

KELP FOREST MONITORING HANDBOOK

Channel Islands

National
Park

National Park Service
U.S. Department of the Interior

KELP FOREST MONITORING HANDBOOK

**CHANNEL ISLANDS NATIONAL PARK
CALIFORNIA**

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INTRODUCTION

Kelp forests constitute one of the largest, most complex, and most threatened ecosystems in Channel Islands National Park. All five park islands are surrounded by extensive kelp forests. Lying across the boundary of two major biogeographical provinces and near unusually persistent upwelling features, the park is endowed with marine ecosystems of exceptional diversity and productivity that support large diverse seabird and pinniped rookeries on the islands. As a result of these conditions and the relative isolation from mainland activities, kelp forests in the park are among the best examples of the last vestige of this important ecosystem in southern California.

The park boundary extends one nautical mile around each of the five islands, including the waters and submerged lands. The living marine resources in the park are managed by the State of California. The National Park Service, in cooperation with the State of California and the U. S. Department of Commerce, are charged with the responsibility of monitoring the health of park ecosystems and recommending actions to better protect those systems (16 USC 410ff Sec. 203). Park waters constitute less than 3% of California's coastal zone, yet produce about 15% of the State's coastal fishery harvests. In spite of closed seasons, individual size and bag limits, and restricted uses in some areas, there are virtually no limits on total harvest of fish, lobster, abalone, and other marine organisms from park waters. With this direct harvest impact and the threat of chronic and acute pollution from mainland waste disposal and from adjacent offshore petroleum development, the potential for major anthropogenic disturbance of these ecosystems is great. Natural disturbance also appears to play an important role in this ecosystem, yet very little information on the long-term dynamics of the system are available. The cost of providing the information required to make wise decision regarding these resources is high, but the cost of losing them through ignorance is higher. Managing and conserving kelp forests requires innovative approaches and more ecological knowledge about them than currently exists.

This handbook describes design considerations for a long-term population dynamics approach to monitoring kelp forest ecosystems and documents the protocol for monitoring kelp forests in the park. Selection of index species and monitoring sites is discussed. Detailed instructions for data collection and

management are presented. Specific logistical considerations are addressed in appendices that will be revised as experience and conditions dictate.

MONITORING DESIGN CONSIDERATIONS

Species Selection

Specific kelp forest plants and animals were selected for monitoring from a list of nearly 1,000 species compiled by Dr. John M. Engle of the Tatman Foundation from the scientific literature and during a series of Foundation supported cruises around the California Channel Islands while he was located at the University of Southern California, Catalina Marine Science Center on Santa Catalina Island. The primary objective in selecting taxa for monitoring was to provide a representative cross section of the ecological roles found in park kelp forests so that they could serve as ecological vital signs of system health. To fulfill this objective, selected species needed to include representatives of all trophic levels, a variety of reproductive strategies, both sessile and mobile organisms, and a variety of feeding techniques.

Six criteria were used to select species from the list. Species were selected that were:

- specifically mentioned in the park's enabling legislation or protected by law (e.g. endangered)
- legally harvested
- exceptionally common or characteristic of entire communities
- alien to the park
- endemic to the park, or extremely limited in distribution
- well known or "charismatic"

Using these criteria, 15 plant, 38 invertebrate, and 15 fish taxa were selected for long-term monitoring. A list of the species selected and the population parameters monitored is found in Appendix A. These species are characteristic of kelp forests throughout the park, representing both boreal and temperate biogeographical provinces and species whose

centers of abundance fall within the transition zone. Some species, such as giant kelp, *Macrocystis pyrifera*, and red sea urchins, *Strongylocentrotus franciscanus*, are ubiquitous in the park and others, such as the California hydrocoral, *Allompsonia californica*, are found only at a few isolated sites. Some are extremely abundant like the purple sea urchin, *S. purpuratus*, whereas others like the giant-spined sea star, *Pisaster giganteus*, are just as wide spread in distribution but occur in low densities. Many of the selected species are long-lived, with life spans of 10 to more than 50 years, thus their abundance provides a stable measure of conditions in kelp forests that is relatively insulated from annual fluctuations. At the same time, reproductive efforts of these populations and annual recruitment to them provide measures of year-to-year fluctuations in conditions which augment observations of short-lived species, like the blue-banded goby, *Lythrypnus dalli*, whose very existence depends on local environmental conditions each year. This combination of organisms provides mechanisms for detecting both short and long-term variations in kelp forests. These species also represent a wide array of trophic levels, from primary producers and obligate herbivores to high level predators and detritivores; feeding techniques ranging from sessile filter feeders and sedentary grazers to highly mobile planktivorous fishes and wide ranging benthic foragers. Reproductive strategies of these species run the gamut from live births of surf perches to precarious releases of gametes into the sea by abalone, *Haliotis* sp., and urchins and long-lived pelagic larvae of spiny lobsters, *Panulirus interruptus*. The selected array of species provides many opportunities to monitor the health of kelp forests and detect many facets of human impact, ranging from pollution to habitat disturbance and direct removal.

Site Selection

The waters of Channel Islands National Park harbor an ecologically diverse array of species assemblages. The park is located at the boundary of two major biogeographical provinces: the Oregonian province to the north and the Californian to the south. The western park islands, San Miguel and Santa Rosa islands, are bathed by northern waters carried south by the California current and therefore reflect the biological assemblages of the Oregonian province. Waters around the eastern park islands of Anacapa and Santa Barbara come from the south along the mainland coast and support the warm temperate biota characteristic of the Californian province. Around Santa Cruz Island, at the boundary of these two provinces, there is a broad transition zone where plants and animals

from both provinces mingle and create a special assemblage of species that are capable of adapting to the unique and variable conditions of the transition zone.

Prevailing winds and the bathymetry of adjacent basins also greatly influence marine communities in the park. Strong north winds buffet the north sides of the islands, while the biota of the southern coasts reflect their more sheltered position. Upwelling nutrients from 2,000 meter-deep basins to the south and west of the park produce exceptionally productive food webs and temperature regimes that differ significantly from the shallow northern sides of the islands.

The sampling sites selected for long-term population monitoring reflect the broad range of conditions and biological assemblages in the park. Sixteen locations representing the north and south sides of each of the islands and the east-west transition from Californian to Oregonian provinces, were selected (see Figure 1). Description of each of the 16 sites and their specific locations are found in Table 1.

Sampling Technique Selection

The diverse array of organisms and physical settings associated with kelp forests in the park required equally diverse sampling approaches to monitor their population dynamics. A workshop to review potential sampling techniques was held at the Marine Science Institute, University of California at Santa Barbara. Thirty-seven scientists participated in the two-day workshop in late January, 1982. Sampling techniques for kelp forest organisms were evaluated using the following criteria:

- ability to sample target species accurately and precisely
- impacts on target and other species
- efficiency (cost effectiveness)
- ability to create permanent records of samples for confirmation and future analysis
- requirements for highly trained observers or extremely complex procedures or equipment.

Accuracy (the closeness of a measure value to its true value) is the paramount attribute of a sampling technique, but precision (the closeness of repeated measurements of the same quantity) and ability to

sample several target species at once must also be great to make a technique efficient for use underwater in a kelp forest. Accuracy and precision of sampling techniques used in long-term monitoring programs must also be transmitted through many generations of observers without degradation. Finally, sampling techniques for this monitoring program must provide values relatively free of variation among observers and must not significantly reduce populations of organisms being monitored or alter their environment.

At this time, the technology for remote sensing or sampling of kelp forest organisms from the sea surface is neither accurate nor precise enough to monitor population dynamics of key species. Development of diving equipment during the past 30 years has spawned an array of *in situ* sampling techniques that have potential for providing accurate and precise measures of population abundance, distribution, age structure, reproduction, recruitment, growth rate, mortality rate, sex composition, and phenology of kelp forest organisms. This program utilizes a variety of techniques that employ photographic systems yielding "permanent" records of non-destructive

samples, that require minimal sampling time on site, and may be operated effectively by non-scientifically trained divers, as well as the more traditional scientific methods.

Permanent 100-meter transects were established at the 16 locations to reduce within site variability and provide precise measurements population dynamics for which the major variable is time. Each transect of 12-mm diameter lead-filled woven nylon line was permanently affixed to the seabed with 11 stainless steel eyebolts. Transects are relocated with Loran-C. The transects provide a reference for diver and sample plot orientation which facilitates collection of information about widely different species during the limited bottom time available to diver/observers. Detailed information on procedures and materials used to install the transects is included in Appendix B.

A variety of sampling techniques including photogrammetric plots, bait stations, line intercept transects, cinetranssects, and experimental marine electroshockers were tested in the field prior to selection of monitoring protocol described here.

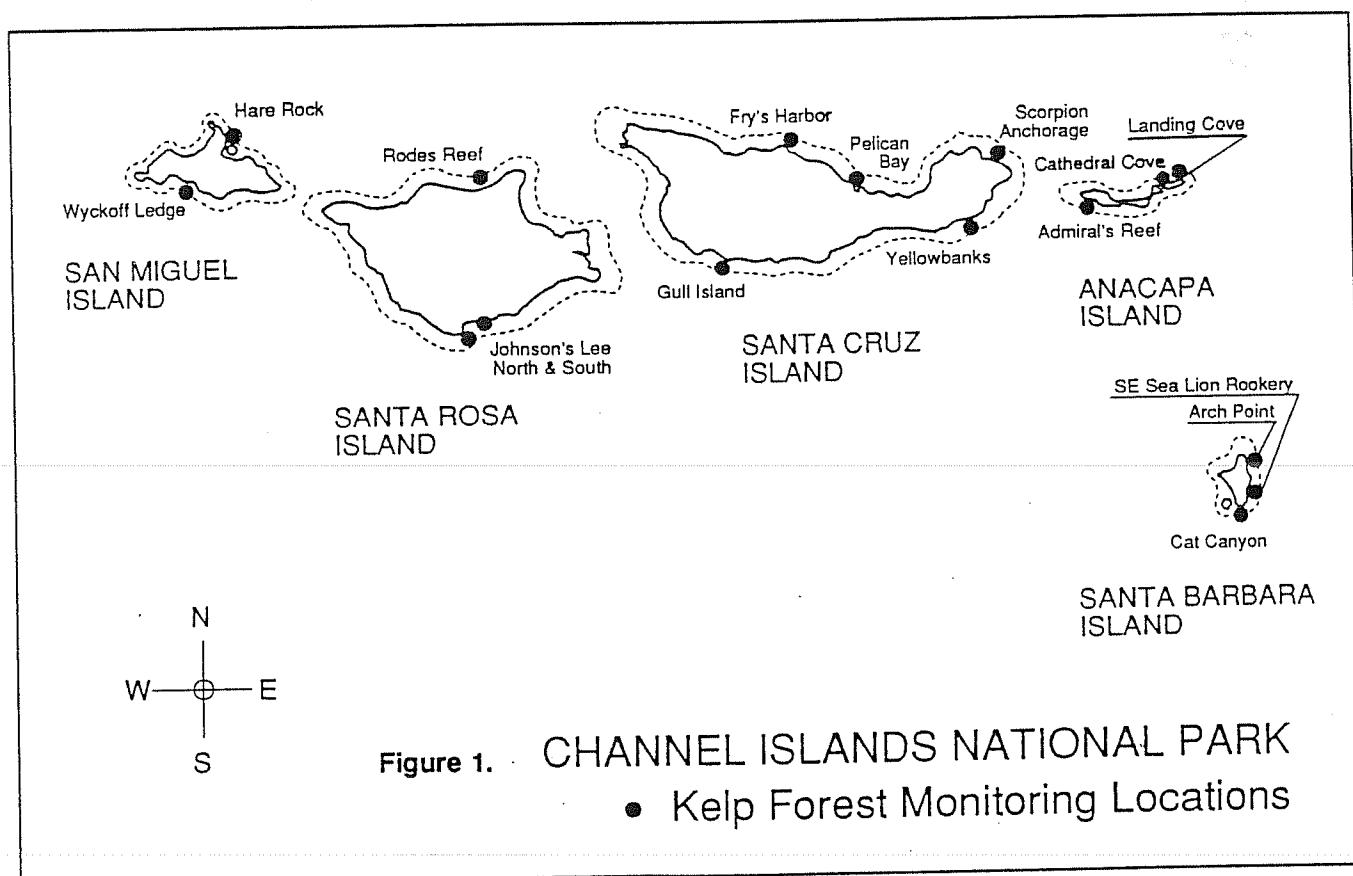


Table 1. Description of Kelp Forest Monitoring Sites

ISLAND	LOCATION	DATE ESTAB.	CODE NAME	LATITUDE/ LONGITUDE	LORAN C (TD1/TD2)	DEPTH (m)
San Miguel	Wyckoff Ledge	1981	SMIWL	34°00.9' N 120°23.31' W	27866.10 41640.01	14 - 16
San Miguel	Hare Rock	1981	SMIHR	34°02.84' N 120°21.45' W	27871.98 41643.56	7 - 10
Santa Rosa	Johnson's Lee North	1981	SRIJLNO	33°53.61' N 120°06.36' W	27911.47 41543.92	8 - 12
Santa Rosa	Johnson's Lee South	1981	SRIJLSO	33°53.35' N 120°06.22' W	27911.77 41542.28	15 - 18
Santa Rosa	Rode's Reef	1983	SRIRR	34°01.38' N 120°06.66' W	27913.32 41576.91	15 - 18
Santa Cruz	Gull Island	1981	SCIGI	33°56.66' N 119°49.57' W	27957.60 41488.58	15 - 18
Santa Cruz	Fry's Harbor	1981	SCIFH	34°03.09' N 119°45.14' W	27972.94 41496.55	13 - 14
Santa Cruz	Pelican Bay	1981	SCIPB	34°01.67' N 119°42.24' W	27980.94 41477.83	6 - 9
Santa Cruz	Scorpion Anchorage	1981	SCISA	34°02.77' N 119°32.81' W	28006.78 41442.33	4 - 8
Santa Cruz	Yellow Banks	1986	SCIYB	33°59.00' N 119°33.81' W	28002.80 41431.00	15 - 16
Anacapa	Admiral's Reef	1981	ANIAR	34°00.33' N 119°25.86' W	28024.35 41402.16	14 - 16
Anacapa	Cathedral Cove	1981	ANICC	34°00.71' N 119°22.29' W	28035.00 41387.50	6 - 11
Anacapa	Landing Cove	1981	ANILC	34°00.70' N 119°21.71' W	28036.80 41383.90	5 - 13
Santa Barbara	Cat Canyon	1986	SBICC	33°27.24' N 119°02.47' W	28064.40 41180.20	7 - 9
Santa Barbara	SE Sea Lion Rookery	1981	SBISESL	33°27.45' N 119°01.52' W	28066.13 41177.19	13 - 15
Santa Barbara	Arch Point	1981	SBIAP	33°28.65' N 119°01.73' W	28067.22 41181.36	7 - 9

TRANSECT BEARING	PHOTO-PLOT LOCATION	HYDROTHERMOGRAPH LOCATION
(SMIWL) 090-270°	40 m from west end, 2 m south	none
(SMIHR) 090-270°	20 m from east end, 6.4 m 30°	10 m from east end, 8.4 m 315°; 20 m from east end, 7.8 m 445°; depth 10 m
(SRIJLNO) 030-210°	36 m from east end on transect line	10 m from north end, 0.2 m 290°; depth 10 m
(SRIJLSO) 020-200°	61 m from north end, 1 m west	none
(SRIRR) 090-270°	60 m from east end, 2 m north	none
(SCIGI) 000-180°	24 m from north end, 2 m west (PVC stakes)	20 m from north end, 8 m 300°; depth 16 m
(SCIFH) 020-200°	45 m from south end, 1 m west	45 m from south end, 4 m 55°; depth 16 m
(SCIPB) 020 - 200°	7 m from south end, 2 m west	none
(SCISA) 0 90 - 270°	3 m from east end on south side	none
(SCIYB) 090-270°	55 m from east end, 3 m north	none
(ANiar) 150-330°	10 m from west end, 5 m northeast	none
(ANICC) 120-300°	36 m from north end, 2 m west	none
(ANILC) 040-220°	2 m from northwest end on reef crest	1 m west from north end; depth 7 m
(SBICC) 090-270°	40 m from west end, 7.9 m 150° 30 m from west end, 9.3 m 220°	none
(SBISESL) 000 - 180°	30 m from south end on west side	none
(SBIAP) 010-190°	10 m from south end, 1 m east	10 m from south end, 1 m east of transect; depth 7 m

MONITORING PROTOCOL

SAMPLING METHODS

Nine sampling techniques are used to gather information on population dynamics of the selected kelp forest organisms. Information is gathered annually during the summer, between June and October, at the 16 fixed transects described in the previous section. Species codes and species checklists useful for all techniques are found in Appendix C. Logistic considerations for monitoring cruises, as well as suggestions for scheduling and acquisition of necessary supplies and materials are discussed in Appendix D.

Table 2. Summary of Sampling Techniques Used to Monitor Population Dynamics of Selected Kelp Forest Organisms

TECHNIQUE	SAMPLE SIZE	NUMBER OF REPLICATES
Quadrat count	1 x 2 m	20 / site
Band transect count	3 x 20 m	12 / site
Random point count	40 points (0.5 x 3 m)	25 / site
Visual fish transect	2(w) x 3(h) x 100(l) m 5 minutes	8 / site
Video transects	2(w) x 3(h) x 100(l) m 5 minutes	4 / site
Size frequency	30 to 100 / species	1 / site
Photogrammetric plots	20 m ² (80-0.5 x 0.5 m)	1 / site
Oceanographic conditions	Hourly	6 sites
Species checklist	30 - 90 minutes	1 / site

Quadrats

Purpose

To determine the abundance of selected sedentary indicator species.

Materials

- 2 underwater clipboards
- 2 underwater quadrat data sheets (see Appendix E)
- 4 3-sided PVC meter square quadrats
- 1 summary quadrat data sheet (see Appendix E)

Personnel

- 2 SCUBA equipped observers

Methods

Data sheets are set up for each diver with twenty non-consecutive random numbers between 0 and 100. The numbers indicate the position along the transect line where observations are made. Each diver is equipped with two three sided meter square quadrats. Each diver performs 20 1 m² quadrat counts along the transect lead line. When the two data sheets are combined it results in 20 1 x 2 m quadrat samples. The divers work on opposite sides of the lead line using the lead line as the fourth side to their three sided quadrat. The quadrat is positioned so that one leg is on the designated meter mark of lead line using the meter tape as a reference and the other leg is on the next greater meter number (see Figure 2).

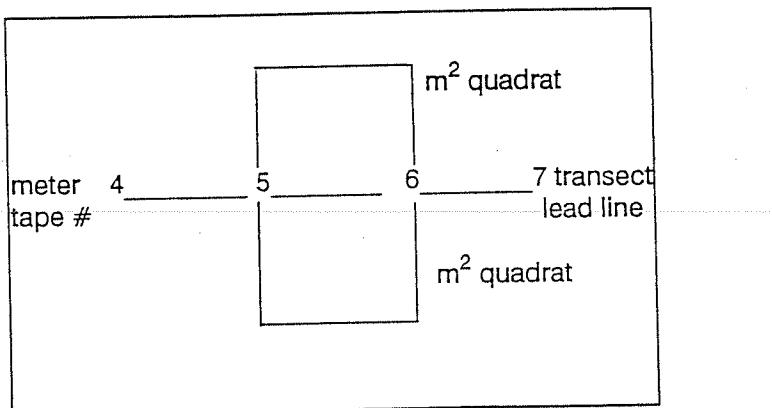


Figure 2 . Placement of Quadrats on Lead Line at Meter Mark 5.

To begin the sampling procedure, each diver places a quadrat down on the first meter mark listed on their data sheet and then proceeds down the lead line to the next meter number on the data sheet and positions the other quadrat. They then return to the first pair of quadrats along the bottom away from transect line and approach them slowly to minimize disturbance which might cause the island kelp fish and gobies to retreat into crevices. These fish are the first organisms to be counted within the quadrat. Once they are counted, no additional fish that swim into the quadrat are counted.

The divers must search under ledges and in cracks for organisms. Urchins can be moved slightly to look underneath them. Sometimes it is necessary to clean off the pebbles and shell that hide organisms in order to identify them. Juveniles and adults are counted for all species, except giant kelp for which juveniles and adults are recorded separately.

After the first set of quadrat counts are completed, the divers then move the PVC quadrats to the third meter number listed on the data sheet. They should carefully swim around the other set of quadrats, keeping at least one meter to the outside of these quadrats. After positioning the third set of quadrats, they return to the second set and begin by counting the fishes. This cycle is repeated until all 20 1 x 2 m quadrats are sampled.

After the divers return to the surface, the two quadrat sheets are combined onto summary quadrat sheets and are stored in the completed data sheet notebook along with the raw data sheets. The summary sheets are used for data entry.

Time Required

Approximately 200 minutes of bottom time are needed. Experienced biologists in an area of low species diversity and/or abundance will take less time.

Organisms Sampled

Fish

Lythrypnus dalli
Coryphopterus nicholsii
Alloclinus holderi

blue banded goby
 blackeye goby
 island kelp fish

Algae

Macrocystis pyrifera
Macrocystis pyrifera
Laminaria farlowii
Eisenia arborea
Pterygophora californica

giant kelp (juveniles)
 giant kelp (adults > 1m)
 oar weed
 southern sea palm
 California sea palm

Invertebrates

Astraea gibberosa
Astraea undosa
Cypraea spadicea
Strongylocentrotus franciscanus
Strongylocentrotus purpuratus
Patiria miniata
Pisaster giganteus
Parastichopus parvimensis
Styela montereyensis

red top snail
 wavy top snail
 chestnut cowrie

red sea urchin

purple sea urchin
 bat star
 giant spined sea star
 warty sea cucumber
 stalked tunicate

Band Transects

Purpose

To determine abundance and distribution of rare and clumped organisms not adequately sampled by quadrats.

Materials

- 2 underwater clipboards
- 2 1.5-m PVC rods
- 2 small meter tapes (30 m)
- 2 underwater band transect data sheets
(see Appendix E)
- 1 band transect summary data sheet

Personnel

- 2 SCUBA equipped observers

Methods

Data sheets are marked with twelve randomly selected numbers between 0 and 100, ordered for efficiency, with at least 2 m between numbers to avoid overlap. Number sets are generated by a Pascal program and are kept in a folder in the data sheet box. At each sampling point along the transect line, divers attach a meter tape to the lead line and swim out perpendicular to the line in opposite directions to a distance of 10 m. The divers then secure their tape reels and work their way back to the lead line along one side of the tape, counting the organisms listed on the data sheet that occur within 1.5 m of the tape. A 1.5-m PVC rod is used as to measure the distance from the line. Once the lead line is reached, the divers then work their way back to the reel along the opposite side of the tape, again counting target organisms within 1.5 m of the tape (see Figure 3). Once the reel is reached, the tape is wound up and the divers move on to the next randomly selected meter number along the lead-line.

Swimming in this manner, each diver covers an area of 3 m x 10 m. Adjacent segments from both divers are added together on the summary data sheet to produce a sampled area of 3 m x 20 m at each of the 12 randomly selected points. Divers must search the habitat thoroughly, including cracks, crevices, and under rocks for elusive animals.

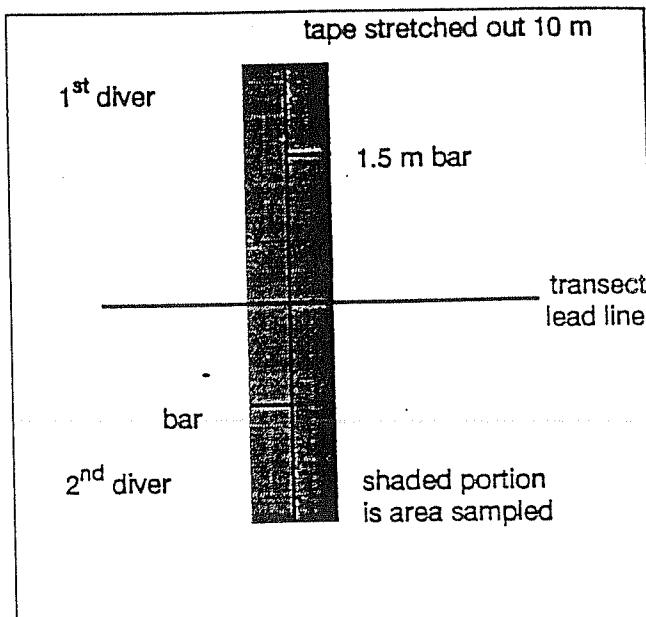


Figure 3. Band Transect Sampling Procedure

Time Required

A minimum of 100 minutes for experienced biologists, or more typically 120 to 150 minutes is required. Sampling time is decreased for flat, low relief habitats. A larger number of dives will be required at deep stations. Sampling time will increase at high relief, high cover areas. In addition, areas with large densities of the white urchin, *Lytechinus anamesus*, will significantly slow sampling, and may be best sampled using quadrats at the discretion of chief scientist of the cruise.

Organisms Sampled

<i>Tethya aurantia</i>	orange puffball sponge
<i>Polymastia pachymastia</i>	aggregated vase sponge
<i>Leucetta losangelensis</i>	white calcareous sponge
<i>Allopora californica</i>	California hydrocoral
<i>Tealia lofotensis</i>	white-spotted rose anemone
<i>Lophogorgia chilensis</i>	red gorgonian
<i>Muricea fruticosa</i>	brown gorgonian
<i>Megathura crenulata</i>	giant keyhole limpet
<i>Haliotis rufescens</i>	red abalone
<i>Haliotis corrugata</i>	pink abalone
<i>Haliotis fulgens</i>	green abalone
<i>Kelletia kelletii</i>	Kellet's whelk
<i>Hinnites giganteus</i>	rock scallop
<i>Lytechinus anamesus</i>	white sea urchin
<i>Pycnopodia helianthoides</i>	sunflower star
<i>Aplysia californica</i>	California brown sea hare
<i>Panulirus interruptus</i>	California spiny lobster

Random Point Contact Quadrats

Purpose

To estimate substrate composition and percent cover of selected algal and invertebrate taxa.

Materials

- 2 random point contact (RPC) bars—a PVC bar with two strings, each string with 5 knots. The bar is 1.5 m long. One string is 1.8 m long, the other 1.2 m long. The long string is attached to the end of the bar, the short string is attached 25 cm in from each end. Knots are at least 20 cm apart.
- 2 RPC data sheets (see Appendix E)
- 2 summary sheets (see Appendix E)
- 2 clipboards
- 1 laminated species list
- 1 surface supplied diving equipment—dive control system (DCS), band mask, and umbilicals

Personnel

- 1 console operator/data recorder
- 1 line tender
- 1 umbilical equipped observer

Methods

Data sheets are numbered with 25 randomly selected numbers from 0 to 100. Numbers indicate the position along the transect line at which observations are made. The numbers are generated by a Pascal program, and a printed copy of sets of numbers is kept in a labelled folder near the blank data sheets.

The diver carries the RPC bar and laminated species list (if necessary) underwater. The diver locates the transect line, and proceeds to one end of the line to begin sampling. The console operator provides the diver with the random spots along the line at which to stop and make observations. Once the diver has arrived at the designated random meter mark, the console operator will measure the depth with the pneumofathometer of the DCS and record this on the data sheet.

To collect data, the diver places the RPC bar perpendicular to the transect line, holds it in place, and stretches the string taut at each knot. An imaginary line is visualized running vertically through the knot up to one meter above the substratum. The diver next relates to the console operator/ recorder the organisms

that intersect this line, usually starting at the top with the canopy organisms and finishing with the substrate. This parallels the way the data sheet is organized and facilitates data recording. The diver proceeds in this manner, doing both strings on one side of the bar, then doing the same on the opposite side of the bar. Next, the diver places the RPC bar on the opposite side of the transect line and repeats the process. For a pictorial representation of the sampling technique, see Figure 4.

The organisms to be scored are listed on the laminated data sheet which the diver carries underwater. Other attached or sessile animals providing cover are recorded as "miscellaneous invertebrates." Motile invertebrates are not counted, but should be moved to determine what is underneath.

The substrate type is always recorded. The number of substrate tallies can be used to double check for missed points. Each column on the data sheet corresponds to the observations taken for two strings on one side of the RPC bar. Therefore, each column should list ten substrate tallies, and each quadrat, forty. The three types of substrate are defined as: "sand" sediment that one can push a finger into without hitting rock, "cobble" rock easily moved by a diver, and "rock" is immovable. "Bare" is used when the substrate is devoid of any living organisms and can be used in combination with any substrate type.

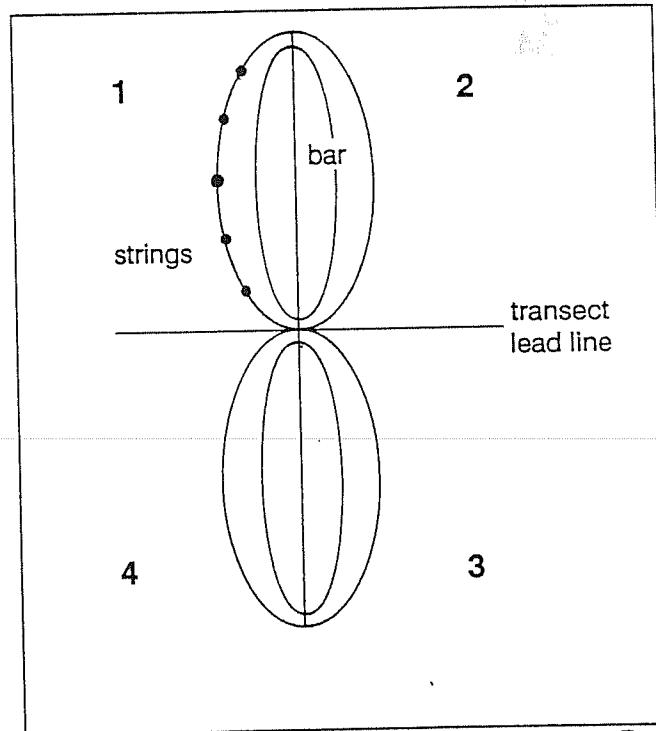


Figure 4. Orientation of Random Point Contact Bar and String During Sampling

When monitoring deep sites, it is important that both the console operator and the diver be aware of depth and bottom times because of the unlimited air supply. The diver and console operator can assist one another in retaining proper sampling orientation and ensuring the proper number of points are scored by indicating "other string," "other side of the bar," "other side of the transect line" and "next quadrat" when appropriate.

Additional information on this technique can be found in Carter et al. (1978), Goodall (1952), Johnston (1957), Kemp (1956), and Winkworth (1955).

Time Required

Five to fifteen minutes are required at each quadrat. Familiarity with the organism list, a console operator/recorder who is adept at scoring data sheets, and areas with few canopy species will decrease bottom time. Heavy surge, dense canopy, and deep sites increase bottom time and/or the number of dives necessary to complete a site.

Organisms Sampled

Plants

<i>Macrocystis pyrifera</i>	giant kelp
<i>Eisenia arborea</i>	southern sea palm
<i>Pterygophora californica</i>	California sea palm
<i>Laminaria farlowii</i>	oar weed
<i>Desmarestia</i> sp.	acid weed
<i>Cystoseira</i> sp.	bladder chain kelp
other brown algae	
articulated coralline algae	
encrusting coralline algae	
<i>Gelidium</i> sp.	agar weed
<i>Gigartina</i> sp.	sea tongue
other red algae	
green algae	
miscellaneous plants (e.g. diatoms, <i>Phyllospadix</i>)	

Animals

<i>Astrangia lajollaensis</i>	La Jolla cup coral
<i>Balanophyllia elegans</i>	orange cup coral
<i>Diopatra ornata</i>	ornate tube worm
<i>Phragmatopoma californica</i>	colonial sand-tube worm
<i>Serpulorbis squamigerus</i>	scaled tube shell
<i>Corynactis californica</i>	strawberry anemone
<i>Diaporecia californica</i>	southern staghorn bryozoan
other bryozoans	
tunicates	
sponges	
miscellaneous invertebrates	

Bare (no cover)

Substrates
rock
cobble
sand

Visual Fish Transects

Purpose

To determine the abundance of selected fish species along the 100 m transect line.

Materials

- 2 underwater clipboards with watches
- 2 underwater visual fish survey data sheets (see Appendix E)
- 1 30-m tape and secchi disk
- 1 surge meter

Personnel

- 2 SCUBA equipped observers

Methods

Each diver swims at a uniform speed of 20 m per minute on one side of the 100-m transect line counting and recording all the indicator fish species 3 m above the meter tape/lead line and 1 m on each side of the line (see Figure 5) to sample an area of 200 m², within 3 m of the bottom, in five minutes.

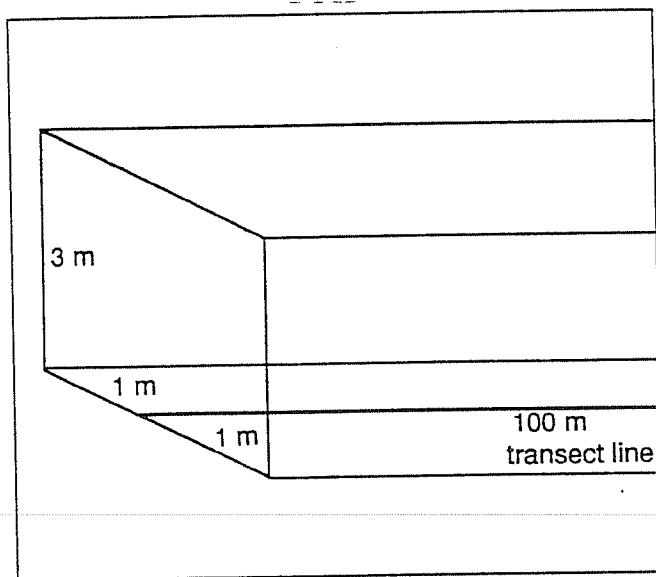


Figure 5. Area Covered for 100 m Visual Fish Counts (100 m long x 2 m wide x 3 m high).

If using the video, one diver will count and one diver will operate the video. (NOTE: Use of video requires preparation as described on next section, Preparation of VCR for Video Transects.) In either case the rate of swimming is 20 m/min so the swim will take 5 minutes. Four replicate counts are taken. Counts are differen-

tiated by species and by age class (adults or juveniles, with juveniles usually defined as less than 10 cm in length). After each 100 m count, the divers should swim about 5 m past the end of the line and then turn around to begin the next count. There are four columns on the data sheets for each transect swim. If the numbers are not legible, once at the surface be sure to enter the totals for each species for each transect count.

After the four fish counts have been completed, visibility and surge are measured. Visibility is measured horizontally near the bottom with a 20 cm secchi disk. One diver holds the secchi disk, attached to a meter tape, facing the other diver and swims away from the diver holding the meter tape reel. When the secchi disk disappears, the diver with the reel stops the tape, records the distance, and winds in the tape. When the secchi disk reappears, the distance is recorded. Visibility is recorded as the mean of the two distances. The secchi disk is always oriented to face the sun, i.e. to the east in the morning and to the west in the afternoon. Surge is recorded as the maximum degrees from vertical a small fishing float on a 30 cm-long string is displaced.

Organisms Sampled

Species Name Name	Common Characteristics	Juvenile
<i>Chromis punctipinnus</i>	blacksmith	yellow tail coloration
<i>Oxyjulis californica</i>	senorita	< 10 cm length
<i>Sebastes mystinus</i>	blue rockfish	< 10 cm length red color
<i>S. serranoides</i>	olive rockfish	< 10 cm length
<i>S. atrovirens</i>	kelp rockfish	< 10 cm length
<i>Paralabrax clathratus</i>	kelp bass	< 10 cm length
<i>Semicossyphus pulcher</i>	sheephead	< 10 cm length black fin
<i>Embiotoca jacksoni</i>	black surfperch	< 10 cm length
<i>E. lateralis</i>	striped surfperch	< 10 cm length
<i>Damalichthys vacca</i>	pile perch	< 10 cm length
<i>Hypsypops rubicundus</i>	garibaldi	< 10 cm length blue spots
<i>Girella nigricans</i>	opaleye	< 10 cm length

Video-taped Transects

Purpose

General appearance of the kelp forest is recorded along the fixed leadline transect following the same procedures employed for the visual fish transects. A video camera is used to record conditions along the 100-m transect line, about 1 m off the bottom, during a five minute period. Four replicate transect swims are recorded simultaneously with the first four fish transects.

Materials

- 1 underwater video camera and recorder
- 1 60 min video tape, high quality VHS format

Personnel

- 2 SCUBA equipped divers

Methods

Follow these steps to prepare, set-up, and operate the underwater video recorder to videotape the transects.

Camera/recorder preparation

- 1) Check battery status. Three solid bricks should be displayed on the recorder when the battery is inserted and the power turned on. If there are not three solid bricks, change batteries.
- 2) Fill out label with station and date and stick on tape.
- 3) Insert tape in recorder.
- 4) Hook camera cable up to recorder.
- 5) Attach viewfinder to camera.
- 6) Set recorder to the following:
 - a. VCR on
 - b. Camera remote on
 - c. Speed at 'SP'
- 7) To label tape:
 - a. Reverse/ normal switch to normal
 - b. Front camera switches to 'character', 'title' and camera
 - c. Use character location switches to label tape with site code on line one and date below

- i. Open eyepiece and look in viewfinder
- ii. Change characters by using forward/reverse buttons
- iii. Do not turn off VCR or change camera settings until after step 8 (below)

CAUTION: DO NOT POINT CAMERA DIRECTLY INTO THE SUN.

8) To shoot title:

- a. Set white balance by pointing camera at a white surface, pushing 'AWB' button on front of camera until light in viewfinder turns solid green
- b. Set lens to desired setting (not "Macro")
- c. Take panoramic view of the area for approximately 30 seconds, make sure U/ W lens is off

9) Housing - Prell and wipe front port inside and out.

10) Visually inspect housing, O- ring, and operating levers for cracks and other problems.

Camera set-up for underwater use

- 11) Title/ VCR switch to middle setting, 'fade' off, camera/VCR switch to 'camera'.
- 12) Light setting sunlight.
- 13) Attach U/ W lens; clean before attaching if necessary.
- 14) Set telephoto to arrow in middle of macro and focus to infinity.

Camera installation

- 15) Remove view finder.
- 16) Put camera onto right hand attachment and secure with bolt into base.
- 17) Slide VCR in sideways with eject button facing out and on the bottom.
- 18) Attach view finder and slide in on top of VCR and camera.
- 19) Replace housing back, check back knob adjustment, and remove back.
- 20) Realign and re-tighten bolt to camera if necessary.

- 21) Switch VCR power to "ON." 'Play,' 'record', and 'pause' lights will be on.
- 22) Change camera operation buttons to "display" from "standby".
- 23) Check image in viewfinder—if upside down, change switch to left of eyepiece.
- 24) If there are no numbers in the display, switch the "title" switch to the center location.
- 25) Turn OFF after checking if not using immediately.

Final preparation

- 26) Put weights in bottom of housing.
- 27) Install alarm and test.
- 28) Tuck camera/ VCR cord away.
- 29) Switch power on VCR to ON, and replace housing back.
- 30) Test operation of standby switch on the surface.

In the water, at the surface

- 31) Turn camera operation switch to ON.
- 32) Press forward switch to the front and whitebalance against a white slate. Hold until white balance light in viewfinder is solid green.

On the transect

- 33) Move operate switch to display for counter operation.
- 34) Press rear housing switch forward which will release the pause switch and begin recording. This will also cause the red indicator light to the left of the eyepiece to blink on and off and the red indicator light in the eyepiece to go on.
- 35) Swim the transect (100 meters) with the camera as level as possible approximately 1 m off the bottom, with a slight downward angle. This should take five minutes.
- 36) Once at the end of the transect, press rear housing switch forward once again to place the

VCR in pause mode.

- 37) Move the display switch to the middle position to reset the clock, and then move back to display.
- 38) Repeat steps 34-37 three more times for a total of four 100 meter transects.

Back on the boat

- 39) Place housing in the shade.
- 40) Hose down the housing with fresh water and allow to dry.
- 41) Disassemble unit and put away.
- 42) Put battery on to charge.

Time Required

Approximately 30 minutes of bottom time.

Organisms Sampled

Kelp forest community

Size Frequency

Purpose

Size frequency distributions are used to estimate population age structure, and thence growth and mortality rates, and to identify and monitor recruitment cohorts.

Materials

- 6 vernier calipers, stainless steel, 220 mm
- 2 meter sticks, non-floating
- 2 1 x 1 m quadrats
- 4 large canvass sided collection bags
- 2 small pry bars
- 4 underwater slates with 17 sheets of vellum
- 20 size frequency data sheets

Personnel

- 6 SCUBA equipped divers

Methods

It is very important in sampling for size frequency distributions that all individuals in the target population are represented in proportion to their abundance in the population. To reduce bias every member of the target species in the study plot must be found and measured. Carefully noted areas along the fixed lead-line transect are searched until the number of individuals indicated in the table below are found and measured. Pairs of divers are assigned three to six species that are found in close proximity to maximize diver efficiency.

All measurements are made to the nearest millimeter, except for warty sea cucumbers, *Parastichopus parvimensis*, which are measured in centimeters. Measurements are made *in situ* with minimal disturbance to the organisms, except for sea urchins and sea cucumbers which are collected, measured on board the research vessel, and returned to the point of collection. The minimum sample sizes and types of measurements for each species are indicated in the section on organisms sampled. Data are transferred to summary sheets from underwater vellum.

Time Required

Sea urchin and cucumber collection and return requires about 100 minutes, the kelp stipe counts require 60-80 minutes, and the remaining measurements take 210-320 minutes of bottom time.

Organisms Sampled

Genus	Sample Size	Measurement
<i>Macrocystis</i>	100	Stipe count, 1 m above bottom
<i>Tethya</i>	30	Max. diameter, mm
<i>Allopora</i>	50	Max. height and width, mm
<i>Lophogorgia</i>	30	Max. height and width, mm
<i>Muricea</i>	30	Max. height and width, mm
<i>Megathura</i>	30	Max. shell length, mm
<i>Haliotis</i>	30	Max. shell length, mm
<i>Astraea</i>	30	Max. shell diameter, mm
<i>Cypraea</i>	30	Max. shell length, mm
<i>Kelletia</i>	30	Max. shell length, mm
<i>Hinnites</i>	30	Max. shell width, mm
<i>Strongylocentrotus</i>	100	Max. test diameter, mm
<i>Lytechinus</i>	100	Max. test diameter, mm
<i>Pycnopodia</i>	30	Length of longest ray, mm
<i>Patiria</i>	30	Length of longest ray, mm
<i>Pisaster</i>	30	Length of longest ray, mm
<i>Parastichopus</i>	30	Length when contracted, cm

Photogrammetric Plots

Purpose

To determine abundance (density) of selected invertebrates and algae. Photogrammetry is also an excellent source of visual documentation for algae, invertebrates, and substratum in order to determine any temporal changes on a long-term basis.

Materials

- 1 PVC grid frame, 2 m x 2 m
- 1 PVC photostand, camera mount,
 0.5 m x 0.5 m x 0.7 m
- 3 Nikonos V cameras
- 3 Nikkor 15-mm lenses
- 1 Nikkor 28-mm lens
- 3 angle iron or mounting brackets with screws
- 2 pelican boxes (camera and accessory storage)
- 3 rolls Ektachrome color slide film, 36 exposure,
 100 ASA per photoplot
- lens paper
- O-ring grease (silicone)
- blower brush
- 1 O-ring set (extra) for camera, lens, and e/o
 connector
- 1 black case (film and accessory storage)
- 3 Oceanic 2001 strobes
- 3 Oceanic strobe chargers (full charge = 3-5 hours)
- 4 e/o connectors
- 2 Oceanic strobe arms
- 2 Oceanic metal knobs (secures strobes to arms)
- 2 Oceanic plastic knobs (secures arms to photo-
 stand)
- 2 Q-lites
- 2 Q-lite holders (secured between strobe and arm)
- 2 Q-lite chargers (full charge = 8 hours)
- 1 large white case (strobe, Q-lite and accessory
 storage)
- Brass stakes (to replace photoplot stakes as
 needed)
- Epoxy cartridges (to secure brass stakes to
 substrata)
- Hammer drill with bits (for stake replacement)

Personnel

- 2 SCUBA equipped observers. (Under conditions of heavy surge or current or high relief rocky areas, a third diver may be required to carry out sampling.)

Methods

Photogrammetry is the process of surveying an area by means of photography. Sampling methods are organized under four headings, care and maintenance of equipment, equipment set-up, technique, and processing and labeling film.

Care and Maintenance of Equipment

It is essential that photographic and accessory equipment receive proper care. High initial and replacement costs, along with lost sampling time due to equipment failure or repair, reinforces the importance of proper maintenance. Equipment inspection and care is extremely important before sampling is done, therefore this section proceeds the actual methodology involved.

Cameras. Each camera should be cleaned and inspected before each photoplot is done using the following procedure:

- 1) Wash hands and dry thoroughly (especially after contact with seawater)
- 2) Open camera body and remove lens
- 3) Remove O-ring from camera body, 15-mm lens, and e/o connector by applying pressure to O-ring with fingers and pinching together so that it can be easily lifted out of the groove; never pry O-ring off with a sharp object as this will damage the O-ring
- 4) Clean the groove with a cotton swab or lens paper
- 5) Clean the O-ring with lens paper to remove grease and dirt
- 6) Inspect the O-ring for nicks and cuts; replace if any are found
- 7) Apply a thin coat of silicone grease to the O-ring so it appears "wet looking"; excess grease is as bad as not enough - both will prevent a watertight seal
- 8) Secure O-ring in groove
- 9) Inspect camera for dirt or other foreign material and remove; it is especially important that nothing comes in contact with the O-ring surface as this will prevent a watertight seal
- 10) Carefully load the camera with film

After sampling is completed, rinse the camera thoroughly in fresh water and dry completely, preferably by air drying. However, if the film needs to be changed in order to continue sampling, a towel can be used after rinsing. Extreme care should be taken to prevent moisture from entering the camera. Even small droplets can cause damage. After sampling is completed and the camera is dry, remove the e/o connector from the camera body and replace the screw-in metal plug. Attach the 28-mm lens and store camera in pelican box.

If the camera becomes flooded, immediately open up camera and remove the four small screws that hold the metal plate. Remove the plate and immerse camera in fresh water. As soon as possible, take the camera to an authorized dealer for repair (Authorized Camera Service in Sherman Oaks). Do not immerse in alcohol as this will damage the internal electronics.

Lenses. There may be four or more different lenses. Each one needs the O-ring cleaning and inspection described above, as well as actual cleaning of the glass itself. Seawater tends to form crystals over the glass when not cleaned thus flaving the clarity of the picture. In order to clean the lenses follow these steps:

- 1) Clean, inspect, and grease the O-ring
- 2) Using the blower brush, clear away all loose dirt and debris
- 3) Apply a couple of drops of lens cleaning solution onto a piece of lens paper. Using small circles, start in the center and work your way out using larger and larger circles and wipe the lens free of all oils and dirt.
- 4) Using a fresh piece of lens paper, dry the lens incorporating this circle technique
- 5) Repeat on second glass surface
- 6) Replace the O-ring

Strobes. Strobes should be fully charged before sampling (3-5 hours charging time). Turn strobe "off", unscrew black cap which covers the charging port and plug charging unit into strobe and electrical wall outlet. Do not charge the strobe longer than the recommended charging time. The black cap covering the charging port possesses an O-ring which should be cleaned and inspected (as described above).

REMEMBER to replace black cap after charging or you will flood the strobe.

Additional topside care should include protection from direct sunlight by covering with a towel. Direct sunlight may burn out the built in light sensor. Also the strobe plug (for the e/o connector) should be protected by using a tight fitting cork.

After sampling has been completed, rinse the strobes and accessories with fresh water, let dry and place in storage cases.

Q-lites. Q-lites require a much longer charging time than do strobes (8 hours). Unscrew the large blue knob and remove the battery from its casing. Plug charging unit (different unit than the one used for strobes) into port at end of battery and into electrical wall outlet. Do not charge Q-lite longer than the recommended charging time. Clean and inspect the O-ring on the blue knob. After charging, put the battery back into casing. Screw in the blue knob far enough so that the O-ring forms a seal or the Q-lite will flood. After sampling has been completed, rinse Q-lites and holders in fresh water, let dry and place in storage case.

Accessory Equipment. Other equipment associated with photoquadrats (ie; photogrid, photostand, etc.) should be thoroughly rinsed with fresh water either after sampling, or upon return from a cruise.

Equipment Set-up

The following checklist should be used when assembling equipment for sampling:

- 1) Write out an identification sheet for each roll of film used and include site location, date, and roll number
- 2) Load cameras with film, set correct film speed (should be 100 ASA)
- 3) Attach mounting brackets to camera using screws and washers
- 4) Screw e/o connectors into camera (e/o connector possesses an O-ring which should be cleaned and inspected) and tighten locking nut against mounting bracket
- 5) Photograph roll identification sheets using 28-mm lens

- 6) Remove 28-mm lens and replace with 15-mm lens. Make sure the lens is seated (sealed) properly. Set F-stop and focus (f16 and 0.7 m)
- 7) Attach strobes and Q-lite holders to strobe arms using Oceanic metal knobs
- 8) Place Q-lites in holders
- 9) Attach strobe arms to photostand using Oceanic plastic knobs
- 10) Insert mounting bracket (with camera attached) into slots on photostand so that camera is centered
- 11) Pull surgical tubing over bolts at end of mounting bracket so as to secure camera to photostand
- 12) Place other cameras in a small goody bag to take down with you

- 13) Grease the e/o plug (for e/o connector) at the end of the cord attached to the main strobe so a watertight seal can be made. Leakage will result in random firing of strobe
- 14) Connect the e/o cord from main strobe to e/o connector. The slave e/o cord remains unattached and fires automatically when the main strobe fires

Technique

One diver holds the photogrid in place to ensure a minimal amount of grid movement and repositions the PVC counter on the photostand to record quadrat number. The other diver photographs the quadrat while helping to position and steady the photostand.

First determine the photoplot location at the station being sampled using the site description binder. The two divers carry the photogrid, equipped photostand and extra cameras to the photoplot site and locate the four photopoints (brass, plastic or PVC stakes).

Find the northeast corner of the photoplot and orient the photogrid so that it is set against the two northernmost stakes (see Figure 6). Quadrats are sampled from east to west and north to south. The first 16 quadrats (photos) can be sampled with the grid in this initial position. The grid should then be moved south so that it is set against all four photopoints. The next 16 quadrats can then be photographed (32 photos in all so far). Continue to move the photogrid south to set it against the two southernmost points, and then

the two western-most points and finally the two eastern-most points for a total of 80 quadrats. Divers should remember that minimal disturbance of the substratum is needed to ensure water clarity and an accurate characterization of the area sampled. To this end, divers should remain over unsampled areas or areas already photographed.

With three cameras, sampling can usually be accomplished in one dive. Changing cameras on the photostand underwater merely requires that the e/o connector be disconnected and the camera with mounting bracket be removed from the photostand. The next camera with mounting bracket can then be inserted/centered onto the photostand, secured by the surgical tubing, and the e/o connector reconnected. After sampling has been completed, all film should then be labelled and stored until return from the cruise. Wash and stow all gear (see section on care and maintenance).

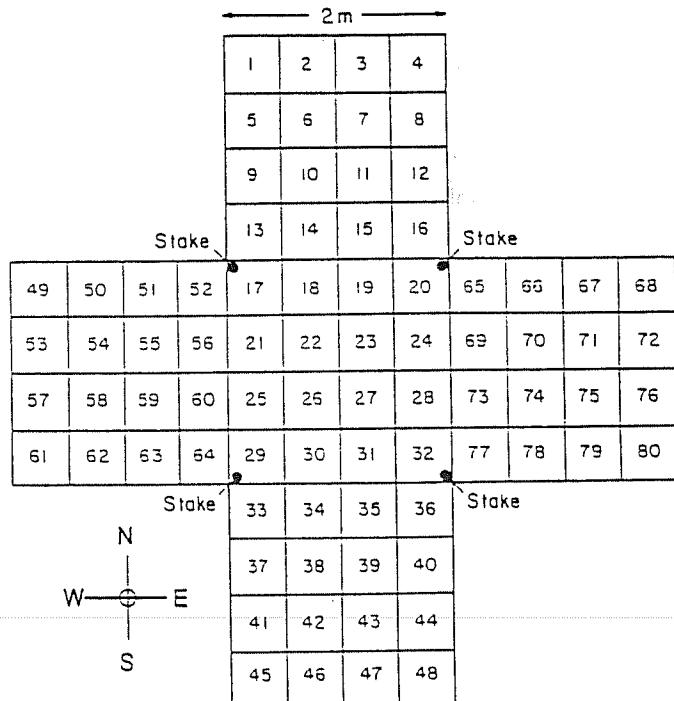


FIGURE 6. Diagram of Photoplot Showing the Array of 0.25 m^2 ($0.5 \text{ m} \times 0.5 \text{ m}$) Quadrats Photographed in Sequence from 1 to 80.

Processing and Labeling Film

Film should be taken to a local photography store or business for processing (e.g., Hallas Color Lab or Jaffe's Camera). Ektachrome film can usually be processed in one or two days. All slides should be mounted and many stores will keep your slides numbered. After processing, identify each box of slides by the slide which is a photograph of the slide identification sheet. Label each slide as to location, date, and quadrat number. A changeable rubber stamp may be used to facilitate labelling.

While numbering slides you will want to "score" each slide as to its quality (light, clarity, and focus or ability to see). The scale is as follows:

- 4 = perfect slide, can see everything perfectly
- 3 = slide clarity diminished but still discernable
(ie: poor visibility, low light)
- 2 = slide clarity severely impaired, some objects not discernable.
- 1 = slide indiscernible
- 0 = no slide

Record the score for each slide in the photolog.

When finished, store the slides in their respective boxes and identify each box by location, date, and quadrat numbers enclosed. Store boxes in files and away from sunlight.

Species Checklist

The relative abundance of all species observed at each site is estimated every year. During the quantitative and size frequency sampling, notes are kept by all observers on the occurrence and abundance of all species encountered. Near the end of each site visit, one or more observer pairs search the entire monitoring site for rare or obscure species and make specific notes on the relative abundance of all species. Relative abundance for the species observed is recorded on a scale of X, 0, 1, 2, 3, or 4, where:

- X = present, but with no reliable estimate of abundance
- 0 = absent, expected but unfound upon directed search
- 1 = rare
- 2 = present
- 3 = common
- 4 = abundant

The value recorded for each species is a concensus, determined by the cruise's chief scientist in conference with all observers using the check list of known species in Appendix C, and reflects the potential abundance of each species. For example, sightings of four giant sea bass, *Stereolepis gigas*, at a site would be recorded as abundant (4), whereas 100 purple sea urchins, would probably rate only present (2) or common (3).

Oceanographic Conditions

Purpose

Water temperature and depth recorders are used to monitor temperature and tidal fluctuations at six kelp forest monitoring sites.

Materials

Sea Data TDR-2A Microloggers are the sensing and recording device used

Equipment needed for trip to service recorders is included in CHECKLIST #1 (in Appendix F).

Equipment is kept in the ranger cage in the shop in the right, red cupboard on the top two shelves.

Methods

Water temperature and depth are recorded at hourly intervals onto cassette tapes inside the Micrologger recorders. The recorders are serviced every three months, at which time the tapes with the recorded data are retrieved and the recorder is replaced with a newly serviced recorder. The tapes are brought back to headquarters and read by the tape reader. Data are transferred to the computer and then reduced and reports generated. More information on the operation, interpretation of data, and maintenance of equipment is found in Sea Data Micrologger Manual.

Recorder Locations

Recorders are located at the following six kelp forest monitoring sites.

Anacapa Island, Landing Cove (ANILC)

Santa Barbara Island, Arch Point (SBIAP)

Santa Cruz Island, Fry's Harbor (SCIFH)

Santa Cruz Island, Gull Island South (SCIGISO)

Santa Rosa Island, Johnsons Lee North (SRIJLNO)

San Miguel Island, Hare Rock (SMIHR)

Sites were selected to represent areas of differing water conditions. Specific locations of recorders in relationship to transect lines can be found in the kelp forest monitoring sites location descriptions (Table 1).

To Service the Recorder

First become familiar with the equipment.

Have a recorder in hand to familiarize yourself with the

components. The recording instrumentation itself is housed in the PVC case. The temperature probe and pressure sensor are attached to the bottom of the case. The recorders are o-ring sealed and therefore difficult to open. Use a spoon to lift the top end cap off the case at latches.

Top Panel

Inspect the instrument controls on the top panel and locate the following:

ON/OFF switch. Enabling this switch connects power to all components of the micrologger. In the OFF position, the instrument draws no power from the battery. Flipping the power switch to ON causes the instrument to set itself to all proper initial values and clears all data storage registers except the internal clock.

MEASUREMENT INTERVAL rotary switch. This switch allows selection of any one of sixteen scaling intervals. The microprocessor examines the setting of this switch every five seconds.

I/O output. This connector is used to check battery voltage. A connector cable is plugged into the port and connected to a voltmeter to determine voltage.

S/N. The serial number of the instrument.

SDBY/RUN toggle switch. The position of this switch determines whether the instrument is in STANDBY or RUN mode. When it is set to RUN, the recorder does the following:

- a) at the end of the current measurement interval, it takes readings from sensors and stores them in RAM
- b) writes data onto tape and clears the data memory if the RAM is filled
- c) increments the time counter.

When the switch is set to SDBY, the recorder does the following:

- a) writes the contents of the RAM onto tapes
- b) looks to see if a CLOCK RESET request has been made
- c) continues to increment the time counter, but takes no sensor reading

CLOCK RESET push button. This recessed button will set the recorder's time counter to zero.

START push button. Pressing the start button with the power on causes the instrument to set itself to proper initial values and clears all data registers ex-

cept the clock. When there is a tape in the recorder, pressing START causes the instrument to check whether the tape is on the foil beginning-of-tape (BOT) mark.

Electronics package

Inspect the electronics package by pulling on the top panel guard.

DIP switch. This switch is located on the circuit board. The switch has six positions which control channel enabling. Position 1 through 4 control sensor channels. Channels are enabled by flipping them to the numbered side of the DIP switch, while channels without sensors should be switched to OPEN to avoid unnecessary battery drain and waster tape space. In our recorders, position 1 enables the temperature sensor and position 2 enables the pres-

sure (depth) sensor. Position 5 enables the TIDE mode.

Battery Pack. The battery pack can be located on the opposite side of the electronics package from the DIP switch. Packs can be replaced by removing the nuts in the slot and disconnecting the white plastic plug above.

To Install, Remove, and Maintain Recorders

The recorders should be replaced every three months. The tapes will last for six months if weather does not permit three month servicing. Follow these steps in the order presented for installation, removal, and servicing of the recorders.

1. Check the ANNUAL SCHEDULE to determine when and how much time is required for maintenance

Table 3. Annual Schedule for Hydrothermograph Maintenance

MONTH	WEEK	TASK	TIME (DAYS)	CHECKLIST
January	1	Maintenance	2	#1, #2, #3
		Trip 1	2	#3, #4
	2	Trip 2	2	#3, #4
		Maintenance	2	#5
	3	Data Management-Process Tapes	5	#6
	4	Date Management-Quarter Report	5	#6
	1	Data Management-Annual Report	5	#6
	2	Maintenance	2	#1, #2, #3
		Trip 1	2	#3, #4
	3	Trip 2	2	#3, #4
February		Maintenance	2	#5
	3	Data Management-Process Tapes	5	#6
	4	Date Management-Quarter Report	5	#6
	1	Maintenance	2	#1, #2, #3
April	1	Trip 1	2	#3, #4
	2	Trip 2	2	#3, #4
		Maintenance	2	#5
	3	Data Management-Process Tapes	5	#6
July	4	Date Management-Quarter Report	5	#6
	1	Maintenance	2	#1, #2, #3
		Trip 1	2	#3, #4
	2	Trip 2	2	#3, #4
		Maintenance	2	#5
	3	Data Management-Process Tapes	5	#6
	4	Date Management-Quarter Report	5	#6
	1	Maintenance	2	#1, #2, #3
October		Trip 1	2	#3, #4
	2	Trip 2	2	#3, #4
		Maintenance	2	#5
	3	Data Management-Process Tapes	5	#6
	4	Date Management-Quarter Report	5	#6
	1	Maintenance	2	#1, #2, #3
		Trip 1	2	#3, #4
	2	Trip 2	2	#3, #4

Checklists:

- #1 - Equipment for Trip
- #3 - Installation of Recorder
- #5 - Maintenance

- #2 - Tape Preparation
- #4 - Removal of Recorder
- #6 - Data Management

and data management and boat scheduling needs (see Table 3).

2. Check the SERVICING SCHEDULE on Checklist #5 for each recorder to determine the placement and servicing of recorders.

3. Follow through the checklists for instructions on installation, removal, and maintenance of the recorders. The checklists are found in Appendix F.

CHECKLIST #1 - Equipment for Trip

CHECKLIST #2 - Tape Preparation

CHECKLIST #3 - Installation of Recorder

CHECKLIST #4 - Removal of Recorder

CHECKLIST #5 - Servicing of Recorder

Servicing Schedule

The following is a schedule of installation, removal, and annual servicing of recorders. The recorders can be installed/recovered from all stations in two two-day trips, weather permitting. As examples:

- Trip 1 Day 1: Headquarters to SCIFH to SMIHR
Day 2: San Miguel Island to SRIJLNO to SCISISO to Headquarters
- Trip 2 Day 1: Headquarters to SBIAP
Day 2: Santa Barbara Island to ANILC to Headquarters

Proper rotation of recorders brings each recorder back to headquarters once a year for annual servicing. A blank form for recording maintenance and for rotating recorders is found in Appendix F. Copy and fill out the maintenance schedule each year.

DATA MANAGEMENT

Data input, analysis, and reporting is different for each of the sampling methods described in the previous section. Therefore, data management is discussed by sampling method used to collect the data. Specific information on data entry and use of the computer programs for data analysis is given in this section.

dBase III Plus is used for data management. For summarizing the data and generating reports, the statistical software package SPSS/PC+ is used. Once the data are entered into dBase III files, an SPSS/PC+ translate program is used to translate the dBase III data file to an SPSS file. SPSS programs are then used to summarize the data.

Quadrat Data

Each year a new file is created that contains all the quadrat data for all stations for that year. This data file is called QUAD**.DBF (**=year). There will be a separate file for every year of monitoring. The file QBLANK.DBF is a blank structure file to facilitate data entry. Once all the data have been entered and verified, backup copies of the file should be made and no more editing done to the file. For analysis, data files are copied to another file called QUADYEAR.DBF. This file (QUADYEAR.DBF) should be cleared of previous data and the data for the year(s) to be analyzed appended to it. QREPORT.PRO prepares a table of mean values for the data in QUADYEAR.DBF to produce a table of summary means and standard deviations by species and station, which is saved to a file named QREPORT.RSL.

dBASE FILE STRUCTURE

dBase III Plus file structure for quadrat data is as follows:

FIELD	FIELD NAME	TYPE	WIDTH
1	Location	Numeric	2
2	Year	Numeric	2
3	Species	Numeric	5
4	Quadrat	Numeric	2
5	Count	Numeric	4

Field 1 is the location or site code number (see Appendix C)

Field 2 is the last two digits of the year (1987 would be 87)

Field 3 is the species code number (Appendix C)

Field 4 is the quadrat number (1-20) included for more efficient data entry

Field 5 is the number of individuals of that species found in the quadrat

The dBase III files are stored on the hard disk under the C:\QUADRATS directory and on floppy disks. Each year of data is entered in a file. The data file names are as follows:

FILE NAME	YEAR	NUMBER OF QUADRATS	QUADRAT DIMENSIONS
QUAD82.dbf	1982	30	1x1 m
QUAD83.dbf	1983	40	1x1 m
QUAD84.dbf	1984	40	1x1 m
QUAD85.dbf	1985	20	1x2 m
QUAD86.dbf	1986	20	1x2 m
QUAD87.dbf	1987	20	1x2 m

The file QUADYEAR.DBF is used for SPSS data analysis and is discussed below.

CREATING A NEW DATA FILE

To create a new data file, you can copy the structure of an old data file to the new one and then start appending data. For example, if you want to start entering the quadrat data for 1987, do the following.

Enter dBase III, once at the dot type these commands

```
. use c:\quadrats\QUAD86.dbf  
      (this opens old database file)  
  
. copy structure to c:\quadrats\QUAD87.dbf  
      (this creates a new empty file using the same structure)  
  
. close all  
      (closes all files)
```

ENTERING DATA AND UPDATING FILES

Once you have created the new data file QUAD87.dbf, you can begin entering data or updating the file with a new station of data by typing the following commands. (If you are using a floppy disk, change the

default disk drive. To do this, enter the command .set default to b:). Use quadrat summary data sheets for data entry.

- . use c:\quadrats\QUAD87
(accesses file)
- . append from c:\quadrats\Qblank.DBF
(this adds 360 blank records to the file)
- . locate for location = 0
(this locates the first record of the station)
- . replace next 360 location with _
(enter location code for that station)
- . go _
(enter the record number of the first record for that station given with the third command)
- . browse
(finds the data base file at the first record for that station)

Now move over to the count column and start entering data. The species are listed in the same order as the data sheet. The very last species in the data file is 11004 which is for white urchins, however if these were sampled with band transects and not quadrats those 20 records need to be deleted. To do this, while in browse go to quadrat 1 of species 11004 and do the following:

- Press Ctrl End
- . delete next 20
 - . pack
(to save time pack can be done once at the end of the session)

Close the data file when you have finished editing. To do this enter the following command:

- Press Ctrl End
- . Close all
(exits and saves file)
(closes all data bases)

QBLANK.DBF

Qblank contains all the records needed for data from one site and has the current year already in the 360 records. Each year, change the year in Qblank to the current one. To do this edit Qblank.dbf as follows:

- . use c:\quadrats\Qblank.dbf
- . replace all year with 88
- . close all

OTHER dBASEIII COMMANDS

The commands listed above allow data entry into dBase files. To find a specific record that needs to be edited, use the locate command. For example to edit the records for Admiral's Reef for *Macrocystis pyrifera*, type the following command. Continue allows the search for this species at the specified site to proceed after a record is found.

- . locate for location = 11 .and. species = 2010
- . continue

To find a specific record, the quadrat number can be added.

- . locate for location = 11 .and. species = 2010
- .and. quadrat = 12

PREPARING FOR DATA ANALYSIS

Once all the data for the most recent year have been entered, it can then be appended to the QUADYEAR.dbf file by the following commands:

- . use c:\quadrats\QUADYEAR.db
- . append from c:\quadrats\QUAD87.dbf
- . close all

The contents of QUADYEAR.DBF can be changed by erasing all the records in that file and appending the ones that are to be included in the report. For example, to analyze three years of data, enter the following from dBaselll:

- . use c:\quadrats\quadyear.dbf
(accesses dBaselll file)
- . zap
(deletes and packs all records in that file)
- . append from quad85.dbf
(appends 1985 data to quadyear.dbf)
- . append from quad86.dbf
(appends 1986 data to quadyear.dbf)
- . append from quad87.dbf
(appends 1987 data to quadyear.dbf)
- . close all
(closes quadyear.dbf)

You can use these commands to alter QUADYEAR.dbf any way you like.

SPSS DATA ANALYSIS AND REPORTS

The QUADYEAR.DBF file is used for data analysis with SPSS. As the file could get quite large, be selective with the number of years of data entered. To change the contents of QUADYEAR.dbf, ZAP all the records and append it with only the years to be analyzed.

To generate a report using the data in QUADYEAR.DBF, run SPSS/PC+. Use the menu selection on the Resource Management computer. Select SPSS (1) from the main menu and then QUADRATS (A). Begin by moving to the SPSSPC prompt :, press F10, then E at the SPSSPC: prompt. Run QREPORT.PRO to generate a report for each station by species by year by entering the following command:

SPSSPC: include QREPORT.PRO.

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

When the program has finished running (it might take quite a while so be patient), it will return to the SPSSPC: prompt. Type finish to exit SPSS. Print the report using DOS. In order to print, you must be in the c:\quadrats directory. Use the DOS print command as follows-

c:\quadrats > print QREPORT.RSL

As an alternative, the file can be copied to the word perfect directory and edited using the word processor.

See Appendix G for the documentation for the program QREPORT .PRO.

default disk drive. To do this, enter the command .set default to b:). Use quadrat summary data sheets for data entry.

- . use c:\quadrats\QUAD87
(accesses file)
- . append from c:\quadrats\Qblank.DBF
(this adds 360 blank records to the file)
- . locate for location = 0
(this locates the first record of the station)
- . replace next 360 location with _
(enter location code for that station)
- . go _
(enter the record number of the first record for that station given with the third command)
- . browse
(finds the data base file at the first record for that station)

Now move over to the count column and start entering data. The species are listed in the same order as the data sheet. The very last species in the data file is 11004 which is for white urchins, however if these were sampled with band transects and not quadrats those 20 records need to be deleted. To do this, while in browse go to quadrat 1 of species 11004 and do the following:

Press Ctrl End

- . delete next 20
- . pack
(to save time pack can be done once at the end of the session)

Close the data file when you have finished editing.
To do this enter the following command:

- Press Ctrl End
- . Close all
(exits and saves file)
(closes all data bases)

QBLANK.DBF

Qblank contains all the records needed for data from one site and has the current year already in the 360 records. Each year, change the year in Qblank to the current one. To do this edit Qblank.dbf as follows:

- . use c:\quadrats\Qblank.dbf
- . replace all year with 88
- . close all

OTHER dBASEIII COMMANDS

The commands listed above allow data entry into dBase files. To find a specific record that needs to be edited, use the locate command. For example to edit the records for Admiral's Reef for *Macrocystis pyrifera*, type the following command. Continue allows the search for this species at the specified site to proceed after a record is found.

- . locate for location = 11 .and. species = 2010
- . continue

To find a specific record, the quadrat number can be added.

- . locate for location = 11 .and. species = 2010
- .and. quadrat = 12

PREPARING FOR DATA ANALYSIS

Once all the data for the most recent year have been entered, it can then be appended to the QUADYEAR.dbf file by the following commands:

- . use c:\quadrats\QUADYEAR.db
- . append from c:\quadrats\QUAD87.dbf
- . close all

The contents of QUADYEAR.DBF can be changed by erasing all the records in that file and appending the ones that are to be included in the report. For example, to analyze three years of data, enter the following from dBaselII:

- . use c:\quadrats\quadyear.dbf
(accesses dBaselII file)
- . zap
(deletes and packs all records in that file)
- . append from quad85.dbf
(appends 1985 data to quadyear.dbf)
- . append from quad86.dbf
(appends 1986 data to quadyear.dbf)
- . append from quad87.dbf
(appends 1987 data to quadyear.dbf)
- . close all
(closes quadyear.dbf)

You can use these commands to alter QUADYEAR.dbf any way you like.

SPSS DATA ANALYSIS AND REPORTS

The QUADYEAR.DBF file is used for data analysis with SPSS. As the file could get quite large, be selective with the number of years of data entered. To change the contents of QUADYEAR.dbf, ZAP all the records and append it with only the years to be analyzed.

To generate a report using the data in QUADYEAR.DBF, run SPSS/PC+. Use the menu selection on the Resource Management computer. Select SPSS (1) from the main menu and then QUADRATS (A). Begin by moving to the SPSSPC prompt :, press F10, then E at the SPSSPC: prompt. Run QREPORT.PRO to generate a report for each station by species by year by entering the following command:

SPSSPC: include QREPORT.PRO.

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

When the program has finished running (it might take quite a while so be patient), it will return to the SPSSPC: prompt. Type finish to exit SPSS. Print the report using DOS. In order to print, you must be in the c:\quadrats directory. Use the DOS print command as follows-

c:\quadrats > print QREPORT.RSL

As an alternative, the file can be copied to the word perfect directory and edited using the word processor.

See Appendix G for the documentation for the program QREPORT .PRO.

Band Transect Data

Separate data files are created for each year called B**.DBF (** = year). Once all data are entered and verified, backup copies should be made, and no more editing done to the file. BTRBLANK.DBF is a blank structure file used to facilitate data entry. BTRANALL.DBF is created by appending appropriate years to it. This file is used by BDTRCALC.PRO which creates a summary table of means and standard deviations by species and location and saves the results to BTRAN.RSL.

dBASE FILE STRUCTURE

dBase III Plus structure for Band Transect files is as follows:

FIELD	FIELD NAME	TYPE	WIDTH
1	Location	Numeric	2
2	Species	Numeric	6
3	Year	Numeric	2
4	Transect	Numeric	2
5	Count	Numeric	4

Field 1 is the location or site code number (see Appendix C).

Field 2 is the species code number (see Appendix C).

Field 3 is the last two digits of the year sampled.

Field 4 is number of transects sampled

Field 5 is the number of individuals found on the transect.

The dBase III files are stored on the hard disk in the BANDTRAN directory and are backed up on floppy disks. Sampling techniques have varied somewhat from the inception of the program. Below are the files to date along with information on sampling for the year specified:

FILENAME	YEAR	TRANSECTS
B83.DBF	1983	10
B84.DBF	1984	10
B85.DBF	1985	12
B86.DBF	1986	12
B87.DBF	1987	12

CREATING A NEW DATA FILE

Use the following procedure to create a new band transect file once you are in dBase III:

- . use c:\bandtran\btrblank.dbf
(accesses blank file)
- . copy to c:\bandtran\bxx.dbf
(copies the blank file to the new year file you are creating. You supply year at x)
- . close all

ENTERING DATA AND UPDATING FILES

After the new file is established, begin entering data. The order of the species on the data sheets is the same as that in the file {btrblank.dbf}, so data entry should go smoothly. To enter information and data, proceed in the following manner after entering dBase III:

- . use c:\bandtran\bxx.dbf
(accesses file)
- . replace all loc with _____
(you enter location code here)
- . replace all year with _____
(year enter two digits for year here)
. 1
(takes you to the first record for data entry. You may go to any record number by simply typing the number at the dot prompt)
- . browse
(most efficient command for data entry)

Now move to the count column and begin entering data.

To modify the file for the second and subsequent stations, issue the following commands:

- . use c:\bandtran\bxx.dbf
(accesses file)
- . append from c:\bandtran\btrblank.dbf
(appends blank records for one station to the file)

Once the blank records have been appended, fill in the information for the year and location in the following way:

- . x
(type in the record number where you wish to begin)
- . replace next y loc with _____
(replaces blank station with the number of the station working on)

- .x (returns to record number where you started)
- . replace next y year with (adds year designation to year field)
- .x (back where you started)
- . browse (into edit mode to begin data entry)

Do not worry initially if the locations are not in sequence. After entering data for all the stations, the file can be sorted in several ways. For example, to sort by station:

```
. use c:\bandtran\bxx.dbf
. sort to c:\bandtran\{filename.extension} by loc
. close all
```

You may then delete the old file:

```
. erase c:\bandtran\bxx.dbf
```

and rename the sorted file to the old filename:

```
. rename c:\bandtran\{file name.extension} to
c:\bandtran\bxx.dbf
```

Two final important points: remember to press **Control-End** to save changes you make in browse and to type in "**close all**" before proceeding to work on another file or exiting dBase III plus.

PREPARATION FOR DATA ANALYSIS

Band transect files from several years may be appended together prior to analysis with SPSS. Select the years to be include in the analysis, copy the first year file to a new filename and append the other files to the new file. For example, to summarize information for years 1983 through 1987, files b83.dbf, b84.dbf, b85.dbf, b86.dbf and b87.dbf would be compiled into the large file btranall.dbf in the following manner:

```
. use c:\bandtran\btranall.dbf
. zap
. append from c:\bandtran\b87.dbf
. append from c:\bandtran\*data file*
. close all
```

Use these commands to modify btranall.dbf any way you like.

SPSS DATA ANALYSIS AND REPORTS

SPSS is used to analyze data catalogued in dBase III. In order to do this, the dBase file must be converted to a form that SPSS can understand using the SPSS translate utility. For example, to translate the large file btranall.dbf to SPSS, do the following at the SPSS prompt:

SPSSPC: translate from = 'c:\bandtran\btranall.dbf'.

For large files, this may take some time, so be patient. Once this has finished, proceed with commands for analysis. The program {bdtrcalc.pro} is used to translate and calculate mean count for 3 m x 20 m band transect species and is listed in Appendix G. When {bdtrcalc.pro} is run, it saves results to the file c:\bandtran\btran.rsl. This is a text file and is best edited by using a word processor. To convert it to WordPerfect, use the Text In/ Text Out feature, Control-F5, and select option 3. Edit and add titles, page numbers, and a cover page as desired. A summary using this process has been completed for data from 1983-1987 and is saved in the file {wpbtran.rsl}.

If bdtrcalc.pro already contains a translate statement (as it does in the example in Appendix G), execute the program by doing the following at the SPSSPC prompt:

SPSSPC: include c:\bandtran\bdtrcalc.pro.

This step translates and performs the calculations indicated by the program without having to enter the "review" feature of SPSS, blocking and running.

In order to avoid the time consuming translation step, you can save translated files to SPSS system files, directly accessible by SPSS with the GET command. Do the following at the SPSS prompt to save the translated dBase file to an SPSS system file:

SPSSPC: save out = '\bandtran\btrallyr.sys'

If analysis is only required for one station, species or year, one may selectively analyze these categories using the "Process if" or "Select if" commands. For example, to compute means for station 10 only, insert the following command before the "means tables" command:

process if (loc=10)

Random Point Contact Data

Separate data files are created for each year called R**.DBF (** = year). Once all data are entered and verified, backup copies should be made, and no more editing done to the file. Only the current year will be opened. RPCBLANK.DBF is a blank structure file used to facilitate data entry. RPCALL.DBF is created by appending appropriate years to it. This file is used by RPCCALC.PRO which creates a summary table of means and standard deviations by species and location.

dBASE FILE STRUCTURE

dBase III Plus structure for Random Point Contact (RPC) files is as follows:

FIELD	FIELD NAME	TYPE	WIDTH
1	Location	Numeric	2
2	Species	Numeric	6
3	Year	Numeric	2
4	Quadrat	Numeric	2
5	Count	Numeric	4

Field 1 is the location or station code number (see Appendix C).

Field 2 is the species code number (see Appendix C).

Field 3 is the last two digits of the year sampled.

Field 4 is the number of quadrats sampled (see * in next table).

Field 5 is the number of individuals found in the quadrat.

The dBbase III files are stored on the hard disk in the RPC directory and are backed up on floppy disks. Sampling techniques have varied somewhat from the inception of the program. Below are the files to date along with information on sampling for the year specified:

Filename	Year	Quadrats*	Points/ Quad.	# of Organisms
R82.DBF	1982	25	20	29
R83.DBF	1983	40	10	29
R84.DBF	1984	10	50	24
R85.DBF	1985	25	40	27
R86.DBF	1986	25	40	27
R87.DBF	1987	25	40	27

Years 1982 through 1984 were often sampled irregularly with many missing quadrats. Therefore, do not be surprised by odd numbers of quadrats.

CREATING A NEW DATA FILE

Use the following procedure to create a new RPC file after entering dBbase III:

- . use c:\rpc\rpcblank.dbf
(this gives complete path and filename)
- . copy to c:\rpc\rxx.dbf
(this copies the blank file to the new file being created. Supply the year at x)
- . close all

ENTERING DATA AND UPDATING FILES

Once the new file is created, begin entering data. The order of the species on the data sheets is the same as that in the file {rpcblank.dbf}, so data entry should go smoothly. To enter information and data, proceed in the following manner after entering dBbase III:

- . use c:\rpc\rxx.dbf
(accesses file)
- . replace all loc with _____
(enter location code here)
- . replace all year with _____
(enter two digits for year here)
. 1
(takes you to the first record for data entry. Go to any record number by simply typing the number at the dot prompt)
- . browse
(most efficient command for data entry)

Now move to the count column and begin entering data.

To modify the file for the second and subsequent stations, issue the following commands:

- . use c:\rpc\rxx.dbf
(accesses file)
- . append from c:\rpc\rpcblank.dbf
(appends blank records for one station to the file)

Once the blank records are appended, fill in the information for the year and location in the following way:

- .x (type in the record number where you wish to begin)
- . replace next y loc with _____ (replaces blank station with the number of the station you want to work on)
- .x (returns to record number where you started)
- . replace next y year with _____ (adds year designation to year field)
- .x (back to starting point)
- . browse (into edit mode to begin data entry)

Do not worry initially if the locations are not in sequence. After entering data for all the stations, the file can be sorted in several ways. For example, to sort by station:

- . use c:\rpc\rxx.dbf
- . sort to c:\rpc\{filename.extension} by loc
- . close all

You may then delete the old file:

- . erase c:\rpc\rxx.dbf

and rename the sorted file to the old filename:

- . rename c:\rpc\{filename.extension} to c:\rpc\rxx.dbf

Two final important points: remember to press **Control-End** to save changes made in browse and to type in "close all" before proceeding to work on another file or exiting dBase III plus.

PREPARATION FOR DATA ANALYSIS

RPC files from several years may be appended together prior to analysis with SPSS. Select the years to be included in your analysis, copy the first year file to a new filename of your choosing and append the other files to the new file. For example, to summarize information for years 1982 through 1987, files r82.dbf, r83.dbf, r84.dbf, r85.dbf, r86.dbf are compiled into the large file rpcall.dbf in the following manner:

- . use c:\rpc\r82.dbf
- . copy to c:\rpc\rpcall.dbf
- . close all
- . use c:\rpc\rpcall.dbf
- . append from c:\rpc\r83.dbf
- . append from c:\rpc\r84.dbf
- . append from c:\rpc\r85.dbf
- . append from c:\rpc\r86.dbf

- . append from c:\rpc\r87.dbf
- . close all

SPSS DATA ANALYSIS AND REPORTS

SPSS is used to analyze data catalogued in dBase III. In order to do this, the dBase file must be converted to a form that SPSS can understand using the SPSS translate utility. For example, to translate the large file rpcall.dbf to SPSS, do the following at the SPSS prompt:

SPSSPC: translate from = 'c:\rpc\rpcall.dbf'.

For large files, this may take some time, so be patient. Once this has finished, proceed with commands for analysis. The program {rpccalc.pro} is used to translate and calculate mean per cent cover for RPC species and is listed in Appendix G. When {rpccalc.pro} is run, it saves results to the file c:\rpc\rpc.rsl. This is a text file and is best edited by using a word processor. To convert it to Word Perfect, use the Text In/Text Out feature, Control-F5, and select option 3. Edit and add titles, page numbers, and a cover page as desired. This has been done with the summary from 1982- 1987 and is saved in the file {wprpc.rsl}.

If rpccalc.pro already contains a translate statement (as it does in the example in Appendix G), execute the program by doing the following at the SPSSPC prompt:

SPSSPC: include c:\rpc\rpccalc.pro.

This step translates and performs the calculations indicated by the program without having to enter the "review" feature of SPSS, blocking and running.

In order to avoid the time consuming translation step, save translated files to SPSS system files, directly accessible by SPSS with the GET command. Do the following at the SPSS prompt to save the translated dBase file to an SPSS system file:

SPSSPC: save out = '\rpc\rpcallyr.sys'.

If analysis is only required for one station, species or year, one may selectively analyze these categories using the "Process if" or "Select if" commands. For example, to compute means for station 10 only, insert the following command before the "means tables" command:

process if (loc=10)

Visual Fish Transect Data

Separate data files are created for each year called FISH**.DBF (** = year). Once all data are entered and verified, backup copies should be made, and no more editing done to the file. FBLANK14.DBF is a blank structure file used to facilitate data entry; FBLANK58.DBF works like FBLANK14.DBF for replicate transect counts. FISHYEAR.DBF is created by appending appropriate years (data files) to it. This file is used by the SPSS program FSPERPT.PRO which translates the DBase file and creates a report (Fish Species Report) containing mean values and standard deviations for the numbers of fish per transect and saves the results to a file named FSPERPT.RSL.

dBASE FILE STRUCTURE

dBase III Plus file structure for Fish Transect data is as follows:

FIELD	FIELD NAME	TYPE	WIDTH
1	Location	Numeric	2
2	Date	Numeric	6
3	Species	Numeric	5
4	Transect	Numeric	2
5	Count	Numeric	4

Field 1 is the location or station code number (see Appendix C)

Field 2 is the date of the sampling. August 13, 1987 would be 870813

Field 3 is the species code number (see Appendix C)

Field 4 is the transect number (1-8 included for more efficient data entry)

Field 5 is the number of fish of that species seen on the transect

The dBAsE III files are stored on the hard disk under the c:\fishtran directory and on floppy disks. Each year of data is entered in a file. The data file names are as follows:

FISH85.dbf
FISH86.dbf
FISH87.dbf

The file FISHYEAR.DBF is used for SPSS data analysis and is discussed below.

CREATING A NEW DATA BASE FILE

To create a new data file, copy the structure of an old data file to the new one and then start appending data. For example, to start entering the fish transect data for 1987, do the following.

Enter dBAsE III, once at the dot type these commands:

```
. use c:\fishtran\FISH86.dbf
      (this opens old database file)
. copy structure to c:\fishtran\FISH87.dbf
      (this creates a new file using
       the same structure)
. close all
      (closes all files)
```

ENTERING DATA AND UPDATING FILES

Once the new data file FISH87.dbf is established, begin entering data or updating the file by typing the following commands-(to use a floppy disk, change the default disk drive by entering the command: . set default to b:)

```
. use c:\fishtran\FISH87.dbf
. append from c:\fishtran\fblank14.dbf
      (this adds 96 blank records
       to the file)
. locate for location = 0
      (this locates the first record
       of the station)
. replace next 96 location with _
      (_ enter location code for that
       station)
. go _
      (_ enter the record number of
       the first record for that station
       given with the third command)
. replace next 96 date with _
      (_ enter the date of sampling)
. go _
      (_ enter the record number of
       the first record for that station
       given with the third command)
. browse
      (puts you in the data base file
       at the first record for that
       station)
```

Now move to the count column and start entering data. The species are listed in the same order as the data sheet. If there were two observers and hence eight 100 m fish transects on one date of sampling, the second data sheet should be entered as transect 5-8. To do this append from fblank58.dbf and follow the above.

When editing of a particular data file is completed, close that file. To do this, enter the following commands:

Press Ctrl End (exits and saves file)
. Close all (closes all data bases)

OTHER dBASEIII COMMANDS

The above commands allow data entry into the data base files. To find a specific record that needs for editing, use the locate command. For example to edit the records for Cat Canyon for *Sebastes mystinus* adults, type the following command.

locate for location = 16 .and. species = 14005

To obtain a specific record, specify the quadrat number

. locate for location = 16 .and. species = 14005
. and. quadrat = 12

PBFPARATION FOR DATA ANALYSIS

You can change the contents of FISHYEAR.DBF by erasing all the records in that file and appending the ones that you want to be included in the report. For example, to analyze three years of data, enter the following from dBaseIII:

- . use c:\fishtran\FISHYEAR.dbf
(accesses dBaselII file)
- . zap
(deletes and packs all records in that file)
- . append from fish85.dbf
(appends 1985 data to fishyear.dbf)
- . append from fish86.dbf
(appends 1986 data to fishyear.dbf)
- . append from fish87.dbf
(appends 1987 data to fishyear.dbf)
- . close all
(closes fishyear.dbf)

Once the data for the most recent year have been entered, it can then be appended to the FISHYEAR.dbf file in the following way:

```
.use c:\fishtran\FISHYEAR.dbf  
.append from c:\fishtran\FISH87.dbf  
.close all
```

You can use these commands to alter FISHYEAR.dbf any way you like.

SPSS DATA ANALYSIS AND REPORTS

FISHYEAR.DBF will be used for data analysis with SPSS. The file could get quite large requiring selectivity in deciding the number of years of data to analyze. To change the contents of FISHYEAR.dbf, ZAP all the records and append it with only the years to be analyzed. (As above in data preparation for analysis) To generate a report using the data in FISHYEAR.DBF, run SPSS/PC+. To do this, use the menu selection on the Resource Management computer. Select SPSS (1) from the main menu and then FISH TRANSECT (E). When into SPSS at the SPSSPC: prompt, run FSPEPRT.PRO. The fish species report program generates an annual report for each site by species (adult and juvenile fish are separated by year). To do this enter the following command:

SPSSPC: include FSPERPT.PRO.

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

Once the program is completed, it will return to the SPSSPC: prompt. Type finish to exit out of SPSS. Then print the report using DOS. Print while in the c:\fishtran directory. Use the DOS print command as follows:

c:\fishtran print FSPERPT.RSL

See Appendix G for the documentation for the program FSPERPT.PRO.

To present the data as means for juvenile and adult fish, treat each year of data separately with SPSS. The fishyear.dbf is too large to use with the aggregate command "ALL". *check change*. To do this enter the following commands at the SPSS prompt for the most recent year of data.

SPSSPC: Translate from = 'fish87.dbf'.
(creates spss active file)

Once at the prompt enter the following:

SPSSPC: Include fishgrop.pro.
(runs the aggregate program
fishgrop.prg)

SPSSPC: Save file = 'fish87.sf'.
(saves the file as an SPSS
system file)

Next, combine the current year of "grouped" data with the previous years of grouped data. Combine the system files created as above. The file which contains the grouped data for all the years is named FISHYEAR.SF. This is an SPSS system file. To combine the individual system files to one large file enter the following commands at the SPSS prompt.

```
SPSSPC: join add file = 'fish85.sf'
/file = 'fish86.sf'
/file = 'fish87.sf'. (combines fish85.sf, fish86.sf
and fish87.sf into a spss
active file)

SPSSPC: save outfile = 'fishyear.sf'.
(saves the combined active
files to the system file
fishyear.sf)
```

Now use SPSS to generate a report from the data stored in the file FISHYEAR.SF. Two different reports can be generated. One program will generate a report of means for each fish group (juveniles and adults combined) by site by sampling date and the other program will generate a report of means for each fish group by site by sampling year.

FGRDATE.PRO- (FISH GROUP REPORT BY SAMPLING DATES)

At the SPSSPC: prompt run FGRDATE.PRO. The fish group report program generates a report for each station by group (adult and juvenile fish combined) by sampling date. To do this, enter the following command:

SPSSPC: include FGRDATE.PRO.

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

Once the program run is complete, it will return to the SPSSPC: prompt. Type finish to exit out of SPSS. Print the report using DOS while in the c:\fishtran directory. Use the DOS print command as follows:

```
c:\fishtran print FGRDATE.RSL
```

Copy the file to the WordPerfect directory and edit it using the word processor. See Appendix G for the documentation for the program 4FGRDATE.PRO.

FGRYEAR.PRO- (FISH GROUP REPORT BY SAMPLING YEARS)

At the SPSSPC: prompt, run FGRYEAR.PRO. The fish group report program generates a report for each station by group (adult and juvenile fish combined) by sampling year. To do this enter the following command:

SPSSPC: include FGRYEAR.PRO.

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

Once the program run is complete, it will return you to the SPSSPC: prompt. Type finish to exit SPSS. Print the report using DOS while in the c:\fishtran directory. Use the DOS print command as follows-

```
c:\fishtran print FGRYEAR.RSL
```

You could also copy the file to the WordPerfect directory and edit it using the word processor. See Appendix G for documentation for the program FGRYEAR.PRO.

Size Frequency Data

Separate files are created for each year called SIZE**.DBF (**=year).FREQHIST.PRO is an SPSS program that creates histograms for selected species, stations, and years.

dBASE FILE STRUCTURE

dBase III Plus file structure for size frequency data is as follows:

FIELD	FIELD NAME	TYPE	WIDTH
1	Size	Numeric	4
2	Species	Numeric	5
3	Location	Numeric	2
4	Year	Numeric	2

Field 1 is the measurement in millimeters
 Field 2 is the species code number (see Appendix C)
 Field 3 is the location or site code number (see Appendix C)
 Field 4 is the last two digits of the year, 1987 would be 87

The structure of this data base is not consistent with the other files in order to facilitate data entry.

The dBase III files are stored on the hard disk under the c:\sizefreq directory and on floppy disks. Each year of data is entered in a file. The data file names are as follows:

SIZE85.dbf
 SIZE86.dbf
 SIZE87.dbf

CREATING A NEW DATA FILE

To create a new data file, copy the structure of an old data file to the new one and then start appending data. For example to start entering the size frequency data for 1987, do the following:

enter dBase III, once at the dot type these commands:

- . use C:\sizefreq\SIZE86.dbf
 (this opens old database file)
- . copy structure to C:\sizefreq\SIZE87.dbf
 (this creates a new file using the same structure)
- . close all
 (closes all files)

ENTERING DATA AND UPDATING FILES

When entering data, do not enter data for multiple measurement species such as *Macrocystis* and gorgonians. All size data are recorded in mm, except *Parastichopus parvimensis* which is in cm. Once the new data file SIZE87.dbf is created, you can begin entering data or updating the file with data from a new site by typing the following commands. (When using a floppy disk, change the default disk drive, by entering the command: . set default to b:)

. use C:\sizefreq\SIZE87.DBF

(if the file is new and there is no data in it use the append command and enter some erroneous data for one record and escape and continue as follows)

. set carry on

(turns on carry mode so data is copied from the prior record to a new record when using browse)

. go bottom

(positions at bottom of file)

. browse

(provides access to the data base file in browse mode)

Now enter the first measurement and the species code, location code, and year. Position the cursor at the size_mm column and press the down arrow. When asked whether you want to add new records, answer yes. Each time the down arrow is pressed, all the data in the prior record is copied. Re-enter the size_mm even though it might be the same. Repeat this for each species remembering to change the species code. For any species on the size frequency list for which there are no data (because none were collected), you must enter a zero for the size_mm for every station where the species was omitted, otherwise the SPSS histogram program will stop at the first species for which there is no entry. Repeat for each station remembering to change the location code. When finished entering data leave the last record in the file with all zeros, so that the starting place is clearly indicated for the next session. When all the data for that year is entered, remove that last dummy record from the file.

When editing of a particular data file is complete, close that file. To do this enter the following command:

Press Ctrl End (exits and saves file)
 . Close all (closes all data bases)

OTHER dBASEIII COMMANDS

The above commands are used to enter new data into the data base files. To find a specific record that needs to be edited, use the locate command. For example to edit the records for Cat Canyon for *Pisaster giganteus* adults, type the following command to gain access to those records:

. locate for location = 16 .and. species = 11002

SPSS DATA ANALYSIS AND REPORTS

With the size frequency data, one year of data will be used at a time. Using SPSS select the location for histogram results. To generate a report using the size frequency data, run SPSS/PC+. Use the menu selection on the Resource Management computer. Select SPSS (1) from the main menu and then SIZE FREQUENCIES (D). The following is an example using 1987 data.

Once the complete year of size frequency data has been entered, an SPSS system file is created. Once you are into SPSS at the SPSSPC: prompt you can enter the following command.

SPSSPC: translate from = 'size87.dbf'.
(converts dBaseIII file to
SPSS active file)

SPSSPC: save outfile = 'size87.sys'.
(saves active file to an SPSS
system file)

Once the system file has been created there is no need to issue the above commands again.

Using one year of data at a time, select one location (site) and run the freqhist.pro (size frequency histogram program) to generate a report of histograms for all the size frequency species at that site. For example-

SPSSPC: get file = 'size87.sys'.
(retrieves system file)
SPSSPC: select if (location = 1).
(selects cases for location 1)
SPSSPC: include freqhist.pro.
(generates a frequency table with
all statistics for the location 1
for all species)

(See Appendix G for program)

Press the space bar once each time when "MORE" appears in the upper right hand corner of the screen.

To generate another histogram report for a different location, enter the commands starting with the "get file" statement as above.

Each time freqhist.pro is run, the results in sreport.rsl from the previous run will be erased. To print the results, print before running freqhist.pro again.

When the program run is complete, the SPSSPC: prompt will appear. Type finish to exit out of SPSS. Print the report using DOS while in the c:\sizefreq directory. Use the DOS print command as follows:

c:\sizefreq print SREPORT.RSL

To edit, copy the file to the WordPerfect directory and use the word processor.

Photogrammetric Plot Data

No protocols have been developed yet for photogrammetric data management.

Oceanographic Conditions Data

No protocols have been developed for management of the oceanographic data.

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APPENDIX A. Summary of Kelp Forest Population Parameters Monitored in Channel Islands National Park

TAXON	SAMPLING FREQUENCY	LOCATIONS	ABUNDANCE	STRUCTURE	SIZE/AGE	REPROD.	GROWTH RATE	MORT. RATE	PHENOLOGY
FISHES									
Blue rockfish <i>Sebastodes mystinus</i>	annual	16	relative	no	no	YOY*	no	no	no
Kelp rockfish <i>Sebastodes atroviridis</i>	annual	16	relative	no	no	YOY	no	no	no
Olive rockfish <i>Sebastodes serranooides</i>	annual	16	relative	no	no	YOY	no	no	no
Black perch <i>Embiotoca jacksoni</i>	annual	16	relative	no	no	YOY	no	no	no
Striped seaperch <i>Embiotoca lateralis</i>	annual	16	relative	no	no	YOY	no	no	no
Pile surfperch <i>Damalichthys vacca</i>	annual	16	relative	no	no	YOY	no	no	no
Opaleye <i>Girella nigricans</i>	annual	16	relative	no	no	YOY	no	no	no
California sheephead <i>Semicossyphus pulcher</i>	annual	16	relative	yes	no	YOY	no	no	no
Senorita <i>Oxyjulis californica</i>	annual	16	relative	no	no	no	no	no	no
Blackeye goby <i>Coryphopterus nicholsi</i>	annual	16	density	no	no	no	no	no	no
Bluebanded goby <i>Lythrypnus dalli</i>	annual	16	density	no	no	no	no	no	no

TAXON	SAMPLING FREQUENCY	LOCATION	ABUNDANCE	STRUCTURE	SIZE/AGE	REPROD.	GROWTH RATE	MORT. RATE	PHENOLOGY
FISHES (cont')									
Island kelp fish <i>Alloclinus holdei</i>	annual	16	density	no	no	no	no	no	no
Blacksmith <i>Chromis punctipinnis</i>	annual	16	relative	no	no	YOY	no	no	no
Garibaldi <i>Hypsopops rubicundus</i>	annual	16	relative	no	no	YOY	no	no	no
Kelp bass <i>Paralabrax clathratus</i>	annual	16	relative	no	no	YOY	no	no	no
*YOY = Young of the year									
INVERTEBRATES									
Orange puffball sponge <i>Tethya aurantia</i>	annual	16	density	size-freq	no	no	yes	yes	no
Aggregated vase sponge <i>Polymastia pachymastia</i>	annual	16	density	no	no	no	no	no	no
White calcareous sponge <i>Leucetta losangeensis</i>	annual	16	density	no	no	no	no	no	no
Misc. sponges	annual	16	% cover	no	no	no	no	no	no
California hydrocoral <i>Allopora californica</i>	annual	16	density	size-freq	no	no	no	no	no
La Jolla cup coral <i>Astrangia lajollensis</i>	annual	16	% cover	no	no	no	no	no	no
Orange cup coral <i>Balanophylax elegans</i>	annual	16	% cover	no	no	no	no	no	no

TAXON	SAMPLING FREQUENCY	LOCATIONS	ABUNDANCE	STRUCTURE	EFFORT	RECRUIT	GROWTH RATE	MORT. RATE	PHENOLOGY
INVERTEBRATES (con't)									
Red gorgonian <i>Lophogorgia chilensis</i>	annual	16	density	size-freq	no	no	yes	yes	no
Brown gorgonian <i>Muricea fruticosa</i>	annual	16	density	size-freq	no	no	yes	yes	no
Strawberry anemone <i>Corynactis californica</i>	annual	16	% cover	no	no	no	no	no	no
White-spotted rose anemone <i>Tealia lofotensis</i>	annual	16	density	no	no	no	no	no	no
Ornate worm tube <i>Diopatra ornata</i>	annual	16	% cover	no	no	no	no	no	no
Colonial sand-tube worm <i>Phragmatopoma californica</i>	annual	16	density	no	no	no	no	no	no
California spiny lobster <i>Panulirus interruptus</i>	annual	16	density	no	no	no	no	no	no
Giant keyhole limpet <i>Megathura crenulata</i>	annual	16	density	size-freq	no	no	yes	yes	no
Red abalone <i>Haliotis rufescens</i>	annual	16	density	size-freq	no	no	yes	yes	no
Pink abalone <i>Haliotis corrugata</i>	annual	16	density	size-freq	no	no	yes	yes	no
Green abalone <i>Haliotis fulgens</i>	annual	16	density	size-freq	no	no	yes	yes	no
Wavy top snail <i>Astrea undosa</i>	annual	16	density	size-freq	no	no	yes	yes	no

TAXON	SAMPLING FREQUENCY	LOCATIONS	ABUNDANCE	STRUCTURE	REPROD. EFFORT	RECRUIT	GROWTH RATE	MORT. RATE	PHENOLOGY
INVERTEBRATES (con't)									
Red top snail <i>Astrea gibberosa</i>	annual	16	density	size-freq	no	no	yes	yes	no
Chestnut cowrie <i>Cypraea spadicea</i>	annual	16	density	size-freq	no	no	yes	yes	no
Keller's whelk <i>Kellia kelletii</i>	annual	16	density	size-freq	no	no	no	no	no
Scaled tube shell <i>Serpulorbis squamigerus</i>	annual	16	% cover	no	no	no	no	no	no
Rock scallop <i>Himites giganteus</i>	annual	16	density	size-freq	no	no	yes	yes	no
California brown sea hare <i>Aplysia californica</i>	annual	16	density	no	no	no	no	no	no
Southern staghorn bryozoan <i>Diaperoecia californica</i>	annual	16	% cover	no	no	no	no	no	no
Misc. bryozoans	annual	16	% cover	no	no	no	no	no	no
Misc. tunicates	annual	16	% cover	no	no	no	no	no	no
Misc. marine invertebrates	annual	16	% cover	no	no	no	no	no	no
Giant red sea urchin <i>Strongylocentrotus franciscanus</i>	annual	16	density	size-freq	no	no	yes	yes	no

TAXON	SAMPLING FREQUENCY	LOCATIONS	ABUNDANCE	STRUCTURE	SIZE/AGE	REPROD. EFFORT	GROWTH RATE	MORT. RATE	PHENOLOGY
INVERTEBRATES (con't)									
Purple sea urchin <i>Strongylocentrotus purpuratus</i>	annual	16	density	size-freq	no	yes	yes	yes	no
White sea urchin <i>Lytachinus anamesus</i>	annual	16	density	size-freq	no	yes	yes	yes	no
Sunflower star <i>Pycnopodia helianthoides</i>	annual	16	density	size-freq	no	yes	yes	yes	no
Sea bat <i>Patiria miniata</i>	annual	16	density	size-freq	no	no	yes	yes	no
Giant-spined sea star <i>Pisaster giganteus</i>	annual	16	density	size-freq	no	yes	yes	yes	no
Warty sea cucumber <i>Parastichopus parvimensis</i>	annual	16	density	size-freq	no	no	yes	yes	no
Aggregated red cucumber <i>Pachyhydione rubra</i>	annual	16	% cover	no	no	no	no	no	no
Stalked tunicate <i>Styela montereyensis</i>	annual	16	density	no	no	no	no	no	no
ALGAE									
Bladder chain kelp <i>Cystoseira osmundacea</i>	annual	16	% cover	no	no	no	no	no	no
Acid weed <i>Desmarestia ligulata</i>	annual	16	% cover	no	no	no	no	no	no
Southern sea palm <i>Eisenia arborea</i>	annual	16	density & % cover	no	no	no	no	no	no
Oar weed <i>Laminaria farlowii</i>	annual	16	density & % cover	no	no	no	no	no	no

TAXON	SAMPLING FREQUENCY	LOCATIONS	ABUNDANCE	STRUCTURE	SIZE/AGE	REPROD.	GROWTH RATE	MORT. RATE	PHENOLOGY
ALGAE (cont.)									
Giant kelp <i>Macrocystis pyrifera</i>	annual	16	density & % cover	size-freq	yes	no	no	no	no
California sea palm <i>Ptychopora californica</i>	annual	16	density & % cover	no	no	no	no	no	no
Sargassum weed <i>Sargassum muticum</i>	annual	16	% cover	no	no	no	no	no	no
Sea tongue <i>Gigartina</i> spp.	annual	16	% cover	no	no	no	no	no	no
Agar weed <i>Gelidium robustum</i>	annual	16	% cover	no	no	no	no	no	no
Crustose coralline algae Corallinaceae	annual	16	% cover	no	no	no	no	no	no
Articulated coralline algae Corallinaceae	annual	16	% cover	no	no	no	no	no	no
Misc. brown algae	annual	16	% cover	no	no	no	no	no	no
Misc. red algae	annual	16	% cover	no	no	no	no	no	no
Green algae (marine)	annual	16	% cover	no	no	no	no	no	no
Misc. marine plants	annual	16	% cover	no	no	no	no	no	no

APPENDIX B. Procedure for Establishing Underwater Transect

Using the National Park Service's 17 m-long vessel Pacific Ranger as a base of operation, a total of 45 SCUBA divers conducted 643 dives to locate and establish the 100-m transects in August and September, 1981. Six week-long cruises were conducted, with eight to ten divers on each cruise. Five diving biologists from the California Department of Fish and Game assisted the National Park Service in selecting and marking the transects. During the remaining cruises, 33 divers from the National Park Service Western Region dive team and seven scientists from local universities and the National Marine Fisheries Service established the permanent transect lines on the sea floor. Establishment of each transect line consisted of a sequence of operations involving specialized equipment and skills developed specifically for this project.

Emplacement procedures were designed to be conducted in stages by a series of divers because the time an individual diver can spend underwater without risk of decompression sickness (the bends) is extremely limited. Even at the relatively shallow 18-m maximum depth of the transects, a diver can spend only two hours per day on the bottom.

The first pair of divers laid out a 100-m fiberglass measuring tape on a section of relatively continuous rocky bottom with a conspicuous kelp canopy or cover. The tape was anchored at both ends by cement filled automobile tires weighing about 60-100kg on the surface. Using the tape measure as a guide, the second pair of divers drilled 11 holes into the bedrock at 10 m intervals. Each hole was 2.5 cm in diameter and 20-25 cm deep. The holes were drilled with a hydraulic hammer drill (Stanley HD-45) modified for use underwater, and a carbide-tipped fluted drill (Skill #736). The holes were drilled in basalt and other volcanic rocks at the rate of 1-2 cm per minute, and 3-5 cm per minute in sandstone. The hammer drill, which requires a flow of 25-35 liters per minute at 105 bar, was driven with a hydraulic pump mounted on the Pacific Ranger, and was connected to the boat by 150 m of 2.5 cm diameter synflex hydraulic hose. The drilling team also placed a 30 x 1 cm stainless steel eyebolt in each hole.

The next team consisted of three divers who measured the precise distance between the eyebolts, cut 1.2 cm diameter leadcore nylon sammson line to appropriate lengths, draped the line over the sea floor between the eyebolts, and secured the line at both ends using opposing figure eight knots at each

eyebolt. The leadcore line for each transect weighted 30-40 kg depending on the amount of vertical relief traversed, and required considerable skill and ingenuity to deploy underwater in kelp forests and strong wave surge.

The last dive team injected each hole with a two-part epoxy bonding adhesive (Celtite 42-45 hi bond) that was mixed underwater in cartridges designed for this use by Semco Inc., of Glendale, CA. The adhesive was applied with a pneumatic caulking gun (Semco Model 550) modified to operate with a SCUBA tank and modified regulator. The last dive team also retrieved the measuring tape and inspected the transect line. The adhesive was reported to harden in 40-60 minutes, but apparently cool (14-20 degree C) temperatures and extreme humidity slowed the curing process of an order of magnitude to 10-12 hours. Each finished transect line consists of 11 stainless steel eyebolts anchored in bedrock in ten meter intervals connected by ten lengths of leadcore nylon line. The advantages of this design are that the 11 eyebolts provide precise locations to which various biological sampling schemes may be referenced, loss of an entire transect line to storm or a boat anchor drug across the line is greatly reduced, and if an entire line were lost, relocation would be much easier and quicker with several eyebolts for which to search.

APPENDIX C. Kelp Forest Species Codes and Species Checklist

<u>STATIONS</u>		<u>CODE</u>	<u>TECHNIQUE*</u>	<u>SPECIES</u>
1	SMIWL	5000		Porifera
2	SMIHR	5001	R	Miscellaneous sponges
3	SRIJLNO	5002	QS	<i>Tethya</i>
4	SRIJLSO			
5	SRIRR	6000		Cnidaria
6	SCIGI	6001	B	<i>Allopora</i>
7	SCIFH	6002	B	<i>Tealia lofotensis</i>
8	SCIPB	6003	R	<i>Corynactis</i>
9	SCISA	6004	R	<i>Balanophyllia</i>
10	SCIYB	6005	R	<i>Astrangia</i>
11	ANIAAR	6006	BS	<i>Lophogorgia chilensis</i>
12	ANICC	6007	BS	<i>Muricea fruticosa</i>
13	ANILC	6008	S	<i>Muricea californica</i>
14	SBISESL			
15	SBIAP	7000		Annelida, Polychaeta
16	SBICC	7001	R	<i>Diopatra ornata</i>
		7002	R	<i>Phragmatopoma</i>
		7003	R	<i>Spirobranchus</i>
<u>SPECIES CODES</u>				
<u>CODE</u>	<u>TECHNIQUE*</u>	<u>SPECIES</u>		
1000		Green algae		
1001	R	Miscellaneous green algae		
2000		Brown algae		
2001	R	Miscellaneous brown algae		
2002	QS	<i>Macrocystis pyrifera</i> ADULT		
2003	R	<i>Desmarestia</i>		
2004	Q	<i>Eisenia</i>		
2005	Q	<i>Pterygophora</i>		
2006	RQ	<i>Laminaria farlowii</i>		
2007	R	<i>Cystoseira</i> sp.		
2008	R	Mixed <i>Macrocystis</i> , <i>Eisenia</i> , <i>Pterygophora</i>		
2009	Q	<i>Macrocystis pyrifera</i> JUVENILE		
2010	RQ	<i>Macrocystis pyrifera</i> ALL		
2011	R	<i>Sargassum</i> spp.		
3000		Red Algae		
3001	R	Miscellaneous red algae		
3002	R	Articulated coralline algae		
3003	R	Encrusting coralline algae		
3004	R	<i>Gelidium</i> sp.		
3005	R	<i>Gigartina</i> sp.		
4000		Plants (e.g. <i>Phyllospadix</i> , diatoms)		
4001	R	Miscellaneous		
* R = RPC		Q = Quadrats;		F = Fish Transects
B = Band Transect		S = Size Frequency		

CODE	TECH-NIQUE*	SPECIES
12000		Tunicates
12001	R	Miscellaneous tunicates
12002	Q	<i>Styela</i>
13000	R	Miscellaneous invertebrates
14000		Fishes
14001	F	<i>Chromis</i> adult
14002	F	<i>Chromis</i> juvenile
14003	F	<i>Oxyjulis</i> adult
14004	F	<i>Oxyjulis</i> juvenile
14005	F	<i>Sebastes mystinus</i> adult
14006	F	<i>Sebastes mystinus</i> juvenile
14007	F	<i>S. serranoides</i> adult
14008	F	<i>S. serranoides</i> juvenile
14009	F	<i>S. atrovirens</i> adult
14010	F	<i>S. atrovirens</i> juvenile
14011	F	<i>Paralabrax</i> adult
14012	F	<i>Paralabrax</i> juvenile
14013	F	<i>Semicossyphus</i> male
14014	F	<i>Semicossyphus</i> female
14015	F	<i>Embiotoca jacksoni</i> adult
14016	F	<i>Embiotoca jacksoni</i> juvenile
14017	F	<i>E. lateralis</i> adult
14018	F	<i>E. lateralis</i> juvenile
14019	F	<i>Damalichthys vacca</i> adult
14020	F	<i>Damalichthys vacca</i> juvenile
14021	F	<i>Hypsypops</i> adult
14022	F	<i>Hypsypops</i> juvenile
14023	F	<i>Girella nigricans</i> adult
14024	F	<i>Girella nigricans</i> juvenile
14025	Q	<i>Lythrypnus dalli</i>
14026	Q	<i>Coryphopterus nicholsii</i>
14027	Q	<i>Alloclinus holderi</i>
15000		Substrates
15001	R	Bare
15002	R	Rock
15003	R	Cobble
15004	R	Sand

* R = RPC
B = Band Transect

Q = Quadrats;
S = Size Frequency

F = Fish Transects

Gigartina		Lithothrix aspergillum
Gracilaria robusta		Maripelta rotata
Gracilaria sjoestedtii		Mastocarpus (=Gig.) papillatus
Gracilaria verrucosa		Melobesia mediocris
Gracilaria		
Gracilariphila oryzoides		Mesophyllum lamellatum
Gratelouphia		Microcladia coulteri
Griffithsia pacifica		Nemalion helminthoides
Gymnogongrus leptophyllus		Neoptilota densa
Gymnogongrus platyphyllus		
Haliptylon gracile		Nienburgia andersoniana
Halymenia californica		Opuntiella californica
Halymenia		
Halymenia/Schizymenia		Ozophora latifolia
Helminthocladia australis		Peyssonnellia
Herposiphonia	"	Rhycoctrys isabelliae
		Phycodrys setchellii
Heterosiphonia erecta		Pikea robusta
Hildenbrandia		Platoma n.sp.
Hymenena flabilligera		Plocamium cartilagineum
Hypnea cervicornis		Plocamium violaceum
Hypnea variabilis		Podonophorella californica
Iridaea cordata		Polyneura latissima
Iridaea linearis		
Iridaea		Polysiphonia
Jania		P. pacifica var deliculata
Jantinella verrucaeformis		Porphyra perforata
Kallymenia pacifica		Predea masonii
Laurencia crispa		Prionitis angusta
Laurencia masonii		Prionitis australis
Laurencia pacifica		Prionitis cornea
Laurencia snyderiae		Prionitis lanceolata
Laurencia spectabilis		Prionitis
L. spectabilis var diegoensis		"Priopeltis" (?Carpopeltis d.)
Laurencia splendens		
Laurencia subopposita		Pseudogloiocephala confusa
Laurencia		
Leptocladia binghamiae		Pterochondria woodii
Liagora californica		Pterocladia capillacea
Lithothamnion australe		Pterosiphonia bailevii
		Pterosiphonia dendroidea

Ptilothamniopsis lejolisea		PHYLUM PROTOZOA	
Pugetia fragilissima		Foraminifera	-
Rhodoglossum affine		Homotrema rubrum (red "coral")	
Rhodoglossum roseum		Gromia oviformis	
Rhodoptylum plumosum			
Rhodymenia arborescens		PHYLUM PORIFERA	
Rhodymenia californica		CLASS CALCAREA	
Rhodymenia callophyllidoides		Clathrina blanca	
Rhodymenia pacifica		Clathrina coriacea	
Rhodymenia			
Rhodymeniocolax botryooides		Leucandra heathi (dirty)	
Sarcodiotheca furcata		Leucandra/Scypha	
S. gaudchaudii (= Neo. baileyi)		Leucetta losangelensis	
Schizymenia epiphytica		Leucilla nuttingi	
Schizymenia pacifica		Leucosolenia eleanor	
Sciadophycus stellatus		Scypha ciliata (spicule crown)	
Scinaia articulata		CLASS DEMOSPOONGIAE	
Scinaia johnstonii		Acarnus erithacus	
Scinaia			
Smithora naiadum		Adocia	
Sorella deliculata		Anaata spongigartina	
Stenogramme interrupta		Antho lithophoenix	
Tenare dispar		Aplysilla glacialis	
Tiffaniella snyderiae		Artemisia archegona	
Weeksia reticulata		Astylinifer arndti	
PHYLUM TRACHEOPHYTA		Axinella mexicana	
Phyllospadix scouleri		Axocielita originalis	
Phyllospadix torreyi		Clathriopsamma pseudonadya	
Phyllospadix			
Zostera marina		Cliona celata var californiana	
MISCELLANEOUS PLANT TYPES		Cyamon neon	
Cyanobacterial film		Dysidea ambla	
Diatom film		Eurypon asodes	
"Schizynema" colonial diatoms		Geodia mesotriaena	
Hypsypops nest turf		Halichondria	
		Halicina permollis (lavender)	

Haliclona			Aglaphenia
Halisarca sacra			Allopora californica
Hemectyon hyale (orange finger)			A. porphyra (= Stylantheca p.)
Higginsia higginsima			Antenella avalonia
Hymedesmia breslae			Bougainvillia
Hymenamohiaстра cyanocryota			Campanularia
Hymeniacidon			Clytia
Iophon chelifer			Corymorphia palma
Lissodendoryx firma			Coryne/ Syncoryne
Lissodendoryx topsentii			Eucopella
Microciona parthena			Eudendrium californicum
Microciona microjoanna			Garveia annulata
Mycale macginitiei			Hydractinia
Myxilla			Lytocarpus nuttingi
Ophilitaspongia pennata v.calif.			Obelia
Penares cortius			Plumularia
Plocamia karvkinia			Sertularella
Plocamissa iago			Sertularia
Polymastia pachymastia			Tubularia
Red sponges - encrusting			CLASS SCYPHOZOA
Spheciospongia confoederata			Pelagia colorata
Stelletta estrella			Stauromedusae
Suberites			CLASS ANTHOZOA
Tethya aurantia			ORDER CERIANTHARIA
Tetilla arb (purple)			Pachycerianthus fimbriatus
Tetilla flaminco (1 osculum)			ORDER STOLONIFERA
Toxodocia zumi			Clavularia (octocoral)
Verongia aurea			ORDER GORGONACEA
Xestospongia vanilla			Eugorgia rubens
X. trindanea (root beer)			Lophogorgia chilensis
PHYLUM CNIDARIA			Muricea californica
CLASS HYDROZOA			Muricea fruticosa
Abietinaria			

ORDER PENNATULACEA		Balanophyllia elegans		
Acanthoptilum gracile		Coenocyathus bowersi		
Ptilosarcus gurneyi		Paracyathus stearnsi		
Renilla kollikeri		PHYLUM CTENOPHORA		
Stylatula elongata		Beroe		
Virgularia		Leucothea		
ORDER ZOANTHINIARIA		Pleurobrachia		
Epizoanthus induratum		PHYLUM PLATYHELMINTHES		
Epizoanthus leptoderma		Enchiridium punctatum		
E. induratum/leptoderma		Eurylepta aurantiaca		
Parazoanthus lucificum		Eurylepta californica		
ORDER CORALLIMORPHARIA		Leptoplana/Notoolana		
Corynactis californica		Prostheceraeus bellostriatus		
ORDER ACTINIARIA		Pseudoceros luteus		
Anthopleura artemisia		Pseudoceros montereyensis		
Anthopleura elegantissima		Pseudoceros perviciaceus		
Anthopleura xanthogrammica		Stylochus insolitus		
Cactosoma arenaria		Stylochus tripartitus		
Diadumene		Thysanozoon californicum		
Epiactis prolifera		PHYLUM NEMERTEA		
Halicampa decententaculata		Harenactis attenuata		
		Baseodiscus dunnettii		
Metridium exilis		Emplectonema gracile		
Metridium senile		Lineus pictifrons		
Phyllactis		Micrura pardalis		
Sagartia catalinensis		Paranemertes peregrina		
Tealia columbiana		Tubulanus sexlineatus		
Tealia coriacea		PHYLUM SIPUNCULA		
Tealia ?coriacea		Phascolosoma aqassizii		
Tealia crassicornis		Sipunculus nudus		
Tealia lofotensis		Themiste pyroides		
Tealia piscivora				
Tealia				
Zaolutus actius				
ORDER MADREPORARIA				
Astrangia lajollaensis				

PHYLUM ECHIURA		Spirorbidae
<i>Urechis caupo</i>		Terebellidae
PHYLUM ANELIDA		<i>Thelepus crispus</i>
CLASS POLYCHAETA		
<i>Arctonoe pulchra</i> (cucumbers)		PHYLUM ARTHROPODA
Anaitides		CLASS PYCNOGONIDA
<i>Bispira turneri</i>		Pycnogonids
<i>Chaetopterus variopedatus</i>		CLASS CRUSTACEA
<i>Diopatra ornata</i>		SUBCLASS CIRRIFERIA
<i>Dodecaceraia fewkesi</i>		<i>Armatobalanus nefrens</i>
<i>Eudistylia polymorpha</i>		<i>Balanus aquila</i>
<i>Harmothoe lunulata</i>		<i>Balanus aquila/nubilus</i>
<i>Mesochaetopterus</i>		<i>Balanus glandula</i>
<i>Myxicola infundibulum</i>		<i>Balanus nubilus</i>
Nereid		<i>Balanus pacificus</i>
<i>Ophiodromus gigantensis</i>		<i>Balanus trigonus</i>
<i>Phramatopoma californica</i>		<i>Balanus-type</i>
<i>Phyllochaetopterus prolificus</i>		<i>Chthamalus dalli/fissus</i>
Phyllodocid		<i>Conopea galeata</i>
<i>Pista elongata</i>		<i>Megabalanus californicus</i>
<i>Polydora alloporos</i>		<i>Membranobalanus orcutti</i>
Polynoid (scale worm)		<i>Pollicipes polymerus</i>
<i>Sabella crassicornis</i>		<i>Tetraclita elegans</i>
<i>Sabellaria cementum</i>		<i>Tetraclita rubescens</i>
Sabellid		SUBCLASS MALACOSTRACA
Sabellid with eyestalk		ORDER MYSIDA
<i>Salmacina tribrochiata</i>		Mysids
<i>Serpula vermicularis</i>		ORDER ISOPODA
Serpulid		<i>Cirolana harfordi</i>
<i>Spiochaetopterus costarum</i>		Idotea
<i>Spirobranchus spinosus</i>		<i>Ligia occidentalis</i>
		ORDER AMPHIPODA
		Amphipod tube masses
		<i>Ampithoe humeralis</i> (curler)
		Brown & yellow pleustid
		Caprellid

Gammarid		SECTION BRACHYURA		
Pleustes platypa		<i>Cancer antennarius</i>		
Talitrid		<i>Cancer anthonyi</i>		
		<i>Cancer gracilis</i>		
ORDER DECAPODA		<i>Cancer jordani</i>		
SUBORDER NATANTIA		<i>Cancer productus</i>		
		<i>Cancer</i>		
Alpheid		<i>Cycloanthrops novemdentatus</i>		
Alpheus (pistol)		<i>Erioleptus spinosus</i>		
Betaeus harfordi (abalone)		<i>Herbstia parvifrons</i>		
Betaeus longidactylus				
Betaeus macginitiae (urchin)		<i>Heterocrypta occidentalis</i>		
Betaeus				
Heptacarpus		<i>Lophopanopeus</i>		
Hippolyte californiensis		<i>Loxorhynchus crispatus</i>		
		<i>Loxorhynchus grandis</i>		
Hippolytid		<i>Mimulus foliatus</i>		
Lysmata californica		<i>Oregonia gracilis</i>		
Pandalus		<i>Pachygrapsus crassipes</i>		
SUBORDER REPTANTIA		<i>Paraxanthias taylori</i>		
SECTION PALINURA				
		<i>Pelia tumida</i>		
Panulirus interruptus		<i>Pilumnus spinohirsutus</i>		
SECTION ANOMURA				
		<i>Pinnotherid</i>		
Blepharipoda occidentalis		<i>Podochela hemphilli (thin)</i>		
Cryptolithodes sitchensis		<i>Portunus xantusii</i>		
Emerita analoga				
		<i>Pugettia dalli</i>		
Hapalogaster cavicauda		<i>Pugettia producta</i>		
		<i>Pugettia richii</i>		
Isocheles pilosus		<i>Randallia ornata</i>		
Pachycheles rudis		<i>Scyra acutifrons</i>		
Paguristes		<i>Taliepus nuttalli</i>		
Pagurus samuelis				
Pagurus-type		ORDER STOMATOPODA		
Petrolisthes				
		<i>Hemisquilla ensigera</i>		
Pleuroncodes planipes				
		PHYLUM MOLLUSCA		
Polyonyx quadriungulatus		CLASS GASTROPODA		
		SUBCLASS PROSOBRANCHIA		
Pylopagurus				
		<i>Acanthina punctulata</i>		
		<i>Acanthina</i>		

<i>Acmaea mitra</i>			<i>Haliotis fulgens</i>
<i>Alia carinata (= Mitrella c.)</i>			<i>Haliotis rufescens</i>
<i>Amphissa versicolor</i>			<i>Haliotis sorenseni</i>
			<i>Hipponix</i>
<i>Astraea gibberosa</i>			<i>Homalopoma luridum</i>
<i>Astraea undosa</i>			<i>Kelletia kelletii</i>
<i>Balcis rutila</i>			<i>Lamellaria</i>
<i>Bittium</i>			<i>Latiaxis oldroydi</i>
<i>Bursa californica</i>			<i>Littorina planaxis</i>
<i>Calliostoma annulatum</i>			<i>Littorina scutulata</i>
<i>Calliostoma canaliculatum</i>			<i>Macron lividus</i>
<i>Calliostoma gemmulatum</i>			<i>Maxwellia gemma</i>
<i>Calliostoma ligatum</i>			<i>Maxwellia santarosana</i>
<i>Calliostoma supragranosum</i>			
<i>Calliostoma</i>			
<i>Cancellaria cooperi</i>			<i>Megasurcula carpenteriana</i>
			<i>Megasurcula stearnsiana</i>
<i>Ceratostoma foliatum</i>			<i>Megathura crenulata</i>
<i>Ceratostoma nuttalli</i>			
<i>Cerithiopsis</i>			<i>Mitra idae</i>
<i>Collisella digitalis</i>			<i>Mitromorpha carpenteri</i>
<i>Collisella limatula</i>			
<i>Collisella scabra</i>			<i>Nassarina penicillata</i>
<i>Collisella</i>			
<i>Conus californicus</i>			<i>Nassarius</i>
<i>Crassispira semiinflata</i>			<i>Norrisia norrisi</i>
<i>Crepidula dorsata (= Crepidat.)</i>			<i>Notoacmea insessa</i>
<i>Crepidula norrisiarum</i>			<i>Notoacmea</i>
<i>Crepidula perforans</i>			<i>Oceanebra</i>
<i>Crepidula</i>			
<i>Crucibulum spinosum</i>			<i>Olivella baetica</i>
			<i>Olivella biplicata</i>
<i>Cypraea spadicea</i>			<i>Pedicularia californica</i>
<i>Dendropoma lituella</i>			<i>Petaloconchus montereyensis</i>
<i>Diodora</i>			<i>Polinices</i>
<i>Epitonium</i>			<i>Pseudomelatoma</i>
<i>Fissurella volcano</i>			<i>Pteropurpura</i>
<i>Fusinus kobelti</i>			<i>Seila montereyensis</i>
<i>F.k. goblet egg capsules</i>			
<i>Fusinus luteopictus</i>			<i>Serpulorbis squamigerus</i>
<i>Haliotis corrugata</i>			<i>Simnia vidleri</i>
<i>Haliotis cracherodii</i>			

<i>Tegula aureotincta</i>			<i>Armina californica</i>		
<i>Tegula brunnea</i>			<i>Atagema quadrimaculata</i>		
<i>Tegula eiseni</i>					
<i>Tegula funebralis</i>			<i>Cadlina flavomaculata</i>		
<i>Tegula gallina</i>			<i>Cadlina limbaughi</i>		
<i>Tegula regina</i>			<i>Cadlina luteomarginata</i>		
<i>Tegula</i>					
<i>Terebra pedroana</i>			<i>Cerberilla</i>		
<i>Tricolia</i>			<i>Chromodoris macfarlandi</i>		
<i>Trivia californiana</i>			<i>Conualevia alba</i>		
<i>Trivia solandri</i>			<i>Corambe pacifica</i>		
<i>Volvarina taeniolata</i>			<i>Coryphella trilineata</i>		
SUBCLASS OPISTHOBRANCHIA			<i>Coryphella</i>		
<i>Aplysia californica</i>			<i>Cuthona lagunae</i>		
<i>Aplysia vaccaria</i>			<i>Dendrodoris n.sp.</i>		
<i>Berthella californica</i>			<i>Dendronotus</i>		
<i>Berthellina engeli</i>			<i>Diadumena sandiegensis</i>		
<i>Bulla gouldiana</i>			<i>Dirina albolineata</i>		
<i>Chelidonura inermis</i> (Navanax)			<i>Dirina picta</i>		
<i>Haminoea virescens</i>			<i>Doriopsilla albopunctata</i>		
<i>Iselica ovoidea</i>			<i>Facelina stearnsi</i>		
<i>Pleurobranchus</i>			<i>Flabellinopsis iodinea</i>		
<i>Rictaxis punctocaelatus</i>			<i>Hermisenda crassicornis</i>		
<i>Rictaxis "DNA" egg spirals</i>			<i>Hopkinsia rosacea</i>		
<i>Tylospina fungina</i>			<i>Hypselodoris californiensis</i>		
ORDER NUDIBRANCHIA			<i>Jorunna pardus</i>		
<i>Acanthodoris brunnea</i>			<i>Laila cockerelli</i>		
<i>Acanthodoris rhodoceras</i>			<i>Melibe leonina</i>		
<i>Aegires albopunctatus</i>			<i>Mexichromis porterae</i>		
<i>Aeolidia papillosa</i>			<i>Peltidoris n.sp.</i>		
<i>Aldisa sanguinea</i>			<i>Phidiana pugnax</i>		
<i>Ancula pacifica</i>			<i>Polycera atra</i>		
<i>Anisodoris nobilis</i>			<i>Polycera tricolor</i>		
<i>Antiopella barbarensis</i>			<i>Precuthona divae</i>		
<i>Archidoris montereyensis</i>			<i>Rostanga pulchra</i>		
<i>Archidoris odhneri</i>					

<i>Spirilla chromosoma</i>			<i>Florimetus obesa</i>		
<i>Spirilla oliviae</i>					-
<i>Thordisa bimaculata</i>			<i>Glans carpenteri</i>		
<i>Trinchesia</i>			<i>Hiatella arctica</i>		
<i>Triopha catalinae</i>			<i>Hinnites giganteus</i>		
<i>Triopha maculata</i>			<i>Irusella lamellifera</i>		
<i>Tritonia diomedea</i>			<i>Kellia laperousii</i>		
<i>Tritonia festiva</i>			<i>Leptopecten latiauratus</i>		
CLASS POLYPLACOPHORA			<i>Lima hemphilli</i>		
<i>Callistochiton crassicostatus</i>			<i>Lithophaga plumula</i>		
<i>Callistochiton</i>			<i>Macoma secta</i>		
<i>Chaetopleura gemma</i>			<i>Mytilimeria nuttallii</i>		
<i>Cryptochiton stelleri</i>			<i>Mytilus californianus</i>		
<i>Cyanoplax dentiens cryotica</i>			<i>Mytilus edulis</i>		
<i>Cyanoplax hartwegii</i>			<i>Panopea generosa</i>		
<i>Cyanoplax</i>			<i>Parapholus californica</i>		
<i>Lepidozona pectinulata</i>			<i>Pecten diegensis</i>		
<i>Lepidozona</i>			<i>Penitella conradi</i>		
<i>Mopalia muscosa</i>			<i>Penitella penita</i>		
<i>Mopalia</i>			<i>Pholad</i>		
<i>Nuttallina californica (=fluxa)</i>			<i>Pitar newcombianus</i>		
<i>Placiphorella velata</i>			<i>Pododesmus cepio</i>		
<i>Stenoplax consocia</i>			<i>Protorthaca</i>		
<i>Stenoplax</i>			<i>Saxidomus nuttalli</i>		
<i>Tonicella lineata</i>			<i>Semele decisa</i>		
CLASS BIVALVIA			<i>Semele rupicola</i>		
<i>Adula falcata</i>			<i>Septifer bifurcatus</i>		
<i>Americardia biangulata</i>			<i>Tagelus</i>		
<i>Chaceia ovoidea</i>			<i>Tellina</i>		
<i>Chama arcana</i>			<i>Tivela stultorum</i>		
<i>Chione undatella</i>			<i>Trachycardium quadragenarium</i>		
<i>Chlamydoconcha orcutti</i>			<i>Tresus nuttallii</i>		
<i>Diploponta</i>			<i>Ventricolaria fordii</i>		
<i>Donax</i>					
<i>Epilucina californica</i>					

CLASS CEPHALOPODA				
<i>Loligo opalescens</i>				<i>Membranipora membranacea</i>
<i>Octopus</i>				<i>Microporella</i>
<i>O. bimaculatus/bimaculoides</i>				<i>Parasmittina californica</i>
<i>Octopus micropyrus</i>				<i>Parasmittina/Rhynchocoelium</i>
<i>Octopus rubescens</i>				<i>Pherusella brevituba</i>
PHYLUM ECTOPROCTA				<i>Phidolopora labiata</i>
<i>Aetea</i>				<i>Rhynchocoelium</i>
<i>Antropora tincta</i>				<i>Schizoporella</i>
<i>Bicrisia edwardsiana</i>				<i>Scrupocellaria</i>
<i>Bugula neritina</i>				<i>Thalamoporella californica</i>
<i>Bugula</i>				<i>Tricellaria</i>
<i>Callopora</i>				<i>Tubulipora</i>
<i>Cauloramphus</i>				PHYLUM ENTOPROCTA
<i>Cellaria</i>				<i>Barentsia</i>
<i>Celleporaria brunnea</i>				PHYLUM PHORONIDA
<i>Celleporella</i>				<i>Phoronis vancouverensis</i>
<i>Coleopora gigantea</i>				<i>Phoronopsis californica</i>
<i>Costazia robertsoniae</i>				PHYLUM ECHINODERMATA
<i>Crisia</i>				CLASS ASTEROIDEA
<i>Diaperoecia californica</i>				<i>Astrometis sertulifera</i>
<i>Disporella</i>				<i>Astropecten armatus</i>
<i>Eurystomella</i>				<i>Dermasterias imbricata</i>
<i>Fenestulina malusii</i>				<i>Henricia leviuscula</i>
<i>Filicrisia</i>				<i>Leptasterias</i>
<i>Flustrella</i>				<i>Linckia columbiae</i>
<i>Heteropora magna</i>				<i>Luidia foliolata</i>
<i>Hippodiplosia insculpta</i>				<i>Mediaster aequalis</i>
<i>Hippothoa distans</i>				<i>Orthasterias koehlerii</i>
<i>Lagenipora</i>				<i>Patiria miniata</i>
<i>Lichenopora novae-zelandiae</i>				<i>Pisaster brevispinus</i>
<i>Lyrula hippocrepis</i>				<i>Pisaster giganteus</i>

<i>Pisaster ochraceus</i>				<i>Parastichopus californicus</i>		
<i>Pycnopodia helianthoides</i>				<i>Parastichopus parvimensis</i>		
CLASS ECHINOIDEA				PHYLUM CHORDATA		
<i>Centrostephanus coronatus</i>				SUBPHYLUM UROCHORDATA		
<i>Dendraster excentricus</i>				<i>Aplidium californicum</i>		
<i>Lovenia cordiformis</i>				<i>Aplidium propinquum</i>		
<i>Lytechinus anamesus</i>				<i>Aplidium solidum</i>		
<i>L. anamesus juveniles</i>				<i>Aplidium</i>		
<i>Strongylocentrotus franciscanus</i>				<i>Archidistoma diaphanes</i>		
<i>S. franciscanus juveniles</i>				<i>Archidistoma molle</i>		
<i>Strongylocentrotus purpuratus</i>				<i>Archidistoma psammion</i>		
<i>S. purpuratus juveniles</i>				<i>Archidistoma ritteri</i>		
CLASS OPHIUROIDEA				<i>Archidistoma</i>		
<i>Amoniodis occidentalis</i>				<i>Ascidia ceratodes</i>		
<i>Amphipholis squamata</i>				<i>Boltenia villosa</i>		
<i>Ophiactis simplex</i>				<i>Botrylloides diegensis</i>		
<i>Ophioderma panamense</i>				<i>Botryllus tuberatus</i>		
<i>Ophionereis</i>				<i>Clavelina huntsmani</i>		
<i>Ophiotholus</i>				<i>Cnemidocarpha finmarkiensis</i>		
<i>Ophiopterus esmarki</i>				<i>Cystodytes lobatus</i>		
<i>Ophicosila californica</i>				<i>Didemnid</i>		
<i>Ophiopteris papillosa</i>				<i>Didemnum carinatum</i>		
<i>Ophiothrix soiculata</i>				<i>Diplosoma macdonaldi</i>		
CLASS HOLOTHUROIDEA				<i>Distaplia occidentalis</i>		
<i>Cucumaria curata/pseudocurata</i>				<i>Euherdmania claviformis</i>		
<i>Cucumaria lubrica</i>				<i>Halocynthia hilgendorfi igaboja</i>		
<i>Cucumaria miniata</i>				<i>Metandrocarpa dura</i>		
<i>Cucumaria piperata</i>				<i>Metandrocarpa taylori</i>		
<i>Cucumaria salma</i>				<i>Molgula</i>		
<i>Cucumaria</i>				<i>Perophora annexans</i>		
<i>Eupentacta quinquesemita</i>				<i>Polyclinum planum</i>		
<i>Leptosynapta albicans</i>				<i>Pycnoclavella stanleyi</i>		
<i>Lissothuria nutriens</i>				<i>Pyura haustor</i>		
<i>Pachythylene rubra</i>				<i>Ritterella</i>		
				<i>Styela montereyensis</i>		
				<i>Styela</i>		

<i>Synoicum parfustis</i>			
<i>Trididemnum opacum</i>			
SUBPHYLUM VERTEBRATA			
CLASS CHONDRICHTHYES			
<i>Cephaloscyllium ventriosum</i>			
<i>Heterodontus francisci</i>			
<i>Mustelus</i>			
<i>Myliobatis californica</i>			
<i>Platyrhinoidis triseriata</i>			
<i>Prionace glauca</i>			
<i>Rhinobatos productus</i>			
<i>Squatina californica</i>			
<i>Torpedo californica</i>			
<i>Triakis semifasciata</i>			
<i>Urolophus halleri</i>			
CLASS OSTEICHTHYES			
ORDER ANGUILLIFORMES			
<i>Gymnothorax mordax</i>			
ORDER BATRACHOIDIFORMES			
<i>Parichthys notatus</i>			
ORDER GOBIESOCIFORMES			
<i>Gobiesox eugrammus</i>			
<i>Gobiesox maeandricus</i>			
<i>Gobiesox rhessodon</i>			
<i>Rimicola muscarum</i>			
ORDER GADIFORMES			
<i>Chilara taylori</i>			
ORDER AETHERINIFORMES			
<i>Atherinops affinis</i>			
<i>Atherinops/Leuresthes</i>			
<i>Cypselurus californicus</i>			
ORDER GASTEROSTEIFORMES			
<i>Aulorhynchus flavidus</i>			

<i>Syngnathus arctus</i>			
<i>Syngnathus californiensis</i>			
<i>Syngnathus leptorhynchus</i>			
ORDER PERCIFORMES			
AGONIDAE (Poachers)			
<i>Poacher</i>			
ANARHICHADIDAE (Wolffishes)			
<i>Anarrhichthys ocellatus</i>			
BATHYMASTERIDAE (Ronquils)			
<i>Rathbunella hypoplecta</i>			
BLENNIIDAE (Blennies)			
<i>Hypsoblennius gilberti</i>			
<i>Hypsoblennius jenkinsi</i>			
<i>Hypsoblennius</i>			
CARANGIDAE (Jacks)			
<i>Seriola lalandei</i>			
TRACHURUS SYMMETRICUS			
CHAETODONTIDAE (Butterfly)			
<i>Chaetodon falcifer</i>			
CLINIDAE (Clinids)			
<i>Alloclinus holderi</i>			
<i>Chaenopsis alepidota</i>			
GIBBONSIA			
<i>Gibbonsia elegans</i>			
<i>Gibbonsia metzi</i>			
<i>Gibbonsia</i>			
HETEROSTICHUS ROSTRATUS			
NEOCLINUS			
<i>Neoclinus blanchardi</i>			
<i>Neoclinus stephansae</i>			
<i>Neoclinus uninotatus</i>			
<i>Neoclinus</i>			
PARACLINUS INTEGRIPINNIS			
COTTIDAE (Sculpins)			
<i>Artedius corallinus</i>			
<i>Artedius creaseri</i>			
CLINOCOTTUS ANALIS			
LEIOCOTTUS HIRUNDO			

LABRIDAE (Wrasses)				Orthopristis triacis
Halichoeres semicinctus				Scorpaenichthys marmoratus
H. semicinctus females				EMBIOTOCIDAE (Surfperches)
H. semicinctus males				Amphistichus argenteus
H. semicinctus juveniles				Brachyistius frenatus
Oxyjulis californica				Cymatogaster aggregata
O. californica juveniles				Damalichthys vacca
Semicossyphus pulcher				Embiotoca jacksoni
S. pulcher females				Embiotoca lateralis
S. pulcher males				Hyperprosopon argenteum
S. pulcher juveniles				Hyperprosopon
MALACANTHIDAE (Tilefishes)				Hypsurus caryi
Caulolatilus princeps				Micrometrus aurora
PERCICHTHYIDAE (Temp. Bass)				Micrometrus minimus
Stereolepis gigas				Phanerodon atripes
PHOLIDAE (Gunnels)				Phanerodon furcatus
Pholis				Phanerodon
Ulvicola sanctaerosae				Rhacochilus toxotes
POMACENTRIDAE (Damselfishes)				GOBIIDAE (Gobies)
Chromis punctipinnis				Coryphopterus nicholsi
C. punctipinnis juveniles				Lythrypnus dalli
Hypsypops rubicundus				Lythrypnus zebra
H. rubicundus juveniles				HAEMULIDAE (Grunts)
SCIAENIDAE (Croakers)				Anisotremus davidsoni
Atractoscion nobilis				Xenistius californiensis
Cheilotrema saturnum				SERIOPHIDAE (Sea Robin)
Seriphidus politus				Hexagrammos decagrammus
Umbrina roncadour				Ophiodon elongatus
SCOMBRIDAE (Mackerels)				Oxylebius pictus
Sarda chiliensis				KYPHOSIDAE (Sea Chubs)
Scomber japonicus				Girella nigricans
SCORPAENIDAE (Rockfishes)				Hermosilla azurea
Scorpaena guttata				Medialuna californiensis
Sebastodes atrovirens				
S. atrovirens juveniles				

<i>Sebastes carnatus</i>				
<i>Sebastes caurinus</i>				
<i>S. carnatus/caurinus juveniles</i>				-
<i>Sebastes chrysomelas</i>				
<i>S. chrysomelas juveniles</i>				
<i>Sebastes constellatus</i>				
<i>Sebastes dalli</i>				
<i>Sebastes melanops</i>				
<i>Sebastes miniatus</i>				
<i>S. miniatus juveniles</i>				
<i>Sebastes mystinus</i>				
<i>S. mystinus juveniles</i>				
<i>Sebastes paucispinis</i>				
<i>Sebastes rastrelliger</i>				
<i>Sebastes rosaceus</i>				
<i>Sebastes serranoides</i>				
<i>S.s./S. flavidus juveniles</i>				
<i>Sebastes serriceos</i>				
<i>S. serriceps juveniles</i>				
<i>Sebastes</i>				
<i>Sebastes juveniles</i>				
SERRANIDAE (Basses)				
<i>Paralabrax clathratus</i>				
<i>P. clathratus juveniles</i>				
<i>Paralabrax maculatofasciatus</i>				
<i>Paralabrax nebulifer</i>				
SPHYRAENIDAE (Barracudas)				
<i>Sphyraena argentea</i>				
STICHAEIDAE (Pricklebacks)				
<i>Cebidichthys violaceus</i>				
<i>Prickleback</i>				
ORDER PLEURONECTIFORMES				
BOTHIDAE (Lefteye Flounders)				
<i>Citharichthys sordidus</i>				
<i>Citharichthys juveniles</i>				
<i>Paralichthys californicus</i>				
<i>Xystreurus liolepis</i>				
CYNOGLOSSIDAE (Tonguefishes)				
<i>Syphurus atricauda</i>				
<i>Sebastes carnatus</i>				
<i>Sebastes caurinus</i>				
<i>S. carnatus/caurinus juveniles</i>				
<i>Sebastes chrysomelas</i>				
<i>S. chrysomelas juveniles</i>				
<i>Sebastes constellatus</i>				
<i>Sebastes dalli</i>				
<i>Sebastes melanops</i>				
<i>Sebastes miniatus</i>				
<i>S. miniatus juveniles</i>				
<i>Sebastes mystinus</i>				
<i>S. mystinus juveniles</i>				
<i>Sebastes paucispinis</i>				
<i>Sebastes rastrelliger</i>				
<i>Sebastes rosaceus</i>				
<i>Sebastes serranoides</i>				
<i>S.s./S. flavidus juveniles</i>				
<i>Sebastes serriceos</i>				
<i>S. serriceps juveniles</i>				
<i>Sebastes</i>				
<i>Sebastes juveniles</i>				
SERRANIDAE (Basses)				
<i>Paralabrax clathratus</i>				
<i>P. clathratus juveniles</i>				
<i>Paralabrax maculatofasciatus</i>				
<i>Paralabrax nebulifer</i>				
SPHYRAENIDAE (Barracudas)				
<i>Sphyraena argentea</i>				
STICHAEIDAE (Pricklebacks)				
<i>Cebidichthys violaceus</i>				
<i>Prickleback</i>				
ORDER PLEURONECTIFORMES				
BOTHIDAE (Lefteye Flounders)				
<i>Citharichthys sordidus</i>				
<i>Citharichthys juveniles</i>				
<i>Paralichthys californicus</i>				
<i>Xystreurus liolepis</i>				
CYNOGLOSSIDAE (Tonguefishes)				
<i>Syphurus atricauda</i>				

APPENDIX D. Logistical Considerations and Equipment for Research Cruises

CRUISE PREPARATION

INTRODUCTION

This is an organizational handbook designed to help prepare for the seven, five-day, kelp forest monitoring cruises. Its objective is to increase efficiency, minimize stress, and hopefully keep from forgetting anything. Included are some little tricks it took several field seasons to figure out, please add any new helpful hints or clarify confusing instructions. In this way, the job will become easier. The cruises run in two week cycles. The starting point for this discussion is at the return to mainland point, just after the end of a cruise.

PROCEDURE

Friday, after the cruise:

- Wash all sampling gear. If the weather is calm this can be done on the boat as you return to Ventura.
- Store it in the locked storage cage to dry. Goodie bags can be hung on a RPC bar and strung across a corner.
- Scrub the insides of the ice chests and trash cans then store them open to dry inside the cage.
- Refreeze the ice savers and 2.5 gallon water bottles.
- Freeze any saveable food. Remember to leave the skipper whatever he wants on the boat.
- Wash all the dive gear, including dry suits inside and out. Hang to dry inside-out making sure the hoods drain.
- Take home the dry suit underwear to wash over the weekend. Use very little soap, cool water, and gentle cycle. Hang dry.

Monday, after the cruise:

- Bring the dry suit underwear back, roll and stow in closet.
- Put away dry gear in cage.
- Scrub slates and U/W mylar with Ajax. Be sure the slates have two complete pencils.

- Repair and rewind meter tapes and pelican bouys.
- Lubricate carabiners, meter tape handles and calipers.
- Turn dry suits right side in, powder seals and wax zippers, then roll and stow in closet.
- Take photoplot film to be developed (usually Hal-las color lab).
- Clean and lubricate cameras, lenses, video, strobes, and edges (remember to remove batteries).

Tuesday through Thursday, before the cruise:

- Check your suggestion sheet from the cruise before and do necessary repairs, get replacements, and new helpful items.
- Get the slides back from the processing lab and evaluate (see photoplot handbook).

Friday, before the cruise:

- Charge and lubricate strobes, Q-lites and video batteries.
- Do food (see food handbook)
- Load what gear you can, secure over the weekend, and get the rest ready to load for Monday morning.

Monday of the cruise:

- Load gear. Check and recheck list. Be sure everything is tied down on boat.

During the cruise:

- Keep track of where things are! Not only will this make more room on deck if it is kept neat, but keeping things in their place will prevent accidental loss or breakage. Try to keep tapes and bouys wound neatly and keep up on repairs (on dry suits, meter tapes, etc.)

EQUIPMENT CHECKLIST

LOCATION	ITEM	CONTENTS	QUANTITY
BOAT	HYDRAULIC HOSES		1
CAGE	1 X 1 PVC QUADRATS		6
CAGE	1.5 M PVC BAND TRANSECT BARS		3
CAGE	BLUE ICE CHEST	BACK PACK	1
CAGE	BLUE ICE CHEST	KNEE PADS	2 PR
CAGE	BLUE ICE CHEST	FINS	1 PR
CAGE	BLUE ICE CHEST	EPOXY NOZZLE	1
CAGE	BLUE ICECHEST	REGULATOR/PRESSURE GAUGE	1
CAGE	BLUE ICE CHEST	WEIGHT BELTS/WEIGHTS	1
CAGE	BLUE ICE CHEST	U/W EPOXY TUBES	2
CAGE	BLUE ICE CHEST	SURVEYOR STAKES	5
CAGE	BLUE ICE CHEST	GLOVES	2 PR
CAGE	BLUE ICE CHEST	BOOTIES	2 PR
CAGE	BLUE ICE CHEST	STAB JACKET	1
CAGE	BLUE ICE CHEST	MASK AND SNORKEL	1
CAGE	BLUEICECHEST	CHILL CHECK THERMOMETER	1
CAGE	BLUEICECHEST	STAB JACKET INFLATOR HOSE	1
CAGE	BLUE ICE CHEST	VIKING INFLATOR HOSE	1
CAGE	DCS CONSOLE		1
CAGE	DCS HOSES		2 SET
CAGE	DRILL ICE CHEST	HAMMER DRILL	1
CAGE	DRILL ICE CHEST	DRILL BIT	2
CAGE	BLACK REPAIR BOX	AQUASEAL /CATALYST/TUBE	1
CAGE	BLACK REPAIR BOX	VIKING GLUE/SOLVENT/CATALYST	1
CAGE	BLACK REPAIR BOX	VIKING NECK/WRIST SEALS	2/4
CAGE	BLACK REPAIR BOX	VIKING REPAIR KIT	1
CAGE	BLACK REPAIR BOX	POWDER BAG	1
CAGE	BLACK REPAIR BOX	PARAFIN WAX	1
CAGE	BLACK REPAIR BOX	WETSUIT GLUE	1
CAGE	BLACK REPAIR BOX	NEOPRENE REPAIR TAPE	1
CAGE	FREEZER	2.5 GAL BOTTLED WATER (FOR ICE)	4
CAGE	FREEZER	ICE SAVERS	12
CAGE	ICE CHESTS		4
CAGE	METAL METER STICKS/LARGE CALIPERS		2/2
CAGE	MILK CRATE 1	30 M TAPE WITH SECCHI DISK	1
CAGE	MILK CRATE 1	30 M TAPES	3
CAGE	MILK CRATE 1	100 M TAPES	4
CAGE	MILK CRATE 2	CONSOLE CLIPBOARDS	2
CAGE	MILK CRATE 2	U/W SLATES WITH PENCILS	8
CAGE	PHOTOGRID/BUNGIES		1/2
CAGE	PHOTOSTAND		1
CAGE	RED ICE CHEST	REGULATOR MOUTHPIECE	1
CAGE	RED ICE CHEST	BLACK MARKING INK CAN	1
CAGE	RED ICE CHEST	10 GAUGE WIRE	1
CAGE	RED ICE CHEST	2 PART EPOXY	1
CAGE	RED ICE CHEST	ABALONE IRON	2
CAGE	RED ICE CHEST	TEFLON TAPE	1
CAGE	RED ICE CHEST	SUNSCREEN	1
CAGE	RED ICE CHEST	PARAFIN WAX	1
CAGE	RED ICE CHEST	KNIFE	1
CAGE	RED ICE CHEST	CORKS	6

Equipment List (continued)

LOCATION	ITEM	CONTENTS	QUANTITY
CAGE	RED ICE CHEST	FLARE	1
CAGE	RED ICE CHEST	DSI COMM SET (2 EARPHONE, 1 MICROP)	1
CAGE	RED ICE CHEST	DSI ORAL NASAL RUBBER	1
CAGE	RED ICE CHEST	DSI BANANA PLUGS	2
CAGE	RED ICE CHEST	TANK O-RINGS	5
CAGE	RED ICE CHEST	REGULATOR PORT PLUG	2
CAGE	RED ICE CHEST	ELECTRICAL EYE CONNECTOR	4
CAGE	RED ICE CHEST	STAB JACKET INFLATOR PUSH BUTTON	1
CAGE	RED ICE CHEST	VIKING INFLATOR PUSH BUTTON	2
CAGE	RED ICE CHEST	REGULATOR EXHAUST TEE	1
CAGE	RED ICE CHEST	RUBBING ALCOHOL	1
CAGE	RED ICE CHEST	DPV HEADLAMPS	2
CAGE	RED ICE CHEST	DUCT TAPE	1
CAGE	RED ICE CHEST	DSI HOODS	2
CAGE	RED ICE CHEST	DEPTH GAUGE	1
CAGE	RED ICE CHEST	COMPASS	1
CAGE	RED ICE CHEST	THERMOMETER	1
CAGE	RED ICE CHEST	CARABINER	1
CAGE	RED ICE CHEST	REGULATOR DIAPHRAGM	1
CAGE	RED ICE CHEST	DSI BATTERY CHARGING CORD	1
CAGE	RED ICE CHEST	DSI HEADPHONES	1
CAGE	RED ICE CHEST	DSI WHISKER RUBBER EXHAUST	1
CAGE	RED ICE CHEST	DSI ONE WAY VALVE REPAIR KIT	1
CAGE	RED ICE CHEST	SUPERTECT (OR SILICONE SPRAY)	1
CAGE	RED ICE CHEST	EPOXY PUTTY	1
CAGE	RED ICE CHEST	MASK STRAPS	2
CAGE	RED ICE CHEST	FIN STRAPS	4
CAGE	RED ICE CHEST	LEG STRAPS	2
CAGE	RED ICE CHEST	WATCH PINS	2
CAGE	RED ICE CHEST	TIE WRAPS	10
CAGE	RED ICE CHEST	ELECTRICAL TAPE	1
CAGE	RED ICE CHEST	LEADER CLAMPS	5
CAGE	RED ICE CHEST	DPV O-RINGS	1
CAGE	RED ICE CHEST	SILICON GREASE	1
CAGE	RED ICE CHEST	VELCRO WRIST BAND	2
CAGE	RED ICE CHEST	WIRE LEADER ROLL	1
CAGE	RED ICE CHEST	EYEBOLTS/ALLTHREAD	8/4
CAGE	RED ICE CHEST	SLATE SCREWS	5
CAGE	RED ICE CHEST	SURGICAL TUBING	3 FT.
CAGE	RED ICE CHEST	SPLIT SHOT BAG	1
CAGE	RED ICE CHEST	WATCH	1
CAGE	RED ICE CHEST	STAB JACKET TANK STRAP	1
CAGE	RPC BARS		4
CAGE	TRASH CAN	CANVAS GOODIE BAGS(VARIOUS SIZES)	5
CAGE	TRASH CAN	MESH GOODIE BAGS(VARIOUS SIZES)	8
CAGE	TRASH CAN	LAUNDRY BAGS	3
CAGE	TRASH CAN	FLOATS	5
CAGE	TRASH CAN	PELICAN BOUYS	8
CAGE	TRASH CAN	PELICANETTE BOUYS	2
CAGE	TRASH CAN	POLYPRO LINE SPOOL	1
CAGE	TRASH CAN	WEIGHTS	20 LB

Equipment List (continued)

LOCATION	ITEM	CONTENTS	QUANTITY
CAGE	WHITE DCS BOX	PADDED BAGS	2
CAGE	WHITE DCS BOX	BAND MASKS WITH RINGS	2
CAGE	WHITE DCS BOX	SPIDERS	2
CAGE	WHITE DCS BOX	PRESSURE GAUGES/QUICK DISCONNECT	2
CAGE	WHITE DCS BOX	PONY BOTTLES WITH BACKPACKS	2
CAGE	WHITE DCS BOX	HOODS	2
CAGE	WHITE DCS BOX	TOOL BOX	1
CAGE			4
CLOSET	HANGERS		1/1
CLOSET	HYDROTHERMOGRAPH/HOUSING		10
CLOSET	SHRIMP BASKETS		4
CLOSET	VIKING DRY SUITS		4
CLOSET	VIKING DRY SUIT UNDERWEAR		2
DIVE LOCKER	DOUBLE TANKS		12
DIVE LOCKER	TANKS		4
DIVE LOCKER	PERSONAL DIVE GEAR		1
WORKROOM	2 GALLON AQUARIUM	ASA 100, 36 EXP COLOR SLIDE FILM	12 +
WORKROOM	BLACK CASE	BLOWER BRUSH	1
WORKROOM	BLACK CASE	LENS CLEANER FLUID	1
WORKROOM	BLACK CASE	LENS PAPER	1PKG
WORKROOM	BLACK CASE	PERMANENT INK MARKER	1
WORKROOM	BLACK CASE	Q-TIPS	10 +
WORKROOM	BLACK CASE	SILICONE GREASE	1
WORKROOM	BLACK PELICAN CASE	VIDEO CAMERA AND VIEWFINDER	1
WORKROOM	BLACK PELICAN CASE	NIKONOS V CAMERAS	3
WORKROOM	BLACK PELICAN CASE	28 MM LENSES	3
WORKROOM	BLACK PELICAN CASE	15 MM LENSES	3
WORKROOM	BLACK PELICAN CASE	E/O CONNECTORS	4
WORKROOM	BLACK PELICAN CASE	O-RING SET WITH GREASE	2
WORKROOM	BLACK PELICAN CASE	BATTERIES	3 +
WORKROOM	BLACK PELICAN CASE	ANGLE IRON BRACKETS AND SCREWS	3
WORKROOM	BLACK PELICAN CASE	VIDEO RECORDER AND PATCH CORDS	1
WORKROOM	BLUE PELICAN CASE	FLOODING ALARM	1
WORKROOM	BLUE PELICAN CASE	PENCILS/ERASERS/LEADS	15/5/5
WORKROOM	BOOK COOLER	PERMANENT INK MARKER	1
WORKROOM	BOOK COOLER	SAMPLE BOTTLES	4
WORKROOM	BOOK COOLER	DECOMPRESSION	1
WORKROOM	BOOK COOLER	HAND LENS	1
WORKROOM	BOOK COOLER	SCALPEL/BLADES/TWEEZERS	1/2/1
WORKROOM	BOOK COOLER	CARPENTERS CRAYONS	1
WORKROOM	BOOK COOLER	SURGE METER	2
WORKROOM	BOOK COOLER	HOLE PUNCH	1
WORKROOM	BOOK COOLER	9 V BATTERIES (FOR EDGES)	8
WORKROOM	BOOK COOLER	6 V BATTERIES (FOR DIVE LIGHTS)	2
WORKROOM	BOOK COOLER	FORMALDEHYDE BOTTLE	1
WORKROOM	BOOK COOLER	VERNIER CALIPERS	6
WORKROOM	BOOK COOLER	VIDEO TAPES	2
WORKROOM	BOOK COOLER	ELECTRICAL TAPE	1
WORKROOM	BOOK COOLER	DECOMPRESSION TABLES	1
WORKROOM	BOOK COOLER	ABBOTT & HOLLENBERG, ALGAE	1
WORKROOM	BOOK COOLER	BEHRENS, NUDIBRANCHS	1

Equipment List (continued)

LOCATION	ITEM	CONTENTS	QUANTITY
WORKROOM	BOOK COOLER	DAWSON & FOSTER, PLANTS	1
WORKROOM	BOOK COOLER	ESCHMEYER, FISHES	1
WORKROOM	BOOK COOLER	GOTSHALL & LAURENT, FISHWATCHERS	1
WORKROOM	BOOK COOLER	KEEN & KOAN, MOLLUSCS	1
WORKROOM	BOOK COOLER	KFM PROJECT REPORT	1
WORKROOM	BOOK COOLER	LIGHTS MANUAL	1
WORKROOM	BOOK COOLER	MILLER & LEA, FISHES	1
WORKROOM	BOOK COOLER	MORRIS, ALBERT & HADERLIE, INVERT	1
WORKROOM	BOOK COOLER	MCDONALD & NYBAKKEN, NUDIBRANCHS	1
WORKROOM	BOOK COOLER	PETERSON, BIRDS	1
WORKROOM	BOOK COOLER	WATALAND, SEAWEED	1
WORKROOM	BOOK COOLER	WILSON & WILSON, FISHES	1
WORKROOM	BOOK COOLER	USC INVERTEBRATE LIST	1
WORKROOM	DATA SHEET BOX	BOAT DIVE LOGS	5+
WORKROOM	DATA SHEET BOX	BAND TRANSECT U/W DATA FORMS	10+
WORKROOM	DATA SHEET BOX	BAND TRANSECT SUMMARY FORMS	5+
WORKROOM	DATA SHEET BOX	COMPLETED DATA SHEET BINDER	1
WORKROOM	DATA SHEET BOX	DAILY LOG BINDER	1
WORKROOM	DATA SHEET BOX	DAILY LOG FORMS	5+
WORKROOM	DATA SHEET BOX	FISH TRANSECT U/W DATA FORMS	5+
WORKROOM	DATA SHEET BOX	QUADRAT U/W DATA FORMS	10+
WORKROOM	DATA SHEET BOX	QUADRAT SUMMARY FORMS	5+
WORKROOM	DATA SHEET BOX	KFM HANDBOOK	1
WORKROOM	DATA SHEET BOX	RPC DATA FORMS(5 PER STATION)	5+
WORKROOM	DATA SHEET BOX	RPC SUMMARY FORMS(2 PER STATION)	5+
WORKROOM	DATA SHEET BOX	RPC U/W CUE CARDS	1
WORKROOM	DATA SHEET BOX	SIZE FREQUENCY DATA FORMS	70+
WORKROOM	DATA SHEET BOX	SITE DESCRIPTION BINDER	1
WORKROOM	DATA SHEET BOX	SITE DESCRIPTION FORMS	5+
WORKROOM	DATA SHEET BOX	SPECIES LIST BINDER	1
WORKROOM	DATA SHEET BOX	PAPER	5
WORKROOM	DATA SHEET BOX	U/W MYLAR	20+
WORKROOM	GREEN VIDEO CASE	VIDEO HOUSING WITH WEIGHTS	1
WORKROOM	GREEN VIDEO CASE	FULL/SPLIT O-RINGS	1/1
WORKROOM	GREY PELICAN BOX	VIDEO BATTERY CHARGER	1
WORKROOM	GREY PELICAN BOX	VIDEO BATTERIRES	5
WORKROOM	PLANT PRESS	BLOTTER	10
WORKROOM	PLANT PRESS	CARDBOARD	10
WORKROOM	PLANT PRESS	HERBARIUM PAPER	10
WORKROOM	PLANT PRESS	WAX PAPER	10
WORKROOM	RECIPE BOX/MENU		1
WORKROOM	VIDEO MONITOR		1
WORKROOM	WHITE CASE	OCEANIC 2001 STROBES	3
WORKROOM	WHITE CASE	OCEANIC STROBE CHARGERS	3
WORKROOM	WHITE CASE	STROBE ARMS WITH KNOBS	2
WORKROOM	WHITE CASE	Q-LITES	2
WORKROOM	WHITE CASE	Q-LITE HOLDERS	2
WORKROOM	WHITE CASE	Q-LITE LAMPS	2
WORKROOM	WHITE CASE	Q-LITE O-RINGS	2

FOOD HANDBOOK FOR THE KELP FOREST MONITORING PROJECT

INTRODUCTION

Menus for five days must be planned for the seven kelp forest monitoring cruises. Examples from previous years can be used. However, there is no set format nor obligation to use these and creativity is encouraged. The previous menus are on the floppy disk entitled KFM-FOOD, using Wordstar software. Software files are labelled MENU.1 through MENU.7. Hard copies are also available in the file labelled KFM-FOOD which can be found in the workroom or in the back of the recipe box.

There are also corresponding food order lists that will be sent to the vendor, Ven Oak Market, for delivery. Make sure that the vendor receives your order at least three days (preferably five days) before delivery date. Copies of these food lists can be found either in the KFM-FOOD file (workroom) or on the KFM-FOOD floppy disk. These Wordstar files are entitled FOOD-LIST.1 through FOODLIST.7. The food list for the first cruise will be exceptionally large because it will include sundries that must always be kept in stock. If one of these items runs low before the next cruise, be sure to reorder more. The list of sundries can be found either in the front of the recipe box or in the KFM-FOOD file in the workroom.

Estimated costs for each food order are:

Food list cruise one	\$650.00
Food list cruises two through seven	\$570.00

PROCEDURE

Friday, one week prior to cruise:

- Make two hard copies of appropriate food list.
- Fill out DI1, using estimated cost. Attach one copy and give to the Account Officer(A/O).
- Mail the other copy to;

Ven Oak Market
690 Ventura Road
Oakview, California 93022
Attention: Lee or Karen

- Include a cover letter detailing where and when you want it delivered (generally the Friday before the cruise), and your phone number in case there are any questions. Feel free to use the format

from previous letters from the KFM-FOOD file or the VENOAK.LET Wordstar file on floppy disk.

- Fill out a menu to post on the boat.

Tuesday, the week before the cruise:

- Call Ven Oak Market (649-1241) and confirm that they have received your order or have any questions.
- Refreeze the four 2.5 gallon water containers and ice savers in the cage freezer so you will have ice for the next cruise.

Friday, the week before the cruise:

- Clean four large ice chests (two for drinks, two for fruit and vegetables).
- When the food order arrives;
- Be sure to get a signed itemized receipt for the A/O.
- Check the order against the receipt, note shorts and whether we were charged for them.
- Store perishable items in the maintenance refrigerator and frozen items in the cage freezer.
- All other nonperishable items can be stored in the main salon on the boat such as, canned goods under the rear port bench, dry goods under the forward port bench, paper products under the forward starboard bench, sundries in the galley and drinks in the forward bilge.

Monday of the cruise:

- Stop on way to work and purchase milk and any other perishable items that won't survive the weekend as well as any other shorted items from the food order. Be sure to fill out a DI1 prior to purchase and keep all receipts for A/O.
- Load fruit and vegetables from the maintenance refrigerator into their respective ice chests lined with ice savers and covered with a piece of cardboard (to prevent food from freezing). Place on boat.

- Load the 2.5 gallon ice blocks with ice savers in the other two ice chests and fill with drinks. Place on boat.
- Load dairy products from maintenance refrigerator and frozen foods from cage freezer into cold box on boat. Try to put the frozen food in the cold box in the opposite order in which you'll use them as to avoid too much digging later on. Make sure all packages are labelled.
- Post menu and load recipe box on board boat.

During the cruise:

- Keep a bowl of trail mix, raisins or nuts and a bowl of fruit out for snacking.
- Be sure to make extra pasta, rice, etc. for salads the next day when applicable.
- Keep drinks in the ice chests stocked.
- Make sure that you start defrosting that night's dinner by noon.

Monday, following the cruise:

- If you were overcharged, call Ven Oak and straighten it out with them.
- Make a copy of the itemized receipt with correct billing amount and give the original to the A/O. Attach the copy to the DI1 in the Resource Management billing file.

CONCLUSION

- Don't worry about it.

CHANNEL ISLANDS NATIONAL PARK - KELP FOREST MONITORING PROJECT

QUADRAT DATA SHEET

Date	Location	Time In	Time Out	Quadrat Size	Vis (bottom)	Vis (Total)	Observer m	Temp (bottom) m	Temp (Total) m	Depth	Partner	Surge (ft.)
Random meter number	1	2	3	4	5	6	7	8	9	10	11	12
Quadrat number												
<i>Lythrypnus dalli</i> Blue Banded Goby												
<i>Coryphopterus nicholsii</i> Black Eye Goby												
<i>Allocinclus holderi</i> Island Kelp Fish												
<i>Macrocystis pyrifera</i> Giant Kelp	juvenile											
<i>Macrocystis pyrifera</i> Giant Kelp	adult > 1m											
<i>Laminaria larvata</i> Oar Weed												
<i>Eisenia arborea</i> Southern Sea Palm												
<i>Pterygophora californica</i> California Sea Palm												
<i>Astraea undosa</i> Wavy Turban Snail												
<i>Cypraea spadicea</i> Chestnut Cowry												
<i>Strongylocentrotus franciscanus</i> Red Sea Urchin												
<i>S. purpuatus</i> Purple Sea Urchin												
<i>Palmaria minima</i> Bat Star												
<i>Pisaster giganteus</i> Giant Spined Sea Star												
<i>Parastichopus parvimensis</i> Warty Sea Cucumber												
<i>Styela montereyensis</i> Stalked Tunicate												

EXAMPLE

CHANNEL ISLANDS NATIONAL PARK - KELP FOREST MONITORING PROJECT

SUMMARY		QUADRAT DATA SHEET		Quadrat Size	Observer	Partner		
Date	Location	Time In	Time Out	Vis (bottom)	m	Temp (bottom)	m	Surge (ft.)
				Total	Depth			
Random meter number		1	2	3	4	5	6	7
Quadrat number								
<i>Lythrypnus dalli</i> Blue Banded Goby	14025							
<i>Coryphopterus nicholsii</i> Black Eye Goby	14026							
<i>Alloclinus holderi</i> Island Kelp Fish	14027							
<i>Macrocystis pyrifera</i> Giant Kelp	juvenile 2009							
<i>Macrocystis pyrifera</i> Giant Kelp	adult >1m 2002							
<i>Laminaria farinosa</i> Oar Weed	2006							
<i>Eisenia arborea</i> Southern Sea Palm	2004							
<i>Pterygophora californica</i> California Sea Palm	2005							
<i>Astrea undosa</i> Wavy Turban Snail	9007							
<i>Cypraea Spadicea</i> Chestnut Cowry	9005							
<i>Strongylocentrotus franciscanus</i> Red Sea Urchin	11005							
<i>S. purpuroides</i> Purple Sea Urchin	11006							
<i>Patiria miniata</i> Bat Star	11001							
<i>Pisaster giganteus</i> Giant Spined Sea Star	11002							
<i>Parastichopus parvimensis</i> Warty Sea Cucumber	11007							
<i>Syphela montereyensis</i> Stalked Tunicate	12002							

EXAMPLE

CHANNEL ISLANDS NATIONAL PARK - KELP FOREST MONITORING PROJECT

SUMMARY		BAND TRANSECT COUNTS		Transsect Dims	Observer									
Date	Location	Vis (bottom)	Total	m	Temp (bottom)	Surge (ft.)								
Time In	Time Out	Depth	1	2	3	4	5	6	7	8	9	10	11	12
Intersect (m)														
<i>Tethya aurantia</i> Orange pillball sponge														
<i>Leucetta losangeensis</i> White calcareous sponge														
<i>Polymastia pachymastia</i> Aggregated vase sponge														
<i>Allopora californica</i> California hydrocoral														
<i>Tealia lofotensis</i> White-spotted rose anemone														
<i>Lophogorgia chilensis</i> Red gorgonian														
<i>Muricea fructicosa</i> Brown gorgonian														
<i>Megathura crenulata</i> Giant keyhole limpet														
<i>Haliotis rufescens</i> Red abalone														
<i>H. corrugata</i> Pink abalone														
<i>H. fulgens</i> Green abalone														
<i>Kelletia kelletii</i> Kellet's whelk														
<i>Himites giganteus</i> Rock scallop														
<i>Lycettinus anamesus</i> White sea urchin														
<i>Pycnopodia helianthoides</i> Sunflower star														
<i>Aplysia californica</i> California brown sea hare														
<i>Panulirus interruptus</i> California spiny lobster														

EXAMPLE

CHANNEL ISLANDS NATIONAL PARK
Kelp Forest Monitoring Project - Random Point Contact (RPC)

*****SUMMARY*****

Date	Location	Time In	Time Out	Vis (bottom)	m	Temp (bottom)	m	Depth	Observer	Surge (ft.)
SPECIES				QUADRAT #		QUADRAT #		QUADRAT #		QUADRAT #
<i>Macrocystis, Eisenia, Pterygophora</i>										
<i>Laminaria farlowii</i>										
<i>Desmarestia</i> spp.										
<i>Sargassum muticum</i>										
<i>Cystoseira</i> spp.										
Other brown algae										
Articulated corallines										
Encrusting corallines										
<i>Gelidium</i> spp.										
<i>Gigartina</i> spp.										
Other Reds										
Green Algae										
Misc. plants (ex. <i>Phyllospadix</i> , diatoms)										
<i>Astrangia lajollensis</i>										
<i>Balanophyllum elegans</i>										
<i>Cornucalis californica</i>										
<i>Diopatra ornata</i>										
<i>Piragmatopoma californica</i>										
<i>Serpulorbis squamigerus</i>										
<i>Diaperioecia californica</i>										
Byozoans, other										
Tunicates										
Sponges										
Misc. invertebrates										
Bare										
Rock										
Cobble										
Sand										

EXAMPLE

= 10/column

CHANNEL ISLANDS NATIONAL PARK - KELP FOREST MONITORING PROJECT
Visual Fish Survey

Observer _____ Partner _____ Video Operator _____
 Location _____ Vis (bottom) _____ m Surge (bottom) _____ ft.
 Date _____ Time In _____ Time Out _____ Transect (100L x 2W x 3H)

	CODE	1	2	3	4
<i>Chromis punctipinnis</i> BLACKSMITH					
Adult	14001				
Juvenile	14002				
<i>Oxyjulis californica</i> SEÑORITA					
Adult	14003				
Juvenile	14004				
<i>Sebastodes mystinus</i> BLUE ROCKFISH					
Adult	14005				
Juvenile	14006				
<i>Sebastodes serranoides</i> OLIVE ROCKFISH					
Adult	14007				
Juvenile	14008				
<i>Sebastodes atrovirens</i> KELP ROCKFISH					
Adult	14009				
Juvenile	14010				
<i>Paralabrax clathratus</i> KELP BASS					
Adult	14011				
Juvenile	14012				
<i>Semicossyphus pulcher</i> SHEEPHEAD					
Male	14013				
Female	14014				
<i>Embiotoca jacksoni</i> BLACK SURFPERCH					
Adult	14015				
Juvenile	14016				
<i>Embiotoca lateralis</i> STRIPED SURFPERCH					
Adult	14017				
Juvenile	14018				
<i>Damalichthys vacca</i> PILE PERCH					
Adult	14019				
Juvenile	14020				
<i>Hypsypops rubicundus</i> GARIBALDI					
Adult	14021				
Juvenile	14022				
<i>Girella nigricans</i> OPALEYE					
Adult	14023				

EXAMPLE

APPENDIX F. Checklists, Supply Lists, Contacts, and Maintenance Schedule for Oceanic Conditions Recorder (Micrologger)

CHECKLIST #1 - Equipment for Trip

- Recorder(s)
- Tape(s)
- Voltmeter
- I/O connector
- Wrenches (2-3/4 in.)
- Thermometer
- Oil
- Silicone
- Bolts
- Spare O-ring(s)
- Spare batteries
- Spare latches
- Spare case
- Epoxy (5 minute)
- Wire brush
- Checklists and folders for recorders
- Determine which recorders need to come in for servicing, and switch accordingly
- Manual (Micologger Oceanographic Instrumentation Manual)

CHECKLIST #2 - Tape Preparation

Tapes must be checked before taking them into the field. Use the following steps:

- 1) Have on hand
 - a) recorder
 - b) tapes to be checked
 - c) microreader
- 2) Hook microreader to printer with microreader's RS232 cable
- 3) Switch dial on back of microreader to 1200 baud
- 4) Insert tape in microreader
- 5) Press FIND BOT
- 6) Turn recorder on STANDBY, then ON
- 7) Insert tape in recorder
- 8) Press START button. Watch SCAN and RECORD lights flash as tape advances. If not, continue anyway.
You may see "ERROR" at top of printout
- 9) Press CLOCK RESET
- 10) Write test records:
 - a) Set at 5 second measurement interval
 - b) Switch to RUN, SCAN will flash within 5 seconds
 - c) Switch to STANDBY - RECORD will flash and tape will advance
 - d) Repeat once
- 11) Remove tape from recorder
- 12) Insert in microreader and press FIND BOT
- 13) Check that microreader switches are on SINGLE AND FORMATTED
- 14) Turn printer on. In the following steps you should see blocks of data output on the printer. Note that the following is present in the header of the block "GOOD DATA", correct serial #, "TIDE MODE", "000 DAYS", "00 MIN". 1st block = "30 SEC", 2nd block = "30 SEC", "INTERVAL: 5 SEC".
 - a) Press READ on the microreader. The following block of data will print.

GOOD DATA	MOD#	006	S/N	00375	REC#	001	TIDE MODE		
LAST MEASUREMENT:	000	DAYS	00	HRS	00	MIN	15	SEC	
#1	#2	#1	#2	#1	#2	#1	#2	#1	#2
.7480	.0462	.7480	.0462	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

- b) Press READ again. Another block of data will print.

GOOD DATA	MOD#	006	S/N	00375	REC#	002	TIDE MODE		
LAST MEASUREMENT:	000	DAYS	00	HRS	00	MIN	30	SEC	
#1	#2	#1	#2	#1	#2	#1	#2	#1	#2
.7480	.0462	.7477	.0460	.0000	.0000	.0000	.0000	.0000	.0000
.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000

- 15) Press READ again. The green "DRIVE ON" light will remain on and nothing will output on the printer. Press RESET
- 16) Press FIND BOT
- 17) Switch dial on back on microreader to 4800 BAUD
- 18) Erase the tape with magnetic tape eraser. Hold the eraser to the tape with button depressed and pull away
- 19) Tape is now ready for the field

CHECKLIST #3 - Installation of Recorder

DATES _____ S/N of RECORDER _____ EXACT TIME OF CLOCK _____
LOCATION _____ TAPE NUMBER _____ RESET _____

PLEASE DO THE FOLLOWING CHECKS

Steps A, B, C, D, and E can be done before leaving headquarters:

A - DIP SWITCH

- 1) Open top end cap of recorder, slide out inside section to reach circuit board.
- 2) Locate small box with 6 switches. Push switches 1, 2, and 5 down toward numbers.
- 3) Slide section back in.
- 4) Check above to indicate that this step is completed.

B - BATTERY VOLTAGE

- 1) Voltmeter: Plug in black and red cords, switch top knob to 20, switch bottom knob to DC, turn power on.
- 2) On top panel, switch recorder to STANDBY, power ON.
- 3) Locate I/O port on top panel of recorder, plug connector in.
- 4) Clip brown wire to red probe, black wire to black probe. Connect to voltmeter.
- 5) Reading should be 8.7 or greater. If not, change battery pack.
- 6) Press START button, switch from STANDBY to RUN, watch for SCAN light to flash and at same time watch voltage reading. If voltage drops by 5 or more volts, change battery pack. Switch to STANDBY.
- 7) Record voltage above.

C - PRESSURE FITTINGS

- 1) Place recorder bottom end up.
- 2) Unscrew pressure fitting.
- 3) Fill with oil to level with surface.
- 4) Screw fitting back in, tighten half turn past snug. Wipe excess oil off.
- 5) Check off this step.

D - CASE INSPECTION

- 1) Inspect case for cracks and gouges
- 2) Check end cap latches for corroded or loose pins, screws, and latches. Light rust coating OK. Replace latches, if questionable.

E - O-RINGS

- 1) O-rings on top end cap need to be replaced every 6 months
- 2) Indicated on RECORDER SCHEDULE in folder for recorder if o-rings have been changed.

Continue other side

F - TAPE CHECK

- 1) Check tested tape has foil showing through window
- 2) Switch recorder to STANDBY. Turn power ON.
- 3) Watch for flash of SCAN-light.
- 4) Load cassette into slot (label side toward interval setting).
- 5) Press START button. SCAN light should flash, then record light as tape advances. If RECORD light does not flash, continue anyway. Check #5.
- 6) Write test records:
 - (a) Set 5 second scanning interval.
 - (b) Switch to RUN, SCAN will flash and tape will advance.
 - (c) Switch to STANDBY, RECORD will flash and tape will advance.
 - (d) Repeat step 6. Check #6.
- 7) Set measurement interval to 60 Min. Check #7.
- 8) Press RESET CLOCK and record exact time of clock reset above. Check #8.
- 9) Switch from STANDBY to RUN. Check #9.
- 10) Check off this step.

G - CLOSING-UP

- 1) Make sure surface of top end cap o-ring is free of dirt.
- 2) Apply small amount of silicone grease to o-ring surfaces.
- 3) Line up latches, press end cap into place, fasten latches.
- 4) Check off this step.

PLEASE READ CHECKLIST #4 BEFORE GOING IN WATER

CHECKLIST #4 - Removal of Recorder

LOCATION _____ SERIAL NUMBER OF RECORDER _____ DATE _____

TIME OF REMOVAL _____ TEMPERATURE AT REMOVAL _____ TIME POWER OFF _____

CONDUCT THE FOLLOWING CHECKS

- 1) Prepare recorder to be installed by filling out checklist #3.
- 2) Bring in goody bag on dive:
 - a) 2-3/4 in. box/open wrenches
 - b) wire brush
 - c) thermometer
 - d) extra nuts

Read next step before going in water

- 3) Removal of recorder:
 - a) loosen nuts with 2 wrenches and unscrew
 - b) remove top PVC lid
 - c) remove recorder
 - d) check inside of case and holes for barnacles and algae (scrub off with wire brush if necessary)
 - e) install new recorder and replace lid and nuts
 - f) take temperature reading
- 4) Back on boat:
 - a) record time of removal and temperature at top of form
 - b) open recorder lid
 - c) switch to STANDBY - RECORD light should flash as tape advances
 - d) remove tape and mark with location and date

CHECKLIST #5 - Maintenance

DATE _____

PLEASE DO THE FOLLOWING

ANNUAL SERVICING

- 1) Recorders brought in should be sent off for servicing
- 2) Box up recorders in original boxes, then in a larger box and send via UPS to:
Terminal Technicians
San Luis Obispo, CA 93401
- 3) Record date sent in folder for recorder.

SCHEDULING

- 1) Tentatively schedule trips for next quarter
- 2) Attend boat meeting for proper month

EQUIPMENT CHECK

- 1) Check equipment inventory and annual supplies and order equipment and supplies as needed.
- 2) If fall quarter, order annual supplies needed

SERVICING SCHEDULE

LOCATION

QTR	YEAR	SCIFH	SMIHR	SRIJLNO	SCIGISO	SBIAR	ANILC	SERV.
Win								
Spr								
Sum								
Fall								

RECORDER MAINTENANCE SCHEDULE

Please fill in information on each category for each recorder. This sheet should be in the front of each recorder folder. Please note any problems with recorders.

Recorder S/N _____ O-rings replaced _____

EQUIPMENT, SUPPLIES, AND CONTACTS FOR OCEANOGRAPHIC MONITORING.

EQUIPMENT INVENTORY

Item	Serial Number	Property Number
Sea Data TDR-2A Recorder	334	45414
Sea Data TDR-2A Recorder	336	45416
Sea Data TDR-2A Recorder	337	45417
Sea Data TDR-2A Recorder	338	45418
Sea Data TDR-2A Recorder	339	45419
Sea Data TDR-2A Recorder	375	45437
Sea Data TDR-2A Recorder	378	45438
Sea Data TDR-2A Recorder	410	45415
Sea Data Microreader	036	45420
Micronota Voltmeter		
Realistic Magnetic Eraser		
Pelican Box		
Thermometer (Forestry Suppliers)		
Wrenches (2-3/4 in. box/open)		
Dive Gear (yellow tape)		
Backpack		
Gauges/Regulator		

ANNUAL SUPPLIES

ITEM	COST (8-85)	COMPANY*
Recorder batteries	\$35	Sea Data
Recorder fasteners (latches)	\$25/4	Sea Data
Recorder tapes	\$10	Sea Data
Anti-fouling paint (with tributyl tin fluoride)	\$20/qt.	Beacon Marine
O-rings (pg 41 of Micrologger Manual) endcap, small = Buna-N, Size 241 endcap, large = Buna-N, Size 245	\$15/50	McMaster-Carr
Computer Diskettes	\$14/10	See Procurement
Cases (materials needed) PVC pipe schedule 40, 6 in. diameter Flanges schedule 80, for 6 in. pipe PVC sheet 1/4 in. thick Epoxy 2-part, 5 min.	\$4/ft. \$20 each \$45/sq. ft. \$3	Aqua Flo Aqua Flo McMaster-Carr LP Home Center
Mooring materials Threaded rods 18-8 stainless steel, 1/2 in., course thread, 3 ft. length Finished, full nuts 18-8 stainless steel, 1/2 in., course thread	\$7 each \$12/100	McMaster-Carr McMaster-Carr
Epoxy "Semkit" Cartridges with sikastix 370 sikdur hi-bod epoxy, 6 oz.	\$8 each	Semko Division Products

*see project contacts

PROJECT CONTACTS

CONTACTS FOR MICROLOGGER SUPPLIES, EQUIPMENT, AND SERVICE

Company	Address	Contact	Service
Sea Data Corp	1Bridge Street Newton, MA 02158 (617)244-8191	Jeff Smith Patty	Technician Acocunting
Terminal Technicians	843 Via Esteban San Luis Obispo, CA93401 (805)541-5941	Ken Slusser Lenore	Recorder Service Sales
McMaster Carr Supply	PO Box 54960 Los Angeles, CA 90054 (213)692-5911		Various parts supplier
Aqua Flo Supply	1940 E. Ojai Ave. Ojai, CA 93023 (805)646-7244		PVC pipe supplier
Semko Division Prod.	5454 San Fernando Rd. Glendale, CA 91209 (213)247-7140		Underwater epoxy supplier
infoMax Computer Sys.	2956-H Treat Blvd. Concord, CA 94518 (415)689-2331	Sally Schag	Computer hardware
Software Centre	4020 E. Main Street Ventura, CA 93009	Paul	Computer software

APPENDIX G. Data Base Conversion Programs

{ System name : QREPORT.PRO

Date : 18 August 1987

Author : David Forcucci

Discussion : This program accesses the Dbase file quadyear.dbf and translates it to an SPSS system file. It assigns the species codes and station codes a name, and generates a report as 1 X 1 m quadrat means by station by species by year. }

translate from = 'QUADYEAR.dbf'.

value labels / species

2002 'M. PYRIFERA ADULT'
2004 'EISENIA ARBOREA'
2005 'PIERYGOPHORA'
2006 'LAMINARIA FARLOWII'
2009 'M. PYRIFERA JUVENILE'
2010 'M. PYRIFERA ALL'
9005 'CYPRAEA SPADICEA'
9007 'ASTRAEA UNDOSA'
11001 'PATIRIA MINIATA'
11002 'PISASTER GIGANTEUS'
11004 'LYTECHINUS ANAMESUS'
11005 'S. FRANCISCANUS'
11006 'S. PURPURATUS'
11007 'PARASTICHOPUS PARVIMENSIS'
12002 'STYELA MONTEREYENSIS'
14025 'LYTHRYPNUS DALLI'
14026 'CORYPHOPTERUS NICHOLSONII'
14027 'ALLOCLINUS HOLDERI'.

VALUE LABELS /LOCATION

1 'S M I WYCKOFF LEDGE'
2 'S M I HARE ROCK'
3 'S R I JOHNSONS LEE NORTH'
4 'S R I JOHNSONS LEE SOUTH'
5 'S R I RODES REEF'
6 'S C I GULL ISLAND SOUTH'
7 'S C I FRY'S HARBOR'
8 'S C I PELICAN BAY'
9 'S C I SCORPION ANCHORAGE'
10 'S C I YELLOW BANKS'
11 'A N I ADMIRALS REEF'
12 'A N I CATHEDRAL COVE'
13 'A N I LANDING COVE'
14 'S B I SOUTHEAST SEALION'
15 'S B I ARCH POINT'
16 'S B I CAT CANYON'.

COMPUTE KOUNT = COUNT/2.

IF (YEAR >= 82 AND YEAR <= 84) KOUNT = COUNT .

```
SET LISTING = 'QREPORT.RSL'/LENGTH=56/WIDTH=79.  
SET LISTING = 'SPSS.LIS'.  
SET LISTING = 'QREPORT.RSL'/LENGTH=56/WIDTH=79/eject=on.
```

```
MEANS TABLES = KOUNT BY SPECIES BY LOCATION BY YEAR.
```

{Program name: bdtrcalc.pro

Date: September 13, 1987

Author: John Trone

Notes: Use this program when running SPSS to access and translate the band transect database file btranall.dbf. With slight modification, it can also convert any other band transect database from DBase III. This program assigns the location and species codes from the DBase III band transect file a name and initiates calculation of summary statistics for the SPSS report.}

translate from='c:\bandtran\btranall.dbf'/map.

set beep=off.

value labels/ species

06001 'ALLOPORA CALIFORNICA'
09011 'APLYSIA CALIFORNICA'
09003 'HALIOTIS CORRUGATA'
09004 'HALIOTIS FULGENS'
09002 'HALIOTIS RUFESCENS'
09010 'HINNITES GIGANTEUS'
09006 'KELLETTIA KELLETII'
06006 'LOPHOGORGIA CHILENSIS'
11004 'LYTECHINUS ANAMESUS'
09009 'MEGATHURA CRENULATA'
06008 'MURICEA CALIFORNICA'
06007 'MURICEA FRUTICOSA'
08001 'PANULIRUS INTERRUPTUS'
11003 'PYCNOPODIA HELIANTHOIDES'
06002 'TEALIA LOFOTENSIS'
05002 'TEHYA AURANTIA'.

VALUE LABELS /LOC

1 'SMI WYCKOFF LEDGE'
2 'SMI HARE ROCK'
3 'SRI JOHNSONS LEE NORTH'
4 'SRI JOHNSONS LEE SOUTH'
5 'SRI RODES REEF'
6 'SCI GULL ISLAND SOUTH'
7 'SCI FRY'S HARBOR'
8 'SCI PELICAN BAY'
9 'SCI SCORPION ANCHORAGE'
10 'SCI YELLOWBANKS'
11 'ANI ADMIRALS REEF'
12 'ANI CATHEDRAL COVE'
13 'ANI LANDING COVE'
14 'SBI SOUTHEAST SEA LION'
15 'SBI ARCH POINT'
16 'SBI CAT CANYON'.

compute kount=count/60.

set listing= 'btran.rsl'/length=59/width=79.

set listing='spss.lis'.

set listing='btran.rsl'/length=59/width=79/eject=on.

means tables = kount by species by loc by year.

(Program name: rpocalc.pro

Date: September 13, 1987

Author: John Trone

Notes: Use this program when running SPSS to access and translate the random point contact database file rpcall.dbf from DBase III. With slight modification, it may also be used to translate other RPC files from DBase III. This program assigns location and species labels to the codes found in the DBase III program. It also performs a calculation for percent cover based on number of points sampled per quadrat per year. Last, it performs calculation of mean percent cover for RPC species for the SPSS summary report.}

translate from='c:\rpc\rpcall.dbf'/map.

```
set beep=off.  
value labels/ species  
02008 'MACRO., EISENIA, PTERY.'  
02006 'LAMINARIA FARLOWII'  
02003 'DESMARESTIA SPP.'  
02007 'CYSTOSEIRA SPP.'  
02001 'MISC. BROWN ALGAE'  
03002 'ARTICULATED CORALLINE ALGAE'  
03003 'CRUSTOSE CORALLINE ALGAE'  
03004 'GELIDIUM SPP.'  
03005 'GIGARTINA SPP.'  
03001 'MISC. RED ALGAE'  
01001 'GREEN ALGAE'  
04001 'MISC. PLANTS'  
06005 'ASTRANGIA LAJOLLAENSIS'  
06004 'BALANOPHYLLIA ELEGANS'  
06003 'CORYNACTIS CALIFORNICA'  
07001 'DIOPATRA ORNATA'  
07002 'PHRAGMATOPOMA CALIFORNICA'  
09001 'SERPULORBIS SQUAMIGERUS'  
10002 'DIAPEROECIA CALIFORNICA'  
10001 'BRYOZOANS, OTHER'  
12001 'TUNICATES'  
05001 'SPONGES'  
13001 'MISCELLANEOUS INVERTEBRATES'  
02011 'SARGASSUM SP.'  
07003 'SPIROBRANCHUS'  
06009 'HYDROIDS'  
08002 'BALANUS'  
05003 'LEUCETTA LOSANGELENSIS'  
05004 'POLYMASTIA PACHYMASTIA'  
11008 'PACHYTHYONE RUBRA'  
15001 'BARE SUBSTRATE'  
15002 'ROCK'  
15003 'COBBLE'  
15004 'SAND'.
```

VALUE LABELS /LOC
1 'SMI WYCKOFF LEDGE'
2 'SMI HARE ROCK'
3 'SRI JOHNSONS LEE NORTH'
4 'SRI JOHNSONS LEE SOUTH'
5 'SRI RODES REEF'
6 'SCI GULL ISLAND SOUTH'
7 'SCI FRY'S HARBOR'
8 'SCI PELICAN BAY'
9 'SCI SCORPION ANCHORAGE'
10 'SCI YELLOWBANKS'
11 'ANI ADMIRALS REEF'
12 'ANI CATHEDRAL COVE'
13 'ANI LANDING COVE'
14 'SBI SOUTHEAST SEA LION'
15 'SBI ARCH POINT'
16 'SBI CAT CANYON'.

compute pctcover = count/40*100.
if (year = 84) pctcover = count/50*100.
if (year = 83) pctcover = count/10*100.
if (year = 82) pctcover = count/20*100.
set listing= 'rpc.rsl'/length=59/width=79.
set listing= 'spss.lis'.
set listing= 'rpc.rsl'/length=59/width=79/eject=on.
means tables = pctcover by species by loc by year.

{ System name : FSPERPT.PRO

Date : 18 August 1987

Author : David Forcucci

Discussion : This program accesses the Dbase file FISHYEAR.dbf and translates it to an SPSS system file. It assigns the species codes and station codes a name, and generates a report with means by species by station by year. }

translate from = 'FISHYEAR.dbf'.

value labels / species

14001 'CHROMIS ADULT'
14002 'CHROMIS JUV.'
14003 'OXYJULIS ADULT'
14004 'OXYJULIS JUV.'
14005 'S. MYSTINUS ADULT'
14006 'S. MYSTINUS JUV.'
14007 'S. SERRANOIDES ADULT'
14008 'S. SERRANOIDES JUV.'
14009 'S. ATROVIRENS ADULT'
14010 'S. ATROVIRENS JUV.'
14011 'PARALABRAX CL. ADULT'
14012 'PARALABRAX CL. JUV.'
14013 'SEMICOSSYPHUS MALE'
14014 'SEMICOSSYPHUS FEMALE'
14015 'EMBIOTOMA JACKSONI ADULT'
14016 'EMBIOTOMA JACKSONI JUV.'
14017 'EMBIOTOMA LATERALIS ADULT'
14018 'EMBIOTOMA LATERALIS JUV.'
14019 'DAMALICHTHYS ADULT'
14020 'DAMALICHTHYS JUV.'
14021 'HYPSEPOPS ADULT'
14022 'HYPSEPOPS JUV.'
14023 'GIRELLA ADULT'
14024 'GIRELLA JUV.'.

VALUE LABELS / LOCATION

1 'S M I WYCKOFF LEDGE'
2 'S M I HARE ROCK'
3 'S R I JOHNSONS LEE NORTH'
4 'S R I JOHNSONS LEE SOUTH'
5 'S R I RODES REEF'
6 'S C I GULL ISLAND SOUTH'
7 'S C I FRY'S HARBOR'
8 'S C I PELICAN BAY'
9 'S C I SCORPION ANCHORAGE'
10 'S C I YELLOW BANKS'
11 'A N I ADMIRALS REEF'
12 'A N I CATHEDRAL COVE'
13 'A N I LANDING COVE'
14 'S B I SOUTHEAST SEALION'

15 'S B I ARCH POINT'
16 'S B I CAT CANYON'.

SET LISTING = 'FSPERPT.RSL'/LENGTH=56/WIDTH=79.
SET LISTING = 'SPSS.LIS'.
SET LISTING = 'FSPERPT.RSL'/LENGTH=56/WIDTH=79/eject=on.

MEANS TABLES = COUNT BY SPECIES BY LOCATION BY DATE.

{ System name : FISHGROP.PRO
Date : 14 OCTOBER 1987
Author : David Forcucci
Discussion : This program uses the translated fish data base file and groups the juvenile and adult fish counts for each species into one group. It computes the group from the species codes and aggregates the cases for juvenile and adult counts into one group "all". }

COMPUTE GROUP = 1.
IF (SPECIES >=14003 AND SPECIES <= 14004 GROUP = 2.
IF (SPECIES >=14005 AND SPECIES <= 14006 GROUP = 3.
IF (SPECIES >=14007 AND SPECIES <= 14008 GROUP = 4.
IF (SPECIES >=14009 AND SPECIES <= 14010 GROUP = 5.
IF (SPECIES >=14011 AND SPECIES <= 14012 GROUP = 6.
IF (SPECIES >=14013 AND SPECIES <= 14014 GROUP = 7.
IF (SPECIES >=14015 AND SPECIES <= 14016 GROUP = 8.
IF (SPECIES >=14017 AND SPECIES <= 14018 GROUP = 9.
IF (SPECIES >=14019 AND SPECIES <= 14020 GROUP = 10.
IF (SPECIES >=14021 AND SPECIES <= 14022 GROUP = 11.
IF (SPECIES >=14023 AND SPECIES <= 14024 GROUP = 12.
FORMATS GROUP (F2.0.

SORT BY GROUP LOCATION DATE TRANSECT.

AGGREGATE OUTFILE= *
/BREAK = GROUP LOCATION DATE TRANSECT
/KOUNT = SUM (COUNT.

{ System name : FGDATE.PRO
Date : 18 August 1987
Author : David Forcucci
Discussion : This program accesses the SPSS system file FISHYEAR.SF and generates a report of means by group by station by date.)

GET FILE = 'FISHYEAR.SF'.

VALUE LABELS /LOCATION
1 'S M I WYCKOFF LEDGE'
2 'S M I HARE ROCK'
3 'S R I JOHNSONS LEE NORTH'
4 'S R I JOHNSONS LEE SOUTH'
5 'S R I RODES REEF'
6 'S C I GULL ISLAND SOUTH'
7 'S C I FRY'S HARBOR'
8 'S C I PELICAN BAY'
9 'S C I SCORPION ANCHORAGE'
10 'S C I YELLOW BANKS'
11 'A N I ADMIRALS REEF'
12 'A N I CATHEDRAL COVE'
13 'A N I LANDING COVE'
14 'S B I SOUTHEAST SEALION'
15 'S B I ARCH POINT'
16 'S B I CAT CANYON'.

VALUE LABELS /GROUP
1 'CHROMIS ALL'
2 'OXYJULIS ALL'
3 'S. MYSTINUS ALL'
4 'S. SERRANOIDES ALL'
5 'S. ATROVIRENS ALL'
6 'PARALABRAX CL. ALL'
7 'SEMICOSSYPHUS ALL'
8 'E. JACKSONI ALL'
9 'E. LATERALIS ALL'
10 'DAMALICHTHYS ALL'
11 'HYPSYPOPS ALL'
12 'GIRELLA ALL'.

SET LISTING = 'FGDATE.RSL'/LENGTH=56/WIDTH=79.
SET LISTING = 'SPSS.LIS'.
SET LISTING = 'FGDATE.RSL'/LENGTH=56/WIDTH=79/eject=on.

MEANS TABLES = KOUNT BY GROUP BY LOCATION BY DATE.

{ System name : FGRYEAR.PRO

Date : 18 August 1987

Author : David Forcucci

Discussion : This program accesses the SPSS system file FISHYEAR.SF and generates a report of means by group by station by year.)

GET FILE = 'FISHYEAR.SF'.

VALUE LABELS /LOCATION

- 1 'S M I WYCKOFF LEDGE'
- 2 'S M I HARE ROCK'
- 3 'S R I JOHNSONS LEE NORTH'
- 4 'S R I JOHNSONS LEE SOUTH'
- 5 'S R I RODES REEF'
- 6 'S C I GULL ISLAND SOUTH'
- 7 'S C I FRY'S HARBOR'
- 8 'S C I PELICAN BAY'
- 9 'S C I SCORPION ANCHORAGE'
- 10 'S C I YELLOW BANKS'
- 11 'A N I ADMIRALS REEF'
- 12 'A N I CATHEDRAL COVE'
- 13 'A N I LANDING COVE'
- 14 'S B I SOUTHEAST SEALION'
- 15 'S B I ARCH POINT'
- 16 'S B I CAT CANYON'.

VALUE LABELS /GROUP

- 1 'CHROMIS ALL'
- 2 'OXYJULIS ALL'
- 3 'S. MYSTINUS ALL'
- 4 'S. SERRANOIDES ALL'
- 5 'S. ATROVIRENS ALL'
- 6 'PARALABRAX CL. ALL'
- 7 'SEMICOSSYPHUS ALL'
- 8 'E. JACKSONI ALL'
- 9 'E. LATERALIS ALL'
- 10 'DAMALICHTHYS ALL'
- 11 'HYPSYPOPS ALL'
- 12 'GIRELLA ALL'.

SET LISTING = 'FGRYEAR.RSL'/LENGTH=56/WIDTH=79.

SET LISTING = 'SPSS.LIS'.

SET LISTING = 'FGRYEAR.RSL'/LENGTH=56/WIDTH=79/eject=on.

COMPUTE YEAR = TRUNC (DATE/10000).

FORMATS YEAR (F2.0).

MEANS TABLES = KOUNT BY GROUP BY LOCATION BY YEAR.

```
{ System name : FREQHIST.PRO
Date       : 20 OCTOBER 1987
Author     : David Forcucci
Discussion : This program clears the file sreport.pro and generates
             size frequency histograms for all species at the selected
             location. }

set listing = 'sreport.pro'/length=56/width=79.
set listing = 'spss.lis'/length=56/width=79.
set listing = 'sreport.pro'/length=56/width=79/eject=on.

process if (species= 5002).
list /cases = to 1.

process if (species= 5002).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9002).
list /cases = to 1.

process if (species= 9002).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9003).
list /cases = to 1.

process if (species= 9003).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9004).
list /cases = to 1.

process if (species= 9004).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9005).
list /cases = to 1.
```

```
process if (species= 9005).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9006).
list /cases = to 1.

process if (species= 9006).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9007).
list /cases = to 1.

process if (species= 9007).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9008).
list /cases = to 1.

process if (species= 9008).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9009).
list /cases = to 1.

process if (species= 9009).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 9010).
list /cases = to 1.

process if (species= 9010).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11001).
list /cases = to 1.

process if (species= 11001).
```

```
process if (species= 11001).
list /cases = to 1.

process if (species= 11001).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11002).
list /cases = to 1.

process if (species= 11002).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11003).
list /cases = to 1.

process if (species= 11003).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11004).
list /cases = to 1.

process if (species= 11004).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11005).
list /cases = to 1.

process if (species= 11005).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11006).
list /cases = to 1.

process if (species= 11006).
frequencies var = size_mm
/format = notable
/stats = all
/hist = percent = increment (4).

process if (species= 11007).
list /cases = to 1.

process if (species= 11007).
```

```
frequencies var = size_mm  
/format = notable  
/stats = all  
/hist = percent = increment (4).
```

TABLE OF CONTENTS

	page
INTRODUCTION	1
MONITORING DESIGN CONSIDERATIONS	1
Species Selection	1
Site Selection	2
Sampling Technique Selection	2
MONITORING PROTOCOL	6
SAMPLING METHODS	6
Quadrats	6
Band Transects	8
Random Point Contact Quadrats	9
Visual Fish Transects	11
Video-taped Transects	12
Photogrammetric Plots	15
Species Checklist	18
Oceanographic Conditions	19
DATA MANAGEMENT	22
Quadrat Data	22
Band Transects	25
Random Point Contact Data	29
Visual Fish Transect	29
Size Frequency Data	32
Photogrammetric Plots	33
Oceanographic Conditions	33
LITERATURE CITED	34
APPENDICES	
A Summary of Kelp Forest Population Parameters Monitored	A - 1
B Procedures for Establishing Underwater Transects	B - 1
C Species Codes and Checklist	C - 1
D Logistical Considerations	D - 1
E Field Data Sheets	E - 1
F Checklists, Supplies, Contacts, and Maintenance Schedule for Oceanic Conditions Recorder	F - 1
G Data Base Conversion Programs	G - 1
TABLES	
Table 1. Description of Kelp Forest Monitoring Sites	4
Table 2. Summary of Sampling Techniques Used to Monitor Population Dynamics of Selected Kelp Forest Organisms	6
Table 3. Annual Schedule of Hydrothermograph Maintenance	20

FIGURES

	page
Figure 1. Kelp Forest Monitoring Locations	3
Figure 2. Placement of Quadrats on Lead Line	6
Figure 3. Band Transect Sampling Procedure	8
Figure 4. Orientation of Random Point Contact Bar and String During Sampling	9
Figure 5. Area Covered for 100 m Visual Fish Counts	11
Figure 6. Diagram of Photoplots	17

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