 99mm. Two fresh *H. corrugata* shells (30, and 65mm), and one fresh *H. rufescens* shell (28mm) were found along the transect. One *Crassispira semiinflata* was observed, this was unusual since it is a southern species.

Paralabrax clathratus, female *Semicossyphus pulcher*, *Oxyjulis californica*, and *Sebastes atrovirens* were all common. *Embiotoca jacksoni* were uncommon. Top smelt, *Atherinops affinis*, were moderately abundant on the surface. Several *Myliobatis californica* were observed and possible predation on *Astraea undosa* was evident from the presence of crushed shells. Several California barracuda, *Sphyraena argentea*, and one small C-O turbot, *Pleuronichthys coenosus*, were observed. *Coryphopterus nicholsii* were common with a density of 0.50/m^2, and only one *Alloclinus holderi* was observed on quadrats. Roving diver fish counts were conducted on August 21st by five divers and on September 16th by five divers. On the fish counts, 20 and 24 species of fish were observed, respectively.

All three groups of five ARMs were intact. Of these, six were monitored for all indicator species (three from the east group, one from the middle group, and two from the west group), and nine were monitored for all indicator species except sea urchins. Within any of the groups of five ARMs, there was surprising variability with regards to the number of both adult and juvenile sea urchins. Similar to the rest of the site, there was notably less silt in the ARMs than last year. All of the number tags were in good shape, however they were reinforced with cable ties.

Three *Haliotis corrugata* (12, 20, and 27mm) and one *H. rufescens* (74mm) were observed in the 20 ARMs this year. *Cypraea spadicea* were abundant with 12/ARM. Relative to previous years, *Hinnites giganteus* were more abundant in the ARMs this year (1.7/ARM). Small *Pisaster giganteus* were common, with a mean of 1.7/ARM. Small *Patiria miniata* were also common. *Strongylocentrotus franciscanus* density

decreased to 32/ARM, almost half of last year. *S. purpuratus* density in the ARMs remained about the same as last year (175/ARM).

Unfortunately the Hobotemp temperature logger only recorded one data point after it was deployed on July 28, 1995 and the Stowaway temperature logger that was deployed on September 13, 1995 stopped recording on June 6, 1996 due to battery corrosion.

On August 21, there were three commercial sport fishing boats fishing near the transect. On the bottom along the transect, a snorkel, a bait net, some fishing line, fishing lure, and a intact Gumby-surfer beach chair were found. This area was definitely being extensively used by both commercial and sport fishing boats.

Location: Offshore of Hungryman gulch, Santa Cruz Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Latitude: N 34:01.35 Longitude: W 114:31.50
1996 sampling date: 10/3.
1996 status: *Strongylocentrotus purpuratus* barrens.

A recreational night dive was conducted hear at a depth of 3-10 meters. The area was mostly *Strongylocentrotus purpuratus* barrens with low species diversity on the bottom (mostly bare). There was, however, some macroalgae on the tops of rocks in the shallow inshore areas. Many of the *S. purpuratus* had wasting syndrome. *Panulirus interruptus* and octopus were common.

Location: Admiral's Reef, Anacapa Island

1996 sampling dates: 7/12, 8/22, 10/1, 10/4.
1996 status: Sparse kelp forest/*Strongylocentrotus purpuratus* and *Ophiothrix spiculata* (brittle star) barrens.

Overall, the condition of this site has changed little from last year. The transect continues to be dominated by the brittle star, *Ophiothrix spiculata* and *Strongylocentrotus purpuratus* on the east 70 meters. The west 30 meters have remained kelp forest. Just inshore of the transect on top of the reef, *Macrocystis pyrifera* was still abundant. However, it appeared there was low cover of understory algae, and the cover of *Ophiothrix spiculata* was increasing. *M. pyrifera* canopy cover over the transect was estimated at 10% and was entirely over the western end of the transect. Densities of adult, subadult, and juvenile *Macrocystis*

pyrifera along the transect were low, 0.065/m^2, 0.055/m^2, and 0.29/m^2 respectively. In July about half of the *M. pyrifera* appeared healthy, while the other half had tattered fronds. During our August visit we estimated only 20% of the plants appeared healthy while the other 80% had tattered fronds with an abundance of epiphytic bryozoans (*Membranipora* sp.) and hydroids (*Obelia* sp.). All algae combined, excluding encrusting coralline algae, covered 18% of the bottom. This is the lowest coverage of algae recorded at this site since monitoring began. *Macrocystis pyrifera*, *Eisenia arborea,* and *Pterygophora californica* combined covered 5.3% of the bottom, the lowest cover recorded for this category at this site. Adult and juvenile *Eisenia arborea* were common on the tops of rocks along the west end of the transect, their densities were both 0.17/m^2. The density of adult and juvenile *E. arborea* combined was similar to last year, but low compared to the previous six years. *Laminaria farlowii* plants continued to be rare. No adults and only one juvenile were observed on quadrats. No *Agarum fimbriatum* plants were observed. In past years, the eastern half of the transect typically had an abundance of *L. farlowii* and *A. fimbriatum*. *Cystoseira* spp. was rare along the transect, and none was observed during RPCs. Miscellaneous brown algae (0.5%), *Cystoseira* spp. (0.0%), *Laminaria farlowii* (0.0%), miscellaneous red algae (10%), and articulated coralline algae (0.67%) were all had lower values than have ever been seen at this site. Miscellaneous red algae covered 10% of the bottom. Most of the miscellaneous red algae was a filamentous type that was more abundant on the western 30m of the transect. Encrusting coralline algae covered 27% of the bottom. Bare substrate was relatively common for this site covering 27% of the bottom.

The most common miscellaneous invertebrates encountered on RPCs were *Ophiothrix spiculata*, *Spirobranchus spinosus*, hydroids, and gorgonians (mostly *Eugorgia rubens).* Because *Ophiothrix spiculata* were so abundant and covered much of the bottom, we counted them separately and then added them to the miscellaneous invertebrate category on RPCs. Miscellaneous invertebrates covered 55% of the bottom, of this 36% were *O. spiculata* and 19% were other miscellaneous invertebrates. This was about the same cover as last year. As usual, the purple gorgonian, *Eugorgia rubens*, was abundant along the transect. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all common. *Corynactis californica*, and *Astrangia lajollaensis* were common and covered 4.3%, and 5.5% of the bottom respectively.

Similar to last year, *Strongylocentrotus purpuratus* and the brittle star, *Ophiothrix spiculata*, dominated the eastern 67 meters of the transect. *S. purpuratus* density was relatively high at 25/m^2, although this was about half the density observed in 1995. *S. franciscanus* were abundant (9.4/m^2). *Lytechinus anamesus* density was 0.32/m^2, however these sea urchins appeared much smaller than those seen in previous years. One square meter quadrats were used to locate *S. purpuratus* for size frequencies. *S. franciscanus* and *S. purpuratus* were not observed in grazing fronts as they were in 1995. *Centrostephanus coronatus* were relatively common, however none were observed in quadrats. Wasting syndrome was commonly observed in *S. purpuratus*, and several *Lytechinus anamesus* were also observed with this syndrome. *Pisaster*

giganteus were common with densities of 0.035/m^2 and 0.083/m^2 on 5m^2-quadrats and quadrats respectively. *Asterina* (*Patiria) miniata* continued their gradual increase in density since 1992, and were recorded at 0.92/m^2. *Parastichopus parvimensis* were abundant with a density of 2.2/m^2, their highest recorded density for this site.

Astraea undosa were rare along the transect, and none were observed in quadrats. *Crassedoma (Hinnites) giganteum* were common on the steep inshore side of the transect, but like last year didn't appear to be as abundant as in the early 1990's. This years density was 0.056/m^2. *Megathura crenulata* were common. *Aplysia californica* were common with a density of 0.018/m^2, but were not as abundant as last year. No *Haliotis corrugata* were observed during band transects. This is the second subsequent year this has occurred. We were only able to locate five live *H. corrugata* for size frequency measurements. Four fresh *H. corrugata* shells (120, 146, 146, and 148 mm) were found along the transect. No *Panulirus interruptus* were found during band transects. Two lobster traps were present along the transect, and in one of the traps a large (estimated at 4 pounds) lobster was observed.

Chromis punctipinnis were common near the bottom, but were present in small groups. *Oxyjulis californica*, female *Semicossyphus pulcher* and *Halichoeres semicinctus* were common. *Medialuna californiensis* and *Girella nigricans* were moderately abundant on the western part of the transect that had *Macrocystis pyrifera*. *Coryphopterus nicholsii* were common with a density of 1.2/m^2. Roving diver fish counts were conducted on July 12 with three divers and on October 1st with five divers. On the fish counts, 20 and 23 species of fish were observed respectively.

The seven ARMs were sampled for all indicator species. The number of *Strongylocentrotus franciscanus* continued to decline, this year the mean was 22/ARM. The number of *S. purpuratus* also declined to 90/ARM, about half the abundance of last year. Small juvenile (less than 10mm) *S. franciscanus* and *S. purpuratus* were common. Two C*entrostephanus coronatus* was found in the seven ARMs. *Asterina (Patiria) miniata* were abundant with 81 counted in the seven ARMs. Only 13 *Crassedoma (Hinnites) giganteus* were found in the seven ARMs.

Location: Cathedral Cove, Anacapa Island

1996 sampling dates: 7/21, 8/8.
1996 status: Kelp forest.

Overall, this site appeared similar to previous years. *Macrocystis pyrifera* canopy over the transect was estimated at 35% and most of the plants appeared healthy. Adult *M. pyrifera* plants were less abundant

than subadults and juveniles. Their densities were 0.1/m^2, 0.82/m^2, and 1.8/m^2 respectively. *M. pyrifera* coverage was high at 41%. Many of the small kelp plants were attached to small rocks, and will probably drift away when the plants get larger. Juvenile *Laminaria farlowii* were relatively abundant with a density of 1.6/m^2. Adults were common, but only one was observed in the quadrats. No sea palms were observed on quadrats. Miscellaneous brown algae, mostly *Dictyota/Pachydictyon*, were abundant covering 12% of the bottom. *Cystoseira Spp.* was moderately abundant covering 9.8% of the bottom. Miscellaneous red algae was common covering 7.3% of the bottom. Articulated and encrusting coralline algae covered 24% and 56% of the bottom respectively. Bare substrate covered 24% of the bottom, similar to previous years. Cobble substrate decreased by about 11%, while sand increased by about 11%, rock remained the same. Their coverage's were 9.7%, 23.7%, and 66.7% respectively. The large cobble area inshore at about 30 meters along the transect had little *M. pyrifera* compared to previous years.

The most common miscellaneous invertebrates on RPCs were *Spirobranchus spinosus* and hydroids. This category covered 5.8% of the bottom. *Phragmatopoma californica* were uncommon covering 0.33% of the bottom. Bryozoans were common, combined they covered 8.0% of the bottom. Tunicates covered 1.2% of the bottom.

Strongylocentrotus franciscanus and *S. purpuratus* densities were 5.8/m^2 and 2.6/m^2 respectively. *Asterina (Patiria) miniata* were uncommon with a density of 0.13/m^2, however, we do seem to see a few more every year and juveniles are common under small rocks. *Pisaster giganteus* are uncommon and none were observed on quadrats and 5m^2-quadrats. However, 21 were found in the seven ARMs. *Parastichopus parvimensis* were common with a density of 1.5/m^2.

Panulirus interruptus density was relatively low this year at 0.011/m^2. Although common along the transect, they did not appear as abundant as in previous years, and there were not as many in the "lobster cave" at 32 m mark on the transect. Large and small *Lithopoma (Astraea) undosum* were abundant with a density of 4.6/m^2. *Crassedoma (Hinnites) giganteum* density was 0.0985/m^2, and the majority were on the inshore side of the north end of the transect along the wall. *Aplysia californica* density was 0.0056/m^2, and were not as abundant as last year. Black sea hares, *Aplysia vaccaria*, were common on the deeper side of the transect and there egg masses were observed. Only one *Haliotis corrugata* was observed on band transects this year (0.0014/m^2), and only two more were found for size frequency measurements. There are very few abalone left along this transect. Several small (45, 46, and 83mm) fresh *Haliotis corrugata* shells were found indicating some recent recruitment.

Fish were moderately abundant. *Girella nigricans*, *Medialuna californiensis*, *Paralabrax clathratus*, *Oxyjulis californica*, *Chromis punctipinnis*, and female *Semicossyphus pulcher* were all common along the transect.

Adult and juvenile *Hypsypops rubicundus* were present, and a tagged one was observed on June, 21. Several *Halichoeres semicinctus* and male *S. pulcher* were also observed. *Coryphopterus nicholsii* were relatively uncommon with a density of 0.13/m^2. *Alloclinus holderi* were common with a density of 0.71/m^2. One large *Stereolepis gigas* (giant black sea bass) was observed north of the north end of the transect. We were only able to conduct roving diver fish counts once on August 8th with six divers, 24 species of fish were observed.

The ARMs were intact this year and appear to have moved little. The seven were sampled for all indicator species except sea urchins which were monitored from just four. Two small *Haliotis corrugata* were found, both were 19mm. There were less than half of the number of *Crassedoma (Hinnites) giganteus* found this year than in 1995, and there were proportionally less smaller ones. The mean number per ARM was 5.9. *Cypraea spadicea* were abundant with a mean of 19/ARM. *Asterina (Patiria) miniata* and *Pisaster giganteus* were common. The number of *Strongylocentrotus franciscanus* per ARM greatly decreased from last year, and the mean size inversely increased, indicating less recruitment. This year there were 60/ARM with a mean size of 24. *S. purpuratus* were abundant and increased slightly to 175/ARM. Two small (both less than 10mm*) Centrostephanus coronatus* were found in the four ARMs monitored for sea urchins.

Location: Landing Cove, Anacapa Island

1996 sampling dates: 7/26, 8/9, 10/3.
1996 status: Open kelp forest

The condition of this site is similar to past years. *Macrocystis pyrifera* canopy cover was estimated at 20% and was thin probably due to the boat traffic in the cove. Adult *M. pyrifera* was present along the entire transect, but was most abundant on the eastern end. *M. pyrifera* coverage on the bottom was 11%, and adult, subadult and juvenile densities were 0.075/m^2, 0.30/m^2, and 2.2/m^2 respectively. Understory algae was abundant along the transect. *Eisenia arborea*, and, *Gelidium purpurescens*, were abundant as usual on the top of the reef on the shallow/eastern end of the transect. Adult and juvenile *Eisenia arborea* densities were 0.71/m^2 and 0.58/m^2 respectively, and covered 19% of the bottom. *Gelidium* sp. (*G. purpurescens*) coverage was 21%. *Pterygophora californica* were common along the deeper parts of the transect, however none were observed during quadrats. Their coverage was recorded at 3.3%. Adult and juvenile *Laminaria farlowii* were abundant in the deeper parts of the transect with densities of 1.8/m^2 and 5.5/m^2 respectively, and covering 16% of the bottom. *Cystoseira* spp. was common covering 4.2% of the bottom. Miscellaneous red and brown algae were common with coverage's of 12% and 9.8% respectively. Brown diatom tufts (recorded as miscellaneous plants) were common covering 3.5% of the bottom. Articulated and

encrusting coralline algae covered 13% and 36% of the bottom. Bare substrate covered 17% of the bottom and was common in the deeper part of the transect.

The most common miscellaneous invertebrates on RPCs were hydroids. This category covered 15% of the bottom. Bryozoans were common growing epiphytically on the *Gelidium purpurescens*. Combined bryozoans covered 14% of the bottom. Most of the bryozoans and hydroids were found on top of the reef at the shallow/eastern end of the transect. Tunicates, sponges, and *Corynactis californica* were moderately abundant on the shallow/eastern part of the transect. Their coverage's were 3.8%, 5.5%, and 3.3% respectively.

Asterina (Patiria) miniata were uncommon with a density of 0.17/m^2. *Pisaster giganteus* were also uncommon and were counted on both quadrats and 5m^2-quadrats, their respective densities were 0.0/m^2 and 0.1/m^2. *Strongylocentrotus franciscanus* and *S. purpuratus* were common with densities of 3.5/m^2 and 3.0.m2 respectively. *Parastichopus parvimensis* were notably small, and their density was 0.75/m^2. Earlier in the summer we noticed an abundance of *P. parvimensis* below the reef at the east end of the transect. In October it appeared that there were less *P. parvimensis* in this area.

Lithopoma (Astraea) undosum were common with a density of 1.2/m^2. *Crassedoma* (*Hinnites) giganteum* were abundant along the vertical walls as usual for this site, their density was 0.27/m^2. *Haliotis corrugata* were common with a density of 0.026/m^2. A good search effort was made to locate *H. corrugata* for size frequency measurements along the transect, 50 were found. On October 3rd, seven fresh *H. corrugata* shells were found along the transect, indicating recent mortality. The shell sizes were 41, 53, 139, 158, 158, 168, and 186.

Fish were moderately abundant which is normal for Landing Cove. Adult *Chromis punctipinnis*, Adult and juvenile *Oxyjulis californica*, adult and juvenile *Embiotoca jacksoni*, adult *Paralabrax clathratus*, and adult *Girella nigricans* were all common. Several large male and female *Semicossyphus pulcher* were observed. *Coryphopterus nicholsii* and *Alloclinus holderi* were common with densities of 0.67/m^2 and 0.29/m^2 respectively. We conducted roving diver fish counts once on October 3rd with five divers, and 22 species of fish were observed.

The ARMs appeared to have moved little since last year, however ARM #2374 was upside down. The five ARMs were sampled for all indicator species. Seven small *Haliotis corrugata* were found, more than has been found in the previous four years. Their sizes were 22, 22, 31, 40, 42, 50 and 58mm, and indicate recruitment from this year as well as last. Small *Crassedoma (Hinnites) giganteus* were common with a mean of 6.4/ARM. *Asterina (Patiria) miniata* were moderately abundant with 9.3/ARM. Small *Pisaster*

giganteus were common with 1.6/ARM. *Strongylocentrotus franciscanus* were abundant with 89/ARM and a mean size of 30mm, similar to last year. There appeared to be less *S. purpuratus* recruitment this year. *S. purpuratus* abundance decreased and their mean size increased. There were 229/ARM with a mean size of 26mm.

On September 5, we placed two new ARMs at Landing cove. The new ARM numbers are 2410, and 2412. We also reinforced the numbers on the other ARMs with cable ties, and placed new stainless tags on two ARMs where tags were missing. These two ARMs still had brass tags on them, so brass tag #190 is now stainless tag #2407. And brass tag #193 is now stainless tag #2416.

Location: Survey Rock, Anacapa Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
1996 sampling dates: 8/22.
1996 status: *Strongylocentrotus purpuratus* barrens with a moderate density of *Ophiothrix spiculata.*

We conducted a *Stereolepis gigas* (giant black sea bass) survey offshore of Survey Rock at a depth of 12-19 meters. We observed at least three, and possibly up to six *S. gigas*. We did not observe the *S. gigas* with the deformed head that we saw last year.

Location: Southeast Sea Lion, Santa Barbara Island

1996 sampling dates: 6/17, 6/18, 6/20, 8/19.
1996 status: *Strongylocentrotus purpuratus* barrens.

This site has changed little since 1995 and continues to be dominated by *Strongylocentrotus purpuratus*. Macroalgae continued to be virtually absent along the transect. Six juvenile *M. pyrifera* plants were observed near the transect. All of these were growing epiphytically on *Muricea californica,* five were on one gorgonian. There were also several patches of the brown algae, *Dictyota/Pachydictyon*, and some of the green algae, *Codium setchellii*. Not including coralline algae, algae combined covered only 3.3% of the bottom. Encrusting coralline algae was abundant covering 52% of the bottom. Articulated coralline algae were relatively rare covering 0.5% of the bottom. Bare substrate covered 27% of the bottom.

Overall, the site appeared similar on our second visit on August 19, except for the notable increase in filamentous red algae (*Polysphonia*-like algae). We estimated this filamentous red algae to cover 20% of the bottom. *Aplysia californica* also appeared more abundant, and were feeding on the algae.

Miscellaneous invertebrates on RPCs covered 6.7% of the bottom and consisted mostly of a small unidentified sea anemone (possibly *Sagartia catalinensis*). *Balanophyllia elegans*, and *Astrangia lajollaensis* were common covering 2.3% and 4.8% of the bottom respectively. Sponges, bryozoans and tunicates were all well below their 15 year means for this site. Their coverage's were 0.17%, 0.50%, and 2.0% respectively. *Tethya aurantia* were abundant with a density of 0.13/m^2. *Lophogorgia chilensis*, and *Muricea californica* were common, while *M. fruticosa* were less common along the transect. Their densities were 0.15/m^2, 0.026/m^2 and 0.0028/m^2 respectively.

Strongylocentrotus purpuratus were abundant, dominating the site. *S. purpuratus* density was 53/m^2, less than half of the density in 1995. *S. franciscanus* were common with a density of 2.5/m^2. This density was also a decrease from last year by almost half. Unlike last year, juvenile *S. franciscanus* and *S. purpuratus* were uncommon. Quadrats (1m^2) were used to locate *S. purpuratus* for size frequency measurements. *Lytechinus anamesus* were common and were counted on both band transects and quadrats. Their densities were 1.2/m^2 and 3.0/m^2 respectively. In general, sea urchins were out in the open and not confined to crevices. Both small and large *Centrostephanus coronatus* were relatively common with a density of 0.29/m^2. *Asterina (Patiria) miniata* and *Pisaster giganteus* were common with densities of 0.17/m^2 and 0.13/m^2 respectively on quadrats. *P. giganteus* were also counted in 5m^2-quadrats with a density of 0.14/m^2. *Parastichopus parvimensis* were common with a density of 0.79/m^2. The brittle star, *Ophiothrix spiculata* were patchy, and moderately abundant east of the transect. However, they appeared less abundant than last year in this area.

Sea urchin wasting syndrome was observed in *S. purpuratus* and *Strongylocentrotus franciscanus*, and we estimated this syndrome to affect less than 10% of the sea urchins. Although it was common, it appeared less prevalent than last year. No *Lytechinus anamesus* were observed with wasting syndrome. Whole sea urchin tests were common for all species, but not notably abundant. No sea stars were observed with wasting disease.

Lithopoma (Astraea) undosum and *Megathura crenulata* were common with densities of 0.38/m^2, and 0.017/m^2 respectively. *Crassedoma (Hinnites) giganteum* were relatively uncommon with a density of 0.0069/m^2. *Kelletia kelletii* were uncommon, and none were observed during band transects. No *Haliotis spp.* were observed during band transects, however one small (less than 10mm) live *Haliotis corrugata* and three small (25, 29, and 31mm) fresh *H. corrugata* shells were found during our June visit and one (38mm) during our August visit. *Haliotis spp*. shells were collected, measured and disposed of off the transect. *Aplysia californica* were abundant with a density of 0.16/m^2. The turban snails, *Tegula eiseni* were common, and *T. aureotincta* were uncommon.

Overall, there was a low abundance of fish at this site. *Coryphopterus nicholsii* and *Alloclinus holderi* were common with densities of 0.54/m^2 and 0.38/m^2 respectively. Small/juvenile *Coryphopterus nicholsii* were common. One *Stereolepis gigas* (giant black sea bass), was observed on June 17, and two were observed on June 20, 1996. Very small female *Semicossyphus pulcher* were abundant, juvenile *Semicossyphus pulcher* were common, and males were rare. Male and female *Halichoeres semicinctus* were moderately abundant. Small adult *Paralabrax clathratus*, *Chromis punctipinnis*, *Hypsypops rubicundus*, and *Oxylebius pictus* (painted greenlings) were all common. Several *Caulolatilus princeps* (ocean whitefish) and one *Scorpaena guttata* (California scorpionfish) were observed. Fish trappers were actively working the areas around the transect. Roving diver fish counts were conducted on June 20 with six divers and on August 19th with five divers. Fish species diversity was low on both dates with 14 and 12 species being observed respectively.

The temperature logger housing was attached to the new thread rod that was installed about one meter west of the north end of the transect last year.

Location: Arch Point, Santa Barbara Island

1996 sampling dates: 6/18, 6/20, 8/20
1996 status: *Strongylocentrotus purpuratus* barrens.

Similar to Southeast Sea Lion, this site has changed little and continues to be dominated by *Strongylocentrotus purpuratus*. There was no *Macrocystis pyrifera* along the transect. There was one *M. pyrifera* plant about 13 m east of the line on a small rock surrounded by sand. Algae combined (excluding coralline algae) covered 7.8% of the bottom. Most (6.2%) of this algae was miscellaneous red algae. The brown algae *Pachydictyon/Dictyota*, and *Colpomenia sp.*, and the red alga, *Laurencia pacifica*, were present. Articulated coralline algae were relatively uncommon covering 3.0% of the bottom. Encrusting coralline algae were abundant covering 62% of the bottom and 25% of the bottom was bare substrate. This site looked similar during our second visit on August 20th, with the exception of a notable increase in filamentous red and green algae, similar to what we observed at Southeast Sea Lion. We estimated these filamentous algae covered 50% of the bottom. The area inshore and shallow contained a moderate and relatively diverse population of macroalgae.

The most common miscellaneous invertebrates on RPCs were hydroids and barnacles. This category covered only 2.5% of the bottom, and is the lowest recorded coverage for this category at this site. The small unidentified anemone (possibly *Cactosoma arenaria* or *Sargartia catalinensis*) that were common last

year were less abundant. *Corynactis californica* were common covering 3.2%. Tunicates and sponges were uncommon covering 0.17% and 0.0% respectively. Coverage of bryozoans continued to be low, covering 1.2% of the bottom. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all present, but uncommon. Their densities were 0.0069/m^2, 0.0028/m^2, and 0.0014/m^2 respectively. We estimated that 70% of the temperature logger housing was covered with the *Spirobranchus spinosus*.

Only one *Asterina (Patiria) miniata* and one *Pisaster giganteus* were observed on quadrats. *Pisaster giganteus* were also counted on the 5m^2-quadrats, their density was 0.04/m^2. A good search effort was made for size frequencies and only nine *Asterina (Patiria) miniata*, and 16 *Pisaster giganteus* were found. *Parastichopus parvimensis* were relatively uncommon with a density of 0.125/m^2. No sea star wasting disease was observed.

Strongylocentrotus franciscanus were common. However their density declined to 2.7/m^2, down from 11.4/m^2 in 1995. *S. purpuratus* were abundant and dominated the site with a density 96/m^2. This is a decrease from the 1995 density of 134/m^2. Unlike last year, juvenile *S. franciscanus* and *S. purpuratus* were uncommon. No *Lytechinus anamesus* were observed during band transects, however there was a small number east of the transect over sandy substrate. In general, sea urchins were out in the open and not confined to crevices. Quadrats (1m^2) were used to locate *S. purpuratus* for size frequency measurements. Sea urchin wasting syndrome was observed in both *S. franciscanus* and *S. purpuratus*, and we estimated less than 10% of the sea urchins being affected. Whole sea urchin tests, mostly from *S. purpuratus*, were common indicating recent mortality.

Aplysia californica were very abundant with a density of 0.35/m^2, their highest recorded density ever at this site. *Lithopoma (Astraea) undosum* were common with a density of 1.21/m^2. *Crassedoma (Hinnites) giganteum* were common with a density of 0.033/m^2. The turban snails, *Tegula aureotincta*, and *T. eiseni* were moderately abundant.

Adult *Hypsypops rubicundus* were abundant, while juveniles were common. *H. rubicundus* nests were common, and two tagged *H. rubicundus* were observed. *Chromis punctipinnis*, *Paralabrax clathratus*, *Medialuna californiensis*, *Girella nigricans*, female *Semicossyphus pulcher*, *Halichoeres semicinctus*, and *Oxyjulis californica* were all common. Two moray eels, *Gymnothorax mordax* were observed. Two *Caulolatilus princeps* were observed. *Coryphopterus nicholsii* were common on the sandy bottom several meters away from the transect line, but none were counted during quadrats. *Alloclinus holderi* were abundant with a density of 0.75/m^2. A school of about 25 Zebra perch, *Hermosilla azurea* were observed north of the transect. Roving diver fish counts were conducted on June 20th by six divers and on August 20th by five divers. On the fish counts, 21 and 20 species of fish were observed respectively.

Location: Cat Canyon, Santa Barbara Island

1996 sampling dates: 6/19, 6/20.
1996 status: Mature kelp forest.

This site has a abundance of macroalgae that is dominated by *Macrocystis pyrifera*. *M. pyrifera* canopy coverage was estimated at 95%, and most of the plants appeared healthy, but some had moderate amounts of epiphytic bryozoans (*Membranipora* sp.) and the hydroid, *Obelia* sp., growing on them. Juvenile *M. pyrifera* plants were common, while large and small adult plants were relatively abundant. On quadrats, adult and juvenile densities were 0.70/m^2 and 0.33/m^2 respectively, and covered 20% of the bottom on RPCs. Adult and subadult *M. pyrifera* densities on the 5m^2-quadrats were 0.47/m^2 and 0.29/m^2 respectively (please note that adult and subadults combined on 5m^2-quadrats are equal to the adult category on quadrats). The majority of the understory algae consisted of *Cystoseira* spp. and articulated coralline algae. These algae covered 4.0% and 33% of the bottom respectively. Several *Eisenia arborea* and *Laminaria farlowii* were observed. Adult *L. farlowii* densities were 0.083/m^2, and no *E. arborea* were observed on quadrats. No juvenile *E. Arborea*, *P. californica*, or *L. farlowii* were present on quadrats. Miscellaneous brown and red algae coverage's greatly decreased from last year. Their coverage's were 0.5%, and 2.8% respectively.

During our second visit to this site on August 20th, we observed that juvenile *M. pyrifera* was common, but patchy. Small adult and large subadult *M. pyrifera* plants were moderately abundant, but the plants appeared to have thinned out since June. Canopy cover was estimated at 80%. Overall, this site changed little from June to August.

Miscellaneous invertebrates on RPCs covered 16% of the bottom, and consisted mostly of hydroids and the worm, *Spirobranchus spinosus*. *Phragmatopoma californica* were common covering 7.2% of the bottom. Bryozoans combined were common covering 12% of the bottom. Tunicates, mostly *Aplidium spp*. and *Pycnoclavella stanleyi* were abundant covering 20% of the bottom, and appeared more abundant than last year. Coverage of tunicates has fluctuated greatly at this site during the past three years. To the best of our knowledge, it appears that this fluctuation is real, and not an artifact of tunicate/sponge misidentification. Gorgonians are rare at this site, and none were observed on band transects.

Asterina (Patiria) miniata were rare with a density of 0.042/m^2. However, juvenile *A. miniata* were common under small rocks. *Pisaster giganteus* were common with a density of 0.083/m^2 on quadrats, and 0.065/m^2 on the 5m^2-quadrats. *Strongylocentrotus franciscanus* and *S. purpuratus* densities were similar to last

year. This years densities were 12/m^2 and 14/m^2 respectively. Many of the *S. franciscanus* and *S. purpuratus* were out in the open, and not confined to crevices. Small patches (approximately several square meters) of sea urchin barrens consisting mostly of *S. franciscanus* were common along the transect. Larger areas of sea urchin barrens were present about 5-10m south of the transect. Several juvenile *S. purpuratus* and no juvenile *S. franciscanus* were observed. No sea urchin wasting syndrome was seen, however, several *S. purpuratus* and *S. franciscanus* were observed with short spines that appeared to be re-growing/recovering from this syndrome. During our second visit to this site on August 20th, it appeared that the sea urchin barrens on the south side of the transect are slowly encroaching towards the transect.

Lithopoma (Astraea) undosum density was 0.17/m^2, and were less abundant than last year. The turban snails, *Tegula eiseni*, were abundant, and *T. aureotincta* were common. Two large adult *Haliotis fulgens* were observed just east of the transect. Two *H. corrugata* were observed on band transects (0.0028/m^2). Three juvenile *H. corrugata* were found under small rocks, indicating some recruitment at this site. *Crassedoma (Hinnites) giganteum* were rare along the transect, and none were observed during band transects. *Kelletia kelletii* were also rare with a density of 0.0042/m^2. *Megathura crenulata* were common with a density of 0.022/m^2. *Aplysia californica* were rare with a density of 0.0028/m^2. *Panulirus interruptus* were common with a density of 0.015/m^2. Old *Haliotis* spp. shells were collected, measured and disposed of off the transect.

Fish were relatively abundant at this site. *Myliobatis californica* were abundant and observed foraging for food. Juvenile and adult *Oxyjulis californica*, male and female *Halichoeres semicinctus*, female *Semicossyphus pulcher*, *Embiotoca jacksoni*, and *Medialuna californiensis* were all common. Male *Semicossyphus pulcher* were rare, and several juveniles were observed. One zebra gobi, *Lythrypnus zebra*, was observed. *Coryphopterus nicholsii* were uncommon and none were counted during quadrats. *Alloclinus holderi* were moderately abundant with a density of 0.71/m^2. One giant black sea bass, *Stereolepis gigas*, was observed. Roving diver fish counts were conducted on June 19th by six divers and on August 20th by five divers. On the fish counts, 23 and 20 species of fish were observed respectively.

Two commercial sea urchin boats were observed taking *Strongylocentrotus franciscanus* near the transect. The boat “Paragon” was working approximately 200 m west of the transect, and the “Reneway” was working approximately 100 m southwest of the transect.

Location: Sutil Island, Santa Barbara Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.

Latitude: 33 27.13 Longitude: 119 02.74

Loran #s: 28063.4; 41181.6
Sampling Date: 6/19
Status: Mature kelp forest with patches of surrounding sea urchin barrens.

The areas where *Macrocystis pyrifera* was present were typical of a mature kelp forest. These areas consisted of a moderate density of medium to large *M. pyrifera* plants with understory algae consisting mostly of *Cystoseira* spp., the brown algae *Dictyota* sp./*Pachydictyon* sp., and articulated coralline algae. Juvenile *M. pyrifera* was also common. Approximately half of the *M. pyrifera* appeared healthy, while the other half had tattered fronds with epiphytic bryozoans (*Membranipora* sp.) and hydroids (*Obelia* sp.) growing on the blades. Several juvenile *Laminaria farlowii* plants were observed. Bryozoans were abundant, and consisted mostly of *Diaperoecia californica,* and *Bugula* spp. Around the kelp forest, there were relatively high densities of both *Strongylocentrotus franciscanus* and *S. purpuratus,* and several sea urchin feeding fronts were observed on the forest edge. Within the kelp forest, most of the *Strongylocentrotus* spp. were confined to crevices. *Lytechinus anamesus* were also observed but were uncommon. Small to medium sized *Parastichopus parvimensis* were common. Sponges were abundant and diverse. *Lophogorgia chilensis* were abundant.

Six divers conducted a abalone survey. A total of eight *Haliotis corrugata* were measured, their sizes were 136, 145, 165, 132, 152, 148, 127, and 139mm. One fresh *H. corrugata* shell measuring 130mm was found.

Medialuna californiensis, and *Girella nigricans* were common. *Sebastes atrovirens* were moderately abundant. One large male *Semicossyphus pulcher* was observed. Female *Semicossyphus pulcher* were abundant and larger than at Southeast Sea Lion, and juveniles were common.

Location: Between Shag Rock, and Arch Point, Santa Barbara Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Sampling Date: 6/20
Status: The deeper areas (9 meters and deeper) were *Strongylocentrotus purpuratus* barrens. The shallow areas were *Eisenia arborea* forests.

Overall this site was very similar to the Arch Point transect. The bottom was sandy below a depth of about 15 meters, then became hard bottom that was sea urchin barrens consisting of mostly *Strongylocentrotus purpuratus*, however *S. franciscanus* were also common. At a depth of about 9 meters and shallower, there was a thick forest of *Eisenia arborea* with a understory of the red algae *Gelidium purpurescens*. There were also some juvenile and subadult *Macrocystis pyrifera* plants. The main difference between this area and

Arch Point was that there were steeper walls, and less of the gradual sloping substrate than can be seen at Arch Point. On these walls there was an abundance and diverse group of invertebrates. Most notable was the abundance of tunicates. Three live *Haliotis corrugata* (all between approximately 125 - 175 mm) and one large *H. fulgens* (approximately 175 mm) were observed. *Panulirus interruptus* were moderately abundant in the small caves and crevices.

Location: Landing Cove, Santa Barbara Island

Note: This is a survey site and not one of the permanent kelp forest monitoring sites.
Sampling Date: 8/19
Status: Mostly a sandy area; areas of rock reef were sea urchin barrens.

Derek Lerma and David Kushner conducted a survey dive east of the mooring can near the Landing Cove dock. We swam from a depth of about 8 meters to 17 meters. Most of the bottom was sand, however there was more rocky substrate than we expected. The rocky areas were mostly devoid of algae and were sea urchin barrens with a moderate density of both *Strongylocentrotus franciscanus* and *S. purpuratus* . The sandy area was quite lively. Most notable, were the abundant small sand stars, *Astropecten armatas*, and the extremely abundant sea pen, *Stylatula* sp.. Several sheep crabs, *Loxorhynchus grandis,* and *Portunis xantusii xantusii*, were observed.

DISCUSSION

General Biology:

In 1996, *Macrocystis pyrifera* (giant kelp) forests were present at seven of the 16 sites. These sites included, Wyckoff Ledge at San Miguel Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, Yellowbanks at Santa Cruz Island, Cathedral Cove and Landing Cove at Anacapa Island, and Cat Canyon at Santa Barbara Island. One site, Rodes Reef at Santa Rosa Island was an open area with a moderate amount of red algae. Eight sites were dominated by echinoderms. Gull Island South, Pelican Bay, and Scorpion Anchorage at Santa Cruz Island, Southeast Sea Lion Rookery and Arch Point at Santa Barbara Island were dominated by *Strongylocentrotus purpuratus*. Hare Rock, San Miguel Island was dominated by *Strongylocentrotus franciscanus*. Admiral's Reef, Anacapa Island was dominated by both *S. purpuratus* and *Ophiothrix spiculata*, however some *M. pyrifera* was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*, and had a moderate density of *S. purpuratus*.

Seven sites had high *Strongylocentrotus purpuratus* (purple sea urchins) densities this year compared to five sites with high densities in 1995. On Santa Cruz, Anacapa, and Santa Barbara Islands *S. purpuratus* are abundant and dominating many of the areas that would probably be kelp forests if *S. purpuratus* densities were lower. Much of the subtidal habitat at Santa Barbara Island appeared to be sea urchin barrens with high densities of *S. purpuratus* and occasionally high densities of *S. franciscanus*. These observations are similar to what was seen in 1995. There were few canopy forming plants at Santa Barbara except for some remnant kelp forests around Sutil Island and Cat Canyon and some very small patches of kelp close to shore scattered around the island. At middle and west Anacapa Islands, much of the south side and parts of the islands have high densities of *S. purpuratus* and little *Macrocystis pyrifera* (giant kelp). However, the two kelp forest monitoring sites within the Ecological Refuge on Anacapa Island have healthy *M. pyrifera* forests, with low densities of *S. purpuratus*. Four of the five sites at Santa Cruz Island have high densities of *S. purpuratus*.

We continue to observe and receive reports of the brittle star *Ophiothrix spiculata* dominating areas around the islands. *O. spiculata* continued to be abundant at Admiral's Reef, Anacapa Island, and they are increasing in abundance at Fry's Harbor, Santa Cruz Island. At these two sites, we kept track of *O. spiculata* separately while conducting RPCs. At Admiral's reef their abundance was similar to 1995, and at Fry's Harbor their abundance appears to be increasing, but we did not count them separately in 1995. During survey dives, and from "word of mouth" reports it appears that *O. spiculata* are continuing to increase in abundance around Santa Barbara, Anacapa, and Santa Cruz Islands.

Sea urchin wasting syndrome (Richards and Kushner, 1994) was observed at eight sites this year compared to five in 1995. The three sites where this syndrome was observed this year and not in 1995 were all on Santa Cruz island. The syndrome was most common in *Strongylocentrotus purpuratus* and at all eight sites this species was observed with wasting syndrome. *S. franciscanus* was observed with wasting syndrome at four sites and *Lytechinus anamesus* at three sites.

Sea star wasting disease (Schroeter and Dixon, 1988) was also observed at more sites this year. It was observed at Pelican Bay and Scorpion anchorage, Santa Cruz Island, late in the summer on October 2nd. *Asterina (Patiria) miniata* and *Pisaster giganteus* were diseased at both of these sites. This disease was observed at eight sites in 1992, and gradually decreased until it was observed at no sites in 1995. We also observed *Parastichopus parvimensis* that appeared to have the same or similar wasting disease at Pelican Bay, Santa Cruz Island.

We continued to record more frequent sightings of *Stereolepis gigas*, giant black sea bass, this year. During our first cruise to Santa Barbara Island we observed *S. gigas* at two of the three monitoring sites. At Cat Canyon we observed one *S. gigas* on Wednesday, and at Southeast Sea Lion we observed one on Monday, and two on Thursday of the trip. During cruise #5 we observed one S. gigas at Sutil Island, Santa Barbara Island, and at least three at Survey Rock, Anacapa Island. There may have been up to six observed at Survey Rock, but no more than three were observed at any one time.

Protocol Changes:

The reduction of the number of quadrats from 40 to 24 has created some concern that we will be less able monitor species that have low densities or are patchy. At Wyckoff Ledge, San Miguel Island, *Strongylocentrotus franciscanus* and *S. purpuratus* were common, but were patchy and confined to crevices. This year, none of either species were observed on quadrats. This is possibly due to a combination of *Strongylocentrotus* spp. patchiness at this site, and the decreased number of quadrats.

The new $5m^2$-quadrat protocol is very efficient and seems to be working well for *Pisaster giganteus*, adult and subadult *Macrocystis pyrifera*. Since the definitions for the adult and subadult plants are different from pre-existing protocols, two new species numbers were created. These are described in the updated Kelp Forest Monitoring Handbook (Davis et al., in prep.).

We sometimes observe large changes at sites during the course of the summer. At the Johnson's Lee sites it appeared that there was a notable increase in the number of subadult *Macrocystis pyrifera* plants between our visit on August 5th and September 17th. This prompted us to conduct the $5m^2$-quadrat counts for a second time at the Johnson's Lee North site. The results showed an increase in subadult plants of about $1/m^2$ in about six weeks. We usually don't have time to re-sample if large changes in populations are observed over the course of the summer. However, we feel that we are able to observe such changes and document them in the site descriptions.

During the Kelp Forest Monitoring Review Workshop held in 1995 (Davis et al., 1996), there was much discussion on the fish transect protocol. Prior to 1996, four 2 X 3 X 100m long transects were conducted. Since each of the four transects is conducted over the same area, only the first transect can be looked at as a independent sample. The new fish transect protocol developed this year consists of four 2 X 3 X 50m transects all covering unique area. However, transect 3 and 4 are adjacent to transect 1 and 2. This new technique is back-compatible for analysis with the past protocol by combining transects 1 and 2 and comparing this with transect 1 of the old protocol.

Artificial Recruitment Modules (ARMs):

All of the Artificial Recruitment Modules (ARMs) present at ten sites were monitored this year. One of the most notable changes in the ARMs is the stabilization or decrease in the mean number per ARM of *Strongylocentrotus franciscanus* and *S. purpuratus*. The number of *Strongylocentrotus* spp. continued to increase for several consecutive years after the ARMs were deployed at most of the sites. This may have been due to immigration and/or recruitment. However, in 1995 and 1996 we are beginning to see a stabilization or decrease in the number per ARM at many of the sites with ARMs. The total number of *Crassedoma (Hinnites) giganteus* found in the ARMs this year (186) was similar to last year. Only five *Haliotis rufescens* were found in the 91 ARMs sample this year, compared to 12 in 1995. Thirteen *H. corrugata* were found this year compared to 11 in 1995.

Stainless steel number tags were attached to the ARM's in 1995 to replace the corroding brass tags. These new tags are already falling off. We believe this is due to the poor quality of the stainless steel wire with which the new number tags were attached. We will now start using plastic cable ties to attach number tags, and replaced any tags that are missing. We have created a new table in Access (Davis et al., 1996) that contains the tag number history for each ARM. So, even though a ARM may have had three or more tag numbers we are able to track which ARM is which for most of the ARMs.

Temperature:

It appears from the temperature data presented in this report (Appendix L) that the remote temperature loggers we are using are working well. Battery failure, however, is the most common cause of data loss from the temperature loggers. We are unsure of the reasons for the battery failures, but possible causes may be moisture in the temperature housings, or a bad batch of batteries. We were recently informed that the data collection setting (the mean of 100 readings every hour) we have been using requires more power than some of the other settings or a combination of these potential causes. Unfortunately, we found out about the latter, after the season ended, so all of the STOWAWAY™ loggers are set with this setting. Next time we deploy the temperature loggers (in the summer of 1997), they will be set to take one temperature point every hour. This should have little effect for data comparisons with prior years, and hopefully eliminate data loss. We also placed two silicate packets in each of the housings which will hopefully keep them dryer.

On cruise #4 of this summer we began calibrating the temperature loggers by taking the water temperature with a 50°F mercury thermometer when the loggers are retrieved. The thermometer temperature is then compared with the last recorded logger temperature. Although the temperature logger does not record the temperature at the same time we read the thermometer, we hope that this will help us detect any gross differences in temperature. We were prompted to start doing this because of the unusually cold water temperatures that was being recorded at Wyckoff Ledge, San Miguel Island.

Resource Use:

Commercial fish trapping continues to be active on the Channel Islands. We observed several fish trappers working around Santa Barbara Island, and we were able to observe the trapper “High life” pull in two traps on June 17, 1996. One of the traps had two *Semicossyphus pulcher*, and the other had four or five fish, at least two of which were *S. pulcher*. The other fish appeared darker and may have been *Girella nigricans*, or another fish of similar coloration. All fish were relatively small (approximately 1-2 pounds). We again observed the fish trapper “High Life” on August 19th and 20th during our second visit to Santa Barbara Island. On this trip we observed the fisherman pulling traps from Arch Point to Sutil Island, and they may have been working traps elsewhere around the island as well. There were fish traps near Arch Point and Cat Canyon transects. During a recreational dive at Landing Cove, Santa Barbara Island we looked at a trap that was

recently set to see what the fisherman were using for bait. This trap contained a large rock crab (*Cancer antennarius* or *C. productus*) and a small juvenile sheep crab (*Loxorhynchus gr*and*is*). Both crabs were fresh and crushed as if been hit by a large mallet. We observed another trap near the Cat Canyon site that contained two small juvenile sheep crab for bait, and one live *Hypsypops rubicundus*.

The commercial squid fishery continued in force this summer with boats from at least as far as Washington to fish at the Channel Islands. We observed numerous boats fishing at night (as indicated by the bright lights used to attract the squid) during cruises 4, 6 and 7. Most of the boats we observed were concentrated at the southeast end of Santa Rosa Island. However, due to our night anchorage locations it is likely that there are locations where squid fishing occurs that we did not observe. During the summer it was also common to see squid boats on the Northwestern side of Santa Cruz Island from the mainland on clear nights.

During cruise #4, on August 8th, Mark Senning's the Anacapa Island Ranger, received a report from one the Santa Barbara based dive boats about some possible illegal traps that were observed at the "Goldfish bowl", West Anacapa Island. The dive boat thought the traps were illegal because they appeared to be fishing, using dead sea birds as bait, and had no buoys that reached the surface. Ian Taniguchi from the Department of Fish and Game, and David Kushner made a dive on the traps. All four traps reported were found. Three were next to each other, and the fourth was about 10 meters away. Only one of the traps had a closed door and was actively fishing. This trap had several medium size *Loxorhynchus grandis* (sheep crab), several *Astraea undosa*, three *Panulirus interruptus* (one was a 3-4 pounds), and a cormorant that probably had been dead for several days. There was also a dead cormorant on the top of one of the other traps. We released the animals from the trap that was fishing, and dismantled it by cutting it open. All of the traps were old and fairly well corroded. It would be difficult to determine how the cormorant got inside the cage. Just in case someone was actively fishing with the traps, we placed notes written on underwater paper, stating that the traps were illegal, and took some video footage for documentation. Our opinion after observing the traps was that they were "ghost traps" and they were not being actively used.

Logistics:

Overall, our research vessel the "Pacific Ranger" ran well this year, and we had better weather than the previous several years, however we did experience a few minor problems as expected for a boat. A cylinder head gasket blew out in the air compressor during the first trip. We were able to repair this in the field using a piece of cardboard for a new gasket. On the second cruise, we experienced some major generator

problems that forced us to stay at the dock for the first two days of the trip until we realized that we would not be able to fix it before the end of the week. We used a portable Honda generator and made a 3-day trip.

During cruise #6, a little after 1600 hours on September 9th while heading to Johnson's Lee, Santa Rosa Island from Gull Island, Santa Cruz Island, we experienced some undesirable weather that was worse than expected. There were high winds and wind swells that were of short interval and up to 8 feet plus in the gap between Santa Cruz and Santa Rosa Islands. The two ice chests containing spare gear kept in a cabinet on the upper deck of the Pacific Ranger were lost overboard. The ice chest moved with such force from the rough seas that they banged against the locker door of the cabinet and broke the latch and slid overboard. By chance we noticed the coolers being blown rapidly down wind while we were reinforcing some other equipment on the back deck. Diane was able to maneuver the boat, and locate two buoyancy control vests with new ScubaPro Air ll's, and a spare regulator that stayed afloat because it was stored in a plastic trash bag. We were able to retrieve these items. A list of lost equipment is available in the trip report for Cruise #6.

We continued to have numerous requests for Kelp Forest Monitoring data in 1996. All Kelp Forest Monitoring data was sent to Ginny Eckert at the University of California, Santa Barbara. All of the *Strongylocentrotus franciscanus* and *S. purpuratus* data were sent to Lance Morgan at the Bodega Marine Laboratory, Mia Tegner at Scripps Institute of Oceanography, and to Peter Kalvass at the California Department of Fish and Game. The density and size frequency data was also sent to Mia Tegner. All of the *Parastichopus parvimensis* data was sent to Deborah McArdle at the California Sea Grant Extension Program. All available temperature data was sent to Donna Schroeter and Arnold Ammann at the University of California at Santa Barbara. All of the data on *Semicossyphus pulcher* was sent to Kimberly K Mckee-Lewis at the California Department of Fish and Game. A collecting permit was issued and collection of *Coryphopterus nicholsii* were made for Dr. Milton Love at the University of California at Santa Barbara. In addition, Michael Pentony completed his masters project titled "Commercial Harvesting Impacts on The Channel Islands National Park, California, Populations of the Red Sea Urchin, *Strongylocentrotus franciscanus*".

For additional copies of this report, other annual reports, or if you are interested in obtaining the raw data, please write to the address below:

Kelp Forest Monitoring
Channel Islands National Park
1901 Spinnaker Drive
Ventura, CA 93001

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Table 1. Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
ALGAE		
Miscellaneous Green Algae		R
Miscellaneous Red Algae		R
Articulated Coralline Algae		R
Encrusting Coralline Algae		R
Agar weed	*Gelidium spp.*	R
Sea tongue	*Gigartina spp.*	R
Miscellaneous Brown Algae		R
Acid weed	*Desmarestia* spp.	R
Oar weed	*Laminaria farlowii*	R,Q
Bladder chain kelp	*Cystoseira* spp.	R
Giant kelp	*Macrocystis pyrifera*	R,Q,M
California Sea Palm	*Pterygophora californica*	R,Q
Southern Sea Palm	*Eisenia arborea*	R,Q
Miscellaneous plants		R
INVERTEBRATES		
Miscellaneous Sponges		R
Orange puffball sponge	*Tethya aurantia*	B,S
Southern Staghorn Bryozoan	*Diaperoecia californica*	R
Miscellaneous Bryozoans		R
California hydrocoral	*Allopora californica*	B,S
White-spotted rose anemone	*Tealia lofotensis*	B
Red gorgonian	*Lophogorgia chilensis*	B,S
Brown gorgonian	*Muricea fruticosa*	B,S
California golden gorgonian	*Muricea californica*	B,S
Strawberry anemone	*Corynactis californica*	R
Orange cup coral	*Balanophyllia elegans*	R
Cup coral	*Astrangia lajollaensis*	R
Hydroids		R
Ornate tube worm	*Diopatra ornata*	R
Colonial sand-tube worm	*Phragmatopoma californica*	R
Scaled-tube snail	*Serpulorbis squamigerus*	R
Chestnut cowrie	*Cypraea spadicea*	Q
Wavy turban snail	*Astraea undosa*	Q,S
Red turban snail	*Astraea gibberosa*	Q,S
Bat star	*Patiria miniata*	Q,S
Giant-spined sea star	*Pisaster giganteus*	Q,S,M
Sunflower star	*Pycnopodia helianthoides*	B,S
White sea urchin	*Lytechinus anamesus*	B,S
Red sea urchin	*Strongylocentrotus franciscanus*	Q,S
Purple sea urchin	*Strongylocentrotus purpuratus*	Q,S
Warty sea cucumber	*Parastichopus parvimensis*	Q
Aggregated red sea cucumber	*Pachythyone rubra*	R
Red abalone	*Haliotis rufescens*	B,S
Pink abalone	*Haliotis corrugata*	B,S
Green abalone	*Haliotis fulgens*	B,S

Table 1. Continued.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
Kellet's whelk	*Kelletia kelletii*	B,S
Giant keyhole limpet	*Megathura crenulata*	B,S
California brown sea hare	*Aplysia californica*	B
Rock scallop	*Hinnites giganteus*	B,S
California spiny lobster	*Panulirus interruptus*	B
Tunicates		R
Stalked tunicate	*Styela montereyensis*	Q
Miscellaneous Invertebrates		R
FISH		
Bluebanded goby	*Lythrypnus dalli*	Q
Blackeye goby	*Coryphopterus nicholsii*	Q
Island kelpfish	*Alloclinus holderi*	Q
Blacksmith	*Chromis punctipinnis*	V
Señorita	*Oxyjulis californica*	V
Blue rockfish	*Sebastes mystinus*	V
Olive rockfish	*Sebastes serranoides*	V
Kelp rockfish	*Sebastes atrovirens*	V
Kelp bass	*Paralabrax clathratus*	V
California Sheephead	*Semicossyphus pulcher*	V
Black surfperch	*Embiotoca jacksoni*	V
Striped surfperch	*Embiotoca lateralis*	V
Pile perch	*Damalichthys vacca*	V
Garibaldi	*Hypsypops rubicundus*	V
Opaleye	*Girella nigricans*	V
Rock Wrasse	*Halichoeres semicinctus*	V
SUBSTRATE		
Bare substrate		R
Substrates: Rock		R
Cobble		R
Sand		R

B= Band Transect
Q= Quadrat
R= Random Point Contact
M= $5m^2$-Quadrat
S= Size frequency Measurement
V= Visual Transect

CHANGES IN SCIENTIFIC NOMENCLATURE:

Patiria miniata	=	*Asterina miniata*
Astraea undosa	=	*Lithopoma undosum*
Astraea gibberosa	=	*Lithopoma gibberosum*
Hinnites giganteus	=	*Crassedoma giganteum*
Allopora californica	=	*Stylaster californica*

Table 2. Station Information.

ISLAND	LOCATION	ABBREVIATION	DEPTH METERS	YEAR ESTABLISED
San Miguel	Wyckoff Ledge	SMWL	13-15	1981
San Miguel	Hare Rock	SMHR	6-9	1981
Santa Rosa	Johnson's Lee North	SRJLNO	9-11	1981
Santa Rosa	Johnson's Lee South	SRJLSO	14-16	1981
Santa Rosa	Rodes Reef	SRRR	13-15	1983
Santa Cruz	Gull Island South	SCGI	14-16	1981
Santa Cruz	Fry's Harbor	SCFH	12-13	1981
Santa Cruz	Pelican Bay	SCPB	6-8	1981
Santa Cruz	Scorpion Anchorage	SCSA	5-6	1981
Santa Cruz	Yellowbanks	SCYB	14-15	1986
Anacapa	Admiral's Reef	ANAR	13-15	1981
Anacapa	Cathedral Cove	ANCC	6-11	1981
Anacapa	Landing Cove	ANLC	5-12	1981
Santa Barbara	Southeast Sea Lion Rookery	SBSESL	12-14	1981
Santa Barbara	Arch Point	SBAR	7-8	1981
Santa Barbara	Cat Canyon	SBCAT	7-9	1986

Table 3. Summary of sampling techniques used to monitor population dynamics of selected kelp forest organisms.

TECHNIQUE	SAMPLE NUMBER OF SIZE REPLECATES
Quadrat count	1 m X 1 m 24X / site
Band Transect count	3 m X 10 m 24X / site
$5m^2$-Quadrat	1 m X 5m 40X/ site
Random Point Contact	40 points 15X / site (0.5 x 3 m)
Visual Fish transects	2 m(w) X 3 m(h) X 50 m(l) 8X / sites 5 minutes
Video transects	5 minutes / 100 m; 2X / site, and also a 360° pan at 0, 50 and 100m along transect.
Size frequency measurements	30 to 200 / species: 1X / site (see size frequency measurement dimensions below)
Species Checklist	30 - 90 minutes, 1X / site
Artificial Recruitment Modules	7 - 15 modules / site

Size Frequency measurement dimensions:

Genus	Sample Size	Measurement
Macrocystis	100	Stipe count (1 m above bottom), max. holdfast diameter, mm
Tethya	30	Max. diameter, mm
Stylaster (Allopora)	50	Max. height and width, mm
Lophogorgia	30	Max. height and width, mm
Muricea	30	Max. height and width, mm
Megathura	30	Max. shell length, mm
Haliotis	30	Max. shell length, mm
Lithopoma (Astraea)	30	Max. shell diameter, mm
Kelletia	30	Max. shell length, mm
Crassedoma (Hinnites)	30	Max. shell length, mm
Strongylocentrotus	200	Max. test diameter, mm
Lytechinus	200	Max. test diameter, mm
Pycnopodia	30	Length of the longest ray, mm
Asterina (Patiria)	30	Length of the longest ray, mm
Pisaster	30	Length of the longest ray, mm

Table 4. Kelp forest monitoring site status 1996.

ISLAND/SITE	STATUS
San Miguel Island:	
Wyckoff Ledge	Mature kelp forest with a dense understory of red and brown algae.
Hare Rock	Sea urchin barrens, high density of S*trongylocentrotus franciscanus*.
Santa Rosa Island:	
Johnson's Lee North	Kelp forest.
Johnson's Lee South	Mature kelp forest with a dense understory of red algae.
Rodes Reef	Open area with a moderate amount of understory red algae.
Santa Cruz Island:	
Gull Island South	Sea urchin barrens with a moderate density of S*trongylocentrotus purpuratus*
Fry's Harbor	Open area with an abundance of *Pachythyone rubra*, *Strongylocentrotus purpuratus* and *Astrangia lajollaensis*.
Pelican Bay	Sea urchin barrens with a moderate density of S*trongylocentrotus purpuratus* .
Scorpion Anchorage	Sea urchin barrens with a high density of S*trongylocentrotus purpuratus* .
Yellowbanks	Mature kelp forest.
Anacapa Island:	
Admiral's Reef	*Strongylocentrotus purpuratus* and *Ophiothrix* s*piculata* barrens, with a sparse kelp forest on the west end of the transect.
Cathedral Cove	Kelp forest.
Landing Cove	Open kelp forest.
Santa Barbara Island:	
Southeast Sea Lion Rookery	Sea urchin barrens with a high density of S*trongylocentrotus purpuratus* .
Arch Point	Sea urchin barrens with a high density of S*trongylocentrotus purpuratus* .
Cat Canyon	Mature kelp forest.

Table 5. 1996 Kelp Forest Monitoring Program participant and cruise list.

PARTICIPANTS	AFFILIATION	CRUISES PARTICIPATED
Alburn, Tessa	University of California Los Angeles	5
Baltz, Kenneth	NOAA	1
Berg, William	University of California Santa Cruz	4
Brooks, John	NPS Submerged Cultural Resources Unit	7
Conti, John	Channel Islands National Park VIP	3
Cox, Ken	Channel Islands National Park VIP	3
Crow, Karen	University of California Santa Cruz	6
Davis, Gary	National Biological Survey	1
Fastenau, Henry	University of California Davis	6
Freedman Bernard	University of California Santa Barbara	2
Gorodezky, Laura	NOAA-Channel Islands NMS	7
Haaker, Peter	California Dept. of Fish and Game	6
Hansen, Mellisa	Humboldt State University	5
Kim, Stacey	National Marine Fisheries Service	7
Kushner David	Channel Islands National Park	1,2,3,4,5,6,7
Lerma Derek	Channel Islands National Park	1,2,3,4,5,6,7
Manjani, Eric	Channel Islands National Park VIP	4
Meyer, Carolyn	Channel Islands National Park VIP	1
Mollenkoph Peggy	Channel Islands National Park	2,3,4,5
Mondragon, Jeff	Channel Islands National Park	1,2,3,4,5
Morgan, Jennifer	Channel Islands National Park	1,2,3,4,5
Morgan, Lance	University of California Davis	3
Paddack, Michelle	University of California Santa Cruz	4
Provo, John	Channel Islands National Park	1
Readdie Mark	University of California Santa Cruz	2
Reaugh Kathleen	University of California Santa Cruz	2
Richards, Dan	Channel Islands National Park	1,2
Richardson, Diane	Channel Islands National Park	1,2,3,4,5,6,7
Shaffer, Johnathan	Humboldt State University	6
Stoltz, Dave	Channel Islands National Park	7
Sullivan, Deidre	Moss Landing Marine Laboratory	3
Taniguchi, Ian	California Dept. of Fish and Game	4
Trone, John	University of California Santa Cruz	7
Walder, Ron	Moss Landing Marine Laboratory	5

CRUISE NUMBER	CRUISE DATES	SITES VISITED
Cruise #1	June 17-21, 1996	SBSESL, SBAP, SBCAT
Cruise #2	July 8-12, 1996	SRRR, SCGI, ANAR
Cruise #3	July 22-26, 1996	SMWL, SMHR, SCFH, SCPB, SCSA, ANLC
Cruise #4	August 5-9, 1996	SMHR, SRJLNO, SRJLNO, ANCC, ANLC
Cruise #5	August 19-23, 1996	SCYB, ANAR, SBSESL, SBAP, SBCAT
Cruise #6	September 16-20, 1996	SMWL, SMHR, SRJLNO, SRJLSO, SRRR, SCYB
Cruise #7	Sept. 30 - Oct. 4, 1996	SCGI, SCFH, SCPB, SCSA, ANAR, ANLC

Table 6. 1996 Echinoderm wasting disease/syndrome observations.

ISLAND/SITE	Sea Star Wasting Syndrome		Sea Urchin Wasting Syndrome	
	SPECIES OBSERVED	DATE(s)	SPECIES OBSERVED	DATE(s)
San Miguel Island				
Wyckoff Ledge	none		none	
Hare Rock	none		none	
Santa Rosa Island				
Johnson's Lee North	none		none	
Johnson's Lee South	none		none	
Rodes Reef	none		none	
Santa Cruz Island				
Gull Island South	none		2	7/11, 9/30
Fry's Harbor	none		2	7/24, 10/2
Pelican Bay	1,4,7	10/2	2	7/25, 10/2
" "			3	10/2
" "			6	7/25, 10/2
Scorpion Anchorage	1,4	10/2	2	7/25, 10/2
" "			6	7/25
Yellowbanks	none		2	8/21, 8/22
"			3	8/21
Anacapa Island				
Admiral's Reef	none		2	7/12, 8/22, 10/1
" "	none		3	8/22, 10/4
Cathedral Cove	none		none	
Landing Cove	none		none	
Santa Barbara Island				
SE Sea Lion Rookery	none		2,6	6/17, 8/19
Arch Point	none		2,6	6/18, 6/20
Cat Canyon	none		none	

SPECIES LEGEND:

1 = *Asterina* (*Patiria) miniata*
2 = S*trongylocentrotus purpuratus*
3 = *Lytechinus anamesus*
4 = *Pisaster giganteus*
5 = *Astrometis sertulifera*
6 = S*trongylocentrotus franciscanus*
7 = *Parastichopus parvimensis*

none = not observed at this site during our visits in 1996
date = date(s) disease/syndrome was observed

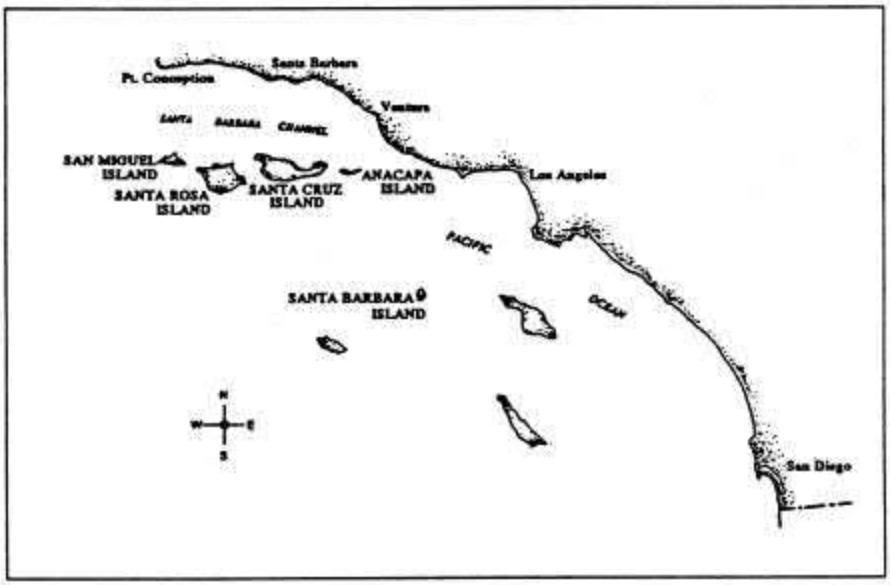

Figure 1. Kelp Forest Monitoring Locations (•) in Channel Islands National Park. Insert shows location of the five park islands in the Southern California Bight.

Appendix K. 1996 Species List for all Channel Islands National Park Kelp Forest Monitoring Stations.

Introduction:

The species list contains presence/absence and relative abundance data for all species that could be found and identified during the site visits between June and September. Generally at least one dive is made by an experienced biologist strictly for species list observations. The overall effort varies from station to station with the water conditions and available time. Relative abundance values are subjective, and generally based on opinions of several divers viewing the overall site. Some species assemblages are more difficult to identify than others and may be lumped into general categories. Organisms were general not collected for additional taxonomic work. When identification is tentative we either do not mark it or place a question mark on the list. Some categories, (e.g. Sponges or tunicates) may be much more diverse than it would appear from the list.

Abundance Ratings:

X - present, no relative abundance rating given
4 - abundant, organism present in higher than normal densities
3 - common, organism found over most of site or in high density patches
2 - present, organism found in moderate numbers
1 - rare, few organisms found
0 - noticeably absent, an effort was made to look for an organism that was not found.

Notes:

e	- eggs
j or jvs	- juvenile
s	- shell only
int	- intertidal
d	- drift
PM or night	- seen only on night dive
JX	- juveniles present and adults present
J#/#	- (e.g. J3/2 - juvenile abundance 3, adult abundance 2)
nests	- *Hypsypops* nest turf
dis	- diseased

Station names are listed in Table 2 of the text.

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
CHLOROPHYTA		X														
BRYOPSIS CORTICULANS					3									2	1	
CHAETOMORPHA SPIRALIS																1
CLADOPHORA SP.			1							X			1			
CODIUM CUNEATUM														1		1
CODIUM FRAGILE						1			1		2		X		2	
CODIUM HUBBSII/SETCHELLII														2	2	2
CODIUM SETCHELLII			1							1						
DERBESIA MARINA					2									2		
ENTEROMORPHA SP.												2				
GREEN MAT ON SAND										2						
HALICYSTIS OVALIS						2					X	2	X	2	1	2
ULVA SP.	D															
PHAEOPHYTA																
AGARUM FIMBRIATUM				X												
COILODESME RIGIDA												4				
COLPOMENIA SP.			2		2	X	1	1					X			
COLPOMENIA/HYDROCLATHRUS												2		1	1	1
CYSTOSEIRA SP.		1	2	2	2					3	X		3			
CYSTOSEIRA NEGLECTA	3				3							3			1	2
CYSTOSEIRA OSMUNDACEA																
DESMARESTIA SP.	3						0	0								
DESMARESTIA LIGULATA	3	1	2		3											
DICTYONEUROPSIS RETICULATA					2											
DICTYOPTERIS UNDULATA												2		1		1
DICTYOTA BINGHAMIAE						X										
DICTYOTA FLABELLATA												2			1	1
DICTYOTA/PACHYDICTYON			X	X	3			1	1	X	X		2	1	2	2
EGREGIA MENZIESII												X			1	
EISENIA ARBOREA	1	1/J1	0	1/J1	1JV	1JV	1			2	2/J2	X	3/J2		2(inside)	1
LAMINARIA FARLOWII			2	3/J2	2	D	1	0	1	3		2	3/J3			2
MACROCYSTIS PYRIFERA	3/J3	0/J1	4/J3	4/J3	1/J1	1/J1	0	0	1/J1	2/J2	2/J2	3/J3	3/J2	0/J1	0/J1	4/J2
PACHYDICTYON CORIACEUM												2				
PTERYGOPHORA CALIFORNICA	2		2				0	0		3	0		3/J2			
SARGASSUM MUTICUM					1											
TAONIA LENNEBACKERIAE												2			3	
ZONARIA FARLOWII												2				1
RHODOPHYTA										2						
ACROSORIUM UNCINATUM					4							X			1	1
BOSSIELLA/CALLIARTHRON						2						2				
BOTRYOCLADIA PSEUDODICHOTOMA					2											
BOTRYOGLOSSUM FARLOWIANUM					X											
CALLIARTHRON SP.														1	2	3
CALLOPHYLLIS SP.	X															
CALLOPHYLLIS FIRMA					3											
CALLOPHYLLIS FLABELLULATA	3		X		3											
CALLOPHYLLIS VIOLACEA			X	X	3											
CORALLINA OFFICINALIS						X						2			1	2
CORALLINES - ENCRUSTING	3	3	2	2	2	4			4	3	3	3	3	3	4	3
CORALLINES - ERECT	2	2	2	2		2			2	2	2	2	3	1	2	3
CRYPTOPLEURA VIOLACEA	X				2											
FARLOWIA COMPRESSA			X													
FARLOWIA CONFERTA			X													
FAUCHEA LACINIATA					4	2										
GELIDIUM PURPURASCENS								X	X		2		3		2	

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
GELIDIUM ROBUSTUM															1	
GIGARTINA SP.	2	1	3	X									X			
GIGARTINA CORYMBIFERA		1	2	3	2									1		
GRIFFITHSIA PACIFICA					2											
JANIA SP.																2
LAURENCIA SP.														X		
LAURENCIA PACIFICA		2					X	1	2	X	3			1	1	1
LITHOTHAMNION/LITHOPHYLUM												X		X	X	X
LITHOTHRIX ASPERGILLUM												1			1	2
NIENBURGIA ANDERSONIANA					3											
OPUNTIELLA CALIFORNICA		1			3											
PHYCODRYS SETCHELLII					2											
PIKEA ROBUSTA					2											
PLOCAMIUM SP.											X		X			1
POLYNEURA LATISSIMA					3											
PSEUDOSCINAIA SNYDERIAE					3											
PTILOTHAMNIOPSIS LEJOLISEA						2										
RHODOGLOSSUM SP.					X											
RHODOPTILUM PLUMOSUM					2											
RHODYMENIA SP.			2													
RHODYMENIA CALIFORNICA						2						1				
RHODYMENIA PACIFICA					3	2										
SCHIZYMENIA SP.					2											
SCHIZYMENIA/HALIMENIA					2											
SCIADOPHYCUS STELLATUS						2						1				
STENOGRAMME INTERRUPTA					1											
FILAMENTOUS RED ALGAE			X		2	2			X	X	2	X		3	3	2
NON - FILA. REDS microscopic															1	
HYPSYPOPS TURF NEST			1									2	X		3	2
ANGIOSPERMA																
PHYLLOSPADIX SP.	D														D	
PHYLLOSPADIX SCOULERI																
PHYLLOSPADIX TORREYI																1
DIATOMS																
DIATOM FILM			X			X			X	X						
SCHIZYMENIA COLONIAL DIATOMS					4	2						2		X	X	
PROTOZOA																
HOMOTREMA RUBRUM				X					X		X	2	2	2	2	2
PORIFERA		X		3					2	2						2
LEUCETTA LOSANGELENSIS		X										2				1
LEUCILLA NUTTINGI	X	X														1
LEUCOSOLENIA ELEANOR					2				1		2	1	2			2
YELLOW SPONGE W/TALL PORES	3		2													
ACARNUS ERITHACUS			X		X											
APLYSILLA GLACIALIS														1		
CLIONA SP.						X								1		
CLIONA CELATA	2									X						
CLIONA CELATA VAR. CALIFORNIANA			X													
HALICLONA SP.	X	X			X									2		1
HYMENAMPHIASTRA CYANOCRYPTA	2		2	3	2	2						2	2			2
LISSODENDORYX TOPSENTI						2								1		1
OPHALITASPONGIA PENNATA		X														
PENARES CORTIUS												1			?	1
POLYMASTIA PACHYMASTIA					2											
RED SPONGES - ENCRUSTING	X		2	2	2	2		X	X	X	2	1		1	1	1

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
SPHECIOSPONGIA CONFOEDERATA			2		2											
TETHYA AURANTIA	3	2	2	3	3	2	2	1	1	1	1	2		3/J3	1	1
TETILLA ARB					1											
TETILLA FLAMINGO					3											
VERONGIA AUREA													1	1		1
XESTOSPONGIA TRINDINAEA			X	2	2	2				X		1				1
CNIDARIA																
HYDROZOA																
ABIETINARIA SP.												X				
AGLAOPHENIA SP.					2							2		X		X
AGLAOPHENIA LATIROSTRIS	3	1	2	3						2			2			
ALLOPORA CALIFORNICA						3										
ANTENELLA AVALONIA												2				X
GARVEIA ANNULATA						3										
HYDRACTINIA SP.				2	3	2	2	4				2		2	2	1
LYTOCARPUS NUTTINGI															1	2
OBELIA SP.	3	X	3	2	2				1	2		X	X	X		3
PHYSOPHORA HYDROSTATICA																
PLUMULARIA SP.					2	2			1			2		2	2	2
SERTULARELLA SP.	X	X	X	X			X	X	X	X			X	2	2	2
SERTULARIA SP.	X	X	X	X			X	X	X	X			X			X
PACHYCERIANTHUS FIMBRIATUS	2	2	2	X	2	2	2	2	X	X	1	2	2	2		
CLAVULARIA SP.									1			2		2	1	1
ANTHOZOA																
EUGORGIA RUBENS									0		4					
LOPHOGORGIA CHILENSIS	0	0	1	2	1	3	3	3	1	2/J2	2	2	1	2/J2	1	1
MURICEA CALIFORNICA	0	0		X		2	?	1	0	2	2			2	1	
MURICEA FRUTICOSA	0	1				1	?	?	0	X	2			1	1	
RENILLA KOLLIKERI												2				
STYLATULA ELONGATA					X							2				
CORYNACTIS CALIFORNICA	2	3	2		3	3	2	1	1	X		1	2	2	2	1
ANTHOPLEURA ARTEMISIA	X													2	1	2
ANTHOPLEURA ELEGANTISSIMA	3	2	X		2				2	X			X	1	2	
CACTOSOMA ARENARIA						X										
EPIACTIS PROLIFERA	3	X	2	2	2			X	1						1	1
HALCAMPA DECEMTENTACULATA														X		
HARENACTIS ATTENUATA												X				
METRIDIUM EXILIS					X											
METRIDIUM SENILE		X														
PHYLLACTIS BRADLEYI												3			3	
SAGARTIA CATALINENSIS														*	*	*
TEALIA CORIACEA	X		2	X	3				1	2	2	1	1	2		1
TEALIA CRASSICORNIS					X	2										
TEALIA LOFOTENSIS	3	1	X	2	3		0	0		0						
ZAOLUTUS ACTIUS					2	2	2					2		2	2	X
ORDER MADREPORARIA																
ASTRANGIA LAJOLLENSIS (=A. HAIMEI)	2	3	2	2	3	3	4	4	3		2	2	2	2	2	2
BALANOPHYLLIA ELEGANS	2	3	2	2	2	2	2	2	2		2		1	2/J2	2	2
COENOCYATHUS BOWERSI		X													2	
PARACYATHUS STEARNSI (=P. STEARNSII)	2	2		2	X	2	2	2	1		X		2	2	2	
CTENOPHORA																
BEROE SP.												X				
PLATYHELMINTHES		X			X	X	X	X	2			3				X
KABURAKIA		X														
NEMERTEA			X						X							

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
CEREBRATULUS SP.						X						X				
PARANEMERTES PEREGRINA		X														
TUBULANUS SEXLINEATUS		2														
SIPUNCULA					X											
SIPUNCULUS NUDUS		X														
THEMISTE PYROIDES									1							
ANNELIDA																
POLYCHAETA	X			X												
ARCTONOE SP.			X													
ARCTONOE PULCHRA												X				
ARCTONOE VITTATA									X		X	X				X
CHAETOPTERUS VARIOPEDATUS	X	2	X	X	3	2	X	3	2	X	2	3	2	2	2	2
DIOPATRA ORNATA	3	2	2	X	2	4		1	2	X		2	X	1	1	2
DODECACERIA FEWKESI	3	4		X	2	3			2	X				2	2	1
EUDISTYLIA POLYMORPHA	1	2	1	2	2	2	1		1		1					
MYXICOLA INFUNDIBULUM		X			2	2	2	2	2	X	X		X	1		
NEREID																
OPHIODROMUS PUGETTENSIS					4	3			2		X	X		2		
PHRAGMATOPOMA CALIFORNICA	2	1	X						2		X	2	X	1	1	3
PHYLLOCHAETOPTERUS PROLIFICA																
PHYLLODOCE HARTMANAE																
PHYLLODOCID																
PISTA ELONGATA	3	2	2	X	3	2	X		2				2	1		
SABELLID		X										X		X		X
SALMACINA TRIBRANCHIATA		1	2	2	2		X	X	1	X	X	2		X	2	2
SERPULID					X	2						X				
SPIROBRANCHUS SPINOSUS		2	X			2	2	3	4		2	2	2	2	2	4
SPIRORBID	2		2	X					X	2	X	2	2	X		X
TEREBELLID	X		X			X	2	4	2		1	X	X			
THELEPUS CRISPUS		4														
POLYCHAETE "BALLOONS"									2				X			
ARTHROPODA																
PYCNOGONIDA						X										
CRUSTACEA																
CIRRIPEDIA/THORACIA																
BALANUS SP.		X	X	X		X	2	3	1		X		X	2		
BALANUS AQUILA/NUBILUS		X														
BALANUS NUBILUS					2	X										
MEGABALANUS CALIFORNICUS						X						X				
TETRACLITA ELEGANS						2	2					X		1		1
TETRACLITA RUBESCENS	X	X								X						
MALACOSTRACA																
MYSIDS (brown canopy dwellers)	3				2											
MYSIDS (clear bottom dwellers)	4	4	X		4							X		X		
ISOPODA																
CIROLANA SP.	X															
COLIDOTEA												X			X	X
IDOTEA RESECATA	4			2	X					X	2					X
AMPHIPODA																
AMPHIPOD TUBE MASSES	X			2		X										2
AMPITHOE HUMERALIS	3															
CAPRELLID	3			X	3					X					X	X
GAMMARID	X	X	X	X					X	X	X	X	X	X	X	X
COPEPODS												X	X			3
COPEPODS ON MEGATHURA CRENULATA						3										
COPEPODS ON FISH	2		2	X	3	X										

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
DECAPODA																
ALPHEUS SP.				X					2				X			
BETAEUS MACGINITIEAE		X	X		X	X	3			X	2		X	0		
CRANGON SP.			X													
HEPTACARPUS SP.			X						X							
LYSMATA CALIFORNICA									X				X		X	
PANDALUS SP.						2										
PANDALUS DANAE	X	4	2		2			1	X	X		1		2		
PANULIRUS INTERRUPTUS	0	0	1	0			1	1	2		1	2	3		2	3
CRYPTOLITHODES SITCHENSIS			X													
HAPALOGASTER CAVICAUDA			X	X	X					X						1
PAGURISTES SP.						2						X				
PAGURUS SP.	X	X							2					1	2	X
PETROLISTHES SP.	X	2		X			X		2			X	X			
CANCER SP.										M						S
CANCER ANTENNARIUS	2		X	X					S				M			
CANCER PRODUCTUS	2				X											
HERBSTIA PARVIFRONS			2				X		2		X	X		X	X	X
HETEROCRYPTA OCCIDENTALIS												X				
LOPHOPANOPEUS SP.																1
LOXORHYNCHUS CRISPATUS	X															
LOXORHYNCHUS GRANDIS		1			X									1JV	2	
PARAXANTHIAS TAYLORI		X			X	X	X		2		X	3		X	1	2
PELIA TUMIDA			X	X			X					X				
Pimochirus californiensis														X	X	X
PUGETTIA SP.									2							
PUGETTIA PRODUCTA	4									M			M			
PUGETTIA RICHII		2														
SCYRA ACUTIFRONS				X								X				
TALIEPUS NUTTALLI										1					X	
MOLLUSCA																
GASTROPODA																
ACMAEA MITRA		3						X								
ALIA CARINATA (=Mitrella carinata)														1		
AMPHISSA VERSICOLOR	X		X		X				X		X	X		1		S
ASTRAEA GIBBEROSA (=Lithopoma gibberosum)	3								0							
ASTRAEA UNDOSA (=Lithopoma undosum)	0	S	X		2	2	2	3	4/J2	2/JX	2	3	4/J2	3	4	3
BITTIUM SP.												X				
BURSA CALIFORNICA														1	2	
CALLIOSTOMA SP.									X					X		
CALLIOSTOMA ANNULATUM	X				X	X										
CALLIOSTOMA LIGATUM	X	2														
CALLIOSTOMA SUPRAGRANOSUM														2	1	1
CERATOSTOMA FOLIATUM		2			X											
CERATOSTOMA NUTTALLI		S					X	X	3			3		1	1	2-(E)
CONUS CALIFORNICUS	X	S	X						1	2		3	1	2	2	3-(E)
CREPIDULA SP.	X	X		X			X	X	X	X	X		X			
CREPIDULA DORSATA (=Crepipatella dorsata)						2						3		2	X	X
CYPRAEA SPADICEA	X	3	2		3	2	2	1	3	X	2	3(E)	2	1	1	1
FUSINUS KOBELTI			3									2				1
FUSINUS LUTEOPICTUS						X										
HALIOTIS CORRUGATA	0	0	S	S		S		S	0	1	1	1	3	0/J1		1/J2
HALIOTIS CRACHERODII	0	S	0	0			0	0	0	0	0	0	0			
HALIOTIS FULGENS	0	0	0	0			0	0	0	0	0	0	0			1
HALIOTIS RUFESCENS	2	0/J2	2	2			0	0	0	1	0	0	0			
HALIOTIS SORENSENI	0	0	0	0			0	0	0	0	0	0	0			

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
HALIOTIS WALALLENSIS	S	0	0	0			0	0	0	0	0	0	0			
HALIOTIS ASSIMILIS	0	0	0	0			0	0	0	0	0	0	0			
HOMALOPOMA SP.		3							X							
HOMALOPOMA LURIDUM					X	X										
KELLETIA KELLETII	2	1	X	X	3(E)	3	2	1	1	2		2(E)	1/J1	0	0	1(E)
MAXWELLIA GEMMA						X			X					1		2
MAXWELLIA SANTAROSANA					X							X				X
MEGATHURA CRENULATA	1	1	2	2	2	2/JV	3	0	3	2	2	X	2	2		2
MITRA IDAE	2	X			X	2			1	X		X				1
NORRISIA NORRISI	2		X			2					X	2	2	S	1	4
OCENEBRA SP.																X
OLIVELLA BIPLICATA	X															
PEDICULARIA CALIFORNICA						2										
POLINICES SP.	S													E		
SERPULORBIS SQUAMIGERUS		X	X	X		2			4		2	2	2	2	2	2
SIMNIA VIDLERI (=Neosimnia)						2										
TEGULA SP.								2	2							
TEGULA AUREOTINCTA												1		1	3	2
TEGULA EISENI												2	2	2	3	4
TEGULA FUNEBRALIS												X				
TEGULA REGINA						2								2	2	1
TRIVIA CALIFORNIANA												X				
TRIVIA SOLANDRI		X	X							X		2			S	S
VOLVARINA TAENIOLATA			X				X	3	2			2				
OPISTOBRANCHIA																
APLYSIA CALIFORNICA	2	2	X	X	3	2	0	1	2		2	2	X	3	3	2
APLYSIA VACCARIA												1				
BERTHELLINA ENGELI								X				2	X			
NAVANAX INERMIS	X		X			X				2		2				
RICTAXIS PUNCTOCAELATUS			X													
RICTAXIS "DNA" EGG SPIRALS															1	
VOLVULELLA PANAMICA																X
NUDIBRANCHIA																
ANISODORIS NOBILIS	X		X													
BAPTODORIS MIMETICAL		X			?											
CADLINA SP.													X			
CADLINA LIMBAUGHI			X													
CHROMODORIS MACFARLANDI														1		
CORYPHELLA TRILINEATA												X				
DENDRODORIS N.SP.									1							
DIAULULA SANDIEGENSIS	X					3			1		X					
DORIOPSILLA ALBOPUNCTATA					2							X				
FLABELLINOPSIS IODINEA (=Coryphella iodinea)		X	X			2	X	X	2		X	X	X		X	X
HERMISSENDA CRASSICORNIS	3	X	2		2	3	2									X
JORUNNA PARDUS														2	1	1
LAILA COCKERELLI					X		1		1						X	
MEXICHROMIS PORTERAE														X		
PHIDIANA PUGNAX		X	X		3									X		X
POLYCERA ATRA												X				
TRIOPHA CATALINAE	X	X		X	2		1		1							X
POLYPLACOPHORA		2	X						X					X	X	X
TONICELLA LINEATA	X	2														
BIVALVIA																
AMERICARDIA BIANGULATA							S	S						S		
CHACEIA OVOIDEA					2		3	2								
CHAMA ARCANA		2		X		2			2	X	2	X	3	X	X	

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
DIPLODONTA SP.															S	
GARI CALIFORNICA		S				S								S	S	
HINNITES GIGANTEUS (=Crassedoma giganteum)	2	2	2	2	2	2	2	2	2/J2	X	3	3	4	X/JS	2	2
KELLIA LAPEROUSII															S	
LIMA HEMPHILLI	S	X		S	S		2	3	2			2	X	X		
MYTILUS CALIFORNIANUS							INT					S	INT			
MYTILUS EDULIS		S													S	
PARAPHOLUS CALIFORNICUS								X								
PECTEN DIEGENSIS								X								
PHOLAD	X	X	2	X		JV4			X				X			
PODODESMUS CEPIO		3	3	2		2	X	X	2	X	X			2	2	
SEMELE DECISA						S								S		
SEMELE RUPICOLA												X				
TRACHYCARDIUM QUADRAGENARIUM					S					S				S		
VENTRICOLARIA FORDII		S			S3	S2	S	2	1	S	X	S	S	S3	2	S
CEPHALAPODA																
OCTOPUS SP.			2				X					X			X	X
OCTOPUS BIMACULATUS															2	
OCTOPUS BIMACULOIDES							2	2	X				X			
OCTOPUS RUBESCENS		X							X			X	X			
ECTOPROCTA																
AETEA SP.									X							
ANTROPORA TINCTA					2	2										
BUGULA CALIFORNICA	X	X	2	2	3		X	X		X	X	X	X			X
BUGULA NERITINA		X	2	2		3			1		X	3	X	2	3	3
COSTAZIA ROBERTSONIAE		X	X	X	2							X				
CRISIA SP.												X				
DIAPEROECIA CALIFORNICA	X	X	2		2	3	4	X	2	2	2	2	3	1	1	2
EURYSTOMELLA SP.												X		2	2	X
HETEROPORA MAGNA	2		X	X												
HIPPODIPLOSIA INSCULPTA												1				
LICHENOPORA NOVAE-ZELANDIAE						2			1			1		2	1	1
MEMBRANIPORA SP.	X	X	3	X			X	X	2	X	X		2	X		
MEMBRANIPORA MEMBRANACEA					X							X				3
PARASMITTINA/RHYNCHOZOON					X	2						2		2	2	X
PHIDOLOPORA LABIATA					2	2										
PHIDOLOPORA PACIFICA	1	X	X	3			X		1			2		2	2	1
THALAMOPORELLA CALIFORNICA			2	2			X		1			2	X		2	3
ENTOPROCTA																
BARENTSIA SP.															1	1
PHORONIDA																
PHORONIS VANCOUVERENSIS								3				2				
BRACHIOPODA																
TEREBRATALIA SP.						X										
ECINODERMATA																
ASTEROIDEA																
ASTROMETIS SERTULIFERA												1		1		
ASTROPECTEN SP.								X								
DERMASTERIAS IMBRICATA	4		2	2	2		0	0		2						
HENRICIA LEVIUSCULA	2		2	X	3	3			1	X	2		X	2		
HENRICIA N.SP.					2											
LINCKIA COLUMBIAE								1	1		2					
MEDIASTER AEQUALIS	0			X	2	2				X						
ORTHASTERIAS KOEHLERI	2	2			1	1			1							
ASTERINA MINIATA (=Patiria miniata)	4	4	3	4	4	3	3	1	2	2	2	2		2	1	1/J2

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
PISASTER BREVISPINUS			1		2	1									1	
PISASTER GIGANTEUS	2	4	2	2	3	3	2	1	1	2	1	2	1	2	2	2
PISASTER OCHRACEUS															1	
PYCNOPODIA HELIANTHOIDES	1	3	3	2	3	3	1	0	0	2	0	0		0	0	0
ECHINOIDEA																
CENTROSTEPHANUS CORONATUS	0		0				X	2	X			2/XJV	X	3	2	X
LYTECHINUS ANAMESUS	0	1	0	0	0	1	2	2	1	2			0	3	1	
LYTECHINUS ANAMESUS JUVENILES	0		0	0					0	2			0	1		
STRONGYLOCENTROTUS FRANCISCANUS	3	4	2	2	3	4	2	2	3	2		3	4	3	3	4
STRONGLYOCENTROTUS FRANCISCANUS JUV.	2	3	1	1	2	1	2	1	1	2		3	2	1	1	0
STRONGYLOCENTROTUS PURPURATUS	2	2	2	2	2	4	4	4	4	2		3	3	4	4	4
STRONGLYOCENTROTUS PURPURATUS JUV.	2	2	1	1	2	1	3	2	2	2		3	2	1	1	1
OPHIUROIDEA																
OPHIODERMA PANAMENSE	X		X		X		X		X	X	2	2	X	2	3	2
OPHIOPLOCUS ESMARKI		X			2	3						2		2	2	
OPHIOPSILA CALIFORNICA					2	3				2						
OPHIOPTERIS PAPILLOSA		X	X	X		2		X	X	2		3		2	2	2
OPHIOTHRIX SPICULATA		2				4	4	0	X	2	4	3		3	2	
HOLOTHUROIDEA																
CUCUMARIA MINIATA					2		X	X	2		2		X			
CUCUMARIA PIPERATA		X	X	X	4		3	X								
CUCUMARIA SALMA						3						2				
EUPENTACTA QUINQUESEMITA		X	X	X	2				2							
PACHYTHYONE RUBRA							4	0								
PARASTICHOPUS CALIFORNICUS	1					1	0	0								
PARASTICHOPUS PARVIMENSIS	2	2	2	2	2	2	3	1	2	2	2	2/J2		3	2	2
CHORDATA																
UROCHRDATA (TUNICATA)																
APLIDIUM SP.			X		2	X						2			X	4
BOLTENIA VILLOSA	2		0	2	3											
BOTRYLLUS/BOTRYLLOIDES						X?								X?	X?	X?
CIONA INTESTINALIS						X										
CLAVELINA HUNTSMANI			X	2	2	2								1		1
CNEMIDOCARPA FINMARKIENSIS		X		2	2								X	X	X	
CYSTODYTES LOBATUS	2	X		2	2	X				1						
DIDEMNUM SP.														X	X	X
DIDEMNUM/TRIDIDEMNUM		X	X	3					X	X	X	X	X	X		
DISTAPLIA OCCIDENTALIS														X		
EUHERDMANIA CLAVIFORMIS						2										
METANDROCARPA TAYLORI								X	X			3		X		
UNID. WHITE TUNICATE												3				
POLYCLINUM PLANUM	2				?											
PYCNOCLAVELLA STANLEYI					2							4		3		3
PYURA HAUSTOR												X		X		X
STYELA CLAVA						X										
STYELA MONTEREYENSIS			2	2	3		0	0								
VERTEBRATA																
CHONDRICHTYES																
CEPHALOSCYLLIUM VENTRIOSUM	X		1	2			X									
HETERODONTUS FRANCISCI						X	X	X	2			X			1	1
MYLIOBATIS CALIFORNICA			X							X		X	X	2		3
OSTEICHTHYES																
HYDROLAGUS COLLIEI																
GYMNOTHORAX MORDAX									1					X	3	
GOBIESOX SP.		X	X						X			X				X
SARDINOPS SAGAX				X												

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
ENGRAULIS MORDAX											X			X	X	X
ATHERINOPS AFFINIS	X		3	3	2				X	4		2			X	2
ATHERINOPS/LEURESTHES														0	0	2/J2
AULORHYNCHUS FLAVIDUS	4				3/J3											
RATHBONELLA SP.									X							
RATHBUNELLA HYPOPLECTA					3											X
TRACHURUS SYMMETRICUS			2				X			2	X					
ALLOCLINUS HOLDERI			X			1	1	1	1	1	3	3	2	3	3	3
GIBBONSIA SP.	2		2									X		1		1
GIBBONSIA ELEGANS			X													
HETEROSTICHUS ROSTRATUS			J2		X					X		J2	2/J2			2/J2
NEOCLINUS STEPHANSAE						2	1	2	0							
COTTIDAE			X											2	2	
ARTEDIUS CORALLINUS		X		X	3			1	1	X		X				
ARTEDIUS CREASERI					1							X				X
LEIOCOTTUS HIRUNDO			X							X				X	X	
ORTHONOPIAS TRIACIS		X			3	2	X	1	1		X				2	
SCORPAENICHTHYS MARMORATUS	X	X		3	X	1		X			X				X	
BRACHYISTIUS FRENATUS	X		2	2						X		2	2			2
CYMATOGASTER AGGREGATA	X															
RHACOCHILUS VACCA	2	X	2	3	1	1	2	2	2	X	X	X	1			
EMBIOTOCA JACKSONI	2	X	2/J3	3/J2	2	2	2	2	2	1		2	2		2	2
EMBIOTOCA LATERALIS	4	X	2/J2	3/J2	2		X	0	0				0			X
HYPSURUS CARYI	X		X	2						2		X				
MICROMETRUS MINIMUS					1											
RHACOCHILUS TOXOTES	X		2	2	2		2	2	2			2				X
CORYPHOPTERUS NICHOLSI	2	2/J3	2	3	1	2	4/J3	3/J3	4	2/J2	3	2	2	3	3	2
LYTHRYPNUS DALLI							3	3	3		1		1			
LYTHRYPNUS ZEBRA						2	X	X		X	1			1	1	1
HEXAGRAMMOS DECAGRAMMUS	X										X					
OPHIODON ELONGATUS	X	X				X	X									
OXYLEBIUS PICTUS	3	3	X	3	3/J2	3/J2	2	2	2	2	3	X	1	2	2	1
GIRELLA NIGRICANS	X		X			2	2	2	2	1	3	3	3	2	2	3
HERMOSILLA AZUREA															X	
MEDIALUNA CALIFORNIENSIS			X			1	1	1	1		2	1	2	1	2	2
HALICHOERES SEMICINCTUS	X	0	X			1	2	2	2	1	3	2	2	3	2	3
H. SEMICINCTUS (FEMALES)							1	1	2	1	X	X	2	2	2	3
H. SEMICINCTUS (MALES)			1				1	1	1	1	X	X	1	3	2	3
H. SEMICINCTUS (JUVENILES)							0	0	0			X	0		1	1
OXYJULIS CALIFORNICA	2	0	2	3	1	2	2	2	2	3	3	X	2	2	2	2
O. CALIFORNICA (JUVENILES)	X		3			2				3			1		3	4
SEMICOSSYPHUS PULCHER	2	2	2	3	3	3	2	1	X	X	2	4	2	2	1	3
S. PULCHER (FEMALES)	2	2		3	2	3	2	2	2	2		4	2	2	1	3
S. PULCHER (MALES)	1	1		2	3	2	2	1	0	0		4	1	1	1	1
S. PULCHER (JUVENILES)	0	0		2	0	2	0	0	0				1	0	0	1
CAULOLATILUS PRINCEPS					2	2		X					1	1	2	1
STEREOLEPIS GIGAS														1		1
CHROMIS PUNCTIPINNIS	2	2	2	3	2	3	3	2	2	1	2	3	2	2	2	3
CHROMIS PUNCTIPINNIS (JUVENILES)	0	0	0	0			2	2		0		4	2	3	3	2
HYPSYPOPS RUBICUNDUS		0	2	0		1	2	2	2		3	3	2	2	3	3
HYPSOPOPS RUBICUNDUS (JUVENILES)		0	0	0			0	0	0			X	0		2	2
SCORPAENA GUTTATA						1				1	X	2	X		X	
SEBASTES SP.										2						
SEBASTES SP. (JUVS.)	4	2	2	2		X	X	X		2			2			
SEBASTES AURICULATUS	2		X	X		X			X	2						
SEBASTES ATROVIRENS	3	3	2	2	3	3	X	X	1	2	2	X	2	1	1	2

Location:	SMWL	SMHR	SRJLNO	SRJLSO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
#:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SPECIES																
S. ATROVIRENS (JUVENILES)		2	2	2				X								
SEBASTES CARNATUS	X	X		X	1	1	1	X								
SEBASTES CAURINUS	2	X			2	X	X									
S. CARNATUS/CAURINUS (JUVENILES)	X				X											
SEBASTES CHRYSOMELAS	2	2	3	3	2	2	1	0	X	X	X				1	
SEBASTES MELANOPS	X															
SEBASTES MINIATUS	X															
SEBASTES MYSTINUS	2	3	X	2	3	2	1									
S. MYSTINUS (JUVENILES)		0		0												
SEBASTES PINNIGER	X															
SEBASTES RASTRELLIGER									X						1	1
SEBASTES SERRANOIDES	X	2	3	3	2	2		X				1				1
S. SERRAN./S. FLAVIDUS (JUVENILES)				X												
SEBASTES SERRICEPS	2	X	X	2		2	X	X	X	X	2	X	1		1	
S. SERRICEPS (JUVENILES)		X	1	2									1		1	
PARALABRAX CLATHRATUS	0	0	1	X	2	2	3	2	2	2	2	3	2	2	2	1
P. CLATHRATUS (JUVENILES)		0	0	0			0	0		X			1			1
SPHYRAENA ARGENTEA										2						
CITHARICHTHYS STIGMAEUS	X															
PARALICHTHYS CALIFORNICUS													1			
PLEURONICHTHYS COENOSUS	X							X		1						X

Appendix L. 1996 Temperature data collected at Channel Islands National Park Kelp Forest Monitoring Stations by remote temperature loggers.

Introduction:

This appendix contains the temperature data (presented graphically) collected by STOWAWAY$^{TM.}$ temperature loggers that were deployed at all 16 Kelp Forest Monitoring sites. Missing data at some sites is the result of technical problems or loss of temperature logger.

IslandCode	SiteCode	Date	AvgOfTemperatureC	
AN	AR	6/1/95	13.03	
AN	AR	6/2/95	12.99	
AN	AR	6/3/95	13.78	
AN	AR	6/4/95	13.92	
AN	AR	6/5/95	14.30	
AN	AR	6/6/95	13.78	
AN	AR	6/7/95	13.42	
AN	AR	6/8/95	14.11	
AN	AR	6/9/95	14.03	
AN	AR	6/10/95	13.91	
AN	AR	6/11/95	13.98	
AN	AR	6/12/95	14.24	
AN	AR	6/13/95	14.00	
AN	AR	6/14/95	13.96	
AN	AR	6/15/95	14.35	
AN	AR	6/16/95	13.16	
AN	AR	6/17/95	13.62	
AN	AR	6/18/95	14.11	
AN	AR	6/19/95	14.37	
AN	AR	6/20/95	14.45	
AN	AR	6/21/95	14.61	
AN	AR	6/22/95	14.64	
AN	AR	6/23/95	14.41	
AN	AR	6/24/95	14.40	
AN	AR	6/25/95	14.75	
AN	AR	6/26/95	14.35	
AN	AR	6/27/95	14.34	
AN	AR	6/28/95	13.68	
AN	AR	6/29/95	14.55	
AN	AR	6/30/95	14.86	
AN	AR	7/1/95	15.51	
AN	AR	7/2/95	15.80	
AN	AR	7/3/95	16.35	
AN	AR	7/4/95	15.89	
AN	AR	7/5/95	15.87	
AN	AR	7/6/95	15.29	
AN	AR	7/7/95	15.64	
AN	AR	7/8/95	16.09	
AN	AR	7/9/95	15.64	
AN	AR	7/10/95	14.99	
AN	AR	7/11/95	15.67	
AN	AR	7/12/95	15.53	
AN	AR	7/13/95	15.90	
AN	AR	7/14/95	15.91	
AN	AR	7/15/95	15.92	
AN	AR	7/16/95	16.03	
AN	AR	7/17/95	15.73	
AN	AR	7/18/95	15.54	
AN	AR	7/19/95	14.73	
AN	AR	7/20/95	14.06	
AN	AR	7/21/95	13.90	

AN	AR	7/22/95	15.72	
AN	AR	7/23/95	16.85	
AN	AR	7/24/95	16.75	
AN	AR	7/25/95	17.02	
AN	AR	7/26/95	16.86	
AN	AR	7/27/95	16.59	
AN	AR	7/28/95	16.62	
AN	AR	7/29/95	18.08	
AN	AR	7/30/95	17.53	
AN	AR	7/31/95	15.79	
AN	AR	8/1/95	14.12	
AN	AR	8/2/95	15.17	
AN	AR	8/3/95	15.64	
AN	AR	8/4/95	15.50	
AN	AR	8/5/95	17.00	
AN	AR	8/6/95	16.36	
AN	AR	8/7/95	16.78	
AN	AR	8/8/95	16.97	
AN	AR	8/9/95	16.13	
AN	AR	8/10/95	16.29	
AN	AR	8/11/95	15.87	
AN	AR	8/12/95	14.78	
AN	AR	8/13/95	15.01	
AN	AR	8/14/95	13.35	
AN	AR	8/15/95	13.23	
AN	AR	8/16/95	13.53	
AN	AR	8/17/95	14.63	
AN	AR	8/18/95	15.66	
AN	AR	8/19/95	16.65	
AN	AR	8/20/95	17.19	
AN	AR	8/21/95	18.12	
AN	AR	8/22/95	18.65	
AN	AR	8/23/95	19.08	
AN	AR	8/24/95	18.27	
AN	AR	8/25/95	17.91	
AN	AR	8/26/95	18.42	
AN	AR	8/27/95	18.53	
AN	AR	8/28/95	18.71	
AN	AR	8/29/95	18.40	
AN	AR	8/30/95	18.87	
AN	AR	8/31/95	18.47	
AN	AR	9/1/95	18.58	
AN	AR	9/2/95	17.97	
AN	AR	9/3/95	18.10	
AN	AR	9/4/95	17.65	
AN	AR	9/5/95	17.16	
AN	AR	9/6/95	16.46	
AN	AR	9/7/95	16.06	
AN	AR	9/8/95	16.13	
AN	AR	9/9/95	16.67	
AN	AR	9/10/95	17.05	
AN	AR	9/11/95	17.41	

AN	AR	9/12/95	18.11	
AN	AR	9/13/95	18.39	
AN	AR	9/14/95	18.00	
AN	AR	9/15/95	17.92	
AN	AR	9/16/95	18.21	
AN	AR	9/17/95	17.92	
AN	AR	9/18/95	18.26	
AN	AR	9/19/95	17.86	
AN	AR	9/20/95	17.92	
AN	AR	9/21/95	17.20	
AN	AR	9/22/95	18.09	
AN	AR	9/23/95	17.88	
AN	AR	9/24/95	17.69	
AN	AR	9/25/95	18.26	
AN	AR	9/26/95	17.58	
AN	AR	9/27/95	17.42	
AN	AR	9/28/95	17.91	
AN	AR	9/29/95	18.47	
AN	AR	9/30/95	18.51	
AN	AR	10/1/95	17.82	
AN	AR	10/2/95	17.37	
AN	AR	10/3/95	18.11	
AN	AR	10/4/95	17.16	
AN	AR	10/5/95	16.88	
AN	AR	10/6/95	16.94	
AN	AR	10/7/95	16.31	
AN	AR	10/8/95	16.94	
AN	AR	10/9/95	17.27	
AN	AR	10/10/95	17.58	
AN	AR	10/11/95	17.94	
AN	AR	10/12/95	17.95	
AN	AR	10/13/95	18.30	
AN	AR	10/14/95	18.03	
AN	AR	10/15/95	18.00	
AN	AR	10/16/95	18.44	
AN	AR	10/17/95	19.13	
AN	AR	10/18/95	18.77	
AN	AR	10/19/95	18.78	
AN	AR	10/20/95	18.16	
AN	AR	10/21/95	17.89	
AN	AR	10/22/95	17.83	
AN	AR	10/23/95	17.28	
AN	AR	10/24/95	16.56	
AN	AR	10/25/95	17.20	
AN	AR	10/26/95	17.79	
AN	AR	10/27/95	18.21	
AN	AR	10/28/95	17.35	
AN	AR	10/29/95	17.60	
AN	AR	10/30/95	17.25	
AN	AR	10/31/95	17.17	
AN	AR	11/1/95	17.32	
AN	AR	11/2/95	17.41	

AN	AR	11/3/95	17.06	
AN	AR	11/4/95	17.00	
AN	AR	11/5/95	17.02	
AN	AR	11/6/95	17.13	
AN	AR	11/7/95	17.09	
AN	AR	11/8/95	16.43	
AN	AR	11/9/95	15.89	
AN	AR	11/10/95	15.67	
AN	AR	11/11/95	15.63	
AN	AR	11/12/95	15.86	
AN	AR	11/13/95	16.43	
AN	AR	11/14/95	16.51	
AN	AR	11/15/95	16.25	
AN	AR	11/16/95	16.40	
AN	AR	11/17/95	16.20	
AN	AR	11/18/95	15.76	
AN	AR	11/19/95	16.04	
AN	AR	11/20/95	15.17	
AN	AR	11/21/95	14.95	
AN	AR	11/22/95	15.22	
AN	AR	11/23/95	14.91	
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AN	AR	11/26/95	15.07	
AN	AR	11/27/95	15.39	
AN	AR	11/28/95	15.49	
AN	AR	11/29/95	15.20	
AN	AR	11/30/95	15.26	
AN	AR	12/1/95	15.17	
AN	AR	12/2/95	15.51	
AN	AR	12/3/95	15.30	
AN	AR	12/4/95	15.99	
AN	AR	12/5/95	16.04	
AN	AR	12/6/95	15.11	
AN	AR	12/7/95	14.92	
AN	AR	12/8/95	14.97	
AN	AR	12/9/95	15.55	
AN	AR	12/10/95	15.86	
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AN	AR	12/12/95	16.40	
AN	AR	12/13/95	16.29	
AN	AR	12/14/95	15.25	
AN	AR	12/15/95	15.59	
AN	AR	12/16/95	14.94	
AN	AR	12/17/95	15.43	
AN	AR	12/18/95	15.64	
AN	AR	12/19/95	15.52	
AN	AR	12/20/95	15.14	
AN	AR	12/21/95	14.91	
AN	AR	12/22/95	14.64	
AN	AR	12/23/95	14.10	
AN	AR	12/24/95	13.20	

AN	AR	12/25/95	13.39	
AN	AR	12/26/95	13.68	
AN	AR	12/27/95	13.60	
AN	AR	12/28/95	13.98	
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AN	AR	1/27/96	13.61	
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AN	AR	2/10/96	14.57	
AN	AR	2/11/96	14.46	
AN	AR	2/12/96	14.41	
AN	AR	2/13/96	14.59	
AN	AR	2/14/96	14.58	

AN	AR	2/15/96	14.46	
AN	AR	2/16/96	14.17	
AN	AR	2/17/96	14.21	
AN	AR	2/18/96	13.79	
AN	AR	2/19/96	14.15	
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AN	AR	2/23/96	13.55	
AN	AR	2/24/96	13.67	
AN	AR	2/25/96	13.39	
AN	AR	2/26/96	13.09	
AN	AR	2/27/96	13.37	
AN	AR	2/28/96	13.58	
AN	AR	2/29/96	13.58	
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AN	AR	3/2/96	13.36	
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AN	AR	3/4/96	13.13	
AN	AR	3/5/96	12.82	
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AN	AR	3/29/96	12.10	
AN	AR	3/30/96	12.36	
AN	AR	3/31/96	12.56	
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AN	AR	4/2/96	12.05	
AN	AR	4/3/96	12.11	
AN	AR	4/4/96	12.01	
AN	AR	4/5/96	12.61	
AN	AR	4/6/96	12.71	

AN	AR	4/7/96	12.54	
AN	AR	4/8/96	12.32	
AN	AR	4/9/96	12.63	
AN	AR	4/10/96	12.39	
AN	AR	4/11/96	12.49	
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AN	AR	4/13/96	12.17	
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AN	AR	4/15/96	12.63	
AN	AR	4/16/96	12.49	
AN	AR	4/17/96	12.04	
AN	AR	4/18/96	11.46	
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AN	AR	4/22/96	11.86	
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AN	AR	5/14/96	15.51	
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AN	AR	5/16/96	14.91	
AN	AR	5/17/96	15.22	
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AN	AR	5/22/96	14.81	
AN	AR	5/23/96	14.68	
AN	AR	5/24/96	14.37	
AN	AR	5/25/96	14.23	
AN	AR	5/26/96	13.59	
AN	AR	5/27/96	13.47	
AN	AR	5/28/96	13.60	

AN	AR	5/29/96	13.19	
AN	AR	5/30/96	13.00	
AN	AR	5/31/96	14.35	
AN	CC	6/1/95	13.75	
AN	CC	6/2/95	14.56	
AN	CC	6/3/95	14.71	
AN	CC	6/4/95	14.98	
AN	CC	6/5/95	15.47	
AN	CC	6/6/95	15.42	
AN	CC	6/7/95	14.78	
AN	CC	6/8/95	14.59	
AN	CC	6/9/95	14.95	
AN	CC	6/10/95	15.01	
AN	CC	6/11/95	15.26	
AN	CC	6/12/95	15.60	
AN	CC	6/13/95	15.76	
AN	CC	6/14/95	14.83	
AN	CC	6/15/95	14.93	
AN	CC	6/16/95	14.87	
AN	CC	6/17/95	14.90	
AN	CC	6/18/95	14.76	
AN	CC	6/19/95	14.61	
AN	CC	6/20/95	15.03	
AN	CC	6/21/95	15.22	
AN	CC	6/22/95	15.59	
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AN	CC	6/26/95	15.05	
AN	CC	6/27/95	15.09	
AN	CC	6/28/95	15.50	
AN	CC	6/29/95	15.94	
AN	CC	6/30/95	16.30	
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AN	CC	7/2/95	16.63	
AN	CC	7/3/95	16.75	
AN	CC	7/4/95	16.85	
AN	CC	7/5/95	16.83	
AN	CC	7/6/95	16.97	
AN	CC	7/7/95	17.02	
AN	CC	7/8/95	17.05	
AN	CC	7/9/95	17.38	
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AN	CC	7/12/95	17.22	
AN	CC	7/13/95	17.18	
AN	CC	7/14/95	16.30	
AN	CC	7/15/95	17.09	
AN	CC	7/16/95	17.27	
AN	CC	7/17/95	17.33	
AN	CC	7/18/95	17.53	
AN	CC	7/19/95	17.62	

AN	CC	7/20/95	17.46	
AN	CC	7/21/95	17.22	
AN	CC	7/22/95	17.36	
AN	CC	7/23/95	17.47	
AN	CC	7/24/95	17.69	
AN	CC	7/25/95	17.92	
AN	CC	7/26/95	18.24	
AN	CC	7/27/95	18.34	
AN	CC	7/28/95	18.32	
AN	CC	7/29/95	18.20	
AN	CC	7/30/95	18.14	
AN	CC	7/31/95	18.86	
AN	CC	8/1/95	18.28	
AN	CC	8/2/95	18.01	
AN	CC	8/3/95	17.82	
AN	CC	8/4/95	18.28	
AN	CC	8/5/95	18.14	
AN	CC	8/6/95	18.35	
AN	CC	8/7/95	18.20	
AN	CC	8/8/95	18.02	
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SC	SA	11/5/95	17.34	
SC	SA	11/6/95	17.22	
SC	SA	11/7/95	16.97	
SC	SA	11/8/95	17.05	
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SC	SA	11/12/95	16.42	
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SC	SA	11/14/95	16.64	
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SC	SA	11/28/95	15.72	
SC	SA	11/29/95	16.03	
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SC	YB	4/2/96	12.87	
SC	YB	4/3/96	12.78	
SC	YB	4/4/96	12.70	
SC	YB	4/5/96	12.70	
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SC	YB	4/7/96	12.59	
SC	YB	4/8/96	12.61	
SC	YB	4/9/96	12.67	
SC	YB	4/10/96	12.41	
SC	YB	4/11/96	12.23	
SC	YB	4/12/96	12.24	
SC	YB	4/13/96	12.35	
SC	YB	4/14/96	12.23	
SC	YB	4/15/96	12.47	
SC	YB	4/16/96	12.29	
SC	YB	4/17/96	12.14	
SC	YB	4/18/96	12.36	
SC	YB	4/19/96	12.14	
SC	YB	4/20/96	11.94	
SC	YB	4/21/96	11.60	
SC	YB	4/22/96	11.49	
SC	YB	4/23/96	11.62	
SC	YB	4/24/96	11.51	
SC	YB	4/25/96	11.65	
SC	YB	4/26/96	11.45	
SC	YB	4/27/96	12.42	
SC	YB	4/28/96	12.81	
SC	YB	4/29/96	14.20	
SC	YB	4/30/96	13.91	
SC	YB	5/1/96	13.54	
SC	YB	5/2/96	13.01	
SC	YB	5/3/96	13.10	
SC	YB	5/4/96	13.11	
SC	YB	5/5/96	12.80	
SC	YB	5/6/96	12.46	
SC	YB	5/7/96	12.02	
SC	YB	5/8/96	13.81	

SC	YB	5/9/96	14.19	
SC	YB	5/10/96	13.91	
SC	YB	5/11/96	14.31	
SC	YB	5/12/96	14.66	
SC	YB	5/13/96	14.69	
SC	YB	5/14/96	14.51	
SC	YB	5/15/96	14.31	
SC	YB	5/16/96	13.44	
SC	YB	5/17/96	13.55	
SC	YB	5/18/96	13.95	
SC	YB	5/19/96	12.82	
SC	YB	5/20/96	13.91	
SC	YB	5/21/96	14.35	
SC	YB	5/22/96	14.08	
SC	YB	5/23/96	13.95	
SC	YB	5/24/96	13.64	
SC	YB	5/25/96	13.56	
SC	YB	5/26/96	13.36	
SC	YB	5/27/96	13.09	
SC	YB	5/28/96	12.91	
SC	YB	5/29/96	13.05	
SC	YB	5/30/96	13.11	
SC	YB	5/31/96	14.77	
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SM	HR	6/22/95	11.77	
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SM	HR	6/25/95	12.85	
SM	HR	6/26/95	13.44	
SM	HR	6/27/95	13.81	
SM	HR	6/28/95	14.37	
SM	HR	6/29/95	15.09	

SM	HR	6/30/95	14.69	
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SM	WL	7/27/95	12.07	
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SM	WL	8/17/95	13.00	
SM	WL	8/18/95	12.29	

SM	WL	8/19/95	13.22	
SM	WL	8/20/95	14.76	
SM	WL	8/21/95	14.82	
SM	WL	8/22/95	13.66	
SM	WL	8/23/95	13.29	
SM	WL	8/24/95	14.53	
SM	WL	8/25/95	14.09	
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SM	WL	8/27/95	13.47	
SM	WL	8/28/95	13.31	
SM	WL	8/29/95	12.88	
SM	WL	8/30/95	12.67	
SM	WL	8/31/95	12.64	
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SM	WL	9/2/95	11.98	
SM	WL	9/3/95	11.41	
SM	WL	9/4/95	11.54	
SM	WL	9/5/95	11.94	
SM	WL	9/6/95	13.82	
SM	WL	9/7/95	14.43	
SM	WL	9/8/95	12.42	
SM	WL	9/9/95	12.61	
SM	WL	9/10/95	12.67	
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SM	WL	9/12/95	11.95	
SM	WL	9/13/95	11.19	
SM	WL	9/14/95	11.23	
SM	WL	9/15/95	12.20	
SM	WL	9/16/95	12.88	
SM	WL	9/17/95	12.85	
SM	WL	9/18/95	13.29	
SM	WL	9/19/95	14.53	
SM	WL	9/20/95	14.81	
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SM	WL	9/22/95	12.73	
SM	WL	9/23/95	12.04	
SM	WL	9/24/95	12.13	
SM	WL	9/25/95	12.01	
SM	WL	9/26/95	12.59	
SM	WL	9/27/95	13.35	
SM	WL	9/28/95	12.98	
SM	WL	9/29/95	11.55	
SM	WL	9/30/95	13.07	
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SM	WL	10/2/95	14.82	
SM	WL	10/3/95	14.81	
SM	WL	10/4/95	14.78	
SM	WL	10/5/95	15.51	
SM	WL	10/6/95	14.91	
SM	WL	10/7/95	14.16	
SM	WL	10/8/95	15.04	
SM	WL	10/9/95	14.93	

SM	WL	10/10/95	14.59	
SM	WL	10/11/95	14.65	
SM	WL	10/12/95	14.87	
SM	WL	10/13/95	15.06	
SM	WL	10/14/95	15.50	
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SM	WL	10/16/95	13.97	
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SM	WL	11/26/95	12.35	
SM	WL	11/27/95	12.14	
SM	WL	11/28/95	13.81	
SM	WL	11/29/95	13.83	
SM	WL	11/30/95	13.50	

SM	WL	12/1/95	13.25	
SM	WL	12/2/95	12.54	
SM	WL	12/3/95	12.57	
SM	WL	12/4/95	11.73	
SM	WL	12/5/95	12.10	
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SM	WL	1/4/96	13.23	
SM	WL	1/5/96	12.44	
SM	WL	1/6/96	12.88	
SM	WL	1/7/96	13.22	
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SM	WL	1/10/96	13.06	
SM	WL	1/11/96	13.72	
SM	WL	1/12/96	13.96	
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SM	WL	1/17/96	12.04	
SM	WL	1/18/96	12.17	
SM	WL	1/19/96	12.24	
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SM	WL	3/9/96	13.43	
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SM	WL	4/30/96	11.04	
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SR	JLSO	3/13/96	13.35	
SR	JLSO	3/14/96	13.69	
SR	JLSO	3/15/96	13.92	
SR	JLSO	3/16/96	13.54	
SR	JLSO	3/17/96	13.82	
SR	JLSO	3/18/96	13.61	
SR	JLSO	3/19/96	13.60	
SR	JLSO	3/20/96	13.60	
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SR	JLSO	3/24/96	12.38	
SR	JLSO	3/25/96	12.36	
SR	JLSO	3/26/96	12.26	
SR	JLSO	3/27/96	12.29	
SR	JLSO	3/28/96	12.85	
SR	JLSO	3/29/96	12.39	
SR	JLSO	3/30/96	12.72	
SR	JLSO	3/31/96	13.11	
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SR	JLSO	4/2/96	13.14	
SR	JLSO	4/3/96	12.60	
SR	JLSO	4/4/96	12.60	
SR	JLSO	4/5/96	12.75	
SR	JLSO	4/6/96	13.01	
SR	JLSO	4/7/96	13.02	
SR	JLSO	4/8/96	13.14	
SR	JLSO	4/9/96	12.94	
SR	JLSO	4/10/96	12.10	
SR	JLSO	4/11/96	11.81	
SR	JLSO	4/12/96	11.54	
SR	JLSO	4/13/96	11.71	
SR	JLSO	4/14/96	11.74	
SR	JLSO	4/15/96	12.11	
SR	JLSO	4/16/96	12.38	
SR	JLSO	4/17/96	12.77	
SR	JLSO	4/18/96	12.40	
SR	JLSO	4/19/96	12.19	
SR	JLSO	4/20/96	11.35	
SR	JLSO	4/21/96	11.09	
SR	JLSO	4/22/96	11.25	
SR	JLSO	4/23/96	11.67	
SR	JLSO	4/24/96	10.88	
SR	JLSO	4/25/96	11.07	
SR	JLSO	4/26/96	11.21	
SR	JLSO	4/27/96	11.55	
SR	JLSO	4/28/96	11.76	
SR	JLSO	4/29/96	12.13	
SR	JLSO	4/30/96	12.27	

SR	JLSO	5/1/96	12.62	
SR	JLSO	5/2/96	12.71	
SR	JLSO	5/3/96	12.47	
SR	JLSO	5/4/96	12.36	
SR	JLSO	5/5/96	12.55	
SR	JLSO	5/6/96	11.45	
SR	JLSO	5/7/96	11.48	
SR	JLSO	5/8/96	11.97	
SR	JLSO	5/9/96	12.08	
SR	JLSO	5/10/96	13.28	
SR	JLSO	5/11/96	13.64	
SR	JLSO	5/12/96	13.38	
SR	JLSO	5/13/96	13.58	
SR	JLSO	5/14/96	13.51	
SR	JLSO	5/15/96	12.96	
SR	JLSO	5/16/96	13.13	
SR	JLSO	5/17/96	13.25	
SR	JLSO	5/18/96	12.69	
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SR	JLSO	5/20/96	11.37	
SR	JLSO	5/21/96	11.68	
SR	JLSO	5/22/96	12.20	
SR	JLSO	5/23/96	11.22	
SR	JLSO	5/24/96	11.47	
SR	JLSO	5/25/96	12.75	
SR	JLSO	5/26/96	12.89	
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SR	JLSO	5/31/96	11.95	
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SR	RR	6/17/95	12.89	
SR	RR	6/18/95	13.34	
SR	RR	6/19/95	13.06	
SR	RR	6/20/95	12.38	
SR	RR	6/21/95	12.39	

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SR	RR	8/8/95	15.33	
SR	RR	8/9/95	15.15	
SR	RR	8/10/95	15.68	
SR	RR	8/11/95	15.10	
SR	RR	8/12/95	14.57	

SR	RR	8/13/95	14.33	
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SR	RR	8/15/95	14.92	
SR	RR	8/16/95	15.31	
SR	RR	8/17/95	15.47	
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SR	RR	9/29/95	16.33	
SR	RR	9/30/95	15.44	
SR	RR	10/1/95	15.80	
SR	RR	10/2/95	15.80	
SR	RR	10/3/95	15.69	

SR	RR	10/4/95	16.08	
SR	RR	10/5/95	15.36	
SR	RR	10/6/95	16.31	
SR	RR	10/7/95	17.18	
SR	RR	10/8/95	17.21	
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SR	RR	10/16/95	18.82	
SR	RR	10/17/95	17.53	
SR	RR	10/18/95	16.93	
SR	RR	10/19/95	16.20	
SR	RR	10/20/95	17.08	
SR	RR	10/21/95	17.33	
SR	RR	10/22/95	16.97	
SR	RR	10/23/95	16.49	
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SR	RR	11/20/95	15.49	
SR	RR	11/21/95	15.74	
SR	RR	11/22/95	15.91	
SR	RR	11/23/95	15.64	
SR	RR	11/24/95	15.38	

SR	RR	11/25/95	15.16	
SR	RR	11/26/95	15.54	
SR	RR	11/27/95	15.45	
SR	RR	11/28/95	15.10	
SR	RR	11/29/95	14.68	
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SR	RR	1/11/96	14.02	
SR	RR	1/12/96	14.21	
SR	RR	1/13/96	14.58	
SR	RR	1/14/96	14.59	
SR	RR	1/15/96	14.58	

SR	RR	1/16/96	14.31	
SR	RR	1/17/96	14.10	
SR	RR	1/18/96	13.76	
SR	RR	1/19/96	13.74	
SR	RR	1/20/96	13.52	
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SR	RR	1/25/96	12.41	
SR	RR	1/26/96	12.25	
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SR	RR	3/5/96	13.69	
SR	RR	3/6/96	13.86	
SR	RR	3/7/96	13.92	

SR	RR	3/8/96	13.76	
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SR	RR	3/10/96	14.51	
SR	RR	3/11/96	14.97	
SR	RR	3/12/96	14.90	
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SR	RR	4/24/96	11.32	
SR	RR	4/25/96	11.31	
SR	RR	4/26/96	11.40	
SR	RR	4/27/96	11.34	
SR	RR	4/28/96	11.58	

SR	RR	4/29/96	11.77	
SR	RR	4/30/96	12.26	
SR	RR	5/1/96	12.83	
SR	RR	5/2/96	13.28	
SR	RR	5/3/96	13.71	
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SR	RR	5/19/96	15.21	
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SR	RR	5/23/96	12.43	
SR	RR	5/24/96	12.26	
SR	RR	5/25/96	12.47	
SR	RR	5/26/96	12.20	
SR	RR	5/27/96	13.26	
SR	RR	5/28/96	12.65	
SR	RR	5/29/96	12.59	
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