Pacific Gas and Electric Company

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September 30, 2000

PG&E Letter DCL-2000-558

Mr. Roger Briggs, Executive Officer
Central Coast Regional Water
Quality Control Board (CCRWQCB)
81 Higuera Street, Suite 200
San Luis Obispo, CA 93401-3147

Re: PG&E Diablo Canyon Submittal -

Receiving Water Monitoring Program 1999 Annual Report

Dear Mr. Briggs:

PG&E is hereby submitting the Diablo Canyon Power Plant Receiving Water Monitoring Program 1999 Annual Report. This report presents the physical and biological data collected in 1999. The report fulfills the requirements contained in the following:

- Letter from the Central Coast Regional Water Quality Control Board (CCRWQCB), dated December 9, 1998 that specifies modifications to the DCPP Receiving Water Monitoring Program.
- Letter DCL 99-503 addressed to Mr. Briggs of the CCRWQCB, dated January 8, 1999, documenting and clarifying the modified Receiving Water Monitoring Program.

A draft of this report entitled Draft Diablo Canyon Power Plant Receiving Water Monitoring Program 1999 Annual Report, was submitted April 30, 2000 for review and comment by the CCRWQCB staff and their scientists. Comments were provided via e-mail by the CCRWQCB staff to PG&E on May 30, 2000. A meeting was held with the CCRWQCB consultants on August 2, 2000 to review and resolve comments received on the draft report. Resolved comments have been incorporated into this final version of the 1999 annual report.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, I certify that the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

David H. Oatley

2000558/AMJ/kmo
Enclosure

IE25

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Diablo Canyon Power Plant

Receiving Water Monitoring Program: 1999 Annual Report

September 28, 2000

Prepared for:
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SUMMARY

Physical and biological characteristics of the Pacific Gas & Electric Company (PG&E) Diablo Canyon Power Plant (DCPP) discharge receiving waters were monitored from January 1999 through December 1999 under Monitoring and Reporting Program 90-09 revised by the Central Coast Regional Water Quality Control Board (CCRWQCB) in February 1995. Comprehensive reports on the effects of the discharge on the marine environment have been previously submitted to the Board (Tenera 1997, Tenera 1999a, and Tenera 1999b). This report identifies new or continuing effects of the DCPP discharge on nearshore marine communities by qualitatively comparing the results from 1999 with results from the 1995–1998 study period in the most recent progress report (Tenera 1999b). These comparisons were made using graphical analyses of community composition and individual taxa, and multivariate analysis of community change. This report also contains the results of several special studies conducted during 1999.

The Receiving Water Monitoring Program (RWMP) was reviewed by the CCRWQCB staff and their consultants in 1998, and as a result, several changes to the program were made and implemented in early 1999. The changes primarily consisted of expanding the frequency of sampling for the biological tasks from two times per year to four times, adding some stations to each study, and eliminating the separate studies for black and red abalone and dissolved oxygen. Although specific studies for black and red abalone were eliminated from the program, abalone continued to be sampled as part of the intertidal horizontal band transect and subtidal benthic studies.

Seawater Temperatures

As part of the Receiving Water Monitoring Program (RWMP) we collected data on ambient seawater temperatures during 1999 to describe natural variability. The oceanographic conditions in 1999 produced the coldest mean annual ambient seawater temperatures since plant operation began. The cooler seawater temperatures were partially the result of strong northwesterly winds that persisted from March through July. The winds resulted in upwelling of cooler deeper seawater to the surface along the coast, producing ideal conditions for the growth of kelp and other marine algae. The cool water temperatures during 1999 were a continuation of La Niña

conditions that began during the later portion of 1998. Cooler La Niña conditions commonly follow warm water El Niño conditions associated with the El Niño Southern Oscillation (ENSO).

The temperature of the DCPP cooling water discharge varies with ambient intake temperature, electrical generation heat load, condenser cooling efficiency, and other operating conditions of the power plant. Although these factors caused variation in absolute seawater temperature at the point of discharge, discharge delta-T° values (difference from ambient measured at the intake) remained relatively steady over the year at about 11°C (≈20°F). Average annual delta-T° has increased approximately 1.0–2.0°C since plant operations began. Corrective maintenance to plant equipment in spring 1994 stabilized delta-T°, but since 1996 the delta-T° has increased to levels observed prior to 1994.

Monthly mean intertidal and shallow subtidal seawater temperatures at North and South Diablo Cove, and South Diablo Point stations were elevated due to the discharge during 1999. Temperature increases due to the discharge detected at South Diablo Point and Field's Cove stations were less than temperatures recorded in Diablo Cove. The frequency and magnitude of delta-T° values at both the intertidal and subtidal stations in North Diablo Cove increased during 1999 from previous years of operation. This may have been caused by the extensive canopy of giant kelp in the north channel of Diablo Cove that restricted flow out of the channel and increased the residence time of the plume in North Diablo Cove. As was typical of most years of plant operation, monthly mean delta-T° values in South Diablo Cove were greater than the values in North Diablo Cove during the winter and early spring months when strong northwesterly winds may move the surface plume into South Diablo Cove. Results from deeper (-8 m and -10 m) subtidal stations in Diablo Cove show that plume contact is intermittent at these depths.

Additional temperature monitoring was conducted at 13 intertidal and 6 subtidal temperature recorders in Field's Cove starting in summer 1997. The purpose of the additional intertidal monitoring was to provide more complete documentation on the extent and magnitude of delta-T° north of Diablo Cove. The subtidal recorders were used to collect data that was to be used in verification of a model of the dispersion of the plume in Field's Cove. Results for the subtidal data are only presented in the appendices as daily mean temperatures because large gaps in the data records made analysis and comparison of results among stations difficult. Results for the intertidal stations showed that average delta-°T was less than 1.0°C throughout Field's Cove. The maximum average delta-°T and maximum temperatures occurred in the most protected area of

Field's Cove. This area of Field's Cove is shallow and less subject to wave-generated turbulence. These factors may result in ambient conditions that are naturally warmer than the control station temperatures. Average delta-°T values were lower in the northern parts of Field's Cove that are furthest from Diablo Cove and more exposed to winds and waves.

Biological Studies

We collected and analyzed data to compare the abundances of intertidal and subtidal algae, invertebrates, and fishes in discharge and control areas. The sampling methods used for the RWMP were identical to those used since the studies first began in 1976. An array of stations inside and outside Diablo Cove were sampled during the 1999 study period.

Intertidal Algae

Effects of the discharge on the algal communities in Diablo and Field's Coves continued during 1999. Algal abundances remain low in Diablo Cove compared to pre-operational levels and to areas outside the influence of the discharge. Several of the same species that have declined in Diablo Cove have also declined at South Diablo Point, which was not sampled between 1995 and 1999. Total algal cover, which was slowly declining at the South Diablo Point stations prior to 1995 during plant operation, has continued to decline during the period of time the stations were not sampled and is now at the lowest levels recorded at those stations.

Discharge effects in Field's Cove for certain temperature sensitive species were more variable with decreases in *Mazzaella flaccida*, variable patterns among stations for the rockweed *Pelvetia* (=*Silvetia*) *compressa*, and increases in the feather boa kelp (*Egregia menziesii*). Dense stands of temperature-sensitive oar kelp (*Laminaria setchellii*) were also observed emerging above the water line at low tide in all areas fringing the southern shore of Field's Cove. These results indicate that Field's Cove represents an area with much reduced discharge effects compared to Diablo Cove.

Intertidal Invertebrates

The intertidal invertebrate communities monitored were variable within and among areas in 1999 relative to previous years. In general, the intertidal invertebrate community of Diablo Cove

continued to be characterized by large populations of grazing limpets, filter feeding barnacles, and patchy areas of purple urchins, relative to control sites. Multivariate analysis showed community composition in Field's Cove was more similar to control areas for the upper tidal elevation transects and more similar to Diablo Cove at the lower tidal elevation. Abundances of species varied substantially between all three areas. Community composition at South Diablo Point has always differed substantially from the other areas because it is exposed to much greater wave action. Changes at South Diablo Point following power plant start-up were characterized by large increases in several invertebrate species including *Mytilus californianus* (California mussel), *Strongylocentrotus purpuratus* (purple sea urchins), *Tetraclita rubescens* (volcano barnacle), and *Anthopleura elegantissima* (aggregating anemone). These species have colonized much of the bare space available in the area that has occurred with the decline in foliose algae. This bare space may be maintained by the abundant sea urchins.

Intertidal Fishes

Two new control stations north and south of Diablo Cove were established during 1999. Fish abundance and diversity at these stations were high relative to the Diablo Cove and Field's Cove stations. Whereas total fish abundance at the Field's Cove station increased in 1999 relative to the previous period, abundances continued to decline in Diablo Cove. A total of 3 fish were observed during four surveys at the North Diablo Cove station. The diversity of taxa at the South Diablo Cove station has also declined from previous periods. Although, the majority of the fishes observed at the station have been juvenile *Xiphister* spp. (pricklebacks) larger individuals of these have not increased at the two Diablo Cove stations despite continued recruitment into the cove.

Subtidal Algae

Changes in the subtidal algal community in Diablo Cove that occurred following power plant start-up continued during 1999, including further increases in giant kelp. Giant kelp increased in 1999 to the highest levels of abundance recorded in the study. The large increase resulted from oceanographic conditions that were favorable to its growth. Documented increases in giant kelp in southern California in 1999 were associated with cooler seawater temperatures and abundant nutrients due to upwelling. Oceanographic conditions also resulted in large increases in the abundances of both giant and bull kelp outside Diablo Cove. Increases in subcanopy kelps

(*Pterygophora californica* and *Laminaria setchelli*) also occurred at the Field's Cove and South Control stations during 1999. Kelp populations in these areas have historically consisted of surface bull kelp and these two subcanopy species. Similar increases were not observed at the Diablo Cove stations. These subcanopy kelps have not been tolerant of the warmer seawater temperatures in the shallow portions of Diablo Cove and have declined at these stations during power plant operation. Many of the changes in other benthic algal taxa in Diablo Cove were likely influenced by continuing changes in the surface kelp canopy.

Subtidal Invertebrates

Invertebrate assemblages and individual taxa at subtidal stations in Diablo Cove showed continuing changes due to the discharge during 1999. Most notably, several species of marine snails continued to decrease and purple sea urchins continued to increase. In contrast to Diablo Cove, abundances of most invertebrate taxa remained unchanged at the Field's Cove and control area stations. Although a few taxa in Field's Cove had changes in abundance that paralleled the patterns of change observed for those species in Diablo Cove, other taxa that have declined in Diablo Cove (e.g. *Tegula brunnea*, brown turban snail) have increased in Field's Cove. These results indicate that discharge effects in Field's Cove are much reduced in magnitude from effects observed in Diablo Cove.

Subtidal Fishes

Subtidal fish observation results for 1999 generally reflect a continuation of the same patterns described from previous periods of power plant operation. *Oxyjulis californica* (señorita) continued to be the numerical dominant in nearly all areas. Warm-temperate species remained common in North Diablo Cove, but occurred in limited abundance elsewhere in the vicinity of DCPP. New fish transects in Field's Cove were sampled for the first time in 1999, and it appeared that bathymetry, kelp coverage, and water temperatures on the transects were conducive to rockfish settlement. Fish abundance and composition in Field's Cove might be expected to closely resemble South Control stations, because it is located outside the direct influence of the thermal discharge. While, species richness (number of species) and total counts of fishes in Field's Cove were less than those in South Control on benthic transects, it is likely that these differences would not prove statistically significant because of high natural variability associated with the estimates. Juvenile bocaccio rockfish, which have not been observed in the area for

several years, occurred in substantial numbers on the transects in Field's Cove. Jack mackerel, a migratory species with the majority of their distribution centered in cool-temperate waters, occurred in relatively high abundance in North Diablo Cove. Their appearance could be related to the cooler water temperatures during 1999.

Special Studies

The 1999 Annual Report also presents results from several special studies conducted during the year. These are included as appendices in the report and their findings are briefly summarized below.

Shell Debris Deposition

Fragments of shell debris from the biofouling assemblage (e.g., barnacles and mussels) growing in the Diablo Canyon Power Plant cooling water system are discharged into Diablo Cove with the effluent. A study on shell debris deposition was required by an amendment to the plant's NPDES permit. The amendment required a study to determine the effects of shell debris, generated by the discharge on the Diablo Cove environment.

Areas where the shell debris settles and accumulates in the cove were mapped by visually estimating the coverage of shell debris along a series of transects perpendicular to the shoreline near the discharge structure. Sampling was done during a refueling outage when two of the four circulating water pumps were shut down to allow access to areas near the discharge that are too turbulent to sample during normal pump operation. We observed that most of the shell debris accumulates in a natural channel that extends out from the discharge structure. Recently dislodged shell debris was observed scattered in the channel after the refueling outage, but all shell debris was dispersed after subsequent storm activity. Ocean swells caused the shell debris to be broken into smaller fragments that then mixed with sand and natural shell sediments from the surrounding area. The areas affected by shell debris are not biologically diverse due to the unstable substrata from constant motion of waves and currents. However, shell debris containing the remains of biofouling organisms does appear to attract round rays, leopard sharks, bat rays, and bony fishes that forage on this supplemental food supply in and around the turbulent discharge zone.

Surfgrass Survey

A surfgrass study on the abundance and condition of surfgrass and associated organisms was conducted in winter of 1999 in response to a review of ongoing monitoring programs by consultants for the CCRWQCB. Stations were established at the remaining surfgrass beds in Diablo Cove, Field's Cove, and North and South Control areas.

Storms associated with the 1983 El Niño had initially reduced surfgrass abundance in Diablo Cove to small beds in North and South Diablo Cove. Surfgrass beds formed a nearly continuous band around the perimeter of Diablo Cove from the low intertidal (ca. 0.0 m MLLW) into the shallow subtidal (ca. -3.0 m MLLW) prior to 1983. The variation in the abundance of surfgrass at our intertidal stations in Diablo Cove was greater than control areas in the pre-operational period. Our lowest transect elevation is +0.3 m MLLW and the increased variation may be due to differences in habitat in Diablo Cove that have a greater affect on coverage estimates when sampling at the upper extremes of the vertical distribution of surfgrass. Results of the 1999 survey indicated that the density and size of surfgrass blades in Diablo Cove were reduced in comparison to other areas. This may affect seed production and reduce the potential for recruitment and recovery in Diablo Cove. Invertebrate species richness, measured as the number of species present, was lowest in Diablo Cove. With the exception of *Tectura palacea*, a small grazing limpet that is an obligate on surfgrass blades, no invertebrates sampled were unique to surfgrass habitat.

Effects of the DCPP Discharge on Bull Kelp

Quantitative sampling was conducted to describe the magnitude, timing, and spatial extent of early senescence in the bull kelp population during 1999 as a function of decreasing temperature associated with increasing distance from the DCPP discharge structure. Surveys were done once per month from July through December along surface and underwater transects located at various distances from the discharge structure. While much of the bull kelp population was still present outside Diablo Cove in December, plants inside Diablo Cove showed deterioration as early as July and were gone by September. Individual bull kelp plants showing signs of early senescence were also present outside Diablo Cove in areas contacted by the discharge (i.e., near North Diablo Point, South Diablo Point, offshore of Diablo Rock, and in Field's Cove). However, bull kelp at these locations co-occurred with healthy kelp plants. Bull kelp plants in control areas appeared normal throughout the year. The spatial extent of early senescence in 1999 was

considerably less than the maximum extent observed in 1987 when early senescence of bull kelp was observed as far northward as Lion Rock. The spatial extent of effects in 1987 was the result of higher discharge temperatures associated with the warmer ambient water temperatures during the 1987 El Niño.

Discharge Effects along Subtidal Depth Gradients

Diver surveys were conducted along a series of transects to document the composition and abundances of invertebrates and algae in relation to water depth and distance from the DCPP cooling water discharge structure. Earlier studies had described statistically significant changes among various taxa to depths of at least -5 m MLLW in Diablo Cove that were attributed to plant operation, but potential changes at greater depths had not been documented. The purpose of this study was to use a gradient study design to examine spatial abundance patterns of benthic taxa in Diablo Cove and Field's Cove. We found that the distribution and abundance of laminarian kelps (*Pterygophora californica* and *Laminaria setchelli*) and shelled gastropods (*Tegula* spp.) were good indicators of the extent of power plant effects on the subtidal community. Both kelp species were nearly absent to depths of approximately -5 m ft at our stations in Diablo Cove, but were relatively abundant at this depth in neighboring Field's Cove. The North Channel of Diablo Cove had intermediate densities of these species. At a depth of approximately -6.5 m in Diablo Cove laminarian kelps were more abundant, with maximum densities occurring at depths of approximately 9–11 m. The kelp densities in Field's Cove at the 9–11 m depth range were equivalent to those of Diablo Cove. Shelled gastropods, especially the brown turban snail (*Tegula brunnea*), were more abundant at all depths outside of Diablo Cove. Analysis of covariance found statistically significant relationships between abundance and depth or area for several of the more abundant taxa. The distributions of uncommon taxa were too patchy to draw conclusions about potential discharge effects. Data from the gradient study suggested that some subtidal species that in earlier studies had been found to be significantly affected by thermal discharges in Diablo Cove at depths less than 5 m, appeared to be unaffected at greater depths in Diablo Cove, and remained abundant at all depths in Field's Cove. This is consistent with results of temperature monitoring that show little effect of the plume at deeper depths.

1.0 INTRODUCTION

Monitoring of the marine environment near the Diablo Canyon Power Plant (DCPP) was conducted from January 1999 through December 1999 as required by National Pollutant Discharge Elimination System (NPDES) Permit Order No. 90-09 revised in February 1995 by the Central Coast Regional Water Quality Control Board (CCRWQCB). Changes in the marine environment in the vicinity of DCPP are monitored by the Receiving Water Monitoring Program (RWMP) in accordance with the NPDES Permit to detect effects of the plant's cooling water discharge. This report describes new or continuing effects of the DCPP discharge on nearshore marine communities observed during 1999.

Nearshore communities of DCPP have been monitored and reported on since 1976. Results from 1976 through June 1995 were presented in the Thermal Effects Monitoring Program (TEMP) Analysis Report (Tenera 1997). This report contained comprehensive analyses and descriptions of changes in the receiving water community resulting from the DCPP discharge. Three semi-annual reports (PG&E 1996a, 1996b, 1997) presented data collected in the RWMP from July 1995 through December 1996. Two comprehensive reports on the RWMP results from 1995–1997 (Receiving Water Monitoring Program - 1995–1997 Progress Report) and from 1995–1998 (Receiving Water Monitoring Program - 1995–1998 Progress Report) described new or continuing changes resulting from the discharge that occurred after the completion of the TEMP (Tenera 1999a, 1999b). These reports have described changes resulting from the discharge in both the intertidal and subtidal marine communities. Changes were greatest in magnitude in the intertidal and shallow subtidal areas of Diablo Cove. Changes of lesser magnitude were detected in the intertidal areas of South Diablo Point and in Field's Cove to the north of Diablo Cove.

The previous report for the 1995–1998 period (Tenera 1999b) partitioned the operation period into two sub-periods:

- 'OpPeriod-1' – January 1987 through June 1995
- 'OpPeriod-2' – July 1995 through December 1998

Changes between these two periods were used to identify new or continuing effects of the DCPP discharge. Changes that may represent new or continuing effects of the discharge are identified

in this current report by comparing changes identified in the 1995–1998 Progress Report to changes detected during 1999. In this report we identify changes in previous patterns of abundances, but attributing these to effects of the discharge is difficult with only the 1999 year of additional data for comparison. The large natural variation in many of these populations can cause large interannual changes in abundance that are not necessarily a result of the discharge. In addition, variation in any one year may appear reduced when they are averaged over several years.

1.1 Study Design and Analysis

Stations contacted by the discharge plume (discharge stations) were compared with control stations to determine if observed changes exceeded natural variation and could be the result of effects from the discharge. The study area extends from Point Buchon to Point San Luis (**Figure 1-1**). Within the study area, stations were located in the areas of Diablo Cove and Field's Cove that were exposed to the thermal discharge and in control areas beyond the influence of the discharge. Ambient water temperatures and abundances of organisms at control area stations (control stations) provided baseline information on natural changes.

The RWMP was reviewed by the CCRWQCB staff and their consultants in 1998 and as a result several changes to the program were made and implemented in early 1999. **Table 1-1** shows the study components and sampling frequency of the RWMP for 1998. Changes to the program that were agreed to at the RWMP review and presented in a December 9, 1998 letter from the CCRWQCB resulted in the program presented in **Table 1-2**. The changes primarily consisted of expanding the frequency of sampling for the biological tasks from two times per year to four times, adding some stations to each study, and eliminating the separate studies for black and red abalone and dissolved oxygen. Although specific studies for black and red abalone were eliminated from the program, abalone are still sampled as part of the continuing intertidal horizontal band transect and subtidal benthic studies. In response to the December 9, 1998 letter from the CCRWQCB, PG&E verified and agreed to these program changes in a letter dated January 8, 1999.

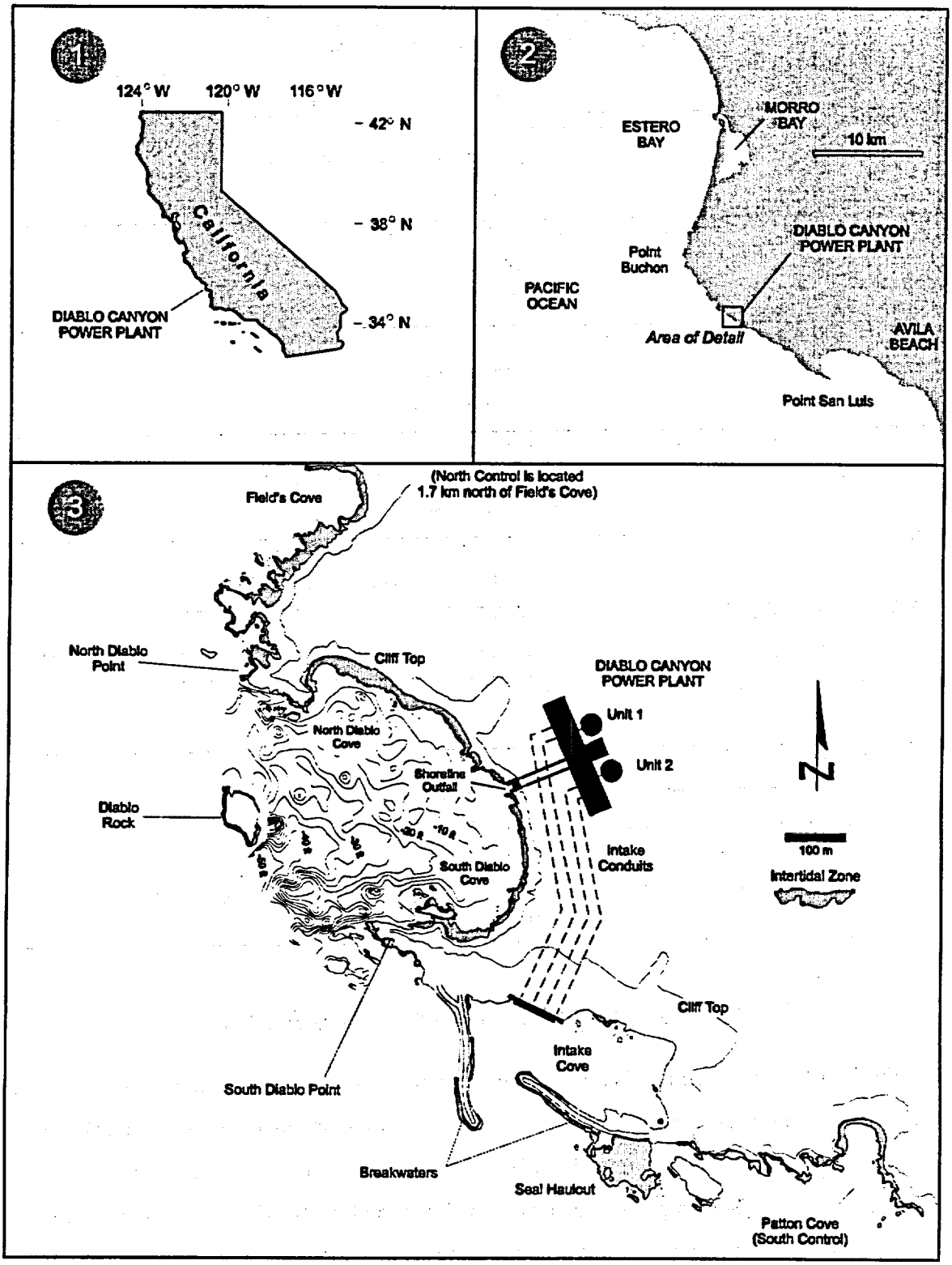


Figure 1-1. Location of the Diablo Canyon Power Plant.

Table 1-1. Tasks, stations, and frequency of surveys for the DCPP Receiving Water Monitoring Program, 1995–1998.

Task and Sampling Frequency	Stations
Intertidal Horizontal Band Transects (algae, invertebrates, substrate)	
2 surveys per year	NC-1, NDC-2, NDC-3, SDC-1, SDC-3, SC-1
4 surveys per year	FC-1, FC-2, FC-3
Intertidal Vertical Band Transects (algae, invertebrates, fishes, substrate)	
1 survey per year	NDC 1-V, SDC 2-V
4 surveys per year	FC 1-V
Intertidal Black Abalone Census (abalone, substrate)	
1 survey per year	10 - 100 m transects
1 survey per year	10 - 2x10 m transects
Subtidal Benthic Stations (algae, invertebrates, substrate)	
2 surveys per year	NDC 3 -3m, NDC 4 -4m, NDC 6 -3m, SDC 2 -3m, SDC 3 -4m 1, SC 1 -3m
4 surveys per year	FC 1 -3m, FC 2 -9m
Subtidal Fish Assessment (fishes)	
2 surveys per year	NDC FO-1, 2, 3; SDC FO-1, 2, 3; SC FO-1, 2, 3
Subtidal Red Abalone Census (abalone, macroinvertebrates)	
2 surveys per year	20 sta. (Diablo Cove) + 10 sta. (Field's Cove and South Control combined)
Habitat-Forming Kelp Survey (bull kelp, giant kelp)	
1 survey per year	Diablo Cove
Physical Oceanographic Monitoring	
Intertidal Temperatures (every 20 min)	NC-1, NC-2, NDC-2, NDC-3, SDC-1, SDC-3, SC-1
Subtidal Temperatures (every 20 min)	[-3 m] NC 1, FC 1, NDC 3, NDC 6, SDC 1, SC 1; [-4 m] NDC 4, SDC 4
Dissolved Oxygen (4 surveys per year)	[-3 m] NC 1, FC 1, NDC 3, NDC 6, SDC 1, SC 1; [-4 m] NDC 4, SDC 4

1.1.1 Analytical Comparison with Previous Results

Results for 1999 presented in this report were compared qualitatively with statistical results from the 1995–1998 Progress Report to determine if the new or continuing effects of the discharge identified in that report had continued in 1999. These comparisons were done using graphical analyses of community composition and individual taxa, and multivariate analysis of community change. The community comparisons used the same set of stations analyzed for the 1995–1998 Progress Report and did not include stations that were newly sampled in 1999. Graphs of individual taxa abundances are presented for all the stations sampled in 1999 and show the interruptions in sampling at these stations.

Table 1-2. Tasks, stations, and frequency of surveys for the DCPP Receiving Water Monitoring Program, 1999. Note: Stations added to the program in 1999 are highlighted as bold text.

Task and Sampling Frequency	Stations
Intertidal Horizontal Band Transects (algae, invertebrates, substrate)	
4 surveys per year	NC-1, FC-1, FC-2, FC-3, NDC-2, NDC-3, SDC-1, SDC-3, SC-1
4 surveys per year	**NC-2, NDC-1, SDC-2, SDP-1, SDP-2**
Intertidal Vertical Band Transects (fishes)	
4 survey per year	FC 1-V, NDC 1-V, SDC 2-V
4 surveys per year	**NC 1-V, SC 1-V**
Subtidal Benthic Stations (algae, invertebrates, substrate)	
4 surveys per year	FC 1 -3m, NDC 3 -3m, NDC 4 -4m, SDC 2 -3m, SDC 3 -4m 1, SC 1 -3m
4 surveys per year	**NDC 2 -3m, SC 2 -6m**
Subtidal Fish Assessment (fishes)	
4 surveys per year	NDC FO-1, 2, 3, 4; SDC FO-1, 2, 3; SC FO-1, 2, 3
4 surveys per year	**FC FO-1, 2, 3**
Habitat-Forming Kelp Survey (bull kelp, giant kelp)	
1 survey per year	Diablo Cove
Physical Oceanographic Monitoring	
Intertidal Temperatures (every 20 min)	NC-1, -2, FC-1, -2, -3, NDC-1, -2, -3, SDC-1, -2, -3, SDP-1, -2, SC-1, SC1-V
Subtidal Temperatures (every 20 min)	[-3 m] NC 1, FC 1, NDC 2, NDC 3, SDC 1, SC 1; [-4 m] NDC 4, SDC 4 [-6 m] SC 2

Multivariate statistical methods are useful for characterizing communities and measuring responses of communities to natural and human-induced disturbances (Boesch 1977; Green 1979). These methods provide representations of community structure and dynamics that can be examined for spatial and temporal responses to disturbances or ecological interactions (Ardisson et al. 1990; Gray et al. 1990; Agard et al. 1993; Olsgard and Gray 1995). Correspondence analysis (CA) was used in this report to summarize and contrast community changes over time at control and plume-contacted areas (Greenacre 1984; Digby and Kempton 1987; ter Braak 1987).

The occurrence of rare taxa within a sample can distort the results of CA, therefore, an analysis was done for each study to eliminate rare taxa. Only those taxa that comprised the majority (95 or 99 percent) of the total abundance and that occurred in a majority (80 or 90 percent) of the surveys were used in the analyses. Data for some of the studies were log transformed (log[x+1]) prior to analysis to compensate for scale differences among taxa that can occur when both count and coverage data are used in the analysis, or when there are large counts for some taxa. Annual means for the period of 1990 through 1999 were computed and analyzed using CA to derive

annual survey and taxa scores. Only these years were analyzed in order to eliminate variation due to the initial effects of the discharge. CA annual survey and taxa scores were plotted to examine contrasting patterns of temporal variation among discharge and control stations.

1.1.2 Species Identifications and Coding

We used the terms "taxon" and "species" interchangeably in this report. "Taxon" is a more general term that may refer to a single species or to several species grouped together. Although most organisms were identified to the species level during the RWMP study, some species were grouped for analysis if they were closely related and difficult to distinguish or if they formed a logical ecological grouping such as filamentous algae. For example, various species of the algae *Farlowia* and *Pikea* that are usually identified individually in the field were combined for analysis due to known difficulties in identifying these species.

1.2 Report Format

Sections 1 and 2 of this report provide background information and physical data relevant to the biological results presented in subsequent sections. Methods of the intertidal and subtidal biological studies followed by their results and discussion are detailed in Sections 3 and 4. A list of literature cited in this report is contained in Section 5.

Appendices following Section 5 comprise the Special Studies and summaries of the temperature and biological data for all study tasks and taxa. The Special Studies include:

- **APPENDIX A –** Shell Debris Deposition from the DCPP Discharge
- **APPENDIX B –** 1999 Surfgrass Survey
- **APPENDIX C –** Effects of the DCPP Discharge on Bull Kelp (*Nereocystis*): Results of the 1999 Survey
- **APPENDIX D –** Discharge Effects on Selected Algae and Invertebrates along Subtidal Depth Gradients in Diablo Cove, North Channel, and Field's Cove

Meteorological conditions during the study period were recorded daily and are archived at the Diablo Canyon Power Plant oceanographic laboratory. The Special Studies in Appendices A–D contain complete Introduction, Methods, Results, and Discussion of preliminary studies conducted in the waters around DCPP. These preliminary studies were conducted at the request of the CCRWQCB and their consultants. The study plans (included in these appendices) reflect discussions and comments of the CCRWQCB and their consultants.

2.0 POWER PLANT OPERATIONS AND TEMPERATURE MONITORING

This section provides a basic explanation of the design and operation of the cooling water system at DCPP and describes its effect on ocean temperatures in the vicinity of the power plant during 1999 and prior years of operation.

2.1 Power Plant Operations and Discharge Temperatures

The main cooling systems at DCPP condense steam from the turbine-power cycle of the plant and discharge heated seawater from the system into Diablo Cove. Two independent generation units with separate systems of intake and discharge conduits share the same intake structure and discharge location (**Figure 1-1**). During normal operation, two circulating water pumps (CWP) for each unit draw seawater from the Intake Cove through the Unit 1 and Unit 2 shoreline intakes. The seawater is pumped through thousands of 1 inch diameter, 40 foot long titanium tubes in the condensers of each power plant unit. High-pressure steam passes over the array of tubes and re-condenses in the power plant's secondary cooling loop. The manufacturer's estimated average flow rate of each CWP is 433,500 gallons per minute. The combined flow for both units and all four CWPs is 2.5 billion gallons per day at maximum capacity. Flow rates are less when CWPs are taken out of service during maintenance and refueling outages (**Figure 2-1a**). Both units went through refueling outages during 1999 (**Table 2-1**).

Table 2-1. DCPP refueling outage dates and duration, 1999.

Unit	Start Date	End Date	Duration (days)
1	07 Feb 99	15 Mar 99	35
2	26 Sep 99	27 Oct 99	32

Discharge temperatures are higher than ambient ocean temperatures (**Figure 2-1b**) because heat is transferred to the flowing seawater from steam in the secondary coolant loop that is cooled when it contacts the condenser tubes. The resulting liquid-water condensate returns to the steam generator to sustain the power cycle. The warmed seawater then exits the condenser and discharges into the ocean at the shoreline of Diablo Cove. The resulting discharge water temperature is about 11°C (≈20°F) warmer than the incoming seawater. The first warm-water discharges from DCPP began intermittently in 1984 with start-up testing of Unit 1. Commercial (full power) operation of Unit 1 began in May 1985 and Unit 2 began in March 1986.

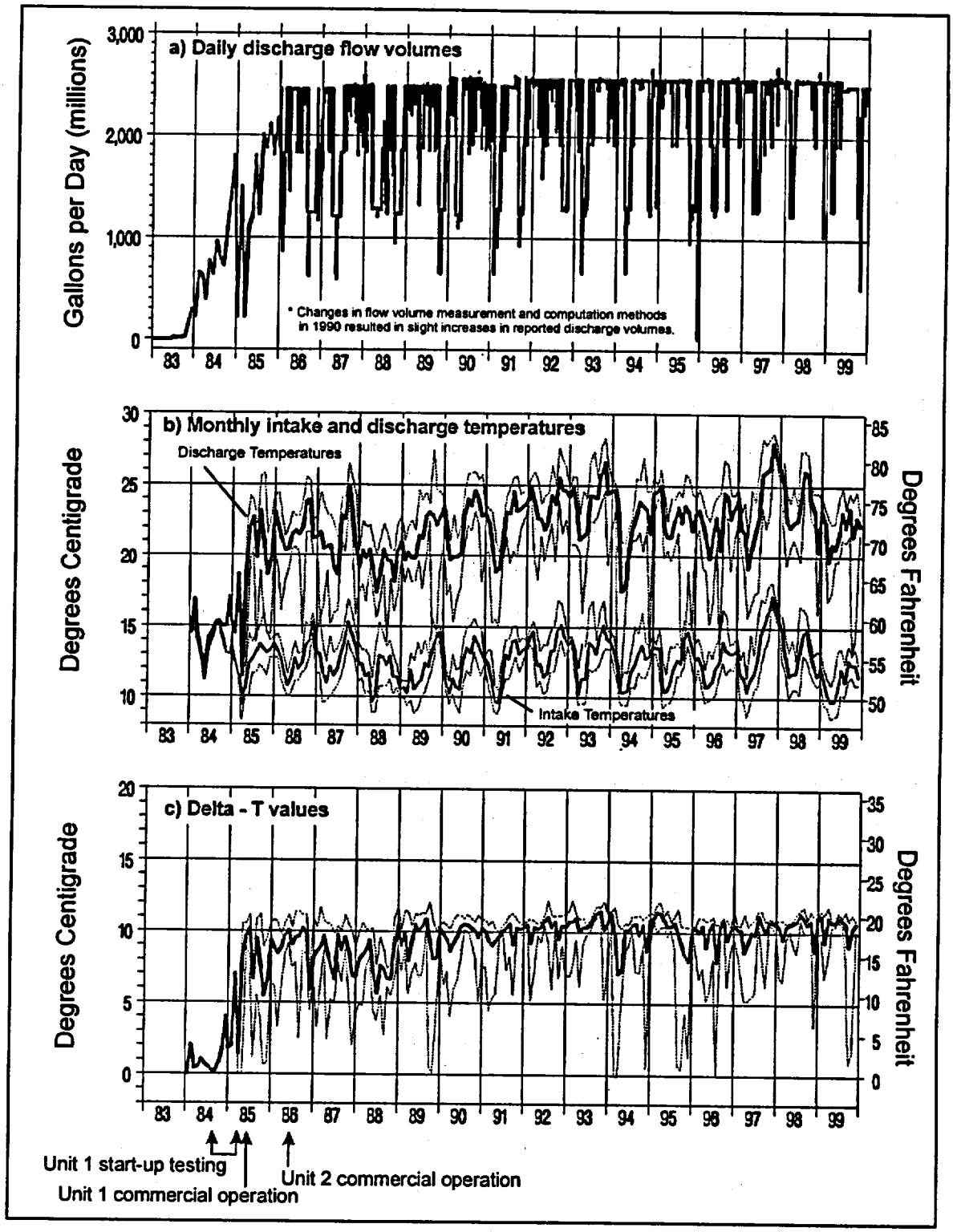


Figure 2-1. Power plant discharge characteristics. (a) Daily discharge flow volumes. (b) Monthly intake and discharge temperatures. (c) Monthly differences between intake and discharge temperatures (delta–T values). Data in b and c are averages of daily temperature values with dotted lines being the highest and lowest daily temperature values by month. Data were from monthly and annual NPDES reports submitted by PG&E to the RWQCB.

The amount of temperature rise at the point of discharge (delta-T°) (**Figure 2-1c**) varies depending on electrical generation heat load, pump flow (**Figure 2-1a**), ambient intake temperatures (**Figure 2-1b**), condenser cooling efficiency, and other operating conditions of the power plant. Discharge temperatures are lower during curtailments (periods of less than 100% power production) and during outages (periods of no power generation) if the CWPs remain operational for the unit that is out of service. Warmest ambient temperatures normally occur in fall (approximately 15°C or 59°F) and coolest ambient temperatures normally occur in late spring (approximately 11°C or 48°F). Throughout the commercial operation of DCPP, several oceanographic events have altered this normal temperature pattern. Warm water periods associated with El Niño Southern Oscillation (ENSO) punctuated the operational period in 1986–88, 1990–95, and 1997–98 while cooler periods resulting from La Niña events occurred in 1984-85, 1988-89, 1995–97, and 1998–99 (**Figure 2-2, Table 2-2**). Over the 15 years of operation the warmest monthly mean ambient (17.2°C or 63°F) and discharge temperatures (28°C or 82°F) occurred in November 1997 (**Figure 2-1b**). The coolest monthly ambient temperatures (9.7°C or 49.5°F) occurred in May 1991 (**Figure 2-1b**). These deviations from long-term average ambient temperatures (12.9°C or 55.2°F) reflect the influences that global changes in tropical weather patterns can have on local oceanic phenomena (Chavez 1999).

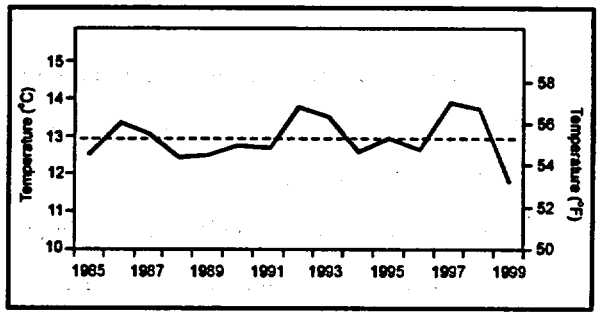


Figure 2-2. Annual mean ambient temperatures at the DCPP intake 1985–1999
(Source: http://wwwnpg/businfo/environmental.htm).

The oceanographic conditions in 1999 resulted in the coldest mean annual ambient seawater temperatures since plant operation began (**Figure 2-2**). The cooler seawater temperatures were partially the result of strong northwesterly winds that persisted from March through June and July. This is shown in **Figure 2-1b** by the low intake temperatures that persisted for a much longer time period than previous years. The winds resulted in upwelling of cooler deeper seawater to the surface along the coast, producing ideal conditions for the growth of kelp and other marine algae.

Table 2-2. Presence and relative magnitude of El Niño (W) and La Niña (C) events from 1984 through 1999 in the tropical Pacific: relatively strong events are noted with (+), relatively weak events with (-), and C* denotes anomalously warm La Niña conditions postulated by Schwing et al. (1997). Blank cells (e.g. in 4th quarter of 1999) represent non-ENSO (= normal) periods. Table combines data from Schwing et al. (1997) and the NOAA ensoyears.html page at www.noaa.gov.

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1984	C-	C-		C-
1985	C-	C-		
1986			W-	W
1987	W	W	W+	W
1988	W-		C-	C+
1989	C+	C-		
1990			W-	W-
1991	W-	W-	W	W
1992	W+	W+	W-	W-
1993	W-	W	W	W-
1994			W	W
1995	W			C-
1996	C*	C*	C*	C*
1997	C*	W	W+	W+
1998	W+	W	C-	C
1999	C+	C	C-	

DCPP thermal discharges have modified the temperature regime in portions of Diablo Cove over the past 15 years. Discharge flows, temperatures, and delta-T° values varied considerably due to start-up testing of both units and lengthy refueling outages. There was a slow rise in delta-T° values from 1988 to 1994 (**Figure 2-1c**) as plant components aged. Corrective maintenance to plant equipment in spring 1994 stabilized the pattern, but since 1996 this trend of slightly increasing discharge delta-T° temperatures has reoccurred (**Table 2-3**). In 1999, intake and discharge temperatures were lower from prior years due to oceanographic conditions. However, delta-T° temperatures were higher, based on times when all circulating pumps were in operation (**Table 2-3**).

Table 2-3. Annual mean discharge delta-T°C. Calculations of annual mean only includes data when pumps for both units were operating. Although the plant began operation earlier, 1987 was the first year with continuous operation of both units.

Year	Annual Mean delta-T°C
1987	8.87
1988	8.01
1989	10.02
1990	10.08
1991	9.90
1992	10.41
1993	10.77
1994	10.32
1995	10.58
1996	10.34
1997	10.42
1998	10.63
1999	10.90

Since 1996, the DCPP Unit 1 and Unit 2 fuel cycles have been extended to a total of 21 months from a previous cycle duration of 18

months. Therefore, each unit's fuel cycle lasted about 100 days longer in 1997–1999 than in previous years. Accompanying these longer cycles, the duration of refueling outages has decreased. Initially lasting over 100 days, recent outages have been completed in about 33 days. The longer fuel cycles and shorter outages better balance discharge volumes and temperatures, helping to stabilize the thermal regime in the discharge cove.

2.2 Receiving Water Temperature Monitoring

Ocean temperatures were measured continuously at permanent stations in the vicinity of the DCPP thermal discharge. This section explains the methods (including instrumentation and study sites) used for measuring temperatures, presents the results for the temperature monitoring, and compares the 1999 temperature monitoring data with temperature measurements from previous years. This section also presents results from additional temperature monitoring conducted in Field's Cove to help determine the magnitude an spatial extent of discharge effects on seawater temperatures.

2.2.1 Methods

To characterize the effect of power plant operation on seawater temperature, instruments at 22 permanent stations located along the Diablo coastline continually record temperature and monitor the extent of the thermal plume **(Figures 2-3 and 2-4).** Instruments, secured inside metal canisters for protection, record temperature data. The following 13 stations are near to the point of discharge in Diablo Cove and are contacted regularly by the discharge plume:

- Intertidal (NDC-1, NDC-2, NDC-3, SDC-1, SDC-2, SDC-3, SDP-1, and SDP-2)
- Subtidal (NDC 2-3m, NDC 3-3m, NDC 4-4m, SDC 1-3m, and SDC 3-4m)

The following six stations are located in Field's Cove, approximately one kilometer upcoast of Diablo Cove:

- Intertidal (FC-1, FC-2, FC-3 and SDP-1, SDP-2)
- Subtidal (FC 1-3m)

The six following control stations measure ambient ocean temperatures at sites beyond the influence of the discharge:

- Intertidal (NC-1, NC-2, SC-1 and SC-1V)
- Subtidal (NC 1-3m, SC 1 -3m and SC 2 -6m)

In addition, temperature units were installed for the first few months of 1999 at two deeper subtidal stations in Diablo Cove, SDC 5-10m and NDC 5-8m. Temperature units at intertidal stations are located along the rocky shore at the +0.6 m mean lower low water (MLLW) elevation (**Figure 2-3**). Subtidal temperature recorders are located at depths from -3 to -6 m MLLW (**Figure 2-4**). The designation of individual stations reflects the area location and

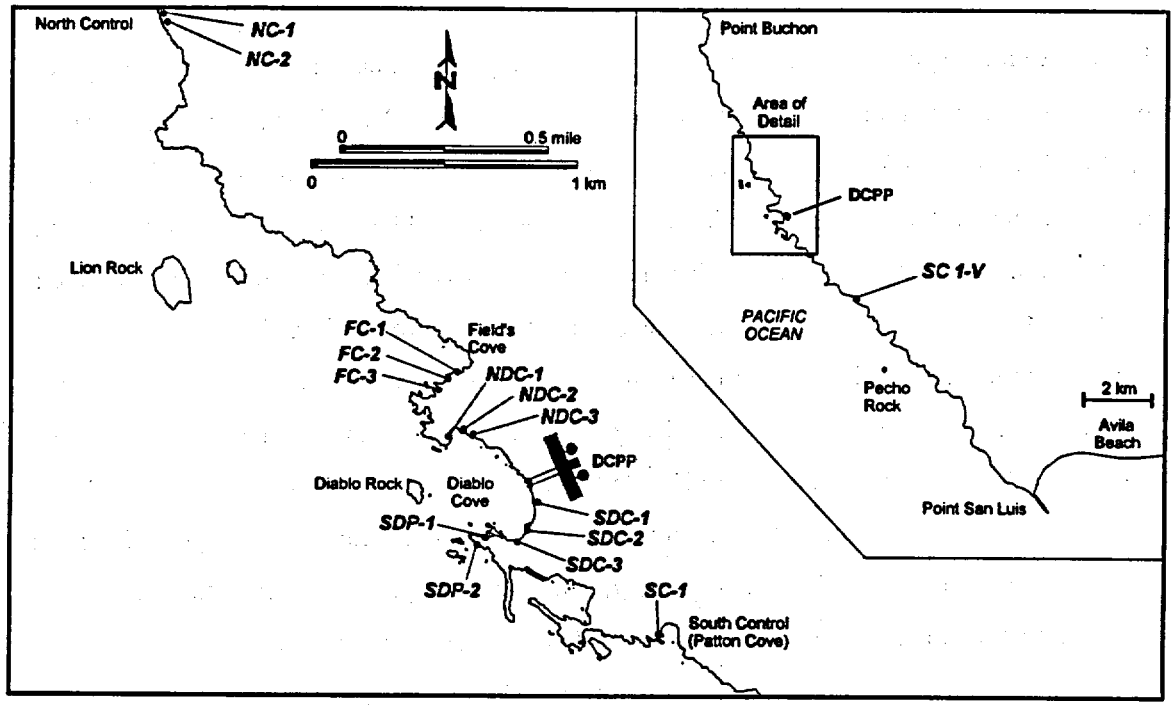


Figure 2-3. Locations of intertidal temperature monitoring stations.

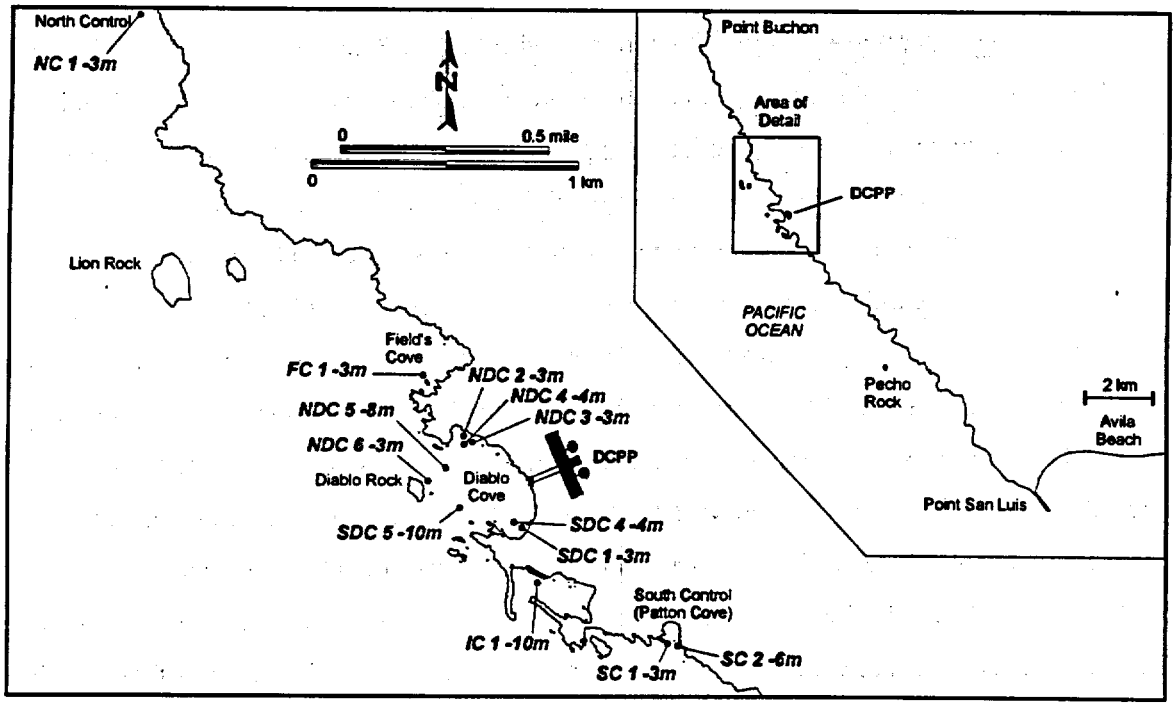


Figure 2-4. Locations of subtidal temperature monitoring stations.

number, followed by the elevation or depth, relative to MLLW (e.g., NDC1-3m is subtidal station 1 at North Diablo Cove at a depth of -3 m MLLW).

Each instrument synchronously logs temperatures every 20 minutes throughout its deployment period. Instrument precision is 0.01°C with an accuracy of ± 0.2°C. Temperature units are deployed at a station for approximately 60 days and then exchanged with a serviced unit. Intertidal temperature units record air temperatures when tidal levels recede below about +0.6 m MLLW. Air temperatures are not analyzed and were removed from the database by referencing concurrent tidal height measurements. The average temperature readings for the simultaneous 20-minute records at control stations are used to determine ambient temperature conditions for intertidal and subtidal areas separately. These average temperatures are used to compute the differences between ambient and both Diablo Cove and transition station temperatures (delta-T°). Delta-T° values are computed by subtracting the mean temperature for the pooled control stations, averaged for each 20 minute reading, from the corresponding temperature record (or temperature mean for multiple stations) for the discharge cove and transition stations. We summarize the data in this report as monthly means ±99 percentile values.

2.2.2 Results

Monthly mean temperatures recorded at intertidal and subtidal (-3 m MLLW) stations in North Diablo Cove, South Diablo Cove, South Diablo Point and Field's Cove (**Figures 2-5a-d** and **2-6a-e**) illustrate the long-term pattern of receiving water temperatures and delta-T° values before and during power plant operation. Prior to power plant start-up, water temperatures at the intertidal and shallow subtidal stations were similar to controls, except in the intertidal at South Diablo Cove (**Figure 2-5b**). Solar warming and low water circulation at South Diablo Cove likely caused seasonal temperatures to be naturally warmer than control station temperatures by as much as 2°C (**Figure 2-5b**). After power plant start-up, delta-T° values increased at discharge cove and to a lesser extent at transition stations (**Figures 2-5 and 2-6**). Historically (1985-98), intertidal and shallow subtidal (-3 m MLLW) North Diablo Cove temperatures exceeded those at either South Diablo Cove or Field's Cove. Temperatures at shallow subtidal stations (-3 m MLLW) in South Diablo Cove exceeded those in other areas from January through May and in December. This pattern of warmer temperatures in South Diablo Cove during part of the year has been observed each year during plant operation.

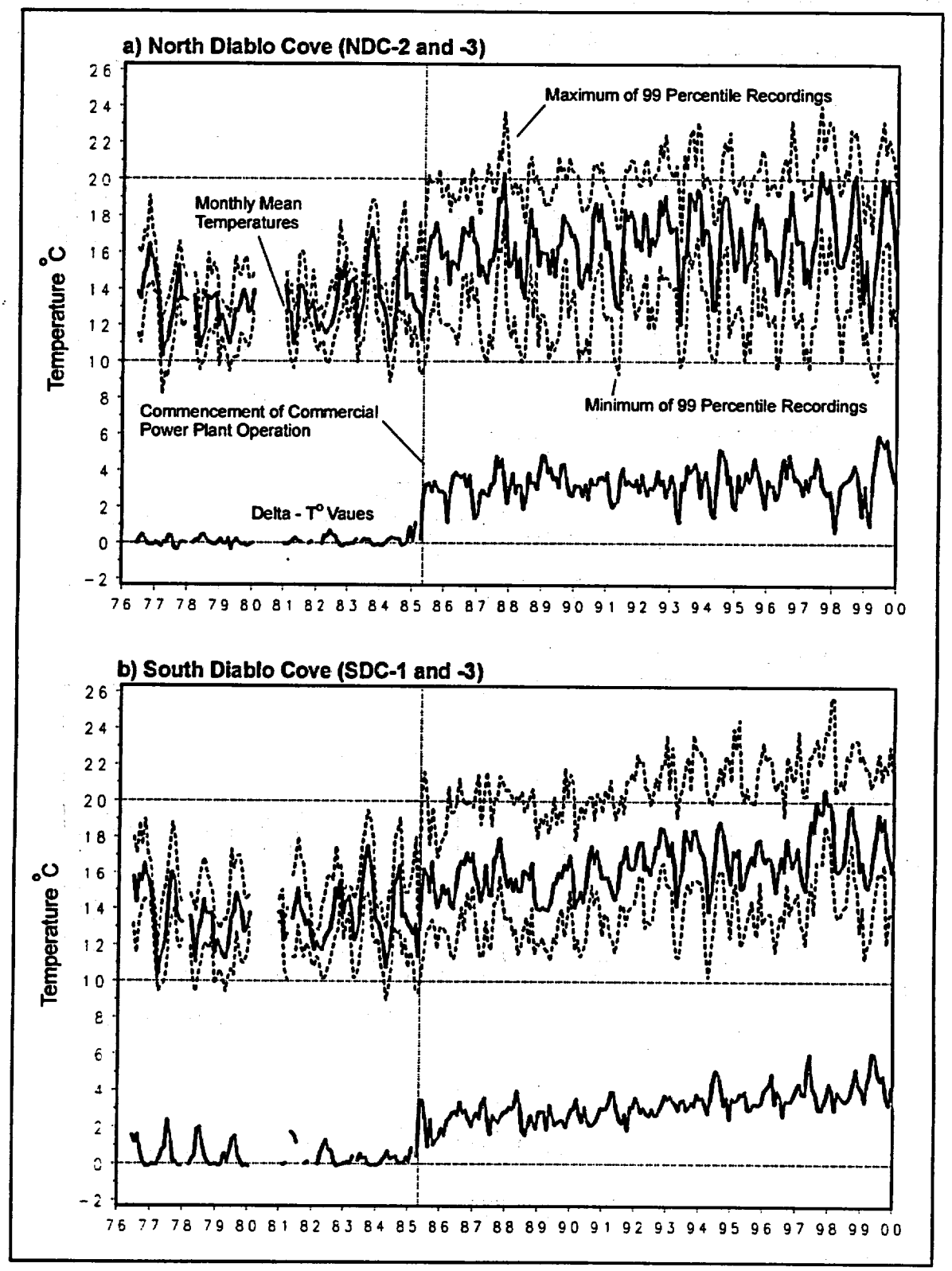


Figure 2-5. Intertidal (+0.6 m MLLW) monthly mean temperatures and delta–T^{O} values for the (a) North Diablo Cove, (b) South Diablo Cove, (c) South Diablo Point, and (d) Field's Cove stations. Dotted lines denote the highest and lowest 99 percentile values of recordings taken every 20 minutes in the month. Ambient temperatures were measured at NC-2 and SC-1.

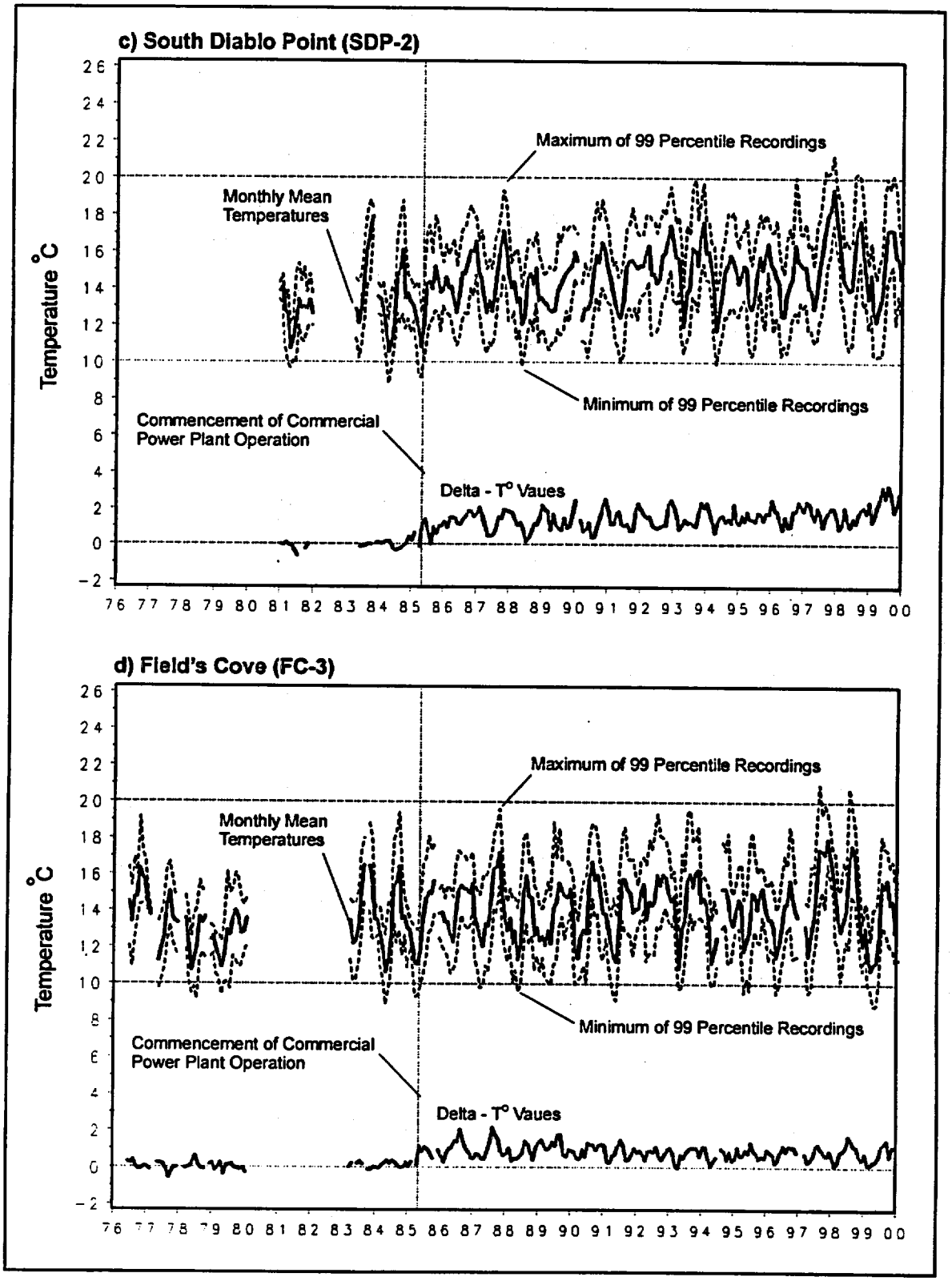


Figure 2-5 (continued). Intertidal (+0.6 m MLLW) monthly mean temperatures and delta–T^{O} values for the (a) North Diablo Cove, (b) South Diablo Cove, (c) South Diablo Point, and (d) Field's Cove stations. Dotted lines denote the highest and lowest 99 percentile values of recordings taken every 20 minutes in the month. Ambient temperatures were recorded at NC-2 and SC-1.

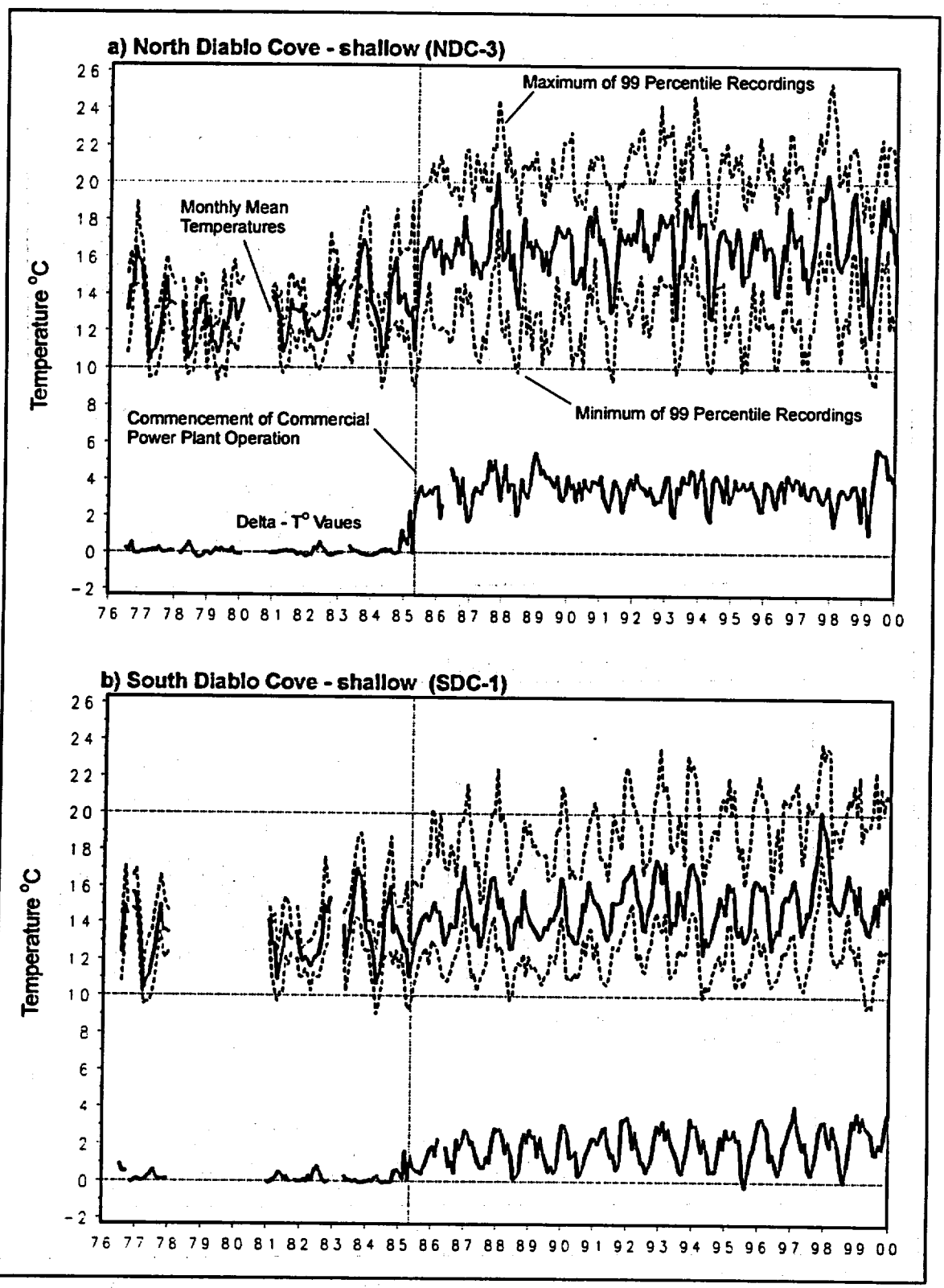


Figure 2-6. Subtidal monthly mean temperatures and delta–T^{O} values for (a) North Diablo Cove shallow, (b) South Diablo Cove shallow, (c) North Diablo Cove deep, (d) South Diablo Cove deep, and (e) Field's Cove shallow stations. Dotted lines denote the highest and lowest 99 percentile values of recordings taken every 20 minutes in the month. Ambient temperatures were recorded at NC-1 and SC-1.

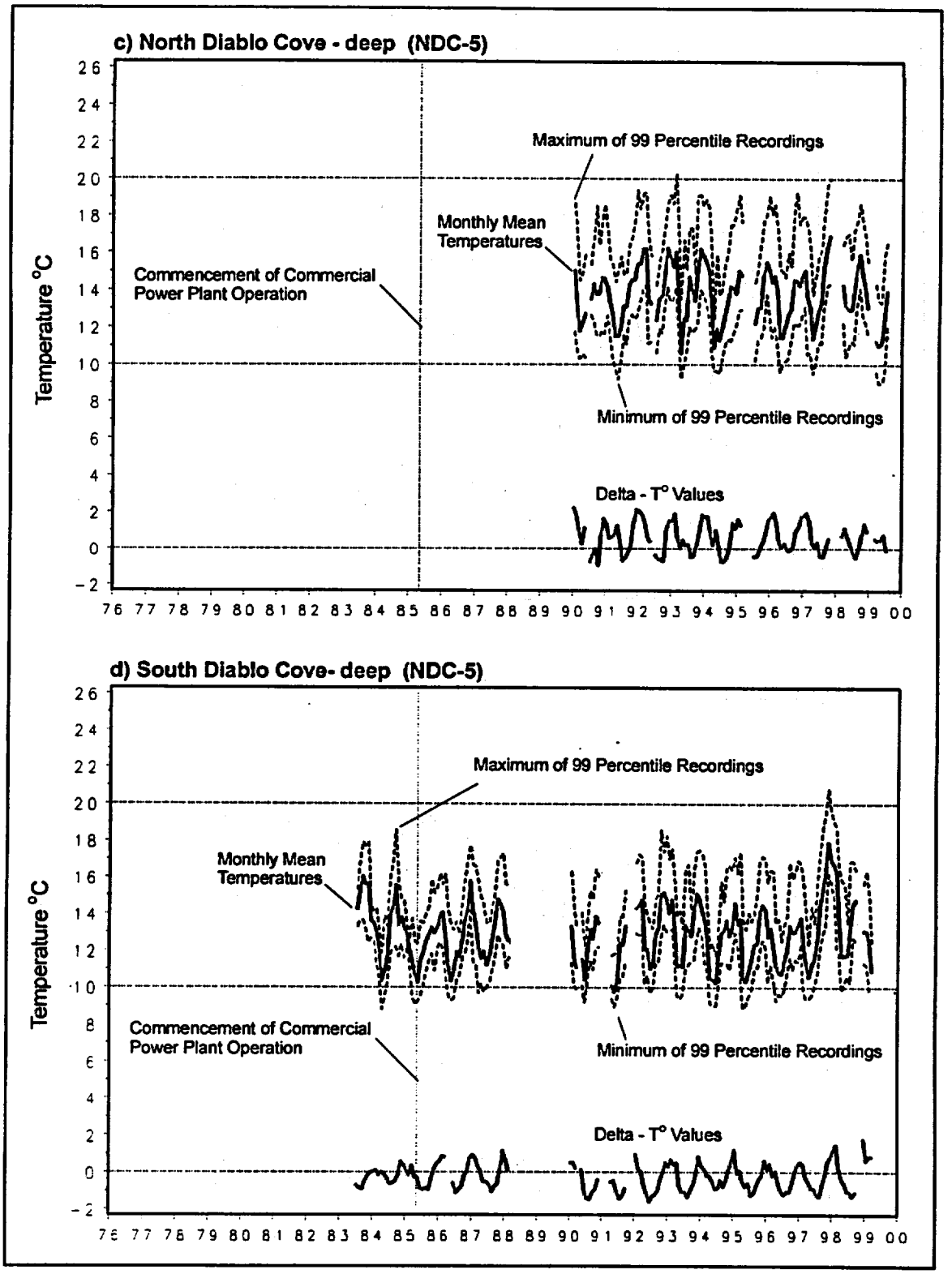


Figure 2-6 (continued). Subtidal monthly mean temperatures and delta–T° values for (a) North Diablo Cove shallow, (b) South Diablo Cove shallow, (c) North Diablo Cove deep, (d) South Diablo Cove deep, and (e) Field's Cove shallow stations. Dotted lines denote the highest and lowest 99 percentile values of recordings taken every 20 minutes in the month. Ambient temperatures were recorded at NC-1 and SC-1.

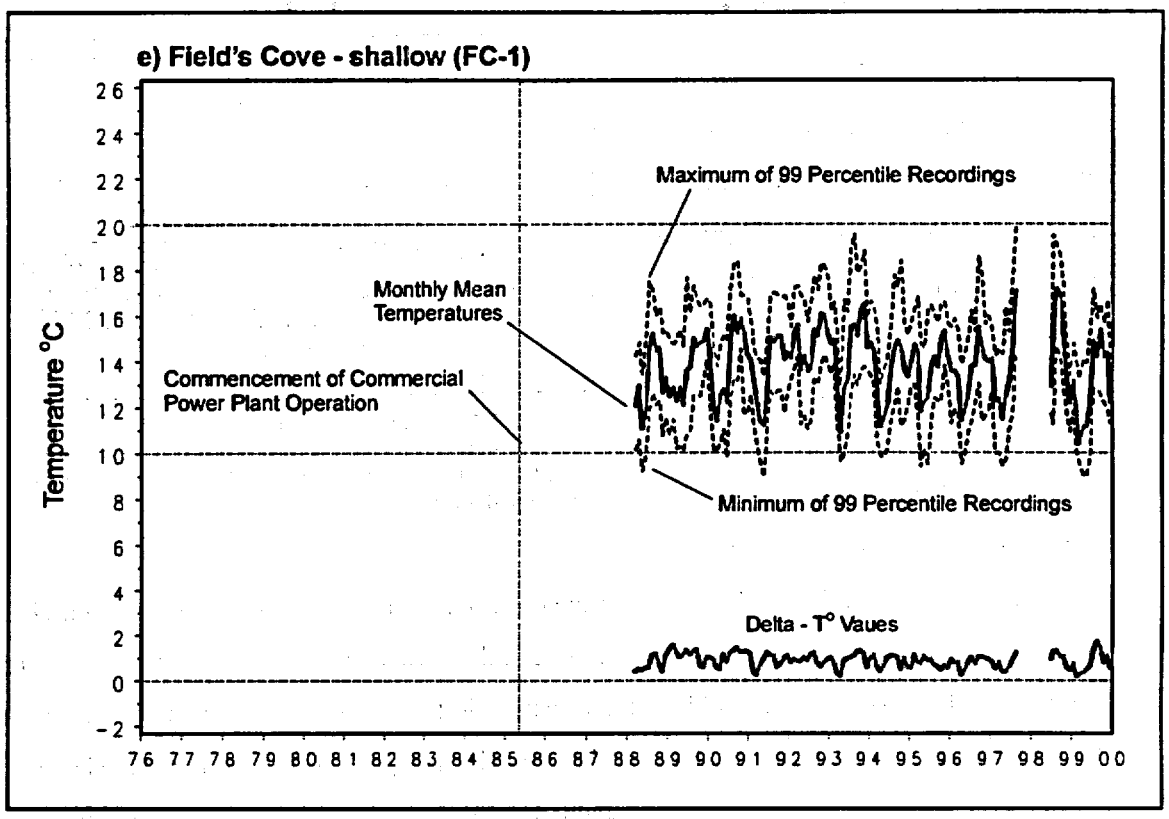


Figure 2-6 (continued). Subtidal monthly mean temperatures and delta–T^{O} values for (a) North Diablo Cove shallow, (b) South Diablo Cove shallow, (c) North Diablo Cove deep, (d) South Diablo Cove deep, and (e) Field's Cove shallow stations. Dotted lines denote the highest and lowest 99 percentile values of recordings taken every 20 minutes in the month. Ambient temperatures were recorded at NC-1 and SC-1.

Long-term increasing trends in temperature through 1999 are apparent at the intertidal and shallow subtidal stations at South Diablo Cove (**Figure 2-5b**) and South Diablo Point (**Figure 2-5c**). These trends probably reflect the rising discharge temperature delta-T° that was first observed from 1990 through 1994 but has now reoccurred since 1996 (**Table 2-3**). Although monthly mean discharge delta-T° averaged close to 11°C during 1999 (**Figure 2-1c**), monthly mean delta-T° at all the intertidal and subtidal stations in Diablo Cove are less, never exceeding about 6°C and averaging about 4°C (**Figures 2-5** and **-6**). In 1999, the delta-T° values in North Diablo Cove were close to 6°C for an extended period.

Equipment failure occasionally prevented collection of temperature data at some subtidal and intertidal stations. A complete summary of temperature data for each station is presented in **Appendix G.**

Intertidal Temperatures

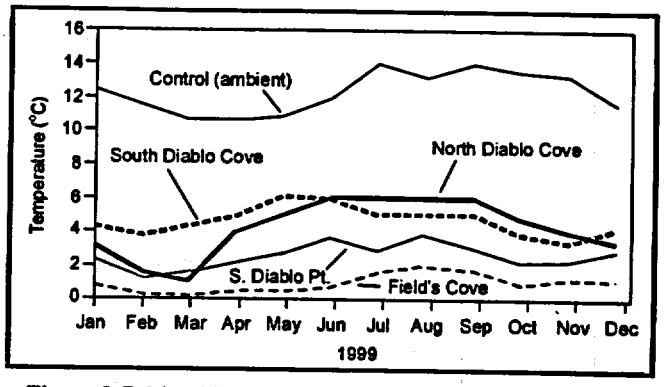


Figure 2-7. Monthly mean ambient temperatures at intertidal control stations and monthly mean temperatures above ambient (delta-T°) at North and South Diablo Cove, South Diablo Point, and Field's Cove stations.

Monthly mean intertidal seawater temperatures exceeded ambient at North and South Diablo Cove, and South Diablo Point stations (**Figure 2-7**) throughout 1999. This continued the pattern evident since power plant start-up in 1985 (**Figure 2-5a,b** and **c**). Increased delta-T° at the North Diablo Cove intertidal stations in 1999 may have been caused by the extensive canopy of giant kelp in the north channel of the cove that restricted flow out of the channel. This may have altered the flow of the discharge plume and increased the residence time of the plume in North Diablo Cove. Mean monthly delta-T° values in South Diablo Cove were greater than the values in North Diablo Cove from January through May (**Figure 2-7**). This may have been caused by the strong northwesterly winds that occurred throughout the spring that tended to move the surface plume into South Diablo Cove.

The monthly mean delta-T° at Diablo Cove stations ranged from less than 2°C to greater than 6°C above ambient, with highest delta-T° occurring from May to September (**Figure 2-7**). Monthly mean intertidal water temperatures ranged from 0–2°C above ambient at the three Field's Cove stations (**Figure 2-5c, Figure 2-7**). Temperatures at both North Diablo Cove and South Diablo Cove stations were closer to ambient (+1°C) during the Unit 1 refueling outage in February–March. Elevated temperatures in Diablo Cove were not noticeably reduced, however, during the Unit 2 outage in September–October.

Subtidal Temperatures

Seawater temperatures exceeded ambient at shallow subtidal stations (-3 and -4 m MLLW) in Diablo Cove throughout the year (**Figure 2-6a** and **b**). The monthly mean delta-T° at stations in Diablo Cove ranged from less than 2°C to almost 6°C above ambient except during the Unit 1 refueling outage. The discharge plume flowed more consistently toward North Diablo Cove than toward South Diablo Cove, causing warmer average temperatures in North Diablo Cove for most of the year (**Figure 2-8**). Similar to the intertidal data, increased delta-T° at the North Diablo

Cove subtidal stations in 1999 may have been caused by the extensive canopy of giant kelp in the north channel of the cove that altered the flow of the discharge plume and increased the residence time of the plume. The increased delta-T° during the spring months that was identified in the intertidal data from South Diablo Cove was much reduced in the subtidal data (**Figure 2-6b**). This further supports the explanation that the increased delta-T° was caused by the strong northwesterly winds that would tend to have a greater effect on the surface layers of the plume and intertidal temperatures. The outage in March with reduced seawater flow probably contributed to these results.

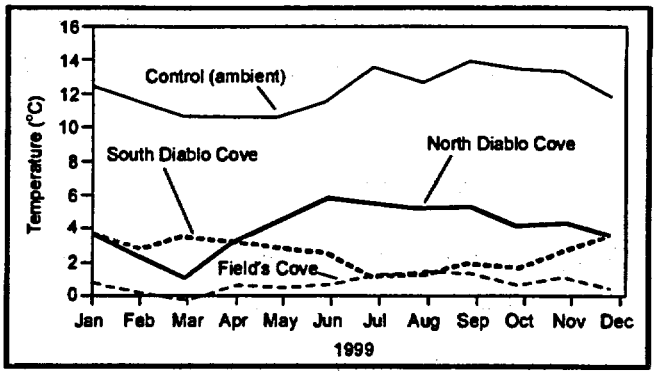


Figure 2-8. Monthly mean ambient temperatures at subtidal control stations compared to monthly mean temperatures above ambient (delta-T°) at North and South Diablo Cove, and Field's Cove stations.

Slight increases in seawater temperature (less than 2°C on average)were measured at two deeper subtidal stations in Diablo Cove (**Figure 2-6c** and **d**). At the deeper station in South Diablo Cove (-10 m) seawater temperatures are commonly lower than ambient temperatures measured at -3 m at control stations. Although the discharge plume can contact this station the average monthly temperatures from 1999 and previous years show that the frequency of plume contact is much reduced compared to the shallower subtidal stations. These results and the results for the deeper station in North Diablo Cove (NDC5 -8m) show a strong seasonal component in delta-T°. The greatest increases in delta-T° occur in the fall and winter months while temperatures at the stations are typically lower than ambient during the spring and summer months.

Seawater temperature above ambient was also measured in Field's Cove during the year except in March when Unit 1 was not operating (**Figure 2-8**). Mean monthly subtidal delta-T° values at the Field's Cove station ranged from 0–1.5°C above ambient.

The temperature patterns along the coast reflect the strong upwelling that began in late 1998 and continued in 1999, particularly in April 1999. According to Hayward et al. (1999), upwelling anomalies in California were the largest in the 50+ year record of the upwelling index. These were comparable to anomalies in the early spring of other La Niña years (e.g., 1964 and 1968), but periods of strong upwelling are not necessarily always linked to equatorial La Niña events

(Hayward et al. 1999). The temperature pattern observed in 1999, however, represents a major change from strong, warm-water El Niño conditions in early 1998 to cool-water conditions.

Field's Cove Monitoring

Analysis of data collected as part of the RWMP indicated elevated seawater temperatures (delta-T°) and biological effects due to the DCPP discharge at intertidal and subtidal stations in Field's Cove (Tenera 1997). PG&E installed 13 intertidal and 6 subtidal temperature recorders in Field's Cove in the Summer and Fall of 1997. The purpose of the additional monitoring was to provide more complete documentation on the extent and magnitude of delta-T° north of Diablo Cove. The locations of these stations, and stations monitored as part of the RWMP, are shown in **Figures 2-9** (intertidal) and **2-10** (subtidal).

Intertidal Results

Between October 1997 and August 1998, intertidal water temperatures in the vicinity of Field's Cove were recorded at the 14 stations shown in **Figure 2-9**. Station FC54, located just onshore from Lion Rock was lost sometime after January 28, 1998 when the unit was retrieved and redeployed after the data from the unit was downloaded for processing. The temperature units used in the study were Hugrun Seamon-mini™ recorders that have a reported accuracy of 0.05 °C and a precision of 0.001 °C. Monthly mean temperatures and ranges are presented for the 14 stations and RWMP stations FC-3 and NC-3 are presented in **Appendix H**. The data were corrected to remove any air temperatures recorded when the units were exposed during low tide. The data for Station NC-3 at North Control are presented for a comparison with control area temperatures and was used in computing delta-°T values for the Field's Cove stations shown in **Figure 2-9**. The results show that average delta-°T is less than 1.0°C for all of the intertidal stations. The maximum average delta-°T and maximum temperatures occurred at Station FC-42 located in the small cove in the most protected area of Field's Cove. This area of Field's Cove is shallow and less subject to wave-generated turbulence and these factors may result in ambient conditions that are naturally warmer than the control station temperatures. Average delta-°T values decrease at the stations north of FC-42 that are more exposed. Although the average delta-°T is lowest at the station furthest north (FC-52), the maximum delta-T° values for that station are more similar to the stations closest to Diablo Cove. This may be caused by the location of the station on a small promontory that puts it in the direct path of the plume as it exits the north

channel of Diablo Cove. During the fall season, northerly flowing currents may help in directing the discharge plume out the north channel into the more northern portions of Field's Cove. During the spring and summer, northwesterly winds and southerly flowing currents probably limit the spread of the discharge plume in Field's Cove.

Subtidal Results

Between July 1997 and December 1999, subtidal water temperatures in the vicinity of Field's Cove were recorded at the 9 stations shown in **Figure 2-10**. The temperature records for the stations are not continuous, because the data were collected for model verification and not long-term monitoring. No summary statistics were calculated because differences among the stations would be affected by the periods of time data were available. Most stations had units deployed at depths of -0.6 m (2 ft) and -3 m (9 ft) below the surface. Station FC had an additional unit at a depth of -5 m (16 ft). The units were deployed from a buoyed mooring and therefore remained at those depths despite changes in tidal height. The temperature units used in the study were a mix of Hugrun Seamon™ and Seamon-mini™ recorders. The data for the stations are reported in **Appendix H** as daily means.

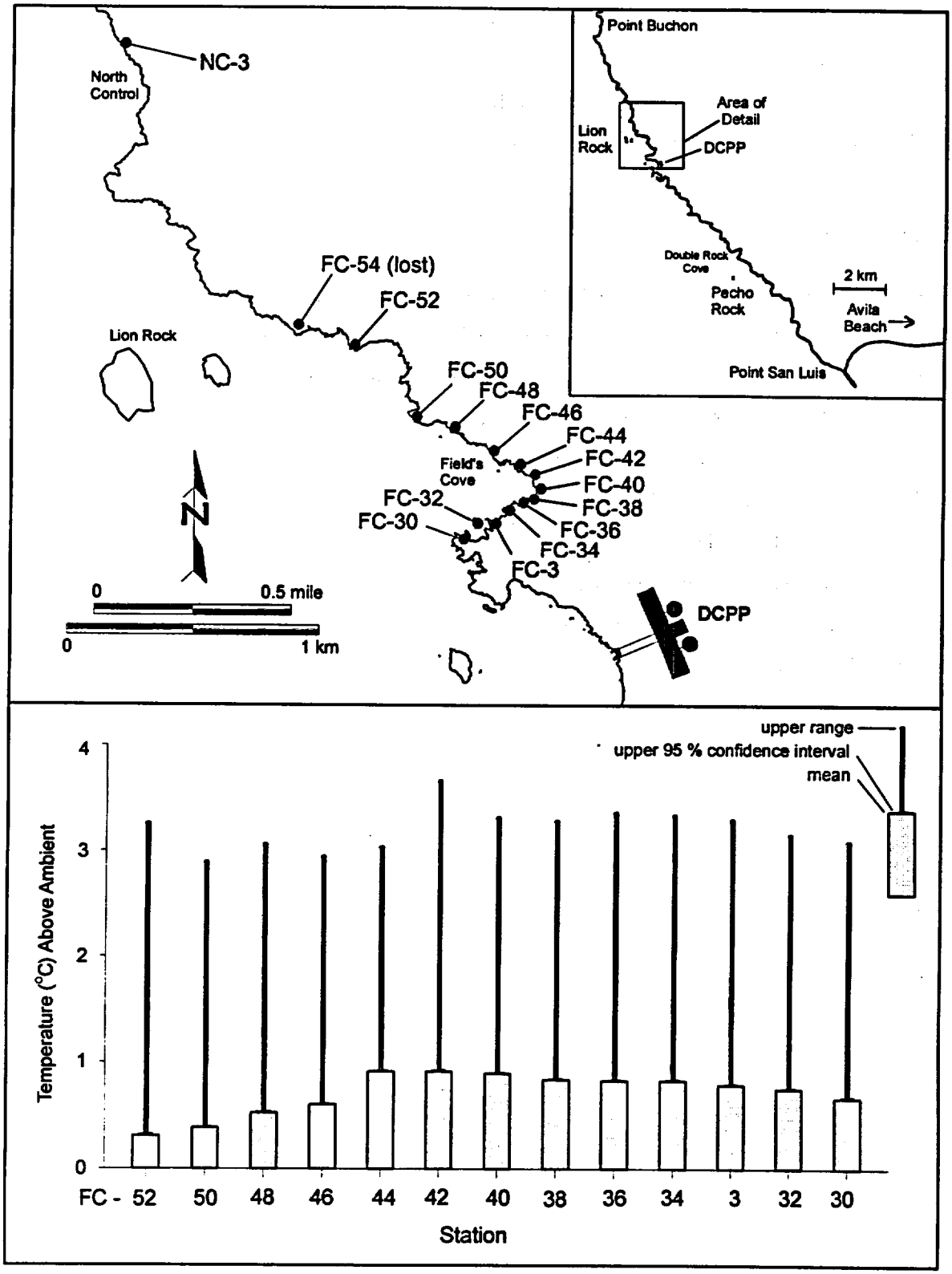


Figure 2-9. Intertidal water temperatures above ambient at the Field's Cove supplemental temperature stations. Ambient temperatures were measured at Station NC-3. Number of temperature recordings (n) at each station =12048, except at FC-44 where n=8998.

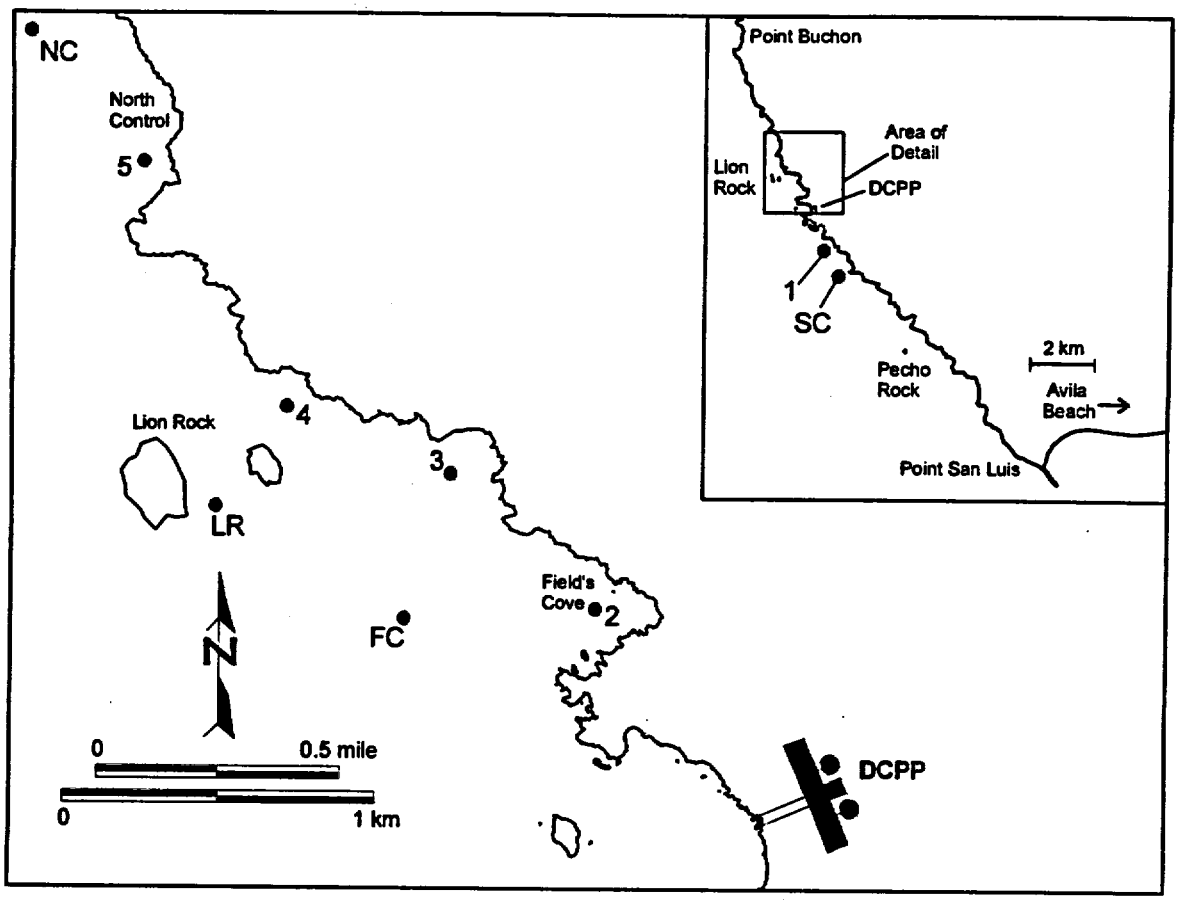


Figure 2-10. Supplemental subtidal water temperature stations.

3.0 INTERTIDAL STUDIES

Intertidal algae, invertebrates, and fishes have been studied at DCPP during pre-operation and operation periods. The primary intertidal community study was the horizontal band transect study (HBT) that collected data on the abundance of algae and invertebrates. Counts of intertidal fishes were recorded in vertical band transect (VBT) surveys.

3.1 Intertidal Algae

Descriptions of previous discharge effects on intertidal algae were based on statistical analysis of data collected in the pre-operation study period (1976-1985) and two power plant operation study periods: 1985–95 (Tenera 1997) and 1995–98 (Tenera 1999b). The collective findings from the two study periods revealed that after power plant start-up algal cover decreased at stations in Diablo Cove, relative to controls. Losses in algal cover resulted in increased amounts of bare rock substrate. Portions of the areas with bare rock became colonized by ephemeral (seasonal or short-lived) algae. Changes also occurred in some of the same taxa at the Field's Cove and South Diablo Point stations, but changes at these stations were reduced in magnitude due to the increased distance from the discharge structure and reduced plume contact.

This section describes the 1999 results for intertidal algae at the HBT stations in Diablo Cove, Field's Cove, South Diablo Point, and control areas. Comparisons of the 1999 data to prior findings are qualitative and based on comparisons of species composition, correspondence analysis results of community-level changes, and time-series abundance plots for individual species.

3.1.1 Sampling Methods

The HBT sampling method used in 1999 was the same as that used in all previous years. All HBT stations (**Figure 3-1**) had been established before the power plant began commercial operation and were sampled at various time intervals before and after power plant start-up. Stations were mainly on bedrock and boulders, but various amounts of cobble and sand also occurred at the stations.

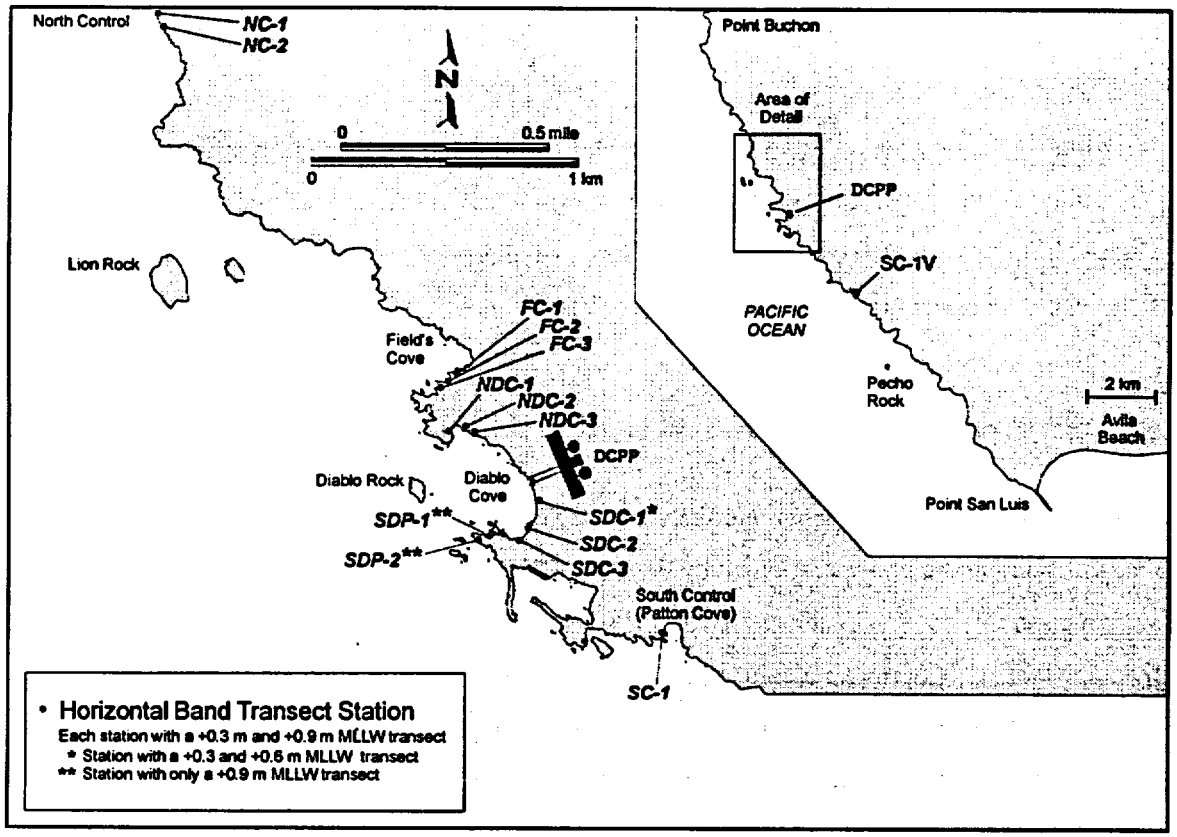


Figure 3-1. Horizontal band transect stations.

Intertidal algae and invertebrates tend to occur in zones or bands along the shore. Therefore, each station consists of an upper and lower elevation sampling transect, both oriented parallel to the waterline. Each transect was about 30 m long, one at the +0.9 m (3 ft) and the other at the +0.3 m (1 ft) MLLW tide level. The +0.9 m and +0.3 m sampling elevations correspond to the lower portion of the high intertidal zone and lower portion of the mid-intertidal zone, respectively, as described by Ricketts et al. (1985). The sampling area of each transect consisted of ten 1 m^2 fixed quadrats. The substrate at the +0.9 m MLLW level and higher at SDC-1 near the discharge was mainly cobble that was barren in the pre-operation period. Therefore, the upper transect at that station was located lower at the +0.6 m MLLW tide level where intertidal algae and invertebrates were more abundant. The data for this transect was analyzed with the +0.9 m transects at the other stations.

We used sampling techniques and measures of abundance that are commonly used in intertidal studies. Visual estimates of percent cover were made for all algal species and bare substrate. Overstory species were sampled first for coverage estimates, and then their branches and blades were brushed aside to allow estimates of understory and crustose species cover. Species less than

one percent cover were recorded as "present" on the data sheet. Total algal cover plus bare substrate cover per quadrat often exceeded 100 percent due to overlayering of multiple algal taxa on the rocks. The HBT sampling method is described in greater detail in Tenera (1997).

3.1.2 Results

The following section describes the biological communities at the study areas, analysis results of community-level changes, and changes in individual species. The biological communities for each study area sampled in 1999 are described using the taxa that formed 95 percent of the total algal cover in addition to crustose taxa and bare rock. The taxa examined in the correspondence analysis were those that formed 95 percent of the total algal cover and which occurred in at least 20 percent of the surveys.

Biological Community Descriptions

The following description is subdivided by area, with the two control stations combined for purposes of comparison to the other areas.

Controls (North and South)

Baseline changes were measured at control stations shown in **Figure 3-1**. The upper intertidal algal assemblage at control stations in 1999 was characterized by *Endocladia muricata*, *Mastocarpus papillatus*, and *Mazzaella flaccida* (**Figure 3-2a**). The lower sampling elevation was characterized by taxa more common to low intertidal zones, including *Mazzaella flaccida*, *Chondracanthus canaliculatus*, *Phyllospadix* spp., and *Gastroclonium subarticulatum* (**Figure 3-2b**). Crustose algae were abundant underneath the blades of the 'upright' taxa at both sampling elevations. Variation over time among the individual upright taxa did not result in large changes in total cover (all upright taxa) between study periods (**Figure 3-2**). For example, in 1999 *M. flaccida* declined slightly in abundance at the lower elevation control transects, but the decline was offset by increases in *Phyllospadix* spp. (**Figure 3-2b**).

Diablo Cove

Many of the algal taxa that were abundant in control areas were also present in North and South Diablo Cove, but most, with the exception of crustose algae, were reduced in abundance

compared to earlier study periods (**Figures 3-3** and **3-4**). Crustose algae are generally not emphasized in habitat characterizations, unless they are the only taxa present from reductions in other algae, such as in sea urchin barren zones (Leighton et al. 1966; North 1969, 1971; PG&E 1971; Lawrence 1975; Ayling 1981; Choat and Schiel 1982; Breitburg 1984).

With the exception of crustose algae, only a few upright algal taxa were conspicuous in the upper intertidal zone. *Endocladia muricata*, one of the more common species in Diablo Cove in 1999, had previously declined in abundance in the upper intertidal in North and South Diablo Cove (**Figure 3-3a**), and remained at reduced levels of abundance in 1999. *Mastocarpus papillatus* (foliose alga) was also present in the upper intertidal in both North and South Diablo Cove. Changes in those areas were similar to *E. muricata*, but *M. papillatus* further declined in abundance in 1999 at both sampling elevations in North and South Diablo Cove (**Figures 3-3a** and **3-4a**). *M. papillatus* also declined by a small amount at the upper intertidal transects at the control area stations (**Figure 3-2a**). *Mazzaella flaccida* (iridescent seaweed) remained absent in the upper and lower intertidal zones in Diablo Cove in 1999. This species was once one of the most abundant taxa in Diablo Cove and declined to very low levels of abundance shortly after power plant start-up (**Figures 3-3** and **3-4**). *Chondracanthus canaliculatus* and *Gastroclonium subarticulatum*, two common branch-like species in low intertidal zones, remained reduced in abundance in North and South Diablo Cove in 1999 (**Figures 3-3b** and **3-4b**). Abundances of these two species remained relatively high in control areas (**Figure 3-2b**).

Figure 3-3b shows a large difference in the abundance of *Phyllospadix* spp. (surfgrass) in the lower elevation transects in North Diablo Cove before and immediately after power plant start-up. The decline actually began before power plant start-up, during large storms associated with the 1983 El Niño (Tenera 1998). Abundances have since remained low but some recovery at the North Diablo Cove lower transects is apparent in subsequent sampling periods (**Figure 3-3b**). Surfgrass has shown similar long-term increases at low elevation transects in control areas and in Field's Cove after power plant start-up (**Figures 3-2b** and **3-5b**, respectively). However, the increase in North Diablo Cove, as well as in Field's Cove, were not as large as at control transects. Although still present in some areas of South Diablo Cove in low abundance, *Phyllospadix* spp. was not recorded at the South Diablo Cove low intertidal transects in 1999 (**Figure 3-4b**). Changes in the abundance of surfgrass at individual HBT stations are described more in detail in Appendix B.

Overall, the collective changes in individual species in 1999 resulted in the total coverage of upright taxa declining further at both sampling elevations in North and South Diablo Cove, with bare rock substrate increasing as a result (**Figures 3-3** and **3-4**). Species richness (number of taxa/m^2) also remained at levels recorded in other study periods following power plant start-up.

Further changes were also observed in species that were previously absent in Diablo Cove. *Sargassum muticum*, a bladder chain-like kelp plant that appeared in the intertidal zone for the first time in 1998, mainly in South Diablo Cove, increased in abundance in 1999 (**Figure 3-4**). *S. muticum* was not observed at or near transects in any of the other study areas. *Macrocystis pyrifera* also remained present at the lower elevation only in South Diablo Cove.

Field's Cove

The upper and lower intertidal horizontal band transects in Field's Cove were generally characterized by the same taxa found in control areas. These taxa remained relatively abundant in Field's Cove in 1999 although they have experienced smaller long-term changes (**Figure 3-5**). Some of the changes in individual taxa in Field's Cove generally followed the same patterns of change observed in Diablo Cove, while for others the changes more closely followed the changes observed in control areas. Other taxa exhibited different trends than in Diablo Cove or control areas. For example, in earlier years the upper intertidal population of *Endocladia muricata* reversed a prior decrease relative to controls (Tenera 1999b) and then remained relatively unchanged in abundance in 1999 (**Figure 3-5a**). The data for *Mazzaella flaccida* show a long-term decline at both sampling elevations in Field's Cove, but this taxa remained as one of the most abundant algae in the area in 1999. In contrast, the abundance of *M. flaccida* in control transects has remained more stable (**Figure 3-2**), but the 1999 results for this species at the lower elevation control transects show abundances had dropped below the long-term averages for previous sampling periods. *Egregia menziesii* (feather boa kelp) increased in abundance by large amounts in the low intertidal zone of Field's Cove in 1999 (**Figure 3-5b**), a change that contrasts with declines after plant start-up that resulted in reduced abundances in Diablo Cove.

The collective changes among the various taxa in Field's Cove, however, resulted in an overall decrease in total algal cover, that is also reflected by increases in bare rock substrate through 1999 (**Figure 3-5**). These same changes occurred in Diablo Cove, but were of greater magnitude (**Figures 3-4** and **3-5**).

South Diablo Point

The South Diablo Point stations were sampled on four different occasions in the May 1995–December 1999 study period with three of the surveys occurring in 1999 (**Figure 3-6**). Therefore, the data for the May 1995–December 1999 study period reflects changes that occurred mainly in 1999.

The most noticeable difference at South Diablo Point in 1999, compared to previous times when it was sampled, was a decrease in most foliose algal cover, with the exception of *Gelidium coulteri* (**Figure 3-6**). In 1999, South Diablo Point was characterized by articulated coralline algae (*Corallina vancouveriensis* and *Calliarthron/Bossiella* spp.) and crustose algae. Bare rock space was more abundant as a result.

Community Analysis

This section presents an analysis of the results organized by tidal elevation.

Upper Elevation

The combined results for all taxa (excluding crustose taxa) summarized as total algal cover for the upper elevation transects indicate that further reductions in algal abundance occurred in 1999, mainly in North and South Diablo Cove and at South Diablo Point (**Figure 3-7**). In 1999, the lowest levels of abundance during the study were recorded at nearly all of the upper intertidal transects in these areas. The trends are consistent with results from statistical analyses of data collected in earlier years (Tenera 1997, 1999b). Total algal cover in 1999 at the South Diablo Point transects was largely represented by the persistence of articulated coralline algae (*Corallina vancouveriensis* and *Calliarthron/Bossiella* spp.).

Results of correspondence analysis of data collected from 1990 through 1999 show that species composition and abundance at the upper elevation transects in Diablo Cove, Field's Cove, and control areas remained distinct from one another in 1999 (**Figure 3-8**). Species common to the Field's Cove and control area transects are shown by the first axis scores, that include *Mazzaella flaccida, Mastocarpus papillatus, Mastocarpus jardinii, Endocladia muricata,* and *Pelvetia compressa*. The Field's Cove and control area transects differed from one another on the second

axis in the proportional abundances of these species. For example, *Mazzaella flaccida* was more common at the controls, and *Endocladia muricata* was more common in Field's Cove (**Figure 3-8**).

The Diablo Cove transects remained different in algal assemblage composition from control and Field's Cove assemblages (**Figure 3-8**). The annual survey score for 1999 shows the greatest similarity to the other areas. This was likely caused by changes in the relative proportions of less abundant taxa. The distance on the first axis between the 1998 and 1999 survey scores show the large interannual variation that has occurred at the upper elevation transects in Diablo Cove.

Lower Elevation

The combined results for all taxa in 1999, summarized as total algal cover (excluding crustose algae), show continued reductions in algal abundance at many of the stations in Diablo Cove (**Figure 3-9**). The reductions were most noticeable at most of the low elevation transects in South Diablo Cove and at one transect (NDC-1) in North Diablo Cove. Many of the changes in total algal cover in Diablo Cove were due to increases in ephemeral algae (e.g., filamentous red algae, **Figures 3-3b and 3-4b**)

Results of correspondence analysis showed that lower elevation transects in 1999 in Diablo Cove, Field's Cove, and control areas remained distinct from one another in species composition and abundance (**Figure 3-10**). Species common to the Field's Cove and control area transects, as shown by the first dimension species scores (**Figure 3-10**), consisted of a relatively large assemblage of species that included *Mazzaella flaccida, Mazzaella heterocarpa, Phyllospadix* spp., *Egregia menziesii, Chondracanthus canaliculatus,* and *Gastroclonium subarticulatum* among others. The Field's Cove and control area transects differed from one another on the second dimension axis in the proportional abundances of these species. For example, *E. menziesii* was more common in Field's Cove, while *M. flaccida* was more common in control areas. The Diablo Cove transects remained different in algal assemblage composition from control and Field's Cove assemblages in 1999, changing little in species composition and abundance from previous years of operation. The Diablo Cove lower elevation transects remained characterized by species that included the ephemerals *Ulva/Enteromorpha* spp. and filamentous red algae.

Select Species Changes

Changes in abundance over time are shown for individual taxa as examples of the types of changes that have continued since previous analyses (Tenera 1997, 1999b). Other taxa that have shown new changes in 1999 are also discussed. Annual mean abundances for are presented in Appendix E for each individual algal taxa by station and elevation from 1976 through 1999.

Mastocarpus papillatus (foliose red alga) is one of the most common species in central California intertidal zones, including the Diablo Canyon area. It is widespread, occurring in both upper and lower intertidal zones. Declines in *M. papillatus* at the upper elevation transects in Diablo Cove, relative to controls, were detected through statistical analysis of data collected through 1995 (Tenera 1997) and continued in 1995–98 (Tenera 1999b). Results for 1999 revealed abundances further declined to near-absence at both the upper and lower intertidal transects in Diablo Cove (**Figures 3-11** and **3-12**). Abundances through 1999 at control and Field's Cove transects show some decreases in abundance, but not to the low levels of abundance observed in Diablo Cove.

Endocladia muricata (nail brush seaweed) is another common species in California, including Diablo Cove, that mainly occurs in the upper intertidal zone. Changes in this species have been variable (**Figure 3-13**). The abundance of *E. muricata* declined significantly after power plant start-up through 1995, relative to controls (Tenera 1997), but then increased in 1995–98 (Tenera 1999). In 1999, however, *E. muricata* declined to its lowest levels of abundance in Diablo Cove, particularly at NDC-3. Although pre-operation abundances were not initially high at the South Diablo Cove transects, *E. muricata* has not recovered from declines to near-zero abundance levels. The resumption of monitoring at the South Diablo Point stations in 1999 showed *E. muricata* had declined at Station SDP-1 to almost zero abundance. Patterns of abundance from 1976 through 1999 at control and Field's Cove transects have also declined, but to a similar extent. Although some of the stations in the control areas and Field's Cove have also shown decreases in abundance they are not of similar magnitude to the declines in Diablo Cove and at Diablo Point.

Pelvetia (= *Silvetia*) *compressa* is a rockweed species that occurs only in the upper intertidal zone. There were contrasting changes in the abundance of this species among the Field's Cove stations (**Figure 3-14**). A new pattern of change in 1995–1998 that differed from changes reported in Tenera (1997) was a decrease in abundance at Station FC-3 in Field's Cove relative

to controls (Tenera 1999b). Sampling in 1999 showed further declines in abundance at FC-3. However, abundances at control transect NC-1 also declined in 1999. In contrast, increases occurred at neighboring transects FC-1 and FC-2 in Field's Cove, indicating the variable nature of *P. compressa*. Declines in this taxa had previously occurred in Diablo Cove (Tenera 1997).

Mazzaella flaccida (iridescent seaweed) is a widespread intertidal alga that occurs in both the upper and lower intertidal zones. Changes in this species at Diablo Canyon have been well documented (Tenera 1997, 1999). Sampling in 1999 has shown that abundances of this taxa have also declined to very low levels at the South Diablo Point stations (**Figures 3-15** and **3-16**). Similar declines in abundance had occurred previously at Diablo Cove upper and lower intertidal transects (Tenera 1997, 1999b). This species remained more abundant in Field's Cove and control areas, although furthering declines are evident over the past several years at all lower elevation transects in Field's Cove and at lower elevation control transects NC-2 and SC-1 (**Figure 3-16**).

Chondracanthus canaliculatus is a branched alga that forms mats of entangled branches in the low intertidal zones. This species has demonstrated long-term increases in abundance at control and Field's Cove transects during power plant operation through 1999 (**Figure 3-17**). While this pattern was closely paralleled in North and South Diablo Cove during the early and mid-1990s, abundances have since declined. Observations in 1999 revealed further reductions to near-zero abundance.

Gastroclonium subarticulatum is another branched, mat-forming alga that also occurs primarily in the low intertidal zone. Changes at control and Field's Cove transects indicate the persistent nature of this species (**Figure 3-18**). Changes in 1999 show reductions to very low levels of abundance at the South Diablo Cove transects and at North Diablo Cove transect NDC-1. Abundances at NDC-2 remained reduced at levels similar to previous years. This species also declined to very low levels of abundance at SDP-2 on South Diablo Point. These transects at South Diablo Point are subject to heavy surge and wave action and are therefore more comparable to the low elevation transects in other areas.

Phyllospadix spp. (surfgrass) occurs mainly in the low intertidal and shallow subtidal zone. When abundant, surfgrass appears as grass green meadows fringing the shoreline at low tide. Surfgrass has been the subject of additional studies at DCPP, and the results for the horizontal

band transect study show increases in the abundance of surfgrass in North Diablo Cove. The results are further discussed in a special study on surfgrass in **Appendix B.**

3.1.3 Discussion

The majority of results for 1999 reflect a continuation of the same trends described for previous periods of power plant operation (Tenera 1997, 1999b). The most persistent trend was a decline in algal abundance in Diablo Cove. Diablo Cove remained uniquely characterized by a lack of the taxa abundant in control areas and in Field's Cove. The results for 1999 indicated that many of these taxa declined to near-zero abundance levels in Diablo Cove. Declines in many of the same taxa also occurred at South Diablo Point.

Field's Cove had results that show the variable nature of any discharge effects that may be occurring in this area. Certain temperature sensitive species, such as *Mazzaella flaccida*, further declined in abundance in 1999, but so did control populations at the lower sampling elevation (e.g., Stations NC-2 and SC-1 in **Figure 3-16**). Highly variable patterns were observed for the rockweed *Pelvetia (=Silvetia) compressa*. Declines at FC-3, relative to controls, were detected as a discharge effect (Tenera 1999b). However, the abundance of *Pelvetia* at other transects in Field's Cove increased through 1999. An increase in the feather boa kelp (*Egregia menziesii*) in Field's Cove in 1999 contrasts with previous descriptions of discharge effects for this species that showed declines in Diablo Cove. Dense stands of temperature-sensitive oar kelp (*Laminaria setchellii*) were also observed emerging above the water line at low tide in all areas fringing the southern shore of Field's Cove (Tenera, unpublished observations). These changes are inconsistent with previous descriptions of discharge effects in Diablo Cove and indicate that Field's Cove represents an area with much reduced discharge effects.

Changes at stations on South Diablo Point observed in 1999 were more apparent than those observed in Field's Cove. Total algal cover continued to decline in 1999. The decline was notable because the South Diablo Point stations were not sampled in the previous three years when species abundances were still relatively high despite decreases from pre-operational levels of abundance (Tenera 1997). The taxa affected included those that have exhibited temperature-related changes in Diablo Cove, including *Mazzaella flaccida* and *Egregia menziesii*. However, whether the changes were the result of discharge temperature or secondary effects remains

unknown, since coincident with the decline in the algae was a large increase in grazing purple sea urchins (see Section 3.2 *Intertidal Invertebrates*).

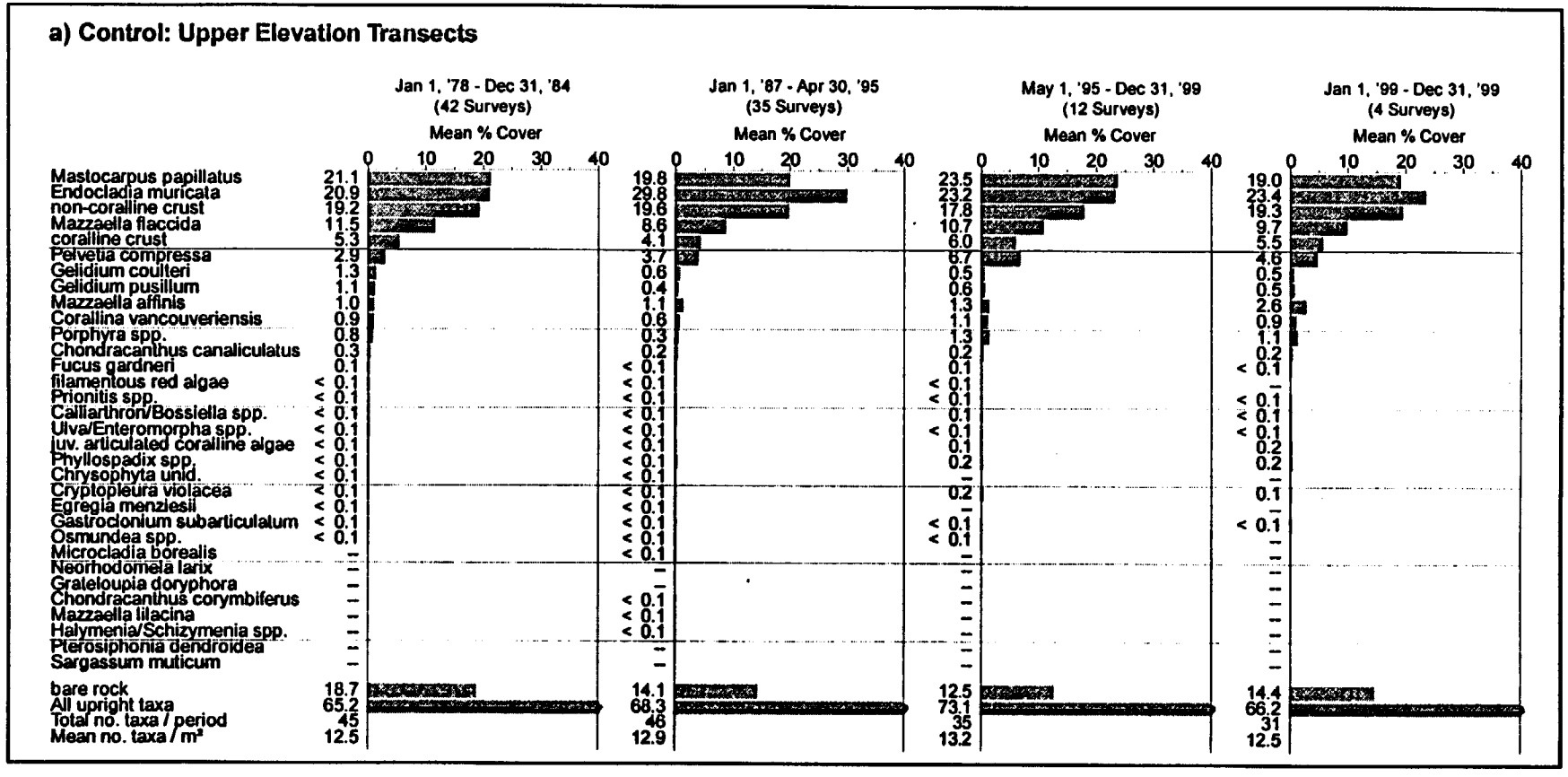


Figure continued on next page.

Figure 3-2. Intertidal algal abundances at the control (a) upper and (b) lower elevation transects. Stations = NC-1, NC-2, and SC-1.

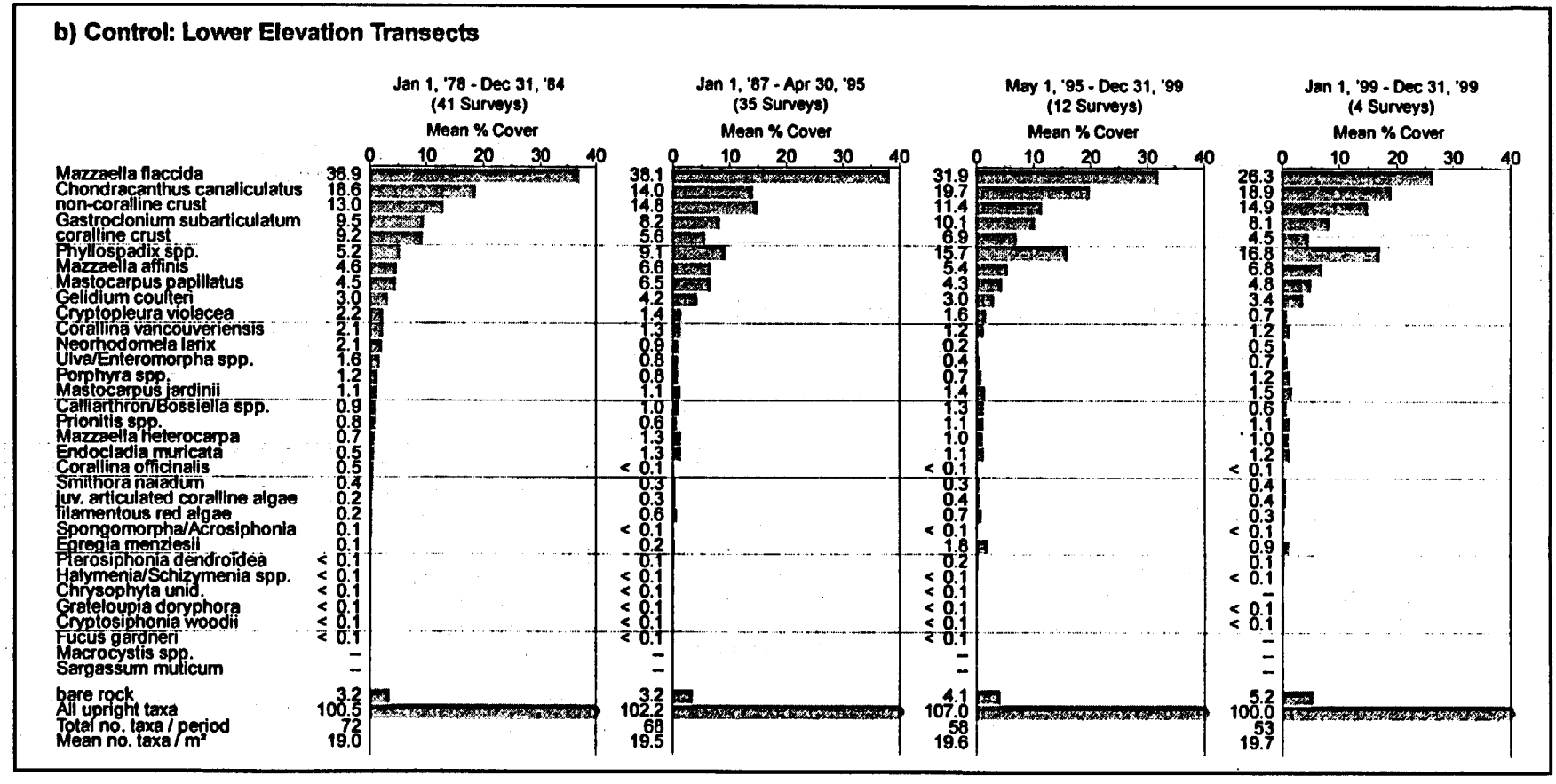


Figure 3-2 (continued). Intertidal algal abundances at the control (a) upper and (b) lower elevation transects. Stations = NC-1, NC-2, and SC-1.

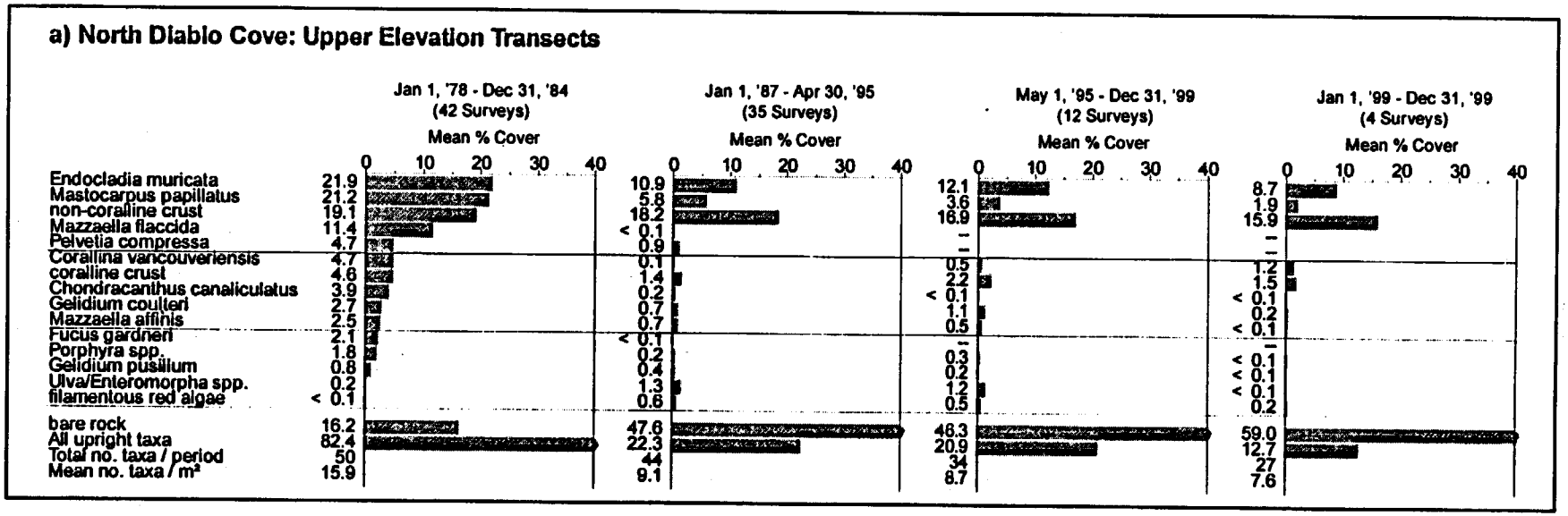


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Figure 3-3. Intertidal algal abundances at the North Diablo Cove (a) upper and (b) lower elevation transects. Stations = NDC-1, -2, and -3.

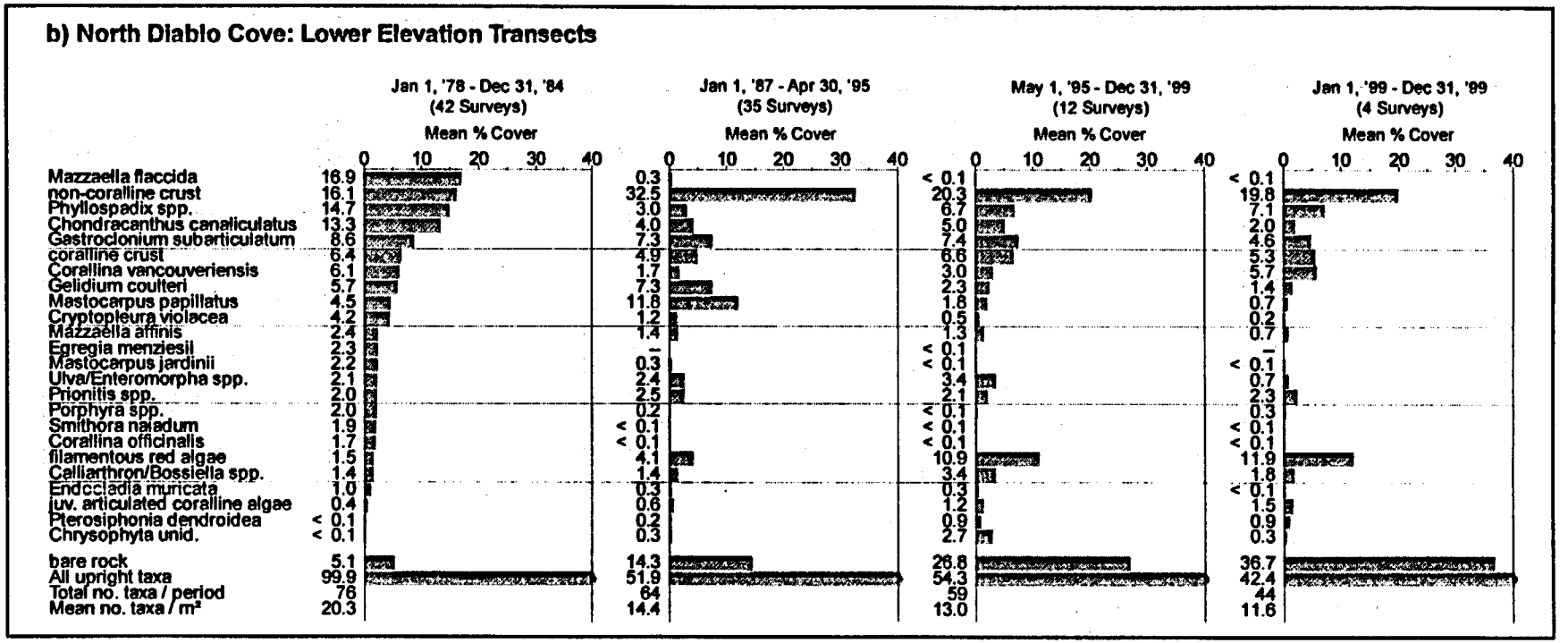


Figure 3-3 (continued). Intertidal algal abundances at the North Diablo Cove (a) upper and (b) lower elevation transects. Stations = NDC-1, -2, and -3.

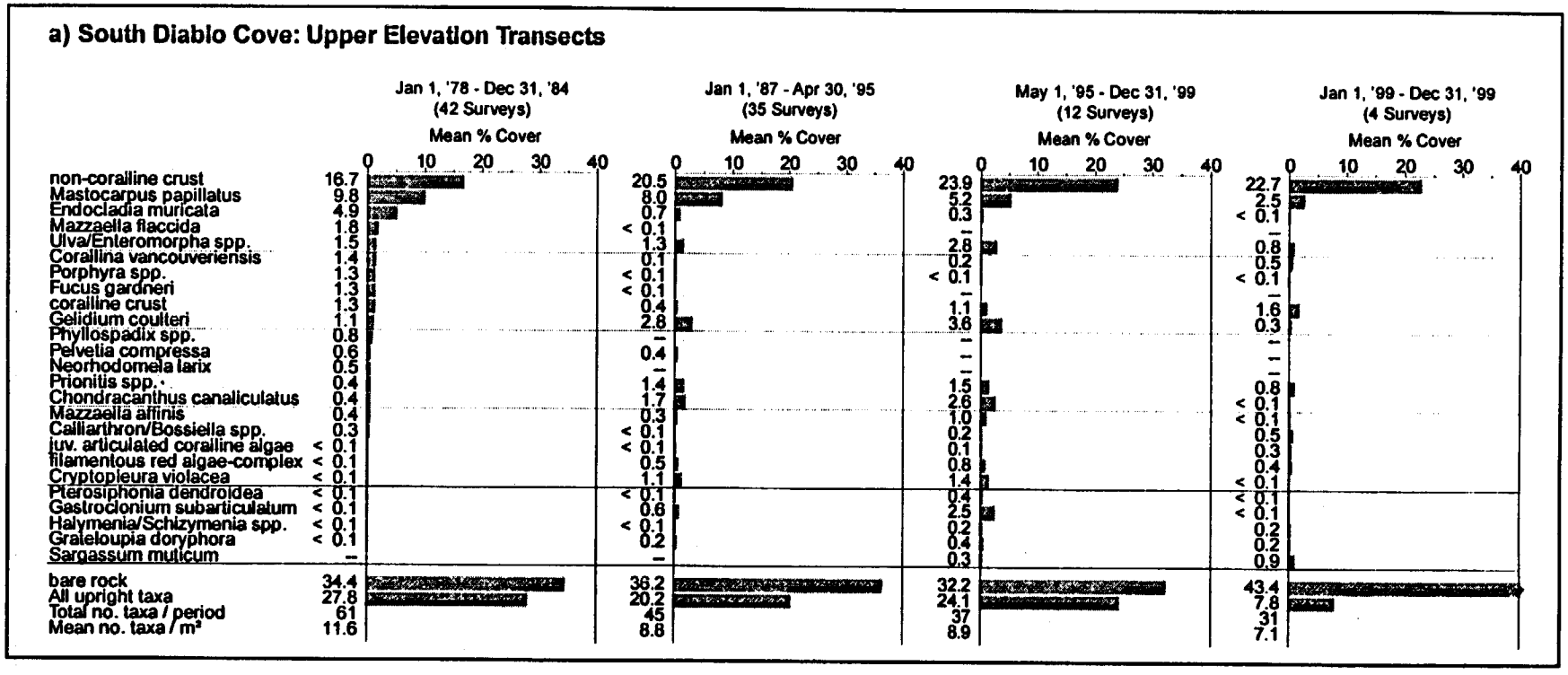


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Figure 3-4. Intertidal algal abundances at the South Diablo Cove (a) upper and (b) lower elevation transects. Stations = SDC-1, -2, and -3.

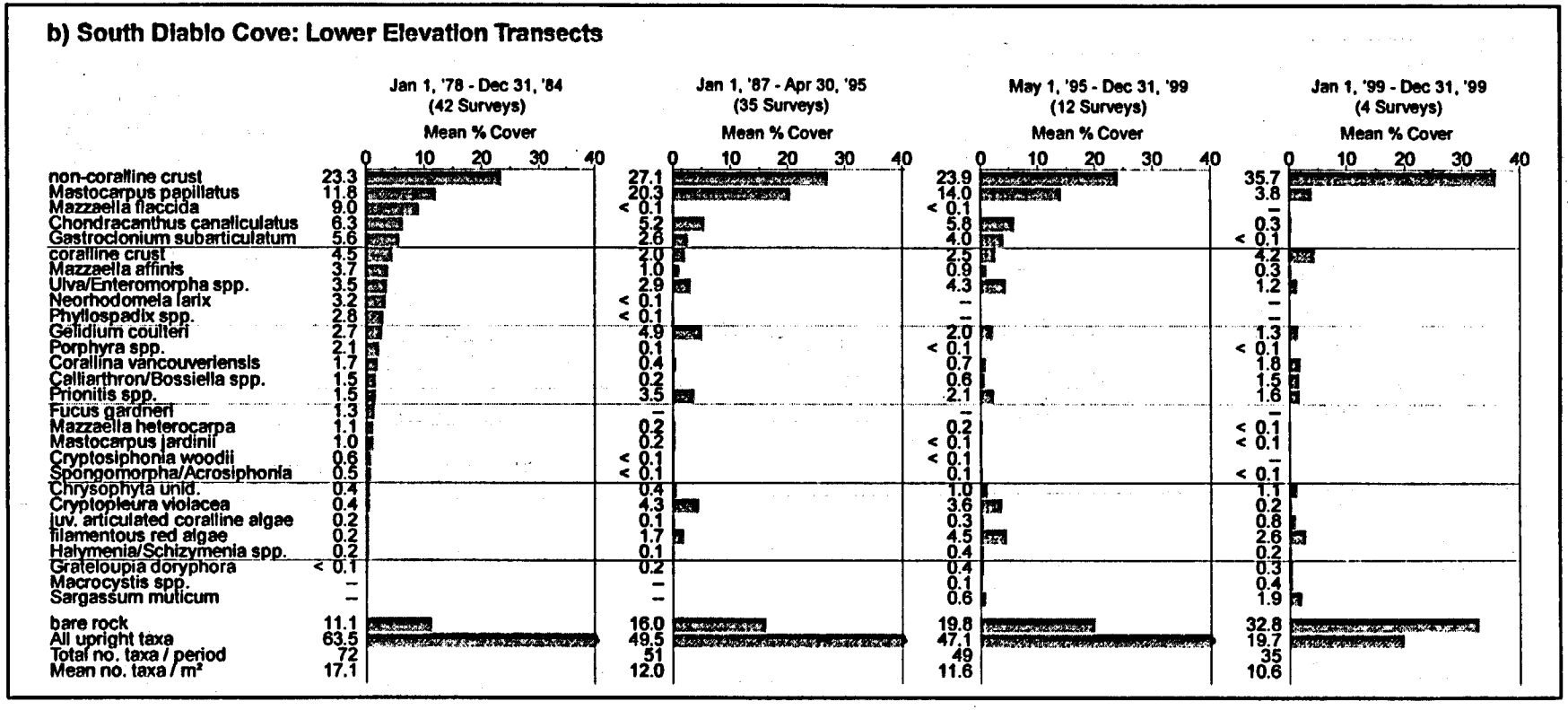


Figure 3-4 (continued). Intertidal algal abundances at the South Diablo Cove (a) upper and (b) lower elevation transects. Stations = SDC-1, -2, and -3.

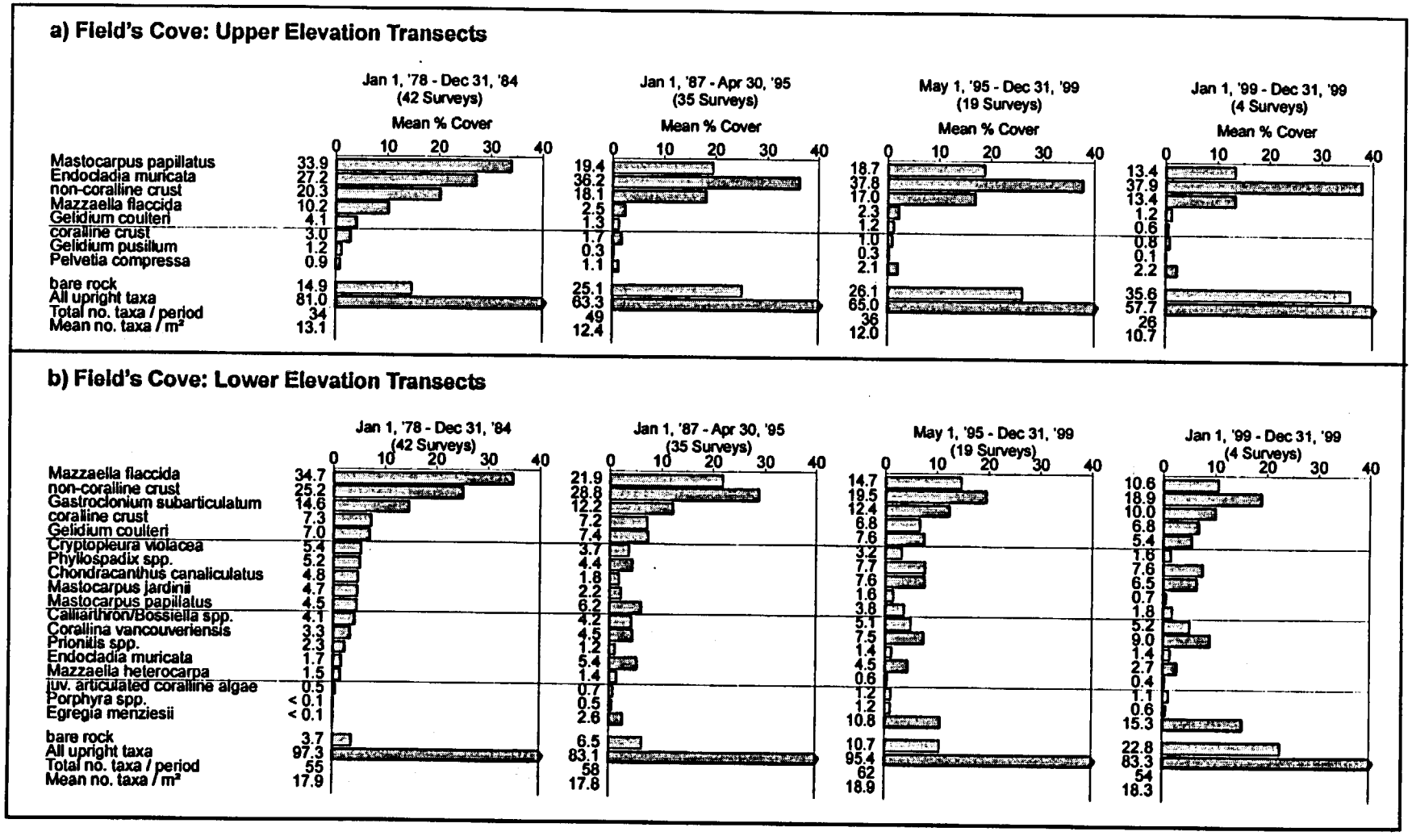


Figure 3-5. Intertidal algal abundances at the Field's Cove (a) upper and (b) lower elevation transects. Stations = FC-1, –2, and -3.

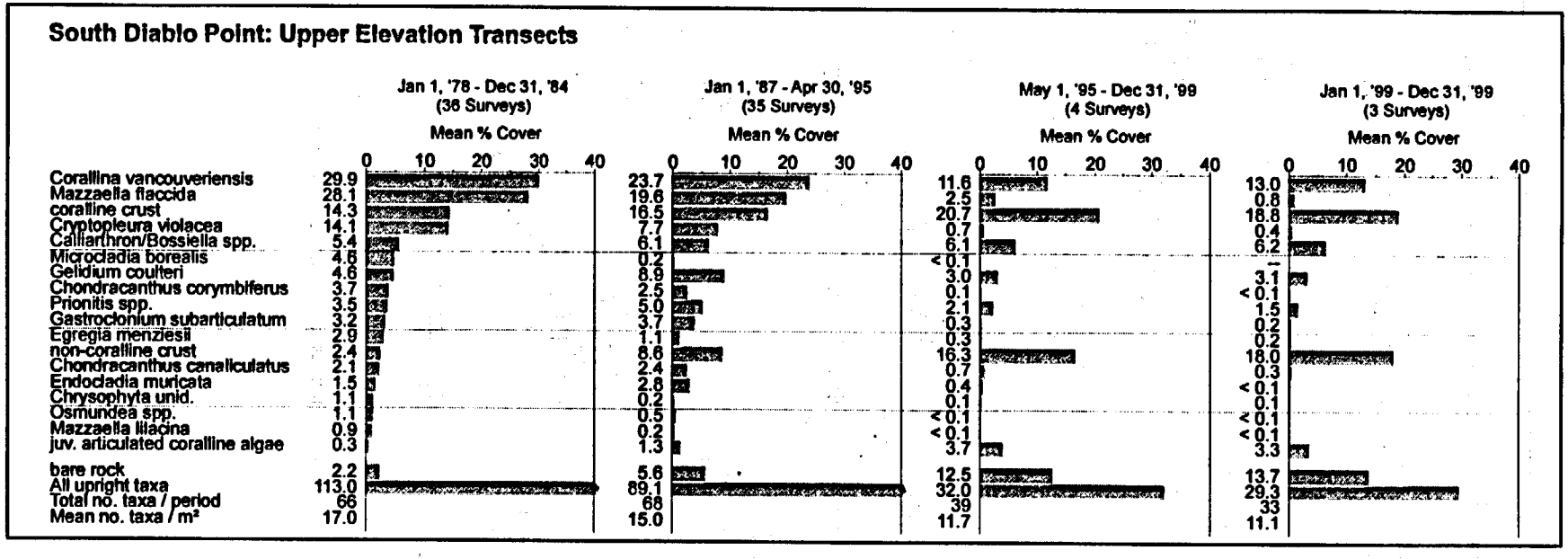


Figure 3-6. Intertidal algal abundances at the South Diablo Point upper elevation transects. Stations = SDP-1 and -2.

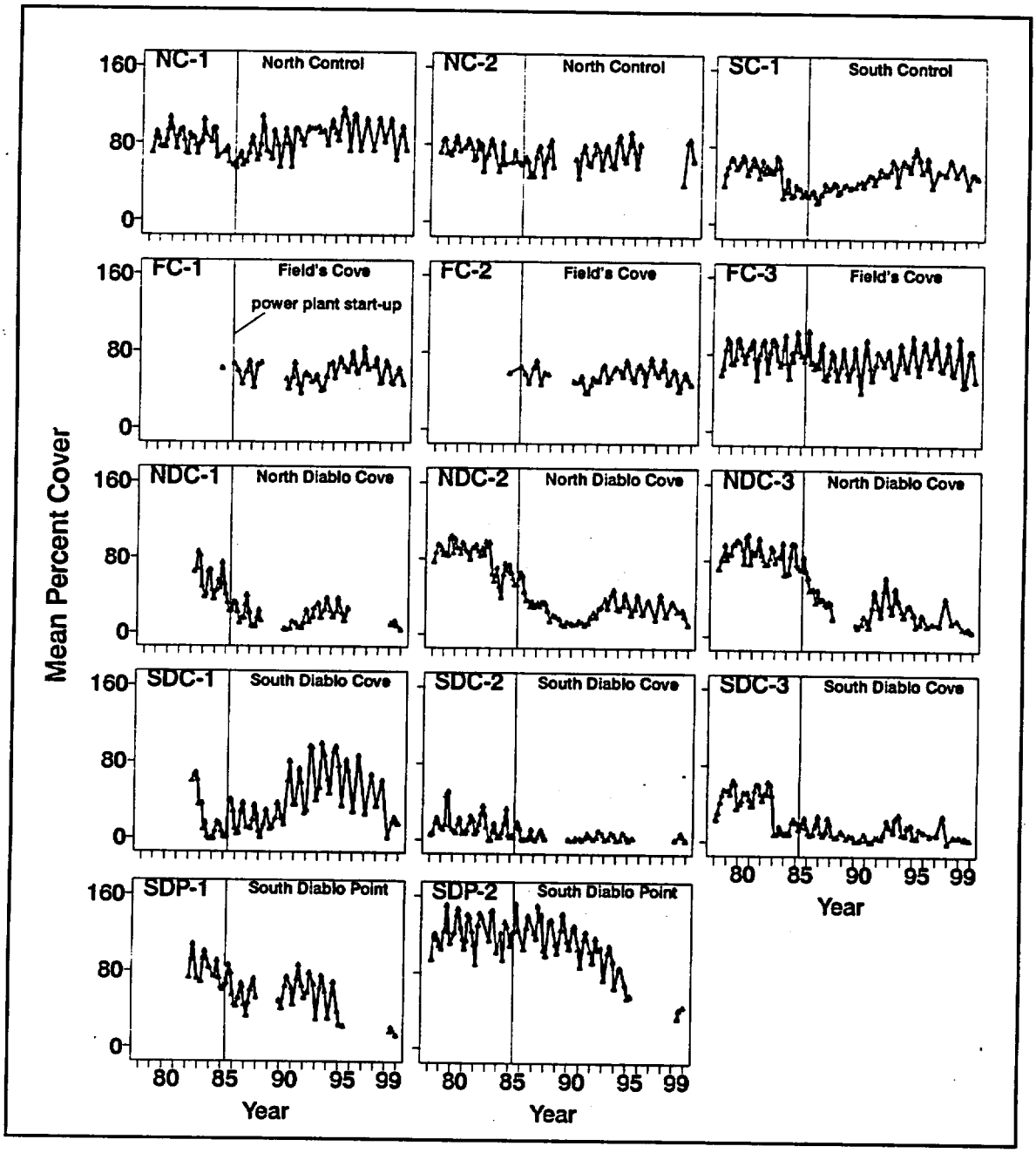


Figure 3-7. Total algal cover: changes in abundance at upper intertidal transects.

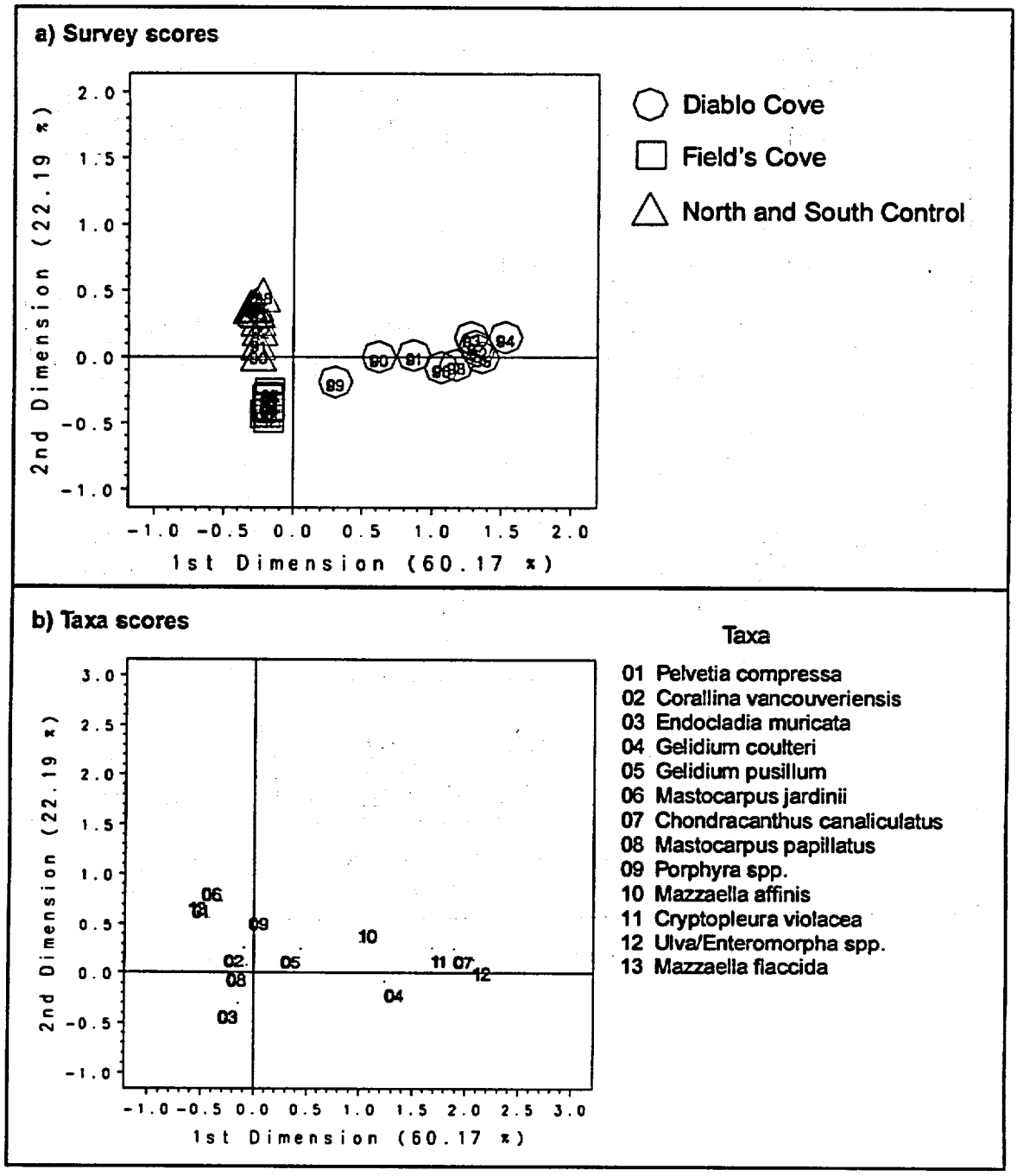


Figure 3-8. Correspondence analysis of upper intertidal algal cover (a) survey scores and (b) taxa scores

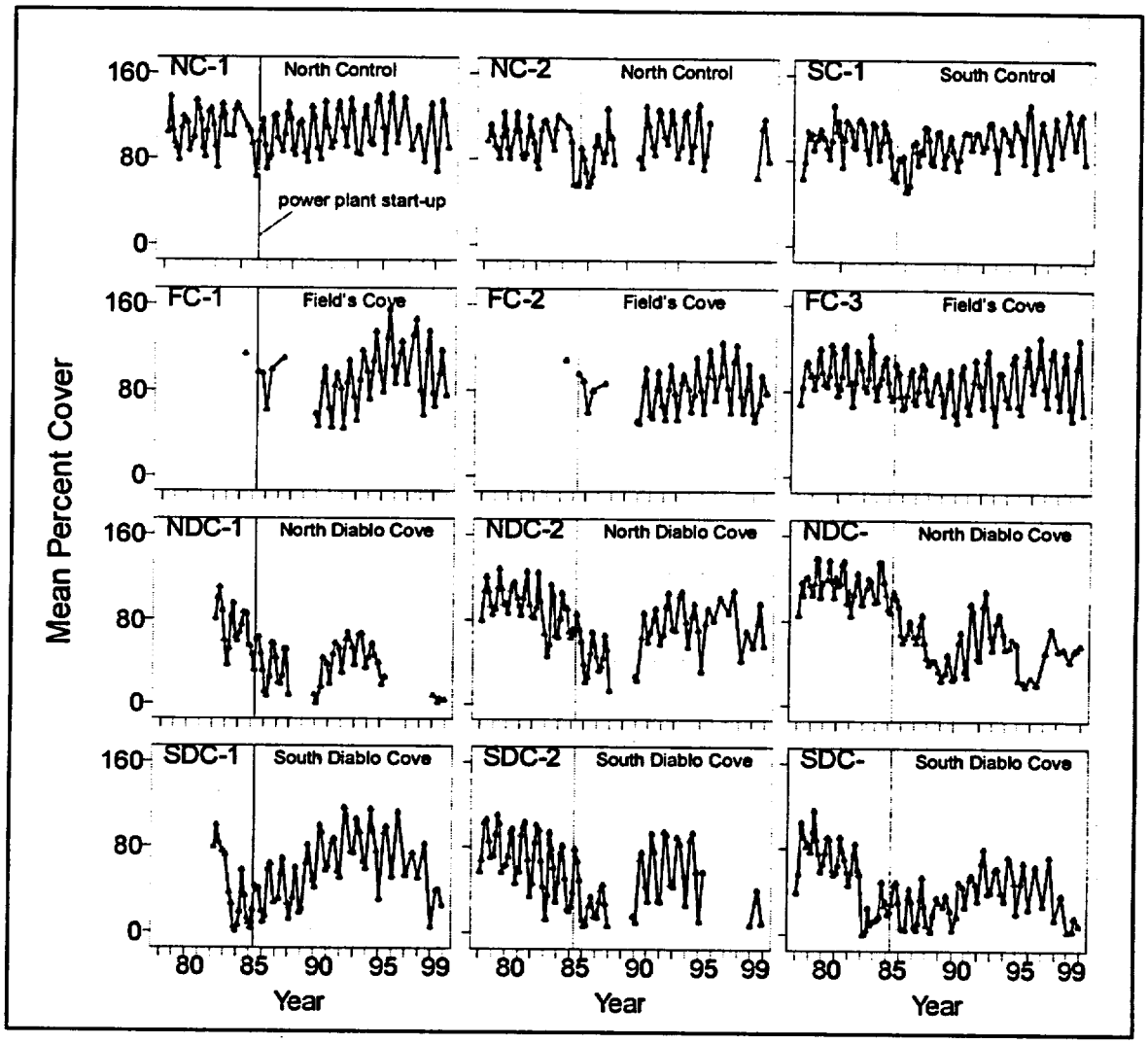


Figure 3-9. Total algal cover: changes in abundance at lower intertidal transects.

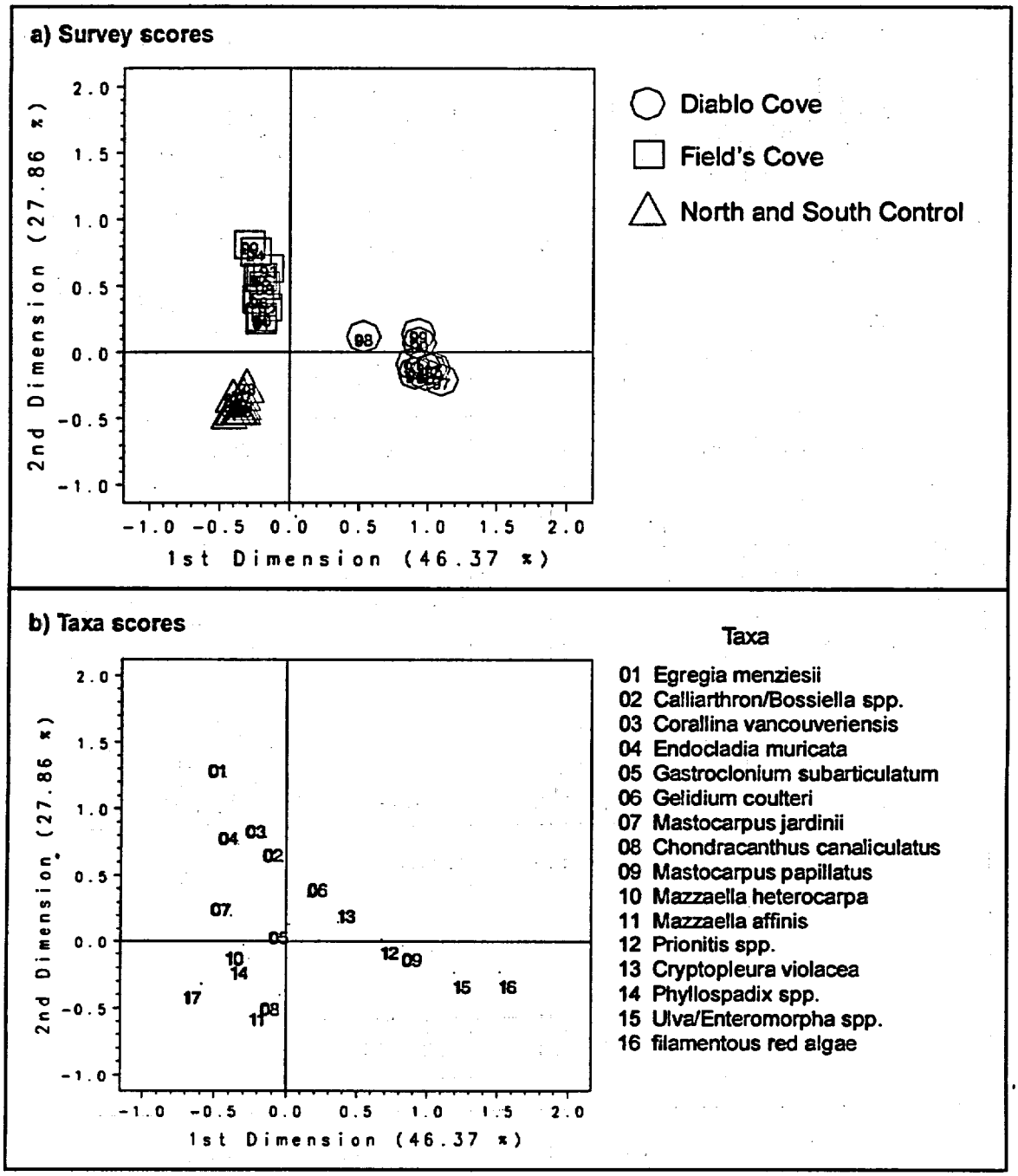


Figure 3-10. Correspondence analysis of lower intertidal algal cover (a) survey scores and (b) taxa scores

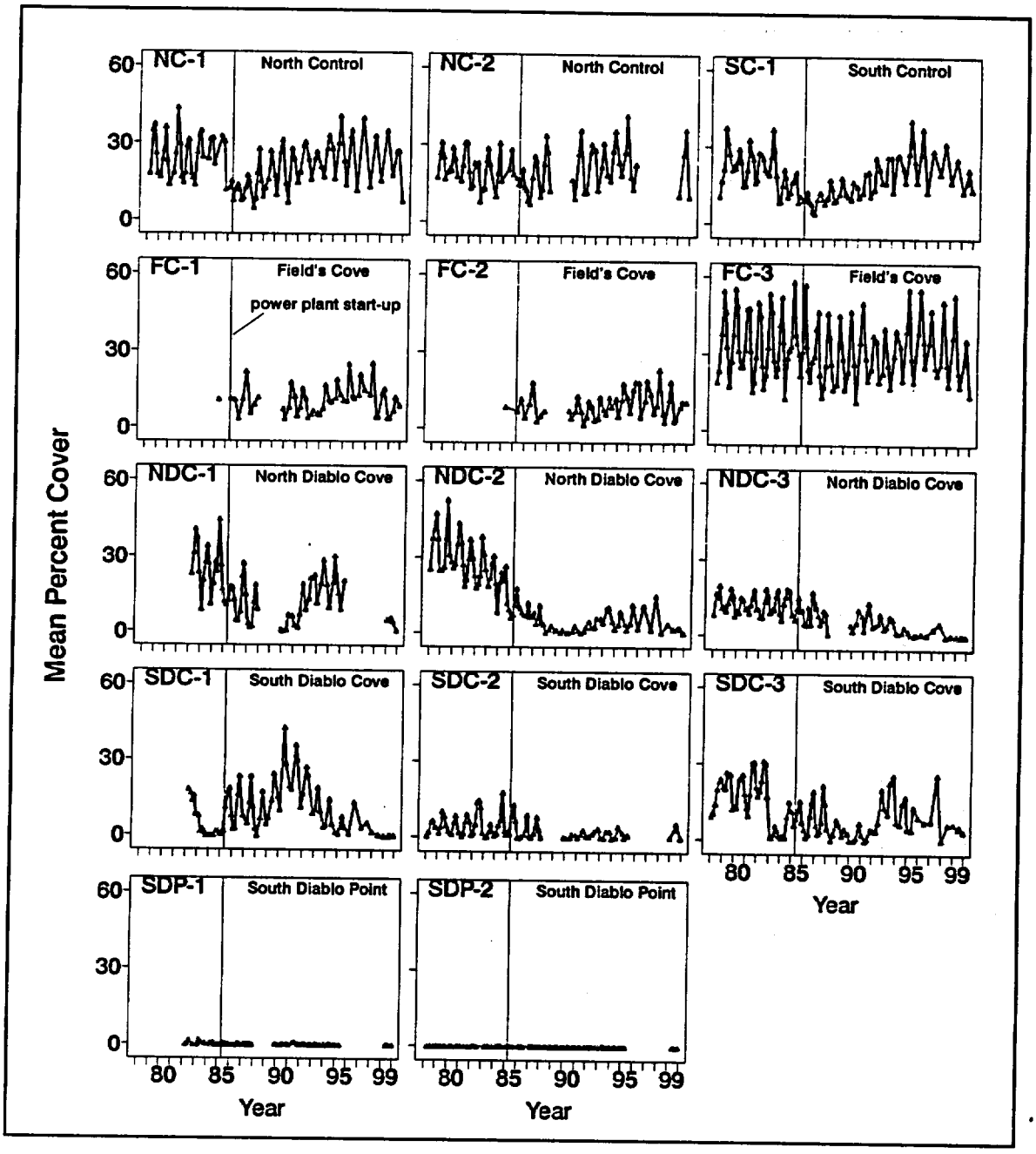


Figure 3-11. *Mastocarpus papillatus*: changes in abundance at upper intertidal transects.

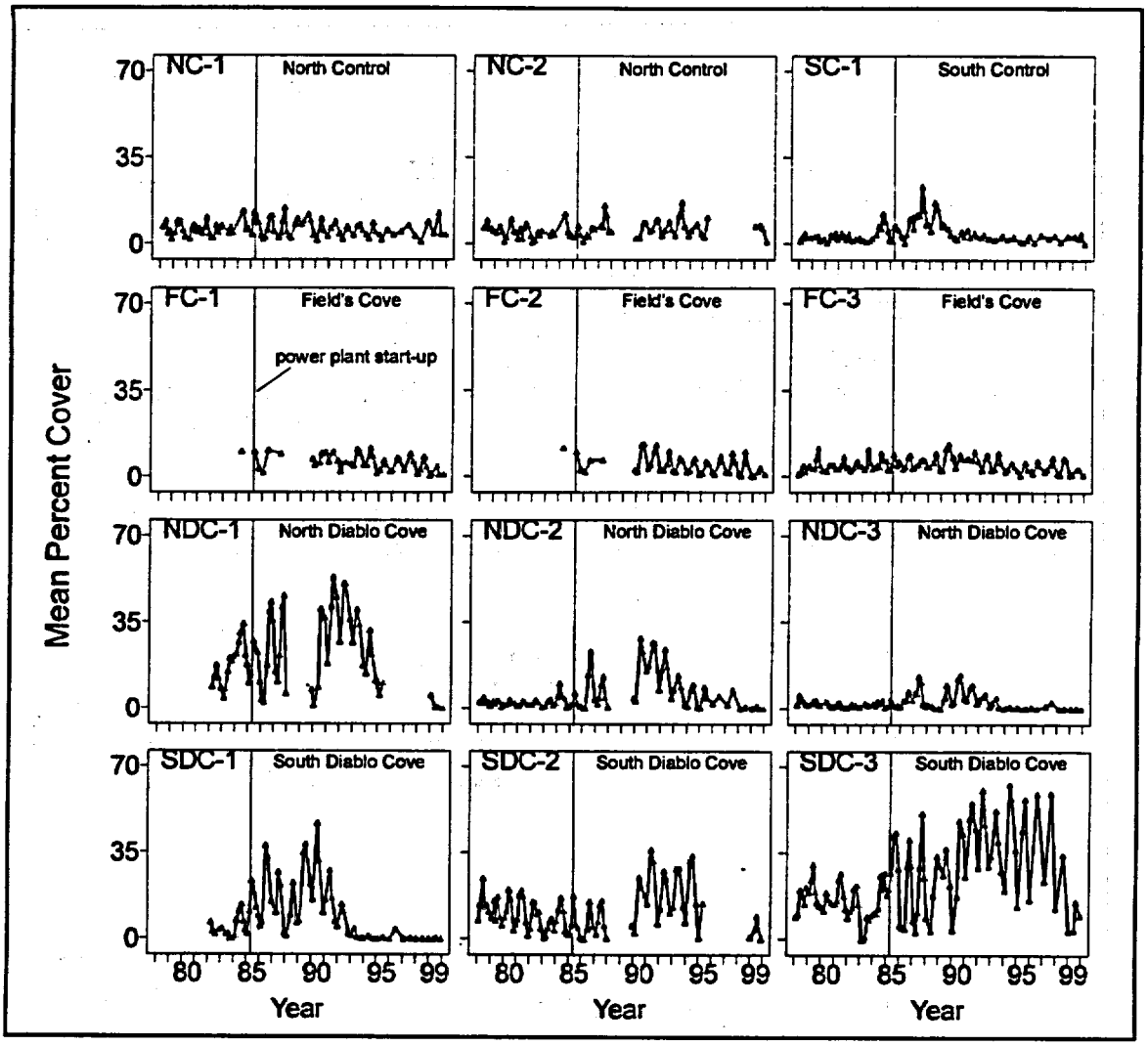


Figure 3-12. *Mastocarpus papillatus*: changes in abundance at lower intertidal transects.

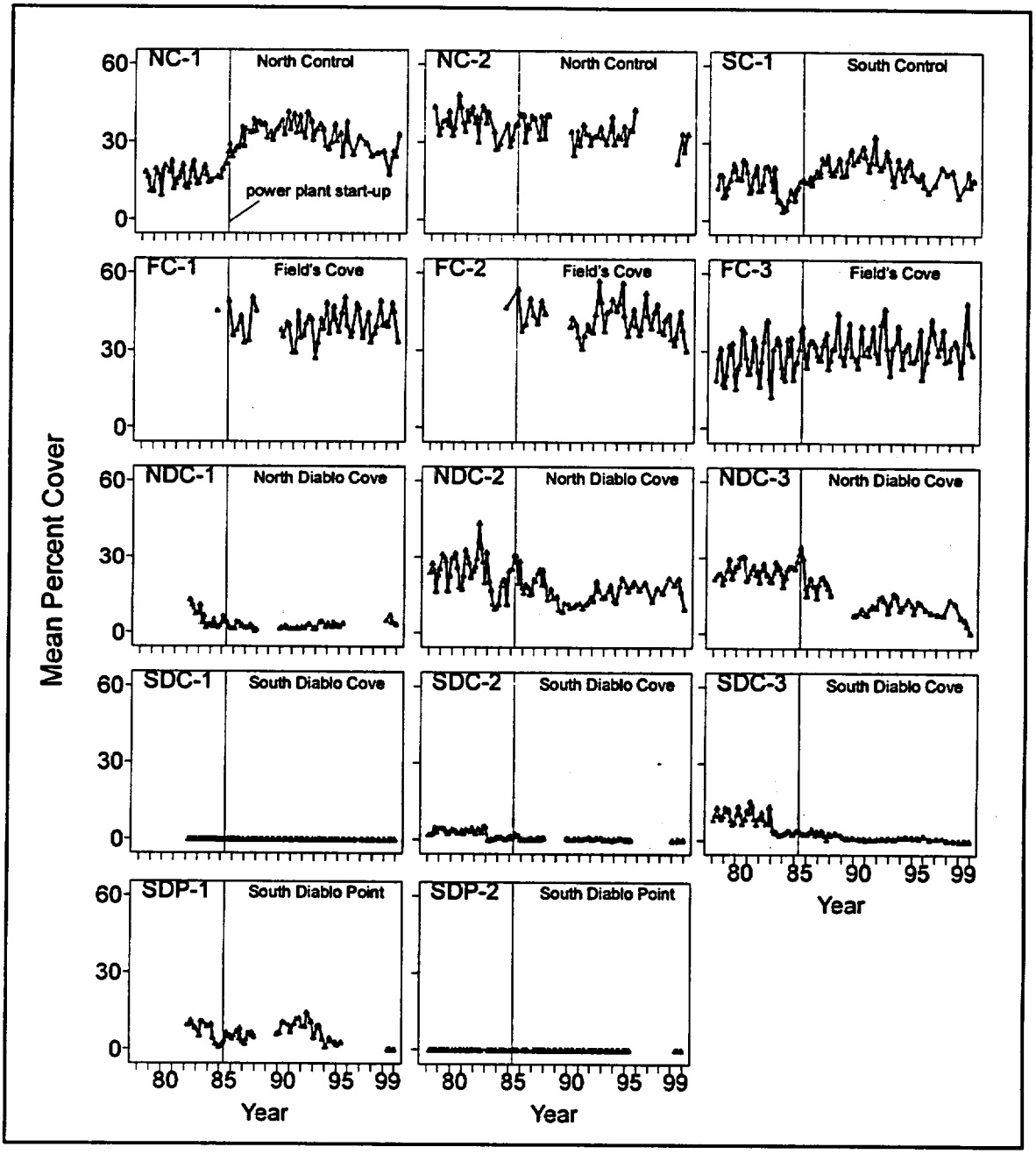


Figure 3-13. *Endocladia muricata*: changes in abundance at upper intertidal transects.

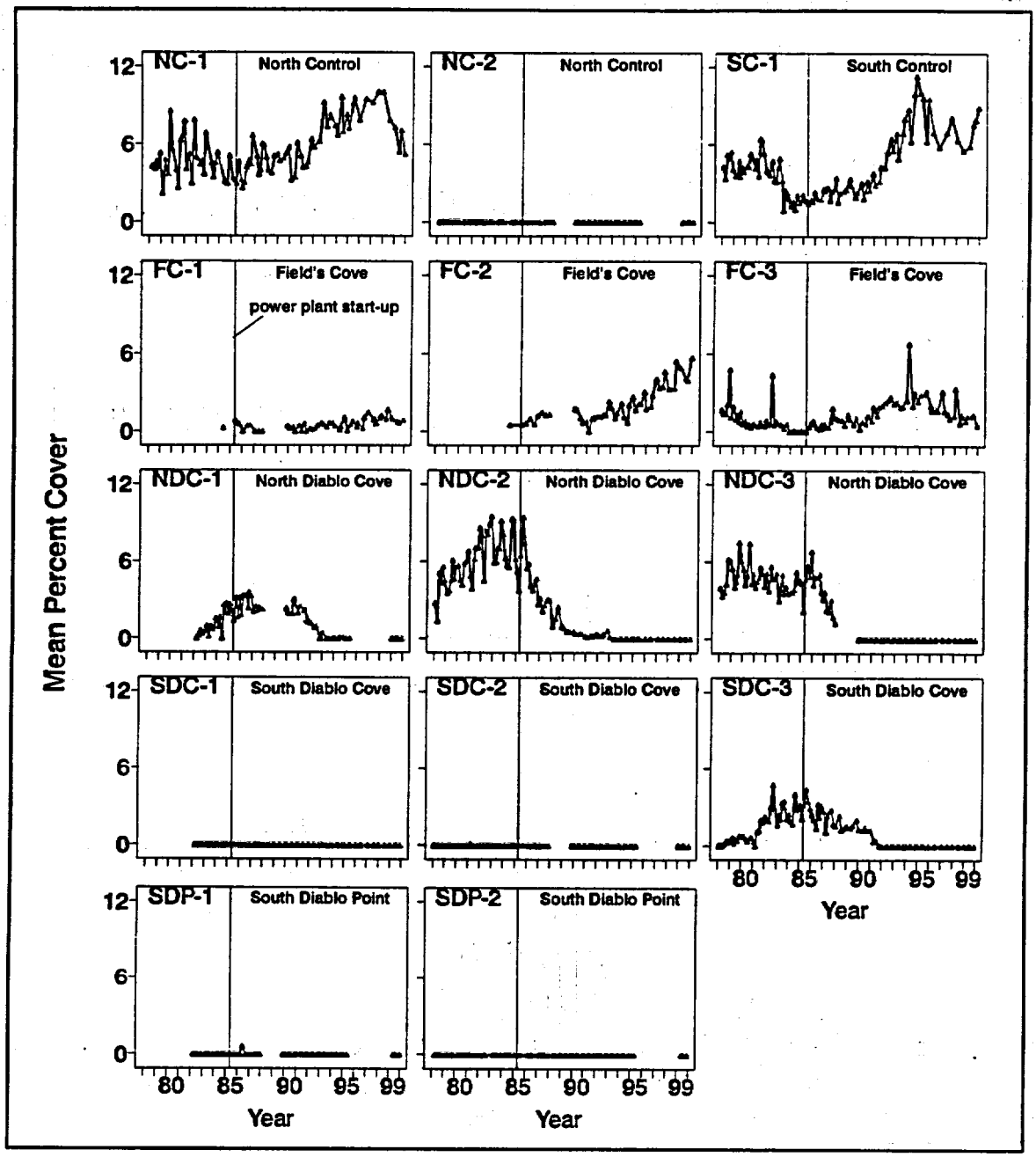


Figure 3-14. *Pelvetia* (*Silvetia*) *compressa*: changes in abundance at upper intertidal transects.

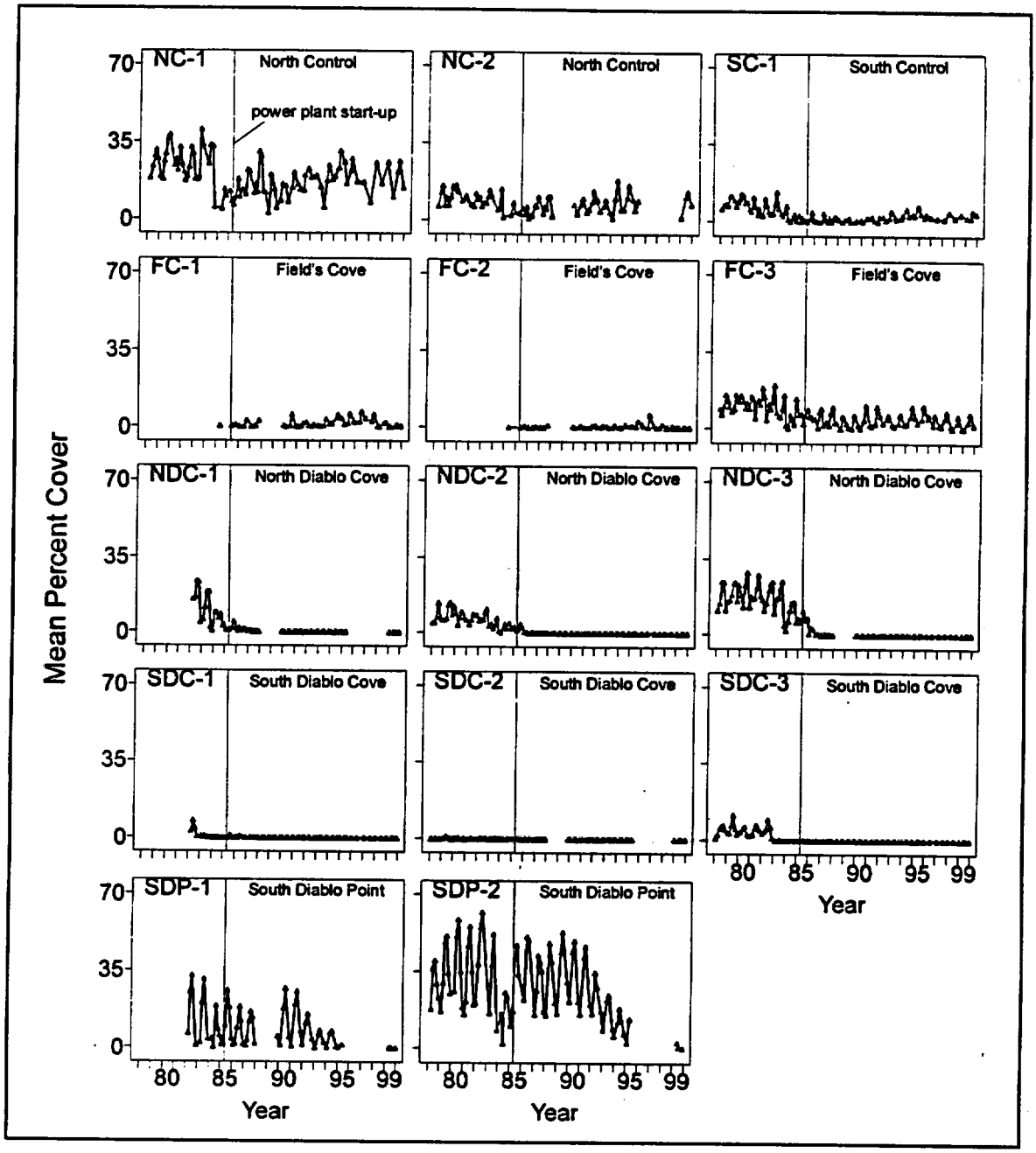


Figure 3-15. *Mazzaella flaccida*: changes in abundance at upper intertidal transects.

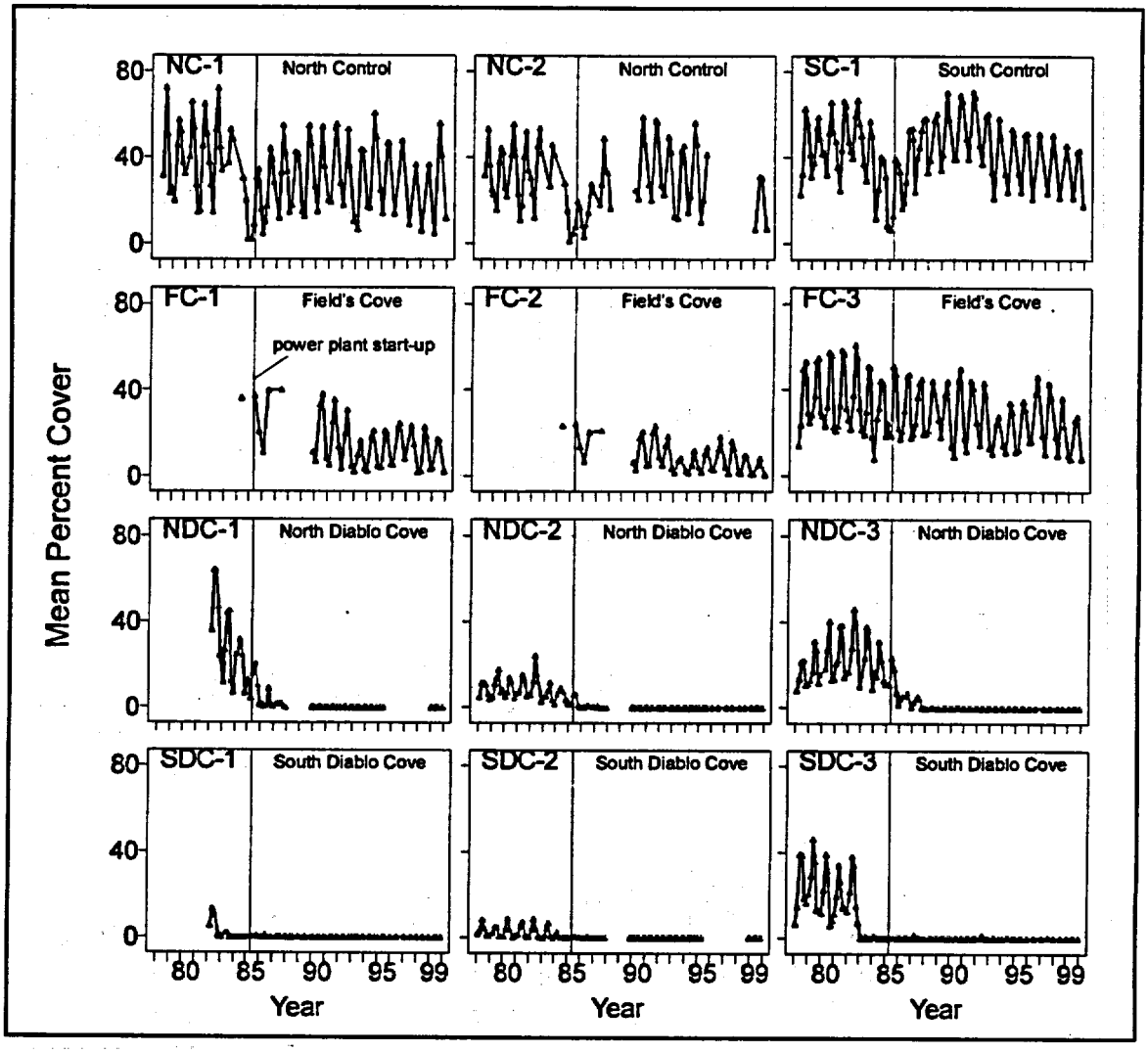


Figure 3-16. *Mazzaella flaccida*: changes in abundance at lower intertidal transects.

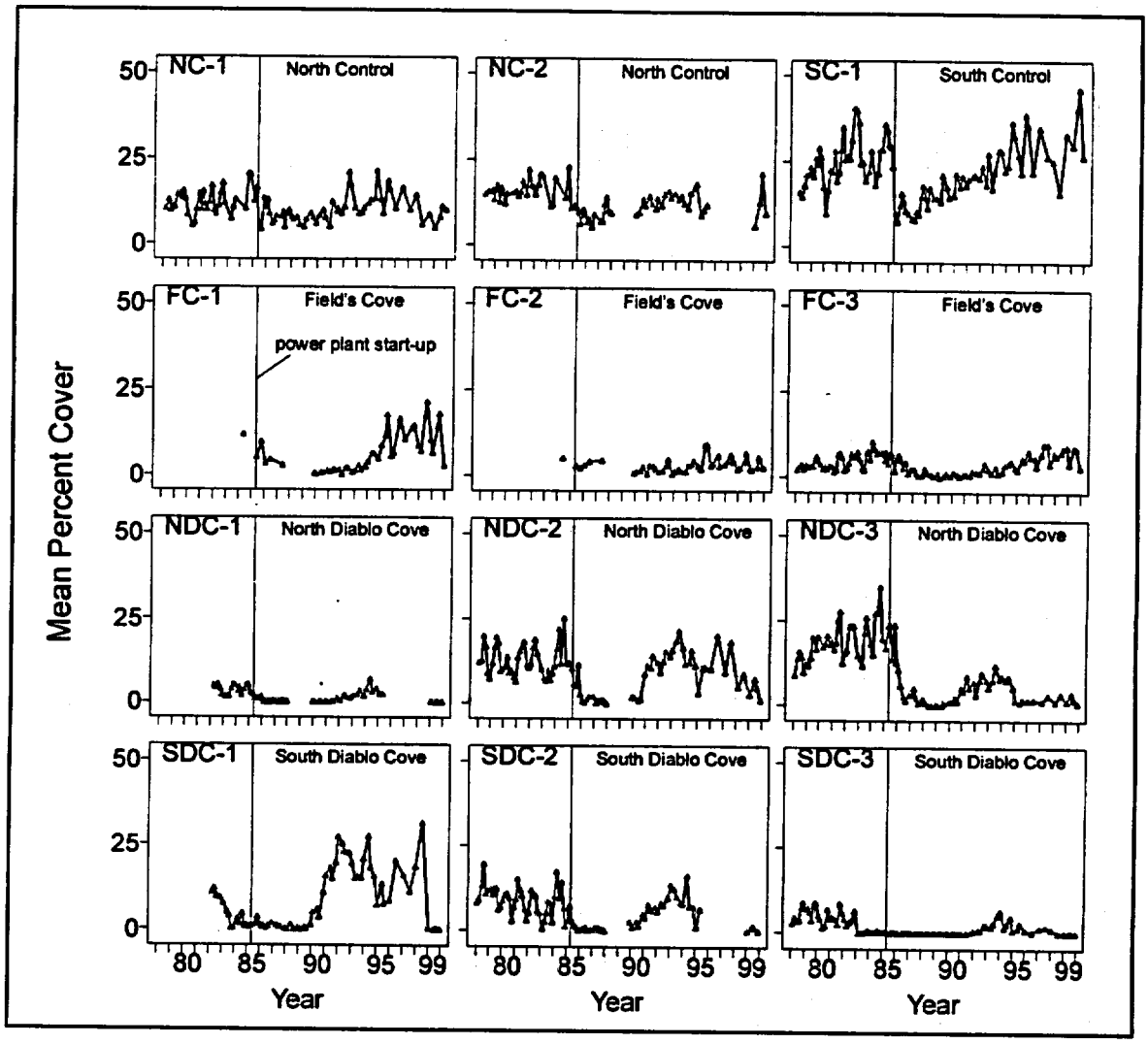


Figure 3-17. *Chondracanthus canaliculatus*: changes in abundance at lower intertidal transects.

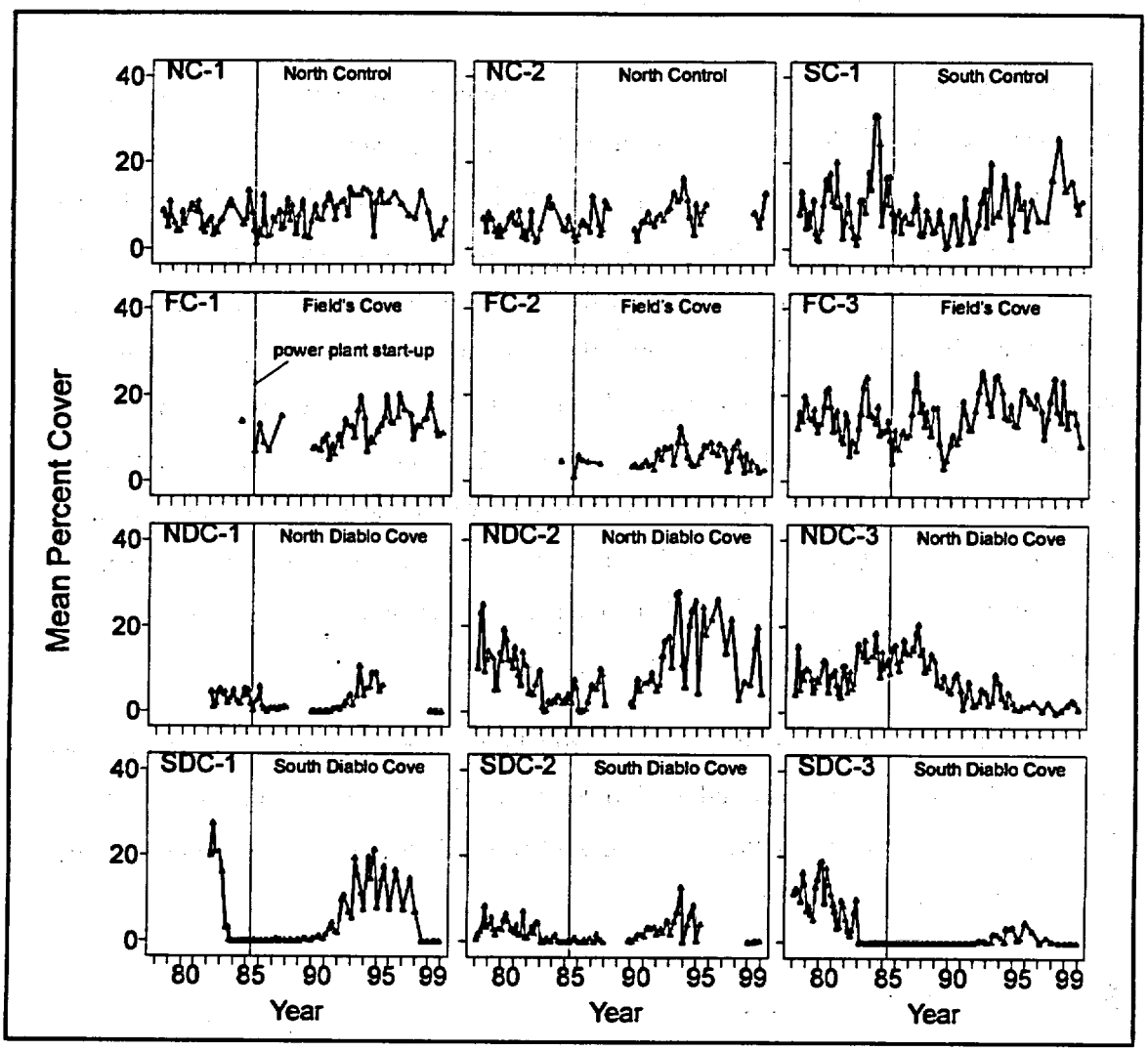


Figure 3-18. *Gastroclonium subarticulatum*: changes in abundance at lower intertidal transects.

3.2 Intertidal Invertebrates

Intertidal invertebrates have been studied at DCPP using the horizontal band transect (HBT) method since 1976. Following power plant start-up in 1985, invertebrate species richness at Diablo Cove stations increased at the upper intertidal elevation and did not change at the lower intertidal elevation. Changes in the invertebrate community were characterized by increases in purple urchins, limpets, barnacles, and tube-dwelling polychaetes and by declines in six-rayed sea stars and black abalone. Intertidal invertebrate community structure (composition and abundance) at Diablo Cove stations showed a marked change until late 1992, with changes of lesser magnitude continuing from 1992 through 1995 (Tenera 1997). In the 1995 through 1998 period, grazing limpets continued to be an abundant invertebrate guild in the upper intertidal zone of Diablo Cove (Tenera 1999b). A similar pattern of changes in community structure was also evident at Field's Cove stations, though the magnitudes of the changes were generally less than those observed within Diablo Cove.

This section presents changes observed in intertidal invertebrates through analysis of the HBT data collected at Diablo Cove, South Diablo Point, Field's Cove, and control stations during 1999. Results are described in the context of discharge effects presented in previous analysis reports (i.e., Tenera 1997; 1999b).

3.2.1 Sampling Methods

In the HBT study, we sampled invertebrates in the same quadrats as the algae (see Section 3.1.1 *Intertidal Algae Sampling Methods*) at both the +0.9 m and +0.3 m MLLW tidal elevations.

In five of ten quadrats, all species were recorded as either present or absent, and individuals larger than 2.5 cm in greatest dimension were counted. In the remaining five quadrats, the same method was used except that select species of invertebrates were counted regardless of size. The percent cover of sessile invertebrates such as sponges and tunicates was estimated using the same methods as used for algae. All sizes of black abalone were counted within these ten quadrats and within an additional five quadrats.

Community descriptions focus largely on numerically dominant taxa that contribute to the top 95 percent cumulative abundance and display a minimum abundance of five individuals/m^2 or 5

percent cover. Mean species richness (total number of species) per m^2 is presented among areas and time periods. The mean species richness is used for comparison among areas and periods because the number of quadrats and surveys could vary and affect the estimate.

Prominent changes in invertebrate community structure over time are described using correspondence analysis (CA), a multivariate technique. Nine stations at three areas were used in the CA, including

- Diablo Cove stations (NDC-2, NDC-3, SDC-1, and SDC-3)
- Field's Cove stations (FC-1, FC-2, and FC-3)
- Control stations (NC-1 and SC-1)

The taxa that comprised the majority (95 percent) of the total abundance and that occurred in at least 10 percent of the surveys were used in the CA. Abundance data for these taxa were log(x+1) transformed to compensate for scale differences between counted (e.g., *Tegula* spp.) and coverage (e.g., *Chthamalus* sp.) taxa, and then combined into annual means for the stations in the three areas noted above.

Unlike previous monitoring reports (Tenera 1997, 1999b), no univariate analyses are used within the present 1999 annual report. Rather, those taxa contributing to CA score variability, in particular impact station score divergence from the controls (i.e., those taxa most important in community structure changes due to the discharge), are presented descriptively using abundance tables and individual species plots over time.

3.2.2 Results

The intertidal invertebrate communities monitored were variable within and among areas in 1999 and relative to previous years. In general, the intertidal invertebrate community of Diablo Cove continued to be characterized by large populations of grazing limpets, filter feeding barnacles, and patchy areas of purple urchins, relative to control sites. Community composition in Field's Cove was similar to that of Diablo Cove, but abundances of species varied substantially between areas. Conversely, community composition at South Diablo Point has always differed—and continues to differ—substantially from that of either the control stations or Diablo Cove. Overall, no substantial differences in species richness appeared to exist among areas in 1999.

Biological Community Descriptions

The following description is subdivided by area, with the two control stations combined for purposes of comparison to the other areas.

Controls (North and South)

Fifty five invertebrate taxa were observed at upper elevation control stations in 1999, with the most abundant species including *Tegula funebralis* (black turban snail), *Macclintockia scabra* (rough limpet), *Pagurus* spp. (hermit crabs), and *Anthopleura elegantissima* (aggregating anemone). While several of the taxa at the control areas changed among periods, most notably *T. funebralis*, community composition and species abundance did not vary substantially among time periods (**Figure 3-19**).

At lower elevation control stations in 1999, 63 invertebrate taxa were observed, with the most abundant species including *T. funebralis*, *Pagurus* spp., *Tegula brunnea* (brown turban snails), and *Lottia pelta* (shield limpet). Community composition and the abundance of numerically dominant species did not vary notably through time, though the abundance of the barnacle *Tetraclita rubescens* in 1999 ($4/m^2$) was notably lower than prior time periods (**Figure 3-20**).

North Diablo Cove

Forty six invertebrate species were observed at upper elevation North Diablo Cove (NDC) stations in 1999, with the most abundant taxa including *Lottia* (= *Macclintockia*) *scabra*, *Tegula funebralis*, *Lottia digitalis* (finger limpet), *Anthopleura elegantissima*, *Lottia limatula* (file limpet), *Lottia pelta*, *Tectura scutum* (plate limpet), and the acorn barnacle *Chthamalus fissus*. The abundance of *T. funebralis*, *M. scabra*, and *C. fissus* increased markedly after power plant start-up, while the abundance of the limpets *L. limatula*, *L. pelta*, and *L. digitalis* has increased since 1995 (**Figure 3-21**). These changes were still apparent in 1999.

Sixty two taxa were present at the lower elevation NDC stations in 1999, with numerically abundant species including *M. scabra*, *Tetraclita rubescens*, *L. pelta*, *T. funebralis*, *L. digitalis*, *L. limatula*, *Fissurella volcano* (volcano limpet), *Strongylocentrotus purpuratus* (purple urchin), and *Tegula brunnea*. The abundance of *T. rubescens*, *T. funebralis*, and *M. scabra* increased after power plant start-up, though that of *T. funebralis* has been somewhat temporally variable. The

abundance of grazing limpets—namely *L. pelta, L. limatula*, and *L. digitalis*—has increased notably since 1995 at NDC stations (**Figure 3-22**). As in the upper intertidal, these changes were still apparent in 1999.

South Diablo Cove

Forty four invertebrate species were observed at upper elevation South Diablo Cove (SDC) stations in 1999, with the most abundant taxa including *T. funebralis, T. rubescens, Macclintockia scabra, Anthopleura elegantissima*, and *L. pelta*. The abundance of *T. funebralis* and *T. rubescens* increased following power plant operation, while the abundance of *A. elegantissima* and hermit crabs (*Pagurus* spp.) has declined since 1995 (**Figure 3-23**). *T. rubescens* continued to increase in 1999 but *T. funebralis* and *Pagurus* spp. declined. *A. elegantissima* abundance was unchanged in 1999 compared to the previous 5-year period average.

Fifty one taxa were observed at the lower elevation SDC stations in 1999, with numerically abundant species including *T. funebralis, M. scabra, T. rubescens, L. pelta, A. elegantissima, Lottia limatula, Fissurella volcano* and *Pagurus* spp. (**Figure 3-24**). Similar to NDC and upper elevation SDC stations, the abundance of most of these taxa was greater than that of the pre-operation period.

South Diablo Point

The intertidal community at South Diablo Point (SDP) has always differed in composition from that of either the control or Diablo Cove stations, due largely to wave exposure and substratum differences among sites (i.e., SDP is characterized by a wave-swept bedrock bench). Fifty nine invertebrate species were observed at SDP in 1999, with the most abundant taxa including *Mytilus californianus* (California mussel), *Strongylocentrotus purpuratus, Tetraclita rubescens, Anthopleura elegantissima, Macclintockia scabra, Lottia pelta, Balanus* spp. (barnacles), *Fissurella volcano, Pollicipes polymerus* (gooseneck barnacle), and *Nuttallina californica* (chiton). Changes at SDP following power plant start-up were characterized by large increases in most of these taxa (**Figure 3-25**). These changes were still apparent in 1999.

Field's Cove

Thirty four invertebrate species were observed at upper elevation Field's Cove (FC) stations in 1999, with the most abundant taxa including *Tegula funebralis*, *Anthopleura elegantissima*, *Macclintockia scabra*, and *Pagurus* spp. The abundance of *A. elegantissima* and *M. scabra* increased following power plant start-up (**Figure 3-26**).

Sixty five taxa were observed at the lower elevation FC stations in 1999, with numerically abundant species including *M. scabra*, *T. funebralis*, *Strongylocentrotus purpuratus*, *Pagurus* spp., *A. elegantissima*, *L. pelta*, *T. rubescens*, *Tegula brunnea*, and *Nuttallina californica*. The abundance of *T. funebralis*, *T. rubescens*, and *S. purpuratus* increased, and that of *T. brunnea* declined, following power plant operation (**Figure 3-27**). Abundances were relatively unchanged in 1999 compared to the previous period, except for *M. scabra*, which increased in 1999.

Community Analysis

This section presents an analysis of the intertidal invertebrate results by tidal elevation.

Upper elevation

Upper elevation invertebrate community structure (based on the abundance of eight eligible taxa) differed among all three analysis areas (Diablo Cove, Field's Cove, and controls) during the period 1990–1999 (**Figure 3-28a**). These spatial differences largely reflected differences in the relative abundance of select taxa among areas, including

- abundant *Lottia digitalis* (fingered limpet), *Chthamalus fissus* (acorn barnacle), and *Tetraclita rubescens* (red volcano barnacle) within Diablo Cove, and their relative scarcity or absence at both Field's Cove and control stations (**Figure 3-28b**).

- abundant *Anthopleura elegantissima* (aggregating anemone) within Field's Cove, and its relative scarcity at control stations (**Figure 3-28b**).

Based on the clusterings of survey scores in the correspondence analysis, the structure of the upper intertidal invertebrate community in Diablo Cove was distinctly different from the control stations and Field's Cove during the period 1990–99. Much of the dissimilarity between Diablo Cove and the other areas was due to increases in the abundance of *Lottia digitalis, Chthamalus fissus*, and *Tetraclita rubescens* in Diablo Cove. The abundance of *Anthopleura elegantissima* (anemone) at Field's Cove, and its relative scarcity at control stations, accounted for the majority

of the difference between these two areas. Unlike Diablo Cove, however, community variability was not apparent within Field's Cove during the period 1990–99, indicating relative stability in both community composition and species abundance. There was greater variability among years in both Diablo Cove and the controls during the analysis period.

Lower elevation

Lower elevation invertebrate community structure (based on the abundance of 14 eligible taxa) differed among all three analysis areas (Diablo Cove, Field's Cove, controls) during the period 1990–1999 (**Figure 3-29a**). As was the case with the upper elevation (+0.9m), these spatial differences largely reflected differences in the relative abundance of select taxa among areas. These included:

- an abundant limpet fauna including *Macclintockia scabra* (rough limpet), *L. pelta* (shield limpet), *L. limatula* (file limpet,), and *Fissurella volcano* (keyhole limpet) within Diablo Cove, relative to either Field's Cove or control stations (**Figure 3-29b**). Also, an abundance of *Strongylocentrotus purpuratus* (purple urchin) within Diablo Cove, relative to the control stations.

- an abundance of *Nuttallina californica* (chiton) at Field's Cove relative to other areas, and an abundance of *Strongylocentrotus purpuratus* at Field's Cove relative to the control stations (**Figure 3-29b**).

- abundant *Tegula brunnea* (brown turban snail) and *Pista* sp. (tube polychaete) at control stations relative to other areas (**Figure 3-29b**).

The correspondence analysis indicates that lower intertidal community structure in Field's Cove was more similar to Diablo Cove in 1998 and 1999 than in previous years. However, survey scores for both areas were different from the control for all years, including 1999. Most of this dissimilarity was due to the continued presence and relative abundance of limpets at Diablo Cove, and scarcity of *Strongylocentrotus purpuratus* at the controls.

Select Species Changes

This section presents an analysis of abundance of several species sampled during the study period. Appendix F2 presents annual mean abundances for intertidal invertebrates, by station and elevation, from 1976 through 1999.

Lottia digitalis (fingered limpet) increased at upper elevation North Diablo Cove stations, with notably large abundance increases documented at NDC-2 in 1996 and 1999, and at NDC-3 during 1994 through 1999 (**Figure 3-30**). The increased abundance of *L. digitalis* within Diablo Cove in 1999 (19.6/m^2) contributed to the differences between Diablo Cove and the control stations that was evident in the correspondence analysis. The average abundance of this species at North Diablo Cove station NDC-3 in 1999 (61.3/m^2) was the highest ever recorded in the monitoring studies (**Appendix F2**).

Similar to *L. digitalis*, *Chthamalus fissus* (acorn barnacle) increased during power plant operation at North Diablo Cove upper elevation stations, with very large increases noted at NDC-2 in 1995–97, and at NDC-3 during the 10-year period 1990–99. The 1999 mean abundance for *C. fissus* within Diablo Cove (2.6 percent cover) was the lowest during the period 1990–99, and the abundance of this species at both NDC-2 (2 percent) and NDC-3 (7.5 percent) was the lowest recorded since 1989 (**Figure 3-31**).

Tetraclita rubescens (red volcano barnacle) is ubiquitous throughout Diablo Cove, but less so at the control stations where it only occurs in substantial abundance at SC-1. Though never particularly abundant at North Diablo Cove station NDC-2 and South Diablo Cove station SDC-3, *T. rubescens* increased at South Diablo Cove station SDC-1 after power plant start-up in 1985, and at North Diablo Cove NDC-3 after 1989 (**Figure 3-32**). However, the abundance of this species at Diablo Cove stations in 1999 was low relative to the 1987-1995 period. Despite this, *T. rubescens* remained more abundant within Diablo Cove than at the controls, contributing to the differences between Diablo Cove and the control stations evident in the correspondence analysis.

Anthopleura elegantissima (aggregating anemone) has never been particularly abundant at North Diablo Cove lower elevation stations, though it increased notably at South Diablo Cove stations following power plant start-up (**Figure 3-33**). While the abundance of *A. elegantissima* in 1998 (5.1/m^2) and 1999 (7/m^2) was the lowest ever recorded for station FC-3 (**Appendix F2**), the

overall abundance of this species at Field's Cove upper (79.4/m^2) and lower (10/m^2) elevation transects in 1999 remained largely unchanged since 1995 (**Figure 3-26** and **3-27**). *A. elegantissima* has always been relatively scarce at the lower elevation control transects.

Members of the grazing limpet guild—comprised of rough limpets (*Macclintockia scabra*), file limpets (*L. limatula*), and shield limpets (*L. pelta*)—increased in abundance at most Diablo Cove stations during the operation period. Many of the mean annual abundance values recorded in 1999 were the highest observed during the period 1990–99. These included *M. scabra* at stations NDC-2 (210.2 individuals/m^2), NDC-3 (98.9/m^2), and SDC-1 (76/m^2); *L. pelta* at NDC-2 (44.1/m^2), SDC-1 (44.5/m^2), and SDC-3 (5.3/m^2); and *L. limatula* at NDC-2 (16.1/m^2) and SDC-1 (17.9/m^2) (**Appendix F2**). Overall, the abundance of *M. scabra* in Diablo Cove during 1999 (109.1/m^2) was the highest recorded during the period 1990–99. Similar trends were observed in 1999 at Field's Cove stations, though abundance values were somewhat less than those observed within Diablo Cove. No such pattern was evident at the control stations.

Strongylocentrotus purpuratus (purple urchin) increased in abundance after the power plant start-up in both Diablo and Field's coves, peaking in 1994–95 and generally declining thereafter (**Figure 3-34**). In 1994 and 1995, the increase in the abundance of *S. purpuratus* at North Diablo Cove created an urchin barrens zone (Tenera 1997), where urchins numbered over 300/m^2. This condition persisted through 1996, after which time the abundance of *S. purpuratus* began to decline. Mean abundance values in 1999 for this species were considerably below the 1994–95 abundances (**Figure 3-34**). *Strongylocentrotus purpuratus* also increased within Field's Cove and at South Diablo Point during the operation period, particularly after 1990. The overall mean abundance of this species on the Field's Cove transects generally exceeded that of Diablo Cove during the period 1990–99. The continuing high densities of *S. purpuratus* at South Diablo Point likely contributed to the significant declines in foliose algal cover observed in 1999 (see Section 3.1 - *Intertidal Algae*). Urchins have been nearly absent at the control stations NC-1, NC-2, and SC-1 since 1976, although large increases occurred at control Station NC-3 from 1990-1995 (Tenera 1997).

Tegula brunnea (brown turban snail) has always been somewhat abundant at lower elevation control stations, and the 1999 mean abundance of this species at SC-1 (18.6/m^2) was the largest ever recorded (**Figure 3-35**). Similarly, its abundance at the pooled control stations (9.6/m^2) was the greatest recorded during the period 1990–99. *T. brunnea* was also abundant within Diablo

Cove and Field's Cove prior to the operation of DCPP. Its numbers declined following power plant start-up at several stations in Diablo Cove but has increased in abundance at NDC-1. Fewer changes have been observed at the Field's Cove stations.

3.2.3 Discussion

Overall, no new changes in intertidal invertebrate community composition or species abundance was evident in 1999 relative to 1998, based on correspondence analysis. Rather, abundance trends and patterns presented in previous monitoring reports continued. Tenera (1999b) reported a relationship in North Diablo Cove where discharge-related declines in the abundance of foliose red algae resulted in the creation of open space (bare rock) that was later colonized by diatom films and crustose algal species. This, in turn, was followed by substantial increases in the abundance of grazing limpets, apparently a result of the increase in diatom films and crustose algal species—preferred food for limpet species (Morris et al. 1980; Wara and Wright 1964). Monitoring within Diablo Cove in 1999 indicated that intertidal algal cover continued to decline and open space (bare rock) continued to increase, relative to controls (see Section 3.1–*Intertidal Algae*).

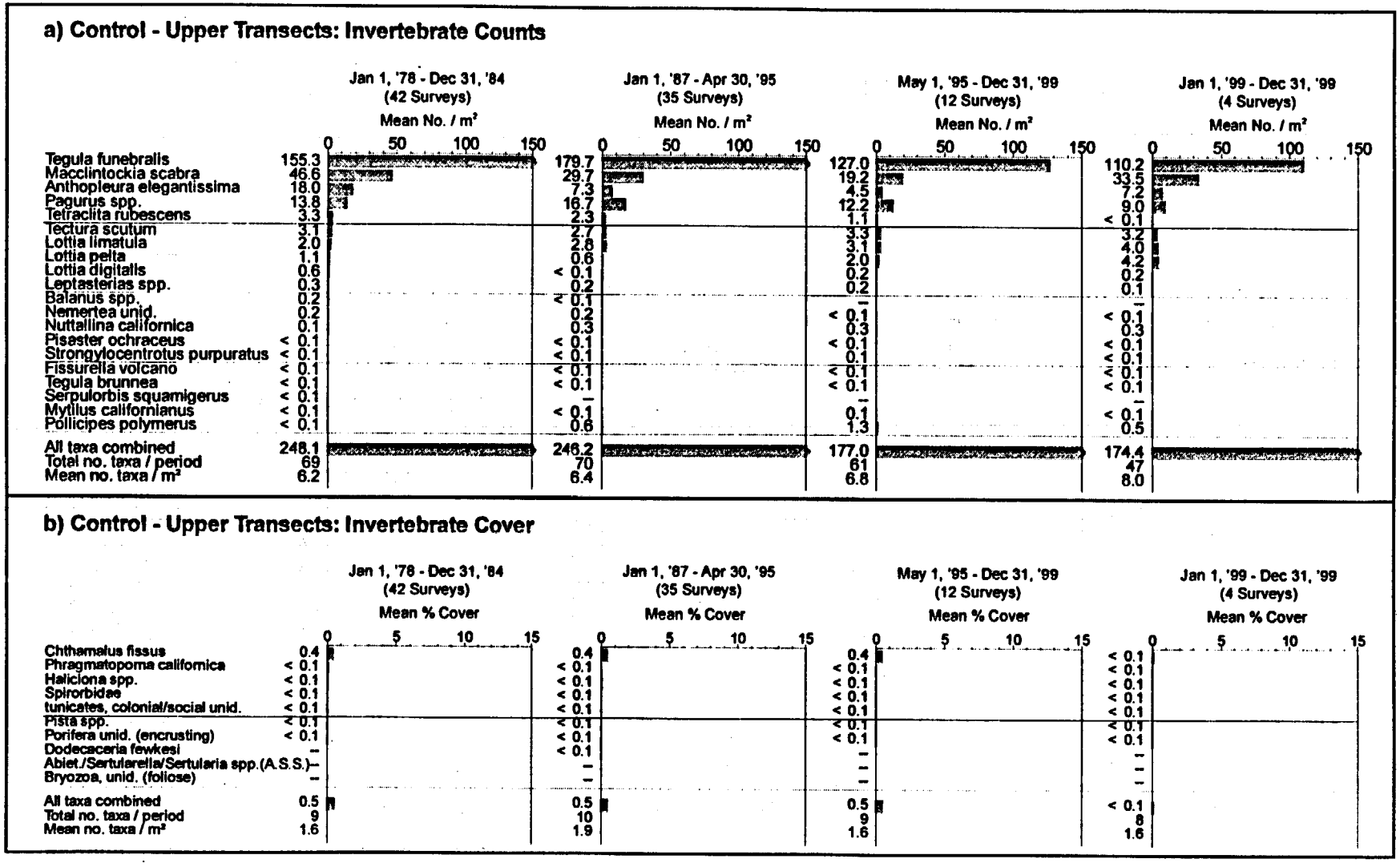


Figure 3-19. Intertidal invertebrate abundances at the control upper elevation transects: a) counts and b) cover. Stations = NC-1, NC-2, and SC-1.

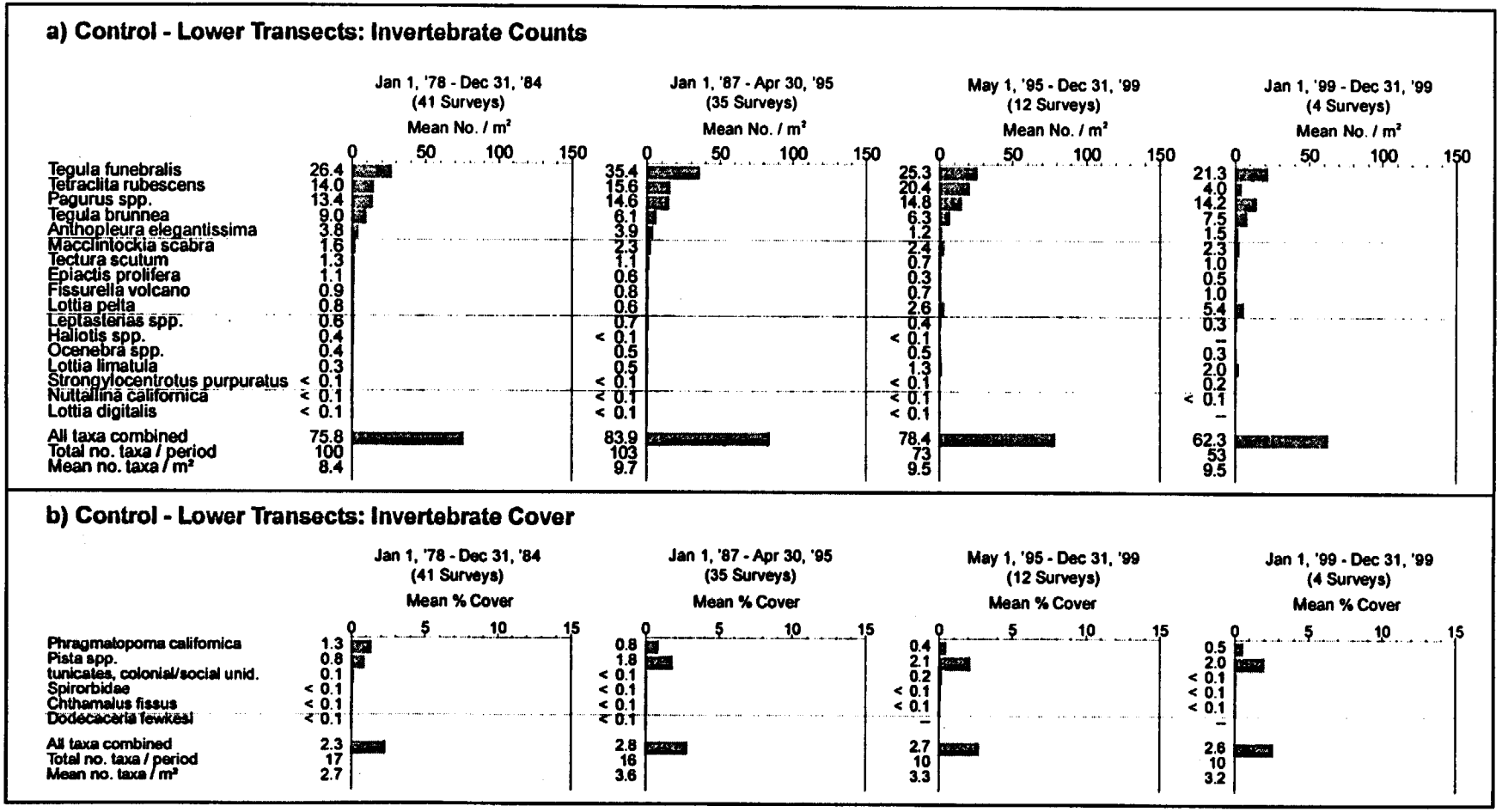


Figure 3-20. Intertidal invertebrate abundances at the control lower elevation transects: a) counts and b) cover. Stations = NC-1, NC-2, and SC-1.

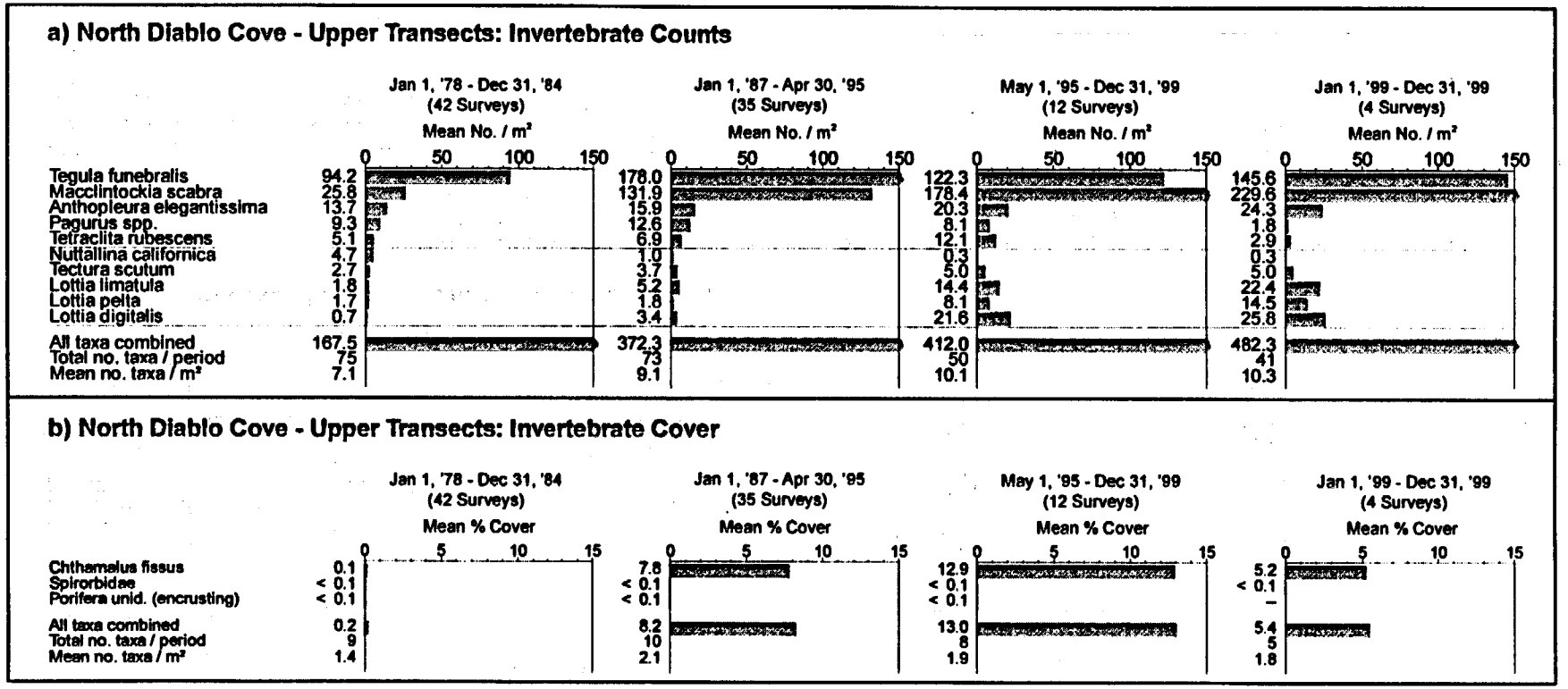


Figure 3-21. Intertidal invertebrate abundances at the North Diablo Cove upper elevation transects: a) counts and b) cover. Stations = NDC-1,-2, and-3.

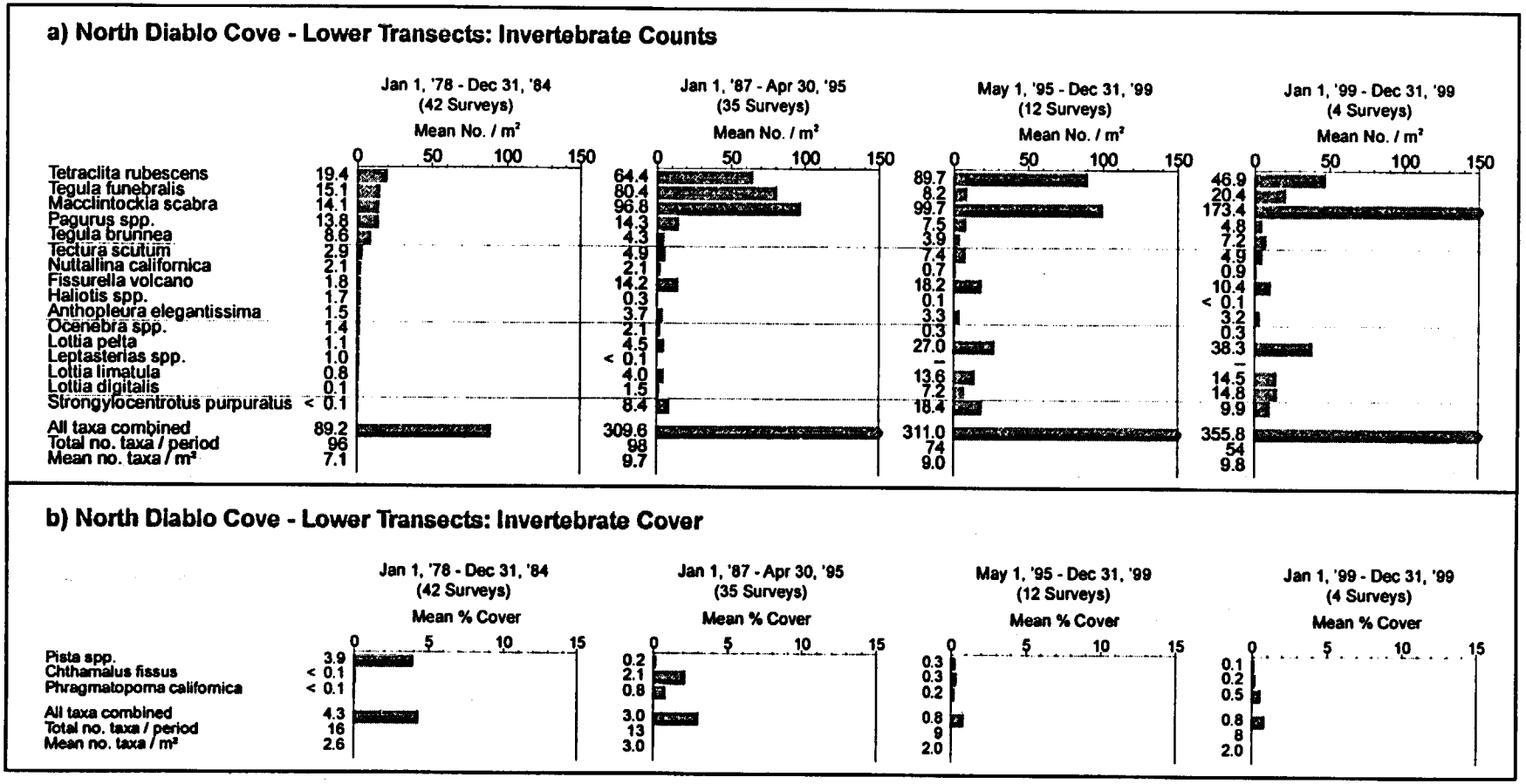


Figure 3-22. Intertidal invertebrate abundances at the North Diablo Cove lower elevation transects: a) counts and b) cover. Stations = NDC-1, -2, and -3.

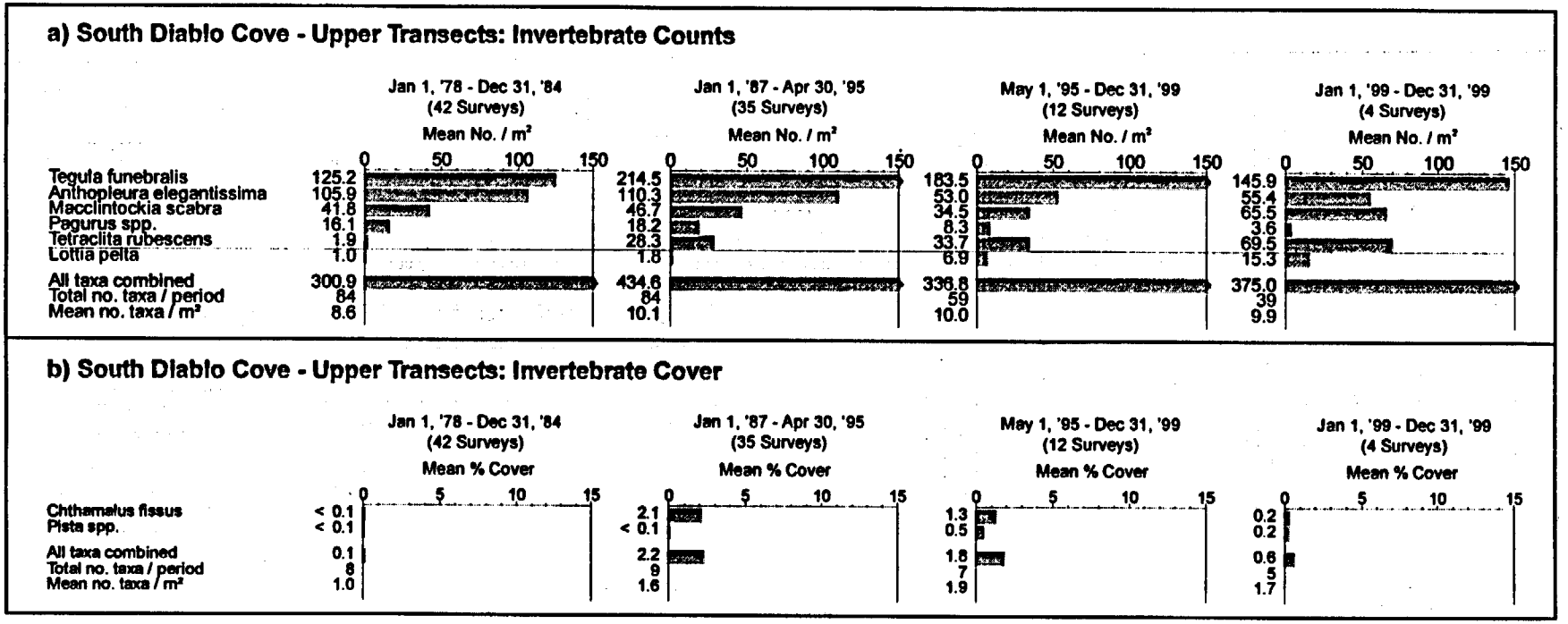


Figure 3-23. Intertidal invertebrate abundances at the South Diablo Cove upper elevation transects: a) counts and b) cover. Stations = SDC-1,-2, and -3.

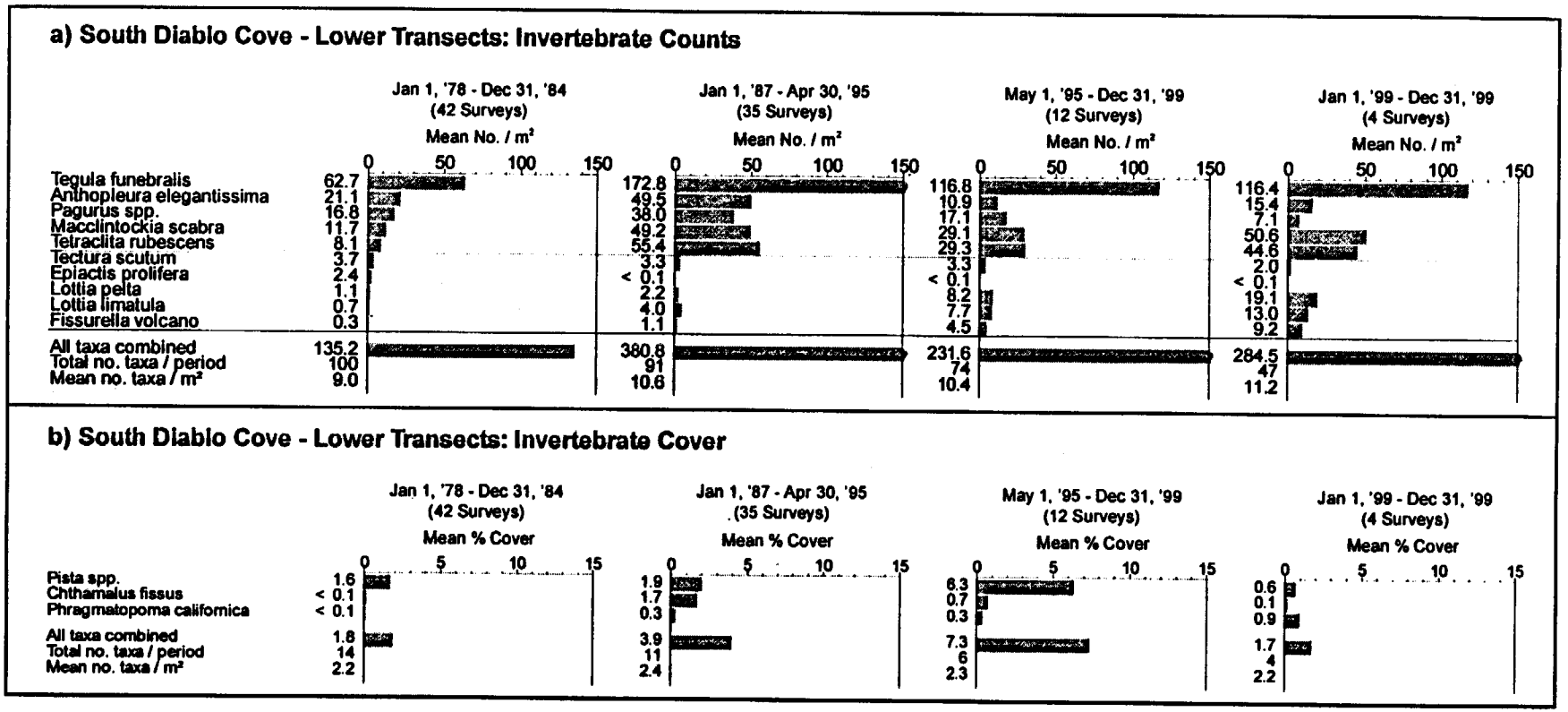


Figure 3-24. Intertidal invertebrate abundances at the South Diablo Cove lower elevation transects: a) counts and b) cover. Stations =SDC-1, -2, and -3.

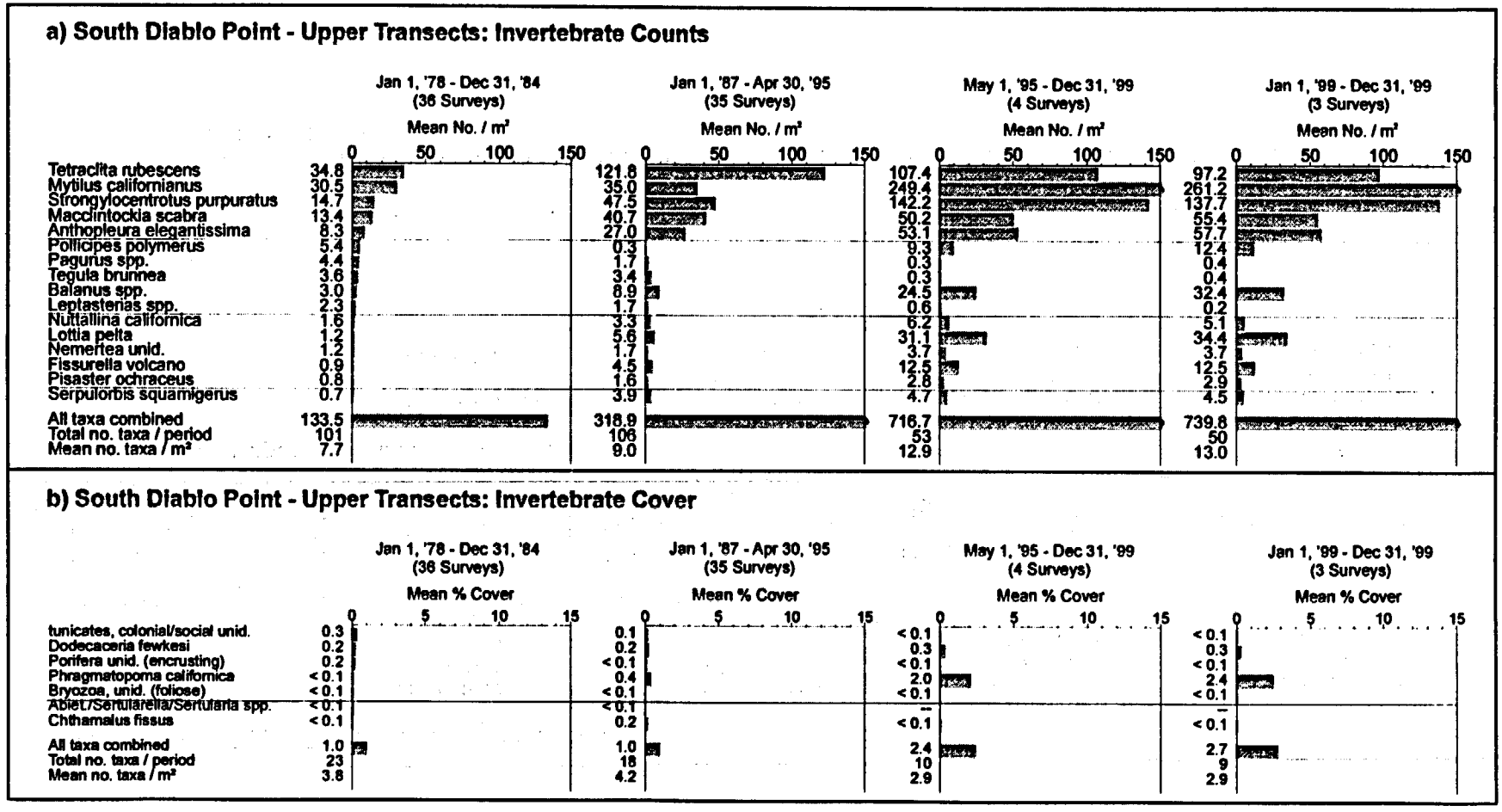


Figure 3-25. Intertidal invertebrate abundances at the South Diablo Point upper elevation transects: a) counts and b) cover. Stations = SDP-1 and -2.

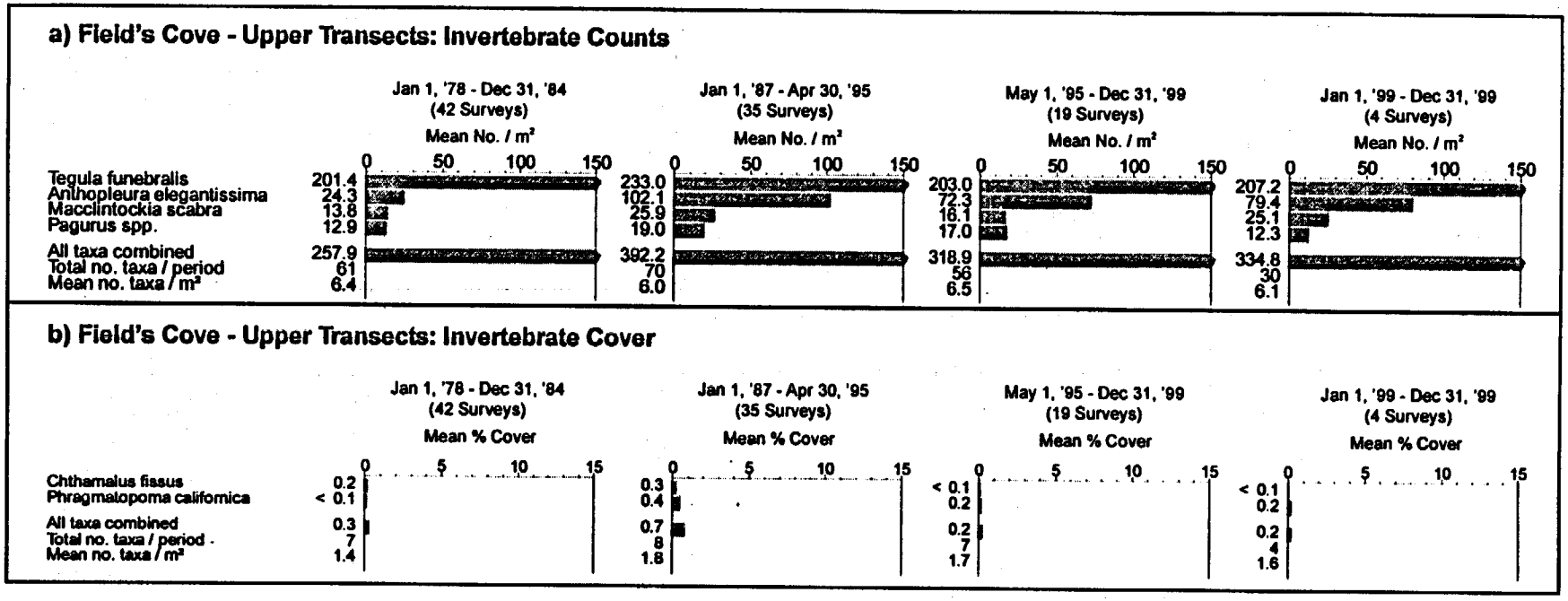


Figure 3-26. Intertidal invertebrate abundances at the Field's Cove upper elevation transects: a) counts and b) cover. Stations = FC-1,-2, and -3.

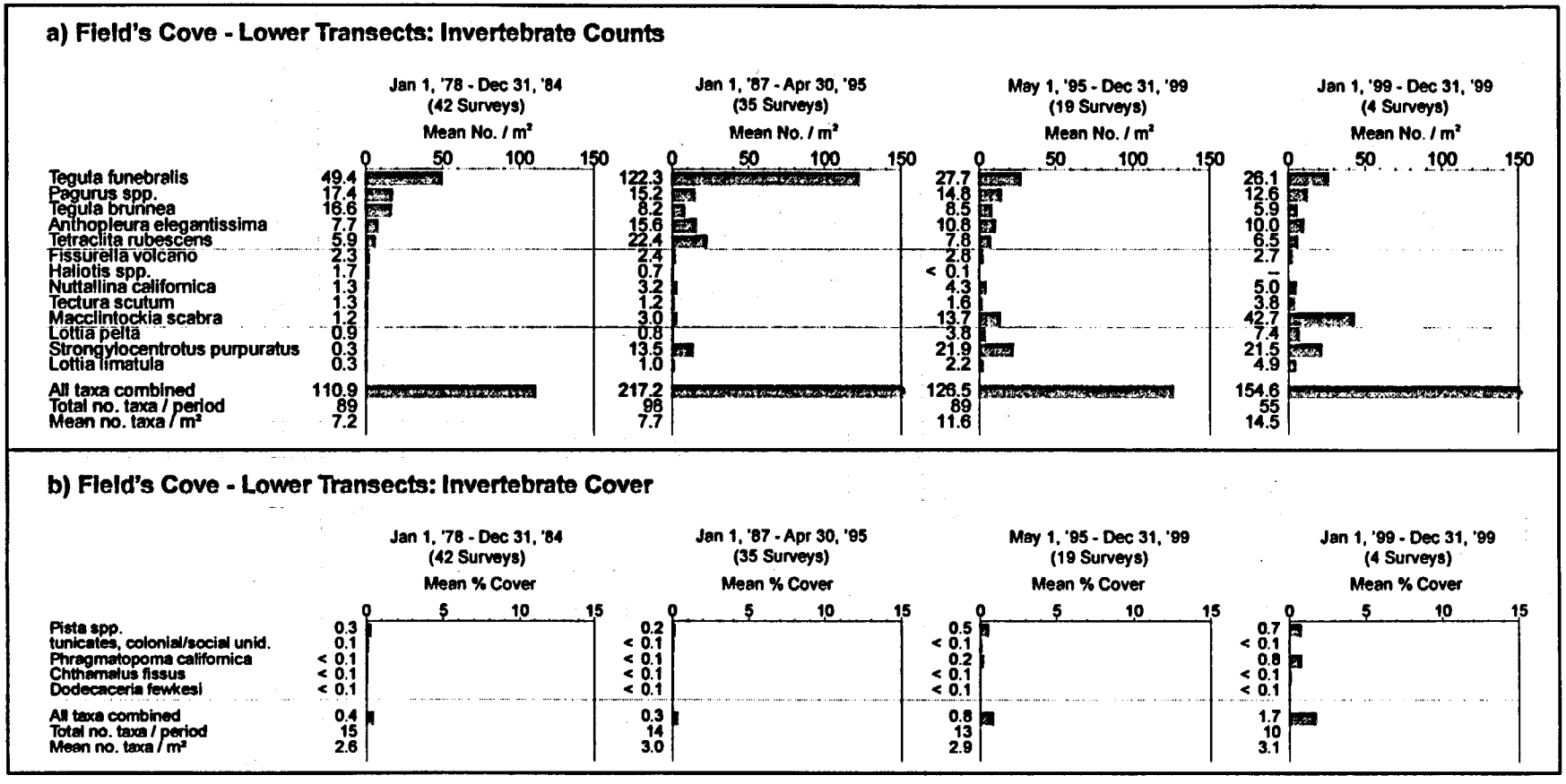


Figure 3-27. Intertidal invertebrate abundances at the Field's Cove lower elevation transects: a) counts and b) cover. Stations = FC-1,-2, and -3.

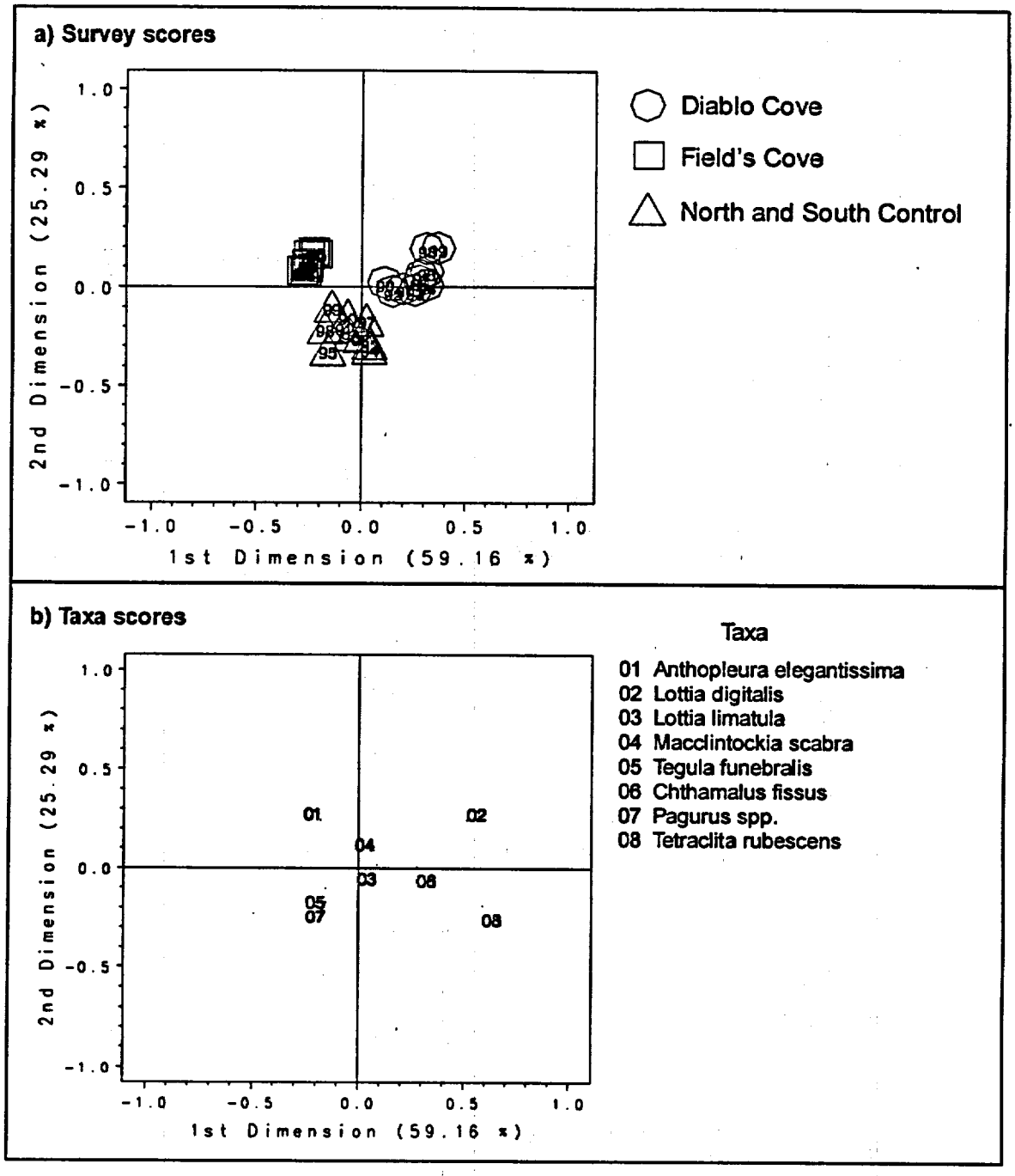


Figure 3-28. Results of correspondence analysis for upper intertidal invertebrates (a) survey scores and (b) taxa scores

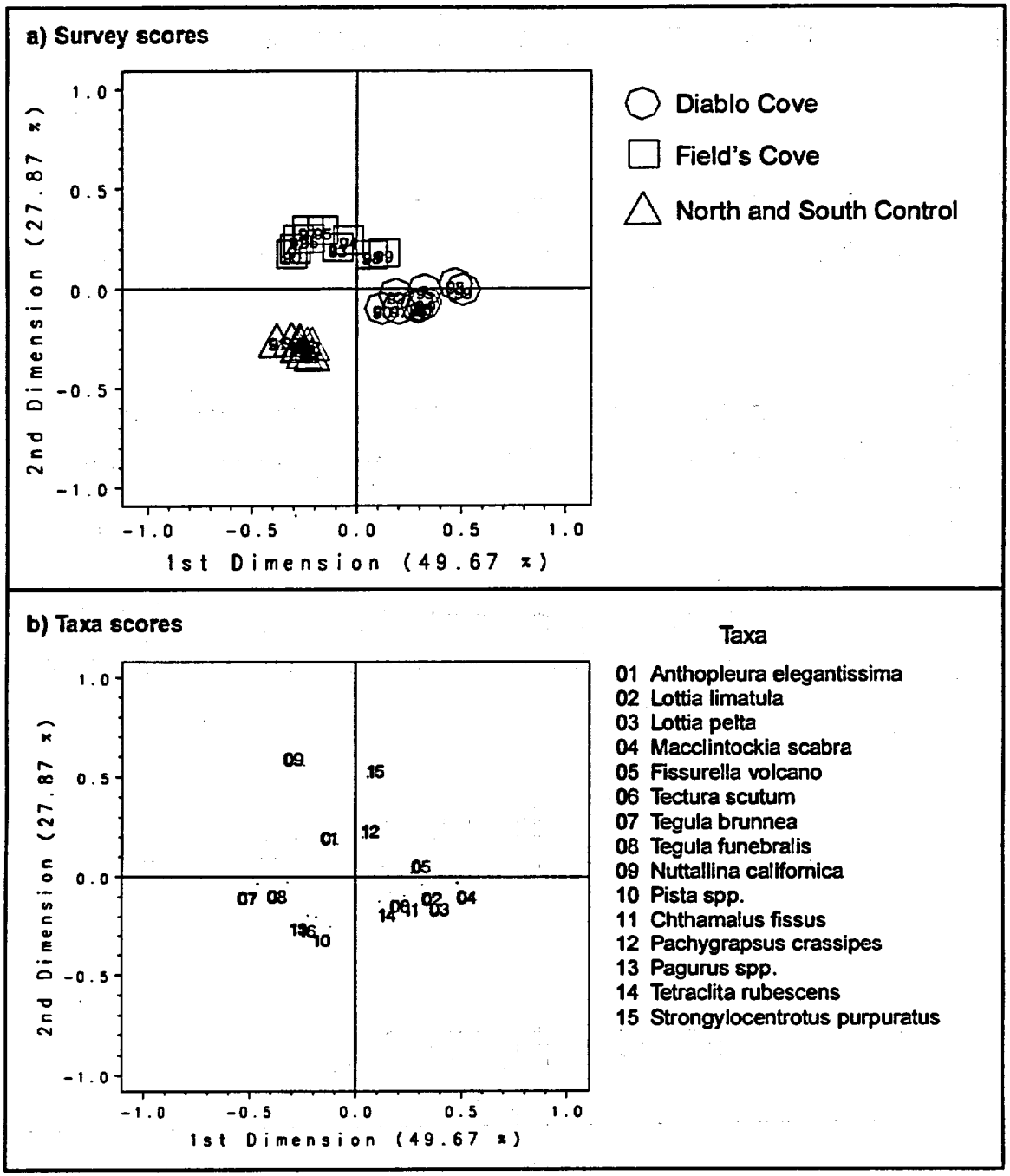


Figure 3-29. Results of correspondence analysis for lower intertidal invertebrates (a) survey scores and (b) taxa scores

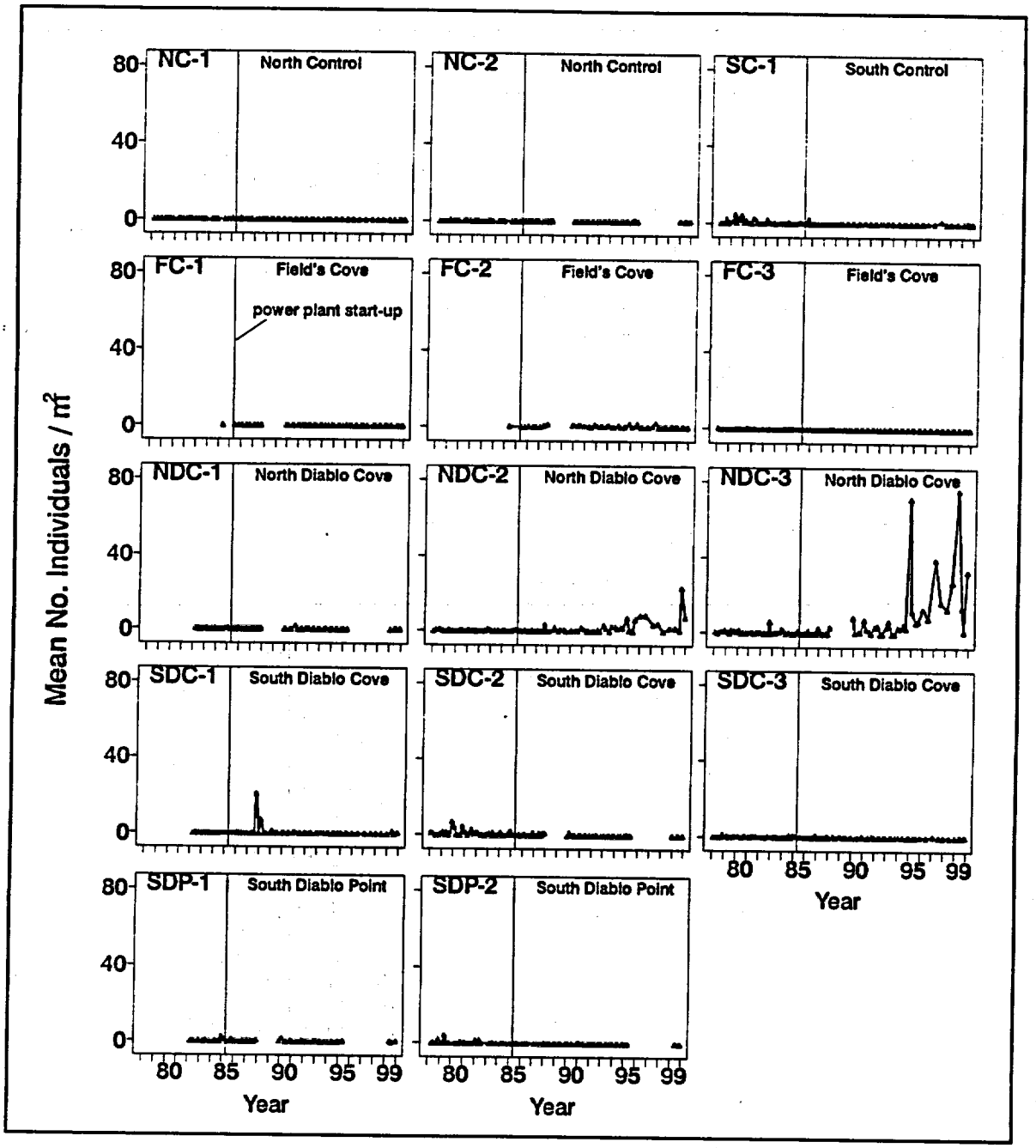


Figure 3-30. *Lottia digitalis*: changes in abundance at upper intertidal transects.

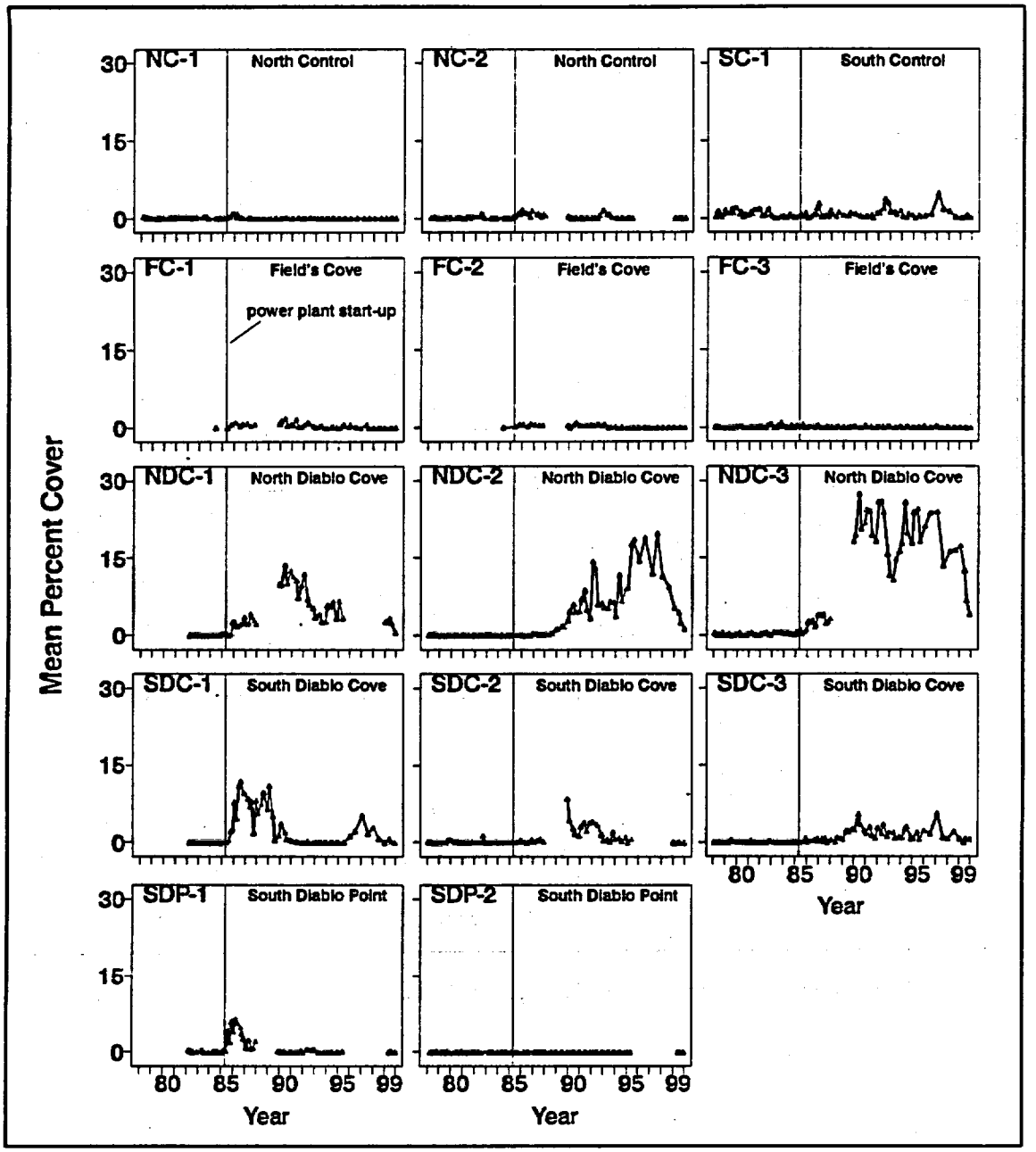


Figure 3-31. *Chthamalus fissus*: changes in abundance at upper intertidal transects.

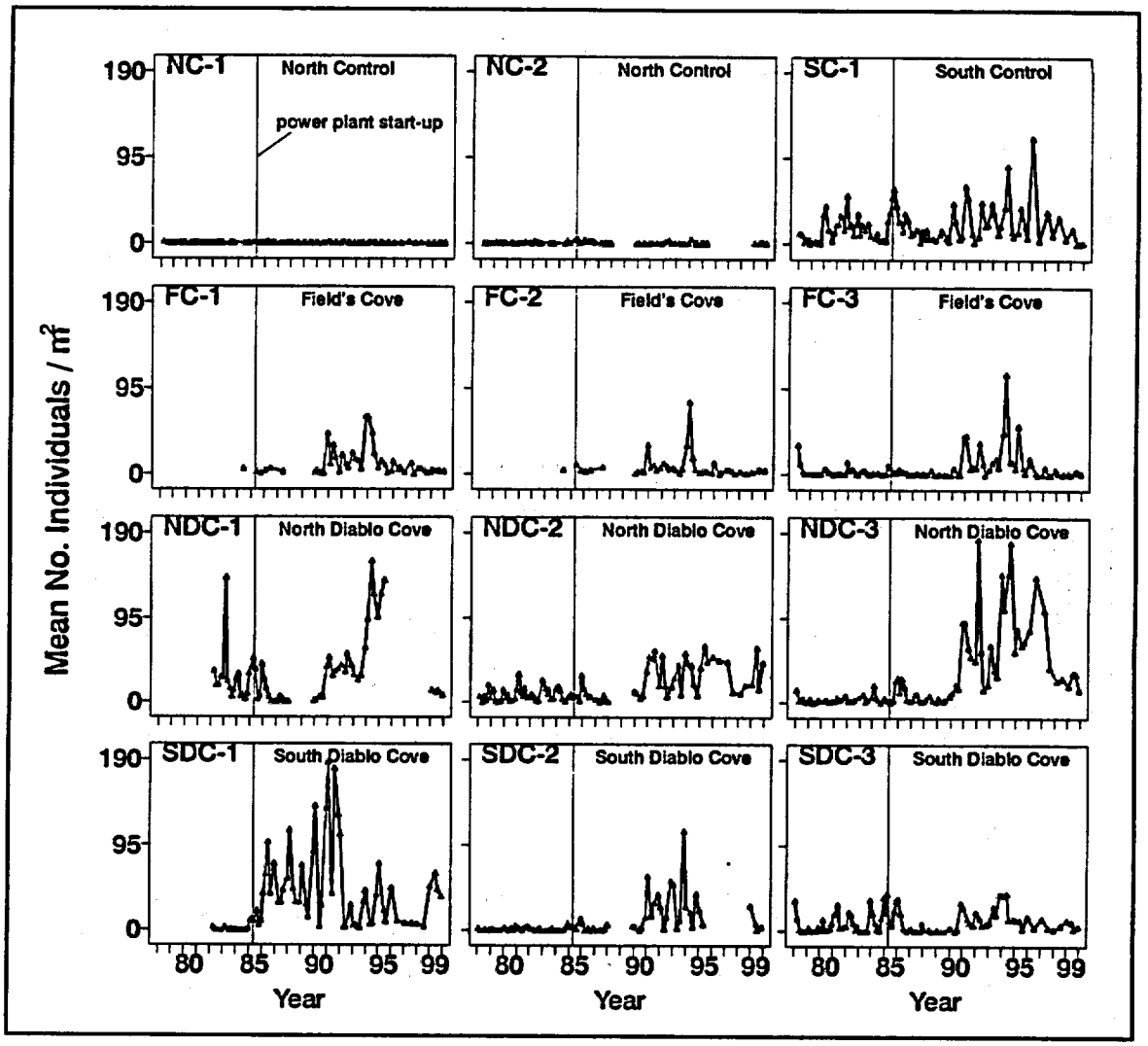


Figure 3-32. *Tetraclita rubescens*: changes in abundance at lower intertidal transects.

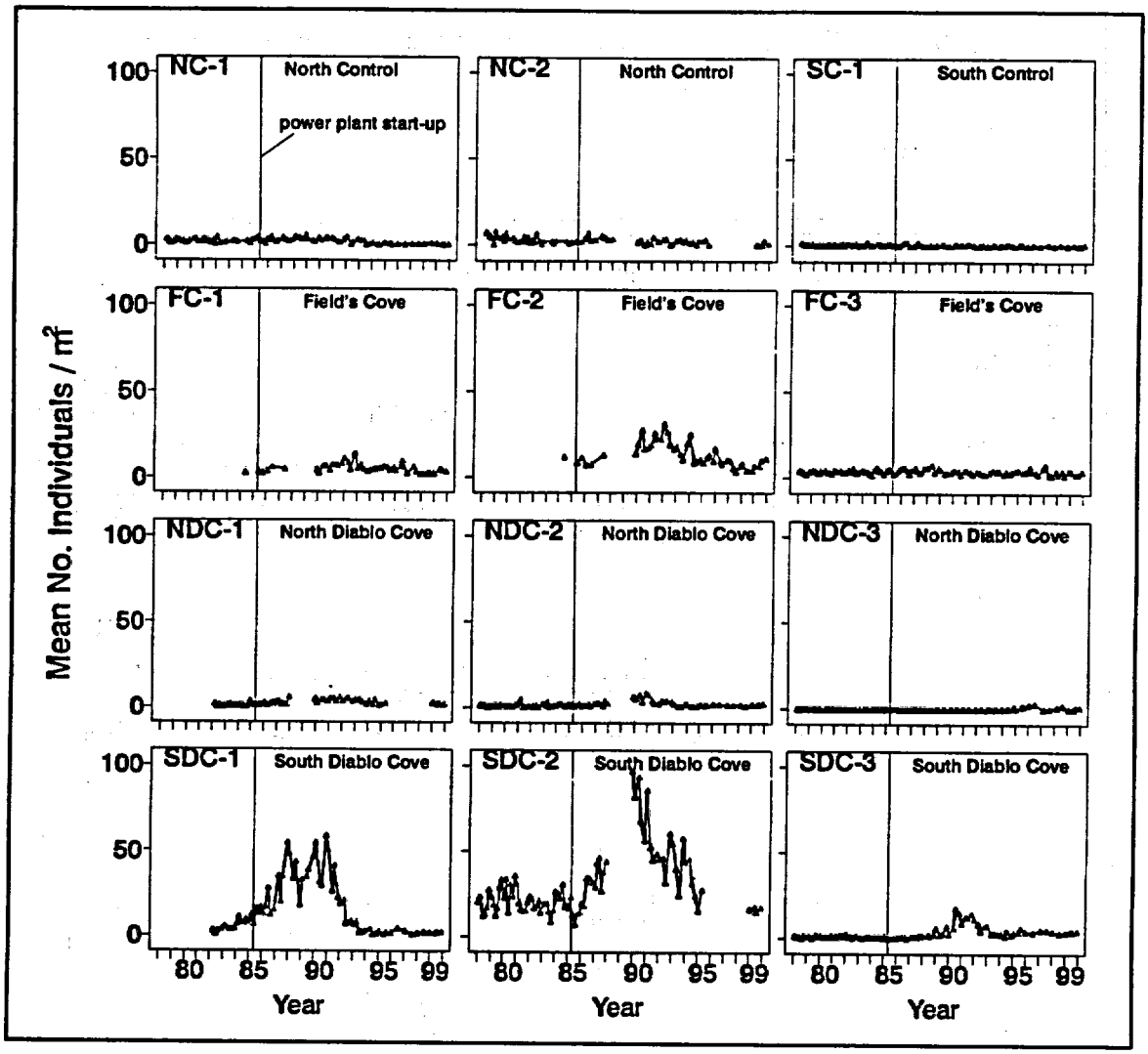


Figure 3-33. *Anthopleura elegantissima*: changes in abundance at lower intertidal transects.

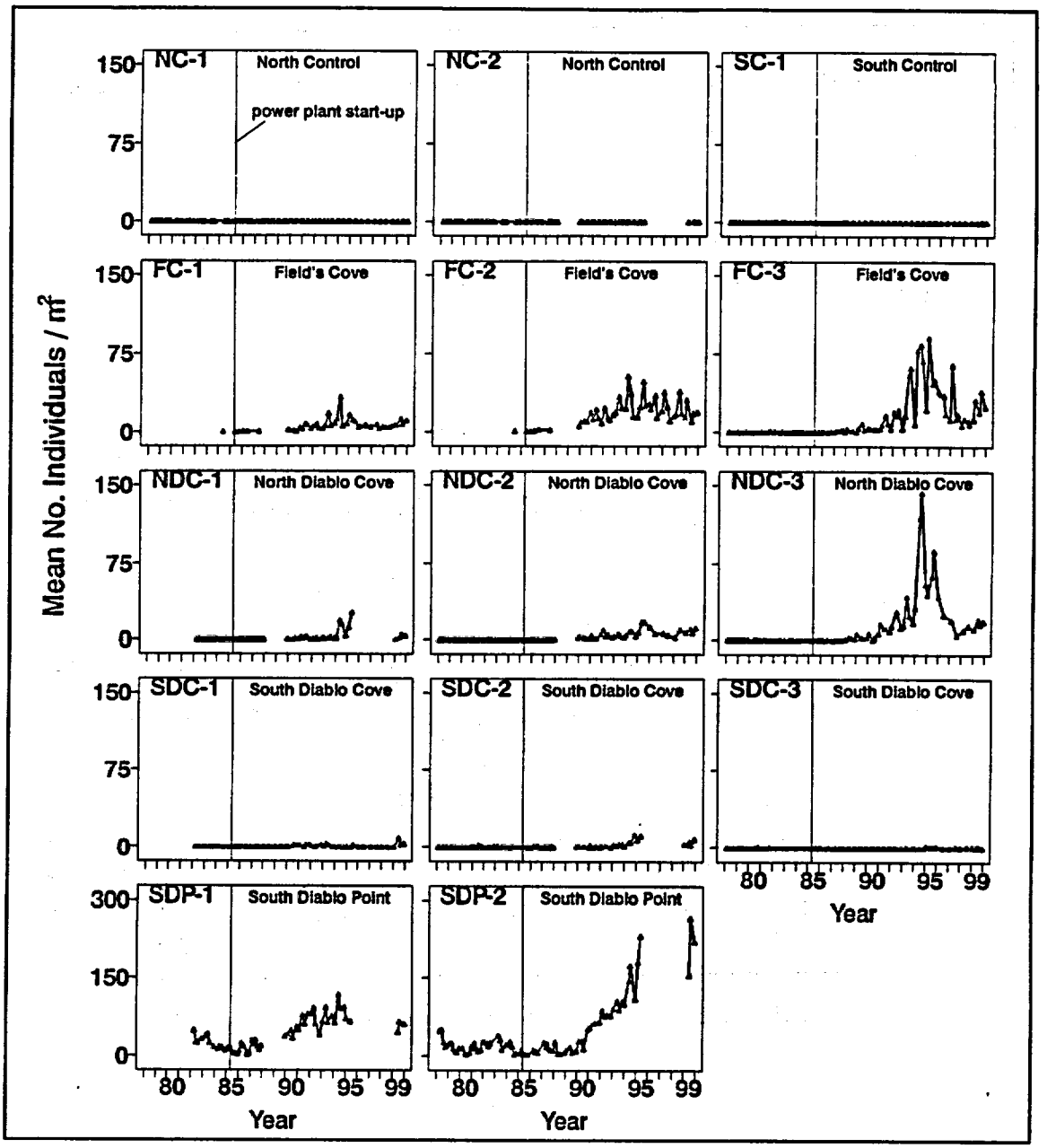


Figure 3-34. *Strongylocentrotus purpuratus*: changes in abundance at lower intertidal transects. Note: SDP-1 and -2 are upper elevation transects at South Diablo Point.

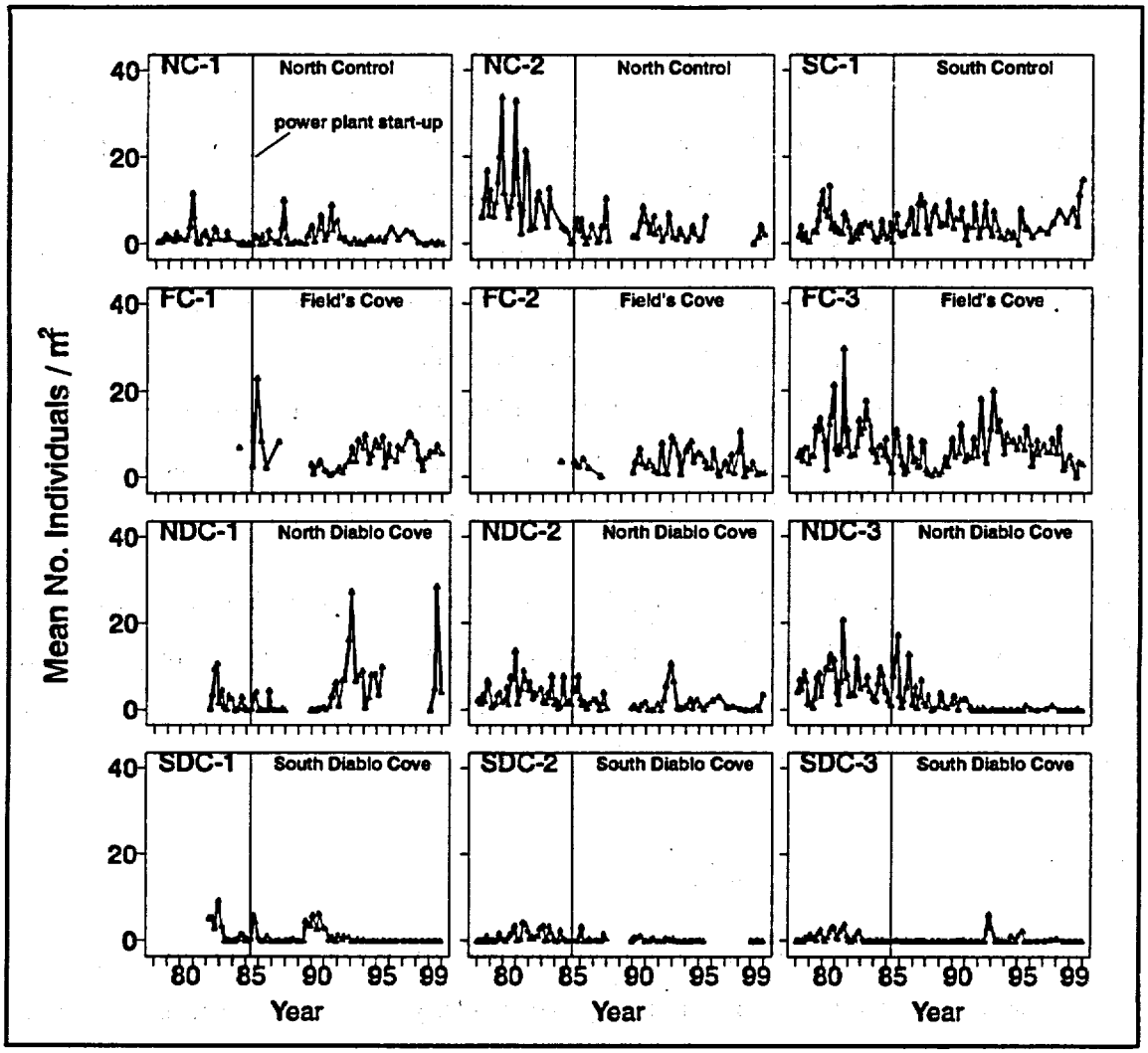


Figure 3-35. *Tegula brunnea*: changes in abundance at lower intertidal transects.

3.3 Intertidal Fishes

The intertidal fish community in Diablo Cove and Field's Cove prior to power plant operation (Kelly et al. 1985) was similar to other central California rocky coast areas (Horn et al. 1983). It was mainly comprised of eel-like fishes that are typically found beneath shoreline cobbles, boulders, or algae during low tides. *Xiphister mucosus* (rock prickleback), *X. atropurpureus* (black prickleback), and *Cebidichthys violaceus* (monkeyface eel) were some of the more abundant species. After power plant operation began, the discharge caused declines in most intertidal fishes in Diablo Cove, but did not substantially alter their relative abundances within areas (Tenera 1997). Warmer water temperatures and reduced algal cover in Diablo Cove after power plant start-up were probably the most important factors contributing to their declines.

This section describes the results from 1999 surveys at the VBT stations in Diablo Cove, Field's Cove, and the control stations. Comparisons of the 1999 data to prior findings are qualitative, based on species abundance summaries, results of community-level correspondence analyses, and time-series abundance plots for individual species.

3.3.1 Sampling Methods

We sampled intertidal fishes using the vertical band transect (VBT) sampling task. At each of five stations, three transects were positioned perpendicularly to the shoreline at fixed locations (**Figure 3-36**). Each transect originated in the high intertidal zone (approximately +1.5 m MLLW) and terminated in the low intertidal zone (approximately -0.2 m MLLW). Transects at each station were separated by approximately 3 m. Each transect was used as a reference line to position twelve 1 m^2 permanent sampling quadrats, for a total of thirty-six 1 m^2 quadrats per station. Moveable rocks were carefully lifted and any fishes seen were captured in small hand nets. We also searched for cryptic fishes among the foliose algae. Fishes were identified to the lowest practical taxonomic level, measured, and returned to the quadrat. Newly settled juvenile fishes were not identified to the species level but were grouped into composite taxa (e.g., *Anoplarchus/Cebidichthys*). Diablo Cove VBT stations NDC1-V and SDC2-V and Field's Cove station FC1-V were sampled four times during 1999. Two new stations were established in 1999 at North and South Control locations and were sampled three times.

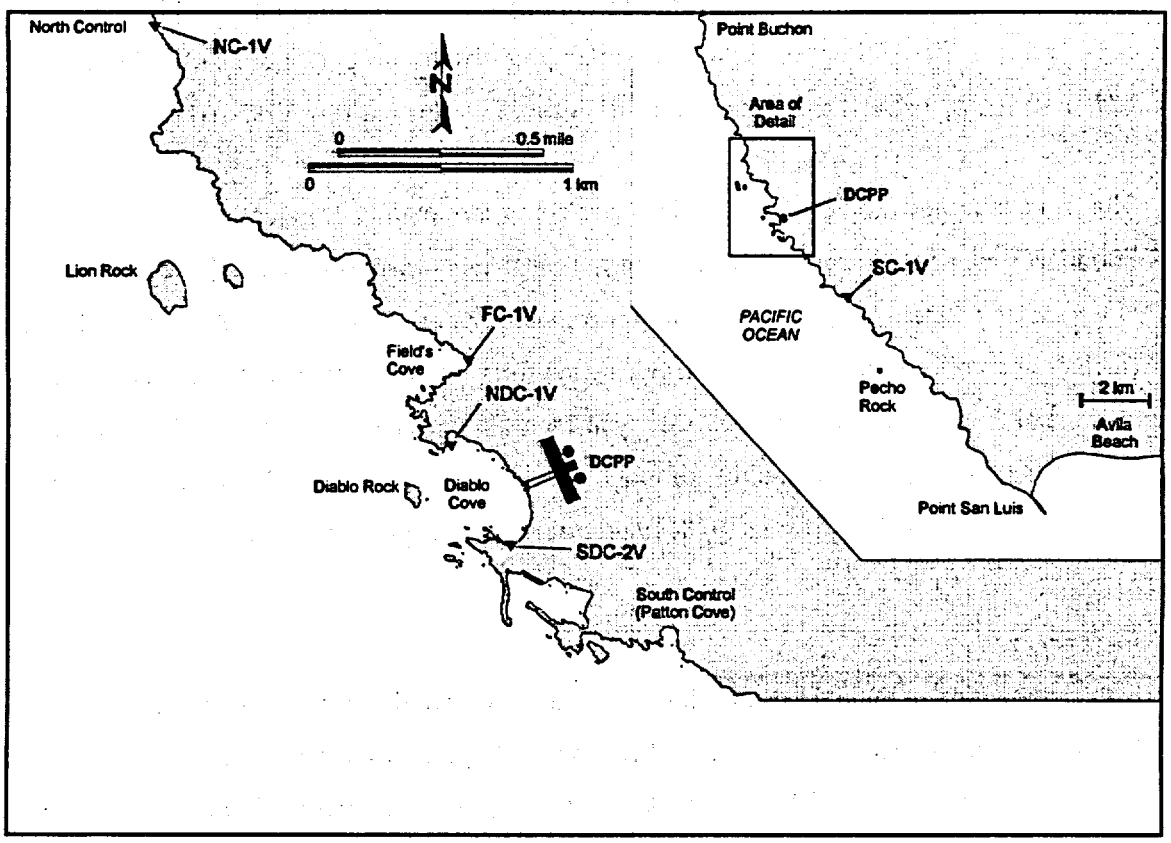


Figure 3-36. Location map of Vertical Band Transect (VBT) fish stations.

3.3.2 Results and Discussion

This section presents results from the four intertidal fish surveys that were completed during 1999 (January 1–December 31). Similar to previous years, fishes of the family Stichaeidae numerically dominated the intertidal fish fauna at all stations in 1999.

Biological Community Descriptions

The following description is subdivided by area, with the two control stations combined for purposes of comparison to the other areas.

Controls (North and South)

Two control stations were newly established in 1999. Prior to 1999, Station FC-1V was used as a comparison station to evaluate discharge effects in Diablo Cove. However, since Field's Cove intertidal areas had slightly increased water temperatures (<1 °C) as a result of plant operation, changes in the Diablo Cove intertidal fish fauna may have been underestimated as a result

(Tenera 1997). Therefore, two new control stations were established at intertidal locations beyond the far-field influence of the power plant thermal discharge (**Figure 3-36**). Both stations had elevation ranges and substrate composition similar to the existing VBT stations.

The fish community at the control stations was comprised mainly of juvenile Pholidae/Stichaeidae (largely *Xiphister* spp.), *Anoplarchus purpurescens*, *Cebidichthys violaceus*, *Xiphister* spp. (adult), and *Gobiesox maeandricus* (**Figure 3-37**). A total of 14 taxa (including combination categories) was identified from the two stations in three surveys. An average of 89.2 fish was counted per survey at each station. The species composition at the control stations and the total number of individuals per survey were similar to those seen in Field's Cove and Diablo Cove in 1978–1984, prior to power plant start-up.

Field's Cove

Fish composition in Field's Cove during 1999 was similar to the previous four-year period (**Figure 3-38**), but the average number of fishes was 37 percent greater. *Xiphister mucosus* was the most abundant species followed by *Oligocottus snyderi* and *Cebidichthys violaceus*. The *Anoplarchus/Cebidichthys* taxon was not recorded in 1999, although it had been the most numerous taxon in the pre-operational period. The reason for this is that the two species had been combined from 1978–1995 because of taxonomic uncertainties in all but the largest specimens. After 1995, the difficulties had largely been resolved, and the two species were identified separately. The combined average abundance of these species in 1999 was 11.8 fish per survey, compared to 31.4 per survey in the pre-operation period and 16.0 per survey in the operation period from 1987–1995. The average combined abundance of *Anoplarchus/Cebidichthys* was 7.2 per survey in the 1995-1999 period.

The total number of taxa at the Field's Cove station in 1999 was 12, including the combination categories. This was similar to the number of taxa sampled in previous periods. There were no new taxa sampled at the station in 1999.

North Diablo Cove

Fish composition and abundance in North Diablo Cove during 1999 was the lowest since the intertidal fish surveys began in 1978. In 1999, only three fish were found at Station NDC-1V

(**Figure 3-39**). The pre-operational survey average at this station was 66.8 fish represented by 13 taxa.

The abundance and species richness of intertidal fishes in North Diablo Cove have declined substantially in each sampling period since the 1978–1984 pre-operation period. The reasons for the decline are likely related to changes in habitat suitability in the warmer water conditions of North Diablo Cove combined with the significant declines in foliose algal coverage at the station. Laboratory heat tolerance tests and optimal growth temperature studies were conducted on *X. mucosus* (PG&E 1982). In the 120-day growth experiment, the optimal temperature range for this species was 14–15°C. Water temperatures from June to September 1999 averaged nearly 20°C at the North Diablo Cove intertidal fish station. Declines in algal coverage result in decreased micro-invertebrate food resources upon which many juvenile intertidal fishes depend (Setran and Behrens 1993; Norton and Cook 1999). Substrate composition is also considered an important factor in determining intertidal fish abundance (Gibson and Yoshiyama 1999), but this was unchanged at the station between periods and therefore would not have contributed to the declines.

South Diablo Cove

In 1999 there was an average of 39 fish per survey and a total of 10 taxa sampled at the South Diablo Cove station (**Figure 3-40**). Juvenile *Xiphister* spp. accounted for nearly 80 percent of the individuals counted at the station. The next most abundant species was *Cebidichthys violaceus*, which comprised 7 percent of the fishes. The species composition in 1999 was very similar to the most recent years, but less diverse than the earliest surveys prior to plant operation. One unusual species, the graveldiver (*Scytalina cerdale*), had been seen during previous periods (accounting for 17.5 percent of the individuals from 1978–1984) but was not found at the station in 1999. The species has very specific habitat requirements in terms of intertidal elevation, substrate type, and degree of wave exposure (Setran and Behrens 1990). Diablo Cove also represents the known southern range limit for this species.

One of the major events that affected abundances and species richness of intertidal fishes in South Diablo Cove was a cliff collapse in 1983. Rock fragments buried almost the entire intertidal zone, dramatically altering the substrate composition and benthic community structure. Intertidal fishes partially recovered in the following years, as evidenced by an increase in species richness and the moderate abundances of fishes at the station. However, it is not possible to

separate changes in the fish community due to power plant operation and changes due to factors related to the cliff slide. In any event, the area has not completely recovered to pre-slide levels of abundance or species richness in the presence of the thermal discharge.

Select Species Changes

Abundance over time plots are shown for select species in this section as examples of the types of changes observed in the study from 1976 through 1999. The species were selected based on two criteria: they typically characterize central California intertidal fish assemblages, including Diablo Cove, and they represent new or continuing changes from previous findings (Tenera 1997, 1999b). Appendix F3 presents annual mean abundances for intertidal fishes, by station, from 1979 through 1981, and from 1985 through 1999.

Xiphister mucosus, the rock prickleback, comprised 23.7 percent of the total number of fish sampled in 1999, although many small Stichaeidae/Pholididae juveniles were probably *X. mucosus*. In previous years this species has typically shown abundance peaks during summer and low abundances during winter. The pattern was mainly caused by recruitment episodes that have increased the overall population size during summer. In May 1999 there was a recruitment pulse at North Control and South Diablo Cove with high numbers of juvenile *Xiphister* spp. and Stichaeidae/Pholididae juveniles in the 20–30 mm size range (**Figure 3-41**). In the following survey (July) the mean size increased, reflecting growth of individuals in the earlier settlement cohort. Natural mortality, however, decreased the overall population abundance of *Xiphister* at all stations in subsequent surveys.

A long-term plot of *Xiphister mucosus* abundance for each sampling area is presented in **Figure 3-42**. Abundances declined at the North Diablo Cove station after plant start-up in comparison to the Field's Cove station. In 1999, *X. mucosus* was relatively abundant at the control stations and Field's Cove, but was scarce in Diablo Cove. Abundances have fluctuated over time within stations, primarily in response to recruitment episodes.

Xiphister atropurpureus, the black prickleback, is closely related to *X. mucosus* and similar in appearance. The species decreased in overall abundance in Diablo Cove and Field's Cove during the operational period and in 1999 remained at low abundances (**Figure 3-43**). North and South Control were the main stations where *X. atropurpureus* was found in 1999. *X. atropurpureus* was generally more abundant in Diablo Cove than in Field's Cove prior to plant start-up.

Anoplarchus purpurescens/Cebidichthys violaceus are the two species that comprise the high cockscomb/monkeyface eel complex. Identification uncertainties have made it necessary to combine small (<50 mm) *Anoplarchus* and *Cebidichthys* in field counts, but larger specimens are counted separately. *Anoplarchus* is known to attain lengths of 200 mm and *Cebidichthys* may grow to 760 mm (Eschmeyer et al. 1983). Large individuals are principally subtidal and most intertidal specimens found during the surveys were probably juveniles. *Cebidichthys* was primarily found in Field's Cove and South Diablo Cove, with high abundances also found at the new South Control station in 1999 (**Figure 3-44**). South Control also had the highest abundances of *Anoplarchus purpurescens* of all the stations (**Figure 3-45**) in 1999. Historically *Anoplarchus* has been moderately abundant in Field's Cove but has only occurred sporadically in South Diablo Cove. Prior to 1991, *Anoplarchus* of all sizes were included in the *Anoplarchus/Cebidichthys* complex and are, therefore, not included in the figure.

During the pre-operational phase, *Anoplarchus/Cebidichthys* were generally more abundant at the Field's Cove station than at either North or South Diablo Cove stations. A general decline in abundance occurred in all areas in 1989–1990. Gradual increases in subsequent years occurred in all areas but North Diablo Cove. The reasons for this pattern are not known.

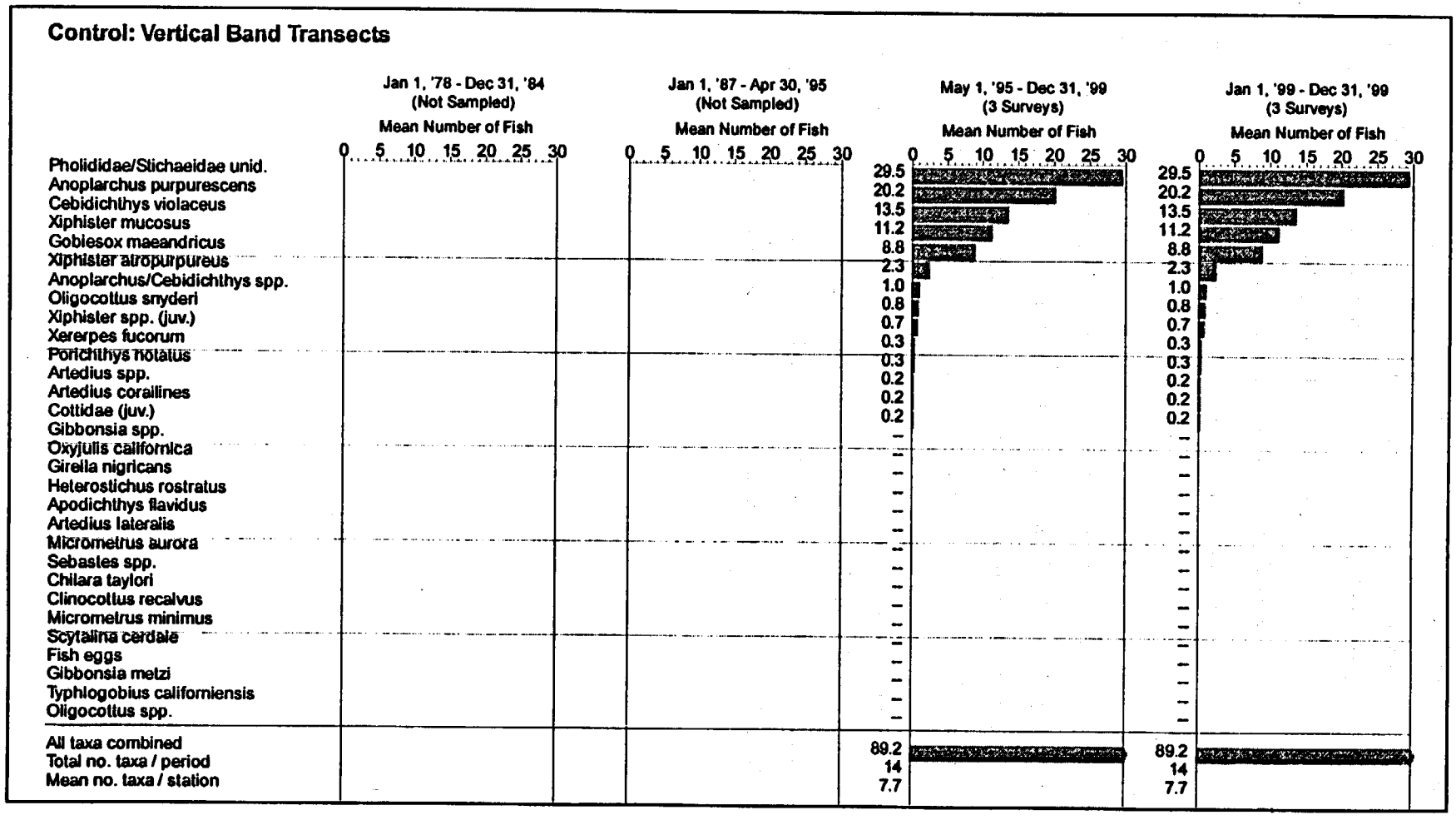


Figure 3-37. Intertidal fish abundance at North Control (NC-1V) and South Control (SC-1V) combined.

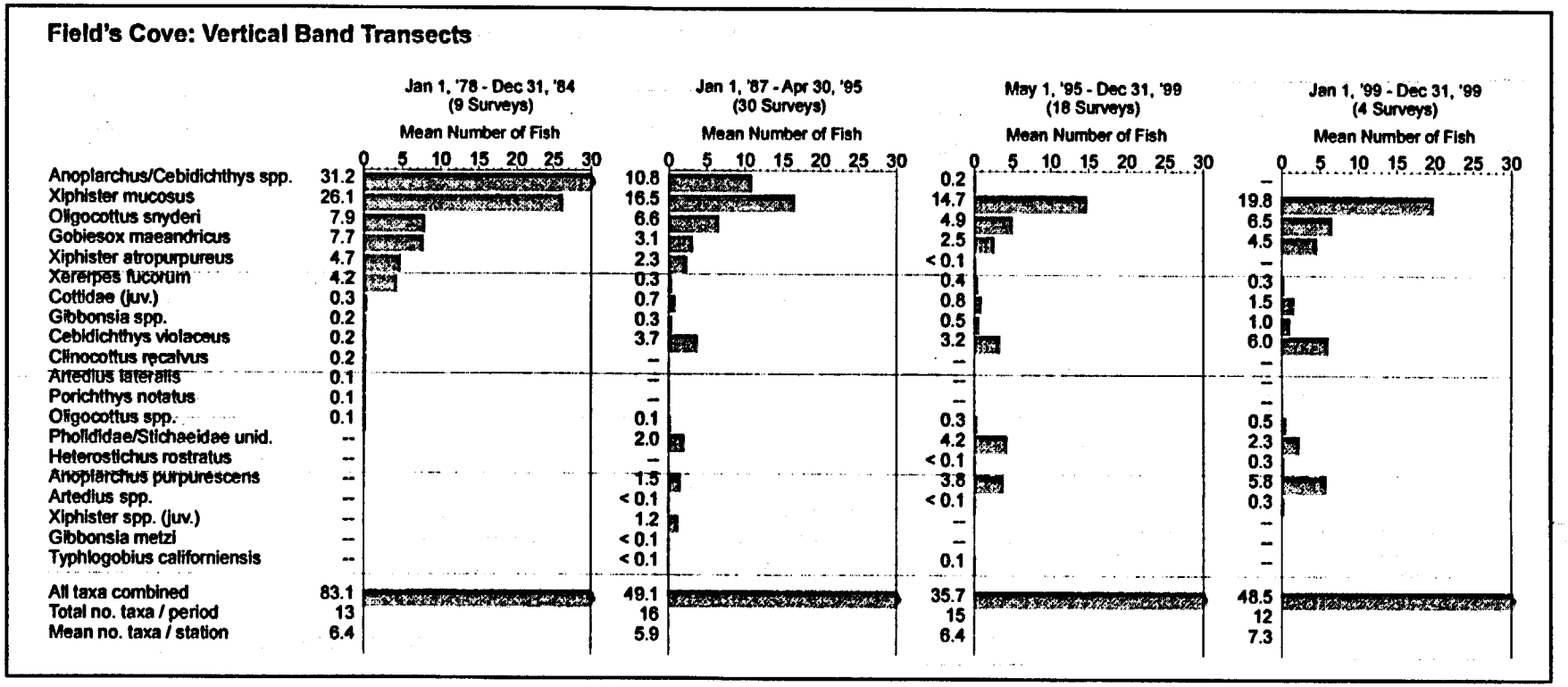


Figure 3-38. Intertidal fish abundance at Field's Cove station FC-1V .

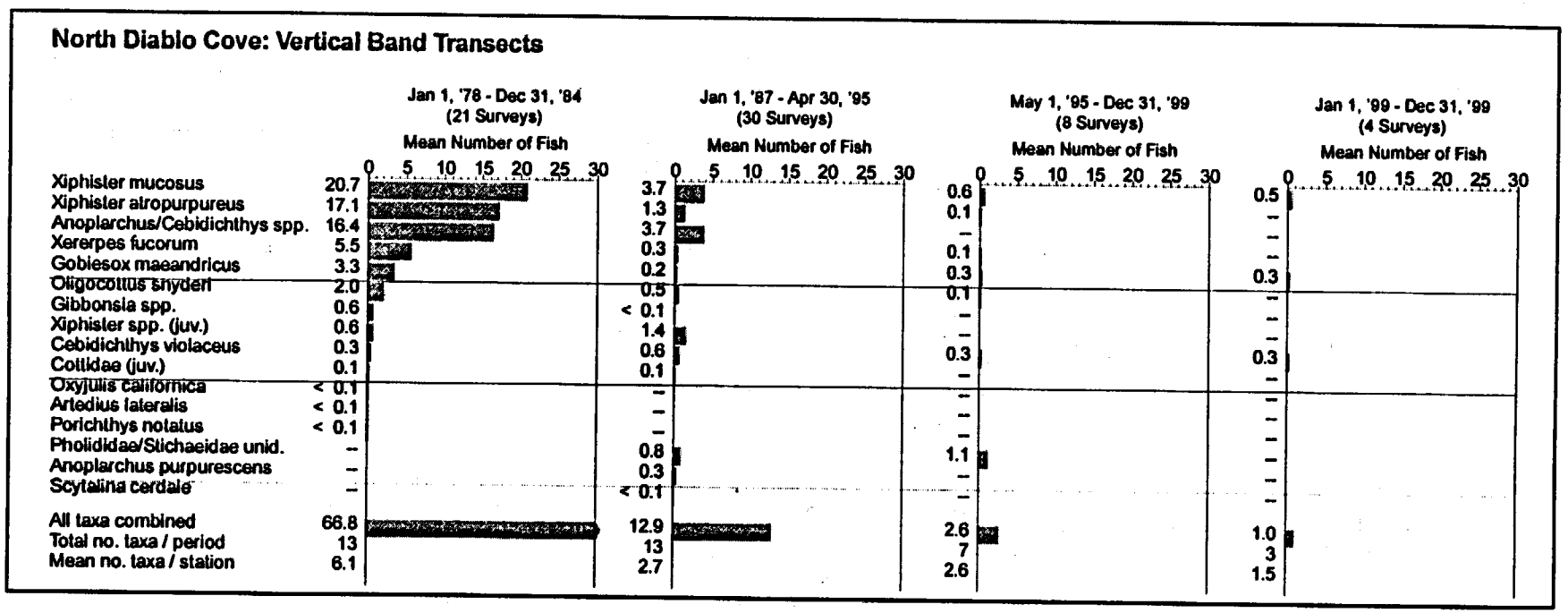


Figure 3-39. Intertidal fish abundance at North Diablo Cove station NDC-1V .

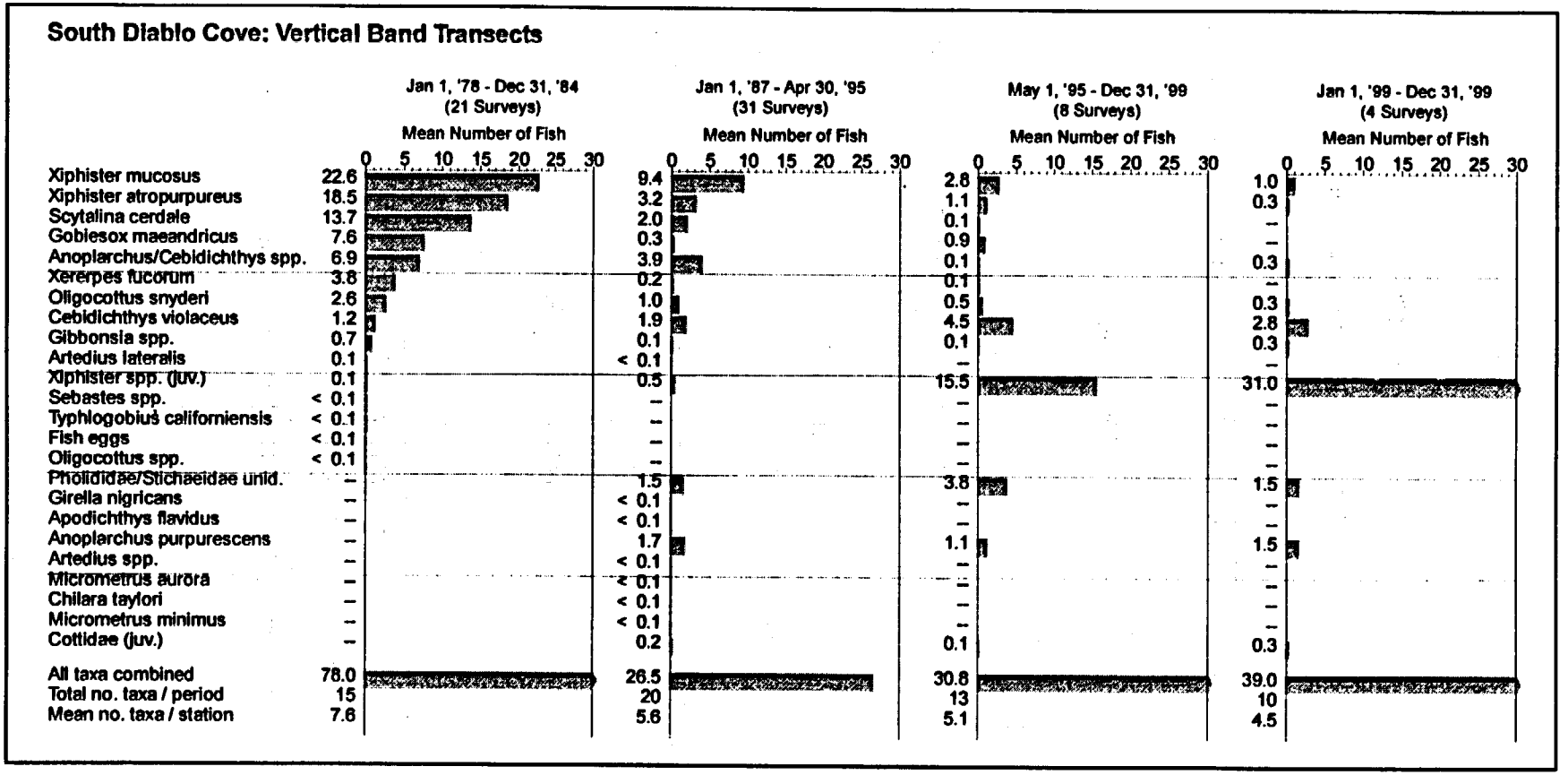


Figure 3-40. Intertidal fish abundance at South Diablo Cove station SDC-2V .

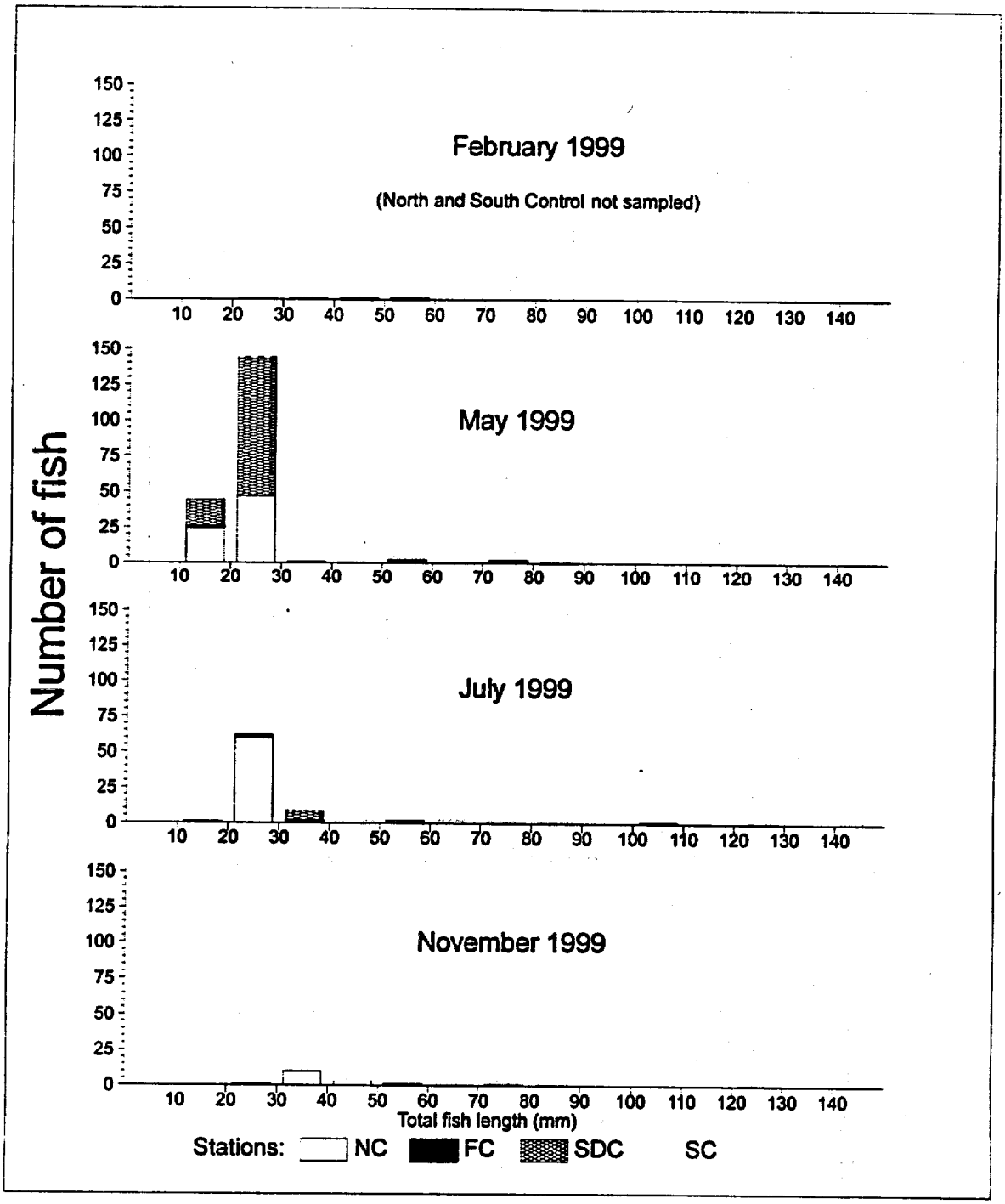


Figure 3-41. Length frequency distribution for *Xiphister* spp. and juvenile Stichaeidae/Pholididae.

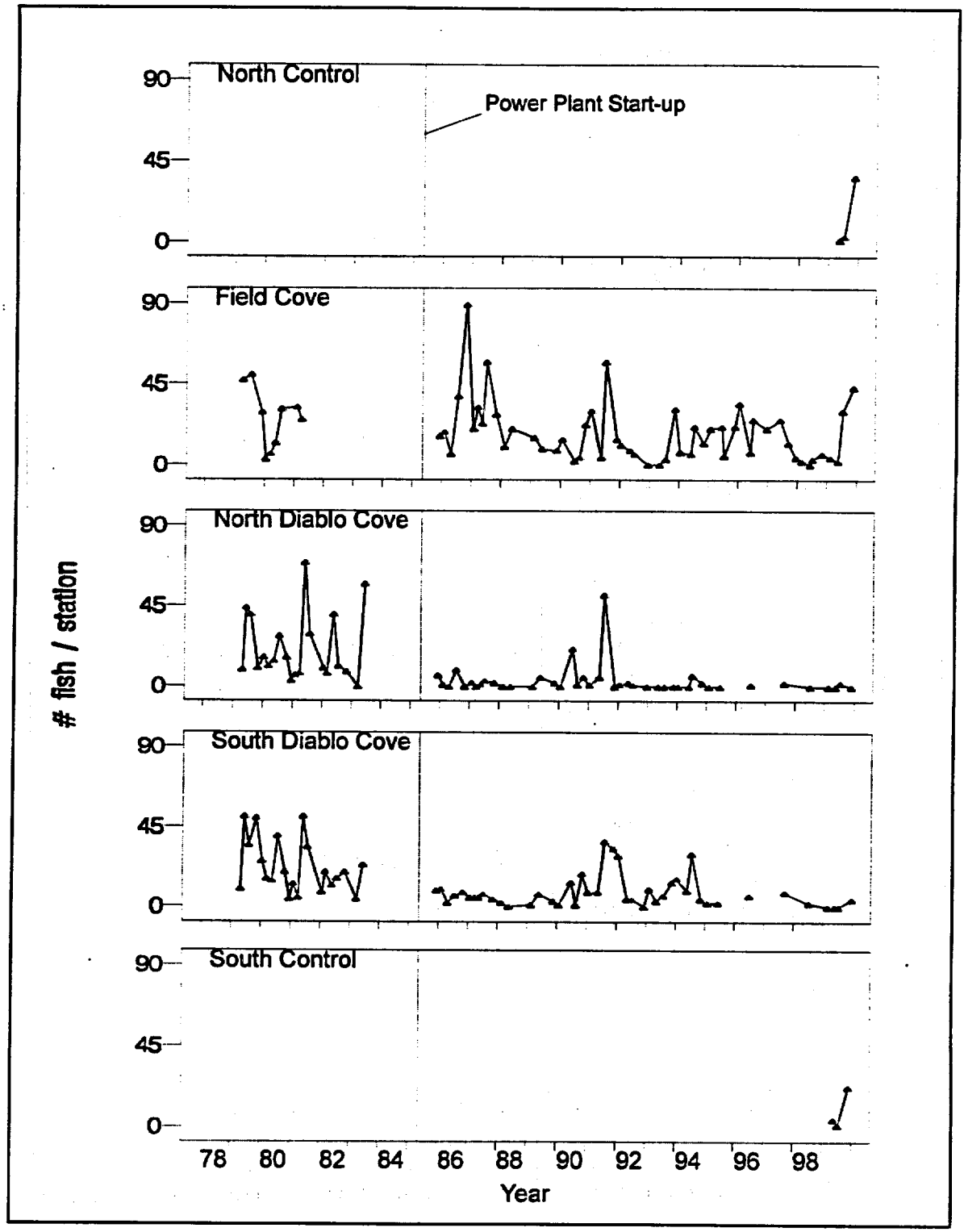


Figure 3-42. *Xiphister mucosus*: changes in abundance at intertidal fish stations.

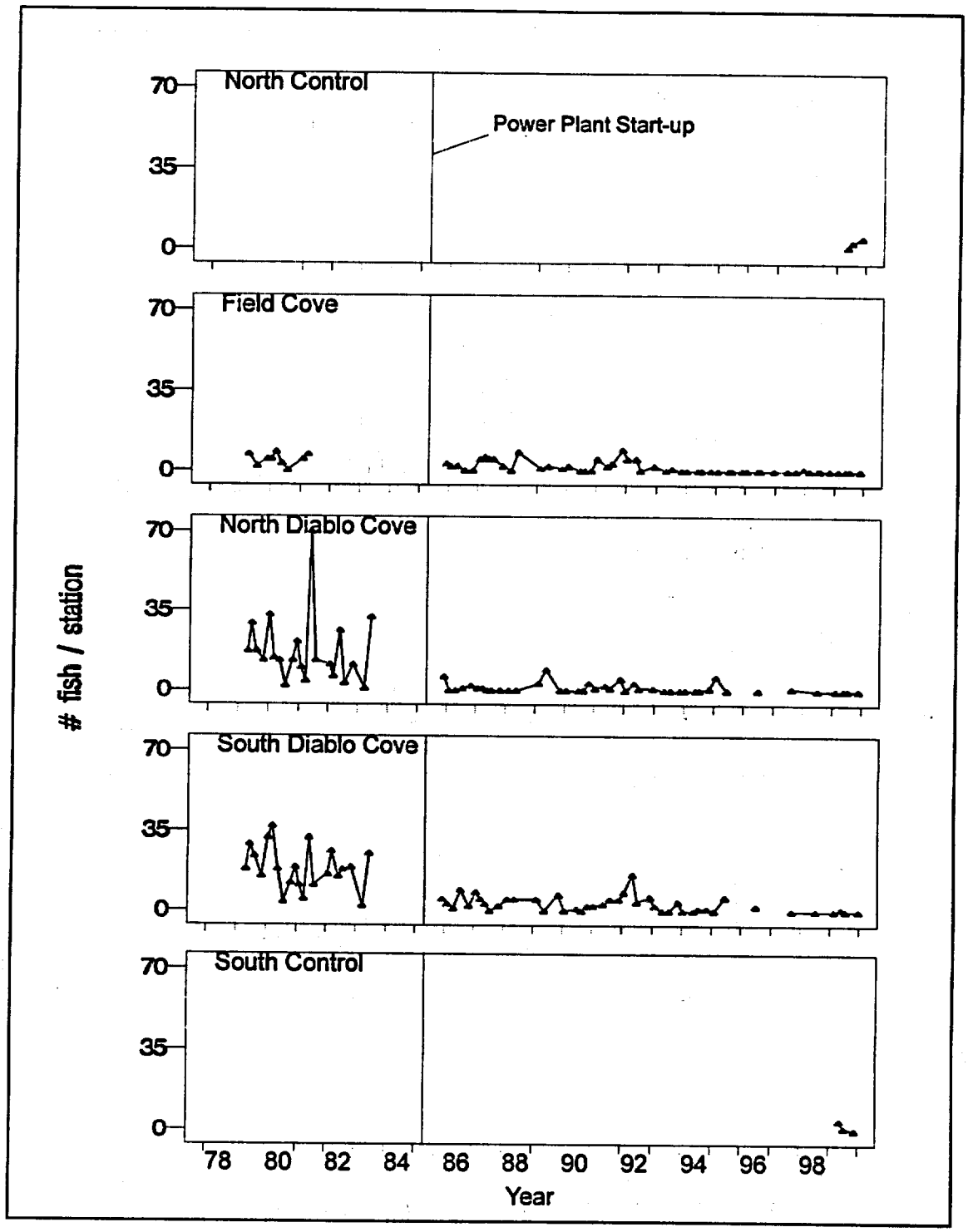


Figure 3-43. *Xiphister atropurpureus*: changes in abundance at intertidal fish stations.

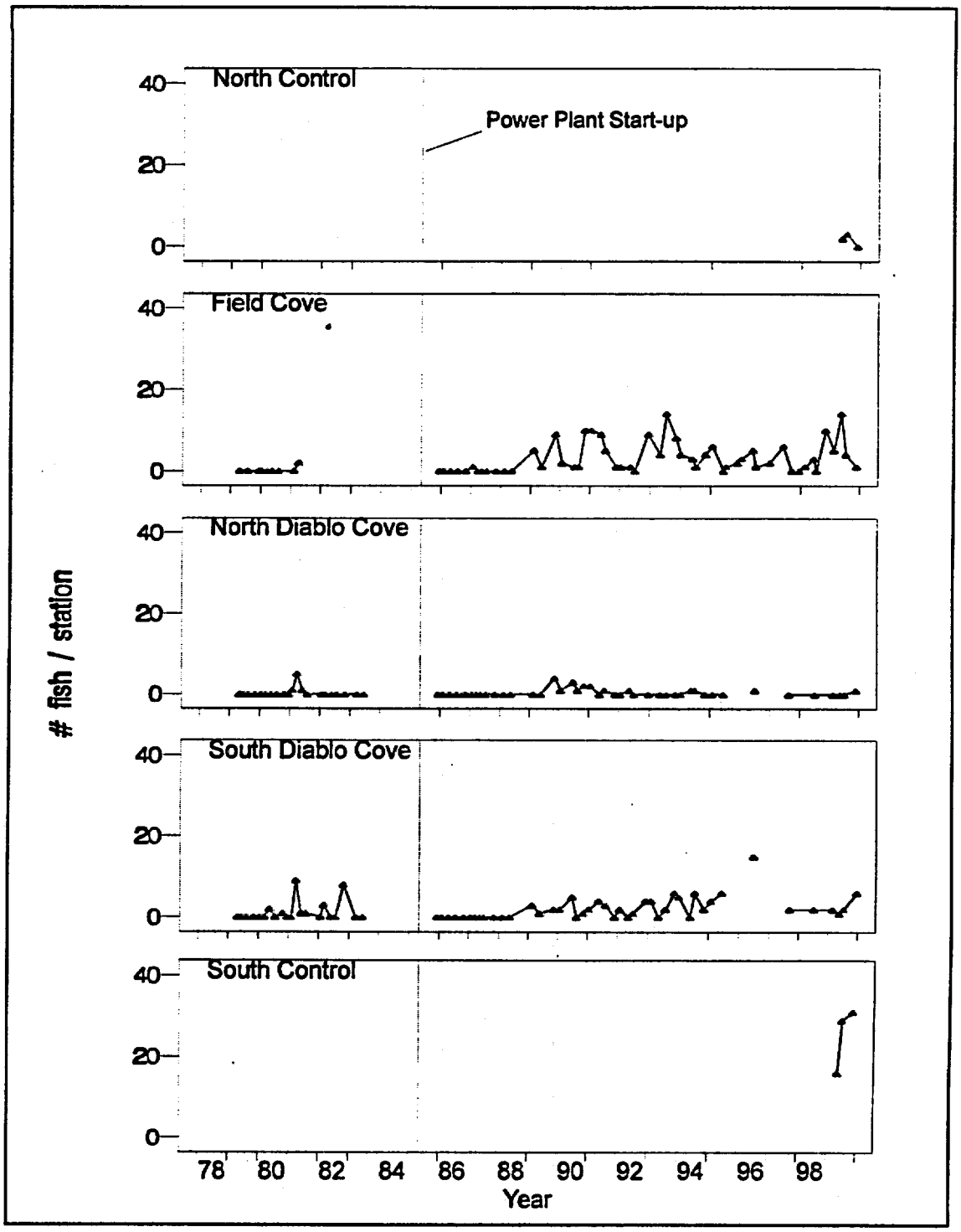


Figure 3-44. *Cebidichthys violaceus*: changes in abundance at intertidal fish stations.

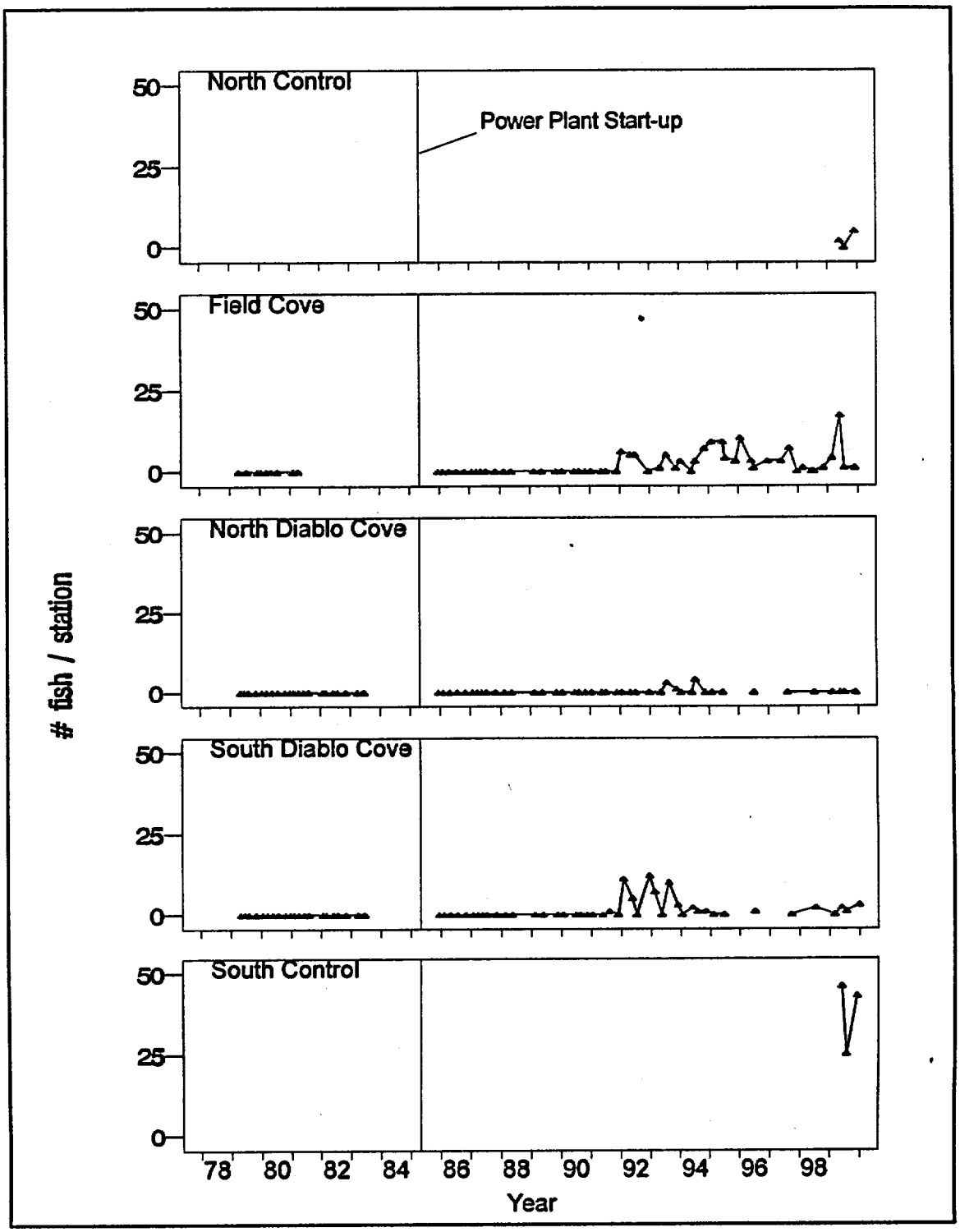


Figure 3-45. *Anoplarchus purpurescens*: changes in abundance at intertidal fish stations.

4.0 SUBTIDAL STUDIES

Subtidal algae, invertebrates, and fishes were sampled in several field studies as part of the 1999 RWMP. This included sampling of algae and invertebrate communities for species composition and abundance at permanent benthic stations, and identification and enumeration of fishes along permanent transects located near the benthic stations. The distribution and abundance of *Nereocystis luetkeana* (bull kelp) and *Macrocystis pyrifera* (giant kelp) in Diablo Cove were mapped in the habitat-forming kelp study.

4.1 Subtidal Algae

Subtidal algae have been sampled at DCPP since 1976. Earlier analyses of data collected through June 1995 detected declines in surface canopy-forming bull kelp, subsurface canopy-forming kelps, and some understory algal species in shallow areas of Diablo Cove as a result of the discharge (Tenera 1997). Coincident with these changes were increases in several algal species that were uncommon prior to plant start-up. The changes in the subsurface canopy-forming kelps and the algal understory were restricted to depths shallower than about 7 m in Diablo Cove. Discharge effects in *Nereocystis luetkeana* (bull kelp), detected as early deterioration of surface fronds, extended over a larger area (Field's Cove and areas northward to Lion Rock) during the 1987 El Niño when ambient water temperatures were warmer than normal. *Macrocystis pyrifera* (giant kelp) surface canopies increased in abundance throughout Diablo Cove beginning in about 1992.

Subsequent reports for the time period of 1995–98 showed that changes continued to occur in many taxa (Tenera 1999b). Decreases occurred in many of the understory algae leading to declines in total understory algal cover, despite increases in taxa with previously low abundances. Much of the change in understory algae resulted from changes in surface canopy kelps and grazer abundances.

This section describes the 1999 results for subtidal algae at the benthic stations in Diablo Cove, Field's Cove, and Patton Cove (control area). Comparisons of the 1999 data to prior findings are qualitative and based on summaries of algal composition, correspondence analysis of community-level changes, and time-series abundance plots for individual taxa.

4.1.1 Sampling Methods

The same sampling methods for subtidal kelp counts and understory algal coverage measurements have been used since the monitoring studies began in 1976. All benthic stations (**Figure 4-1**) had been established before the power plant began commercial operation and were sampled at various time intervals before and after power plant start-up. The stations were established primarily on substrates of mixed bedrock and boulders with small amounts of cobble and sand. Depths ranged from -3 m to -6 m (-10 ft to -20 ft) MLLW.

Each station was circular with a radius of 3.15 m and a sampling area of 28 m^2. The center 3.1 m^2 area, which contained a mooring wheel, was not sampled to avoid any unnatural algal and invertebrate growth associated with the mooring. Each station was divided into four equal sections, or "arc quadrants", 7 m^2 in area.

Kelp species (brown algae of the order Laminariales and Fucales) and macroinvertebrates (see Section 4.2 – *Subtidal Invertebrates*) were sampled as counts of individuals using the subtidal arc quadrant (SAQ) sampling method. The subsurface canopy-forming kelps were *Pterygophora californica, Laminaria setchelli*, and *Egregia menziesii*. The surface canopy-forming kelps were

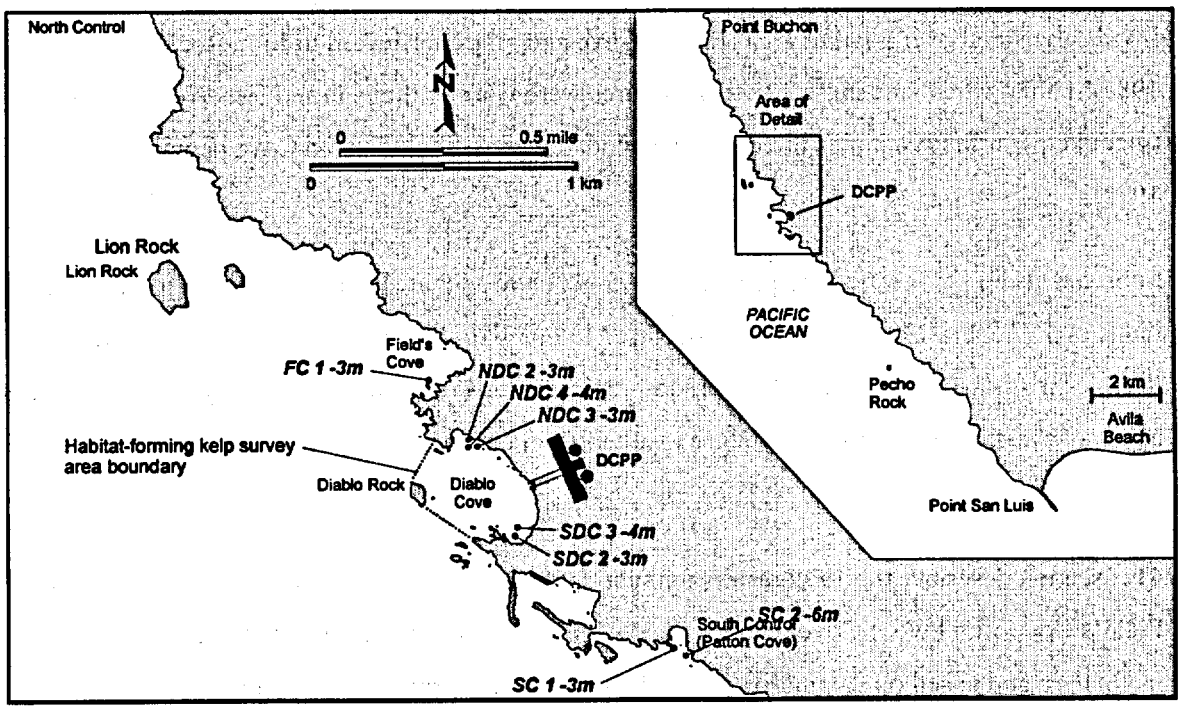


Figure 4-1. Subtidal benthic stations and habitat-forming kelp survey area in Diablo Cove.

Nereocystis luetkeana and *Macrocystis pyrifera*. Juvenile plants of these subsurface and surface canopy-forming species (which could not be identified to the species level) were counted and recorded as "Laminariales." The kelps *Sargassum muticum* and *Cystoseira osmundacea* were also counted. *C. osmundacea* was further differentiated into plants with only a small basal portion and larger plants with floating reproductive fronds.

Other subtidal algal species are more difficult to count because they are usually small or occur as dense clumps. These species are often collectively referred to as the algal understory as they occur beneath kelp fronds. We quantified all understory species at the stations in percent cover using a random point contact (RPC) sampling method. A line with ten points positioned at increasing intervals toward the station perimeter was attached to the center of the station and used to locate sampling loci in each quadrant. Fifty points within each quadrant, or 200 points per station, were randomly selected (using a random numbers table) before sampling. For each survey we sampled a new set of randomly selected points. The presence of all algal species, sessile invertebrates, and substrates observed directly under the points was recorded. Holdfasts of kelp species were also included when contacted by the sample points. Percent cover of the understory algae was derived by dividing the number of "contacts" by the number of points sampled. Species were identified to the lowest taxonomic level practical. Unknown taxa were collected outside the sampling area, if possible, and returned to the laboratory for identification.

Maps of surface kelp canopies in Diablo Cove documented changes in kelp distribution and abundance outside the fixed benthic stations. We conducted the 1999 annual habitat-forming kelp survey for *Nereocystis luetkeana* (bull kelp) and *Macrocystis pyrifera* (giant kelp) in October for North and South Diablo Cove. Near the end of the annual growth cycle in October, the maximum number of bull kelp plants have reached the surface and can be counted. Two observers at each point counted and mapped the extent of bull kelp plants and giant kelp canopies. The occurrence of bull kelp plants with bare bulbs, indicating early senescence in plants, was also noted when possible. An annual census total of bull kelp for Diablo Cove and a composite map depicting the locations of bull kelp and giant kelp canopies were developed from the data.

4.1.2 Results

The following section describes the algal communities at the study areas, analysis results of community-level changes, and changes in individual taxa. The algal communities for each study

area sampled in 1999 are described by the taxa that formed 95 percent of the total algal cover in addition to crustose taxa and bare rock. The taxa examined in correspondence analysis were those that formed 95 percent of the total algal cover and occurred in at least 20 percent of the surveys.

Biological Community Descriptions

This section describes the biological communities organized by the three areas sampled.

South Control

Stations SC-1 and SC-2 were sampled in the control area of Patton Cove in 1999 (**Figure 4-1**) where the red foliose, algal understory assemblage was characterized by *Cryptopleura ruprechtiana* and *Chondracanthus exasperata/corymbiferus* (**Figure 4-2**). Articulated coralline algae (*Calliarthron/Bossiella* spp.) and crustose coralline algae were also abundant members of the algal understory.

The abundance of kelp is better described from counts of individuals (density) (**Figure 4-2b**) rather than coverage of holdfasts (**Figure 4-2a**). An increase in the density of the subcanopy kelp *Pterygophora californica* and juvenile form of this species (Laminariales) was among the most noticeable change at the control stations in 1999 (**Figure 4-2b**). The increase followed a 1999 storm disturbance that allowed kelp to colonize the new bare rock space. Other kelp taxa did not increase by similar amounts (**Figure 4-2b**).

Diablo Cove

While articulated coralline algae and crustose coralline algae were abundant, the red, foliose algal understory assemblage in 1999 at stations sampled at the North and South Diablo Cove stations was comprised of different taxa than at the controls. *Prionitis* spp., *Farlowia/Pikea* spp., and *Gelidium robustum* were more common in North Diablo Cove, as were benthic diatoms (Chrysophyta) (**Figure 4-3**). Benthic diatoms were also conspicuous at stations in South Diablo Cove (**Figure 4-4**). *Cryptopleura ruprechtiana* was the numerically dominant foliose understory alga at the North and South Diablo Cove stations before power plant start-up, but was nearly absent at the stations in 1999. *C. violacea*, which had increased during power plant operation at the North and South Diablo Cove stations, declined in cover in both areas in 1999 back to levels observed before power plant start-up.

Giant kelp (*Macrocystis pyrifera*) continued to be the most abundant kelp species in North and South Diablo Cove in 1999, and the kelp holdfasts were sampled as part of the algal understory (**Figures 4-3** and **4-4**). The annual habitat-forming kelp survey conducted in October 1999 noted that the surface canopies of giant kelp covered most areas of North and South Diablo Cove, with the area extending from the central portion of Diablo Cove past the southern tip of Diablo Rock remaining largely devoid of giant kelp because the bottom consists largely of sand flats. The annual habitat-forming kelp survey also documented a total of two surface-occurring bull kelp individuals (*Nereocystis luetkeana*) in Diablo Cove, which occurred close to the shoreline of South Diablo Point. Both individuals occurred as bare bulbs that lacked blades.

Field's Cove

In general, species composition and abundance of the foliose, red algal understory and kelp assemblage at FC-1 in Field's Cove were more similar to controls than to stations in Diablo Cove (**Figure 4-5**). Namely, the foliose red alga *Cryptopleura ruprechtiana* and *Chondracanthus exasperata/corymbiferus* were among the most abundant at FC-1 as in control stations. Also, large increases that occurred in 1999 in the subcanopy kelp species *Pterygophora californica* and *Laminaria setchellii* at the control stations also occurred at FC-1.

Community Analysis

Results of correspondence analysis (CA) highlight some of the more obvious and subtle dissimilarities in species composition and abundance among the stations in Diablo Cove, Field's Cove, and Patton Cove (South Control) since 1990 (**Figure 4-6**). The first axis separates Diablo Cove from the other study areas, and shows the dissimilarity has been largely due to the abundance of giant kelp (*Macrocystis pyrifera*) in Diablo Cove. Other taxa in Diablo Cove accounting for differences include understory algae consisting of *Nienburgia andersoniana*, Chrysophyta, *Cryptopleura violacea*, and *Farlowia/Pikea* spp. The second axis separates the control area from Field's Cove. The control area was characterized by the relative abundance of *Pterygophora californica* and Laminariales. Field's Cove was characterized by the relative abundance of *Mazzaella lilacina*, *Cryptopleura ruprechtiana*, and *Callophyllis* spp. However, both the control and Field's Cove stations have become more similar since 1997, due to the occurrence of Laminariales and *Pterygophora californica*.

Select Species Changes

Although some increases have been observed in 1999, an overall declining trend in total algal cover, with the exception of crustose algae, has been occurring at the North and South Diablo Cove and Field's Cove stations since 1990-92 (**Figure 4-7**). Total algal cover has remained relatively unchanged at the South Control stations, but declines occurred in 1999 at SC 1 -3m, related to large storms that occurred during the year. Declines in Diablo Cove and Field's Cove in 1999 were probably related to the same storms. **Appendix F1** and **F2** presents annual mean abundances for the individual subtidal algal taxa from 1976 through 1999.

Cryptopleura violacea (foliose red alga) was not abundant in Diablo Cove before power plant start-up. An increase during power plant operation through about 1992–94 was followed by a decline in 1995–98 (**Figure 4-8**). This was detected as a statistically significant change from the earlier increase (Tenera 1999b). The decline continued in 1999, returning to pre-operational levels of abundance. This species has always been low in abundance at control and Field's Cove stations throughout the study.

Macrocystis pyrifera (giant kelp) began increasing in abundance in Diablo Cove in 1990-92 (**Figure 4-9**). Abundances in 1995–98 were statistically significant, representing a continuing rise in the densities of this kelp species (Tenera 1999b). Further increases occurred in 1999 in Diablo Cove, consistent with large coastwide increases in surface canopy kelp species (Tenera, unpublished observations). *M. pyrifera* has not been found at the South Control stations. *M. pyrifera* is more common north of the power plant (Tenera 1999c). A few individual kelp plants were recorded for the first time at FC 1 -3 m in Field's Cove in 1998, and densities were similar in 1999 (**Figure 4-9**).

Pterygophora californica (a subcanopy kelp) changed markedly in abundance among the subtidal algae in 1999 at the two control stations (**Figure 4-10**). The increase at those stations was accompanied by increases in 'Laminariales', a taxon we use for kelp plants that are too small to distinguish to the species level (**Figure 4-2b**). It is assumed that many of the Laminariales kelp plants at the control stations in 1999 were small *P. californica.* A relatively small increase in *P. californica* occurred at the Field's Cove station in 1999. There, another subcanopy kelp, *Laminaria setchellii,* increased more markedly in abundance in 1999 (**Figure 4-5b**). No large changes occurred in the abundance of *P. californica* or *L. setchellii* at the Diablo Cove stations in 1999 (**Figures 4-3b and 4-4b**).

4.1.3 Discussion

The study areas in 1999 were characterized by taxa typical of central California rocky subtidal zones. However, the relative proportions and levels of abundance of various taxa in Diablo Cove differed from pre-operational abundance levels and from levels in control and Field's Cove areas. The differences resulted largely from previous changes in Diablo Cove that began after power plant start-up. Initial changes were subsequently influenced by the increase in surface canopies of giant kelp (Tenera 1997). The coverage of understory algae increased after power plant start-up, but then declined in the presence of giant kelp. Some of the changes included species returning to pre-operation levels of abundance. For example, *Cryptopleura violacea* increased after power plant start-up, but declined to pre-operation levels of abundance after surface canopies of giant kelp had formed in Diablo Cove.

The abundance of giant kelp increased further in 1999 to the highest levels of abundance recorded in the study. The large increase probably resulted from oceanographic conditions that were favorable to its growth. The expansion of kelp in 1999 was not unique to Diablo Cove. Remarkable high levels of giant kelp abundance, including bull kelp, were observed concurrently in 1999 along other portions of the central California coast (Tenera, unpublished observations). Increases in giant kelp in southern California in 1999 were associated with cooler seawater temperatures and abundant nutrients due to upwelling during the La Niña (Hayward et al. 1999). Recruitment potential in kelp is high, which has enabled them to respond quickly to changes in ocean conditions and rapidly populate areas (Dayton et al. 1982).

The ability of the giant kelp surface canopies to modify understory species composition presents difficulties for determining the spatial extent of discharge effects using previously identified indicator species. We previously used *Cryptopleura violacea* to delineate areas of effects to understory algae in Diablo Cove, based on areas where this species was abundant (Tenera 1997). However, its abundance now appears to be inversely related to the abundance of giant kelp, making it less useful as an indicator of discharge effects on understory algae in Diablo Cove. The subcanopy kelps *Pterygophora californica* and *Laminaria setchellii* declined at shallow stations contacted by the discharge, and their absence was used to delineate areas of discharge effects to these subcanopy kelps in Diablo Cove (Tenera 1997). However, shading from giant kelp can also reduce or maintain the abundance of understory algae at low levels (Pearse and Hines 1979, Kimura and Foster 1984, Reed and Foster 1984). Consequently, species distributions alone can

no longer be considered reliable for mapping the spatial extent of discharge effects in areas of Diablo Cove, as long as giant kelp remains abundant in the cove.

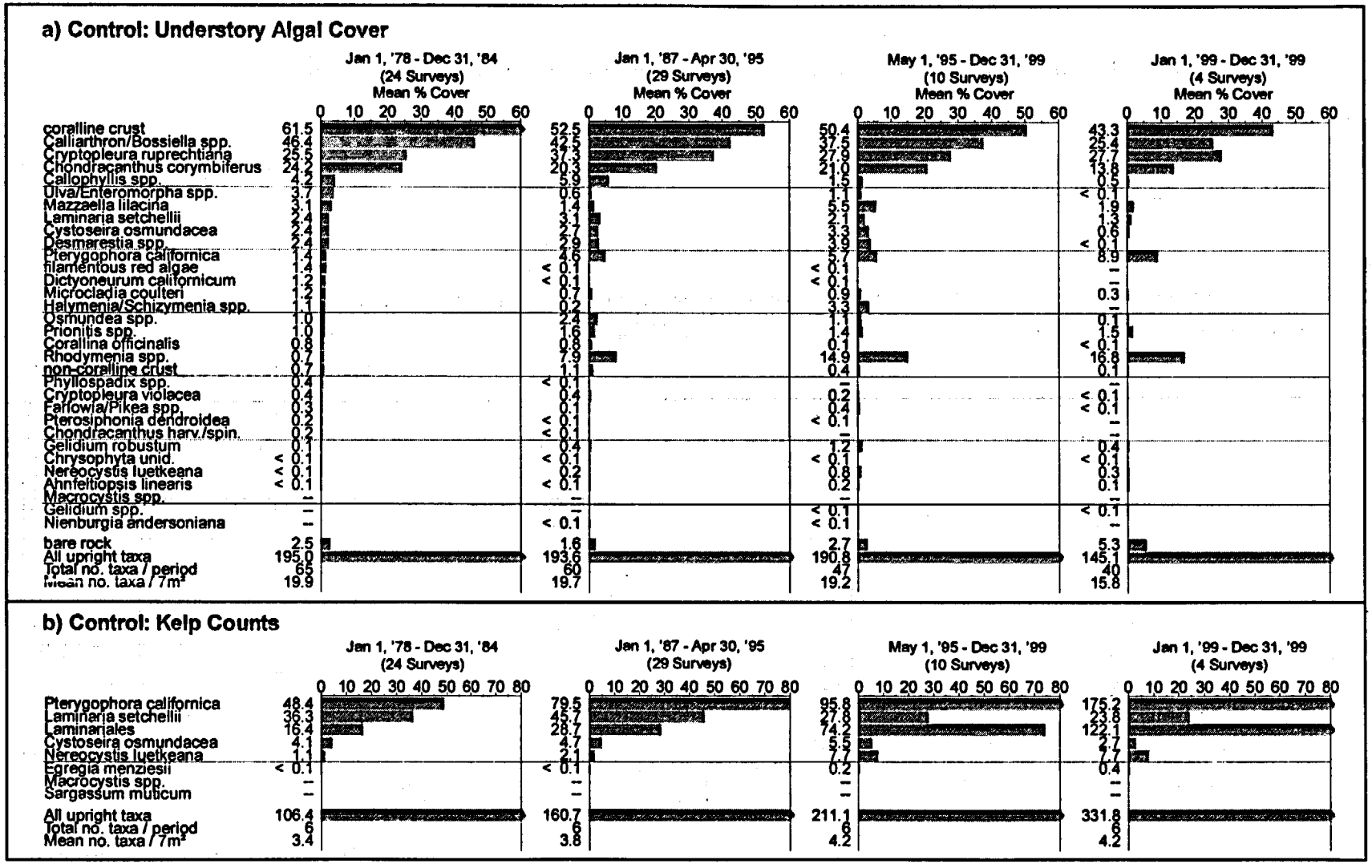


Figure 4-2. Subtidal algal abundances at the control stations: (a) understory algal cover and (b) kelp counts. Stations = SC-1 and SC-2.

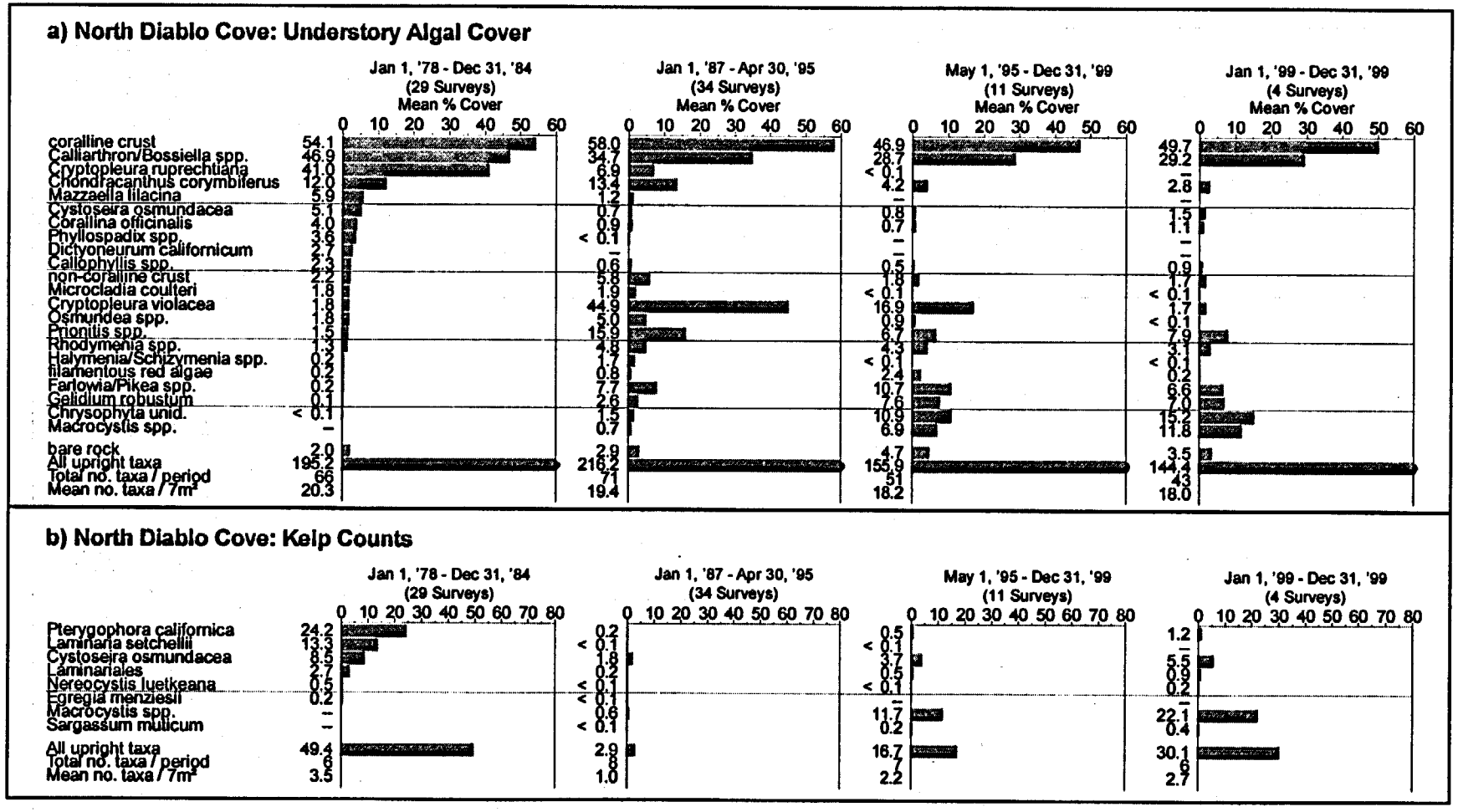


Figure 4-3. Subtidal algal abundances at the North Diablo Cove stations: (a) understory algal cover and (b) kelp counts. Stations = NDC-2, -3, and -4. .

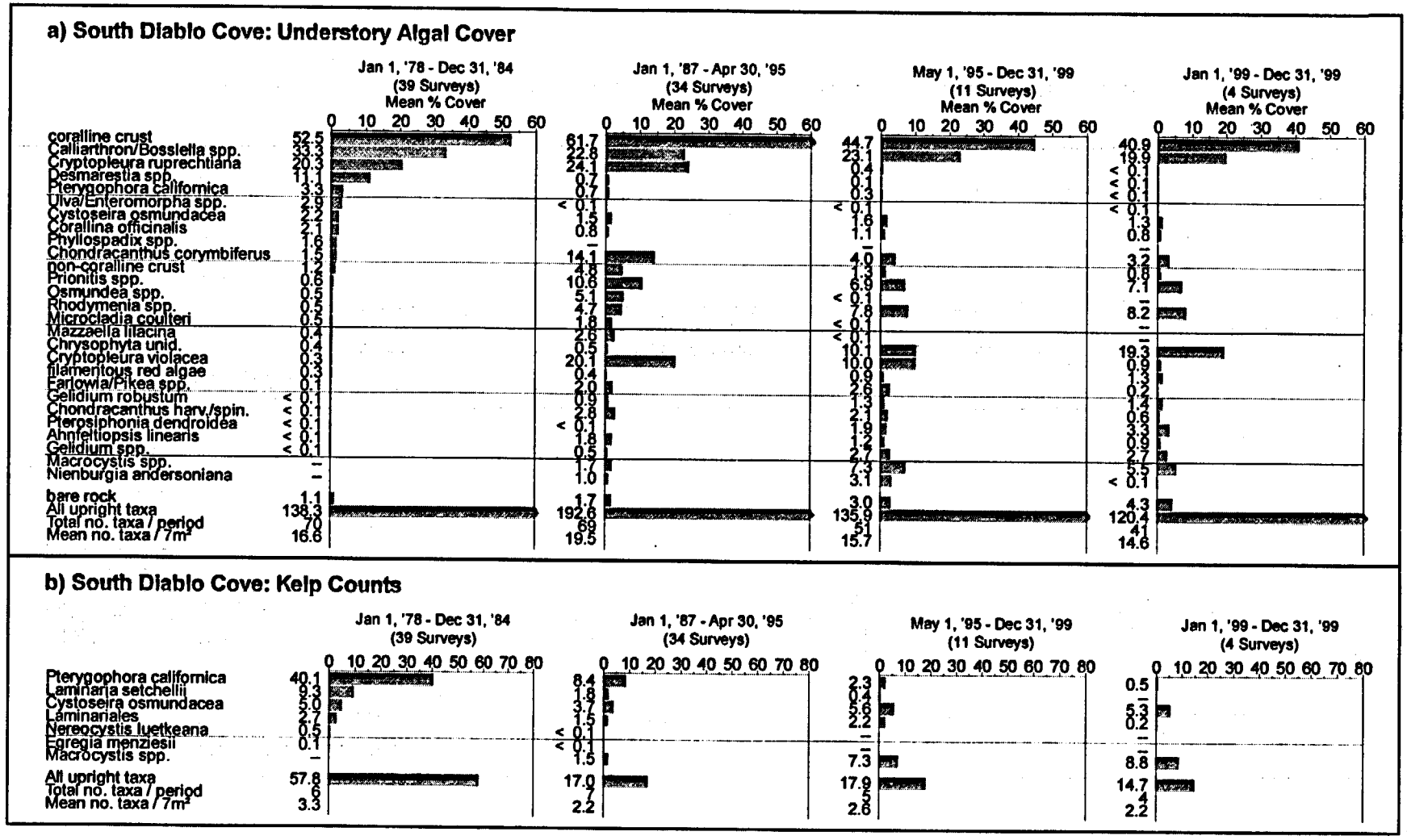


Figure 4-4. Subtidal algal abundances at the South Diablo Cove stations: (a) understory algal cover and (b) kelp counts. Stations = SDC-2 and -3.

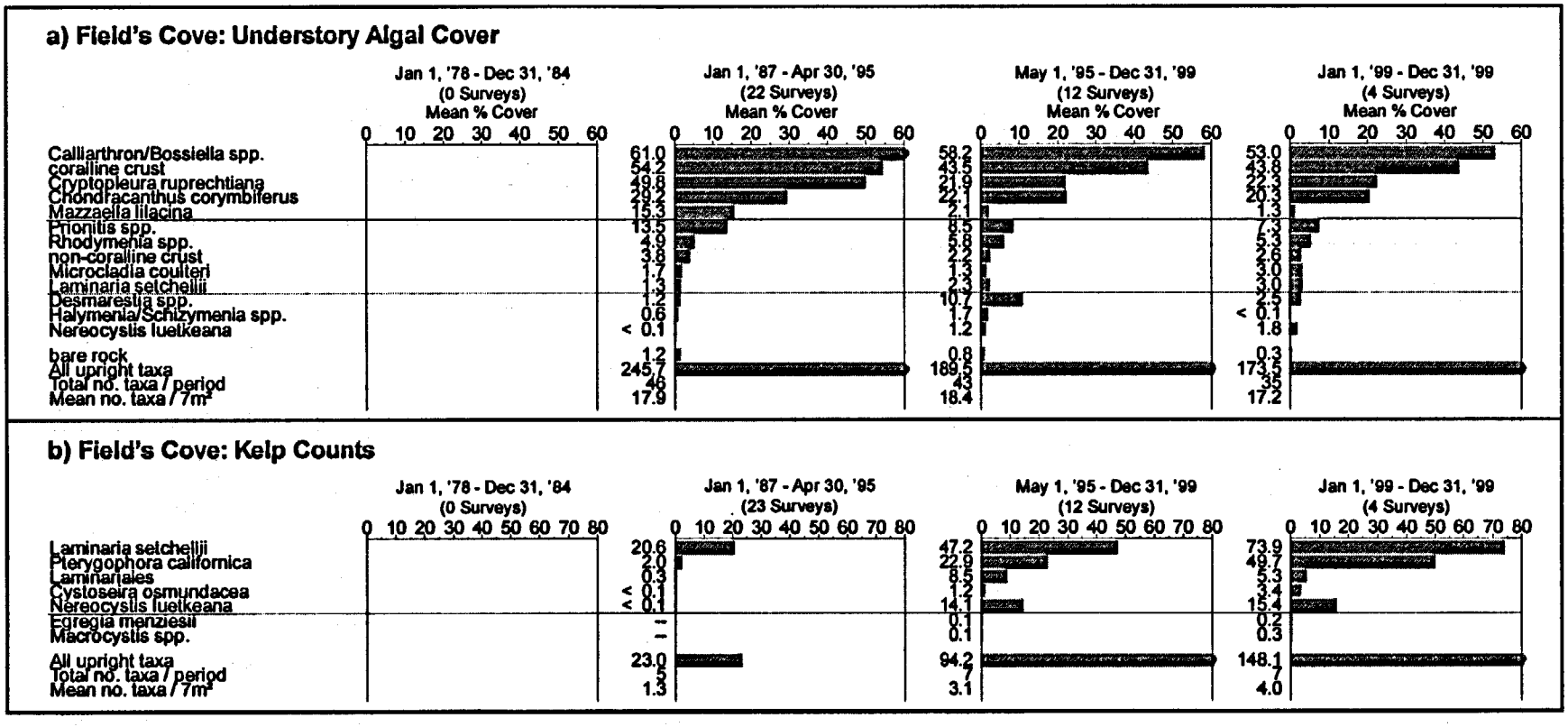


Figure 4-5. Subtidal algal abundances at the Field's Cove station: (a) understory algal cover and (b) kelp counts. Station = FC-1.

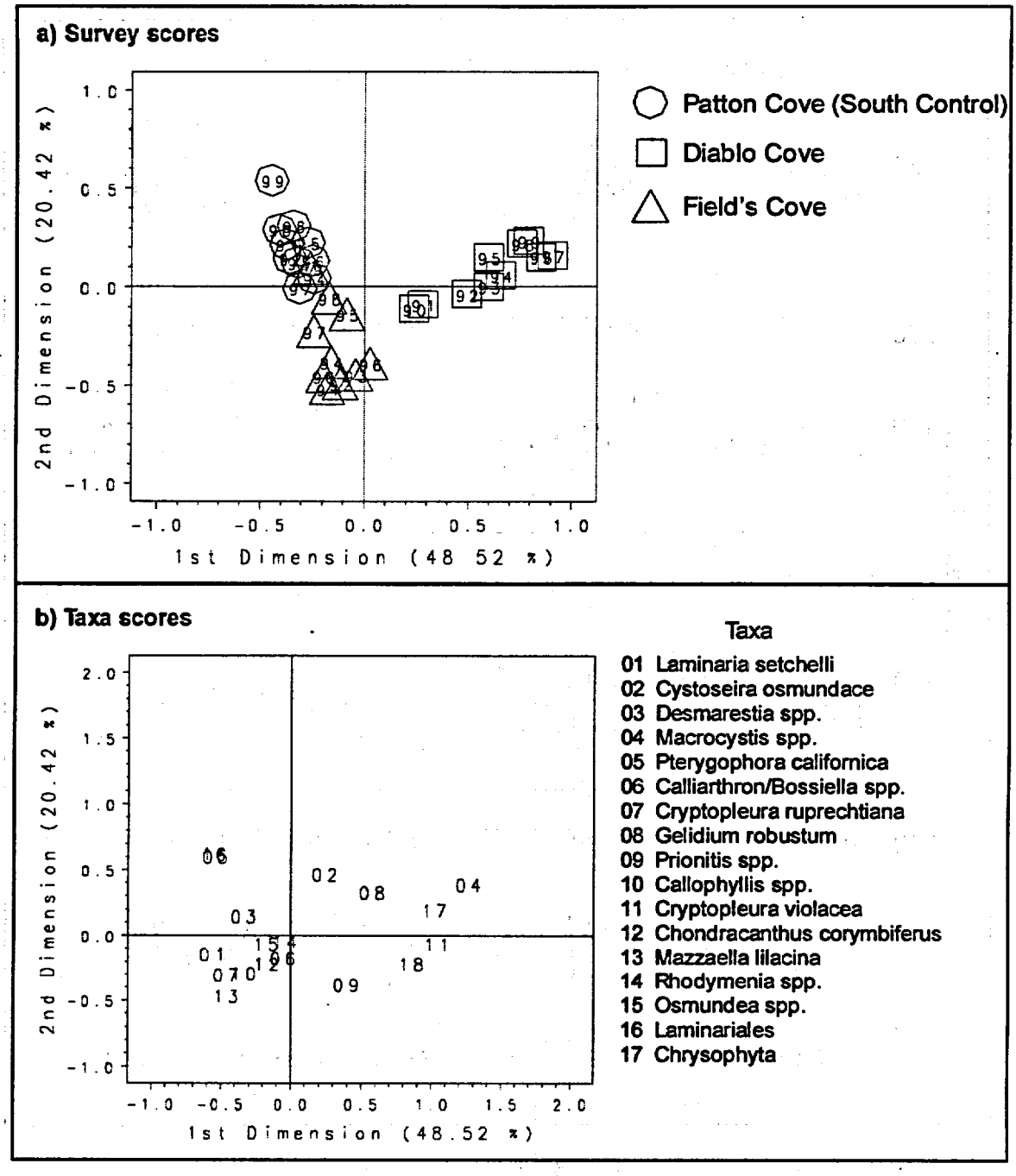


Figure 4-6. Results of correspondence analysis for subtidal algae (a) survey scores and (b) taxa scores.

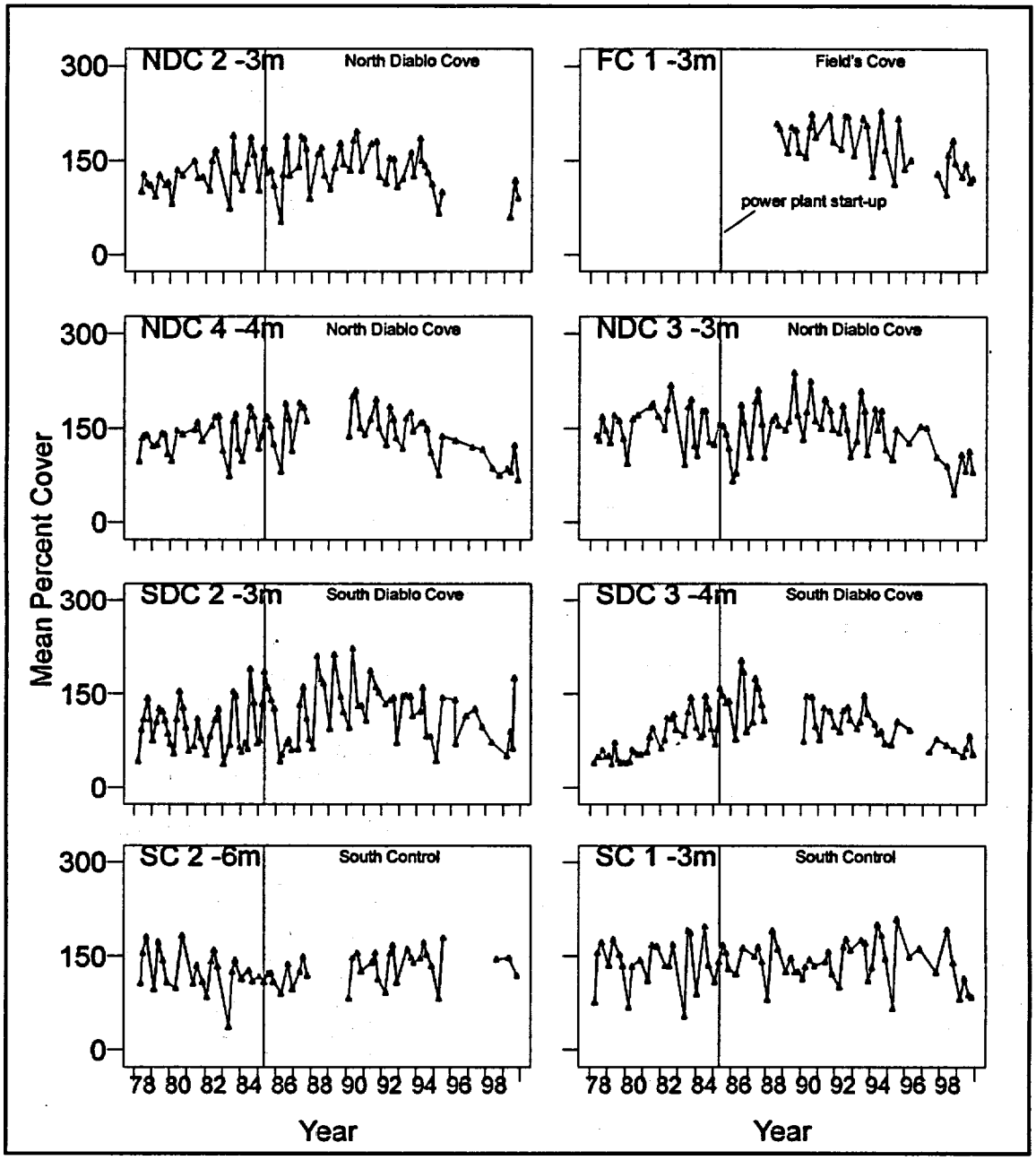


Figure 4-7. Total algae: changes in abundance at subtidal benthic stations.

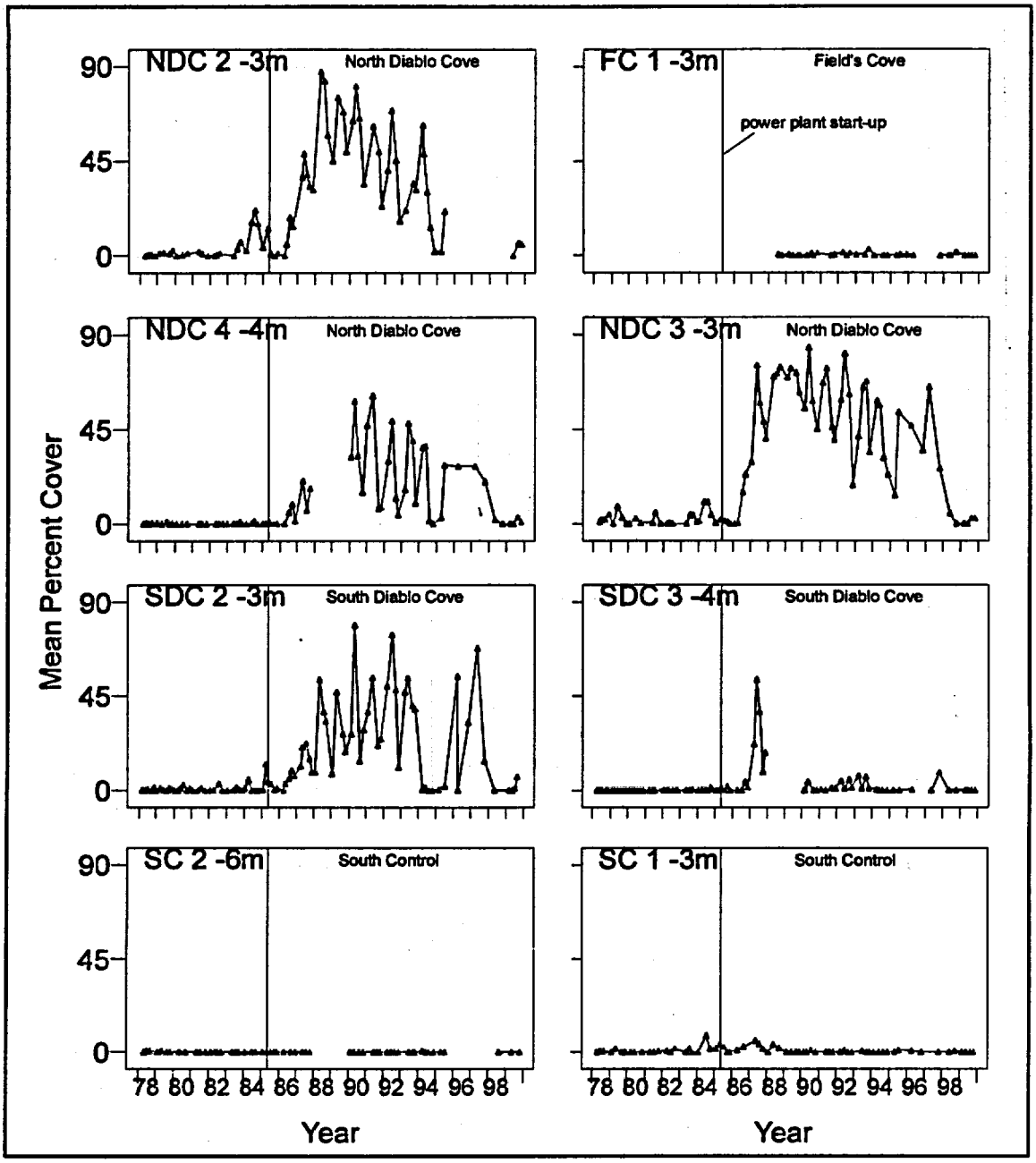


Figure 4-8. *Cryptopleura violacea*: changes in abundance at subtidal benthic stations.

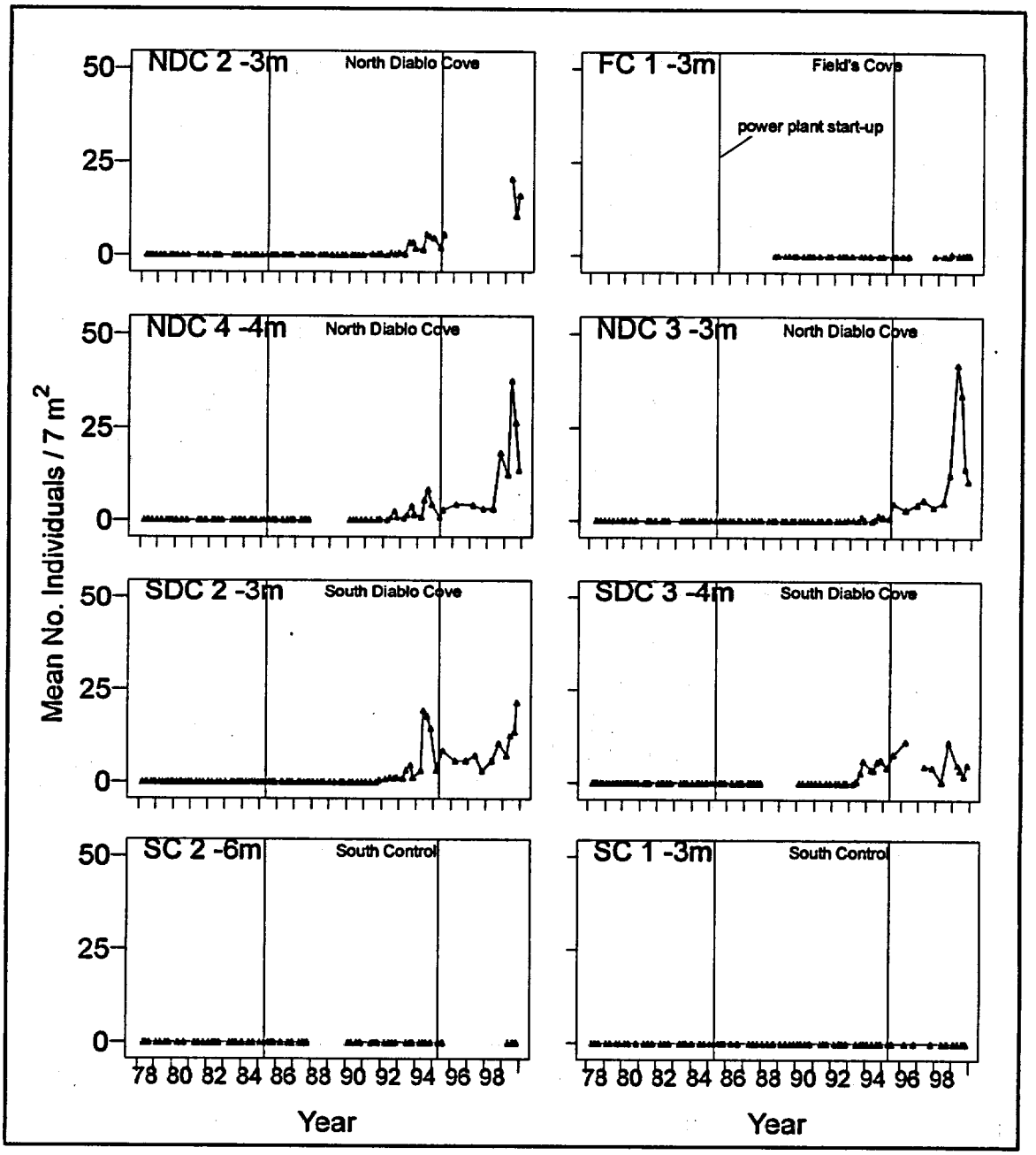


Figure 4-9. *Macrocystis pyrifera*: changes in abundance at subtidal benthic stations.

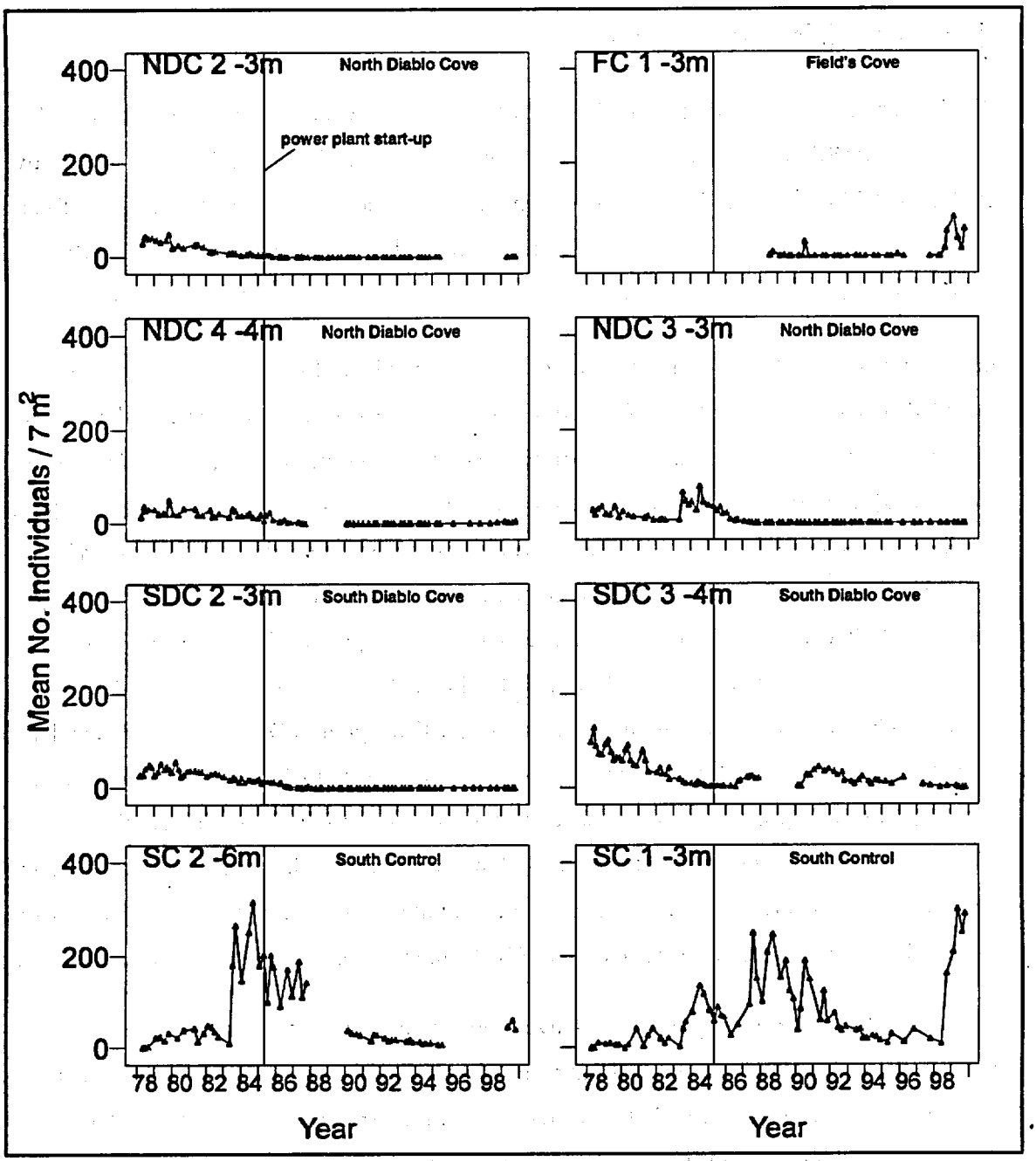


Figure 4-10. *Pterygophora californica*: changes in abundance at subtidal benthic stations.

4.2 Subtidal Invertebrates

Subtidal invertebrates have been monitored by the subtidal arc quadrant (SAQ) and subtidal fixed quadrat (SFQ) methods since 1976 on the benthic stations in the DCPP study area. Between 1987 and 1994 the subtidal invertebrate community in Diablo Cove changed as a result of the DCPP discharge (Tenera 1997). Further discharge-related changes occurred between 1995 and 1998 (Tenera 1999b).

Invertebrate taxa that showed a persistent increase in abundance from 1987 through 1998 included anemones (*Anthopleura elegantissima*), tube worms (*Pista* spp.), thatched barnacles (*Tetraclita rubescens*), tube snails (*Dendropoma* spp.), and purple urchins (*Strongylocentrotus purpuratus*). Persistent decreases occurred in encrusting sponges, hermit crabs (*Pagurus* spp.), small seastars (*Henricia leviuscula* and *Leptasterias* spp.), and shelled gastropods (*Tegula brunnea, T. montereyi, Calliostoma ligatum* and *Homalopoma* spp.). Reversals in previously determined effects (e.g. a significant increase in a taxon that previously showed a significant decrease) that occurred between 1987 through 1994 and 1995 through 1998 included increases in encrusting bryozoans, encrusting tunicates, orange puffball sponges (*Tethya aurantia*), and kelp crabs (*Pugettia* spp.) and decreases in limpets (*Acmaea mitra* and *Fissurella volcano*), brittle stars (*Ophiothrix* spp.), and giant spined sea stars (*Pisaster giganteus*). Additional discharge effects were detected during 1995 through 1998 in giant gumboot chitons (*Cryptochiton stelleri*), sand tube worms (*Phragmatopoma californica*), and miter shells (*Mitra idea*), and decreases in the small gastropod (*Amphissa* spp.), limpets (*Lottia ochracea*), and bat stars (*Asterina miniata*).

A few taxa that occurred only in Diablo Cove following power plant operation were not statistically analyzed in previous analysis reports because of their generally low abundances (Tenera 1997, 1999b). These included Norris' top snail (*Norrisia norrisi*), spiny lobster (*Panulirus interruptus*), a brittle star (*Ophiactis simplex*), and black sea hares (*Aplysia vaccaria*). Mean taxa richness for the larger invertebrate taxa increased in Diablo Cove between OpPeriod-1 and OpPeriod-2 but decreased for the smaller invertebrate taxa. Multivariate analysis showed that the subtidal invertebrate community structure in Diablo Cove continued to diverge from pre-operation conditions through 1998 (Tenera 1999b).

The Field's Cove benthic station is contacted by the DCPP thermal discharge much less frequently than stations at similar depths in Diablo Cove, such that the average delta-T° is about 1° C above ambient (Tenera 1997). As a result of the reduced plume contact, possible discharge

effects were detected in only a few invertebrate taxa between 1995 and 1998 (Tenera 1999b). Increases in *S. purpuratus* and decreases in *Leptasterias* spp. paralleled discharge effects observed in Diablo Cove. Similarly, macroinvertebrate species diversity increased during this period. However, correspondence analysis (particularly 1998) and ANOVA results indicated that invertebrate community structure at the Field's Cove subtidal station did not differ substantially from the control station (Tenera 1999b).

Red abalone were abundant in Diablo Cove until 1988 when they began to decline, presumably due to the effects of withering syndrome (WS) (Tenera 1999b). Abalone in Field's Cove and South Control remained relatively abundant through 1995 with no evidence of WS. Red abalone survey results showed a higher rate of decline in Diablo Cove from 1995 through 1998, compared to other areas, and indicated that they continued to be affected by the warm water discharge after 1995 (Tenera 1999b).

This section describes any important new or continuing effects of the power plant discharge on subtidal invertebrates through the analysis of the SAQ and SFQ data sets collected at Diablo Cove, Field's Cove, and control stations during 1999. New or continuing effects were determined by qualitatively comparing the results with the results from OpPeriod-2.

4.2.1 Sampling Methods

The SAQ method was used to sample macroinvertebrates at eight benthic stations during 1999. Five discharge stations were located within Diablo Cove, one discharge station was located within Field's Cove, and two control stations were located at Patton Cove (**Figure 4-1**). For sampling, a station was subdivided into four 7 m^2 quadrants, and macroinvertebrates were counted within each of these quadrants. All individuals of select invertebrate taxa were counted regardless of their size. Individuals of other non-encrusting invertebrates were counted if they were larger than 2.5 cm (length or width). A few common species that generally occurred in numbers too high to accurately count were sampled only in the first one-third (2.33 m^2) of each quadrant.

The SFQ method sampled four circular quadrats with an area of 0.25 m^2 at fixed locations at each subtidal station to determine the species composition and abundance of smaller, cryptic, subtidal invertebrates. Each fixed quadrat was located within an SAQ quadrant at a subtidal station, generally on bedrock or boulder substrate. Depending upon the degree of topographical relief, two quadrats were located on horizontal-aspect substrate and two quadrats were located on

vertical-aspect substrate. Non-encrusting taxa were identified and counted. The coverage of encrusting taxa (e.g., colonial/social tunicates) was quantified in square centimeters if the total equaled or exceeded 6.5 square centimeters, or was recorded as "present" if coverage was less. There was no minimum or maximum size limits for invertebrates in the SFQ study.

Correspondence analysis was used to contrast patterns of change in invertebrate assemblages among areas. The taxa that comprised the majority (95%) of the total abundance and that occurred in at least 20% of the surveys were used in analyses for each elevation. Data for these taxa were log(x+1) transformed to compensate for scale differences between counted and coverage taxa and then combined into annual means for six stations in three areas:

- Control (SC-1);
- Diablo Cove (NDC-3, NDC-4, SDC-2 and SDC-3); and
- Field's Cove (FC-1).

4.2.2 Results

Subtidal invertebrates showed no substantial changes in 1999 from patterns described in Tenera (1999b). With a few exceptions, all subtidal invertebrate taxa occurred on the benthic stations in each of the areas sampled in 1999. Differences among benthic stations in the three Diablo sampling areas were primarily the result of differences in the relative abundances of taxa. Subtidal invertebrate taxa richness (total number of invertebrate taxa) was generally similar among all benthic stations sampled in 1999 (**Figures 4-11** through **4-18**).

Biological Community Descriptions

Among the macroinvertebrates, the most abundant taxa in Diablo Cove in 1999 were purple urchins (*Strongylocentrotus*) followed by anemones (*Anthopleura*), tube worms (*Diopatra*), and dunce cap limpets (*Acmaea*) (**Figures 4-11** and **4-12**). Sand tube worms (*Phragmatopoma*) were the most abundant smaller invertebrate taxon followed by purple urchins, brittle stars (*Ophiactis*), boring clams, and barnacles (*Balanus/Tetraclita*) (**Figures 4-15a** and **4-16a**). Shelled gastropods, when present, consisted of a few smaller individuals in cryptic habitats (under cobbles, in crevices, under dense algal cover). Similarly, hermit crabs, six rayed seastars (*Leptasterias*) and proliferating anemones (*Epiactis*) remained rare or absent (**Figures 4-15a** and **4-16a**).

Invertebrate species composition and abundance remained generally similar on the benthic stations at the control and Field's Cove in 1999 (**Figures 4-13** and **4-14**). Large sized brown turban snails (*Tegula*) remained abundant followed by bat stars (*Asterina*), hermit crabs (*Pagurus*), anemones, the snail *Homalopoma*, and cup corals (*Balanophyllia*). Although *Phragmatopoma* was more abundant at the control than at the Field's Cove station (**Figures 4-17a** and **4 -18a**), they were not as abundant as in Diablo Cove. *Leptasterias* and *Epiactis* may have increased at both control and Field's Cove stations in 1999. Encrusting invertebrate forms (tunicates, bryozoans, sponges) continued to be more abundant on these stations than on those in Diablo Cove (**Figures 4-15b** to **4-18b**).

Community Analysis

Results of the correspondence analysis of 18 taxa for 1990–1999 showed that, compared to the control and Field's Cove stations, macroinvertebrate community structure varied considerably among years in Diablo Cove (**Figure 4-19a**). In 1999, Diablo Cove benthic stations continued to differ from the other areas by the presence and abundance of purple urchin (*Strongylocentrotus purpuratus*), spiculate brittle star (*Ophiothrix spiculata*), and Hilton's nudibranch (*Phidiana hiltoni*) and the absence or paucity of brooding sea stars (*Leptasterias* spp), hermit crabs (*Pagurus* spp), brown turban snails (*Tegula brunnea*), and blue top snail (*Calliostoma ligatum*) (**Figure 4-19b**). Purple urchins continued to increase in Diablo Cove in 1999 and, consequently, the invertebrate community structure in Diablo Cove continued to differ from the control. Community structure at Field's Cove continued to resemble the control station during 1999. Differences between these two areas are represented on the second axis by differences in the relative proportions of several shared taxa. Namely, there were relatively greater abundances of *Leptasterias*, serpulids, *Acmaea* mitra and *Serpulorbis* at Field's Cove and relatively greater abundances of *Lottia* and *Asterina* at the control station.

Select Species Changes

No discernible shifts in trends occurred in 1999 among taxa with previously detected discharge effects reported in Tenera (1997). For example, *Strongylocentrotus purpuratus* (**Figure 4-20**) continued to increase at all Diablo stations except SDC 2-3m. *Tegula brunnea* (brown turban snail), *Leptasterias* spp. (six armed sea star), *Pagurus* spp. (hermit crabs) (**Figure 4-21**), and *Calliostoma ligatum* (lined top shells) continued decreases or remained at low levels of

abundance in Diablo Cove as first reported in Tenera (1997). Similarly, taxa that showed new increases during OpPeriod-2 appear to have persisted. These include *Mitra*, *Asterina*, and *Phragmatopoma* (**Figure 4.-22**). Conversely, *Cryptochiton* declined in 1999 (**Figure 4-23**).

Colonial/social tunicates continued to have low levels of abundance at south Diablo Cove stations in 1999 after persisting at moderate levels prior to power plant start-up (**Figure 4-24**). There was an increase in abundance of this taxon in 1999 at the shallow south Control station (SC 1-3m), and it was basically unchanged at the Field's Cove station compared to the previous four-year average.

Red abalone, not abundant on benthic stations since 1995, may have increased slightly in 1999. Three abalone were seen on the benthic stations sampled during the surveys from 1995 through 1998 (Tenera 1999b). On the benthic stations sampled during the surveys in 1999, a total of 10 abalone was observed, six within Diablo Cove. Six abalone were observed during the October 1999 survey alone, four within Diablo Cove and one each at the control and Field Cove stations.

4.2.3 Discussion

Predation by fishes, invertebrates, and sea otters, in combination with heated water from the discharge, have been cited as important factors regulating the abundances of shelled gastropods in the subtidal zone of Diablo Cove (Tenera 1997, 1999b). Many species of shelled gastropods continued to be in very low abundance in Diablo Cove in 1999 compared to the control stations. Affected taxa include herbivorous taxa (*Tegula*, *Calliostoma*, *Lithopoma*, *Homalopoma*, and *Amphissa)* and predatory taxa (*Ocenebra*, *Fusinus*). As in previous years, large-sized individual snails (> 1cm) were uncommon and those found on the subtidal stations were mainly small-sized individuals that occurred in cryptic habitats (e.g., crevices, under cobbles). Large, herbivorous snails were fairly common at South Control and Field's Cove in 1999. Miter shells (*Mitra idea*) are one of the predatory snails that has increased in Diablo Cove since power plant operation. The shell shape and thickness of miter shells are known to effectively deter many potential fish and invertebrate predators in tropical areas (Vermeij 1978, 1993). Norris's top shell (*Norrisia*), a large, conspicuous snail often found several meters above the bottom on the fronds of giant kelp plants, are less commonly observed in Diablo Cove over the last two years. Evidence (cracked

shells) suggests that increased predation, presumably by sea otters, on these snails may be contributing to the decline.

The abundance of several taxa of ubiquitous and generally abundant subtidal invertebrates appeared to be substantially reduced on all subtidal stations in 1999. These taxa include volcano limpets (*Fissurella volcano*), kelp crabs (*Pugettia*), bat stars (*Asterina*), giant spined seastars (*Pisaster giganteus*), hermit crabs (*Pagurus*), and lined chitons (*Tonicella*). Several more species appear to be declining within Diablo Cove: giant keyhole limpets (*Megathura*), gumboot chitons (*Cryptochiton*), brittle stars (*Ophiothrix*), Kellet's whelk (*Kelletia*), and Hilton's nudibranch (*Phidiana*). These apparent declines are unexplained but may be related in some way to the anomalous temperature regime recorded in Diablo Cove and elsewhere along the Pacific Coast in 1999.

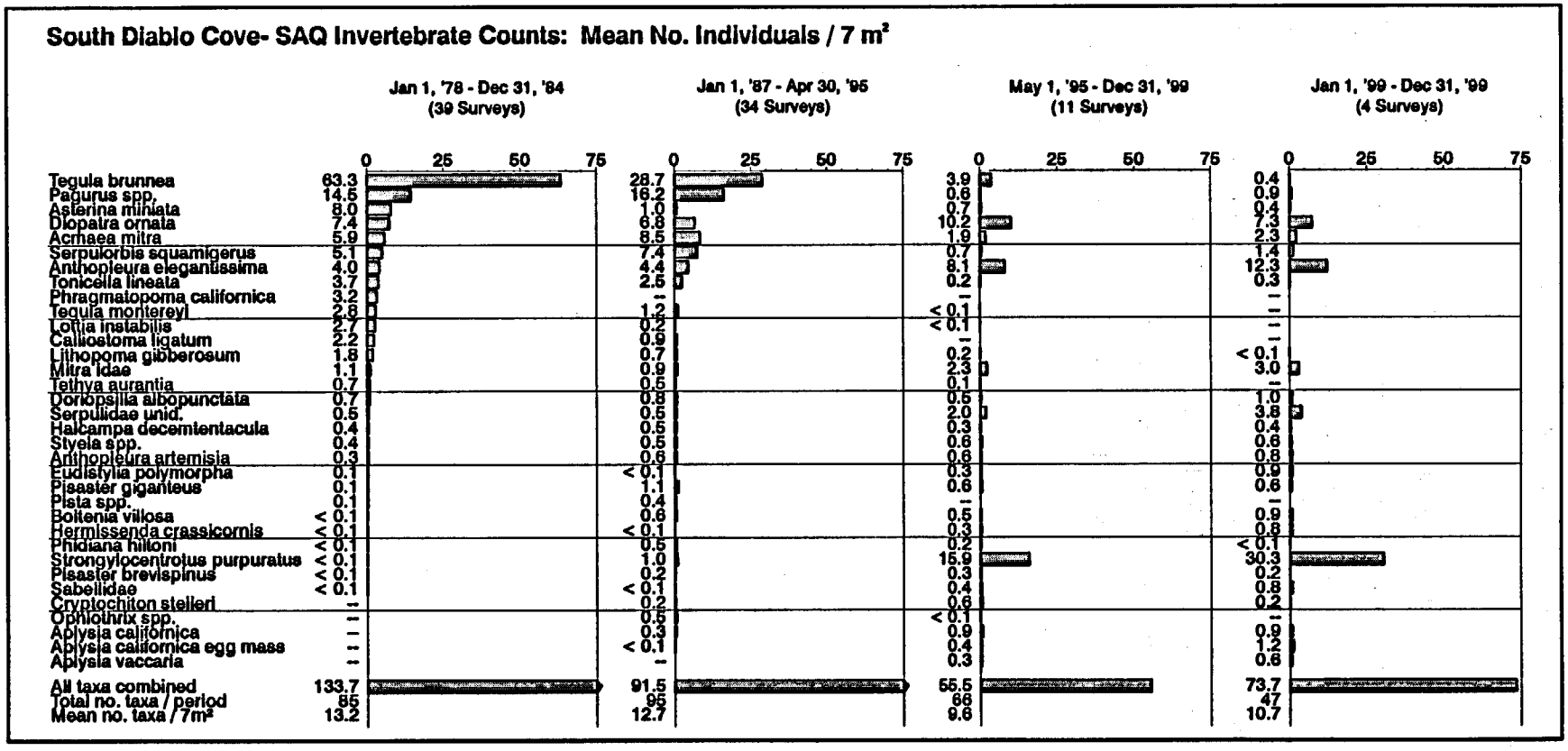


Figure 4-11. Subtidal SAQ invertebrate abundances at the South Diablo Cove stations. Stations = SDC-2 and -3.

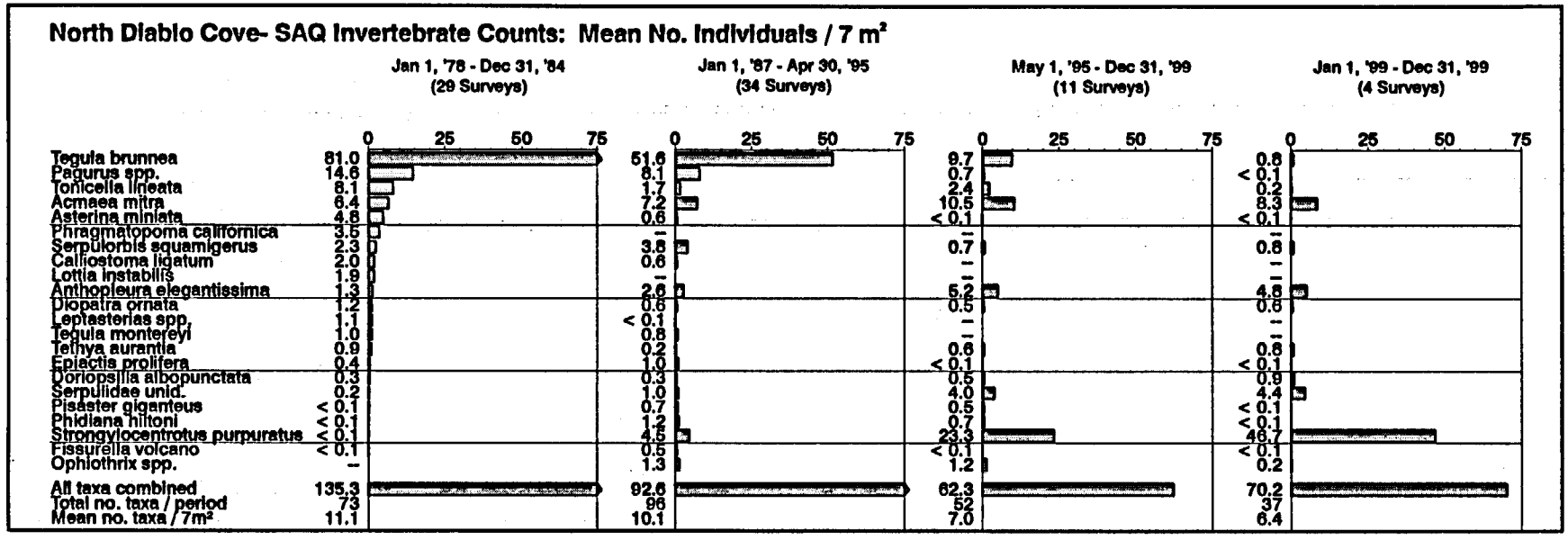


Figure 4-12. Subtidal SAQ invertebrate abundances at the North Diablo Cove station.
Stations = NDC-2, -3, and -4.

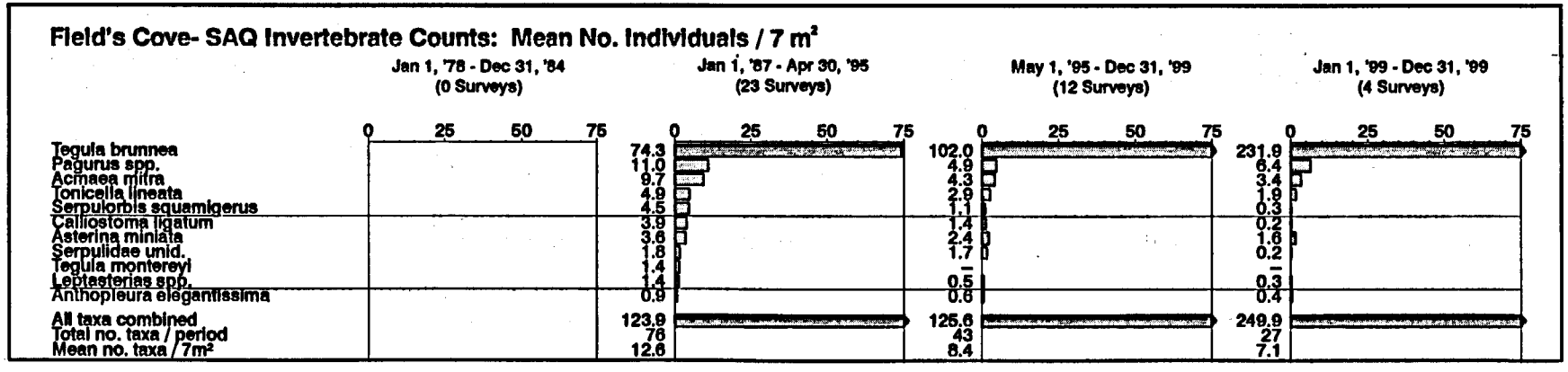


Figure 4-13. Subtidal SAQ invertebrate abundances at the Field's Cove station.
Station = FC-1.

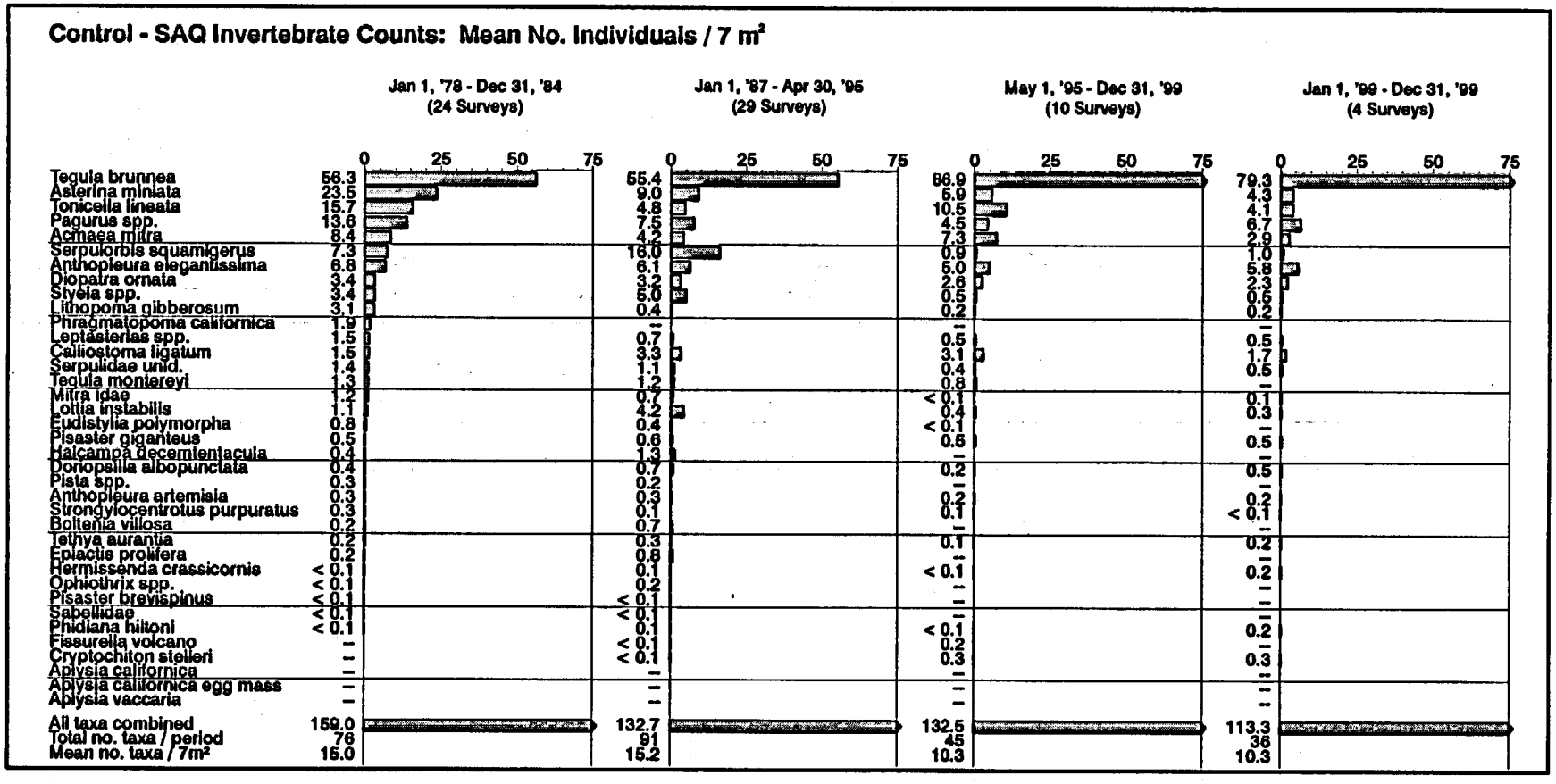


Figure 4-14. Subtidal SAQ invertebrate abundances at the control stations: a) counts and b) number of square centimeters cover. Stations = SC-1 and -2.

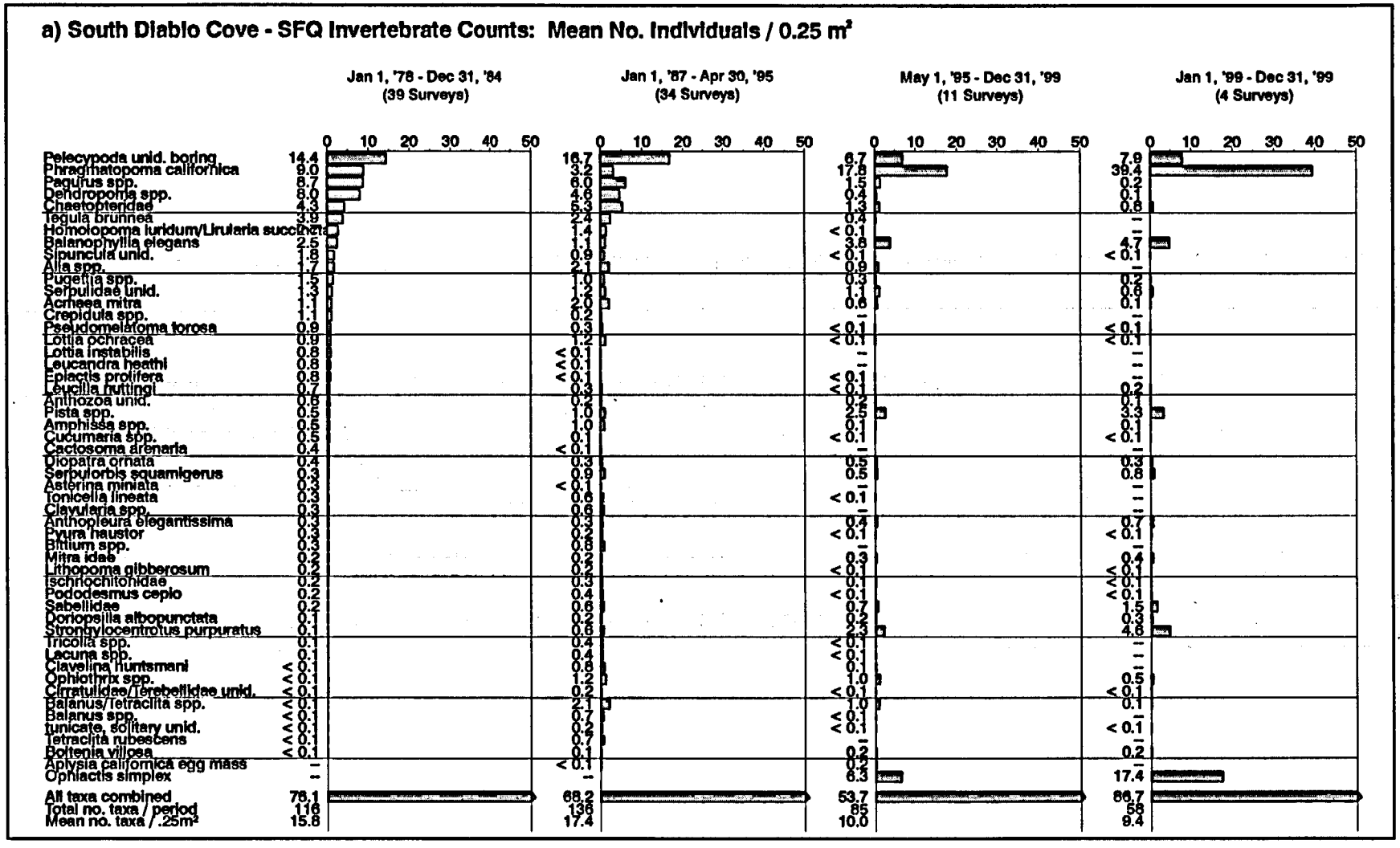


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Figure 4-15. Subtidal SFQ invertebrate abundances at the South Diablo Cove stations: a) counts and b) number of square centimeters cover. Stations = SDC-2 and -3.

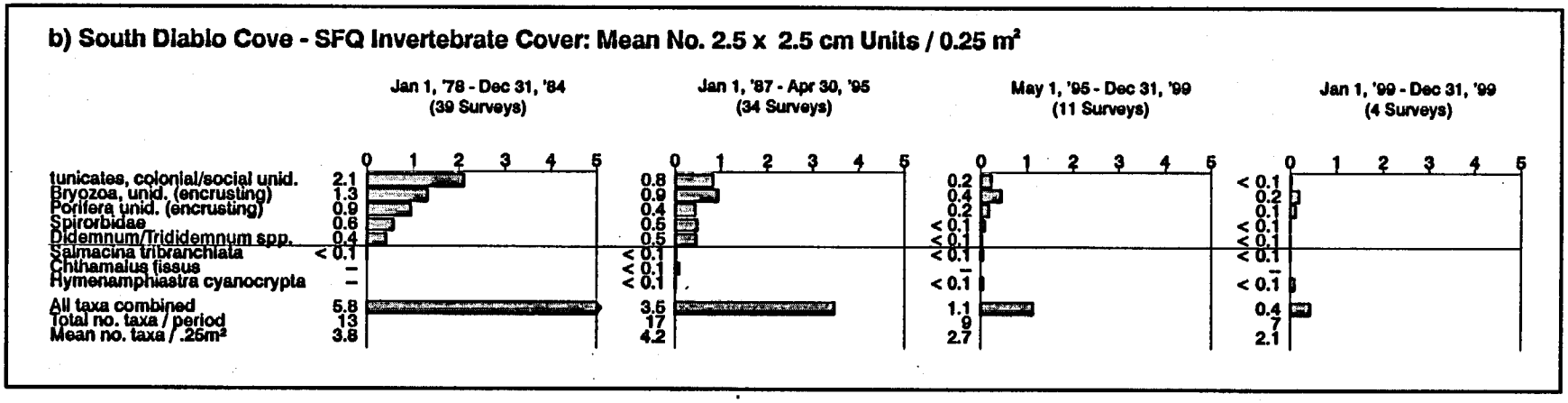


Figure 4-15 (continued). Subtidal SFQ invertebrate abundances at the South Diablo Cove stations: a) counts and b) number of square centimeters cover. Stations = SDC-2 and -3.

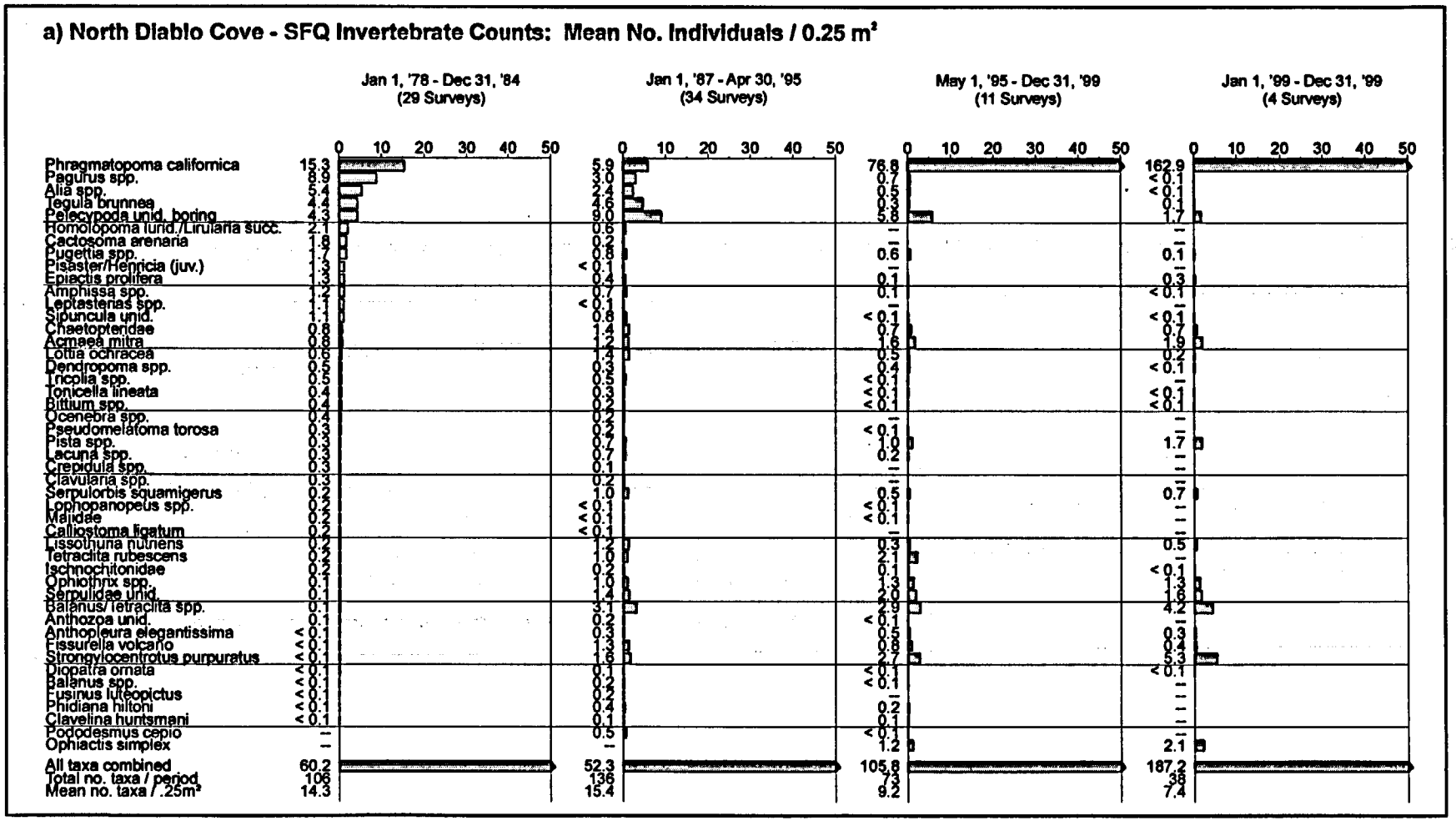


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Figure 4-16. Subtidal SFQ invertebrate abundances at the North Diablo Cove stations: a) counts and b) number of square centimeters cover. Stations = NDC-2, -3, and -4.

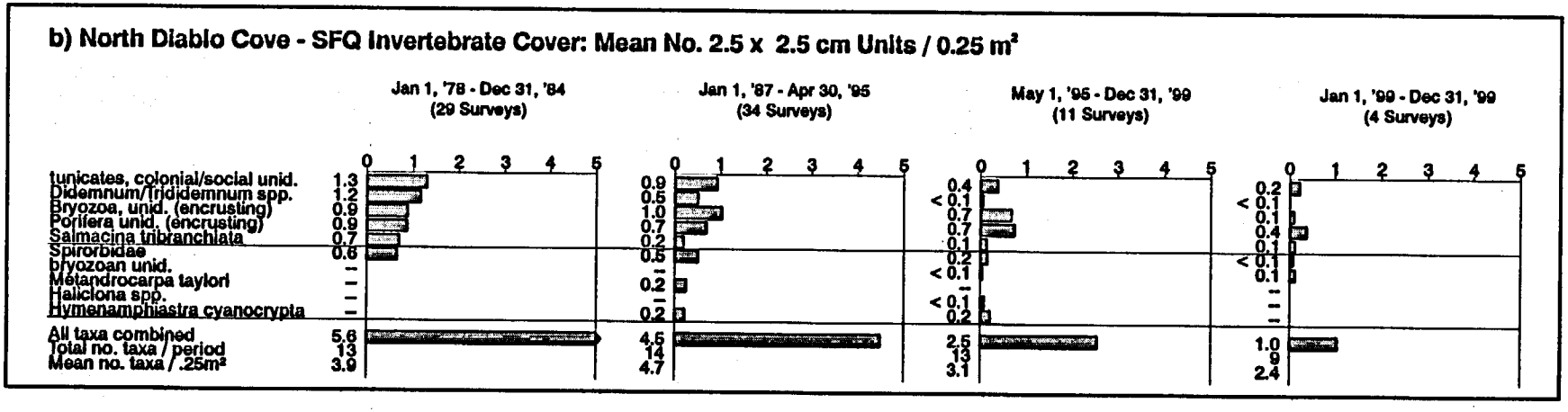


Figure 4-16 (continued). Subtidal SFQ invertebrate abundances at the North Diablo Cove stations: a) counts and b) number of square centimeters cover. Stations = NDC-2, -3, and -4.

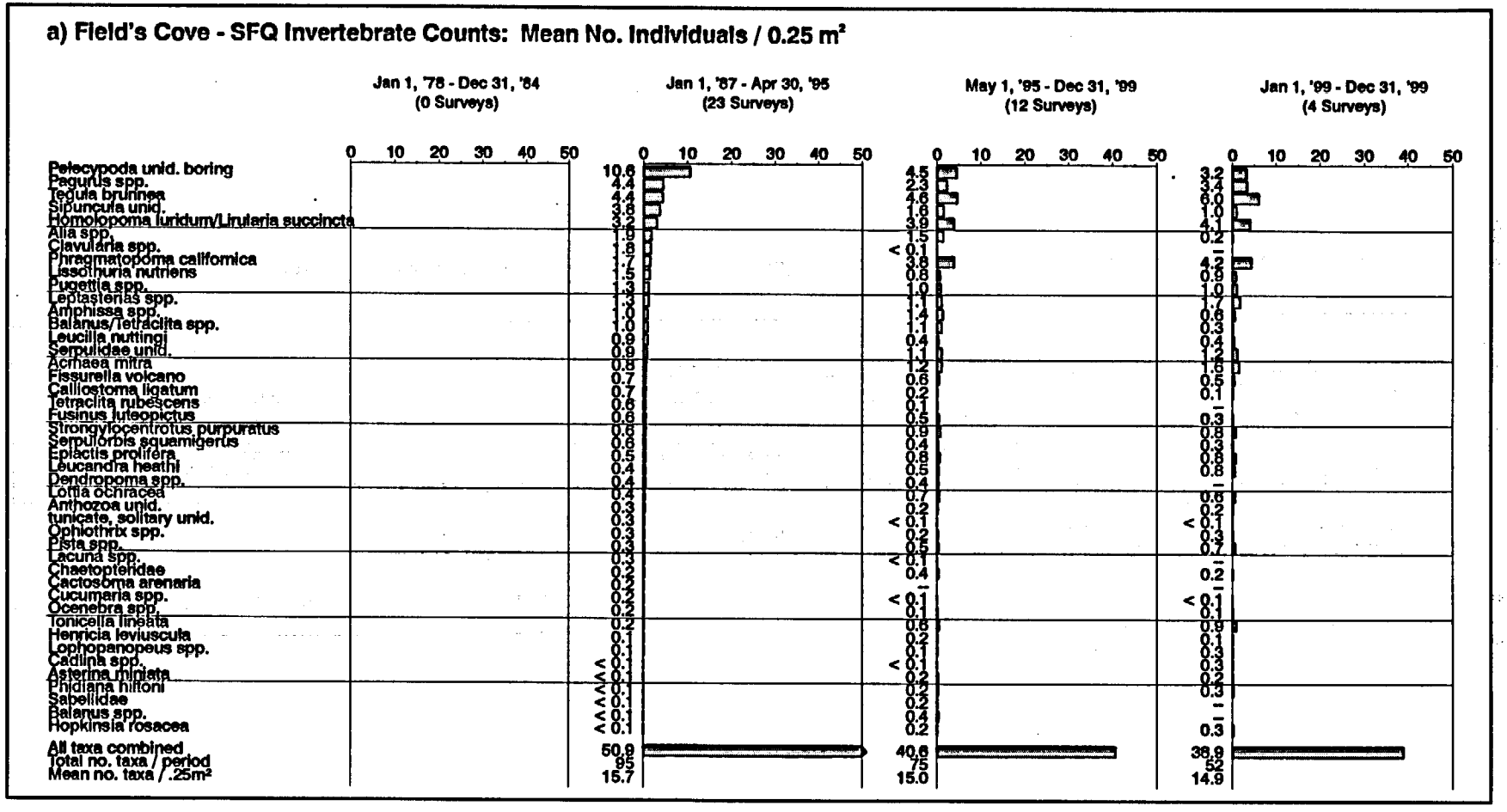


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Figure 4-17. Subtidal SFQ invertebrate abundances at the Field's Cove station: a) counts and b) number of square centimeters cover. Station = FC-1.

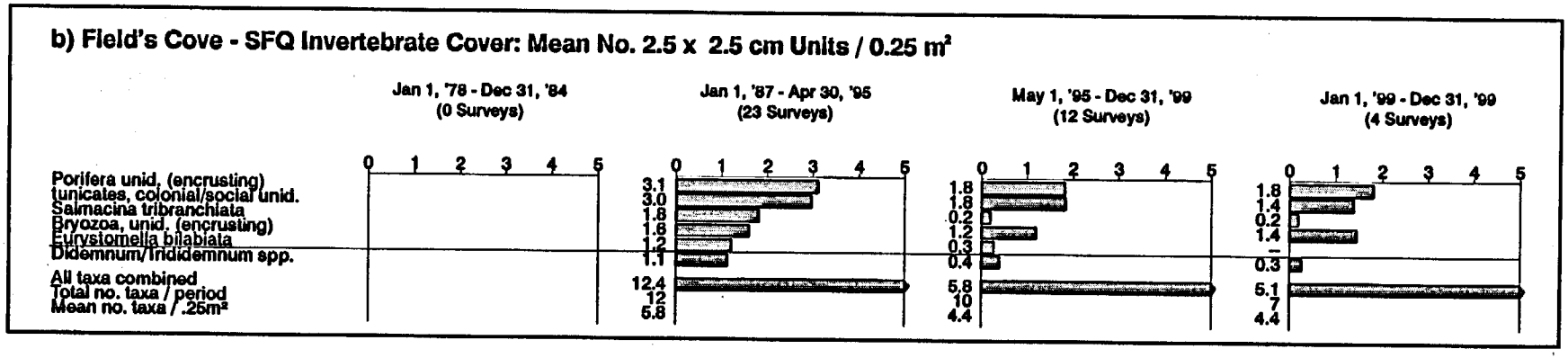


Figure 4-17 (continued). Subtidal SFQ invertebrate abundances at the Field's Cove station: a) counts and b) number of square centimeters cover. Station = FC-1.

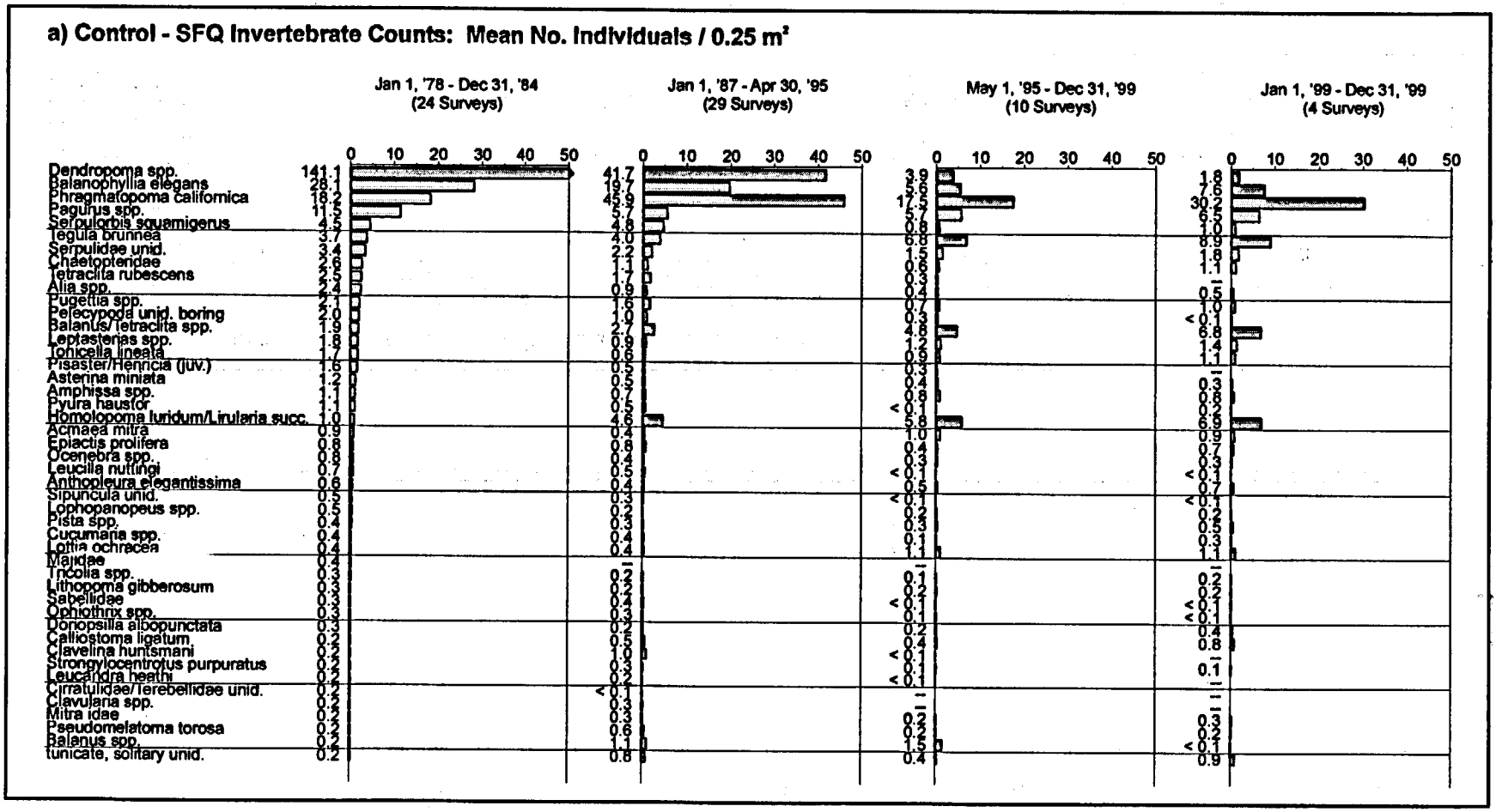


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Figure 4-18. Subtidal SFQ invertebrate abundances at the control stations: a) counts and b) number of square centimeters cover. Stations = SC-1 and -2.

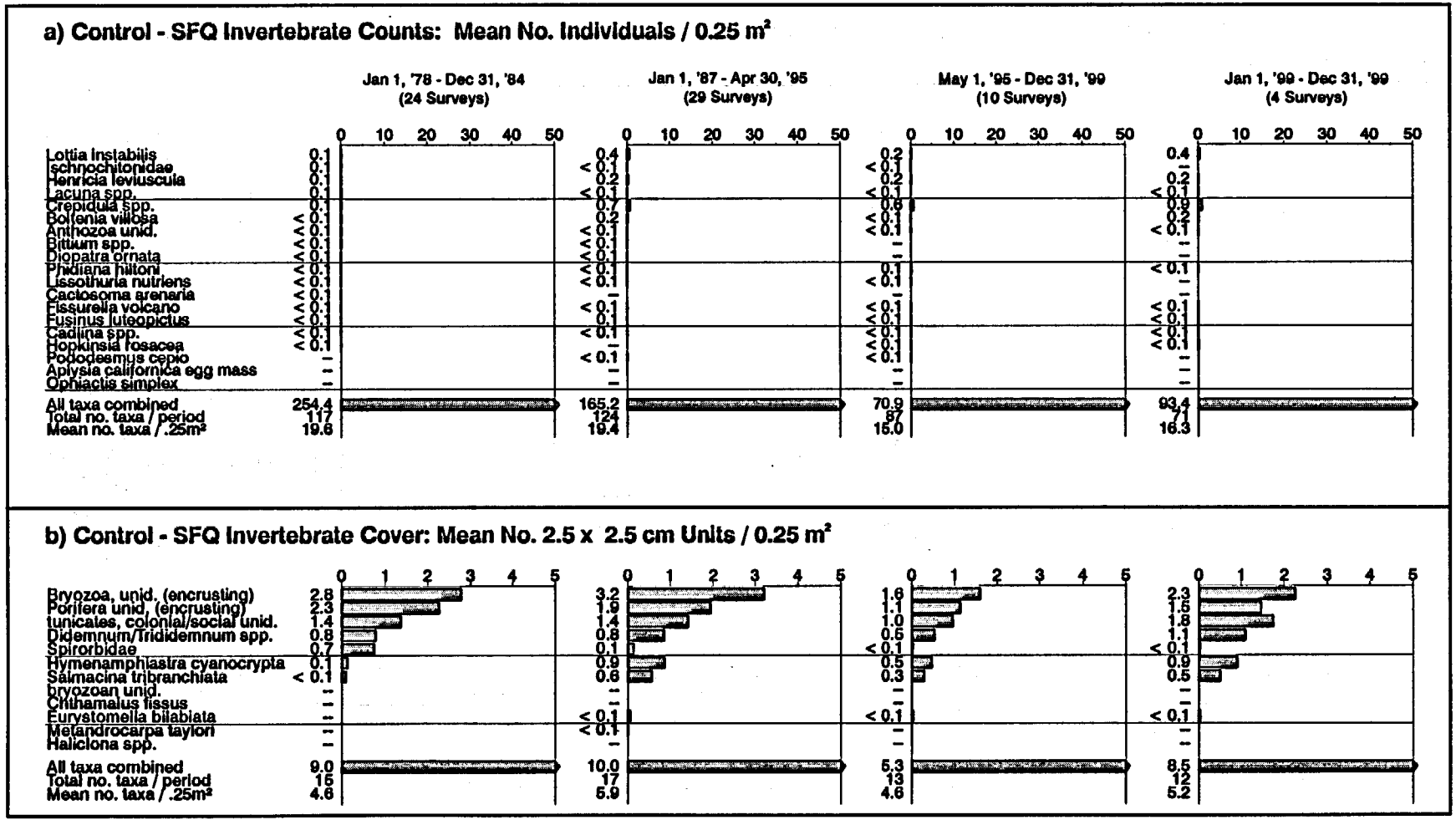


Figure 4-18 (continued). Subtidal SFQ invertebrate abundances at the control stations: a) counts and b) number of square centimeters cover. Stations = SC-1 and -2.

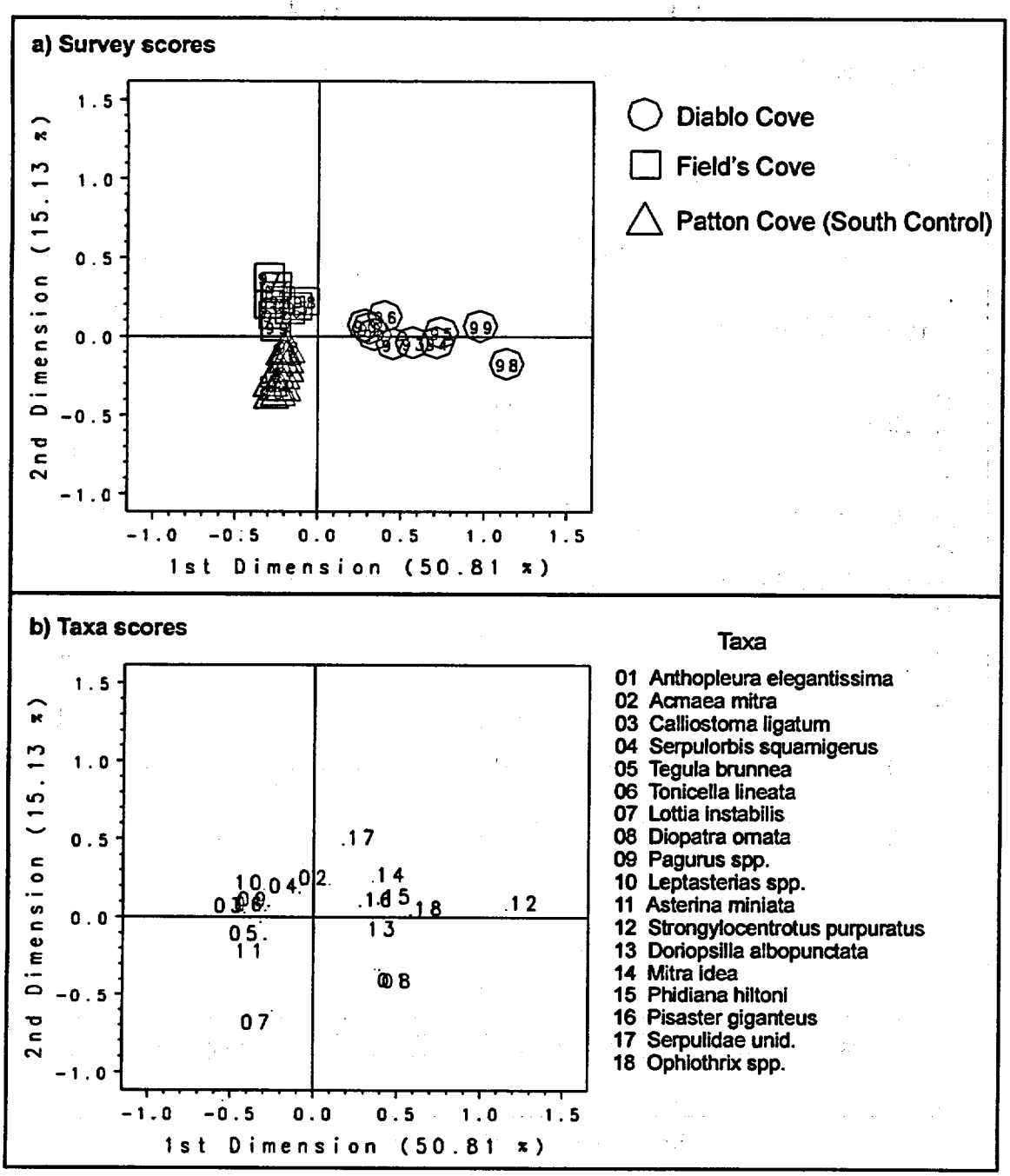


Figure 4-19. Results of correspondence analysis for subtidal invertebrates: (a) survey scores and (b) taxa scores.

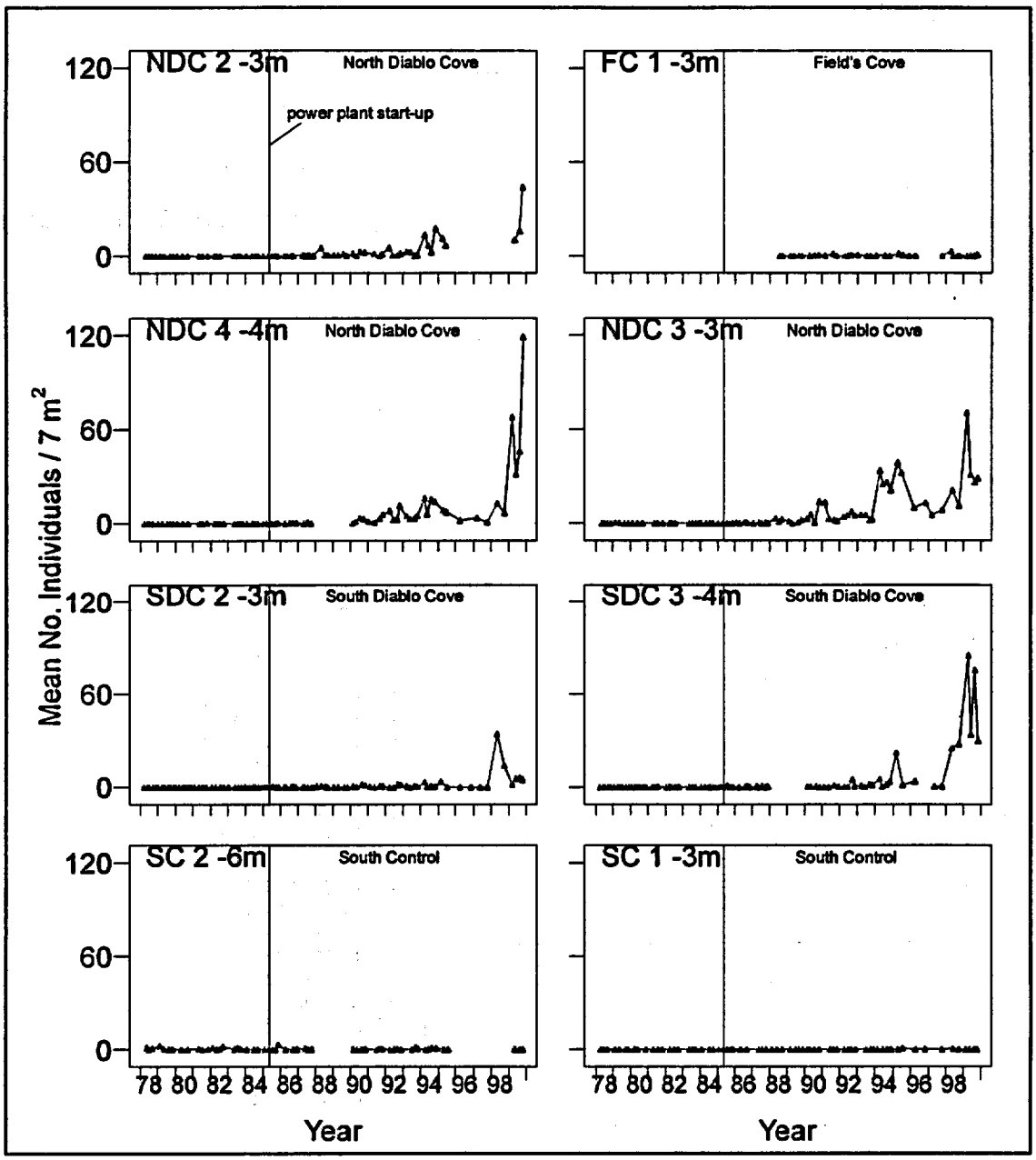


Figure 4-20. *Strongylocentrotus purpuratus*: changes in abundance at subtidal benthic stations: SAQ method.

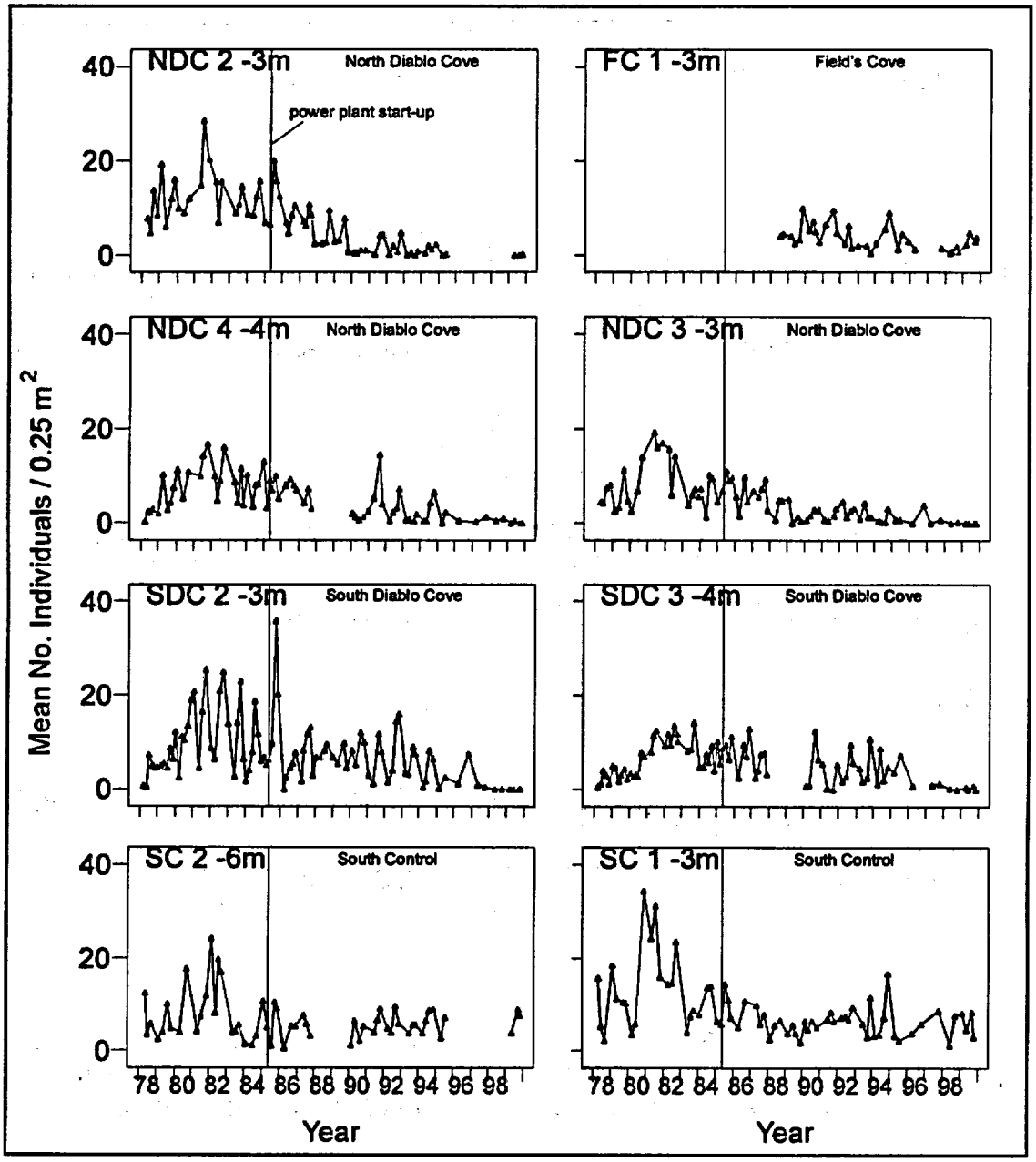


Figure 4-21. *Pagurus* spp.: changes in abundance at subtidal benthic stations: SFQ method.

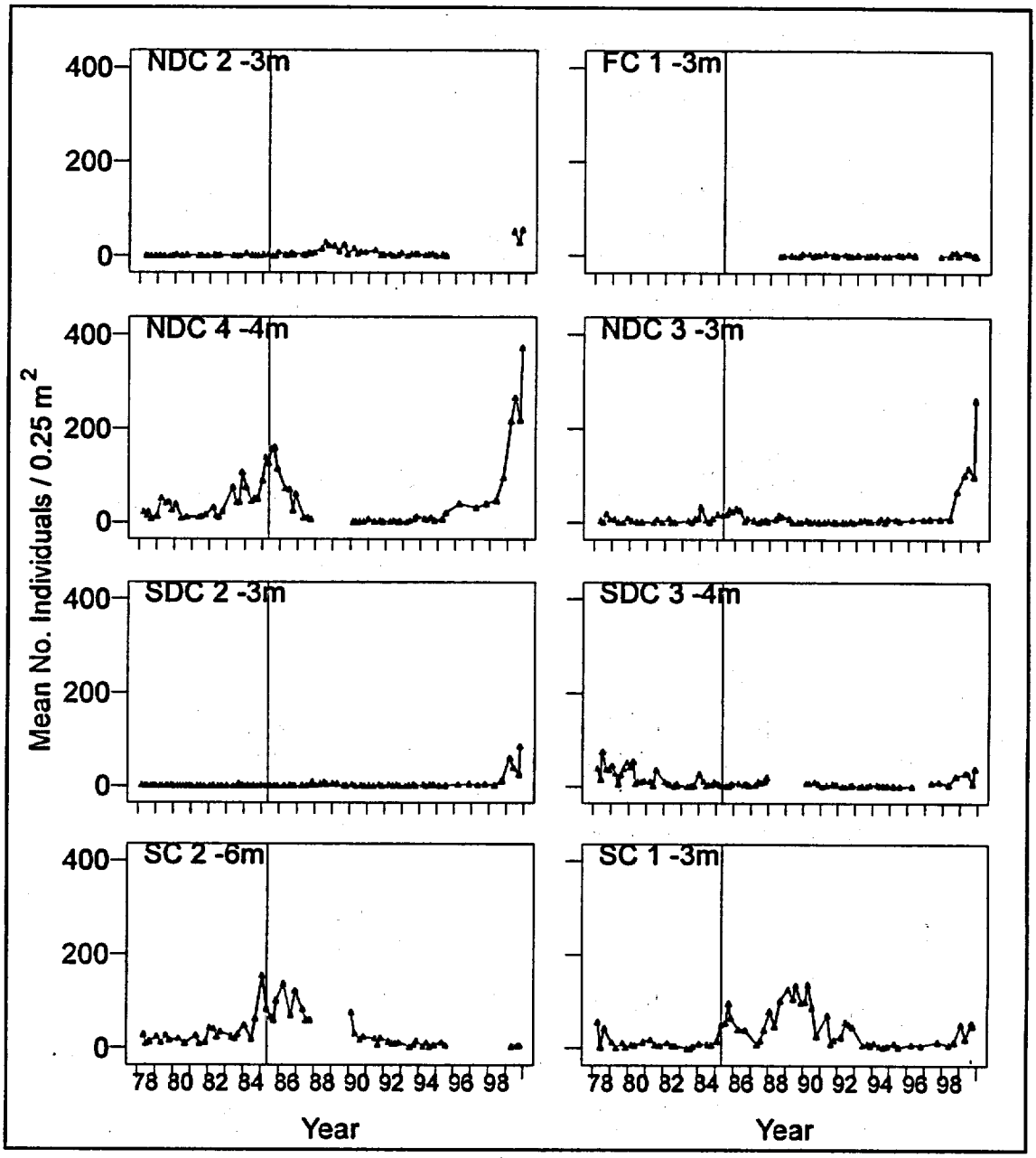


Figure 4-22. *Phragmatopoma californica*: changes in abundance at subtidal benthic stations: SFQ method.

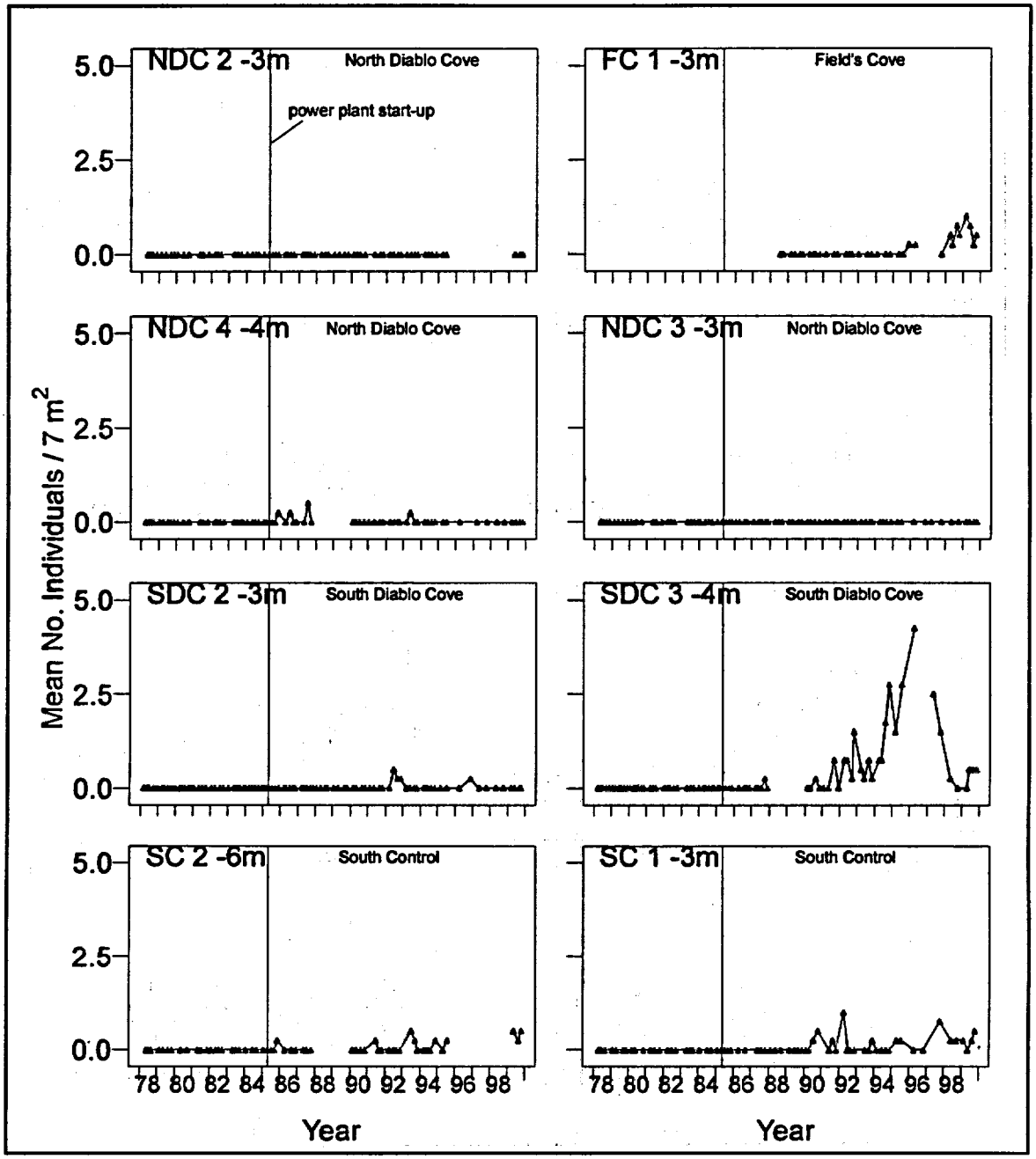


Figure 4-23. *Cryptochiton stelleri*: changes in abundance at subtidal benthic stations: SAQ method.

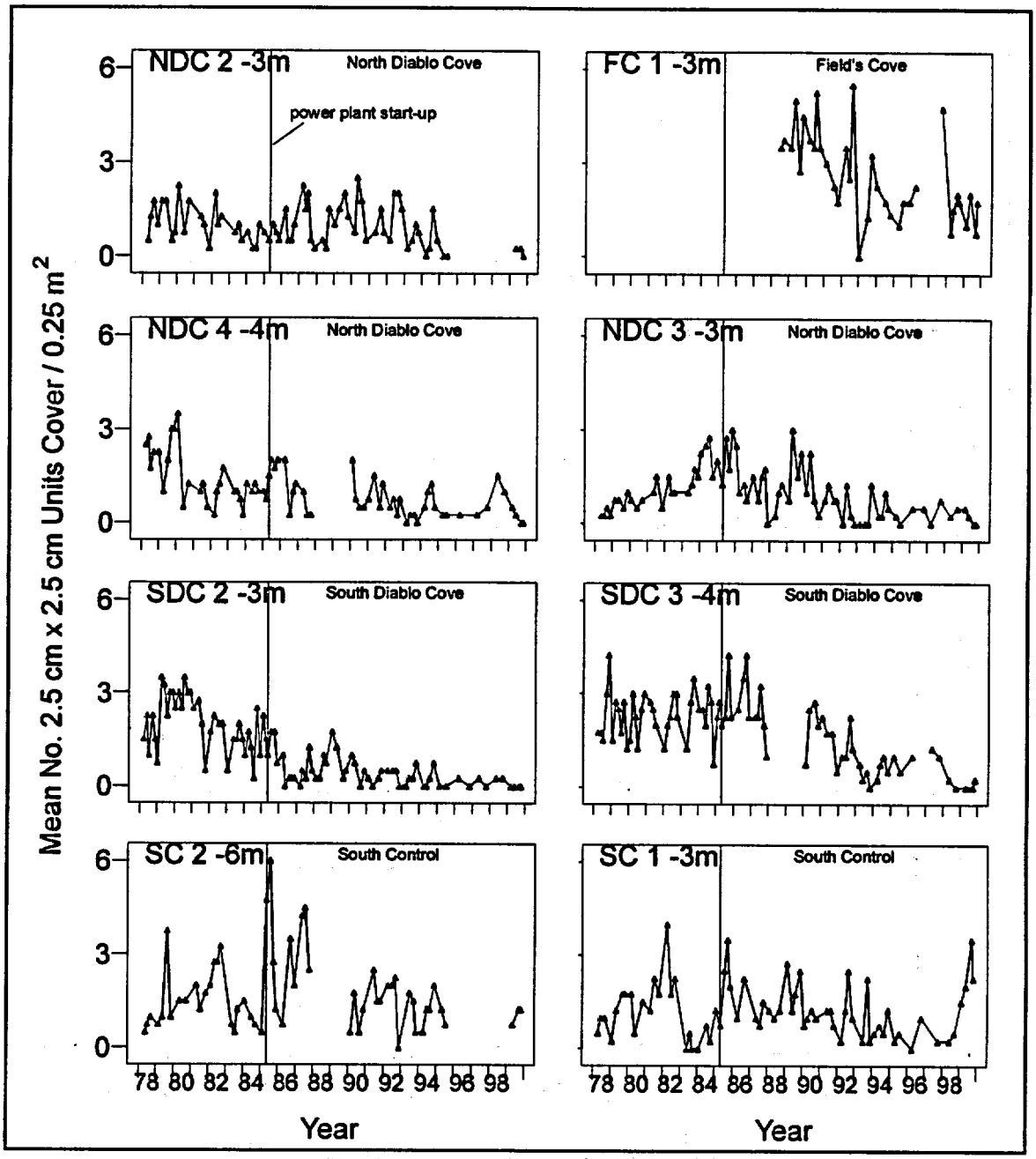


Figure 4-24. Tunicates: changes in abundance at subtidal benthic stations: SFQ method

4.3 Subtidal Fishes

Previous discharge effects on subtidal fishes were described in an Analysis Report (Tenera 1997) that compared data from 1976–1995, and in a later report (Tenera 1999b) that focused on changes during 1995–98 in comparison to previous findings. Fishes in the vicinity of DCPP have been counted by underwater visual censuses since 1976. After power plant start-up, fish species richness increased in North Diablo Cove and decreased in South Diablo Cove (Tenera 1997). The warm water has been a significant factor in maintaining local populations of fishes that occur more commonly in waters south of Point Conception such as *Semicossyphus pulcher* (sheephead), *Girella nigricans* (opaleye), *Medialuna californiensis* (halfmoon), and *Paralabrax clathratus* (kelp bass). Prior to power plant start-up, these species were rare in Diablo Cove. Other species attracted to the discharge were *Triakis semifasciata* (leopard shark), *Myliobatis californica* (bat ray), *Urolophus halleri* (round ray), and *Atractoscion nobilis* (white seabass). Cool-temperate fish families such as Cottidae (sculpins) and Hexagrammidae (greenlings) have generally become less common in shallow areas of Diablo Cove since power plant start-up. However, these species persist below the thermocline and in fringe areas of the discharge plume where cool and warm waters mix. Changes in factors other than temperature (e.g., algal community structure and food availability) may have also contributed to changes in fish community composition and distribution in Diablo Cove after power plant start-up.

Changes in algal community structure are known to affect the distribution and abundance of temperate reef fishes (Carr 1989). Cool-temperate kelp species (*Nereocystis luetkeana* and *Cystoseira osmundacea*), formerly abundant in Diablo Cove, declined after power plant start-up, and giant kelp (*Macrocystis pyrifera*) began to increase in abundance during the early 1990s. Although the composition of the algal assemblage changed, the surface kelp canopy continued to provide habitat for *Brachyistius frenatus* (kelp surfperch), *Paralabrax clathratus*, and juvenile *Sebastes* spp. (rockfishes) (Tenera 1997).

This section describes the results from 1999 surveys at the subtidal fish observation stations in Diablo Cove, Field's Cove, and South Control (**Figure 4-25**). Comparisons of the 1999 data to prior findings are qualitative, based on species abundance summaries, results of community-level correspondence analysis, and time-series abundance plots for individual species.

4.3.1 Sampling Methods

Sampling methods used to conduct subtidal fish observations in 1999 were the same as those used at DCPP since 1976 (see Tenera 1999b). In 1999, three new sampling stations in Field's Cove were added to the existing array of fixed subtidal stations (**Figure 4-25**). The Field's Cove sampling was conducted using the same diver observation methodology used at other stations.

Differences in abundance among areas and years were evaluated graphically. The top 95 percent most abundant taxa were analyzed for the 1999 study period. Diversity and abundance in 1999 were compared with annual means from three previous study periods:

1) January 1, 1978–December 31, 1984 (24 surveys),
2) January 1, 1987–April 30, 1995 (28 surveys), and
3) May 1, 1995–December 31, 1999 (eight surveys).

Data from benthic and midwater transects were analyzed separately since the fish assemblages in these two habitats typically differ. Replicate surveys were pooled by survey area for analysis.

Correspondence analysis (CA) was used to compare fish assemblages among areas over time.

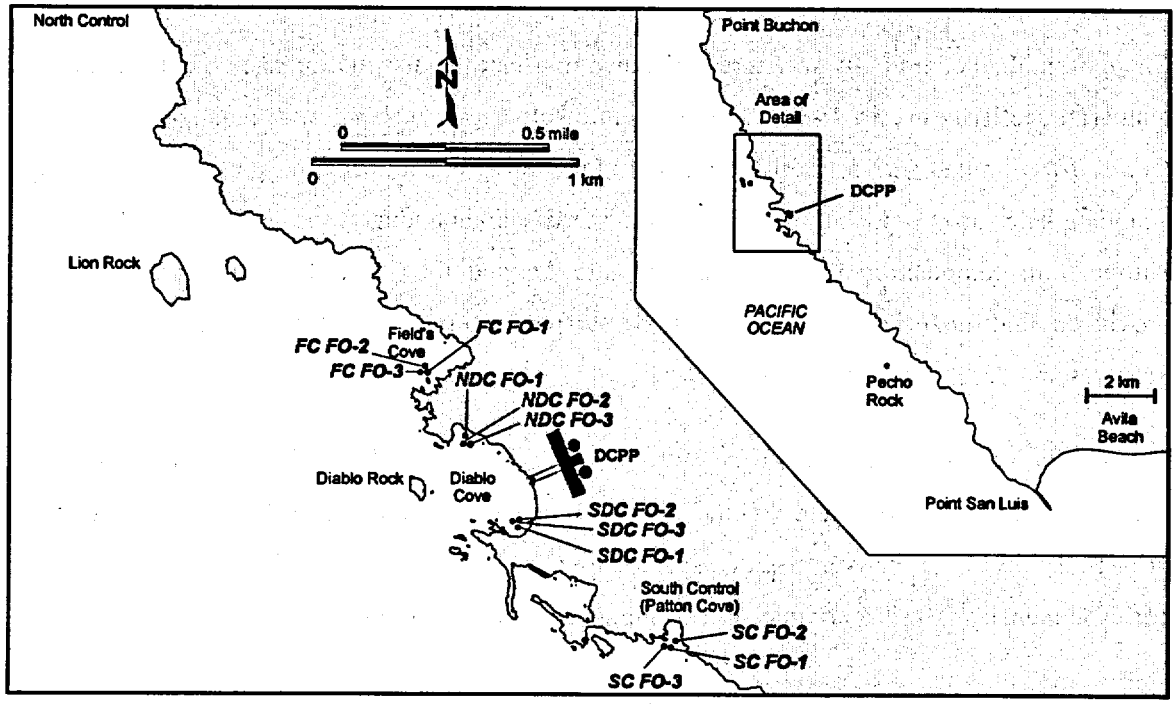


Figure 4-25. Subtidal fish observation transects.

Data from only benthic transects were analyzed because these data included more taxa and were less variable than the midwater transect data. Annual means for individual taxa used in the analysis were computed from survey means for the benthic transects in Diablo Cove and South Control.

4.3.2 Results

Three subtidal fish observation surveys were completed during 1999 (January 1–December 31). Similar to previous years, the señorita (*Oxyjulis californica*) numerically dominated the benthic fish fauna in 1999. On midwater transects, señorita were also numerically dominant at nearly all stations in 1999 except in North Diablo Cove where jack mackerel (*Trachurus symmetricus*) was numerically dominant for the first time in the study. Juvenile rockfishes (*Sebastes* spp.) were also abundant at nearly all stations on both benthic and midwater transects.

Biological Community Descriptions

This section describes the fish assemblages found at the four fish study areas in South Control, North Diablo Cove, South Diablo Cove, and Field's Cove.

South Control

Fish abundance at South Control was higher in 1999 than in previous years, averaging approximately 100 fish per transect with benthic and midwater stations combined (**Figure 4-26**). Señorita and juvenile rockfishes, mainly yellowtail/olive complex (*Sebastes flavidus/S. serranoides*) and blue rockfish juveniles (*S. mystinus*), numerically dominated both the benthic and midwater fish assemblages in 1999. Compared with the five-year average included in the 1995–1999 period, señorita, yellowtail/olive rockfish juveniles, blue rockfish juveniles, and black rockfish juveniles (*S. melanops*) occurred at South Control in higher abundance. On South Control benthic transects in 1999, both the striped surfperch (*Embiotoca lateralis*) and the juvenile black-and-yellow/gopher rockfish complex juveniles (*S. chrysomelas/S. carnatus*) were below the five-year average. In the midwater, the juvenile black-and-yellow/gopher rockfish complex was absent in 1999, and the tubesnout (*Aulorhynchus flavidus*) was below the 1995–1999 average.

North Diablo Cove

Fish remained relatively abundant on benthic transects in North Diablo Cove during 1999 with increases in several taxa compared to previous periods (**Figure 4-27**). Señorita was the numerically dominant species, as in previous years, and was similar in abundance to the 1995–1999 average. The appearance of high numbers of jack mackerel on both the benthic and midwater transects in 1999 was unusual since they have not been recorded during subtidal fish observations in North Diablo Cove since the inception of the study. However, small schools of jack mackerel have been seen in previous years directly in the discharge turbulence zone. They were the most abundant species in midwater transects in 1999, replacing señorita as the dominant taxon in most other years.

South Diablo Cove

Fish abundance in South Diablo Cove was lower during 1999 than in previous years (**Figure 4-28**). Overall abundance of fishes on benthic transects in South Diablo Cove continued a trend of gradual decline that began after power plant start-up. Average abundance of fishes on midwater transects was markedly lower in 1999 (18.5/transect) than during the 1995–1999 period (55/transect). This difference is primarily accounted for by the reduced abundance of silversides in 1999.

Relative importance of the dominant fish taxa has changed little over the course of the study in South Diablo Cove. Señorita and juvenile yellowtail/olive rockfishes numerically dominated the benthic habitats there in 1999. In the 1995–1999 period, señorita and juvenile black-and-yellow/gopher rockfishes were the two most abundant taxa. Señorita and silversides numerically dominated the water column fish assemblage in South Diablo Cove as they did during the period from 1995–1999.

Field's Cove

Subtidal fish assemblages in Field's Cove were sampled for the first time during 1999 (**Figure 4-29**). Señorita and juvenile rockfishes (yellowtail/olive complex, black and bocaccio) were some of numerically dominant fish taxa in Field's Cove on both benthic or midwater transects. A relatively high number of bocaccio juveniles (*Sebastes paucispinis*) were observed in 1999. This taxon was also observed on the benthic transects at South Control in 1999 and has also been seen sporadically in the vicinity of DCPP in previous years. Several species of surfperches were also

common at the Field's Cove stations including pile (*Damalichthys vacca*), black (*E. jacksoni*), striped (*E. lateralis*), and rainbow (*Hypsurus caryi*).

Community Analysis

Correspondence analysis of common fish taxa was used to compare the subtidal transect data from 1999 with earlier years (**Figure 4-30**). Each area had a unique assemblage. Control stations were characterized by four taxa: striped surfperch (*Embiotoca lateralis*), painted greenling (*Oxylebius pictus*), blue rockfish (*Sebastes mystinus*), and black-and-yellow rockfish (*S. chrysomelas*). North Diablo Cove had fishes that are more common in warm temperate waters to the south including California sheephead (*Semicossyphus pulcher*) and opaleye (*Girella nigricans*) in combination with cool temperate species including black surfperch (*Embiotoca jacksoni*), blackeye goby (*Coryphopterus nicholsi*), and pile perch (*Damalichthys vacca*). South Diablo Cove was characterized by the tubesnout (*Aulorhynchus flavidus*) and sanddabs (*Citharichthys* spp.), which are common at this location because of the greater amount of sand bottom but generally uncommon at other sampling locations.

The fish assemblages in 1999 differed from the general trends seen over the previous ten years. South Control appeared to be more similar to North Diablo Cove in 1999 than in previous years although the composition and diversity of fishes in North Diablo Cove continued to segregate it from the other areas as a unique assemblage. The fish assemblage in South Diablo Cove during 1999 was similar to those observed in previous years. Field's Cove was not included in the community analysis since there were no data from previous years for comparison.

Select Species Changes

Señorita have shown large fluctuations in abundance among years in all areas (**Figure 4-31**) with much of the variation related to differences in the numbers of juveniles occurring from year to year. The greatest increase in señoritas in 1999 occurred at the South Control stations. Señoritas continued to be moderately abundant in Diablo Cove, and as previously stated, señoritas are numerically dominant at most locations both inside and outside Diablo Cove.

Rockfish recruitment, evidenced by YOY abundance at all stations, has been episodic and variable through time as seen in black-and-yellow/gopher rockfish complex (*Sebastes chrysomelas/S. carnatus*). Rockfishes typically spawn during winter and early spring along the

California coast. Juveniles and YOY are typically benthic or epibenthic in kelp forests. Recruitment for this taxonomic grouping was low in 1999, although olive/yellowtail YOY were moderately abundant (**Figure 4-32**).

Some of the less common fish taxa also demonstrated continued change in 1999. The warm-temperate fish opaleye (*Girella nigricans*), abundant only in North Diablo Cove, continued a trend of increasing abundance in 1999 (**Figures 4-33**). Opaleye are more common south of Point Conception (Eschmeyer et al. 1983) and are probably well adapted to warmer water conditions associated with the discharge plume.

In 1999, juvenile bocaccio rockfish also made their first appearance in any significant numbers since the late 1970s, occurring primarily at the stations in Field's Cove (**Figure 4-34**). The last strong year class of bocaccio recruited in 1977, and the population has been declining since (Bloesser 1999). Strong recruitment was noted in 1999 along the central California coast from Santa Barbara (pers. comm., Dr. Milton Love, UCSB) to Monterey (pers. comm., Dave VenTresca, CDF&G).

4.3.3 Discussion

The majority of results for 1999 reflect a continuation of the same patterns described from previous periods of power plant operation (Tenera 1997, 1999b). The señorita (*Oxyjulis californica*) continued to be the numerical dominant in nearly all cases (among stations, at benthic vs. midwater transects). Warm-temperate species remain common at North Diablo Cove, but occur in limited abundance elsewhere in the vicinity of DCPP. California sheephead abundance decreased markedly in 1991 and has remained low and variable through the present study period.

Two changes in abundance were not continuations of existing trends. Bocaccio rockfish occurred in substantial numbers in Field's Cove. This was the first year in which Field's Cove was sampled for subtidal fish abundance, and it appears that the bathymetry, kelp coverage, and water temperatures on the transects are conducive to rockfish settlement. Bocaccio only utilize the nearshore habitat for several months before moving into deeper water as they grow larger. Interestingly, the most recent strong bocaccio year class occurred in 1977 (PG&E 1988) at the beginning of a California Current-wide climate regime shift toward overall warmer water temperatures (Holbrook et al. 1997). However, water temperatures recorded at DCPP in 1999

were some of the coldest on record. Jack mackerel occurred in relatively high abundance in North Diablo Cove. They are a migratory species with the majority of their distribution centered in cool-temperate waters, although they are also commonly found in southern California and Baja California. The appearance of this species during 1999 could be related to the cooler water temperatures and experienced across the region.

As mentioned above, Field's Cove was sampled in 1999 for the first time since these studies began. Field's Cove, located north of the DCPP discharge structure, might be expected to most closely resemble South Control stations based on water temperatures that are only slightly above ambient, on average. Species richness (number of species) and total counts of fishes in Field's Cove were less than those in South Control on benthic transects. It is likely, however, that these differences would not prove statistically significant because of high natural variability associated with the estimates. Species richness and abundance on midwater transects at these two locations were nearly identical. However, a percent similarity index (PSI) indicates that while the taxonomic composition of fishes is relatively similar on benthic transects in Field's Cove and South Control (48 percent similarity), the composition on midwater transects is very dissimilar between the two locations (2 percent similarity). This low similarity may be the result of site-specific natural variation in habitat factors such as bathymetry and algal structure.

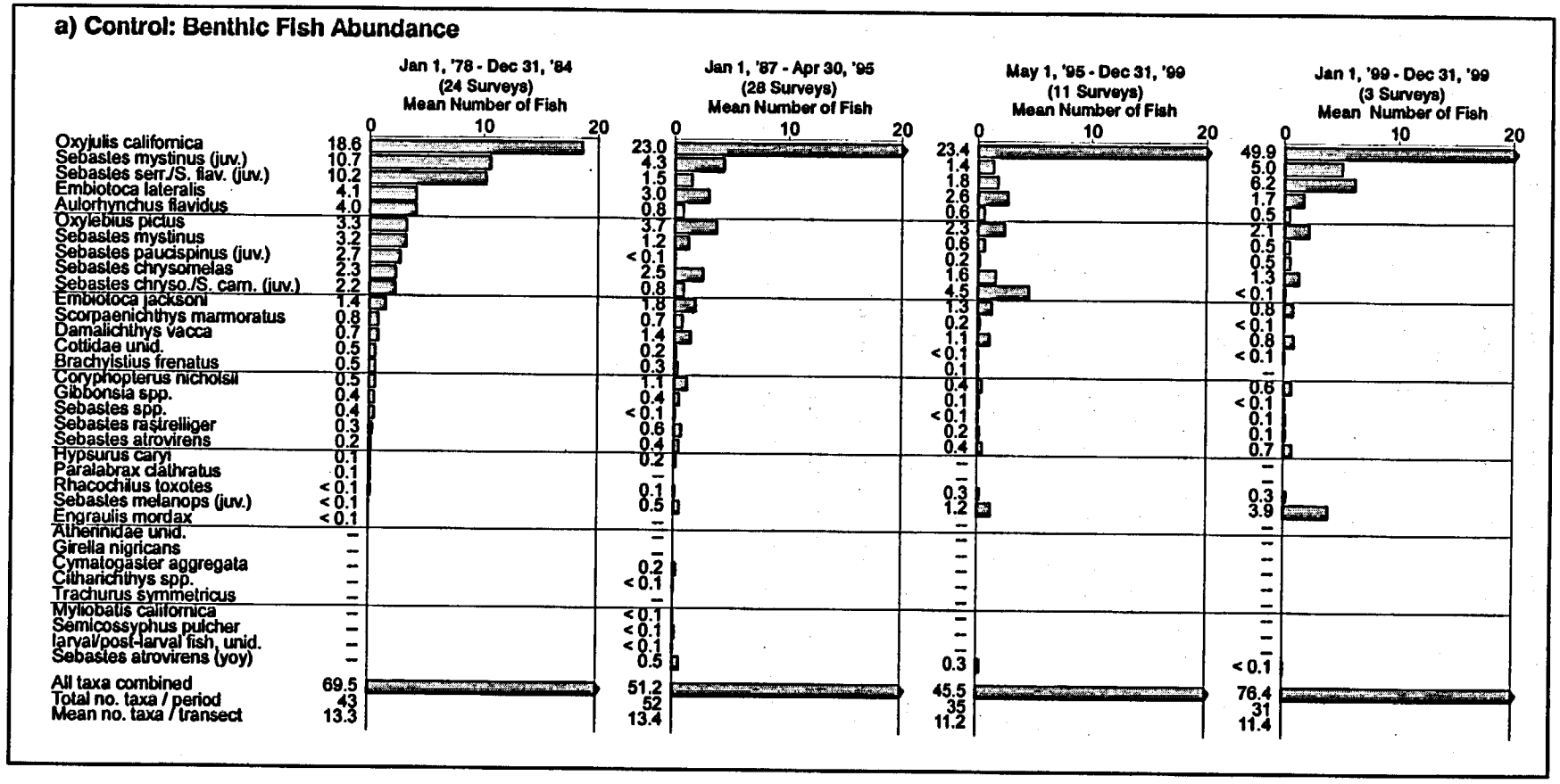


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Figure 4-26. Subtidal fish abundances at the South Control stations: (a) benthic transects and (b) midwater transects.

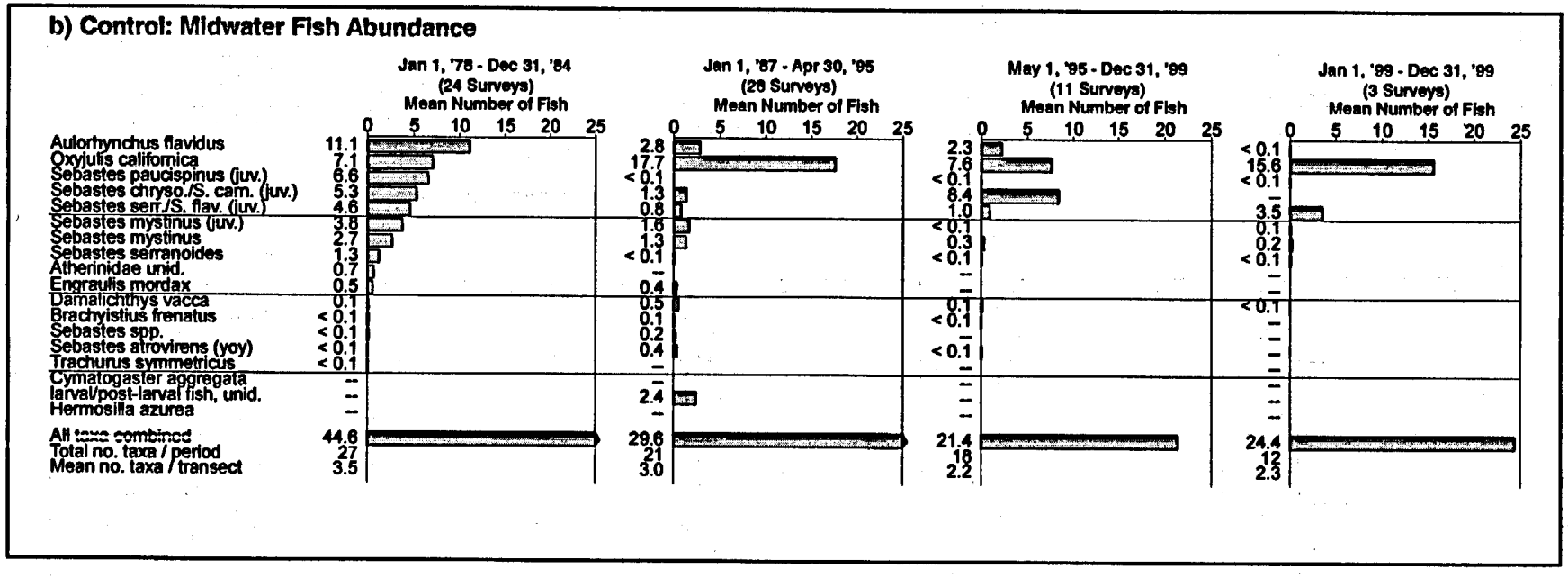


Figure 4-26 (continued). Subtidal fish abundances at the South Control stations: (a) benthic transects and (b) midwater transects.

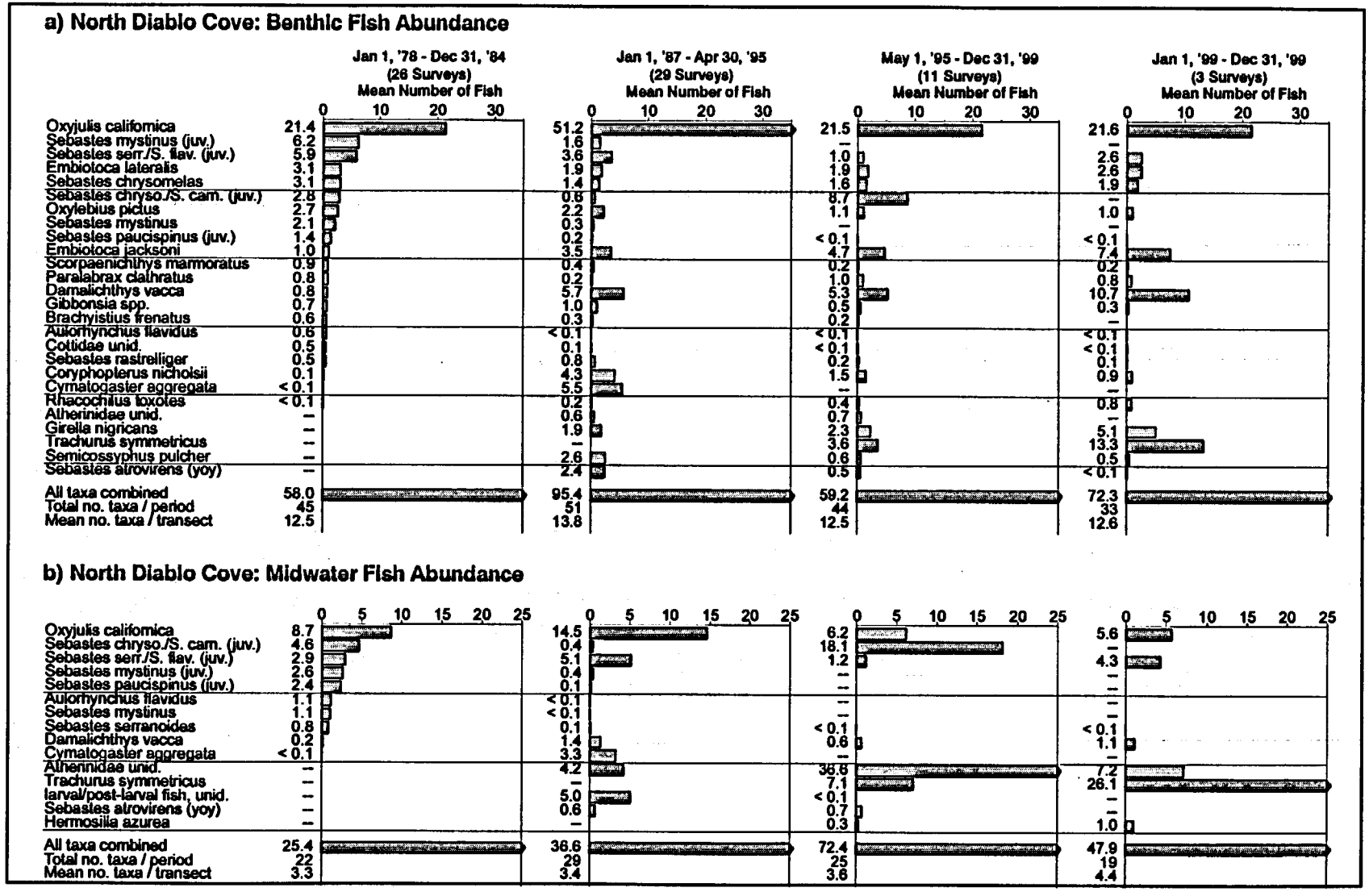


Figure 4-27. Subtidal fish abundances at the North Diablo Cove stations: (a) benthic transects and (b) midwater transects.

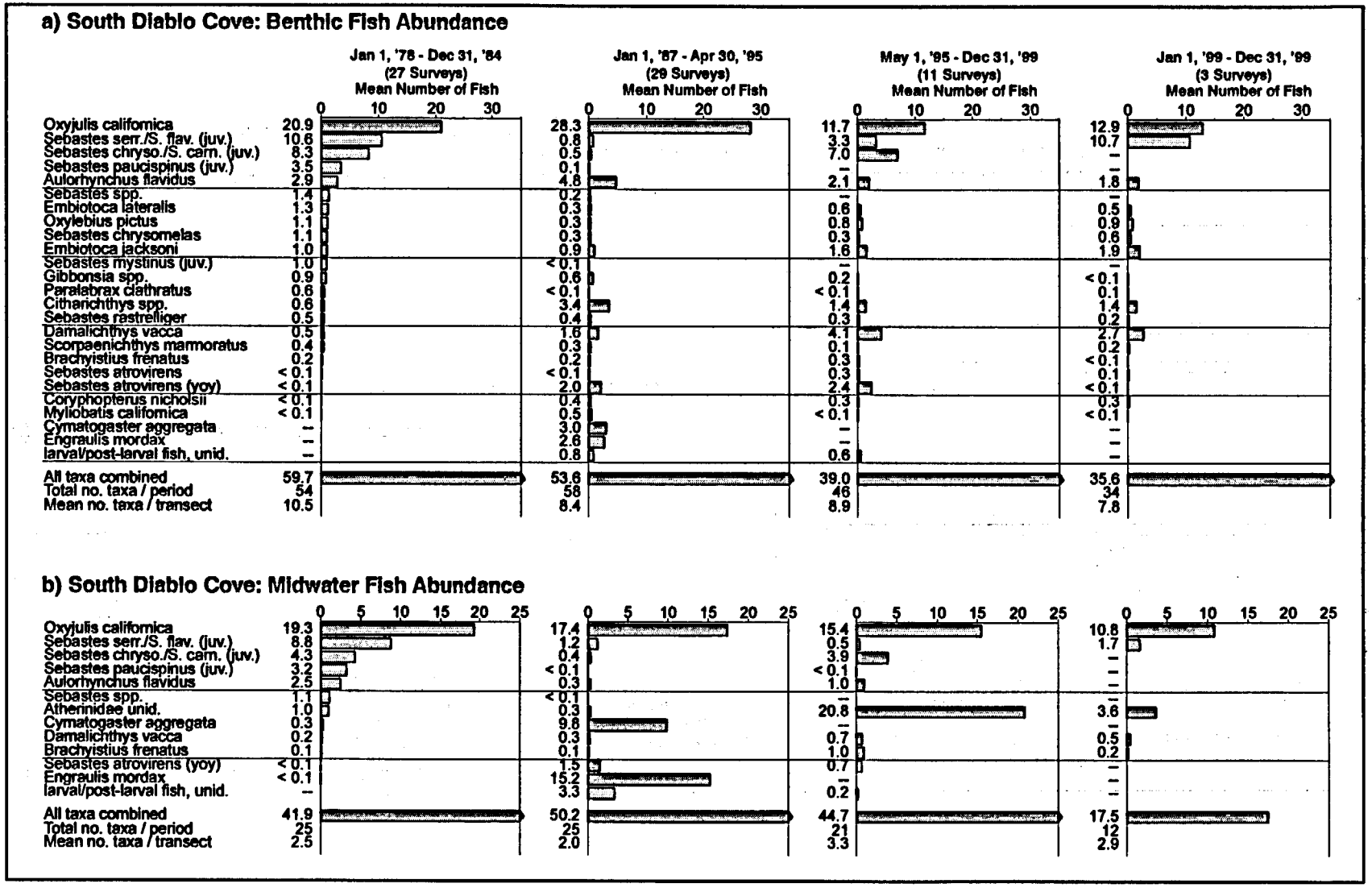


Figure 4-28. Subtidal fish abundances at the South Diablo Cove stations: (a) benthic transects and (b) midwater transects.

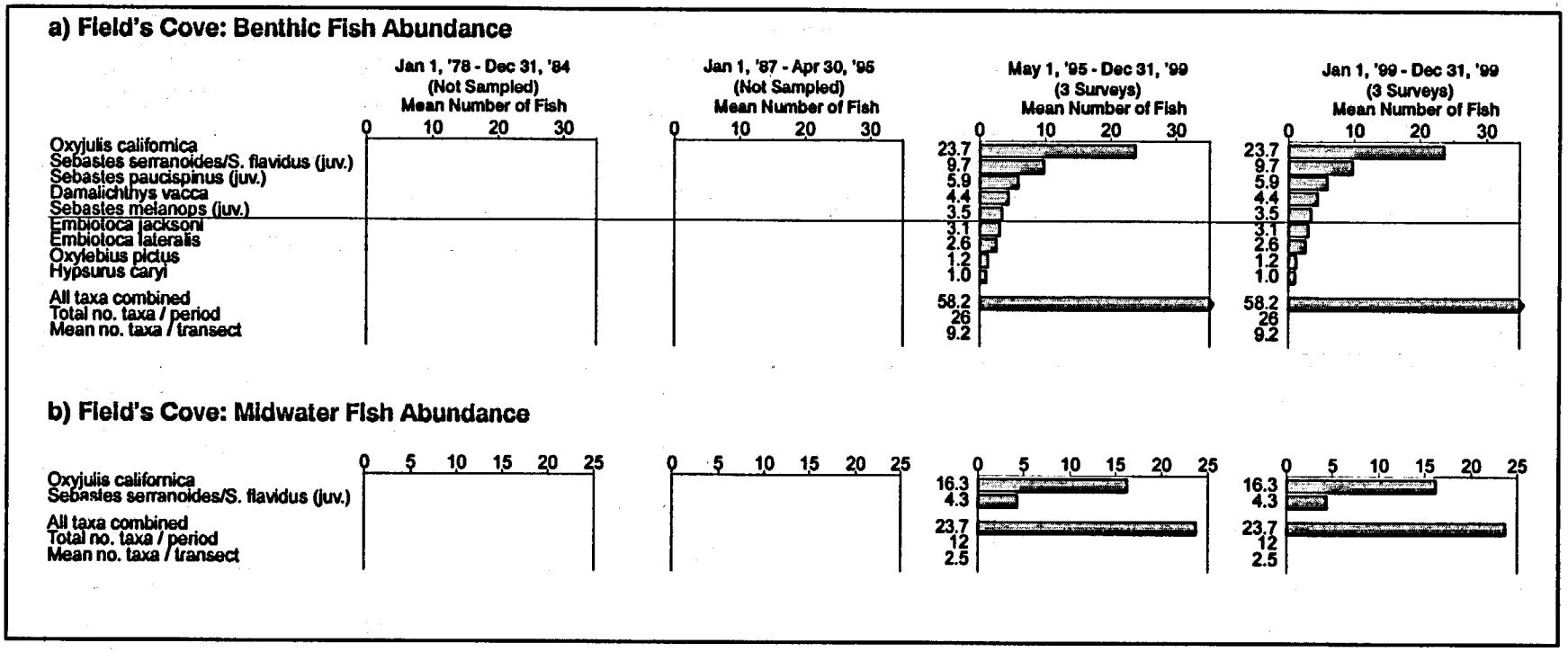


Figure 4-29. Subtidal fish abundances at the Field's Cove stations: (a) benthic transects and (b) midwater transects. Note: The Field's Cove stations were sampled for the first time in 1999. Therefore, abundances shown for the third and fourth sampling periods are identical. .

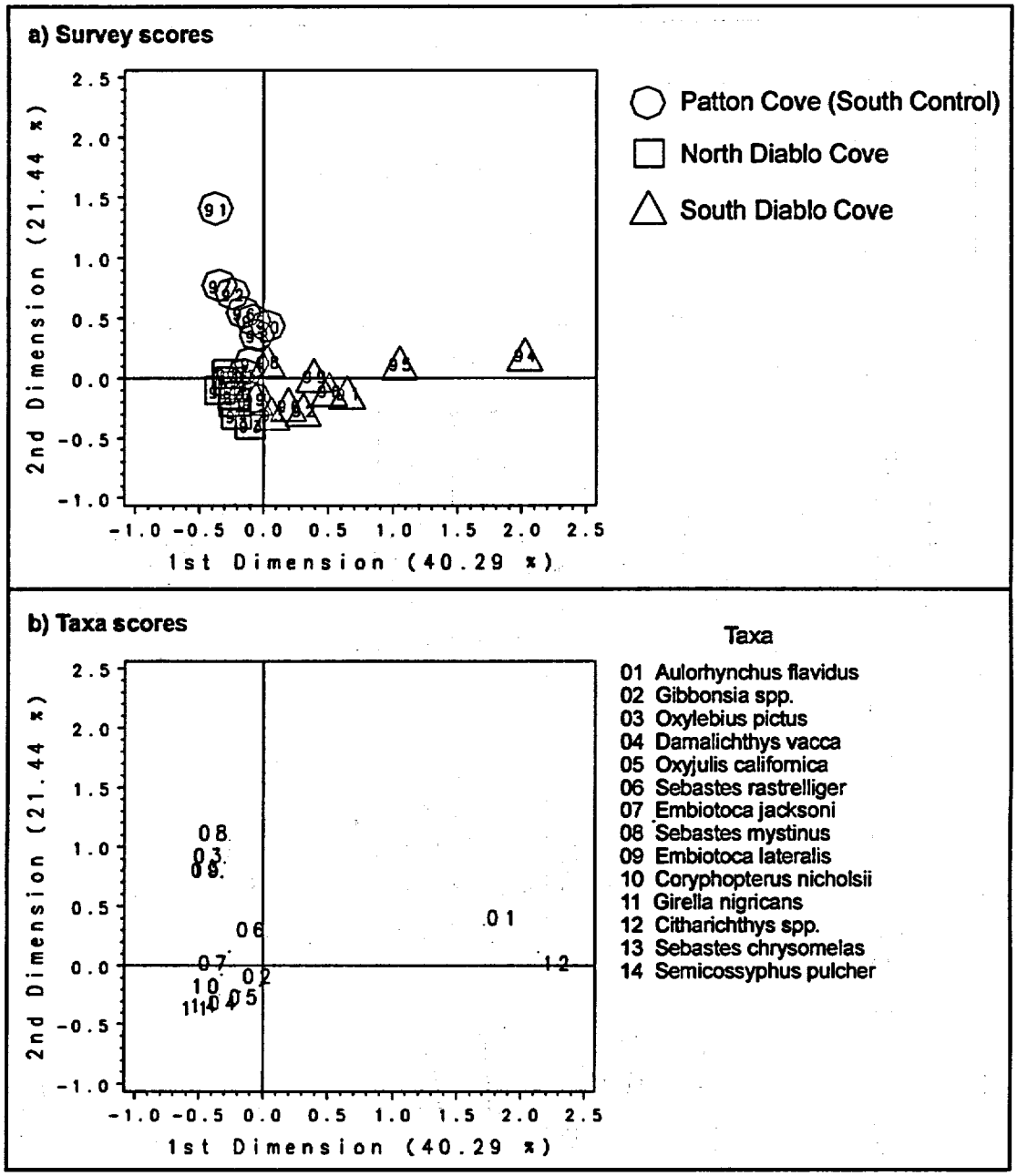


Figure 4-30. Correspondence analysis for subtidal benthic fishes: (a) survey scores and (b) taxa scores

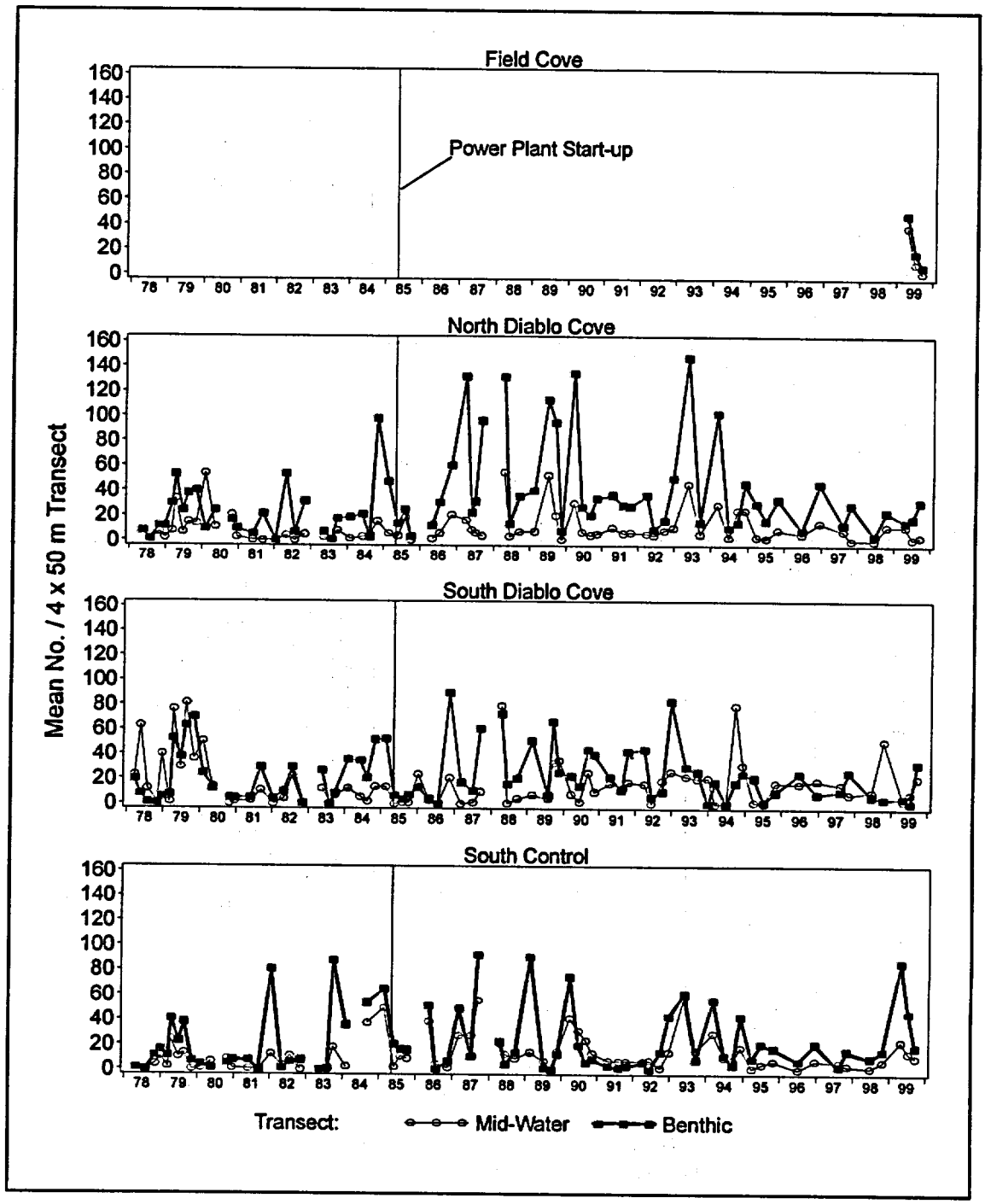


Figure 4-31. *Oxyjulis californica*: changes in abundance on benthic and midwater fish transects.

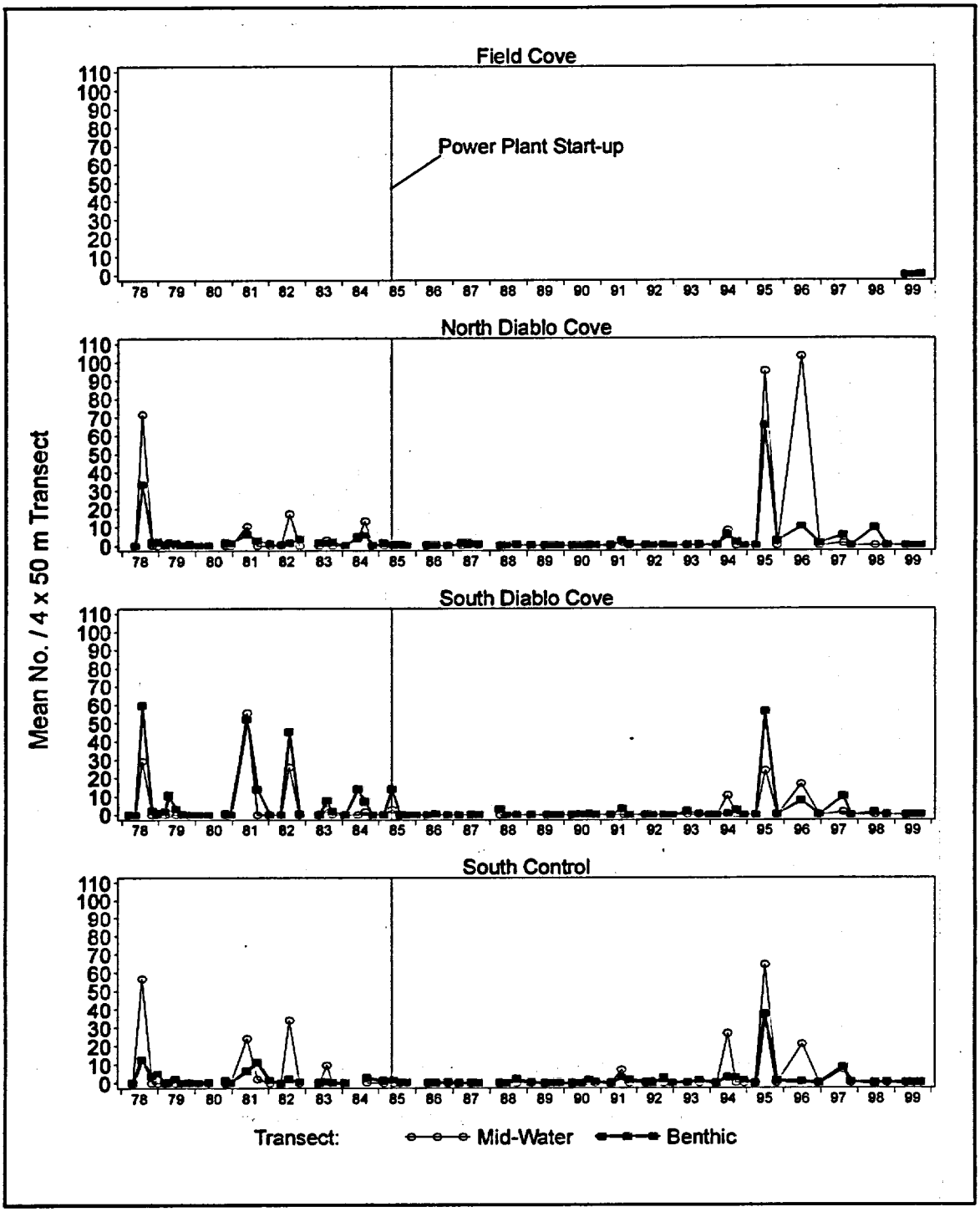


Figure 4-32. *Sebastes chrysomelas/ S. carnatus* (YOY): changes in abundance on benthic and midwater fish transects.

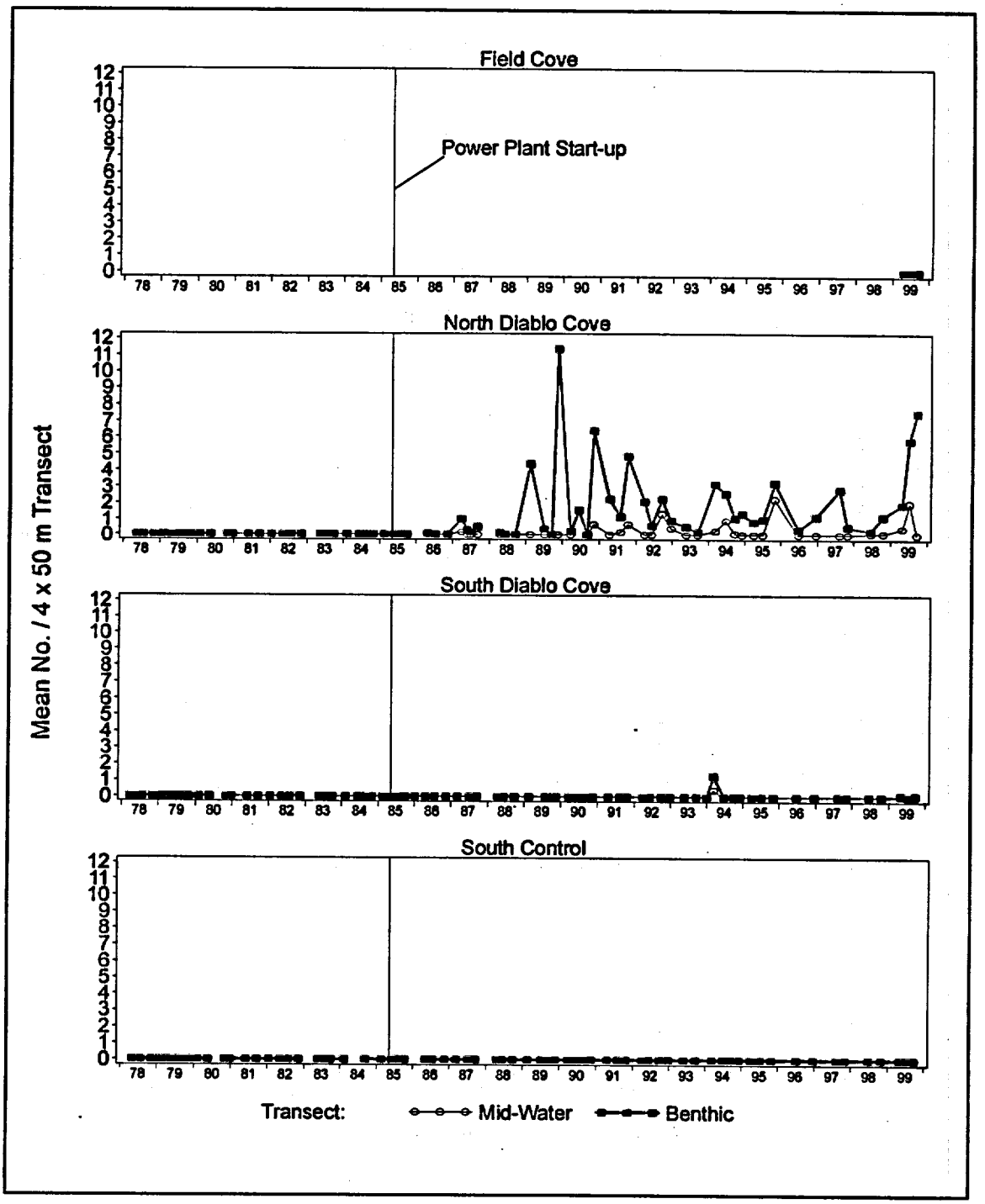


Figure 4-33. *Girella nigricans*: changes in abundance on benthic and midwater fish transects.

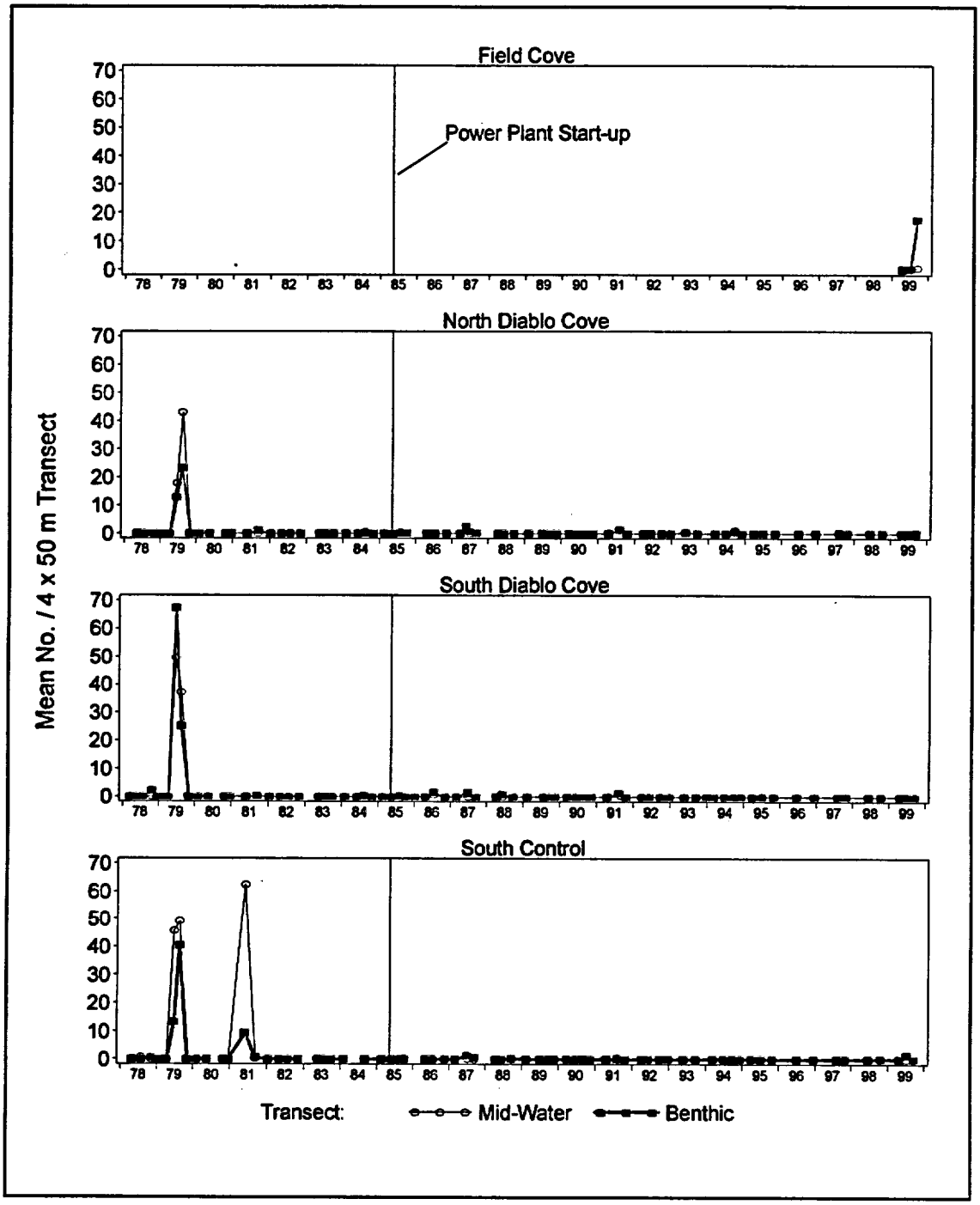


Figure 4-34. *Sebastes paucispinis* (YOY): changes in abundance on benthic and midwater fish transects.

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Appendix A

Shell Debris Deposition from the DCPP Discharge

SHELL DEBRIS DEPOSITION FROM THE DCPP DISCHARGE

Summary

Fragments of shell debris from the biofouling assemblage (e.g., barnacles and mussels) growing in the Diablo Canyon Power Plant cooling water system are discharged into Diablo Cove with the effluent. Areas where the shell debris settles and accumulates in the cove were mapped by visually estimating the coverage of shell debris along a series of transects perpendicular to the shoreline near the discharge structure. Sampling began in Fall 1999, when two of the four circulating water pumps were shut down for refueling outage 2R9. This permitted access to areas near the discharge that are too turbulent to sample during normal pump operation. We observed that most of the shell debris accumulates in a natural channel that extends underwater in a westerly direction away from the discharge structure. The channel is approximately 20 m wide and 200 m long. Recently dislodged shell debris was observed scattered in the channel after the refueling outage, and all shell debris was dispersed after subsequent storm activity. Ocean swells cause the shell debris to be broken into smaller fragments that then mix with sand and natural shell sediments from the surrounding area. Variation in the bedload (depth) of shell debris and sediments were measured at four permanent locations in Diablo Cove using permanent sediment stakes. Variation in sediment depth at these locations was related to storm events.

Shell debris deposition does not appear to have an adverse effect on marine habitat. Shell debris observed in the study did not bury rocks that would have otherwise been colonized by algae or invertebrates because the shell debris was settled and accumulated at the base of rocks and in areas of natural sand/shell sediment accumulation. These areas are not biologically diverse due to the unstable substrata from constant motion of waves and currents. However, shell debris containing the remains of biofouling organisms does appear to attract round rays, leopard sharks, bat rays, and fishes that forage on this supplemental food supply in and around the turbulent discharge zone.

Introduction

The biofouling community at DCPP is primarily composed of mussels and barnacles (**Figure A-1**) that attach to the conduit walls and grow to form a layer about 15 cm (6 in.) thick. The organisms are continuously being sloughed off the walls and then replaced. The intake and discharge conduit walls and high flow of seawater through the Diablo Canyon Power Plant (DCPP) condenser cooling system provide an ideal environment for the growth of these attached, filter-feeding invertebrates. Fragments of shells (tests), somatic tissue, and whole animals, collectively referred to as "shell debris," are sloughed off of the walls and are subsequently deposited in Diablo Cove. Particles of shell debris from the intake conduit walls smaller than 2.5 cm (1 in.) are able to pass through the condenser tubes. Larger particles can plug the tube openings, reducing cooling seawater flow. Shell debris from the discharge conduits flows directly into Diablo Cove and can include fragments and animals larger than 2.5 cm.

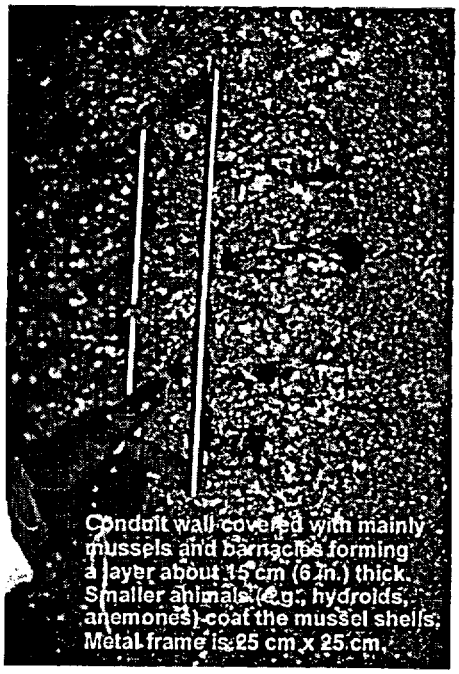


Figure A-1. Biofouling community on discharge conduit wall. Photograph taken on September 28, 1999.

Increases in shell debris deposition in Diablo Cove from the power plant may occur after refueling outages. During refueling outages, cooling water pumps are typically shut off for an extended period of time (several weeks) to the unit being refueled. When the intake and discharge conduits are drained, biofouling organisms are exposed for extended periods and can weaken or die. The intake conduits are cleaned, scraped, and repainted, with the debris disposed off-site. In contrast, the discharge conduits are not cleaned. When cooling water discharge flow resumes at normal rates (i.e., both units operating), large numbers of weakened or dead organisms in the discharge conduits break free and are deposited in Diablo Cove. Shell debris deposition probably decreases during normal power plant operation.

The present study was conducted as a response to an amendment to the waste discharge requirements of PG&E's Diablo Canyon Power Plant stating, "an acceptable monitoring program shall be designed and conducted to determine the effects of...shell debris, generated by the

discharge on the Diablo Cove environment" (Monitoring and Reporting Program No. 90-09 adopted by the Regional Water Quality Control Board on 2/20/95). The shell debris study plan was requested in a letter dated August 3, 1998 from the Regional Water Quality Control Board (RWQCB) addressed to PG&E. A preliminary plan was submitted for review in September 1998 (Tenera and PG&E 1998). The study plan was refined through discussions with RWQCB staff and their consultants at Moss Landing Marine Laboratories on September 24, 1999 (Tenera 1999) **(Attachment A-1)**.

Purpose

The purpose of the present study was to:

- Determine the extent and fate of shell debris discharged from the DCPP cooling water system.
- Determine whether shell deposition increases after refueling outages.
- Determine whether shell debris deposition affects marine habitat.

Sampling Methods

Indicator species were used to differentiate between shell debris from the power plant and naturally occurring shell (test) fragments. Whole tests (generally > 2.5 cm) of *Megabalanus californianus* (barnacle) were the most reliable indicator of shell deposition from the power plant since *Megabalanus* is an abundant biofouling organism that is not abundant in Diablo Cove. *Pollicipes polymerus* (gooseneck barnacle) and *Mytilus* spp. (mussel) were also used when clumps of shells or clusters of intact animals occurred close to the discharge. Broken or eroded shell fragments (<0.6–1.3 cm) were considered indicative of power plant shell deposition only if they occurred as a thick, mono-specific layer near the discharge and were not markedly mixed with sand. It was not possible to determine if smaller shell fragments had come from the power plant or from other areas, particularly when they were mixed with sand or the shells (tests) of organisms not considered common members of the biofouling community (e.g., chitons, sea urchins). However, the combination of small shell debris fragments mixed with sand and shells (tests) from non-biofouling organisms were used to delineate the outer extent of shell debris deposition by the power plant.

The percent cover of shell debris, bedrock, boulder, cobble, and sand/shell sediments was visually estimated on seven 2 m × 2 m plots spaced 5 m apart along roughly parallel 200 m transects normal to the shoreline and along a single 100 m oblique transect (**Figure A-2**). The transects were positioned during the initial survey (September 30–October 5, 1999). The transects were selected to include areas where shell deposition was greatest, transition zones where shell debris was mixed with other sediments, and areas with no perceptible shell deposition. Parallel transect lines were deployed by divers swimming a 230° magnetic north compass course from each transect origin. The origin of each transect was positioned as close to the shoreline as ocean conditions permitted. The 100 m oblique transect (OBL-1) was deployed along the center line of a natural surge/sand channel located in front of the discharge structure. The discharge channel appeared to be the area where shell deposition was greatest and where an obvious gradient of shell deposition was observed.

Surface buoys were deployed to mark the origin and terminus of each transect and their locations were recorded using a global positioning system (GPS). These data were later downloaded into a geographic information system (GIS) for mapping. Some transect origins were underneath the whitewater and foam created by the discharge and therefore surface buoys could not be deployed for these transects. For those transects, the origin beneath the whitewater and foam was estimated from compass bearings and distances from the offshore terminus.

Initial sampling of all transects (September 30–October 5, 1999) was completed during refueling outage 2R9. During the refueling outage, two of the four main circulating water pumps were not in operation. The reduced discharge outflow combined with calm seas provided exceptional dive conditions in this area which is normally very turbulent and difficult to sample. Sea conditions worsened after the refueling outage (**Figure A-3**), but the oblique transect (OBL-1) was sampled a second time on January 5, 2000.

Sediment stakes were installed at four locations (**Figure A-2**) on October 5, 1999 to measure changes in shell/sediment height. Stake 1 was placed in the discharge channel as close to the discharge structure as possible. Stake 2 was also placed in the discharge channel, 40 m from Stake 1, in what appeared to be a transition area where shell deposition from the power plant was reduced. Stake 3 was placed in a rock depression lateral to the discharge structure. This depression is typically filled with a layer of barnacle shell debris from the power plant. Stake 4 was placed in a natural sand flat area near the middle of Diablo Cove. The distance from the top

of each stake to the top of the shell/sediment layer was measured to the nearest centimeter on October 5, 1999 and again on January 5, 2000.

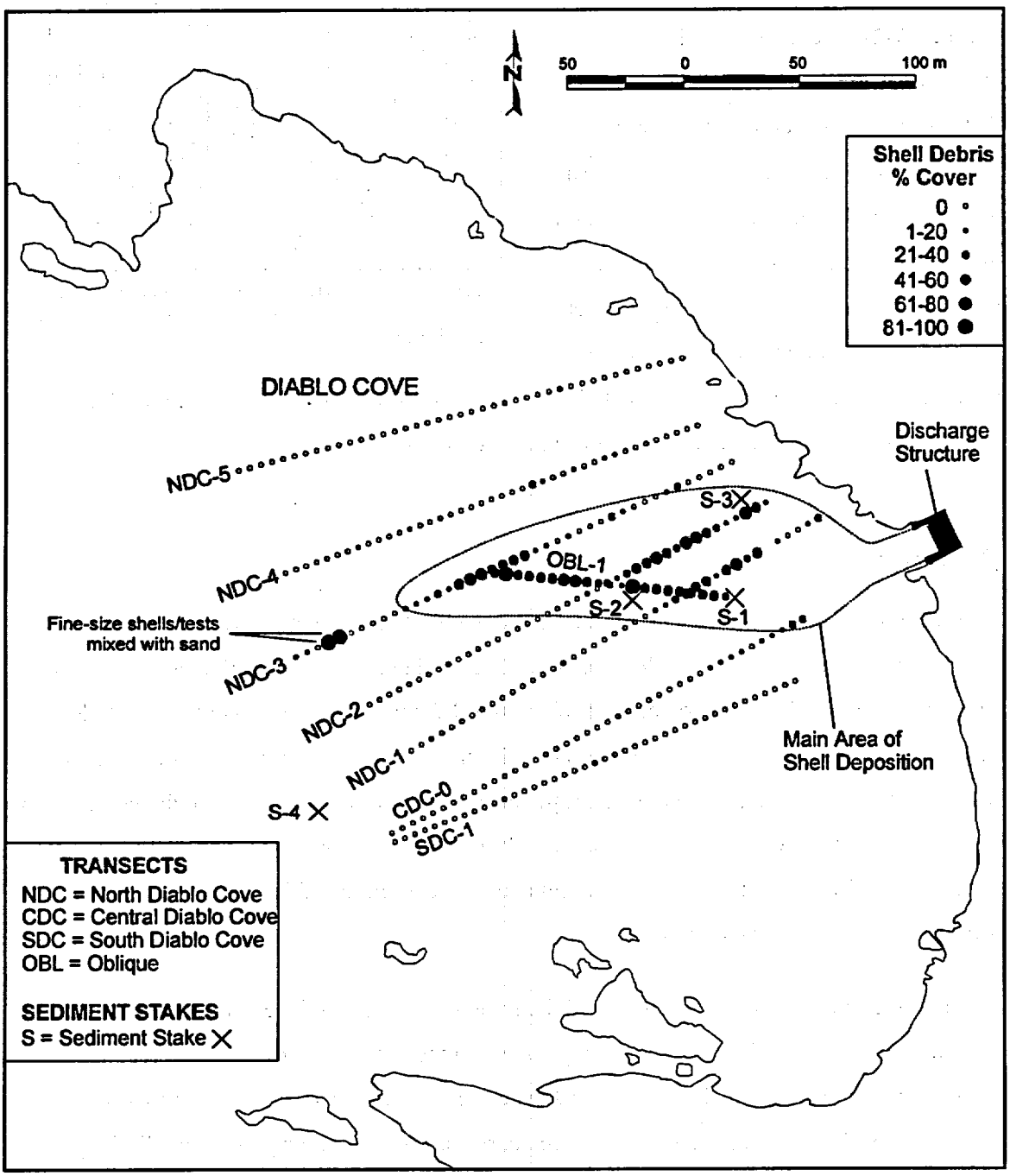


Figure A-2. Locations of transects and sediment stakes, including the cover of shell debris along the transects in September and October 1999. Transect OBL-1 runs along the centerline of a natural underwater channel (discharge channel).

A one-liter bottom-grab sample of surface shell/sediments was obtained on October 5, 1999 near Stake 1 and another at the terminus location of Transect OBL-1 (**Figure A-2**). These were used to characterize the composition and size distribution of shell debris at different distances from the discharge structure. An underwater video survey was completed on the same day to photo-document shell debris in the discharge channel. An inspection of the biofouling community in both of the Unit 2 discharge conduits was conducted on September 28, 1999 (**Figure A-1**) by walking approximately 50 m along the length of each conduit tunnel.

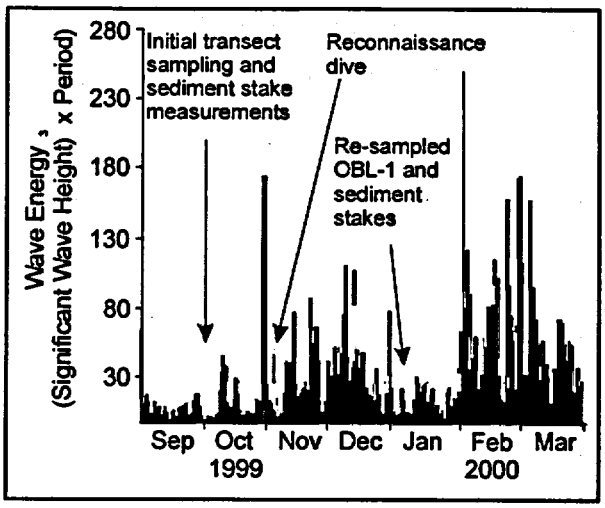


Figure A-3. Weekly average wave conditions and sampling occurrences. Note storm season beginning on October 28.

Results

Shell debris deposition varied with distance from the discharge structure with the greatest deposition in areas <200 m from the discharge. The shell debris closest to the discharge was a nearly pure layer of broken barnacle tests about 0.6–1.2 cm long, but also contained whole barnacle tests and mussel shells (**Figure A-4a**). Farther from the discharge, shell fragments were smaller, mixed with sand, and included fragments that were obviously not from the power plant biofouling community (e.g., chiton plates, sea urchin tests; **Figure A-4b**). The source of some smaller-sized fragments mixed with sand found near the terminus of Transect NDC-3 (**Figure A-2**) could not be determined.

A storm system that immediately followed the refueling outage produced large waves and prohibited replication of the transects sampled during the outage (**Figure A-3**). A reconnaissance survey of the study area on November 2, 1999 near the end of the storm revealed that scattered, whole mussel shells and clusters of gooseneck barnacles were tumbling along the discharge channel in the same direction as the discharge plume (also shown in underwater video survey). These larger shells were not present during the first sampling effort, and were probably organisms dislodged from the biofouling community in the discharge conduit following

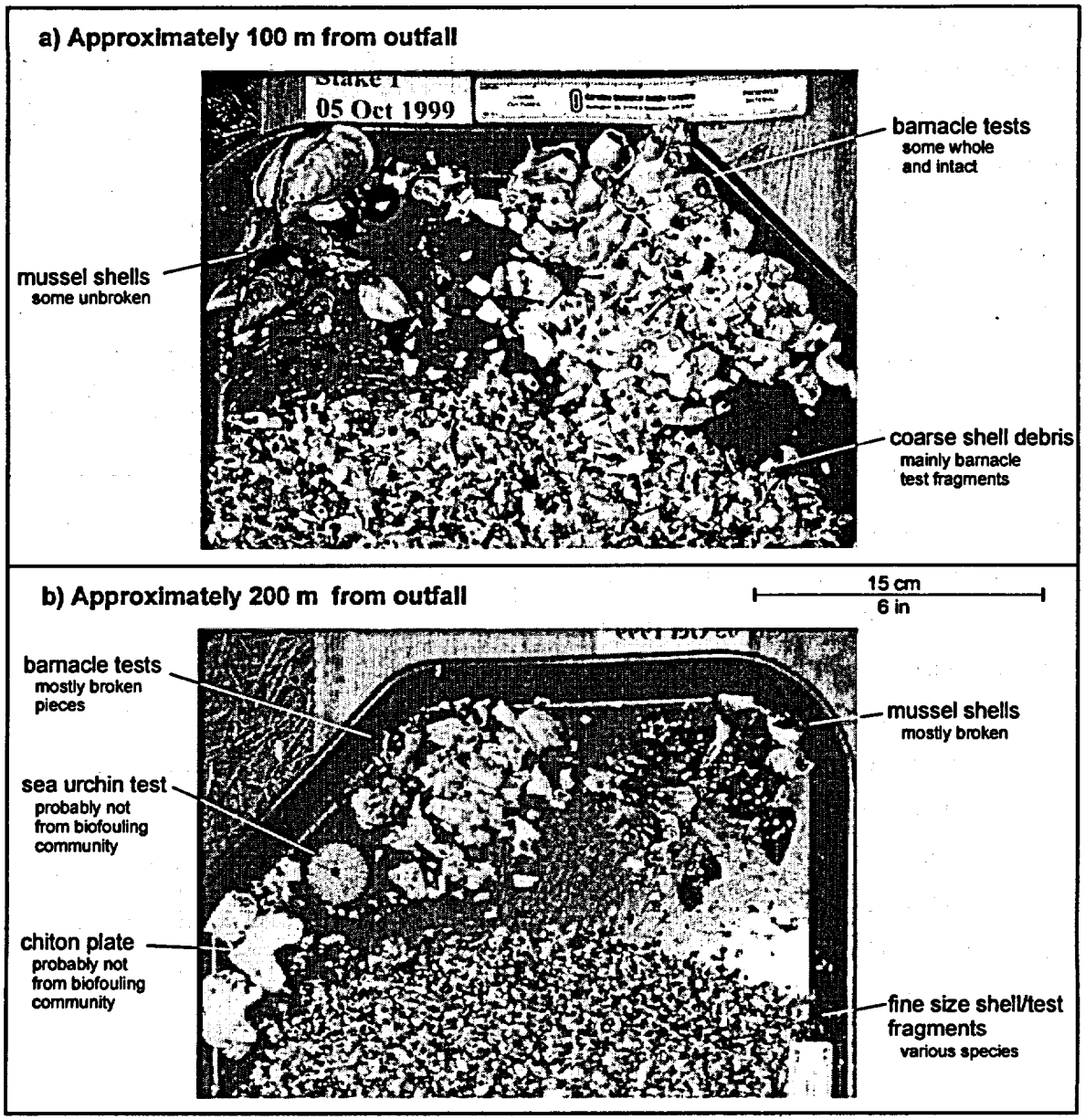


Figure A-4. Shell debris collected in 1-liter bottom grab samples in the discharge channel on October 5, 1999.

resumption of cooling water discharge flow. This conclusion was further supported by the fact that some of the gooseneck barnacles were still alive. The apparent fresh shell deposition in the discharge channel ended approximately 200 m from the discharge.

Continued storm activity (**Figure A-3**) further delayed re-sampling of the shore-normal transects, but Transect OBL-1 in the discharge channel was re-sampled on January 5, 2000. Less shell debris was observed along Transect OBL-1 compared to the first sampling effort (**Figure A-5**). In addition, the transition zone in the discharge channel, where smaller sized shell debris

becomes mixed with sand, was closer to the discharge structure than observed in the first sampling survey. On January 7, 2000, a PG&E biologist observed that the discharge channel contained very little shell debris, indicating that much of the shell debris had been scoured out and dispersed during the storms (Jim Kelly, PG&E, pers. comm.).

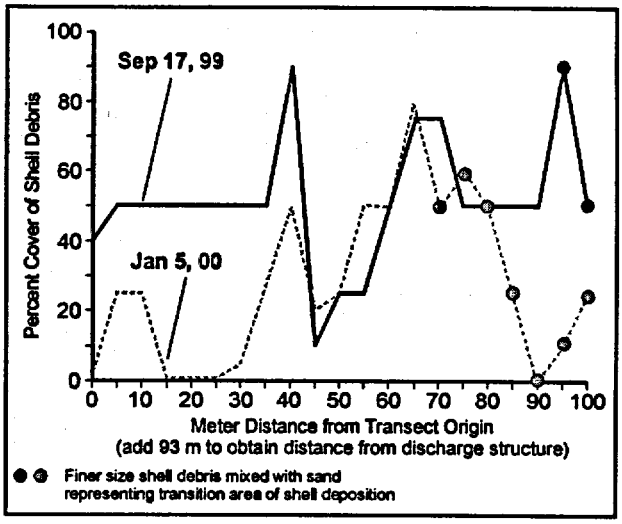


Figure A-5. Percent cover of shell debris along transect OBL-1 before and after cooling seawater pump start-up of Unit 2.

Sediment layer heights at Stakes 1 and 2 in the discharge channel increased after the refueling outage and subsequent storms (**Figure A-6**). However, the changes were not caused by shell debris deposition from the power plant. Cobbles had covered the areas around stakes 1 and 2 and there was no shell debris beneath the cobbles. Shell debris was also absent in the depression located to the side of the discharge at Stake 3, and the substratum had been scoured down to bare cobble overlying bedrock. Additionally, the sediment height on the sand flat at Stake 4 decreased, indicating that some sand had shifted out of the area (**Figure A-6**).

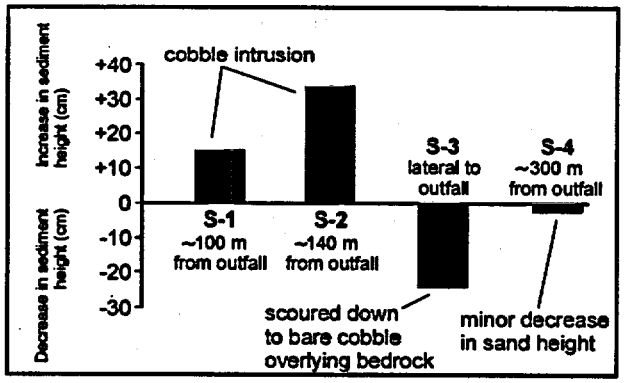


Figure A-6. Changes in sand/shell heights at sediment stakes after cooling seawater pump start-up for Unit 2.

Discussion

The spatial extent of shell deposition from the Diablo Canyon Power Plant discharge was determined from a systematic search effort completed between September 1999 and January 2000. The results of the study corroborated previous dive observations that most of the shell debris occurred in a natural underwater surge/sand channel located at the head of Diablo Cove in front of the power plant's discharge structure. The channel runs in a direction approximately due west from the discharge. It is about 20 m wide and 200 m long. Areas immediately to the north of the channel also contained shell debris that consisted of smaller fragments mixed with sand and

other sediments. Very little to no shell deposition was found downcoast (south) of the discharge structure.

The composition and abundance of shell debris have likely changed as a result of changes in biofouling control methods. Biofouling was controlled with heat treatments in the intake and discharge conduits at power plant start-up in 1985 through January 1989. Heat treatment has since been replaced by manual cleaning of the intake conduits; workers scrape all of the biofouling off of the conduit walls and dispose of the scrapings off-site. Since 1993, chemical treatment of the intake conduits using the anti-fouling agent ActiBrom™ (Nalco Chemicals) has been employed to suppress the establishment and growth of biofouling organisms and to reduce the amount of material removed during manual scraping. The effectiveness of the chemical treatments quickly diminishes in the cooling water system with distance from the site of application. Consequently, most of the shell debris from the power plant emanates from the conduits located on the discharge side of the condenser since no biofouling control methods are applied to this portion of the cooling water system.

The present study found that shell debris deposition from the discharge conduits is variable. Shell deposition can increase after refueling outages when cooling seawater pumps are reactivated. Fresh shell debris was observed after refueling outage 2R9, but its contribution to the total bedload of shell debris already present in Diablo Cove could not be determined, due to the large amount of background variation. In addition, storms quickly dispersed the shell debris.

Variation of the extent and elevation of sand/shell sediments in nearshore coastal environments is the product of normal, seasonal processes of onshore/offshore transport of sediments (**Figure A-7**). At Carmel Beach, California, beach sand is moved offshore during the winter and accumulates onshore during the summer months (Bascom 1964). These changes in beach morphology can be directly linked to changes in wave activity and ocean currents related to the change of seasons.

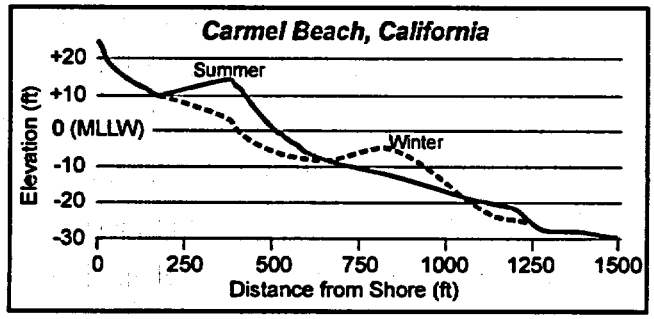


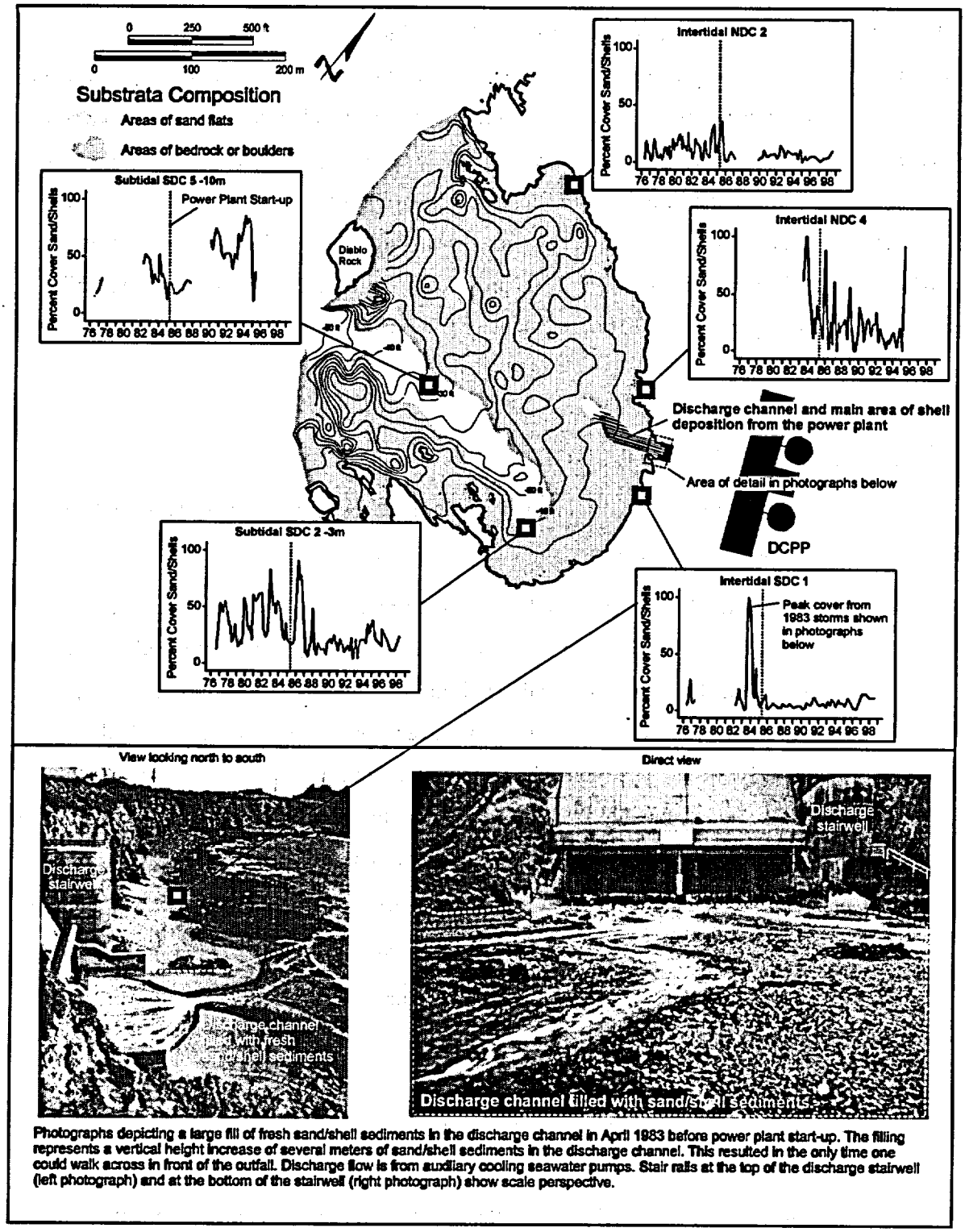
Figure A-7. Typical seasonal changes in beach profiles in California showing buildup of berm sediments in summer and displacement and formation of offshore sandbar in winter (modified from Bascom 1964).

Prior to power plant start-up in 1985, long-period storm waves associated with the 1983 El Niño caused a massive onshore transport of sand/shell sediments in Diablo Cove. The result was that the discharge channel filled in with natural sand/shell sediments and rocky intertidal habitats near the discharge structure became buried by the sand (**Figure A-8**). Another example of the variability of sediment height in Diablo Cove can be illustrated by the results of an El Niño-related storm in 1997. Storm-generated swell activity cleared the channel in front of the discharge of nearly all sand and shell debris leaving only exposed bedrock and cobble (Tenera, unpublished observations).

The following points provide perspective on the amount of shell debris potentially discharged into Diablo Cove:

- The majority of shell debris comes from the four discharge conduits.
- The biofouling community can be up to 15 cm (6 in.) thick.
- The total surface area of the discharge conduits is approximately 4,750 m^2 (i.e., conduit length ranges from 54–108 m with a cross sectional diameter of 4 m).
- The total surface area of the bottom of Diablo Cove is approximately 161,880 m^2 (ca. 16 ha).

In a hypothetical scenario, if the entire volume of the biofouling assemblage within the discharge side of the cooling water system were discharged into Diablo Cove at one time, sediment height would increase slightly less than 0.5 cm (0.2 in.) over the entire cove, assuming the bottom of Diablo Cove is flat. However, Diablo Cove is not flat and debris tends to settle and accumulate at the bases of rocks and in low-relief areas. These areas may represent approximately one tenth of Diablo Cove, so the hypothetical increase in bedload would be about 5 cm (2 in). If all the shell debris settled and accumulated only in the discharge channel, sediment heights in the channel would rise by approximately 17.5 cm (7 in). Even these extreme examples fall within the range of observed sediment load variation in Diablo Cove. The entire biofouling assemblage has never become dislodged at one time during the 15 years of plant operation, and these examples are only used to illustrate the relative volumes of shell material available for deposition.



Photographs depicting a large fill of fresh sand/shell sediments in the discharge channel in April 1983 before power plant start-up. The filling represents a vertical height increase of several meters of sand/shell sediments in the discharge channel. This resulted in the only time one could walk across in front of the outfall. Discharge flow is from auxiliary cooling seawater pumps. Stair rails at the top of the discharge stairwell (left photograph) and at the bottom of the stairwell (right photograph) show scale perspective.

Figure A-8. Changes in sand/shell sediments near the DCPP discharge structure highlighting the sediment deposition around the structure during the 1983 El Niño.

Benthic marine habitats (rock/sand substrates) in Diablo Cove do not appear affected by shell debris deposition from the DCPP discharge. Shell deposition from the power plant occurs in areas where natural sand/shell sediments commonly accumulate (e.g. bases of rocks, sand flats) and there are no areas where the shell debris buries rocks that would otherwise be colonized by algae and invertebrates. In addition, the areas of Diablo Cove containing sand/shell sediments do not support rich infaunal assemblages (e.g. clams, burrowing worms, sand dollars) since the substratum is highly mobile and subject to marked seasonal transport. However, organisms dislodged from the biofouling community do provide a plentiful food supply for more mobile animals such as leopard sharks, bat rays, and other fishes (Tenera 1997 and November 2, 1999 underwater video tape).

Conclusions and Recommendations

We do not recommend further monitoring of shell debris deposition from the DCPP cooling water system for the following reasons:

- Shell debris from DCPP settles and accumulates primarily in a natural underwater surge/sand channel that is about 20 m wide and 200 m long in front of the discharge structure. In this location it breaks down, is mixed with sand, and is ultimately dispersed by waves and currents to other areas of the cove where naturally occurring shell sediments also occur. The shell debris does not necessarily bury rocks that would otherwise provide habitat for algae and invertebrates. However, the shell debris provides a constant food supply that attracts leopard sharks, bat rays, and numerous fishes.
- Increases in sediment heights caused by shell debris discharged from DCPP are minor in comparison to the magnitude of changes in sediment bedload that can occur naturally.
- Physical changes in front of the discharge structure include increased water velocities, scouring effects, and increased water temperatures. Shell debris deposition from the discharge is part of the physical change.
- An exhaustive amount of field sampling and experimental studies combined with extensive laboratory processing would be needed to more precisely determine the spatial extent of shell debris deposition from the DCPP, because the smaller fragments further from the discharge are indistinguishable from naturally occurring shell sediments and that background variation can be large. A preliminary evaluation of the expanded effort needed would probably not substantially change the conclusions of this study.

Literature Cited

Bascom, W. 1964. Waves and Beaches: The Dynamics of the Ocean Surface. Doubleday & Company, Inc. Garden City, New York.

Tenera. 1997. Thermal effects monitoring program, analysis report: Chapter 1 - Changes in the marine environment resulting from the Diablo Canyon Power Plant discharge. Prepared for Pacific Gas and Electric Company, San Francisco, CA.

Tenera. 1999. Shell debris sampling plan. Prepared for Pacific Gas and Electric Company, San Francisco, CA.

Tenera. and PG&E. 1998. Draft Comprehensive Evaluation of the Diablo Canyon Power Plant Receiving Water Monitoring Program. Prepared for Pacific Gas and Electric Company. San Francisco, CA.

Attachment A-1

Submitted: September 1999

Study Plan: Shell Debris Sampling

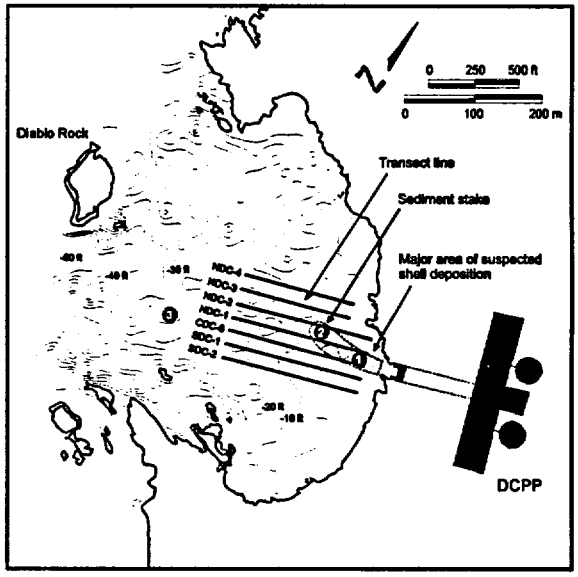
The following sampling plan is based on the Draft Comprehensive Evaluation of the DCPP Receiving Water Monitoring Program (Sept. 1998) and discussions with the Regional Water Quality Control Board Working Group. The study will provide a qualitative description of shell deposition based on consistent and repeatable data collection methods.

Purpose

- Determine the spatial extent and bedload of shell debris from DCPP and changes resulting from outage 2R9.

Sampling Methods

The study objectives will be completed using the following sampling methods completed before and after outage 2R9. Outage 2R9 is scheduled to begin at the end of September and will terminate in mid-October.



Shell debris sampling: design locations.

Spatial extent of shell debris

- A series of transect lines that run parallel with the discharge flow will be sampled for shell debris and substratum composition. The transect lines, each approximately 200 m long, will be spaced about 20 m apart to encompass the entire area where shell deposition has been observed.
- The cover of shell debris, bedrock, boulder, cobble, and sand will be estimated in 2m x 2m plots spaced every 5 m along each transect line.

- GPS coordinates will be obtained for the origin and terminus of each transect.

Bedload of shell debris

- Sediment stakes will be installed at the three locations shown in the accompanying figure.
- Sediment levels (bedload height) will be recorded at each stake.
- Photographs will be taken to document the materials at the base of each sediment stake.

Composition and size structure of shell debris

- Samples (1 liter bottle grab samples) of surface sediments will be obtained near each stake to characterize the nature of the shell debris (fragments, whole clusters, species). All the shell debris presently in front of the outfall consists of broken barnacle fragments that are ¼ in. to 1 in. in size. These cover up to 100% of the bottom in some areas. New shell deposition would be indicated by the presence of whole shells on top of the existing layer of smaller fragments.

Analysis Methods

The data will be analyzed to describe shell deposition before and after outage 2R9 as follows.

Extent of shell debris

- GIS will be used to map the areas of shell deposition.
- The GIS will also be used to construct of map of the substratum composition in the surrounding area.

Bedload of shell debris

- Data from the sediment stakes will be portrayed graphically.

Composition and size structure of shell debris

- Shell debris composition and size structure of particles will be described based on qualitative examination of the sediment grab samples.

Reporting

The shell debris report will be about 5-10 pages in length and will contain the following.

- Maps of substratum composition and shell debris.
- Analysis of the effect of outage 2R9 on shell deposition.
- Photographs of shell debris.
- Description of natural variation in soft sediment cover using data from RWMP intertidal and subtidal stations, including large increase in soft sediment bedload during the 1983 El Niño.
- Description on how changes in biofouling control may have changed the nature of shell deposition (e.g. shift from pulses of large fragments after heat treatments to "trickle" effect of smaller particles and lower biomass using Actibrom).
- Qualitative assessment of non-ecological effects (shell debris migrates and accumulates in natural sand pockets, depressions, and channels, and does not bury bedrock).

Appendix B

1999 Surfgrass (*Phyllospadix*) Survey

1999 SURFGRASS (*PHYLLOSPADIX*) SURVEY

Summary

This report presents results from a special surfgrass study implemented in winter of 1999 at the Diablo Canyon Power Plant (DCPP). Following a review of ongoing monitoring programs by consultants for the Central Coast Regional Water Quality Control Board, a surfgrass study was designed to monitor Diablo Cove's two remaining surfgrass beds. Stations were established in these beds and beds in North and South Control areas and in Field's Cove, an area with reduced thermal plume contact. All stations were located at the MLLW tidal elevation. The purpose of the study is to obtain data on the abundance and condition of surfgrass and associated organisms.

Previous to 1983, surfgrass beds formed a nearly continuous band around the perimeter of Diablo Cove from the low intertidal (ca. 0.0 m MLLW) into the shallow subtidal (ca. -3.0 m MLLW). Surfgrass now occurs as only two small beds in North and South Diablo Cove. Declining surfgrass abundance and shrinking distribution in Diablo Cove were first observed following the 1983 El Niño storms. Prior to 1983, surfgrass was abundant at the lower intertidal level transects (+0.3 m MLLW) sampled as part of the Thermal Effects Monitoring Program (TEMP). Following the El Niño storms, the surfgrass that remained occurred only on lower elevation transects in North Diablo Cove.

Preliminary results of the first survey of this study indicated that surfgrass beds in Diablo Cove, particularly the South Diablo Cove bed, had fewer blades per 0.25 m^2 than areas outside the cove. Blade lengths in Diablo Cove were also shorter compared to other areas. The results may reflect natural spatial variation, but the fewer blades and the smaller sizes of the surfgrass beds in Diablo Cove, compared to other areas, may lead to low seed production and reduced potential for recruitment and recovery. No surfgrass plants in reproductive condition were observed during the first survey in any of the areas sampled, including controls.

Algae were also identified and enumerated at each station sampled during the first survey. Most algae sampled were not unique to surfgrass habitat; *Smithora naiadum* and *Melobesia mediocris* were exceptions since they only grow attached to surfgrass blades. Differences among algae across stations corresponded to differences in substratum relief rather than the abundance of

surfgrass or distance from the discharge. In general, algal abundance was greatest at stations with higher amounts of rock relief.

Invertebrate species richness, measured as the number of species present, was lowest in Diablo Cove. With the exception of *Tectura palacea*, a small grazing limpet that is an obligate on surfgrass blades, no invertebrates sampled were unique to surfgrass habitat. This limpet was absent from the South Diablo Cove surfgrass bed, but common in the other beds sampled.

Introduction

Surfgrasses, *Phyllospadix* spp., are flowering marine plants that occur in low intertidal habitats. They are submerged much of the time, but are occasionally exposed to air. They differ from marine algae in that surfgrasses reproduce from seeds rather than spores. Two species of surfgrasses occur in the study area. *Phyllospadix scouleri* is the most abundant, but small patches of *P. torreyi* can occasionally be found growing next to the more expansive patches of *P. scouleri*. Surfgrasses occur from British Columbia, Canada to Baja, California (Turner 1985).

This report describes results of a special study on surfgrass comparing areas contacted and not contacted by the Diablo Canyon Power Plant (DCPP) discharge plume. The purpose of this study is to monitor the abundance and condition of surfgrass and associated organisms to detect any effects on local surfgrass beds attributable to the operation of DCPP's cooling water system. This study was initiated following a review of the findings of thermal effects on surfgrass beds (Tenera 1997) reported from long-term studies (1976–1995). An additional qualitative survey completed in 1997 (Tenera 1999a) was also considered. Some of the findings from these studies are included:

- Before power plant start-up, surfgrass in Diablo Cove was more variable in abundance than in Field's Cove and control areas.
- The nearly continuous band of surfgrass beds around Diablo Cove was reduced in size in 1983 from severe El Niño winter storms and in 1987-88 after power plant start-up. Two relatively small beds remain in the north and south parts of the cove.
- Surfgrass beds outside of Diablo Cove were not affected by the 1983 El Niño storms or the discharge plume and remain abundant.

- After power plant start-up, surfgrass abundance increased above pre-operation levels in areas outside Diablo Cove.
- Surfgrass increased in North Diablo Cove during power plant operation, following the earlier declines, but did not increase in South Diablo Cove.

Following the 1983 El Niño storms, remaining portions of the surfgrass beds in Diablo Cove occurred on only the lower elevation TEMP transects in North Diablo Cove (i.e., these transects sampled the upper vertical distribution limit of surfgrass). Based on these changes in surfgrass distribution, the Central Coast Regional Water Quality Control Board ("the Board") requested that PG&E design a study focused on surfgrass beds and their associated algal and invertebrate assemblages in the lower intertidal zone (ca. 0.0 m MLLW) where the beds remained more common in Diablo Cove and in control areas. This request is described in a letter from the Board to PG&E dated August 3, 1998 under Item 3c of "Specific comments and requirements for review of the receiving water monitoring program."

A preliminary study plan was submitted to the Board for review (Tenera and PG&E 1998). This study plan was refined with written comments received from the Board and their consultants and through discussions held at the Moss Landing Marine Laboratories on September 24, 1999. The final study plan, including these refinements, was submitted to the Board in December 1999 (**Attachment B-1**); sampling efforts based on this plan were implemented in November 1999.

Purpose

The purpose of the new study is to obtain data from five new surfgrass stations detailing:

- Surfgrass cover, associated algae, and substrata
- Blade density and length
- Vertical distribution and spatial extent of surfgrass beds
- Macroinvertebrate composition

Sampling Methods

Five surfgrass monitoring stations were established in and around Diablo Cove (**Figure B-1**) and were sampled for the first time in November and December 1999. Each station consisted of a

fifteen 30 m transect tape fastened between permanent stakes at the MLLW tidal elevation. All stations were placed in areas with relatively similar wave exposure. The North Control (NC) and both North and South Diablo Cove stations (NDC and SDC, respectively) were on flat bedrock. The Field's Cove (FC) and South Control (SC) stations were on slightly higher relief bedrock with boulders and cobbles.

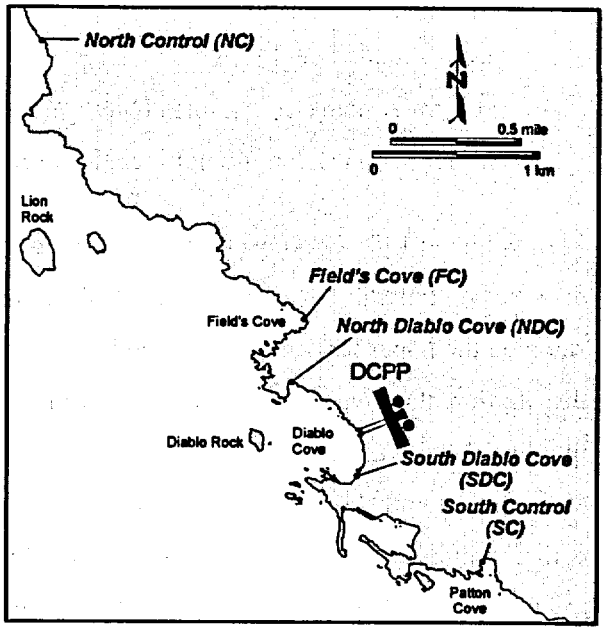


Figure B-1. Surfgrass monitoring stations.

Stations were established according to the sizes and locations of the surfgrass beds. Surfgrass was widespread and abundant at North Control, Field's Cove, and South Control. Consequently, many appropriate locations were available for positioning the new stations. Ultimately, they were positioned arbitrarily within these beds at the MLLW tidal elevation. In contrast, surfgrass in Diablo Cove occurred as two relatively small beds, one in North and one in South Diablo Cove. Each of these beds was small and the 30 m transect bisected the entire bed.

Surfgrass Cover, Associated Algae, and Substrata

Percent cover was estimated separately for surfgrass, algae, and bare substrata using ten 1 m^2 quadrats randomly placed along each station transect. The quadrat was a 1 m^2 plastic frame subdivided by strings into sixteen $^1/_{16}$ m^2 (0.062 m^2) sub-quadrats. These sub-quadrats were further segregated into nine equal parts by eye for the determination of surfgrass and algae cover and amount of bare substratum. Taxa found in <1 of a ninth sub-unit in each sub-quadrat were recorded as present (+) with this symbol treated as 0.01% cover for analysis.

Overstory species were estimated first and then moved aside to allow estimates of the understory and crustose species and substrata. Total plant cover plus bare substrate cover per quadrat often exceeded 100% due to the layering of multiple taxa. Areas under overhanging rocks were not

sampled and rocks were not overturned. Vertical substratum relief in a quadrat was usually less than 0.25 m.

Blade Density and Length

Blades of surfgrass were counted in ten 0.062 m^2 quadrats randomly placed along each transect. Within each of the random 1 m^2 quadrats sampled for surfgrass cover, the position of a single 0.062 m^2 sub-quadrat was randomly selected and sampled for surfgrass blade counts. Typically, several blades arise from a common sheath at the rhizome base. However, the 100s-1000s of individual blades arising from the sheaths in each sub-quadrat were difficult to count. Instead, individual sheaths in all sub-quadrats were counted as a representation of blade densities per 0.062 m^2.

Fifty individual surfgrass blades at each station were measured and their blade lengths were recorded. In each of the ten 1 m^2 quadrats, five sheaths were picked according to five random X–Y loci using equal divisions on the quadrat frame to form a grid. The surfgrass sheath closest to the random loci was selected, and the longest blade arising from the sheath was measured for length to the nearest centimeter.

Vertical Distribution and Spatial Extent of Surfgrass Beds

The distribution of surfgrass at its upper tidal elevation immediately onshore of each station was surveyed using a transit and stadia rod. Points of known elevation were used for reference. At least five locations, separated by 5-10 m, along the upper fringe of surfgrass were surveyed to determine the magnitude of variation in the upper limit of surfgrass distribution.

Lower vertical limits of surfgrass relative to MLLW were measured for the Diablo Cove surfgrass beds, but could not be measured at other stations. The lower distribution limit of surfgrass in the two Diablo Cove beds was nearly exposed at MLLW, and could be measured using the transit and stadia rod. However, the lower distribution limits of surfgrasses at stations outside Diablo Cove extended into the subtidal and were not measured.

Similar to the lower elevations of surfgrass beds, the area coverage of the surfgrass beds was determined inside Diablo Cove, but could not be delineated for beds outside of the cove. The area coverage of the two Diablo Cove surfgrass beds was recorded by walking the perimeter of

each bed with a hand-held global positioning system (GPS) unit. The data was downloaded to a geographic information system (GIS) database for mapping and calculating area cover. The dimensions of the beds at the stations outside Diablo Cove were not delineated because they constituted continuous beds extending up and down coast, as well as offshore into subtidal zones.

Macroinvertebrate Composition

Invertebrates associated with surfgrass beds were identified and enumerated in five 0.25 m^2 quadrats randomly placed along each transect. The study plan (**Attachment B-1**) specified that each quadrat sample have surfgrass covering at least 75% of the 0.25 m^2 quadrat area; otherwise an alternate location should be sampled. In practice, many locations did not meet this minimum standard. As a result, all quadrats sampled had at least 50% surfgrass rhizome or blade cover. Only the motile invertebrates associated with the rhizomes or blades of surfgrass were counted. Percent cover of encrusting and attached invertebrates (e.g., sponges, tunicates, and tube dwelling organisms) was estimated for each 0.25 m^2 quadrat.

Results

Surfgrass Cover, Associated Algae, and Substrata

Two species of surfgrasses that are similar in appearance occur in the study area. *Phyllospadix scouleri* is the most abundant, but small patches and a few blades of *P. torreyi* were also sampled in the study. These species can be difficult to distinguish from one another when not reproductive. The data for both species were pooled and treated as a single taxon (*P. scouleri*) for analyses.

Surfgrass was the most abundant plant taxon across all stations (**Table B-1**). The understory algae occurring beneath the blades of surfgrass were sparse at North Control (NC) and Diablo Cove stations (NDC and SDC), although species richness was relatively high at station NDC. In contrast, understory algal species were relatively abundant at the Field's Cove (FC) and South Control (SC) stations; these stations also had greater rock relief. Stations with the lowest substratum relief (NC and SDC) had the fewest understory algal species (**Table B-1**). The occurrence of the brown kelp, *Sargassum muticum*, was unique to Station SDC. This species experienced increased abundance in Diablo Cove after power plant start-up (Tenera 1999b).

Most algal species identified from surfgrass beds were not specific to these habitats, but there were exceptions. *Smithora naiadum*, a small red bladed species, and *M. mediocris*, a crustose coralline species, occur only on surfgrass blades and were encountered in the surfgrass beds sampled. Station NC had the highest abundance of *S. naiadum* on surfgrass.

A large number of juvenile surfgrass plants was observed near Station SC in January 2000 during an unrelated intertidal study (horizontal band transect sampling). As many as 200 small surfgrass recruits/m^2 were found germinating from seeds anchored in mats of *Gastroclonium subarticulatum*. The blades of the new recruits were 2-3 cm long. A few recruits were also found near the NC Station while no seeds or recruits were observed in North Diablo Cove. No plants in reproductive condition (i.e., flowering) were observed in any of the areas (North and South Control, Field's Cove, Diablo Cove).

Table B-1. Mean percent cover of plant taxa and bare substrata at the five surfgrass stations during November-December 1999.

	NC	FC	NDC	SDC	SC
Magnoliophyta					
Phyllospadix scouleri (blades)	90.3	61.3	71.7	63.1	52.2
Phyllospadix scouleri (rhizomes)	35.0	27.8	31.0	20.1	27.0
Chlorophyta					
Cladophora spp.		0.1	<0.1		<0.1
Ulva Entermorpha spp. (epiphyte)		0.4	0.7		0.3
Ulva Enteromorpha spp.			0.3		
Phaeophyta					
Cystoseira osmundacea					<0.1
Egregia menziesii (frond)	4.6				
Egregia menziesii (holdfast)				0.1	0.1
Laminaria setchellii					0.3
Sargassum muticum				0.7	
Rhodophyta					
Calliarthron Bossiella spp	<0.1	0.1	0.7		1.2
Callithamnion Pleonosporium spp.					<0.1
Callophyllus spp.	0.1		0.2		
Chondracanthus canaliculatus	0.1	0.1	0.6	<0.1	6.3
Chondracanthus exasp. corymb.	0.1		1.3		2.8
Chondracanthus harveyanus			0.1		
Chondracanthus leptophyllus			<0.1		
Chondria decipiens		<0.1			
Colpomenia spp.				<0.1	
Corallina officinalis			<0.1	<0.1	0.6
Corallina vancouveriensis			0.1	0.6	0.1
coralline crust	2.8	0.8	0.6	1.5	8.2
Cryptopleura ruprechtiana		<0.1			1.3
Cryptopleura violacea	<0.1	0.1	<0.1	<0.1	0.7
Cryptosiphonia woodii		<0.1			
Endocladia muricata		<0.1			
Gastroclonium subarticulatum	1.2	17.4	2.8	<0.1	9.6
Gelidium coulteri	0.3	<0.1		<0.1	
Gelidium pusillum			<0.1		
juvenile articulated coralline algae				<0.1	0.1
Mastocarpus papillatus	0.7	0.3	0.1		0.2
Mazzaella affinis		<0.1	<0.1	<0.1	0.2
Mazzaella flaccida	0.3	<0.1			3.3
Mazzaella heterocarpa	<0.1	<0.1	<0.1	<0.1	<0.1
Mazzaella lilacina	0.3				2.6
Melobesia mediocris (epiphyte)	0.3	<0.1	0.1	0.1	<0.1
Microcladia coulteri		<0.1			
Nienburgia andersoniana			<0.1		
non-coralline crust	0.6	5.1	2.0	10.3	4.1
Osmundea spectabilis		<0.1	0.2		0.1
Pikea californica			0.1		
Polysiphonia spp				0.1	
Prionitis lanceolata	0.2	3.5	0.1	1.9	3.3
Prionitis lyalli	0.1				
Pterosiphonia dendroidea			1.0	0.1	
Rhodymenia spp	0.1		<0.1		
Sarcodiotheca gaudichaudii	<0.1	0.1	<0.1		0.3
Smithora naiadum (epiphyte)	5.9	0.1	0.5		<0.1
Substrata					
bare rock	4.9	10.8	2.7	8.7	18.0
bare cobble	4.3	6.9	5.8	3.6	9.9
sand	0.3	0.4	14.7	1.1	12.8
trapped sand	23.1	11.3	34.4	18.5	5.0
UNDERSTORY ALGAE PERCENT COVER	3.5	21.7	7.5	2.7	32.9
SPECIES RICHNESS (mean / m^2)	8.6	12.4	11.4	6.2	16.0

Long-term changes in surfgrass cover have been monitored at the TEMP horizontal band transect (HBT) stations (**Figure B-2**). The results from the HBT studies show that surfgrass has maintained, and in some cases increased, its relative abundance in areas unaffected by DCPP's thermal plume (**Figure B-2**). Concurrently, surfgrass has been more variable in abundance in Diablo Cove. Surfgrass increased in North Diablo Cove in the 1970s then decreased from storms during the 1983 El Niño, but the decline during the El Niño in North Diablo Cove was not as large as in South Diablo Cove. Surfgrass at North Control HBT transects were not as affected by the El Niño. Surfgrass abundance at the

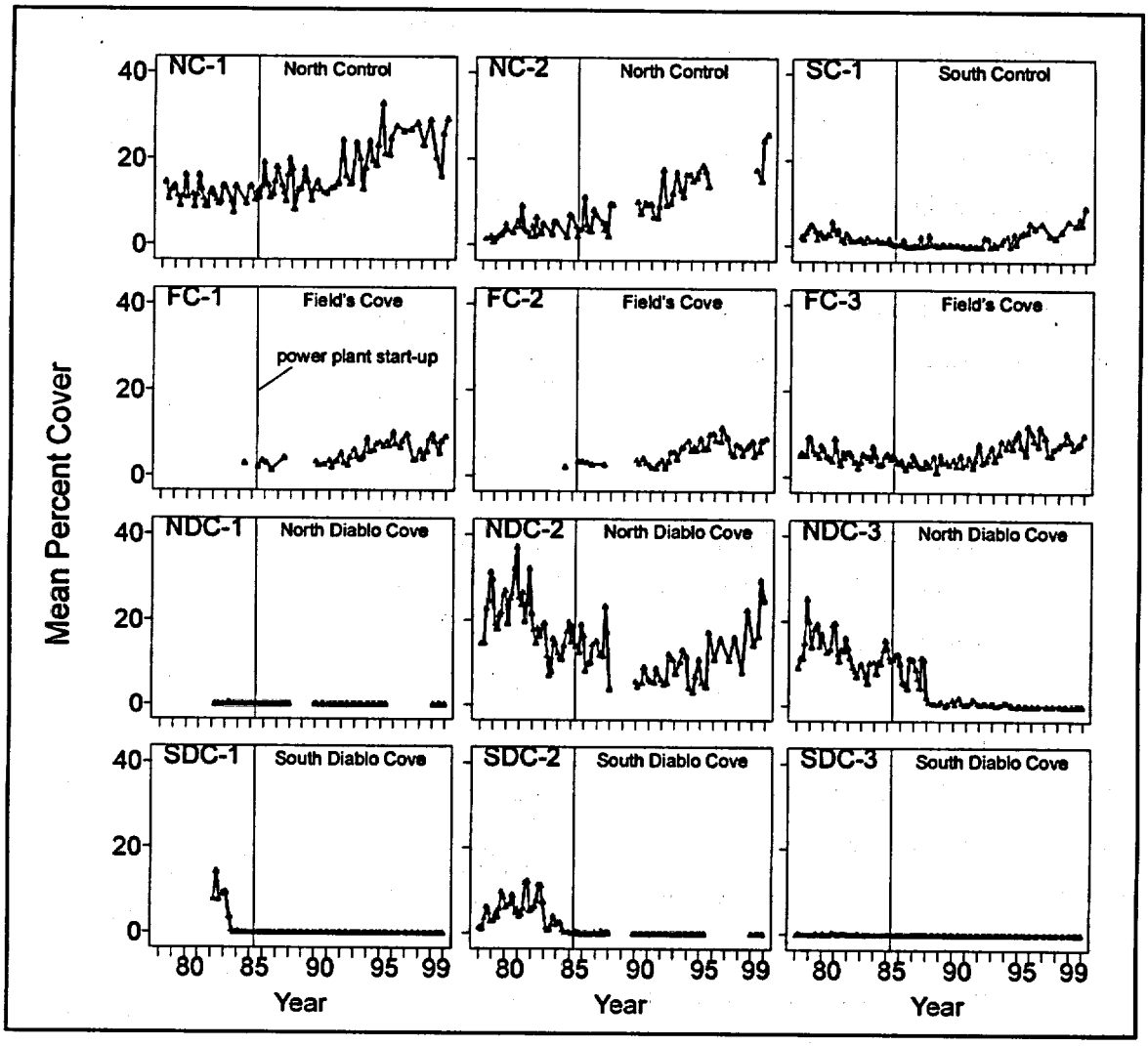


Figure B-2. Abundance of surfgrass at the +0.3 m MLLW horizontal band transects.

South Diablo Cove HBT stations fell to zero in 1983 and has remained at that level. Although some surfgrass remained in North Diablo Cove upon power plant start-up, a notable decline occurred again in 1987-88. Since then, surfgrass has not reoccurred at Station NDC-3, but recovery has occurred at NDC-2 to levels close to pre-operational abundances (**Figure B-2**).

Blade Density and Length

Blade density and blade length (**Figure B-3**) showed the same patterns at the stations established for this study. Station SDC had the lowest density of blades and shortest blades per 0.062 m^2.

Vertical Distribution and Spatial Extent of Surfgrass Beds

The two surfgrass beds in Diablo Cove had limited vertical distribution in comparison to the stations outside the cove (**Figure B-4**). The vertical extent of the surfgrass beds at Stations NDC and SDC was confined to the intertidal zone around the MLLW tide mark. The upper and lower elevations of the surfgrass beds outside the cove were considerably greater with the lower limit extending into the subtidal to depths of approximately 3-4 m (10-15 ft) below MLLW.

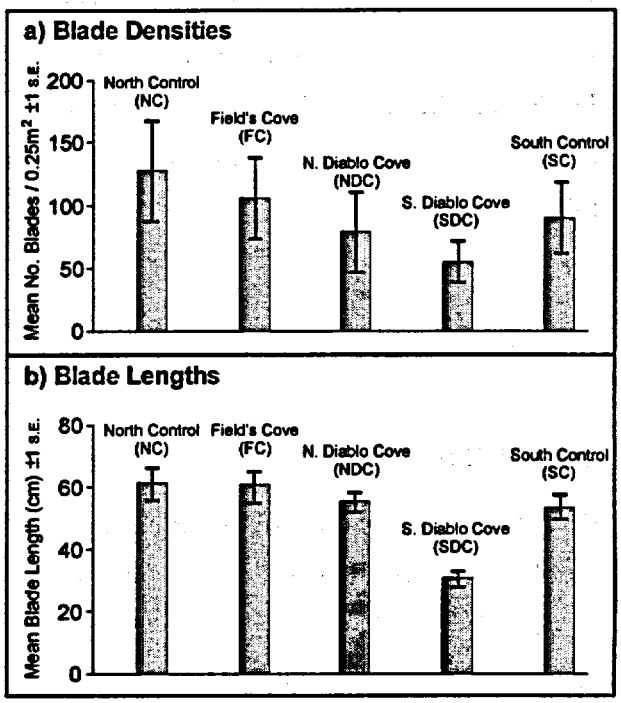


Figure B-3. Surfgrass blade density and length.

The size of the surfgrass bed at Station NDC was approximately 525 m^2 and the bed at Station SDC was 117 m^2. The sizes of surfgrass beds sampled outside Diablo Cove were not delineated since they occurred as part of nearly continuous band along the shoreline that extended into the subtidal.

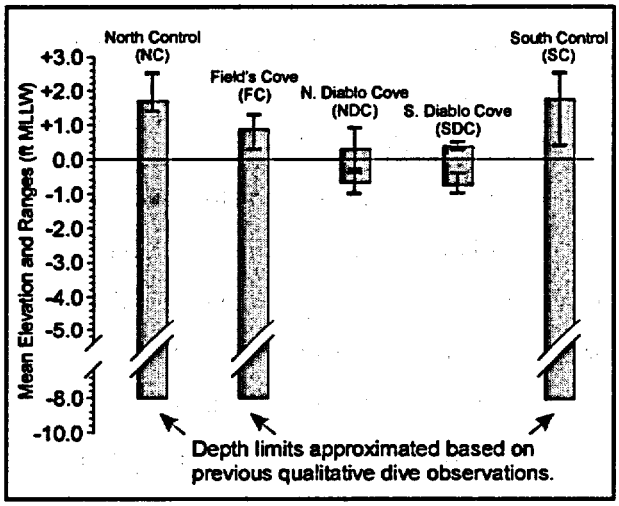


Figure B-4. Surfgrass tidal elevation distribution (mean and ranges of upper and lower limits; ft MLLW). Note that the lower limits of surfgrass extended into the subtidal at NC, FC, and SC and could not be measured using a transit and stadia rod.

Macroinvertebrate Composition

Abundance data for the invertebrates associated with the rhizomes and blades of surfgrass were summarized as mean density across quadrats within a station regardless of surfgrass cover (**Table B-2**). Invertebrate assemblages were characterized by the herbivorous snail *Lacuna* spp., the tube worm *Pista* spp., and hermit crabs (*Pagurus* spp.). The lowest species richness and abundance of invertebrates occurred at the two Diablo Cove stations. For example,

Lacuna spp., abundant elsewhere, was found in relatively low abundance at Station SDC. In addition, the limpet (*Tectura palacea*), an obligate on surfgrass blades, was absent at this station.

Table B-2. Abundance of invertebrate taxa at the five surfgrass stations during November-December 1999.

Mean Counts	NC	FC	NDC	SDC	SC
Acanthina spirata				0.2	
Acmea mitra					0.2
Alia carinata	0.8				2.2
Alia spp.	0.2				0.8
Amphissa colombina	0.4				
Amphissa spp.		0.2			
Anthopleura elegantissima		0.2	0.6		
Aphrodita spp.	0.2				
Bittium spp.	2.0	0.2			
Calliostoma spp. (juv)					0.4
Callistoma ligatum	0.2				1.0
Cancer spp. (juv)		0.8			
Clavelina huntsmani	1.0	0.2	0.6		2.2
Crepidula spp.					1.0
Diodora aspera					0.2
Diopatra ornata					0.6
Epiactis prolifica					0.2
Epilucina californica				0.2	
Fissurella volcano	0.2	0.4			
Henrecia leviuscula					1.0
Hermissenda crassicornis					0.2
Homolopoma luridum	0.2	0.4			
Homolopoma spp.					1.2
Idotea spp.	0.4				
Lacuna spp.	51.0	97.4	50.2	17.8	237.2
Lacuna spp. (egg mass)	+	+	+		+
Leptasterias spp.					1.4
Lophophanopeus spp.					0.2
Mitra idea	0.4				
Nereidae	0.2				
Ocenebra interfossa	0.2				0.4
Ophioroidea	1.6				
Ophiothrix spiculata			0.2		
Pagurus spp.	10.0	6.2	3.2	2.6	3.4
Phidiana hiltoni		0.4			
Photis conchicola	0.2				
Pisaster Henrecia spp. (juv)	0.2				0.6
Pseudomelatoma torosa		0.2			1.6
Pugettia producta	0.2		0.6		1.2
Pugettia richii			0.2		0.4
Salmacina tribranchiata					0.6
Scyra acutifrons					0.2
Spirobranchus spinosus					0.2
Strongylocentrotus franciscanus		0.4			
Strongylocentrotus purpuratus	0.2				
Styela montereyensis.					0.4
Tectura paleacea	2.4	1.4	5.0		7.6
Tegula brunnea	1.4	1.0	0.6		0.6
Tegula funebralis	0.2	0.6	2.2	7.6	0.2
Tonicella lineata					0.2
Tricolia spp.	4.0	3.6	0.2	0.8	1.0
Mean Percent Cover					
C/S tunicates	2.0	<0.1	<0.1		1.2
encrusting bryozoan	0.4				0.2
encrusting sponge					0.6
Leucosolenia elenor	<0.1				
Phragmatopoma californica		<0.1			<0.1
Pista spp.	48.0	60.0	35.0	56.0	<0.1
Spirorbidae	<0.1	<0.1	<0.1		<0.1
SPECIES RICHNESS (MEAN)	14.4	10.8	7.8	4.4	17.6

Discussion

Surfgrass

Reductions in surfgrass cover occurred in Diablo Cove during the 1983 El Niño storms and in 1988 after the power plant had been operating for two years. Surfgrass in Diablo Cove was reduced to two relatively small intertidal beds with a markedly smaller subtidal component. Before power plant start-up, dense stands of surfgrass occurred in other areas of Diablo Cove and to depths of approximately –2 m to –3 m below MLLW (Tenera 1998). Since its decline in Diablo Cove, surfgrass abundance in the intertidal zone of North Diablo Cove has slowly increased to levels approaching pre-operation levels of cover. Much of the increase occurred during the 1997-98 El Niño, demonstrating the tolerance of surfgrass to warm water. However, surfgrass cover has not increased in other areas of Diablo Cove.

Two of the most severe ocean warming events occurred during studies conducted at Diablo Canyon; the 1983 and 1997 El Niños were the most severe ocean warming events recorded this century (Holbrook et al. 1997, Lynn et al. 1998). Although both events resulted in significantly warmer seawater temperatures, the 1983 event was also characterized by extremely severe storms (Tenera, personal observations). Storm effects of the 1983 El Niño contributed to the largest declines in surfgrass before power plant start-up.

The amount of variation that occurred at the HBT stations in both the pre-operation and operation study periods was different among areas. Changes before power plant start-up at Diablo Cove HBT stations were much greater than the changes at control stations (**Figure B-2**). (There was too few data collected at the Field's Cove stations prior to power plant start-up for pre-operation comparisons to Field's Cove stations.) Since 1990, the trend of increasing abundance at HBT station NDC-2 in North Diablo Cove has corresponded to increases observed at HBT stations in Field's Cove and control areas. In contrast to Station NDC-2, there has been no indication of recovery in South Diablo Cove. The different abundance patterns in Diablo Cove observed mainly before power plant start-up relative to other areas sampled may indicate that surfgrass in Diablo Cove is subject to a greater range of normal variation.

Natural differences related to site selection may account for the fewer and shorter blades found in the surfgrass beds in Diablo Cove, particularly in South Diablo Cove, compared to control areas. For example, surfgrass in South Diablo Cove may be prone to greater blade losses from natural desiccation, bleaching, and erosion, compared to the other areas studied. These differences could also result from small natural environmental differences, such as wave and sun exposure, among other factors, that were not apparent when the station locations were chosen.

The thermal tolerance of surfgrass is demonstrated by its continued presence in the warmest water areas of Diablo Cove. However, the spatial extent and condition of the surfgrass in Diablo Cove may indicate that other aspects of the cove (e.g., competitive species, space availability) may hinder increases in surfgrass beds. In addition, the lower density and shorter blade lengths of plants at the SDC station are likely to produce fewer seeds, limiting potential for recruitment and recovery.

Results showed that surfgrass cover, blade density, and condition at the Field's Cove station were similar to control stations. Previous analyses of HBT data showed discharge effects on surfgrass at the Field's Cove HBT stations (Tenera 1997, 1999b). However, the time series graphs of surfgrass abundance show that similar trends occurred among the control and Field's Cove HBT stations (**Figure B-2**). Increases occurred after power plant start-up at the Field's Cove and control stations, but the rates of increases were found to be statistically different between HBT stations in Field's Cove and control areas (Tenera 1997, 1999b). Although abundances generally doubled at all of the stations, the larger relative increases at the North Control HBT stations were probably due to the greater abundance of surfgrass at those stations.

A log transformation of the data would have corrected for these differences, and analysis of those data may have resulted in a different finding. The fact that surfgrass increased in absolute abundance at the Field's Cove HBT stations indicates that conditions were favorable for recruitment and growth of rhizomes and blades.

Associated Algae and Invertebrates

Differences among stations in understory algal abundance and composition were related to substratum relief, as opposed to location or distance from the discharge. Stations with higher vertical rock relief (stations FC and SC) had greater abundance of algae, due to algae occupying the sides of rocks, cobbles, and tidepools where surfgrass rhizomes were absent. The lowest relief stations (NC and SDC) had the lowest abundance of algae, presumably due to the coverage of surfgrass rhizomes, dense tube worms (*Pista* spp.), and layers of sand trapped by the rhizomes preempting space for the establishment of understory algae.

Sampling for invertebrates may need to be altered to include the entire quadrat area, rather than only the rhizomes and blades in the quadrats. In practice, it was found that rhizome cover could not always be easily determined because of sand burial. Consequently, it was difficult to determine whether certain invertebrates occurred nestled between or on top of the rhizomes. In addition, blade cover was often not representative of the amount of actual surfgrass habitat present because density of the surfgrass varied among stations. For example, the same amount of cover in surfgrass could be formed by 100 blades or 500 blades. Using the entire quadrat area introduces other sources of variation into the data since limpets, barnacles, and anemones that occur on only the bare or smooth surfaces of rocks would be sampled. While these species would be recorded, they may not be associated with surfgrass.

Some clear patterns were evident in the invertebrate data. The limpet (*Tectura palacea*) that is obligate on surfgrass blades was absent from Station SDC and common elsewhere. The low density of surfgrass and condition of the blades at this station may limit its use by this limpet. Other differences among the invertebrates may be associated with the amounts of surfgrass and algae habitat in the quadrats. For example, the low abundance of the small snail (*Lacuna* spp.) at the South Diablo Cove station may have been related to the low density of surfgrass and algae in the quadrats.

Spatial differences in invertebrate assemblages between stations may also be related to exposure to increased temperature in Diablo Cove. Species richness was greater at the North Diablo Cove station compared to the South Diablo Cove station. The density and length of the blades in the surfgrass beds in north Diablo Cove are more similar to control areas and therefore may support a richer invertebrate assemblage.

Conclusions

The following conclusions can be drawn from the results of this study:

- Remaining patches of surfgrass in South Diablo Cove were characterized by fewer and shorter blades than in other areas studied. This, in combination with the reduced size of the surfgrass bed in South Diablo Cove, may inhibit recovery due to low seed production.
- Surfgrass in a small intertidal portion of North Diablo Cove is recovering.
- Recovery is not evident in other intertidal areas of Diablo Cove or in the subtidal.
- Invertebrate species richness was lower in Diablo Cove than outside the cove.
- Surfgrass in Field's Cove is similar in abundance and condition to beds in control areas.
- The occurrence of associated understory algae appeared related to differences in rock relief among the stations and not to surfgrass cover.

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Attachment B-1

Submitted: December 1999

Document No. E9-029.1

Study Plan: Effects of the DCPP Discharge on Surfgrass (*Phyllospadix*)

Background

Surfgrass occurs in the zone between the low intertidal (about +0.3 m MLLW) and the shallow subtidal (about -3m MLLW). Previous findings on surfgrass from quantitative sampling and qualitative observations (Tenera 1997, 1998) include:

- The spatial extent of surfgrass in Diablo Cove was reduced prior to power plant start-up from storm effects during the 1983 El Niño. The nearly continuous band of surfgrass around Diablo Cove was reduced to about 20% of pre-storm abundance leaving two relatively small beds in north and south Diablo Cove. Recovery has not occurred during power plant operation. Surfgrass was also reduced by storm effects outside Diablo Cove, but recovery has occurred in these areas.
- The surfgrass in Diablo Cove decreased at the upper and lower margins of the surfgrass beds.
- The two remaining surfgrass beds in Diablo Cove consist of numerous patches of surfgrass. The spatial extent (outer boundaries) of the patches forming each bed has not changed substantially since 1983.
- Individual surfgrass plants in Diablo Cove are shorter and are colonized by more epiphytes than plants outside the cove.

Based on these findings, Pacific Gas and Electric Company, the Regional Water Quality Control Board, and its consultants concluded that:

- The remaining surfgrass beds in north and south Diablo Cove are not adequately sampled in the Receiving Water Monitoring Program (RWMP). The upper margin of one of the remaining surfgrass beds in north Diablo Cove occurs across the station at +0.3 m MLLW tidal elevation.

- Any additional sampling for surfgrass in Diablo Cove should be done at the MLLW tide level where surfgrass is most abundant.
- There are no data on associated macroinvertebrate community in surfgrass beds contacted and not contacted by the discharge plume.

A previous study plan was submitted to the Regional Board staff and their consultants for review and comment. The focus of the sampling proposed in the previous study plan was obtaining a better estimate of the areal coverage of surfgrass affected by the power plant discharge. This study plan focuses on monitoring changes in surfgrass. This shift in focus for the study was based on written comments received from the Regional Board staff and their consultants and discussions with them held at a meeting at the Moss Landing Marine Laboratories on September 24, 1999.

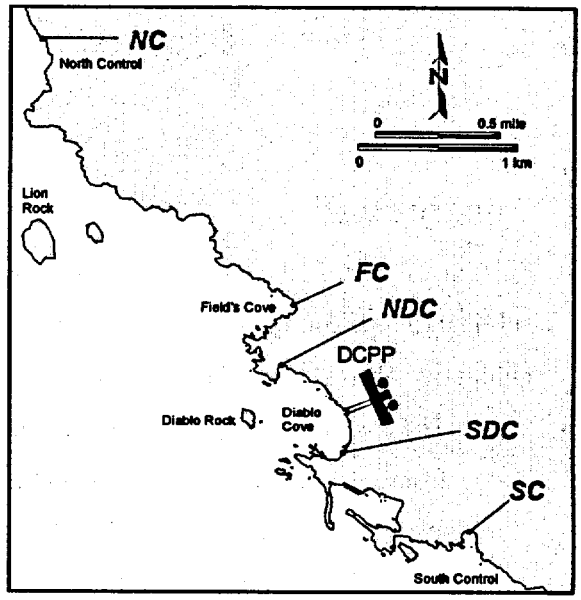


Figure 1. Planned surfgrass monitoring stations.

Purpose

The purpose of this proposed surfgrass study is to:

- Determine the effects of the discharge on the remaining surfgrass beds in Diablo Cove.
- Determine if there is a difference between the surfgrass macroinvertebrate communities in areas contacted and not contacted by the discharge plume.
- Determine if there are differences in the vertical distribution of surfgrass between areas contacted and not contacted by the discharge plume.

Sampling Methods

The proposed monitoring stations are shown in **Figure 1**. The areas are similar in wave exposure, substrate composition, and shoreline slope although the north control station is more exposed to wave surge than the other four. The stations will be established at the 0.0 m MLLW tidal elevation. Intertidal sampling will be completed during the lowest tides of the year when the areas are exposed. Diving will be conducted to determine the subtidal extent of surfgrass distribution.

Abundance Estimates

This study will obtain percent coverage data from 10-1 m^2 quadrats sampled annually at each station.

- A fixed 30 m long transect at the 0.0 m MLLW tide level (**Figure 2**) will be established at each of the five stations shown in **Figure 1**.
- Ten-1 m^2 quadrats randomly chosen each survey will be sampled along each transect per survey.
- The percent cover of surfgrass and epiphytes will be estimated as they lay naturally over the rocks (regardless of attachment within or outside the quadrat frame).
- The reproductive status of surfgrass in the quadrats will be recorded.

Blade densities

Blade densities may change without a resulting change in percentage cover, due to overlap of multiple blades. This study will obtain blade density data from 10-0.062 m^2 (25 cm x 25 cm) subquadrats annually at each station.

- Each 1 m^2 fixed quadrat will be divided into 16-0.062 m^2subquadrats (**Figure 2**).
- A single subquadrat within each of the 10-1 m^2 quadrats will be randomly chosen during each survey within which all surfgrass blades will be counted (**Figure 2**).

Blade lengths

This study will provide 50 blade length measurements per station annually.

- The lengths of 5 randomly chosen surfgrass blades within each of the 10-1 m^2 quadrats will be measured to the nearest centimeter.
- The blades will be chosen by using X-Y coordinates in each 1 m^2 quadrat randomly chosen each survey (**Figure 3**). The blade whose attachment is closest to each random coordinate will be measured.

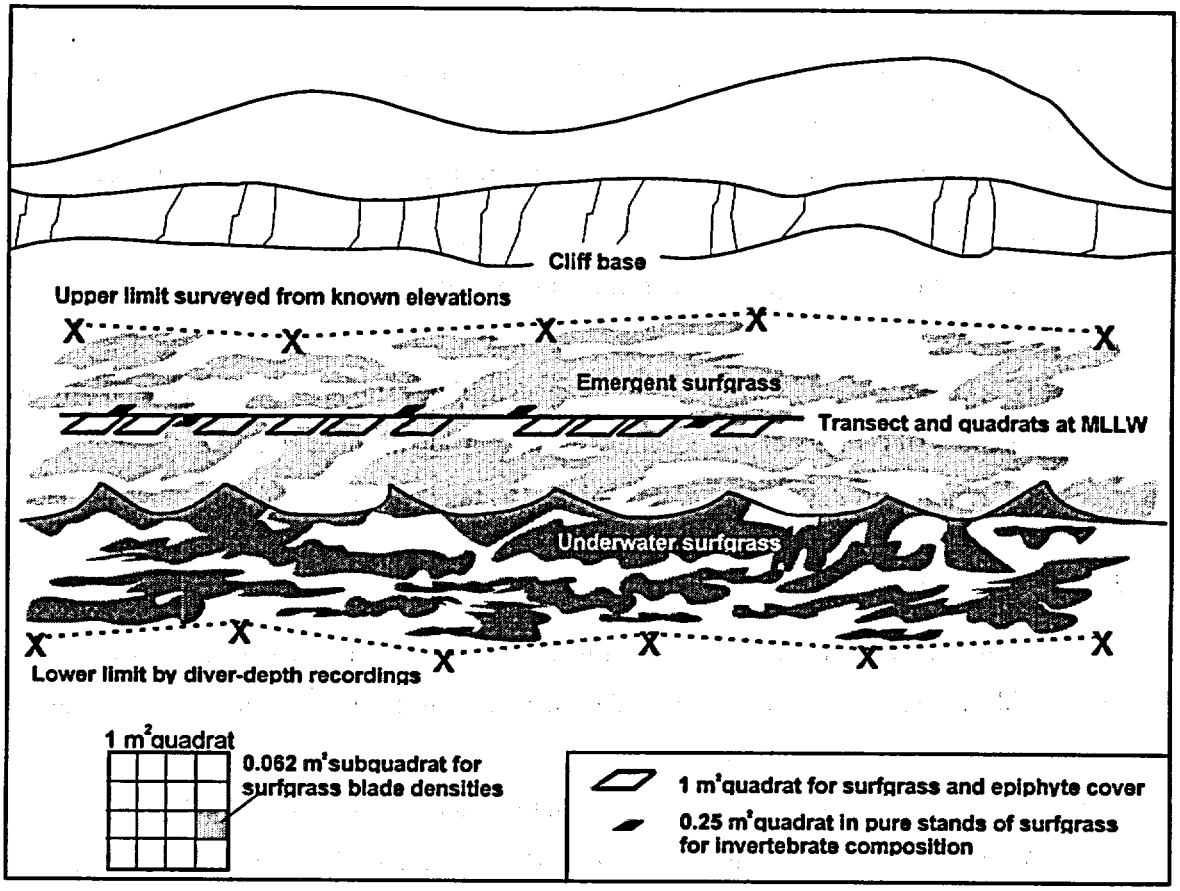


Figure 2. Station layout at low tide and sampling methods.

Vertical distribution

The vertical distribution of surfgrass outside Diablo Cove is broader than within the cove. The vertical ranges of surfgrass will be surveyed inside and outside Diablo Cove (**Figure 2**).

- The depth limit of surfgrass at each transect station will be delineated by diver observations.
- The upper elevation of surfgrass at each transect station will be determined from surveyed elevations at intervals along the upper fringe of the surfgrass bed.

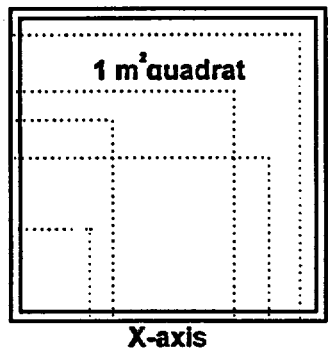


Figure 3. Example random coordinates for selecting blades for length measurements.

Bed sizes in Diablo Cove

Two separate surfgrass beds presently occur in Diablo Cove, one in the north and one in the south. These beds are largely confined to the intertidal. The spatial extent (outer boundary of the patches) of these two surfgrass beds in Diablo Cove will be surveyed.

- The overall size of each surfgrass bed will be delineated during low tide using a global positioning system (GPS).
- The boundaries will be analyzed using a geographic information system (GIS) to determine overall bed sizes and locations.

Macroinvertebrate composition

Surfgrass provides important habitat for invertebrates. Sampling will be done to determine if the surfgrass beds in Diablo Cove have a different assemblage of invertebrates than surfgrass beds outside the cove.

- Five-0.25 m^2 quadrats will be randomly sampled in "pure stands" of surfgrass (**Figure 2**). A "pure stand" will be defined as a quadrat with at least 75 % cover of surfgrass.
- Counts of all macroinvertebrates (greater than 1 cm in greatest dimension) will be made in each 0.25 m^2 quadrat.
- A different set of random quadrats will be sampled each survey. Surveys will be done annually.

Literature Cited

Tenera, Inc. 1997. Thermal effects monitoring program, analysis report: Chapter 1 - Changes in the marine environment resulting from the Diablo Canyon Power Plant discharge. Prepared for Pacific Gas and Electric Company, San Francisco, CA.

Tenera, Inc. 1998. Surfgrass (*Phyllospadix*) in the vicinity of the Diablo Canyon Power Plant discharge. Prepared for Pacific Gas and Electric Company, San Francisco, CA.

Appendix C

Effects of DCPP Discharge on Bull Kelp (*Nereocystis*): 1999 Results

EFFECTS OF THE DCPP DISCHARGE ON BULL KELP (NEREOCYSTIS): RESULTS OF THE 1999 SURVEY

Summary

Quantitative sampling was conducted to describe the magnitude, timing, and spatial extent of early senescence in the bull kelp population during 1999 as a function of decreasing temperature associated with increasing distance from the DCPP discharge structure. The study was designed following qualitative observations in previous years that indicated that bull kelp in the vicinity of Diablo Cove senesced prematurely (Tenera 1997, 1999a). Data for the present study were collected once per month from July through December 1999 along surface and underwater transects located at various distances from the discharge structure.

The annual decline in bull kelp forests outside the influence of the DCPP thermal plume occurred mainly in the latter part of February 2000, at the beginning of the storm season. We assumed, then, that February represented the typical (control) time of demise of the 1999 bull kelp population along the central coast of California. In contrast, much of the 1999 bull kelp population within Diablo Cove had senesced by July 1999, and observations showed that no bull kelp plants reached the sea surface. By September 1999, nearly all bull kelp plants in Diablo Cove were gone. Thus, the loss of the 1999 bull kelp population inside Diablo Cove occurred approximately five months prior to the disappearance of bull kelp in areas outside of the influence of the DCPP thermal plume. However, this time disparity would have been less (ca. three months) if winter storms had occurred in December, a typical first month of the winter storm season.

Individual bull kelp showing signs of early senescence were also present outside Diablo Cove in areas contacted by the discharge (i.e., near North Diablo Point, South Diablo Point, and offshore of Diablo Rock, and in Field's Cove). However, bull kelp at these locations co-occurred with healthy kelp plants. Unlike Diablo Cove, the early senescence observed at these far-field locations did not result in all bull kelp plants detaching from the bottom prior to February 2000.

The spatial extent of early senescence in 1999 was considerably less than the maximum extent observed in 1987. In 1987, early senescence of bull kelp was observed as far northward as Lion Rock, while in 1999, this phenomenon was observed only as far northward as Field's Cove. The

1987 spatial extent was the result of higher discharge temperatures associated with the warmer ambient water temperatures during the 1987 El Niño. The smaller area of effect in 1999 was similar to that observed in most other non-El Niño years. Additionally, dense forests of giant kelp (*Macrocystis pyrifera*) in the northern part of Diablo Cove in 1999 may have redirected or decreased the momentum of the thermal plume exiting the northern channel of Diablo Cove. The shut down of Unit 2 for refueling during the present study, and the consequent lower discharge temperatures may have also contributed to a smaller spatial extent of effects in 1999, relative to 1987.

Introduction

Bull kelp (*Nereocystis luetkeana*) is a large annual alga that forms extensive kelp forests and surface canopies starting in the spring and extending into the fall (**Figure C-1**). Spores released from the mature, attached algae settle to the bottom and develop into microscopic gametophytes. The fertilized egg of each female gametophyte develops into a large bull kelp plant (sporophyte) in spring. Bull kelp sporophytes grow and mature from spring to fall, and most are later dislodged from the substratum during winter storms. From winter into the spring, bull kelp forests are generally not evident off the central coast. However, some individuals can live as long as 18 months, persisting through winter.

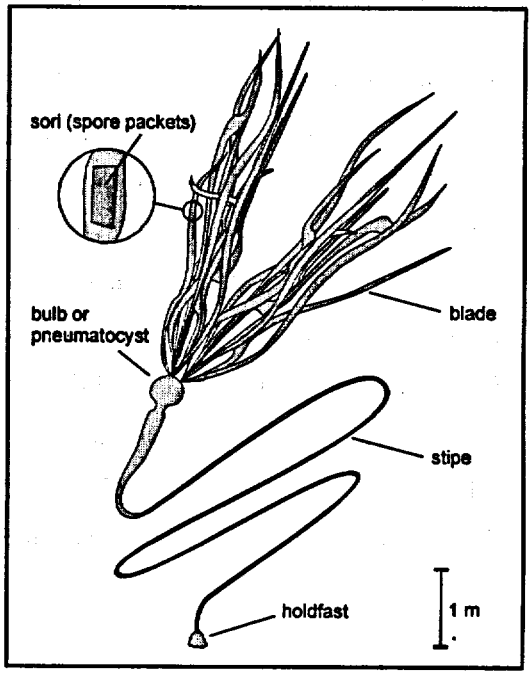


Figure C-1. Bull kelp (*Nereocystis luetkeana*).

Previous environmental monitoring in marine habitats around the Diablo Canyon Power Plant (DCPP) revealed a relationship between warm water from the thermal discharge and the deterioration of bull kelp blades (Tenera 1997, 1999a). This condition has been referred to as "early senescence" and describes a deterioration and consequent loss of blade tissue (**Figure C-2**). Blades begin deteriorating before or soon after reproductive structures (sori) develop on the blades, resulting in shorter blades with a tattered appearance. Eventually, the loss

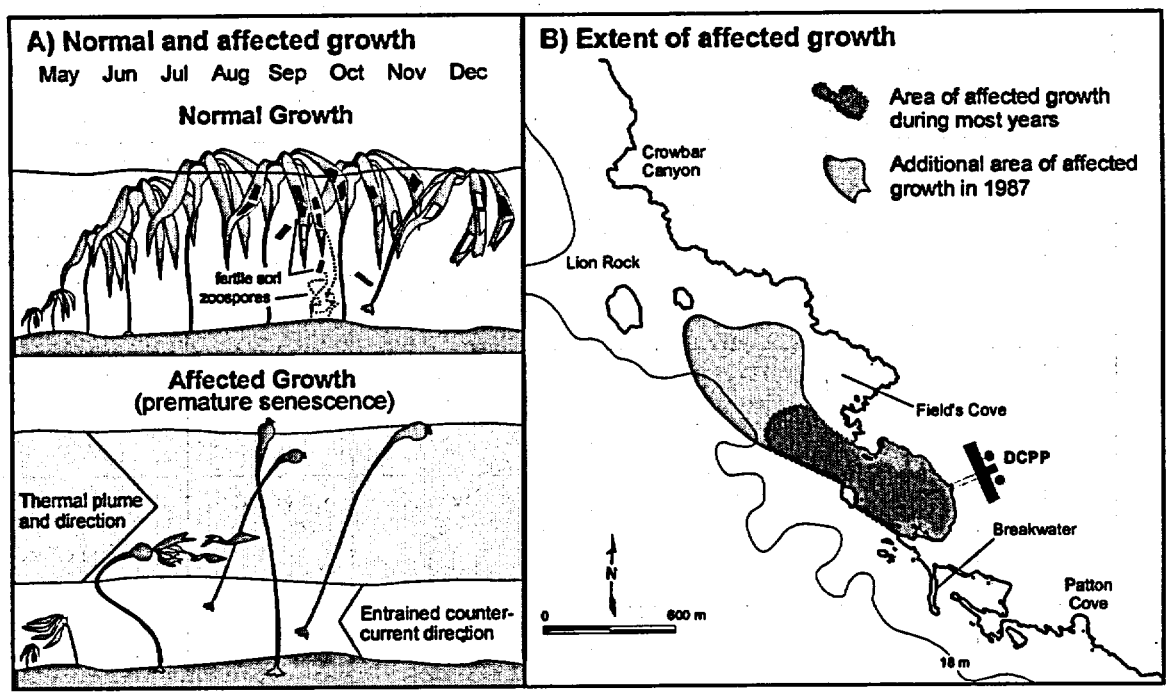


Figure C-2. Growth changes in bull kelp (from Tenera 1997).

of blades results in a bare bulb at the end of the stipe. Severely affected kelp plants can detach sooner from the bottom than do unaffected individuals when the holdfasts anchoring them to the rocks weaken. Early deterioration of fronds usually begins once the bull kelp individuals are near the sea surface, but previous monitoring observations showed that some juvenile and subadult bull kelp individuals in Diablo Cove deteriorated prior to reaching the sea surface.

The spatial extent of early senescent bull kelp has been approximated from qualitative observations (**Figure C-2**). Bull kelp forests not contacted by the thermal plume do not consist of an unusual number of individuals with characteristics of deteriorated blades and bare bulbs shown in **Table C-1**. Unaffected forests persist with long blades that have released the fertile sori packets. These forests then follow the normal annual life cycle of these algae and are detached from the bottom by winter storm waves.

Purpose

The purpose of this study is to describe the magnitude, timing, and spatial extent of early senescence in bull kelp as a function of temperature gradients associated with distance from the

Table C-1. Condition categories for bull kelp.

Original Condition Category	Revised Category for Analysis	Appearance	Description	Normal Period of Occurrence	Occurrence Near the Discharge Structure
1	A		Long blades.	Spring.	Most individuals do not reach the sea surface.
2	A		Long blades with fertile sori packets.	Summer and early fall.	May not occur in areas with persistent plume contact
3	A		Long blades with evidence of released sori packets.	Late summer through fall.	May not occur in areas with persistent plume contact
4	B		Short, tattered blades.	Not generally seen.	Spring-summer. Indicative of discharge effect.
5	C		Bare bulb, no blades.	Not generally seen.	Spring-summer. Indicative of discharge effect.

DCPP discharge structure. The present report describes the results from the 1999 sampling season.

Study Methods

A preliminary draft of the study plan developed in 1998 (Tenera and PG&E 1998) was submitted to the Central Coast Regional Water Quality Control Board ("the Board") and its consultants on July 15, 1999 for their review. Comments were received by Pacific Gas and Electric Company (PG&E) in a letter on August 16, 1999. Items highlighted in the letter were discussed with the Board and its consultants the following month. The final revised plan was submitted to the Board on October 22, 1999 (**Attachment C-1**).

Surface Bull Kelp Sampling

Data on surface bull kelp abundance and condition were obtained monthly (July–December 1999) by sampling stations spaced approximately 50 m apart along cruise transects (**Figure C-3**). The transects began at permanent buoys and were established using compass headings and land mark way points. Approximately 24 and 12 stations were sampled along Transects A-1 and A-2, respectively. Transect A-2 was established and first sampled in August 1999. Transects were

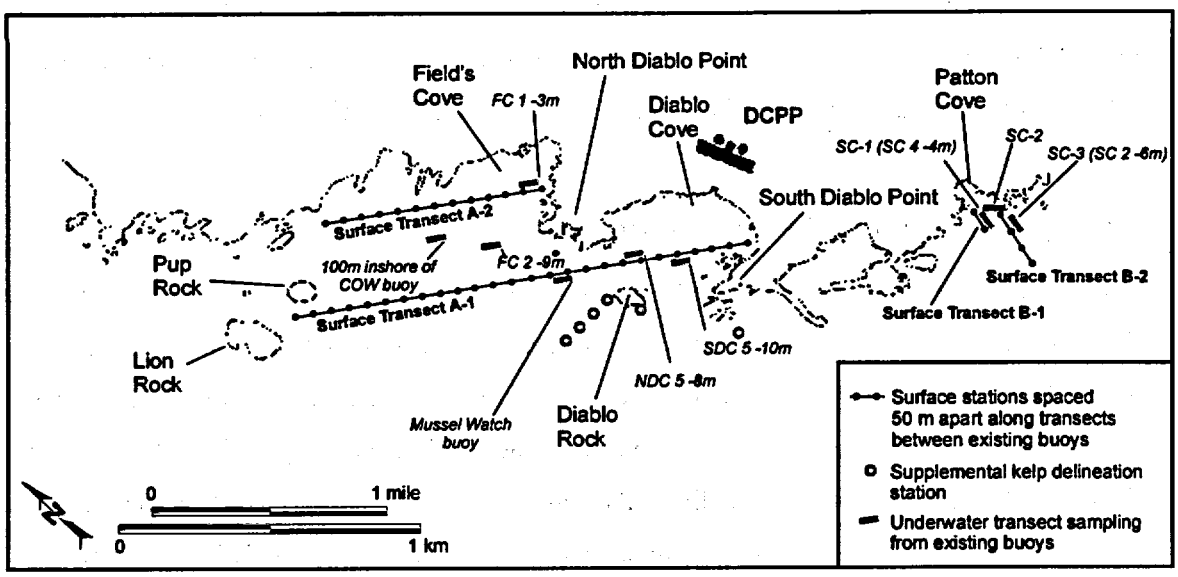


Figure C-3. Sampling stations and transects.

aligned to sample for gradient effects moving northward from Diablo Cove. Areas to the north of the discharge structure commonly contain bull kelp forests and have historically been the locations of observed early senescence (Tenera 1997). The offshore movement of the plume bypasses most areas south of South Diablo Point. Surface stations were also sampled in the South Control area of Patton Cove along compass courses from permanent buoys.

Two global positioning system (GPS) units were used to determine the sampling locations along each transect. One GPS unit allowed the boat operator to position the boat approximately every 50 m by monitoring the distance traveled along the transect relative to the starting point. A second, differential GPS unit was used to record the locations sampled with higher precision.

The number and condition of bull kelp in 4 m × 5 m plots of ocean surface on each side of the boat were recorded at each station. The sampling areas were approximated using the boat as a length reference. Counts were made according to condition categories (**Table C-1**) and sampling times were recorded. Surface water temperatures were measured at each station using a YSI thermometer, CTD unit, or Hugrun thermometer. The thermometer used in the July and September surveys malfunctioned, but the malfunction was not detected until after the surveys were completed. Therefore, there are no temperature data for these surveys.

In August, September, and October 1999, more patches of bull kelp containing normal and early senescent bull kelp individuals were found in areas not covered by the transects. These were sampled in "supplemental surveys", and were mainly offshore of Diablo Rock and offshore of

South Diablo Point (**Figure C-3**). These patches were sampled from the boat and their locations recorded using the GPS. Sampling at these locations was non-specific since new patches were selected when found and the boat intentionally positioned in specific beds.

Subsurface Bull Kelp Sampling

Early senescence of some bull kelp individuals occurs when they first contact the bottom of the thermal plume and before they are visible on the sea surface (**Figure C-2**). This phenomenon has primarily been observed inside Diablo Cove. Diver surveys were completed to determine the extent and timing of early senescence in the subsurface bull kelp canopy during 1999, because of the possibility that many of these individuals would never reach the surface. The subsurface bull kelps were sampled by divers along 50 m underwater transects that paralleled the surface transects sampled from the boat (**Figure C-3**). Sampling was conducted monthly from July through October 1999, and was coincident with the boat transect surveys. Subsurface bull kelp sampling was not conducted in November and December 1999, as had originally been planned, due to poor diving conditions.

The origin of each dive transect was marked by a buoy. At each transect, a 50 m fiberglass transect tape was deployed along a pre-determined compass course. Underwater kelp counts and indices of kelp condition along the 50 m transect were recorded in 3 m (10 ft) depth increments, with the depth of the kelp bulb designating the depth of the kelp. The width of the transect was 6 m (3 m on either side of the transect tape). The area within 1 m of the substratum was not sampled. This avoided having to search through subcanopy kelps (e.g., *Pterygophora* and *Laminaria*) and understory algae. A vertical profile of water temperature from the bottom to the sea surface was recorded at the origin of each dive transect, monthly from July through December 1999.

Results

Data for the original five condition categories were condensed into three categories. Condition 1, 2, and 3 categories consisted of healthy individuals in various stages of growth and fertility and were combined as Condition A. Condition 4 ("tattered blades") and Condition 5 ("bare bulb") individuals were renamed to Condition B and C, respectively.

Sampling Constraints That May Affect Results

Changes in tidal height and adverse sampling conditions can affect the absolute number of individuals sampled in this type of study and contribute to excessive sampling error. Consequently, results reported herein include proportions of individuals (%) for each condition by study area through time, to standardize the data independent of the absolute number of individuals observed.

Drift kelp is not easily distinguished from attached kelp when tangled together on the sea surface. Suspected drift kelp, therefore, was pulled upon to determine whether or not it was attached to the bottom. Verified drift kelp was not included in the present analysis.

Large-scale breakup of the 1999 bull kelp population did not occur until the last week of February 2000, approximately two months later than the typical end of the bull kelp season. As such, discussions of the temporal effects of early bull kelp senescence in Diablo Cove (i.e., how much earlier was the senescence process in Diablo Cove relative to areas not contacted by the plume) should be considered in two ways: within the context of a "typical" bull kelp growing season (spring through December), and within the context of the 1999 kelp year (spring 1999 through February 2000).

Water Temperature Distributions

Differences in surface water temperatures between August, October, November, and December reflect seasonal variation, power plant operating characteristics, tidal elevation, wind, and currents. In general, surface water temperatures decreased with distance from the discharge structure to areas of ambient temperature outside Diablo Cove (**Figure C-4**). Higher than ambient surface water temperatures were mainly evident in Diablo Cove, offshore of Diablo Rock, and offshore of North and South Diablo Point. Surface water temperatures in Field's Cove and areas to the north were near ambient temperature levels measured in the control area of Patton Cove.

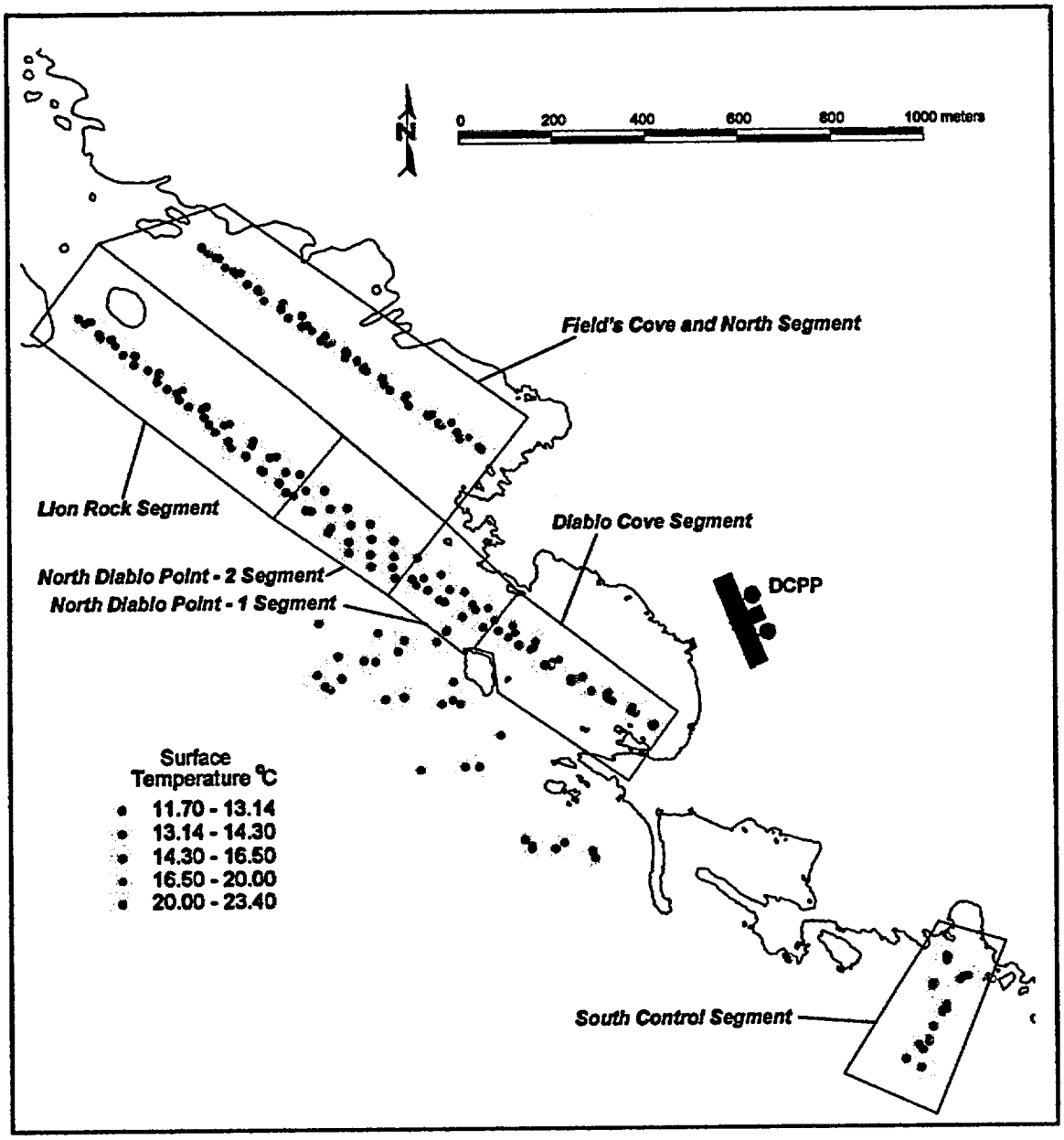


Figure C-4. Surface water temperatures in August, October, November, and December 1999 and transect segment locations partitioned according to stations with similar temperature regimes. Temperatures outside the transect segments are shown for the supplemental boat survey stations.

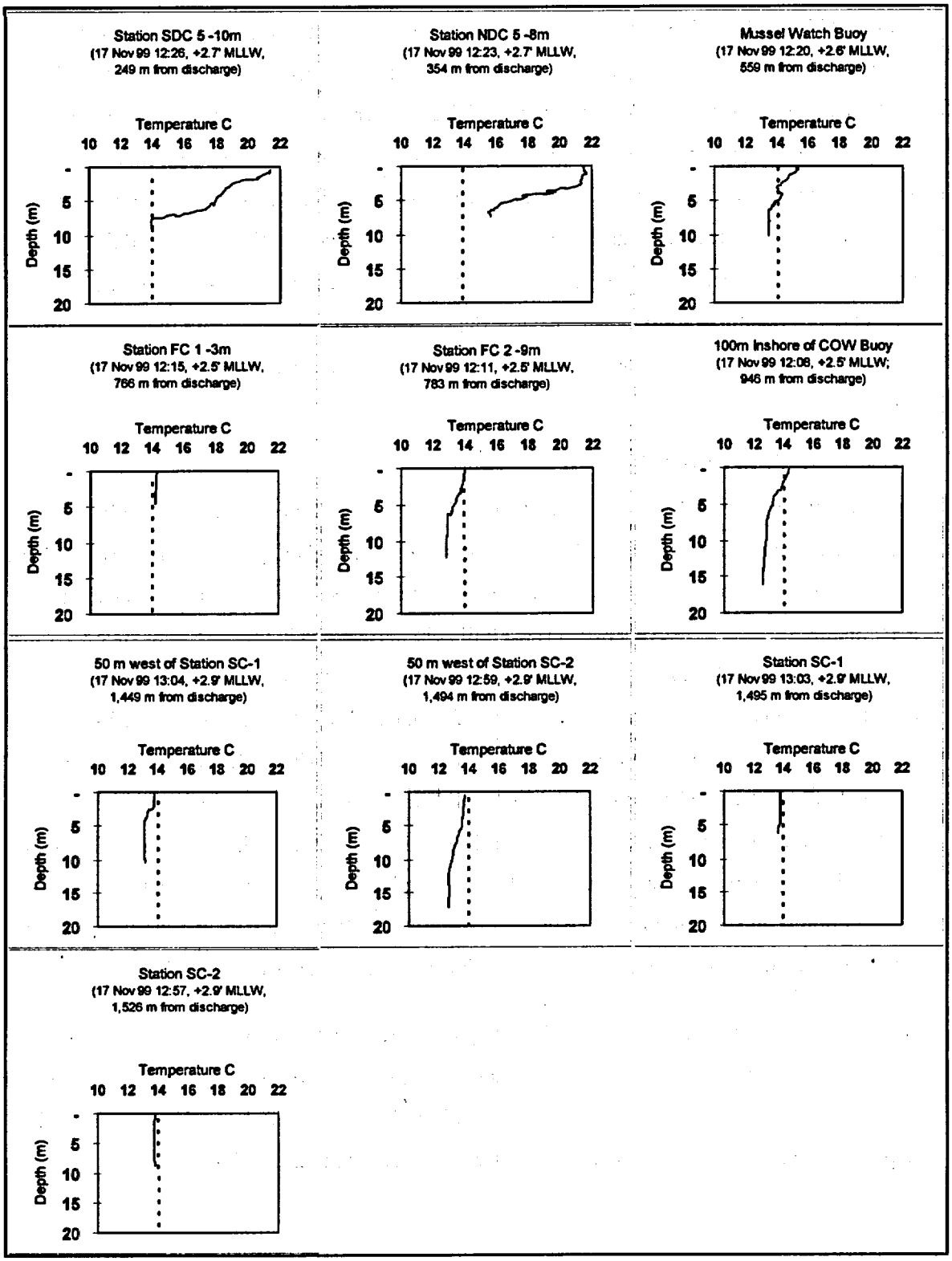


Figure C-5. Vertical temperature profiles at the subtidal dive transects on November 17, 1999.

Water temperatures with depth (vertical profile) differed between Diablo Cove and Patton Cove stations (**Figure C-5**). Higher temperatures were measured in the water column at all stations located in Diablo Cove and within the north channel of Diablo Cove off North Diablo Point. Water temperatures near Field's Cove Station FC 2 -9 were very similar to those measured atPatton Cove. The warmest temperatures occurred throughout the water column to depths of approximately -5 m at Diablo Cove stations NDC 5 -8 m and SDC 5 -10 m. These warmer subsurface temperatures decreased near the Mussel Watch Buoy at North Diablo Point (**Figure C-3**). Temperatures near the bottom at the deeper station SDC 5 -10 m were near ambient. Temperatures from the surface to a depth of several meters beneath the surface at Stations FC 1 -3 m and COW were slightly above ambient, relative to controls.

Spatial Distribution of Kelp Condition

Kelp condition increased (i.e., kelp forests were healthier) with increasing distance from the DCPP discharge structure (**Figure C-6**). No surface bull kelp plants were observed within Diablo Cove during the present study because they had already senesced or ceased growth before reaching the surface. However, two surface bull kelp individuals in the bare bulb state were observed in Diablo Cove next to South Diablo Point in October during the annual habitat-forming kelp survey (see Section 4.1 *Subtidal Algae*). Condition B and C individuals were documented outside of Diablo Cove mainly at distances of 400-700 m from the discharge structure. These included areas offshore of North Diablo Point, South Diablo Point, and Diablo Rock, and areas within Field's Cove (**Figure C-6**). All of these areas, however, also harbored normal, healthy bull kelp plants mixed with senescing individuals. For example, the proportion of Condition B and C individuals offshore of North Diablo Point (ca. 700 m from the discharge structure) was approximately 30% with the majority being healthy (**Table C-2**).

In contrast to the above findings, most bull kelp offshore of Patton Cove showed no signs of senescence for the duration of the present study. Several Condition B individuals were observed offshore of Patton Cove, and this result likely indicated variability in naturally occurring bull kelp senescence. No Condition C individuals were observed in Patton Cove.

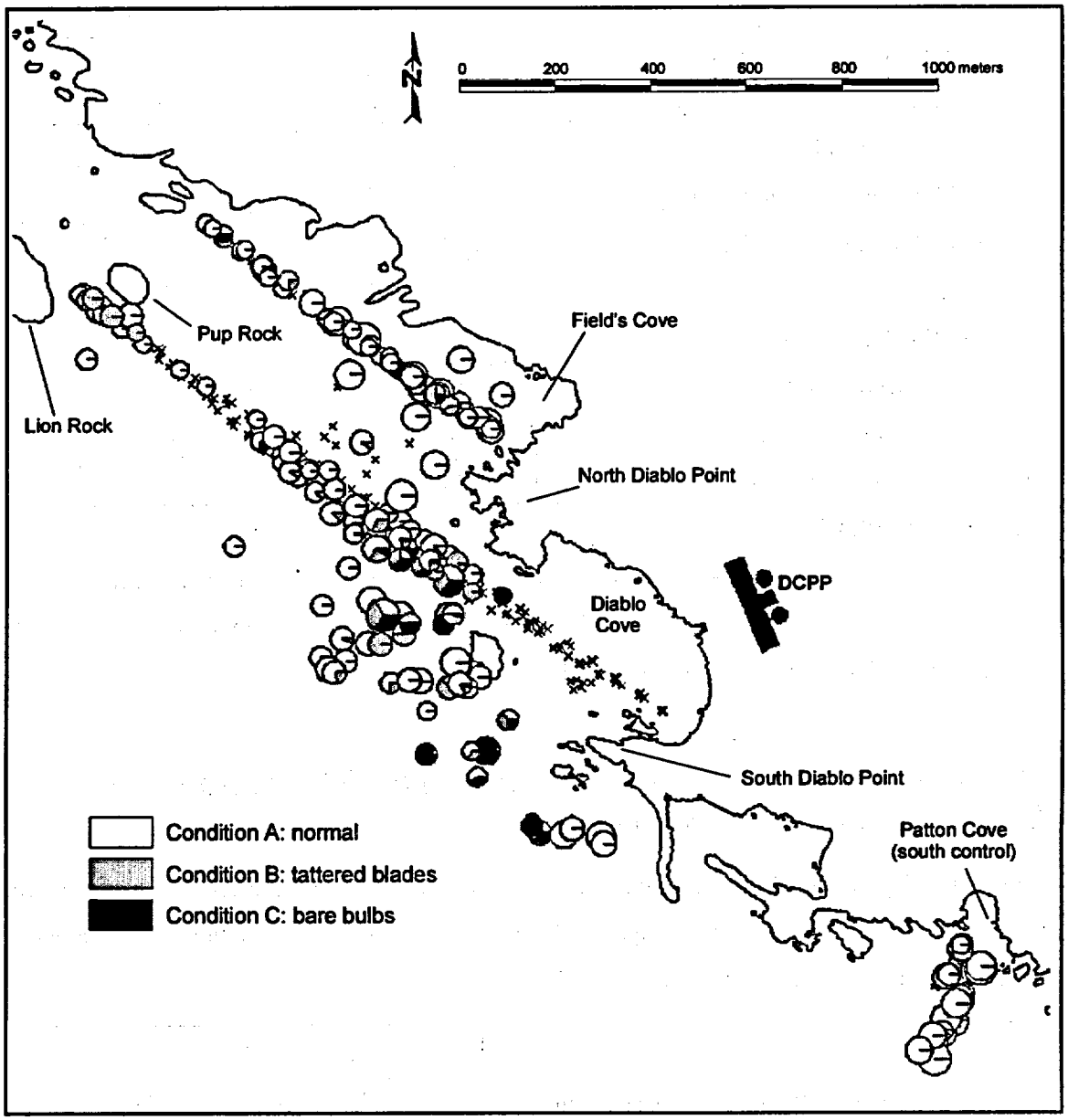


Figure C-6. Extent of surface bull kelp with early senescent characteristics for all sampling months. Size of bubble from largest to smallest denotes density of bull kelp individuals ranging from 153 individuals per station to 1 individual per station. "X" symbols denote stations with no surface bull kelp. Pie sections in bubbles denote percentage of plants in condition categories with values summarized in **Table C-2**.

Onset of Early Senescence

The onset of early senescence was not fully documented in the present study, as the first bull kelp survey was conducted in July well after bull kelp had formed forests in the study area. In addition, many bull kelp individuals near the discharge structure (in Diablo Cove) had already senesced by July. Senescent bull kelp individuals were also observed during the month of July offshore of North Diablo Point, South Diablo Point, and Diablo Rock. In contrast, bull kelp individuals with early senescent characteristics were first observed in Field's Cove in December, presumably due to cooler water temperatures relative to the three sites noted above (**Figure C-5**).

Table C-2. Occurrence of bull kelp condition in relation to distance from the discharge structure.

Distance (m) from Discharge Structure	No. Stations	Total No. of Individuals	Percent Composition of Condition to Total		
			A	B	C
101 - 200	16	0	0	0	0
201 - 300	15	0	0	0	0
301 - 400	12	0	0	0	0
401 - 500	15	74	75.7	17.6	6.8
501 - 600	28	730	54.5	21.9	23.6
601 - 700	26	1222	70.6	18.3	11.0
701 - 800	27	564	92.2	7.4	0.4
801 - 900	26	600	93.7	6.0	0.3
901 - 1000	24	296	98.6	0.7	0.7
1001 - 1100	20	291	99.0	0.7	0.3
1100 - 1200	21	67	95.5	4.5	0.0
1200 - 1300	18	79	94.9	5.1	0.0
1300 - 1400	19	72	94.4	4.2	1.4
1400 - 1500	35	1073	95.1	4.8	0.1
1500 - 1600	8	603	99.5	0.5	0.0

Relationships of Surface Kelp Density with Distance from the Discharge Structure and Time

The results depicted in **Figure C-7** are from the boat transect surface stations grouped according to similar temperature regimes portrayed in **Figure C-4**. The number of stations sampled over time in each transect segment are presented in **Table C-3**.

Patterns of surface bull kelp densities over time differed among areas. While not entirely clear, there did appear to be a relationship between kelp abundance over time and distance from the discharge structure (**Figure C-7**). Surface bull kelp was never observed in Diablo Cove in the present study (**Figure C-7**). Declines in surface kelp abundance at the Field's Cove and North

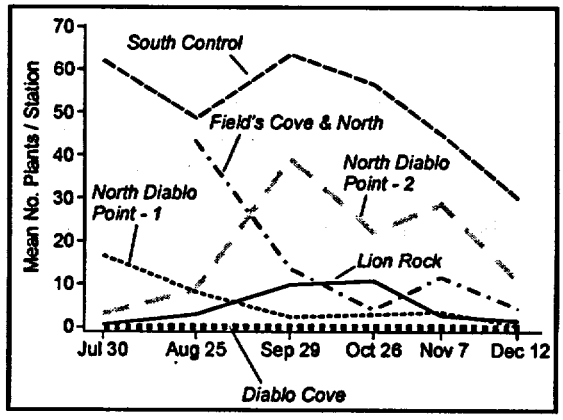


Figure C7. Changes in bull kelp density in surface transect segments.

segment, and at the North Diablo Point-1 segment were evident in September, and declines at the North Diablo Point-2, Lion Rock, and South Control segments appeared to occur after the September survey.

Table C-3. Number of surface stations sampled in transect segments. Refer to **Figure C-4** for segment locations.

	Jul	Aug	Sep	Oct	Nov	Dec
Field's Cove and North	0	12	13	15	14	14
Lion Rock	10	10	10	10	12	11
North Diablo Point -2	5	4	5	5	5	6
North Diablo Point -1	4	4	2	4	3	5
Diablo Cove	7	7	7	7	8	7
South Control	3	4	5	6	6	6

Variation over time within a transect segment, however, may reflect tidal height differences between surveys (i.e., lower tides exposing more kelp plants), slight variations in the cruise track leading to different patches being sampled, or the occurrence of new kelp plants as subadults reach the sea surface. The consistent pattern of lowest abundance in December likely reflects the process of natural attrition at the end of the growing season. **(Figure C-7).**

Other factors may also account for the variability in kelp densites over time and among segments evident in **Figure C-7**. Although storms in February 2000 caused coastwide declines in bull kelp, the large decline that occurred at the Field's Cove and North segment between August and September **(Figure C-7)** may be due to proximity to the shoreline where depths become shallower. Typically, kelp forests closer to the shoreline and in shallower water (e.g., the Field's Cove and North segment) are more adversely affected by breaking waves than kelp forests further from shore and in deeper waters.

Relationships of Subsurface Kelp Density with Distance from the Discharge Structure

Difficulties arose during the dive surveys that affected the subtidal survey results with uncertain consequences . There was likely some duplication of counts of bulbs situated close to the sampling boundaries of the 3 m (10 ft) depth intervals. Also, it was sometimes difficult to determine the number and condition of bull kelp when clusters were tightly coiled together and the blades of various conditions entangled in a mass. Furthermore, transects were sometimes relocated at inexact positions when permanent buoys were lost.

Despite sampling difficulties, Condition C (bare bulb) individuals could readily be distinguished from the other condition categories. Analyzing the collected data as a percentage of bare bulb condition individuals relative to the total number of individuals sampled overcame the limitations of not having sampled identical kelp patches repetitively (**Figure C-8**). Although early senescence in bull kelp is mainly a surface phenomenon, it was found in individuals several meters beneath the sea surface in Diablo Cove and in slightly shallower water offshore of North Diablo Point (Mussel Watch Station).

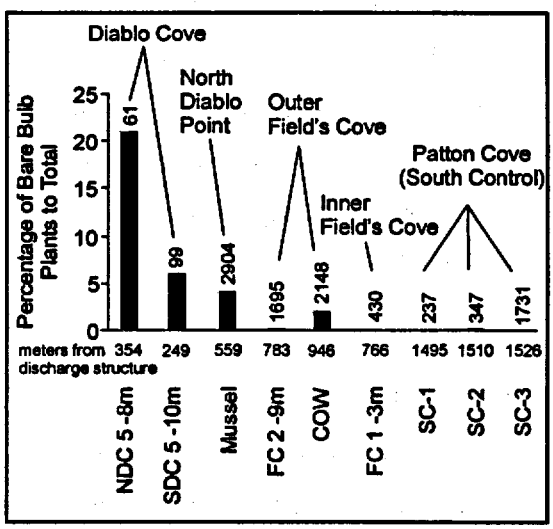


Figure C-8. Percentage of bare bulb individuals to total number observed in the midwater during the study. Numbers above bars are total numbers of individuals sampled.

Bull kelp displaying early senescence well beneath the sea surface were generally mixed with healthy kelp at the same depths in all areas. However, the total abundance of all bull kelp beneath the sea surface was lowest in Diablo Cove (Stations NDC 5 -8m and SDC 5 -10m; **Figure C-9**). None of these individuals at the Diablo Cove stations reached the sea surface (**Figure C-6**), and subsurface bull kelp in Diablo Cove declined almost completely in abundance by September (**Figure C-9**). The abundance of subsurface bull kelp at control stations (S-1, S-2, and S-3) was relatively low, as most individuals were already at the surface in July. However, the abundance of subsurface bull kelp at the control stations remained relatively constant through August (**Figure C-9**), indicating consistent growth of juvenile and subadult plants. Subtidal bull kelp at stations located in and surrounding Field's Cove were more abundant than other areas, though numbers declined to those similar to the controls. Subtidal bull kelp abundance at Station COW was extremely variable, and this variability may reflect the difficulty in relocating this station.

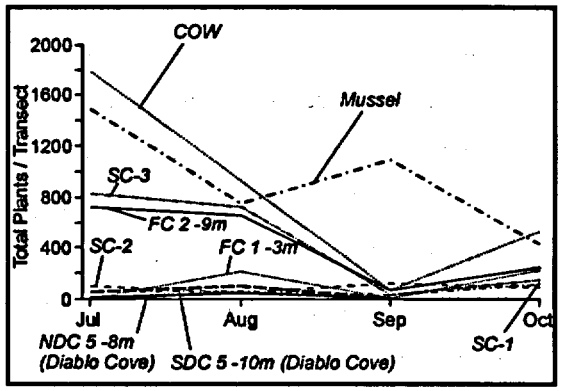


Figure C-9. Changes in bull kelp in the subtidal surveys.

Relationships Between Water Temperature and Early Senescence

Early senescence of bull kelp is the result of increased temperatures which occur in a gradient, decreasing with distance from the DCPP discharge structure. The amount of increase in water temperatures resulting from the DCPP thermal discharge varies over time and space dependent on changes in oceanographic conditions, ambient temperature, tidal elevation, wind, currents, and power plant operating characteristics (Tenera 1997). The present study recorded instantaneous temperatures at the stations sampled for bull kelp. These temperatures were used to associate the relationship of early senescence with temperature with the understanding that those temperatures were only an instantaneous representation of the temperature distribution in the vicinity of the power plant. Early senescence related to increased temperatures is the product of chronic and episodic temperature changes and may not be well correlated with instantaneous, single-point measurements of temperature.

Condition C (bare bulbs) bull kelp was associated with the highest temperatures. Condition A (normal) individuals were typically associated with the lowest temperatures, and Condition B (tattered blade) kelp was found in generally all temperatures measured (**Figure C-10**). The data in **Figure C-10** are from the November 1999 boat transect and temperature survey since kelp sampled during this month were exposed to the local temperature regime for a sufficient time to begin showing characteristics of early senescence and because large natural attrition of kelp had not yet occurred in the study area. Plots of instantaneous surface temperatures versus kelp conditions for other monthly surveys were more variable.

Increased water temperatures beneath the sea surface were recorded mainly in Diablo Cove and offshore of North Diablo Point (**Figure C-5**). Above ambient temperatures in these locations extended to depths of approximately -5 m. The greatest incidence of subsurface, senescent bull kelp occurred in areas with above ambient temperatures (e.g., at Stations NDC 5 -8m, SDC 5 -10m, and Mussel Watch; **Figures C-3** and **C-9**). Early senescence was primarily a surface phenomenon in areas further from the discharge structure, where surface temperatures were only slightly (ca. 1 °C) above ambient, and where smaller proportions of plants exhibited early senescent characteristics.

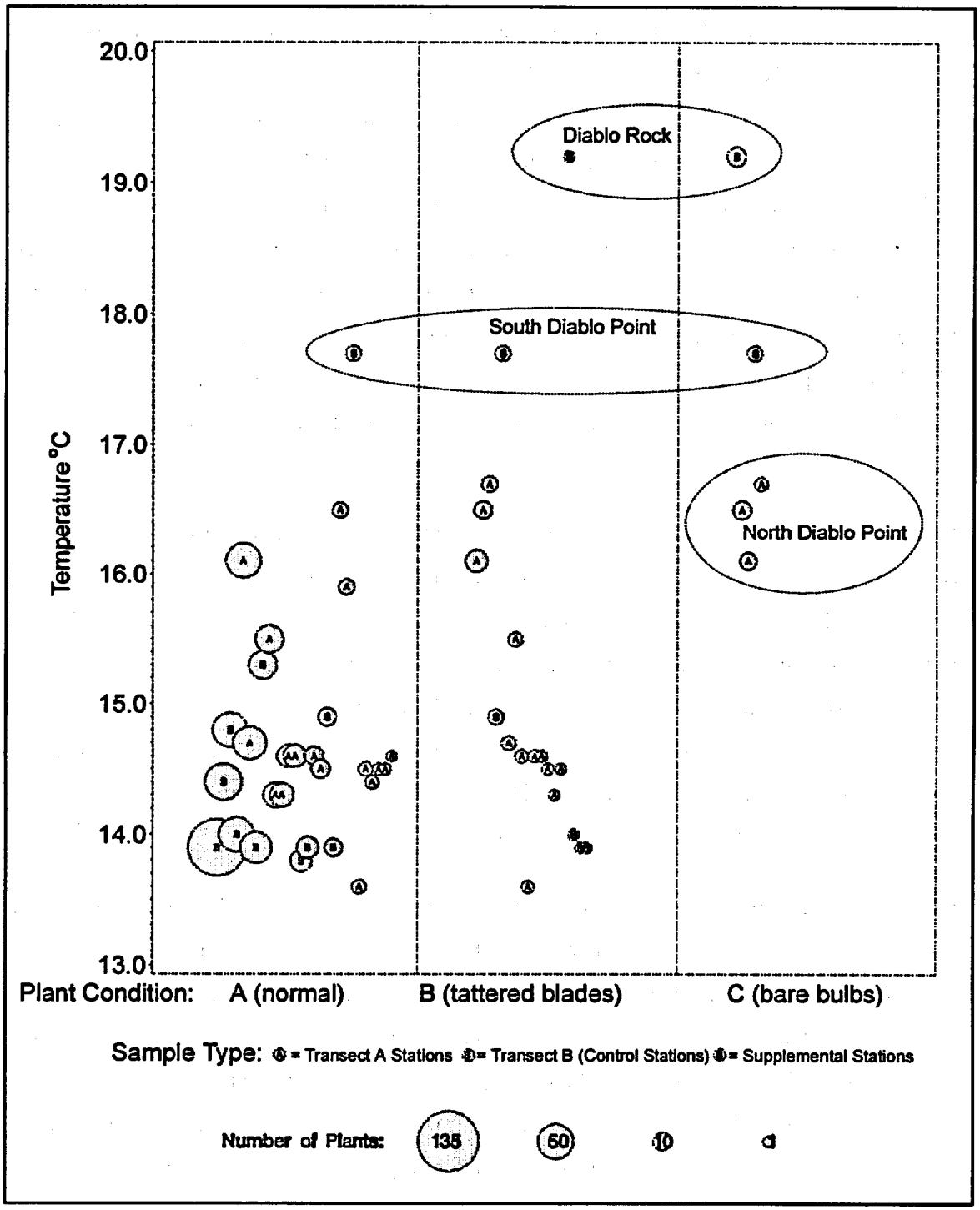


Figure C-10. Relationship between surface temperatures and condition categories in surface bull kelp. Data are from the November 1999 survey. Sizes of the circle symbols denote number of plants along a continuum from 1 to 135 plants per station. The circle symbols are spaced apart horizontally in each condition category to avoid overprinting.

Discussion

The results of the present study documented the extent of early senescence in the 1999 bull kelp population and changes in bull kelp abundance near the DCPP discharge structure. The data collected provide some evidence that early senescence of bull kelp each year is a function of time, depth, and distance from the discharge structure, related to increased water temperatures which vary as a function of distance from the DCPP discharge. Changes resulting from the discharge during the present study were confined mainly to individuals in Diablo Cove and offshore of North Diablo Point. Affected areas, however, contained both healthy and prematurely senescent bull kelp. We hypothesize that this mixture of healthy and senescent kelp results from a combination of the age of individual kelps and the duration of their exposure to elevated temperature. Presumably, unaffected kelp in areas contacted by the thermal plume consist of the younger individuals of the annual cohort which have not had sufficient exposure to elevated temperature (thermal dose) to senesce prematurely. In contrast, the older individuals presumably have been exposed to the thermal plume for a longer period of time, and therefore, develop signs of premature senescence.

Bull kelp with early senescent characteristics were probably present in Diablo Cove prior to the beginning of the study in July 1999. This can be surmised since the warmest water temperatures occur in Diablo Cove. Also, the 1999 bull kelp population in Diablo Cove detached from the bottom five months before the breakup of kelp forests not exposed to the plume. Early demise of the 1999 bull kelp population outside Diablo Cove resulting from early senescent individuals was not clearly evident. Some bull kelp had prematurely senesced offshore of North Diablo Point in July-November 1999, and in December 1999, some senescent bull kelp was observed in Field's Cove. However, the majority of bull kelp in all these areas outside Diablo Cove consisted of healthy kelp, which remained attached for longer periods than in Diablo Cove.

Areas outside of Diablo Cove (e.g., Field's Cove) demonstrated a temporal lag in the development of senescent characteristics in bull kelp within the study period. This may result from lower temperature elevations in these locations relative to Diablo Cove. Thus, a longer exposure period to less pronounced temperature elevations led to an extended period of time before senescence in bull kelp was induced. Small temperature elevations, relative to Diablo Cove, were recorded in Field's Cove during the present study, and have been described in a previous report (Tenera 2000).

Several factors may account for the effects of early senescence being limited largely to Diablo Cove and immediate vicinity. Lower temperature elevations from the power plant during the refueling outage for Unit 2 may have limited the extent of premature senescence from expanding further beyond North Diablo Point during most of the study period. Unit 2 underwent a refueling cycle from September 26 to October 27, 1999. During the refueling outage, the circulating water pumps were shut down for a portion of this interval, resulting in reduced volume and reduced temperature elevations.

The development of a large and dense giant kelp (*Macrocystis pyrifera*) forest in Diablo Cove, in particular in the north channel of Diablo Cove, may also have limited, or slowed, the effects of early senescence to regions offshore of North Diablo Point. Giant kelp forests are known to alter ocean current patterns (Jackson 1998). The dense giant kelp forest in Diablo Cove and off North Diablo Point undoubtedly restricted a portion of the thermal plume moving out the north channel of Diablo Cove, to Field's Cove and Lion Rock. Giant kelp was absent from Diablo Cove in 1987, when the maximum extent of early bull kelp senescence (to near Lion Rock) was observed (Tenera 1997).

The amount of time between the loss of prematurely senescent bull kelp and the natural reduction of the population due to winter storm waves (five months in 1999) may vary in other years. The present study was conducted during a year of unusually calm sea conditions and high kelp abundance. Several storm events took place before the largest storm in late February 2000 cleared out much of the remaining bull kelp forests. The interval between loss of prematurely senescent kelp and normal disappearance of healthy kelp would be less (ca. three months) during typical years when large storms break up kelp forests in December-January (Tenera 1997).

Early senescence of bull kelp was observed once prior to power plant start-up; during the 1983 El Niño (PG&E 1990; Tenera 1997). An El Niño also occurred in 1976, though this event did not cause premature bull kelp senescence. The 1976 El Niño was a less severe climatological and oceanographic event than that observed in 1983. Similarly, there was no evidence of prematurely senescent bull kelp in areas not contacted by the discharge plume during the weak 1987 and 1992 El Niño events (Tenera 1997, 1999a), or during the 1997-98 El Niño. However, warm water temperatures associated with the 1987 El Niño, combined with consequent increases of thermal plume temperatures and the lack of giant kelp in the north channel of Diablo Cove probably

contributed to the maximal spatial extent of prematurely senescent bull kelp observed to date (Tenera 1997).

The ecological consequences for marine habitat affected by premature senescence outside of Diablo Cove can be considered minimal since results of the present study indicate affected kelp individuals remain attached for extended periods, and co-occur with unaffected kelp. One hypothesis suggests that repeated years of early senescence of bull kelp may result in progressively lower kelp abundance in the affected areas due to reduced spore production and, therefore, reduced recruitment. This hypothesis has been investigated in areas outside Diablo Cove using aerial photographs of surface kelp canopies (Tenera 1999b). However, results of the analyses were not definitive due to high variation of kelp canopy extent prior to and during power plant operation in both the control and impact areas. One component of this variation was that bull kelp abundance increased at stations sampled in Field's Cove after power plant start-up (Tenera 1999a). This showed that kelp able to reach reproductive maturity and disperse spores in the areas of Field's Cove was important in repopulating areas contacted by the discharge beyond the boundaries of Diablo Cove. However, as indicated in the present study, a small portion of the bull kelp population in Field's Cove is exposed each year to increased temperatures that can lead to early senescence, but not necessarily early detachment from the bottom.

Conclusions

Conclusions from the 1999 study include:

- Early senescence in bull kelp occurred as a function of time, depth, and distance from the discharge structure.

  Bull kelp in Diablo Cove senesced before they reached the sea surface, and detached from the bottom at least five months before the breakup of bull kelp forests in control areas. This time disparity would be shorter in years when storms occur earlier (e.g., December or January).

  Many bull kelp individuals offshore of North Diablo Point exhibited characteristics of early senescence in July, while premature senescence of surface bull kelp in Field's Cove was not detected until December. Most of the bull kelp population outside Diablo Cove remained attached as long as controls throughout the study.

- The spatial extent of early senescence in 1999 was not as large as the extent observed in 1987, near Lion Rock.

  The relatively small affected area could have been related to the dense giant kelp forest in Diablo Cove restricting the dispersion of the thermal plume out the north channel towards Lion Rock and into Field's Cove.

  The smaller affected area in 1999 could have also been related to the reduction of thermal plume volume and temperature during refueling outage 2R9, and to the lack of an El Niño event.

- Bull kelp is a good indicator species of thermal discharge effects.

  Blade condition categories can be used to map the depth, surface extent, and timing of discharge effects. The bull kelp annual life cycle provides a new population each year to map variations in the extent of effects.

- The present study indicates that early senescence in bull kelp remains within areas previously described by qualitative observations.

  The population outside Diablo Cove in areas contacted by the discharge consists mainly of unaffected plants.

Recommendations

Based on the first survey, we have identified certain study objectives, sampling techniques, and analytical approaches that need to be reviewed by PG&E, the Regional Board Staff, and its consultants. This review should be completed prior to conducting the next survey. These elements include:

- The study period should encompass the entire bull kelp life cycle. The surveys should begin earlier in the year (e.g., May) so that the initial density and fate of individuals can be more fully documented.
- A consistent method is needed for designating the endpoint of the annual kelp life span. Most of the annual population is removed by winter storms, but some kelp may persist through the winter. A decline to a pre-determined proportion of the beginning population abundance may be used to designate the end point of the kelp yearly life span.

- The subtidal survey effort may be reduced to sampling subtidal transects only in Diablo Cove, as this is the only area where bull kelp appears to be largely affected beneath the sea surface.
- Condition categories were used to differentiate "normal" from "affected" bull kelp. However, there was some variation among observers in making these distinctions in all categories except Condition C (bare bulb individuals). Therefore, more specific and clear criteria are needed for each condition category.
- Annual overflight photographs could be conducted in fall with the bull kelp senescence study for determining the hectares of kelp contained within the boundaries of observed effects. Mapping techniques can be completed as in Tenera (1999c).
- The spatial extent and timing of early senescence in bull kelp were described in this report based on a qualitative interpretation of the data and general observations. Appropriate statistical approaches should be developed to analyze these data. For example, an analysis of co-variance (ANCOVA) could be used to examine kelp condition as a function of month, and temperature within months, with the data weighted by number of individuals in each condition category.
- Outplanting bull kelp cultured on ropes may overcome the difficulties of sampling natural populations. The monitoring of outplanted bull kelp will enable specific individuals, depths, and areas to be mapped for the spatial extent of early senescence. Kelp abundance was unusually high in the present study, with many of the bull kelp individuals persisting through the storm season. These over-wintering individuals from the 1999 population may become mixed with the 2000 population. Monitoring outplanted bull kelp cultured on ropes would avoid the problems of distinguishing between senescent individuals from different yearly cohorts and would augment the boat and diver surveys of populations in affected and control areas.

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Tenera, Inc. 2000. Draft report: Effects of water temperature on the distribution and abundance of intertidal organisms in Field's Cove. Draft report. Diablo Canyon Power Plant. Receiving water monitoring program. Prepared for Pacific Gas and Electric Company, San Francisco, CA.

Attachment C-1

Submitted: October 22, 1999

Document No. E9-026.3

STUDY PLAN: EFFECTS OF THE DCPP DISCHARGE ON BULL KELP (*NEREOCYSTIS*)

Introduction

Previous marine environmental monitoring at the Diablo Canyon Power Plant (DCPP) has observed a relationship between warm water from the thermal discharge and the deterioration of surface fronds in bull kelp (*Nereocystis luetkeana*). This condition has been referred to as "early senescence" and refers to a deterioration and subsequent loss of blade tissue that is similar to that of naturally senescent plants, but occurs earlier in the growing season. The loss of blades results in a bare bulb at the end of the stipe.

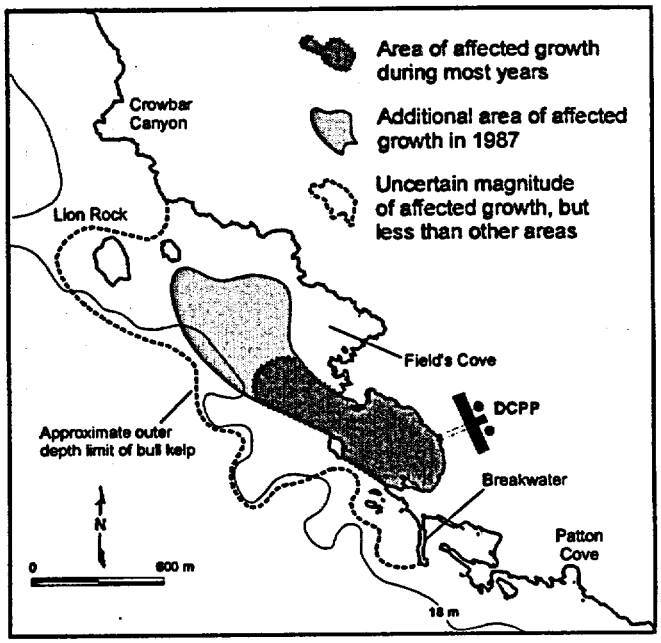


Figure 1. Approximate extent of premature senescence in bull kelp. Illustration from Tenera, 1997.

Early senescence in bull kelp is largely a surface phenomenon. Small plants develop normally beneath the discharge plume thermocline, but begin deteriorating as they grow into the surface plume (Tenera, 1997). The spatial extent of early senescence has been approximated from qualitative observations (**Figure 1**). The timing and magnitude of change occur soonest and is greatest in plants closest to the outfall structure. However, the spatial extent and numbers of plants that become affected have not been determined from quantitative studies.

Purpose

The purpose of this study is to quantify the magnitude, timing, and spatial extent of early senescence in bull kelp as a function of distance from the DCPP outfall structure.

A previous study plan was submitted for review to the Regional Water Quality Control Board and its consultants on July 15, 1999. Review comments consisting of items for clarification and

recommended study modifications were received by Pacific Gas and Electric Company on August 16, 1999. The elements of the review were discussed with the Board and its consultants the following month. The present plan incorporates the recommended modifications to the original plan, namely the sampling of an additional transect north of Diablo Cove to more completely account for the spatial extent of changes.

Study Methods

The study objectives require sampling methods that are repeatable in order to monitor changes along discharge plume gradients. The study methods consist of surface and underwater sampling to document the time course and extent of early senescence in bull kelp at fixed stations. Surveys will be conducted monthly in 1999 from July through November when bull kelp surface canopies are most extensive.

Surface Bull Kelp Sampling

Data on surface bull kelp abundance and condition will be collected by boat sampling at stations spaced 50 m apart along transects (transect stations) in areas contacted and not contacted by the discharge (**Figure 2**). Transects A-1 and A-2 will run between existing buoys. (Transect A-2 is a new transect added to the study plan during the August survey.) Approximately 24 and 12 stations will be sampled along Transects A-1 and A-2, respectively. Transect A-1 follows the general path of the thermal plume as it exits Diablo Cove. Six surface stations will be sampled in the reference area of Patton Cove (**Figure 2**). Two stations will be sampled along Transect B-1, and four stations will be sampled along Transect B-2.

Two global positioning system (GPS) units will be used during surface boat sampling. One GPS unit will allow the boat operator to correctly position the boat at each sampling station by determining the distance traveled along the transect relative to the starting point. A second GPS unit with greater precision (differential GPS) will be used to record the locations sampled.

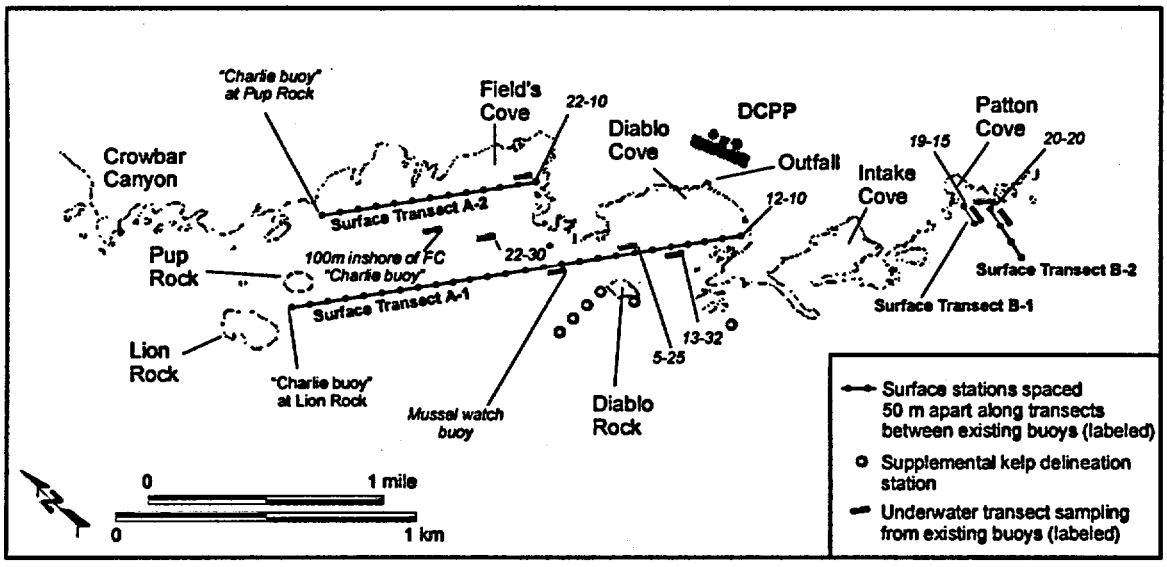


Figure 2. Sampling layout.

Table 1. Condition indices for bull kelp.

Condition Index	Appearance	Description	Normal Period of Occurrence	Occurrence Near the Outfall
1		Growth phase. Some plants with developed blades on the surface.	Spring	Spring
2		Developed blades with fertile sori packets present. No deterioration.	Summer	May not occur in areas with persistent plume contact
3		Some blades with evidence of released sori packets.	Late summer through fall	May not occur in areas with persistent plume contact
4		Short, tattered blades.	Late fall	Summer
5		Bare bulb, no blades.	Late fall through early winter	Summer

At each station the abundance and condition of bull kelp plants in 5 m x 10 m areas of ocean surface on each side of the boat will be counted and recorded by two observers. The counts will be made according to condition categories described in **Table 1**. The surface bull kelp data sheet is shown as **Attachment 1**. Surface water temperatures will be recorded concurrently at each station.

Areas of early senescent bull kelp outside the sampling areas of the transect stations will be delineated using supplemental surface surveys. The boat will be placed at various locations within specific kelp beds and sampling at each location using the same procedure used in the transect station sampling. The areas that will be sampled using this method include offshore areas of Diablo Rock and south Diablo Point (**Figure 2**).

Subsurface Bull Kelp Sampling

Early senescence of some bull kelp plants occurs when they first contact the bottom of the warm water layer before they reach the surface. Consequently, plants do not appear on the surface. This typically occurs in Diablo Cove. Subsurface sampling will be used to document the growth and condition of the population in Diablo and Field's coves in comparison to the reference area of Patton Cove. Subsurface bull kelp plants will be sampled by divers along several 50 m underwater transects that parallel the surface transects (**Figure 2**). This procedure will describe plant condition as a function of depth, time, and distance from the outfall.

The origin of each subsurface transect will be an existing buoy (**Figure 2**). The transect tape will be run from these origin points in parallel to the surface transects. At each transect, a pair of divers will deploy a 50 m fiberglass meter tape on the ocean bottom along a pre-determined compass course. The divers will count and record the condition of all bull kelp plants according to depth intervals along a sampling area that is 3 m to either side of the 50 m transect and 1 m

above the bottom (**Attachement 2**). A CTD instrument will be lowered at the station to obtain a profile of the water temperature and depth.

Analysis

Data from the transects will be analyzed using analysis of covariance. The proportion of plants in each condition index at each station along each transect will be analyzed against distance along the transect. Both the absolute numbers of plants and proportions of plants in the condition categories will be analyzed. The results will be portrayed in maps prepared using a geographic information system (GIS). In areas affected by the discharge, surface water temperature is inversely correlated with distance from the point of discharge. In the reference areas there should be no relationship between condition factor and distance along the transect. The null hypothesis tested by the analysis is that there is no difference in the relationship between condition index and distance along the transects.

Initially each survey will be analyzed separately. A probability level of 0.10 will be used to determine statistical significance. Tests could identify significant differences along Transect A if higher proportions of plants exhibited early senescence at stations closer to Diablo Cove. Signs of early senescence would not be expected in reference area plants during the surveys through late summer. Statistically significant results could occur if the data from the reference area transect had no relationship between distance along the transect and kelp condition factor.

Changes in plant density and percentages of plants by condition categories will also be analyzed as a function of distance and time (month). Subsurface bull kelp data from the underwater transects will also be analyzed similarly. The analysis will be used to delineate significant differences in condition parameters as a function of time and distance from the discharge.

Data from the underwater measurements of plant condition, plant location relative to the water surface, and water temperature will be analyzed to describe the progression of early senescence relative to reference populations. A series of plots will be developed for each survey that graphically compare these variables.

Appendix D

Discharge Effects on Selected Algae and Invertebrates along Subtidal Depth Gradients in Diablo Cove, North Channel, and Field's Cove

A STUDY OF DISCHARGE EFFECTS ON SELECTED ALGAE AND INVERTEBRATES ALONG SUBTIDAL DEPTH GRADIENTS IN DIABLO COVE, NORTH CHANNEL, AND FIELD'S COVE

Summary

Diver surveys were conducted along a series of transects to document abundances of invertebrates and algae in relation to water depth and distance from the DCPP cooling water discharge structure. Earlier studies had described statistically significant changes among various taxa to depths of at least -15 ft MLLW in Diablo Cove that are attributed to plant operation, but potential changes at greater depths had not been documented. The purpose of this study was to use a gradient study design to examine spatial abundance patterns of benthic taxa in Diablo Cove and Field's Cove. We found that the distribution and abundance of laminarian kelps (*Pterygophora californica* and *Laminaria setchelli*) and shelled gastropods (*Tegula* spp.) were good indicators of the extent of power plant effects on the subtidal community. Both kelp species were nearly absent to depths of approximately -15 ft at our stations in Diablo Cove, but were relatively abundant at this depth in neighboring Field's Cove. The North Channel of Diablo Cove had intermediate densities of these species. At a depth of approximately -20 ft in Diablo Cove the laminarian kelps became more abundant, with maximum densities occurring at depths of approximately 30–35 ft. The kelp densities in Field's Cove at the 30–35 ft depth range were equivalent to those of Diablo Cove. Shelled gastropods, especially the brown turban snail (*Tegula brunnea*), were more abundant at all depths outside of Diablo Cove. Analysis of covariance found statistically significant relationships between abundance and depth or area for several of the more abundant taxa. The distributions of uncommon taxa were too patchy to draw firm conclusions about potential discharge effects. Data from the gradient study suggested that some subtidal species that in earlier studies had been found to be significantly affected by thermal discharges in Diablo Cove at depths less than 15 ft, appeared to be unaffected at greater depths in Diablo Cove, and remained abundant at all depths in Field's Cove.

Introduction

Since DCPP has begun operation the abundances and distributions of many species of algae, invertebrates and fishes in Diablo Cove have changed (PG&E 1988; North et al. 1989; Tenera 1997). Most changes have occurred within the zone of warm water discharged from the plant that extends to an average depth of approximately -20 ft MLLW* in south Diablo Cove and -26 ft in north Diablo Cove. The thermal layer comprising the discharge plume dissipates as it exits Diablo Cove, becoming thinner and cooler as it mixes with ambient ocean water (Tu et al. 1986). The TEMP Analysis Report (Tenera 1997) differentiated between discharge effects at the -10 ft depth and the -15 ft depth based on a statistical comparison of taxon abundance at several benthic stations. There was no quantitative description of biological changes at greater depths because data from two deeper stations -25 ft and -32 ft in Diablo Cove could not be analyzed due to the lack of pre-operation data and inadequate controls.

The gradients of change in the Diablo Cove benthic community as a function of depth, and between Diablo Cove and neighboring Field's Cove as a function of distance from the discharge, have not been well described. Qualitative observations from the RWMP and data from North et al. (1989) showed that declines in laminarian kelps (e.g., *Pterygophora*, *Laminaria*) were one indicator of thermal effects. Most areas in Diablo Cove shallower than -15 ft had losses of these kelps although some effects extended below 20 ft on the inshore side of Diablo Rock where downwelling of the plume occurs. North et al. (1989) also found that the diversity of encrusting organisms such as sponges, tunicates and bryozoans declined in the shallower depths of the cove after power plant start-up. Describing the depth of effects on motile invertebrates and fishes is more difficult because of their greater spatial variation and mobility. Some of the general changes in these groups in the shallow areas of Diablo Cove have been decreases in shelled gastropods, increases in sea hares and sea urchins, and increases in the abundance of warm-water fishes (Tenera 1997).

The purpose of this study is to describe spatial gradients of biological change in Diablo Cove and Field's Cove as a function of water depth and distance (upcoast) from the discharge. We were also interested in quantifying the spatial distribution of several species previously identified as having been significantly affected by the thermal discharge. The subtidal zone in Field's Cove below a depth of approximately -10 ft is essentially unaffected by warm water from the DCPP

discharge, and it appears very similar to the benthic assemblages characteristic of open coastal areas in the vicinity of Diablo Cove. By sampling a contiguous series of transects across the spatial gradients, we were able to define magnitudes of change between Diablo Cove and Field's Cove for several taxa. This study did not use a "control" and "impact" station study design to statistically test differences in the abundances of taxa between areas. Instead, taxa that showed strong gradients in abundance between areas at similar depths were postulated as having been affected by the discharge.

A plan for this study was previously submitted to the Central Coast Regional Water Quality Board ('the Board') staff for review and comment. A meeting was held with the Board staff and their consultants, Drs. Michael Foster and David Schiel, to discuss their comments and review sampling approaches for studying subtidal gradients. This study design largely incorporated the written comments that were submitted by the Board's consultants to PG&E on August 16, 1999, with the exception that no discontinuous control site was sampled. We determined that a distant control site would be redundant because we would be able to sample a full range of habitat conditions between the affected areas below -10 ft (-3 m) MLLW in Diablo Cove and corresponding depths in Field's Cove. Subtidal areas shallower than -10 ft (MLLW) were not sampled.

Methods

Field data collection

Abundances of invertebrates and algae were sampled along transects that were located perpendicular to the shoreline and spanned a range of depths and distances from the discharge (**Figure D-1**). Stations were 2 m x 2 m in area and were located at 20 m intervals along 13 transects in Diablo Cove, the north channel area between Diablo Cove and Field's Cove, and in Field's Cove itself. Each transect extended from approximately -10 ft to a depth of -40 ft and transects were spaced 80 m apart. The actual placement of the transects and the depths sampled differed slightly from the locations specified in the original study design to avoid emergent rocks and hazardous areas close to shore. The origin and terminus of each transect sampled were delineated using a geographic positioning system (GPS).

* Depths are only specified in feet below Mean Lower Low Water (MLLW) throughout this chapter.

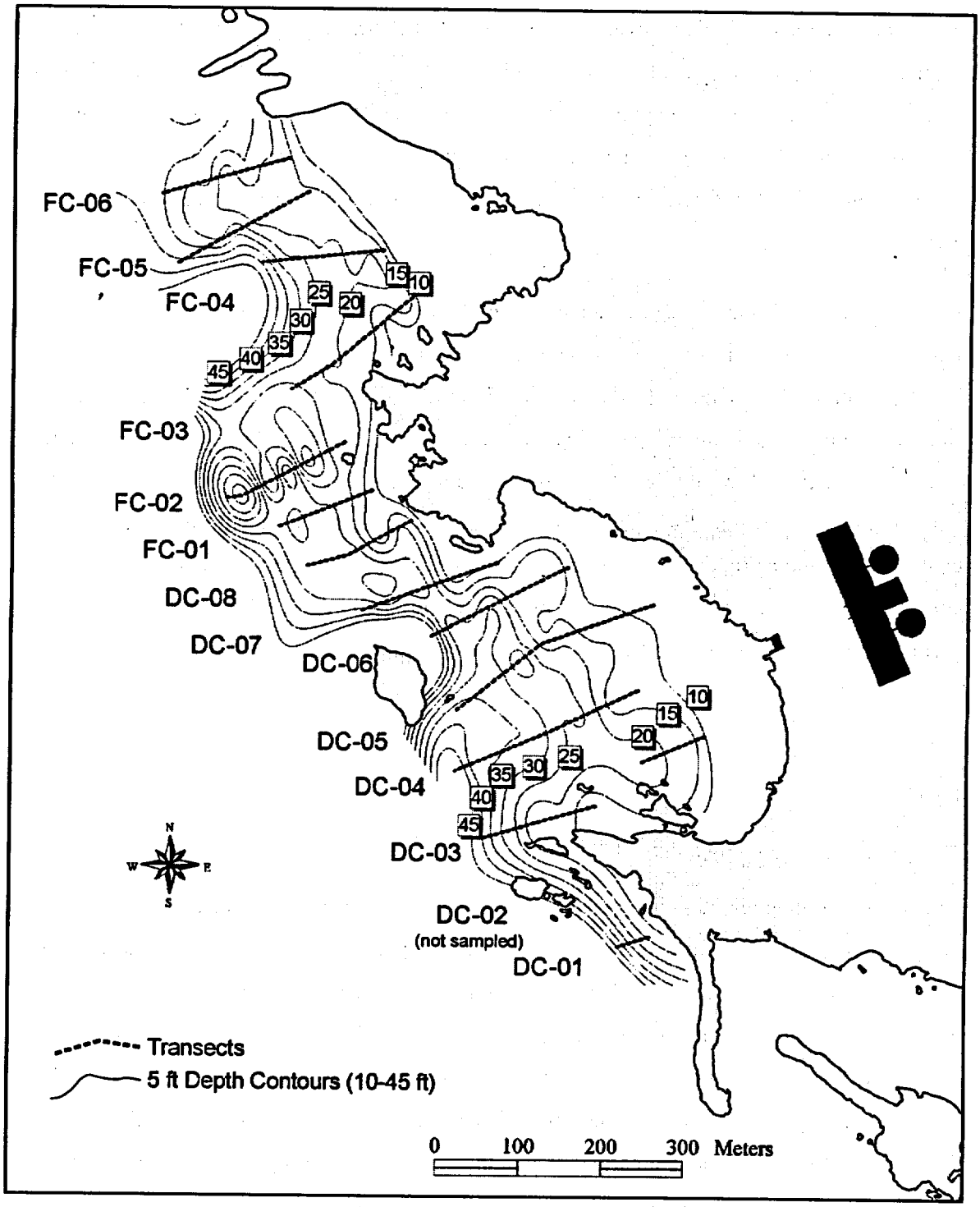


Figure D-1. Transect locations of subtidal gradient study sampling sites.

The starting position of each transect was established based on landmarks and buoys used to mark existing RWMP stations. To sample a transect, a team of three divers descended to the bottom at the transect origin (approximately -10 ft MLLW). One diver established the sampling station by deploying a measuring tape along a pre-determined compass course, starting at the transect origin. While the measuring tape was being deployed, the two other divers began sampling by first positioning a 2 m long reference bar along the centerline of the sampling area. The reference bar divided the sampling area in half, and provided a measurement reference for establishing the boundaries of the area to be sampled. Each diver recorded bottom depth and substrate composition, and counted or estimated coverages of the target organisms **(Table D-1)** within adjacent 1 m x 2 m areas, resulting in a total area of 4 m^2 surveyed at each site. After completing the counts, divers swam along the measuring tape to the next sampling point. Sampling continued along the transect sequentially until all stations to a depth of approximately -40 ft had been surveyed. The position of the transect terminus was taken using a GPS when the divers surfaced directly above the last sampling station. Some transects required a sequence of two dives to be completed, and in these cases an intermediate position along the transect was recorded.

Table D-1. List of representative taxa sampled at each station. Taxa with an asterisk (*) were quantified as percent cover only. All other taxa listed were quantified by counting individuals.

Algae	Invertebrates	Substrate Types
Laminaria setchellii	*Aplysia californica*	Rock*
Macrocystis pyrifera	*Asterina miniata*	Cobble*
Nereocystis luetkeana	*Crassoderma gigantea*	Sand*
Pterygophora californica	*Cryptochiton stelleri*	
foliose red algae*	*Diopatra ornata**	
	Haliotis rufescens	
	Lithopoma gibberosum	
	Megathura crenulata	
	Norrisia norrisi	
	Octopus spp.	
	Orthosterias koehleri	
	Panulirus interruptus	
	Parastichopus spp.	
	*Phragmatopoma californica**	
	Pisaster brevispinis	
	Pisaster giganteus	
	Pisaster ochraceus	
	Pycnopodia helianthoides	
	Strongylocentrotus spp.	
	Tegula brunnea	

Data analysis

Transect data were grouped by area and partitioned into 5 ft depth increments to examine distribution patterns along depth gradients and among areas. Transects were grouped as follows:

Diablo Cove	DC-03, DC-04, DC-05, DC-06
North Channel	DC-07, DC-08, FC-01, FC-02
Field's Cove	FC-03, FC-04, FC-05, FC-06

Distribution patterns were also examined on maps that were developed using a geographic information system (GIS) that combined station position and taxon density.

An analysis of covariance (ANCOVA) was used to detect statistically significant differences between depths and transects (SAS 1990). According to Sokal and Rohlf (1969) ANCOVA tests whether a group of means of the dependent variable (taxon abundance in this case) are significantly different among groups (depths or areas) and whether this difference is due to differences in the independent variable among the groups. ANCOVA fits a common regression line to the group means of the dependent variable and tests whether there is a significant heterogeneity among these means around this regression line. A significance level of $p>0.10$ was used to test differences.

Results

A total of 122 stations encompassing 488 m^2 was sampled along 13 transects between November 4, 1999 and January 7, 2000 (**Table D-2**). Sampling was restricted to periods of low swell and good visibility, and was therefore completed over a period of several weeks, as conditions permitted. Data were obtained on 5 algal taxa, 20 invertebrate taxa, substrate composition, and depth at each station (**Table D-1**).

Physical Data

Depths sampled (corrected for tidal height at the time of sampling) ranged from -7.6 to -50.5 ft MLLW. Diablo Cove had the greatest proportion of shallow stations (<20 ft) and deep stations (>31 ft) among the three areas, whereas Field's Cove and North Channel had more stations of intermediate depth (21–30 ft) (**Figure D-2**). Depth profiles of several transects illustrates the variation in bathymetry between areas (**Figure D-3**). Transect DC-04 extended from the

Table D-2. Sampling dates, transects sampled, and participating biologists for the subtidal gradient study. Transect DC-02 was a potential sampling location off Diablo Point that was inaccessible and therefore was not sampled.

Date	Transect	Biologists
November 4, 1999	DC-06, FC-03	J. Carroll, J. Blecha, J. Altstatt
November 5, 1999	DC-03(1), DC-07, FC-05	J. Carroll, J. Altstatt, R. Moran
November 15, 1999	DC-05	J. Carroll, J. Altstatt, D. Innis
December 17, 1999	DC-04	J. Carroll, J. Blecha, J. Altstatt
January 4, 2000	FC-01	J. Carroll, D. Innis, J. Tupen
January 5, 2000	FC-04, FC-06	J. Carroll, J. Blecha, D. Innis
January 6, 2000	DC-08, FC-02	J. Carroll, J. Blecha, J. Reinhardt
January 7, 2000	DC-03(2), DC-01	J. Carroll, J. Blecha, D. Innis

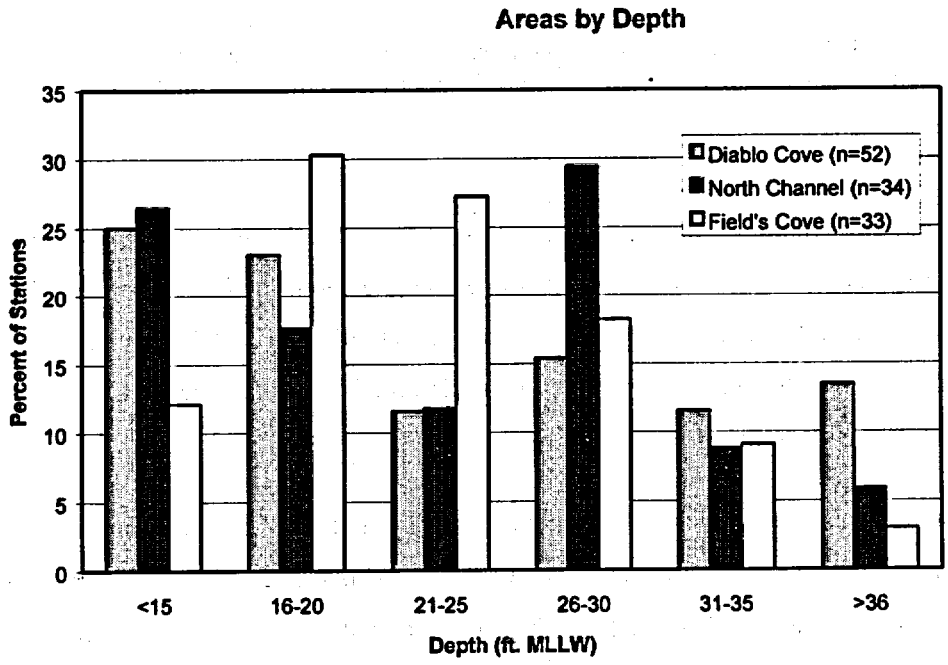


Figure D-2. Depth distribution of stations by area.

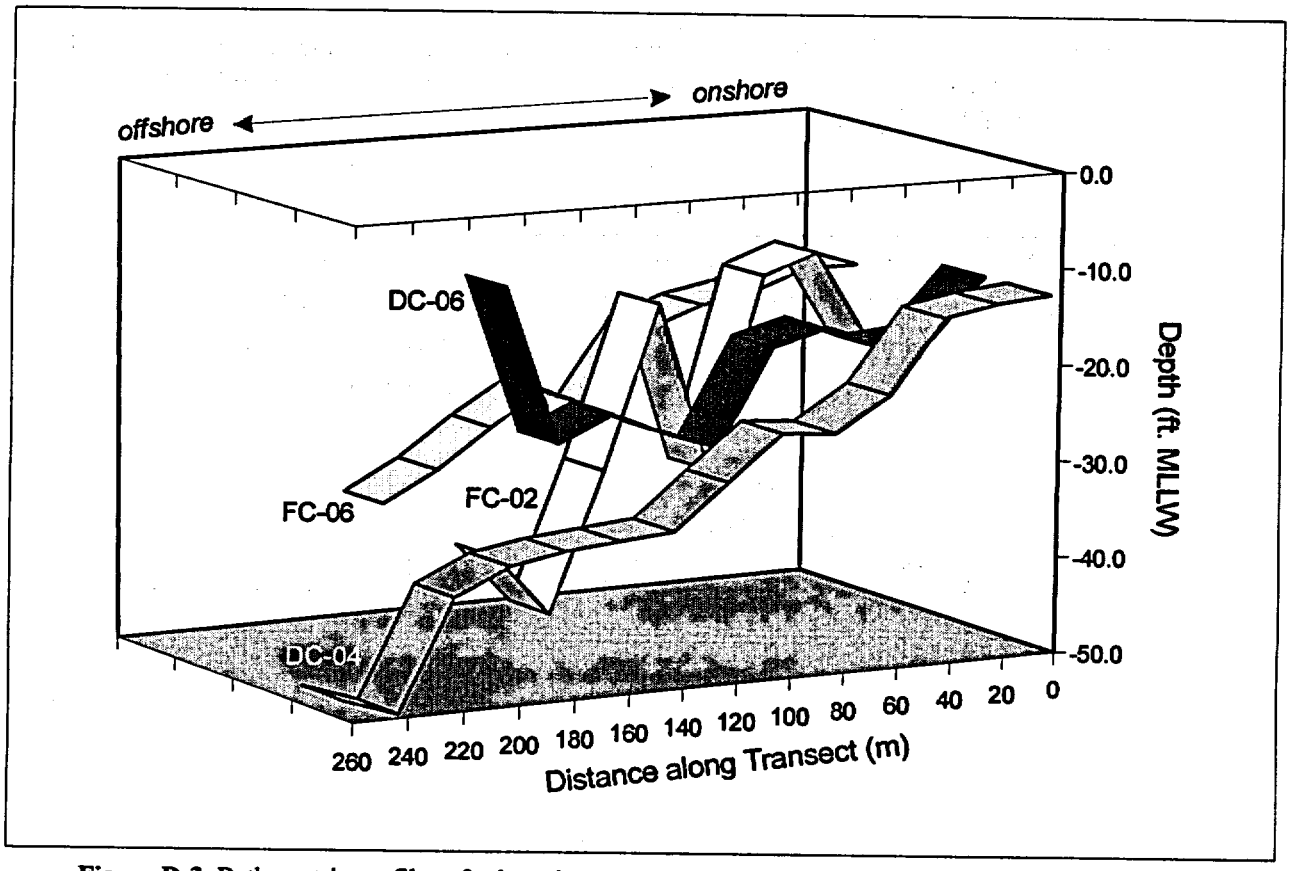


Figure D-3. Bathymetric profiles of selected transects in Diablo Cove, North Channel and Field's Cove. Vertical exaggeration is 12:1. Refer to Figure D-1 for location of transects on the y-axis.

discharge out through the south channel of Diablo Cove and had a gradual depth profile. Transect DC-06 in north Diablo Cove extended across intermediate depths and terminated on the shallow shelf inshore of Diablo Rock. North Channel transect (FC-02) had high bathymetric relief, and Field's Cove (FC-06) had relatively low bathymetric relief. These transects were characteristic of the adjacent transects in the area.

The substratum types sampled were largely bedrock or boulder, averaging approximately 75–85% coverage at most stations. Sand and shell debris had coverages of greater than 50% at some intermediate depth stations (25–35 ft) in Diablo Cove and at the deepest stations (>36 ft) in Field's Cove.

Biological Data

Several taxa showed significant gradient effects in this study (**Table D-3**). The determination of whether or not a taxon displayed a gradient in abundance among depths or areas was based on an evaluation of both the abundance plots for the taxon and the ANCOVA statistical results. All of the algal taxa examined had gradients in abundance related to depth, and three of the five taxa showed differences between areas. Only five of the twenty invertebrate taxa examined had definitive depth gradients, but over half showed substantial differences among transects in the three areas. Statistical analyses that did not detect any significant depth or spatial gradients were probably caused by the high variation in abundance among stations for these less common taxa.

Algal Assemblage

The two dominant understory kelps (*Pterygophora californica* and *Laminaria setchelli*) both had gradients in abundance as a function of depth and distance from the discharge. *Pterygophora* was absent in areas of Diablo Cove shallower than -15 ft MLLW, and gradually increased in abundance to reach a maximum density between 30–35 ft (**Figure D-4, D-5a**). Some kelps were

Table D-3. Summary of gradient study results and comparison to TEMP Analysis Report results (Tenera 1997). Taxa with no discernible gradients in abundance among depths or areas (based on abundance plots or ancova results) are listed with a '—'. Zones or areas of highest density are listed for those taxa with discernible gradients. Significant ANCOVA results ($p<0.10$) are in **bold** type.

	Depth Gradient			Spatial Gradient			Discharge Effects (from Analysis Report)				
	Zone of highest density	F value	P value	*Area of highest density*	F value	P value	Increase	Decrease	No change	Inconclusive	Not Tested
Algae											
% Foliose Reds	Shallow	41.68	<0.001	—	0.29	0.751					X
# *Pterygophora*	Deep	20.38	<0.001	—	1.61	0.208		X			
# *Laminaria*	Shallow	1.12	0.318	Field's	1.90	0.205		X			
# *Macrocystis*	Shallow	2.31	0.132	Diablo	2.40	0.146	X				
# *Nereocystis*	Deep	5.49	0.039	Field's	0.54	0.583		X			
Echinoderms											
# *Asterina miniata*	Deep	14.68	0.003	No. Channel	3.11	0.049	X(s)	X(d)			
# *Pisaster giganteus*	—	0.91	0.360	—	2.1	0.178	X				
# *Pisaster brevispinis*	—	1.00	0.319	—	1.45	0.240				X	
# *Pisaster ochraceus*	—	2.23	0.138	—	1.32	0.271					X
# *Pycnopodia helianth.*	—	0.03	0.870	—	0.11	0.898		X			
# *Parastichopus spp.*	—	0.46	0.501	Diablo	1.43	0.245					X
# *Orthasterias kohleri*	—	2.04	0.156	Diablo	1.21	0.303					X
# *Strongylocentrotus spp.*	Shallow	3.36	0.094	Diablo	1.09	0.376	X				
Mollusks											
# *Tegula brunnea*	Shallow	24.30	<0.001	Field's	20.00	<0.001		X			
# *Lithopoma gibberosum*	—	0.11	0.741	—	1.44	0.241	X				
# *Aplysia spp.*	Shallow	0.50	0.480	Diablo	0.41	0.676	X				
# *Cryptochiton stelleri*	Deep	1.43	0.256	—	0.24	0.795				X	
# *Haliotis rufescens*	—	1.26	0.264	No. Channel	2.99	0.054				X	
# *Norrisia norrisi*	—	0.78	0.379	Diablo	0.08	0.927	X				
# *Octopus spp.*	—	0.07	0.791	—	0.01	0.991					X
# *Megathura crenulata*	—	0.73	0.394	Diablo	0.56	0.571					X
# *Crassedoma giganteus*	—	0.37	0.542	—	0.23	0.798		X			
Polychaetes											
% *Phragmatopoma cal.*	—	0.08	0.782	Diablo	1.61	0.253	X(s)	X(d)			
% *Diopetra ornata*	—	1.39	0.242	Diablo	0.34	0.710			X		
Crustaceans											
# *Panulirus interruptus*	—	0.76	0.385	—	0.26	0.774					X

(s)=shallow [-10 ft MLLW] stations
(d)=deep [-15 ft MLLW] stations

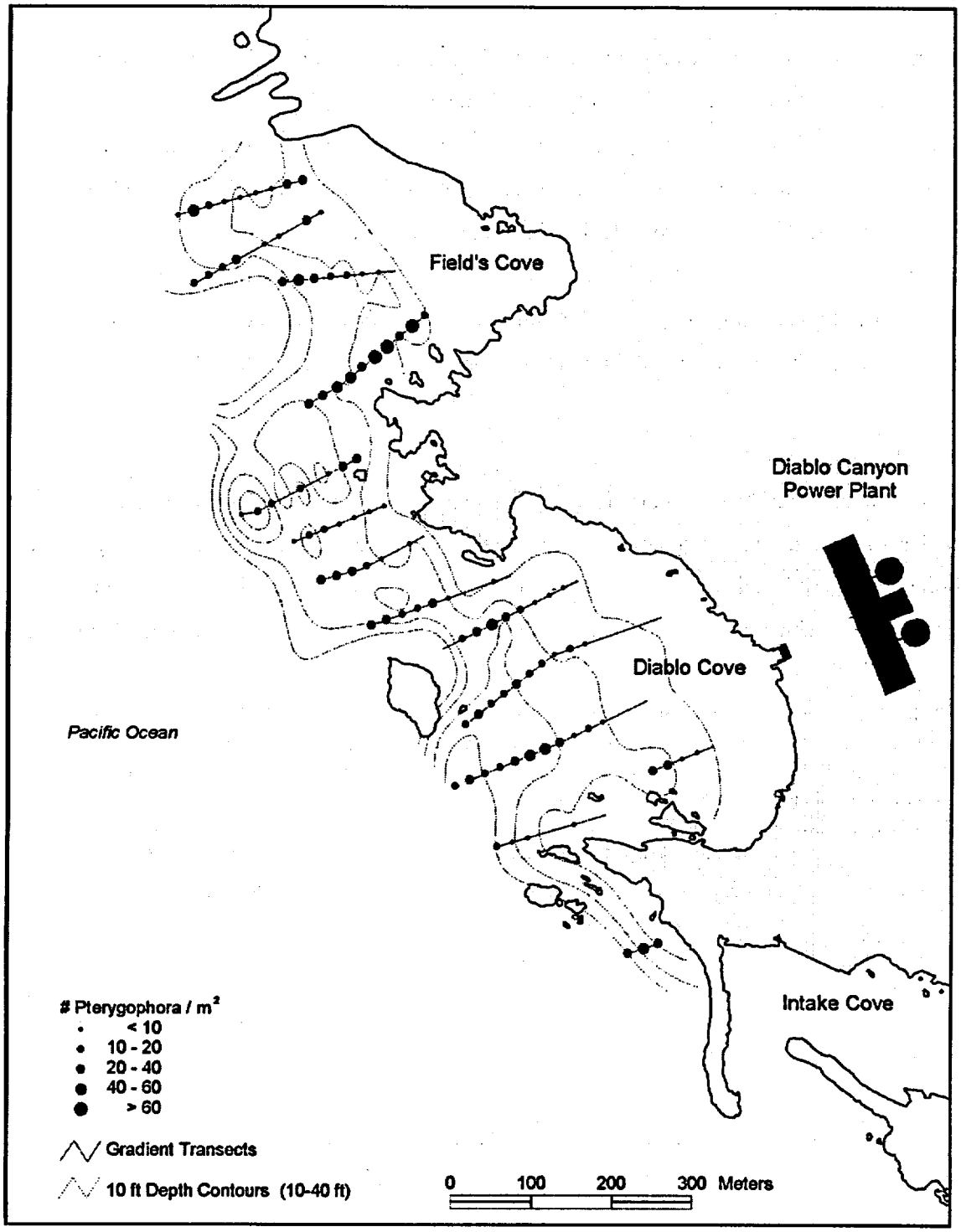


Figure D-4. Abundance gradients in *Pterygophora californica.*

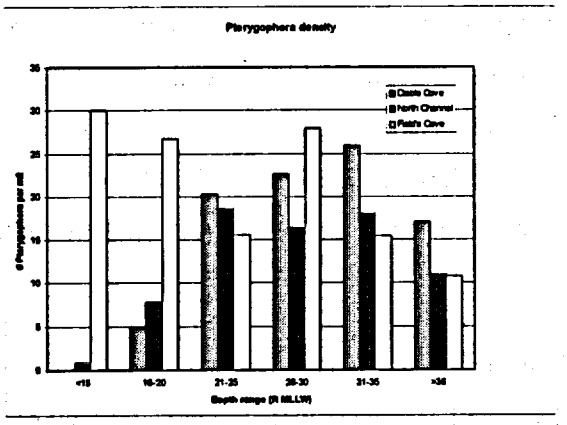


Figure 5a. *Pterygophora californica*

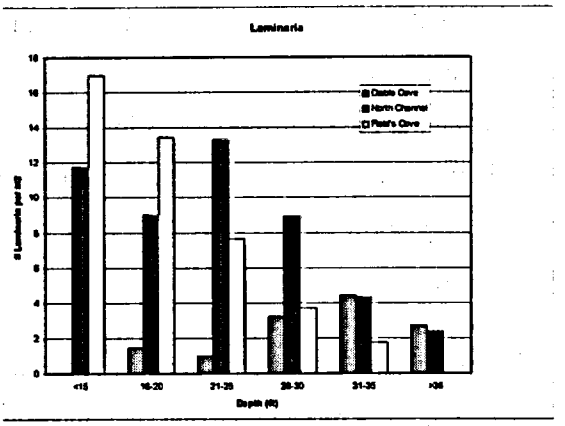


Figure 5b. *Laminaria setchelli*

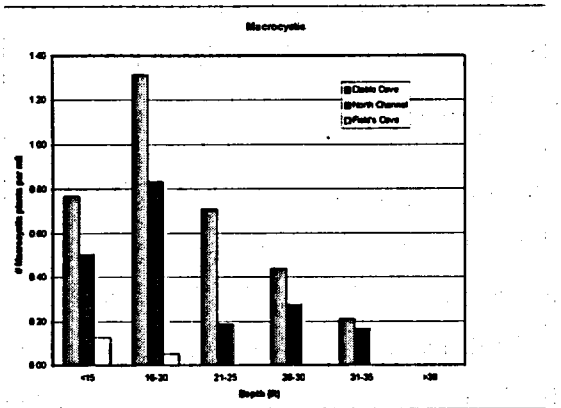


Figure 5c. *Macrocystis pyrifera*

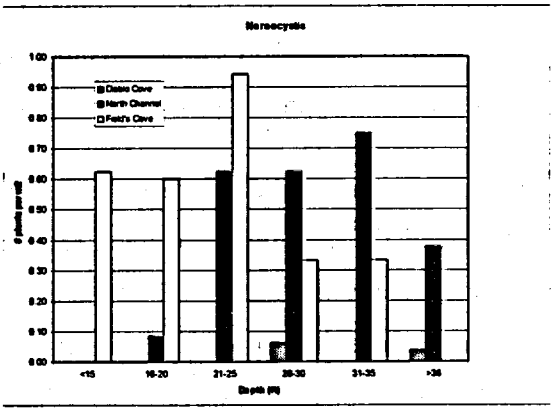


Figure 5d. *Nereocystis luetkeana*

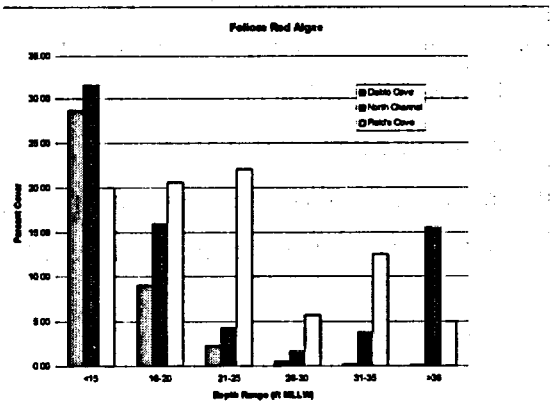


Figure 5e. Foliose red algae.

Figure D-5 (a-e). Abundances of five algal taxa in three areas as a function of depth.

present at shallow sites in North Channel, increasing to their highest densities between 25–35 ft. In contrast to the lack of *Pterygophora* at the shallow stations in Diablo Cove, this species was abundant at the shallow stations in Field's Cove, attaining average densities of 30 /m^2. Densities in Field's Cove declined gradually with depth, with the lowest average densities (10/m^2) occuring below 36 ft. The ANCOVA statistical test identified a significant depth gradient in this species.

Laminaria had a similar pattern of distribution between depths and areas as *Pterygophora*. It was scarce in areas of Diablo Cove shallower than -15 ft, and gradually increased to a maximum density between a depth of 30–35 ft (**Figure D-5b**). Highest densities in North Channel occurred in the 21–25 ft depth range, diminishing rapidly with depth. *Laminaria* was most abundant at the shallow stations in Field's Cove, attaining average densities of 17/m^2. Densities in Field's Cove declined evenly with depth, and this kelp was absent in samples below -36 ft.

The surface forming kelps, *Macrocystis pyrifera* and *Nereocystis luetkeana*, had different gradient distributions between areas. *Macrocystis* was most abundant in Diablo Cove with highest average densities of 1.3/m^2in the 16–20 ft depth range (**Figure D-5c**). It occurred at intermediate densities in North Channel and was all but absent in Field's Cove. *Nereocystis* was most abundant in Field's Cove, intermediate in density in North Channel, and absent in Diablo Cove except for a few individuals at depths below 26–30 ft (**Figure D-5d**).

Foliose red algae (a combined taxon group including *Cryptopleura* spp., *Gelidium* spp., *Prionitis* spp., *Mazzaella* spp., *Callophyllis* spp., and others), were most abundant (up to 30% cover) in the shallow depths of all areas (**Figure D-5e**). They declined rapidly with depth in Diablo Cove and North Channel, although they showed an increase in coverage below 30 ft at North Channel stations. It occupied approximately 20% cover at Field's Cove stations in the 10–25 ft depth range, and declined to 5–10% cover in the deeper areas. The ANCOVA statistical test identified a significant depth gradient in this taxon.

Invertebrate Assemblage

Several species of macroinvertebrates were counted at each station, although only a few of these were common enough to be useful in examining distributional gradients. Among the more abundant taxon groups were echinoderms (seastars and sea urchins), shelled gastropods (snails),

and encrusting tube worms. Some of these taxa demonstrated statistically significant gradient effects.

Echinoderms

Of the six species of seastars that were counted, only *Asterina miniata* and *Pisaster giganteus* were abundant enough to describe gradients in relation to depth and distance from the discharge. *Asterina* had a statistically significant increase in abundance with depth but showed no clear relationship with distance from the discharge. It was least abundant in the shallow areas of Diablo Cove (<0.5/m^2), and gradually increased out to the deepest areas sampled (**Figure D-6a**). The highest densities overall (4.5/m^2) occurred in North Channel at the 31–35 ft depth range. Field's Cove had moderate densities of 1.5/m^2 that centered in the 21–30 ft range. *Pisaster* showed no clear relationship either among depths or areas. These seastars were most abundant

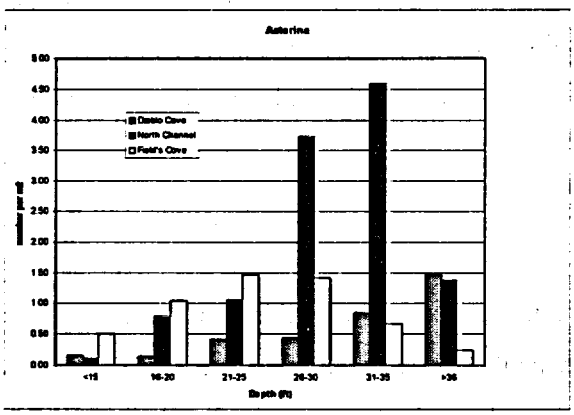


Figure 6a. *Asterina minata*

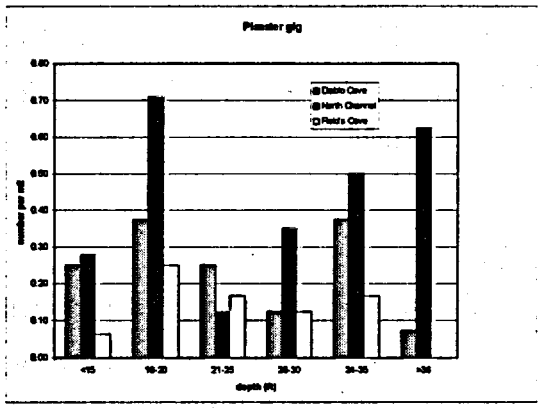


Figure 6b. *Pisaster giganteus*

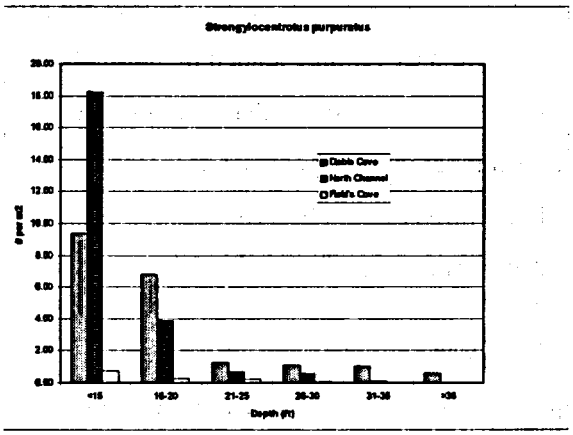


Figure 6c. *Strongylocentrotus purpuratus*

Figure D-6 (a-c). Abundances of three echinoderm taxa in three areas as a function of depth.

(up to 0.7 /m^2) in North Channel and least abundant in Field's Cove (**Figure D-6b**). Diablo Cove seastar abundance averaged approximately 0.3/m^2. There were no observations of sea star "wasting disease" in any areas. This bacterial disease is usually associated with periods of warm water, that can occur during El Niño events, and is apparent by the progressive deterioration of individual sea stars (Eckert et al. 2000).

Sea urchins (primarily *Strongylocentrotus purpuratus*) demonstrated a definitive gradient in relation to depth. They were most numerous in the shallow depths of all areas, but were particularly numerous in Diablo Cove and North Channel in comparison to Field's Cove (**Figure D-6c**). The few shallow stations in North Channel that had very high densities of urchins (>65/m^2) were overgrazed patches of substratum mainly covered by crustose and branched coralline algae.

The holothuroid echinoderm (sea cucumber, *Parastichopus* spp.) was found in low abundance, and only in Diablo Cove. There was no relationship between abundance and depth. Sea cucumbers can also be susceptible to 'wasting disease', but all individuals that were observed appeared healthy.

Mollusks

One of the most apparent differences between the invertebrate fauna in Diablo Cove and Field's Cove is shown by the abundance of brown turban snails (*Tegula brunnea.*). The ANCOVA statistical test identified significant depth and area gradients in this taxon. In Field's Cove, *Tegula* averaged approximately 15/m^2 to depths of 25 ft, but were absent or in very low densities at the same depths in Diablo Cove (**Figure D-7a**). In Field's Cove, they tended to gradually decline in abundance at depths greater than 25 ft. Most of the individuals that were present in Diablo Cove and North Channel were small (≅ 1 cm) compared to individuals in Field's Cove (>2 cm). Other species of *Tegula* (*T. montereyi* and *T. pulligo*) were observed during the survey but occurred too infrequently to determine their distributional patterns.

Two other marine snails were quantified in the study, *Norrisia norrisi* and *Lithopoma gibberosum. Norrisia,* a species with a warm-temperate distribution, occurred in low densities (average <0.2/m^2) at depths of 30 ft and shallower, but only in Diablo Cove. This herbivorous snail was associated with the kelps *Macrocystis* and *Pterygophora.* In contrast, *Lithopoma* was

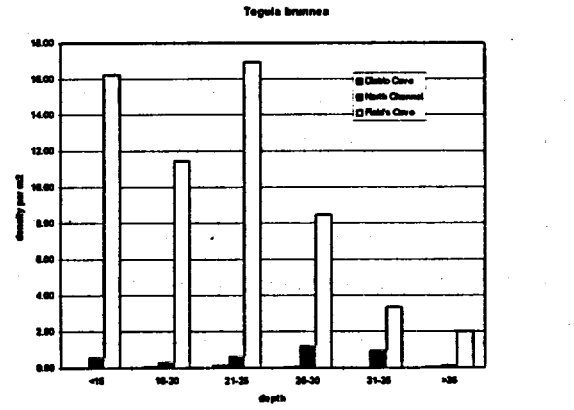


Figure 7a. *Tegula brunnea*

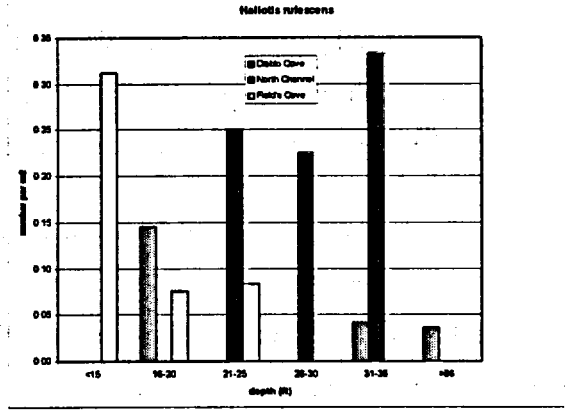


Figure 7b. *Haliotis rufescens*

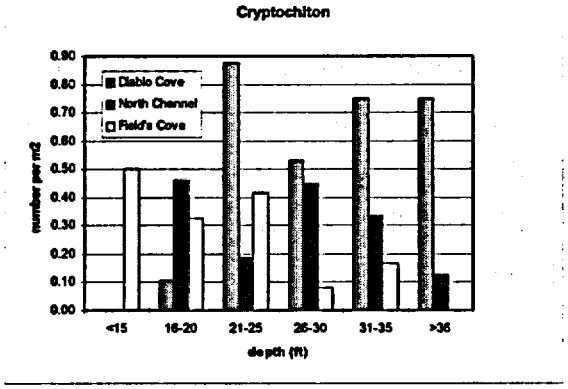


Figure 7c. *Cryptochiton stelleri*

Figure D-7 (a-c). Abundances of three mollusk ttaxa in three areas as a function of depth.

absent from Diablo Cove in depths shallower than 25 ft, and only occurred in low densities (<0.05/m^2) below this depth. It is classified as a species with a cool-temperate distribution. In Field's Cove, *Lithopoma* was present in higher densities (approx. 0.2/m^2) from shallow depths down to 30 ft. It did not occur shallower than 20 ft in North Channel.

Red abalone (*Haliotis rufescens*) were found at low densities in all areas (**Figure D-7b**), although Field's Cove was the only location where they occurred in depths shallower than 15 ft. There was no obvious gradient in abalone abundance related to depth. The ANCOVA identified a statistically significant difference in abundance among areas. Most of the individuals seen during the study were less than 100 mm in length, and there was no evidence of the withering syndrome disease that has been seen locally in populations of both red and black abalone.

Sea hares (*Aplysia* spp.) and giant keyhole limpets (*Megathura crenulata*), were present in Diablo Cove and portions of North Channel down to depths of 30 ft, but were absent in Field's Cove. Although scarce, their distributions suggested that there was a gradient in abundance among the three areas with their greatest concentrations occurring in Diablo Cove.

Giant gumboot chitons (*Cryptochiton stelleri*) were common and widespread, but had differing depth distributions among areas. In Diablo Cove they mainly occurred below 20 ft, but in Field's Cove they were most common above 25 ft (**Figure D-7c**). They were present in all but the shallowest areas in North Channel.

Polychaetes

The sand tube worm (*Phragmatopoma californica*) was a major space occupier in Diablo Cove, covering an average of 25% of available rock habitat across all depths. Coverage increased with depth, reaching a maximum of 40% at the 31-35 ft depth range (**Figure D-8**). Stations in Field's Cove had relatively little cover of *Phragmatopoma*. This gradient was reflected in the intermediate abundances found at North Channel stations.

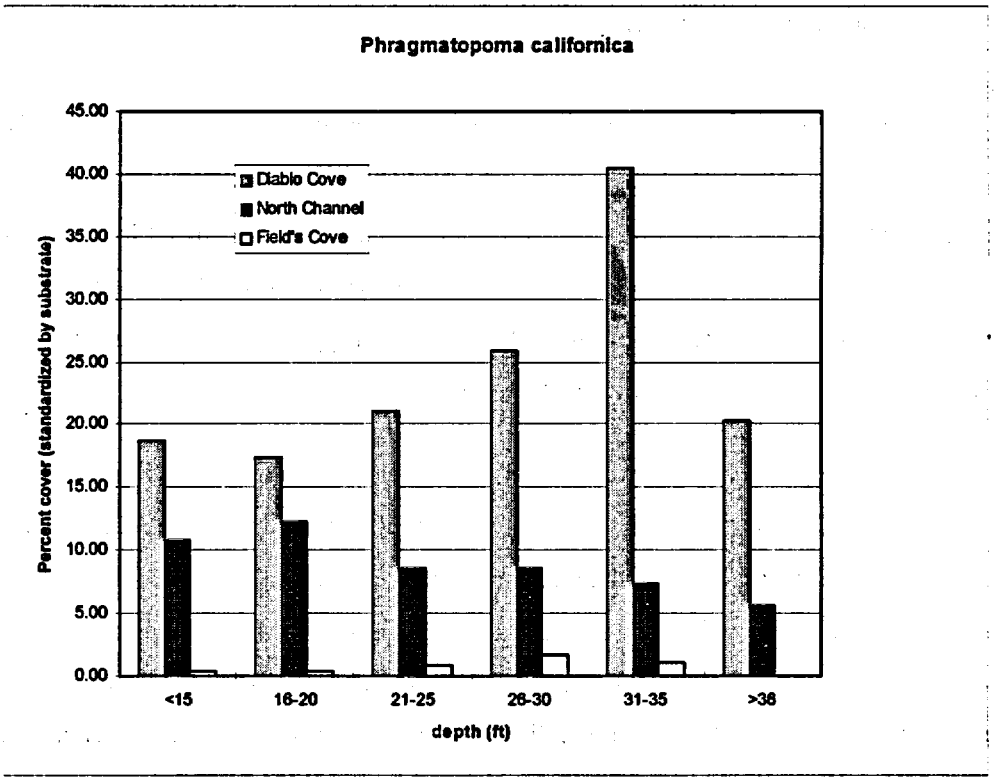


Figure D-8. Percent cover of *Phragmatopoma californica* in three areas as a function of depth.

Another tube-building polychaete (*Diopatra ornata*) was very common in Diablo Cove but not elsewhere. It occupied stable sand habitats below 20 ft but did not display a strong gradient as a function of depth.

Other taxa

Several other macroinvertebrate taxa were seen during the survey but were judged to be too infrequent to include in the results. These included several species of crabs (e.g., *Cancer* spp. and *Pugettia* spp.), snails (e.g., *Calliostoma* spp. and *Mitra idae*), and nudibranchs. Another large group of organisms that was not quantified were the encrusting forms such as tunicates, sponges, and bryozoans. We believed that they would be too difficult to accurately assess using these study methods because of their patchy distributions and the relatively large quadrat size used by the observers. Nevertheless, our qualitative observations were that these encrusting forms appeared to be more common in Field's Cove and North Channel than they were at comparable depths in Diablo Cove.

Discussion

Surveying the abundances of several algal and invertebrate taxa over a relatively wide area enabled us to delineate distribution patterns that were related to depth and distance from the discharge. The most conclusive patterns were seen in the algal taxa, many of which show distinctive natural depth distributions in nearshore areas in response to gradients in light levels and wave exposure. For example, data in the present study from Field's Cove showed that *Laminaria* is naturally more abundant in shallow subtidal areas and gradually becomes less abundant with depth. A comparison of the depth distributions in this species among areas at the depths sampled provides evidence that it was likely not affected below -10 ft in Field's Cove, below -21 ft in North Channel, or below -31 ft in Diablo Cove. While *Laminaria* has been affected by the discharge at depths shallower than -10 ft in Diablo Cove (Tenera 1997), those depths were not sampled in Field's Cove. These conclusions, however, are consistent with temperature data and modeling results showing that the thermal layer from the discharge plume dissipates as it exits Diablo Cove, becoming thinner and cooler as it mixes with ambient ocean water (Tu et al. 1986, Tenera 1997).

We were able to establish a statistical relationship between proximity to the discharge and abundance for only the most abundant invertebrates. This was probably a result of the inherent

patchiness of many of the macroinvertebrates that were sampled. Consequently, even obvious differences between areas, for example the high density of *Aplysia* in Diablo Cove, went undetected in the ANCOVA. However, *Tegula brunnea*, were numerous and widespread enough to yield statistically significant results. It was evident that these snails showed significant reductions in abundance in Diablo Cove at all depths, and that they were also less abundant in North Channel to depths of at least -30 ft. The TEMP Analysis Report (Tenera 1997) identified significant declines in this species to at least -15 ft in Diablo Cove. Therefore, the gradient study corroborated qualitative observations that effects on *Tegula brunnea* were widespread in Diablo Cove, and extended to moderate depths in North Channel.

Unlike the patterns of change seen in *Laminaria* and *Pterygophora*, the widespread effects on *Tegula brunnea* suggest that they were not entirely related to direct contact with the thermal plume. Secondary ecological effects may have played a role in their decline as well. One plausible explanation, suggested by Tenera (1997), was that a higher concentration of fish predators, specifically California sheephead (*Semicossyphus pulcher*), were attracted to the discharge and that their foraging activities in Diablo Cove may have caused declines in *Tegula* throughout the cove. *Tegula* are commonly found in association with kelp species, and while *Laminaria* and *Pterygophora* have declined in abundance in Diablo Cove, *Macrocystis* (giant kelp) has increased (Tenera 1997).

Some species that were shown by Tenera (1997) to have statistically significant changes in abundance did not appear to have any discernible distribution patterns in the gradient study that were related to the discharge. For example, *Pisaster giganteus* increased at the monitoring stations (-10 ft and -15 ft depths) in Diablo Cove after power plant start-up, but showed a wide and variable distribution in the gradient study. This suggests that factors other than depth, or the thermal discharge, may be more influential in determining their distribution. In fact, availability of prey (mussels, barnacles, snails, and chitons) is generally the most important factor regulating the distribution of motile predators such as seastars. Therefore, it is not surprising that our distributional analysis, which covered a broad range of depths and habitats, failed to find any significant relationship with the thermal discharge.

Any distributional study of this type must have adequate replication among areas or depths to resolve the natural variation introduced by habitat heterogeneity. The methods we used worked well for the larger and more widely distributed species, but were unable to yield any conclusions

concerning the extent of potential discharge effects on smaller and less common species. However, the study did demonstrate that some major benthic habitat formers in Field's Cove were most likely unaffected by thermal discharges from DCPP, and that deeper areas in Diablo Cove harbored a diverse assemblage of understory kelps and benthic macroinvertebrates.

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Attachment D-1

Submitted: October 20, 1999
Document No. E9-028.1

Study Plan: Subtidal Gradients in Discharge Effects on Selected Marine Organisms in Diablo Cove and Field's Cove

Introduction

The DCPP discharge has affected the abundances and distributions of many species of algae, invertebrates and fishes in Diablo Cove (PG&E 1988; North et al. 1989; Tenera 1997). Most changes have occurred within the discharge thermal layer which extends to an average depth of approximately -6 m (20 ft) MLLW in south Diablo Cove and -8 m (26 ft) in north Diablo Cove. The thermal layer from the discharge plume becomes thinner as it exits Diablo Cove. The TEMP Analysis Report (Tenera 1997) differentiated between discharge effects at the -3 m (10 ft) depth and the -4.5 m (15 ft) depth based on a comparison of several benthic stations at each depth. However, there was no quantitative description of biological changes at greater depths because data from two deeper stations (-8 m and -10 m) in Diablo Cove could not be analyzed due to the lack of pre-operation data and inadequate controls.

Despite previous studies, the spatial gradient between affected and unaffected zones in Diablo Cove has not been clearly defined as a function of depth or distance from the discharge. Qualitative observations in the RWMP and data from North et al. (1989) showed that losses of Laminarian kelps (e.g. *Pterygophora, Laminaria*) was one indicator of thermal effects. Most areas in the Diablo Cove shallower than -4.5 m (15 ft) had losses of these kelps although some effects extended below -6 m (20 ft) on the inshore side of Diablo Rock where plume downwelling occurred. North et al. also found that the diversity of encrusting organisms such as sponges, tunicates and bryozoans declined in the shallower depths of the cove after power plant start-up. Describing the depth of effects on motile invertebrates and fishes has been more difficult because of their greater spatial variation. Some of the general changes in these groups in the shallow areas of Diablo Cove have been decreases in shelled gastropods, increases in sea hares and sea urchins, and increases in the abundances of warm-water fishes (Tenera 1997).

A study plan was previously submitted to the Regional Board (the Board) staff for review and comment. A meeting was held with the Board staff and their consultant, Dr. Michael Foster, to discuss their comments and review sampling approaches for studying the subtidal gradient of effects. This plan incorporates the comments and discussion from our meeting.

Purpose

The purpose of this study is to describe spatial gradients of biological change in Diablo Cove and Field's Cove as a function of water depth and distance from the discharge. In addition to using descriptions and analyses of previous work, this study will include a one-time subtidal survey along several transects located inside and outside of Diablo Cove. The transects will extend across a range of depths from approximately -3 m (10 ft) to -12 m (40 ft) MLLW.

The proposed gradient study will focus on representative taxa (**Table 1**) that are relatively abundant in either Diablo Cove or control areas and have been previously shown to be affected by the discharge. Laminarian kelps (*Pterygophora* and *Laminaria*) will be used as representative taxa because of their widespread distribution and previously identified thermal effects. Results have shown that the absence of these kelps in zones where they would normally be expected to occur (rock substrate, shallow depths) would be a good indicator of areas affected by the discharge. Other algae and selected macroinvertebrates will also be sampled along the transects encompassing the depth gradients.

Methods

Data will be collected during a single survey to describe differences in the distributions of selected target organisms as a function of depth and distance from the main DCPP discharge.

Sample sites will be located at 20 m intervals along 14 transects in Diablo Cove and Field's Cove (**Figure 1**). A total of 151 sites are proposed, although the number may be slightly higher or lower depending on transect bathymetry. A team of two divers will descend to the bottom at the inshore site of a transect. The starting position and ending position of each transect will be established based on landmarks and recorded with a GPS. One diver will deploy a 100 m measuring tape along a pre-determined compass course. When the tape is secured, the diver will deploy a marker buoy to the surface. This position will be recorded with the GPS. The other diver will begin sampling by counting the target organisms within a 2 m x 2 m area (total 4 m^2)

every 20 m along the transect. The second team member will also sample sites in the reverse direction until the two divers meet. At that time the divers will swim to the measuring tape terminus, rewind the tape, recover the surface float, and then deploy the tape along the next section of the transect along the same compass course. Sampling will continue along the transect until all points have been surveyed. Only points located between -3 m (10 ft) and -12 m (40 ft) will be sampled. Abundance estimates on the taxa shown in **Table 1** will be collected at each point.

Table 1. List of representative taxa to be sampled at each point.

Scientific name	Common name
Laminaria dentigera	Palm kelp (#)
Pterygophora californica	Palm kelp (#)
Macrocystis pyrifera	Giant kelp (#)
Tegula brunnea	Brown turban snail (#)
Lithopoma gibberosum	Top shell (#)
Aplysia californica	Sea hare (#)
Strongylocentrotus spp.	Sea urchins (#)
Asterina miniata	Bat star (#)
Pisaster spp.	Sea star
Cryptochiton stelleri	Gumboot chiton (#)
Rhodophyta	Red algae (%)
	Substrate (rock, cobble, sand) (% by type)

Existing Data Sources

Taken as a whole, the biological and oceanographic studies at Diablo Canyon from 1976–1998 provide a useful database for describing changes in the subtidal biological community within Diablo Cove as a function of depth. One advantage of the long-term data sets is that they illustrate the temporal changes at several depths as a result of the discharge. There have been fewer comparable data, however, collected in control areas outside of Diablo Cove. The spatial extent of changes as a function of distance from the discharge has also not been well described. Historical data from other studies in Diablo Cove will be compared to the recent data to gain perspective on the nature of long-term changes in Diablo Cove as a function of depth. Studies that will be reviewed include:

- The Receiving Water Monitoring Program (formerly the Thermal Effects Monitoring Program), a long-term database on abundances of benthic algae and invertebrates at several permanent stations inside and outside of Diablo Cove (Tenera 1997, 1999). The following

table summarizes the number of RWMP benthic stations with data suitable for analysis by depth range and location:

Station Depth	Diablo Cove	Field's Cove	South Control
-3 m (10 ft)	4	1	1
-4.5 m (15 ft)	2	1	–
>-4.5 m (15 ft)	2	1	2

- Also included in the RWMP was a subtidal red abalone study that was done annually from 1990–1998. It included counts of selected macroinvertebrates and estimates of kelp abundance at randomly located stations in Diablo Cove and controls. Approximately 60 stations inside Diablo Cove and 20 stations outside Diablo Cove were sampled annually at depths ranging from -2 m (6 ft) to -15 m (48 ft) MLLW.

- Subtidal video transects were filmed annually in Diablo Cove from 1984–1989. A series of 22 transects 100 m in length covered depths from approximately -3 m (10 ft) to -15 m (48 ft) MLLW. The data included permanent videotape records and lists of species of each transect based on reviews of the tapes.

- Wheeler J. North and associates collected quantitative data on changes in kelp populations on three subtidal transects (North et al. 1989). They compared data between shallow (-3 m MLLW) and deep (-8 m MLLW) zones on transects in Diablo Cove, off Diablo Rock and off Pup Rock north of Field's Cove.

- The RWMP subtidal temperature database contains temperature measurements at selected stations inside and outside of Diablo Cove. Nearly all of the subtidal biological stations have continuous records of water temperature.

Analysis and Reporting

The data collected in the new sampling program will be presented as a series of abundance plots for each target organism as a function of depth and distance along each transect. Only sites that have at least 80% of the sampled area with hard substrate will be used in the analysis in order to minimize variation in abundances due to substrate type. Data will also be partitioned by depth and area to compare broader scale differences between Diablo Cove and Field's Cove. Data from

South Control and Field's Cove will be used to compare species composition and relative abundances for the long-term data sets at TEMP subtidal benthic stations.

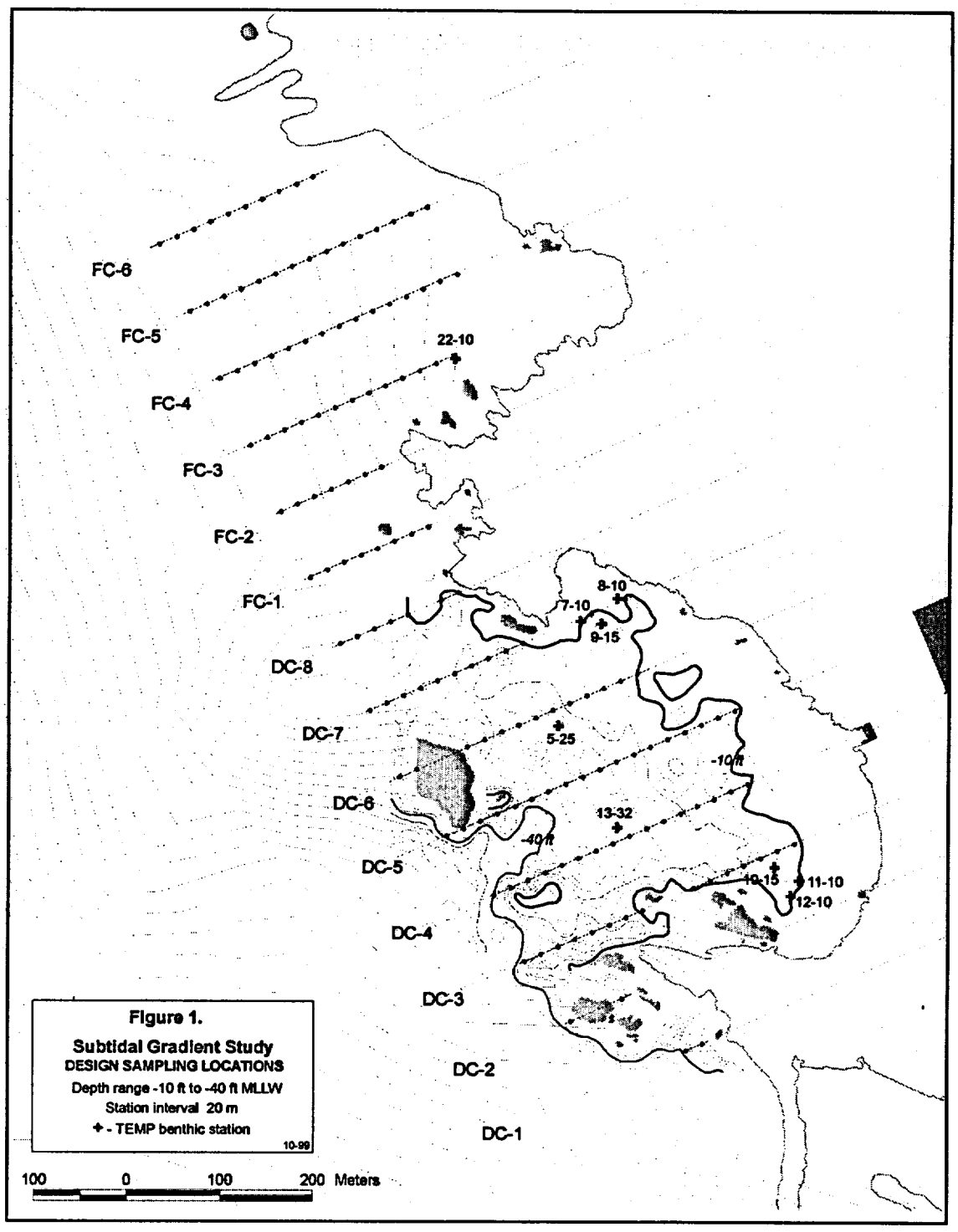


Figure 1. Design locations of subtidal gradient study sampling sites.

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Appendix E

Annual Taxa Means by Intertidal Sampling Method

E1 – Algal Cover in Horizontal Band Transects

E2 – Invertebrate Abundance in Horizontal Band Transects

E3 – Fish Abundance in Vertical Band Transects

E1 – Algal Cover in Horizontal Band Transects

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 1 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	5	6	5	6	5	3	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	-
Calliarthron/Bossiella spp.-complex	0.9	0.4	1.0	0.8	2.3	1.1	1.5	1.6	1.3	1.6	1.9	1.7	1.2	0.9	0.6	0.8	0.7	1.2	1.3	1.5	1.1	0.8	1.7	0.9
Callithamnion pikeanum	<.1	<.1	+	<.1	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	+	<.1	+	<.1	-	+	<.1	<.1	<.1	<.1	<.1
Callithamnion spp./Pleonosporium spp.	-	-	-	<.1	+	+	-	-	+	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Callophyllis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Chondracanthus canaliculatus	9.7	10.6	10.8	13.2	9.2	12.6	12.9	10.2	17.0	10.5	8.5	8.1	6.3	7.4	7.7	10.3	14.9	10.1	15.2	14.6	13.5	12.3	7.3	8.5
Chondracanthus corymbiferus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	+	+	+	+	+	-	-	-	-
Chondracanthus harveyanus/spinosus	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Chondria decipiens	-	-	-	<.1	-	-	<.1	<.1	0.2	<.1	-	-	+	-	<.1	-	-	-	-	-	-	-	+	+
Chrysophyta unid.	-	-	<.1	+	+	-	-	-	0.1	<.1	+	<.1	-	+	+	-	-	0.2	-	+	-	+	-	-
Cladophora spp.	<.1	<.1	+	+	+	+	+	+	+	+	<.1	+	<.1	<.1	+	<.1	+	+	+	+	+	+	+	+
Codium setchellii (prostrate)	0.8	0.7	1.5	1.2	1.1	1.5	1.7	1.9	1.5	1.3	1.5	1.2	1.9	1.1	1.4	1.6	1.9	1.6	1.4	1.6	1.6	2.3	1.5	1.5
Colpomenia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	+	-	-	-
Corallina officinalis	0.3	0.3	0.1	0.3	+	0.1	<.1	<.1	<.1	0.2	0.1	<.1	<.1	+	<.1	+	+	<.1	<.1	<.1	<.1	<.1	<.1	+	+
Corallina vancouveriensis	0.9	1.4	2.0	1.6	1.7	1.5	1.7	2.1	2.2	2.4	3.0	3.1	2.1	1.1	0.7	0.6	0.8	0.5	0.9	0.8	1.0	1.0	0.7	0.9
Cryptopleura violacea	2.3	4.4	3.6	3.1	5.4	4.2	4.4	5.5	2.1	0.9	1.1	2.7	1.6	0.9	2.5	3.4	4.0	2.7	2.1	3.9	2.7	1.4	2.1	0.7
Cryptosiphonia woodii	<.1	-	-	<.1	<.1	+	<.1	-	<.1	<.1	<.1	+	+	-	-	+	-	+	-	-	-	-	+	-
Cystoseira osmundacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Egregia menziesii	-	-	-	-	0.2	<.1	-	-	-	<.1	-	+	-	-	<.1	-	-	<.1	0.3	1.9	<.1	-	2.2	1.3
Endocladia muricata	0.5	1.6	1.5	1.3	1.9	1.7	2.4	2.1	1.9	2.7	2.3	3.6	2.9	2.9	2.9	2.5	2.2	2.1	1.9	1.9	1.4	1.4	1.1	2.1
Farlowia/Pikea spp.-complex	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fucus gardneri	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	+	-
Gastroclonium subarticulatum	6.1	5.0	8.0	5.5	9.7	6.0	5.1	10.4	8.8	5.7	5.1	7.5	8.1	5.5	9.1	9.6	11.3	13.1	10.0	10.8	11.6	7.5	10.9	4.2
Gelidium coulteri	4.8	9.0	7.8	4.8	8.4	7.9	6.7	8.4	7.9	7.0	9.4	10.2	8.6	9.5	10.5	7.3	5.5	5.3	5.1	6.9	5.7	4.3	6.3	7.0
Gelidium pusillum	0.5	0.8	0.4	0.6	0.5	0.6	0.3	0.4	0.7	1.0	0.3	0.5	0.7	0.7	0.8	0.6	0.4	0.7	0.7	0.3	0.1	0.8	0.2	<.1
Gelidium robustum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Grateloupia doryphora	-	+	0.1	<.1	0.2	-	-	0.2	+	+	<.1	<.1	-	-	-	-	<.1	0.1	-	<.1	-	-	0.3	-
Halymenia/Schizymenia spp.-complex	-	-	<.1	-	0.1	+	<.1	+	+	<.1	<.1	<.1	-	-	+	-	<.1	<.1	<.1	0.2	+	+	<.1	+
Hymenena spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Laminariales	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Mastocarpus jardinii	1.7	0.5	0.7	1.3	1.3	1.4	1.4	1.3	1.0	0.3	0.4	0.7	0.9	0.9	0.6	0.8	0.7	0.8	0.7	0.7	1.3	0.9	0.6	1.5
Mastocarpus papillatus	4.9	7.7	5.7	6.6	5.5	5.7	5.8	5.4	8.5	7.1	7.2	6.6	7.2	8.6	5.1	7.0	4.7	6.2	4.9	4.2	4.4	5.5	5.0	6.3
Mazzaella affinis	7.1	6.8	7.3	7.4	8.5	8.8	6.6	9.7	12.7	11.3	12.8	11.7	12.4	11.0	14.1	11.5	12.1	9.6	7.5	8.7	9.9	5.4	8.8	12.9
Mazzaella flaccida	34.1	36.2	40.9	40.7	40.3	40.2	43.8	46.2	17.5	16.1	27.8	31.7	29.2	35.1	31.3	39.1	29.3	27.6	37.9	35.7	30.7	22.8	21.4	28.5
Mazzaella heterocarpa	0.3	0.2	0.6	0.2	1.3	0.5	0.4	0.7	0.6	0.3	0.6	0.6	0.3	1.4	1.1	1.1	0.6	1.0	0.5	0.6	0.2	0.2	0.8	0.6
Mazzaella leptorhynchos	0.8	0.4	0.5	0.3	1.0	0.4	0.4	0.6	1.1	1.0	1.2	0.9	2.2	1.6	0.7	0.8	1.2	1.1	0.7	0.8	0.3	1.0	3.0	0.7
Mazzaella lilacina	<.1	0.3	-	<.1	0.4	<.1	<.1	<.1	<.1	-	-	-	-	<.1	-	<.1	-	<.1	-	<.1	-	<.1	-	<.1
Melobesia mediocris	-	-	<.1	+	+	+	+	+	+	+	+	<.1	-	+	+	+	+	+	+	+	+	+	+	+
Microcladia borealis	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	<.1	<.1	0.3	<.1	<.1	<.1	<.1	0.2	0.1	<.1	<.1	0.1	<.1	+	+	+	<.1	<.1	<.1	+	<.1	<.1	+	+
Neorhodomela larix	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	+	-	<.1	-	-	-	-	-
Non-coralline crust	14.6	13.1	10.3	13.5	13.6	14.6	13.5	10.6	14.5	17.8	15.1	17.4	15.1	15.7	13.1	9.0	10.2	11.0	9.3	8.6	7.5	9.6	13.2	14.5
Osmundea spp.	<.1	0.2	0.2	0.2	0.1	<.1	0.2	<.1	0.1	0.2	<.1	<.1	<.1	<.1	+	<.1	<.1	0.1	0.1	<.1	0.1	0.2	0.1	<.1
Pelvetia compressa	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	12.0	10.5	13.0	11.7	12.2	10.7	11.5	10.4	12.1	13.5	13.9	15.0	12.9	13.2	12.5	16.6	17.1	18.8	23.5	22.3	27.0	27.6	26.2	22.9

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 1 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	5	6	5	6	5	3	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Polyneura latissima	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	-	0.4	<.1	0.2	0.3	0.2	0.1	0.6	1.9	3.0	2.4	0.8	0.3	0.4	0.1	0.7	-	0.6	0.3	0.4	+	-	0.3	0.7
Prionitis spp.	0.2	0.3	0.8	0.9	1.0	0.4	0.2	0.6	0.5	0.4	0.3	0.4	<.1	0.1	0.1	0.5	0.3	0.3	0.5	0.6	0.9	0.4	0.8	0.3
Pterosiphonia dendroidea	<.1	<.1	<.1	0.3	<.1	0.2	0.1	<.1	0.6	<.1	<.1	0.2	+	<.1	<.1	<.1	<.1	0.7	0.2	0.6	0.5	0.2	1.4	0.2
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Sarcodiotheca gaudichaudii	-	<.1	<.1	+	<.1	<.1	+	<.1	<.1	<.1	<.1	<.1	-	+	+	<.1	<.1	<.1	<.1	0.2	0.1	<.1	<.1	+
Smithora naiadum	<.1	-	0.3	0.7	0.3	0.9	1.0	0.2	1.1	1.1	0.4	0.9	<.1	0.7	0.6	0.1	+	+	0.2	-	0.1	0.8	-	0.2
Spongomorpha/Acrosiphonia-complex	-	-	+	+	+	+	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	+	+	+	+	+	+	+	-
Ulva/Enteromorpha spp.	+	+	+	0.4	<.1	<.1	0.2	+	1.0	0.9	<.1	+	<.1	<.1	<.1	0.1	0.1	0.5	0.3	<.1	<.1	0.2	-	0.5
coralline crust	5.3	6.8	5.5	4.8	7.5	6.6	5.7	7.6	5.5	6.9	4.4	5.2	4.5	3.5	5.1	3.3	3.4	5.5	3.7	3.9	3.6	5.8	7.7	4.2
filamentous red algae-complex	<.1	0.1	0.1	0.9	0.4	0.2	0.5	0.3	0.3	2.0	0.1	0.2	0.1	0.5	0.6	0.8	1.0	1.6	2.4	0.7	1.4	2.4	1.9	0.7
juv. articulated coralline algae	-	0.5	<.1	0.3	0.4	0.1	0.2	0.3	0.2	0.2	0.2	0.3	<.1	0.2	0.1	0.1	0.4	0.6	0.1	<.1	0.2	0.1	0.5	0.6

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	5	6	5	6	5	4	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	+	+	<.1	0.1	0.1	<.1	<.1	0.1	<.1	+	<.1	<.1	<.1	0.1	0.2	<.1	0.2	<.1	0.3	0.2	0.3	<.1	<.1
Calliarthron/Bossiella spp.-complex	0.2	<.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.2	0.1	<.1	<.1	0.1	<.1
Callithamnion pikeanum	-	<.1	+	<.1	+	+	+	-	+	+	+	+	+	<.1	-	-	+	-	-	+	-	-	-	<.1
Callithamnion spp./Pleonosporium spp.	+	-	-	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	1.9	0.8	0.4	0.9	0.5	0.6	0.3	0.6	0.7	0.3	0.2	0.1	<.1	<.1	<.1	0.2	0.2	0.2	0.2	0.1	0.1	0.3	0.4	0.4
Chondracanthus corymbiferus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	+	-	-	-	-	-	<.1	-	-	+	+	+	-	-	<.1	-	-	-	-	-	-	-
Cladophora spp.	<.1	<.1	<.1	<.1	+	<.1	<.1	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	<.1	0.5	+	+
Codium setchellii (prostrate)	1.5	1.9	1.8	2.0	2.2	2.8	2.7	1.9	0.7	0.8	1.2	1.8	1.4	0.8	1.1	1.5	1.8	1.3	1.5	2.1	1.6	2.2	2.5	3.0
Corallina officinalis	0.3	0.3	+	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina vancouveriensis	1.0	1.1	1.3	1.5	1.2	1.1	0.9	0.9	0.6	0.8	0.8	0.7	0.7	0.6	0.7	0.7	1.0	0.7	0.8	0.9	1.0	1.4	1.2	1.0
Cryptopleura violacea	+	<.1	<.1	<.1	<.1	-	+	+	<.1	+	-	-	-	-	-	-	-	<.1	<.1	0.2	0.2	0.6	0.6	0.2
Cryptosiphonia woodii	1.1	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	-	-	-	-	-	-	-	-	-	+	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-
Endocladia muricata	15.7	14.7	13.7	17.2	16.7	16.0	17.4	17.0	17.5	26.0	31.3	36.0	34.8	35.2	37.7	35.0	36.4	32.0	32.6	31.0	28.6	27.0	26.1	25.5
Fucaceae unid.	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Fucus gardneri	-	-	-	+	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	<.1	-	-	-	-	-	-	-	+	-	+	-	+	+	+	+	0.3	-	<.1	-	-	+	<.1	<.1
Gelidium coulteri	1.6	1.6	2.1	2.7	1.3	1.5	2.0	1.9	2.5	1.5	1.1	0.7	0.8	0.9	1.4	1.4	1.7	1.3	1.2	0.6	1.2	1.4	0.5	1.2
Gelidium pusillum	2.1	1.9	1.5	1.5	1.7	2.2	1.0	2.2	2.4	0.8	0.4	0.4	0.2	0.3	0.7	0.7	1.4	1.5	0.8	0.7	1.1	1.5	1.6	0.9
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hesperophycus californicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Mastocarpus jardinii	2.7	1.6	1.7	2.7	2.7	2.3	2.3	2.4	1.6	0.6	0.7	1.1	1.6	1.5	1.0	1.3	1.2	1.3	1.3	1.1	1.3	1.6	1.1	1.0
Mastocarpus papillatus	16.1	24.9	26.8	23.3	26.8	21.3	26.3	27.3	25.0	12.2	12.4	13.9	18.2	20.5	18.4	25.5	21.9	26.5	27.5	27.2	25.8	23.2	25.3	19.8
Mazzaella affinis	1.0	0.7	0.9	2.1	0.8	1.3	0.8	0.8	1.7	0.5	0.5	0.4	0.9	0.4	0.6	0.5	1.6	1.0	1.8	0.6	0.9	0.8	1.7	1.4
Mazzaella flaccida	28.2	20.8	25.9	27.8	26.2	23.9	25.8	24.0	9.4	10.8	16.3	18.7	12.1	11.0	14.7	17.3	18.1	16.3	24.7	21.8	16.9	16.6	21.0	18.0
Mazzaella heterocarpa	-	<.1	<.1	0.2	0.4	0.3	0.2	0.3	<.1	<.1	0.3	0.6	0.2	0.5	0.3	0.5	0.4	1.0	0.6	0.7	0.5	0.3	1.1	0.4
Mazzaella leptorhynchos	-	<.1	+	+	+	<.1	+	<.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	+	0.2	0.3	0.2
Melobesia mediocris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
Microcladia borealis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Microcladia coulteri	+	-	+	+	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neorhodomela larix	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	20.5	19.1	20.9	22.1	19.6	25.0	23.8	20.1	22.3	16.2	16.6	25.6	21.3	22.3	21.4	16.0	17.0	16.9	18.6	15.8	14.3	20.2	17.2	17.6
Osmundea spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-
Pelvetia compressa	6.4	6.0	4.5	4.8	5.5	5.0	4.9	4.5	3.7	3.4	4.6	5.0	4.5	5.2	4.5	4.9	6.8	7.8	7.9	8.7	8.7	9.7	9.0	6.3
Phyllospadix spp.	-	+	-	-	<.1	-	0.2	0.1	<.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.3	0.4	0.4	0.5	0.2	0.6
Plocamium violaceum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Porphyra spp.	1.4	3.6	1.1	2.0	0.7	0.9	0.3	0.3	2.9	2.7	1.7	0.9	0.5	0.2	0.7	0.7	<.1	0.6	0.3	0.3	0.3	1.3	0.8	0.8
Prionitis spp.	0.2	<.1	0.1	<.1	<.1	0.1	<.1	<.1	+	0.1	0.1	0.2	0.1	0.1	0.2	0.1	0.3	0.2	0.2	0.3	0.1	0.2	<.1	0.1
Rhodophyta (juv. blades)	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Scytosiphon spp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Spongomorpha/Acrosiphonia-complex	<.1	-	<.1	<.1	<.1	<.1	+	+	<.1	<.1	<.1	<.1	0.2	0.1	+	<.1	+	-	+	-	<.1	-	-	-
Ulva/Enteromorpha spp.	-	<.1	<.1	<.1	+	+	<.1	+	<.1	+	+	+	+	<.1	0.2	+	+	+	<.1	+	+	+	+	+
coralline crust	6.3	7.1	8.2	7.1	7.0	8.5	7.9	12.0	8.4	5.4	5.2	6.2	5.3	5.4	5.2	5.6	4.2	6.9	6.3	6.6	6.5	8.1	9.3	7.1
filamentous red algae-complex	-	+	-	+	+	-	+	-	+	+	-	+	-	-	+	+	+	-	-	+	-	-	+	-
juv. articulated coralline algae	-	-	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.1	<.1	<.1	+	+	<.1	0.1	0.2	<.1	<.1	0.1	0.1	<.1	0.5

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 2 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	4	3	3	6	4	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Analipus japonicus	-	-	-	-	-	-	-	-	-	-	+	+		-	-	-	-	-	-	-				-
Bryopsis spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	+	<.1	-	-				-
Calliarthron/Bossiella spp.-complex	0.2	0.1	0.4	0.6	0.7	0.7	0.6	0.6	0.3	0.9	0.5	0.6		<.1	0.1	0.3	0.2	1.2	0.7	0.3				0.6
Callithamnion pikeanum	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	<.1	+	<.1		-	<.1	-	<.1	-	-	+				-
Callithamnion spp./Pleonosporium spp.	-	-	-	+	+	-	-	-	-	-	-	+		-	+	-	-	-	-	+				-
Callophyllis spp.	-	-	<.1	-	-	<.1	-	-	+	<.1	+	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	13.1	12.9	15.1	14.8	15.3	17.8	18.3	14.3	15.8	9.6	7.1	9.8		8.8	12.2	12	14.9	12.7	14.8	11				12.2
Chondracanthus corymbiferus	-	-	<.1	-	<.1	+	-	-	-	+	-	-		-	-	-	-	-	-	-				-
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Chondria decipiens	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	+				-
Chrysophyta unid.	<.1	-	0.2	<.1	<.1	<.1	<.1	-	<.1	0.2	+	<.1		-	+	-	+	-	<.1	+				-
Cladophora spp.	+	+	<.1	+	+	+	+	+	<.1	<.1	<.1	<.1		+	<.1	+	<.1	<.1	+	+				+
Codium setchellii (prostrate)	1.7	1.9	2	1.7	2.2	1.8	2.6	1.6	1.9	1.4	1.7	1.1		2.7	1.8	1.9	2.1	1.9	1.5	1.5				1.5
Colpomenia spp.	-	-	-	+	-	<.1	<.1	-	+	-	0.2	<.1		-	-	+	+	+	<.1	-				-
Colpomenia/Leathesia/Soranthera spp.	-	-	-	<.1	-	-	-	<.1	-	+	-	<.1		-	-	-	-	<.1	-	-				+
Corallina officinalis	0.2	0.2	<.1	<.1	0.1	0.1	<.1	<.1	<.1	+	<.1	<.1		-	+	+	+	+	+	+				<.1
Corallina vancouveriensis	0.4	0.9	0.3	0.7	0.4	0.7	0.5	0.4	0.7	0.8	1.3	1		0.5	0.6	0.9	0.5	0.5	0.8	0.5				1.4
Cryptopleura ruprechtiana	<.1	-	-	-	-	-	-	+	-	+	-	-		-	-	-	-	-	-	-				<.1
Cryptopleura violacea	0.5	0.2	1.6	1.1	1.7	1.5	1.1	2.5	0.7	0.3	0.3	0.8		<.1	0.5	0.5	0.6	0.8	1	0.7				0.5
Cryptosiphonia woodii	<.1	-	-	<.1	<.1	-	-	-	-	<.1	<.1	<.1		-	<.1	<.1	<.1	0.3	<.1	-				0.1
Egregia menziesii	-	-	0.6	0.2	<.1	<.1	0.4	0.1	0.2	<.1	+	1.4		-	-	0.4	0.1	0.6	0.5	0.6				1.1
Endocladia muricata	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	1	1.9		0.6	0.8	0.3	0.4	0.2	0.3	0.6				0.6
Farlowia/Pikea spp.-complex	<.1	-	<.1	-	-	-	-	-	-	+	<.1	-		-	-	-	-	-	-	-				+
Gastroclonium subarticulatum	3.6	2.5	6.7	4.1	7.4	4.9	3.3	10.8	5.6	4.3	7	7.5		4.7	5.9	6.8	9.6	12.7	6.8	9.6				8.6
Gelidium coulteri	3	2.2	4.3	2.9	3.4	3.1	3.6	2.8	4.4	2.7	3.5	4		4.4	5.4	5.4	4	2.5	4	3.5				2.7
Gelidium pusillum	1	0.3	0.4	0.5	0.6	0.6	0.6	0.2	0.4	0.4	0.4	0.3		2	0.6	0.9	0.7	0.6	0.4	0.2				0.4
Gelidium robustum	<.1	-	-	-	-	-	-	-	-	<.1	-	-		-	+	<.1	-	<.1	-	-				-
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<.1	-	<.1	-				-
Grateloupia doryphora	-	-	<.1	-	<.1	-	-	-	-	-	<.1	+		-	-	-	<.1	<.1	0.1	-				-
Gymnogongrus chiton	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Halicystis ovalis	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Halosaccion americanum	-	-	-	-	-	-	+	-	+	+	+	-		-	+	-	-	-	<.1	+				-
Halymenia/Schizymenia spp.-complex	-	-	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1		-	0.1	<.1	<.1	0.2	0.1	-				<.1
Hymenena spp.	-	-	<.1	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Laminaria setchellii	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				+
Leathesia difformis	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Mastocarpus jardinii	1.1	0.3	1.4	0.8	1.4	1.2	1.3	1.3	1	0.2	0.1	0.2		1.7	0.7	0.9	0.6	1.1	1.3	1.5				0.5
Mastocarpus papillatus	4.8	5.7	7	4.7	5.7	4.7	3.8	4.2	6.9	3.7	4.8	8.6		2.4	6.2	7.2	6	9.8	6.2	6.8				5.6
Mazzaella affinis	7.6	10.2	9.5	9.1	6.9	8.8	8	7.7	5.7	5.8	6.6	8.1		13.2	11.8	9.7	9.4	7.2	6.9	8.2				6.9
Mazzaella flaccida	32.4	37.5	33.9	31.5	34.4	33.1	38.3	38.1	14.9	10.2	18.8	29.7		24.8	38.4	40.2	31.9	28.7	33.6	30.7				18.8
Mazzaella heterocarpa	0.6	0.1	0.7	0.6	0.9	0.8	1	0.7	0.1	0.5	0.7	1		0.5	1.5	1.1	1.4	1.7	0.8	2.2				0.9
Mazzaella leptorhynchos	0.4	0.3	0.3	0.2	0.5	0.5	0.5	0.8	0.8	1	1.1	1.2		0.8	0.4	0.5	1.5	0.9	1.2	1.3				1.5
Mazzaella lilacina	<.1	-	0.2	0.3	0.5	<.1	0.3	0.2	<.1	<.1	+	<.1		-	+	-	<.1	0.5	0.3	0.1				<.1
Melobesia mediocris	-	-	-	+	<.1	+	+	+	+	+	+	+		+	+	+	+	<.1	+	+				0.2
Microcladia borealis	0.1	-	+	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Microcladia coulteri	0.4	+	0.6	0.2	0.1	0.1	0.3	0.6	0.3	<.1	<.1	0.3		<.1	0.1	0.1	0.3	0.6	0.2	+				<.1

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 2 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	4	3	3	6	4	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage (continued)																								
Neorhodomela larix	8	8.7	9	8.1	8	7.5	7.1	8.2	7	9.3	8.9	6.4		3.8	2.6	3	2.3	2.8	2.1	2.8				1.4
Non-coralline crust	21.2	18.1	16	18.5	19.9	18.1	18.9	17.6	14.3	15.3	19.3	23.4		26.4	15.5	12.2	14.4	14.2	17.7	15.1				19.3
Osmundea spp.	<.1	0.1	0.3	0.1	0.3	0.1	<.1	0.1	0.2	<.1	<.1	<.1		-	<.1	<.1	0.2	0.2	0.1	0.2				0.2
Pelvetia compressa	-	-	-	-	-	-	-	-	-	+	+	+		-	-	-	-	-	-	-				-
Phyllospadix spp.	1	0.7	1.5	3.3	5.3	3.3	4.3	4.4	5.3	5	5.6	5.9		10.2	9.1	9.9	12.1	14.3	16.8	15.6				20.9
Plocamium violaceum	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Polyneura latissima	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Porphyra spp.	2.8	1.7	0.3	7.3	1.4	3.1	2.2	1.6	8.9	5.8	8.1	3.7		+	0.3	2.8	1.3	0.2	1.5	0.1				2.8
Prionitis spp.	<.1	0.3	1.3	0.7	0.6	0.5	0.2	1.5	0.7	0.7	0.4	0.4		0.2	0.2	0.6	0.8	0.8	0.6	0.6				0.6
Pterosiphonia dendroidea	-	-	+	<.1	+	<.1	<.1	+	0.3	<.1	<.1	<.1		<.1	<.1	0.2	0.2	0.1	0.1	0.3				0.2
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	+	-	-		-	-	-	-	-	-	-				-
Rhodymenia spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-				-
Sarcodiotheca gaudichaudii	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.1	0.1	<.1	<.1		-	0.2	0.2	0.2	<.1	+	0.1				<.1
Schizymenia epiphytica	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Smithora naiadum	-	-	+	0.3	0.6	0.3	0.5	0.2	0.5	1.2	0.2	0.7		+	0.4	0.3	0.2	+	0.9	-				1
Soranthera ulvoidea	-	-	+	+	<.1	+	+	-	<.1	+	-	-		-	+	<.1	+	-	-	-				-
Spongomorpha/Acrosiphonia-complex	<.1	-	+	<.1	<.1	0.1	<.1	0.6	1.6	0.6	0.2	<.1		-	<.1	+	+	+	+	+				-
Ulva/Enteromorpha spp.	1.3	+	1.1	3.5	1.6	1.8	3.3	2.2	3.1	2.3	1.4	0.2		0.3	0.8	1.4	0.8	<.1	0.3	+				0.6
coralline crust	3.6	3.1	4.6	4	4.8	4.4	3.9	3.4	5	4.5	3.8	3		4.2	3.1	2.6	3.1	2.2	3.6	3				2.5
filamentous red algae-complex	-	+	<.1	<.1	<.1	<.1	0.2	+	<.1	0.3	<.1	0.1		0.1	1.2	2.3	1.5	2.3	1.8	0.6				0.2
juv. articulated coralline algae	-	<.1	<.1	0.4	0.2	0.1	0.3	<.1	0.3	0.5	0.1	0.1		0.1	<.1	0.1	0.3	<.1	0.1	0.5				0.4

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Control Station NC 2 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	5	4	3	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Analipus japonicus	-	-	-	-	-	-	-	+	-	-	<.1	-		-	-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	<.1	+	+	0.1	<.1	<.1	<.1	<.1	<.1	<.1	0.2	0.1		0.2	<.1	<.1	0.2	0.2	0.3	0.6				0.1
Callithamnion pikeanum	<.1	+	<.1	+	<.1	<.1	+	-	-	-	+	+		-	-	+	-	-	+	+				-
Callithamnion spp./Pleonosporium spp.	-	-	-	+	+	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	<.1	<.1	<.1	0.1	+	<.1	0.1	0.4	0.4	<.1	0.3	0.1		+	<.1	<.1	0.2	0.1	0.2	<.1				0.1
Chrysophyta unid.	-	-	-	+	+	+	-	<.1	-	-	-	-		-	+	-	-	-	-	-				-
Cladophora spp.	<.1	+	+	+	+	<.1	+	+	+	+	<.1	+		<.1	<.1	<.1	+	+	+	+				<.1
Corallina officinalis	-	<.1	<.1	<.1	-	+	-	-	-	+	-	-		-	-	-	0.1	0.1	-	-				-
Corallina vancouveriensis	0.4	0.4	0.4	0.5	0.9	1.0	0.9	0.7	0.6	0.6	0.5	0.6		0.3	1.0	0.4	0.5	0.3	0.4	0.6				0.7
Cryptopleura violacea	-	+	-	<.1	-	-	-	-	<.1	+	+	<.1		-	<.1	<.1	<.1	0.2	0.3	<.1				<.1
Cryptosiphonia woodii	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Cumagloia andersonii	-	-	<.1	-	-	-	-	+	+	-	-	-		-	-	-	<.1	-	+	-				+
Endocladia muricata	41.6	40.1	37.7	37.0	41.4	38.5	41.0	29.8	32.4	37.8	38.2	37.1		34.2	31.5	32.1	32.6	34.4	33.2	38.9				28.9
Fucaceae unid.	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Fucus gardneri	<.1	-	-	<.1	-	-	<.1	-	-	-	-	-		-	-	-	-	-	+	<.1				-
Gastroclonium subarticulatum	-	+	-	<.1	-	-	-	-	<.1	<.1	<.1	0.2		<.1	0.2	0.2	0.2	0.1	0.2	<.1				0.2
Gelidium coulteri	0.7	0.6	0.6	0.4	0.4	0.5	0.6	1.0	1.2	0.5	0.6	0.5		0.3	0.7	0.5	0.5	0.3	0.5	0.8				0.2
Gelidium pusillum	0.3	0.3	0.2	0.3	0.2	0.3	0.3	0.4	0.8	0.2	<.1	0.2		0.4	0.4	0.2	0.5	0.2	0.2	0.2				0.3
Gelidium spp.	+	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Mastocarpus jardinii	0.8	0.7	1.0	1.0	1.1	1.2	1.3	0.8	0.4	0.3	0.5	0.4		1.0	0.3	0.6	1.1	1.1	1.1	1.2				0.5
Mastocarpus papillatus	20.3	18.3	23.3	21.9	23.8	17.1	20.0	18.9	22.5	15.4	16.4	19.7		16.4	20.8	24.4	20.9	25.9	26.3	17.7				20.8
Mazzaella affinis	3.0	1.0	2.7	3.1	1.8	2.2	1.9	1.0	1.8	1.4	1.1	1.1		4.7	4.1	2.5	3.8	2.5	4.0	2.2				6.2
Mazzaella flaccida	13.2	8.1	10.1	12.5	9.0	8.4	10.1	6.5	4.5	3.5	5.5	6.2		6.8	5.8	8.8	5.7	8.3	9.9	6.6				8.0
Mazzaella heterocarpa	0.2	-	0.4	0.2	0.2	0.5	0.7	0.4	0.1	0.3	0.2	0.8		0.3	0.2	1.6	1.0	0.7	0.7	0.3				0.6
Mazzaella leptorhynchos	+	<.1	<.1	<.1	<.1	+	<.1	0.4	0.7	<.1	<.1	0.2		+	<.1	<.1	0.3	0.1	<.1	0.1				0.2
Mazzaella lilacina	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<.1	0.1	-				-
Microcladia borealis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-				-
Microcladia coulteri	-	-	-	-	-	-	-	-	+	+	-	+		-	-	-	-	-	+	-				-
Non-coralline crust	12.5	10.3	10.2	14.2	12.4	12.9	13.2	11.6	14.3	12.6	15.0	17.5		22.4	15.9	12.6	18.5	15.8	16.1	19.9				18.0
Osmundea spp.	+	-	-	-	-	-	-	-	<.1	-	-	-		-	-	-	-	-	+	-				-
Pelvetia compressa	<.1	-	+	<.1	+	+	+	+	-	+	+	-		+	+	+	+	+	-	-				+
Phyllospadix spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	+				<.1
Plocamium violaceum	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-				-
Porphyra spp.	0.6	1.1	0.7	1.3	1.3	1.0	<.1	3.1	0.9	0.3	0.3	0.2		0.4	0.5	0.5	<.1	0.2	0.1	+				1.2
Prionitis spp.	<.1	<.1	<.1	<.1	0.1	0.1	<.1	<.1	<.1	<.1	0.2	<.1		0.2	<.1	<.1	<.1	0.2	<.1	0.2				+
Rhodophyta (juv. blades)	-	-	<.1	-	-	-	-	+	-	<.1	<.1	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	-	-	-	-	-	+	-	+	+	-	+	-		-	-	-	-	-	-	-				-
Ulva/Enteromorpha spp.	-	+	+	<.1	<.1	+	+	+	+	+	+	-		+	<.1	+	+	+	-	-				+
coralline crust	3.5	2.7	4.4	4.5	4.7	6.0	4.6	4.8	3.6	5.5	4.2	4.5		4.7	3.8	3.5	5.1	4.6	3.8	5.5				4.3
filamentous red algae-complex	-	-	-	-	-	<.1	+	<.1	-	-	<.1	-		-	-	-	+	+	-	-				-
juv. articulated coralline algae	-	-	+	+	<.1	<.1	<.1	+	<.1	<.1	<.1	<.1		0.1	<.1	<.1	0.2	0.2	0.1	0.1				<.1

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 1 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	3	4	4
% Coverage																								
Analipus japonicus	<.1	-							-	-	-	-		-	-	-	-	-	-	-	0.1	-	-	-
Bryopsis spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	+	+
Calliarthron/Bossiella spp.-complex	1.5	1.1							0.8	0.8	2.0	0.8		1.9	1.4	1.7	1.9	5.1	4.6	3.1	2.7	4.1	3.1	2.6
Callithamnion pikeanum	0.3	0.2							+	<.1	+	<.1		+	0.1	<.1	<.1	<.1	+	<.1	<.1	0.2	<.1	<.1
Callithamnion spp./Pleonosporium spp.	<.1	+							+	-	+	-		-	-	-	+	<.1	+	<.1	+	+	+	<.1
Callophyllis spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	+	-	<.1	+
Chondracanthus canaliculatus	4.8	3.5							11.8	7.4	3.9	2.8		0.4	0.7	1.2	1.1	2.0	5.3	10.9	12.0	12.2	14.0	10.3
Chondracanthus corymbiferus	-	-							-	-	+	<.1		-	-	-	-	0.1	<.1	<.1	<.1	0.1	0.2	0.3
Chrysophyta unid.	-	-							-	<.1	-	<.1		-	-	-	<.1	0.3	+	<.1	<.1	-	-	-
Cladophora spp.	<.1	+							+	+	+	+		+	<.1	<.1	<.1	<.1	+	+	<.1	+	+	+
Colpomenia spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Corallina officinalis	1.7	0.6							+	<.1	-	-		-	-	-	-	+	<.1	<.1	<.1	<.1	0.3	<.1
Corallina vancouveriensis	5.4	9.4							4.6	1.6	3.6	2.2		3.4	4.8	4.4	7.7	6.1	7.0	6.9	6.9	6.3	9.7	10.2
Cryptopleura ruprechtiana	-	-							-	-	-	-		-	-	-	-	-	-	+	-	<.1	-	+
Cryptopleura violacea	6.1	7.0							5.3	6.6	7.0	3.3		3.5	4.8	2.5	9.3	4.3	3.2	8.4	5.1	6.2	2.1	3.1
Cryptosiphonia woodii	-	-							0.2	0.1	0.4	0.6		<.1	0.3	1.0	2.0	0.6	0.4	0.1	0.2	+	<.1	<.1
Delesseriaceae (juv.)	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Egregia menziesii	+	-							-	0.2	+	-		-	-	-	-	12.4	23.8	19.9	10.0	27.3	13.9	16.9
Endocladia muricata	7.3	7.3							11.6	7.8	7.2	10.8		6.4	8.0	9.8	9.1	7.4	7.1	7.6	5.8	4.4	3.8	3.4
Erythrophyllum delesserioides	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	-							-	-	-	-		-	-	-	-	+	+	-	-	+	+	+
Fucus gardneri	0.5	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	9.4	9.5							14.0	10.1	8.1	15.3		7.6	8.8	7.7	12.1	15.3	9.4	15.5	16.4	12.8	15.5	12.7
Gelidium coulteri	10.7	5.9							6.5	13.9	7.6	12.1		7.9	9.5	11.4	6.3	6.2	7.6	8.5	6.9	6.2	5.0	4.4
Gelidium pusillum	0.5	0.4							0.7	+	+	+		+	<.1	+	<.1	0.1	<.1	0.2	0.2	<.1	<.1	+
Grateloupia doryphora	<.1	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Halosaccion americanum	+	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-							-	-	-	0.1		-	-	+	<.1	<.1	+	<.1	-	-	<.1	<.1
Hesperophycus californicus	-	-							-	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Laminaria setchellii	-	-							-	-	-	-		-	-	-	-	<.1	-	-	-	-	<.1	<.1
Laminariales	-	-							-	-	-	-		-	-	-	-	-	-	-	-	+	-	-
Mastocarpus jardinii	1.9	1.1							1.9	1.6	1.4	0.8		0.7	0.6	0.4	0.6	0.5	0.4	0.6	1.3	0.5	0.5	0.3
Mastocarpus papillatus	5.8	7.3							10.3	6.7	6.3	9.3		7.4	7.4	8.0	4.7	7.6	6.5	4.0	4.9	5.6	3.8	1.8
Mazzaella affinis	1.5	1.0							2.8	2.7	1.1	1.7		2.2	1.4	1.9	0.9	1.1	1.8	1.9	2.1	2.2	1.1	0.9
Mazzaella flaccida	25.0	18.6							36.2	28.9	25.3	40.0		11.5	21.7	20.0	14.7	8.1	11.6	12.6	15.2	13.3	11.7	9.9
Mazzaella heterocarpa	0.7	0.7							1.4	2.6	1.7	2.5		0.5	1.5	2.2	2.3	1.9	0.2	0.3	0.4	0.2	0.2	0.6
Mazzaella leptorhynchos	<.1	0.2							0.3	0.5	0.3	0.6		+	0.5	0.2	0.3	0.2	<.1	<.1	0.2	0.4	<.1	+
Mazzaella lilacina	-	-							-	0.6	0.1	1.7		-	-	-	-	+	-	0.1	0.5	2.2	0.9	1.1
Mazzaella rosea	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Melobesia mediocris	-	-							+	-	-	-		-	-	+	+	+	+	+	+	+	+	+
Microcladia borealis	0.4	+							+	<.1	-	-		-	-	-	-	-	-	+	+	<.1	+	<.1
Microcladia coulteri	0.2	+							+	<.1	+	+		-	<.1	+	<.1	<.1	+	+	<.1	0.1	+	+
Neorhodomela larix	-	-							+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Nereocystis luetkeana	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Non-coralline crust	29.9	28.6							31.4	22.4	35.8	20.6		39.7	34.4	33.0	33.8	27.8	22.7	21.1	18.9	17.9	21.3	18.8
Osmundea spp.	-	+							+	0.2	<.1	+		-	<.1	+	+	0.1	0.1	0.5	0.3	0.3	0.3	<.1

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 1 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	3	4	4
% Coverage (continued)																								
Pelvetia compressa	-	-							-	-	-	-		-	-	-	-	-	-	-	+	0.2	-	0.2
Phyllospadix spp.	1.2	1.8							2.9	2.8	2.2	4.2		3.3	2.8	3.5	4.0	5.4	6.7	8.0	8.0	4.5	7.0	7.6
Plocamium violaceum	-	-							-	-	-	-		-	-	-	-	<.1	-	-	<.1	-	-	-
Porphyra spp.	0.1	0.4							1.9	0.2	0.6	0.2		-	<.1	0.3	<.1	1.7	3.8	2.2	0.4	6.3	0.3	0.4
Prionitis spp.	<.1	<.1							0.2	0.4	0.1	0.2		<.1	<.1	0.2	0.3	0.3	0.4	0.8	1.1	0.5	1.1	0.6
Pterosiphonia dendroidea	-	-							+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Rhodophyta (juv. blades)	-	-							-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	<.1	-	-	+
Rosenvingea floridana	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Sarcodiotheca gaudichaudii	<.1	<.1							0.3	<.1	<.1	<.1		-	-	-	-	+	<.1	0.2	0.2	+	0.1	0.1
Smithora naiadum	-	-							-	0.6	-	<.1		-	0.1	0.1	0.6	+	+	<.1	0.5	+	-	+
Spongomorpha/Acrosiphonia-complex	-	-							+	+	-	-		-	+	-	+	0.2	0.4	0.3	<.1	0.4	<.1	<.1
Ulva/Enteromorpha spp.	-	+							+	+	+	-		-	+	-	+	0.6	1.3	2.7	0.9	1.6	0.8	0.4
coralline crust	6.1	7.9							7.2	7.8	9.3	7.2		10.0	9.8	6.9	6.8	8.3	9.2	8.3	6.2	7.4	10.0	7.8
filamentous red algae-complex	<.1	-							+	+	+	-		-	-	-	+	-	+	<.1	<.1	<.1	<.1	0.2
juv. articulated coralline algae	-	0.9							0.8	0.3	1.9	1.2		1.5	0.4	0.7	0.8	1.8	1.2	1.0	1.0	1.4	1.3	0.6

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	3	4	4
% Coverage																								
Calliarthron/Bossiella spp.-complex	1.2	0.7							1.0	1.4	1.0	1.2		1.0	0.6	0.9	0.9	1.3	0.8	0.9	0.8	0.9	0.8	0.8
Callithamnion pikeanum	-	+							-	-	-	+		-	<.1	+	+	+	-	+	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	+	-	-
Chondracanthus canaliculatus	0.7	+							+	0.2	0.3	0.3		-	+	<.1	+	+	<.1	+	+	<.1	<.1	+
Chondracanthus corymbiferus	-	-							-	-	-	-		-	-	-	-	<.1	-	-	-	-	-	-
Chondria decipiens	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Cladophora spp.	0.1	+							<.1	0.2	<.1	<.1		+	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	<.1	<.1
Corallina officinalis	0.2	<.1							-	-	+	-		-	0.1	-	+	-	-	-	+	-	-	-
Corallina vancouveriensis	1.4	1.7							0.9	1.5	1.0	1.2		1.0	1.1	0.6	0.7	0.3	0.2	0.3	0.7	0.5	0.5	0.4
Cryptopleura violacea	<.1	-							-	+	<.1	+		-	+	-	-	-	0.1	+	<.1	+	-	-
Cryptosiphonia woodii	0.6	0.9							0.5	0.7	<.1	+		+	+	<.1	<.1	0.1	<.1	0.2	0.1	0.1	<.1	-
Egregia menziesii	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Endocladia muricata	32.7	30.6							45.3	42.6	38.1	43.3		38.1	36.4	36.3	38.2	40.5	40.8	42.6	41.7	38.1	42.3	41.7
Fucaceae unid.	-	-							-	+	-	-		-	+	+	-	-	+	-	+	-	-	-
Fucus gardneri	<.1	0.2							<.1	<.1	<.1	<.1		-	+	<.1	<.1	<.1	<.1	-	<.1	+	+	<.1
Gastroclonium subarticulatum	0.1	<.1							+	0.1	-	<.1		-	-	-	+	+	<.1	-	+	<.1	-	<.1
Gelidium coulteri	5.4	2.0							1.0	3.7	3.3	2.1		1.6	0.8	0.9	1.5	2.0	2.6	2.6	2.8	1.9	1.6	0.4
Gelidium pusillum	1.1	0.3							1.1	0.1	<.1	+		<.1	0.1	+	<.1	<.1	0.3	0.1	0.4	<.1	<.1	<.1
Grateloupia doryphora	-	-							-	-	-	-		-	-	<.1	-	+	+	-	-	-	+	-
Hesperophycus californicus	+	-							-	-	<.1	<.1		-	0.1	<.1	<.1	+	<.1	-	<.1	<.1	0.1	<.1
Mastocarpus jardinii	-	-							-	-	-	-		0.4	-	-	-	-	-	-	-	-	+	-
Mastocarpus papillatus	11.9	9.9							10.8	10.9	12.1	8.8		7.2	10.2	9.8	5.2	9.9	13.2	14.5	14.9	14.1	9.2	7.8
Mazzaella affinis	1.8	0.6							+	0.3	0.2	<.1		+	+	<.1	+	+	0.1	<.1	<.1	0.2	0.2	+
Mazzaella flaccida	6.1	2.5							0.3	0.5	1.0	1.0		0.6	1.6	0.9	0.5	1.3	3.6	2.7	3.6	2.8	0.8	0.3
Mazzaella heterocarpa	0.4	0.5							0.3	0.2	0.1	<.1		+	<.1	0.1	0.1	0.1	0.2	0.3	0.2	0.3	<.1	0.2
Mazzaella leptorhynchos	<.1	<.1							0.1	0.2	0.2	0.2		+	0.1	0.2	0.2	0.3	0.3	0.2	0.1	0.2	0.3	<.1
Mazzaella lilacina	<.1	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Non-coralline crust	21.5	22.9							11.8	9.7	13.5	18.1		18.8	17.5	14.4	17.7	16.5	21.1	21.3	20.6	15.3	18.5	13.4
Osmundea spp.	-	-							-	+	+	-		-	-	-	-	-	-	<.1	-	-	-	-
Pelvetia compressa	1.8	4.3							0.3	0.7	0.3	+		0.4	0.2	0.2	0.3	0.5	0.5	0.4	0.8	0.9	1.2	0.8
Pelvetiopsis limitata	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Phyllospadix spp.	0.9	0.4							-	-	-	+		0.3	0.5	0.4	0.7	0.7	1.0	1.4	1.4	1.1	0.4	0.4
Porphyra spp.	0.3	<.1							0.5	<.1	0.2	<.1		-	0.3	0.1	<.1	<.1	0.1	0.2	0.2	0.2	0.3	+
Prionitis spp.	0.2	+							-	<.1	-	+		<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.1
Smithora naiadum	-	-							-	-	-	-		-	+	+	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	-							+	<.1	-	+		-	-	-	+	-	+	-	-	-	-	-
Ulva/Enteromorpha spp.	-	+							+	-	+	-		-	-	-	+	-	+	+	+	+	+	+
coralline crust	2.4	4.5							3.2	3.4	2.6	3.3		2.0	2.4	1.8	1.9	2.2	2.0	2.2	1.6	1.6	1.2	1.0
filamentous red algae-complex	-	+							-	+	-	-		-	-	-	-	+	-	-	-	-	-	-
juv. articulated coralline algae	-	0.3							+	0.1	0.3	0.5		0.3	<.1	0.2	<.1	0.1	0.2	<.1	0.1	<.1	<.1	0.2

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 2 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	4	4	4
% Coverage																								
Analipus japonicus	+	+							+	+	+	<.1		<.1	+	+	+	+	+	-	<.1	-	-	-
Calliarthron/Bossiella spp.-complex	3.9	3.3							4.5	2.5	3.6	2.6		4.7	4.4	6.5	5.3	9.3	7.8	5.8	6.4	8.0	6.9	7.5
Callithamnion pikeanum	<.1	0.2							+	<.1	<.1	-		-	<.1	+	-	-	-	+	+	-	-	+
Callithamnion spp./Pleonosporium spp.	-	-							0.2	<.1	<.1	-		-	-	+	-	+	+	<.1	+	0.1	+	<.1
Callophyllis firma	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Callophyllis spp.	-	-							-	+	+	-		-	-	-	+	+	+	<.1	<.1	-	+	-
Chondracanthus canaliculatus	4.2	2.4							5.2	2.6	3.7	4.7		0.8	1.5	2.3	2.5	1.5	3.5	5.7	4.0	4.3	4.0	3.2
Chondracanthus corymbiferus	-	-							0.1	<.1	+	-		-	<.1	-	0.1	+	+	<.1	<.1	+	<.1	<.1
Chrysophyta unid.	-	-							-	-	-	<.1		-	-	+	+	-	+	0.3	0.1	<.1	+	-
Cladophora spp.	<.1	+							+	+	+	+		+	<.1	+	+	<.1	+	+	+	<.1	<.1	<.1
Colpomenia spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Corallina officinalis	0.3	0.7							<.1	<.1	<.1	-		-	+	+	0.1	<.1	+	0.1	0.1	+	0.1	-
Corallina vancouveriensis	12.5	16.7							14.9	6.3	8.4	7.5		9.2	9.5	6.4	8.6	10.1	9.3	9.6	12.0	11.2	12.6	14.1
Cryptopleura ruprechtiana	-	0.1							0.1	+	+	-		-	-	<.1	+	-	-	0.1	0.1	-	+	-
Cryptopleura violacea	6.9	4.3							3.6	4.3	4.0	3.8		1.7	3.4	3.0	7.8	3.2	3.0	4.9	5.0	3.2	1.7	0.9
Cryptosiphonia woodii	0.2	1.3							0.7	0.5	0.5	0.4		<.1	0.7	0.5	0.4	0.3	<.1	<.1	0.3	<.1	<.1	0.2
Dictyoneurum californicum	-	-							-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Egregia menziesii	-	-							4.0	5.1	0.1	-		-	-	0.6	0.4	4.0	10.5	6.6	8.1	9.8	6.1	12.6
Endocladia muricata	10.9	7.4							10.0	11.0	8.4	12.2		7.8	10.4	10.1	11.3	10.9	10.3	9.3	9.1	9.3	6.6	3.7
Erythrophyllum delesserioides	-	<.1							+	-	-	-		-	-	-	-	+	+	-	-	-	-	-
Gastroclonium subarticulatum	5.9	6.4							4.7	3.5	4.8	4.2		3.6	3.9	4.4	7.1	8.6	4.5	7.8	7.3	6.1	4.3	3.4
Gelidium coulteri	11.5	6.0							13.2	19.8	9.3	13.5		7.8	10.7	10.3	8.7	8.9	10.2	13.6	9.9	10.3	10.6	8.3
Gelidium pusillum	+	0.2							0.3	+	<.1	<.1		<.1	+	0.6	0.2	0.2	+	<.1	0.1	0.3	<.1	+
Gelidium robustum	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Halicystis ovalis	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Halymenia/Schizymenia spp.-complex	-	-							-	<.1	+	+		-	<.1	<.1	0.1	<.1	-	+	0.1	-	+	-
Hymenena spp.	-	<.1							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-							-	-	-	-		-	-	-	-	-	+	<.1	0.1	+	<.1	<.1
Laminariales	-	-							-	-	-	-		-	-	-	-	+	+	<.1	+	-	-	-
Mastocarpus jardinii	1.9	0.7							0.9	1.0	0.5	0.8		0.5	0.7	0.9	0.9	0.6	0.7	0.6	0.9	0.5	0.4	0.5
Mastocarpus papillatus	6.4	5.6							11.7	6.4	4.2	6.8		2.6	7.7	7.6	5.0	4.5	4.2	3.7	4.4	4.6	4.1	1.6
Mazzaella affinis	1.0	1.0							1.9	1.6	0.9	2.2		0.6	1.3	1.1	1.0	0.8	1.3	0.9	0.8	0.9	0.7	0.9
Mazzaella flaccida	19.1	10.5							23.4	19.0	13.5	21.0		6.5	11.5	14.5	10.3	4.9	5.6	7.3	9.5	7.9	5.3	3.9
Mazzaella heterocarpa	1.0	1.1							1.9	1.4	1.4	0.6		0.2	1.2	1.5	0.8	0.5	0.4	0.3	0.9	0.4	0.3	0.3
Mazzaella leptorhynchos	<.1	<.1							0.5	0.4	0.2	<.1		+	<.1	<.1	<.1	0.2	<.1	<.1	<.1	0.1	<.1	<.1
Mazzaella lilacina	<.1	0.9							1.2	0.7	0.3	1.1		-	<.1	<.1	0.1	0.2	<.1	0.6	0.4	0.1	0.4	0.3
Melobesia mediocris	-	-							+	+	+	-		-	-	+	-	+	+	+	+	<.1	+	+
Microcladia borealis	0.6	0.1							0.1	<.1	<.1	-		+	<.1	<.1	<.1	-	<.1	<.1	0.1	0.5	<.1	<.1
Microcladia coulteri	0.5	+							-	<.1	+	-		-	0.1	<.1	0.2	<.1	<.1	-	+	<.1	<.1	<.1
Nereocystis luetkeana	-	-							-	-	-	-		-	-	-	-	-	-	+	-	0.3	-	<.1
Non-coralline crust	20.1	24.3							22.3	14.6	29.1	18.1		32.6	26.7	26.5	24.7	21.6	22.6	21.0	16.3	21.3	19.8	14.5
Osmundea spp.	<.1	-							<.1	0.2	<.1	+		+	<.1	<.1	<.1	<.1	<.1	0.2	0.2	<.1	<.1	<.1
Pelvetia compressa	-	-							-	-	-	-		-	-	-	-	-	-	0.4	-	-	-	<.1
Phyllospadix spp.	1.0	1.0							2.2	3.6	3.1	2.8		3.9	3.3	2.8	4.3	6.6	7.0	8.3	9.3	6.4	6.9	7.1
Plocamium violaceum	<.1	-							-	-	-	-		-	-	-	+	<.1	-	-	-	<.1	-	-
Porphyra spp.	<.1	0.5							1.5	0.3	0.2	0.9		-	0.2	0.2	<.1	1.2	1.4	1.5	0.4	2.5	0.1	0.4

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 2 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	4	4	4
% Coverage (continued)																								
Prionitis spp.	1.0	1.6							1.7	1.1	1.6	1.7		1.0	1.2	1.3	1.6	1.5	1.7	1.9	2.2	1.5	2.8	2.4
Rhodymenia spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Sarcodiotheca gaudichaudii	<.1	+							-	<.1	<.1	-		-	<.1	+	<.1	0.1	<.1	<.1	+	0.1	+	-
Smithora naiadum	-	-							+	0.5	+	0.4		-	0.4	0.2	0.7	+	<.1	-	<.1	<.1	+	+
Spongomorpha/Acrosiphonia-complex	-	-							+	+	<.1	+		-	<.1	-	<.1	+	<.1	0.2	0.6	0.7	<.1	0.2
Ulva/Enteromorpha spp.	+	-							+	+	+	+		-	+	-	<.1	+	0.1	<.1	<.1	0.5	0.6	0.3
coralline crust	5.2	7.7							8.6	8.0	11.5	6.6		9.0	8.3	6.9	7.6	10.2	10.1	7.6	6.7	7.6	7.4	8.4
filamentous red algae-complex	<.1	0.2							0.3	<.1	+	-		-	+	<.1	+	<.1	<.1	0.2	0.2	+	+	0.2
juv. articulated coralline algae	-	-							0.2	0.7	0.9	-		0.3	1.0	0.5	1.5	1.3	1.2	0.9	1.2	1.9	1.8	1.3

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 2 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	4	4	4
% Coverage																								
Analipus japonicus	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	<.1	<.1							+	0.2	-	<.1		-	-	+	+	0.2	+	<.1	<.1	<.1	-	+
Callithamnion pikeanum	<.1	<.1							-	-	-	+		-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	<.1	-							+	<.1	+	+		-	-	+	+	-	+	+	+	<.1	+	-
Chondracanthus harveyanus/spinosus	-	-							-	-	-	-		-	-	-	-	-	-	-	0.3	-	-	-
Cladophora spp.	0.5	<.1							<.1	0.3	<.1	<.1		+	0.3	<.1	0.1	<.1	0.2	0.1	0.2	0.3	<.1	0.1
Colpomenia spp.	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Corallina officinalis	-	-							-	+	-	-		-	-	-	-	-	-	-	-	+	-	-
Corallina vancouveriensis	1.3	1.6							1.5	0.6	1.3	0.4		0.4	0.3	0.2	0.1	0.1	0.1	+	0.1	<.1	+	0.1
Cryptopleura violacea	0.2	0.4							-	-	-	+		-	-	0.2	-	-	+	-	+	-	-	-
Cryptosiphonia woodii	0.2	0.2							+	<.1	+	+		+	+	+	<.1	<.1	+	<.1	<.1	<.1	+	+
Endocladia muricata	35.5	41.9							46.6	45.7	44.8	44.8		39.4	37.3	37.8	47	46.6	46.2	40.6	43.4	41.9	38.3	37.3
Fucaceae unid.	-	-							-	-	-	+		-	-	-	+	-	+	-	+	-	-	-
Fucus gardneri	0.4	0.5							+	1.4	1.6	1.2		1.2	0.6	0.7	0.9	0.4	0.8	0.7	0.6	1.5	0.2	<.1
Gastroclonium subarticulatum	<.1	+							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Gelidium coulteri	1.4	0.3							0.8	2	0.9	0.6		<.1	0.1	<.1	0.4	0.3	0.3	0.3	0.2	0.2	<.1	<.1
Gelidium pusillum	0.3	0.5							0.1	<.1	<.1	<.1		+	+	+	<.1	+	<.1	<.1	<.1	0.1	+	-
Grateloupia doryphora	-	-							-	-	-	-		+	-	-	-	-	-	-	-	<.1	-	-
Halymenia/Schizymenia spp.-complex	-	-							-	-	-	+		-	-	-	-	-	-	-	-	-	-	-
Hesperophycus californicus	-	-							-	0.2	0.3	0.2		-	-	<.1	0.5	0.6	0.4	0.2	0.3	0.5	0.7	0.2
Mastocarpus jardinii	<.1	<.1							-	+	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Mastocarpus papillatus	12.1	9.9							8.4	9.4	10.8	5.1		6.9	7.7	6.5	6.9	9.7	11.8	14.7	12.3	11.4	9.2	8.6
Mazzaella affinis	<.1	-							-	+	+	+		+	-	+	+	<.1	+	<.1	<.1	<.1	+	+
Mazzaella flaccida	1.9	0.8							+	0.3	<.1	0.3		0.3	0.2	0.5	0.4	0.4	0.8	1.5	2	0.4	0.1	<.1
Mazzaella heterocarpa	0.1	<.1							-	<.1	<.1	<.1		+	<.1	<.1	0.2	0.2	0.2	0.2	0.2	<.1	<.1	<.1
Mazzaella leptorhynchos	<.1	<.1							+	<.1	<.1	+		+	+	+	<.1	<.1	<.1	<.1	+	<.1	+	+
Mazzaella lilacina	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Non-coralline crust	14.1	14.1							4.2	3.4	5	7.3		10.4	10.4	10	12.6	11.3	12.7	14.3	15.3	15.5	14	10.9
Pelvetia compressa	9.2	6.1							0.5	0.6	0.9	1.3		1.7	1	0.8	1.5	1.6	1.6	2.2	2.6	3.7	4.3	4.7
Phyllospadix spp.	<.1	-							<.1	0.1	0.3	0.2		-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	0.7	0.7							0.7	0.3	0.3	0.2		+	0.9	0.7	0.1	0.3	0.4	0.6	<.1	0.2	0.5	0.2
Prionitis spp.	0.2	0.2							<.1	0.5	0.2	0.1		0.1	<.1	<.1	<.1	0.2	<.1	<.1	<.1	+	<.1	<.1
Rhodophyta (juv. blades)	-	-							-	-	+	+		-	-	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	<.1	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	-							-	-	-	+		-	+	+	-	-	+	-	-	+	-	-
Ulva/Enteromorpha spp.	+	-							-	+	+	-		-	-	+	+	-	-	+	+	+	+	+
coralline crust	1.6	2.4							0.8	0.7	0.7	0.6		0.4	0.5	0.3	0.2	0.5	0.3	0.3	0.3	0.3	0.3	<.1
filamentous red algae-complex	+	-							-	-	-	-		-	-	+	-	-	-	+	<.1	+	-	-
juv. articulated coralline algae	-	0.2							-	<.1	<.1	<.1		+	+	<.1	+	+	<.1	+	<.1	+	<.1	<.1

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 3 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
% Coverage																								
Analipus japonicus	-	-	+	<.1	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Bryopsis spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Calliarthron/Bossiella spp.-complex	3.7	3.6	4.7	3.9	3.8	4.7	4.4	4.0	3.6	4.6	3.6	3.6	2.9	4.0	3.1	4.6	5.3	6.1	5.0	4.6	4.1	5.3	5.2	5.6
Callithamnion pikeanum	0.7	0.6	<.1	<.1	<.1	+	<.1	<.1	<.1	+	+	<.1	+	+	<.1	+	+	<.1	<.1	<.1	0.1	0.1	<.1	0.2
Callithamnion spp./Pleonosporium spp.	-	-	<.1	+	<.1	+	+	+	+	+	-	+	+	-	-	-	+	-	-	-	<.1	+	+	+
Callophyllis spp.	-	+	+	-	<.1	+	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	2.4	3.7	3.0	4.4	2.6	4.5	6.1	6.0	7.0	5.2	3.0	1.4	0.9	0.6	0.9	1.4	2.7	1.9	4.0	5.4	5.6	7.8	7.9	6.1
Chondracanthus corymbiferus	-	<.1	-	-	-	-	-	+	<.1	+	+	-	-	<.1	-	-	-	<.1	-	-	<.1	+	+	<.1
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Chrysophyta unid.	-	<.1	-	<.1	-	<.1	+	<.1	<.1	+	+	<.1	-	-	+	<.1	<.1	+	0.2	<.1	0.4	<.1	0.1	<.1
Cladophora spp.	+	+	+	+	+	<.1	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+	+	+	<.1	+
Codium setchellii (prostrate)	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colpomenia spp.	-	-	-	+	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	+	+
Corallina officinalis	1.0	0.1	0.2	<.1	0.3	<.1	<.1	<.1	<.1	+	+	+	+	+	-	+	<.1	+	<.1	+	0.3	0.1	+	<.1
Corallina vancouveriensis	3.5	2.6	3.1	3.0	4.1	4.2	2.6	3.6	1.8	2.0	2.6	2.4	3.1	1.8	2.5	1.5	1.7	1.3	1.6	2.4	2.0	2.1	3.5	2.9
Cryptopleura ruprechtiana	-	-	0.1	-	+	+	<.1	<.1	<.1	+	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	2.4	3.8	4.4	4.4	5.8	5.5	5.8	6.6	4.9	2.8	3.4	4.6	3.0	2.8	2.7	2.1	4.9	1.7	1.2	3.3	2.6	1.9	1.8	0.7
Cryptosiphonia woodii	0.5	0.2	0.1	<.1	0.1	0.2	0.2	0.3	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.3	0.5	0.6	0.3	0.2	0.3	<.1	0.2	<.1
Cystoseira osmundacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	<.1
Egregia menziesii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	3.1	8.7	7.4	3.2	2.0	3.5	16.4
Endocladia muricata	1.7	1.7	1.4	1.9	1.5	1.9	1.5	1.2	1.3	1.5	2.0	2.8	3.1	1.8	2.0	2.2	2.0	1.5	1.6	1.0	1.1	0.8	1.0	0.9
Erythrophyllum delesserioides	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fucus gardneri	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	11.4	13.0	16.0	13.9	17.5	12.9	10.0	19.4	12.9	9.4	11.9	19.3	15.4	6.5	12.3	14.3	22.5	21.6	15.3	18.9	18.4	17.2	16.8	13.9
Gelidium coulteri	6.7	8.9	7.1	6.1	5.9	7.0	8.2	5.7	9.0	7.4	6.7	4.7	6.2	9.4	8.4	8.1	3.8	3.5	7.7	5.3	6.6	6.8	5.2	3.6
Gelidium pusillum	<.1	0.3	<.1	0.3	0.2	0.5	0.5	0.4	0.4	<.1	0.2	0.1	0.3	<.1	0.3	<.1	0.1	0.3	0.2	0.2	0.1	0.6	0.2	<.1
Grateloupia doryphora	-	-	<.1	-	+	-	+	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	<.1	-	-	<.1	+
Halosaccion americanum	<.1	-	-	-	-	-	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	<.1	0.2	+	<.1	<.1	+	0.1	<.1	<.1	<.1	<.1	-	<.1	+	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	+
Haplogloia andersonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Hymenena spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Laminariales	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+
Mastocarpus jardinii	6.3	6.8	5.1	4.9	5.0	5.0	5.5	3.7	4.2	2.8	3.4	3.6	4.1	2.5	3.2	4.2	3.2	2.2	3.5	3.5	4.8	4.7	3.2	1.3
Mastocarpus papillatus	4.4	5.7	2.8	5.5	3.6	4.6	4.3	5.2	5.8	5.6	5.2	5.6	5.6	8.8	6.8	7.8	5.5	5.2	3.8	3.0	3.8	4.3	4.2	2.0
Mazzaella affinis	0.7	0.6	0.5	0.8	0.5	0.9	0.8	0.8	0.8	0.9	0.9	0.8	0.6	0.9	0.6	1.0	0.6	0.7	0.9	0.8	1.0	0.6	0.9	1.0
Mazzaella flaccida	39.8	32.8	32.6	38.7	35.6	38.3	38.1	29.6	31.5	29.6	30.4	31.7	32.6	28.6	30.4	30.6	27.3	19.4	21.9	23.8	30.2	27.4	20.2	17.9
Mazzaella heterocarpa	0.8	1.6	1.1	1.8	2.3	1.8	1.2	1.1	1.7	1.5	1.3	1.6	1.2	2.2	2.6	2.5	1.0	1.2	0.6	0.7	1.3	1.3	0.8	0.3
Mazzaella leptorhynchos	0.3	0.2	0.2	0.2	0.2	0.2	0.3	<.1	0.6	0.6	0.3	0.4	0.5	0.4	<.1	0.2	0.3	0.2	0.3	0.3	0.2	0.3	0.7	0.2
Mazzaella lilacina	-	<.1	<.1	0.4	<.1	<.1	<.1	<.1	0.1	<.1	<.1	0.5	+	-	-	-	-	0.4	-	0.4	<.1	-	0.2	0.2
Mazzaella linearis	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	+	-	+	+	+	<.1	+	-	+	<.1	-	-	-	-	+	+	+	<.1	+	+	+	+
Microcladia borealis	<.1	<.1	<.1	<.1	<.1	<.1	+	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	+	0.2	-	-
Microcladia coulteri	0.2	0.5	0.3	<.1	<.1	<.1	<.1	0.2	0.2	<.1	<.1	<.1	-	<.1	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.2	+
Nereocystis luetkeana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 3 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
% Coverage (continued)																								
Non-coralline crust	24.4	19.4	22.2	21.5	25.7	26.3	26.3	27.7	26.3	30.6	30.0	30.0	28.7	32.5	33.0	31.6	29.6	25.1	26.3	20.6	17.7	22.8	24.9	23.3
Osmundea spp.	<.1	0.2	0.1	0.2	0.2	0.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	+	+	<.1	0.1	<.1	<.1
Pelvetia compressa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Phyllospadix spp.	2.6	4.4	6.7	6.0	5.6	4.9	4.0	5.2	4.2	4.2	3.5	3.0	3.6	3.7	3.6	4.8	5.1	6.5	9.0	8.9	9.5	6.3	8.9	8.2
Plocamium cartilagineum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Plocamium violaceum	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	<.1	-	-
Porphyra spp.	-	0.2	+	+	<.1	0.2	+	<.1	<.1	0.6	<.1	0.2	<.1	0.4	<.1	0.1	<.1	1.1	0.8	0.5	0.1	1.5	0.3	1.1
Prionitis spp.	0.8	1.6	2.9	1.8	1.7	2.0	1.4	3.3	3.0	1.9	1.6	2.0	1.3	1.1	0.7	1.1	1.4	0.8	1.0	1.2	1.3	0.6	1.6	1.0
Pterosiphonia dendroidea	<.1	+	<.1	<.1	<.1	<.1	<.1	0.3	0.6	0.5	0.2	<.1	<.1	<.1	+	+	+	+	-	-	-	+	-	-
Rhodophyta (juv. blades)	-	-	-	+	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Rosenvingea floridana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	<.1	<.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	+	<.1	0.1	<.1	+	-	-	+	<.1	<.1	<.1	<.1	0.1	<.1	0.3
Scytosiphon spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Smithora naiadum	<.1	-	+	0.5	0.3	0.4	0.2	<.1	<.1	0.2	0.2	0.4	<.1	0.4	0.3	0.4	1.1	+	0.7	<.1	1.8	1.0	<.1	0.2
Spongomorpha/Acrosiphonia-complex	-	-	-	+	<.1	<.1	-	+	+	<.1	+	+	<.1	<.1	+	-	+	0.2	0.2	1.8	0.2	+	-	0.2
Ulva/Enteromorpha spp.	-	+	+	+	-	+	+	<.1	+	0.2	<.1	+	+	-	-	-	<.1	0.3	0.4	0.2	0.2	0.9	0.9	0.9
coralline crust	8.3	5.0	6.3	6.1	8.0	8.5	7.1	7.8	7.2	9.3	8.8	6.5	5.8	6.7	4.7	5.1	4.8	7.7	7.4	6.8	5.6	5.2	6.6	4.2
filamentous red algae-complex	0.6	<.1	+	<.1	-	<.1	<.1	0.1	0.2	<.1	<.1	0.1	+	<.1	-	-	-	-	-	<.1	0.8	0.4	0.4	0.2
juv. articulated coralline algae	-	1.4	0.4	0.5	1.1	0.5	0.3	0.3	0.2	0.6	0.2	0.5	<.1	0.6	0.5	0.5	0.6	0.9	1.0	0.8	0.5	1.4	1.1	1.5

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - Field's Cove Station FC 3 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
Analipus japonicus	-	-	-	-	+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.4	0.8	0.2	0.3	0.7	0.3	0.4	0.6	0.3	0.3	0.1	0.2	0.1	0.3	0.2	<.1	0.1	0.4	<.1	<.1	0.2	<.1	<.1	<.1
Callithamnion pikeanum	-	<.1	+	-	+	<.1	+	+	<.1	+	-	-	-	-	+	+	+	-	+	-	+	+	-	-
Callithamnion spp./Pleonosporium spp.	-	-	<.1	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	1.2	0.5	0.2	0.3	0.3	0.5	0.4	0.9	1.1	0.2	<.1	<.1	<.1	+	<.1	0.1	0.2	<.1	0.2	<.1	<.1	0.2	<.1	+
Cladophora spp.	0.2	<.1	+	0.1	<.1	<.1	<.1	<.1	0.2	0.3	<.1	0.3	0.4	0.2	0.2	<.1	0.3	<.1	0.1	<.1	0.2	0.5	0.1	0.6
Colpomenia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Corallina officinalis	<.1	-	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina vancouveriensis	0.1	<.1	0.3	0.4	0.6	0.7	0.4	0.8	0.9	0.6	0.8	0.9	0.6	0.2	0.3	0.2	0.3	0.3	0.3	0.6	0.9	0.9	0.7	0.4
Cryptopleura violacea	-	-	<.1	-	-	+	<.1	-	+	-	-	+	-	-	+	+	+	-	-	-	-	-	-	-
Cryptosiphonia woodii	1.5	0.9	0.7	0.6	0.1	0.2	0.1	0.2	0.2	0.4	0.2	0.4	0.3	0.2	<.1	0.1	0.2	0.2	0.3	0.2	0.3	0.3	0.1	0.3
Egregia menziesii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-
Endocladia muricata	20.8	22.4	22.1	25.8	28.7	26.5	30	27.4	28.3	32.4	30.5	31.1	32.6	32.2	31.2	31.1	35.1	32.3	29.3	28.2	35.1	31.2	29.9	34.8
Farlowia/Pikea spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-
Fucaceae unid.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Fucus gardneri	-	-	<.1	+	<.1	<.1	<.1	-	+	<.1	+	-	-	-	-	+	<.1	-	-	-	-	-	+	-
Gastroclonium subarticulatum	<.1	-	-	+	<.1	+	+	+	<.1	<.1	+	<.1	-	<.1	+	+	+	+	<.1	-	-	<.1	-	+
Gelidium coulteri	5.3	2.3	3.5	4.5	2.9	3.7	4.3	4.7	5.8	4.6	2.9	1.3	1.5	1.8	1.6	1.6	1.9	1.6	2	2	1.2	1.3	2	1.5
Gelidium pusillum	2	3.3	0.9	0.6	0.9	1.5	1.1	1.7	2.5	0.7	0.5	0.3	0.3	0.3	0.5	0.3	0.6	0.9	0.7	1.2	0.8	1.3	0.5	0.4
Gymnogongrus chiton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Halosaccion americanum	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hesperophycus californicus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	+	<.1	-	-	-	<.1	<.1	<.1
Mastocarpus jardinii	0.4	0.4	0.9	0.4	0.4	0.4	0.4	0.3	<.1	<.1	+	0.1	<.1	<.1	<.1	<.1	<.1	0.1	0.3	0.2	0.2	<.1	<.1	0.2
Mastocarpus papillatus	31.3	33.3	35.8	36.4	34.8	30.7	33.3	31.5	37.4	33.2	31	27.8	27.2	28.5	31.4	29.4	27.4	30.1	36.1	37.4	33.4	31.6	33	23.9
Mazzaella affinis	0.4	0.4	0.5	0.8	0.2	0.5	0.5	0.5	0.8	0.4	0.2	0.4	0.4	0.2	<.1	0.2	0.2	0.2	0.2	0.2	0.3	0.5	0.6	0.8
Mazzaella flaccida	16.5	13	10.7	12.2	12.1	12.5	10.8	6.4	6.7	6.1	4.9	4.8	2.9	2.5	4.5	5.1	4.2	3.4	6	6	4.2	4.1	2.5	3.3
Mazzaella heterocarpa	0.3	0.2	0.1	0.5	0.4	0.4	0.2	0.3	0.2	0.3	0.1	0.2	0.2	0.3	<.1	0.6	0.3	0.6	0.6	0.6	0.4	0.2	0.4	0.6
Mazzaella leptorhynchos	+	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	0.1	<.1	<.1	<.1	<.1	<.1	0.1	0.1	<.1	0.2	<.1	<.1	<.1	0.2	<.1
Mazzaella lilacina	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	24	16.3	17.9	17.6	22.3	23.8	20.6	23.5	18	20.5	22.1	21.4	20.6	21.7	25.2	21.9	20.4	18.9	23.7	22.4	20	23.2	20.7	16
Osmundea spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Pelvetia compressa	6.1	3.1	2.1	1.2	0.5	0.5	1.2	0.4	<.1	0.3	0.4	0.9	0.9	0.7	0.9	1.8	2.4	2.1	3.5	2.7	2	1.3	1.5	1
Phyllospadix spp.	-	-	+	+	<.1	+	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	0.2	2.1	<.1	0.2	0.2	0.1	<.1	<.1	0.2	0.4	0.1	0.1	0.2	0.1	0.2	0.2	<.1	0.2	0.1	0.4	0.1	0.2	<.1	0.1
Prionitis spp.	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.1	<.1	0.2	0.4	0.2	0.2	0.3	0.1	0.2	0.2	0.2	<.1	<.1	<.1	<.1	<.1	<.1
Pterosiphonia dendroidea	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	<.1	-	-	-	-	-	-
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	-	+	<.1	<.1	<.1	-	<.1	+	<.1	<.1	<.1	0.1	<.1	0.2	<.1	<.1	<.1	-	-	-	-	-	-
Ulva/Enteromorpha spp.	-	-	+	+	-	-	+	+	+	+	+	+	-	-	+	-	-	+	+	+	-	+	+	+
coralline crust	2.8	2.6	3.1	2.9	3.2	2.8	3	4.1	1.9	1.9	2.6	2.6	2	2.3	1.9	1.6	1.6	1.8	2.2	2.2	1.5	1.3	1.2	1.3
filamentous red algae-complex	-	<.1	-	-	-	+	-	<.1	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	+
juv. articulated coralline algae	-	<.1	+	<.1	<.1	+	+	<.1	+	<.1	0.1	+	<.1	<.1	<.1	+	0.2	<.1	<.1	+	<.1	<.1	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – North Diablo Cove Station NDC 1 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Analipus japonicus	-	-					-	-	+	<.1	-	-		-	-	-	-	-	-	-				+
Bryopsis spp.	-	+					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	0.1	<.1					0.5	0.4	0.1	<.1	<.1	<.1		+	+	<.1	<.1	<.1	<.1	+				0.6
Callithamnion pikeanum	0.1	<.1					0.1	<.1	+	<.1	-	-		-	-	-	-	-	-	-				-
Callithamnion spp./Pleonosporium spp.	-	<.1					+	+	-	-	-	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	3.8	3.3					4.0	3.1	3.8	1.6	0.1	<.1		<.1	<.1	0.4	1.4	2.3	4.4	2.3				<.1
Chondracanthus corymbiferus	-	-					-	+	+	+	-	-		-	-	-	<.1	+	-	-				-
Chrysophyta unid.	-	-					<.1	<.1	+	<.1	-	<.1		-	1.3	0.8	+	-	-	1.4				0.2
Cladophora spp.	<.1	<.1					+	+	+	+	+	+		+	+	+	+	+	+	<.1				+
Codium setchellii (prostrate)	2.4	1.9					1.8	1.9	1.7	1.3	0.4	<.1		-	-	-	-	-	-	-				-
Colpomenia spp.	-	-					-	-	+	-	-	-		-	-	+	+	+	+	-				<.1
Corallina officinalis	0.4	0.3					+	+	<.1	<.1	-	-		-	-	-	-	-	-	-				-
Corallina vancouveriensis	1.3	2.4					1.6	0.6	0.4	0.5	0.2	<.1		+	<.1	<.1	<.1	+	<.1	0.2				1.0
Cryptopleura violacea	0.8	0.3					2.5	0.5	0.2	0.1	+	0.2		-	+	<.1	0.2	<.1	<.1	+				-
Cryptosiphonia woodii	-	+					<.1	-	+	+	-	-		-	-	-	-	-	-	-				-
Cumagloia andersonii	-	-					-	+	+	-	-	-		-	-	-	+	-	-	-				-
Egregia menziesii	-	-					<.1	-	0.4	-	-	-		-	-	-	-	-	-	-				-
Endocladia muricata	<.1	+					0.3	1.0	1.0	1.6	0.4	0.6		-	-	-	-	-	-	-				+
Farlowia/Pikea spp.-complex	-	-					-	<.1	-	-	-	-		-	-	-	<.1	-	-	-				-
Fucus gardneri	-	-					-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Gastroclonium subarticulatum	4.2	5.4					3.5	3.7	3.3	3.1	0.7	0.9		-	+	0.4	2.0	5.0	7.3	5.5				<.1
Gelidium coulteri	0.7	1.0					1.7	0.9	1.1	1.4	1.1	0.7		<.1	0.3	0.4	0.6	2.5	4.0	0.7				0.2
Gelidium pusillum	1.6	1.9					2.3	3.1	3.2	1.3	0.5	0.2		+	0.1	0.1	0.5	1.0	1.2	1.0				<.1
Gelidium robustum	-	-					-	-	-	-	-	-		-	-	-	+	-	-	-				-
Grateloupia doryphora	-	-					-	-	+	-	-	+		-	-	-	-	-	-	-				-
Halosaccion americanum	<.1	+					+	-	-	-	-	-		-	-	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex	-	<.1					<.1	-	<.1	-	<.1	-		-	-	<.1	0.6	0.3	<.1	-				-
Hesperophycus californicus	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Macrocystis spp.	-	-					-	-	-	-	-	-		-	-	+	-	-	-	-				-
Mastocarpus jardinii	8.6	5.3					6.7	4.8	4.0	2.4	1.5	0.7		<.1	<.1	0.3	0.5	0.7	0.7	0.3				<.1
Mastocarpus papillatus	12.3	17.7					11.9	14.6	25.6	18.2	23.6	23.4		7.6	21.7	39.5	41.0	29.7	19.9	7.8				1.6
Mazzaella affinis	0.4	0.7					1.3	1.7	1.8	1.7	1.3	0.5		0.5	<.1	0.5	1.1	1.4	3.8	1.9				0.2
Mazzaella flaccida	39.9	32.5					46.8	24.3	20.5	10.7	2.4	1.1		-	+	<.1	<.1	+	-	-				-
Mazzaella heterocarpa	0.8	0.4					1.5	0.8	1.0	0.8	1.0	0.9		<.1	0.3	0.2	0.1	0.3	0.4	+				0.1
Mazzaella leptorhynchos	<.1	<.1					+	<.1	0.1	0.2	0.2	0.6		0.1	0.1	<.1	<.1	0.2	<.1	<.1				+
Mazzaella lilacina	-	-					<.1	-	+	0.2	-	+		-	-	-	-	-	-	-				-
Microcladia borealis	<.1	+					<.1	+	-	-	-	-		-	-	-	-	-	-	-				-
Microcladia coulteri	0.2	<.1					0.1	<.1	<.1	-	-	-		-	-	-	-	-	-	-				-
Non-coralline crust	16.8	23.3					20.3	21.3	20.0	25.4	29.0	32.4		48.1	35.4	38.0	33.3	29.2	37.1	43.6				30.8
Osmundea spp.	0.2	<.1					<.1	<.1	0.1	<.1	-	-		-	+	0.2	0.1	<.1	+	+				-
Pelvetia compressa	-	-					-	+	-	+	-	-		-	-	-	-	-	-	-				-
Phyllospadix spp.	-	+					+	<.1	-	<.1	-	-		-	-	-	-	-	-	-				-
Plocamium violaceum	<.1	-					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Polyneura latissima	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Porphyra spp.	<.1	<.1					<.1	2.3	2.2	1.4	0.2	+		-	<.1	<.1	0.3	0.7	+	+				-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – North Diablo Cove Station NDC 1 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage (continued)																								
Prionitis spp.	<.1	<.1					-	<.1	+	<.1	<.1	<.1		0.1	-	<.1	0.3	0.3	0.4	0.1				-
Pterosiphonia dendroidea	-	-					-	-	-	-	-	-		-	-	-	-	+	-	-				+
Rhodophyta (juv. blades)	-	-					-	-	-	+	<.1	-		-	-	-	-	-	-	-				-
Sarcodiotheca gaudichaudii	<.1	-					-	-	+	-	-	-		-	-	<.1	<.1	+	+	-				-
Smithora naiadum	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	-	+					+	+	+	+	+	-		-	+	-	-	-	-	-				-
Ulva/Enteromorpha spp.	0.4	<.1					1.3	1.3	0.5	0.1	+	+		-	0.3	0.8	3.7	4.4	<.1	+				0.1
coralline crust	7.4	7.1					8.9	9.4	8.1	11.6	8.6	5.8		2.7	2.2	1.9	1.6	2.9	5.9	3.6				2.5
filamentous red algae-complex	<.1	+					<.1	+	-	-	-	-		-	+	<.1	0.4	2.2	3.7	1.0				<.1
juv. articulated coralline algae	-	<.1					0.3	<.1	0.2	0.4	0.2	<.1		<.1	+	<.1	<.1	<.1	0.2	0.1				0.4

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Analipus japonicus	<.1	-					<.1	+	+	+	<.1	+		-	-	-	-	-	-	-				-
Bryopsis spp.	-	-					-	-	-	-	+	-		-	-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	+	-					<.1	<.1	<.1	<.1	<.1	+		-	-	-	-	-	+	+				+
Callithamnion pikeanum	<.1	<.1					+	+	+	+	-	-		-	-	-	-	-	-	-				-
Callithamnion spp./Pleonosporium spp.	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	1.7	1.6					0.5	1.0	2.2	0.4	0.1	<.1		+	+	+	0.3	0.4	0.3	0.1				<.1
Chondracanthus corymbiferus	-	-					-	-	-	-	-	+		-	-	-	-	-	-	-				-
Chondria decipiens	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Chrysophyta unid.	-	-					-	0.2	-	-	-	-		-	-	-	-	-	-	-				-
Cladophora spp.	+	+					+	+	+	<.1	<.1	+		+	+	+	+	+	+	+				+
Corallina officinalis	+	0.1					-	+	-	-	-	-		-	-	-	+	-	-	-				-
Corallina vancouveriensis	0.1	<.1					0.6	0.6	0.2	0.2	0.2	0.2		<.1	<.1	<.1	+	+	<.1	<.1				<.1
Cryptopleura violacea	-	+					+	<.1	+	-	-	+		-	-	-	-	-	<.1	-				-
Cryptosiphonia woodii	-	-					<.1	<.1	<.1	<.1	+	-		-	-	-	-	-	-	-				-
Cumagloia andersonii	-	-					-	+	<.1	<.1	+	-		-	-	-	-	-	-	-				-
Egregia menziesii	-	0.1					-	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Endocladia muricata	4.7	5.7					9.6	5.0	3.3	3.3	2.8	1.8		1.6	2.0	1.8	2.5	3.2	3.2	3.1				5.0
Fucaceae unid.	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				-
Fucus gardneri	0.1	<.1					0.2	0.1	0.1	0.7	0.5	<.1		-	-	-	-	-	-	-				-
Gastroclonium subarticulatum	0.5	0.4					0.6	0.3	0.2	<.1	<.1	<.1		-	-	+	+	<.1	+	<.1				<.1
Gelidium coulteri	1.5	0.5					1.3	2.7	2.0	1.2	0.4	0.4		<.1	0.2	0.5	0.3	0.5	0.6	0.2				<.1
Gelidium pusillum	1.2	1.3					0.8	1.0	1.8	0.9	0.3	<.1		+	+	<.1	0.5	1.0	0.5	0.2				+
Grateloupia doryphora	-	-					-	-	-	-	-	-		-	-	+	-	-	-	-				-
Halosaccion americanum	+	-					+	+	-	-	-	-		-	-	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex	-	-					-	-	-	-	-	-		-	-	-	-	-	+	-				-
Mastocarpus jardinii	4.4	2.8					5.3	1.5	1.1	0.6	<.1	<.1		+	+	-	+	<.1	0.1	0.2				<.1
Mastocarpus papillatus	32.7	27.9					31.3	21.4	26.4	13.5	13.3	7.5		0.8	3.3	7.4	16.2	19.3	18.5	14.5				3.8
Mazzaella affinis	1.6	1.7					2.5	3.4	3.5	1.3	0.5	<.1		+	+	<.1	0.2	0.5	0.7	0.9				0.1
Mazzaella flaccida	20.2	12.5					16.3	9.2	6.2	1.8	0.9	0.1		-	-	-	-	-	-	-				-
Mazzaella heterocarpa	0.6	0.3					0.8	0.4	0.3	0.1	<.1	<.1		-	-	<.1	-	+	<.1	-				+
Mazzaella leptorhynchos	0.2	+					+	0.1	0.4	0.2	0.1	<.1		+	+	<.1	0.2	0.3	0.6	0.3				<.1
Mazzaella lilacina	-	<.1					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Microcladia coulteri	0.2	-					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Non-coralline crust	21.0	29.0					27.5	22.6	18.4	26.2	32.7	32.8		29.9	29.4	27.3	30.4	31.3	33.3	34.3				34.1
Pelvetia compressa	1.9	2.3					0.3	0.9	1.6	2.3	2.9	2.3		2.3	2.3	2.0	0.7	0.1	<.1	-				-
Phyllospadix spp.	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Porphyra spp.	-	0.3					0.1	0.8	3.1	0.7	<.1	<.1		+	-	+	+	0.1	<.1	<.1				-
Prionitis spp.	0.3	-					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Pterosiphonia dendroidea	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				+
Rhodophyta (juv. blades)	-	-					-	<.1	-	+	-	+		-	-	-	-	-	-	-				-
Scinaia confusa	-	-					-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Scytosiphon spp.	-	-					-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	-	-					-	+	+	+	<.1	-		-	-	-	-	-	-	-				-
Ulva/Enteromorpha spp.	<.1	-					<.1	+	<.1	+	<.1	+		-	-	+	0.6	0.1	+	-				+
coralline crust	3.7	3.6					3.6	6.5	3.6	4.7	3.3	2.5		0.5	0.8	0.8	0.9	0.8	0.7	1.1				1.1
filamentous red algae-complex	<.1	<.1					-	-	+	-	-	+		-	-	-	0.1	<.1	+	-				-
juv. articulated coralline algae	-	<.1					<.1	<.1	<.1	<.1	+	<.1		+	<.1	+	<.1	<.1	+	+				+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 2 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	5	6	6	6	5	6	ns	1	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	-	<.1	<.1	0.1	<.1	<.1	<.1	<.1	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Antithamnion/Platythamnion spp.-complex	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Bangia vermicularis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Bryopsis spp.	-	-	-	<.1	+	+	-	-	+	<.1	<.1	-		-	-	-	-	-	+	-	+	+	+	<.1
Calliarthron/Bossiella spp.-complex	0.8	0.5	1.1	1.0	1.4	0.9	1.7	1.4	0.8	1.4	1.0	0.4		0.9	0.4	0.1	0.3	1.4	1.0	1.2	1.1	0.4	3.2	0.3
Callithamnion pikeanum	<.1	+	<.1	<.1	+	+	<.1	<.1	+	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	<.1	<.1	0.1	<.1	<.1	<.1	0.2	0.2	0.1	<.1	+	-		-	-	-	-	-	+	-	-	-	-	+
Callophyllis flabellulata	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Callophyllis spp.	-	-	-	-	+	<.1	<.1	-	<.1	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	10.3	14.0	12.8	14.0	9.4	14.2	14.1	8.3	16.3	7.7	1.3	0.6		1.9	3.2	11.8	12.6	18.0	12.4	8.0	15.2	13.7	6.8	4.0
Chondracanthus corymbiferus	-	<.1	0.4	0.2	<.1	<.1	0.2	<.1	0.4	0.3	+	<.1		-	<.1	<.1	+	<.1	<.1	+	+	<.1	<.1	<.1
Chondracanthus harveyanus/spinosus	+	0.1	<.1	<.1	<.1	-	<.1	<.1	0.2	<.1	<.1	-		-	-	-	<.1	-	0.3	+	0.5	-	0.3	+
Chrysophyta unid.	-	<.1	0.2	<.1	<.1	<.1	<.1	+	0.2	0.9	0.3	<.1		-	<.1	0.6	+	-	0.1	0.3	0.2	9.0	+	0.6
Cladophora spp.	<.1	0.1	<.1	+	+	+	+	+	<.1	<.1	<.1	<.1		+	<.1	+	+	+	+	+	+	-	+	<.1
Codium setchellii (prostrate)	-	<.1	<.1	<.1	<.1	<.1	0.1	0.2	0.2	0.2	+	-		-	-	-	-	-	-	-	-	-	-	-
Colpomenia spp.	-	-	+	-	-	-	-	-	-	-	-	-		-	+	+	+	+	+	+	+	-	+	<.1
Colpomenia/Leathesia/Soranthera spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Corallina officinalis	1.3	1.4	1.2	1.9	1.6	1.0	0.9	0.8	0.6	0.2	<.1	+		-	+	+	<.1	<.1	+	+	-	-	<.1	+
Corallina vancouveriensis	3.7	5.9	4.9	5.4	6.3	5.1	5.0	5.7	7.1	5.4	3.4	2.5		3.5	2.1	0.4	0.4	0.6	0.2	0.1	0.2	0.2	3.1	2.9
Cryptopleura ruprechtiana	-	<.1	+	<.1	<.1	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	0.8	1.4	2.2	1.4	1.4	1.7	1.4	1.6	1.9	1.2	0.8	2.0		3.6	2.5	1.7	2.4	2.0	0.7	1.2	1.7	1.8	<.1	0.2
Cryptosiphonia woodii	0.3	0.2	0.2	0.2	0.3	0.2	<.1	<.1	0.3	0.2	+	-		-	-	+	-	<.1	-	-	-	-	+	-
Cystoseira osmundacea	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-	+	-	-	-
Desmarestia tabacoides	-	-	-	-	-	-	<.1	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	0.6	0.5	0.8	0.4	1.8	3.4	0.8	1.7	0.3	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Endarachne/Petalonia-complex	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Endocladia muricata	1.2	1.7	1.8	2.3	2.2	1.7	1.3	1.0	1.3	0.9	0.2	0.6		0.4	0.8	0.5	0.7	1.0	1.1	0.9	0.6	0.9	0.2	0.2
Farlowia/Pikea spp.-complex	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Fucus gardneri	0.2	+	+	<.1	<.1	<.1	+	-	+	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	9.8	8.4	15.8	10.4	14.4	10.6	5.9	1.5	2.8	3.9	2.0	6.5		2.2	5.3	7.1	13.5	19.4	19.1	15.8	24.0	17.9	5.1	11.5
Gelidium coulteri	4.0	4.9	6.5	3.5	4.6	4.2	4.8	4.5	5.7	7.0	7.2	5.0		1.8	7.9	4.1	3.4	3.6	3.4	0.9	1.1	1.8	1.0	0.5
Gelidium pusillum	<.1	0.4	<.1	0.2	0.1	0.1	0.4	0.3	<.1	<.1	<.1	<.1		+	+	<.1	0.2	0.2	0.1	<.1	<.1	+	<.1	+
Gelidium robustum	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-	-	<.1	-	-
Grateloupia doryphora	-	1.5	<.1	<.1	-	0.1	<.1	1.5	0.1	0.2	0.7	0.2		-	0.1	<.1	0.8	<.1	1.4	0.7	-	0.1	-	0.2
Halicystis ovalis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	+	+
Halosaccion americanum	0.2	<.1	+	+	<.1	0.1	0.3	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	0.4	0.4	0.5	0.2	<.1	0.1	0.2	0.2	0.2	0.1	<.1	0.2		-	-	0.1	0.4	0.7	1.1	1.0	0.3	0.2	-	<.1
Haplogloia andersonii	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-	-	<.1	-	+	-	<.1	<.1	+	-	-		-	-	-	-	<.1	-	-	-	-	-	-
Laminariales	-	-	-	-	-	-	+	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	0.2	-	-	-	-	-	-
Mastocarpus jardinii	0.6	0.8	0.7	1.1	0.8	0.5	0.4	0.3	0.2	<.1	<.1	+		-	-	+	0.1	<.1	<.1	<.1	<.1	+	-	<.1
Mastocarpus papillatus	2.1	2.4	2.6	2.1	2.0	1.9	2.2	2.3	4.3	2.3	8.2	5.6		4.2	17.6	19.5	15.2	7.9	4.9	4.5	3.6	4.5	0.4	0.3
Mazzaella affinis	6.0	5.8	4.0	5.4	2.8	3.9	5.5	4.0	4.2	3.7	2.0	0.6		0.5	2.2	3.7	2.6	3.0	5.1	3.0	3.1	3.6	0.9	1.9
Mazzaella californicum	-	-	-	-	-	-	-	<.1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 2 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	5	6	6	6	5	6	ns	1	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Mazzaella flaccida	7.7	8.5	8.0	10.3	8.1	9.0	12.2	5.7	5.8	2.7	0.5	0.2		-	<.1	-	-	-	-	-	<.1	-	-	+
Mazzaella heterocarpa	1.1	0.5	0.2	0.6	0.2	0.7	0.9	1.2	0.6	0.3	<.1	<.1		+	<.1	0.1	<.1	0.1	0.4	+	<.1	0.2	0.1	<.1
Mazzaella leptorhynchos	0.3	0.5	0.6	0.3	0.5	0.6	0.6	1.8	2.7	1.1	0.5	0.6		0.5	0.4	0.3	0.8	0.6	1.1	0.4	0.2	0.3	0.2	0.1
Mazzaella lilacina	0.4	0.1	0.8	0.4	1.2	0.5	0.7	0.8	0.6	0.2	-	<.1		-	<.1	-	-	<.1	-	-	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	+	+	+	+	<.1	0.1	+	+	+	+		-	-	-	<.1	+	+	<.1	-	+	0.1	+
Microcladia borealis	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	<.1	<.1	0.6	0.2	0.2	+	0.3	0.4	0.1	<.1	+	+		-	-	+	<.1	+	+	-	-	+	-	-
Neorhodomela larix	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	13.7	12.9	9.7	9.7	13.6	13.9	12.8	18.1	17.7	18.2	29.5	36.5		42.7	28.0	20.7	18.2	12.8	11.3	23.5	15.9	15.5	21.3	12.6
Opuntiella californica	+	-	<.1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Osmundea spp.	0.2	0.2	0.3	<.1	0.1	0.3	<.1	0.2	0.2	0.2	0.1	0.1		0.3	0.2	0.6	0.7	0.6	0.2	0.3	0.5	0.2	+	0.1
Pelvetia compressa	-	-	-	-	-	-	-	-	-	+	-	<.1		-	-	-	-	-	-	-	-	-	-	<.1
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Phyllospadix spp.	13.1	11.3	23.1	22.3	27.7	24.8	17.4	11.6	14.7	15.8	11.4	13.5		5.6	6.2	6.5	8.3	10.5	6.2	9.1	13.3	13.4	15.2	21.3
Plocamium violaceum	<.1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	1.3	4.0	0.9	1.5	1.8	2.6	2.4	11.4	4.3	2.5	0.3	+		-	<.1	0.6	0.2	<.1	<.1	+	-	<.1	-	<.1
Prionitis spp.	0.8	1.0	2.3	1.3	1.2	0.8	0.8	1.9	0.9	0.8	0.7	0.5		1.7	1.4	0.8	2.3	3.3	3.3	1.1	3.4	2.6	3.2	4.2
Pterosiphonia dendroidea	<.1	0.1	<.1	<.1	<.1	0.2	<.1	0.2	0.6	0.2	<.1	0.2		+	+	0.2	0.5	0.8	1.0	2.7	1.5	<.1	5.2	2.6
Rhodophyta (juv. blades)	-	-	+	-	-	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	<.1	<.1	0.3	<.1	<.1	+	+	<.1	0.1	<.1	+	+		+	<.1	0.5	0.5	0.6	0.4	0.2	0.6	0.5	+	<.1
Scinaia confusa	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	<.1	-
Scytosiphon spp.	-	-	-	-	-	-	-	-	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	-	<.1	2.7	7.0	4.9	5.5	2.4	0.3	0.3	1.0	+	0.2		-	+	-	+	+	<.1	-	-	+	+	+
Soranthera ulvoidea	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	0.6	0.6	0.2	0.5	0.6	+	+	<.1	<.1	+	+	+		-	<.1	-	-	+	-	+	-	-	-	-
Ulva/Enteromorpha spp.	9.3	10.4	1.9	8.0	2.1	2.6	7.1	1.3	3.6	0.9	<.1	+		-	3.7	3.9	4.0	3.5	1.9	2.8	0.7	11.4	0.7	2.0
coralline crust	2.3	5.3	2.9	2.8	4.1	4.3	4.5	10.6	4.6	5.2	5.2	2.9		3.2	2.1	1.1	2.3	2.7	4.9	7.0	3.8	5.0	8.8	5.6
filamentous red algae-complex	2.6	0.7	1.5	2.8	4.8	2.7	2.1	1.2	2.1	3.5	0.2	0.2		<.1	3.8	11.7	14.3	11.8	10.5	12.3	18.5	15.0	8.1	16.5
juv. articulated coralline algae	-	<.1	0.2	0.1	0.5	0.3	0.6	1.2	0.2	0.4	0.8	0.7		0.1	0.3	0.1	0.4	0.2	0.3	0.3	0.4	0.2	1.7	0.9

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 2 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.2	0.1	0.2	0.3	0.7	0.5	0.3	0.1	<.1	0.1	<.1	<.1	<.1	<.1	-	-	+	<.1	<.1	0.2	<.1	-	0.2	+
Callithamnion pikeanum	<.1	<.1	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	+	-	+	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	3.5	1.4	1.5	2.2	1.3	1.5	1.6	1.0	1.1	0.6	<.1	+	-	-	-	+	0.1	0.7	1.1	<.1	<.1	0.2	+	+
Chrysophyta unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-
Cladophora spp.	0.5	<.1	<.1	0.3	<.1	0.1	0.1	<.1	0.2	0.2	<.1	<.1	+	+	+	<.1	<.1	+	<.1	<.1	+	+	+	+
Codium setchellii (prostrate)	<.1	+	<.1	0.1	0.1	0.2	0.2	0.2	0.4	0.2	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina officinalis	0.2	<.1	<.1	<.1	+	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina vancouveriensis	1.0	2.6	3.1	3.9	4.8	4.8	3.5	2.6	1.7	1.5	0.8	0.3	<.1	<.1	<.1	<.1	1.0	0.5	0.4	0.1	0.2	0.2	0.3	1.2
Cryptopleura violacea	<.1	0.1	<.1	0.2	0.2	0.4	0.2	0.2	0.1	<.1	<.1	<.1	+	+	+	+	-	<.1	-	-	-	-	-	-
Cryptosiphonia woodii	<.1	<.1	<.1	0.1	0.3	0.2	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Cumagloia andersonii	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	22.4	23.4	23.4	26.6	24.3	27.2	31.3	13.4	20.2	25.4	17.6	22.0	14.8	10.3	10.9	11.9	16.1	15.9	17.9	18.6	18.6	15.2	18.9	16.8
Fucus gardneri	7.9	7.5	4.8	4.2	6.6	6.2	5.2	1.6	0.9	2.5	0.9	+	-	-	-	<.1	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	-	-	-	-	-	-	-	+	-	+	+	-	-	-	+	<.1	+	<.1	<.1	+	<.1	<.1	+	<.1
Gelidium coulteri	2.1	3.2	2.5	2.6	2.4	3.5	3.1	2.1	2.7	2.7	0.4	<.1	+	<.1	<.1	1.0	2.0	1.9	1.9	3.1	2.5	2.2	1.6	0.3
Gelidium pusillum	1.3	0.8	0.8	0.6	0.6	1.0	1.1	0.9	1.9	1.0	0.1	<.1	+	+	+	0.2	1.0	3.3	2.6	0.6	0.3	0.3	0.4	<.1
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	<.1	+	-	+
Halosaccion americanum	<.1	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Hesperophycus californicus	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Mastocarpus jardinii	0.4	0.3	0.2	0.4	0.3	0.2	0.1	<.1	0.1	<.1	+	-	-	<.1	-	-	+	-	-	-	-	-	-	-
Mastocarpus papillatus	26.4	28.1	35.7	33.4	32.5	26.4	25.8	21.0	18.8	10.3	7.9	6.1	1.5	0.8	1.3	2.2	4.2	7.1	4.5	5.6	6.5	8.2	2.2	1.7
Mazzaella affinis	2.8	3.2	3.1	3.5	2.3	2.6	3.7	2.0	2.9	1.5	0.2	+	+	+	-	<.1	0.6	2.6	3.0	1.4	0.6	0.6	0.6	0.1
Mazzaella flaccida	8.3	7.4	7.1	9.7	6.9	6.6	6.8	2.9	2.7	2.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella heterocarpa	0.1	0.1	0.2	0.3	0.4	0.4	0.2	0.1	<.1	0.2	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-
Mazzaella leptorhynchos	0.2	0.3	0.2	0.3	0.2	0.2	0.2	<.1	<.1	<.1	<.1	<.1	+	+	<.1	0.4	0.1	0.1	<.1	0.2	<.1	<.1	+	+
Mazzaella lilacina	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Non-coralline crust	13.1	15.2	13.5	15.0	19.5	19.8	16.6	12.9	13.1	14.5	19.8	15.1	9.6	4.2	2.9	2.7	4.3	5.5	7.0	7.8	11.6	10.3	7.3	3.4
Osmundea spp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Pelvetia compressa	4.2	3.8	4.0	4.7	5.5	6.3	7.9	7.2	7.0	6.3	4.2	2.8	1.5	0.6	0.4	0.2	0.4	<.1	-	-	-	-	-	-
Phyllospadix spp.	<.1	-	+	<.1	+	0.1	0.2	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	3.8	2.8	1.1	0.8	0.9	0.9	0.4	1.5	6.5	1.0	0.2	<.1	+	-	<.1	0.2	<.1	2.3	0.7	<.1	-	<.1	3.0	0.1
Prionitis spp.	<.1	<.1	<.1	0.1	<.1	<.1	<.1	+	<.1	+	<.1	+	+	-	-	+	-	<.1	<.1	<.1	<.1	0.2	+	+
Rhodophyta (juv. blades)	-	-	+	-	-	-	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	+	+	<.1	+	<.1	<.1	<.1	<.1	+	+	-	-	-	-	-	-	+	+	-	-	-	-	-
Ulva/Enteromorpha spp.	0.2	+	<.1	<.1	+	+	<.1	<.1	<.1	0.2	<.1	+	-	-	+	+	2.4	1.1	+	+	-	2.0	+	+
coralline crust	1.7	3.0	3.3	2.9	3.9	4.2	3.3	4.2	2.8	3.5	2.3	0.8	0.6	0.4	0.7	0.6	1.2	0.9	1.6	2.3	1.2	1.2	1.9	1.4
filamentous red algae-complex	0.3	<.1	+	<.1	<.1	+	<.1	+	-	-	-	-	-	-	-	-	0.5	0.4	0.2	-	0.1	+	-	<.1
juv. articulated coralline algae	-	+	<.1	0.1	0.5	0.1	<.1	<.1	<.1	0.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	0.3	0.2	0.2	0.1	0.3	0.1	0.3

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 3 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	5	6	5	4	6	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Bryopsis spp.	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-	+	+
Calliarthron/Bossiella spp.-complex	2.5	0.7	1.6	1.2	2.0	2.7	2.3	2.2	2.2	3.7	1.7	2.3	0.9	1.2	0.3	2.3	5.2	6.9	4.9	4.3	4.2	0.8	22.2	4.4
Callithamnion pikeanum	0.7	0.4	0.2	0.1	<.1	0.1	<.1	<.1	<.1	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	0.4	1.3	1.0	0.5	1.0	0.4	0.4	0.6	0.2	<.1	+	-	-	-	-	+	+	<.1	<.1	+	-	<.1	+
Callophyllis spp.	-	0.7	<.1	<.1	<.1	<.1	+	<.1	<.1	<.1	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	13.2	12.5	12.1	16.8	18.3	19.2	20.2	19.3	23.9	18.9	4.7	2.3	0.2	0.5	2.4	6.2	6.9	8.1	7.5	1.4	1.6	2.1	2.2	1.9
Chondracanthus corymbiferus	-	-	<.1	<.1	<.1	0.2	<.1	0.2	0.3	0.2	<.1	<.1	-	+	0.1	+	<.1	-	-	-	-	<.1	-	+
Chrysophyta unid.	-	-	<.1	<.1	<.1	+	0.1	+	<.1	<.1	+	-	-	0.6	+	2.4	0.1	0.2	<.1	5.6	+	7.6	6.8	0.1
Cladophora spp.	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	-	+	+
Codium fragile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	-	<.1	<.1	-	-
Codium setchellii (prostrate)	-	-	+	-	<.1	0.1	0.2	0.2	0.4	0.2	0.1	<.1	<.1	-	-	-	-	-	-	-	-	-	+	+
Colpomenia spp.	-	-	+	+	-	-	-	-	-	+	-	-	-	-	+	+	+	<.1	<.1	-	+	+	+	+
Colpomenia/Leathesia/Soranthera spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Corallina officinalis	4.8	3.3	3.9	2.7	4.1	2.8	1.9	2.8	2.1	1.4	0.2	0.1	-	<.1	+	+	0.7	<.1	<.1	-	-	-	+	-
Corallina vancouveriensis	6.9	11.6	8.8	9.1	11.1	8.9	6.8	8.3	6.5	6.3	8.0	2.0	6.1	1.2	2.0	1.1	1.3	4.8	1.7	1.7	1.7	0.9	6.4	13.1
Cryptopleura ruprechtiana	0.1	<.1	0.2	0.1	0.2	0.2	<.1	<.1	0.3	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	4.5	7.4	10.7	7.1	5.9	8.7	6.9	10.7	9.2	5.0	1.7	4.2	1.7	1.2	0.7	0.6	1.6	1.2	0.5	<.1	-	0.7	-	0.3
Cryptosiphonia woodii	<.1	<.1	<.1	<.1	-	<.1	+	<.1	0.1	0.1	+	+	+	-	-	-	+	-	-	-	-	-	-	-
Cystoseira osmundacea	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.1	0.3	0.1	-	-	-
Desmarestia spp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	20.8	10.5	7.0	7.4	5.4	2.3	0.6	<.1	2.0	0.9	<.1	-	-	-	-	-	-	-	-	-	-	0.1	-	-
Endarachne/Petalonia-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	0.1	0.1	-
Endocladia muricata	0.3	0.2	0.3	0.3	0.1	0.1	0.1	-	<.1	+	-	<.1	<.1	0.1	<.1	0.2	<.1	<.1	0.1	0.1	0.2	0.2	-	<.1
Erythrophyllum delesserioides	-	-	+	+	+	<.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Gastroclonium subarticulatum	5.5	5.8	8.8	7.2	9.2	7.7	8.6	13.9	13.2	12.6	13.5	16.4	11.6	6.7	6.9	3.5	3.8	5.2	3.1	1.1	2.0	1.5	0.3	2.1
Gelidium coulteri	10.8	9.7	11.8	7.6	7.9	9.4	8.3	5.1	6.4	7.7	14.3	13.9	11.8	11.1	13.5	14.2	15.5	14.1	8.6	2.2	2.6	6.8	4.9	3.6
Gelidium pusillum	0.3	0.7	<.1	0.4	0.1	0.2	0.3	<.1	0.1	0.2	0.4	0.1	<.1	0.2	0.5	<.1	0.3	<.1	+	<.1	<.1	+	-	+
Gelidium robustum	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Grateloupia doryphora	-	-	-	-	-	<.1	-	-	<.1	-	-	+	-	-	-	-	0.1	-	-	-	-	<.1	-	-
Halorhipis winstonii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Halosaccion americanum	0.6	0.1	<.1	<.1	+	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	0.1	-	<.1	+	-	0.3	-	-	<.1	<.1	<.1	0.2	<.1	<.1	0.1	<.1	+	-	-	-	-	-
Hymenena spp.	-	-	+	-	-	<.1	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Janczewskia gardneri	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Laminariales	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-	+	-	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	+	+	2.2	-	-
Mastocarpus jardinii	5.4	4.3	3.0	3.7	3.2	3.3	2.1	1.7	1.7	1.6	0.8	0.8	0.3	0.1	0.1	0.7	0.7	0.5	0.2	<.1	<.1	<.1	-	<.1
Mastocarpus papillatus	1.5	2.3	2.9	2.4	1.8	1.4	1.2	1.8	2.0	1.8	3.7	6.7	1.1	4.1	8.4	6.2	4.0	1.9	0.7	0.2	0.3	2.0	0.1	0.1
Mazzaella affinis	1.0	0.6	0.5	0.6	0.6	0.5	1.0	0.9	1.3	1.3	2.4	1.6	0.1	0.3	1.0	1.8	2.3	1.5	1.2	<.1	0.2	1.2	0.2	<.1
Mazzaella californicum	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella flaccida	13.9	13.1	14.4	19.2	22.3	24.9	28.1	26.5	18.0	12.0	4.4	2.7	0.1	<.1	0.1	-	-	-	-	-	<.1	-	-	-
Mazzaella heterocarpa	0.7	0.2	<.1	0.3	0.6	0.6	0.3	0.3	0.3	0.3	0.2	0.4	<.1	0.1	0.1	0.2	0.1	<.1	+	-	-	0.1	+	+
Mazzaella leptorhynchos	<.1	-	-	-	+	+	+	0.1	+	<.1	<.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	+	+	-	<.1	-	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 3 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	5	6	5	4	6	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Mazzaella lilacina	<.1	0.8	0.5	0.4	1.0	1.2	0.9	0.5	1.6	0.5	0.1	-	-	-	-	-	-	-	-	-	-	-	-	+
Mazzaella linearis	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	0.1	+	+	<.1	<.1	0.3	<.1	+	<.1	<.1	-	-	+	-	+	-	-	-	-	-	-	-
Microcladia borealis	<.1	<.1	0.1	+	<.1	+	<.1	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	0.4	0.3	0.4	0.4	0.6	0.4	0.3	1.0	0.8	<.1	+	+	-	<.1	0.2	0.5	0.2	+	+	-	-	0.1	-	-
Nereocystis luetkeana	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nienburgia andersoniana	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	18.9	14.0	15.7	15.1	18.9	18.0	19.0	19.2	17.4	21.6	30.8	36.6	37.2	44.7	44.9	36.0	26.1	23.7	24.5	21.3	25.0	27.1	24.1	15.9
Osmundea spp.	0.6	0.8	0.9	0.9	1.9	1.2	0.5	1.4	1.2	0.9	0.3	0.2	<.1	<.1	<.1	0.1	0.3	0.2	<.1	-	-	+	-	-
Pelvetia compressa	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-
Phaeostrophion irregulare	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	<.1	<.1	-	-	-	-	-
Phyllospadix spp.	4.1	7.6	15.3	16.9	15.6	13.2	9.1	8.3	11.7	11.2	7.5	7.3	0.7	0.9	1.0	1.0	0.6	0.5	0.3	<.1	-	-	-	-
Plocamium violaceum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Polyneura latissima	-	-	-	-	-	-	-	<.1	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	0.4	5.4	0.5	1.9	1.2	1.2	0.3	0.6	2.2	1.4	0.3	<.1	+	<.1	<.1	1.6	+	0.1	0.1	+	-	+	+	0.8
Prionitis spp.	1.4	2.1	3.8	4.1	3.0	3.7	2.6	4.1	4.0	3.1	2.7	3.2	3.7	3.1	5.4	5.9	7.4	6.7	3.1	0.5	0.4	2.6	2.8	2.7
Pterocladia caloglossoides	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pterosiphonia dendroidea	-	-	-	-	-	-	-	+	-	<.1	<.1	-	-	-	+	-	-	+	+	-	<.1	+	+	<.1
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Rhodymenia spp.	-	-	-	+	-	-	-	-	<.1	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	-	<.1	0.2	<.1	<.1	<.1	<.1	0.1	0.4	0.4	0.4	0.2	0.2	<.1	0.2	<.1	0.2	0.3	<.1	+	-	+	+	0.1
Scinaia confusa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Scytosiphon spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	1.7	+	-	-
Smithora naiadum	0.1	-	<.1	2.2	0.8	1.3	1.0	<.1	<.1	0.8	<.1	+	-	-	+	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	2.2	0.5	<.1	1.7	+	+	0.1	+	+	+	+	-	-	<.1	+	+	-	+	+	-	-	-	-	0.1
Ulva/Enteromorpha spp.	4.0	2.1	0.3	2.4	0.4	<.1	0.5	0.5	0.9	0.3	<.1	+	+	0.5	4.1	12.8	9.2	5.1	5.2	1.8	4.9	13.7	<.1	<.1
coralline crust	4.0	4.1	5.1	5.2	6.9	8.4	8.8	8.0	10.7	9.8	12.8	6.7	6.3	4.5	3.9	6.1	7.8	9.9	11.3	10.5	10.2	6.9	12.2	7.9
filamentous red algae-complex	1.6	2.4	0.9	0.8	1.2	0.9	0.3	0.4	0.6	0.5	<.1	<.1	-	+	0.3	3.1	17.0	12.9	14.0	1.0	1.6	17.8	5.1	19.0
juv. articulated coralline algae	-	1.2	0.1	0.8	0.6	0.7	0.6	0.5	0.5	0.5	0.5	1.5	0.6	0.5	0.5	1.1	1.3	2.0	1.2	1.6	2.1	1.3	2.0	3.0

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 3 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	-	+	<.1	+	+	+	+	<.1	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.3	0.2	0.3	0.3	0.4	0.4	0.5	0.3	0.3	0.8	0.4	0.2		0.3	+	<.1	0.1	0.1	<.1	0.3	0.1	-	0.2	0.3
Callithamnion pikeanum	0.2	0.7	0.2	<.1	<.1	<.1	+	+	+	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	0.4	<.1	0.2	0.1	<.1	0.2	<.1	<.1	<.1	+	-	+		-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	5.1	5.2	5.2	7.6	7.1	7.6	7.5	7.7	8.2	5.8	1.4	<.1		+	<.1	0.1	0.3	1.0	0.6	0.2	+	<.1	+	+
Chondracanthus corymbiferus	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	+	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	0.2	<.1	-	<.1	+	+	<.1	<.1	-	-		-	-	2.3	1.1	0.6	0.3	0.9	0.6	0.2	<.1	<.1
Cladophora spp.	0.2	<.1	0.1	0.3	<.1	<.1	<.1	<.1	<.1	<.1	+	+		+	+	+	+	+	+	+	+	+	+	+
Codium fragile	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	<.1	+
Codium setchellii (prostrate)	-	-	-	<.1	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Colpomenia spp.	-	-	+	-	-	-	-	+	-	-	-	-		-	-	+	+	+	+	-	-	-	+	+
Corallina officinalis	0.2	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	+	-	-		-	-	-	-	-	-	<.1	-	-	-	-
Corallina vancouveriensis	6.6	7.3	7.8	6.9	8.0	8.2	7.8	5.9	3.9	3.2	1.3	0.4		-	+	+	<.1	<.1	<.1	<.1	+	+	0.6	2.2
Cryptopleura violacea	0.3	0.6	1.2	0.9	1.3	1.7	0.8	1.2	0.9	0.4	<.1	0.1		+	-	+	0.1	<.1	-	-	-	+	-	+
Cryptosiphonia woodii	<.1	<.1	<.1	<.1	0.1	0.2	<.1	<.1	0.1	<.1	<.1	<.1		-	-	-	-	-	-	-	-	-	-	-
Cumagloia andersonii	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	0.5	-	-	-	-	-
Egregia menziesii	1.0	0.6	0.2	0.2	0.3	-	-	<.1	1.4	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	27.0	24.7	22.2	25.4	26.9	24.2	23.6	24.5	25.4	26.4	18.9	19.8		7.6	8.7	10.1	12.9	13.3	12.1	11.3	9.2	7.8	13.0	4.3
Fucus gardneri	0.3	0.3	0.4	0.7	0.3	+	<.1	0.4	0.1	0.2	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	<.1	0.2	0.3	0.3	0.2	0.9	1.5	1.5	1.2	1.6	0.3	0.6		+	+	<.1	-	-	-	<.1	-	0.2	+	+
Gelidium coulteri	3.8	2.8	3.6	2.9	2.3	3.2	2.8	2.9	2.6	1.7	1.7	1.3		0.3	0.4	0.6	0.8	1.8	1.9	0.3	0.2	1.5	0.1	0.3
Gelidium pusillum	2.0	1.9	0.7	0.7	0.5	0.7	0.7	0.7	0.7	0.4	0.2	0.2		<.1	<.1	<.1	0.1	0.4	0.1	+	0.2	0.5	+	+
Gelidium robustum	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	+	-	+	-	-	-	-	-
Halosaccion americanum	0.1	+	<.1	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	+	+	-	-	-	+	-	-
Hesperophycus californicus	-	-	-	-	-	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Laminariales	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	0.3	-	-
Mastocarpus jardinii	5.9	3.4	3.3	4.2	4.0	2.9	2.4	2.2	1.0	1.3	0.8	0.2		-	-	<.1	<.1	<.1	<.1	-	-	-	-	-
Mastocarpus papillatus	14.3	18.5	13.5	13.1	11.5	12.4	11.8	11.6	13.4	9.5	10.3	6.5		4.3	6.5	7.2	5.2	5.0	2.0	0.6	0.8	4.1	0.3	<.1
Mazzaella affinis	2.1	1.7	1.3	2.4	1.6	1.6	1.6	2.0	3.3	3.4	1.7	1.0		0.6	0.2	0.7	2.4	2.6	2.2	0.4	0.1	1.2	<.1	<.1
Mazzaella flaccida	14.5	15.8	16.4	19.7	18.5	19.1	17.1	14.1	10.0	6.6	1.1	<.1		-	-	-	<.1	-	-	-	-	-	-	-
Mazzaella heterocarpa	<.1	0.1	0.2	0.4	0.8	0.6	0.1	0.2	0.4	<.1	<.1	<.1		-	-	+	-	<.1	+	-	-	<.1	+	-
Mazzaella leptorhynchos	-	-	<.1	<.1	<.1	<.1	+	<.1	0.2	0.2	<.1	<.1		-	+	+	<.1	<.1	<.1	+	-	+	-	-
Mazzaella lilacina	-	-	<.1	<.1	-	<.1	-	-	<.1	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Microcladia borealis	-	<.1	+	+	<.1	+	<.1	-	<.1	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	0.7	-	<.1	<.1	+	+	<.1	+	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Neorhodomela larix	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	19.2	16.2	20.3	19.2	22.2	23.0	21.2	23.0	18.8	23.6	27.8	28.3		22.6	27.3	22.8	21.2	22.7	22.3	23.8	25.9	23.5	28.8	10.1
Osmundea spp.	<.1	<.1	0.2	<.1	<.1	0.1	<.1	<.1	<.1	<.1	-	-		-	+	+	+	-	-	-	-	-	-	<.1
Pelvetia compressa	4.5	3.2	4.6	5.4	5.2	4.7	4.8	3.8	4.2	4.8	4.3	2.3		-	-	-	-	-	-	-	-	-	-	-
Phaeostrophion irregulare	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Phyllospadix spp.	-	<.1	+	<.1	+	+	+	+	<.1	-	-	+		-	-	-	-	-	-	-	-	-	-	-
Plocamium cartilagineum	<.1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - North Diablo Cove Station NDC 3 at +0.9m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Plocamium violaceum	-	-	<.1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	2.8	9.1	1.0	4.2	2.4	1.6	0.2	1.0	4.7	0.9	0.6	+		-	<.1	1.0	0.6	0.7	0.4	+	+	+	+	0.1
Prionitis spp.	<.1	<.1	0.1	<.1	<.1	<.1	0.1	0.1	0.2	0.1	<.1	<.1		-	<.1	0.1	0.1	0.1	<.1	0.1	0.1	<.1	+	<.1
Pterosiphonia dendroidea	-	-	-	-	+	-	+	+	+	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	+	-	<.1	+	+	<.1	<.1	<.1	<.1	<.1	<.1	+		-	+	+	-	+	-	-	-	-	+	-
Scinaia confusa	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Scytosiphon spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	<.1	-	-	-
Spongomorpha/Acrosiphonia-complex	0.2	<.1	+	0.4	+	+	+	<.1	-	-	-	-		-	-	+	-	+	+	-	-	-	-	-
Ulva/Enteromorpha spp.	0.1	0.2	0.6	0.8	+	<.1	<.1	0.5	0.4	<.1	+	-		-	+	6.0	12.6	6.1	5.4	2.2	1.9	7.1	0.2	<.1
coralline crust	2.3	4.5	5.1	4.9	5.3	6.6	6.5	6.8	5.5	6.3	5.3	2.0		1.2	1.0	1.4	1.8	3.3	4.9	3.4	3.5	3.1	7.0	2.1
filamentous red algae-complex	0.2	1.0	0.1	0.2	0.1	0.1	0.1	<.1	0.1	<.1	-	+		-	<.1	2.4	5.5	3.6	2.0	<.1	<.1	4.0	0.7	0.5
juv. articulated coralline algae	-	0.3	<.1	0.1	0.5	0.2	0.1	<.1	0.4	0.4	0.1	0.3		+	<.1	+	0.4	0.2	0.3	0.2	0.2	0.2	1.8	0.3

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Cove Station SDC 1 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	4	5	6	6	5	4	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	-					+	<.1	-	-	-	-	-	-	-	-	-	<.1	+	+	-	+	-	-
Analipus japonicus	-	-					-	+	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	-					-	-	-	+	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	2.7	1.2					2.9	1.3	0.4	0.5	1.1	0.2	<.1	-	<.1	<.1	0.1	<.1	<.1	0.2	+	+	0.3	3.6
Callithamnion pikeanum	0.4	+					<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	-					<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callophyllis spp.	-	-					-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1
Chondracanthus canaliculatus	7.0	9.4					10.6	3.6	2.3	1.6	1.1	0.7	0.5	0.6	6.5	17.3	24.6	16.4	20.6	9.5	14.4	13.7	25.0	0.2
Chondracanthus corymbiferus	-	-					0.5	<.1	-	-	-	-	-	-	-	+	0.1	0.2	0.1	<.1	-	0.1	0.5	<.1
Chondracanthus harveyanus/spinosus	-	-					-	-	-	-	-	-	-	-	-	-	0.2	<.1	0.1	0.3	1.2	1.1	0.2	-
Chondria decipiens	-	-					-	-	-	-	-	-	-	-	-	-	<.1	+	+	<.1	0.4	-	<.1	-
Chrysophyta unid.	<.1	0.1					0.3	<.1	0.3	+	<.1	-	-	-	0.3	+	+	0.9	0.7	0.2	1.6	<.1	5.2	3.2
Cladophora spp.	+	+					+	+	+	<.1	<.1	<.1	0.2	<.1	+	+	+	+	+	+	-	<.1	-	+
Colpomenia spp.	-	+					+	-	<.1	<.1	+	-	-	-	-	-	-	+	+	+	-	-	0.1	0.2
Colpomenia/Leathesia/Soranthera spp.	-	-					-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina officinalis	0.2	0.9					0.6	0.3	<.1	+	0.2	-	-	-	+	+	-	-	+	+	-	-	-	-
Corallina vancouveriensis	0.4	1.5					0.5	0.6	0.1	0.1	0.3	0.1	<.1	-	+	<.1	<.1	+	0.2	<.1	<.1	0.1	1.1	3.4
Cryptopleura ruprechtiana	-	-					-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	<.1	0.3					1.5	1.5	<.1	0.6	0.9	8.5	6.0	3.1	6.4	9.4	23.4	23.6	12.5	10.8	5.7	14.0	7.0	0.4
Cryptosiphonia woodii	<.1	0.3					0.2	<.1	+	+	+	+	-	-	-	<.1	+	-	<.1	-	-	0.2	-	-
Derbesia marina (filamentous)	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-
Egregia menziesii	1.2	0.7					<.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	0.1	1.0					<.1	0.5	0.1	-	+	<.1	<.1	<.1	0.2	<.1	<.1	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	<.1	0.1					+	<.1	+	1.2	<.1	-	-	-	-	-	+	<.1	<.1	<.1	+	0.1	-	<.1
Fucus gardneri	<.1	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	13.3	17.2					22.4	4.6	<.1	<.1	<.1	0.3	0.2	0.3	0.8	2.8	7.4	13.1	15.9	13.3	12.2	11.1	3.5	+
Gelidium coulteri	2.0	4.7					2.5	1.8	0.1	1.1	3.7	8.2	9.8	13.8	13.9	12.2	8.3	3.1	2.7	1.3	3.8	1.8	7.2	0.8
Gelidium pusillum	-	-					0.2	+	<.1	<.1	+	+	<.1	<.1	0.4	0.2	0.2	0.2	0.1	-	+	0.2	+	<.1
Gelidium robustum	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	+	-
Grateloupia doryphora	0.2	0.3					0.6	-	0.2	1.2	0.2	0.2	0.2	<.1	<.1	<.1	0.2	0.1	3.1	0.4	2.8	-	-	0.2
Gymnogongrus chiton	-	-					-	-	-	-	-	-	-	-	-	-	+	<.1	-	-	-	-	-	-
Halorhipis winstonii	-	-					-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halosaccion americanum	0.5	<.1					0.2	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Halymenia/Schizymenia spp.-complex	0.5	0.6					0.2	0.2	0.4	<.1	0.5	0.9	+	<.1	0.3	<.1	0.2	0.6	0.8	1.8	0.3	0.4	1.4	0.5
Hymenena spp.	-	-					-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	0.4	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macrocystis spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	1.1
Mastocarpus jardinii	0.1	0.2					0.4	0.3	+	+	+	+	<.1	0.3	+	0.1	<.1	<.1	+	-	-	-	-	+
Mastocarpus papillatus	10.2	9.6					3.8	1.8	7.2	12.9	19.5	15.3	9.9	25.6	26.2	16.6	8.0	1.6	0.5	0.1	2.0	0.1	<.1	<.1
Mazzaella affinis	0.2	0.6					1.4	0.3	0.5	<.1	0.6	1.2	0.7	0.5	2.0	1.5	1.4	1.5	2.0	0.8	1.3	1.2	2.4	0.2
Mazzaella californicum	-	-					-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Mazzaella flaccida	4.2	2.5					7.7	0.8	+	0.2	0.3	<.1	-	-	-	+	<.1	-	-	-	-	-	-	-
Mazzaella heterocarpa	2.0	1.4					1.9	0.4	<.1	<.1	0.2	0.4	0.3	0.4	0.4	0.3	0.4	0.3	0.2	<.1	0.4	+	1.5	<.1
Mazzaella leptorhynchos	1.4	1.2					1.1	0.5	<.1	1.4	0.8	1.1	0.3	0.6	0.6	<.1	0.5	0.2	0.2	<.1	+	+	+	-
Mazzaella lilacina	0.7	1.1					0.3	<.1	-	-	0.2	-	-	<.1	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Cove Station SDC 1 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	4	5	6	6	5	4	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Mazzaella linearis	0.6	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia borealis	<.1	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Microcladia coulteri	0.7	1.4					0.3	<.1	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-
Neorhodomela larix	1.1	1.2					0.9	2.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nienburgia andersoniana	-	-					-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	0.4	-	-
Non-coralline crust	16.2	13.9					17.8	14.4	24.5	22.8	22.6	23.8	38.4	33.0	28.2	22.6	17.5	8.5	7.8	8.8	7.7	8.9	10.3	23.9
Osmundea spp.	<.1	<.1					0.1	<.1	+	0.1	0.2	0.3	<.1	0.3	0.2	0.3	0.6	0.4	0.1	0.1	+	<.1	-	-
Phaeostrophion irregulare	-	-					-	-	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	9.9	3.9					9.8	2.8	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	2.7	1.8					3.8	0.4	1.3	0.9	0.4	0.1	<.1	-	<.1	-	-	-	+	-	-	-	-	-
Prionitis spp.	1.8	5.7					3.6	2.6	2.3	3.4	4.4	8.1	3.1	8.8	9.7	9.1	1.4	1.9	5.8	3.8	3.1	4.8	5.6	0.5
Pterosiphonia dendroidea	<.1	<.1					0.2	0.7	<.1	<.1	<.1	+	-	-	-	+	0.3	0.4	0.2	0.5	0.7	0.9	2.1	0.2
Rhodophyta (juv. blades)	-	-					-	-	<.1	+	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-
Sarcodiotheca gaudichaudii	0.3	0.9					0.3	<.1	+	<.1	<.1	<.1	-	-	+	<.1	<.1	<.1	<.1	<.1	0.2	0.1	-	-
Sargassum muticum	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.0
Scytosiphon spp.	-	-					-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	<.1	-					1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	0.3	1.5					<.1	<.1	4.6	+	<.1	<.1	+	-	-	+	+	+	-	1.7	-	-	-	+
Ulva/Enteromorpha spp.	9.0	8.0					3.9	<.1	3.1	1.7	+	-	-	-	5.6	2.8	1.2	1.1	8.7	11.4	15.9	8.0	1.5	1.3
coralline crust	2.4	1.8					2.3	2.7	1.7	1.0	2.1	1.6	1.2	2.0	1.3	1.7	2.3	1.2	0.9	1.9	0.7	2.0	3.7	5.3
filamentous red algae-complex	0.2	0.1					0.2	0.3	<.1	<.1	<.1	-	-	-	-	<.1	9.7	19.3	12.0	18.2	16.3	5.5	2.8	6.1
juv. articulated coralline algae	-	1.3					0.2	0.2	<.1	0.7	0.3	<.1	+	<.1	<.1	<.1	<.1	0.2	+	<.1	+	0.1	+	0.8

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	5	6	6	6	5	5	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-	-
Analipus japonicus	-	-					-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	<.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	2.5	2.8					4.6	1.4	+	0.1	0.3	<.1	<.1	-	+	+	+	0.1	+	<.1	<.1	+	0.2	1.6
Callithamnion pikeanum	<.1	<.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Chaetomorpha spp.	-	-					-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	2.4	3.3					4	1.7	<.1	0.4	0.3	<.1	<.1	+	0.4	1.1	4.5	12.5	22.6	13.1	5.1	4.9	10.4	0.1
Chondracanthus corymbiferus	-	-					<.1	-	-	-	-	-	-	-	-	<.1	+	+	<.1	-	-	-	-	-
Chondracanthus harveyanus/spinosus	-	-					-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-
Chondria decipiens	-	-					-	-	-	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-					0.6	<.1	0.7	-	<.1	-	-	-	1.6	+	+	1	-	-	-	-	0.8	0.4
Cladophora spp.	+	+					<.1	+	+	<.1	<.1	<.1	0.2	<.1	+	+	+	+	+	+	0.1	+	+	+
Colpomenia spp.	-	-					+	-	+	<.1	+	-	-	-	-	-	-	+	+	-	+	-	+	+
Corallina officinalis	-	0.7					<.1	<.1	-	-	-	-	-	-	-	-	-	-	+	0.2	+	-	-	+
Corallina vancouveriensis	0.8	1					1.5	0.3	<.1	<.1	0.4	0.5	0.2	0.2	<.1	<.1	0.2	<.1	<.1	<.1	<.1	<.1	0.2	1.4
Cryptopleura ruprechtiana	-	-					<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	-	-					0.3	<.1	-	0.1	<.1	1.4	1	0.4	1.1	1.5	5.5	10.2	6.6	3.6	4.1	5.6	3	0.1
Cryptosiphonia woodii	0.1	0.1					0.2	<.1	-	<.1	+	-	-	-	-	-	-	-	+	-	-	<.1	-	-
Cumagloia andersonii	-	-					-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	<.1	-					<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	0.1	0.3					+	<.1	+	-	<.1	<.1	<.1	<.1	<.1	<.1	-	+	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	-					-	-	-	+	<.1	+	-	-	-	-	<.1	-	-	+	-	+	-	-
Gastroclonium subarticulatum	<.1	0.1					0.4	<.1	-	+	<.1	<.1	-	-	<.1	0.1	1.5	3.5	8.7	11.6	9.2	6.9	2.8	<.1
Gelidium coulteri	2.2	2.5					3.2	1.1	+	0.4	0.8	2.7	3.2	3.2	6.3	10	15.8	15	11.2	7.9	12.5	5.6	13.4	0.7
Gelidium pusillum	-	<.1					0.3	<.1	+	+	<.1	+	+	0.2	<.1	0.2	0.9	1.3	0.7	0.3	+	0.6	0.8	<.1
Gelidium spp.	-	-					-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grateloupia doryphora	<.1	-					<.1	-	<.1	0.6	0.1	<.1	<.1	-	-	-	0.1	0.6	3.9	1.2	3.2	-	-	0.5
Halicystis ovalis	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halosaccion americanum	0.3	+					0.3	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	0.2	-					<.1	+	<.1	<.1	<.1	+	<.1	+	<.1	<.1	<.1	0.6	0.4	0.5	+	0.3	1	0.5
Haplogloia andersonii	-	+					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laminariales	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macrocystis spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Mastocarpus jardinii	0.3	0.2					0.8	<.1	-	-	<.1	<.1	-	0.2	-	0.5	0.2	0.2	<.1	+	<.1	-	+	+
Mastocarpus papillatus	13.4	20.7					14.5	2.1	0.7	9.5	10.6	11	7.2	15.1	25.2	23.8	19.1	10.6	6	3.9	7	4.1	0.9	<.1
Mazzaella affinis	0.2	0.3					0.8	0.3	<.1	<.1	0.1	0.1	0.2	<.1	0.4	0.5	0.7	1.9	3.8	2.9	2	1.6	4.4	0.3
Mazzaella flaccida	1.4	1.4					3.1	0.4	-	0.3	0.2	+	+	+	-	-	-	-	-	-	-	-	-	-
Mazzaella heterocarpa	0.6	0.7					1.8	0.1	+	<.1	<.1	0.3	<.1	0.4	0.1	<.1	<.1	0.3	<.1	<.1	+	+	1.7	0.3
Mazzaella leptorhynchos	2.6	3.7					1.7	0.4	<.1	0.8	0.1	0.5	0.3	0.4	0.3	0.2	0.9	0.8	0.5	0.5	0.7	0.3	<.1	+
Mazzaella lilacina	<.1	-					<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella rosea	-	-					-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	0.4	-					+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Neorhodomela larix	-	-					<.1	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nienburgia andersoniana	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 1 at +0.9m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	5	6	6	6	5	5	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Non-coralline crust	21.1	20.7					24.6	7.6	9.1	14.7	22.6	28.5	33.6	38.5	36.9	41.3	32.2	20.1	20.4	25.7	34.1	28.8	27.7	34.8
Osmundea spp.	<.1	+					0.2	<.1	-	+	<.1	<.1	-	-	<.1	0.3	0.3	0.7	0.2	+	<.1	0.2	-	-
Pelvetia compressa	-	-					-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Phaeostrophion irregulare	-	-					-	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	0.7	0.4					2.9	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	2	3.8					9.6	1.3	0.4	6.6	1.9	<.1	<.1	-	+	<.1	-	0.1	0.2	<.1	<.1	-	-	-
Prionitis spp.	1	0.6					1.1	0.2	<.1	1	2.3	2.8	1.7	2.9	3.9	4.3	3.3	3.2	3.6	4.3	2.7	4.1	3	1.6
Pterosiphonia dendroidea	0.2	-					0.2	0.4	<.1	<.1	<.1	-	-	-	-	<.1	0.3	0.7	0.6	0.7	1.8	1.1	1.2	+
Rhodophyta (juv. blades)	-	-					-	+	<.1	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	-	-					-	-	-	-	-	-	-	-	-	-	<.1	0.2	+	0.1	0.2	-	-	-	-
Sargassum muticum	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.6
Smithora naiadum	-	-					0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	0.3	2.9					<.1	+	0.7	<.1	<.1	+	-	-	-	-	+	-	+	<.1	-	-	-	+
Ulva/Enteromorpha spp.	8.7	1.4					4.9	<.1	5.8	0.4	+	-	-	-	8.5	5.9	9.6	5.5	5.3	8.8	5.9	11	2.3	2.4
coralline crust	1	3.1					1.9	1.1	0.3	0.3	0.6	0.3	0.2	0.2	0.4	0.7	1.2	1.1	0.9	1.6	1	2.2	2.6	4.7
filamentous red algae-complex	<.1	0.1					0.4	0.1	-	+	-	-	-	-	-	-	2.4	7	3.8	3	3.5	0.8	1	1.2
juv. articulated coralline algae	-	1.5					0.3	0.2	+	<.1	<.1	0.1	+	+	<.1	<.1	<.1	+	+	<.1	+	+	0.3	0.9

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 2 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	-	-	+	+	-	-	-	+	-	-	-		-	-	-	-	+	+	-				-
Ahnfeltiopsis linearis	-	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Bryopsis spp.	-	0.8	<.1	<.1	<.1	+	+	+	+	+	+	-		-	-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	1.4	1.4	4.5	1.9	4.1	3.0	2.8	1.5	1.8	4.2	1.3	0.6		+	0.3	0.5	0.2	0.4	0.7	0.5				1.0
Callithamnion pikeanum	<.1	<.1	<.1	+	-	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Callithamnion spp./Pleonosporium spp.	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Callophyllis spp.	-	<.1	-	-	-	-	-	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	9.0	9.7	12.2	10.1	8.3	9.4	8.2	4.7	9.9	2.6	0.5	0.4		2.7	2.7	6.3	7.9	11.2	9.8	3.8				0.6
Chondracanthus corymbiferus	<.1	-	<.1	<.1	-	+	-	-	-	<.1	-	-		-	-	-	+	<.1	+	+				-
Chondria decipiens	-	-	<.1	<.1	+	+	+	+	<.1	<.1	+	<.1		0.1	0.2	0.1	0.3	0.1	<.1	<.1				0.2
Chrysophyta unid.	-	-	0.2	0.7	<.1	0.2	0.6	2.6	0.7	<.1	-	-		-	2.5	3.8	<.1	0.2	1.5	0.3				-
Cladophora spp.	+	<.1	<.1	+	<.1	<.1	<.1	+	+	<.1	<.1	<.1		+	+	+	+	+	+	+				+
Colpomenia spp.	-	-	+	+	+	+	<.1	+	<.1	+	-	-		-	-	-	+	<.1	+	+				<.1
Colpomenia/Leathesia/Soranthera spp.	-	<.1	<.1	+	+	-	+	+	-	-	-	-		-	-	-	-	-	-	-				-
Corallina officinalis	1.7	2.4	1.6	1.0	1.4	1.5	0.6	0.3	0.3	0.1	<.1	<.1		-	<.1	+	+	<.1	+	+				-
Corallina vancouveriensis	2.0	2.9	2.7	4.0	5.5	4.0	3.1	1.3	2.6	2.9	1.5	1.9		1.3	0.4	1.0	1.5	1.2	1.1	0.3				1.8
Cryptopleura ruprechtiana	-	<.1	-	-	+	-	<.1	-	+	+	-	-		-	-	-	+	<.1	-	-				-
Cryptopleura violacea	0.2	0.3	0.7	0.5	0.8	0.9	0.6	0.2	0.3	0.7	+	1.8		0.6	0.8	1.7	3.8	4.3	1.6	0.8				<.1
Cryptosiphonia woodii	<.1	0.2	0.2	<.1	0.2	0.1	<.1	<.1	<.1	+	<.1	-		-	0.1	0.2	<.1	0.2	-	-				-
Delesseriaceae (juv.)	-	-	-	-	+	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Egregia menziesii	1.6	0.6	+	<.1	-	-	0.4	0 7	<.1	-	-	-		-	-	-	-	-	-	-				-
Endocladia muricata	-	<.1	-	<.1	-	0.1	<.1	+	<.1	<.1	+	-		-	-	-	-	-	<.1	-				-
Farlowia/Pikea spp.-complex	-	-	<.1	-	<.1	+	-	-	-	<.1	<.1	-		-	-	-	-	-	+	-				-
Fucus gardneri	0.3	0.9	0.1	<.1	<.1	<.1	0.6	+	-	-	-	-		-	-	-	-	-	-	-				-
Gastroclonium subarticulatum	3.2	1.7	3.4	3.5	4.3	3.1	3.0	0.3	0.6	0.4	0.3	0.6		0.4	1.1	2.8	3.1	6.6	4.8	2.3				0.1
Gelidium coulteri	3.8	2.5	4.2	3.4	3.4	4.7	4.8	3.8	2.8	9.4	3.5	6.5		1.5	7.4	6.8	5.7	4.7	4.7	3.4				3.0
Gelidium pusillum	0.1	<.1	<.1	<.1	0.3	0.2	0.2	<.1	<.1	<.1	<.1	0.2		0.2	<.1	0.5	0.6	1.1	0.5	0.1				<.1
Grateloupia doryphora	-	<.1	0.1	-	<.1	0.2	0.1	0.3	<.1	<.1	<.1	<.1		-	-	0.2	<.1	-	+	0.5				0.7
Gymnogongrus chiton	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Halosaccion americanum	<.1	-	-	+	+	+	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex	-	<.1	0.3	0.2	<.1	0.3	0.3	0.5	0.2	0.1	0.1	+		-	<.1	+	<.1	<.1	+	+				-
Laminaria setchellii	-	-	<.1	-	-	-	-	-	<.1	+	-	-		-	-	-	-	-	-	-				-
Laminariales	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	+				-
Mastocarpus jardinii	2.5	1.6	1.8	2.7	2.7	2.9	2.9	0.1	1.1	0.6	<.1	0.2		-	0.4	2.4	2.2	0.5	0.2	+				+
Mastocarpus papillatus	7.5	11.4	14.0	10.4	10.8	11.8	9.9	4.1	8.7	6.0	4.8	7.3		5.3	16.5	22.0	18.6	20.7	21.5	7.5				3.6
Mazzaella affinis	6.0	5.1	4.8	6.9	4.5	4.5	5.9	4.1	4.2	3.5	1.3	0.8		0.1	1.4	1.7	1.1	1.8	2.4	1.8				0.5
Mazzaella flaccida	1.9	3.4	3.4	2.5	3.1	2.9	3.1	2.2	0.7	0.2	0.1	<.1		-	+	-	-	-	-	-				-
Mazzaella heterocarpa	0.8	0.9	0.9	1.3	0.7	2.0	1.0	0.3	0.2	0.2	0.2	0.2		-	0.1	0.2	<.1	0.3	<.1	<.1				-
Mazzaella leptorhynchos	0.5	0.4	0.8	0.3	0.1	0.3	0.3	0.8	0.4	0.2	0.1	0.2		+	0.1	0.1	0.4	0.1	0.6	0.3				<.1
Mazzaella lilacina	0.5	0.4	0.3	0.9	0.4	0.3	0.2	0.6	<.1	<.1	-	<.1		-	-	-	-	-	-	-				+
Mazzaella linearis	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	+	-	-				-
Mazzaella rosea	-	-	-	+	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Melobesia mediocris	-	-	+	+	+	+	+	+	-	-	-	-		-	-	-	-	-	-	-				-
Microcladia borealis	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 2 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage (continued)																								
Microcladia coulteri	0.1	0.4	0.3	<.1	<.1	0.1	0.1	0.2	0.1	+	+	+		-	-	+	-	-	-	+				-
Neorhodomela larix	7.5	5.7	5.7	9.4	6.5	7.3	6.1	2.5	1.7	1.9	0.6	0.4		<.1	<.1	<.1	<.1	-	-	-				-
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<.1	-	-	-				-
Non-coralline crust	23.8	23.0	25.7	20.5	29.5	27.6	22.3	27.7	34.5	31.5	35.6	44.5		62.9	37.1	35.8	32.1	31.0	31.9	42.3				46.4
Osmundea spp.	<.1	<.1	<.1	<.1	0.1	0.2	<.1	+	<.1	<.1	+	+		+	<.1	0.2	0.2	0.1	0.1	+				-
Pelvetia compressa	<.1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Phaeostrophion irregulare	<.1	-	+	<.1	<.1	+	<.1	<.1	<.1	<.1	-	-		-	-	-	-	-	-	-				-
Phyllospadix spp.	6.2	2.6	3.5	6.1	6.7	7.5	8.5	2.0	1.2	0.2	<.1	0.2		-	-	-	-	-	-	-				-
Polyneura latissima	-	<.1	-	<.1	+	0.1	<.1	-	+	+	-	-		-	-	-	-	-	-	-				-
Porphyra spp.	2.9	3.1	2.6	5.1	2.9	2.5	2.3	8.8	2.7	3.1	<.1	<.1		-	0.3	<.1	0.6	0.9	0.6	<.1				<.1
Prionitis australis	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Prionitis spp.	0.8	1.5	3.7	3.0	2.3	2.3	1.3	2.6	2.8	2.9	3.0	5.9		2.9	4.1	4.7	4.1	6.2	7.3	6.6				4.5
Pterosiphonia dendroidea	+	+	<.1	<.1	0.1	0.2	0.1	<.1	<.1	0.1	+	<.1		-	-	+	0.1	0.1	<.1	0.5				<.1
Rhodophyta (juv. blades)	<.1	-	0.1	-	-	<.1	-	<.1	0.2	-	+	-		-	-	-	-	-	-	-				-
Sarcodiotheca gaudichaudii	-	<.1	<.1	<.1	0.1	+	<.1	0.1	<.1	<.1	-	<.1		-	-	+	<.1	<.1	+	+				-
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				0.9
Smithora naiadum	0.4	-	+	0.2	0.2	0.8	0.5	<.1	+	+	-	-		-	-	-	-	-	-	-				-
Soranthera ulvoidea	-	-	+	+	+	+	-	-	+	+	-	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	3.0	1.2	0.2	0.9	0.2	<.1	<.1	3.2	0.8	<.1	+	<.1		-	+	+	-	+	<.1	-				+
Ulva/Enteromorpha spp.	7.0	9.1	9.3	7.1	1.5	2.4	5.2	3.2	4.9	4.7	+	+		-	11.2	2.6	15.2	6.3	9.0	5.1				2.3
coralline crust	3.8	5.6	3.8	3.3	5.6	5.2	6.0	10.8	7.6	9.5	7.8	6.3		3.3	2.3	2.9	3.3	3.8	5.9	10.7				6.8
filamentous red algae-complex	<.1	0.2	<.1	0.2	<.1	0.2	0.3	0.1	0.2	<.1	+	<.1		-	-	+	<.1	0.4	<.1	0.4				1.8
juv. articulated coralline algae	-	0.2	<.1	0.1	0.7	0.3	0.2	1.1	0.3	0.7	0.4	0.7		0.3	<.1	<.1	0.1	0.3	0.2	0.4				1.5

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 2 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Ahnfeltiopsis linearis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-				-
Analipus japonicus	<.1	+	+	+	+	<.1	0.3	-	-	+	-	-		-	-	-	-	-	-	-				-
Bryopsis spp.	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	<.1	+	<.1	+	<.1	0.3	0.2	<.1	<.1	<.1	+	+		-	-	-	-	+	+	-				+
Callithamnion spp./Pleonosporium spp.	-	-	-	+	-	-	-	-	-	+	+	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus	<.1	<.1	+	<.1	+	-	+	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Chondria decipiens	-	-	-	-	-	+	+	+	-	-	-	-		-	-	-	-	-	-	-				-
Chrysophyta unid.	-	-	-	<.1	<.1	<.1	<.1	-	+	+	-	-		-	-	-	-	-	-	-				-
Cladophora spp.	<.1	<.1	+	+	+	<.1	<.1	+	<.1	<.1	+	+		+	+	+	0.1	+	<.1	+				+
Colpomenia spp.	-	-	-	+	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-				-
Colpomenia/Leathesia/Soranthera spp.	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Corallina officinalis	-	0.2	<.1	-	<.1	-	+	+	-	-	-	-		-	-	+	-	-	-	-				-
Corallina vancouveriensis	2.6	1.3	0.9	2.2	0.8	1.4	2.7	0.3	0.4	0.5	0.2	0.3		0.2	<.1	<.1	<.1	<.1	<.1	+				+
Cryptopleura violacea	-	-	-	-	<.1	<.1	-	-	-	<.1	-	+		-	-	-	-	-	-	-				-
Cryptosiphonia woodii	<.1	+	<.1	<.1	<.1	<.1	<.1	-	+	+	+	-		-	-	+	-	0.1	-	-				-
Cumagloia andersonii	-	-	-	-	-	-	<.1	<.1	-	+	-	-		-	-	-	-	-	-	-				-
Endocladia muricata	2.7	1.7	3.2	3.7	3.4	3.6	4.0	0.4	0.9	1.4	0.3	0.6		0.7	0.5	0.6	0.7	0.3	0.5	0.2				<.1
Farlowia/Pikea spp.-complex	+	-	-	-	+	+	<.1	-	-	<.1	<.1	+		-	-	-	-	-	-	-				-
Fucus gardneri	0.2	<.1	0.1	0.2	<.1	0.1	0.2	-	-	-	-	-		-	-	-	-	-	-	-				-
Gastroclonium subarticulatum	-	<.1	+	<.1	-	-	<.1	-	-	-	-	-		-	+	+	-	-	-	-				-
Gelidium coulteri	0.1	<.1	0.2	0.2	0.1	0.2	0.5	0.2	0.3	0.3	0.1	0.2		+	<.1	0.4	0.4	0.1	0.1	+				<.1
Gelidium pusillum	<.1	+	+	+	+	<.1	<.1	<.1	<.1	<.1	+	<.1		-	+	+	<.1	+	+	<.1				<.1
Gracilariopsis lemaneiformis	-	<.1	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Grateloupia doryphora	-	-	<.1	-	<.1	-	-	-	-	-	<.1	-		-	-	<.1	<.1	-	+	-				<.1
Halosaccion americanum	+	-	-	+	+	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex	-	-	0.1	-	-	+	<.1	-	-	-	-	-		-	-	+	-	-	-	-				-
Mastocarpus jardinii	0.1	+	<.1	<.1	+	-	<.1	-	<.1	<.1	-	+		-	-	+	<.1	+	+	+				+
Mastocarpus papillatus	2.5	4.0	3.6	5.1	3.3	3.9	8.0	1.8	5.8	5.2	2.4	2.9		0.2	0.6	1.3	2.0	1.3	1.7	0.6				2.4
Mazzaella affinis	-	<.1	<.1	0.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	<.1		-	+	<.1	<.1	<.1	<.1	<.1				+
Mazzaella flaccida	<.1	<.1	<.1	0.3	0.1	<.1	0.1	<.1	<.1	+	-	-		-	-	-	-	-	-	-				-
Mazzaella heterocarpa	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1		-	-	+	<.1	<.1	+	<.1				-
Mazzaella leptorhynchos	<.1	<.1	0.2	0.3	<.1	0.2	0.3	0.2	<.1	<.1	<.1	<.1		+	<.1	+	<.1	0.2	<.1	<.1				0.1
Melobesia mediocris	-	-	+	-	<.1	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Microcladia coulteri	+	-	+	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Nemalion helminthoides	+	-	-	+	+	+	+	-	+	-	-	-		-	-	-	-	-	-	-				-
Neorhodomela larix	2.7	1.2	0.9	1.9	1.7	1.3	1.4	0.1	<.1	<.1	+	-		-	-	-	-	-	-	-				-
Non-coralline crust	16.8	11.1	11.8	13.8	13.3	14.4	13.8	7.4	18.6	13.3	9.0	13.1		19.0	13.4	13.5	14.8	16.2	14.9	14.8				11.5
Osmundea spp.	-	-	-	+	+	-	+	-	+	-	-	-		-	-	-	+	-	-	-				-
Pelvetia compressa	-	-	+	+	+	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Phaeostrophion irregulare	-	-	<.1	<.1	<.1	+	<.1	-	-	+	-	-		-	-	-	-	-	-	-				-
Phyllospadix spp.	1.2	0.3	0.2	0.9	0.5	1.3	1.1	+	-	-	-	-		-	-	-	-	-	-	-				-
Porphyra spp.	0.4	0.3	1.9	3.8	1.1	0.4	0.7	2.8	0.8	<.1	<.1	+		-	-	<.1	0.3	+	+	-				+
Prionitis spp.	0.7	0.5	0.6	0.9	0.3	1.0	1.1	0.6	0.8	1.3	0.6	1.2		0.2	0.4	1.4	1.3	1.7	0.7	0.7				0.7
Rhodophyta (juv. blades)	-	-	+	+	-	-	-	+	+	+	+	+		-	-	-	-	-	-	-				-
Sarcodiotheca gaudichaudii	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 2 at +0.9m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage (continued)																								
Scytosiphon spp.	-	-	-	+	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Smithora naiadum	-	-	-	+	<.1	+	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Soranthera ulvoidea	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	<.1	0.3	0.2	0.1	0.1	0.1	0.1	+	<.1	+	+	-		-	-	-	<.1	-	+	-				-
Ulva/Enteromorpha spp.	1.0	1.3	1.9	5.1	0.6	0.6	0.6	<.1	2.7	<.1	+	+		-	-	+	0.3	0.2	0.1	-				+
coralline crust	0.3	0.3	1.1	0.4	0.5	0.5	0.4	0.8	0.5	0.1	0.3	0.2		0.3	0.2	0.4	0.2	0.4	0.2	0.3				<.1
filamentous red algae-complex	<.1	+	+	<.1	+	+	<.1	<.1	<.1	+	-	-		-	-	-	-	-	-	-				-
juv. articulated coralline algae	-	<.1	<.1	+	<.1	<.1	<.1	+	<.1	+	<.1	<.1		+	<.1	<.1	<.1	<.1	+	+				+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 3 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analipus japonicus	<.1	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.1	0.1	0.2	<.1	0.3	0.3	0.3	<.1	+	+	-	-	-	<.1	+	-	<.1	+	<.1	+	-	-	+	-
Callithamnion pikeanum	<.1	+	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	5.7	6.3	5.1	6.8	3.9	5	4	0.2	0.4	0.2	<.1	+	+	+	<.1	0.1	1.2	3.1	3.9	1.7	0.7	1.7	0.6	<.1
Chondria decipiens	-	0.2	0.2	0.1	0.2	0.4	0.3	<.1	<.1	+	-	+	+	+	+	-	-	+	-	+	+	-	-	-
Chrysophyta unid.	-	<.1	0.5	<.1	-	<.1	<.1	<.1	<.1	<.1	-	-	-	-	0.1	-	-	-	-	-	+	-	-	0.1
Cladophora spp.	+	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<.1	+	+	+
Colpomenia spp.	-	<.1	0.1	<.1	+	0.2	<.1	+	<.1	+	-	-	-	-	-	-	-	+	+	+	+	-	+	-
Colpomenia/Leathesia/Soranthera spp.	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina officinalis	0.3	+	-	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Corallina vancouveriensis	<.1	0.3	0.2	0.4	0.7	0.4	0.5	0.2	<.1	<.1	<.1	<.1	+	<.1	+	<.1	<.1	+	<.1	<.1	-	<.1	<.1	<.1
Cryptopleura ruprechtiana	-	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura violacea	-	+	-	+	<.1	+	<.1	-	-	+	-	<.1	-	-	<.1	<.1	+	+	+	-	-	2	-	-
Cryptosiphonia woodii	0.2	1.4	2.5	1.7	1.2	1.3	1.2	+	+	<.1	-	-	-	+	+	-	+	+	<.1	-	+	-	-	-
Cumagloia andersonii	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cystoseira osmundacea	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	0.2	-	0.3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	-	+	<.1	-	<.1	<.1	0.1	0.1	<.1	<.1	<.1	0.3	0.2	0.1	<.1	<.1	<.1	<.1	<.1	0.1	<.1	+	0.1	0.1
Fucaceae unid.	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fucus gardneri	5.5	3.6	0.6	3.2	6.4	4.5	1.8	<.1	1.1	0.5	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	9.3	7.8	12.7	9.4	15	7.1	5.1	+	+	<.1	-	+	+	-	<.1	<.1	0.4	1.2	2.2	1.9	3.9	0.7	0.2	-
Gelidium coulteri	0.5	2.3	2.7	1.1	2	2.3	3	0.7	0.8	0.8	1.1	0.9	0.2	0.1	0.5	0.9	0.9	0.6	1	0.8	0.5	0.3	0.5	0.1
Gelidium pusillum	0.3	0.4	0.3	0.5	0.6	0.6	0.6	0.1	0.2	0.1	<.1	<.1	+	+	0.1	0.2	0.6	1.4	0.8	0.8	0.7	1	<.1	+
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Halosaccion americanum	<.1	+	+	+	+	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	+	<.1	-	-	-	-	-	-	-	-	-	-	-
Mastocarpus jardinii	<.1	0.2	0.2	0.2	<.1	0.3	<.1	+	+	<.1	+	-	-	+	+	+	-	<.1	<.1	+	-	<.1	-	<.1
Mastocarpus papillatus	14.3	13.1	15.3	20.2	14.8	18.6	14.8	4.6	17.7	29.9	19.2	21.1	15.9	28.7	28.1	43.7	41.6	38.4	44.1	38.1	37.6	41.5	23.4	7.9
Mazzaella affinis	3.1	3.9	3.8	3.9	2.9	4	5.3	0.4	1.1	0.9	0.4	0.2	0.2	+	0.1	0.5	0.6	1.8	1.7	0.7	0.3	1.4	0.7	0.1
Mazzaella flaccida	27.4	24.4	22.6	26.5	20	20.1	21.6	0.2	0.4	0.1	0.2	0.4	<.1	-	-	<.1	0.4	0.1	0.2	-	-	0.2	-	-
Mazzaella heterocarpa	1.9	1.7	2.4	1.1	1.6	1.6	1.6	<.1	<.1	0.2	0.1	0.4	<.1	0.3	0.2	0.5	<.1	<.1	0.2	0.2	+	0.1	<.1	+
Mazzaella leptorhynchos	0.1	0.4	0.7	0.4	0.6	0.5	0.5	<.1	0.6	0.1	0.1	0.1	0.1	<.1	<.1	<.1	0.2	0.2	0.5	0.4	0.2	0.3	0.5	<.1
Mazzaella lilacina	-	<.1	-	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella rosea	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia borealis	+	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	<.1	+	<.1	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neorhodomela larix	0.7	0.5	1.4	1.4	1.5	1.6	1.3	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	17.6	19.8	20.2	18.9	26.9	25.9	24.5	9.7	17.6	14.6	17.4	18.2	19	22.5	25.8	27.5	24.9	20.9	22.6	24.3	25.2	28.9	33.4	37
Osmundea spp.	-	+	<.1	<.1	<.1	<.1	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pelvetia compressa	-	0.5	<.1	-	-	+	-	<.1	<.1	<.1	-	-	-	-	-	-	-	+	+	<.1	-	-	-	-
Phyllospadix spp.	<.1	<.1	<.1	<.1	0.2	0.2	<.1	-	-	<.1	-	-	-	-	-	-	-	-	+	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 3 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Porphyra spp.	0.3	0.3	0.3	0.9	<.1	0.3	<.1	2.3	1.5	<.1	<.1	-	-	-	-	+	0.2	<.1	0.9	+	-	-	-	-
Prionitis spp.	0.4	0.2	0.1	0.1	<.1	<.1	<.1	-	<.1	-	-	-	+	-	-	-	+	+	<.1	+	-	0.1	-	+
Pterosiphonia dendroidea	-	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	<.1	0.1	-	-	-
Rhodophyta (juv. blades)	-	-	<.1	-	-	-	-	0.2	<.1	+	<.1	+	-	-	+	-	-	+	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	-	<.1	-	-	<.1	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scytosiphon spp.	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	-	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soranthera ulvoidea	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	+	<.1	<.1	0.1	<.1	<.1	0.1	<.1	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	5.8	4.1	4.4	7.1	0.7	1.2	1.1	<.1	1.8	0.3	+	-	-	-	+	+	8.4	3.7	<.1	0.9	0.5	1.1	-	+
coralline crust	6	5.4	5.6	3.7	5	3.4	5.4	1.1	1.1	1.3	0.6	0.6	0.4	0.3	0.3	0.3	0.3	0.7	0.7	0.7	0.7	0.9	1	0.4
filamentous red algae-complex	-	0.4	+	0.3	0.2	0.4	0.4	-	-	-	-	-	-	-	-	-	0.1	0.2	<.1	-	-	-	-	-
juv. articulated coralline algae	-	<.1	0.3	0.2	0.2	<.1	<.1	<.1	+	+	<.1	<.1	<.1	<.1	+	+	<.1	+	+	+	0.1	+	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 - South Diablo Cove Station SDC 3 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	-	+	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.1	<.1	0.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	-	+	-	-	-	-	-	-	-	-	-	-
Callithamnion pikeanum	<.1	+	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	0.6	0.3	0.4	0.6	0.3	0.3	0.2	+	<.1	<.1	+	+	-	+	-	-	+	<.1	-	-	-	-	+	-
Chondria decipiens	-	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	<.1	+	-	<.1	+	+	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Cladophora spp.	<.1	0.5	<.1	<.1	<.1	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Colpomenia spp.	-	-	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina officinalis	<.1	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina vancouveriensis	0.2	2.6	2.1	2.4	2.4	2.3	2.6	0.1	0.4	0.4	0.2	0.1	0.1	0.1	<.1	<.1	<.1	+	+	-	+	+	+	<.1
Cryptopleura violacea	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Cryptosiphonia woodii	<.1	<.1	<.1	0.2	0.2	0.1	0.1	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	5.6	8.8	9.8	9.8	10.3	10.6	9.3	3.1	3.2	3.3	3.3	2.6	2.6	1.4	0.9	0.7	1.0	1.0	1.5	1.3	1.4	1.0	0.2	+
Fucaceae unid.	-	-	<.1	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fucus gardneri	2.7	0.9	1.4	4.0	4.2	4.5	3.4	1.1	0.5	0.1	0.2	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	-	-	<.1	<.1	<.1	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
Gelidium coulteri	1.5	1.0	1.8	1.8	1.6	2.6	2.4	0.6	1.2	1.1	0.5	0.1	0.1	+	<.1	0.1	0.4	0.9	<.1	<.1	+	0.7	<.1	<.1
Gelidium pusillum	0.6	0.8	0.8	1.1	0.5	0.7	1.2	0.2	0.6	0.3	0.1	<.1	+	+	<.1	0.1	0.6	1.1	0.3	<.1	0.1	0.2	0.2	+
Halosaccion americanum	0.2	-	+	+	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hesperophycus californicus	0.2	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mastocarpus jardinii	-	+	<.1	<.1	<.1	0.2	<.1	<.1	<.1	<.1	+	+	-	-	-	-	-	<.1	-	-	-	-	-	-
Mastocarpus papillatus	15.2	16.1	16.7	21.9	19.6	20.3	23.1	2.6	6.7	10.0	8.6	9.3	3.8	3.9	2.0	1.8	8.8	17.9	11.3	7.3	8.2	16.8	3.1	5.1
Mazzaella affinis	0.3	0.6	0.7	1.2	0.8	0.5	0.9	0.2	0.1	0.2	<.1	+	+	+	-	<.1	+	<.1	+	+	-	<.1	+	-
Mazzaella flaccida	6.9	4.9	4.5	5.7	4.1	4.6	5.0	<.1	+	<.1	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-
Mazzaella heterocarpa	0.2	0.4	0.4	0.2	0.3	0.4	0.4	<.1	<.1	<.1	<.1	+	+	<.1	+	+	+	+	<.1	+	-	-	-	-
Mazzaella leptorhynchos	<.1	<.1	0.2	0.2	0.2	0.2	0.1	<.1	<.1	<.1	<.1	+	+	+	+	<.1	+	+	+	+	-	<.1	<.1	+
Mazzaella lilacina	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemalion helminthoides	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Neorhodomela larix	0.1	<.1	<.1	0.2	0.2	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	20.4	20.3	19.5	21.6	26.1	26.1	26.1	10.6	11.9	13.2	11.3	13.7	14.5	13.3	10.9	9.4	15.5	16.9	16.3	22.9	22.8	22.9	21.6	21.7
Pelvetia compressa	0.5	<.1	0.1	0.5	0.6	1.1	2.8	2.5	2.7	3.2	2.4	2.2	1.7	1.6	1.3	0.5	-	-	-	-	-	-	-	-
Phyllospadix spp.	0.6	0.5	1.7	1.0	1.0	0.9	1.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polyneura latissima	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Porphyra spp.	0.2	0.4	0.2	0.6	0.2	0.3	0.1	0.3	0.2	<.1	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-
Prionitis spp.	0.1	<.1	0.2	0.4	0.2	<.1	<.1	+	<.1	-	<.1	<.1	+	+	+	<.1	+	<.1	<.1	<.1	+	<.1	-	<.1
Rhodophyta (juv. blades)	-	-	-	-	-	+	-	<.1	<.1	+	<.1	+	-	-	+	-	-	-	-	-	-	-	-	-
Scytosiphon spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	-	-	<.1	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	<.1	+	0.3	0.2	<.1	0.2	<.1	<.1	<.1	+	+	+	-	-	+	-	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	0.9	0.4	0.6	2.4	<.1	0.2	<.1	+	<.1	0.2	+	-	-	-	-	-	+	+	+	+	+	-	-	-
coralline crust	2.4	2.8	2.3	2.3	2.8	2.1	2.2	1.0	0.9	0.3	0.4	0.6	0.3	0.2	0.2	<.1	<.1	<.1	<.1	0.1	<.1	+	0.2	+
filamentous red algae-complex	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
juv. articulated coralline algae	-	-	<.1	<.1	+	+	+	<.1	+	+	+	+	-	+	+	<.1	+	+	+	+	-	+	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Point Station SDP 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	4	4	5	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	3
% Coverage																								
Alaria marginata							+	-	-	-	-	-		-	-	-	-	-	-	-				-
Analipus japonicus							<.1	<.1	0.2	+	+	+		-	+	-	-	-	-	-				-
Bryopsis spp.							-	+	-	-	-	-		-	-	-	-	-	-	-				+
Calliarthron/Bossiella spp.-complex							4.6	4.3	5.1	5.3	3.4	5.8		4.6	2.2	3.5	2.7	6.1	4.2	2.4				1.5
Callithamnion pikeanum							<.1	0.4	<.1	<.1	+	+		-	<.1	+	+	-	+	-				-
Callithamnion spp./Pleonosporium spp.							0.2	0.8	1.2	0.5	0.4	0.3		+	0.4	0.4	<.1	0.6	0.3	<.1				+
Callophyllis spp.							-	+	-	-	-	-		-	-	-	-	-	-	-				-
Chondracanthus canaliculatus							+	0.1	<.1	0.1	0.2	<.1		<.1	-	+	-	+	+	+				-
Chondracanthus corymbiferus							-	-	<.1	+	-	+		-	+	+	<.1	+	+	-				-
Chondria decipiens							-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Chrysophyta unid.							0.3	2.5	2.4	1.3	0.3	0.7		-	0.1	0.2	0.3	+	+	-				-
Cladophora spp.							+	<.1	<.1	0.2	0.1	<.1		<.1	0.1	0.2	<.1	<.1	<.1	+				+
Codium fragile							0.6	0.5	2.7	1.6	0.3	0.1		<.1	+	<.1	<.1	<.1	+	+				-
Codium setchellii (prostrate)							-	-	+	-	-	-		-	-	-	-	-	+	-				-
Colpomenia spp.							+	+	<.1	<.1	+	<.1		-	<.1	+	-	+	+	-				-
Corallina officinalis							0.1	0.3	0.8	0.1	0.2	<.1		+	0.3	<.1	+	-	-	-				-
Corallina vancouveriensis							34.4	36.5	33.3	29.6	24.3	23.0		20.1	19.6	19.3	22.6	16.9	12.1	8.0				6.5
Cryptopleura violacea							+	+	<.1	<.1	<.1	0.1		<.1	<.1	0.2	0.3	1.1	0.9	0.5				<.1
Cryptosiphonia woodii							<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Cumagloia andersonii							-	-	+	-	-	-		-	-	-	-	-	-	-				-
Cystoseira osmundacea							-	+	+	+	-	-		-	-	-	-	-	-	-				-
Desmarestia spp.							-	-	-	-	-	+		-	-	-	-	-	-	-				-
Egregia menziesii							1.5	1.2	2.1	0.7	<.1	0.7		1.0	0.7	1.1	0.7	2.7	3.9	1.1				-
Endocladia muricata							9.8	9.0	3.9	4.1	5.3	5.0		6.0	9.3	10.3	10.9	6.8	2.9	2.3				0.2
Farlowia/Pikea spp.-complex							-	-	-	-	-	+		-	-	-	-	-	-	-				-
Gastroclonium subarticulatum							-	+	-	-	-	<.1		-	<.1	+	<.1	<.1	<.1	-				-
Gelidium coulteri							4.4	3.1	2.9	4.8	5.0	6.3		8.0	10.0	11.9	10.8	12.5	14.3	3.8				5.0
Gelidium pusillum							+	0.2	<.1	<.1	<.1	<.1		-	0.1	<.1	0.3	0.2	0.1	-				+
Gelidium robustum							+	-	-	-	-	-		-	-	-	-	-	-	-				-
Halosaccion americanum							1.8	0.3	0.1	0.5	0.1	+		-	+	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex							-	-	-	-	-	-		-	-	-	-	<.1	-	-				-
Hymenena spp.							-	-	-	-	+	-		-	-	-	-	-	-	-				-
Laminaria setchellii							+	<.1	+	-	-	-		-	-	-	-	-	-	-				-
Laminariales							-	-	+	+	-	-		-	-	-	-	-	-	-				-
Mastocarpus jardinii							4.4	3.0	4.1	2.0	1.9	1.6		2.4	3.5	4.7	4.0	2.8	1.3	1.1				0.1
Mastocarpus papillatus							0.6	0.9	0.3	0.2	0.1	0.1		0.3	0.2	0.5	0.2	0.1	0.1	+				0.1
Mazzaella affinis							-	<.1	<.1	-	-	<.1		-	-	-	-	-	-	-				-
Mazzaella flaccida							16.4	14.5	7.5	10.3	7.5	8.1		5.3	12.7	13.5	8.1	4.1	3.9	0.8				<.1
Mazzaella heterocarpa							<.1	+	<.1	0.1	<.1	+		-	0.3	<.1	<.1	+	<.1	-				+
Mazzaella leptorhynchos							+	-	-	+	+	-		-	-	-	-	+	<.1	-				-
Mazzaella lilacina							-	<.1	-	<.1	-	<.1		-	-	-	-	<.1	-	-				-
Mazzaella linearis							-	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Mazzaella rosea							-	-	<.1	+	-	-		-	-	-	-	-	-	-				-
Microcladia borealis							3.9	4.9	0.3	1.7	0.8	0.6		<.1	<.1	0.2	<.1	+	-	-				-
Microcladia coulteri							-	-	+	-	<.1	<.1		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Point Station SDP 1 at +0.9m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	4	4	5	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	3
% Coverage (continued)																								
Non-coralline crust							9.3	10.6	9.9	9.0	16.3	20.2		15.6	16.6	18.8	25.0	19.9	22.3	23.9				34.6
Osmundea spp.							-	-	+	-	+	-		-	-	-	-	-	+	-				-
Pelvetia compressa							-	-	-	-	0.1	-		-	-	-	-	-	-	-				-
Phaeophyta (juv.)							-	-	-	-	-	+		-	-	-	-	-	-	-				-
Phaeostrophion irregulare							-	-	0.1	<.1	-	+		-	-	-	+	-	-	-				-
Phyllospadix spp.							+	+	-	-	-	-		-	-	-	-	-	-	-				-
Plocamium cartilagineum							-	-	-	-	-	-		-	-	-	+	-	-	-				-
Plocamium violaceum							<.1	<.1	0.1	<.1	<.1	<.1		+	+	+	<.1	+	<.1	-				-
Porphyra spp.							0.5	0.3	<.1	0.2	<.1	<.1		+	0.1	0.5	0.1	0.3	2.5	+				-
Prionitis spp.							0.2	0.1	0.1	0.1	<.1	0.2		<.1	<.1	<.1	<.1	<.1	<.1	<.1				<.1
Rhodophyta (juv. blades)							-	-	-	+	-	+		-	-	-	-	-	-	-				-
Sarcodiotheca gaudichaudii							-	+	-	+	-	-		-	-	-	-	-	-	-				-
Scytosiphon spp.							-	+	<.1	<.1	+	+		-	-	+	-	-	+	-				-
Soranthera ulvoidea							-	-	-	+	-	-		-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex							<.1	<.1	<.1	+	+	+		-	+	-	-	+	+	-				-
Ulva/Enteromorpha spp.							1.4	2.9	6.8	4.1	1.6	0.2		-	0.1	+	<.1	<.1	0.2	<.1				+
coralline crust							20.7	23.2	28.9	25.1	27.6	21.7		22.2	17.5	13.0	14.8	18.2	20.1	23.9				13.3
filamentous red algae-complex							0.8	0.6	0.8	1.2	0.4	1.0		-	<.1	0.1	+	0.2	+	-				-
juv. articulated coralline algae							0.6	0.2	0.2	0.3	0.8	1.4		1.5	1.2	0.9	2.9	2.6	2.5	4.0				4.4

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Point Station SDP 2 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
% Coverage																								
Ahnfeltiopsis leptophylla	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Ahnfeltiopsis linearis	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Alaria marginata	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	+	-	-	-	-	-	-				-
Analipus japonicus	+	+	+	<.1	<.1	<.1	<.1	+	<.1	+	<.1	-	-	-	-	-	-	-	-	-				-
Bryopsis spp.	-	-	+	+	+	+	+	<.1	-	<.1	+	+	-	+	+	+	+	+	+	+				+
Calliarthron/Bossiella spp.-complex	3.6	4.1	5.1	5.6	5.3	5.4	4.4	6.7	7.9	7.1	4.9	6.9	4.4	6.4	3.9	7.2	9.0	13.8	11.0	10.1				10.9
Callithamnion pikeanum	0.2	0.3	0.1	<.1	<.1	<.1	<.1	<.1	<.1	+	+	+	<.1	+	<.1	<.1	+	-	-	+				-
Callithamnion spp./Pleonosporium spp.	-	<.1	1.3	0.4	0.3	0.1	0.7	0.3	0.6	0.8	<.1	0.5	0.2	0.2	0.9	0.4	0.4	0.1	0.8	0.2				<.1
Callophyllis firma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-				-
Callophyllis spp.	<.1	-	<.1	<.1	<.1	<.1	0.2	<.1	<.1	+	<.1	<.1	<.1	+	-	+	<.1	+	+	-				-
Chondracanthus canaliculatus	0.7	1.6	1.3	2.8	2.9	2.8	3.4	2.5	4.1	5.3	6.1	3.7	4.1	5.5	4.7	4.5	3.3	3.8	2.5	2.7				0.6
Chondracanthus corymbiferus	3.2	3.1	3.9	4.2	4.3	5.0	4.6	5.8	6.8	3.9	5.1	6.3	5.2	4.3	3.5	4.3	3.3	3.5	1.5	1.3				+
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-				-
Chrysophyta unid.	-	+	0.8	0.7	0.1	1.0	1.0	2.0	3.6	0.6	0.1	0.1	0.2	<.1	+	-	+	<.1	0.4	0.4				0.2
Cladophora spp.	+	+	<.1	+	-	+	+	+	<.1	+	-	-	-	-	-	-	-	-	-	-				-
Codium fragile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1				+
Colpomenia spp.	-	-	+	+	+	+	-	+	+	+	-	-	+	-	-	-	-	-	+	-				+
Corallina officinalis	3.3	1.3	0.3	0.8	1.4	1.5	0.9	1.2	0.5	0.6	0.5	0.6	0.3	0.5	0.4	0.3	0.2	<.1	<.1	0.3				-
Corallina vancouveriensis	24.7	22.9	26.2	25.9	33.0	27.7	26.1	34.5	28.7	32.5	26.6	29.9	27.5	27.5	31.0	28.4	30.8	20.4	21.4	12.2				19.6
Cryptopleura ruprechtiana	-	-	+	<.1	<.1	0.1	0.1	0.2	-	+	<.1	0.2	<.1	-	<.1	<.1	0.2	+	+	-				-
Cryptopleura violacea	5.0	11.0	16.6	17.7	19.9	17.5	13.9	18.9	19.8	18.4	14.3	21.8	13.5	14.7	11.8	10.8	9.1	9.3	4.9	4.0				0.8
Cryptosiphonia woodii	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Cystoseira osmundacea	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+	-	-				+
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+				+
Desmarestia spp.	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	+	-	-				-
Egregia menziesii	25.6	9.8	3.8	4.3	1.4	3.0	1.9	2.6	5.9	3.0	1.2	2.5	1.6	0.1	0.1	<.1	<.1	0.9	0.8	0.7				0.3
Endocladia muricata	-	+	-	-	+	<.1	<.1	-	-	-	-	+	-	+	+	+	+	+	-	-				-
Erythrophyllum delesserioides	0.1	+	<.1	0.1	0.2	0.2	0.2	0.3	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	+	<.1	<.1	-				-
Farlowia/Pikea spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	<.1	+	-				-
Gastroclonium subarticulatum	2.0	2.4	3.0	3.9	4.2	4.1	5.0	4.9	5.2	5.1	5.5	5.9	7.4	6.2	6.0	6.3	6.7	7.3	3.4	2.6				0.3
Gelidium coulteri	2.7	2.6	2.8	5.1	5.1	6.5	5.6	4.4	4.9	9.7	10.2	7.8	11.5	10.1	11.6	6.3	5.1	4.6	2.8	1.4				1.1
Gelidium pusillum	-	-	-	+	+	<.1	-	-	-	<.1	-	-	-	-	+	-	+	-	-	-				-
Gelidium robustum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	-	-	-				-
Halicystis ovalis	-	-	-	+	+	+	-	-	+	+	+	-	-	-	-	-	-	+	-	-				-
Halosaccion americanum	-	-	+	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Halymenia/Schizymenia spp.-complex	+	-	+	-	-	<.1	+	+	0.1	-	-	-	<.1	<.1	<.1	-	<.1	+	+	-				-
Haplogloia andersonii	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Hymenena spp.	-	-	-	0.1	0.3	0.5	1.4	1.1	0.3	0.8	0.6	<.1	0.6	0.2	<.1	<.1	<.1	+	<.1	-				-
Laminaria setchellii	<.1	<.1	0.1	<.1	<.1	0.1	+	<.1	<.1	+	-	-	-	-	-	-	-	<.1	<.1	+				-
Laminariales	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-				+
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				+
Mastocarpus jardinii	0.2	0.1	<.1	+	+	+	-	<.1	<.1	<.1	<.1	<.1	0.1	0.1	0.1	0.2	<.1	<.1	+	+				-
Mastocarpus papillatus	<.1	<.1	<.1	<.1	<.1	+	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	+	+	+	<.1	+	-				-
Mazzaella affinis	0.2	-	-	-	<.1	-	-	-	+	-	-	+	<.1	-	<.1	-	-	-	+	-				+
Mazzaella flaccida	14.9	22.3	29.3	34.3	37.9	32.5	44.1	28.8	16.8	30.0	40.8	29.4	31.0	35.9	34.1	31.1	24.0	16.2	11.0	8.4				1.5

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Diablo Point Station SDP 2 at +0.9m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
% Coverage (continued)																								
Mazzaella heterocarpa	0.2	+	0.1	<.1	0.2	<.1	<.1	+	0.1	<.1	+	<.1	<.1	<.1	<.1	+	+	-	-	+				<.1
Mazzaella leptorhynchos	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-				-
Mazzaella lilacina	0.5	0.7	0.8	1.4	1.3	1.3	0.2	0.9	1.3	0.7	0.2	0.6	0.3	0.2	0.2	<.1	0.5	0.9	<.1	<.1				+
Mazzaella linearis	-	-	-	0.9	0.2	0.4	0.1	-	1.2	<.1	-	-	-	-	-	-	-	<.1	<.1	+				-
Mazzaella rosea	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-				-
Microcladia borealis	6.6	9.0	7.3	6.4	4.1	4.3	6.6	5.1	0.8	1.0	0.6	0.2	0.2	0.3	0.1	<.1	<.1	+	+	+				-
Microcladia coulteri	1.3	0.2	0.8	0.4	0.2	0.2	0.1	<.1	0.4	+	<.1	0.2	0.4	<.1	<.1	<.1	0.5	0.7	0.7	0.1				+
Neoptilota hypnoides	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-				-
Non-coralline crust	<.1	0.9	0.3	0.1	0.5	0.5	0.7	0.4	0.3	0.6	0.2	0.4	0.5	0.6	0.8	0.7	0.1	0.9	1.5	1.3				1.3
Opuntiella californica	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-				-
Osmundea spp.	1.1	1.5	1.4	1.2	1.7	1.4	0.5	1.1	2.5	0.8	0.3	1.5	0.6	1.4	0.7	0.6	0.4	0.7	<.1	+				+
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Phaeostrophion irregulare	-	-	-	-	-	+	-	-	+	<.1	-	-	+	-	-	-	-	-	-	-				-
Phyllospadix spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Plocamium cartilagineum	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-				-
Plocamium violaceum	<.1	0.2	<.1	0.2	<.1	<.1	<.1	<.1	+	+	+	<.1	+	-	+	-	+	-	-	-				-
Polyneura latissima	-	-	-	-	-	-	-	-	+	-	-	+	-	-	+	-	-	-	-	-				-
Porphyra spp.	-	+	<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	+	+	<.1	-	+	-	+	+	<.1	+				-
Prionitis spp.	1.9	3.8	4.7	4.7	4.4	4.6	2.2	3.9	5.8	4.3	5.0	8.9	9.5	5.5	6.7	5.4	9.7	9.8	11.9	8.5				2.9
Pterosiphonia dendroidea	-	-	-	-	-	-	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-				-
Rhodophyta (juv. blades)	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Rhodymenia spp.	-	-	-	-	+	-	-	+	-	-	-	-	-	-	+	-	-	<.1	+	+				-
Sarcodiotheca gaudichaudii	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	+	+	-	-				-
Scytosiphon spp.	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	<.1	-	+	-	-	-	-	+	<.1	-	-	-	-	-	-	-	-	+	-	-				-
Ulva/Enteromorpha spp.	+	+	<.1	<.1	<.1	+	+	+	0.8	0.4	+	+	+	+	-	<.1	+	+	+	+				+
coralline crust	8.3	12.9	10.7	9.9	9.9	11.6	12.6	14.0	16.0	14.0	14.1	14.8	12.2	11.9	11.1	15.3	16.2	20.3	22.0	30.4				24.3
filamentous red algae-complex	0.8	2.4	0.8	1.2	1.0	0.9	1.1	0.2	0.4	1.0	1.2	0.4	0.6	0.7	0.4	0.2	0.3	0.2	0.3	<.1				-
juv. articulated coralline algae	-	1.4	0.2	0.3	0.8	0.2	0.4	0.1	0.2	<.1	0.5	0.7	<.1	0.6	0.3	1.1	1.2	1.6	2.1	2.7				2.2

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Control Station SC 1 at +0.3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	4	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Ahnfeltiopsis leptophylla	-	+	<.1	<.1	+	<.1	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ahnfeltiopsis linearis	-	-	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Analipus japonicus	-	-	+	+	-	+	+	+	-	<.1	0.3	0.4	<.1	+	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	0.5	0.1	0.5	0.9	0.6	0.9	1.4	0.9	0.6	0.5	1.1	1.0	0.7	0.4	0.4	1.4	1.7	2.4	3.1	1.9	2.1	2.3	2.5	0.4
Callithamnion pikeanum	0.3	<.1	<.1	0.1	<.1	<.1	<.1	+	<.1	<.1	<.1	0.2	<.1	<.1	+	+	+	<.1	0.1	<.1	+	+	<.1	<.1
Callithamnion spp./Pleonosporium spp.	-	0.2	0.4	0.2	0.2	0.1	0.1	<.1	<.1	<.1	+	+	-	-	-	+	+	<.1	+	<.1	<.1	0.1	+	<.1
Callophyllis firma	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Callophyllis spp.	-	<.1	-	+	<.1	+	<.1	<.1	+	<.1	-	+	-	-	+	<.1	<.1	<.1	<.1	<.1	<.1	+	-	<.1	+
Chondracanthus canaliculatus	21.3	20.2	19.1	24.0	19.7	27.3	33.0	22.0	29.9	16.4	9.8	13.1	14.9	17.2	19.6	20.7	21.8	25.3	30.2	32.2	28.5	26.0	24.6	36.0
Chondracanthus corymbiferus	<.1	0.4	0.3	0.4	0.8	0.4	0.7	0.3	0.4	<.1	<.1	<.1	<.1	<.1	0.1	0.2	0.7	0.9	1.0	0.9	0.6	0.2	1.0	0.8
Chondracanthus harveyanus/spinosus	<.1	<.1	-	0.1	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	<.1	+	+	<.1	+	<.1	<.1	0.1	<.1	-	+	+	<.1	+	-	-	<.1	+	-	-	-	-
Cladophora spp.	+	+	<.1	+	<.1	+	+	+	+	<.1	+	+	+	+	+	+	+	-	+	+	+	<.1	+	+
Colpomenia spp.	-	-	-	-	-	-	-	-	+	+	<.1	-	-	+	-	-	+	-	+	-	-	+	-	-
Corallina officinalis	1.3	1.0	1.8	1.3	1.3	0.4	0.8	0.6	0.1	<.1	<.1	<.1	0.1	<.1	0.1	<.1	0.2	0.1	0.4	0.2	<.1	-	0.1	<.1
Corallina vancouveriensis	2.4	2.6	3.4	3.5	3.7	2.6	2.5	3.0	2.0	2.6	1.5	1.7	1.4	0.6	2.6	2.2	1.2	1.1	1.4	1.8	1.3	2.5	2.2	1.2
Cryptopleura ruprechtiana	-	-	<.1	-	-	-	-	-	+	-	-	<.1	-	-	-	-	<.1	<.1	+	+	-	-	<.1	<.1
Cryptopleura violacea	0.2	0.5	0.9	0.9	1.7	1.8	2.5	1.5	0.9	0.4	0.4	0.8	0.7	0.5	1.3	1.0	1.8	1.3	1.4	2.0	1.8	0.5	2.5	0.9
Cryptosiphonia woodii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	-	-	-	-	-
Cystoseira osmundacea	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Egregia menziesii	0.8	<.1	-	0.6	-	-	+	-	<.1	0.7	<.1	<.1	-	-	<.1	-	0.4	0.5	0.3	4.7	0.5	4.4	1.5	0.3
Endocladia muricata	<.1	<.1	<.1	<.1	-	-	-	+	-	<.1	<.1	0.1	0.2	0.2	0.4	0.4	0.3	0.5	0.4	0.5	0.3	0.6	0.7	0.8
Erythrophyllum delesserioides	<.1	+	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	+	<.1	+	-	-	-	-
Fucus gardneri	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastroclonium subarticulatum	6.8	6.4	8.4	5.9	14.9	8.5	6.0	18.0	16.6	8.6	7.3	7.3	6.3	4.1	6.0	4.6	12.7	10.2	9.8	8.5	9.3	11.5	19.9	11.6
Gelidium coulteri	<.1	0.6	<.1	0.3	<.1	<.1	0.2	0.5	0.5	0.4	0.6	0.5	0.4	0.4	1.0	0.5	0.2	0.4	0.1	<.1	<.1	0.2	+	0.3
Gelidium pusillum	0.2	0.6	0.2	0.2	0.6	0.5	0.6	0.7	0.7	0.5	0.3	0.3	0.4	0.4	0.5	0.3	0.3	0.5	0.5	0.2	+	0.3	0.6	0.3
Gelidium robustum	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Gracilariopsis lemaneiformis	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Grateloupia doryphora	-	<.1	+	-	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	<.1	+	-	-	-	-	<.1
Halosaccion americanum	+	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	0.2	<.1	0.1	<.1	<.1	0.1	<.1	<.1	0.1	0.2	<.1	0.1	<.1	-	<.1	<.1	<.1	<.1	+	+	-	+	0.1	-
Hymenena spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-	-	-	-	+	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	+
Laminariales	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	<.1
Mastocarpus jardinii	0.3	0.7	0.8	0.7	1.4	0.9	0.7	1.1	1.5	1.2	0.9	1.6	2.1	2.5	1.2	1.3	1.5	1.7	1.7	1.8	1.4	1.9	1.7	2.5
Mastocarpus papillatus	1.6	2.0	2.7	2.5	2.5	3.3	2.0	2.3	7.2	4.7	7.1	12.8	11.1	5.3	4.0	3.5	2.7	2.6	2.3	1.9	2.2	3.0	2.1	2.6
Mazzaella affinis	0.1	<.1	0.1	0.2	0.3	0.1	<.1	0.3	0.4	0.7	0.7	0.5	0.4	0.3	<.1	0.2	0.3	0.3	0.5	0.2	0.3	0.3	0.6	0.7
Mazzaella californicum	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella flaccida	55.1	43.4	41.1	47.2	47.4	48.2	51.6	37.1	25.4	24.5	38.0	47.9	47.8	52.4	55.9	56.1	47.6	40.5	40.4	42.2	36.1	37.3	33.8	31.5
Mazzaella heterocarpa	0.3	0.3	0.6	0.6	1.2	1.1	0.7	0.4	1.0	1.1	2.7	2.2	1.4	1.8	1.8	1.9	1.8	1.8	2.5	1.0	1.0	0.9	1.7	1.4
Mazzaella leptorhynchos	-	-	-	<.1	+	-	+	-	<.1	<.1	0.1	0.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	+

(continued)

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Control Station SC 1 at +0.3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	4	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Mazzaella lilacina	<.1	0.4	0.3	0.5	1.2	0.4	0.5	0.1	0.4	0.9	0.9	0.8	0.3	0.1	0.1	0.3	0.8	0.4	0.2	1.5	1.2	-	1.0	1.0
Mazzaella rosea	-	<.1	-	-	-	-	+	-	+	-	-	<.1	-	-	-	-	+	-	-	-	-	-	-	-
Mazzaella volans	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Melobesia mediocris	-	-	-	+	-	-	+	-	+	-	-	+	-	-	-	-	+	+	+	+	+	+	+	+
Microcladia borealis	-	<.1	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	1.7	0.2	0.9	0.2	0.6	0.3	0.6	0.3	0.2	0.2	0.2	1.0	0.1	<.1	<.1	0.2	0.6	0.3	0.1	0.4	0.2	0.1	0.2	<.1
Nemalion helminthoides	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereocystis luetkeana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Non-coralline crust	6.2	7.1	5.9	5.8	7.3	9.9	10.2	12.8	11.6	15.7	21.1	21.2	18.8	15.2	15.1	12.6	12.2	10.2	8.9	8.6	8.9	10.3	13.4	10.9
Osmundea spp.	0.3	0.4	1.0	0.7	1.3	0.4	0.5	0.6	1.0	0.2	0.2	0.2	0.2	<.1	0.2	0.2	0.8	1.1	1.1	0.7	0.1	0.2	0.6	0.6
Pelvetia compressa	-	-	-	-	-	-	-	-	<.1	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Phaeostrophion irregulare	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	1.5	2.0	3.6	2.8	3.7	1.8	1.4	1.6	1.2	0.7	0.1	1.0	0.4	0.3	0.2	0.1	1.2	1.3	1.7	4.1	4.9	2.5	4.9	6.5
Polyneura latissima	<.1	0.1	<.1	0.2	<.1	0.2	<.1	0.3	<.1	<.1	+	<.1	<.1	+	<.1	0.1	0.1	<.1	0.1	0.2	+	-	<.1	<.1
Porphyra spp.	-	0.1	0.5	0.2	0.9	0.3	+	1.6	<.1	2.0	3.3	1.4	1.6	0.1	0.3	0.1	-	0.4	1.0	1.2	+	-	1.5	<.1
Prionitis spp.	0.1	0.6	0.9	1.3	1.2	0.8	0.4	0.9	0.9	0.5	0.3	0.6	0.4	0.2	0.6	0.5	1.5	2.1	3.0	2.6	1.6	1.0	1.9	2.4
Pterosiphonia dendroidea	-	-	+	+	+	<.1	+	+	<.1	+	+	+	-	<.1	-	-	-	<.1	-	-	+	-	-	-
Rhodophyta (juv. blades)	-	-	<.1	-	-	-	-	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Sarcodiotheca gaudichaudii	<.1	0.1	<.1	<.1	0.2	<.1	<.1	<.1	<.1	<.1	+	<.1	+	-	<.1	+	<.1	0.2	0.2	0.2	0.3	0.2	0.2	<.1
Smithora naiadum	+	-	0.5	0.5	0.2	0.6	0.2	+	<.1	<.1	-	<.1	+	+	-	+	0.3	+	<.1	0.2	+	0.3	-	+
Spongomorpha/Acrosiphonia-complex	<.1	+	<.1	+	-	-	-	1.1	<.1	0.4	+	-	+	+	<.1	-	+	+	0.3	<.1	-	+	-	+
Ulva/Enteromorpha spp.	0.7	0.4	2.7	5.5	0.7	0.8	1.1	2.1	4.2	3.5	2.2	1.1	0.5	1.2	4.1	2.7	3.2	1.2	1.0	0.5	0.2	1.1	0.2	1.1
coralline crust	16.8	12.8	12.2	10.2	11.4	12.9	13.8	17.1	11.8	15.3	11.7	7.5	7.5	8.4	8.6	8.1	10.2	8.9	10.1	12.3	14.2	11.3	13.2	6.7
filamentous red algae-complex	<.1	0.2	<.1	0.1	<.1	0.2	<.1	<.1	<.1	<.1	+	<.1	<.1	+	+	<.1	<.1	<.1	<.1	+	+	0.2	+	+
juv. articulated coralline algae	-	1.1	<.1	0.6	0.7	<.1	0.3	<.1	0.2	0.3	0.6	0.2	0.2	0.2	0.1	0.1	1.2	0.7	0.4	1.4	0.1	1.0	0.7	0.2

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Algal Mean Cover/m^2 – South Control Station SC 1 at +0.9m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage																								
Analipus japonicus	<.1	<.1	+	+	+	+	<.1	-	<.1	<.1	<.1	<.1	<.1	+	<.1	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	-	-	-	-	+	+	-	<.1	+	-	+	-	+	-	+	<.1	<.1	<.1	<.1	<.1	0.5	+	+	-
Callithamnion pikeanum	<.1	0.2	<.1	<.1	<.1	<.1	<.1	+	+	+	+	+	+	<.1	+	+	+	<.1	+	+	+	+	-	-
Callithamnion spp./Pleonosporium spp.	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
Chaetomorpha spp.	-	-	-	-	-	-	-	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus canaliculatus	0.8	0.3	<.1	<.1	0.1	<.1	0.1	0.4	0.3	0.2	0.1	<.1	<.1	<.1	0.2	0.3	0.9	0.6	0.4	0.3	0.1	0.2	0.7	<.1
Chondria decipiens	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cladophora spp.	0.2	<.1	<.1	0.2	+	<.1	<.1	+	<.1	<.1	<.1	<.1	0.1	+	<.1	<.1	+	+	<.1	+	<.1	<.1	+	+
Corallina officinalis	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corallina vancouveriensis	0.7	1.1	1.0	1.1	1.2	1.1	1.7	0.5	0.2	0.2	0.1	0.2	0.2	0.1	0.3	0.5	0.6	1.1	1.8	2.0	1.7	1.3	1.0	0.9
Cryptopleura violacea	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	<.1	<.1	0.2	0.2	0.1	0.1	0.4	0.2
Cryptosiphonia woodii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Cumagloia andersonii	-	<.1	+	-	+	-	+	<.1	+	+	-	-	+	-	+	-	+	-	-	-	-	-	-	-
Egregia menziesii	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Endocladia muricata	14.6	15.9	13.5	18.6	17.5	16.1	18.5	6.2	11.1	15.9	18.7	21.3	20.1	24.4	24.9	24.8	22.6	19.0	20.3	16.3	13.0	19.7	14.6	15.7
Fucaceae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Fucus gardneri	0.3	0.4	0.2	<.1	0.3	0.3	0.5	0.3	0.2	<.1	-	-	-	<.1	<.1	0.1	0.6	0.7	0.3	0.3	0.6	0.4	0.1	0.1
Gastroclonium subarticulatum	<.1	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	<.1	-	+	+	-	<.1	0.1	<.1
Gelidium coulteri	0.1	0.3	0.4	0.6	0.6	0.6	0.6	2.1	1.8	0.6	0.2	0.1	<.1	<.1	0.1	0.1	0.2	<.1	0.1	<.1	+	+	<.1	<.1
Gelidium pusillum	1.6	2.7	1.1	0.7	0.9	0.9	0.8	1.2	2.0	0.5	<.1	+	+	<.1	<.1	<.1	0.3	0.5	0.5	0.2	0.1	0.5	0.3	0.4
Gelidium spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halosaccion americanum	0.3	0.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Hesperophycus californicus	<.1	0.2	0.1	0.2	0.3	0.3	-	-	-	-	-	-	-	-	-	+	<.1	-	-	-	-	+	0.1	<.1
Mastocarpus jardinii	4.3	4.5	4.0	3.3	3.6	3.2	2.9	0.9	0.5	0.9	1.1	1.0	1.0	0.9	1.3	1.1	2.7	2.4	2.8	1.7	2.2	1.5	1.3	2.1
Mastocarpus papillatus	25.6	23.6	24.3	24.0	22.8	22.6	25.3	13.9	14.6	10.0	9.0	11.6	13.0	13.2	16.0	18.3	21.5	22.3	27.7	27.5	21.0	26.0	21.3	16.3
Mazzaella affinis	0.1	0.1	0.2	0.5	0.1	0.1	<.1	0.2	0.2	0.1	<.1	<.1	<.1	+	0.1	0.4	0.3	0.4	0.3	0.1	0.1	0.1	0.1	0.2
Mazzaella flaccida	11.1	11.0	8.5	10.0	7.3	5.4	6.6	3.3	1.8	1.5	1.2	1.4	1.2	0.7	1.5	1.6	2.6	3.2	4.3	3.2	2.0	3.0	2.9	3.2
Mazzaella heterocarpa	0.3	0.3	0.1	0.3	0.4	0.4	0.4	0.2	0.1	0.3	0.3	0.7	0.4	0.3	0.4	0.6	0.8	0.7	0.8	0.7	0.2	0.1	1.3	0.5
Mazzaella leptorhynchos	-	-	-	+	-	-	<.1	+	<.1	<.1	<.1	<.1	<.1	+	+	+	<.1	+	<.1	+	+	+	+	<.1
Nemalion helminthoides	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-coralline crust	23.4	20.5	23.3	20.8	22.8	23.9	24.6	17.9	12.8	12.6	15.5	19.4	21.7	20.1	21.7	19.8	21.0	20.7	20.6	18.4	21.2	17.9	19.7	22.4
Osmundea spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Pelvetia compressa	4.4	3.5	4.6	4.0	4.7	5.0	4.0	2.0	1.7	1.8	2.2	2.4	2.7	2.6	2.8	3.7	6.1	7.1	9.4	8.5	6.4	7.5	6.0	7.6
Phyllospadix spp.	-	+	-	+	+	+	+	-	-	+	+	-	+	-	-	-	<.1	-	-	-	+	-	-	+
Plocamium violaceum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Porphyra spp.	0.3	0.8	0.3	0.4	0.2	0.3	+	1.7	0.5	<.1	0.2	<.1	0.1	-	<.1	<.1	<.1	0.6	0.6	0.3	0.1	0.2	7.1	1.3
Prionitis spp.	1.1	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-	+	-
Rhodophyta (juv. blades)	-	-	<.1	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Scytosiphon spp.	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Spongomorpha/Acrosiphonia-complex	-	+	-	<.1	+	+	+	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	<.1
Ulva/Enteromorpha spp.	-	+	<.1	+	+	<.1	+	0.4	<.1	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
coralline crust	2.4	4.1	4.7	4.1	4.7	4.1	3.5	5.0	1.2	1.1	1.4	1.4	2.1	1.0	1.3	1.4	2.6	2.7	4.5	6.3	7.3	5.8	4.8	5.1
filamentous red algae-complex	<.1	0.2	0.2	0.1	0.2	0.1	+	-	-	+	-	-	+	-	-	-	-	-	-	+	-	-	<.1	-
juv. articulated coralline algae	-	<.1	<.1	-	+	-	-	+	+	<.1	+	+	+	<.1	+	<.1	<.1	<.1	<.1	<.1	+	+	<.1	<.1

<.1 = measured but in low abundance; + = only recorded as present

E2 – Invertebrate Abundance in Horizontal Band Transects

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 1 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	5	6	5	6	5	3	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Anthopleura elegantissima	2.2	3.3	4.2	3.7	5.0	3.8	3.6	3.7	3.6	5.1	5.1	5.3	8.7	5.6	7.0	4.7	4.8	3.0	1.0	1.3	0.6	0.6	1.6	0.7
Balanus spp.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	0.3	0.9	1.6	1.1	1.3	0.7	0.3	0.7	-	0.4	0.8	0.2	0.2	0.3	0.6	0.3	0.4	0.6	0.2	0.1	0.2	0.2	0.4	0.6
Fissurella volcano	-	0.1	0.3	<.1	0.4	0.3	0.2	0.1	1.5	0.2	<.1	0.1	-	<.1	<.1	0.3	0.5	0.4	0.5	0.2	0.3	0.2	0.9	+
Haliotis spp.	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	-	-	-	-	-	-
Hemigrapsus nudus	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1
Leptasterias spp.	0.3	0.1	0.6	0.5	0.6	1.3	1.1	0.5	0.1	0.2	0.8	0.6	0.9	1.2	0.9	0.7	0.6	0.2	0.5	0.5	0.5	0.2	0.6	0.2
Lottia digitalis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Lottia limatula	-	-	0.2	-	0.1	0.1	<.1	-	0.3	0.7	0.2	0.2	0.2	<.1	0.3	<.1	0.2	0.3	-	<.1	0.1	-	-	0.2
Lottia pelta	-	-	0.3	0.2	<.1	0.2	0.1	0.3	3.7	1.4	<.1	<.1	0.2	<.1	0.2	0.3	0.3	0.3	0.1	0.1	0.2	0.1	0.3	0.9
Macclintockia scabra	<.1	<.1	<.1	0.1	<.1	-	<.1	-	7.5	17.5	4.9	0.3	<.1	0.3	<.1	0.2	0.3	-	0.2	-	-	-	-	0.4
Mopalia spp.	-	-	0.1	0.1	<.1	<.1	0.2	-	0.2	<.1	-	<.1	0.2	<.1	0.2	<.1	0.3	0.1	<.1	-	-	0.1	0.3	<.1
Nuttallina californica	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	0.2	-	-	-	-	0.1	<.1
Ocenebra spp.	-	-	0.1	0.2	0.3	0.3	0.3	<.1	0.2	0.5	1.4	0.3	0.4	0.1	0.1	0.2	0.6	0.2	0.1	0.1	0.7	0.2	0.1	0.1
Pachygrapsus crassipes	-	<.1	<.1	-	-	-	<.1	0.1	-	0.1	<.1	0.2	0.2	0.1	0.3	0.3	0.2	0.2	0.4	<.1	0.1	-	0.1	0.2
Pagurus spp.	12.3	11.9	11.5	12.9	19.0	14.2	15.3	12.6	10.1	10.0	12.7	14.1	12.7	10.4	19.0	22.0	20.8	19.0	14.5	12.5	19.6	22.3	16.0	14.8
Pisaster ochraceus	<.1	0.1	<.1	<.1	-	<.1	-	-	0.2	<.1	-	<.1	-	-	-	<.1	-	0.1	-	<.1	-	-	+	<.1
Pseudomelatoma torosa	-	-	<.1	-	-	-	-	<.1	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	0.1	-
Strongylocentrotus purpuratus	-	-	<.1	-	-	<.1	-	<.1	-	<.1	-	<.1	+	-	0.2	<.1	0.2	0.1	<.1	0.3	-	-	-	0.2
Tectura paleacea	-	-	-	+	-	+	+	-	-	-	+	-	-	-	-	+	-	+	-	-	+	-	-	-
Tectura scutum	0.3	0.3	0.5	0.1	0.2	0.3	0.5	0.1	3.1	1.2	1.4	0.4	-	0.2	0.1	0.7	<.1	0.3	0.3	0.1	0.1	0.1	0.3	-
Tegula brunnea	2.1	0.7	1.7	2.4	8.5	2.5	3.3	3.3	0.3	1.1	2.3	3.1	0.8	2.3	4.1	8.5	2.0	0.8	2.3	2.4	4.7	5.5	0.3	0.7
Tegula funebralis	48.7	40.4	40.6	71.2	98.4	52.3	20.1	62.7	28.0	82.7	86.1	109.8	97.4	62.2	83.0	38.2	40.8	36.1	24.0	31.3	31.8	30.2	99.8	43.5
Tetraclita rubescens	-	-	0.8	-	<.1	<.1	<.1	0.5	-	0.8	0.8	0.3	<.1	-	1.2	1.2	1.5	0.1	1.2	-	0.2	1.4	0.5	0.2
Only Counted if Greater than 1*																								
Acmaea mitra	-	-	+	-	-	+	-	-	-	<.1	+	-	+	<.1	-	-	-	-	-	-	+	-	+	-
Acmaeidae unid.	-	<.1	+	+	+	+	+	+	+	+	+	+	0.1	+	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Alia spp.	-	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amphissa spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	-	-	-
Anthopleura artemisia	<.1	-	<.1	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-
Anthozoa unid.	-	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Asterina miniata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.1	-	-	-
Asteroidea unid.	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	+	-	+	+	-	-	+	+	+	-	-	-	-	+	-	-	-	-	-	-	-
Bittium spp.	-	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	-	+	+	-	+
Cancer antennarius	-	-	-	-	<.1	-	<.1	-	0.1	<.1	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-
Cancer spp.	-	-	-	-	<.1	<.1	-	+	-	-	-	-	<.1	-	0.1	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	<.1	-	-	-	-	+	-	+	-	-	+	-	+	+	-	-	-	+	-	-
Clavelina huntsmani	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	0.2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cucumaria spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	-	-	-	-	-	+
Diaulula sandiegensis	-	-	-	<.1	-	-	-	-	-	-	-	+	-	<.1	-	-	-	-	-	-	0.1	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	5	6	5	6	5	3	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	-	-	-	-	-
Henricia leviuscula	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	+	+	+	+	+	-	-	-	+	+	-	+	-	-	-	-	+	-	-	-	+	-	+
Homolopoma luridum/Lirularia succincta	-	-	-	+	+	+	+	+	-	-	-	+	-	-	-	+	+	+	+	-	-	+	-	+
Idotea spp.	-	-	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	+	<.1	-	-	-	-
Ischnochitonidae	-	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+
Lacuna spp.	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lepidozona spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Lissothuria nutriens	-	-	-	-	-	-	-	-	-	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	-
Lithopoma gibberosum	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	-	-	+	-	-	+	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	+	-	-
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	+	-	+	-	<.1	+	+	-	-	-	+	-	-	-
Majidae	-	-	+	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-	-	-	-	-	-
Megatebennus bimaculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Mytilus californianus	-	-	-	+	+	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Nemertea unid.	-	-	0.2	0.1	0.4	0.8	0.5	0.2	0.3	0.4	0.3	0.2	0.3	0.4	0.4	0.2	0.1	0.2	0.3	-	0.5	0.1	0.2	0.2
Nereididae unid.	-	<.1	<.1	<.1	-	-	-	-	-	-	+	0.1	0.1	0.1	0.2	-	<.1	+	<.1	-	-	-	-	+
Nitidiscala/Opalia spp.	-	-	+	-	-	+	-	+	-	+	+	+	-	+	-	-	+	+	-	-	-	-	-	-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiuroidea unid.	-	-	-	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	+	+	+	+	+	-	-	<.1	+	+	+	+	-	-	<.1	+	+	+	+	-	-	-
Polychaeta unid.	-	-	-	-	<.1	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Pugettia spp.	0.2	0.1	0.1	0.2	0.4	0.3	0.2	0.5	0.4	0.3	0.4	0.2	<.1	<.1	0.3	0.4	0.5	0.2	0.2	0.3	0.2	0.4	0.3	<.1
Pycnogonida unid.	-	-	+	-	-	<.1	-	-	+	+	-	+	+	+	-	+	+	+	-	-	-	+	-	-
Pycnopodia helianthoides	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Pyura haustor	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rostanga pulchra	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	<.1	+	-	-	-	-	-	-	+	+	+	-	-	+	-	-	+	-	-	+	-	-	+
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Sipuncula unid.	-	-	-	-	-	+	+	+	+	-	<.1	-	-	-	+	-	+	<.1	+	+	+	-	-	+
Tonicella lineata	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-	+	-	-	-
Urticina spp.	-	<.1	-	<.1	0.1	-	-	-	-	-	<.1	<.1	0.1	0.1	<.1	0.1	0.1	<.1	<.1	-	-	-	-	-
tunicate, solitary unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
% Coverage																								
Acarnus erithacus	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Amphipod (tube)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	+	+	+	-	+	+	-	-	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+
Bryozoa, unid. (foliose)	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	5	6	5	6	5	3	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
% Coverage (continued)																								
Chthamalus fissus	-	<.1	+	+	+	+	+	-	+	0.2	0.3	<.1	+	+	+	+	+	+	+	-	+	-	-	+
Dodecaceria fewkesi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliclona spp.	-	-	-	<.1	-	-	-	-	<.1	+	<.1	+	+	<.1	+	-	+	-	-	-	-	+	-	+
Phragmatopoma californica	<.1	-	+	+	+	+	+	-	+	<.1	<.1	+	+	<.1	+	+	+	+	+	+	+	+	+	+
Pista spp.	5.7	0.9	1.2	2.9	1.7	1.3	1.3	0.5	1.9	0.8	0.6	0.6	0.3	0.6	0.9	1.2	1.4	2.5	3.3	2.3	4.7	5.0	2.8	2.0
Porifera unid. (encrusting)	+	+	<.1	<.1	<.1	0.2	<.1	0.1	<.1	<.1	<.1	<.1	+	<.1	+	+	+	+	+	+	+	<.1	+	+
Salmacina tribranchiata	-	-	-	+	+	+	+	-	-	+	+	+	-	+	-	-	+	-	+	+	+	+	-	+
Spirorbidae	-	-	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+
tunicates, colonial/social unid.	0.2	+	<.1	0.5	0.1	0.4	<.1	+	0.1	+	<.1	<.1	<.1	<.1	+	<.1	+	<.1	+	<.1	0.5	2.0	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	5	6	5	6	5	4	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-	-	-	<.1	-	-	-	-	0.4	<.1	0.1	0.3	-	-	0.1	<.1	<.1	-	-	0.1	-	0.1	<.1
Anthopleura elegantissima	13.2	8.3	10.3	12.5	14.4	16.1	6.9	4.7	3.8	5.9	6.9	7.8	4.7	4.3	5.6	3.4	2.7	2.5	2.8	2.1	2.1	1.8	2	1.8
Balanus spp.	-	+	0.2	<.1	-	0.2	<.1	0.6	-	1.4	0.4	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Epiactis prolifera	-	-	0.3	0.3	<.1	0.1	<.1	<.1	<.1	0.3	<.1	<.1	<.1	-	<.1	0.2	<.1	-	-	-	-	-	-	<.1
Fissurella volcano	0.1	<.1	<.1	<.1	0.2	0.1	<.1	0.2	0.5	0.4	0.2	-	0.1	0.1	<.1	<.1	0.4	0.3	0.5	<.1	-	0.1	0.3	0.2
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Haliotis spp.	0.2	0.2	0.2	0.1	0.2	0.2	<.1	0.7	0.2	0.4	0.7	0.8	0.6	0.6	0.6	0.6	0.4	0.6	0.2	-	-	0.1	-	-
Hemigrapsus nudus	-	-	<.1	-	<.1	0.2	<.1	0.2	-	-	<.1	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-
Leptasterias spp.	0.2	0.2	0.3	0.7	0.4	0.5	0.4	0.4	<.1	<.1	0.2	0.4	0.2	0.2	0.2	0.7	0.8	0.2	0.7	0.8	0.2	0.4	0.2	0.3
Lottia digitalis	-	-	-	<.1	-	0.2	-	-	-	0.5	-	-	-	0.1	-	-	-	-	0.1	-	-	0.1	-	-
Lottia limatula	0.3	0.2	0.5	1.3	0.9	1.6	1.2	0.6	1.3	1.5	2	0.8	2.3	1.6	1.3	1.7	1.2	1.3	0.3	0.4	0.8	0.8	0.4	2.6
Lottia pelta	<.1	0.3	0.6	0.8	0.4	1.1	0.6	0.3	6.6	2.1	0.7	0.2	0.2	0.1	0.3	0.4	0.3	0.3	-	-	-	-	0.3	2.3
Macclintockia scabra	1.8	1.3	6.9	5.5	8	16.1	11.7	15.9	130	132	96.5	25.1	11.2	14	14.9	7.3	1.9	2.3	0.5	0.7	0.3	0.4	2.1	7.5
Mopalia spp.	-	-	0.1	<.1	<.1	<.1	0.2	0.2	<.1	0.4	0.6	0.2	0.4	0.3	0.1	<.1	<.1	0.2	0.2	-	0.3	-	-	0.5
Nucella emarginata	<.1	+	<.1	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1
Nuttallina californica	0.1	0.1	-	0.3	0.3	0.5	0.8	0.6	0.3	0.2	0.8	0.2	0.3	0.2	0.6	0.9	0.8	1	0.4	0.4	0.3	0.9	0.9	0.8
Ocenebra spp.	-	<.1	0.2	0.8	0.8	0.4	0.3	0.4	1.5	2.5	1.6	0.7	0.5	0.2	0.9	0.4	0.7	0.8	0.3	0.2	0.1	0.2	0.4	0.5
Pachygrapsus crassipes	0.2	0.1	0.2	0.1	0.3	0.3	0.3	0.6	0.1	0.3	0.5	0.2	0.5	0.7	0.8	0.5	0.4	0.9	0.3	0.5	0.6	0.4	0.1	0.1
Pagurus spp.	6.5	6.9	16.7	14.6	19.5	22.8	17.1	15.7	12.9	13.6	11.3	12	10.7	14.3	25.8	38.5	29.8	27.4	23.1	27.3	27.5	11.3	8.2	8.2
Pisaster ochraceus	-	-	-	<.1	-	<.1	-	-	-	<.1	<.1	-	-	0.1	-	-	-	-	0.2	<.1	-	-	-	-
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	<.1	0.1	<.1	0.2	0.3	0.2	0.2	<.1	-	<.1	<.1	<.1	-	0.1	<.1	-	-	-	<.1	0.5	0.1	0.2	-	<.1
Tectura persona	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	0.6	0.2	1.2	1.7	1.7	1.1	3.9	1.2	3	2.2	2	3	1.8	1	1	1.4	0.5	0.6	0.5	-	0.4	-	0.2	0.3
Tegula brunnea	0.2	-	-	0.1	<.1	<.1	0.3	<.1	-	<.1	<.1	-	-	0.2	-	0.1	<.1	-	-	-	-	0.4	-	-
Tegula funebralis	65.8	69.2	130	131	163	120	122	190	151	272	290	250	230	212	204	146	119	111	86.5	157	124	127	127	111
Tetraclita rubescens	0.2	1.9	2	0.4	0.6	1.9	0.7	2.6	0.7	1.3	0.5	0.1	0.3	0.3	0.7	3.3	1.5	<.1	0.2	0.3	-	0.8	-	0.1
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acmaeidae unid.	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Alia spp.	-	-	+	-	-	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	-	-	-	-	-
Cancer spp.	-	-	+	-	-	-	<.1	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-	+	-	-	+	-	-
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cyanoplax spp.	-	-	-	-	-	<.1	+	-	-	0.3	0.3	0.1	0.2	+	0.1	-	-	-	<.1	<.1	-	-	-	+
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Diodora spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	<.1	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	-	-	-
Hemigrapsus oregonensis	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	5	6	5	6	5	4	3	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Hipponix spp.	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	-	+	+	+	-	-	+	-	+
Idotea spp.	<.1	-	<.1	<.1	-	<.1	<.1	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+	-	-	+	-	-	-	+
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Lissothuria nutriens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-
Littorina spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	+	-	+
Lophopanopeus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0.1	+	+	+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	+	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Majidae	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-
Mytilus californianus	-	-	-	-	-	-	-	-	-	<.1	<.1	0.1	0.3	<.1	+	+	<.1	-	+	-	0.2	0.3	1.1	<.1
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Nemertea unid.	0.2	-	-	0.3	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.5	1	<.1	0.1	0.3	<.1	0.2	-	0.1	0.2
Nereididae unid.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	+
Nitidiscala/Opalia spp.	-	-	+	+	+	+	-	+	-	-	-	-	-	-	+	+	+	-	-	-	-	-	-	+
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Petrolisthes spp.	-	-	-	-	0.2	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	+	+	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Pollicipes polymerus	<.1	-	-	-	-	-	-	+	+	+	+	<.1	0.2	<.1	0.8	1	2.1	3.2	2.2	3.7	3.1	3.4	3.6	0.2
Polychaeta unid.	-	-	-	-	-	+	<.1	-	-	-	-	-	-	-	-	<.1	-	+	-	<.1	-	-	-	-
Pugettia spp.	-	-	<.1	<.1	-	0.2	<.1	<.1	-	-	<.1	+	-	-	-	-	-	+	<.1	<.1	-	-	-	<.1
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	-	<.1	-	-	-	-	-	-	+	<.1	-	-	-	-	-	-	-	-	-	-	-	+
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Sipuncula unid.	-	-	<.1	+	<.1	+	+	+	+	+	-	+	+	+	+	+	-	+	-	-	-	-	-	+
Tricolia spp.	-	-	-	+	-	+	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+
Triopha maculata	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Chthamalus fissus	0.2	<.1	+	<.1	<.1	0.2	0.1	0.4	<.1	0.6	0.4	+	+	+	0.1	0.1	0.1	+	+	+	+	+	+	+
Haliclona spp.	-	-	-	<.1	-	-	-	-	-	+	<.1	<.1	<.1	+	+	+	+	+	+	+	+	+	-	<.1
Phragmatopoma californica	-	-	<.1	+	+	+	+	+	+	<.1	+	<.1	+	+	+	+	+	0.1	+	+	+	+	+	+
Pista spp.	-	-	-	-	-	-	-	-	-	-	+	+	+	+	+	+	-	-	+	+	+	-	-	+
Porifera unid. (encrusting)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	+
Spirorbidae	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
tunicates, colonial/social unid.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 2 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	4	3	3	6	4	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	-	-	-	-	-	-	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Anthopleura elegantissima	7.9	10.9	10.4	8.1	5.4	6.2	6.4	3.9	3.5	5.5	8.2	8.4		3.8	3	6.3	4	5.1	3.5	4.1				2.3
Balanus spp.	-	0.3	-	<.1	-	-	-	-	-	0.2	0.2	-		-	-	-	-	-	-	-				-
Calliostoma ligatum	-	-	-	+	-	-	-	-	-	-	-	-		-	<.1	-	-	<.1	-	-				-
Conus californicus	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<.1	-	-				-
Epiactis prolifera	0.2	0.8	3.4	4.9	4.8	1.7	1	1	1.1	0.9	1.3	0.7		2.4	1	1.9	2	1.3	0.8	1.7				1.1
Fissurella volcano	0.3	0.2	0.3	0.1	0.3	0.3	0.2	0.2	2.5	0.8	-	0.4		1	1	1.4	1.2	1.5	0.8	0.6				1.3
Haliotis spp.	0.1	0.4	0.2	<.1	<.1	<.1	<.1	-	-	<.1	-	-		-	-	-	<.1	<.1	-	-				-
Leptasterias spp.	<.1	-	0.3	1	1.1	0.8	0.6	0.3	0.1	0.4	1.6	2		0.6	2.2	0.6	0.8	0.2	0.4	0.9				0.3
Lottia digitalis	<.1	0.2	-	-	<.1	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Lottia limatula	-	0.3	0.2	<.1	<.1	<.1	0.1	-	0.4	1.2	1.2	0.1		-	0.1	0.2	0.6	0.6	0.3	-				4
Lottia pelta	0.1	0.3	0.6	0.4	0.4	1	0.3	0.7	15.5	8.5	0.7	<.1		-	<.1	0.3	0.2	0.5	0.9	0.7				12.8
Macclintockia scabra	<.1	0.2	0.9	<.1	-	0.2	0.5	0.3	19	62.1	76.2	10.4		0.2	0.2	0.3	0.1	0.1	0.2	0.3				2.7
Mopalia spp.	<.1	-	<.1	0.2	0.1	<.1	0.3	0.1	0.9	0.1	-	-		-	-	-	-	0.2	<.1	0.2				<.1
Nuttallina californica	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				0.1
Ocenebra spp.	-	-	0.1	0.1	0.2	0.5	0.3	<.1	0.4	0.7	1	1.2		-	0.3	0.3	<.1	<.1	0.3	0.1				0.2
Pachygrapsus crassipes	-	-	<.1	<.1	-	-	-	-	-	-	0.1	<.1		-	<.1	-	0.1	0.1	0.2	-				<.1
Pagurus spp.	5.5	6.8	6.6	12.2	15.3	20.9	16.4	11.1	10.3	12.9	9.8	11.1		13.2	25.5	25.3	19.3	14.4	12.5	18.6				13.4
Pisaster ochraceus	-	0.1	-	-	-	<.1	-	-	-	<.1	-	-		-	-	-	-	<.1	-	-				-
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	-	-	-		-	0.1	-	-	-	-	-				-
Strongylocentrotus purpuratus	4.9	-	-	-	<.1	<.1	<.1	-	-	-	-	<.1		-	+	<.1	0.1	-	+	-				-
Tectura paleacea	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-				+
Tectura persona	0.1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tectura scutum	0.5	0.3	1.4	0.3	0.8	1.1	0.9	0.3	4.9	12.8	4.4	0.8		2	0.8	1.3	0.5	0.5	0.8	0.8				2
Tegula brunnea	13.3	1.8	18.5	24.2	29.3	18.7	14	16.2	6.7	6.2	4.1	5.9		2.8	10	7.2	5.9	3.6	4.3	8				3.4
Tegula funebralis	12.4	19.5	11.3	11	16.6	19.4	10.8	37.8	7.8	18.3	42.7	68.7		59.2	40	30	28.9	19.1	12.5	37.2				17.9
Tetraclita rubescens	0.3	-	0.2	1.4	0.8	2.1	2.8	0.6	2.5	7	5.1	0.5		-	<.1	0.9	3.4	0.6	2.7	0.1				1.2
Only Counted if Greater than 1"																								
Acmaea mitra	<.1	-	-	<.1	-	-	-	-	+	+	<.1	-		-	-	-	-	-	+	-				+
Acmaeidae unid.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Alia spp.	-	-	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	+				+
Amphissa spp.	-	-	-	-	-	<.1	-	-	-	-	-	-		-	-	+	+	-	+	-				+
Asterina miniata	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Barleeia spp.	-	-	-	-	-	+	-	-	-	-	-	-		-	+	-	-	-	-	-				-
Bittium spp.	-	-	-	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				-
Cancer antennarius	-	-	-	<.1	0.1	<.1	0.2	-	+	<.1	-	-		-	-	<.1	<.1	<.1	-	-				-
Cancer productus	-	0.1	-	-	-	-	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Cancer spp.	-	-	-	<.1	-	+	+	-	-	-	-	-		-	<.1	-	0.1	-	+	-				-
Chaetopteridae	-	-	-	-	-	-	-	-	<.1	-	-	-		-	+	-	-	-	-	-				-
Clavelina huntsmani	-	-	+	+	-	-	+	-	-	-	-	-		-	-	+	-	-	-	-				-
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				<.1
Cyanoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	+	-	+	-				+
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	0.1	-	-	<.1	-				-
Diopatra ornata	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Discurria insessa	-	-	-	-	+	-	-	-	-	+	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	4	3	3	6	4	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1" (continued)																								
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<.1	-	-	-				-
Grapsidae (juv.)	-	-	-	-	-	-	+	+	+	+	-	+		-	-	+	+	-	+	-				-
Halcampa decemtentaculata	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-				+
Henricia leviuscula	-	-	-	-	<.1	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	+	-	-		-	+	+	-	-	-	-				-
Homolopoma luridum/Lirularia succincta	-	-	-	-	+	+	-	+	-	-	-	-		-	-	-	+	-	-	-				-
Idotea spp.	-	0.1	-	-	-	-	-	<.1	-	-	+	-		-	-	-	-	+	-	-				-
Ischnochitonidae	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	-				+
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lepidozona spp.	-	-	-	-	-	-	-	-	<.1	-	-	-		-	-	0.2	-	<.1	0.1	-				-
Lissothuria nutriens	-	-	<.1	+	+	<.1	+	+	<.1	+	+	+		-	+	+	+	+	+	+				-
Lithopoma gibberosum	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Littorina spp.	-	-	+	+	-	-	-	-	+	+	+	-		-	-	+	-	-	-	-				-
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-				-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-		-	+	+	-	-	-	-				-
Majidae	-	-	-	+	+	+	-	+	+	+	+	+		-	-	-	-	+	-	-				-
Megatebennus bimaculatus	-	-	-	-	-	-	-	-	-	-	-	-		+	-	-	-	-	-	-				-
Mytilus californianus	-	-	-	-	-	-	-	-	-	+	-	-		-	-	-	-	-	-	-				-
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				<.1
Nemertea unid.	-	-	<.1	0.2	0.2	0.4	0.3	0.3	0.1	0.1	0.2	0.4		0.4	0.6	0.1	+	+	0.3	0.3				0.1
Nereididae unid.	-	-	<.1	<.1	+	<.1	0.2	-	-	<.1	+	<.1		-	0.2	0.2	0.1	0.1	+	-				<.1
Nitidiscala/Opalia spp.	-	-	+	+	+	-	-	+	+	-	-	-		+	-	-	+	-	-	-				-
Nudibranchia unid.	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Onchidella borealis	-	-	-	-	+	-	-	+	-	-	-	+		-	-	-	-	-	-	-				-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Parastichopus spp.	-	-	-	-	-	-	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Pelecypoda unid. boring	-	-	-	-	+	-	-	-	-	-	-	-		-	+	-	-	-	-	-				-
Petrolisthes spp.	-	-	-	-	-	<.1	-	-	-	+	-	-		-	-	-	-	<.1	-	-				-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<.1	-	-				-
Pisaster/Henricia (juv.)	-	-	-	<.1	+	+	+	+	+	+	+	+		-	+	<.1	+	+	+	-				-
Platyhelminthes unid.	-	-	+	-	-	<.1	-	-	-	-	-	<.1		-	+	-	-	-	-	-				-
Polychaeta unid.	-	-	-	-	-	-	-	-	<.1	-	-	<.1		-	-	-	-	-	-	-				-
Polynoidae	-	-	-	-	-	-	-	-	-	+	-	<.1		-	-	-	-	-	-	-				-
Pugettia spp.	<.1	0.4	0.4	0.3	0.4	0.8	0.3	0.3	0.2	0.1	0.1	0.3		0.2	0.2	0.3	0.3	0.2	0.1	0.2				0.2
Pycnogonida unid.	-	-	-	+	+	+	-	+	-	-	+	+		-	+	+	+	-	-	-				-
Pycnopodia helianthoides	-	-	-	-	-	-	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Rostanga pulchra	-	-	-	-	-	+	-	-	-	-	-	-		-	-	+	-	-	-	-				-
Serpulidae unid.	-	-	-	+	+	-	-	-	-	-	-	-		-	+	-	+	-	+	-				+
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	<.1	-	<.1	-	-				-
Sipuncula unid.	-	-	-	-	+	<.1	-	-	+	-	+	+		+	-	-	+	-	-	-				+
Tonicella lineata	-	-	<.1	<.1	-	-	-	-	-	0.1	-	-		-	-	-	-	-	-	-				-
Tricolia spp.	-	-	-	+	+	+	+	+	+	+	+	+		-	-	+	-	-	-	-				+
Urticina spp.	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 2 at +0.3m (based on 5 "Tegula" Count Quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	4	3	3	6	4	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Amphipod (tube)	-	-	-	-	-	-	-	-	-	-	-	-		0.3	-	-	-	-	-	-				-
Bryozoa, unid. (encrusting)	-	-	-	+	+	+	+	-	+	+	+	+		+	+	+	+	+	+	+				+
Chthamalus fissus	+	-	+	+	+	+	+	+	+	1	2	1		+	+	+	+	+	-	+				+
Dodecaceria fewkesi	-	-	-	<.1	+	+	<.1	-	-	-	-	-		-	+	<.1	+	-	+	-				-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	-	-	-				-
Haliclona spp.	-	-	-	-	-	+	-	-	-	-	-	+		-	-	-	-	+	+	-				-
Phragmatopoma californica	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Pista spp.	<.1	-	0.4	1.3	1.6	1.9	1.6	0.2	0.3	0.4	0.5	1.2		4.3	1.6	4.1	6.4	5.8	7.3	4.2				1.9
Porifera unid. (encrusting)	-	-	-	+	<.1	+	+	<.1	-	+	+	+		0.1	+	+	+	+	<.1	+				+
Salmacina tribranchiata	-	-	-	-	+	+	-	-	-	-	+	+		-	+	+	+	+	+	+				+
Spirorbidae	-	-	-	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
tunicates, colonial/social unid.	<.1	-	<.1	0.1	0.2	<.1	0.1	+	<.1	+	+	<.1		+	+	+	+	+	<.1	+				0.1

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 2 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	5	6	5	6	5	4	3	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	-	-	0.1	<.1	<.1	0.1	0.2	0.2	-	0.2	<.1	0.2		-	0.1	0.1	0.2	0.2	0.3	0.5				<.1
Anthopleura elegantissima	7.8	17.2	16.1	17.1	18.4	10.8	9.8	7.2	8.5	16.1	14.4	15.4		20.8	14.1	17.8	20.5	12.3	13.2	18.0				15.6
Anthopleura xanthogrammica	0.2	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Balanus spp.	-	-	<.1	-	<.1	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Calliostoma ligatum	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	0.1	-	-				-
Epiactis prolifera	-	-	0.3	<.1	-	<.1	-	<.1	-	-	-	-		-	-	-	-	-	-	-				<.1
Fissurella volcano	-	-	-	-	<.1	-	<.1	0.1	0.1	0.2	-	<.1		-	-	-	-	<.1	0.1	-				<.1
Haliotis spp.	-	-	0.6	<.1	<.1	-	-	-	-	0.1	<.1	<.1		-	-	-	-	-	-	-				-
Hemigrapsus nudus	-	-	<.1	<.1	<.1	0.3	0.3	0.2	0.7	<.1	0.1	0.2		-	-	-	-	-	-	-				-
Leptasterias spp.	0.1	-	0.3	0.3	0.2	0.3	0.2	0.1	-	-	<.1	<.1		0.2	<.1	0.1	0.1	0.2	<.1	0.3				<.1
Lottia digitalis	0.3	-	<.1	0.4	0.5	0.2	0.3	0.2	<.1	0.2	0.2	0.2		-	<.1	-	0.4	-	-	0.7				0.3
Lottia limatula	0.4	0.9	1.2	1.3	2.5	3.6	2.2	2.1	3.5	2.8	2.2	1.6		2.0	2.8	1.7	1.0	2.1	2.2	1.6				2.0
Lottia pelta	0.2	-	0.1	0.2	0.3	0.6	0.3	1.0	0.7	0.9	0.5	0.6		-	0.3	0.5	0.6	0.6	0.7	0.2				3.9
Macclintockia scabra	2.0	4.3	6.8	10.6	13.0	24.2	15.9	13.2	77.3	88.9	82.7	27.4		28.0	25.9	15.9	14.0	6.2	7.4	11.5				40.9
Mopalia spp.	<.1	-	0.1	0.2	0.4	0.6	0.6	0.2	0.2	0.9	0.8	0.4		-	0.4	0.4	0.2	0.3	0.2	0.6				0.2
Nucella emarginata	0.4	0.1	<.1	0.1	0.3	<.1	-	0.2	-	-	0.1	-		-	-	<.1	<.1	<.1	<.1	-				-
Nuttallina californica	-	-	<.1	-	<.1	-	-	0.1	<.1	<.1	0.1	0.3		0.2	0.3	0.2	0.3	0.6	0.2	0.5				0.2
Ocenebra spp.	-	-	1.4	1.6	1.7	1.1	1.7	1.3	1.7	2.7	2.6	4.0		2.6	1.5	2.8	2.6	3.6	2.5	3.9				1.0
Pachygrapsus crassipes	-	-	0.3	0.1	0.2	0.6	0.5	0.8	0.7	0.4	0.4	0.3		-	0.5	0.6	0.6	0.3	0.3	0.4				0.3
Pagurus spp.	22.1	5.8	11.2	26.9	10.2	19.9	28.0	10.4	21.7	17.3	8.8	10.3		13.8	16.0	40.8	27.3	9.9	17.9	19.4				8.6
Pisaster ochraceus	-	-	<.1	-	<.1	-	-	-	-	-	-	<.1		-	-	-	<.1	-	-	0.1				<.1
Strongylocentrotus purpuratus	-	-	<.1	-	<.1	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tectura scutum	1.5	1.7	1.3	1.2	3.1	3.0	4.4	1.6	3.8	4.3	2.8	2.3		3.6	2.8	2.7	2.0	1.7	2.3	2.3				3.1
Tegula brunnea	-	0.2	-	<.1	0.2	-	-	-	-	<.1	<.1	-		-	-	-	-	0.2	<.1	-				-
Tegula funebralis	114.0	118.7	188.5	184.7	234.5	164.5	149.0	173.4	160.5	166.2	153.7	122.7		257.4	140.2	144.5	148.2	134.7	92.7	190.2				84.0
Tetraclita rubescens	-	-	0.4	-	<.1	0.5	0.9	2.3	3.3	4.8	4.4	1.5		-	0.1	0.7	0.2	-	0.2	-				-
Only Counted if Greater than 1*																								
Acmaeidae unid.	0.3	-	<.1	+	+	+	+	+	+	+	+	+		+	+	+	+	0.6	+	+				+
Alia spp.	-	-	+	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Asterina miniata	-	-	-	<.1	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Barleeia spp.	-	-	-	-	+	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Bittium spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Cirratulidae/Terebellidae unid.	-	-	-	-	+	-	-	+	-	+	-	-		-	-	-	-	-	-	-				-
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Cyanoplax spp.	-	-	-	+	0.4	-	<.1	+	0.2	0.2	0.8	0.1		-	0.6	0.2	0.2	<.1	0.2	0.2				0.2
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-		0.2	-	-	-	-	-	-				-
Grapsidae (juv.)	-	-	0.1	+	+	+	+	+	+	+	<.1	+		-	+	+	+	+	+	+				-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	-	-	-				-
Homolopoma luridum/Lirularia succincta	-	-	-	-	-	+	+	-	-	-	-	-		-	-	+	+	+	-	-				+
Idotea spp.	-	-	-	<.1	<.1	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Ischnochitonidae	-	-	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	-				-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	-	+	+	-				-
Littorina spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia asmi	-	-	+	<.1	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia gigantea	-	-	-	-	-	-	-	-	-	0.1	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Control Station NC 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	,5	6	5	6	5	4	3	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1* (continued)																								
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	-	-		+	-	-	-	-	-	-				-
Majidae	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	+	-	-	-				-
Musculus pygmaeus	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Mytilus californianus	-	-	+	-	-	+	-	-	-	+	+	+		+	-	-	-	-	-	-				-
Nemertea unid.	-	-	+	-	0.2	0.2	+	0.2	0.1	<.1	<.1	<.1		-	0.1	<.1	-	-	-	-				-
Nereididae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-	-	-	+	-	+	+	-	-	-	+		-	-	-	+	-	-	-				-
Onchidella borealis	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Petrolisthes spp.	-	-	-	0.1	-	<.1	-	-	-	-	<.1	-		-	-	<.1	-	-	-	-				-
Pisaster/Henricia (juv.)	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<.1	-	-	-				-
Pollicipes polymerus	-	-	-	+	-	+	-	-	-	+	-	+		0.2	1.0	1.0	1.8	0.8	0.9	1.0				1.4
Pugettia spp.	-	-	-	-	-	<.1	-	-	-	-	<.1	-		-	-	-	-	+	-	-				-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	+	-		-	-	-	-	-	-	-				-
Serpulidae unid.	-	-	-	-	-	-	-	+	-	+	<.1	+		-	-	-	-	-	+	+				+
Sipuncula unid.	-	-	-	-	-	-	-	-	-	+	-	-		-	<.1	-	-	-	-	-				-
Tricolia spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Trimusculus reticulatus	-	-	-	-	-	-	-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	+	-				-
Chthamalus fissus	0.7	0.1	0.1	<.1	+	0.1	0.3	+	+	0.4	0.6	0.6		+	+	+	0.1	0.1	+	+				+
Haliclona spp.	-	-	-	-	-	-	-	-	-	-	-	-		0.3	-	-	-	-	-	+				-
Phragmatopoma californica	-	-	+	+	+	+	+	<.1	+	+	+	+		+	+	+	+	+	+	+				+
Pista spp.	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Porifera unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	+	+				-
Salmacina tribranchiata	-	-	-	-	-	-	-	-	+	+	-	-		-	-	-	+	-	-	-				-
Spirorbidae	-	-	+	+	-	<.1	+	0.2	+	+	+	+		+	+	+	<.1	+	+	+				+
tunicates, colonial/social unid.	-	-	+	-	-	+	-	-	-	-	-	-		-	-	-	+	-	+	-				-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 1 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	3	4	4
Counted Regardless of Size																								
Acanthina spp.	<.1	-							-	0.1	-	-		-	-	-	0.1	-	-	-	-	-	-	0.2
Anthopleura elegantissima	5.7	9.1							4.6	5.1	9.1	8.6		8.2	9.4	14.1	18.8	10.4	9.4	10.9	10.8	7.3	4.4	6.7
Balanus spp.	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-							-	-	-	0.2		-	0.2	-	-	-	-	-	-	-	+	-
Epiactis prolifera	0.4	1.7							0.4	0.2	0.5	1.0		1.6	2.0	1.1	1.4	1.5	1.1	1.3	1.6	2.1	0.7	0.8
Fissurella volcano	0.3	-							0.8	1.8	2.7	0.6		1.8	1.3	1.0	1.8	3.6	3.4	0.6	1.8	2.0	5.2	2.1
Fusinus luteopictus	-	-							-	-	-	0.4		-	-	-	0.1	-	-	-	-	-	-	-
Haliotis spp.	4.6	8.5							1.2	0.1	0.5	0.2		1.0	0.8	0.3	0.4	0.2	<.1	0.2	0.6	-	-	-
Hemigrapsus nudus	<.1	-							-	-	-	-		-	-	<.1	0.2	-	-	-	-	-	-	-
Leptasterias spp.	0.2	-							-	0.3	0.3	2.2		0.2	1.3	0.4	0.4	0.8	0.8	0.7	1.0	0.5	<.1	0.4
Lottia digitalis	-	-							-	-	-	-		-	-	0.3	-	-	-	-	-	-	<.1	-
Lottia limatula	0.2	0.1							1.4	0.6	0.5	0.6		0.2	0.7	0.9	1.5	2.6	1.9	0.5	2.3	1.3	2.7	2.6
Lottia pelta	0.1	-							3.0	0.6	0.6	-		-	0.1	<.1	0.2	1.8	2.9	3.0	1.9	1.5	11.8	6.6
Macclintockia scabra	2.0	14.9							21.4	8.0	23.5	0.8		0.2	0.2	0.3	-	5.0	6.1	1.4	1.9	3.4	27.4	76.6
Mitra idae	-	-							-	-	-	-		-	-	-	-	<.1	<.1	-	<.1	<.1	-	-
Mopalia spp.	-	-							0.2	-	0.2	-		-	<.1	-	-	0.1	0.1	-	<.1	0.2	0.1	0.2
Nuttallina californica	0.1	1.5							3.6	3.1	6.3	2.2		3.0	3.7	3.6	4.1	3.2	4.2	5.0	4.2	3.8	3.1	4.5
Ocenebra spp.	<.1	-							1.0	0.8	1.8	2.4		0.4	0.9	0.7	1.2	0.5	0.8	0.3	0.9	0.5	0.6	0.3
Pachygrapsus crassipes	0.3	0.1							0.2	1.0	0.9	1.6		1.6	1.0	1.3	2.4	2.3	1.6	1.7	2.4	2.6	1.3	1.3
Pagurus spp.	4.8	5.9							15.8	14.3	8.8	12.8		25.6	11.4	22.2	12.0	9.8	7.9	10.9	15.2	4.8	5.0	12.9
Pisaster ochraceus	0.1	-							0.2	0.2	0.1	0.2		-	<.1	0.3	0.3	0.1	0.1	0.1	<.1	-	0.3	0.2
Pseudomelatoma torosa	-	-							0.2	0.1	-	-		-	<.1	<.1	-	-	-	<.1	<.1	+	-	-
Strongylocentrotus purpuratus	0.1	1.4							-	0.2	-	0.2		0.8	1.3	3.0	3.2	8.9	11.5	7.5	2.4	1.7	1.8	3.6
Tectura paleacea	-	-							-	-	-	-		-	-	-	-	-	+	+	+	-	-	-
Tectura scutum	1.4	0.4							3.4	2.6	6.0	1.6		1.8	0.6	0.7	0.5	2.9	1.6	0.8	1.5	0.9	1.9	7.9
Tegula brunnea	8.7	5.3							14.2	23.4	9.1	14.0		5.2	4.5	1.5	4.1	11.8	12.6	12.2	11.1	15.7	7.6	11.4
Tegula funebralis	32.1	52.0							25.0	52.9	128.3	220.2		168.8	136.8	229.9	164.9	27.4	1.8	1.2	3.2	4.3	5.3	1.8
Tetraclita rubescens	9.2	14.4							11.6	3.7	9.6	5.0		3.0	25.2	31.4	30.4	49.9	69.6	14.4	13.7	11.7	6.4	7.4
Only Counted if Greater than 1"																								
Acmaea mitra	0.2	-							0.2	0.3	0.4	-		-	+	-	0.3	<.1	0.4	0.1	<.1	+	+	0.6
Acmaeidae unid.	-	-							+	0.1	+	+		-	+	+	+	+	+	+	+	+	+	+
Aldisa sanguinea	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Alia spp.	-	-							+	+	+	+		-	-	+	+	+	+	+	+	+	+	+
Amphissa spp.	-	-							-	+	-	-		-	-	-	-	-	-	-	-	+	-	-
Barleeia spp.	-	-							-	+	-	-		-	+	-	-	-	-	-	-	-	+	-
Bittium spp.	-	-							+	+	+	-		-	-	+	-	+	+	-	+	-	+	-
Cancer antennarius	-	-							-	-	-	-		-	-	-	-	-	0.1	-	-	<.1	-	-
Chaetopteridae	-	-							-	-	-	-		-	-	-	+	+	-	-	-	-	-	-
Crepidula spp.	-	-							+	+	+	+		+	+	+	+	+	+	+	+	+	-	+
Cucumaria spp.	-	-							-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-							-	+	-	-		-	-	-	-	<.1	-	-	+	<.1	+	0.3
Diodora spp.	-	-							-	-	-	-		-	-	-	-	<.1	-	-	<.1	<.1	-	-
Discurria insessa	-	-							-	-	-	-		-	-	-	-	-	0.3	+	+	+	+	+
Doriopsilla albopunctata	-	-							-	0.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-							-	+	+	+		-	+	-	+	+	+	-	-	+	+	-
Henricia leviuscula	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	3	4	4
Only Counted if Greater than 1" (continued)																								
Heptacarpus spp.	-	-							-	-	-	-		-	-	-	+	0.3	-	-	-	-	-	-
Hermissenda crassicornis	-	-							-	-	-	-		-	+	-	-	-	+	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-							-	-	+	-		-	-	-	+	+	-	+	-	-	+	-
Idotea spp.	-	-							-	-	-	-		-	-	-	-	-	-	<.1	-	-	-	-
Ischnochitonidae	-	-							-	+	+	-		-	-	-	+	<.1	+	+	+	+	-	+
Lacuna spp.	-	-							+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Lepidozona spp.	-	-							-	0.1	-	-		-	-	-	+	-	-	+	-	-	-	-
Lissothuria nutriens	-	-							-	+	+	-		-	-	+	-	+	+	+	<.1	-	+	-
Littorina spp.	-	-							-	-	+	-		-	+	-	-	+	-	-	-	-	-	-
Lottia asmi	-	-							+	+	+	+		+	+	+	+	+	+	-	+	-	+	-
Majidae	-	-							+	-	-	-		-	+	-	-	+	-	-	-	-	-	-
Megatebennus bimaculatus	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	<.1
Mytilus californianus	-	-							-	-	-	-		-	+	-	-	+	-	-	-	-	-	-
Natantia unid.	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-							0.6	0.5	0.1	1.4		-	0.1	0.3	0.4	1.5	0.8	0.7	0.6	0.9	0.3	0.8
Nereididae unid.	-	-							-	-	-	-		-	+	-	-	-	0.2	<.1	<.1	-	<.1	-
Nitidiscala/Opalia spp.	-	-							-	+	+	-		-	-	-	-	+	+	+	-	-	-	-
Octopus spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	<.1	<.1
Ophiactis simplex	-	-							-	-	-	-		-	-	-	-	-	-	-	-	+	-	-
Ophiothrix spp.	-	-							-	-	-	-		-	<.1	-	-	-	-	-	-	-	-	-
Panulirus interruptus (puerulus stage)	-	-							-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Pelecypoda unid. boring	-	-							-	-	-	-		-	+	-	-	-	+	-	-	-	-	-
Petrolisthes spp.	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-							-	-	-	-		-	-	-	-	<.1	-	-	-	+	<.1	-
Pisaster/Henricia (juv.)	-	-							-	-	-	+		-	-	+	+	<.1	+	+	+	<.1	-	-
Polychaeta unid.	-	-							-	0.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-							-	0.6	-	+		0.4	<.1	0.1	0.2	+	0.3	<.1	0.5	0.5	<.1	0.2
Pycnogonida unid.	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	0.1
Pycnopodia helianthoides	-	0.1							-	-	-	-		-	-	-	-	<.1	-	-	<.1	<.1	-	-
Serpulidae unid.	-	-							+	0.1	+	0.2		0.4	0.2	0.3	0.3	0.5	0.3	0.7	0.9	0.4	0.5	0.7
Serpulorbis squamigerus	-	-							-	+	0.1	0.8		-	0.3	0.2	0.4	0.2	0.2	0.4	0.3	0.1	0.4	0.5
Sipuncula unid.	-	-							-	-	-	+		-	+	<.1	<.1	+	+	+	+	+	+	+
Stenoplax spp.	<.1	-							-	-	0.2	0.2		-	0.3	-	<.1	-	<.1	-	-	-	-	-
Tonicella lineata	-	-							-	0.1	-	0.2		-	-	-	-	-	-	-	+	<.1	-	-
Tricolia spp.	-	-							-	+	+	-		-	-	-	-	+	+	-	-	-	-	+
% Coverage																								
Bryozoa, unid. (encrusting)	-	-							+	-	-	+		-	+	-	-	+	+	+	+	+	+	+
Chthamalus fissus	0.9	0.7							+	0.2	0.2	0.7		+	+	+	+	+	+	+	+	+	+	0.2
Eurystomella bilabiata	-	-							-	-	-	-		-	-	-	-	-	+	-	-	+	-	-
Haliclona spp.	-	-							-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-							+	+	+	+		+	+	+	+	0.1	+	+	+	+	0.3	0.6
Pista spp.	-	-							+	0.3	0.2	0.1		+	<.1	0.1	0.3	0.3	0.3	1.0	1.8	0.9	1.1	2.4
Porifera unid. (encrusting)	-	-							-	<.1	+	-		-	+	-	+	-	+	+	+	+	+	+
Salmacina tribranchiata	-	-							-	-	-	-		-	-	-	-	-	<.1	+	-	-	+	+
Spirorbidae	-	-							+	0.1	+	+		+	+	+	<.1	+	+	+	+	+	+	+
tunicates, colonial/social unid.	<.1	-							+	0.1	+	+		+	+	+	+	+	<.1	<.1	+	0.1	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	3	4	4
Counted Regardless of Size																								
Acanthina spp.	0.2	-							0.6	0.7	3.4	1.9		1.4	2.0	2.5	1.7	1.1	0.8	0.8	1.1	1.3	1.5	0.9
Anthopleura elegantissima	133.9	206.5							359.8	223.4	251.2	259.3		265.0	271.4	316.1	322.2	231.1	222.8	151.6	161.9	152.7	155.5	172.7
Anthopleura xanthogrammica	-	-							-	-	-	-		-	-	-	-	-	-	-	-	0.2	-	-
Conus californicus	-	-							-	-	-	-		-	-	-	-	<.1	-	-	-	-	-	-
Epiactis prolifera	0.2	-							-	-	<.1	-		0.2	-	-	-	-	-	-	<.1	-	-	-
Fissurella volcano	-	-							0.4	-	<.1	-		-	-	-	-	-	-	<.1	-	0.1	-	<.1
Haliotis spp.	1.2	1.8							0.4	0.4	0.3	0.4		-	<.1	0.1	-	<.1	-	-	<.1	-	-	-
Hemigrapsus nudus	-	0.1							-	0.4	<.1	-		0.2	-	-	<.1	<.1	<.1	0.1	-	0.1	0.1	-
Leptasterias spp.	<.1	0.1							-	-	-	0.1		-	-	-	<.1	-	-	-	0.1	<.1	-	-
Lottia digitalis	-	-							-	-	<.1	-		-	-	-	-	-	-	0.1	-	-	-	-
Lottia limatula	0.6	0.5							1.8	6.7	4.4	5.0		5.2	4.1	4.2	2.8	4.2	2.8	2.5	4.2	2.8	3.5	3.8
Lottia pelta	0.2	-							-	0.3	0.3	-		0.6	0.3	0.5	<.1	0.3	0.4	0.4	0.5	0.5	1.0	1.2
Macclintockia scabra	12.9	3.9							9.2	45.3	42.6	46.4		75.0	65.5	67.3	32.7	36.7	9.2	5.8	12.2	14.9	11.3	32.8
Mopalia spp.	<.1	-							-	0.2	0.4	0.3		-	0.5	0.2	0.1	<.1	0.2	0.3	0.1	0.2	0.2	0.2
Nucella emarginata	-	-							-	-	-	-		-	-	<.1	-	-	-	-	-	-	<.1	-
Nuttallina californica	-	-							0.4	0.1	<.1	0.2		-	0.4	0.2	-	0.3	-	-	<.1	-	-	0.4
Ocenebra spp.	<.1	-							6.0	0.9	2.5	4.3		1.2	3.6	3.1	2.6	2.5	1.7	1.1	1.4	1.1	0.6	0.4
Pachygrapsus crassipes	0.3	-							0.6	1.5	0.7	1.3		1.4	0.8	2.0	1.1	0.7	0.9	1.0	1.5	1.2	0.9	0.6
Pagurus spp.	33.5	53.5							23.2	23.8	26.7	39.4		32.0	29.4	33.6	34.6	44.9	29.4	41.3	62.1	20.7	19.7	18.8
Pisaster ochraceus	<.1	-							0.2	0.1	<.1	-		-	<.1	<.1	0.1	0.2	0.3	0.4	0.1	-	<.1	<.1
Strongylocentrotus purpuratus	-	0.1							0.2	0.2	0.1	0.1		-	0.1	0.1	0.2	0.2	0.3	0.4	0.3	<.1	0.2	-
Tectura persona	0.2	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	0.6	0.6							0.6	11.1	4.6	1.9		6.6	3.7	3.2	0.6	1.5	1.3	1.9	1.3	1.3	0.7	3.4
Tegula brunnea	0.2	-							-	-	-	-		-	<.1	-	<.1	-	-	-	-	-	-	-
Tegula funebralis	281.2	233.5							260.4	321.5	235.7	269.7		267.6	386.6	310.7	271.2	284.6	261.0	214.5	194.7	249.9	221.3	326.3
Tetraclita rubescens	-	-							-	0.1	-	<.1		-	-	0.3	+	0.1	0.3	0.9	0.1	-	<.1	<.1
Only Counted if Greater than 1"																								
Acmaea mitra	-	-							-	-	-	+		-	-	+	-	-	-	-	-	-	-	-
Acmaeidae unid.	0.3	-							+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-							-	-	-	-		-	<.1	-	-	<.1	-	-	-	-	-	-
Alia spp.	-	-							-	-	-	-		-	-	-	-	-	+	+	-	-	+	-
Amphissa spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	-	-	-	-
Bittium spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	+	-	-	-
Cirratulidae/Terebellidae unid.	-	-							-	-	-	+		-	+	+	-	<.1	-	-	+	0.1	-	+
Crepidula spp.	-	-							+	+	+	+		-	+	+	+	+	+	+	+	+	-	+
Cyanoplax spp.	-	0.1							0.6	3.0	0.1	0.7		2.0	3.1	1.8	1.8	0.9	1.0	1.1	0.8	1.2	0.7	0.6
Discurria insessa	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-							+	+	+	+		-	+	+	+	-	+	-	-	+	-	-
Hemigrapsus oregonensis	-	-							-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Heptacarpus spp.	-	-							-	-	-	+		-	+	+	+	+	-	+	+	-	-	-
Hipponix spp.	-	-							-	-	-	-		-	0.1	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-							-	-	-	-		-	-	+	-	-	-	+	-	-	-	-
Idotea spp.	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-							-	+	<.1	+		-	+	+	+	+	+	+	+	-	-	-
Lacuna spp.	-	-							-	+	+	+		-	+	+	-	-	+	+	+	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	3	4	4
Only Counted if Greater than 1" (continued)																								
Lepidozona spp.	-	-							-	-	-	-		-	-	<.1	-	-	-	-	-	-	-	-
Littorina spp.	-	-							+	+	+	+		-	+	+	+	+	+	+	+	0.4	+	
Lophopanopeus spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Lottia asmi	-	-							+	+	+	+		+	+	+	<.1	+	+	+	+	+	+	+
Lottia ochracea	-	-							-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Majidae	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-							0.4	+	<.1	0.2		0.8	0.2	<.1	<.1	0.1	<.1	0.2	<.1	0.3	0.1	+
Nereididae unid.	-	-							-	-	-	-		-	<.1	<.1	-	<.1	-	-	<.1	-	-	-
Nitidiscala/Opalia spp.	-	-							+	-	+	+		-	+	+	+	+	-	-	-	-	+	-
Octopus spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	-	-	-	-
Pelecypoda unid.	-	-							-	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Petrolisthes spp.	-	-							-	+	-	-		-	-	-	-	+	-	-	-	-	-	-
Polychaeta unid.	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Polynoidae	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-							-	-	<.1	-		-	-	-	+	-	-	-	-	<.1	-	-
Serpulidae unid.	-	-							-	+	-	-		-	+	+	<.1	<.1	+	+	<.1	-	-	+
Sipuncula unid.	-	-							-	0.2	-	+		-	+	+	-	+	+	+	+	+	+	+
Tonicella lineata	-	-							-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Xanthidae unid.	-	-							-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	1.0	<.1							0.1	<.1	0.4	0.8		1.5	2.0	1.4	1.4	0.4	0.2	0.6	0.4	0.4	+	<.1
Haliclona spp.	-	-							-	+	-	-		+	-	+	-	-	-	-	+	-	-	-
Phragmatopoma californica	-	0.1							0.3	<.1	<.1	0.1		2.4	2.0	1.2	2.0	0.9	0.3	0.1	+	0.3	<.1	0.6
Pista spp.	-	-							-	-	-	-		-	+	+	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	-							-	-	-	+		+	-	-	-	-	-	-	+	-	-	-
Spirorbidae	-	-							+	+	+	+		-	+	-	+	+	+	+	+	+	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 2 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	4	4	4
Counted Regardless of Size																								
Acanthina spp.	-	-							-	0.1	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Anthopleura elegantissima	29.4	45.9							23.6	20.0	14.9	26.4		27.6	40.3	44.7	46.5	31.0	26.7	21.0	22.2	12.1	10.1	16.9
Balanus spp.	<.1	-							-	2.0	0.4	-		0.8	0.5	-	0.1	-	-	-	-	-	-	-
Calliostoma ligatum	-	-							-	-	-	-		-	<.1	-	-	-	-	-	<.1	0.1	-	-
Epiactis prolifera	0.2	0.4							-	0.5	0.3	-		0.8	0.4	0.5	0.4	1.1	1.3	0.8	0.4	0.7	0.2	0.8
Fissurella volcano	0.2	0.4							4.8	1.5	3.5	1.8		3.8	2.5	1.8	2.9	2.7	2.2	1.5	1.1	5.1	3.8	2.3
Fusinus luteopictus	-	-							-	-	0.5	-		0.2	0.1	-	+	-	-	-	<.1	0.1	-	<.1
Haliotis spp.	4.6	8.6							1.4	0.9	1.3	1.6		0.6	0.7	0.2	0.3	0.2	0.3	-	-	-	<.1	-
Hemigrapsus nudus	0.1	-							-	-	0.4	0.2		-	-	-	<.1	-	-	-	-	-	-	-
Leptasterias spp.	<.1	0.3							1.2	2.0	2.4	2.8		0.4	1.2	0.9	0.6	1.1	1.2	1.1	1.3	0.9	0.1	0.6
Lottia digitalis	-	-							-	0.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Lottia limatula	-	-							1.6	1.3	2.3	0.4		1.2	2.8	1.9	2.1	1.5	1.5	1.0	1.0	1.8	3.1	7.2
Lottia pelta	-	-							8.2	0.3	1.0	0.8		0.2	0.2	0.7	0.7	1.1	0.9	0.5	0.7	0.9	4.9	6.1
Macclintockia scabra	0.3	1.2							15.0	9.1	26.5	13.2		5.8	6.7	3.9	1.8	4.7	11.1	4.3	2.5	2.6	19.8	37.8
Mitra idae	-	-							-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Mopalia spp.	0.1	-							-	0.1	0.3	-		0.2	0.2	<.1	-	0.1	-	<.1	0.1	0.2	-	0.1
Nuttallina californica	1.1	9.3							28.2	10.4	15.9	10.0		3.2	10.1	13.6	12.9	6.1	6.1	5.9	5.5	12.4	5.8	9.7
Ocenebra spp.	0.1	-							0.4	0.6	0.2	0.8		2.0	0.9	1.0	1.1	0.5	1.1	0.4	0.4	1.1	0.2	0.6
Pachygrapsus crassipes	0.2	0.2							0.4	0.5	0.7	0.8		1.2	1.6	1.3	1.1	2.0	1.5	1.8	1.4	1.4	1.5	0.6
Pagurus spp.	7.8	16.3							18.2	17.1	16.4	18.4		15.0	19.9	17.8	21.4	13.8	14.9	25.5	24.6	16.7	7.1	8.5
Pisaster ochraceus	-	0.2							0.2	0.2	0.3	0.4		0.2	0.3	0.2	0.5	0.5	0.2	0.2	0.3	0.4	0.3	<.1
Pseudomelatoma torosa	-	-							-	-	-	-		-	<.1	<.1	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	1.2	3.8							1.4	1.6	1.7	3.4		8.6	13.0	15.6	16.4	23.8	33.7	37.9	23.5	22.4	27.0	22.9
Tectura paleacea	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Tectura persona	0.2	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	0.1
Tectura scutum	0.4	0.3							2.0	3.8	2.6	2.4		4.4	2.4	1.1	0.7	1.2	2.0	0.9	1.0	0.3	0.4	1.0
Tegula brunnea	0.9	2.0							6.6	5.3	5.0	0.4		2.2	5.6	4.1	8.8	10.0	9.7	5.2	3.5	6.7	6.8	2.3
Tegula funebralis	41.8	95.0							56.2	70.1	141.3	77.6		273.8	162.8	187.9	71.1	88.4	36.6	38.9	73.8	62.4	46.0	54.0
Tetraclita rubescens	9.2	16.3							9.8	14.5	7.1	14.6		1.6	20.3	14.2	16.4	21.5	51.9	4.3	9.4	5.0	3.0	7.3
Only Counted if Greater than 1*																								
Acmaea mitra	<.1	-							+	+	0.3	-		0.4	0.2	+	0.1	0.1	0.2	0.1	0.2	0.2	<.1	0.1
Acmaeidae unid.	-	-							+	0.1	+	+		+	+	+	+	+	+	+	+	+	+	+
Aegires albopunctatus	-	-							-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Aeolidia papillosa	-	-							-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Alia spp.	-	-							-	+	+	+		-	+	+	+	+	-	+	+	+	-	-
Amphissa spp.	-	-							-	+	-	-		+	-	-	+	+	-	-	+	+	-	-
Bittium spp.	-	-							-	-	+	-		-	-	-	+	+	-	-	-	-	-	+
Cadlina spp.	-	-							-	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Cancer antennarius	-	0.1							-	+	-	-		-	-	-	-	-	-	-	+	-	-	<.1
Cirratulidae/Terebellidae unid.	-	-							-	+	-	-		-	+	+	-	+	-	-	<.1	+	-	-
Crepidula spp.	+	-							+	+	+	+		+	+	+	+	+	-	+	+	+	-	-
Cryptochiton stelleri	-	-							-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Cyanoplax spp.	-	-							-	0.5	-	-		-	<.1	<.1	<.1	-	<.1	0.1	<.1	-	+	+
Diaulula sandiegensis	-	-							-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Diopatra ornata	-	-							-	-	-	-		-	-	0.1	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1" (continued)																								
Discurria insessa	-	-							+	+	-	-		-	-	-	-	+	+	-	+	+	+	+
Doriopsilla albopunctata	-	-							-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Erato spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	+	-	-	-
Flabellina trilineata	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	<.1
Grapsidae (juv.)	-	-							+	+	+	+		-	+	+	+	+	-	-	+	-	-	-
Halcampa decemtentaculata	-	-							0.2	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Henricia leviuscula	-	-							-	-	-	+		-	<.1	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-							-	+	+	-		-	-	+	-	-	+	-	+	-	-	+
Hermissenda crassicornis	-	-							-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-							+	+	-	-		-	+	+	+	+	-	-	+	+	-	+
Idotea spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	-	-	-	-
Ischnochitonidae	-	-							+	+	+	+		-	+	-	+	-	+	+	+	+	+	+
Isopoda unid.	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	-							+	+	+	+		-	+	+	+	+	+	+	+	+	+	+
Lepidozona spp.	-	-							-	-	-	-		+	-	-	-	-	-	-	-	-	-	-
Lissothuria nutriens	-	-							-	-	-	-		+	+	+	<.1	+	+	+	+	+	-	+
Littorina spp.	-	-							-	-	-	-		-	+	+	+	+	-	+	0.1	-	+	-
Lophopanopeus spp.	-	-							-	0.1	-	-		-	-	-	-	-	-	-	+	-	-	-
Lottia asmi	-	-							+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Lottia gigantea	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	+	-
Lottia ochracea	<.1	-							-	+	-	-		-	+	+	-	-	-	-	-	-	-	-
Macoma spp.	-	-							-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Majidae	-	-							-	+	-	+		-	-	+	+	-	-	-	-	-	<.1	-
Megatebennus bimaculatus	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Musculus pygmaeus	-	-							-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-							-	-	-	-		-	-	-	+	-	-	+	-	-	-	-
Mytilus californianus	0.1	-							+	+	0.4	-		-	-	-	+	+	+	+	+	+	+	+
Natantia unid.	-	-							-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Nemertea unid.	-	0.1							2.0	0.9	0.2	0.6		-	0.3	0.1	0.2	0.4	0.5	0.8	1.2	0.5	<.1	1.1
Nereididae unid.	-	-							-	-	-	-		-	0.2	0.1	<.1	<.1	0.2	<.1	0.1	<.1	+	-
Nitidiscala/Opalia spp.	-	-							-	+	+	-		-	-	+	<.1	+	-	+	-	+	-	-
Ophiothrix spp.	-	-							-	-	-	-		-	<.1	-	-	<.1	-	<.1	-	-	-	-
Ophiuroidea unid.	-	-							-	-	-	+		0.2	-	-	-	-	-	-	-	-	-	-
Orthasterias koehleri	<.1	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-							-	-	-	-		-	-	-	-	+	+	+	+	+	-	+
Petrolisthes spp.	-	-							-	-	-	-		-	<.1	-	-	<.1	-	-	-	-	-	-
Phidiana hiltoni	-	-							-	-	-	-		-	-	-	<.1	-	-	-	-	-	-	-
Pisaster giganteus	-	-							-	-	-	-		-	-	-	-	-	-	-	<.1	-	-	-
Pisaster/Henricia (juv.)	-	-							-	-	-	-		-	-	+	+	+	+	-	+	-	-	+
Platyhelminthes unid.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	<.1	-	-
Pollicipes polymerus	-	-							+	+	+	-		-	-	-	-	-	+	+	-	-	-	-
Polychaeta unid.	-	-							-	-	-	+		-	-	-	-	-	-	-	-	-	-	-
Polynoidae	-	-							-	-	+	-		-	-	-	-	<.1	-	-	-	-	-	-
Pugettia spp.	-	-							0.2	+	+	+		0.2	0.2	<.1	+	0.2	<.1	0.1	0.3	0.6	<.1	<.1
Pycnogonida unid.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Sabellidae	-	-							-	-	-	+		-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	2	1	ns	1	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1" (continued)																								
Serpulidae unid.	-	-							+	+	0.2	0.2		0.4	0.6	0.7	0.1	0.4	0.7	0.3	0.2	0.7	0.5	1.1
Serpulorbis squamigerus	-	-							-	0.4	2.2	-		1.6	1.9	1.7	1.3	2.8	2.3	3.5	1.0	2.7	1.0	1.5
Sipuncula unid.	-	-							-	0.1	0.1	0.2		+	<.1	+	0.1	+	<.1	+	+	+	+	+
Stenoplax spp.	-	-							-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Tonicella lineata	-	-							-	0.2	0.3	0.2		0.2	0.1	<.1	<.1	-	-	-	<.1	0.4	0.1	<.1
Tricolia spp.	-	-							-	-	-	-		+	-	-	-	-	-	-	-	-	+	-
Triopha catalinae	<.1	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Triopha maculata	-	-							-	-	0.1	-		-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-							+	+	+	-		+	+	+	-	+	+	+	+	+	-	+
Chthamalus fissus	+	+							+	0.3	1.0	0.7		0.1	<.1	+	+	<.1	+	+	+	+	+	+
Dodecaceria fewkesi	-	-							+	-	+	-		+	-	+	+	+	+	+	+	-	-	+
Eurystomella bilabiata	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Haliclona spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	-	-	-	-
Phragmatopoma californica	-	-							+	+	+	+		+	+	+	<.1	+	+	+	+	+	+	0.4
Pista spp.	-	-							+	+	<.1	+		+	+	<.1	0.1	<.1	+	+	<.1	<.1	+	0.4
Porifera unid. (encrusting)	-	-							+	+	+	+		+	+	+	+	+	0.1	+	+	+	+	+
Salmacina tribranchiata	-	-							+	-	+	+		-	-	-	+	+	-	+	+	+	-	+
Spirorbidae	-	-							+	+	+	+		+	+	+	<.1	+	+	+	+	+	+	+
tunicates, colonial/social unid.	-	-							+	+	<.1	-		+	+	+	+	+	<.1	+	+	0.2	<.1	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 2 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	4	4	4
Counted Regardless of Size																								
Acanthina spp.	0.5	0.5							0.8	1.6	3.3	1.5		1.4	1.2	1.1	1.5	0.9	1.4	1.4	1	1.1	0.9	0.8
Anthopleura elegantissima	105	142							125	113	98.5	144		145	106	129	150	103	58.2	53.9	60.3	60.7	49.7	58.5
Balanus spp.	-	2.3							-	0.9	0.3	-		0.2	0.1	0.1	<.1	-	0.1	0.1	-	-	-	-
Calliostoma ligatum	-	-							-	-	-	-		-	-	-	-	<.1	-	-	-	+	-	-
Epiactis prolifera	-	-							-	-	-	-		-	-	-	-	-	0.1	-	-	+	-	-
Fissurella volcano	-	-							-	-	-	-		-	<.1	-	-	0.1	-	<.1	-	-	-	-
Haliotis spp.	0.6	1.2							3.2	2.3	2	2.8		1	2.1	1.5	0.5	<.1	<.1	0.3	0.1	0.3	0.2	-
Hemigrapsus nudus	-	-							-	0.1	-	-		0.2	-	<.1	-	<.1	-	-	<.1	<.1	-	-
Leptasterias spp.	-	-							-	-	-	-		-	<.1	-	-	-	-	-	<.1	<.1	-	-
Lottia digitalis	0.4	0.9							0.6	0.1	0.1	1.3		1.8	1.7	1.1	0.7	0.9	1.2	1.3	0.4	1.1	0.3	-
Lottia limatula	0.7	0.7							4.6	3.4	6.7	4.7		0.6	6.2	3.6	3.1	4.4	4.2	2.1	2.7	4.8	4	3.6
Lottia pelta	0.4	0.4							0.8	1.5	0.8	1.5		0.2	0.5	0.5	1.5	2	1.7	1.6	1.1	1.4	0.7	3.3
Macclintockia scabra	11.4	13.7							12.8	56.6	68.5	45.5		145	57.7	52.7	26.8	35.4	14.2	12.5	32.1	25.5	19.3	21.6
Mopalia spp.	-	-							-	0.1	0.3	0.3		0.2	0.4	0.1	-	<.1	-	-	<.1	0.2	<.1	<.1
Nucella emarginata	<.1	0.3							-	0.1	0.5	0.2		-	<.1	<.1	<.1	0.1	<.1	-	<.1	0.1	-	-
Nuttallina californica	-	-							0.6	0.2	0.5	0.7		0.2	0.3	0.3	0.2	0.3	0.3	<.1	-	-	-	-
Ocenebra spp.	-	-							1	2.2	1.9	2.8		0.6	0.8	1	1.4	0.9	0.7	1	1.1	1.1	0.2	0.2
Pachygrapsus crassipes	0.1	0.4							1.6	1.3	0.9	0.6		-	2.1	1.8	0.8	1.2	1.6	1.6	1.3	1.6	1	0.5
Pagurus spp.	8	20.8							3.4	27.6	20.7	17.3		10.6	6.8	6.9	8.8	11.9	11.7	7.3	9.8	10.3	5.9	5.2
Pisaster ochraceus	0.1	-							-	-	-	-		-	0.1	0.1	-	-	-	-	<.1	<.1	-	-
Strongylocentrotus purpuratus	-	0.2							-	-	-	-		-	-	-	-	-	0.1	-	<.1	<.1	-	-
Tectura persona	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	<.1	-
Tectura scutum	1.3	2.7							1.4	8.2	7.8	5.3		8.2	3.3	2.3	0.6	2.9	3.1	2	3	3.2	0.6	1
Tegula brunnea	-	0.1							-	-	-	<.1		-	-	-	<.1	-	-	-	-	-	-	-
Tegula funebralis	155	137							146	191	154	179		240	194	142	153	152	122	161	129	178	143	130
Tetraclita rubescens	-	-							-	-	1.1	+		-	0.2	<.1	0.3	-	-	-	-	-	-	-
Only Counted if Greater than 1"																								
Acmaea mitra	-	-							-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Acmaeidae unid.	0.3	-							+	+	+	+		+	+	<.1	+	+	+	+	+	+	+	+
Alloioplana californica	-	-							-	-	-	-		-	-	-	-	-	-	-	-	+	-	-
Amphissa spp.	-	-							-	-	-	-		-	-	-	-	-	-	+	<.1	-	-	-
Cirratulidae/Terebellidae unid.	-	-							-	-	-	0.2		-	+	0.3	-	+	-	+	+	+	+	+
Crepidula spp.	-	-							+	+	+	-		-	+	-	+	+	+	-	-	+	+	-
Cyanoplax spp.	-	-							0.4	2.4	1.1	2.2		0.8	3.7	2.3	1.2	1.1	1.5	1.1	0.8	0.4	1.7	0.3
Grapsidae (juv.)	-	-							+	+	+	+		-	+	+	+	+	+	+	-	-	-	-
Heptacarpus spp.	-	-							-	+	-	-		-	+	-	<.1	-	-	-	-	-	-	-
Idotea spp.	-	-							-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	0.5							+	+	+	+		+	+	-	+	+	+	+	+	+	+	-
Isopoda unid.	-	-							-	+	-	-		-	-	+	-	-	-	-	-	-	-	-
Lacuna spp.	-	-							-	+	+	+		-	-	+	-	-	-	+	+	-	-	-
Littorina spp.	-	-							+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Lottia asmi	-	-							+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Lottia gigantea	-	-							-	-	-	<.1		-	0.2	-	<.1	-	-	-	-	-	-	<.1
Lottia ochracea	-	-							-	-	-	-		-	-	+	+	-	-	-	-	-	-	-
Majidae	-	-							-	-	-	+		-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	ns	ns	1	2	3	3	ns	1	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1" (continued)																								
Modiolus spp.	-	-							-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Mytilidae	-	-							-	-	-	+		+	-	-	-	-	+	-	-	-	-	-
Mytilus californianus	-	-							-	+	-	-		-	<.1	-	-	+	-	-	-	-	-	-
Natantia unid.	-	-							-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	<.1	-							-	0.9	<.1	+		-	0.2	0.1	-	+	<.1	0.2	-	0.1	-	<.1
Nereididae unid.	-	-							-	0.1	-	-		-	<.1	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-							-	-	+	-		-	-	+	+	+	-	-	+	+	+	+
Pisaster/Henricia (juv.)	-	-							-	-	-	-		-	-	-	<.1	-	-	-	-	-	-	-
Pollicipes polymerus	0.1	-							0.2	0.2	0.5	0.3		1.4	4.9	2.2	0.8	2.3	1.1	1	0.2	1.5	0.5	0.7
Polychaeta unid.	-	-							-	0.1	-	+		-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-							-	-	-	<.1		-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-							-	-	-	-		-	-	-	-	-	-	+	-	-	+	-
Sipuncula unid.	-	-							-	0.2	-	-		-	+	-	+	+	+	+	-	+	+	+
Spionidae unid.	-	-							-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Tonicella lineata	-	0.1							-	-	-	-		0.2	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-							-	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Chthamalus fissus	0.8	0.5							+	0.3	0.5	0.7		+	+	+	<.1	+	+	+	+	+	+	+
Phragmatopoma californica	0.3	1.5							0.1	<.1	0.3	0.5		1	1.1	0.3	0.1	<.1	0.1	<.1	<.1	0.2	<.1	+
Spirorbidae	-	-							-	-	-	+		-	-	+	-	-	-	+	0.1	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 3 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
Counted Regardless of Size																								
Acanthina spp.	-	-	<.1	-	<.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Anthopleura elegantissima	4.8	7.2	6.8	7.3	7.5	7.8	8.3	7.1	8.7	8.5	9.5	9.8	11.8	7.5	7.7	7.2	5.8	8.0	7.5	9.3	8.2	7.9	6.4	6.6
Anthopleura xanthogrammica	-	-	-	-	-	<.1	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	<.1	-
Balanus spp.	-	-	1.6	0.1	0.1	-	<.1	<.1	-	0.4	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	<.1	-	-	<.1	<.1	-	<.1	0.1	-	<.1	<.1	-	0.1	-	-	-	-	-	+	-	-
Conus californicus	-	-	<.1	0.2	0.1	-	<.1	0.1	<.1	<.1	<.1	-	<.1	-	<.1	<.1	<.1	<.1	-	<.1	-	0.2	-	-
Epiactis prolifera	0.1	0.2	1.4	1.3	0.8	0.8	0.4	0.6	0.1	0.3	0.5	0.3	0.2	0.3	<.1	0.4	0.6	0.1	0.6	0.3	0.3	0.3	0.3	<.1
Fissurella volcano	0.4	0.4	1.8	2.8	1.6	1.8	2.3	2.2	3.4	4.0	3.6	2.8	1.6	1.3	2.0	3.3	3.5	5.6	3.9	2.2	1.5	2.7	4.6	3.7
Fusinus luteopictus	-	-	-	-	-	<.1	-	-	+	-	0.1	0.1	<.1	<.1	-	-	0.1	-	-	-	-	-	-	-
Haliotis spp.	2.1	4.0	3.7	3.6	3.5	2.1	1.5	1.6	1.1	1.1	1.7	1.5	2.1	2.0	1.6	1.1	0.6	0.8	0.9	0.5	0.3	0.1	-	-
Hemigrapsus nudus	-	<.1	<.1	-	-	<.1	-	<.1	<.1	-	<.1	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.1	<.1	0.6	0.9	0.7	0.7	0.5	0.4	0.2	0.2	0.6	1.3	0.5	0.4	0.9	0.3	0.3	0.3	0.9	0.7	0.5	0.4	0.3	0.2
Lottia digitalis	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia limatula	-	<.1	0.3	0.1	0.1	0.3	0.5	0.3	0.4	0.5	1.2	0.2	0.3	0.4	0.5	0.5	0.9	2.2	1.7	0.6	0.4	0.3	2.1	5.0
Lottia pelta	<.1	-	1.0	0.6	0.6	0.9	0.5	0.3	1.8	2.1	1.3	0.4	0.5	0.2	0.2	0.4	0.2	3.8	2.7	0.5	0.2	0.4	7.1	9.5
Macclintockia scabra	0.1	0.2	0.6	<.1	0.6	0.6	1.5	0.5	2.6	8.1	7.2	1.9	4.4	0.5	0.5	0.2	0.3	4.5	2.8	4.2	0.4	0.2	3.7	13.8
Mitra idae	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	<.1	-	-	-	0.1	-
Mopalia spp.	<.1	0.1	0.1	0.2	<.1	0.2	0.1	0.2	0.2	0.2	0.2	<.1	<.1	0.1	-	-	-	-	0.2	0.1	-	0.2	-	0.2
Nuttallina californica	-	0.2	1.5	1.6	1.1	1.1	0.8	1.0	0.5	0.9	0.9	0.8	0.9	0.4	0.8	0.4	0.5	0.5	0.5	0.6	0.3	1.0	<.1	0.9
Ocenebra spp.	-	-	1.0	0.2	0.6	0.4	0.2	0.4	0.9	0.6	1.5	1.8	0.6	0.6	0.9	1.1	0.6	0.4	0.9	0.6	0.5	0.6	0.1	<.1
Pachygrapsus crassipes	0.2	<.1	0.1	0.2	0.2	0.2	<.1	0.2	0.4	0.2	0.6	0.5	0.2	1.0	0.9	1.1	1.0	1.2	1.8	1.3	0.7	0.7	0.8	0.2
Pagurus spp.	5.7	9.2	10.4	12.7	21.6	23.5	17.4	17.4	19.1	15.9	15.6	13.5	11.0	17.9	18.7	18.6	13.2	9.6	16.8	22.9	19.9	22.8	8.8	16.5
Pisaster ochraceus	<.1	<.1	<.1	0.3	<.1	0.1	0.1	<.1	<.1	0.1	0.1	<.1	0.7	0.6	-	0.3	0.2	0.1	0.3	0.1	0.2	0.1	0.5	0.3
Pseudomelatoma torosa	-	-	-	-	-	<.1	-	-	<.1	0.1	<.1	0.1	0.1	<.1	0.2	-	-	-	<.1	<.1	-	-	-	-
Strongylocentrotus purpuratus	-	0.3	<.1	0.2	0.4	1.2	0.5	-	-	<.1	0.5	2.2	2.0	4.9	5.3	10.6	20.5	46.0	74.5	73.1	33.5	30.5	10.1	38.1
Tectura scutum	0.4	1.0	1.2	1.0	1.1	1.2	1.3	1.1	2.2	4.1	3.2	0.6	1.2	2.0	0.9	0.1	0.4	2.4	0.5	2.0	0.9	0.7	1.9	2.7
Tegula brunnea	9.3	5.2	9.7	19.1	21.6	20.7	13.7	20.2	11.4	11.2	7.9	8.4	1.7	7.7	12.7	10.0	16.2	19.9	13.1	16.5	10.7	10.8	8.7	4.1
Tegula funebralis	52.6	44.4	43.2	67.0	81.0	50.0	36.1	36.2	32.7	66.5	156.0	134.5	184.6	152.6	192.9	136.0	53.4	11.7	14.6	29.0	26.6	20.5	8.6	22.6
Tetraclita rubescens	0.5	3.6	16.6	0.3	5.1	6.0	6.3	4.0	1.8	10.2	3.0	1.3	3.1	-	24.6	33.7	26.7	43.2	73.5	40.9	8.2	6.8	2.9	4.8
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	0.2	<.1	+	0.2	<.1	<.1	0.1	0.2	<.1	0.2	0.4	0.1	<.1	<.1	0.2	0.4	0.3	0.3	0.1	0.1	<.1	0.2
Acmaeidae unid.	<.1	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Alia spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amphissa spp.	-	-	+	+	+	-	+	-	-	-	+	+	-	<.1	-	-	-	-	-	+	-	-	+	-
Asterina miniata	-	-	<.1	<.1	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-
Balanophyllia elegans	-	-	+	0.2	+	+	-	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	-	-	-	-	-	-	-
Cancer antennarius	-	<.1	<.1	-	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	<.1	-	-	<.1	<.1	-
Cancer productus	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	+	-	+	+	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	<.1	-	-	+	-	+	<.1	+	+	-	-	-	-	-	-	-	+	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	+	-	-	-	-	-	-
Clavelina huntsmani	-	-	<.1	+	+	+	+	<.1	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1" (continued)																								
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Cyanoplax spp.	-	-	-	+	<.1	-	-	-	-	-	-	+	0.2	-	-	-	-	<.1	-	-	-	-	<.1	+
Diaulula sandiegensis	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Diodora spp.	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	+	+	-	+	+
Doriopsilla albopunctata	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	+	<.1	+	+	+	-	+	+	+	+	-	-	+	+	-	-	+
Halcampa decemtentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Henricia leviuscula	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	-	-	-	-	+	-	-	+	-	-	+	-	-	+	+	-	+	-	-	+	-	-
Hermissenda crassicornis	-	-	-	<.1	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Homalopoma luridum/Lirularia succincta	-	-	+	+	+	+	-	+	+	+	+	+	-	-	+	+	-	+	+	+	-	+	-	+
Hopkinsia rosacea	-	-	+	-	+	-	+	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Idotea spp.	-	-	<.1	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Ischnochitonidae	-	-	<.1	<.1	+	+	0.1	+	+	+	<.1	<.1	+	-	+	+	+	-	+	+	+	+	-	-
Lacuna spp.	-	-	+	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lepidozona spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	+	<.1	-	-	-	-	<.1	-	<.1	-
Lissothuria nutriens	-	-	+	+	-	+	-	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+
Littorina spp.	-	-	+	-	-	-	-	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	-	+	-	-	-	-	+	-	+	-	-	-	<.1	-	-	-	-	-	-	+	-	-
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-
Lottia ochracea	-	-	+	-	-	-	-	-	+	+	-	-	0.2	-	+	+	+	-	+	+	-	-	<.1	+
Majidae	-	-	+	+	+	+	+	+	-	+	+	-	0.5	+	+	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus californianus	-	-	-	<.1	+	-	+	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-
Natantia unid.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	<.1	0.2	0.4	0.6	0.6	0.8	0.6	0.6	0.3	0.4	0.7	0.7	0.3	0.3	0.9	0.3	1.0	0.6	0.6	0.9	0.6	0.2	0.4
Nereididae unid.	-	-	<.1	<.1	-	-	<.1	+	-	<.1	0.1	-	<.1	<.1	0.1	-	0.1	<.1	0.1	+	<.1	0.3	-	0.1
Nitidiscala/Opalia spp.	-	-	-	+	+	+	-	-	-	-	+	-	-	+	+	-	-	-	+	-	+	-	+	+
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	+	-	-	-	-	-
Onchidella borealis	-	-	-	+	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiothrix spp.	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiuroidea unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	+	-	+	-	-	-	-	+	-	-	-	-	+	-	+	+	-	-	+	-	-
Petrolisthes spp.	<.1	<.1	0.2	<.1	<.1	-	0.2	-	<.1	<.1	-	+	0.1	-	0.1	-	-	-	-	-	+	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Pisaster/Henricia (juv.)	-	-	-	+	+	+	+	-	+	+	+	<.1	-	-	-	+	+	<.1	-	+	+	+	-	-
Platyhelminthes unid.	-	-	-	-	-	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta unid.	-	-	-	+	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Polyplacophora unid. a	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudochama spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	<.1	0.4	0.6	0.3	0.2	0.7	0.4	0.2	0.1	0.2	0.2	0.2	-	+	0.1	<.1	0.3	0.5	0.5	0.5	0.5	0.3	+
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-
Pycnopodia helianthoides	-	<.1	-	-	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1* (continued)																								
Rostanga pulchra	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	0.2	0.2	0.2	0.1	0.1	0.2	<.1	0.4	0.2	0.4	0.5	0.6	0.4	0.9	0.5	0.8	1.1	0.7	0.3	0.5	0.2	0.4
Serpulorbis squamigerus	0.4	0.1	0.2	0.4	0.5	0.8	0.2	0.6	0.6	1.5	2.7	1.7	3.8	2.6	2.8	3.4	2.8	3.9	3.9	2.9	1.9	3.5	0.7	1.4
Sipuncula unid.	-	-	-	+	-	+	<.1	+	+	+	+	0.1	+	+	+	+	+	+	+	+	+	+	<.1	+
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Tonicella lineata	-	-	<.1	0.2	<.1	-	+	0.1	<.1	<.1	0.2	0.4	0.1	0.4	<.1	-	<.1	-	+	<.1	-	0.1	<.1	-
Tricolia spp.	-	-	-	+	-	+	+	+	+	-	<.1	-	+	-	-	+	-	+	+	+	-	+	-	+
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-
% Coverage																								
Abiet./Sertularella/Sertularia spp..	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	-	-	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+
Bryozoa, unid. (erect)	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (foliose)	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	+	+	+	+	+	+	+	+	+	0.5	0.4	0.2	+	+	+	+	+	+	+	+	+	+	+	0.1
Dendropoma spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dodecaceria fewkesi	-	-	-	+	-	+	-	-	-	<.1	<.1	+	-	-	+	+	+	<.1	-	+	-	-	-	-
Eurystomella bilabiata	-	-	-	+	+	+	-	+	-	+	+	+	-	+	-	-	-	+	-	-	-	-	-	-
Haliclona spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	0.1	<.1	<.1	0.1	+	<.1	<.1	<.1	0.1	<.1	<.1	<.1	<.1	0.1	+	<.1	+	+	+	+	+	0.2	1.7
Pista spp.	-	0.1	0.3	0.8	0.2	0.6	0.2	0.5	0.2	0.2	0.2	0.3	0.1	+	<.1	0.8	0.4	1.3	1.2	1.7	0.9	1.9	0.9	1.4
Porifera unid. (encrusting)	-	-	+	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	<.1	+	+
Salmacina tribranchiata	-	-	+	+	+	+	+	-	+	+	+	-	-	-	-	-	-	-	+	-	-	-	-	-
Spirorbidae	-	-	-	+	<.1	+	+	+	+	<.1	+	<.1	+	+	+	+	+	+	+	+	+	+	<.1	+	0.2
tunicates, colonial/social unid.	-	<.1	0.3	<.1	0.3	0.2	0.2	<.1	+	<.1	+	+	-	+	+	+	+	+	+	+	+	+	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 3 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
Counted Regardless of Size																								
Acanthina spp.	0.2	0.1	0.8	0.6	0.3	0.4	0.1	0.5	0.7	1.0	1.1	0.5	0.2	0.7	0.5	0.2	0.3	0.4	0.4	0.4	<.1	0.3	0.3	0.2
Anthopleura elegantissima	18.1	15.7	13.5	16.3	26.1	27.5	21.0	22.2	18.7	19.0	19.3	24.6	21.1	25.8	28.9	25.3	24.5	18.7	14.2	12.9	10.2	10.5	5.1	7.0
Anthopleura xanthogrammica	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balanus spp.	0.2	-	0.6	-	<.1	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	-	-	<.1	-	0.1	<.1	<.1	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	-	-	-	-	-
Fissurella volcano	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	0.1	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Haliotis spp.	-	<.1	0.1	<.1	<.1	0.1	0.2	0.3	0.2	<.1	<.1	0.1	0.2	0.5	0.2	<.1	-	-	-	-	-	-	<.1	-
Hemigrapsus nudus	-	<.1	0.1	0.1	-	<.1	-	0.1	-	<.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	<.1	-	+	0.2	0.2	0.1	0.1	0.2	<.1	-	<.1	0.1	<.1	<.1	<.1	-	<.1	0.1	<.1	<.1	0.2	0.1	-	-
Lottia digitalis	-	<.1	0.2	<.1	0.3	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Lottia limatula	0.1	0.1	0.4	0.7	0.7	0.7	0.4	0.1	0.2	1.7	1.3	1.9	0.9	1.5	1.9	1.4	1.4	2.0	1.3	0.6	1.8	1.6	6.0	4.6
Lottia pelta	0.1	-	0.4	0.2	0.3	0.5	0.4	0.2	0.3	0.4	0.7	0.2	0.5	0.3	0.3	0.5	0.5	0.8	0.9	1.3	0.4	0.5	2.1	4.2
Macclintockia scabra	7.3	5.1	7.7	5.8	18.6	19.1	25.6	7.2	11.8	12.8	21.4	15.9	15.5	11.0	14.0	13.3	7.8	4.6	3.5	3.7	4.6	6.3	8.8	21.0
Mopalia spp.	0.1	-	0.2	0.4	0.2	<.1	<.1	0.2	<.1	<.1	<.1	<.1	0.2	0.2	<.1	-	-	<.1	-	0.1	<.1	<.1	0.2	<.1
Nucella emarginata	0.3	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Nuttallina californica	-	0.1	0.3	0.2	0.4	0.2	0.1	0.5	0.2	<.1	0.7	0.7	0.2	0.2	0.2	-	-	0.1	-	0.2	0.1	-	0.1	<.1
Ocenebra spp.	-	-	0.9	1.0	1.1	1.5	0.8	1.9	1.2	1.4	1.5	1.4	1.6	0.9	1.1	1.0	1.0	0.6	1.0	1.1	1.3	1.4	0.1	0.7
Pachygrapsus crassipes	-	0.2	0.2	0.4	0.4	0.2	0.5	0.3	0.3	0.2	0.4	0.7	0.2	0.6	0.8	1.3	0.7	1.0	0.8	0.9	1.0	0.7	0.8	0.3
Pagurus spp.	12.2	11.8	8.5	6.7	16.7	20.1	12.4	13.1	11.4	11.6	12.0	14.9	11.9	13.9	15.2	18.0	15.9	16.9	23.6	13.5	9.6	13.3	13.9	12.8
Pisaster ochraceus	<.1	-	-	-	<.1	-	<.1	<.1	-	-	<.1	0.1	-	-	-	-	<.1	0.2	0.2	0.2	<.1	0.1	<.1	<.1
Strongylocentrotus purpuratus	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	0.2	<.1	0.2	0.3	<.1	-	<.1	<.1	0.1
Tectura scutum	0.6	0.3	0.6	0.8	1.3	1.6	0.6	0.6	0.8	2.3	1.8	1.3	1.0	2.7	0.7	1.1	0.3	<.1	1.1	0.4	0.8	0.4	0.5	0.2
Tegula brunnea	-	-	<.1	-	<.1	-	-	0.2	-	-	<.1	<.1	-	-	<.1	-	<.1	-	-	-	0.1	-	<.1	-
Tegula funebralis	168.2	150.5	197.6	243.0	179.0	209.1	182.2	228.6	163.4	256.5	277.8	291.1	201.8	179.3	313.8	203.8	302.9	261.1	229.8	237.9	184.4	225.3	262.3	165.4
Tetraclita rubescens	-	-	0.5	<.1	<.1	0.5	0.1	<.1	-	<.1	-	<.1	-	-	-	-	<.1	0.3	<.1	<.1	-	-	<.1	-
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-
Acmaeidae unid.	-	-	+	+	+	+	+	+	<.1	+	+	+	+	0.1	+	+	+	+	+	+	+	0.4	+	+
Alia spp.	-	-	+	+	-	+	-	-	+	+	-	+	-	-	+	+	-	+	+	-	-	+	-	-
Amphissa spp.	-	-	+	-	-	<.1	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	+	-	-	+	-	-	+	-	+	+	-	-	-	-	-	+	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	+	-	-	-	-	<.1	+	-	+	0.2	+	+	+	+	-	+	-	+	-	-	+	+
Crangon spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
Cryptolithodes sitchensis	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-	<.1	0.2	0.1	0.3	0.3	+	-	0.4	0.2	0.7	1.0	1.0	1.8	1.3	0.3	0.8	0.5	0.7	0.5	0.5	0.1	0.5
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	+	+	+	+	+	+	+	<.1	-	+	+	-	+	-	-	-	-
Heptacarpus spp.	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - Field's Cove Station FC 3 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	4	4	4	4	4
Only Counted if Greater than 1* (continued)																								
Idotea spp.	-	-	+	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	<.1	0.1	<.1	<.1	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	-	-	-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-
Lissothuria nutriens	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	+	-	-	-	-
Littorina spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Majidae	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus californianus	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	0.2	0.2	0.3	0.1	0.1	0.3	0.2	0.3	0.1	0.4	0.2	0.2	0.3	0.2	<.1	0.3	0.3	<.1	-	0.1	<.1	<.1
Nereididae unid.	-	-	-	<.1	<.1	<.1	-	<.1	-	-	-	-	<.1	-	<.1	<.1	-	<.1	+	-	-	-	<.1	<.1
Nitidiscala/Opalia spp.	-	-	+	+	+	+	-	+	+	+	+	+	+	-	<.1	-	+	-	+	-	-	-	-	-
Ophiuroidea unid.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Platyhelminthes unid.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Polychaeta unid.	-	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	<.1	<.1	+	<.1	<.1	<.1	-	+	+	<.1	-	+	+	-	0.1	<.1	-	<.1	<.1	-	-	-
Rostanga pulchra	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	+	-	-	-	-	-	+	<.1	-	+	-	-	+	-	<.1	-	+	+	+	-	<.1	-
Sipuncula unid.	-	-	+	+	-	-	-	-	<.1	+	+	+	0.1	+	0.1	-	+	-	+	+	-	+	+	-
Spionidae unid.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tonicella lineata	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	-	-	-	-	-	-	+	-	-	-	+	+	-	+	-	-	-	-	-	-
% Coverage																								
Chthamalus fissus	2.3	0.4	0.1	<.1	0.1	0.2	0.6	0.6	0.3	0.5	0.4	<.1	0.1	0.1	0.3	0.2	0.2	0.1	0.1	0.2	0.1	0.2	+	+
Haliclona spp.	-	-	-	+	-	+	-	-	+	<.1	-	+	+	+	-	-	-	-	-	+	-	-	-	+
Phragmatopoma californica	-	0.1	<.1	0.2	0.2	+	<.1	<.1	<.1	<.1	0.1	0.1	0.4	0.8	0.6	0.2	0.3	0.2	0.2	0.2	0.2	0.2	<.1	<.1
Pista spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Spirorbidae	-	-	+	-	-	+	+	+	-	+	+	+	-	-	+	+	+	+	+	+	+	-	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 1 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	-	-					-	-	-	<.1	0.3	0.5		-	0.1	-	-	-	-	-				-
Anthopleura elegantissima	1.9	1.2					1.9	2.1	2.3	3.0	4.3	5.3		9.4	7.2	9.4	8.3	7.0	5.3	3.9				4.1
Anthopleura xanthogrammica	0.2	-					0.2	0.4	0.6	0.6	0.7	0.4		0.6	0.7	0.4	0.5	0.3	0.5	0.4				0.9
Balanus spp.	6.3	0.7					0.1	0.4	-	3.6	-	0.2		0.4	0.9	1.3	-	<.1	-	-				-
Calliostoma ligatum	-	-					-	<.1	-	<.1	-	<.1		-	-	-	<.1	-	-	-				-
Calliostoma spp.	-	-					-	-	-	-	-	<.1		-	-	-	-	-	-	0.1				-
Epiactis prolifera	<.1	0.2					<.1	-	<.1	-	<.1	0.1		-	<.1	0.2	<.1	-	-	-				-
Fissurella volcano	0.8	1.0					0.8	0.5	2.6	4.8	2.9	2.1		1.8	1.1	4.8	4.9	7.0	6.7	11.3				3.2
Haliotis spp.	9.3	13.3					1.6	0.3	<.1	0.5	0.4	0.4		-	-	<.1	-	-	0.1	0.4				-
Hemigrapsus nudus	-	-					<.1	0.1	0.1	0.1	0.1	<.1		-	-	<.1	-	-	-	-				-
Leptasterias spp.	<.1	<.1					0.2	0.1	<.1	<.1	-	<.1		-	-	-	-	-	-	-				-
Lottia digitalis	-	+					-	1.2	0.4	0.2	-	0.1		4.2	-	0.4	0.3	0.9	1.2	0.7				11.8
Lottia limatula	<.1	0.1					1.2	2.1	1.5	3.8	4.4	3.1		8.0	3.1	2.5	1.6	3.6	4.2	5.0				10.5
Lottia pelta	0.1	<.1					1.8	2.4	1.9	2.4	1.7	1.1		5.0	1.0	4.2	1.2	4.9	7.3	5.5				29.6
Macclintockia scabra	<.1	<.1					16.0	36.4	67.8	151.2	186.8	212.8		122.2	69.8	90.5	30.7	105.9	91.8	41.6				211.1
Mopalia spp.	0.2	0.2					0.4	0.4	0.3	0.4	0.3	0.1		0.2	<.1	<.1	-	<.1	-	-				0.1
Nucella emarginata	-	-					-	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Nuttallina californica	-	<.1					0.4	<.1	0.1	1.1	2.3	2.0		-	0.2	0.2	-	-	<.1	0.7				0.5
Ocenebra spp.	-	+					2.0	1.8	4.6	4.6	3.5	6.5		1.4	2.8	1.9	0.9	0.4	0.8	0.8				0.6
Pachygrapsus crassipes	<.1	<.1					<.1	0.2	0.2	0.3	0.2	0.9		0.4	0.8	1.1	1.4	0.7	1.8	2.1				0.5
Pagurus spp.	8.8	11.5					20.3	14.0	14.3	13.6	14.8	22.5		33.6	27.0	28.5	13.7	42.1	31.8	52.3				9.6
Pisaster ochraceus	0.1	-					-	<.1	<.1	<.1	<.1	<.1		0.4	0.2	0.5	0.7	0.6	0.4	0.2				-
Pseudomelatoma torosa	-	-					-	<.1	-	-	<.1	-		-	-	-	-	-	-	-				-
Strongylocentrotus purpuratus	-	-					-	-	-	-	-	<.1		0.8	1.0	3.0	1.7	2.0	17.4	30.9				4.1
Tectura scutum	0.8	0.7					6.9	5.5	7.0	13.5	6.9	4.2		6.2	1.7	5.1	0.3	1.1	8.0	1.0				5.0
Tegula brunnea	1.7	0.5					8.7	4.8	1.5	2.4	1.5	0.2		-	0.6	5.4	15.7	25.5	10.1	13.8				19.0
Tegula funebralis	21.1	54.2					29.6	50.9	76.4	161.0	214.4	288.2		285.2	165.1	81.6	17.3	7.8	19.5	78.7				53.9
Tegula spp.	-	-					-	-	-	-	3.3	-		-	-	-	-	-	-	-				-
Tetraclita rubescens	2.2	0.4					51.1	79.9	29.7	58.4	16.2	4.2		2.8	26.4	75.1	84.1	72.1	235.5	260.0				22.3
Only Counted if Greater than 1"																								
Acmaea mitra	-	-					-	+	+	<.1	-	-		-	-	-	-	-	-	-				-
Acmaeidae unid.	-	+					+	+	+	+	+	+		+	+	+	+	+	+	+				+
Alia spp.	-	-					+	+	+	+	-	-		-	-	-	+	+	-	-				-
Amphissa spp.	-	-					-	-	+	-	+	-		-	-	-	+	+	-	-				-
Asterina miniata	0.3	0.1					0.4	0.5	<.1	-	-	0.1		-	-	-	-	<.1	-	-				-
Barleeia spp.	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Bittium spp.	-	-					+	+	-	+	-	-		-	-	-	+	-	-	-				-
Chaetopteridae	-	-					-	-	-	-	-	-		-	-	-	-	+	-	-				-
Crepidula spp.	-	-					+	+	+	+	+	+		+	+	+	+	-	+	-				-
Cyanoplax spp.	-	-					+	+	+	+	0.1	0.1		0.2	0.5	0.1	0.1	-	<.1	-				0.3
Diodora spp.	-	-					+	-	-	+	-	-		-	-	-	-	-	-	-				-
Discurria insessa	-	-					-	-	-	-	+	-		-	-	-	-	-	-	-				-
Doriopsilla albopunctata	-	-					-	-	-	-	+	-		-	-	-	-	-	-	-				-
Flabellina trilineata	-	-					-	-	-	-	+	-		-	-	-	-	-	-	-				-
Grapsidae (juv.)	-	-					-	+	<.1	+	+	+		-	+	-	+	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1" (continued)																								
Hermissenda crassicornis	-	-					-	-	-	-	-	-		-	-	+	-	-	-	-				-
Homolopoma luridum/Lirularia succincta	-	-					-	+	+	+	-	-		-	-	-	-	-	-	-				-
Ischnochitonidae	-	+					+	+	+	<.1	+	+		+	-	+	+	+	-	+				+
Katharina tunicata	-	-					<.1	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Lacuna spp.	-	+					+	+	+	+	+	-		-	-	+	+	+	+	-				-
Lepidozona spp.	-	-					-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Lissothuria nutriens	-	-					-	-	-	-	+	-		-	-	-	-	+	-	+				-
Littorina spp.	-	-					-	+	+	+	+	+		-	+	+	+	-	+	+				+
Lottia asmi	-	-					+	+	+	+	+	+		-	+	+	+	-	+	-				+
Lottia gigantea	-	-					-	-	-	-	-	-		-	-	-	-	-	-	0.1				-
Lottia instabilis	-	-					-	-	-	-	<.1	-		-	-	-	-	-	-	-				-
Lottia ochracea	-	-					+	-	-	-	-	-		-	-	-	<.1	+	-	-				0.2
Majidae	-	-					+	-	-	+	-	-		-	-	-	-	-	-	-				-
Mytilidae	-	-					-	-	-	-	-	-		-	-	-	-	-	-	+				-
Mytilus californianus	-	<.1					+	<.1	+	+	+	+		-	+	-	-	+	-	-				+
Mytilus galloprovincialis	-	-					-	-	-	-	-	-		-	-	-	-	-	-	-				+
Natantia unid.	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				-
Nemertea unid.	-	-					0.6	0.3	<.1	-	+	<.1		-	-	-	-	<.1	0.1	-				-
Nereididae unid.	-	-					-	-	-	-	-	-		-	-	-	-	+	-	-				-
Nitidiscala/Opalia spp.	-	-					-	-	-	-	-	-		-	-	-	-	-	+	-				-
Onchidella borealis	-	-					+	+	+	-	-	-		-	-	-	-	-	-	-				-
Ophiothrix spp.	-	-					-	-	-	-	-	-		-	-	-	<.1	<.1	-	-				-
Pelecypoda unid. boring	-	-					+	+	+	-	-	-		-	-	-	-	-	-	-				-
Petrolisthes spp.	0.2	-					-	-	<.1	-	<.1	-		-	-	-	-	-	-	-				-
Pisaster giganteus	-	-					-	-	-	-	-	-		0.2	-	-	-	<.1	-	-				-
Pollicipes polymerus	-	-					0.4	-	-	-	-	-		-	<.1	+	+	-	-	-				+
Polychaeta unid.	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				-
Pugettia spp.	-	-					0.3	<.1	<.1	-	-	-		-	-	-	+	-	<.1	-				-
Pycnopodia helianthoides	-	-					0.2	<.1	<.1	-	-	-		-	-	-	-	-	-	-				-
Pyura haustor	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Serpulidae unid.	-	-					0.2	<.1	0.2	0.3	0.5	0.9		1.4	0.4	0.7	0.4	0.9	1.3	2.0				1.6
Serpulorbis squamigerus	-	-					-	+	<.1	<.1	<.1	<.1		-	-	<.1	-	-	-	-				-
Sipuncula unid.	-	-					+	+	-	-	-	+		-	-	+	-	-	-	-				-
Stenoplax spp.	-	-					-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Tethya aurantia	-	-					-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Tonicella lineata	-	<.1					-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Tricolia spp.	-	-					+	-	+	-	-	-		-	-	-	-	+	-	-				-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-					+	+	<.1	+	+	<.1		-	-	+	-	+	+	-				-
Chthamalus fissus	0.1	+					<.1	0.8	0.6	3.8	2.2	3.3		9.2	8.4	5.3	1.7	1.6	2.8	3.5				0.8
Phragmatopoma californica	-	-					+	<.1	<.1	0.4	0.2	0.1		0.1	+	<.1	+	+	<.1	+				1.3
Pista spp.	-	+					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Porifera unid. (encrusting)	-	-					+	+	+	+	-	-		-	-	+	-	-	+	-				-
Spirorbidae	-	<.1					+	0.7	<.1	<.1	0.5	0.2		+	+	+	+	+	+	+				+
tunicates, colonial/social unid.	-	+					<.1	+	+	+	-	-		-	+	-	-	+	-	-				-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	0.2	-					+	0.2	0.7	0.6	1.5	2.3		0.8	1.0	0.6	0.2	0.2	0.4	0.4				0.2
Anthopleura elegantissima	14.8	16.7					12.5	19.1	17.2	17.8	28.6	11.5		17.6	14.5	18.0	20.4	15.9	15.1	25.1				27.7
Anthopleura xanthogrammica	0.3	-					0.6	0.1	<.1	0.1	0.1	0.2		-	0.2	0.1	<.1	<.1	0.1	-				0.1
Balanus spp.	-	0.9					<.1	0.3	-	-	<.1	-		-	-	-	-	<.1	-	-				-
Calliostoma ligatum	-	-					-	<.1	-	-	<.1	-		-	-	-	-	-	-	-				-
Epiactis prolifera	-	<.1					-	-	-	-	<.1	<.1		-	-	-	-	<.1	-	-				-
Fissurella volcano	0.2	0.2					0.3	0.2	0.5	0.3	0.3	0.1		-	0.3	0.2	1.5	1.5	0.8	0.4				1.3
Haliotis spp.	4.7	5.2					1.2	0.3	-	-	0.1	0.2		-	-	-	-	-	-	-				-
Hemigrapsus nudus	-	<.1					0.2	0.2	-	<.1	<.1	<.1		-	-	-	-	-	-	-				-
Leptasterias spp.	-	-					0.2	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Lottia digitalis	-	0.5					0.1	0.1	0.3	0.3	-	0.2		-	0.9	0.2	0.3	0.1	-	-				0.4
Lottia limatula	0.1	0.1					1.6	0.7	0.4	4.2	2.8	2.7		2.8	2.4	3.0	2.0	2.8	4.7	0.9				3.8
Lottia pelta	<.1	0.1					1.0	0.4	1.2	1.1	0.3	0.4		0.8	0.6	0.7	0.6	1.6	1.4	0.9				5.8
Macclintockia scabra	1.0	1.2					15.1	16.8	28.4	50.6	114.5	119.6		82.0	41.5	89.6	57.5	84.8	82.7	35.8				125.4
Mopalia spp.	-	-					0.2	0.7	0.3	0.6	0.6	0.4		0.2	<.1	-	-	-	<.1	-				0.3
Nucella emarginata	-	+					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Nuttallina californica	-	-					0.2	0.2	-	0.3	0.4	0.6		-	-	-	-	-	<.1	-				<.1
Ocenebra spp.	-	+					0.6	0.4	0.6	1.2	1.2	1.7		1.4	1.6	0.9	1.7	0.8	0.6	0.5				0.2
Pachygrapsus crassipes	<.1	<.1					0.3	0.1	<.1	<.1	0.3	0.5		0.2	0.7	0.9	0.9	0.6	0.9	0.8				0.4
Pagurus spp.	10.3	15.1					21.8	7.7	7.9	6.4	9.9	9.2		16.6	11.3	18.9	14.9	17.1	11.8	4.5				2.2
Pisaster ochraceus	-	<.1					-	-	-	-	-	-		-	<.1	0.1	0.3	0.2	<.1	-				-
Strongylocentrotus purpuratus	-	-					-	<.1	-	-	<.1	-		0.2	0.1	0.3	0.3	-	0.2	0.6				-
Tectura paleacea	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Tectura persona	-	<.1					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tectura scutum	2.0	0.9					5.1	1.8	2.5	6.2	3.3	2.6		3.2	0.9	4.5	0.4	1.0	2.0	0.9				1.6
Tegula brunnea	<.1	0.1					0.2	0.9	0.1	-	0.1	-		-	-	-	0.3	0.2	-	0.1				-
Tegula funebralis	52.0	81.7					124.8	143.8	113.3	157.8	193.8	183.7		301.6	353.5	214.9	173.1	173.6	192.5	158.0				225.8
Tegula pulligo	-	-					-	-	-	-	+	-		-	-	-	-	-	-	-				-
Tegula spp.	-	-					-	-	-	-	-	+		-	-	-	-	-	-	-				-
Tetraclita rubescens	0.2	0.9					7.1	0.8	<.1	0.1	0.5	<.1		-	0.3	1.8	7.1	2.4	1.3	2.0				-
Only Counted if Greater than 1"																								
Acanthodoris lutea	-	-					-	-	+	-	-	-		-	-	-	-	-	-	-				-
Acmaea mitra	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Acmaeidae unid.	0.2	0.1					+	+	+	+	+	0.1		+	+	+	+	+	+	+				+
Aeolidia papillosa	-	-					-	-	-	-	-	-		-	-	-	-	-	-	-				+
Alia spp.	-	-					-	-	+	+	-	-		-	-	-	+	+	+	-				-
Amphissa spp.	-	-					-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Anthozoa unid.	-	-					-	-	+	-	-	-		-	-	-	-	-	-	-				-
Asterina miniata	-	0.1					<.1	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Balanophyllia elegans	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Bittium spp.	-	-					-	-	-	+	-	-		-	-	-	-	-	-	-				-
Cirratulidae/Terebellidae unid.	-	-					-	-	-	-	-	+		-	-	-	-	-	-	-				-
Crepidula spp.	-	-					+	+	+	+	+	+		+	+	+	+	+	+	-				-
Cyanoplax spp.	-	-					+	+	-	0.3	0.4	0.7		0.2	0.5	0.4	-	0.1	0.5	0.3				0.4
Diopatra ornata	-	-					-	<.1	<.1	-	-	<.1		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	ns	ns	ns	ns	5	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1" (continued)																								
Discurria insessa	-	0.2					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Grapsidae (juv.)	-	-					-	+	-	+	+	+		-	+	+	+	-	+	-				-
Hipponix spp.	-	0.1					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Homolopoma luridum/Lirularia succincta	-	-					-	-	-	+	+	+		-	<.1	-	+	-	-	-				-
Ischnochitonidae	-	-					+	+	+	+	+	+		-	+	-	-	-	+	-				+
Lacuna spp.	-	+					+	+	+	+	+	-		-	-	-	+	-	+	-				-
Lepidozona spp.	-	-					-	-	-	-	-	+		-	-	-	0.2	-	-	-				-
Littorina spp.	-	-					+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia asmi	-	<.1					+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia instabilis	-	-					-	-	-	+	+	+		-	-	-	-	-	-	-				-
Lottia ochracea	-	-					-	-	-	-	-	-		-	+	-	-	+	+	-				-
Majidae	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Modiolus spp.	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Mytilidae	-	-					-	-	-	-	-	-		+	-	-	-	-	-	-				-
Nemertea unid.	-	-					0.2	0.1	0.3	<.1	-	-		-	-	-	-	-	-	-				-
Nereididae unid.	-	-					-	<.1	-	<.1	-	<.1		-	-	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-					+	+	-	+	-	-		+	+	-	+	-	+	+				+
Onchidella borealis	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Petrolisthes spp.	0.1	<.1					-	<.1	-	-	-	-		-	<.1	-	<.1	-	-	-				-
Platyhelminthes unid.	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Polychaeta unid.	-	-					-	-	-	-	-	+		-	-	-	-	-	-	-				-
Porcellanidae unid.	-	<.1					-	-	-	-	-	-		-	-	-	-	-	-	-				-
Pugettia spp.	<.1	-					0.1	<.1	<.1	-	-	-		-	-	-	-	-	-	-				-
Pycnogonida unid.	-	-					-	+	-	+	-	-		-	-	-	-	-	-	-				-
Serpulidae unid.	-	<.1					<.1	<.1	-	<.1	<.1	-		-	0.1	<.1	<.1	<.1	0.1	+				0.3
Sipuncula unid.	-	-					<.1	<.1	-	+	-	+		-	+	-	-	-	+	-				-
Tonicella lineata	-	-					-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Tricolia spp.	-	-					+	-	-	-	-	-		-	-	-	-	-	-	-				-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-					-	+	+	-	-	-		-	-	-	-	-	-	-				-
Chthamalus fissus	<.1	<.1					<.1	<.1	+	0.2	0.9	1.5		6.8	7.3	6.8	3.0	1.9	1.9	1.8				+
Haliclona spp.	-	-					-	-	-	-	-	-		-	+	+	-	-	-	-				-
Phragmatopoma californica	-	-					<.1	+	+	+	+	+		+	<.1	+	+	+	+	+				+
Pista spp.	-	+					-	+	+	+	+	+		-	-	-	-	-	-	-				+
Porifera unid. (encrusting)	-	-					-	+	-	-	-	-		-	-	-	-	-	-	-				-
Spirorbidae	-	+					<.1	<.1	+	+	+	<.1		+	+	+	+	+	+	+				+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 2 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	5	6	6	6	5	6	ns	1	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-	<.1	<.1	-	<.1	<.1	0.1	0.6	1.1	1.1	1.2		0.4	0.2	-	-	-	-	-	-	0.1	-	-
Anthopleura elegantissima	2.2	2.3	2.1	2.4	2.4	3.5	2.0	3.0	3.3	3.0	3.2	4.9		12.4	12.1	8.7	7.7	3.4	3.0	3.2	4.5	3.4	3.3	4.4
Anthopleura xanthogrammica	-	0.1	0.2	0.1	0.1	<.1	<.1	0.1	<.1	0.1	-	-		-	-	-	-	-	-	<.1	-	-	-	<.1
Balanus spp.	1.1	0.4	0.3	1.2	1.3	0.2	0.6	<.1	<.1	0.9	0.6	+		-	0.6	-	-	-	0.3	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	-	-	-	-	-	0.1	-		-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	0.3	1.4	0.6	1.3	1.9	0.4	1.2	0.6	<.1	0.2	0.2	0.2		-	0.2	0.3	0.1	0.2	0.1	0.5	0.8	0.2	0.1	0.3
Fissurella volcano	0.5	0.9	1.6	1.4	1.2	1.3	1.0	1.0	2.9	4.6	1.4	0.9		2.0	3.6	9.6	13.4	24.6	13.5	11.6	9.7	5.0	30.1	9.0
Haliotis spp.	2.7	5.2	6.7	8.3	4.6	2.8	1.5	1.6	1.0	0.5	0.4	0.3		-	-	0.6	0.3	-	0.5	-	0.5	0.1	-	0.1
Hemigrapsus nudus	-	-	0.1	0.2	<.1	-	-	<.1	-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.1	0.1	1.1	2.1	2.1	1.5	0.5	0.4	0.1	0.6	<.1	<.1		-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	-	<.1	0.2	0.1	-	-	-	<.1	0.3	5.6	36.6	17.5		-	6.6	0.3	0.2	-	0.9	-	7.5	10.0	5.5	13.9
Lottia limatula	-	0.3	0.6	1.2	0.9	1.4	1.4	1.1	1.1	3.4	3.0	1.8		1.6	3.1	3.1	2.0	2.0	5.3	5.8	12.7	0.6	13.3	16.1
Lottia pelta	-	0.1	0.2	0.8	0.2	2.7	1.0	0.9	4.4	2.5	1.3	3.6		3.0	2.3	5.3	2.4	5.0	7.0	3.3	8.2	2.5	12.5	44.1
Macclintockia scabra	1.1	3.6	2.9	6.4	6.3	10.3	19.5	47.2	52.8	228.6	189.9	227.6		192.2	171.7	126.8	30.3	64.5	36.5	78.7	114.7	25.8	81.5	210.2
Mitra idae	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-	0.1	-	-	-
Mopalia spp.	0.1	<.1	0.3	0.5	0.9	0.3	0.4	0.5	0.7	1.0	0.4	0.6		0.4	<.1	<.1	-	<.1	0.2	0.3	-	-	0.3	0.2
Nucella emarginata	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	0.1	1.6	2.0	3.5	2.9	3.3	3.7	3.2	3.1	4.2	4.2	2.0		2.4	0.7	0.7	0.8	0.2	0.4	0.4	1.1	0.5	1.7	1.5
Ocenebra spp.	-	0.1	1.4	2.3	1.4	1.7	1.5	1.1	1.4	2.7	2.8	4.5		2.0	2.7	2.2	1.7	1.0	0.2	-	0.2	1.2	0.3	0.2
Pachygrapsus crassipes	<.1	<.1	<.1	0.1	<.1	<.1	-	0.1	<.1	0.4	0.3	0.5		0.6	0.8	1.4	1.1	0.8	1.7	0.9	1.1	2.0	2.6	0.7
Pagurus spp.	4.6	13.9	10.4	12.8	15.2	19.1	20.9	11.1	12.8	16.6	11.8	16.5		24.2	11.3	9.0	14.3	19.1	11.9	8.0	18.6	12.8	1.7	4.6
Pisaster ochraceus	-	<.1	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-		-	<.1	0.3	0.2	0.4	0.2	<.1	0.4	0.1	0.2	0.4
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	<.1	0.1	-	-	-	0.1	-	+		2.0	1.4	2.5	4.5	3.8	7.2	23.3	9.6	7.2	7.4	10.8
Tectura paleacea	-	-	-	-	-	-	+	+	+	-	-	+		-	+	-	-	-	-	+	-	-	-	+
Tectura scutum	0.3	0.5	1.5	2.6	2.2	2.7	2.6	2.0	9.0	6.8	8.4	8.5		6.6	2.0	5.6	0.9	1.7	2.1	4.9	5.6	2.2	1.1	8.0
Tegula brunnea	1.8	1.3	6.6	4.2	10.8	8.7	7.0	5.8	4.6	7.0	2.9	3.3		1.2	2.1	0.8	9.4	4.2	3.1	1.7	5.2	1.5	0.3	2.3
Tegula funebralis	2.5	10.0	7.8	8.6	17.1	12.4	7.2	23.8	12.9	34.6	114.4	137.2		168.2	58.8	7.2	4.4	0.6	4.6	7.8	7.5	-	1.6	7.2
Tetraclita rubescens	-	3.8	13.1	9.9	11.7	24.8	16.6	19.7	14.9	19.0	14.8	5.2		24.0	27.6	87.4	46.7	65.3	55.7	96.6	95.9	55.6	28.4	69.1
Only Counted if Greater than 1"																								
Acmaea mitra	-	<.1	<.1	0.1	<.1	<.1	<.1	<.1	0.1	0.3	+	<.1		-	-	<.1	-	+	+	0.2	+	+	+	0.2
Acmaeidae unid.	0.2	-	+	+	+	+	+	+	<.1	+	+	+		+	+	+	+	+	+	+	+	+	0.1	+
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-		0.2	-	0.1	-	-	-	-	-	-	-	-
Aeolidiacea unid. a	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	-	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	+	+	+	-	-
Amphissa spp.	-	-	-	+	-	<.1	-	-	-	-	-	-		-	-	-	+	-	-	-	-	-	-	-
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0.1	-
Asterina miniata	-	-	-	<.1	<.1	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	+	-	+	-	-	-	+	+	-	-		-	+	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	+	+	+	+	+	+	-	+	-	-		-	+	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	<.1	-	<.1	-	0.1	0.2	<.1	-	<.1	<.1	-		-	-	-	-	-	-	<.1	-	-	-	-
Cancer spp.	-	-	+	+	<.1	<.1	-	-	<.1	+	-	-		-	+	-	-	-	<.1	-	-	-	-	-
Chama spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	+	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	5	6	6	6	5	6	ns	1	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-		-	<.1	-	-	-	-	-	-	-	+	+
Clavelina huntsmani	-	-	-	-	-	+	+	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	0.4	+	+	+	+	+	+	+	+	+	+		-	+	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-	-	0.2	-	-	+	+	-	+	0.2	1.9		+	0.7	0.4	0.4	0.2	0.8	0.3	0.7	0.3	0.8	1.0
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	<.1	<.1	-	-	-	-	-	-	<.1
Diopatra ornata	<.1	-	<.1	0.3	0.2	0.1	0.3	<.1	<.1	0.1	<.1	0.1		-	<.1	<.1	-	<.1	-	-	0.1	0.1	-	-
Discurria insessa	-	-	-	-	-	+	+	+	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Elysia hedgpethi	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	+
Flabellina trilineata	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	<.1
Grapsidae (juv.)	-	<.1	<.1	+	+	-	-	+	+	+	+	+		-	+	+	+	-	-	-	-	-	-	-
Halcampa decemtentaculata	-	-	-	0.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Hemigrapsus oregonensis	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Henricia leviuscula	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	0.1	<.1	<.1	+	-	-	+	-	-	-	-		-	-	-	+	-	0.2	+	-	-	-	+
Hermissenda crassicornis	-	-	-	-	-	-	-	-	-	<.1	-	<.1		-	-	-	+	+	+	-	+	-	0.1	-
Hipponix spp.	-	-	-	-	-	-	-	-	-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	-	-	-	+	-	-	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Idotea spp.	-	-	<.1	-	-	+	-	<.1	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	<.1	<.1	+	+	+	<.1	+	+	+	+	+		+	+	+	+	+	+	+	-	+	-	-
Isopoda unid.	-	-	-	-	+	-	-	-	-	-	+	-		-	-	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	+	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	+	+	+	+	<.1
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	+	<.1	-	+	-	-	-	-	-
Lissothuria nutriens	-	-	-	-	+	+	-	-	-	+	+	+		-	-	+	-	+	+	-	-	+	+	-
Lithopoma gibberosum	-	-	<.1	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0.1	-
Littorina spp.	-	-	+	-	+	+	-	+	+	+	+	+		-	+	+	+	-	-	-	-	+	-	+
Lophopanopeus spp.	-	-	-	-	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Lottia asmi	-	-	-	-	+	+	+	+	+	+	+	+		-	-	-	-	+	+	-	+	-	-	+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	<.1	<.1		-	-	0.1	-	-	0.1	0.1	0.3	0.1	4.3	1.5
Lottia instabilis	-	-	-	-	-	-	-	-	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	+	-	-	-	-	-	-	-		-	+	<.1	+	-	+	-	-	-	-	-
Majidae	-	-	+	+	+	+	+	+	+	+	+	-		-	+	-	-	-	-	-	-	-	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	<.1
Mytilus californianus	-	-	-	<.1	<.1	-	-	+	0.1	+	+	<.1		-	+	+	-	-	-	-	-	-	-	0.2
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	+	-	-	-	-	-	-
Nemertea unid.	-	<.1	-	0.3	0.5	0.7	0.4	0.7	0.5	0.1	<.1	+		-	+	0.1	-	-	-	-	-	-	-	0.1
Nereididae unid.	-	-	<.1	<.1	<.1	<.1	-	+	<.1	+	-	<.1		-	<.1	0.1	-	<.1	0.1	-	-	-	0.1	-
Nitidiscala/Opalia spp.	-	-	+	+	+	+	-	-	+	-	-	-		+	+	-	+	+	-	-	+	+	-	-
Onchidella borealis	-	-	-	-	-	-	+	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	0.3
Ophiuroidea unid.	-	-	-	-	-	-	-	-	+	+	+	-		-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	+	+	+	+	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	0.1	-	-		-	<.1	-	0.2	<.1	0.1	-	-	-	-	-
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<.1	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	+	+	<.1	+	+	+	+	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-	-	-	+	-
Polychaeta unid.	-	-	-	-	-	-	-	-	+	-	-	<.1		-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	5	6	6	6	5	6	ns	1	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Pugettia spp.	0.3	<.1	0.5	0.5	0.3	0.9	0.8	0.4	<.1	0.3	0.2	0.2		-	0.1	0.4	0.9	<.1	<.1	0.3	0.3	0.1	+	0.5
Pycnogonida unid.	-	-	-	-	-	-	+	-	-	-	-	+		-	-	-	-	-	+	-	+	-	-	+
Pycnopodia helianthoides	-	-	-	-	-	-	-	<.1	-	-	-	<.1		-	-	-	-	+	-	-	-	-	-	-
Serpulidae unid.	-	-	-	-	+	+	-	-	<.1	+	0.1	-		0.2	<.1	<.1	-	<.1	-	0.2	0.5	0.4	0.2	0.6
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	0.1
Sipuncula unid.	-	-	-	-	-	-	+	+	+	-	+	+		+	+	-	+	-	+	-	-	+	+	+
Stenoplax spp.	-	-	-	-	-	<.1	-	-	-	-	<.1	-		-	-	-	0.1	-	-	-	0.1	0.1	-	-
Tonicella lineata	0.1	-	-	+	-	<.1	-	-	<.1	<.1	<.1	<.1		-	-	-	-	-	-	-	-	-	-	-
Transennella spp.	-	-	-	+	+	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	+	+	+	+	+	-	-	+		-	-	+	+	+	-	+	-	-	-	-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	0.1	-
% Coverage																								
Abiet./Sertularella/Sertularia spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	-	-	+	<.1	+	+	<.1	0.1	+	+	-		-	-	-	+	+	+	-	-	-	-	+
Bryozoa, unid. (foliose)	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	+	<.1	+	+	+	+	0.2	0.2	0.2	3.4	7.7	8.6		18.2	7.3	4.6	1.3	0.5	0.3	0.3	3.5	1.9	+	0.3
Hydroida	-	-	-	-	-	-	-	+	+	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	<.1	<.1	+	+	+	+	+	+	<.1	<.1	0.3		2.9	0.6	0.3	0.3	0.1	+	+	<.1	+	+	<.1
Pista spp.	1.9	0.8	1.8	7.3	8.0	7.3	3.8	2.1	4.5	4.2	0.7	0.5		0.3	0.2	0.4	0.9	1.5	<.1	+	3.1	<.1	0.2	<.1
Porifera unid. (encrusting)	-	<.1	-	0.2	<.1	<.1	0.2	<.1	0.1	<.1	+	+		-	-	-	-	+	-	-	+	-	-	-
Salmacina tribranchiata	-	-	-	-	-	+	-	+	+	-	-	+		-	-	-	-	+	-	-	-	-	-	-
Spirorbidae	-	-	-	+	+	+	+	+	<.1	+	+	+		+	+	+	+	+	+	+	+	0.3	+	+
tunicates, colonial/social unid.	-	0.1	0.4	0.3	0.3	0.2	0.4	<.1	0.3	0.2	+	+		-	+	+	+	+	-	+	+	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 2 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	0.5	0.3	0.4	0.2	0.5	0.4	0.1	0.2	0.6	0.7	0.5	0.4	0.4	0.2	0.5	0.4	0.2	0.5	0.5	1.0	1.3	0.3	0.4
Anthopleura elegantissima	21.4	28.4	27.7	23.9	35.9	31.6	34.1	12.2	11.7	14.5	15.4	17.4	22.7	22.6	25.9	35.0	31.5	26.6	28.8	29.5	43.1	33.1	38.2	44.9
Balanus spp.	-	+	-	-	-	+	<.1	-	-	-	-	-	-	0.2	<.1	-	0.7	-	0.5	1.5	-	-	-	-
Epiactis prolifera	-	<.1	<.1	0.1	<.1	0.1	-	-	-	-	<.1	0.1	-	-	-	<.1	-	-	-	-	0.1	-	-	-
Fissurella volcano	-	-	-	-	0.1	0.1	0.2	<.1	-	<.1	0.2	<.1	-	-	-	0.1	0.4	2.2	1.9	0.4	0.1	0.2	2.7	0.4
Haliotis spp.	-	-	-	-	0.2	-	-	-	-	-	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-
Hemigrapsus nudus	-	-	0.1	-	<.1	-	<.1	0.1	-	0.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.2	0.2	0.4	0.8	0.6	0.4	0.4	0.3	0.2	0.3	<.1	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	0.1	3.6	0.8	0.3	0.2	0.1	0.5	-	0.3	0.6	<.1	1.3	1.1	0.7	1.4	0.5	1.9	2.9	5.9	4.3	16.3	7.2	1.5	15.8
Lottia limatula	0.2	1.0	1.4	1.2	1.3	2.3	2.6	1.7	1.7	2.9	4.0	3.3	6.3	3.5	6.5	6.6	3.1	7.0	11.6	7.6	18.8	7.8	9.4	24.5
Lottia pelta	1.2	1.4	1.4	1.0	0.4	2.2	1.3	0.4	1.9	1.3	0.9	2.5	4.2	1.9	0.6	0.2	1.4	2.5	1.6	0.7	1.6	1.0	2.1	7.9
Macclintockia scabra	11.4	17.4	16.8	30.7	16.7	43.7	41.9	9.2	60.4	64.2	95.6	113.2	155.8	130.6	85.6	140.0	118.5	172.4	161.6	134.6	207.0	86.5	135.2	328.1
Mopalia spp.	-	0.2	<.1	<.1	0.3	0.4	0.4	0.4	<.1	0.2	0.5	0.3	0.3	0.1	<.1	<.1	0.1	-	-	0.1	-	-	0.1	0.3
Nucella emarginata	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	0.5	2.5	2.9	4.0	4.8	5.7	5.2	5.3	5.3	3.9	5.6	3.6	2.5	0.9	0.5	0.5	0.7	0.5	0.6	0.6	0.7	0.1	0.1	0.4
Ocenebra spp.	-	0.1	1.0	0.4	0.8	0.9	0.4	0.3	0.7	0.5	1.1	1.2	0.6	1.2	1.9	0.9	2.1	0.9	0.5	0.6	1.2	1.5	0.7	0.1
Pachygrapsus crassipes	0.1	0.1	0.5	0.5	0.4	0.5	0.5	0.2	0.3	0.9	0.9	0.8	1.1	1.3	0.9	2.1	1.5	1.6	2.0	2.3	1.9	2.4	1.7	0.8
Pagurus spp.	5.8	8.0	7.5	7.3	10.8	13.3	10.9	7.9	7.7	6.7	9.7	5.0	5.5	5.9	8.0	9.9	15.2	15.2	12.5	6.1	17.9	7.4	2.4	2.4
Pisaster ochraceus	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	0.5	0.1	-	<.1	0.3	-	-	-
Strongylocentrotus purpuratus	0.1	-	-	-	-	0.2	-	<.1	-	-	-	<.1	0.3	0.2	0.2	0.2	0.5	0.2	0.3	0.3	-	-	-	0.1
Tectura persona	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	1.9	0.8	2.5	1.6	1.9	2.3	4.6	1.6	4.7	8.7	5.4	8.0	2.9	5.1	2.9	3.6	3.7	4.7	2.9	6.9	0.7	3.8	3.1	8.7
Tegula brunnea	<.1	<.1	-	-	<.1	<.1	<.1	-	0.1	-	-	<.1	-	<.1	-	-	-	-	-	-	-	1.8	0.1	-
Tegula funebralis	47.3	89.6	131.1	124.0	150.3	165.5	108.8	82.1	89.6	140.5	162.7	156.5	176.8	246.9	269.4	209.8	102.9	116.7	155.5	212.0	120.3	106.3	304.1	145.7
Tegula pulligo	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	-	-	1.1	<.1	0.3	1.3	0.8	0.9	1.1	0.1	0.3	<.1	0.4	0.2	0.2	-	0.1	2.3	2.0	1.7	0.3	0.3	-	<.1
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acmaeidae unid.	<.1	-	+	+	+	+	+	+	+	0.2	+	1.2	0.9	3.9	+	+	+	+	+	+	+	+	+	+
Alia spp.	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Asterina miniata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Barleeia spp.	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	-	-	-	-	+	-
Cucumaria spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	0.1	-	0.5	0.7	1.2	0.7	0.7	<.1	-	0.6	1.0	3.4	4.1	3.5	4.9	2.8	0.4	0.8	1.1	2.0	1.7	3.4	2.2	2.7
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	<.1
Discurria insessa	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	0.1	<.1	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	-	-	-	-	+
Henricia leviuscula	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	-	-	+	+	+	-	+	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-
Idotea spp.	-	-	+	+	+	0.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Ischnochitonidae	0.3	0.4	0.5	+	0.1	+	<.1	+	+	+	<.1	+	-	+	+	-	+	-	-	+	+	-	-	-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	-	+	-	-	-	+	-	+	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Littorina spp.	-	0.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	0.1	+	+	+	+
Lottia asmi	-	-	+	+	+	+	+	+	+	<.1	+	+	+	+	-	+	<.1	+	+	+	+	-	+	+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	-	0.1	0.4	<.1	-	0.1	0.1	0.1
Lottia instabilis	-	-	-	-	-	-	-	<.1	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-
Majidae	-	-	-	+	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+	+	+	-	-	-
Mytilus californianus	-	<.1	<.1	-	-	0.1	0.1	<.1	+	-	<.1	-	-	+	+	0.1	<.1	-	-	-	-	-	-	0.1
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	-	0.3	0.3	0.4	<.1	0.2	-	<.1	-	-	-	-	<.1	-	-	<.1	-	-	0.1	-	-	-
Nereididae unid.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petrolisthes spp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Pisaster/Henricia (juv.)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	<.1	+	<.1	<.1	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Septifer bifurcatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Serpulidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	+	+	-	-	-	0.2
Sipuncula unid.	-	<.1	-	+	-	<.1	-	+	+	+	0.1	+	+	+	+	+	+	+	+	+	-	-	-	+
Spionidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Tonicella lineata	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Chthamalus fissus	0.1	<.1	<.1	+	+	+	+	+	<.1	<.1	<.1	0.2	0.6	1.8	4.2	4.1	8.2	4.2	5.1	13.6	14.6	16.6	5.5	2.0
Haliclona spp.	-	-	-	0.2	<.1	+	0.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	+	+	<.1	+	+	+	+	+	0.1	0.3	1.5	1.4	1.0	0.9	0.5	0.1	+	0.2	0.1	+	+	0.2
Pista spp.	-	-	+	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Porifera unid. (encrusting)	-	-	0.2	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salmacina tribranchiata	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbidae	-	-	-	+	+	+	<.1	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 3 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	5	6	5	4	6	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-	-	-	<.1	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Anthopleura elegantissima	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	<.1	-	0.3	1.3	2.3	5.6	0.3	3.2	1.2
Balanus spp.	1.8	0.2	0.7	0.8	0.1	-	-	-	<.1	<.1	<.1	-	0.5	1.1	0.5	-	0.3	-	-	-	-	-	1.2	-
Calliostoma ligatum	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-
Epiactis prolifera	0.2	0.4	1.9	0.9	1.4	1.4	1.4	1.5	0.9	0.3	0.5	0.2	0.2	0.2	0.2	0.3	0.4	0.3	1.0	0.5	0.1	0.2	0.3	0.5
Fissurella volcano	0.4	0.8	1.9	1.5	2.7	1.5	1.9	2.2	4.4	4.6	5.6	6.8	3.7	3.7	14.3	33.3	64.9	52.3	54.0	41.5	42.5	19.7	49.6	19.0
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Haliotis spp.	3.3	5.3	3.7	3.0	1.6	1.5	1.1	0.8	0.4	<.1	2.0	1.0	2.0	-	-	0.4	0.1	0.2	0.6	0.2	0.5	-	0.2	0.2
Hemigrapsus nudus	-	-	<.1	<.1	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.1	0.1	1.9	1.2	1.6	1.1	0.5	0.8	1.0	1.5	0.6	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	-	-	<.1	-	-	-	-	-	-	-	-	-	0.1	-	0.5	0.1	-	-	-	-	3.5	0.5	-	18.8
Lottia limatula	0.1	<.1	0.1	<.1	0.1	<.1	0.3	0.1	0.5	1.2	3.7	3.5	6.6	7.3	3.7	3.5	1.3	3.0	7.8	15.4	26.6	3.3	21.8	16.9
Lottia pelta	-	<.1	0.2	0.3	0.1	0.6	0.6	0.4	0.8	0.8	2.1	2.0	7.7	3.2	4.6	3.2	2.6	5.4	14.9	4.7	14.3	1.9	121.7	41.2
Macclintockia scabra	<.1	-	<.1	0.2	<.1	-	0.3	0.4	0.1	0.5	48.5	40.5	135.9	143.9	42.0	33.1	5.8	12.5	13.6	49.7	47.2	3.1	65.9	98.9
Mitra idae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Mopalia spp.	<.1	<.1	0.2	0.3	0.6	0.3	0.4	0.3	0.4	0.4	0.6	0.7	1.2	0.3	-	<.1	<.1	0.1	-	<.1	-	0.1	-	0.9
Nucella emarginata	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Nuttallina californica	0.2	1.0	2.1	2.3	1.6	2.1	1.3	1.9	1.0	1.8	2.2	5.6	6.7	4.9	2.7	0.7	0.2	0.1	0.3	0.5	0.5	-	0.8	0.7
Ocenebra spp.	0.1	-	0.6	1.1	0.6	0.6	0.5	0.6	0.9	0.9	2.4	2.5	2.6	1.4	5.6	2.0	0.7	0.2	0.2	-	0.1	0.7	0.1	0.1
Pachygrapsus crassipes	<.1	<.1	-	-	-	-	<.1	-	0.1	0.2	0.8	0.5	1.4	0.9	0.8	2.1	1.6	1.5	2.4	2.9	3.4	1.9	3.2	2.6
Pagurus spp.	6.4	8.6	7.0	7.4	11.2	15.1	13.5	12.6	17.0	12.1	9.4	6.3	11.7	4.1	11.1	5.0	2.6	1.9	6.2	2.9	3.3	3.1	-	0.3
Pisaster ochraceus	-	-	0.1	+	-	<.1	-	<.1	<.1	-	-	<.1	0.2	0.1	0.4	0.8	0.6	0.5	0.7	0.6	0.6	0.7	0.1	<.1
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	<.1	-	-	0.2	0.4	<.1	<.1	-	<.1	0.2	0.3	2.7	3.9	3.7	11.8	20.6	30.0	74.3	59.1	30.2	13.6	11.1	14.8
Tectura paleacea	-	-	-	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	1.2	0.3	1.7	0.6	1.2	1.3	2.2	0.8	0.6	1.6	4.4	6.3	10.9	11.3	3.7	2.0	0.4	1.6	2.5	28.4	13.5	3.1	0.9	1.9
Tegula brunnea	4.5	3.1	9.9	7.1	18.6	12.5	10.7	9.9	10.9	13.6	8.5	5.8	2.4	2.6	3.8	1.2	0.3	0.3	<.1	0.8	0.2	1.3	-	0.2
Tegula funebralis	1.5	3.0	2.5	1.4	3.7	5.5	3.4	4.6	4.8	7.0	110.5	135.2	189.9	60.2	29.8	2.8	<.1	-	0.1	0.1	0.1	-	0.2	0.2
Tegula montereyi	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	4.5	0.7	9.0	3.5	3.8	9.4	6.6	10.5	12.8	20.1	24.3	9.4	8.2	9.4	69.4	124.9	137.5	136.8	244.3	144.1	223.8	144.2	52.2	49.2
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	0.2	0.1	<.1	0.2	<.1	+	0.3	0.2	0.2	<.1	<.1	<.1	<.1	+	<.1	<.1	+	+	+	+	-	0.2
Acmaeidae unid.	2.0	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aegires albopunctatus	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aeolidiella oliviae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Alia spp.	-	-	+	+	+	+	+	+	+	+	+	+	-	-	+	-	+	+	+	-	-	-	-	-
Amphissa spp.	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Asterina miniata	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	-	+	+	+	+	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Cactosoma arenaria	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	-	<.1	-	<.1	<.1	0.1	<.1	<.1	-	-	-	-	-	-	<.1	-	-	<.1	-	-	0.1	-	-
Cancer spp.	<.1	-	+	+	+	+	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	5	6	5	4	6	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Chaetopteridae	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-	+	-	+	+	-	-	-	+
Clavelina huntsmani	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	-	-	+	+	+	-	+	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	0.3	0.3	0.5	0.5	<.1	+	0.2	0.3	+	0.1	-	0.5
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	-	-	0.1	-	+
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.1	<.1	<.1	0.1	0.1	-	-	0.2
Discurria insessa	-	-	+	+	+	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-	+	-	-	<.1	-	-	-	-	-	-
Elysia hedgpethi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	-	-	+	+	+	+	+	-	-	<.1	+	+	-	+	-	-	-	-	-
Hemigrapsus oregonensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Henricia leviuscula	-	-	+	-	-	-	-	0.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	-	-	<.1	+	-	-	-	-	-	+	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	+	+	+	-	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	+
Idotea spp.	-	-	+	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	<.1	+	+	-	+
Isopoda unid.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	+	-	-	-	-	+
Leucandra heathi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Lissothuria nutriens	-	-	-	+	-	-	-	-	+	<.1	+	+	-	-	+	<.1	+	+	0.1	+	+	-	-	<.1
Littorina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	+	-	+	-	-	-
Lophopanopeus spp.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia asmi	-	-	-	-	+	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.2	0.4	1.1	-	0.1	0.7
Lottia instabilis	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	0.1	-	<.1	+	+	+	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Majidae	-	-	+	+	+	+	+	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-
Megatebennus bimaculatus	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	+	+	-	-	-	-
Mytilus californianus	-	-	+	+	-	-	+	-	-	+	<.1	+	0.2	+	-	-	-	+	+	-	-	+	+	0.1
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	0.2
Nemertea unid.	-	<.1	1.0	0.6	0.7	1.1	0.6	0.7	0.4	0.5	0.3	0.1	-	-	<.1	<.1	-	-	0.1	0.3	0.3	-	-	-
Nereididae unid.	-	-	0.2	+	0.1	<.1	-	0.2	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina spp.	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-
Onchidella borealis	-	-	-	+	+	<.1	+	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Ophiothrix spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Ophiuroidea unid.	-	-	-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Parastichopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	5	6	6	5	6	5	4	6	6	5	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Pelecypoda unid. boring	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	-	-
Petrolisthes spp.	-	-	-	<.1	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	0.1	-	-	-	<.1	<.1	<.1	<.1	0.1	+	-	-	0.1	-	-
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	<.1	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	<.1	0.1	<.1	+	<.1	+	+	<.1	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	+	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pollicipes polymerus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	+	-	-	-	+	-	-
Polychaeta unid.	-	-	-	-	-	+	-	0.1	+	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Polynoidae	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	<.1	<.1	0.3	0.5	0.4	0.9	0.7	0.3	0.5	0.5	0.2	<.1	-	+	0.2	0.5	-	0.2	0.2	-	-	0.2	-	0.1
Pycnogonida unid.	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnopodia helianthoides	-	-	-	<.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rostanga pulchra	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Septifer bifurcatus	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+
Serpulidae unid.	-	-	-	-	-	<.1	-	-	<.1	0.1	<.1	<.1	0.5	0.7	0.9	1.2	0.7	1.0	1.4	1.9	1.8	1.0	0.9	2.0
Serpulorbis squamigerus	-	-	-	-	-	-	+	-	-	-	<.1	<.1	<.1	<.1	<.1	-	+	-	0.2	0.1	0.1	-	-	0.3
Sipuncula unid.	-	-	-	-	<.1	-	+	+	+	<.1	+	+	<.1	+	+	-	-	+	+	+	-	-	-	<.1
Tonicella lineata	-	-	0.1	0.1	-	<.1	<.1	-	0.1	<.1	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	+	+	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Trivia spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	+	<.1	<.1	<.1	+	+	+	+	+	+	+	-	+	+	-	+	+	+	-	-	-	+
Bryozoa, unid. (foliose)	-	-	-	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	-	+	+	<.1	+	+	+	+	+	+	0.2	0.6	1.9	10.2	4.9	0.9	0.5	+	+	+	+	+	+	+
Dendropoma spp.	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dodecaceria fewkesi	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurystomella bilabiata	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Haliclona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Hydroida	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Phragmatopoma californica	<.1	-	+	<.1	<.1	+	<.1	+	+	<.1	0.3	0.3	2.9	2.6	1.5	0.4	0.5	0.6	0.5	<.1	<.1	+	+	0.2
Pista spp.	1.0	<.1	0.2	1.1	0.3	0.7	1.1	0.2	0.3	0.6	0.3	<.1	+	+	+	+	-	+	+	-	+	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 3 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-	-	-	-	-	-	-	-	0.3	<.1	<.1		-	-	-	-	<.1	-	-	0.1	-	0.4	1.2
Anthopleura elegantissima	<.1	0.1	0.2	0.2	0.2	0.2	<.1	-	-	-	-	-		-	-	-	<.1	0.2	0.1	0.1	0.4	0.4	0.3	0.3
Balanus spp.	-	1.3	0.3	0.8	0.1	<.1	0.3	<.1	0.2	0.7	0.9	0.3		3.2	4.2	1.4	0.4	0.2	0.3	-	-	-	0.5	-
Epiactis prolifera	<.1	<.1	0.2	0.1	0.3	0.5	0.1	0.2	0.1	<.1	<.1	0.1		-	<.1	0.1	<.1	0.1	-	-	-	-	0.1	-
Fissurella volcano	0.4	0.3	1.0	1.0	0.8	0.9	0.9	1.0	1.4	1.2	0.9	0.8		1.4	2.0	5.0	18.0	14.7	17.7	15.3	6.6	7.4	63.4	4.5
Haliotis spp.	1.5	2.5	3.0	2.3	2.7	3.8	2.8	3.1	3.7	2.4	4.0	4.0		0.2	0.1	<.1	<.1	0.3	0.2	0.6	0.3	-	0.1	<.1
Hemigrapsus nudus	-	-	<.1	0.1	<.1	0.2	0.1	-	-	<.1	<.1	<.1		-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.5	0.1	0.5	1.4	1.2	0.8	0.6	0.6	0.4	0.4	0.2	0.2		-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	0.2	-	1.5	1.5	0.9	0.5	2.2	1.7	0.1	0.9	1.5	1.3		16.2	4.6	3.5	3.7	4.7	40.6	15.9	20.4	54.8	39.4	61.3
Lottia limatula	0.6	<.1	1.8	1.7	1.8	2.4	2.6	2.3	2.2	3.5	6.2	5.1		7.6	6.8	7.7	5.0	7.0	7.8	5.5	11.8	4.1	20.4	38.8
Lottia pelta	0.6	0.3	1.3	1.5	1.1	3.3	5.0	2.4	3.0	1.4	2.6	1.0		1.6	0.9	1.2	0.9	4.8	3.5	2.2	0.8	0.5	30.8	29.9
Macclintockia scabra	5.2	12.9	14.4	19.9	18.3	20.5	25.5	20.8	50.1	96.8	239.7	220.7		170.2	146.6	123.7	142.4	237.5	177.5	178.0	181.3	80.2	181.7	235.5
Mopalia spp.	0.1	-	0.2	0.6	0.8	0.7	0.4	0.5	0.2	0.5	0.8	0.4		0.2	0.2	-	-	<.1	-	0.1	-	-	-	0.4
Nucella emarginata	0.3	-	-	<.1	<.1	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	0.5	2.9	4.6	7.3	6.1	6.5	6.3	6.9	6.0	5.2	5.9	3.2		1.4	0.7	0.4	-	0.2	0.5	0.5	0.3	0.3	0.5	0.5
Ocenebra spp.	0.3	-	1.4	1.0	0.4	0.3	1.1	1.6	1.8	2.1	4.5	6.6		5.4	3.5	2.7	2.8	0.2	1.1	0.7	1.4	1.8	1.9	0.5
Pachygrapsus crassipes	0.1	0.5	0.4	0.3	0.7	0.5	0.7	0.3	0.5	0.6	1.1	2.0		1.2	1.4	1.0	4.1	2.7	3.8	3.9	2.7	4.8	2.4	2.8
Pagurus spp.	9.9	9.5	4.1	6.3	10.3	10.0	12.5	7.9	8.1	7.1	11.0	9.7		14.8	10.2	10.5	24.8	24.7	47.1	17.2	11.0	24.7	0.4	0.8
Pisaster ochraceus	-	-	-	-	<.1	0.1	-	<.1	-	-	-	-		-	-	0.3	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2
Strongylocentrotus purpuratus	<.1	-	-	<.1	<.1	0.1	0.1	<.1	<.1	<.1	0.3	0.2		0.4	0.3	0.9	3.5	3.7	11.9	21.4	11.6	6.7	4.0	3.4
Tectura persona	<.1	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	1.0	1.2	2.7	1.7	2.1	2.3	5.0	3.6	2.7	4.1	4.9	7.9		10.4	4.4	3.4	2.0	3.2	3.0	7.6	10.4	2.1	1.7	4.7
Tegula brunnea	0.9	1.0	1.3	2.9	3.2	4.3	4.8	3.6	2.5	1.3	0.2	-		-	0.2	0.4	3.6	0.4	-	3.3	1.2	6.4	0.3	0.3
Tegula funebralis	28.0	38.8	57.2	39.7	64.5	51.2	44.4	50.4	49.6	77.5	194.4	230.1		160.2	186.7	126.0	66.2	17.5	48.3	44.9	34.1	44.9	15.2	65.2
Tegula spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	0.1	-	-	-	-	-	-	-	-
Tetraclita rubescens	18.1	13.8	18.7	6.5	9.0	12.5	10.3	5.8	6.7	11.6	4.1	4.4		1.2	2.1	17.8	18.0	46.6	53.7	50.7	50.8	19.2	26.8	8.8
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	-	+	-	0.1	<.1	+	<.1	<.1	-	<.1		-	-	-	-	-	-	-	-	-	-	0.1
Acmaeidae unid.	<.1	-	+	+	+	+	+	+	+	+	+	+		+	+	0.2	+	+	+	+	+	+	+	+
Alia spp.	-	-	+	+	+	+	+	+	+	+	+	+		-	-	-	-	+	-	-	-	-	-	-
Amphissa spp.	-	-	-	-	-	-	-	-	+	-	-	+		-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	+	-	-	-	-	+	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Bittium spp.	-	-	-	+	-	-	-	-	+	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	0.1	<.1	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Cancer productus	-	-	-	-	-	-	-	-	-	-	-	<.1		-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	-	+	+	-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	-	+	+	+	+	+	+	-	+	+	+		-	+	+	+	+	-	-	-	-	-	+
Cyanoplax spp.	-	-	-	-	<.1	<.1	<.1	0.1	0.2	+	<.1	0.2		0.4	2.7	1.2	0.4	0.1	0.5	1.3	0.7	0.8	0.5	0.8
Diodora spp.	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-	-	-	-	-
Doriopsilla albopunctata	-	-	-	-	-	-	-	-	-	<.1	-	-		-	<.1	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	-	-	-	-	-
Henricia leviuscula	-	-	-	-	-	-	-	<.1	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	+	+	+	-	-	-	+	-	-	-		-	-	-	-	-	+	-	-	-	-	+
Homolopoma luridum/Lirularia succincta	-	-	-	+	+	+	+	-	+	+	-	-		-	-	-	-	+	-	-	-	-	-	+

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - North Diablo Cove Station NDC 3 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Idotea spp.	-	-	<.1	<.1	-	<.1	<.1	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	<.1	<.1	+	+	+	+	+	+	+	+		-	-	+	+	+	+	-	-	-	-	-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	-		-	-	+	+	+	+	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	0.1	-	-
Leucandra heathi	-	-	-	-	-	-	-	-	-	-	-	-		-	-	+	-	-	-	-	-	-	-	-
Lissothuria nutriens	-	-	-	-	-	+	-	-	-	-	-	-		-	-	+	-	+	+	-	+	-	-	-
Littorina spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
Lophopanopeus spp.	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Lottia asmi	-	-	0.2	+	+	+	+	+	+	+	+	+		-	-	-	+	+	+	-	-	-	-	<.1
Lottia gigantea	<.1	-	<.1	0.1	0.1	-	-	-	<.1	-	-	<.1		-	0.1	0.4	0.6	1.2	2.3	2.9	2.9	2.5	2.8	5.8
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-		-	-	0.2	-	+	-	-	-	-	-	-
Majidae	-	-	-	+	+	-	-	-	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	+	+	-	-	-
Mytilus californianus	1.7	0.1	1.0	0.7	0.5	1.2	0.7	0.4	1.3	1.6	4.0	3.6		9.0	8.2	5.9	0.2	+	+	+	0.9	2.4	+	1.7
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	+
Nemertea unid.	-	<.1	0.2	0.8	0.4	0.6	0.4	0.6	0.3	0.1	<.1	-		-	-	-	-	-	-	-	-	-	-	-
Nereididae unid.	-	-	-	-	-	-	<.1	<.1	-	<.1	-	-		-	-	<.1	-	-	-	<.1	-	-	-	-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	<.1	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-	-	-	-	-
Petrolisthes spp.	-	-	<.1	-	<.1	<.1	0.2	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	<.1	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	+	-	+	-	+	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	<.1	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Pollicipes polymerus	1.0	-	0.8	0.4	0.7	1.3	0.5	0.8	0.5	0.2	0.4	0.5		+	0.3	0.7	0.5	+	0.1	-	-	0.4	-	0.3
Polychaeta unid.	-	-	-	<.1	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	0.2	0.2	0.1	0.2	0.5	0.2	0.1	+	-	-		-	-	<.1	<.1	-	<.1	-	-	0.1	-	-
Pycnopodia helianthoides	-	-	-	-	-	-	<.1	-	-	<.1	-	-		-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	-	+	-	<.1	+	<.1	-	<.1	+	+		-	0.2	<.1	0.3	<.1	0.5	0.2	0.4	0.1	0.9	0.6
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-	0.1	-	-	-
Sipuncula unid.	-	-	-	-	-	-	+	+	-	+	+	-		-	+	-	-	+	+	-	-	+	-	+
Tricolia spp.	-	-	-	+	+	+	-	+	-	+	-	-		-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	+	+	-	+	+	-	+	+	+	-		-	-	-	+	-	+	-	-	-	-	-
Chthamalus fissus	<.1	<.1	0.2	0.2	0.2	0.2	0.3	0.8	0.4	1.1	3.6	4.3		14.7	19.2	19.3	21.0	12.0	17.3	17.2	17.0	16.0	11.5	7.5
Dodecaceria fewkesi	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	+	-	-	-	-	-	-
Haliclona spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	+	+	+	+	+	+	+	<.1	<.1	0.3		0.4	0.3	<.1	+	<.1	<.1	+	+	+	0.1	0.2
Pista spp.	-	-	-	-	+	-	+	+	<.1	+	+	+		-	-	-	+	+	+	-	+	-	-	-
Porifera unid. (encrusting)	-	-	-	+	+	+	<.1	<.1	+	+	+	+		-	-	-	+	+	-	-	-	-	+	-
Salmacina tribranchiata	-	-	-	-	-	-	-	+	+	-	+	-		-	-	-	-	-	-	-	-	+	-	-
Spirorbidae	-	-	+	<.1	<.1	<.1	0.2	0.4	0.2	0.2	<.1	<.1		+	+	+	+	+	+	+	+	+	+	+
tunicates, colonial/social unid.	-	-	-	+	+	+	<.1	+	+	+	+	+		-	-	-	+	-	-	-	-	+	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	4	5	6	6	5	4	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-					-	<.1	<.1	0.2	0.6	0.8	0.2	0.2	<.1	-	-	-	-	-	-	0.1	-	-
Anthopleura elegantissima	21.4	34.6					5.3	8.5	16.8	24.6	34.4	72.6	72.0	76.6	87.5	70.6	28.2	9.9	4.9	3.7	6.4	4.0	3.8	4.4
Balanus spp.	-	-					<.1	-	<.1	1.6	5.6	11.6	6.4	1.5	1.2	0.7	-	-	<.1	<.1	0.2	-	-	-
Calliostoma ligatum	-	-					-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	0.9	1.3					2.6	0.8	0.3	1.0	0.4	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-
Fissurella volcano	0.2	-					<.1	-	0.2	0.1	0.4	1.8	1.3	0.1	1.3	1.6	2.2	4.6	3.3	2.6	1.4	1.7	9.9	23.6
Hemigrapsus nudus	-	-					-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	-	0.1					0.8	0.2	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	0.5	-	<.1
Lottia limatula	0.3	-					0.3	<.1	0.4	2.2	3.5	1.9	2.7	1.7	1.8	1.2	0.7	1.0	2.5	2.2	1.9	1.9	5.5	17.9
Lottia pelta	0.6	-					1.5	0.4	3.7	5.3	6.1	8.4	3.3	1.1	3.5	3.6	1.7	3.4	6.1	2.9	2.7	2.6	5.0	44.5
Macclintockia scabra	1.0	2.2					1.2	1.7	3.9	24.4	152.2	200.8	159.7	21.5	3.0	4.0	2.0	1.6	4.7	4.4	13.5	4.0	3.9	76.0
Mopalia spp.	0.1	-					0.2	0.4	0.5	0.4	0.9	0.3	0.1	-	-	<.1	-	0.3	0.3	0.3	-	0.1	-	1.6
Nucella emarginata	-	-					-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	-	-					-	-	-	<.1	<.1	-	0.2	-	<.1	-	-	-	-	-	-	-	-	<.1
Ocenebra spp.	-	-					0.7	0.2	-	0.4	0.4	0.2	0.4	0.4	-	0.1	-	-	-	-	-	-	-	-
Pachygrapsus crassipes	-	-					<.1	-	<.1	-	0.2	0.2	<.1	0.2	0.3	0.3	0.2	0.3	0.4	0.6	0.3	-	0.3	0.6
Pagurus spp.	3.2	5.9					11.8	2.9	3.8	5.5	7.9	9.8	18.6	30.7	20.4	19.6	8.4	16.3	7.1	4.1	33.6	14.1	1.0	2.6
Pisaster ochraceus	-	-					-	-	-	-	<.1	-	0.1	0.5	0.2	0.2	-	<.1	0.1	-	0.1	0.1	-	-
Strongylocentrotus purpuratus	-	-					-	-	-	-	<.1	<.1	+	0.2	1.5	2.1	2.0	1.9	0.1	0.5	0.4	-	-	4.2
Tectura persona	0.3	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	0.9	0.6					2.2	0.9	3.9	10.6	18.3	3.6	3.8	2.2	2.3	0.7	0.6	0.9	1.4	1.1	0.2	0.5	0.8	1.2
Tegula brunnea	1.3	0.2					9.7	0.6	1.0	3.0	0.7	-	0.2	3.9	9.1	1.8	1.7	0.2	0.1	-	-	-	-	-
Tegula funebralis	1.4	6.3					14.2	39.2	62.4	36.6	109.0	123.6	298.0	173.5	57.4	2.7	4.6	0.4	<.1	0.8	41.0	43.9	-	-
Tetraclita rubescens	<.1	-					2.0	1.5	0.6	23.6	126.6	82.1	110.5	101.7	153.3	268.6	71.2	23.1	49.1	71.0	57.9	15.5	11.3	97.7
Only Counted if Greater than 1"																								
Acmaea mitra	<.1	-					<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Acmaeidae unid.	0.3	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-					-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
Amphiodia occidentalis	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Amphipholis spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Amphissa spp.	-	-					-	<.1	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Anthopleura artemisia	0.1	-					-	-	-	+	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1
Anthozoa unid.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Aplysia californica	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	<.1
Archidoris spp.	-	-					-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Asterina miniata	-	-					-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
Barleeia spp.	-	-					+	-	-	+	+	-	-	-	-	+	+	-	-	-	-	-	-	-
Bittium spp.	-	-					+	+	+	-	+	+	-	-	-	-	+	+	-	-	-	-	-	-
Cancer antennarius	-	-					<.1	-	<.1	-	<.1	-	-	-	-	<.1	-	<.1	<.1	-	-	-	0.1	-
Cancer spp.	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Chaetopteridae	-	-					-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+
Cirratulidae/Terebellidae unid.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Clavelina huntsmani	-	-					0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	4	5	6	6	5	4	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Crepidula spp.	-	-					+	+	+	+	+	+	+	+	+	-	-	+	-	-	-	-	-	-
Cyanoplax spp.	-	-					+	+	-	<.1	0.6	0.3	+	0.2	0.2	-	-	<.1	+	0.1	-	+	-	0.4
Diaulula sandiegensis	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Diodora spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	<.1	-	-	-	<.1
Diopatra ornata	-	-					-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-
Doriopsilla albopunctata	-	-					-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erato spp.	-	-					-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Flabellina trilineata	-	-					-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glans subquadrata	-	-					-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Granulina margaritula	-	-					-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-					-	-	+	-	-	+	+	-	-	-	+	-	+	+	-	-	-	-
Halcampa decemtentaculata	-	-					-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Haminoea spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Hemigrapsus oregonensis	-	-					-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-					-	-	-	-	+	-	-	-	-	+	-	-	-	+	-	-	-	-
Hermissenda crassicornis	-	-					-	-	-	+	-	-	+	-	0.1	+	+	+	+	+	+	0.1	-	-
Homolopoma luridum/Lirularia succincta	-	-					+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Idotea spp.	-	-					-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	<.1	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
Isopoda unid.	-	-					-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Lacuna spp.	-	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-
Lepidozona spp.	-	-					<.1	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Lissothuria nutriens	-	-					-	-	-	-	+	-	<.1	-	+	-	-	+	-	-	-	-	+	-
Lithopoma gibberosum	<.1	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	-					+	+	+	+	+	-	+	-	+	-	+	+	-	-	-	-	-	+
Lophopanopeus spp.	-	-					-	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Lottia asmi	-	-					+	+	+	+	+	+	+	+	+	-	-	-	+	-	+	-	-	-
Lottia gigantea	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7
Lottia instabilis	-	-					-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-					-	-	-	<.1	-	+	-	+	+	+	+	-	+	-	-	-	-	+
Majidae	-	-					+	+	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Megathura crenulata	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Mytilidae	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Mytilus californianus	-	-					-	-	+	<.1	1.5	0.2	+	-	-	-	-	-	+	-	-	-	-	3.2
Mytilus galloprovincialis	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	+	-	0.8
Navanax inermis	-	-					-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-
Nemertea unid.	-	-					0.5	0.9	<.1	-	+	+	-	-	-	-	-	-	-	<.1	0.3	0.1	-	-
Nereididae unid.	-	-					0.3	0.2	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-					-	-	+	+	+	+	+	-	+	+	+	+	+	+	+	+	-	-
Octopus spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Ophiactis simplex	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Ophiothrix spp.	-	-					-	-	-	-	-	-	-	-	<.1	-	-	0.4	0.1	0.1	0.1	-	-	0.4
Ophiuroidea unid.	-	-					+	-	-	-	-	-	-	-	-	-	+	-	+	+	-	-	+	0.2
Pelecypoda unid.	-	-					-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-					-	-	-	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	4	5	6	6	5	4	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Phidiana hiltoni	-	-					-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-					<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta unid.	-	-					-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	0.2	-					0.2	+	<.1	<.1	+	-	<.1	0.2	0.4	0.6	0.1	<.1	0.3	+	0.4	0.7	1.0	<.1
Pycnogonida unid.	-	-					+	+	+	-	-	-	-	-	+	+	+	+	+	+	0.1	-	0.1	+
Pycnopodia helianthoides	-	-					-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-					-	-	-	+	<.1	0.3	+	0.2	+	<.1	-	+	+	+	-	0.1	+	+
Serpulorbis squamigerus	-	-					-	-	-	<.1	0.2	0.5	0.3	0.4	0.2	0.5	0.2	0.5	0.2	-	0.3	-	0.2	0.7
Sipuncula unid.	-	-					+	+	-	-	-	-	-	-	+	+	-	-	-	+	-	-	-	-
Tonicella lineata	-	-					-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.1
Tricolia spp.	-	-					+	+	+	+	+	-	-	-	-	+	+	-	+	+	-	-	-	-
Williamia peltoides	-	-					-	-	-	-	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-					+	+	-	+	+	-	-	+	-	+	+	+	+	-	+	<.1	-	-
Chthamalus fissus	<.1	<.1					+	+	+	2.7	15.1	11.0	12.5	5.1	0.7	0.1	+	+	<.1	0.6	3.5	2.8	1.7	+
Dodecaceria fewkesi	-	-					-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Phragmatopoma californica	-	-					+	+	<.1	0.4	0.2	0.5	1.9	0.2	+	+	+	+	+	+	-	+	1.0	1.0
Pista spp.	0.1	<.1					3.0	0.9	0.1	0.1	0.1	<.1	<.1	0.1	+	0.4	1.1	7.2	16.5	22.1	21.6	19.3	1.5	1.6
Porifera unid. (encrusting)	-	-					+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbidae	-	-					+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+	-	+
tunicates, colonial/social unid.	-	-					0.5	+	-	-	+	-	-	+	+	+	+	+	-	-	-	+	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	5	6	6	6	5	5	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-					0.2	<.1	-	-	0.7	1.8	0.6	<.1	0.2	-	<.1	-	-	<.1	0.2	0.3	-	<.1
Anthopleura elegantissima	80.2	134					71	34.4	18.2	29.4	53.2	51.7	74.7	147	152	145	85.7	39.3	41	44.4	35.4	38.9	30.1	21.8
Balanus spp.	0.2	0.4					-	-	-	5.5	5.4	1.1	6.4	1.8	0.4	<.1	-	-	-	-	-	-	-	-
Epiactis prolifera	0.3	-					2.2	0.4	0.3	0.5	<.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-
Fissurella volcano	-	-					-	-	<.1	<.1	<.1	0.7	0.4	0.3	-	1.8	3	6.2	4.5	5.4	1.4	4.4	15.5	15.5
Haliotis spp.	-	-					-	-	-	-	-	<.1	-	-	-	0.1	-	<.1	-	-	-	-	-	-
Hemigrapsus nudus	-	0.2					-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	-	0.2					1	<.1	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Lottia digitalis	-	0.1					0.1	-	-	-	0.2	8.2	3.5	0.6	0.4	0.3	-	-	-	-	-	-	-	0.9
Lottia limatula	0.4	-					0.2	<.1	0.1	1.1	3.4	5	4.7	2.1	2.7	2.9	1.4	2.8	2.5	4.1	3	4.3	7.5	9.5
Lottia pelta	0.2	0.1					2.1	0.7	1.4	3.2	3.6	4.8	2.6	1.2	2.4	2.2	1	5.6	5.4	5.9	3.5	4	6	39.4
Macclintockia scabra	3	4.3					5.2	0.5	0.8	22.2	120	185	107	24.7	3.2	3.6	0.6	4	8.1	8.3	4.4	15.2	9.4	100
Mitra idae	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Mopalia spp.	0.3	-					0.5	0.3	0.1	0.2	0.4	0.2	0.2	-	-	<.1	<.1	<.1	0.1	0.1	-	0.2	-	1.1
Nucella emarginata	-	-					-	-	-	12.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.1	-	-	0.1
Ocenebra spp.	-	-					0.6	0.2	<.1	-	<.1	0.1	0.6	0.2	-	-	-	-	-	-	0.2	-	0.1	-
Pachygrapsus crassipes	-	-					<.1	-	-	-	0.3	0.7	0.2	0.4	0.3	0.9	0.3	0.3	0.3	0.3	0.1	-	0.4	0.4
Pagurus spp.	3.5	5.6					12.5	2.3	0.5	3.6	9	12.3	23.6	9.7	22.2	7.1	6.9	10.3	4	2.7	5	10.4	0.9	3.3
Pisaster ochraceus	-	-					-	<.1	-	-	-	<.1	-	0.8	0.1	0.9	<.1	0.3	0.2	-	0.1	-	-	-
Strongylocentrotus purpuratus	-	-					<.1	-	<.1	-	<.1	-	0.2	0.2	0.5	0.4	0.4	1.3	0.2	1.7	0.5	0.2	-	1
Tectura persona	<.1	-					0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	2	0.8					6	1.1	2.7	6.4	17.3	11.1	7.7	4.2	1.6	3.1	0.3	0.2	2	3.5	0.5	0.7	1.3	2.5
Tegula brunnea	0.7	0.5					1.3	<.1	<.1	1.4	-	0.1	-	<.1	1.7	0.1	0.2	0.2	<.1	-	-	-	-	-
Tegula funebralis	43.9	76.8					112	62.8	57.8	96.4	151	271	436	274	79.1	24.3	88.6	9.9	53.2	31.3	155	119	2.9	4.2
Tetraclita rubescens	0.7	2.3					4.4	0.8	0.5	17.5	87.4	44.8	46.1	22.8	61.8	165	68.8	54.4	75.1	85.7	64.8	31.5	11.2	209
Only Counted if Greater than 1"																								
Acmaeidae unid.	0.5	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-					<.1	-	-	-	-	+	-	-	-	+	-	-	+	-	-	0.1	-	-
Aeolidiacea unid. a	-	-					-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	-					+	-	-	-	-	-	-	-	-	+	+	+	+	+	-	-	-	-
Amphissa spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Anthopleura artemisia	<.1	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aphrodita spp.	-	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-					-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	0.3	-
Barleeia spp.	-	-					+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Bittium spp.	-	-					+	-	-	-	-	-	-	+	-	-	-	-	+	+	-	-	-	-
Cancer antennarius	<.1	-					-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-
Cancer spp.	-	-					<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-					-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-					-	-	-	-	-	-	-	-	-	<.1	<.1	+	-	-	-	+	0.1	+
Crangon spp.	<.1	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	-					+	+	+	+	+	+	+	+	-	-	+	-	-	+	-	-	-	-
Cyanoplax spp.	-	-					+	-	-	0.2	0.4	0.5	0.2	0.2	0.4	0.4	0.3	0.2	0.3	0.1	0.3	0.5	0.2	0.5
Diodora spp.	-	-					-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	5	6	6	6	5	5	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Diopatra ornata	-	-					-	-	-	-	-	-	-	<.1	<.1	0.1	0.1	0.2	0.1	-	-	0.1	-	<.1
Discurria insessa	-	-					-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doridacea unid.	-	-					-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-					-	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-
Eupentacta quinquesemita	-	-					-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-					+	-	-	-	+	-	-	-	-	-	+	+	+	-	-	-	-	+
Hemigrapsus oregonensis	-	-					-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-					+	-	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-	+
Hermissenda crassicornis	-	-					<.1	-	-	-	+	+	<.1	+	-	+	+	-	+	+	-	0.2	-	+
Homolopoma luridum/Lirularia succincta	-	-					+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Ischnochitonidae	0.1	-					+	+	+	+	+	<.1	+	<.1	+	+	+	+	+	-	+	+	-	-
Lacuna spp.	-	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-
Lepidozona spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Lissothuria nutriens	-	-					+	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Lithopoma gibberosum	<.1	0.1					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	-					+	+	+	+	+	+	+	+	+	-	+	+	-	+	-	-	-	-
Lottia asmi	-	-					+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Lottia gigantea	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.2
Lottia instabilis	<.1	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-					-	-	-	+	-	-	+	-	+	+	-	-	+	-	-	+	-	-
Majidae	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-					-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	+	-	-
Mytilus californianus	-	-					-	-	-	+	0.2	0.5	<.1	0.1	-	-	-	-	+	-	+	-	-	4.1
Mytilus galloprovincialis	-	-					-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	+	-	-	+	0.6
Natantia unid.	-	-					-	-	-	-	-	<.1	-	-	-	-	-	-	+	-	-	-	-	-
Nemertea unid.	-	-					0.7	0.1	<.1	-	<.1	+	-	-	-	-	<.1	-	0.1	<.1	-	0.1	0.1	-
Nereididae unid.	-	-					<.1	-	-	-	-	-	-	+	-	-	-	<.1	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-					+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	+
Octopus spp.	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	0.1	-
Ophiothrix spp.	-	-					-	-	-	-	-	-	-	-	+	-	-	-	<.1	<.1	-	-	-	<.1
Ophiuroidea unid.	-	-					+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	<.1
Phidiana hiltoni	-	-					-	<.1	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-					+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	<.1	-					0.5	-	-	+	<.1	-	0.2	-	0.2	+	0.2	<.1	0.4	<.1	-	0.3	0.3	-
Pycnogonida unid.	-	-					+	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-
Pycnopodia helianthoides	-	-					+	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Septifer bifurcatus	-	-					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+
Serpulidae unid.	-	-					-	-	-	+	+	+	+	+	-	0.1	-	-	+	-	-	0.2	-	+
Serpulorbis squamigerus	-	-					-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	0.2	0.6	0.5	-	1.1
Sipuncula unid.	-	-					+	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Styela spp.	-	-					-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Tricolia spp.	-	-					+	+	+	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	2	ns	ns	ns	ns	5	6	6	6	5	5	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
% Coverage																								
Bryozoa, unid. (encrusting)	-	-					<.1	-	-	+	<.1	-	-	-	+	-	+	+	+	-	+	+	-	+
Chthamalus fissus	+	0.1					+	+	+	1.1	10.8	6.9	6.6	4.7	1.2	<.1	0.1	+	+	+	2.5	4	1.7	0.2
Phragmatopoma californica	-	-					+	+	+	<.1	<.1	0.5	0.3	0.2	+	+	+	+	+	+	+	+	+	0.1
Pista spp.	+	-					1.4	0.1	+	+	+	+	+	+	-	+	+	0.3	1.7	2.2	2.3	2.7	0.4	1
Porifera unid. (encrusting)	-	-					+	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Spirorbidae	-	-					+	-	-	-	+	0.1	+	+	+	+	+	+	+	+	+	+	-	+
tunicates, colonial/social unid.	-	-					<.1	-	-	-	+	-	-	+	-	+	-	+	+	-	-	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 2 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	-	0.4	0.7	0.2	0.4	0.3	0.2	0.4	1.1	0.9	1.4	1.7		0.2	0.3	-	-	-	-	-				+
Anthopleura elegantissima	27.0	33.7	38.1	44.6	53.7	39.5	39.1	33.6	47.3	29.3	55.6	77.9		194.0	150.2	116.6	92.9	88.3	73.3	43.5				33.3
Anthopleura xanthogrammica	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1		-	-	-	-	-	-	-				-
Balanus spp.	<.1	0.4	0.2	1.1	0.1	-	<.1	-	+	0.1	-	<.1		-	4.6	-	-	-	-	-				-
Conus californicus	-	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	-	-	-	-				-
Epiactis prolifera	0.2	0.6	6.8	12.9	5.7	1.2	0.7	1.9	1.0	0.7	<.1	<.1		-	-	<.1	<.1	-	<.1	-				-
Fissurella volcano	<.1	-	<.1	0.1	0.3	0.1	<.1	<.1	0.3	0.1	0.3	0.1		-	-	0.6	1.5	1.5	1.3	1.7				3.6
Haliotis spp.	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.2	0.3	<.1	0.2	<.1		-	-	<.1	<.1	-	-	-				-
Hemigrapsus nudus	<.1	0.1	0.2	0.1	-	0.2	0.1	-	<.1	<.1	-	-		-	-	-	<.1	-	-	-				-
Leptasterias spp.	0.6	0.3	0.4	0.8	0.6	0.3	0.2	<.1	-	<.1	-	-		-	-	-	<.1	<.1	-	-				-
Lottia digitalis	0.8	<.1	<.1	1.1	0.5	0.3	0.3	-	0.5	0.5	-	-		-	-	0.4	-	-	-	-				-
Lottia limatula	1.0	<.1	0.3	0.7	1.2	1.2	1.3	0.8	0.5	3.3	2.6	4.0		2.4	1.5	4.3	2.5	2.9	5.1	3.7				15.9
Lottia pelta	0.2	0.1	1.0	1.9	0.4	1.1	1.1	2.1	3.1	4.2	2.6	1.5		2.0	1.5	2.4	0.7	2.7	2.1	0.2				7.6
Macclintockia scabra	6.3	3.8	4.1	10.7	14.6	11.9	22.9	15.4	19.4	40.3	54.4	65.0		39.4	14.6	7.2	1.3	3.2	5.6	1.7				24.4
Mopalia spp.	0.2	<.1	0.9	0.8	0.2	<.1	0.1	0.2	0.2	0.4	0.2	<.1		-	-	-	-	0.1	<.1	0.1				0.6
Nucella emarginata	-	<.1	-	-	-	-	<.1	-	-	-	0.1	-		-	-	-	-	-	-	-				-
Nuttallina californica	-	-	0.4	0.3	0.3	0.1	0.3	0.5	0.4	0.4	0.2	-		-	-	-	-	-	-	-				<.1
Ocenebra spp.	-	0.2	0.4	1.0	1.0	2.0	0.9	0.2	0.4	0.6	0.3	<.1		-	<.1	-	-	-	<.1	-				-
Pachygrapsus crassipes	<.1	<.1	<.1	-	0.1	<.1	0.3	0.1	<.1	0.3	<.1	0.3		-	1.3	1.0	0.7	0.7	0.6	-				0.7
Pagurus spp.	4.9	17.1	8.2	11.3	20.5	20.8	17.2	5.2	9.2	11.4	10.2	16.8		24.2	15.0	24.2	20.5	33.2	15.1	3.4				4.0
Pisaster ochraceus	<.1	<.1	-	0.1	0.2	<.1	0.1	-	<.1	<.1	<.1	-		0.2	0.2	0.6	0.5	0.6	0.5	0.1				-
Pseudomelatoma torosa	-	-	-	-	-	<.1	-	0.2	-	+	-	-		-	-	-	-	-	-	-				-
Strongylocentrotus purpuratus	0.4	0.1	<.1	<.1	<.1	1.0	<.1	0.2	-	<.1	0.1	0.1		-	0.2	0.1	0.3	1.0	1.4	6.1				1.7
Tectura paleacea	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Tectura scutum	1.1	2.0	2.0	2.6	2.7	2.2	4.8	2.6	8.0	8.6	7.2	8.1		6.0	0.8	1.9	0.6	0.9	1.8	0.5				0.8
Tegula brunnea	0.2	0.4	0.4	1.0	2.5	3.5	2.3	3.1	0.4	0.4	1.5	0.8		-	1.4	0.4	0.3	<.1	-	0.1				-
Tegula funebralis	9.5	60.2	40.4	28.1	42.5	42.6	22.7	76.9	66.5	104.7	237.0	294.3		515.4	160.7	67.1	92.0	134.0	140.2	170.7				111.7
Tegula spp.	-	-	-	-	-	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tetraclita rubescens	5.4	1.3	0.7	1.0	4.7	5.0	2.5	1.5	4.9	12.1	5.2	3.3		9.8	11.4	74.1	48.9	78.7	46.1	29.9				20.6
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	-	+	<.1	+	-	-	<.1	-	+	-		-	-	-	-	-	-	-				-
Acmaeidae unid.	0.5	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	<.1	0.1	+				+
Aeolidia papillosa	<.1	-	<.1	-	<.1	-	<.1	-	-	-	-	-		-	0.2	+	+	-	<.1	-				<.1
Alia spp.	-	+	+	+	+	+	+	+	+	+	+	+		-	-	-	+	+	+	+				-
Amphissa spp.	-	<.1	+	+	+	<.1	+	-	-	+	+	-		-	-	-	+	+	+	+				-
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	<.1		-	-	-	<.1	-	-	-				+
Anthozoa unid.	-	-	-	-	-	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-				<.1
Asterina miniata	-	-	-	-	-	-	-	<.1	-	-	-	-		-	-	-	-	-	-	-				-
Balanus/Tetraclita spp.	-	-	-	-	-	-	-	-	-	4.4	-	-		-	-	-	-	-	-	-				-
Barleeia spp.	-	-	+	+	+	+	+	-	-	+	-	-		-	-	-	+	-	-	-				+
Bittium spp.	-	-	+	+	+	-	+	-	-	+	-	-		-	-	-	-	-	-	-				-
Cancer antennarius	<.1	<.1	0.1	0.2	-	0.1	<.1	<.1	-	-	-	<.1		-	-	<.1	<.1	-	<.1	-				-
Cancer productus	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-				-
Cancer spp.	-	-	-	+	<.1	+	-	+	-	-	-	-		-	-	-	<.1	<.1	+	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1" (continued)																								
Chaetopteridae	-	-	-	-	-	-	-	+	-	-	-	-		-	-	-	-	<.1	-	-				-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				+
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	-	-	+	-	-				-
Cyanoplax spp.	-	<.1	<.1	<.1	0.2	+	0.5	0.1	0.2	0.2	0.2	0.7		0.4	0.5	0.3	0.3	0.6	0.3	0.2				0.8
Diaulula sandiegensis	-	-	-	-	-	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Diopatra ornata	<.1	-	-	0.2	-	-	<.1	0.1	<.1	<.1	<.1	-		-	-	-	-	-	0.2	-				-
Discurria insessa	-	-	-	-	+	-	-	-	-	-	+	-		-	-	-	-	-	-	-				-
Doriopsilla albopunctata	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Grapsidae (juv.)	-	-	-	+	-	+	+	+	+	+	+	+		-	+	-	+	+	-	-				-
Heptacarpus spp.	0.7	-	-	-	-	<.1	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Hermissenda crassicornis	-	-	-	0.4	-	-	-	-	0.1	<.1	-	<.1		-	0.2	+	-	-	<.1	0.1				-
Homolopoma luridum/Lirularia succincta	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Idotea spp.	-	-	+	+	-	<.1	-	-	+	-	-	-		-	-	-	-	-	-	-				-
Ischnochitonidae	-	0.1	<.1	+	<.1	+	+	+	+	+	+	+		+	+	-	-	+	-	-				-
Isopoda unid.	-	+	-	-	+	-	-	-	-	-	+	-		-	-	-	-	-	-	-				-
Lacuna spp.	-	<.1	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	-				-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	<.1	-	-	+	-				-
Littorina spp.	-	-	-	-	+	+	+	+	+	+	+	+		+	+	+	-	+	+	+				+
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	-				+
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-		-	+	+	+	+	+	-				-
Majidae	-	-	+	+	+	+	+	+	+	+	-	-		-	-	-	-	-	-	-				-
Mytilus californianus	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1		+	0.1	0.1	<.1	<.1	-	-				-
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				0.1
Natantia unid.	-	-	-	+	+	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Nemertea unid.	<.1	-	-	0.2	0.1	0.1	0.4	0.2	0.4	-	<.1	-		-	-	-	-	-	+	-				<.1
Nereididae unid.	-	-	<.1	<.1	-	-	0.2	-	-	<.1	+	+		-	<.1	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	0.3	+	+				+
Nuttallina spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Ophiuroidea unid.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	<.1	-	-	-	-				-
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	+	-				-
Petrolisthes spp.	0.3	-	-	-	-	-	-	-	-	-	<.1	-		-	-	-	<.1	-	-	-				-
Pisaster/Henricia (juv.)	-	-	-	+	-	+	+	+	-	-	-	-		-	-	-	-	-	-	-				-
Polychaeta unid.	-	-	-	-	-	+	-	-	-	-	<.1	<.1		-	-	-	-	-	-	-				-
Pugettia spp.	0.2	0.1	0.2	0.5	0.4	0.5	0.7	0.2	0.1	+	-	-		-	+	0.1	<.1	0.3	0.3	+				<.1
Pycnogonida unid.	-	-	-	+	-	+	+	-	-	-	-	+		-	-	+	-	+	+	-				-
Rostanga pulchra	-	-	-	-	-	-	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Serpulidae unid.	-	-	+	-	<.1	-	-	-	+	+	+	+		-	+	<.1	0.2	+	+	+				+
Serpulorbis squamigerus	-	+	-	-	-	-	-	-	-	0.1	0.7	0.7		2.2	0.4	0.5	0.5	0.9	0.8	1.7				1.0
Sipuncula unid.	-	<.1	-	+	<.1	+	0.1	+	<.1	+	+	+		-	-	<.1	+	+	+	-				-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Streblosoma crassibranchia	1.2	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tricolia spp.	-	-	-	+	+	+	+	-	+	-	-	-		-	-	+	-	-	-	-				-
Triopha maculata	-	-	-	-	-	-	-	-	+	-	-	-		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 2 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	5	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
% Coverage																								
Amphipod (tube)	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	<.1	-	-	-	-				-
Bryozoa, unid. (encrusting)	-	-	<.1	<.1	+	+	+	+	+	+	-	-		-	-	+	+	+	+	-				-
Bryozoa, unid. (foliose)	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Chthamalus fissus	0.4	<.1	<.1	<.1	0.1	+	+	<.1	+	0.3	0.4	0.4		3.2	0.8	0.1	0.1	<.1	0.1	+				+
Haliclona spp.	-	-	-	<.1	<.1	<.1	<.1	+	<.1	-	-	+		-	-	-	-	-	-	-				-
Phragmatopoma californica	0.1	-	0.3	<.1	+	<.1	+	+	+	<.1	+	0.1		+	+	+	+	+	+	+				<.1
Pista spp.	0.9	1.0	1.4	2.1	1.7	2.0	0.9	1.9	5.2	0.9	0.2	+		+	+	+	+	+	+	+				+
Porifera unid. (encrusting)	-	-	+	<.1	<.1	<.1	+	<.1	+	+	+	-		-	-	-	-	-	-	-				-
Spirorbidae	-	-	-	-	-	+	-	+	+	+	-	+		-	+	+	+	+	+	+				+
tunicates, colonial/social unid.	-	-	-	+	+	+	+	+	+	+	-	-		-	-	-	+	+	-	-				-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 2 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Counted Regardless of Size																								
Acanthina spp.	0.2	-	0.5	0.6	0.4	0.6	0.8	0.3	0.5	0.8	0.6	0.8		1.2	0.1	0.3	-	0.2	0.2	0.3				0.2
Anthopleura elegantissima	220	160	139	236	242	193	156	58.6	94.5	129	143	173		301	280	317	215	193	175	81				92
Anthopleura xanthogrammica	-	-	<.1	0.2	<.1	<.1	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Balanus spp.	-	-	<.1	<.1	-	-	-	-	-	0.2	0.3	-		0.4	0.4	<.1	0.1	<.1	-	-				-
Epiactis prolifera	-	-	0.2	0.1	<.1	-	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Fissurella volcano	-	-	-	-	-	-	-	-	<.1	-	-	-		-	-	+	-	<.1	-	-				0.1
Haliotis spp.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	0.2	-	-	-	-				-
Hemigrapsus nudus	-	0.2	0.1	<.1	0.1	<.1	0.1	0.1	<.1	<.1	0.1	-		-	<.1	-	-	<.1	-	-				-
Leptasterias spp.	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Lottia digitalis	4.1	0.9	0.8	4	3.2	2.3	0.7	0.8	1.6	-	0.5	0.8		0.2	0.7	<.1	-	<.1	-	0.2				-
Lottia limatula	2.1	0.6	0.7	1.7	1.2	2.2	2.7	1.2	1	2.4	2	3.9		1.8	1.4	4.1	2.8	4	6.7	1.5				6.4
Lottia pelta	0.2	0.4	0.6	1.4	0.5	1.1	1.2	0.9	1.5	0.9	0.8	1.5		1.6	0.4	0.8	0.8	2.9	0.9	0.7				2.8
Macclintockia scabra	47.2	36.7	31.6	59.9	84.6	90.3	78	27.7	37.6	49.5	47.8	62.2		54.8	39.9	26.9	13.1	28.8	21	8				37.5
Mopalia spp.	-	-	0.1	0.2	0.2	-	<.1	<.1	<.1	0.2	0.2	<.1		-	-	-	-	-	-	-				-
Nucella emarginata	-	-	0.8	<.1	<.1	-	-	-	-	-	-	<.1		-	-	0.1	-	-	-	-				-
Nuttallina californica	-	-	<.1	-	-	-	-	<.1	<.1	-	<.1	-		-	-	-	-	-	-	-				-
Ocenebra spp.	-	-	0.2	0.2	0.1	0.3	0.3	0.3	0.1	<.1	<.1	<.1		-	-	<.1	<.1	<.1	<.1	-				-
Pachygrapsus crassipes	-	<.1	0.1	0.2	<.1	<.1	0.1	0.2	<.1	0.2	0.2	0.4		+	0.6	0.4	0.3	0.6	0.5	0.2				0.4
Pagurus spp.	14.9	8	6	19	11	15.8	15.1	5.9	2.7	5.4	6.3	16.1		11.8	16.9	16.5	21.2	21.8	5.4	0.3				2.1
Pisaster ochraceus	-	-	-	<.1	-	<.1	<.1	-	-	<.1	-	-		-	0.3	0.3	0.7	0.3	-	0.1				-
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Strongylocentrotus purpuratus	-	-	<.1	<.1	-	<.1	<.1	-	-	<.1	-	-		-	-	-	<.1	0.1	0.2	0.1				0.1
Tectura persona	-	-	-	-	-	-	<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Tectura scutum	8.7	2.8	3	3.3	4.3	2.8	7.7	2.4	6.8	9.6	4.1	8.5		6.8	1	4.8	1.2	1.4	3.1	2.6				0.8
Tegula brunnea	-	-	<.1	<.1	-	-	<.1	<.1	-	-	-	-		-	0.3	-	-	-	-	0.1				-
Tegula funebralis	83.8	125	85.5	63.2	88.4	84.4	135	109	91.4	113	123	154		145	263	217	120	176	295	217				182
Tegula pulligo	-	-	-	<.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Tetraclita rubescens	<.1	<.1	-	1.7	0.4	0.1	0.3	<.1	0.2	2.1	0.3	0.5		1	4.7	40.5	20	7.5	11.3	6.2				<.1
Only Counted if Greater than 1°																								
Acmaea mitra	-	-	-	-	-	-	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Acmaeidae unid.	0.6	+	+	+	+	+	+	+	<.1	+	+	+		+	+	<.1	+	+	+	+				+
Alia spp.	-	<.1	-	+	+	+	-	+	-	-	+	-		-	-	-	-	+	+	+				-
Amphissa spp.	-	-	+	-	-	-	-	+	-	-	-	-		-	-	-	-	-	-	-				-
Barleeia spp.	-	-	-	+	+	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Bittium spp.	-	-	-	+	+	+	-	-	+	-	-	+		-	-	-	-	-	-	-				-
Cancer spp.	-	-	-	+	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Chaetopteridae	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	+				-
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+		-	+	+	+	+	+	-				-
Cyanoplax spp.	-	0.2	<.1	2.2	2.1	1.6	0.8	1.6	0.9	2.3	1.5	2.6		+	0.4	0.3	0.1	0.7	0.2	0.2				0.3
Diaulula sandiegensis	-	-	-	-	-	-	-	-	<.1	-	-	-		-	-	-	-	-	-	-				-
Diopatra ornata	0.3	<.1	-	0.1	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	+	-		-	-	-	-	-	-	-				-
Grapsidae (juv.)	-	-	-	-	+	+	+	+	+	+	-	+		-	+	-	+	-	-	-				-
Heptacarpus spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	<.1	-	+	+		-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	4
Only Counted if Greater than 1" (continued)																								
Idotea spp.	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Ischnochitonidae	0.3	0.2	0.2	+	+	+	+	+	+	+	+	+		-	+	-	-	+	-	-				-
Isopoda unid.	-	-	-	-	+	+	-	+	-	-	+	-		-	-	-	-	-	-	-				-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+		+	-	-	+	+	-	+				+
Littorina spp.	-	<.1	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lophopanopeus spp.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Lottia asmi	-	-	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+				+
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				<.1
Lottia instabilis	-	-	-	-	+	-	-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	+	+	-	-				-
Majidae	-	-	-	-	-	+	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Mytilidae	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	+	+	+	-				-
Mytilus californianus	-	-	-	-	-	-	-	-	-	-	-	+		+	+	+	-	+	-	-				0.6
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-		-	+	-	-	-	-	-				-
Natantia unid.	-	-	-	-	+	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Nemertea unid.	-	-	+	0.2	0.2	<.1	0.1	0.1	-	<.1	-	-		-	-	-	-	-	-	-				-
Nereididae unid.	-	-	+	-	-	-	<.1	-	-	-	-	0.1		-	+	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-	+	+	+	+	+	-	+	+	+	+		+	+	+	+	+	+	-				-
Platyhelminthes unid.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Pollicipes polymerus	-	-	-	-	-	-	-	-	-	-	-	-		-	+	+	-	-	-	-				-
Polychaeta unid.	-	-	-	-	+	<.1	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Pugettia spp.	-	<.1	-	<.1	<.1	+	<.1	-	-	-	-	-		-	-	<.1	-	-	-	-				-
Pycnogonida unid.	-	-	-	+	+	-	-	-	-	-	-	+		-	-	-	-	-	-	-				-
Serpulidae unid.	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	<.1	-				-
Sipuncula unid.	-	-	-	+	+	<.1	-	-	-	-	-	+		-	-	+	-	+	-	-				-
Spionidae unid.	-	-	-	-	-	-	-	-	+	-	+	-		-	-	-	-	-	-	-				-
Tonicella lineata	-	-	-	-	-	<.1	-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Tricolia spp.	-	-	-	+	-	+	-	-	-	-	-	-		-	-	-	-	-	-	-				-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	+	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-
Chthamalus fissus	1.3	<.1	<.1	0.2	0.2	<.1	0.2	<.1	+	0.2	0.3	0.4		9.3	3.5	3.5	3.8	1.2	0.9	0.4				+
Phragmatopoma californica	-	-	+	+	+	-	+	+	+	+	-	+		-	+	+	+	+	+	+				+
Pista spp.	-	-	+	-	+	+	+	-	+	+	+	+		-	-	+	-	-	-	-				-
Porifera unid. (encrusting)	-	-	-	-	-	-	+	-	-	-	-	-		-	-	-	-	-	-	-				-
Spirorbidae	-	-	-	-	-	-	-	-	+	-	-	+		-	-	+	-	+	+	+				+
tunicates, colonial/social unid.	-	-	-	+	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-				-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	-	0.1	<.1	<.1	0.1	0.1	<.1	0.1	0.2	1.7	0.9	0.5	0.5	-	-	-	-	<.1	-	0.1	-	-	<.1
Anthopleura elegantissima	4.1	2.5	1.8	2.0	2.4	2.8	3.0	1.3	1.4	1.1	1.2	2.3	4.0	9.5	21.3	24.8	16.2	8.9	5.9	9.0	7.8	10.0	7.7	8.5
Anthopleura xanthogrammica	0.1	0.2	0.3	0.3	0.2	0.3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Balanus spp.	0.3	<.1	1.5	0.1	0.5	-	0.9	<.1	<.1	<.1	0.1	+	-	0.1	-	-	<.1	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Conus californicus	0.4	<.1	1.2	0.6	0.4	0.3	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	-	0.4	0.3	1.3	1.0	0.3	0.3	-	-	<.1	-	-	-	<.1	-	-	-	<.1	-	<.1	-	-	0.1	<.1
Fissurella volcano	0.2	<.1	0.3	0.6	1.1	0.6	0.3	-	0.1	0.1	<.1	<.1	0.1	0.1	-	0.2	0.9	0.6	1.7	1.1	0.3	0.1	1.3	0.6
Haliotis spp.	<.1	0.1	0.3	0.2	<.1	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Hemigrapsus nudus	-	0.2	0.1	0.2	0.2	<.1	<.1	0.3	0.3	0.1	<.1	0.3	0.4	0.2	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	0.4	0.2	0.5	0.4	0.5	0.5	0.2	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	-	-	-	0.2	0.1	-	-	0.2	0.1	0.3	-	<.1	0.3	-	-	0.2	-	-	-	-	-	-	-	1.3
Lottia limatula	0.3	<.1	0.5	0.6	0.6	0.6	0.5	1.3	1.2	2.4	6.3	8.0	7.2	4.5	5.5	5.4	4.9	10.4	7.4	10.2	5.3	4.8	4.3	5.2
Lottia pelta	-	-	0.1	0.2	0.2	0.3	1.5	0.5	1.6	1.5	0.6	0.9	0.9	0.1	1.0	1.2	1.5	2.4	3.4	1.6	1.2	2.3	4.5	5.3
Macclintockia scabra	0.2	1.9	4.0	3.7	2.7	4.2	21.2	10.5	57.2	84.8	118.6	111.8	112.1	69.3	40.7	73.2	16.7	28.6	21.4	17.0	19.2	19.2	59.4	51.5
Mitra idae	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mopalia spp.	<.1	<.1	<.1	0.3	<.1	<.1	0.1	0.1	<.1	-	<.1	<.1	-	-	-	-	<.1	<.1	-	<.1	0.1	0.1	-	-
Nassarius spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nucella emarginata	-	-	<.1	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ocenebra spp.	<.1	0.6	0.9	2.1	1.9	1.4	0.9	0.1	0.2	0.5	0.8	1.2	1.4	3.0	1.7	1.5	1.3	0.2	0.4	0.1	0.3	1.1	0.1	<.1
Pachygrapsus crassipes	-	-	-	0.1	-	<.1	0.1	0.2	0.1	0.4	0.4	0.4	<.1	0.2	0.4	1.0	0.2	0.6	0.3	0.2	0.2	1.9	1.8	0.3
Pagurus spp.	9.9	22.8	26.5	17.5	22.1	24.0	25.5	27.6	18.1	12.9	29.2	37.4	28.2	28.2	82.4	211.9	102.6	60.6	68.5	74.7	43.9	24.5	8.5	14.7
Pisaster ochraceus	-	-	-	-	<.1	<.1	<.1	<.1	-	0.1	-	<.1	-	0.2	0.6	0.6	0.1	0.4	0.2	0.2	0.2	0.2	-	<.1
Pseudomelatoma torosa	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	<.1	-	<.1	-	0.2	0.2	0.1	-	<.1	-	<.1	-	<.1	-	<.1	-	<.1	0.3	0.5	2.5	0.8	0.7	0.4	0.8
Tectura persona	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Tectura scutum	1.8	1.3	1.8	2.1	1.5	1.7	18.2	3.1	6.1	7.1	9.7	7.8	2.5	7.2	2.0	13.9	1.4	1.7	1.7	1.7	7.1	5.3	15.9	4.1
Tegula brunnea	-	0.8	0.5	2.7	3.3	4.0	1.7	0.3	0.2	0.1	<.1	-	-	-	0.2	-	3.1	1.8	0.6	2.3	-	0.3	0.5	-
Tegula funebralis	22.4	49.9	47.8	37.8	130.4	82.0	98.3	104.7	125.5	194.9	383.7	291.7	380.0	390.2	260.9	48.5	59.4	82.0	248.9	81.9	140.1	277.3	358.4	237.5
Tegula pulligo	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Tegula spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	0.1	1.0	10.3	3.8	9.7	28.0	20.4	11.7	28.5	45.5	21.1	4.4	1.8	2.0	19.1	29.2	25.2	48.1	54.4	18.1	20.9	18.7	8.9	15.6
Only Counted if Greater than 1"																								
Acmaea mitra	<.1	<.1	+	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Acmaeidae unid.	0.9	-	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aeolidiacea unid. a	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	+	+	+	+	+	+	+	-	+	-	+	-	-	+	+	+	+	+	+	+	+	-	-
Amphissa spp.	-	-	-	+	<.1	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Anthopleura artemisia	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Asterina miniata	<.1	<.1	-	0.1	0.1	<.1	-	-	<.1	-	-	-	-	-	-	-	0.2	0.3	-	<.1	0.1	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Balanus/Tetraclita spp.	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	+	+	+	+	-	+	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-
Bittium spp.	-	-	+	+	+	+	+	-	+	+	+	-	-	-	-	-	+	-	-	+	-	+	-	-
Cancer antennarius	<.1	-	-	<.1	<.1	<.1	<.1	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-
Cancer productus	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	<.1	-	-	+	<.1	<.1	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Cirripedia unid. a	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clavelina huntsmani	0.6	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+	-	-	-	-
Cyanoplax spp.	-	-	-	0.2	<.1	0.1	<.1	-	-	<.1	<.1	0.1	0.1	0.2	<.1	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.2
Decapoda unid.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Diopatra ornata	-	0.6	0.6	1.1	0.9	1.1	0.5	-	<.1	<.1	<.1	-	-	+	0.1	-	-	-	0.1	<.1	0.2	0.1	0.1	0.2
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Doridacea unid.	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flabellina trilineata	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gari californica	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	<.1	<.1	+	-	-	+	+	+	+	+	+	-	+	-	+	-	-	-	-	-	-	-
Hemigrapsus oregonensis	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hipponix spp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	+	+	+	+	-	+	-	+	+	-	-	-	-	+	+	-	+	+	-	+	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Idotea spp.	-	-	-	<.1	-	-	<.1	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	<.1	0.2	<.1	0.3	+	+	+	+	+	+	+	+	+	-	+	+	-	+	-	+	-	-	-
Isopoda unid.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	+
Lacuna spp.	-	+	+	+	+	+	+	-	+	+	+	+	-	-	+	+	+	+	+	<.1	+	+	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	0.1	-	-	-	-	+	-
Lissothuria nutriens	-	-	-	-	-	+	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	-	-	-	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Lottia asmi	-	-	-	+	+	+	+	+	+	+	+	+	+	+	<.1	+	-	-	+	+	-	+	0.1	+
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	<.1	-	-	-	-	+	-
Loxorhynchus spp.	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Majidae	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Mimulus foliatus	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus californianus	-	-	-	-	-	0.2	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	<.1
Nemertea unid.	-	-	-	<.1	0.1	0.2	0.2	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-
Nereididae unid.	-	-	-	<.1	-	+	<.1	-	<.1	+	-	-	-	-	-	<.1	-	+	-	0.1	-	-	-	-
Nitidiscala/Opalia spp.	-	-	-	+	+	+	+	-	+	+	-	-	-	-	+	+	+	+	+	+	-	+	-	-
Nudibranchia unid.	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Onchidella borealis	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	<.1
Pelecypoda unid. boring	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-
Petrolisthes spp.	<.1	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pollicipes polymerus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Polychaeta unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Polyplacophora unid. a	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	<.1	<.1	0.5	1.3	0.6	0.7	0.3	-	<.1	-	-	<.1	<.1	-	-	-	-	-	<.1	-	0.1	0.1	-	-
Pycnogonida unid.	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Serpulidae unid.	-	-	<.1	<.1	0.2	0.1	0.2	-	-	+	+	+	-	-	+	-	-	+	+	-	+	+	+	+
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	0.4	-	0.2
Sipuncula unid.	-	-	-	-	-	+	-	-	+	-	-	<.1	-	-	-	+	-	+	-	+	+	-	+	-
Stenoplax spp.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tonicella lineata	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transennella spp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	-	+	+	-	-	+	-	+	+	-	-	-	-	-	+	-	-	-	-	-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
% Coverage																								
Aglaophenia spp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	-	<.1	+	<.1	<.1	+	+	<.1	+	<.1	-	+	-	+	-	+	+	+	+	-	-	-	-
Bryozoa, unid. (foliose)	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	+	+	<.1	+	<.1	+	<.1	<.1	0.1	1.9	4.9	3.3	2.6	3.4	2.4	1.1	1.2	0.9	0.6	0.5	1.3	1.4	1.3	0.2
Dendropoma spp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurystomella bilabiata	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliclona spp.	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	+	<.1	<.1	+	+	+	+	+	+	+	<.1	0.2	0.2	+	+	+	+	+	+	+	+	+	<.1
Pista spp.	1.2	0.5	0.9	2.3	1.7	1.6	1.1	+	+	<.1	+	+	+	+	-	+	+	+	-	<.1	+	-	-	-
Porifera unid. (encrusting)	-	-	-	<.1	<.1	<.1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbidae	-	+	+	+	<.1	<.1	+	+	+	+	+	<.1	<.1	+	+	<.1	<.1	<.1	<.1	<.1	<.1	+	+	<.1	<.1
tunicates, colonial/social unid.	<.1	-	<.1	<.1	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Anthopleura elegantissima	76.2	90.3	74.8	73.4	81.3	75.3	75.3	23.5	12.2	6.3	8.0	17.7	26.0	39.4	56.0	51.9	65.8	92.9	90.4	70.9	72.6	56.9	56.8	52.3
Anthopleura xanthogrammica	-	0.1	0.1	0.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balanus spp.	0.2	+	+	0.1	<.1	<.1	0.2	-	-	0.1	<.1	<.1	<.1	0.2	-	<.1	0.1	0.1	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma spp.	-	-	-	-	-	-	-	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	-	-	-	0.5	0.3	-	-	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurella volcano	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	0.1	-	-	-	-	-	-	-	-	-	0.2	-
Haliotis spp.	0.4	0.2	0.2	0.3	0.3	0.4	0.2	-	-	-	-	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-
Hemigrapsus nudus	-	<.1	0.1	0.2	0.2	<.1	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.5	0.1	0.2	0.1	-	-	-	-	0.1	-	-
Leptasterias spp.	<.1	-	0.1	<.1	-	0.2	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia digitalis	1.6	2.5	0.6	0.5	0.7	0.7	0.6	0.3	1.1	0.8	0.7	0.4	0.6	0.5	0.4	0.5	<.1	0.2	0.2	-	0.2	0.7	0.1	0.3
Lottia limatula	1.9	1.0	1.5	2.4	1.7	1.7	1.6	1.0	0.8	2.1	2.6	4.7	3.9	6.4	4.5	5.8	2.9	5.3	2.8	4.1	2.3	3.0	5.5	3.7
Lottia pelta	0.4	0.3	0.2	0.5	0.2	1.3	2.5	1.1	0.7	1.3	0.7	0.8	1.1	1.9	1.7	1.1	0.4	<.1	<.1	0.3	0.4	0.8	0.5	3.7
Macclintockia scabra	16.8	44.2	24.2	27.1	36.0	39.3	54.3	34.3	39.5	51.5	52.6	113.2	74.4	63.2	34.1	31.4	26.4	35.4	27.4	18.2	24.2	34.1	31.9	58.8
Mitra idae	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mopalia spp.	0.1	0.1	<.1	<.1	<.1	<.1	0.2	<.1	0.1	<.1	0.1	<.1	0.1	<.1	-	-	-	<.1	-	-	0.1	-	-	-
Nucella emarginata	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-
Nuttallina californica	-	-	<.1	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ocenebra spp.	-	0.1	0.5	0.2	0.9	1.0	0.5	0.4	0.2	0.3	0.3	0.8	0.7	1.3	2.0	0.7	0.6	0.6	0.3	0.2	0.7	1.1	0.3	0.2
Pachygrapsus crassipes	<.1	<.1	0.3	0.3	0.2	0.1	0.2	0.3	<.1	0.2	0.2	0.4	0.4	1.0	0.6	1.1	0.6	0.7	0.5	0.1	0.7	0.2	0.7	0.6
Pagurus spp.	41.7	17.9	18.3	22.5	30.8	35.6	31.1	15.2	11.0	10.6	16.6	17.3	9.9	11.0	24.9	27.3	71.9	39.9	24.3	15.7	20.3	27.9	3.8	5.3
Pisaster ochraceus	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	<.1	0.1	<.1	0.6	-	-	0.2	0.4	-	-
Strongylocentrotus purpuratus	<.1	-	-	-	-	<.1	<.1	-	-	-	-	<.1	+	-	-	-	<.1	-	0.1	-	0.3	-	-	-
Tectura paleacea	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura persona	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	6.8	4.2	2.0	2.9	3.0	1.8	5.8	1.7	4.0	6.5	3.3	4.2	2.9	8.9	2.3	3.9	1.6	1.9	1.3	0.7	2.0	1.9	2.8	3.9
Tegula brunnea	-	-	<.1	0.2	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.2
Tegula funebralis	111.7	173.7	169.9	136.9	217.5	216.1	158.7	170.3	141.5	207.7	232.3	229.9	201.2	366.7	361.4	370.8	184.6	213.6	243.1	342.9	294.2	313.3	298.8	251.5
Tegula spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	<.1	<.1	1.1	3.9	6.1	4.1	4.7	0.7	1.0	3.8	1.9	0.9	2.7	1.6	2.8	3.7	2.5	4.0	3.0	0.4	0.1	3.0	0.1	<.1
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	-	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Acmaeidae unid.	0.1	-	+	+	+	+	+	+	+	<.1	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+
Aeolidia papillosa	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	-	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphissa spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Asterina miniata	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Bittium spp.	-	-	-	+	+	+	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer productus	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	<.1	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chaetopteridae	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	+	+	-	-	+	-	-	-	+	-	+	-	+	-	<.1	+	-	-	+	-	+
Cirripedia unid. a	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Crangon spp.	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Crepidula spp.	-	-	+	+	+	+	+	<.1	+	+	+	<.1	+	+	+	+	+	+	-	+	-	-	+	-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Cyanoplax spp.	<.1	-	+	1.0	0.4	0.2	1.0	0.4	0.1	0.7	0.6	1.1	0.4	0.8	0.8	0.5	0.1	0.4	0.2	0.2	0.2	0.4	0.9	0.4
Diopatra ornata	-	<.1	0.1	0.1	0.3	0.3	0.4	-	-	<.1	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	+	+	+	+	+	+	-	+	-	+	-	+	-	+	-	-	-
Hemigrapsus oregonensis	-	-	-	<.1	<.1	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	0.3	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	+	+	-	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Idotea spp.	-	-	<.1	+	-	+	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	<.1	0.3	<.1	<.1	<.1	+	<.1	+	<.1	<.1	-	+	+	+	-	-	+	-	+	+	-	-	-	-
Isopoda unid.	-	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	-	-	+	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Littorina spp.	-	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia asmi	-	-	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	+	-	-	-	-	-	-	-	-
Majidae	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Mytilidae	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	+	-	-	-	-	-
Mytilus californianus	-	-	-	-	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.1	0.4	0.3	0.2	-	+	0.2	0.4	-	0.1	0.6	0.3
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	-	<.1	<.1	0.2	0.1	<.1	-	<.1	-	-	-	-	<.1	<.1	+	-	-	-	-	-	-	-
Nereididae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	+	+	+	+	+	-	+	+	-	+	-	+	+	+	+	+	+	-	-	+	+	+
Ophiuroidea unid.	-	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Petrolisthes spp.	-	-	-	-	0.1	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	-	-	+	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	+	+	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Pollicipes polymerus	-	-	-	-	-	-	-	-	-	-	+	0.2	1.2	2.9	10.3	10.8	16.7	9.2	7.4	8.1	4.7	7.7	7.4	3.9
Polychaeta unid.	-	-	+	-	+	-	-	+	-	<.1	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Pugettia spp.	<.1	-	+	+	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Cove Station SDC 3 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Pycnopodia helianthoides	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Septifer bifurcatus	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
Sipuncula unid.	-	-	-	-	-	<.1	-	+	-	-	-	+	-	-	+	+	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	-	+	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chthamalus fissus	0.7	0.9	<.1	0.3	0.2	0.2	0.2	<.1	+	<.1	0.3	0.5	0.6	1.9	3.8	2.3	2.1	1.8	2.0	1.3	2.1	3.2	1.9	0.6
Dendropoma spp.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	<.1	+	+	+	<.1	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	-	0.3
Pista spp.	-	+	+	<.1	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbidae	-	-	+	+	+	+	+	+	+	<.1	+	<.1	+	-	+	+	<.1	<.1	+	+	+	<.1	+	+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	4	4	5	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Anthopleura elegantissima							36.1	35.8	32.5	16.1	21.3	25.2		57.2	49.8	63.2	68.8	99.1	100.2	78.1				92.6
Anthopleura xanthogrammica							0.7	0.8	0.9	0.8	0.7	0.7		0.4	1.1	0.6	1.1	1.1	0.9	0.8				0.9
Balanus spp.							7.0	3.7	<.1	35.9	18.9	77.0		9.4	16.4	<.1	1.0	-	-	0.5				51.3
Calliostoma ligatum							-	<.1	-	-	<.1	-		-	-	-	-	-	-	0.1				-
Epiactis prolifera							-	0.2	-	0.3	0.1	<.1		-	<.1	0.1	-	0.2	-	-				-
Fissurella volcano							2.5	1.2	4.7	3.3	3.5	6.1		2.4	1.8	5.4	6.1	6.4	11.7	16.3				12.5
Haliotis spp.							0.2	<.1	0.1	0.5	0.8	0.7		-	-	0.4	0.3	0.3	0.7	-				<.1
Hemigrapsus nudus							<.1	-	-	0.3	0.2	-		-	-	-	-	-	-	-				-
Leptasterias spp.							1.4	3.1	0.7	2.4	2.5	3.6		2.4	2.0	1.6	0.2	0.2	-	-				-
Lottia digitalis							0.2	0.3	1.2	1.0	0.2	0.3		0.4	1.0	0.2	0.1	0.2	-	0.3				0.5
Lottia limatula							1.7	1.8	2.6	2.7	2.9	2.2		4.2	2.2	2.7	1.8	3.2	2.4	2.3				7.1
Lottia pelta							0.7	5.1	8.7	3.1	4.2	4.6		5.0	5.3	10.2	7.9	25.1	16.0	17.8				28.9
Macclintockia scabra							30.0	43.2	96.4	57.6	92.8	136.4		238.0	143.0	96.8	65.9	55.3	60.2	74.9				108.5
Mopalia spp.							0.2	0.2	<.1	0.3	0.2	0.1		-	<.1	-	<.1	0.1	0.1	0.2				0.2
Nucella emarginata							0.2	0.1	0.2	0.8	0.7	0.6		0.4	0.3	0.3	0.3	0.4	0.1	0.1				<.1
Nuttallina californica							8.3	5.4	3.5	7.3	15.5	14.0		14.0	11.9	6.8	1.5	1.3	4.6	9.8				6.7
Ocenebra spp.							<.1	<.1	0.2	0.2	0.2	<.1		0.2	0.8	0.7	0.5	0.5	0.3	0.4				-
Pachygrapsus crassipes							0.7	0.6	0.5	0.7	1.1	1.0		0.4	0.5	2.9	1.6	2.3	1.9	0.8				2.9
Pagurus spp.							9.1	4.0	3.1	3.9	6.9	3.9		8.2	4.2	1.2	1.3	1.1	0.4	0.6				0.7
Pisaster ochraceus							0.3	0.3	0.3	0.2	0.4	0.8		1.0	1.0	1.5	1.1	1.8	1.2	1.6				0.1
Pseudomelatoma torosa							-	-	-	-	<.1	-		-	-	<.1	-	-	-	-				-
Strongylocentrotus purpuratus							42.7	38.6	19.1	13.0	17.1	27.1		42.2	40.6	66.1	78.1	67.9	98.0	67.3				63.5
Tectura scutum							1.7	1.6	1.9	2.5	2.5	0.8		4.0	0.5	0.5	1.4	1.1	-	0.2				0.4
Tegula brunnea							4.2	3.6	6.7	2.9	5.2	2.4		2.4	2.5	1.3	1.0	0.2	0.1	-				<.1
Tegula funebralis							0.2	0.5	0.8	1.4	3.5	4.4		14.0	13.1	3.7	0.5	0.4	0.1	0.1				0.7
Tegula spp.							-	-	-	<.1	-	-		-	-	-	-	-	-	-				-
Tetraclita rubescens							66.7	44.1	37.8	61.0	60.2	113.0		258.0	289.0	281.7	207.0	446.6	411.8	266.6				143.9
Only Counted if Greater than 1"																								
Acmaea mitra							0.2	0.2	+	0.1	0.1	0.1		0.2	<.1	+	<.1	-	-	+				-
Acmaeidae unid.							+	+	+	<.1	+	+		+	+	+	+	+	+	+				+
Aeolidia papillosa							-	-	-	-	-	-		+	-	-	-	-	-	-				-
Aeolidiacea unid. a							-	-	-	-	-	+		-	-	-	-	-	-	-				-
Amphissa spp.							-	-	+	-	-	-		-	-	-	-	-	+	-				-
Asteroidea unid.							-	-	-	+	-	-		-	-	-	-	-	-	-				-
Balanus/Tetraclita spp.							-	-	-	-	-	8.8		-	-	-	-	-	-	-				-
Barleeia spp.							-	-	-	+	+	-		-	-	-	-	-	-	-				-
Bittium spp.							-	+	-	-	-	-		-	-	-	-	-	-	-				-
Cancer antennarius							<.1	<.1	-	<.1	-	-		-	-	-	-	0.1	-	-				-
Cirratulidae/Terebellidae unid.							-	+	-	-	+	-		-	-	-	-	-	-	+				-
Corynactis californica							-	-	-	-	-	-		-	-	-	-	-	-	-				+
Crepidula spp.							-	-	-	+	+	+		+	+	+	-	-	-	-				-
Cyanoplax spp.							-	0.1	-	<.1	+	<.1		-	-	0.5	<.1	0.8	1.4	0.1				1.7
Diaulula sandiegensis							-	-	-	<.1	-	-		-	+	-	-	-	-	-				-
Diodora spp.							-	+	-	-	-	-		-	-	-	-	-	-	-				-
Discurria insessa							+	-	-	-	+	-		-	-	-	-	+	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	4	4	5	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	3
Only Counted if Greater than 1* (continued)																								
Grapsidae (juv.)							+	+	+	+	+	+		-	+	+	-	-	+	-				-
Henricia leviuscula							<.1	-	-	-	-	-		-	-	-	-	-	-	-				-
Homolopoma luridum/Lirularia succincta							-	+	-	+	<.1	-		-	-	-	-	-	-	-				-
Hopkinsia rosacea							-	-	-	-	-	<.1		-	-	-	-	-	-	-				-
Idotea spp.							0.2	0.2	-	<.1	<.1	-		-	-	-	-	-	-	-				-
Ischnochitonidae							+	-	+	<.1	+	+		+	+	-	+	+	-	+				+
Isopoda unid.							-	-	-	+	+	-		-	-	-	-	-	-	-				-
Katharina tunicata							-	-	-	-	-	-		-	<.1	-	-	-	-	-				-
Lacuna spp.							-	+	+	+	+	+		-	+	+	-	-	-	-				-
Lepidozona spp.							-	-	-	-	-	-		-	-	+	-	-	+	-				-
Lissothuria nutriens							-	-	-	-	-	-		-	+	-	-	-	-	-				-
Littorina spp.							+	+	+	+	+	+		-	+	-	+	+	+	+				+
Lottia asmi							+	-	-	+	-	+		+	+	-	-	-	-	+				+
Lottia gigantea							<.1	<.1	<.1	0.1	0.5	0.9		2.8	1.3	0.9	1.2	1.5	1.9	3.1				11.5
Lottia ochracea							-	+	+	-	-	-		-	-	0.3	+	0.4	-	-				+
Majidae							-	-	-	+	+	-		-	-	-	-	-	-	-				-
Megatebennus bimaculatus							-	-	+	-	-	-		-	-	-	-	-	-	-				-
Mytilidae							-	-	-	-	-	-		-	-	-	+	-	-	-				-
Mytilus californianus							2.1	0.6	0.5	7.7	93.0	133.2		115.4	49.9	1.2	0.4	0.8	83.1	193.4				304.3
Mytilus galloprovincialis							-	-	-	-	-	-		-	-	-	+	-	-	-				-
Nemertea unid.							1.9	2.4	0.9	2.0	1.2	2.6		0.6	0.2	1.5	0.2	1.9	1.8	2.2				2.4
Nereididae unid.							<.1	<.1	+	+	<.1	-		+	<.1	<.1	<.1	0.2	<.1	0.1				0.1
Nitidiscala/Opalia spp.							-	-	-	-	-	-		-	-	+	+	-	-	-				-
Octopus spp.							-	-	-	-	-	-		-	-	-	+	<.1	-	0.1				-
Onchidella borealis							+	+	+	+	+	-		-	-	-	-	-	-	-				-
Ophiuroidea unid.							-	-	-	-	<.1	-		-	-	-	-	-	-	-				-
Pelecypoda unid. boring							+	+	+	+	+	+		-	+	+	-	+	+	-				+
Pisaster/Henricia (juv.)							+	+	-	+	+	+		+	+	-	-	+	-	-				-
Pollicipes polymerus							0.3	0.5	0.3	0.6	0.5	0.6		1.4	1.1	0.3	0.7	<.1	0.3	0.3				+
Polychaeta unid.							-	-	-	+	<.1	0.1		-	-	+	-	-	-	-				-
Polynoidae							-	-	-	-	-	-		-	-	-	<.1	-	-	-				-
Polyplacophora unid. a							-	-	-	-	-	-		-	0.1	-	-	-	-	-				-
Pugettia spp.							0.8	0.2	<.1	0.1	0.2	<.1		-	<.1	0.2	-	-	+	-				-
Pycnogonida unid.							-	-	+	+	-	-		-	-	-	-	-	-	-				-
Rostanga pulchra							-	-	-	-	-	-		-	-	+	-	-	-	-				-
Serpulidae unid.							+	-	<.1	0.1	<.1	0.3		0.4	<.1	<.1	0.2	0.2	0.1	0.3				0.4
Serpulorbis squamigerus							<.1	-	+	<.1	+	<.1		-	-	<.1	-	0.2	0.1	-				-
Sipuncula unid.							+	0.9	+	0.1	<.1	0.1		+	+	+	+	0.1	+	+				+
Spionidae unid.							-	-	-	+	-	-		-	-	-	-	-	-	-				-
Tonicella lineata							<.1	0.1	0.4	0.4	0.1	0.1		0.8	-	-	-	-	-	-				-
Tricolia spp.							-	-	+	-	-	-		-	-	-	-	-	-	-				-
% Coverage																								
Bryozoa, unid. (encrusting)							+	+	+	+	+	+		0.3	+	+	+	+	-	+				-
Bryozoa, unid. (foliose)							-	-	-	+	-	-		-	-	-	-	-	-	-				-
Chthamalus fissus							0.4	0.3	<.1	2.9	7.0	1.7		0.3	<.1	<.1	0.5	0.2	+	0.1				+

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	4	4	5	6	6	6	ns	1	4	4	4	4	4	2	ns	ns	ns	3
% Coverage (continued)																								
Dodecaceria fewkesi							<.1	+	<.1	<.1	<.1	0.1		0.3	<.1	0.1	0.1	0.2	0.3	0.5				0.2
Eurystomella bilabiata							-	-	+	+	-	<.1		-	-	-	-	-	-	-				-
Haliclona spp.							-	-	+	+	-	-		-	-	+	-	-	-	-				-
Phragmatopoma californica							+	<.1	+	<.1	0.1	0.2		1.9	0.2	<.1	0.2	1.0	1.9	3.6				4.3
Pista spp.							-	-	-	-	+	-		-	-	-	-	-	-	-				-
Porifera unid. (encrusting)							+	+	+	+	+	+		-	-	-	+	+	-	+				+
Salmacina tribranchiata							+	+	+	<.1	+	+		-	+	+	+	-	+	-				-
Spirorbidae							+	+	+	+	+	+		+	+	+	+	+	+	+				+
tunicates, colonial/social unid.							+	+	+	+	<.1	+		-	-	-	-	-	+	-				-

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 2 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
% Counted Regardless of Size																								
Acanthina spp.	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Anthopleura elegantissima	1.2	3.2	1.8	1.7	1.2	1.2	1.1	0.2	0.8	0.6	0.4	0.5	0.4	0.4	1.2	1.8	2.2	3.3	5.2	10.1				22.9
Anthopleura xanthogrammica	0.4	0.1	0.8	0.4	0.9	0.8	0.7	0.2	0.3	0.5	0.1	0.3	0.3	0.3	0.2	0.3	0.2	0.7	1.1	1.1				0.9
Balanus spp.	1.5	6.7	7.3	3.8	2.0	2.0	1.8	0.3	0.4	2.8	1.2	2.1	0.4	1.1	3.7	4.9	3.4	1.4	1.8	1.0				13.5
Calliostoma ligatum	-	-	0.1	0.2	0.3	0.2	0.3	0.5	1.6	1.2	1.1	1.5	1.6	0.9	1.7	1.3	0.5	0.1	0.1	0.1				<.1
Conus californicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-				-
Epiactis prolifera	-	0.2	0.5	0.8	0.7	0.4	0.6	0.1	0.5	0.2	0.3	-	<.1	0.2	0.2	0.2	-	0.4	0.4	0.1				0.2
Fissurella volcano	<.1	<.1	0.3	0.3	0.4	0.3	0.2	0.2	0.7	0.8	1.3	0.8	1.2	1.4	2.6	3.5	2.9	5.6	12.6	4.6				12.5
Haliotis spp.	0.8	1.2	1.0	0.8	0.5	0.8	0.8	0.4	1.3	0.6	0.9	0.4	0.4	1.2	1.0	0.6	<.1	0.4	0.7	0.1				0.3
Hemigrapsus nudus	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Leptasterias spp.	0.3	0.3	1.6	2.6	3.8	1.9	3.6	2.1	2.3	2.8	2.3	2.7	2.2	1.6	1.5	1.9	1.5	1.6	1.5	2.8				0.5
Lottia digitalis	-	-	1.2	1.5	0.3	0.2	1.6	0.1	-	-	-	-	<.1	-	0.1	0.2	-	-	-	-				-
Lottia limatula	-	-	-	<.1	-	-	-	-	<.1	-	-	-	0.2	-	-	-	-	<.1	1.1	0.6				0.3
Lottia pelta	0.2	0.5	0.2	0.2	0.1	0.2	0.9	0.1	0.9	0.2	2.3	0.8	2.0	1.8	3.4	2.4	1.2	1.9	6.5	7.4				39.9
Macclintockia scabra	-	1.4	0.4	1.3	3.5	1.2	1.3	0.4	0.5	0.4	1.0	1.0	0.2	0.3	1.3	0.3	-	0.4	3.5	0.4				2.3
Mopalia spp.	0.1	0.3	-	0.1	-	<.1	0.1	0.2	-	0.2	<.1	0.1	0.1	-	0.1	0.2	<.1	0.1	-	0.1				-
Nucella emarginata	-	-	<.1	0.1	0.1	0.1	0.1	-	0.2	0.2	<.1	-	-	-	-	0.3	<.1	0.1	<.1	0.4				0.3
Nuttallina californica	-	0.1	0.2	0.7	0.8	0.4	0.9	0.1	0.4	0.6	<.1	0.1	0.5	<.1	0.2	0.2	0.3	1.2	1.5	5.1				3.6
Ocenebra spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-				-
Pachygrapsus crassipes	-	-	0.2	-	<.1	<.1	-	<.1	-	-	<.1	0.1	0.3	0.7	0.3	0.9	0.3	1.3	0.9	1.9				1.5
Pagurus spp.	1.6	2.9	1.7	2.1	3.0	10.0	3.4	0.7	5.5	3.3	2.1	1.5	1.4	0.4	2.1	1.5	0.7	1.4	1.1	0.9				0.2
Pisaster ochraceus	0.5	0.2	0.6	0.9	1.7	0.8	1.2	1.1	0.9	2.0	0.9	0.9	1.8	1.1	1.5	2.2	2.2	2.5	3.1	3.3				5.7
Strongylocentrotus purpuratus	12.1	24.8	19.8	12.1	6.3	8.0	6.7	8.6	4.9	2.4	4.3	6.6	8.6	8.7	16.7	35.9	51.5	84.6	136.0	214.8				211.9
Tectura scutum	-	-	0.2	<.1	0.3	-	-	-	-	-	-	<.1	0.1	-	-	-	-	<.1	-	0.2				0.3
Tegula brunnea	0.2	0.9	2.4	3.1	4.2	3.7	3.1	3.0	2.0	1.7	4.0	4.2	5.0	5.1	6.0	6.5	7.3	5.3	0.9	1.2				0.7
Tegula funebralis	1.0	-	<.1	0.2	-	0.2	-	<.1	-	-	-	<.1	-	<.1	<.1	-	-	<.1	<.1	-				<.1
Tetraclita rubescens	3.6	5.8	44.6	31.3	38.7	25.4	37.6	8.4	4.1	9.9	13.7	5.1	6.7	9.2	45.2	30.2	16.6	16.0	29.3	52.6				50.6
Only Counted if Greater than 1"																								
Acmaea mitra	-	-	0.2	<.1	+	<.1	0.2	<.1	0.2	<.1	0.1	<.1	<.1	+	+	0.5	+	+	0.2	0.1				0.3
Acmaeidae unid.	<.1	-	+	+	+	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+				+
Aeolidia papillosa	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	+	-	-				-
Aeolidiacea unid. a	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-				-
Alia spp.	-	-	+	+	-	+	-	+	+	+	+	-	+	-	-	+	-	+	-	-				-
Amphissa spp.	-	-	+	-	-	-	+	-	-	-	-	-	<.1	-	<.1	+	+	+	+	+				+
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-				-
Anthozoa unid.	-	-	-	-	<.1	-	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-				-
Archidoris spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-				-
Asterina miniata	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-				-
Balanophyllia elegans	-	-	-	-	+	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-				-
Balanus/Tetraclita spp.	-	-	+	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-				-
Barleeia spp.	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Bittium spp.	-	-	-	+	+	+	+	+	-	-	+	-	+	-	-	-	-	+	-	-				-
Cadlina spp.	-	-	-	+	-	-	-	-	-	<.1	-	<.1	-	+	-	-	-	-	-	-				-
Cancer antennarius	<.1	-	0.2	0.1	0.3	0.2	0.1	-	<.1	0.1	0.3	<.1	-	-	-	-	<.1	0.1	-	-				0.1
Cancer spp.	<.1	-	<.1	<.1	+	+	-	-	-	-	-	+	-	-	<.1	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
Only Counted if Greater than 1* (continued)																								
Chaetopteridae	-	-	-	0.2	+	+	+	-	-	+	+	+	-	-	+	-	+	+	+	+				-
Chama spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.4	-	-	-	-				-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-				+
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-				-
Corynactis californica	0.5	-	+	1.1	<.1	<.1	0.4	0.4	0.2	0.3	0.1	0.1	0.1	+	+	+	+	+	+	+				+
Crepidula spp.	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	+	-	-	-	-				-
Cryptochiton stelleri	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Cyanoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-				+
Diodora spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	<.1	-	-	-				<.1
Discurria insessa	-	-	+	<.1	+	+	-	+	+	<.1	-	+	+	-	-	-	-	+	+	+				-
Doridacea unid.	-	-	-	-	-	<.1	+	-	-	-	-	-	-	<.1	-	-	-	-	-	-				-
Doriopsilla albopunctata	-	-	<.1	<.1	-	+	-	-	0.2	-	-	+	-	-	-	+	-	-	<.1	-				-
Doto kya	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Flabellina trilineata	-	-	-	-	-	+	-	-	+	-	-	+	-	-	-	+	-	-	-	-				-
Grapsidae (juv.)	-	-	-	-	-	-	+	-	+	+	-	-	+	-	+	-	+	-	-	-				-
Henricia leviuscula	-	-	-	-	-	<.1	+	<.1	-	-	<.1	+	0.2	-	<.1	+	-	<.1	<.1	-				-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	-				-
Hermissenda crassicornis	-	-	0.1	<.1	<.1	-	<.1	0.3	-	+	+	+	<.1	<.1	-	+	+	+	-	-				-
Homolopoma luridum/Lirularia succincta	-	-	-	-	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	-				-
Hopkinsia rosacea	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	+	-	-				-
Idotea spp.	-	-	<.1	0.4	0.1	0.1	0.1	0.3	+	0.1	-	<.1	0.2	0.3	0.2	-	-	-	-	-				-
Ischnochitonidae	-	-	<.1	0.1	+	<.1	+	+	+	+	+	+	+	+	+	+	+	+	-	-				-
Isopoda unid.	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Katharina tunicata	-	-	-	<.1	<.1	<.1	0.2	0.3	<.1	<.1	<.1	<.1	-	<.1	-	-	-	-	-	-				-
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-				+
Laila cockerelli	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	0.1				-
Leucandra heathi	-	-	-	+	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-				-
Leucilla nuttingi	-	-	-	+	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-				-
Lissothuria nutriens	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-				-
Littorina spp.	-	-	+	-	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-				-
Lophopanopeus spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Lottia asmi	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	+	-	-	-	-				-
Lottia gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-				-
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-				-
Lottia ochracea	-	-	+	+	-	-	+	-	+	-	-	-	-	-	-	+	-	0.2	+	-				+
Majidae	-	-	-	+	+	+	+	-	-	+	+	+	-	-	-	-	-	-	-	-				-
Megatebennus bimaculatus	-	-	-	-	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	+				-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	+				-
Mytilimeria nuttalli	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Mytilus californianus	135.2	96.8	45.4	58.9	74.0	20.6	5.6	0.7	2.4	3.8	+	0.1	1.0	0.2	0.4	0.9	1.0	25.6	129.1	200.4				218.1
Nemertea unid.	<.1	0.1	0.8	0.8	0.6	1.3	1.9	1.4	2.3	2.5	0.6	1.4	3.2	0.8	1.0	1.3	1.0	2.0	4.9	2.5				5.0
Nereididae unid.	-	-	<.1	<.1	<.1	<.1	0.1	<.1	-	-	0.1	<.1	0.2	-	<.1	<.1	0.2	+	0.2	-				0.1
Nitidiscala/Opalia spp.	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Nudibranchia unid.	-	-	<.1	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
Only Counted if Greater than 1" (continued)																								
Nuttallina spp.	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Onchidella borealis	-	-	+	+	-	+	+	+	+	-	+	+	-	+	-	-	-	-	-	-				-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.2	-				<.1
Ophiuroidea unid.	-	-	-	-	+	+	+	<.1	-	+	-	+	-	-	-	-	-	-	-	-				-
Pachycheles spp.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	<.1	-				-
Pelecypoda unid.	-	-	-	+	-	-	+	-	-	+	-	-	-	-	-	-	+	-	-	-				-
Pelecypoda unid. boring	-	-	+	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+				+
Petrolisthes spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	0.1	-				-
Pisaster/Henricia (juv.)	-	-	-	0.2	+	+	0.2	+	+	<.1	<.1	+	-	+	+	+	+	<.1	+	-				-
Platyhelminthes unid.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-				-
Pododesmus cepio	-	-	<.1	0.2	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.8	0.5	1.1	1.4	0.5	0.5	0.6	0.7				0.3
Pollicipes polymerus	-	0.8	10.4	11.8	8.1	3.9	2.1	+	<.1	+	+	<.1	+	+	+	0.2	<.1	0.2	0.6	1.2				24.9
Polychaeta unid.	-	-	-	-	<.1	+	0.2	-	-	<.1	-	0.2	-	-	-	-	-	-	-	-				-
Polynoidae	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				+
Polyplacophora unid. a	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Pugettia spp.	1.2	0.3	0.6	1.1	0.3	0.8	1.1	0.5	0.8	0.7	1.3	0.5	0.9	0.5	0.3	0.4	0.2	0.2	0.4	-				-
Pycnogonida unid.	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	+	-	-	-				+
Pyura haustor	-	-	-	-	-	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-				-
Rostanga pulchra	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-				-
Sabellidae	-	-	-	<.1	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-				-
Serpulidae unid.	-	<.1	<.1	0.1	0.2	0.2	0.2	0.2	0.4	0.2	0.5	0.4	0.9	0.8	2.0	1.6	0.6	0.5	2.0	4.4				11.3
Serpulorbis squamigerus	0.2	0.3	0.4	0.4	0.6	1.2	1.6	1.8	1.6	1.6	7.2	6.2	6.1	5.3	6.6	9.0	7.5	6.5	5.7	10.2				9.0
Sipuncula unid.	-	-	+	+	<.1	0.2	+	+	0.2	<.1	0.3	0.2	+	+	+	+	+	+	+	+				0.1
Styela spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-				-
Tectura fenestrata	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Tonicella lineata	-	-	0.6	0.4	0.3	0.3	0.3	0.3	0.3	0.6	0.3	0.6	0.7	0.6	0.7	0.4	0.5	0.6	0.5	0.6				0.5
Tricolia spp.	-	-	-	+	+	+	+	+	+	-	-	+	-	-	-	-	-	-	-	-				-
Triopha catalinae	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Triopha maculata	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-				-
Trivia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-				-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-				-
snail, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-				-
% Coverage																								
Abiet./Sertularella/Sertularia spp.	-	-	<.1	0.1	0.1	<.1	<.1	<.1	<.1	0.2	+	+	<.1	+	+	+	+	+	+	+				-
Aglaophenia spp.	-	-	+	-	+	+	<.1	-	+	+	+	+	-	-	+	+	+	+	+	+				-
Bryozoa, unid. (encrusting)	-	-	+	+	<.1	<.1	<.1	<.1	+	+	<.1	<.1	+	+	+	+	+	+	+	+				+
Bryozoa, unid. (erect)	-	-	+	+	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-				-
Bryozoa, unid. (foliose)	-	-	+	<.1	0.2	0.1	0.1	0.2	+	<.1	+	0.1	+	+	+	+	+	+	+	+				+
Chthamalus fissus	<.1	0.2	<.1	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+				+
Dendropoma spp.	-	-	+	+	+	+	+	+	-	-	-	+	+	+	+	-	-	-	+	-				-
Dodecaceria fewkesi	0.4	1.8	0.1	0.3	0.2	0.4	0.6	0.7	0.8	0.9	0.5	0.8	0.7	<.1	0.4	0.1	0.3	0.3	<.1	0.8				0.4
Entoprocta unid. a	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Eurystomella bilabiata	-	-	+	+	+	+	+	+	+	+	+	0.1	+	+	+	+	+	+	+	-				-
Haliclona spp.	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Diablo Point Station SDP 2 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	3	5	6	5	6	4	4	4	5	3	6	4	4	4	4	4	4	4	2	ns	ns	ns	3
% Coverage (continued)																								
Hydroida	-	-	+	-	+	-	+	+	-	+	+	+	-	+	-	-	+	-	-	-				-
Leucosolenia spp.	-	-	-	<.1	+	+	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Metandrocarpa taylori	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Phragmatopoma californica	-	-	1.1	+	+	+	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+				0.1
Pista spp.	-	-	-	+	+	-	+	+	-	-	-	-	-	-	+	-	-	-	-	-				-
Porifera unid. (encrusting)	-	0.3	0.1	0.1	0.4	0.5	0.4	0.3	0.2	0.3	0.2	0.2	0.3	0.1	+	0.1	<.1	<.1	+	+				+
Salmacina tribranchiata	-	-	+	+	+	+	+	+	+	+	+	+	+	+	0.1	+	+	+	+	+				+
Spirorbidae	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				+
Stylantheca porphyra	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-				-
Stylantheca spp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-				-
bryozoan unid. a	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
tunicates, colonial/social unid.	-	-	0.2	0.4	0.6	0.3	0.8	0.6	0.6	0.8	0.4	0.7	0.5	0.3	+	<.1	<.1	+	+	+				+

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Control Station SC 1 at +0.3m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	4	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Anthopleura elegantissima	1.6	2.7	2.2	1.1	1.6	1.8	2.0	2.7	2.2	2.0	2.2	1.8	1.7	1.4	1.8	1.5	1.3	1.4	1.4	1.1	1.2	1.5	1.5	1.6
Anthopleura xanthogrammica	0.2	<.1	0.1	0.1	0.2	<.1	0.1	0.3	0.5	0.3	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-
Balanus spp.	4.0	0.2	1.4	0.3	0.3	-	0.1	0.1	<.1	0.4	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	+	<.1	-	+	-	-	<.1	-	<.1	-	-	<.1	0.2	-	-	<.1	-	<.1	+	+	-	-
Calliostoma spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Conus californicus	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	-	0.5	0.5	0.3	0.4	0.4	0.4	0.2	<.1	0.1	0.1	0.1	0.3	0.5	0.2	0.7	0.6	0.3	0.3	0.2	-	0.6	0.1	-
Fissurella volcano	1.1	1.0	1.6	1.7	1.3	1.3	1.0	0.3	1.4	4.3	2.7	1.0	0.6	0.7	1.1	1.7	2.4	1.6	0.8	0.8	0.3	1.7	1.0	1.8
Haliotis spp.	0.5	2.3	2.6	0.8	0.4	0.2	0.2	<.1	0.1	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Hemigrapsus nudus	-	-	0.1	-	-	-	<.1	0.1	0.1	0.1	<.1	-	-	-	-	<.1	-	-	-	-	-	0.1	-	-
Leptasterias spp.	-	0.2	0.5	0.5	0.7	0.7	0.2	0.4	0.1	0.2	0.3	0.3	0.2	-	0.3	0.3	0.5	1.2	0.4	0.8	0.3	0.3	-	0.4
Lottia digitalis	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Lottia limatula	-	0.4	0.7	0.1	0.2	0.4	0.8	0.4	1.1	2.8	1.5	0.5	0.6	1.2	1.4	0.3	0.7	1.7	1.4	0.9	4.0	2.0	1.0	1.8
Lottia pelta	0.2	-	<.1	0.2	<.1	0.7	0.3	0.8	0.7	3.0	1.3	1.6	1.8	0.6	0.8	0.4	1.6	1.3	1.8	3.1	2.0	1.4	1.7	2.7
Macclintockia scabra	0.1	<.1	0.1	0.3	0.5	1.0	0.5	0.7	7.2	70.8	43.9	12.6	8.4	4.0	1.5	0.3	0.6	1.0	0.6	2.2	4.3	10.6	2.9	3.9
Mopalia spp.	<.1	<.1	0.1	0.2	-	0.1	0.1	0.1	<.1	0.1	-	<.1	-	0.2	0.2	<.1	<.1	0.1	-	0.4	0.1	0.8	0.1	0.1
Nucella emarginata	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	-	-	<.1	<.1	<.1	-	-	-	-	0.1	<.1	-	0.1	-	-	-	-	-	-	-	0.3	-	-	0.1
Ocenebra spp.	-	<.1	0.2	0.5	0.5	0.3	0.4	0.3	1.0	0.2	0.6	0.5	0.8	0.5	1.3	1.1	0.8	0.9	0.6	0.5	0.2	2.2	0.8	0.6
Pachygrapsus crassipes	-	-	-	<.1	-	-	-	-	-	-	<.1	-	<.1	0.1	-	0.3	-	0.4	0.1	-	-	0.6	0.1	-
Pagurus spp.	3.7	16.0	6.3	12.9	18.7	19.6	12.0	12.1	16.9	10.8	9.2	12.5	11.4	7.7	8.8	19.1	11.3	12.3	9.5	7.4	13.1	17.7	11.6	14.4
Pisaster ochraceus	-	0.2	<.1	-	0.2	0.1	<.1	<.1	0.2	0.1	0.2	0.1	-	<.1	<.1	-	-	<.1	<.1	-	-	0.1	0.1	<.1
Pseudomelatoma torosa	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	0.1	0.2	<.1	-	-	-	-	-
Strongylocentrotus purpuratus	<.1	0.2	<.1	<.1	<.1	0.1	-	-	-	<.1	-	<.1	-	+	-	0.2	+	-	-	-	-	0.1	-	0.3
Tectura paleacea	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-	+
Tectura persona	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	0.5	1.2	1.6	1.4	1.9	2.1	2.2	0.9	3.2	6.7	3.4	2.2	5.4	2.1	1.2	1.5	1.0	1.2	1.2	1.5	1.5	0.8	0.1	0.9
Tegula brunnea	0.2	1.9	3.5	11.2	11.7	8.3	4.1	7.1	4.2	6.6	8.7	14.1	10.1	10.5	9.8	8.7	9.8	6.9	3.3	10.0	4.5	7.4	11.0	18.6
Tegula funebralis	9.6	9.5	9.2	6.5	8.9	10.2	5.2	15.0	18.3	9.1	14.8	5.2	10.2	3.6	1.5	5.5	1.7	0.1	0.3	3.7	22.6	4.0	5.1	2.6
Tegula spp.	-	-	0.2	-	-	0.2	<.1	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	4.0	27.2	11.8	13.7	31.4	58.2	40.4	27.9	18.5	80.1	37.1	23.8	14.9	35.9	52.5	37.4	67.4	54.4	62.1	45.7	122.0	46.9	36.5	10.6
Only Counted if Greater than 1"																								
Acmaea mitra	<.1	0.4	0.2	<.1	0.4	0.2	<.1	+	<.1	0.2	0.1	0.2	<.1	<.1	<.1	-	+	<.1	0.3	+	0.2	0.2	+	<.1
Acmaeidae unid.	-	0.2	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Aldisa sanguinea	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alia spp.	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-
Amphissa spp.	-	-	<.1	+	+	<.1	-	-	-	-	-	+	+	0.1	-	-	-	+	-	-	-	+	-	+
Anthopleura artemisia	1.2	-	-	0.1	<.1	<.1	-	0.2	-	0.1	0.1	<.1	-	<.1	<.1	0.1	-	-	-	-	0.1	-	-	-
Anthozoa unid.	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Asterina miniata	0.2	0.3	0.5	0.4	0.9	0.5	0.2	0.7	-	-	<.1	<.1	-	0.1	0.3	0.3	0.2	<.1	0.2	0.1	-	0.2	0.2	0.2
Asteroidea unid.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-	-
Cancer antennarius	-	-	-	<.1	<.1	+	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.1	-	-
Cancer spp.	-	-	+	+	-	<.1	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Control Station SC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	4	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Chaetopteridae	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-
Cirratulidae/Terebellidae unid.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clavelina huntsmani	-	<.1	<.1	<.1	+	<.1	-	-	-	-	-	+	<.1	+	+	-	+	0.1	-	-	-	+	-	-
Corynactis californica	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-
Crepidula spp.	-	+	+	+	+	+	-	+	+	+	+	+	+	-	+	+	+	+	-	+	+	-	+	+
Cryptolithodes sitchensis	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cucumaria spp.	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanoplax spp.	-	-	<.1	-	-	-	-	-	<.1	+	-	-	-	-	-	-	-	-	<.1	-	-	0.1	-	<.1
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-
Diodora spp.	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	+	+	-	-
Diopatra ornata	-	-	-	<.1	0.1	0.1	<.1	0.2	<.1	0.4	-	<.1	0.2	-	-	-	<.1	-	-	<.1	-	-	-	-
Discurria insessa	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	+	-	-
Doridacea unid.	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Grapsidae (juv.)	-	-	+	+	+	+	+	-	+	+	-	+	-	-	-	-	+	+	+	-	-	-	-	+
Halcampa decemtentaculata	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Henricia leviuscula	-	-	<.1	-	-	-	+	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	-	+	-	-	-	<.1	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	+	-	-	+	-	-	-	-	-	+
Hipponix spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homolopoma luridum/Lirularia succincta	-	-	-	+	-	+	-	+	+	+	+	+	+	-	-	-	+	+	+	+	+	+	+	+
Hopkinsia rosacea	-	-	+	-	<.1	-	-	+	-	-	-	-	-	-	-	-	+	<.1	-	-	-	-	-	-
Idotea spp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	0.2	<.1	+	<.1	<.1	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
Isopoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Lacuna spp	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Laila cockerelli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
Lepidozona spp.	-	-	-	-	-	-	+	-	<.1	<.1	0.1	<.1	-	-	0.1	+	+	-	0.2	-	-	+	-	<.1
Lissothuria nutriens	-	-	-	-	-	-	-	-	+	-	-	-	-	-	+	+	-	+	-	+	-	+	-	+
Lithopoma gibberosum	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	-	+	-	-	+	+	-	-	+	-	-	-	-	-	+	-	+	-	+	+	-	-	-
Lophopanopeus spp.	-	-	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-
Lottia asmi	-	+	-	-	+	-	+	+	-	+	+	+	-	-	-	-	+	-	-	+	+	+	-	-
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	+
Lottia ochracea	-	-	<.1	+	+	+	-	-	+	+	-	-	<.1	-	+	<.1	+	+	+	-	-	-	-	+
Majidae	-	-	-	+	+	+	+	+	+	+	+	-	+	-	+	+	+	+	-	-	-	-	-	-
Megatebennus bimaculatus	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
Mytilus californianus	-	-	-	-	-	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	0.1	0.5	0.7	0.5	0.9	0.5	0.7	0.3	0.7	1.1	0.9	0.6	0.6	0.3	0.7	+	0.4	0.7	0.5	0.2	0.3	0.2	0.2
Nereididae unid.	-	-	+	<.1	-	<.1	0.1	-	-	-	-	<.1	-	0.1	0.2	<.1	0.2	0.1	-	<.1	-	-	+	-
Nitidiscala/Opalia spp.	-	-	-	-	-	+	-	-	-	+	-	-	-	-	+	-	+	+	-	-	-	-	-	-
Nudibranchia unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
Octopus spp.	<.1	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Control Station SC 1 at +0.3m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	6	6	6	6	6	6	4	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Onchidella borealis	-	-	+	+	+	+	+	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiuroidea unid.	-	-	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	+	-	-
Petrolisthes spp.	-	-	0.1	+	-	-	-	<.1	<.1	-	-	-	+	-	-	-	+	-	-	+	-	-	0.1	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	+	-	-
Pisaster/Henricia (juv.)	-	<.1	+	<.1	+	+	+	+	-	+	-	+	-	+	+	<.1	+	+	-	+	-	-	0.1	+
Platyhelminthes unid.	-	-	-	-	-	-	+	-	<.1	-	-	<.1	-	-	-	<.1	-	+	-	-	-	-	-	-
Polychaeta unid.	-	-	-	-	-	-	<.1	+	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Polyplacophora unid. a	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	0.5	1.4	0.5	0.4	0.4	1.0	0.3	0.3	0.2	0.6	0.5	0.3	0.6	0.5	0.6	0.2	0.3	0.7	+	0.4	0.3	0.3
Pycnogonida unid.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnopodia helianthoides	-	-	-	-	<.1	0.1	<.1	<.1	<.1	-	-	<.1	<.1	-	<.1	0.2	-	<.1	0.1	+	-	-	-	-
Rostanga pulchra	-	-	-	-	-	+	-	-	-	-	-	-	-	-	+	+	-	-	+	-	-	-	-	+
Serpulidae unid.	-	-	0.1	<.1	<.1	<.1	+	+	<.1	0.2	0.3	0.1	+	<.1	0.1	0.3	<.1	0.1	0.2	<.1	0.2	0.2	0.3	0.4
Serpulorbis squamigerus	<.1	-	<.1	-	-	<.1	-	<.1	-	<.1	<.1	<.1	<.1	<.1	0.3	0.3	-	<.1	+	<.1	-	-	-	-
Sipuncula unid.	-	-	-	+	-	+	<.1	-	<.1	+	-	<.1	-	+	-	-	+	-	+	-	-	+	-	+
Stenoplax spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-
Tonicella lineata	-	-	0.2	0.5	0.3	0.1	<.1	+	0.1	<.1	-	<.1	-	-	0.2	<.1	-	+	-	0.2	-	0.1	-	+
Transennella spp.	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Tricolia spp.	-	-	-	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	-	+	-	-	-	+
snail, unid.	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	<.1	+	+	<.1	<.1	+	+	+	<.1	<.1	<.1	<.1	+	+	+	0.1	+	+	+	+	+	<.1
Bryozoa, unid. (erect)	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (foliose)	-	-	-	-	-	+	-	-	-	-	-	+	+	-	+	-	-	-	-	-	-	-	-	-
Chthamalus fissus	+	+	<.1	+	+	+	+	+	+	0.3	0.6	0.1	<.1	+	+	+	+	+	<.1	+	+	+	+	+
Dendropoma spp.	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurystomella bilabiata	-	-	-	+	+	-	+	-	-	-	+	+	-	+	+	+	+	+	+	-	-	-	-	-
Haliclona spp.	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	+	-	-	-	-	-	-	-	-
Leucosolenia spp.	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	<.1	2.0	5.3	3.4	2.7	0.9	1.0	0.3	0.2	0.7	1.3	2.2	2.8	5.4	5.0	2.0	1.5	0.6	0.3	0.3	0.3	1.5	0.7	1.4

<.1 = measured but in low abundance; + = only recorded as present

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Control Station SC 1 at +0.9m (based on 5 "Tegula" count quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Counted Regardless of Size																								
Acanthina spp.	-	0.2	0.3	<.1	0.2	0.2	0.2	<.1	<.1	<.1	0.3	0.2	0.3	0.2	0.1	-	-	0.2	<.1	0.1	-	0.9	0.1	0.3
Anthopleura elegantissima	41.6	48.0	54.5	37.3	30.5	32.4	26.6	9.2	6.2	5.1	5.6	4.6	3.6	4.4	4.5	3.6	4.0	3.0	3.5	2.5	3.6	4.4	2.5	4.4
Anthopleura xanthogrammica	0.8	0.4	0.2	0.3	0.3	0.5	0.4	0.4	0.5	0.4	0.3	<.1	0.2	0.2	0.2	0.2	0.1	0.4	0.2	-	0.1	-	0.3	0.2
Balanus spp.	19.6	0.3	0.3	0.4	0.5	0.2	0.4	0.5	-	1.0	0.1	0.3	+	0.3	0.1	0.3	-	[illegible]	-	-	-	-	-	-
Calliostoma canaliculatum	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Epiactis prolifera	-	<.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	<.1
Fissurella volcano	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	-	-	-	<.1	-	0.4	-	-	-	-
Haliotis spp.	3.9	6.6	5.1	4.4	3.9	4.9	2.9	0.9	0.4	0.5	0.2	<.1	<.1	0.2	-	0.2	<.1	0.2	-	<.1	-	0.5	-	-
Hemigrapsus nudus	0.5	0.2	0.4	0.7	0.4	<.1	0.2	0.2	0.4	0.2	<.1	0.2	0.1	<.1	0.2	0.2	0.5	0.4	0.2	0.9	0.5	0.4	0.1	0.3
Leptasterias spp.	0.1	0.5	0.2	0.5	0.4	0.4	0.5	<.1	-	<.1	<.1	0.1	-	0.2	0.2	0.2	0.4	0.3	<.1	0.2	-	0.1	-	-
Lottia digitalis	-	10.5	1.2	5.0	1.8	0.8	0.9	0.2	0.1	0.9	-	0.1	-	-	0.3	-	0.1	<.1	-	-	0.3	1.5	-	0.2
Lottia limatula	1.2	2.1	1.9	3.1	2.0	5.2	4.6	1.3	1.5	2.5	3.7	4.5	5.5	4.7	5.0	8.3	3.9	3.6	3.8	3.9	5.4	6.7	2.8	7.3
Lottia pelta	1.1	1.4	2.6	2.6	1.9	2.5	0.7	0.3	1.1	1.1	0.7	0.7	1.7	0.3	1.1	0.6	1.5	1.0	1.3	2.3	2.6	1.5	1.1	6.4
Macclintockia scabra	27.9	95.1	66.4	79.4	76.1	100.3	87.9	44.1	109.2	189.4	125.6	99.7	100.2	73.7	55.2	39.8	17.6	23.8	12.0	6.4	17.9	45.0	22.7	52.2
Mopalia spp.	-	0.4	0.2	<.1	-	<.1	-	<.1	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	0.1	-	-
Nucella emarginata	<.1	-	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Nuttallina californica	-	0.1	0.2	<.1	-	<.1	<.1	<.1	-	<.1	0.1	<.1	-	-	<.1	-	-	<.1	-	-	-	-	0.3	-
Ocenebra spp.	-	<.1	0.6	0.6	0.4	0.3	0.1	0.2	<.1	0.3	0.6	0.8	1.0	0.3	0.7	0.8	0.8	0.6	1.0	0.2	0.4	1.1	1.7	0.4
Pachygrapsus crassipes	0.2	<.1	0.6	0.5	0.3	0.5	0.2	0.4	0.3	0.1	0.2	0.4	0.2	0.5	0.4	0.9	0.8	1.0	0.7	0.5	0.2	0.9	0.7	0.6
Pagurus spp.	4.9	5.5	7.7	9.1	12.2	8.5	13.3	5.3	8.1	7.1	5.4	7.4	8.7	6.8	12.5	10.2	14.2	11.1	11.0	13.3	5.6	11.6	7.5	10.1
Pisaster ochraceus	-	<.1	<.1	0.1	0.3	0.2	0.2	<.1	0.2	<.1	<.1	0.3	0.2	0.2	0.3	0.1	0.2	0.2	0.2	0.3	-	-	-	<.1
Pseudomelatoma torosa	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	<.1	-	-	-	-	-	0.1	-	-	-
Strongylocentrotus purpuratus	-	-	<.1	<.1	-	-	0.2	-	-	-	<.1	-	-	0.1	0.4	0.2	0.2	0.3	0.3	0.1	0.1	0.1	-	0.2
Tectura persona	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura scutum	0.6	3.1	3.6	5.0	3.4	5.1	9.2	1.3	4.8	6.2	5.9	7.4	3.8	5.2	4.8	4.5	2.9	3.2	2.6	7.1	7.8	8.1	1.2	6.4
Tegula brunnea	-	-	-	-	-	-	-	<.1	-	<.1	<.1	<.1	-	-	<.1	-	-	-	-	-	-	-	-	+
Tegula funebralis	69.6	141.0	98.4	186.9	184.5	184.6	142.5	142.8	163.0	162.2	264.2	293.9	276.1	250.0	234.4	248.4	142.1	100.5	90.8	123.2	127.6	78.3	207.5	136.2
Tegula pulligo	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	0.2	4.5	1.1	0.3	3.4	6.5	5.0	35.3	1.0	1.0	0.7	0.4	0.9	1.1	2.9	1.2	8.6	11.8	21.6	1.7	8.2	2.2	0.6	-
Only Counted if Greater than 1*																								
Acmaea mitra	-	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-	-	-	-	+	-	-	+	-
Acmaeidae unid.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Alia spp.	-	-	+	-	+	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Asterina miniata	-	-	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barleeia spp.	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
Bittium spp.	-	-	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Cyanoplax spp.	-	0.1	<.1	0.5	0.7	0.2	0.3	-	<.1	+	0.2	0.5	0.2	+	0.1	0.1	0.2	+	0.1	0.1	-	0.4	0.1	<.1
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	-	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
Grapsidae (juv.)	-	<.1	<.1	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	-	+	-
Homolopoma luridum/Lirularia succincta	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-	-

(continued)

Horizontal Band Transects - Annual Invertebrate Mean Abundance/m^2 - South Control Station SC 1 at +0.9m (based on 5 "Tegula" count quadrats) (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	4	4	6	6	6	6	6	6	6	6	6	6	4	4	4	4	4	4	4	3	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Idotea spp.	<.1	-	+	0.3	0.1	0.2	-	-	-	-	-	0.1	+	<.1	<.1	<.1	-	-	-	-	+	-	-	-
Ischnochitonidae	0.2	-	0.2	0.1	+	<.1	+	+	+	+	+	+	-	+	+	-	-	-	+	-	+	0.1	-	+
Lacuna spp.	-	-	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+	+	+	-	-	-	+	+
Lepidozona spp.	-	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lithopoma gibberosum	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Littorina spp.	-	+	0.3	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia asmi	-	-	+	+	+	<.1	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Lottia instabilis	-	-	-	-	-	-	-	-	-	-	+	<.1	+	-	+	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	-	-
Majidae	-	-	-	-	-	-	+	+	+	-	-	+	-	+	-	-	-	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	+	-	-	-
Mytilus californianus	-	0.2	0.1	-	+	+	-	-	+	+	0.1	0.1	0.3	+	0.3	<.1	-	-	-	-	-	-	-	+
Nemertea unid.	-	-	<.1	0.2	0.1	0.2	0.4	<.1	-	0.2	<.1	0.1	0.1	0.3	0.1	0.4	<.1	-	0.2	0.1	0.1	0.1	-	-
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	+	+	+	+	-	+	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Pelecypoda unid. boring	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Petrolisthes spp.	-	-	-	-	-	-	<.1	-	-	+	-	-	-	-	-	-	<.1	+	-	+	-	-	-	0.1
Pisaster/Henricia (juv.)	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	+	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pollicipes polymerus	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Polychaeta unid.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	+	-	<.1	-	-	-	-	-	-
Serpulidae unid.	-	-	-	+	-	-	+	-	-	+	-	-	-	-	-	-	-	<.1	-	-	+	-	-	-
Serpulorbis squamigerus	-	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sipuncula unid.	-	-	-	+	+	0.1	-	-	-	-	-	-	-	-	+	-	-	-	-	+	-	0.1	-	-
Tricolia spp.	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Velutina velutina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
% Coverage																								
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
Chthamalus fissus	0.6	0.7	0.5	0.5	0.7	1.5	0.9	0.1	0.3	0.7	1.9	1.0	1.3	1.0	0.8	0.8	3.8	2.0	1.0	0.6	1.0	4.5	1.2	0.5
Haliclona spp.	-	-	-	<.1	<.1	<.1	<.1	-	+	+	<.1	-	-	+	-	-	-	-	+	-	-	-	-	-
Phragmatopoma californica	0.1	1.3	0.6	0.5	0.6	0.5	0.2	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.1	<.1	+	<.1	+	+	+	<.1	<.1	<.1
Pista spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
Porifera unid. (encrusting)	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spirorbidae	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
tunicates, colonial/social unid.	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

<.1 = measured but in low abundance; + = only recorded as present

E3 – Fish Abundance in Vertical Band Transects

Vertical Band Transects - Annual Fish Mean Abundance (# of fish per station) - North Control Station NC 1-V (36 quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	3
Anoplarchus purpurescens																								2.3
Artedius spp.																								0.3
Cebidichthys violaceus																								1.7
Cottidae (juv.)																								0.3
Gobiesox maeandricus																								10.0
Oligocottus snyderi																								0.3
Pholididae/Stichaeidae unid.																								49.3
Xererpes fucorum																								0.3
Xiphister atropurpureus																								3.0
Xiphister mucosus																								13.3

Vertical Band Transects - Annual Fish Mean Abundance (# of fish per station) – Field's Control Station FC 1-V (36 quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Surveys	ns	ns	ns	3	4	2	ns	ns	ns	1	4	5	2	3	4	4	4	3	4	4	4	3	4	4
Anoplarchus purpurescens				-	-	-				-	-	-	-	-	-	-	4.0	2.3	3.3	6.3	4.3	3.3	0.5	5.8
Anoplarchus/Cebidichthys spp.				40.3	26.5	27.0				31.0	23.8	43.2	31.5	1.3	3.0	6.8	-	-	0.5	0.3	0.5	-	-	-
Artedius corallines				-	-	-				-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius lateralis				-	-	0.5				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius spp.				-	-	-				-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	0.3
Cebidichthys violaceus				-	-	1.0				-	-	0.2	-	5.0	3.5	6.3	2.8	8.7	3.0	2.3	2.8	2.0	3.5	6.0
Clinocottus recalvus				0.7	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cottidae (juv.)				-	0.8	-				-	-	-	-	-	-	1.5	1.8	0.7	1.8	0.5	1.5	0.3	-	1.5
Gibbonsia metzi				-	-	-				-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Gobiesox maeandricus				8.7	4.3	13.0				5.0	3.5	6.4	2.5	1.0	1.0	4.3	3.5	1.0	2.0	3.3	3.5	1.7	0.3	4.5
Heterostichus rostratus				-	-	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Oligocottus snyderi				8.3	7.0	9.0				10.0	6.3	16.0	14.0	4.0	4.0	1.3	2.5	5.0	5.5	4.0	7.0	4.3	3.5	6.5
Oligocottus spp.				0.3	-	-				-	-	-	-	-	-	-	0.3	-	0.8	-	0.8	-	-	0.5
Pholididae/Stichaeidae unid.				-	-	-				-	-	-	-	-	-	1.3	3.8	4.3	4.8	5.0	8.0	5.3	1.3	2.3
Porichthys notatus				-	0.3	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prionitis lanceolata				-	0.3	0.5				-	-	-	-	-	-	0.3	0.5	-	0.3	1.3	0.8	-	0.5	1.0
Typhlogobius californiensis				-	-	-				-	-	0.2	-	-	-	-	-	-	-	-	-	-	0.5	-
Xererpes fucorum				9.7	2.3	-				-	1.0	0.4	-	-	-	0.8	0.3	-	0.5	1.0	0.3	-	0.3	0.3
Xiphister atropurpureus				4.7	4.0	6.0				3.0	1.0	4.6	4.0	1.3	0.5	4.8	3.0	0.3	-	-	-	0.3	-	-
Xiphister mucosus				42.0	13.0	28.5				16.0	37.8	32.0	15.0	10.7	10.5	26.3	6.3	11.3	11.5	16.8	21.5	13.7	2.8	19.8
Xiphister spp. (juv.)				-	-	-				-	-	3.4	1.5	-	0.5	2.8	0.8	-	-	-	-	-	-	-

Vertical Band Transects - Annual Fish Mean Abundance (# of fish per station) – North Diablo Cove Station NDC 1-V (36 quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Surveys	ns	ns	ns	4	6	4	5	2	ns	1	4	5	2	3	4	4	4	3	4	2	1	1	1	4
Anoplarchus purpurescens				-	-	-	-	-		-	-	-	-	-	-	-	-	1.3	1.0	-	-	-	-	-
Anoplarchus/Cebidichthys spp.				24.0	15.3	11.8	19.0	7.0		17.0	14.5	17.6	4.5	1.3	-	2.3	-	-	0.3	-	-	-	-	-
Artedius lateralis				-	-	0.3	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cebidichthys violaceus				-	-	1.8	-	-		-	-	-	-	1.3	1.8	0.8	0.3	-	0.5	-	1.0	-	-	0.3
Cottidae (juv.)				0.8	-	-	-	-		-	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-
Gobiesox maeandricus				4.3	3.7	1.3	4.0	2.5		2.0	0.8	0.4	-	-	-	1.0	-	-	-	-	1.0	-	-	0.3
Oligocottus snyderi				2.3	1.0	1.8	3.0	2.0		-	0.8	1.2	-	-	0.3	0.3	0.3	0.7	0.8	-	-	1.0	-	-
Oxyjulis californica				0.3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae/Stichaeidae unid.				-	-	-	-	-		-	-	-	-	-	-	-	-	2.3	3.5	4.0	3.0	1.0	-	-
Porichthys notatus				-	-	-	0.2	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prionitis lanceolata				-	0.5	-	2.0	-		-	-	-	-	-	-	-	-	0.3	0.3	-	-	-	-	-
Scytalina cerdale				-	-	-	-	-		-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Xererpes fucorum				7.5	3.3	8.3	4.8	4.5		2.0	0.8	0.4	-	-	-	2.0	-	-	-	-	1.0	-	-	-
Xiphister atropurpureus				19.0	16.0	24.3	11.4	16.5		6.0	0.8	0.4	-	4.0	0.8	2.3	1.3	-	0.3	3.0	-	1.0	-	-
Xiphister mucosus				25.8	14.7	27.8	15.2	28.5		6.0	2.5	1.6	-	2.3	6.8	14.3	1.0	-	2.0	-	1.0	2.0	-	0.5
Xiphister spp. (juv.)				3.0	-	-	-	-		-	-	5.4	7.5	-	-	-	-	-	-	-	-	-	-	-

Vertical Band Transects - Annual Fish Mean Abundance (# of fish per station) – South Diablo Cove Station SDC 2-V (36 quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Surveys	ns	ns	ns	4	6	4	5	2	ns	1	4	5	2	3	4	4	4	4	4	2	1	1	1	4
Anoplarchus purpurescens				-	-	-	-	-		-	-	-	-	-	-	0.3	7.0	5.0	1.0	-	1.0	-	2.0	1.5
Anoplarchus/Cebidichthys spp.				8.0	7.8	7.0	6.4	2.5		17.0	16.5	15.0	10.0	1.3	1.0	3.0	-	-	1.8	-	-	-	-	0.3
Apodichthys flavidus				-	-	-	-	-		-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-
Artedius lateralis				0.3	0.3	-	-	-		-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-
Artedius spp.				-	-	-	-	-		-	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-
Cebidichthys violaceus				-	0.5	2.8	2.2	-		-	-	-	-	2.0	2.0	2.3	1.8	3.0	3.3	5.0	15.0	2.0	2.0	2.8
Chilara taylori				-	-	-	-	-		-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Cottidae (juv.)				-	-	-	-	-		-	-	-	-	-	-	0.8	0.5	-	0.5	-	-	-	-	0.3
fish eggs				0.3	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Girella nigricans				-	-	-	-	-		-	-	-	-	-	-	-	-	0.3	0.3	-	-	-	-	-
Gobiesox maeandricus				11.8	6.3	4.3	11.0	1.0		3.0	0.5	0.2	1.0	0.3	-	0.3	0.5	0.3	-	1.0	3.0	2.0	-	-
Micrometrus aurora				-	-	-	-	-		-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-
Micrometrus minimus				-	-	-	-	-		-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	-
Oligocottus snyderi				2.8	3.7	2.8	1.2	2.0		-	0.5	0.4	-	2.0	0.8	1.0	0.8	2.0	1.0	0.5	-	2.0	-	0.3
Oligocottus spp.				-	-	-	0.2	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae/Stichaeidae unid.				-	-	-	-	-		-	-	-	-	-	-	0.5	1.5	6.5	3.3	2.0	15.0	4.0	2.0	1.5
Prionitis lanceolata				-	0.8	0.3	1.8	-		-	-	-	-	-	-	-	0.8	-	0.3	-	-	-	-	0.3
Scytalina cerdale				27.3	10.5	10.3	14.6	1.0		17.0	1.8	4.8	-	1.7	0.8	3.0	3.3	0.5	0.8	0.5	-	-	-	-
Sebastes spp.				0.5	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Typhlogobius californiensis				0.3	-	0.3	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xererpes fucorum				3.8	2.0	4.5	4.4	6.5		-	1.3	-	-	0.3	-	1.0	0.3	-	0.3	-	1.0	-	-	-
Xiphister atropurpureus				21.5	20.3	14.8	18.8	13.5		5.0	3.8	3.6	5.0	4.0	0.8	3.8	8.5	1.5	0.5	3.0	2.0	-	-	0.3
Xiphister mucosus				36.5	20.2	25.8	15.2	14.0		9.0	6.5	5.2	1.0	3.7	8.8	21.5	9.3	8.3	14.8	2.0	6.0	8.0	2.0	1.0
Xiphister spp. (juv.)				0.8	-	-	-	-		-	-	0.4	2.5	-	1.3	0.8	-	-	-	-	-	-	-	31.0

Vertical Band Transects - Annual Fish Mean Abundance (# of fish per station) – South Control Station SC 1-V (36 quadrats)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	3
Anoplarchus purpurescens																								38.0
Anoplarchus/Cebidichthys spp.																								2.0
Artedius corallines																								0.3
Cebidichthys violaceus																								25.3
Gobiesox maeandricus																								7.7
Oligocottus snyderi																								1.3
Pholididae/Stichaeidae unid.																								9.7
Porichthys notatus																								0.7
Xererpes fucorum																								0.3
Xiphister atropurpureus																								1.7
Xiphister mucosus																								9.0
Xiphister spp. (juv.)																								1.3

Appendix F

Annual Taxa Means by Subtidal Sampling Method

F1 – Algal, Invertebrate and Substrate Cover on Subtidal Benthic Stations (Line Contact Method)

F2 – Algal Abundance on Subtidal Benthic Stations (Arc Quadrant Method)

F3 – Invertebrate Abundance on Subtidal Benthic Stations (Arc Quadrant Method)

F4 – Invertebrate Abundance on Subtidal Benthic Stations (Fixed Quadrat Method)

F5 – Fish Abundance on Subtidal Fish Observation Transects

F1 – Algal, Invertebrate and Substrate Cover on Subtidal Benthic Stations (Line Contact Method)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – Field's Cove Station FC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	2	4	2	3	3	1	1	4	4
Coverage Based on # of Contact Points																								
Ahnfeltiopsis leptophylla													-	-	-	-	<.1	-	-	-	-	-	-	-
Ahnfeltiopsis linearis													<.1	<.1	<.1	0.3	<.1	<.1	<.1	<.1	2.0	0.5	0.1	0.6
Bryopsis spp.													-	-	-	-	-	-	-	-	-	-	-	0.1
Calliarthron/Bossiella spp.-complex													50.8	56.3	59.1	64.0	64.6	76.3	64.3	56.8	56.0	65.5	60.5	53.0
Callithamnion spp./Pleonosporium spp.													-	-	-	-	-	-	<.1	-	-	-	-	-
Callophyllis firma													<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	-	-	-
Callophyllis flabellulata													<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	0.5	-	<.1	<.1
Callophyllis spp.													2.8	4.1	5.3	3.3	5.5	3.0	0.8	1.3	1.0	<.1	0.4	0.3
Chondracanthus corymbiferus													31.5	26.6	29.0	28.8	28.1	38.3	31.2	23.7	26.5	21.5	20.5	20.3
Chrysophyta unid.													-	-	-	-	-	-	-	4.0	2.0	-	3.3	-
Corallina officinalis													0.3	0.1	<.1	<.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	0.3
Cryptopleura ruprechtiana													65.8	49.8	45.6	59.0	52.9	56.3	41.7	28.0	19.5	24.5	15.4	22.3
Cryptopleura violacea													0.3	0.1	0.5	0.3	0.8	1.8	-	0.3	-	-	0.8	<.1
Cystoseira osmundacea													-	<.1	-	<.1	<.1	-	-	-	-	0.5	-	0.1
Delesseria decipiens													-	-	-	-	-	-	-	-	-	-	-	<.1
Desmarestia spp.													-	<.1	0.1	-	-	<.1	8.3	20.3	0.5	-	14.3	2.5
Dictyoneurum californicum													<.1	<.1	0.1	<.1	<.1	<.1	<.1	0.2	<.1	-	-	-
Egregia menziesii													-	-	-	-	-	-	<.1	<.1	-	-	<.1	<.1
Erythrophyllum delesserioides													2.8	3.3	2.9	2.8	1.0	1.0	0.7	<.1	<.1	<.1	0.5	-
Farlowia/Pikea spp.-complex													0.5	0.8	0.6	0.8	1.5	3.0	1.0	1.8	6.0	<.1	1.0	0.6
Gastroclonium subarticulatum													-	-	-	0.5	-	-	<.1	-	-	-	-	-
Gelidium robustum													<.1	<.1	<.1	<.1	0.3	0.5	0.2	0.3	<.1	0.5	0.3	0.8
Halicystis ovalis													-	-	-	-	-	-	-	<.1	<.1	-	<.1	-
Halymenia/Schizymenia spp.-complex													0.5	0.3	0.8	<.1	1.0	<.1	0.7	1.3	4.5	-	3.4	<.1
Hymenena spp.													-	-	-	-	-	-	<.1	-	-	-	-	-
Laminaria setchellii													0.8	2.5	1.9	1.5	0.5	0.3	0.7	0.5	0.5	5.0	2.3	3.0
Laminariales													-	-	-	-	-	-	-	<.1	<.1	-	<.1	<.1
Macrocystis spp.													-	-	-	-	-	-	-	-	-	-	<.1	0.4
Mazzaella lilacina													31.8	20.5	20.3	16.0	10.8	8.8	5.7	2.0	3.5	1.5	2.3	1.3
Mazzaella rosea													<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	0.6	<.1
Microcladia coulteri													0.8	1.8	3.8	0.8	<.1	4.0	1.2	0.3	1.5	<.1	0.4	3.0
Neoptilota densa													-	<.1	<.1	<.1	<.1	0.3	0.3	0.2	0.5	<.1	0.1	1.3
Nereocystis luetkeana													-	-	0.1	-	-	-	<.1	0.5	0.5	0.5	1.1	1.8
Non-coralline crust													1.5	6.0	3.8	7.0	3.4	2.0	2.7	3.2	1.5	2.0	1.3	2.6
Osmundea spp.													0.3	0.6	1.1	<.1	1.4	1.0	<.1	0.3	0.5	<.1	0.1	0.3
Pikea robusta													0.5	-	-	-	-	-	-	0.2	-	-	-	-
Plocamium cartilagineum													-	<.1	-	-	-	-	-	-	-	-	-	-
Polyneura latissima													-	<.1	<.1	-	<.1	-	-	0.2	-	-	<.1	<.1
Porphyra spp.													-	-	-	-	-	-	-	-	-	-	<.1	-
Prionitis australis													<.1	0.1	<.1	<.1	0.9	0.3	<.1	0.5	0.5	-	<.1	1.5
Prionitis spp.													10.5	12.0	16.5	15.0	14.6	12.5	13.3	8.5	10.0	7.0	9.9	7.3
Pterocladia caloglossoides													<.1	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-	-
Pterosiphonia dendroidea													<.1	-	-	-	-	-	-	-	-	-	<.1	0.1
Pterygophora californica													<.1	<.1	0.1	-	-	-	-	<.1	-	-	2.9	1.4
Rhodymenia spp.													4.5	3.0	4.4	8.0	7.3	4.3	3.7	4.2	14.5	2.5	5.9	5.3
Sarcodiotheca gaudichaudii													<.1	0.1	<.1	-	0.4	<.1	<.1	<.1	0.5	<.1	<.1	<.1

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – Field's Cove Station FC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	2	4	2	3	3	1	1	4	4
Coverage Based on # of Contact Points (continued)																								
Scinaia confusa													<.1	-	-	-	-	-	-	-	-	-	0.1	-
Ulva/Enteromorpha spp.													-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	0.1	<.1
Weeksia spp.													<.1	-	-	-	-	-	-	-	-	-	-	-
coralline crust													55.0	56.4	56.0	64.8	54.0	52.8	42.8	39.8	55.5	35.0	47.4	43.8
filamentous red algae-complex													-	-	-	-	0.1	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points																								
Ahnfeltiopsis leptophylla	-	-	<.1	<.1	-	-	-	-	-	<.1	-	<.1	-	-	-	-	<.1	-	-	-				-
Ahnfeltiopsis linearis	-	-	-	-	-	-	<.1	-	-	<.1	<.1	<.1	<.1	0.1	0.1	0.3	0.8	0.6	<.1	0.3				0.8
Antithamnion/Platythamnion spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1				-
Calliarthron/Bossiella spp.-complex	39.5	42	44.5	39.9	43.2	47	46.5	38.7	36.1	35.6	35	35.6	23.3	23.3	31.1	29.7	31.3	37	32	28				29.8
Callophyllis firma	-	-	<.1	-	-	-	-	-	-	-	<.1	-	<.1	<.1	<.1	-	-	-	-	-				-
Callophyllis flabellulata	-	-	-	-	<.1	-	<.1	<.1	-	<.1	<.1	<.1	-	<.1	0.1	<.1	0.1	-	<.1	-				<.1
Callophyllis spp.	-	0.2	0.4	0.1	0.5	1	1.8	0.8	0.6	0.1	<.1	0.4	0.3	0.9	0.9	0.8	<.1	0.3	0.6	-				2
Chondracanthus canaliculatus	-	-	-	-	-	<.1	-	-	-	<.1	<.1	0.2	0.3	0.3	<.1	<.1	-	<.1	<.1	<.1				-
Chondracanthus corymbiferus	5.5	7.8	7.4	5.9	9.3	7.8	15	12.3	15.1	11.4	18.5	15.1	14.5	10.3	14.8	12.3	13.3	10.9	2.8	2.3				1.5
Chondracanthus harveyanus/spinosus	-	-	-	-	-	<.1	0.2	<.1	0.1	<.1	-	<.1	-	0.1	0.6	0.8	1.4	3.3	2.6	1.5				0.7
Chrysophyta unid.	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	1.9	3.2	2.5	1.4	2.9	3.3				19.7
Clathromorphum parcum	-	-	-	-	-	-	<.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-				-
Coilodesme californica	-	-	-	-	-	-	<.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-				-
Colpomenia spp.	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	<.1	0.1	0.1	0.3	<.1				<.1
Corallina officinalis	2	3.3	4.8	3	3.3	3.2	1.5	2.7	1.5	1.5	3.4	0.6	5.2	<.1	<.1	1	0.5	<.1	0.1	<.1				<.1
Cryptopleura ruprechtiana	-	18	30.8	29.1	26.3	36.3	36.8	38.8	48.4	40.2	23.8	30.2	4.2	6.6	2.3	2.5	-	-	-	-				-
Cryptopleura violacea	-	0.7	0.3	1.5	0.5	1	0.5	3.3	13.9	3.8	9.4	37.8	75.8	59.5	61	44.8	42.9	37.4	23.6	11.5				3.8
Cystoseira osmundacea	4	4.8	4.3	4.5	4.3	5.8	9.7	7.3	7.4	7.8	3.3	1.8	1	<.1	<.1	<.1	0.5	0.9	0.9	0.3				2.5
Delesseriaceae (juv.)	24	6.3	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-				-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	<.1				-
Desmarestia spp.	-	2	-	<.1	0.3	-	<.1	2.7	-	-	-	0.3	-	0.1	1.8	0.7	0.1	0.3	5.6	0.5				3.3
Dictyoneurum californicum	-	0.2	-	<.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Dictyota binghamiae	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-				-
Egregia menziesii	1	0.3	0.3	0.1	0.2	<.1	-	<.1	<.1	<.1	-	-	-	-	-	-	-	<.1	-	-				-
Erythrophyllum delesserioides	-	0.3	0.4	<.1	0.7	0.3	0.5	0.2	0.3	<.1	0.1	-	-	-	-	-	-	-	-	-				-
Farlowia/Pikea spp.-complex	-	0.2	<.1	0.3	0.2	0.2	0.2	<.1	0.4	1.4	0.5	2.6	1.3	2.8	1.5	1.5	4.8	15.4	20.3	14				8.3
Gastroclonium subarticulatum	-	-	-	-	-	-	<.1	<.1	<.1	<.1	<.1	0.2	0.2	0.8	1.3	1.7	0.1	0.5	0.1	-				<.1
Gelidium coulteri	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Gelidium pusillum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Gelidium robustum	-	<.1	<.1	0.3	<.1	-	<.1	<.1	<.1	0.2	<.1	0.4	0.3	1	0.6	1.2	3.4	6.8	9.4	7.5				2.7
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-				-
Gloiosiphonia californica	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	<.1	<.1	<.1				-
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	<.1	0.3	0.3	-	-	-	-	-	-	-				-
Halicystis ovalis	-	<.1	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	<.1	<.1	-	-				<.1
Halymenia/Schizymenia spp.-complex	<.1	<.1	<.1	-	0.3	<.1	0.5	0.3	0.1	0.6	3.5	1.5	6.3	1.3	1.5	1.5	0.1	0.1	<.1	<.1				<.1
Laminaria setchellii	1	0.7	1	1.9	0.5	1.2	0.3	0.2	0.1	0.4	<.1	-	-	-	<.1	<.1	-	-	<.1	-				-
Laminariales	-	0.2	-	<.1	0.3	-	-	-	-	<.1	-	<.1	-	-	<.1	-	-	-	<.1	-				<.1
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.6	1.5	7.1	3				7.7
Mazzaella affinis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-				-
Mazzaella heterocarpa	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Mazzaella lilacina	4	1.8	1	4.5	6	10.5	7.8	11.5	15.4	15.3	14	6.9	1.5	1	0.4	0.2	<.1	<.1	-	-				-
Mazzaella rosea	-	-	-	-	-	<.1	<.1	0.2	0.1	0.1	0.4	0.6	1.2	1.4	0.5	0.5	1.6	0.1	0.3	<.1				<.1
Melobesia mediocris	-	-	<.1	0.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-				<.1
Microcladia coulteri	2.5	2.2	1.1	2.1	1.2	1	1.3	6	2.5	2.1	<.1	2.6	0.7	2.6	2.6	7.8	0.1	<.1	0.1	-				<.1
Neoptilota densa	0.5	-	-	<.1	-	0.2	<.1	0.2	<.1	<.1	-	-	-	-	-	0.8	-	-	-	-				-
Nereocystis luetkeana	-	<.1	0.1	<.1	0.3	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-				<.1

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points (continued)																								
Nienburgia andersoniana	-	-	-	-	-	-	-	<.1	0.4	0.1	-	-	-	-	-	<.1	1.4	3.1	1.3	0.8				-
Non-coralline crust	12	8.3	2.4	5.3	2.7	1	1	6.2	7.6	6.6	5.9	8.9	10.5	8.6	8.4	8.8	4	3.9	2.8	4				1.7
Opuntiella californica	-	-	<.1	-	<.1	<.1	<.1	<.1	-	<.1	<.1	0.2	-	<.1	-	<.1	-	-	-	-				-
Osmundea spp.	0.5	1.5	2.4	2.6	2.8	4.2	3.2	0.7	0.1	2.9	2.6	3.3	3	6	13.5	20	2.3	3	1.9	0.5				0.2
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-				-
Phycodrys spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Phyllospadix spp.	12	7.7	10.8	9.1	7.7	8	8.5	3.7	3.3	1.5	0.4	0.1	-	-	-	-	-	-	-	-				-
Plocamium cartilagineum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-				-
Polyneura latissima	-	0.5	-	0.1	-	-	<.1	<.1	0.1	<.1	<.1	<.1	-	<.1	-	<.1	-	<.1	<.1	-				-
Porphyra spp.	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-				-
Prionitis australis	<.1	-	-	-	-	0.2	<.1	0.2	<.1	0.1	-	0.1	-	<.1	<.1	0.2	0.3	0.1	-	-				<.1
Prionitis spp.	-	0.5	0.6	1.4	1.7	1.7	0.7	0.7	1.6	2.4	5.4	9.5	10.3	18.9	17.4	22.8	20.9	20.8	15	7.3				6
Pterochondria woodii var. woodii	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Pterocladia caloglossoides	0.5	0.7	0.3	0.5	0.2	0.5	0.2	<.1	0.1	<.1	<.1	0.1	0.2	0.3	<.1	<.1	<.1	-	<.1	-				-
Pterosiphonia baileyi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Pterosiphonia dendroidea	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	<.1	<.1	0.1	0.3	<.1				0.2
Pterygophora californica	3	1.3	1.9	2.6	2.3	0.5	1	0.7	0.3	0.4	<.1	-	-	-	-	-	-	-	-	-				-
Rhodophyta (juv. blades)	1	-	0.1	0.1	-	-	-	<.1	-	0.3	-	-	0.2	-	-	-	-	-	-	-				-
Rhodymenia spp.	-	-	-	0.1	<.1	0.2	0.3	<.1	<.1	0.3	0.8	0.2	0.2	1.4	2.9	3.8	3	2.5	1.9	2.3				0.2
Sarcodiotheca gaudichaudii	-	0.3	0.8	0.4	0.5	0.2	0.3	0.2	0.8	1	3.1	3.5	1.8	3	2	1.3	0.3	0.4	<.1	0.5				<.1
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				0.3
Scinaia confusa	-	<.1	-	<.1	<.1	-	-	<.1	<.1	<.1	-	<.1	-	<.1	-	<.1	<.1	-	-	<.1				-
Smithora naiadum	-	1	<.1	1.4	1	1	2.5	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Spongomorpha/Acrosiphonia-complex	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Ulva/Enteromorpha spp.	6.5	2.2	<.1	<.1	0.7	0.2	0.3	0.8	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.8	<.1	1.1	0.1	<.1				0.3
coralline crust	54	36.8	37.9	44	49.8	38.7	53.8	46.7	57.4	60.6	62	64	62.7	48.9	50.9	59.2	59.5	67.5	58.4	46				55
filamentous red algae-complex	0.5	0.5	0.1	0.1	-	-	<.1	-	-	<.1	<.1	<.1	-	<.1	3.5	<.1	0.3	1.3	0.5	0.5				<.1
juv. articulated coralline algae	-	-	0.6	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 3 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of Contact Points																								
Acrosorium uncinatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Ahnfeltiopsis leptophylla	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-	0.1	<.1	-	-	-	-	-	-	-	-
Ahnfeltiopsis linearis	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.6	1.1	1.3	0.3	-	0.3	0.4
Antithamnion/Platythamnion spp.-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1	-	-	<.1
Bryopsis spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-	<.1	-	<.1	-	-	<.1
Calliarthron/Bossiella spp.-complex	61.0	47.8	52.5	53.6	49.8	54.8	58.2	38.6	44.6	46.7	43.3	41.9	29.8	29.6	35.0	35.0	29.4	26.3	22.5	15.3	18.5	20.8	18.0	20.8
Callithamnion spp./Pleonosporium spp.	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Callophyllis firma	-	-	-	-	-	-	-	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	-	-	-	-	-	-	-
Callophyllis flabellulata	-	<.1	0.3	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	0.3	0.1	<.1	<.1	-	0.1	<.1	-	-	-	<.1
Callophyllis spp.	-	2.2	0.6	0.6	1.2	1.7	3.2	0.6	0.1	0.3	0.2	<.1	0.3	0.8	0.4	1.3	0.3	0.3	-	0.3	0.8	0.3	-	0.8
Chondracanthus canaliculatus	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-
Chondracanthus corymbiferus	11.5	14.8	14.8	14.8	19.2	22.5	21.7	22.9	16.4	16.1	16.2	18.1	14.3	18.4	22.0	17.6	11.8	10.1	10.9	7.5	5.8	3.0	4.5	2.1
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	<.1	-	<.1	<.1	0.1	-	0.1	-	0.3	<.1	2.0	1.6	1.0	1.8	1.8	0.5	0.1
Chrysophyta unid.	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	1.5	2.1	0.4	0.8	11.0	2.8	13.5	7.8	11.8	21.1
Colpomenia spp.	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	0.1
Corallina officinalis	2.5	16.3	11.1	9.6	11.7	10.5	13.0	8.0	6.8	7.7	8.0	2.5	0.7	0.4	1.9	2.6	0.5	1.3	0.8	0.5	1.3	0.5	0.8	2.8
Corallina vancouveriensis	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura ruprechtiana	-	35.8	40.8	43.0	35.3	52.7	44.5	37.3	44.9	38.7	18.5	14.3	0.2	1.3	0.1	0.1	0.1	-	-	-	-	-	-	-
Cryptopleura violacea	-	0.5	2.4	2.9	1.0	2.0	0.2	2.4	6.8	1.0	13.7	55.5	72.0	69.5	60.6	56.8	55.0	52.0	42.5	33.3	40.8	45.8	2.5	1.3
Cystoseira osmundacea	0.5	0.5	0.3	0.1	0.5	0.3	1.2	0.1	0.5	1.0	0.5	-	-	<.1	<.1	<.1	<.1	0.3	0.1	<.1	<.1	<.1	<.1	2.0
Delesseria decipiens	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Delesseriaceae (juv.)	39.0	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-
Desmarestia spp.	-	7.5	0.1	-	0.3	0.7	<.1	4.8	<.1	-	-	-	-	<.1	0.4	0.1	-	0.1	<.1	<.1	-	-	-	0.3
Dictyoneurum californicum	-	-	<.1	0.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dictyota binghamiae	-	-	-	-	-	<.1	<.1	<.1	-	-	<.1	<.1	-	-	-	-	-	-	-	-	0.3	-	<.1	<.1
Egregia menziesii	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Erythrophyllum delesserioides	-	0.5	0.3	<.1	0.5	0.3	0.2	0.9	0.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	0.2	<.1	0.5	<.1	0.3	0.5	<.1	0.4	0.6	0.9	2.4	2.8	3.3	1.6	2.0	12.5	23.9	21.6	19.5	16.0	19.3	1.8	6.4
Gastroclonium subarticulatum	-	-	-	-	-	<.1	0.2	0.3	0.5	0.2	<.1	0.3	1.2	2.0	1.6	0.9	0.1	0.3	0.1	0.3	0.3	<.1	-	<.1
Gelidium coulteri	-	-	-	-	-	-	-	-	-	-	-	<.1	0.2	-	-	-	-	-	-	-	-	-	-	-
Gelidium pusillum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-
Gelidium robustum	-	0.2	0.4	0.3	0.7	0.3	0.3	0.1	0.3	0.1	0.4	0.3	0.5	0.6	1.6	2.8	5.4	6.3	9.1	10.3	13.8	9.0	11.3	11.9
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Gloiosiphonia californica	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	<.1	-	<.1	<.1	<.1	-	-	<.1	-
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	-	<.1	0.2	-	-	<.1	-	-	<.1	-	-	-	-	-
Halicystis ovalis	-	0.2	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	<.1	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	0.3	0.4	-	<.1	<.1	<.1	2.5	0.1	0.2	1.5	2.6	15.7	4.3	0.6	0.8	<.1	<.1	<.1	-	<.1	0.3	-	-
Hymenena spp.	-	-	-	-	-	0.2	-	-	-	-	-	-	<.1	-	-	-	-	0.1	-	-	-	-	-	-
Laminaria setchellii	-	0.7	0.3	1.1	0.3	1.0	<.1	0.3	0.3	0.4	0.3	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Laminariales	-	0.3	<.1	-	<.1	-	-	<.1	<.1	<.1	-	-	-	<.1	-	<.1	-	-	<.1	-	-	0.3	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	<.1	1.1	2.0	3.8	4.3	3.5	14.6
Mastocarpus papillatus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella affinis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
Mazzaella leptorhynchos	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Mazzaella lilacina	8.5	4.0	6.1	7.3	11.3	14.3	14.3	15.0	10.5	13.1	7.3	5.3	4.0	1.0	0.5	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of Contact Points (continued)																								
Mazzaella rosea	-	0.2	-	-	<.1	<.1	<.1	0.1	<.1	0.1	0.5	0.6	0.8	0.9	0.8	0.9	2.1	<.1	0.5	1.8	0.5	<.1	<.1	<.1
Melobesia mediocris	-	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Membranoptera/Branchioglossum spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	1.0	3.8	3.1	1.8	2.3	4.8	4.7	2.4	4.1	1.5	<.1	5.5	0.7	4.9	7.0	4.5	<.1	<.1	<.1	<.1	-	-	-	-
Neoptilota densa	0.5	0.7	0.3	<.1	0.3	0.3	0.7	0.3	0.6	0.2	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Neoptilota hypnoides	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereocystis luetkeana	-	0.3	-	<.1	<.1	<.1	<.1	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.8	2.8	7.0	4.3	7.0	2.5	2.3	0.5	0.1
Non-coralline crust	-	3.7	1.8	2.8	1.0	0.2	3.2	3.4	3.9	6.4	7.1	7.9	10.2	12.4	7.3	5.0	5.8	4.8	3.1	3.0	3.3	3.5	2.3	2.9
Opuntiella californica	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-
Osmundea spp.	1.0	2.0	2.8	3.4	2.5	3.2	5.0	2.5	2.1	3.4	0.7	3.8	6.5	16.0	7.9	11.0	2.0	0.6	0.3	0.3	3.5	0.8	-	<.1
Phaeophyta (juv.)	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phycodrys spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	14.0	8.7	5.0	4.6	4.7	6.5	10.3	3.1	1.6	0.9	0.3	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Pikea robusta	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plocamium cartilagineum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-
Polyneura latissima	-	-	-	-	<.1	0.2	<.1	<.1	0.3	<.1	<.1	<.1	-	<.1	<.1	0.1	-	0.1	-	-	-	-	-	-
Prionitis australis	-	0.2	<.1	-	-	<.1	-	-	0.1	<.1	0.2	<.1	0.2	-	0.1	0.4	0.4	<.1	0.4	0.8	0.5	-	-	0.9
Prionitis spp.	1.0	2.0	0.6	0.9	0.5	0.5	1.7	2.3	2.4	3.1	4.7	11.1	9.2	19.0	23.1	23.5	17.8	13.4	16.6	7.0	7.5	5.5	2.8	6.8
Pterochondria woodii var. woodii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Pterocladia caloglossoides	<.1	1.8	1.6	0.3	0.5	0.5	0.8	0.1	0.1	0.3	0.2	0.1	1.7	0.6	0.3	<.1	<.1	-	-	-	-	-	-	-
Pterosiphonia dendroidea	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	<.1	<.1	1.1	0.6	0.5	0.5	0.5	-	0.9
Pterygophora californica	1.5	0.3	0.6	1.5	0.3	0.2	0.2	2.1	3.5	2.5	0.4	<.1	-	-	-	-	-	-	-	-	-	-	<.1	<.1
Rhodophyta (juv. blades)	-	0.2	0.1	0.4	<.1	-	-	<.1	<.1	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-
Rhodoptilum plumosum	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	-	-	-	<.1	<.1	0.3	0.6	0.3	0.1	0.3	0.3	0.8	4.4	3.9	4.4	4.4	5.1	7.5	7.0	6.0	3.3	1.0	3.1
Sarcodiotheca gaudichaudii	-	1.5	2.1	1.1	0.3	1.7	2.0	0.9	0.9	0.8	1.2	2.0	0.7	2.8	0.4	0.3	<.1	0.1	<.1	<.1	<.1	<.1	-	<.1
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.5
Scinaia confusa	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Smithora naiadum	<.1	-	-	0.3	0.3	0.8	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	4.0	1.8	<.1	0.3	0.2	0.2	<.1	0.6	<.1	<.1	<.1	<.1	<.1	<.1	0.6	<.1	<.1	0.5	0.3	0.3	<.1	0.3	0.3	<.1
coralline crust	29.5	60.0	34.8	39.4	41.5	45.5	50.5	62.4	62.5	56.3	47.1	58.9	63.8	59.9	54.4	56.8	62.5	54.6	53.8	51.5	49.3	44.0	53.5	54.9
filamentous red algae-complex	-	0.2	<.1	-	0.2	<.1	-	<.1	-	<.1	<.1	<.1	<.1	-	1.4	0.1	0.6	4.0	2.3	6.8	2.8	2.0	8.8	<.1
juv. articulated coralline algae	-	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 4 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points																								
Acrosorium uncinatum	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	0.1
Ahnfeltiopsis leptophylla	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Ahnfeltiopsis linearis	-	-	<.1	0.3	-	0.3	-	<.1	0.1	0.3	0.4	0.3			0.4	0.9	2.3	0.4	0.9	0.3	0.5	1.0	1.5	0.4
Amplisiphonia pacifica	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	<.1	-
Antithamnion/Platythamnion spp.-complex	-	-	-	-	-	-	-	-	-	-	<.1	-			-	<.1	0.3	<.1	<.1	<.1	-	-	-	0.3
Bryopsis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	<.1
Calliarthron/Bossiella spp.-complex	54.5	57.0	47.5	51.8	49.7	53.7	49.1	40.4	44.4	47.6	43.0	50.5			46.1	42.9	50.6	47.3	46.1	36.8	47.0	39.3	37.0	36.4
Callithamnion spp./Pleonosporium spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Callophyllis firma	-	-	-	-	-	-	-	<.1	-	-	-	<.1			-	<.1	<.1	-	-	-	-	-	-	<.1
Callophyllis flabellulata	-	<.1	<.1	0.3	<.1	0.2	0.9	<.1	0.3	0.4	0.1	1.2			0.1	0.3	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.3
Callophyllis spp.	3.0	4.5	2.9	3.2	3.5	4.2	7.9	4.3	4.3	3.2	2.1	1.7			3.0	1.4	0.3	0.6	<.1	0.8	1.0	<.1	-	0.4
Chondracanthus canaliculatus	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Chondracanthus corymbiferus	4.5	6.0	7.5	5.9	6.5	9.3	10.3	9.5	12.0	12.8	15.0	19.2			18.3	18.8	12.3	9.1	12.0	6.3	3.5	5.0	4.3	4.3
Chondracanthus harveyanus/spinosus	<.1	-	-	-	-	-	<.1	-	<.1	<.1	0.1	-			0.1	0.4	1.4	1.8	3.6	1.3	-	1.8	0.8	0.9
Chrysophyta unid.	-	-	-	<.1	-	-	-	-	-	-	-	-			<.1	0.1	3.0	0.5	5.0	0.5	6.5	6.5	6.3	7.4
Coilodesme californica	-	-	-	<.1	-	-	-	-	<.1	-	-	-			-	0.1	-	-	-	-	-	-	-	-
Colpomenia spp.	-	-	-	-	-	-	-	-	-	-	<.1	<.1			<.1	<.1	<.1	<.1	0.1	<.1	-	-	<.1	<.1
Corallina officinalis	-	-	0.4	0.5	0.7	<.1	0.1	0.1	0.1	0.3	0.3	0.3			0.1	0.1	0.1	0.1	<.1	<.1	-	<.1	<.1	0.1
Cryptopleura ruprechtiana	-	31.5	40.3	39.9	42.8	49.8	51.8	44.8	54.5	51.5	43.3	54.7			24.4	14.6	2.5	1.8	0.4	-	0.5	<.1	-	-
Cryptopleura violacea	-	-	0.1	0.4	-	-	-	0.3	0.5	0.2	4.1	14.7			34.5	30.9	24.0	28.5	18.8	15.5	27.5	23.8	1.0	1.0
Cystoseira osmundacea	8.0	7.0	5.1	5.8	9.3	10.0	13.0	8.3	9.4	11.2	8.3	8.0			0.4	0.4	2.0	0.6	0.8	1.0	1.5	0.3	0.8	0.6
Delesseriaceae (juv.)	33.0	-	0.5	0.2	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.3	-	-
Desmarestia spp.	-	-	0.3	-	<.1	-	-	2.5	0.3	<.1	<.1	-			2.3	0.4	-	0.1	0.4	3.5	-	<.1	<.1	<.1
Dictyoneurum californicum	6.5	5.0	7.6	6.5	6.5	7.0	6.4	6.9	6.1	5.3	0.6	-			-	-	-	-	-	-	-	-	-	-
Dictyota binghamiae	-	<.1	0.1	<.1	-	-	-	<.1	0.1	-	<.1	<.1			-	-	-	-	-	-	-	-	-	-
Egregia menziesii	-	-	0.1	<.1	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Endarachne/Petalonia-complex	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Erythrophyllum delesserioides	<.1	-	0.5	0.1	<.1	0.2	0.3	0.3	0.5	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	<.1	<.1	<.1	0.2	0.2	0.2	<.1	0.1	<.1	<.1	1.3	2.2			1.8	5.0	15.0	16.5	19.5	13.0	12.0	19.3	3.3	6.5
Fauchea laciniata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Gastroclonium subarticulatum	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	<.1	-	0.5	-	-	<.1
Gelidium robustum	-	<.1	-	-	<.1	0.2	<.1	<.1	<.1	0.2	<.1	<.1			0.9	1.8	2.6	1.8	2.8	1.5	5.0	1.8	3.5	5.0
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	<.1	-	-
Gloiosiphonia californica	-	-	-	-	-	-	-	-	-	-	<.1	<.1			<.1	-	<.1	-	<.1	<.1	-	-	-	-
Halicystis ovalis	-	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1			<.1	-	<.1	-	-	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	0.1	-	0.2	-	-	0.1	<.1	<.1	0.6	0.5			0.4	0.1	<.1	0.1	<.1	0.3	-	<.1	-	<.1
Hymenena spp.	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	0.1	-	-	-	-	-
Laminaria setchellii	1.0	1.0	2.5	2.1	1.7	1.0	1.3	0.4	0.9	0.6	0.3	<.1			<.1	<.1	-	<.1	<.1	<.1	<.1	-	-	-
Laminariales	-	-	<.1	<.1	<.1	-	-	<.1	<.1	-	0.1	<.1			<.1	-	<.1	<.1	<.1	<.1	<.1	-	-	<.1
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	0.6	3.0	3.4	2.8	3.0	2.5	7.5	10.5
Maripelta rotata	-	-	0.1	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Mazzaella heterocarpa	-	-	<.1	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Mazzaella lilacina	2.0	0.5	0.4	0.8	0.7	0.8	0.9	0.8	2.8	1.3	2.4	3.3			0.3	0.3	-	-	-	-	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	-	0.3	<.1	<.1	0.1	<.1			<.1	0.1	<.1	0.1	<.1	0.5	-	0.5	<.1	<.1
Membranoptera/Branchioglossum spp.	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	0.5	0.5	0.3	0.4	0.5	1.3	0.8	0.6	1.1	0.3	0.6	1.5			1.8	4.0	<.1	<.1	<.1	<.1	-	<.1	-	<.1

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points (continued)																								
Neoptilota densa	-	-	0.1	<.1	<.1	0.2	0.1	<.1	0.1	<.1	0.1	-			-	-	-	-	-	-	-	-	-	-
Neoptilota hypnoides	<.1	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Nereocystis luetkeana	0.5	-	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-			<.1	0.4	0.3	4.3	2.0	0.8	1.0	2.0	-	0.5
Non-coralline crust	2.5	3.0	1.3	1.5	0.2	0.5	<.1	<.1	0.6	0.8	2.3	1.7			1.8	1.9	1.4	0.6	0.5	1.3	-	<.1	0.5	0.3
Opuntiella californica	1.5	<.1	-	0.3	<.1	0.3	0.3	0.3	0.3	0.3	<.1	0.2			0.1	<.1	-	-	-	-	-	-	-	-
Osmundea spp.	<.1	<.1	0.5	0.8	0.5	0.3	0.4	0.1	0.4	0.6	1.5	2.5			7.5	6.4	1.1	0.1	<.1	0.3	3.5	0.5	-	<.1
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Phycodrys spp.	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	2.0	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pikea robusta	-	-	-	-	-	-	-	-	-	-	0.1	<.1			-	-	-	-	-	-	-	-	-	-
Polyneura latissima	-	1.0	3.1	0.9	1.2	1.2	1.1	2.5	2.5	0.9	0.1	0.5			0.1	0.1	<.1	0.1	<.1	<.1	-	<.1	-	<.1
Prionitis australis	1.5	2.0	0.6	-	-	0.5	0.9	0.6	0.3	0.3	-	0.5			0.8	2.0	2.3	0.8	1.0	1.8	-	0.3	0.3	0.6
Prionitis spp.	0.5	0.5	2.3	1.8	1.7	1.7	0.9	0.8	2.0	2.0	5.3	8.7			19.6	19.0	16.5	16.8	15.1	8.0	8.5	4.3	7.5	9.8
Pterochondria woodii var. woodii	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pterocladia caloglossoides	0.5	5.0	0.9	0.2	<.1	<.1	0.3	<.1	<.1	<.1	<.1	<.1			<.1	<.1	<.1	1.5	-	-	-	-	-	-
Pterosiphonia dendroidea	1.0	<.1	0.1	<.1	-	-	-	-	-	-	<.1	<.1			<.1	<.1	<.1	0.1	0.4	0.5	4.5	0.3	0.5	0.3
Pterygophora californica	2.0	-	1.6	2.8	1.8	2.3	1.4	1.3	2.8	1.9	0.5	<.1			0.1	-	-	-	-	-	-	-	<.1	<.1
Rhodophyta (juv. blades)	1.0	0.5	0.5	0.5	-	-	-	0.4	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Rhodoptilum plumosum	-	<.1	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	6.0	1.9	1.5	1.8	2.5	4.5	4.9	4.5	3.8	7.8	7.5			12.0	12.3	14.9	14.3	9.6	8.5	5.5	5.5	5.0	4.5
Sarcodiotheca gaudichaudii	-	1.5	<.1	0.1	<.1	<.1	<.1	0.1	<.1	0.2	0.1	1.2			0.4	0.1	<.1	<.1	<.1	-	-	<.1	-	-
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.3	<.1	-	<.1	<.1	<.1
Scinaia confusa	-	-	-	-	<.1	-	-	0.4	<.1	-	<.1	-			<.1	-	<.1	<.1	<.1	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	<.1
Ulva/Enteromorpha spp.	1.5	-	0.1	<.1	<.1	<.1	<.1	0.8	<.1	<.1	0.1	<.1			<.1	<.1	0.1	0.1	<.1	<.1	<.1	<.1	<.1	-
coralline crust	52.5	60.5	67.8	65.3	61.7	60.0	62.6	52.6	68.3	56.7	67.8	70.0			63.9	61.1	51.6	47.1	45.1	50.3	58.0	39.3	34.8	40.1
filamentous red algae-complex	6.5	5.0	0.4	0.6	<.1	<.1	<.1	0.9	0.1	<.1	<.1	<.1			0.3	0.5	0.6	1.8	3.0	3.8	-	4.3	2.8	0.5

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of Contact Points																								
Ahnfeltiopsis leptophylla	-	0.7	-	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1	0.1	0.5	<.1	-	<.1	<.1	-	-	<.1	-	<.1	0.1
Ahnfeltiopsis linearis	-	-	-	<.1	-	-	0.3	-	<.1	0.4	1.1	2.6	3.1	1.3	1.9	1.3	1.3	2.9	6.5	3.5	<.1	0.8	2.5	0.4
Amplisiphonia pacifica	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antithamnion/Platythamnion spp.-complex	-	-	-	0.3	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	0.3	<.1	-
Botryocladia pseudodichotoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Bryopsis spp.	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Calliarthron/Bossiella spp.-complex	40.5	41.2	33.4	39.3	36.4	29.4	33.1	21.5	17.6	18.5	11.0	16.8	15.9	22.3	22.3	34.6	24.4	22.5	24.8	16.5	19.5	15.5	11.0	10.4
Callithamnion pikeanum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Callithamnion spp./Pleonosporium spp.	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Callophyllis firma	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Callophyllis flabellulata	-	<.1	0.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	0.3	<.1	0.5	0.8	0.6	1.4	0.1	0.1	<.1	<.1	<.1	<.1	-	0.5
Callophyllis spp.	0.5	1.8	0.1	0.3	0.2	0.1	<.1	<.1	<.1	0.2	0.6	0.1	1.0	1.5	0.1	2.0	0.4	0.1	0.1	-	-	<.1	-	-
Chondracanthus canaliculatus	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	<.1	-	-	-	<.1	<.1	-	-	-	-	-
Chondracanthus corymbiferus	1.0	0.2	<.1	2.3	1.8	1.1	1.8	1.5	4.9	11.2	6.5	18.7	21.9	14.9	16.8	12.0	8.3	9.5	11.5	8.8	5.8	1.8	0.8	3.9
Chondracanthus harveyanus/spinosus	-	-	-	-	<.1	<.1	0.1	0.3	0.3	0.9	0.5	2.3	7.9	1.6	7.3	4.3	0.8	5.5	7.3	10.0	6.0	2.3	<.1	1.3
Chondria decipiens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Chrysophyta unid.	-	-	-	<.1	-	-	-	-	1.3	<.1	<.1	-	-	-	0.1	0.1	0.3	2.6	3.6	0.8	0.5	1.0	21.3	31.4
Cladophora spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Coilodesme californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Colpomenia spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	<.1	<.1	<.1	0.1	<.1	-	-	<.1	0.1
Corallina officinalis	3.0	2.5	6.3	5.7	5.2	2.5	3.8	1.6	3.4	3.1	0.6	1.7	0.5	<.1	0.5	2.6	0.6	2.4	2.5	4.5	1.3	1.5	1.0	1.6
Cryptopleura ruprechtiana	-	11.3	12.4	28.3	25.9	19.6	23.6	12.3	19.0	45.8	18.9	13.8	18.1	20.9	10.3	12.1	2.5	<.1	0.1	-	-	-	-	0.1
Cryptopleura violacea	-	-	0.4	0.5	0.8	0.3	0.8	0.4	1.0	3.6	5.0	15.6	33.0	25.1	37.3	34.4	45.9	45.0	0.5	1.3	43.5	41.0	-	1.9
Cystoseira osmundacea	3.5	3.5	4.3	3.1	3.7	3.0	3.0	2.5	0.4	<.1	0.2	<.1	-	<.1	0.1	2.4	2.3	6.0	4.5	4.3	2.5	1.8	0.5	1.9
Delesseriaceae (juv.)	7.5	0.2	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Derbesia marina (filamentous)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Desmarestia spp.	1.0	7.2	31.2	6.3	15.3	12.4	11.1	46.0	17.1	6.9	-	0.1	0.4	<.1	0.8	<.1	-	<.1	0.3	-	-	<.1	<.1	0.1
Dictyoneurum californicum	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Egregia menziesii	<.1	-	-	<.1	0.2	<.1	-	-	-	-	-	-	-	-	0.1	<.1	-	0.1	-	-	-	-	-	-
Endarachne/Petalonia-complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
Erythrophyllum delesserioides	-	-	-	-	-	-	<.1	0.2	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	<.1	0.1	0.3	<.1	0.1	0.3	<.1	0.5	1.0	1.1	1.5	1.6	2.9	0.9	1.0	4.3	6.9	1.9	0.3	9.3	8.8	<.1	0.4
Gastroclonium subarticulatum	-	-	-	-	<.1	-	<.1	<.1	-	<.1	<.1	0.1	-	0.6	1.8	1.1	0.4	0.1	0.1	-	-	-	-	-
Gelidium robustum	-	0.7	0.2	0.2	0.3	<.1	0.1	<.1	<.1	<.1	0.1	0.2	0.5	0.5	1.6	1.5	2.4	1.6	3.6	1.8	1.0	0.8	1.0	1.8
Gelidium spp.	-	<.1	-	-	-	-	-	-	<.1	0.2	<.1	0.1	0.1	0.1	0.1	1.1	0.9	1.9	3.9	2.8	3.5	6.0	5.8	5.4
Gracilariopsis lemaneiformis	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-
Grateloupia doryphora	-	-	-	-	-	-	-	-	-	-	-	0.1	0.3	-	-	-	-	-	-	-	-	-	-	-
Halicystis ovalis	-	-	-	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1	<.1	-	-	<.1	-	-	<.1	<.1	-	-	-	-	-
Halymenia/Schizymenia spp.-complex	-	-	0.2	-	0.2	<.1	<.1	0.9	0.7	<.1	<.1	4.4	2.1	0.1	0.1	-	-	-	-	-	-	0.3	-	-
Haplogloia andersonii	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hymenena spp.	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-
Laminaria setchellii	<.1	0.3	0.5	0.8	0.3	0.6	0.4	0.3	0.3	0.2	<.1	-	-	<.1	<.1	<.1	-	-	-	-	<.1	-	-	-
Laminariales	-	0.7	0.2	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	<.1	-	<.1	-	<.1	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.9	5.4	9.1	6.8	5.3	3.8	10.8	5.9
Mazzaella lilacina	-	<.1	0.6	1.7	0.5	0.6	0.6	0.6	1.1	4.6	1.7	8.9	6.0	3.9	2.5	1.3	<.1	-	0.1	-	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	<.1	<.1	<.1	<.1	<.1	0.5	0.8	<.1	<.1	<.1	<.1	<.1	0.3	<.1	<.1	-	-	<.1

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of Contact Points (continued)																								
Melobesia mediocris	-	-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia borealis	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	-	<.1	0.1	0.8	0.3	1.0	1.6	0.3	2.2	4.3	1.3	4.6	7.0	4.4	0.3	1.5	<.1	<.1	<.1	<.1	-	-	-	-
Neoptilota densa	-	-	<.1	-	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nereocystis luetkeana	-	0.3	<.1	0.4	0.3	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	2.0	3.6	6.9	1.1	3.5	11.0	14.0	<.1	-
Non-coralline crust	1.5	1.7	2.0	3.3	1.4	0.8	2.3	0.8	4.1	4.5	0.8	8.3	8.9	8.5	9.8	5.5	7.0	1.8	3.6	0.5	1.5	1.5	0.3	0.1
Opuntiella californica	-	-	-	-	-	-	-	<.1	-	<.1	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Osmundea spp.	-	0.7	<.1	1.7	0.4	1.1	0.8	0.4	1.3	10.0	2.6	3.6	7.8	19.9	8.0	6.4	3.0	0.3	<.1	<.1	<.1	0.3	-	-
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Phaeostrophion irregulare	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phycodrys spp.	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Phyllospadix spp.	0.5	3.8	4.2	3.6	4.1	4.4	4.4	1.8	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pikea robusta	-	-	-	-	<.1	-	-	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Plocamium cartilagineum	-	<.1	-	<.1	-	<.1	-	-	<.1	-	-	<.1	<.1	-	<.1	0.3	-	-	-	-	-	-	-	-
Polyneura latissima	-	-	0.1	<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	<.1
Porphyra spp.	-	-	-	-	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prionitis australis	-	-	<.1	-	<.1	0.1	<.1	0.1	<.1	<.1	0.1	0.1	0.9	-	<.1	1.1	0.9	0.4	0.4	0.5	-	0.3	0.5	1.9
Prionitis spp.	1.0	0.2	0.5	0.5	0.8	0.6	1.4	1.0	2.8	3.1	6.9	6.6	16.3	19.0	23.0	22.0	13.0	10.4	19.1	13.5	12.5	4.8	10.3	11.9
Pterochondria woodii var. woodii	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pterocladia caloglossoides	-	-	-	<.1	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Pterosiphonia dendroidea	-	<.1	-	<.1	<.1	<.1	-	-	-	-	<.1	<.1	-	-	<.1	<.1	<.1	<.1	<.1	0.5	3.0	2.3	-	3.0
Pterygophora californica	6.0	4.8	2.4	3.9	1.9	1.4	2.6	1.2	1.3	1.0	0.4	<.1	<.1	-	-	<.1	0.1	<.1	-	<.1	<.1	<.1	-	-
Rhodophyta (juv. blades)	-	-	0.3	0.4	-	-	-	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhodoptilum plumosum	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Rhodymenia spp.	-	<.1	<.1	0.6	0.4	<.1	1.0	0.5	0.4	0.3	0.6	1.3	1.9	2.5	7.3	5.4	6.4	8.0	10.1	10.8	4.0	5.5	6.5	10.6
Sarcodiotheca gaudichaudii	-	-	<.1	0.3	0.3	0.3	0.8	0.1	0.9	2.2	1.2	4.9	5.3	1.8	2.3	1.0	<.1	0.1	-	0.3	<.1	<.1	-	-
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Scinaia confusa	-	-	<.1	-	<.1	-	-	<.1	<.1	-	-	<.1	-	-	-	-	<.1	-	<.1	-	<.1	-	-	<.1
Smithora naiadum	-	-	-	<.1	-	0.6	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	2.5	2.2	2.2	2.9	2.8	0.3	1.3	0.4	20.0	19.6	<.1	<.1	0.5	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1
coralline crust	35.5	36.3	35.5	43.8	34.5	20.5	36.8	27.9	47.8	57.9	21.2	64.0	54.1	61.5	48.0	55.3	58.3	44.5	38.8	34.8	40.5	44.3	36.8	24.3
filamentous red algae-complex	-	-	<.1	<.1	0.2	<.1	0.3	1.0	0.3	<.1	0.1	0.1	0.1	-	-	<.1	0.1	0.5	0.9	4.3	-	-	0.5	0.3

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 3 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points																								
Acrosorium uncinatum	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.5	<.1
Ahnfeltiopsis leptophylla	-	-	-	-	-	-	-	-	<.1	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Ahnfeltiopsis linearis	-	-	-	-	-	-	-	-	-	<.1	<.1	0.1			0.1	0.1	0.1	0.6	2.0	2.3	1.5	<.1	1.8	1.5
Amplisiphonia pacifica	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	<.1	-	-	-	-
Antithamnion/Platythamnion spp.-complex	-	-	-	-	<.1	<.1	<.1	<.1	<.1	-	-	-			-	-	<.1	<.1	<.1	<.1	3.5	0.3	0.5	0.5
Bryopsis spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-			-	-	-	-	-	-	-	-	-	<.1
Calliarthron/Bossiella spp.-complex	30.5	37.2	31.5	30.0	29.5	43.7	48.2	45.8	37.3	34.1	35.4	25.6			22.8	18.4	24.8	27.6	26.5	33.8	39.0	34.3	35.5	29.4
Callophyllis firma	-	-	-	-	-	<.1	-	-	-	-	<.1	<.1			<.1	<.1	-	-	<.1	<.1	-	-	-	<.1
Callophyllis flabellulata	-	<.1	0.2	0.3	0.2	0.2	1.1	0.2	<.1	0.4	<.1	0.1			<.1	0.4	0.9	0.8	<.1	1.0	<.1	<.1	<.1	0.1
Callophyllis spp.	-	0.7	0.2	0.2	<.1	1.2	1.1	0.5	0.4	0.9	1.4	1.1			1.3	3.8	3.1	0.9	0.3	<.1	-	-	-	-
Chondracanthus canaliculatus	-	-	-	-	-	-	-	-	-	-	<.1	<.1			-	-	-	-	<.1	-	-	-	-	-
Chondracanthus corymbiferus	-	-	-	-	0.3	<.1	0.7	1.3	4.8	9.1	9.6	9.5			12.9	14.6	16.3	15.8	11.1	11.5	3.5	2.0	2.5	2.5
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	0.3	-	-	-	-	-
Chrysophyta unid.	-	10.0	-	-	-	-	-	-	3.8	-	-	-			<.1	<.1	<.1	1.1	1.0	3.5	12.0	-	1.8	7.1
Cladophora spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Clathromorphum parcum	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Coilodesme californica	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Colpomenia spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-			-	-	<.1	-	<.1	0.3	-	-	-	<.1
Corallina officinalis	-	<.1	0.3	-	<.1	0.2	0.4	0.3	<.1	<.1	0.1	0.4			<.1	<.1	0.3	0.1	0.1	<.1	<.1	0.8	0.3	<.1
Cryptopleura ruprechtiana	-	4.7	6.0	8.3	11.3	23.8	31.0	35.5	35.2	70.3	48.1	61.7			59.9	56.0	43.4	39.9	12.6	3.5	1.0	-	-	-
Cryptopleura violacea	-	0.2	<.1	-	<.1	<.1	<.1	0.2	0.4	0.5	1.4	27.9			1.0	0.6	3.0	3.9	0.1	<.1	0.5	4.3	<.1	<.1
Cystoseira osmundacea	1.0	0.2	0.7	0.3	0.7	1.2	2.8	2.8	2.3	0.3	0.1	1.0			1.0	1.1	1.5	2.3	1.6	3.3	2.5	1.0	0.3	0.6
Delesseria decipiens	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Delesseriaceae (juv.)	6.0	1.3	<.1	<.1	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	<.1
Desmarestia spp.	-	1.0	-	-	1.6	0.8	1.3	18.3	6.3	1.3	39.5	-			9.5	<.1	0.3	0.3	<.1	1.3	<.1	-	<.1	<.1
Dictyota binghamiae	-	<.1	<.1	<.1	0.2	<.1	0.2	-	<.1	-	<.1	0.2			<.1	<.1	-	-	-	-	-	-	<.1	<.1
Egregia menziesii	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	0.1	-	-	-	-	-	-	-
Erythrophyllum delesserioides	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Farlowia/Pikea spp.-complex	-	<.1	<.1	<.1	<.1	<.1	0.2	<.1	<.1	1.2	0.3	0.3			0.5	0.1	1.6	3.3	2.5	0.8	5.0	0.5	<.1	<.1
Gastroclonium subarticulatum	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Gelidium coulteri	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Gelidium robustum	-	-	<.1	-	-	-	<.1	-	<.1	<.1	<.1	<.1			0.1	<.1	0.5	0.4	0.8	0.5	1.0	1.8	1.3	1.0
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	<.1
Gloiosiphonia californica	-	-	-	-	-	-	-	-	-	-	-	0.1			-	-	-	-	-	-	-	-	-	-
Halicystis ovalis	-	<.1	-	-	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1			<.1	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-
Halymenia/Schizymenia spp.-complex	-	<.1	-	-	<.1	-	-	-	0.2	<.1	<.1	<.1			<.1	<.1	-	-	-	-	-	-	-	-
Hymenena spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Laminaria setchellii	-	-	0.7	0.5	0.4	0.2	0.7	1.5	0.4	0.2	<.1	0.1			0.1	0.3	1.4	0.3	0.8	0.3	0.5	<.1	-	<.1
Laminariales	-	-	<.1	-	<.1	<.1	-	-	0.3	-	0.1	-			<.1	<.1	<.1	<.1	<.1	0.3	0.5	-	<.1	<.1
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	2.3	8.3	5.0	6.0	15.8	8.3	5.1
Mazzaella lilacina	-	<.1	-	-	<.1	<.1	<.1	<.1	0.2	0.3	0.4	1.7			1.8	1.5	1.4	2.3	0.4	<.1	-	-	-	-
Mazzaella rosea	-	-	-	-	-	-	<.1	-	<.1	-	-	0.2			-	<.1	<.1	<.1	-	-	-	-	-	-
Membranoptera/Branchioglossum spp.	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1			<.1	-	-	-	-	-	-	-	-	-
Microcladia coulteri	-	<.1	<.1	-	-	<.1	<.1	<.1	0.3	0.7	<.1	0.1			<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	-
Neoptilota densa	-	-	<.1	<.1	<.1	-	-	-	<.1	0.2	<.1	-			<.1	-	<.1	<.1	-	-	-	-	-	-
Nereocystis luetkeana	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	<.1	-	-	-	-	-	-

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points (continued)																								
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-			-	0.4	0.6	1.0	0.5	-	-	<.1	-	<.1
Non-coralline crust	1.0	0.8	0.5	0.4	<.1	0.2	0.4	<.1	0.5	0.3	0.3	1.6			0.4	1.6	1.6	1.1	1.4	0.5	2.0	3.5	1.8	1.4
Opuntiella californica	-	-	<.1	-	<.1	0.2	<.1	<.1	0.2	0.3	<.1	0.1			<.1	<.1	-	<.1	-	-	-	-	-	-
Osmundea spp.	-	0.2	-	-	<.1	<.1	0.3	<.1	0.2	1.7	2.0	2.4			0.8	2.0	2.9	1.1	<.1	-	-	-	-	-
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Phaeostrophion irregulare	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Phycodrys spp.	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	1.0	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pikea robusta	-	-	-	-	<.1	-	-	<.1	<.1	<.1	<.1	-			-	-	-	-	<.1	-	-	-	-	-
Plocamium cartilagineum	-	-	-	-	<.1	-	<.1	-	-	-	-	<.1			-	<.1	-	<.1	-	-	-	-	-	-
Polyneura latissima	-	0.2	0.3	0.6	1.4	1.8	2.5	6.3	1.5	0.5	0.3	1.4			<.1	0.1	-	0.4	-	<.1	-	<.1	-	-
Porphyra spp.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Prionitis australis	-	-	-	-	-	-	<.1	-	<.1	-	<.1	-			0.6	0.6	0.1	<.1	1.4	-	-	-	-	0.6
Prionitis spp.	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	0.1			0.4	2.0	2.1	2.5	3.4	2.5	2.5	0.5	3.5	2.3
Pterocladia caloglossoides	1.0	-	<.1	<.1	<.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1			<.1	-	<.1	-	-	-	-	-	-	-
Pterosiphonia dendroidea	-	0.7	<.1	0.3	<.1	0.2	<.1	<.1	<.1	<.1	<.1	0.2			0.1	<.1	<.1	0.1	<.1	0.3	1.5	0.5	<.1	3.5
Pterygophora californica	12.5	8.7	9.4	6.9	4.9	4.5	3.6	0.8	1.1	0.3	0.4	0.8			0.8	2.9	2.4	2.4	1.5	3.0	0.5	0.5	<.1	<.1
Rhodophyta (juv. blades)	-	0.2	-	<.1	<.1	-	-	-	<.1	-	-	-			-	-	0.1	-	-	-	-	<.1	-	-
Rhodoptilum plumosum	-	-	-	-	-	-	<.1	-	<.1	<.1	-	<.1			-	<.1	-	-	<.1	<.1	-	<.1	-	-
Rhodymenia spp.	-	0.2	<.1	0.4	0.3	<.1	0.8	1.8	0.7	<.1	0.3	0.9			2.9	1.6	6.0	7.6	10.9	11.0	10.5	5.5	7.8	5.8
Sarcodiotheca gaudichaudii	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.3			<.1	<.1	0.1	<.1	-	-	-	-	-	-
Scinaia confusa	-	-	-	-	-	-	-	-	<.1	-	-	<.1			<.1	<.1	<.1	<.1	-	<.1	-	-	-	-
Spongomorpha/Acrosiphonia-complex	-	0.2	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	-	0.5	<.1	<.1	<.1	<.1	<.1	-	9.2	2.0	-	<.1			<.1	<.1	<.1	-	<.1	<.1	-	-	<.1	<.1
Weeksia spp.	-	-	-	-	-	<.1	<.1	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
coralline crust	53.5	61.8	73.1	67.5	73.4	72.8	72.0	72.0	69.8	76.3	79.4	86.2			78.8	75.4	75.1	69.4	62.3	53.8	52.0	60.3	55.0	57.5
filamentous red algae-complex	-	1.0	0.2	<.1	<.1	0.3	0.6	1.2	0.5	<.1	<.1	<.1			<.1	0.1	0.1	0.3	1.5	4.0	0.5	-	0.3	2.4

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Control Station SC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Coverage Based on # of Contact Points																								
Ahnfeltiopsis leptophylla	-	-	-	<.1	<.1	-	-	-	<.1	<.1	-	-	-	-	-	-	<.1	0.2	-	-	-	-	-	-
Ahnfeltiopsis linearis	-	-	-	0.1	-	-	-	-	<.1	<.1	<.1	0.3	-	<.1	<.1	-	<.1	0.2	0.3	<.1	0.5	0.5	<.1	0.1
Antithamnion/Platythamnion spp.-complex	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryopsis spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliarthron/Bossiella spp.-complex	68.0	64.3	58.2	62.5	56.3	63.8	70.5	32.2	37.5	44.1	34.3	42.7	35.0	40.8	41.8	47.0	45.0	46.5	45.3	34.8	48.0	48.5	35.8	22.5
Callophyllis firma	-	-	-	-	-	-	<.1	<.1	<.1	-	<.1	0.7	<.1	<.1	<.1	<.1	<.1	-	<.1	<.1	<.1	-	-	<.1
Callophyllis flabellulata	-	0.8	0.2	<.1	<.1	0.3	1.2	0.2	0.2	0.3	0.5	<.1	0.3	0.4	<.1	0.2	0.4	0.2	<.1	<.1	0.3	<.1	-	<.1
Callophyllis spp.	1.5	1.3	1.2	1.1	0.8	1.8	2.8	0.3	0.7	1.6	2.3	3.2	3.3	5.8	7.8	4.5	4.0	3.5	3.3	1.3	1.8	0.5	1.3	0.1
Chondracanthus canaliculatus	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chondracanthus corymbiferus	18.5	23.3	20.3	25.0	21.7	23.7	18.5	22.8	26.7	27.8	23.0	17.2	20.7	17.0	17.1	17.5	22.9	21.7	27.0	26.0	29.8	14.0	22.0	11.6
Chondracanthus harveyanus/spinosus	-	-	0.2	0.3	<.1	<.1	0.2	0.2	2.0	<.1	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-
Chrysophyta unid.	-	-	<.1	-	-	-	-	1.3	-	-	3.3	-	0.5	<.1	<.1	-	-	-	-	-	-	-	-	-
Corallina officinalis	3.0	1.5	1.2	1.3	1.5	1.2	2.2	2.3	1.2	0.8	1.8	0.2	1.8	2.0	1.9	0.8	0.9	0.7	0.5	0.5	0.3	-	<.1	0.1
Corallina vancouveriensis	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cryptopleura ruprechtiana	24.5	27.5	27.8	38.8	19.3	36.8	33.5	10.0	25.0	28.2	25.0	39.3	31.2	29.6	35.1	37.8	42.9	49.0	50.9	15.8	23.5	26.0	16.8	21.1
Cryptopleura violacea	1.0	-	0.3	0.4	-	0.2	0.7	0.5	3.2	1.5	1.8	3.7	1.8	-	0.3	-	0.3	0.2	-	0.5	0.3	-	0.3	<.1
Cystoseira osmundacea	-	0.5	0.2	0.3	<.1	1.2	<.1	0.2	0.2	0.4	<.1	0.7	0.7	1.4	2.9	3.7	6.5	5.8	9.0	11.3	6.5	7.5	1.5	0.8
Delesseria decipiens	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	<.1	<.1	0.2	<.1	-	-	<.1	0.3	-	<.1	-
Delesseriaceae (juv.)	-	5.0	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Desmarestia spp.	-	23.0	1.2	-	0.3	1.7	<.1	3.3	0.7	0.1	13.8	0.5	12.8	3.0	1.0	1.2	0.1	0.5	0.6	10.8	0.8	-	12.5	-
Dictyoneurum californicum	9.0	3.8	3.3	4.4	0.3	0.5	0.8	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	-
Egregia menziesii	-	-	-	-	-	-	-	-	-	<.1	<.1	0.2	<.1	<.1	-	-	-	-	-	-	0.3	-	0.3	<.1
Erythrophyllum delesserioides	-	-	-	<.1	<.1	-	-	<.1	0.2	-	-	<.1	0.3	0.1	<.1	<.1	<.1	-	<.1	<.1	-	-	<.1	<.1
Farlowia/Pikea spp.-complex	-	<.1	0.7	0.3	0.5	<.1	0.3	0.3	1.2	0.8	0.3	1.2	0.2	0.1	<.1	<.1	<.1	<.1	0.5	<.1	1.3	<.1	0.3	<.1
Gastroclonium subarticulatum	-	-	-	-	-	-	-	0.2	<.1	0.2	<.1	0.2	-	<.1	<.1	<.1	-	-	<.1	<.1	1.3	0.5	<.1	<.1
Gelidium robustum	-	0.3	0.2	0.3	0.2	0.2	0.3	<.1	<.1	<.1	<.1	0.2	<.1	0.6	0.4	0.8	0.9	1.2	1.5	2.0	1.5	1.0	2.5	0.8
Gelidium spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Halicystis ovalis	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	<.1	-
Halymenia/Schizymenia spp.-complex	<.1	0.3	<.1	<.1	0.7	<.1	0.2	12.7	0.7	-	0.3	-	0.2	<.1	-	0.3	0.3	-	-	2.3	1.0	-	13.5	-
Haplogloia andersonii	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	2.0	0.5	2.5	2.8	3.2	3.7	5.7	1.3	4.5	5.7	6.0	7.5	3.2	6.0	4.8	6.0	3.6	2.5	1.9	1.3	3.3	6.5	1.3	1.9
Laminariales	0.5	-	<.1	0.1	0.2	<.1	<.1	0.2	<.1	<.1	1.5	0.2	0.8	0.5	<.1	<.1	<.1	-	<.1	<.1	<.1	-	5.0	<.1
Mazzaella affinis	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mazzaella lilacina	4.0	2.0	3.7	0.9	3.2	1.7	2.3	8.7	8.2	2.2	7.3	4.2	2.3	0.4	0.4	1.8	5.0	3.0	2.4	8.0	5.8	7.0	9.8	1.6
Mazzaella rosea	-	-	-	0.3	-	<.1	0.2	1.2	0.3	-	-	<.1	<.1	0.1	<.1	0.3	<.1	<.1	-	2.3	<.1	-	1.0	0.3
Melobesia mediocris	-	-	-	<.1	<.1	<.1	<.1	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Membranoptera/Branchioglossum spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia borealis	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Microcladia coulteri	1.5	6.0	2.7	2.1	0.5	1.0	0.5	4.7	2.7	0.2	0.8	1.0	2.2	0.9	0.8	0.3	1.4	<.1	2.0	3.0	1.0	0.5	1.0	0.6
Neoptilota densa	-	<.1	-	<.1	<.1	0.3	<.1	-	-	<.1	<.1	<.1	<.1	-	-	0.2	-	<.1	-	<.1	<.1	-	-	-
Nereocystis luetkeana	-	-	0.2	0.3	<.1	0.3	<.1	<.1	-	<.1	<.1	0.2	0.8	0.3	-	<.1	<.1	<.1	<.1	0.5	0.3	<.1	2.8	0.1
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	<.1	-	<.1	-
Non-coralline crust	0.5	0.8	1.3	0.3	1.7	<.1	1.3	1.3	1.7	0.9	1.8	0.7	2.3	2.4	1.0	1.3	1.1	1.5	0.9	1.0	0.8	<.1	0.8	0.1
Osmundea spp.	3.5	1.8	0.8	0.9	0.7	0.8	1.0	<.1	6.5	16.1	2.5	4.2	4.8	4.1	2.1	2.8	3.5	3.7	4.4	1.5	3.5	1.5	0.3	0.3
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Phyllospadix spp.	2.0	2.5	0.7	2.3	1.5	0.2	0.2	0.2	<.1	0.1	0.5	0.2	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Control Station SC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Coverage Based on # of Contact Points (continued)																								
Pikea robusta	-	-	-	-	-	-	-	0.2	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Polyneura latissima	<.1	0.5	-	0.4	0.2	<.1	<.1	0.2	0.2	<.1	0.3	0.3	1.5	0.4	0.6	<.1	0.5	0.3	0.3	0.8	1.8	-	1.8	0.6
Porphyra spp.	-	-	-	-	-	-	-	0.2	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	9.8	-
Prionitis australis	-	-	-	-	-	-	<.1	0.2	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	<.1
Prionitis spp.	<.1	0.8	1.7	1.8	1.2	1.5	1.0	2.7	2.5	2.8	1.8	6.5	3.7	3.5	1.8	1.2	0.6	1.0	1.4	1.0	1.0	1.0	2.5	1.8
Pterocladia caloglossoides	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-
Pterosiphonia dendroidea	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	<.1	-	-	-	-	-	-	-	<.1	-
Pterygophora californica	-	-	<.1	0.1	0.2	1.2	1.5	1.0	2.7	6.2	8.3	7.2	7.7	8.4	6.4	4.2	4.3	2.3	2.9	1.8	3.8	1.5	8.3	12.5
Rhodophyta (juv. blades)	-	-	0.2	0.1	0.2	-	0.2	0.8	0.7	-	0.3	-	0.2	<.1	-	-	-	-	-	-	-	-	-	-
Rhodoptilum plumosum	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-
Rhodymenia spp.	<.1	1.3	1.3	0.9	<.1	0.7	1.2	1.0	3.7	2.0	2.5	8.7	6.3	4.6	6.3	9.0	8.4	10.2	11.9	13.3	17.5	9.0	12.3	16.5
Sarcodiotheca gaudichaudii	2.0	1.3	2.0	1.1	0.3	1.2	1.0	1.0	0.7	0.2	1.3	0.7	0.3	0.8	<.1	0.3	<.1	0.3	0.3	0.5	0.3	-	0.3	<.1
Scinaia confusa	-	-	<.1	-	<.1	<.1	-	0.5	-	-	-	-	<.1	<.1	-	<.1	-	-	-	<.1	<.1	-	<.1	-
Smithora naiadum	-	0.3	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ulva/Enteromorpha spp.	3.5	2.5	3.2	1.4	2.7	5.3	0.3	33.3	9.8	0.2	3.8	1.7	2.3	0.9	1.1	0.7	<.1	0.2	<.1	<.1	1.0	-	4.3	<.1
coralline crust	59.5	48.3	51.8	39.4	53.8	47.3	52.2	55.5	56.5	51.5	53.0	50.2	48.3	41.8	42.8	46.7	49.8	52.5	44.5	53.0	47.0	45.5	59.0	41.8
filamentous red algae-complex	0.5	2.0	1.5	0.4	0.2	<.1	0.5	0.5	0.2	<.1	0.3	<.1	<.1	0.1	<.1	<.1	<.1	<.1	0.1	<.1	-	<.1	-	-

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Control Station SC 2 at -6m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points																								
Antithamnion/Platythamnion spp.-complex	-	-	-	-	-	<.1	<.1	<.1	-	-	-	<.1			-	<.1	<.1	-	-	-				-
Bryopsis spp.	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-				-
Calliarthron/Bossiella spp.-complex	18.0	24.0	26.8	28.1	41.0	40.5	46.9	38.3	44.7	46.0	38.8	39.3			42.3	48.0	45.9	45.0	46.0	43.8				33.3
Callithamnion spp./Pleonosporium spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-				-
Callophyllis firma	-	-	-	-	-	-	-	0.2	<.1	<.1	0.2	0.2			<.1	<.1	<.1	<.1	<.1	<.1				<.1
Callophyllis flabellulata	2.0	4.5	0.3	2.4	1.3	1.0	2.3	1.2	2.2	1.0	0.7	1.5			1.1	2.8	0.8	0.2	1.3	0.3				<.1
Callophyllis spp.	5.5	8.8	8.8	9.9	10.8	7.7	7.4	1.5	3.8	6.6	4.7	8.3			9.0	8.0	8.6	8.7	8.8	6.5				1.2
Chondracanthus corymbiferus	7.5	11.0	22.7	30.3	32.5	22.7	26.6	15.2	28.0	24.0	19.5	17.3			17.9	21.2	20.0	26.0	25.5	22.8				20.8
Chondracanthus harveyanus/spinosus	-	-	-	-	-	-	-	0.2	-	<.1	-	-			-	-	-	-	-	-				-
Chrysophyta unid.	-	-	-	0.1	-	-	-	-	-	-	0.2	0.2			-	-	-	-	-	-				<.1
Corallina officinalis	2.0	-	-	-	-	0.2	-	-	<.1	-	<.1	-			<.1	-	<.1	-	-	-				-
Cryptopleura ruprechtiana	-	22.5	21.7	29.0	30.0	25.5	28.8	9.7	15.7	22.3	27.7	40.7			32.6	36.0	37.0	47.5	43.3	36.5				53.0
Cryptopleura violacea	-	<.1	0.3	0.1	-	-	<.1	<.1	-	-	-	<.1			-	-	-	<.1	0.1	<.1				-
Cystoseira osmundacea	2.5	0.8	3.2	4.3	6.0	5.0	6.6	1.8	3.7	2.6	1.8	1.2			1.5	1.3	0.9	1.0	2.1	2.3				0.2
Delesseriaceae (juv.)	12.5	-	-	2.5	1.8	0.3	-	<.1	0.2	0.2	-	-			-	-	-	-	-	-				-
Desmarestia spp.	1.5	5.3	13.2	<.1	2.0	1.2	0.1	13.2	-	<.1	0.5	-			7.0	0.5	3.3	-	2.8	0.5				0.8
Dictyoneurum californicum	1.0	0.3	2.7	1.9	2.3	0.7	0.1	-	-	-	-	-			<.1	<.1	-	<.1	<.1	-				-
Dictyota binghamiae	-	0.8	0.7	0.5	0.8	0.3	0.4	<.1	<.1	0.1	0.5	0.5			0.1	<.1	0.1	0.3	0.6	<.1				0.2
Egregia menziesii	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-				-
Erythrophyllum delesserioides	-	1.0	3.0	1.1	1.5	0.8	0.9	0.7	0.5	0.2	0.7	<.1			0.1	0.2	0.3	1.0	1.1	0.5				0.7
Farlowia/Pikea spp.-complex	-	-	<.1	0.6	<.1	-	<.1	<.1	<.1	<.1	<.1	<.1			<.1	<.1	<.1	<.1	<.1	<.1				0.3
Fauchea laciniata	-	-	<.1	-	-	-	<.1	-	-	-	-	<.1			<.1	<.1	<.1	<.1	<.1	-				-
Fryeella gardneri	-	-	-	-	-	-	-	-	-	-	<.1	<.1			-	<.1	<.1	<.1	<.1	-				-
Gastroclonium subarticulatum	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	-	-	-	-	-				-
Gelidium robustum	-	-	-	<.1	<.1	<.1	<.1	<.1	0.3	0.1	0.2	<.1			<.1	<.1	<.1	<.1	0.1	-				-
Halicystis ovalis	-	-	-	-	<.1	<.1	-	-	-	<.1	-	-			-	-	<.1	-	<.1	-				<.1
Halymenia/Schizymenia spp.-complex	0.5	1.0	1.3	0.3	0.8	0.3	-	0.7	0.3	<.1	0.5	<.1			0.5	0.5	0.1	0.3	1.4	1.3				0.2
Hymenena spp.	-	-	-	-	-	0.2	<.1	-	-	-	0.3	-			-	-	-	-	-	-				-
Laminaria setchellii	-	<.1	0.2	1.6	1.8	1.7	2.4	0.8	2.2	1.2	1.0	1.2			1.3	2.0	0.8	0.5	0.6	0.3				0.3
Laminariales	-	-	<.1	<.1	0.3	<.1	<.1	<.1	<.1	<.1	0.3	<.1			0.1	-	-	-	<.1	-				<.1
Mazzaella lilacina	5.0	5.8	7.2	2.1	2.8	1.7	1.1	0.3	0.7	0.4	0.3	0.3			-	0.2	<.1	0.7	0.5	1.0				2.3
Mazzaella rosea	-	-	-	-	-	-	-	<.1	-	-	-	<.1			<.1	-	<.1	-	<.1	<.1				0.2
Membranoptera/Branchioglossum spp.	-	-	-	-	-	-	-	-	<.1	-	-	<.1			<.1	-	-	-	-	<.1				-
Microcladia coulteri	<.1	1.3	1.0	1.0	0.3	0.5	0.5	0.2	0.3	<.1	<.1	0.5			0.1	<.1	<.1	0.2	<.1	<.1				<.1
Neoptilota densa	0.5	0.5	0.7	0.5	0.5	0.3	<.1	0.2	0.5	0.7	<.1	<.1			<.1	<.1	0.4	0.2	<.1	<.1				0.3
Nereocystis luetkeana	-	0.3	<.1	<.1	<.1	<.1	<.1	<.1	-	-	0.2	<.1			0.3	0.2	-	<.1	0.3	<.1				0.8
Nienburgia andersoniana	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Non-coralline crust	2.5	0.3	<.1	0.8	<.1	0.5	0.8	<.1	<.1	0.9	0.2	0.2			0.4	0.8	0.1	0.7	0.4	<.1				<.1
Opuntiella californica	-	0.3	<.1	<.1	0.5	<.1	0.8	<.1	0.2	0.3	0.5	0.5			0.3	0.2	0.1	<.1	<.1	0.3				<.1
Osmundea spp.	-	0.5	1.8	1.3	<.1	0.5	0.4	-	0.5	0.6	<.1	0.3			0.1	<.1	<.1	0.2	<.1	<.1				<.1
Phaeophyta (juv.)	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Phycodrys spp.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Phyllospadix spp.	-	-	-	-	-	-	-	<.1	<.1	-	-	-			-	-	-	-	-	-				-
Pikea robusta	-	-	-	-	-	-	-	-	-	-	<.1	<.1			-	<.1	<.1	0.3	<.1	-				-
Polyneura latissima	-	12.5	21.2	7.1	3.5	4.5	2.3	7.5	5.0	1.4	1.8	8.5			5.6	4.5	3.8	4.2	2.5	7.0				3.2
Porphyra spp.	-	-	-	-	-	-	-	-	-	-	<.1	<.1			-	-	<.1	-	-	-				0.3

(continued)

Subtidal Line Contact - Annual Algal and Substrate Mean Abundance/7m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points (continued)																								
Prionitis spp.	0.5	0.3	0.5	0.5	0.3	0.5	0.1	0.2	0.2	0.2	0.2	<.1			<.1	<.1	<.1	<.1	<.1	0.3				0.2
Pterocladia caloglossoides	-	0.5	-	0.3	<.1	0.2	-	<.1	<.1	-	-	-			-	-	-	-	-	-				-
Pterosiphonia dendroidea	-	1.0	0.3	0.8	0.3	0.2	0.5	0.2	0.7	0.1	<.1	<.1			<.1	-	-	<.1	<.1	-				-
Pterygophora californica	-	-	<.1	1.3	1.0	1.0	1.8	3.5	6.5	8.2	6.3	5.8			4.3	3.2	1.3	1.5	1.4	<.1				2.5
Rhodophyta (juv. blades)	4.0	5.3	<.1	0.1	-	-	<.1	0.5	-	-	<.1	-			<.1	-	-	-	-	-				-
Rhodoptilum plumosum	-	0.3	0.5	0.5	<.1	<.1	<.1	<.1	<.1	<.1	<.1	<.1			<.1	<.1	<.1	<.1	<.1	0.5				<.1
Rhodymenia spp.	-	0.3	0.7	0.5	<.1	<.1	0.8	0.2	0.3	1.1	2.3	5.2			4.6	7.8	8.3	12.2	13.8	8.0				17.2
Sarcodiotheca gaudichaudii	-	0.8	0.2	0.1	0.3	<.1	0.1	<.1	-	<.1	<.1	0.2			<.1	<.1	<.1	0.2	<.1	0.3				<.1
Schizymenia epiphytica	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Scinaia confusa	-	-	<.1	<.1	<.1	<.1	-	<.1	0.2	-	<.1	-			<.1	-	<.1	<.1	-	<.1				<.1
Ulva/Enteromorpha spp.	0.5	0.3	0.3	<.1	<.1	<.1	<.1	1.7	0.2	<.1	<.1	<.1			<.1	0.3	<.1	<.1	<.1	<.1				<.1
Weeksia spp.	-	-	-	-	-	<.1	<.1	-	0.2	<.1	-	<.1			<.1	-	0.1	<.1	-	-				-
coralline crust	45.0	44.3	68.0	68.6	81.5	73.3	76.3	73.5	68.3	72.4	61.7	64.7			67.4	60.5	63.1	60.8	54.3	67.5				53.0
filamentous red algae-complex	19.0	22.5	9.2	2.8	<.1	0.5	<.1	4.5	1.3	<.1	0.2	0.2			<.1	0.2	0.1	<.1	<.1	0.3				-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – Field's Cove Station FC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	2	4	2	3	3	1	1	4	4
Coverage Based on # of Contact Points																								
Bryozoa, unid. (encrusting)													-	-	-	0.3	-	-	-	-	-	-	-	-
Phragmatopoma californica													-	-	-	0.3	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)													-	0.1	0.5	0.8	0.1	-	-	-	-	-	-	-
Serpulorbis squamigerus													-	-	0.3	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.													-	0.5	0.4	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points																								
Anthozoa unid.	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Bryozoa, unid. (encrusting)	1.0	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Dodecaceria fewkesi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-				-
Epiactis prolifera	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Hydroida	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Phragmatopoma californica	-	-	-	-	-	-	-	-	-	0.1	-	0.3	1.7	2.4	0.3	-	-	-	-	-				0.8
Porifera unid. (encrusting)	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-				-
tunicates, colonial/social unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-				-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 3 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of Contact Points																								
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Didemnum/Trididemnum spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	-	-	-	-	-	-	-	1.0	0.8	-	0.2	0.1	-	-	-	-	-	-	-	-	-	0.6
Pista spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-	0.1	-	-	-	-	-	-	-	-	-	-
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – North Diablo Cove Station NDC 4 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points																								
Abiet./Sertularella/Sertularia spp.	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Anthopleura elegantissima	1.0	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.3	-
Didemnum/Tididemnum spp.	-	0.5	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	-	0.1	-	-	-	2.6	3.4	10.3	7.4	1.3			-	0.3	-	-	0.3	-	-	7.5	16.5	23.1
Porifera unid. (encrusting)	3.5	-	-	-	-	-	-	-	-	-	0.3	-			-	-	-	-	-	-	-	0.3	-	-
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	0.1	-			-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points																								
Anthopleura elegantissima	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Didemnum/Tididemnum spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-
Halcampa decemtentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	0.5	1.3	2.9
tunicates, colonial/social unid.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – South Diablo Cove Station SDC 3 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of Contact Points																								
Anthopleura elegantissima	-	0.2	-	<.1	-	-	-	-	-	-	-	0.2			-	-	-	-	-	-	-	-	-	-
Anthopleura xanthogrammica	-	0.2	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	0.3	-			-	-	-	-	-	-	-	-	-	-
Dendropoma spp.	-	0.2	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Diopatra ornata	2.0	0.3	-	0.8	-	-	-	-	-	0.2	0.1	0.2			0.1	0.4	0.4	0.4	-	0.5	1.5	2.5	0.5	0.6
Epiactis prolifera	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	-	0.2	0.4	-	-	-	-	-	<.1	-	-			0.6	0.3	-	-	-	-	-	2.3	2.8	1.0
Porifera unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	0.1	-			-	0.1	-	-	-	0.3	-	-	-	-
Serpulidae unid.	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Styela spp.	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	-	0.2	0.4	<.1	-	-	-	-	-	-	0.1	-			0.1	-	-	-	-	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Coverage Based on # of Contact Points																								
Anthopleura elegantissima	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	-	-	-	1.3	0.2	0.8	0.3	-	-	-	-	-	-	-	-	-	-
Dendropoma spp.	-	0.3	-	-	-	0.3	-	-	-	-	0.3	0.2	-	-	0.3	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-
Epiactis prolifera	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phragmatopoma californica	-	0.3	-	-	-	-	0.3	-	0.8	8.5	7.5	7.5	7.5	10.0	8.6	6.2	3.9	0.5	0.6	-	0.5	1.0	3.3	14.6
Porifera unid. (encrusting)	0.5	0.3	-	-	-	-	-	-	-	-	-	0.3	-	-	0.1	-	-	-	-	-	0.3	-	-	-
Serpulidae unid.	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Serpulorbis squamigerus	-	0.3	-	-	-	-	-	-	-	-	1.0	-	2.8	0.5	0.1	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	-	-	-	0.1	-	-	-	-	-

Subtidal Line Contact - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 2 at -6m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Coverage Based on # of Contact Points																								
Aglaophenia spp.	-	-	-	-	-	-	-	-	-	-	-	0.2			-	-	-	-	-	-				-
Anthopleura elegantissima	1	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Balanophyllia elegans	-	-	-	-	-	-	-	-	-	0.2	-	-			-	-	-	-	-	-				-
Balanus spp.	0.5	-	-	-	-	-	-	-	-	-	0.5	-			0.3	-	-	-	-	-				-
Bryozoa, unid. (encrusting)	-	-	-	-	-	-	-	0.3	0.2	1.1	2	4.3			0.8	4.5	0.6	4.3	1.6	-				-
Bryozoa, unid. (erect)	-	-	-	-	-	-	-	-	-	-	-	0.2			0.5	-	-	-	-	-				-
Bryozoa, unid. (foliose)	-	-	-	-	-	-	-	-	-	-	0.2	0.2			-	-	-	-	-	-				-
Corynactis californica	0.5	-	-	0.1	-	-	-	-	-	0.2	-	0.2			-	-	-	-	-	-				-
Dendropoma spp.	-	1	1.2	-	-	-	0.1	0.3	0.2	0.2	0.3	0.5			-	-	-	-	-	-				-
Diopatra ornata	-	-	-	-	-	-	-	-	-	-	-	-			-	0.2	-	-	-	-				-
Dodecaceria fewkesi	4	3.5	3.7	2.8	-	0.7	0.6	1.7	0.3	0.5	-	0.3			-	-	-	-	-	-				-
Eudistylia polymorpha	1	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Hymenamphiastra cyanocrypta	-	-	-	-	-	-	-	-	-	0.2	-	-			-	-	-	-	-	-				-
Phragmatopoma californica	-	-	-	0.1	-	-	0.5	-	2.5	5.2	10.2	5.3			1.9	1	0.3	0.2	0.1	-				-
Porifera unid. (encrusting)	-	-	-	-	-	-	-	-	-	0.2	1.5	3.7			1.1	0.8	0.1	0.2	-	-				-
Serpulidae unid.	2.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Serpulorbis squamigerus	-	-	-	-	-	-	-	-	-	-	0.5	2			0.6	0.2	0.1	-	-	-				-
tunicates, colonial/social unid.	-	-	-	-	-	-	-	-	-	0.2	0.7	0.5			1	1	-	-	0.3	-				-

F2 – Algal Abundance on Subtidal Benthic Stations (Arc Quadrant Method)

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – Field's Cove Station FC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Counted Regardless of Size																								
Cystoseira osmundacea													-	<.1	-	0.2	0.1	0.1	<.1	0.2	-	0.3	-	3.4
Egregia menziesii													-	-	-	-	-	-	-	<.1	-	-	<.1	0.2
Laminaria setchellii													43.3	37.8	18.5	20.0	12.9	8.8	9.3	8.2	28.8	41.3	45.3	73.9
Laminariales													-	-	-	-	-	0.1	1.9	8.6	-	3.8	13.1	5.3
Macrocystis spp.													-	-	-	-	-	-	-	-	-	-	0.1	0.3
Nereocystis luetkeana													-	-	0.1	-	-	-	<.1	8.3	2.8	2.0	19.6	15.4
Pterygophora californica													5.9	0.9	7.7	-	-	0.1	-	1.4	-	-	18.1	49.7

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – North Diablo Cove Station NDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Cystoseira osmundacea	2.3	6.3	6.0	5.9	6.5	11.3	12.4	19.0	6.6	5.7	3.6	2.5	0.3	0.3	0.1	0.4	4.1	4.6	2.4	1.1				6.8
Egregia menziesii	-	2.3	0.3	0.3	0.4	1.5	1.2	-	0.6	-	-	-	-	-	-	-	-	0.1	-	-				-
Laminaria setchellii	24.5	17.8	23.3	12.2	13.5	9.4	12.9	5.9	6.9	5.7	1.7	-	-	-	-	-	-	-	0.1	-				-
Laminariales	-	-	-	-	0.7	0.6	1.3	7.7	0.6	-	-	-	-	-	0.5	0.8	-	-	0.2	-				3.4
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.3	2.1	4.1	3.8				15.7
Nereocystis luetkeana	-	2.9	0.1	0.8	3.2	0.2	0.4	<.1	<.1	-	-	-	-	-	-	-	-	<.1	-	-				0.7
Pterygophora californica	19.3	19.6	38.3	38.1	21.7	25.4	12.4	8.5	6.2	4.2	0.3	<.1	-	-	-	-	-	-	-	-				-
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				0.8

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – North Diablo Cove Station NDC 3 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Cystoseira osmundacea	-	<.1	4.4	1.1	2.3	2.1	2.7	5.4	1.1	0.8	0.8	-	-	1.0	0.6	1.1	1.3	0.3	0.9	-	3.9	1.3	1.6	7.6
Egregia menziesii	-	-	-	-	-	-	-	0.9	0.3	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Laminaria setchellii	9.3	3.7	9.8	15.6	10.3	12.9	10.8	13.4	9.8	12.2	1.5	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Laminariales	-	-	-	-	0.5	-	0.4	21.8	16.0	1.2	-	-	-	0.6	-	-	-	-	-	0.1	-	-	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.4	0.8	2.8	3.8	4.8	8.8	25.3
Nereocystis luetkeana	3.3	1.1	0.3	0.1	1.0	0.8	0.7	0.9	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pterygophora californica	16.3	15.2	27.9	21.6	18.3	11.1	7.2	39.6	49.3	31.5	9.1	0.6	-	0.3	-	-	-	-	-	-	-	-	0.3	<.1
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.5

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – North Diablo Cove Station NDC 4 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Cystoseira osmundacea	9.8	8.0	13.3	9.7	10.5	16.5	15.1	15.9	11.9	10.1	7.3	7.1			1.9	5.3	3.2	3.0	4.1	4.1	8.8	2.9	1.3	2.4
Egregia menziesii	-	-	0.3	<1	-	-	-	-	-	-	-	-			-	0.1	-	-	-	-	-	-	-	-
Laminaria setchellii	15.0	15.3	15.8	18.2	17.5	17.9	16.6	11.8	4.8	5.9	3.2	0.5			0.1	<1	0.1	<1	<1	0.1	0.5	-	-	-
Laminariales	-	-	0.2	0.2	0.7	0.4	0.3	2.8	2.4	-	0.5	-			0.4	0.2	-	0.5	0.7	3.1	0.5	-	-	<1
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<1	0.9	1.8	4.7	1.8	4.3	3.5	10.5	22.4
Nereocystis luetkeana	0.3	-	0.9	0.5	0.3	<1	0.3	0.5	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pterygophora californica	21.3	18.0	27.6	28.5	23.8	23.5	20.2	22.3	18.2	14.6	4.3	1.3			0.3	-	-	-	-	-	-	-	0.9	3.0
Sargassum muticum	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.2	-	-	0.1	0.1	<1

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – South Diablo Cove Station SDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Cystoseira osmundacea	-	2.4	11.8	6.8	4.7	7.4	5.7	4.1	2.1	1.1	0.5	0.9	-	0.4	2.7	11.3	7.8	7.8	8.3	7.6	8.5	4.3	9.3	8.4
Egregia menziesii	-	-	-	0.9	0.6	0.1	-	-	-	-	-	-	-	-	0.3	0.6	-	0.1	-	-	-	-	-	-
Laminaria setchellii	4.0	5.6	4.9	16.3	9.2	11.4	12.8	7.8	4.8	4.8	1.9	-	<1	-	0.1	0.4	<1	<1	-	-	0.1	0.4	0.1	-
Laminariales	2.0	-	1.2	1.2	1.0	0.6	0.5	30.8	1.0	0.1	-	-	-	-	0.3	<1	-	<1	-	-	0.1	-	-	-
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	1.1	2.5	13.6	5.9	5.8	5.1	8.1	13.7
Nereocystis luetkeana	0.3	1.2	1.3	4.1	1.4	<1	<1	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pterygophora californica	35.8	31.1	38.1	40.2	36.7	36.0	29.1	18.8	16.0	13.9	6.2	1.3	0.2	0.1	-	0.3	<1	-	-	-	0.3	0.1	-	-

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – South Diablo Cove Station SDC 3 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Cystoseira osmundacea	-	0.8	2.4	3.9	3.0	5.7	6.3	5.7	3.5	1.9	2.1	2.8			1.8	4.1	5.8	3.6	2.0	4.0	7.0	2.4	3.5	2.2
Egregia menziesii	-	-	0.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Laminaria setchellii	5.0	3.8	10.2	7.5	9.6	13.3	10.5	7.0	5.6	5.4	2.8	4.1			5.3	5.4	4.9	3.3	4.4	4.5	3.8	0.5	-	-
Laminariales	-	0.6	0.6	-	1.6	-	0.3	<1	1.5	0.3	109.8	2.5			14.1	0.9	0.8	5.8	0.4	16.3	12.8	0.5	-	0.3
Macrocystis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	2.3	4.8	6.0	11.3	4.4	5.8	3.8
Nereocystis luetkeana	-	<1	-	-	-	-	0.2	-	-	-	-	-			-	0.2	-	-	-	-	-	-	-	-
Pterygophora californica	111.5	96.7	92.7	76.9	64.7	58.0	32.8	13.7	8.2	3.6	8.1	22.1			15.4	39.4	27.4	14.5	12.6	10.3	21.5	5.8	2.0	1.1

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – South Control Station SC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size																								
Cystoseira osmundacea	-	0.1	<.1	0.2	0.9	1.3	1.0	1.2	1.0	0.9	0.4	3.3	2.4	6.6	6.0	7.0	7.4	7.0	7.4	8.3	11.0	5.0	5.0	4.9
Egregia menziesii	-	-	-	-	-	-	0.3	-	<.1	0.1	0.1	0.3	0.4	-	-	-	-	-	-	-	0.1	-	0.1	0.6
Laminaria setchellii	22.0	21.9	40.3	64.2	57.3	49.1	98.1	20.7	73.0	89.0	50.8	73.5	101.3	75.9	82.4	52.0	47.0	35.1	20.8	18.9	33.4	67.3	15.6	96.2
Laminariales	-	-	2.8	-	3.8	2.2	8.1	17.8	62.3	15.2	139.3	125.9	89.4	50.1	24.4	13.0	7.7	5.6	0.5	38.1	17.5	-	90.0	217.5
Nereocystis luetkeana	-	0.1	2.8	0.3	0.7	1.0	<.1	1.3	-	<.1	2.0	2.0	13.7	1.1	0.5	2.4	0.2	0.3	-	9.1	0.6	0.3	17.8	3.4
Pterygophora californica	-	0.4	3.3	7.8	15.7	23.7	16.6	33.1	107.9	72.1	38.5	163.6	184.0	142.1	114.9	79.3	49.9	32.6	21.0	19.6	25.5	18.5	84.9	200.6

Subtidal Arc Quadrant - Annual Algal Mean Cover/7m^2 – South Control Station SC 2 at -6m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Cystoseira osmundacea	-	1.3	8.3	6.8	7.4	9.2	5.8	4.7	8.8	3.6	3.1	2.7			3.8	3.8	2.9	2.8	2.7	2.4				0.2
Egregia menziesii	-	-	-	-	0.1	-	-	-	-	-	-	-			-	0.2	-	-	-	-				-
Laminaria setchellii	2.8	5.5	6.5	15.3	17.4	20.5	22.7	10.4	12.8	20.5	26.5	28.5			12.1	19.2	13.4	13.3	9.9	11.5				7.8
Laminariales	-	-	0.5	1.1	-	4.1	2.3	108.3	41.7	60.1	21.3	35.6			6.4	4.0	4.2	0.5	0.4	-				2.3
Nereocystis luetkeana	2.8	0.4	4.3	0.3	1.5	0.9	0.6	2.3	-	-	0.3	<.1			1.5	0.7	0.1	<.1	0.8	-				15.8
Pterygophora californica	-	0.9	1.7	23.2	29.8	28.9	38.4	152.3	237.0	171.6	123.5	145.5			31.5	22.8	17.6	13.9	10.1	6.4				47.3

F3 – Invertebrate Abundance on Subtidal Benthic Stations (Arc Quadrant Method)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - Field's Cove Station FC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Counted Regardless of Size																								
Acmaea mitra													15.4	18.4	5.8	5.3	6.6	3.8	8.3	10.8	6.0	8.3	3.0	3.4
Anthopleura elegantissima													3.0	2.8	0.1	0.2	0.3	0.3	0.3	0.3	0.5	0.3	0.9	0.4
Asterina miniata													1.8	3.3	2.4	2.9	5.1	5.3	3.6	3.7	11.0	3.0	0.4	1.6
Calliostoma ligatum													4.5	8.6	3.6	5.5	3.4	0.8	0.5	-	-	12.0	1.1	0.2
Cancer antennarius													0.1	-	0.1	0.3	-	-	-	-	-	-	-	<.1
Diopatra ornata													0.4	0.7	0.3	0.5	0.2	-	-	-	-	0.3	0.4	0.2
Eudistylia polymorpha													0.1	<.1	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.													1.1	0.9	3.0	1.8	1.5	0.1	0.7	<.1	-	2.0	0.6	0.3
Lithopoma gibberosum													0.1	-	-	-	-	-	-	<.1	0.3	1.0	0.4	0.7
Pagurus spp.													12.5	10.9	11.0	20.2	9.7	5.9	8.0	6.7	1.8	9.3	2.1	6.4
Pisaster giganteus													0.3	0.3	0.4	0.3	0.4	0.1	0.4	0.4	0.5	1.0	0.3	0.1
Pisaster ochraceus													0.6	<.1	0.1	<.1	-	-	-	<.1	-	-	-	<.1
Pycnopodia helianthoides													-	0.3	0.3	0.3	0.1	-	0.4	0.2	-	-	0.4	0.1
Styela spp.													0.3	0.5	<.1	<.1	-	-	-	-	-	-	0.1	-
Tegula brunnea													146.3	78.9	51.2	98.8	82.3	88.9	19.8	20.5	6.8	126.0	33.6	231.9
Tegula montereyi													-	1.5	0.6	5.0	2.1	-	0.3	-	-	-	-	-
Tethya aurantia													-	0.3	<.1	0.2	0.4	0.1	0.2	-	-	-	-	<.1
Tonicella lineata													3.4	8.6	2.6	2.3	4.7	6.4	4.8	5.3	4.5	8.3	1.5	1.9
Urticina spp.													-	-	-	<.1	-	-	-	-	-	-	-	-
Only Counted if Greater than 1"																								
Aeolidia papillosa													-	<.1	-	<.1	-	-	-	-	-	-	-	-
Anthopleura artemisia													-	-	-	<.1	<.1	-	-	-	-	-	-	-
Aplysia californica													-	-	-	-	-	-	-	-	-	-	<.1	-
Archidoris spp.													0.1	<.1	<.1	<.1	0.8	-	0.3	-	-	0.5	<.1	<.1
Boltenia villosa													-	<.1	<.1	-	-	-	<.1	-	-	-	-	-
Cadlina spp.													-	-	-	-	-	-	-	-	-	-	<.1	-
Cancer productus													-	-	-	-	-	-	-	<.1	-	-	<.1	-
Cancer spp.													-	-	-	-	-	-	-	0.2	-	-	-	-
Clavelina huntsmani													0.8	0.3	-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis													-	-	0.1	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri													-	-	-	-	-	-	-	<.1	0.3	-	0.5	0.6
Cryptolithodes sitchensis													-	-	<.1	<.1	-	0.1	-	<.1	0.3	-	<.1	-
Cucumaria spp.													-	-	<.1	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis													0.1	-	0.1	-	<.1	-	-	-	-	-	-	-
Diodora spp.													-	0.1	0.3	0.3	-	-	<.1	<.1	-	-	0.4	-
Doridacea unid.													-	-	-	-	-	-	<.1	-	-	-	-	-
Doriopsilla albopunctata													0.1	0.1	0.4	0.3	0.7	0.1	-	0.2	-	-	<.1	0.2
Epiactis prolifera													-	<.1	0.8	-	-	0.9	-	-	-	-	-	-
Eupentacta quinquesemita													-	-	-	<.1	0.1	0.1	-	-	-	-	-	-
Fissurella volcano													-	0.2	0.3	0.5	0.4	0.3	0.2	0.2	-	-	-	-
Fusinus luteopictus													-	-	<.1	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata													-	-	-	-	<.1	0.4	-	-	-	-	-	-
Haliotis spp.													-	<.1	0.1	-	<.1	0.1	-	<.1	-	-	-	-
Henricia leviuscula													0.3	-	0.5	0.2	0.9	1.1	0.4	0.3	-	-	0.1	-
Hermissenda crassicornis													0.1	0.3	0.2	-	0.2	0.6	0.4	<.1	-	-	0.3	0.2

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - Field's Cove Station FC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Only Counted if Greater than 1* (continued)																								
Hopkinsia rosacea													-	-	<.1	<.1	<.1	-	0.2	-	-	-	0.3	0.2
Ischnochitonidae													-	-	-	-	<.1	-	-	-	-	-	-	-
Lamellariidae													-	-	-	-	<.1	-	-	-	-	-	-	-
Lepidozona spp.													-	-	-	-	0.1	0.1	-	-	-	-	-	-
Leucandra heathi													-	-	0.1	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.													-	-	-	-	<.1	-	-	-	-	-	-	-
Lottia instabilis													-	0.3	0.2	0.9	-	0.1	<.1	0.3	-	-	-	-
Lottia ochracea													-	-	0.9	-	-	-	-	-	-	-	-	-
Loxorhynchus spp.													-	-	-	-	<.1	-	-	0.4	-	-	-	-
Megathura crenulata													-	-	-	-	-	-	-	-	-	-	<.1	-
Mimulus foliatus													-	-	0.2	<.1	-	-	-	-	-	-	-	-
Mitra idae													0.1	0.4	0.4	0.3	1.1	0.4	0.3	0.4	0.3	0.8	0.3	0.1
Mopalia spp.													-	0.3	0.1	0.2	0.1	0.1	-	<.1	-	-	-	-
Ocenebra spp.													-	-	0.1	<.1	-	-	-	-	-	-	-	-
Octopus spp.													-	-	-	-	-	-	-	<.1	-	-	-	-
Ophioplocus spp.													-	-	0.1	<.1	-	-	<.1	<.1	0.3	-	-	-
Ophiothrix spp.													-	<.1	0.4	0.5	-	-	-	-	-	-	-	-
Pachycheles spp.													-	-	-	-	<.1	-	-	-	-	-	-	-
Paraxanthias taylori													-	-	<.1	-	<.1	0.1	-	-	-	-	-	-
Pelecypoda unid.													-	-	-	<.1	-	-	-	-	-	-	-	-
Phidiana hiltoni													-	-	-	0.4	0.1	-	0.2	-	0.3	0.3	<.1	-
Pisaster brevispinus													-	0.1	-	<.1	-	-	0.2	-	-	0.3	-	-
Pisaster/Henricia (juv.)													-	0.3	-	0.4	<.1	-	-	-	-	-	-	-
Pista spp.													-	-	0.8	<.1	-	-	-	-	-	-	-	-
Placiphorella velata													-	-	-	-	-	-	-	-	-	-	<.1	-
Pododesmus cepio													-	<.1	-	<.1	-	-	-	-	-	-	-	-
Pseudomelatoma torosa													-	0.2	<.1	<.1	<.1	0.1	-	<.1	-	-	<.1	<.1
Pugettia spp.													0.3	0.5	0.2	0.4	0.6	0.6	0.2	<.1	-	0.8	<.1	0.1
Pyura haustor													-	<.1	-	<.1	<.1	-	-	-	-	-	-	-
Scyra acutifrons													-	-	-	-	0.1	0.3	-	-	-	-	0.1	<.1
Serpulidae unid.													3.0	-	0.3	1.1	2.9	6.1	1.2	1.4	1.0	10.0	2.1	0.2
Serpulorbis squamigerus													6.0	4.7	4.8	3.8	6.1	5.3	1.8	1.7	0.8	4.8	1.3	0.3
Sipuncula unid.													-	-	-	-	-	0.3	-	-	-	-	-	-
Strongylocentrotus purpuratus													-	-	0.3	0.5	0.4	-	0.2	0.7	-	-	0.7	0.4
Tegula pulligo													-	0.3	0.2	-	-	-	-	-	-	-	-	-
Triopha catalinae													-	-	-	-	-	-	-	-	-	0.5	-	-
tunicate, solitary unid.													-	-	-	0.2	-	-	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Acmaea mitra	14.3	6.8	6.0	5.8	2.8	0.5	5.3	3.0	6.2	15.9	11.3	4.5	2.0	6.9	3.4	8.5	11.1	4.3	19.7	6.8				6.3
Anthopleura elegantissima	0.3	0.4	0.3	0.6	0.6	1.5	0.3	0.3	0.6	1.3	0.9	0.8	1.8	0.9	1.1	1.9	2.3	1.5	3.5	2.8				2.3
Asterina miniata	0.5	1.0	1.4	1.8	0.8	4.2	3.5	2.7	<.1	-	0.1	<.1	0.2	-	0.1	0.3	0.3	-	-	-				<.1
Calliostoma ligatum	-	0.5	0.4	2.8	1.0	0.3	1.0	0.3	1.5	1.4	2.1	1.5	1.0	0.4	-	-	-	-	-	-				-
Cancer antennarius	1.0	<.1	<.1	0.3	0.2	<.1	<.1	0.2	<.1	<.1	<.1	-	-	-	-	-	-	<.1	-	-				-
Diopatra ornata	-	<.1	0.3	1.7	0.2	0.7	0.3	-	1.1	0.6	0.6	0.4	0.3	0.1	<.1	0.3	0.8	0.3	1.3	-				0.4
Eudistylia polymorpha	0.5	0.3	-	-	-	-	-	-	0.3	0.2	-	-	<.1	-	-	-	<.1	-	-	-				-
Leptasterias spp.	-	1.0	<.1	0.8	0.3	1.9	3.1	1.3	0.9	1.0	0.8	0.5	0.3	-	-	-	-	-	-	-				-
Lithopoma gibberosum	1.8	0.5	0.1	0.4	1.4	0.2	0.2	<.1	0.1	-	<.1	0.2	0.2	-	<.1	-	-	-	-	-				-
Pagurus spp.	8.5	7.0	12.0	11.0	17.9	23.5	15.8	15.4	23.1	13.4	19.3	15.8	21.3	17.9	1.6	0.8	-	1.2	1.6	-				0.2
Parastichopus spp.	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	0.1	<.1	-				<.1
Pisaster giganteus	-	<.1	0.2	-	-	-	<.1	-	-	-	-	<.1	<.1	0.5	1.0	1.1	1.2	0.4	0.7	0.5				-
Pisaster ochraceus	-	-	-	0.1	-	0.2	-	0.3	0.1	-	-	<.1	-	-	<.1	0.3	0.1	<.1	<.1	-				-
Pycnopodia helianthoides	0.8	0.2	0.4	0.4	0.8	0.3	0.6	0.5	0.2	0.2	0.3	0.3	<.1	0.1	0.1	0.3	0.4	0.2	0.1	0.1				-
Styela spp.	-	-	-	0.3	-	0.2	-	-	-	0.3	0.1	<.1	-	0.3	0.3	-	-	-	-	-				-
Tegula brunnea	23.3	19.8	59.4	154.7	92.8	75.5	63.8	92.0	195.6	100.5	157.1	204.2	174.8	42.6	3.6	2.3	22.1	7.9	9.6	-				1.5
Tegula montereyi	-	3.5	-	0.9	-	3.8	2.0	0.3	-	2.1	0.9	1.5	7.3	0.4	-	-	-	-	-	-				-
Tethya aurantia	-	-	-	<.1	-	-	<.1	-	-	-	-	-	0.2	-	-	-	<.1	-	-	-				<.1
Tonicella lineata	1.5	1.5	3.0	13.5	3.8	4.5	1.8	9.5	10.3	5.4	9.9	3.0	5.5	2.4	0.8	0.8	0.6	0.2	-	0.8				0.3
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				0.2
Only Counted if Greater than 1"																								
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-				-
Anthopleura artemisia	-	-	-	0.1	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	-	-	-				-
Anthozoa unid.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-				-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	<.1	-				-
Archidoris spp.	-	-	<.1	0.3	-	-	0.3	-	-	0.1	-	<.1	-	<.1	<.1	-	-	-	-	-				-
Boltenia villosa	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	<.1	-	-	-				-
Cancer spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-				-
Chama spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Chromodoris macfarlandi	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-				-
Cnemidocarpa finmarkiensis	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-				-
Crangon spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Cryptolithodes sitchensis	-	<.1	-	-	-	<.1	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-				-
Cucumaria spp.	-	-	-	-	0.3	-	-	<.1	-	0.2	<.1	-	-	-	-	-	-	-	-	-				-
Disalula sandiegensis	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Diodora spp.	-	-	-	-	-	-	-	-	-	0.2	-	-	0.3	<.1	<.1	-	0.2	0.1	0.2	-				-
Doriopsilla albopunctata	-	-	-	0.6	<.1	<.1	<.1	-	-	0.3	0.3	0.2	0.2	0.1	0.2	0.3	0.3	0.1	0.3	0.1				0.3
Epiactis prolifera	5.0	2.6	-	0.9	2.1	0.5	0.3	-	0.3	1.0	2.0	1.7	3.1	3.1	0.9	<.1	0.2	-	-	-				-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-				-
Fissurella volcano	-	-	-	-	-	-	-	0.2	-	-	0.3	<.1	1.5	0.9	1.1	<.1	0.1	0.5	0.9	-				-
Flabellina trilineata	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Halcampa decemtentaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	<.1	-	0.3				-
Haliotis spp.	2.8	0.3	1.5	0.6	1.1	0.2	<.1	<.1	<.1	0.3	0.4	1.9	1.0	0.6	0.2	<.1	<.1	-	<.1	-				0.3

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Only Counted if Greater than 1" (continued)																								
Henricia leviuscula	-	-	0.3	-	<.1	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Hermissenda crassicornis	-	-	<.1	0.1	-	-	-	-	-	0.3	0.1	0.2	0.2	-	-	-	<.1	-	-	-				-
Hopkinsia rosacea	-	-	-	-	-	-	<.1	-	<.1	<.1	0.2	<.1	-	0.1	0.2	-	<.1	-	-	-				-
Idotea spp.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-				-
Ischnochitonidae	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Lepidozona spp.	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-	-	0.1	0.2	-	-	-	-				-
Leucandra heathi	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Leucilla nuttingi	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-				-
Lottia instabilis	-	-	0.4	2.8	2.3	4.7	2.8	1.2	1.9	4.9	-	-	-	-	-	-	-	-	-	-				-
Lottia ochracea	-	0.5	-	-	-	-	-	-	-	-	-	-	-	3.2	1.8	0.4	-	0.6	-	-				-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	0.1	0.4				<.1
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1				-
Mexichromis porterae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-				-
Mitra idae	-	-	<.1	-	0.2	0.3	-	-	0.4	0.4	0.9	0.2	0.5	<.1	0.1	<.1	-	-	<.1	-				<.1
Mopalia spp.	-	0.4	0.3	0.1	0.3	<.1	<.1	<.1	0.4	0.1	-	<.1	-	-	-	<.1	<.1	<.1	-	-				-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1				0.2
Ocenebra spp.	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-				-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-				<.1
Ophioplocus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	<.1	0.1				0.2
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	0.1	2.6	0.6				0.2
Orthasterias koehleri	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	-	-	-	-	-	-				-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	0.2	0.4	1.6	0.6	0.8	1.1	1.3	1.9	2.3				-
Phragmatopoma californica	-	-	0.8	0.2	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Pisaster/Henricia (juv.)	-	-	0.4	0.2	0.5	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Pista spp.	-	-	0.1	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	0.2	2.1	2.4				-
Placiphorella velata	-	<.1	-	-	-	-	<.1	-	0.1	-	-	<.1	<.1	-	-	-	-	-	-	-				-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-				-
Podochela hemphill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				<.1
Pododesmus cepio	-	-	-	-	0.2	<.1	-	-	-	-	-	0.3	0.8	0.4	-	-	-	<.1	-	-				-
Pseudomelatoma torosa	-	<.1	<.1	0.1	0.2	-	0.2	<.1	0.3	0.3	0.6	<.1	<.1	0.1	-	-	-	-	-	-				-
Pugettia spp.	0.3	0.2	0.2	1.2	0.9	0.4	0.4	0.2	0.8	0.8	0.6	0.5	0.5	0.2	-	<.1	<.1	0.1	0.9	-				<.1
Pyura haustor	-	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	<.1	-	-	-	-	-	-				-
Sabellidae	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Serpulidae unid.	-	-	0.1	<.1	0.2	0.3	-	-	-	<.1	0.6	-	2.2	0.6	0.1	0.3	1.1	1.9	1.5	-				2.6
Serpulorbis squamigerus	-	-	<.1	0.6	0.5	1.2	1.4	1.7	2.8	7.6	4.0	6.3	11.7	3.3	1.5	0.6	0.2	0.6	0.3	0.6				0.4
Strongylocentrotus purpuratus	-	-	-	-	-	-	-	-	-	-	<.1	0.3	2.1	0.7	1.6	0.9	2.1	1.5	10.1	9.0				23.3
Tegula pulligo	-	-	-	1.0	<.1	0.3	-	0.4	-	-	0.3	-	0.3	-	-	-	-	-	-	-				-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 3 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Acmaea mitra	1.5	4.5	5.4	11.3	6.0	10.8	8.8	4.9	9.2	9.9	8.0	5.6	1.5	14.4	3.9	5.1	4.9	0.8	7.3	15.4	31.5	8.3	0.8	11.1
Anthopleura elegantissima	-	0.3	0.5	0.8	0.9	0.7	1.4	1.2	0.3	0.8	1.0	1.1	0.4	2.2	1.8	2.3	2.5	2.2	4.8	4.6	6.4	5.0	3.3	2.6
Asterina miniata	-	0.8	2.6	1.9	3.8	5.7	5.5	4.3	0.1	<.1	0.1	0.3	-	1.1	0.2	0.5	1.2	<.1	<.1	-	-	0.1	-	<.1
Calliostoma ligatum	-	0.5	0.2	0.9	1.5	-	2.3	1.3	0.9	3.3	2.0	2.3	0.8	0.6	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	-	0.1	0.1	0.3	<.1	<.1	0.1	0.1	<.1	0.1	<.1	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	0.3	0.2	0.3	-	-	0.5	0.2	0.1	<.1	0.3	0.3	0.4	0.5	0.3	0.6	0.7	0.4	0.5	0.8	-	0.1	0.3
Eudistylia polymorpha	-	-	-	0.3	-	-	-	<.1	0.3	0.2	-	0.2	-	0.2	-	-	-	0.1	-	-	-	-	0.1	-
Leptasterias spp.	-	1.5	0.3	2.3	3.4	5.5	2.4	1.1	0.6	1.0	0.7	0.3	-	0.2	-	-	-	-	-	-	-	-	-	-
Lithopoma gibberosum	0.3	0.3	0.3	0.2	0.5	0.3	<.1	<.1	0.1	-	0.3	0.8	0.2	0.1	<.1	-	-	-	-	-	-	-	-	-
Pagurus spp.	-	3.8	4.9	13.7	10.9	20.7	13.8	16.7	14.2	12.2	18.4	19.6	8.6	10.5	7.4	2.6	1.1	0.4	0.4	0.6	1.5	4.3	-	-
Parastichopus spp.	-	-	0.1	-	-	<.1	<.1	-	<.1	-	-	<.1	-	-	-	-	-	<.1	<.1	-	-	0.3	0.1	0.1
Pisaster giganteus	-	-	0.2	-	-	-	0.3	-	<.1	-	<.1	-	0.3	0.3	0.6	1.3	1.2	0.5	0.6	0.5	1.4	1.0	0.1	<.1
Pisaster ochraceus	-	-	-	0.1	<.1	<.1	<.1	0.2	-	<.1	-	<.1	-	0.3	<.1	<.1	-	<.1	<.1	-	-	-	-	-
Pycnopodia helianthoides	-	0.2	0.2	0.6	0.2	0.5	0.3	0.6	0.4	0.2	0.2	0.1	0.3	<.1	0.3	0.6	0.5	0.1	0.3	0.1	-	0.1	-	-
Styela spp.	-	-	-	<.1	-	-	-	-	-	0.1	-	0.2	-	0.2	-	-	-	-	-	-	-	0.1	-	-
Tegula brunnea	6.8	18.3	28.1	53.3	56.5	70.8	54.5	43.5	53.8	92.0	88.7	93.8	128.8	36.9	3.6	2.3	14.3	0.9	3.8	14.6	23.3	17.6	-	-
Tegula montereyi	-	9.3	-	0.6	-	-	1.3	0.4	0.9	2.6	1.1	0.4	1.0	0.8	-	-	-	0.4	-	-	-	-	-	-
Tethya aurantia	-	-	<.1	<.1	<.1	-	-	<.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Tonicella lineata	-	0.5	5.4	10.1	13.0	5.8	5.8	10.7	5.3	7.5	4.2	4.5	2.3	4.3	1.9	0.4	0.6	0.2	0.4	-	11.3	0.8	-	0.2
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Only Counted if Greater than 1°																								
Acmaeidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Anthopleura artemisia	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	0.2	<.1	0.4	<.1	0.4	-	-	-	0.5	-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Archidoris spp.	-	-	0.1	0.3	0.3	0.3	0.3	-	<.1	-	0.3	-	<.1	<.1	0.2	<.1	0.2	-	-	0.3	0.4	-	0.1	0.1
Balanus spp.	-	-	-	0.3	-	-	-	0.3	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	<.1	0.2	-	-	-	-	-	-	<.1	-	-	<.1	-	-	<.1	0.1	0.1	-	-	-	-	-
Cadlina spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ceratostoma foliatum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Chama spp.	-	-	-	-	<.1	-	-	-	-	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Chromodoris macfarlandi	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-
Conus californicus	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Cryptolithodes sitchensis	-	<.1	-	-	-	0.2	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Cucumaria spp.	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	-	<.1	-	-	<.1	-	<.1	-	-	0.1	-	-	-	<.1	-	-	-	-	-	-	-	0.1	-	-
Diodora spp.	-	-	-	-	-	-	-	-	-	0.2	-	-	0.3	<.1	<.1	-	-	-	-	0.1	0.1	-	-	0.1
Doriopsilla albopunctata	-	-	0.2	0.5	0.3	-	-	-	0.2	0.5	0.4	-	<.1	0.1	0.3	0.5	<.1	0.1	0.1	0.4	0.4	0.3	0.1	0.4
Epiactis prolifera	-	1.1	-	1.4	0.7	0.6	0.5	<.1	0.3	0.9	0.7	1.0	5.0	2.0	1.9	0.1	-	0.2	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Fissurella volcano	-	-	-	-	-	-	-	-	-	-	0.1	0.5	1.3	0.3	2.4	0.4	0.3	-	0.6	-	-	-	-	<.1
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	<.1	1.0	-	<.1	0.3	-	-	-	-	-	-	-	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Only Counted if Greater than 1* (continued)																								
Halcampa decemtentaculata	-	-	-	0.2	-	0.2	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	0.3	-	-	-
Haliotis spp.	-	-	<.1	0.8	0.7	0.5	0.2	0.2	0.1	0.3	0.3	0.4	0.3	0.4	-	<.1	-	-	0.2	-	-	-	0.1	<.1
Henricia leviuscula	-	-	-	0.3	0.2	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	0.1	0.1	<.1	0.1	0.3	<.1	-	-	-	<.1	-	-	-	-	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	0.1	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Leucandra heathi	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Limaria hemphilli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Lissothuria nutriens	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
Lottia instabilis	-	-	0.3	0.8	1.9	2.8	1.7	0.6	1.3	3.9	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	0.4	<.1	-	-	-	-	-	-	0.2	-	-	0.6	0.9	1.1	-	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6	-
Mitra idae	-	-	0.1	0.3	<.1	-	-	0.2	<.1	0.7	0.9	0.6	0.7	0.3	0.3	0.2	-	-	-	-	0.1	-	-	0.1
Mopalia spp.	-	<.1	<.1	0.2	0.3	0.2	0.3	0.4	0.5	0.2	0.1	<.1	-	0.1	<.1	-	-	<.1	-	-	0.1	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Nassarius spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Nemertea unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.1
Ocenebra spp.	-	-	-	-	-	-	-	-	-	<.1	0.1	0.1	0.2	-	-	-	-	-	-	-	-	-	-	-
Octopus spp.	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-
Ophioplocus spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.1	<.1	0.4	<.1	-	-	-	-	-	<.1
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.5	2.7	2.3	2.8	5.0	18.9	-	5.0	0.1	0.6
Ophiuroidea unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Orthasterias koehleri	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	<.1	-	<.1	-	-	-	-	-	<.1	0.8	0.3	0.3	2.5	1.8	1.0	0.9	0.9	0.6	0.9	1.6	1.6	-	-
Phragmatopoma californica	-	-	0.4	1.2	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster brevispinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	0.2	<.1	-	0.5	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pista spp.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	-	-	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	-	-	-	-	-	<.1	-	-	-	0.1	1.4	2.5	0.2	0.4	<.1	0.1	<.1	-	0.1	-	-	-	-
Pseudomelatoma torosa	-	<.1	-	-	-	0.5	0.2	0.2	<.1	0.6	0.6	0.1	0.5	0.1	<.1	-	-	-	-	-	-	-	-	-
Pteropurpura festiva	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Pugettia spp.	-	0.2	<.1	0.1	0.4	1.0	0.3	0.3	0.3	0.6	0.1	0.4	0.3	<.1	0.4	<.1	0.1	-	1.6	-	0.6	0.4	-	-
Sabellidae	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	-	0.3	-	-	0.3	0.6	0.1	0.2	0.1	-	0.2	0.5	0.7	1.4	1.3	1.2	1.4	1.3	11.1	0.8	-	2.5
Serpulorbis squamigerus	-	-	0.2	0.3	0.3	0.5	2.7	3.9	2.0	4.9	8.0	10.1	5.7	4.6	3.3	1.8	0.9	0.7	0.6	0.1	0.6	1.9	-	0.4
Sipuncula unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	0.2	-	<.1	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	0.2	-	-	-	-	-	-	0.2	0.2	2.3	1.0	5.7	4.9	5.5	3.8	26.3	35.3	11.5	6.9	16.3	39.3
Tegula pulligo	-	<.1	-	-	-	-	0.3	-	-	-	0.2	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 4 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Acmaea mitra	5.3	9.8	7.1	7.4	4.3	4.3	7.9	5.3	2.8	7.9	9.6	11.5			6.8	12.4	8.8	2.8	17.6	7.1	3.0	1.1	1.9	8.4
Anthopleura elegantissima	1.3	2.3	2.3	1.8	2.2	2.8	2.4	2.4	2.1	2.3	2.6	4.3			4.4	5.2	4.6	4.1	8.6	6.0	5.8	6.4	4.6	8.6
Asterina miniata	6.5	8.0	7.3	9.0	9.8	13.8	9.1	6.8	1.3	0.7	1.5	1.7			1.5	2.4	1.9	1.1	0.3	0.4	-	-	-	0.1
Calliostoma ligatum	-	1.5	1.1	4.4	3.3	3.0	2.3	4.1	2.3	2.1	5.1	5.0			-	-	-	-	0.2	-	-	-	-	-
Cancer antennarius	-	-	0.2	0.2	-	0.2	<.1	-	<.1	<.1	<.1	-			-	-	-	<.1	-	-	-	-	-	-
Diopatra ornata	-	1.0	2.7	2.2	3.5	4.3	2.4	1.2	1.2	1.3	0.7	1.3			0.4	0.8	1.6	1.7	1.1	1.5	-	0.1	0.9	1.1
Eudistylia polymorpha	0.3	-	-	-	-	-	1.1	0.7	0.3	<.1	0.3	0.6			-	<.1	0.4	-	0.2	0.1	-	0.1	-	-
Leptasterias spp.	0.5	2.5	<.1	0.4	0.3	0.3	1.1	1.4	0.4	0.2	0.4	0.8			-	-	-	-	-	-	-	-	-	-
Lithopoma gibberosum	2.0	1.5	0.4	1.1	0.8	0.3	0.4	0.4	0.4	0.2	0.8	2.2			0.1	<.1	-	-	-	0.1	-	-	-	<.1
Pagurus spp.	2.0	-	4.6	9.7	15.3	27.2	19.2	19.5	15.6	16.6	10.4	18.7			0.9	0.6	2.5	0.4	1.2	-	-	-	-	<.1
Parastichopus spp.	0.5	0.8	<.1	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.2	0.2			<.1	0.1	<.1	-	0.3	-	0.3	0.5	0.4	0.9
Pisaster giganteus	-	1.0	0.1	-	0.2	-	<.1	<.1	0.1	0.2	0.1	0.3			0.9	1.4	1.3	1.6	1.6	0.6	0.8	1.4	0.1	-
Pisaster ochraceus	-	-	<.1	-	<.1	0.4	0.1	0.4	0.3	-	-	<.1			-	-	<.1	-	-	-	-	-	-	-
Pycnopodia helianthoides	0.3	-	0.3	1.0	0.4	0.3	0.5	0.4	0.3	0.5	0.3	0.5			0.2	0.3	0.6	0.4	0.4	-	-	-	-	-
Styela spp.	-	-	0.4	0.2	<.1	-	0.1	<.1	0.4	0.3	0.2	0.8			-	-	-	-	-	-	0.3	0.1	-	-
Tegula brunnea	11.3	42.0	52.7	82.7	102.5	96.8	82.5	93.2	99.4	91.5	86.3	99.5			2.3	18.4	70.3	7.3	9.4	-	3.0	28.9	-	1.1
Tegula montereyi	-	-	-	1.1	1.0	1.3	1.5	2.8	3.2	4.6	2.4	3.5			-	-	0.2	0.2	-	-	-	-	-	-
Tethya aurantia	2.3	3.0	1.3	1.8	2.3	2.0	2.8	2.6	2.7	2.0	1.9	1.2			1.1	0.9	0.6	0.9	0.7	1.3	1.5	1.4	1.1	1.9
Tonicella lineata	0.8	9.8	6.2	12.6	10.3	3.5	8.8	7.3	9.2	6.3	4.7	4.3			0.9	1.5	1.3	0.2	0.8	0.8	0.8	0.8	0.4	0.2
Urticina spp.	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Only Counted if Greater than 1"																								
Anthopleura artemisia	-	-	-	0.2	-	-	-	0.1	-	0.2	-	-			0.3	<.1	0.3	0.3	<.1	-	-	-	0.1	0.3
Anthopleura xanthogrammica	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	0.8	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	<.1	-			0.1	0.2	1.0	-	1.1	-	-	-	1.0	-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	0.1	-	-	-	-	-	-
Archidoris spp.	0.3	-	1.1	0.3	0.3	0.4	0.8	0.3	0.4	0.1	<.1	<.1			0.6	0.1	-	0.2	<.1	0.3	-	0.1	-	-
Balanus spp.	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Balanus/Tetraclita spp.	-	-	-	-	1.3	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	<.1	<.1	0.4	-	-	0.2	-	<.1	0.3	-			0.1	-	0.3	0.2	0.2	0.4	-	0.1	-	-
Cadlina spp.	-	-	-	-	-	-	-	0.1	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Cancer productus	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	-	<.1	-	-	-	<.1	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Chama spp.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	-	-	-	-	-	<.1	0.3	0.1	0.3			0.1	-	-	-	-	-	-	-	-	-
Conus californicus	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	0.1	-	-	-	-
Crepidula spp.	-	-	-	-	0.2	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	<.1	<.1	0.2			-	-	-	<.1	-	-	-	-	-	-
Cryptolithodes sitchensis	-	-	-	-	-	-	-	<.1	<.1	-	<.1	0.3			-	-	-	-	-	-	-	-	-	-
Cucumaria spp.	-	-	0.1	<.1	0.6	-	-	-	-	0.5	-	-			-	-	-	-	-	0.3	-	-	-	-
Diaulula sandiegensis	-	0.3	-	-	0.2	<.1	-	-	-	-	-	<.1			<.1	-	-	-	<.1	-	-	-	0.1	0.1
Diodora spp.	-	-	-	-	-	-	-	-	-	<.1	<.1	-			0.1	<.1	-	-	-	0.3	-	-	-	0.3
Doriopsilla albopunctata	-	-	<.1	0.7	0.8	0.3	0.1	0.6	0.6	1.5	1.0	0.2			1.5	0.8	0.6	0.5	0.8	2.6	0.3	0.3	-	1.6
Epiactis prolifera	-	-	-	0.2	0.3	0.3	-	0.6	<.1	1.0	0.3	0.7			0.3	0.2	-	0.1	<.1	-	-	-	-	0.2
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	0.1	-			<.1	<.1	-	-	-	-	-	-	-	-
Fissurella volcano	-	-	-	-	-	-	-	0.1	-	-	0.2	<.1			0.8	-	0.1	<.1	0.3	-	-	-	-	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Only Counted if Greater than 1* (continued)																								
Flabellina trilineata	-	-	-	-	<1	<1	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	<1	0.4	0.3			-	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata	-	-	-	0.4	0.3	-	-	0.1	0.8	0.2	-	-			0.4	-	-	-	0.3	-	-	-	-	<1
Haliotis spp.	-	-	-	0.1	0.3	-	<1	0.1	-	<1	0.4	0.3			0.1	-	-	<1	0.1	0.1	-	-	-	<1
Henricia leviuscula	-	-	<1	0.3	0.5	0.8	0.4	0.4	-	<1	-	-			<1	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	0.1	-	-	0.1	-	<1	0.3	-	-			<1	-	-	0.4	-	-	-	-	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	<1	-	-	-	<1			<1	<1	<1	-	-	-	-	-	-	-
Kelletia kelletii	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	0.3	0.1	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<1	-	-	-	-	-
Leucandra heathi	1.5	-	<1	0.2	-	<1	-	-	-	-	0.1	-			-	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<1	-	-	-	-	-	-	-
Lottia instabilis	-	-	-	1.3	1.9	1.0	4.1	3.8	4.0	4.6	1.6	-			-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	0.1	-	-			<1	<1	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	0.2	0.2	-	0.3	-	-	-	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.1	0.1	<1
Melibe leonina	-	-	-	-	-	-	-	0.1	-	-	-	-			-	-	-	-	0.1	-	-	-	-	-
Mexichromis porterae	-	-	-	-	-	-	-	-	-	-	-	-			-	<1	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	-	-	-	-	-	-	<1	-	-			-	-	-	-	-	-	-	-	-	-
Mitra idae	-	-	0.2	0.5	1.2	0.3	0.4	0.9	0.8	1.0	0.4	0.6			0.1	0.3	0.3	0.3	<1	0.4	0.3	0.1	0.3	0.3
Mopalia spp.	0.3	-	<1	0.1	-	<1	-	<1	-	<1	-	<1			<1	<1	-	-	<1	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<1	-	-	-	-	-	-	-
Navanax inermis	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<1	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	-	-	-	-	-	-	-	-	-	-			<1	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<1	-	-	-	-	-
Ocenebra spp.	-	-	-	-	-	-	-	-	-	-	<1	0.3			-	-	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<1	<1	-	0.1	0.1	-	-	-	-
Ophioplocus spp.	-	-	-	-	-	<1	-	<1	-	<1	<1	-			0.2	0.1	0.5	0.3	<1	0.3	0.3	0.8	0.1	0.1
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-			0.3	2.8	1.4	1.9	5.3	0.5	-	-	-	-
Ophiuroidea unid.	-	-	-	-	<1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Orthasterias koehleri	-	-	-	-	-	<1	-	<1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Paraxanthias taylori	-	-	-	-	-	-	-	<1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	0.2	0.2	-	<1	-	-	-	0.3	0.5	0.2			1.8	1.3	1.8	2.1	1.2	1.8	-	1.0	0.3	<1
Phragmatopoma californica	1.3	-	7.8	24.3	7.5	-	-	10.6	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pisaster brevispinus	-	-	-	-	-	-	-	-	-	-	<1	-			-	<1	-	<1	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	0.2	0.4	-	-	-	-	-	<1	<1			-	-	-	-	-	-	-	-	-	-
Pista spp.	-	-	-	-	-	-	-	-	-	-	-	-			<1	0.2	0.3	0.3	-	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	-	-	-	<1	-	-			-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<1	<1	-	-	-	-	-
Pododesmus cepio	-	-	-	-	0.2	-	-	-	-	<1	<1	0.5			1.0	0.8	0.3	-	-	-	-	-	-	-
Pseudomelatoma torosa	-	-	-	<1	0.5	-	<1	0.3	0.3	0.5	0.5	0.7			<1	-	-	-	-	-	-	-	-	-
Pugettia spp.	-	-	0.3	0.5	0.7	0.3	0.4	0.9	0.3	0.5	0.5	0.5			<1	-	-	<1	0.4	-	-	-	-	-
Pyura haustor	-	-	-	-	-	<1	-	0.3	0.7	0.5	0.2	-			<1	0.1	<1	-	-	-	-	-	-	-
Sabellidae	0.5	-	-	-	-	-	-	-	-	-	-	-			-	<1	-	-	-	-	-	0.3	-	-
Scyra acutifrons	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.1	-	-
Serpulidae unid.	-	-	-	0.4	0.7	-	0.3	<1	0.3	<1	-	<1			0.7	0.4	1.8	3.5	2.9	3.0	-	3.8	-	8.3
Serpulorbis squamigerus	2.8	-	1.2	1.5	3.8	0.9	4.9	5.3	13.4	6.4	17.4	12.3			3.9	1.8	3.3	0.6	1.3	1.0	-	0.5	0.6	1.4
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-			<1	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Only Counted if Greater than 1" (continued)																								
Strongylocentrotus purpuratus	0.3	-	-	-	-	<.1	-	-	-	<.1	0.3	0.3			1.9	2.8	6.1	4.0	12.8	7.9	2.0	2.1	9.8	65.9
Tegula pulligo	-	-	-	0.3	0.3	-	0.4	0.1	-	<.1	0.8	0.4			-	-	<.1	<.1	-	-	-	-	-	-
Tetraclita rubescens	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	<.1	-	-	-	-	-	<.1
Triopha maculata	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Acmaea mitra	6.0	1.5	6.0	3.3	3.3	1.3	1.3	0.3	3.9	9.3	0.8	11.3	11.4	16.3	5.3	4.3	12.2	1.7	0.9	7.1	2.3	1.9	0.4	-
Anthopleura elegantissima	0.5	0.5	1.0	1.3	1.6	1.1	1.2	0.7	1.4	0.9	1.2	3.3	1.7	0.9	1.1	1.4	1.0	1.1	1.8	0.9	1.1	1.8	1.0	2.1
Asterina miniata	3.8	2.3	3.6	3.0	3.8	5.3	4.2	1.6	0.2	0.5	0.2	1.3	0.7	1.0	0.6	0.8	2.6	1.2	0.3	0.4	0.6	0.3	0.1	0.1
Calliostoma ligatum	-	0.5	0.2	2.1	1.5	0.2	1.7	1.5	0.4	2.6	2.9	2.0	1.7	0.4	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	0.5	-	0.3	0.4	<.1	0.1	<.1	<.1	0.1	-	<.1	0.2	-	-	-	<.1	-	-	-	-	0.1	-	-	-
Diopatra ornata	1.0	1.8	1.1	1.3	0.8	-	0.3	0.1	<.1	0.5	0.1	0.6	0.6	0.3	0.3	0.8	2.2	3.8	2.1	0.8	0.9	5.9	4.5	3.4
Eudistylia polymorpha	-	-	-	-	-	<.1	-	<.1	0.2	0.1	-	0.1	-	-	<.1	<.1	<.1	<.1	<.1	-	-	0.1	-	0.1
Leptasterias spp.	0.3	0.4	0.2	0.4	0.4	0.9	0.6	0.3	<.1	0.2	0.4	0.2	0.4	-	-	<.1	-	-	-	-	-	-	-	-
Lithopoma gibberosum	1.3	1.3	1.7	1.0	1.3	1.8	0.3	0.3	0.1	0.5	0.8	1.6	3.2	0.5	-	-	-	-	-	-	-	-	-	-
Pagurus spp.	7.5	5.3	8.0	14.3	11.8	19.4	10.9	15.8	13.3	11.8	20.4	30.6	62.1	24.1	11.1	1.9	2.3	0.4	<.1	0.6	0.3	0.4	-	<.1
Parastichopus spp.	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster giganteus	-	0.3	<.1	<.1	<.1	0.3	-	-	<.1	<.1	0.1	0.2	1.0	0.9	1.3	1.5	1.9	2.1	0.7	0.6	0.8	0.6	-	0.4
Pisaster ochraceus	-	-	-	-	<.1	0.3	-	-	<.1	-	-	0.2	-	<.1	-	0.2	-	0.1	-	-	-	-	-	-
Pycnopodia helianthoides	1.3	-	0.3	0.7	0.5	0.4	0.4	0.2	0.2	<.1	<.1	0.5	0.2	0.4	0.2	0.1	0.3	0.3	0.1	0.1	0.1	-	-	<.1
Styela spp.	0.5	<.1	<.1	0.2	0.2	-	0.1	-	<.1	0.3	-	0.6	0.4	1.0	0.7	0.3	-	-	<.1	-	0.1	0.6	0.1	0.2
Tegula brunnea	15.8	13.5	53.4	106.1	57.4	65.4	45.0	36.9	31.3	36.4	35.0	62.9	37.1	26.8	1.3	5.1	60.6	1.3	-	0.4	16.5	1.9	-	-
Tegula montereyi	0.8	0.5	5.6	1.8	2.1	1.1	4.1	2.1	0.8	2.3	1.4	7.7	2.1	-	-	-	-	0.2	-	-	-	-	-	-
Tethya aurantia	-	<.1	0.2	0.3	0.3	0.3	0.2	0.5	0.8	0.3	0.5	0.3	0.1	0.3	0.1	0.5	0.1	0.1	<.1	-	-	-	-	-
Tonicella lineata	1.5	0.3	1.1	3.8	4.5	4.3	2.3	0.9	1.3	4.4	1.4	2.3	5.1	4.1	1.1	0.8	0.6	-	-	-	-	-	-	-
Urticina spp.	-	-	-	0.2	<.1	-	-	-	-	-	-	-	-	0.4	<.1	-	<.1	-	-	-	-	-	0.1	<.1
Only Counted if Greater than 1"																								
Acanthodoris lutea	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthopleura artemisia	-	0.2	0.2	0.6	0.3	<.1	0.4	0.1	0.3	0.4	0.4	0.2	1.9	0.6	0.5	0.4	0.4	0.3	0.6	0.1	0.4	0.1	0.9	1.1
Anthozoa unid.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	0.3	0.3	0.6	1.6	0.1	-	-	3.0	1.6
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.6	-	-	-	-	-	-	-	0.8
Aplysia vaccaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.6
Archidoris spp.	-	-	0.4	0.3	0.8	0.2	0.2	-	0.2	0.1	0.1	-	0.3	-	<.1	<.1	-	<.1	0.1	-	-	-	0.8	-
Ascidia spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Balanophyllia elegans	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balanus spp.	-	-	-	-	0.1	0.3	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	-	<.1	-	-	-	-	-	<.1	0.3	<.1	1.1	0.2	0.3	<.1	1.1	0.4	0.3	0.1	0.3	0.3	-	<.1
Cadlina spp.	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma annulatum	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer productus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	0.1	-	-	<.1
Cancer spp.	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Ceratostoma foliatum	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chama spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromodoris macfarlandi	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Chthamalus fissus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Clavelina huntsmani	-	-	0.5	-	-	-	-	-	-	-	-	0.3	0.6	1.3	-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	-	-	-	-	-	<.1	0.3	-	<.1	0.3	<.1	<.1	-	<.1	-	-	-	-	-	-	-
Conus californicus	-	<.1	0.1	<.1	<.1	0.4	<.1	<.1	-	-	<.1	<.1	0.2	-	<.1	<.1	-	<.1	-	-	-	-	-	-
Crangon spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	0.1	-	-	-
Cryptolithodes sitchensis	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Cucumaria spp.	-	-	-	<.1	-	-	-	0.2	-	<.1	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	-	<.1	-	-	-	0.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diodora spp.	-	-	-	-	<.1	-	<.1	-	-	0.1	0.1	0.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-
Discurria insessa	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Doridacea unid.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	0.2	0.3	0.6	<.1	<.1	-	<.1	0.6	1.9	0.8	0.4	0.4	0.5	0.4	0.8	0.9	0.3	0.3	0.6	-	-	-	0.2
Epiactis prolifera	0.3	0.3	-	0.7	-	-	-	-	<.1	<.1	0.1	-	0.5	0.4	<.1	-	0.1	-	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Fissurella volcano	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	<.1	-	<.1	-	-	-	-	-	-
Flabellina trilineata	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Geitodoris heathi	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata	0.3	-	0.1	1.8	-	-	<.1	-	-	-	-	-	1.6	0.6	-	-	<.1	-	0.2	0.3	-	-	-	0.4
Haliotis spp.	-	-	-	-	<.1	-	<.1	-	-	0.2	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	0.1
Henricia leviuscula	-	-	0.1	<.1	<.1	-	0.1	-	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Holothuroidea unid. a	-	-	-	-	<.1	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	0.5	<.1	-	0.1	<.1	-	<.1	-	-	0.1	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Leucandra heathi	-	-	-	3.1	<.1	-	0.3	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leucilla nuttingi	0.3	-	-	-	0.4	0.6	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia instabilis	-	-	1.3	3.5	2.5	7.2	3.4	1.5	2.3	1.7	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	-	-	<.1	-	-	-	-	-	-	-	-	0.3	0.3	0.5	-	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	0.3	<.1	0.3	-	0.3	-	0.3	0.1
Majidae	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Melibe leonina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.2	-	<.1	-	-	-	-	<.1
Mitra idae	1.0	<.1	1.0	1.0	0.8	<.1	0.2	0.4	0.9	1.0	0.8	1.7	1.7	1.0	0.3	0.6	0.6	0.1	0.3	0.6	0.6	0.5	0.1	0.3
Mopalia spp.	-	<.1	<.1	0.4	0.2	0.4	-	<.1	0.2	0.5	0.2	<.1	0.1	0.3	<.1	-	-	-	-	-	-	0.1	-	-
Nassarius spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	<.1	<.1	-	-	-	-	-	-
Navanax inermis	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	0.1	-	-	-	0.3	-
Nemertea unid.	-	-	-	<.1	-	-	0.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	0.5	-	-	-	-
Ocenebra spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Olivella biplicata	-	-	-	-	-	-	-	0.2	0.2	<.1	1.2	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	0.6	1.1	0.9	1.6	1.4	-	-	-	-
Ophiuroidea unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	<.1	<.1	-	-	0.4	1.6	1.3	0.3	0.9	<.1	<.1	0.3	0.9	0.1	0.1	-
Phragmatopoma californica	-	-	0.6	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster brevispinus	-	-	-	-	-	-	-	-	<.1	-	0.1	<.1	0.3	<.1	0.1	<.1	0.3	0.3	0.3	-	-	0.6	-	<.1

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Only Counted if Greater than 1" (continued)																								
Pisaster/Henricia (juv.)	-	-	-	0.3	<1	<1	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pista spp.	-	<1	-	-	-	-	-	-	-	-	<1	-	0.1	-	0.3	0.5	1.9	0.5	1.2	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	<1	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	-	-	-	<1	-	-	-	-	<1	0.1	0.1	0.2	0.6	0.3	0.4	-	-	-	-	-	-	-	-
Pseudomelatoma torosa	-	-	-	0.1	0.3	<1	0.3	-	0.1	0.1	0.2	0.4	-	<1	-	-	<1	-	-	-	-	-	-	-
Pugettia spp.	0.5	<1	0.2	1.2	0.8	0.8	1.0	0.3	0.5	0.7	0.5	0.2	0.4	0.4	0.2	0.1	0.6	<1	0.1	0.1	0.1	-	-	<1
Pyura haustor	-	-	-	-	-	-	-	<1	<1	<1	-	0.5	0.2	<1	-	-	-	-	-	-	-	-	-	-
Sabellidae	0.8	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	0.4
Scyra acutifrons	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
Serpulidae unid.	-	-	-	0.4	0.3	0.4	0.4	1.0	0.1	<1	-	0.8	-	0.1	<1	0.8	2.8	0.4	0.6	0.6	1.1	0.4	0.1	0.3
Serpulorbis squamigerus	-	0.2	1.3	2.4	1.8	3.5	1.8	2.7	9.2	8.1	20.8	17.3	23.1	8.4	6.8	3.4	2.3	0.4	0.5	-	0.5	-	0.3	0.7
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	0.3	<1	-	-	-	-	-	-	-	<1	0.1	-	0.4	-	0.9	0.4	0.8	0.4	1.1	1.8	-	-	24.1	4.6
Tegula pulligo	0.8	-	1.2	0.5	0.2	0.4	0.3	0.3	-	0.4	<1	0.3	0.2	0.1	-	-	<1	<1	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Triopha maculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-
Tritonia festiva	-	-	-	-	-	0.1	<1	-	<1	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 3 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Acmaea mitra	5.3	5.8	10.7	3.3	7.0	4.5	10.5	10.8	17.1	23.9	8.4	6.3			3.2	5.6	8.4	7.5	9.9	10.1	2.3	2.3	0.4	4.5
Anthopleura elegantissima	1.3	6.0	6.1	5.0	10.1	9.8	5.6	4.5	6.5	5.8	6.8	8.2			4.5	7.1	10.8	9.0	14.4	15.1	11.5	12.6	8.1	22.6
Asterina miniata	10.0	15.6	17.5	13.5	18.6	15.7	14.8	9.5	1.6	0.3	0.7	0.3			0.5	0.6	2.2	1.4	1.3	1.6	1.5	3.0	0.1	0.7
Calliostoma ligatum	-	1.3	3.5	4.5	3.4	1.8	3.4	3.0	3.0	8.4	9.6	5.7			0.2	0.8	-	-	-	-	-	-	-	-
Cancer antennarius	-	0.2	<.1	0.2	-	-	0.2	<.1	-	-	<.1	-			-	-	0.1	0.1	-	-	-	-	-	-
Diopatra ornata	8.3	15.1	22.4	25.8	20.7	10.6	8.3	4.6	6.3	5.5	5.8	8.6			6.9	20.7	23.7	19.4	16.3	20.6	26.0	28.5	21.5	11.3
Eudistylia polymorpha	-	0.3	-	-	0.5	0.3	0.3	0.3	0.4	0.5	-	0.3			-	0.1	-	-	-	-	-	-	-	1.7
Leptasterias spp.	-	0.4	0.5	0.1	0.3	1.0	0.4	<.1	0.1	<.1	0.1	<.1			-	<.1	0.1	-	<.1	-	-	-	-	-
Lithopoma gibberosum	2.5	2.2	1.5	1.4	6.8	2.8	2.6	1.2	0.5	1.0	1.3	1.1			0.3	-	-	<.1	-	-	0.3	1.6	-	<.1
Pagurus spp.	1.8	5.2	5.8	15.2	15.5	18.0	22.8	19.7	17.3	15.0	7.6	18.7			5.1	9.3	6.3	4.9	0.6	0.5	-	1.3	-	1.7
Parastichopus spp.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.1	0.3
Pisaster giganteus	0.5	0.2	0.4	0.3	0.3	-	<.1	<.1	<.1	<.1	-	<.1			0.6	1.9	2.4	0.9	1.7	0.9	2.3	1.0	0.5	0.7
Pisaster ochraceus	-	-	0.1	-	<.1	-	<.1	<.1	0.2	-	-	-			-	<.1	<.1	<.1	-	-	-	-	-	-
Pycnopodia helianthoides	-	0.8	1.0	1.3	0.8	0.6	0.3	0.4	0.3	0.2	0.3	0.4			0.4	0.2	0.4	0.4	0.2	0.4	-	0.8	-	-
Styela spp.	2.0	3.4	2.3	1.0	0.3	<.1	0.2	<.1	0.8	0.9	0.9	0.3			1.0	1.0	0.6	<.1	0.3	-	0.5	2.1	0.9	0.9
Tegula brunnea	18.0	67.8	68.9	96.0	79.9	72.8	80.5	41.3	34.6	22.3	44.1	107.1			7.1	33.2	24.9	0.8	4.5	18.0	3.0	5.3	-	0.8
Tegula montereyi	-	5.5	2.4	1.3	4.9	3.5	6.5	0.5	1.6	2.6	0.6	3.9			0.6	0.2	-	0.2	-	0.4	-	0.4	-	-
Tethya aurantia	-	0.4	0.8	1.3	1.0	1.4	1.1	0.7	1.4	0.8	1.0	0.8			0.7	0.8	1.0	1.1	0.9	0.6	0.3	1.0	-	-
Tonicella lineata	-	0.5	6.2	2.8	5.3	4.0	6.9	5.0	3.9	11.6	3.8	7.4			2.4	2.1	3.4	0.8	0.9	0.4	-	0.4	-	0.6
Urticina spp.	-	-	<.1	<.1	<.1	-	<.1	-	-	-	-	<.1			<.1	0.1	<.1	-	0.3	-	-	0.1	-	0.2
Only Counted if Greater than 1*																								
Aeolidiacea unid. a	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	0.1
Anthopleura artemisia	-	0.3	0.2	0.5	<.1	<.1	0.3	-	0.6	0.1	0.3	0.3			0.3	0.8	0.3	0.5	0.6	0.1	0.5	0.4	0.5	0.6
Anthozoa unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	0.8	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	<.1	-			<.1	<.1	0.3	0.3	1.4	0.1	-	-	3.0	0.1
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	<.1	0.3	-	-	-	-	-	1.6
Aplysia vaccaria	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.8	0.6
Archidoris spp.	-	0.3	2.8	1.0	0.6	0.5	0.3	0.2	0.4	<.1	0.3	0.3			0.6	1.6	<.1	-	0.5	-	-	0.1	-	-
Balanophyllia elegans	4.0	0.5	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Balanus spp.	0.8	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	0.1	0.4	-	-	<.1	-	<.1	-	0.6	0.6			0.9	0.8	1.0	1.4	0.4	-	-	1.0	0.5	1.7
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Cactosoma arenaria	-	-	-	-	-	-	-	-	-	-	-	-			-	-	1.4	-	-	-	-	-	-	-
Cadlina spp.	-	<.1	-	-	<.1	<.1	-	-	-	<.1	-	-			-	-	-	<.1	<.1	-	-	0.1	-	-
Calliostoma annulatum	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Cancer productus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Cancer spp.	-	-	-	-	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Ceratostoma foliatum	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-	-	-	-	-
Chama spp.	-	-	-	-	-	-	-	-	-	-	0.1	-			-	-	-	-	-	-	-	-	-	-
Chromodoris macfarlandi	-	-	-	-	-	<.1	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	0.1
Cirratulidae/Terebellidae unid.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Clausocalanus spp.	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	-	0.1	0.2	-	-	-	1.0	0.6	0.3			0.6	0.5	0.4	0.3	<.1	0.8	-	0.4	-	0.2
Conus californicus	-	-	-	-	-	-	-	-	-	0.2	0.4	0.2			-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Only Counted if Greater than 1* (continued)																								
Craniella arb	-	-	-	-	-	-	-	-	-	-	-	-			0.1	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	<.1			<.1	0.2	0.8	0.4	1.5	2.1	4.3	2.0	0.1	0.4
Cryptolithodes sitchensis	-	-	-	-	-	-	-	-	<.1	<.1	-	0.1			-	0.3	-	-	-	-	-	-	-	-
Cucumaria spp.	-	0.4	0.3	0.2	-	0.3	-	-	0.1	0.1	<.1	-			-	-	-	-	0.2	-	0.3	-	-	-
Diaulula sandiegensis	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Diodora spp.	-	-	<.1	-	-	-	-	-	-	0.2	0.3	<.1			-	<.1	-	<.1	-	-	-	-	-	<.1
Doriopsilla albopunctata	-	<.1	1.2	2.6	0.8	0.5	1.2	0.4	1.0	2.4	1.6	2.1			1.1	0.6	2.8	0.8	0.7	0.6	0.3	0.6	-	1.9
Epiactis prolifera	0.3	-	<.1	0.1	-	-	-	-	-	<.1	0.4	0.1			0.1	0.2	0.6	-	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	0.3	0.2			<.1	-	-	-	-	-	-	0.1	-	0.2
Fissurella volcano	-	-	-	-	-	-	<.1	-	<.1	<.1	0.5	-			-	<.1	-	-	-	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Halcampa decemtentaculata	0.3	0.5	-	0.8	-	-	1.2	0.8	0.4	1.8	-	-			-	<.1	-	3.2	0.9	-	-	-	1.3	0.4
Haliotis spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.1	-	<.1
Henricia leviuscula	-	-	0.2	-	0.1	<.1	<.1	-	-	-	-	-			<.1	-	0.2	-	<.1	0.1	-	-	-	-
Hermissenda crassicornis	-	-	-	0.1	0.1	-	-	-	-	-	-	-			-	-	-	-	-	0.5	-	-	-	1.6
Holothuroidea unid. a	-	-	-	0.3	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Kelletia kelletii	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	0.3	0.5	0.5	-
Leucandra heathi	-	0.2	0.9	2.8	-	<.1	0.2	-	-	0.1	0.1	-			-	-	-	-	-	-	-	-	-	-
Leucilla nuttingi	1.5	1.9	0.6	-	-	0.3	-	-	-	-	0.2	-			-	-	-	-	-	-	-	-	-	-
Lissothuria nutriens	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Lottia instabilis	-	2.8	1.1	1.6	2.1	5.7	3.2	2.4	2.8	1.0	0.4	0.4			1.1	1.4	-	0.3	0.3	0.5	-	0.1	-	-
Lottia ochracea	-	-	-	-	-	-	-	-	-	0.3	-	-			<.1	<.1	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	<.1	-	-	0.3	0.3	-	0.3	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.3	-	-
Melibe leonina	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	0.2	-	<.1	0.1	-	0.3	-	-
Mitra idae	0.8	0.9	1.8	1.5	2.1	0.9	1.6	0.8	1.6	1.1	1.2	1.3			0.8	1.1	1.1	0.8	0.7	2.6	1.3	5.3	4.6	5.8
Mopalia spp.	-	<.1	-	-	<.1	0.2	-	-	<.1	-	0.1	-			-	-	-	<.1	-	-	-	-	-	-
Nassarius spp.	-	-	-	-	-	-	-	-	-	-	0.1	-			-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	<.1
Nemertea unid.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	0.5	0.3	0.7	2.1	1.0	0.3	-	<.1
Ocenebra spp.	-	-	-	-	-	-	-	-	-	-	<.1	-			-	<.1	-	-	-	-	-	-	0.1	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	<.1	0.1	0.3	-	-	<.1
Ophioplocus spp.	-	-	0.1	-	<.1	-	-	<.1	-	<.1	-	-			-	-	1.6	0.4	0.2	0.5	0.3	0.4	-	0.3
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	<.1	-			0.3	0.2	1.0	0.3	1.2	-	-	0.8	-	-
Orthasterias koehleri	-	0.2	<.1	0.2	0.1	-	-	<.1	-	-	-	-			-	-	-	-	<.1	-	-	-	0.1	-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	-	-	0.2	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	<.1	0.2	<.1	0.4	<.1			0.6	0.2	0.8	0.3	0.3	0.5	-	0.1	-	<.1
Phragmatopoma californica	-	-	14.5	28.8	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pisaster brevispinus	-	-	-	-	<.1	-	-	-	-	0.1	-	<.1			-	0.3	0.3	<.1	0.7	0.5	0.3	1.3	0.3	0.3
Pisaster/Henricia (juv.)	-	-	-	0.1	-	-	<.1	-	-	-	-	-			-	-	0.1	-	-	-	-	-	-	-
Pista spp.	0.5	2.7	1.2	-	-	-	-	0.8	-	-	-	0.2			0.6	0.4	<.1	-	0.3	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	<.1	-	-	-	-	0.1	0.1	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 - South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Only Counted if Greater than 1* (continued)																								
Pododesmus cepio	-	-	-	-	-	-	-	-	-	<.1	0.1	1.4			0.6	0.2	-	-	-	-	-	-	-	0.3
Protothaca laciniata	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pseudomelatoma torosa	-	-	-	0.7	0.5	0.4	0.3	0.3	0.3	-	0.4	0.7			-	0.1	-	-	-	-	-	-	-	-
Pugettia spp.	0.3	<.1	<.1	-	0.9	0.3	0.5	0.5	0.4	0.7	0.2	0.4			0.3	0.4	0.6	0.2	-	-	-	1.4	-	0.3
Pyura haustor	-	-	-	-	0.2	<.1	0.1	<.1	0.2	0.2	0.1	0.3			0.1	<.1	-	-	0.3	0.1	-	-	-	0.2
Rictaxis punctocaelatus	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Sabellidae	0.3	-	-	<.1	-	-	-	-	-	<.1	-	-			-	0.1	-	<.1	-	0.1	0.3	-	0.8	1.1
Scyra acutifrons	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.4	-	-
Serpulidae unid.	0.8	-	-	2.0	-	1.0	0.3	0.4	0.2	0.4	0.2	-			<.1	0.3	0.8	1.4	0.4	1.4	0.3	1.5	0.3	7.4
Serpulorbis squamigerus	0.3	0.3	2.4	2.5	2.5	10.5	9.3	6.6	13.7	9.8	19.3	16.4			3.3	2.1	1.4	0.9	0.2	0.6	-	0.4	1.0	2.1
Sipuncula unid.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	<.1	-	-	-	-	-	-	-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	<.1			<.1	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	-	<.1	<.1	-	-	0.2	0.3	0.3			0.3	0.4	1.5	1.2	2.8	11.9	3.8	0.4	26.6	55.9
Tegula pulligo	1.0	-	1.1	2.2	0.5	0.6	0.8	<.1	0.1	<.1	-	2.2			0.1	-	0.1	-	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	<.1	-	-	-	0.3	0.1	-	-
Tritonia festiva	-	-	-	-	-	0.6	<.1	-	<.1	-	-	<.1			<.1	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	0.3	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size																								
Acmaea mitra	3.0	2.3	3.3	7.5	3.3	4.3	4.3	1.5	12.8	6.2	2.3	2.3	6.0	0.6	0.9	-	1.7	1.8	2.3	10.1	22.9	0.8	4.1	2.4
Anthopleura elegantissima	1.3	2.4	1.9	4.1	4.1	2.4	4.2	3.5	3.0	3.3	3.8	3.8	8.1	4.3	3.4	4.9	6.9	4.2	4.9	4.9	7.0	1.0	4.4	5.1
Asterina miniata	16.5	19.8	17.1	18.8	23.1	19.8	30.4	25.3	2.3	2.1	2.9	2.8	5.7	4.8	7.4	7.3	9.7	6.3	6.0	7.5	9.4	9.0	0.9	1.8
Calliostoma ligatum	-	-	-	0.2	1.3	0.8	1.5	0.3	1.0	1.1	2.6	3.5	2.5	3.4	3.4	1.3	1.1	1.0	1.1	2.3	9.0	3.0	1.1	2.1
Cancer antennarius	-	0.1	-	0.1	<.1	0.2	-	<.1	-	-	0.1	-	-	-	0.1	-	<.1	<.1	<.1	-	0.4	-	-	-
Diopatra ornata	-	-	<.1	0.5	1.4	1.0	2.2	0.3	3.3	2.6	3.3	6.9	6.8	5.1	2.9	2.3	1.9	1.8	1.3	4.5	3.6	2.8	1.6	1.3
Eudistylia polymorpha	-	0.1	-	-	-	0.4	<.1	<.1	<.1	0.2	-	-	<.1	0.3	-	-	0.1	-	-	-	0.1	-	-	-
Leptasterias spp.	2.3	0.8	0.6	1.6	0.5	3.8	3.2	0.3	0.9	0.8	1.0	0.8	1.3	0.9	0.4	1.0	0.4	0.8	0.3	0.1	0.5	-	1.0	0.9
Lithopoma gibberosum	2.0	1.0	0.4	1.3	4.1	1.1	0.9	<.1	1.3	<.1	0.4	0.5	0.7	0.4	0.1	0.2	0.2	-	<.1	0.4	0.5	0.3	0.1	0.2
Pagurus spp.	2.8	11.3	5.8	14.9	10.9	17.6	10.9	14.4	12.5	10.0	6.0	14.0	10.1	6.0	6.4	10.2	8.9	5.1	3.2	15.0	3.8	1.3	2.4	4.6
Parastichopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-
Pisaster giganteus	-	0.3	<.1	0.1	<.1	-	-	<.1	-	0.1	0.1	0.2	-	0.2	0.2	0.2	0.6	0.6	0.3	0.1	0.6	0.5	-	0.1
Pisaster ochraceus	-	-	<.1	0.1	<.1	<.1	-	-	0.2	<.1	-	-	0.2	-	<.1	0.2	-	-	-	0.1	0.1	-	-	0.1
Pycnopodia helianthoides	1.0	0.5	1.2	0.4	0.8	0.9	0.3	0.8	0.3	0.3	0.9	0.6	0.8	0.7	0.8	0.9	0.5	0.6	0.3	0.3	0.1	0.8	0.3	0.3
Styela spp.	-	-	-	0.6	0.6	0.3	0.4	-	1.0	3.3	1.8	2.5	3.7	0.9	0.9	-	0.5	0.2	0.1	-	0.4	0.8	0.4	0.4
Tegula brunnea	8.3	21.0	20.0	76.7	58.5	78.3	56.8	24.0	67.8	75.8	57.0	67.8	44.5	42.9	64.1	104.3	97.3	101.0	70.9	104.6	102.0	60.0	115.9	96.2
Tegula montereyi	-	0.4	0.5	0.2	-	2.0	1.0	0.3	0.5	2.3	-	1.3	0.5	0.4	-	3.0	1.1	0.3	-	1.5	3.0	-	-	-
Tethya aurantia	-	-	0.3	-	-	-	-	-	-	<.1	-	-	0.4	-	-	-	-	-	-	-	0.1	-	-	-
Tonicella lineata	3.0	1.9	2.3	14.4	13.5	9.5	15.0	7.8	16.0	6.2	4.9	4.0	12.0	1.1	2.4	1.5	3.9	3.5	4.3	5.6	33.0	3.0	7.9	5.4
Urticina spp.	-	-	0.2	<.1	0.3	-	-	-	-	-	-	-	<.1	<.1	-	-	0.1	<.1	0.1	0.1	-	-	-	<.1
Only Counted if Greater than 1"																								
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Anthopleura artemisia	-	-	-	<.1	-	0.3	0.3	-	-	0.4	-	0.2	0.6	0.3	0.7	0.4	0.1	0.6	0.3	0.3	0.4	-	-	0.3
Anthopleura xanthogrammica	-	-	-	-	-	-	-	-	0.2	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthozoa unid.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Archidoris spp.	-	-	0.3	-	0.4	0.3	-	<.1	0.3	-	-	0.2	<.1	0.3	<.1	<.1	0.1	-	-	-	-	-	-	-
Ascidia spp.	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	-	-	-	-	-	-	-	0.2	0.1	-	1.3	0.1	-	-	-	-	-	-	-	-	-	-
Cactosoma arenaria	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Cadlina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Calliostoma annulatum	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Ceratostoma foliatum	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clavelina huntsmani	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	-	-	-	-	-	<.1	0.2	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	0.3	<.1	-	0.3	-	0.8	0.3	0.3
Cryptolithodes sitchensis	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	<.1	-	-	-	-	-	-
Cucumaria spp.	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-
Dendronotus spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-	-	<.1	-	-	-	-	<.1
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Doridacea unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	0.2	0.4	0.2	<.1	0.3	<.1	<.1	0.7	1.5	0.7	0.3	0.8	0.3	0.2	0.9	0.3	0.2	-	-	-	-	0.4
Epiactis prolifera	1.3	0.1	-	<.1	-	<.1	-	<.1	-	0.3	1.5	0.6	1.8	1.6	0.9	0.8	0.6	0.3	<.1	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-
Fissurella volcano	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Only Counted if Greater than 1" (continued)																								
Halcampa decemtentaculata	-	0.9	-	1.4	0.7	-	3.1	-	0.4	1.7	-	1.5	1.3	3.1	4.1	5.2	1.6	0.3	-	-	-	-	-	-
Haliotis spp.	1.0	1.1	0.2	<.1	<.1	-	<.1	<.1	-	<.1	-	-	<.1	-	<.1	<.1	0.1	0.2	-	-	-	-	-	-
Henricia leviuscula	-	-	-	0.1	0.2	-	0.3	-	-	-	-	-	-	-	0.4	-	0.4	0.3	<.1	-	-	-	-	-
Heptacarpus spp.	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	0.2	-	-	0.2	-	<.1	-	-	0.2	-	0.3	0.2	0.5	-	0.2	0.2	-	-	-	-	0.4
Hopkinsia rosacea	-	0.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	0.2	0.2	<.1	-	-	-	0.3	<.1
Ischnochitonidae	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Leucandra heathi	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Lottia instabilis	-	-	-	-	0.7	2.2	1.5	-	1.4	6.8	7.8	3.8	9.3	6.4	5.0	3.3	4.4	4.8	1.1	1.9	-	0.5	0.4	0.4
Lottia ochracea	-	-	-	-	-	-	-	-	-	<.1	-	1.8	-	-	-	-	-	-	-	-	-	-	-	0.4
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-	-	-	-	-
Mimulus foliatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Mitra idae	-	-	0.2	-	0.2	-	-	-	0.5	0.4	0.4	0.3	0.5	<.1	-	-	-	0.2	0.1	0.3	-	-	-	<.1
Mopalia spp.	0.3	0.1	<.1	0.4	0.3	<.1	0.3	0.3	0.5	0.3	0.4	0.2	0.7	0.2	<.1	-	<.1	0.3	<.1	0.3	0.3	0.3	0.3	-
Nemertea unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Ocenebra spp.	-	-	-	-	-	-	-	-	-	-	0.1	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-
Ophiothrix spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	0.1	-	-	-	-	-
Orthasterias koehleri	-	-	-	0.1	-	-	-	<.1	-	-	-	<.1	-	-	<.1	-	0.1	-	-	-	0.1	-	-	-
Petrolisthes spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.4	-	0.5	<.1	-	-	-	-	-	-	0.3
Phragmatopoma californica	-	-	4.2	4.4	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pisaster brevispinus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	-	0.1	0.3	0.2	-	-	-	-	0.1	-	-	0.1	<.1	-	<.1	<.1	-	-	-	-	0.5	0.2
Pista spp.	0.5	-	-	-	-	-	-	-	-	-	-	0.2	0.3	0.1	-	-	<.1	-	-	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	0.1	<.1	<.1	-	-	-	-	-	-	-	<.1	0.5	<.1	-	-	-	-	-	-	-	-	-	-
Polychaeta unid.	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudomelatoma torosa	-	-	-	-	-	<.1	-	-	1.1	<.1	0.6	0.4	0.3	0.2	<.1	0.3	-	0.2	-	0.1	-	-	-	-
Pugettia spp.	0.8	0.1	-	0.9	0.2	0.7	0.7	0.3	<.1	0.2	-	-	0.2	-	0.3	0.4	0.4	<.1	0.2	-	-	0.3	0.3	-
Pyura haustor	-	-	-	-	-	-	-	-	0.6	0.3	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Sabellidae	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Serpulidae unid.	-	-	-	0.4	1.6	0.5	-	<.1	0.3	-	-	-	0.8	0.2	-	-	0.6	0.6	-	-	-	-	1.0	1.0
Serpulorbis squamigerus	-	0.5	2.1	3.2	3.7	1.6	3.5	4.3	3.9	16.9	6.5	6.3	20.5	13.0	4.3	5.5	1.3	1.8	1.5	2.1	-	-	-	0.9
Strongylocentrotus purpuratus	0.5	0.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.1	-	0.3	-
Tegula pulligo	0.3	-	<.1	0.1	-	-	-	-	<.1	-	-	-	-	<.1	-	-	<.1	0.2	-	-	-	-	-	-

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 2 at -6m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Acmaea mitra	18.0	7.9	12.8	26.1	16.9	7.0	8.1	4.3	4.3	7.7	17.8	20.0			2.4	3.0	9.9	6.3	4.3	5.6				3.3
Anthopleura elegantissima	9.3	9.0	5.7	10.7	10.6	11.3	12.5	12.2	7.3	13.8	9.0	10.6			6.6	5.4	7.6	4.2	10.1	5.3				6.3
Asterina miniata	24.8	29.1	18.4	18.2	21.3	39.3	33.1	46.4	9.8	10.4	12.5	11.9			14.0	17.3	15.1	10.3	15.1	11.8				8.2
Calliostoma ligatum	0.8	1.1	1.0	1.7	0.4	1.8	3.0	1.5	3.3	9.2	9.5	6.3			5.3	5.0	4.7	3.0	2.1	8.6				1.5
Cancer antennarius	-	-	<.1	0.2	-	-	-	-	-	-	-	<.1			-	-	-	-	<.1	-				-
Diopatra ornata	1.0	2.6	1.0	5.7	3.6	9.1	9.1	4.9	3.6	2.4	6.7	1.9			2.8	2.7	0.9	2.2	1.9	0.9				3.8
Eudistylia polymorpha	2.5	2.4	0.3	0.2	2.4	1.0	1.4	0.7	4.5	0.9	2.6	4.1			0.8	0.3	0.5	0.2	<.1	0.1				-
Leptasterias spp.	1.5	0.6	0.8	0.9	0.5	2.8	2.3	1.2	0.4	0.6	1.1	1.6			0.2	0.4	0.8	0.3	0.4	0.5				-
Lithopoma gibberosum	-	1.1	3.8	9.4	5.3	3.9	3.4	1.8	2.5	0.2	1.0	2.6			0.4	0.3	0.9	<.1	-	0.3				0.2
Pagurus spp.	0.8	3.4	2.6	6.9	9.3	20.8	19.8	15.8	18.9	9.9	7.6	9.2			3.0	9.5	5.8	8.8	4.9	2.4				9.8
Parastichopus spp.	-	-	<.1	<.1	-	0.2	0.3	-	-	-	-	<.1			<.1	-	-	-	-	-				0.2
Pisaster giganteus	-	1.4	0.8	0.8	0.5	0.8	1.5	0.8	0.3	1.6	1.0	1.2			1.3	1.0	0.9	0.9	1.8	2.5				1.1
Pisaster ochraceus	-	0.8	0.2	0.7	0.5	0.4	0.3	<.1	0.3	0.7	0.3	0.4			0.2	-	<.1	-	-	-				0.2
Pycnopodia helianthoides	0.3	0.3	-	0.6	0.4	<.1	0.2	0.3	0.3	0.3	0.2	0.3			0.5	0.7	0.3	-	0.3	-				<.1
Styela spp.	5.5	4.5	1.0	5.7	5.0	10.3	10.6	4.6	4.7	22.7	29.9	24.5			20.7	12.4	8.4	1.3	2.6	2.5				0.6
Tegula brunnea	3.0	14.6	18.8	40.9	73.1	35.8	80.3	28.3	89.5	78.6	99.3	66.3			15.9	22.3	35.1	39.5	24.4	34.5				44.5
Tegula montereyi	-	3.0	2.0	1.5	1.1	1.0	5.4	-	0.8	1.7	3.5	2.5			0.8	1.5	3.8	1.0	2.4	0.8				-
Tethya aurantia	-	0.1	<.1	0.5	1.0	-	0.3	<.1	1.0	1.0	0.8	2.4			0.1	0.2	0.6	0.3	0.3	0.5				0.4
Tonicella lineata	11.3	13.5	12.3	31.3	31.9	7.3	17.1	9.0	24.0	9.5	5.8	10.3			1.7	1.5	3.9	8.3	7.5	5.6				2.8
Urticina spp.	-	-	0.5	0.3	0.8	0.3	0.3	<.1	0.3	0.2	0.8	0.5			0.1	<.1	<.1	<.1	0.1	-				0.2
Only Counted if Greater than 1*																								
Aldisa sanguinea	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-				-
Anthopleura artemisia	-	-	<.1	0.2	1.3	1.1	0.6	0.3	-	0.6	-	<.1			0.3	<.1	0.3	<.1	0.3	0.5				0.2
Anthozoa unid.	-	-	-	0.3	1.0	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Archidoris spp.	0.8	0.1	<.1	0.3	-	0.3	-	-	0.3	0.3	0.6	0.5			0.6	<.1	0.1	0.3	-	0.1				<.1
Balanophyllia elegans	36.8	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Balanus spp.	-	-	-	-	-	-	0.1	-	0.7	-	-	-			-	-	0.4	-	-	-				-
Boltenia villosa	-	-	-	0.7	0.4	0.6	0.4	0.5	0.8	4.2	1.9	5.4			1.6	0.4	0.5	1.4	0.3	-				-
Calliostoma annulatum	-	-	-	-	-	-	0.1	-	-	-	0.3	<.1			0.2	-	-	-	-	-				-
Calliostoma canaliculatum	-	-	-	-	-	-	-	-	-	<.1	0.3	-			-	-	-	<.1	-	-				-
Cancer spp.	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	0.1	-	-	-				-
Ceratostoma foliatum	-	0.6	-	<.1	0.1	<.1	-	<.1	0.2	<.1	-	<.1			-	<.1	0.1	-	-	-				-
Chelyosoma productum	-	-	-	-	-	-	-	0.2	-	-	-	-			-	-	-	-	-	-				-
Chromodoris macfarlandi	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-				-
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	-	0.4			-	-	-	-	-	-				-
Cnemidocarpa finmarkiensis	-	-	-	-	-	0.3	<.1	-	-	1.3	0.9	1.3			0.4	-	0.1	0.7	0.2	0.1				-
Conus californicus	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-				-
Corynactis californica	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	<.1	-	-			-	<.1	-	0.3	<.1	0.1				0.4
Cryptolithodes sitchensis	-	-	-	<.1	-	0.2	-	-	<.1	<.1	0.3	0.2			-	<.1	0.2	-	0.2	0.4				-
Cucumaria spp.	-	-	-	-	-	0.7	<.1	0.3	-	-	-	0.9			<.1	0.6	-	-	0.3	-				-
Dendronotus spp.	-	-	-	-	-	-	-	-	-	-	0.4	-			-	-	-	-	-	-				-
Diaulula sandiegensis	-	-	-	-	-	-	<.1	-	-	-	<.1	-			-	<.1	<.1	-	-	-				-
Diodora spp.	-	-	-	-	-	-	-	<.1	-	-	0.2	<.1			-	-	-	<.1	-	-				-
Doriopsilla albopunctata	-	0.4	-	0.6	0.6	0.8	0.8	0.5	-	0.5	3.8	0.4			2.6	0.3	1.3	0.2	1.3	0.6				0.7

(continued)

Subtidal Arc Quadrant - Annual Invertebrate Mean Abundance/7m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Only Counted if Greater than 1" (continued)																								
Epiactis prolifera	0.3	-	-	0.1	0.8	0.5	0.3	1.3	-	0.3	1.6	0.8			1.9	0.2	0.5	<.1	-	-				-
Eupentacta quinquesemita	-	-	-	-	-	0.2	-	-	-	0.4	-	<.1			<.1	<.1	0.1	0.3	<.1	-				-
Fissurella volcano	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Flabellina iodinea	-	-	-	-	-	-	-	-	0.2	-	-	-			-	-	-	-	-	-				-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Halcampa decemtentaculata	-	-	-	-	-	0.4	0.2	-	-	0.2	-	-			-	-	-	-	-	-				-
Haliotis spp.	-	-	-	0.3	0.3	<.1	0.6	0.8	0.6	0.5	0.3	1.0			-	-	0.6	1.0	0.1	0.1				-
Henricia leviuscula	-	0.3	-	0.3	-	0.6	0.6	0.2	-	0.3	-	0.2			1.7	0.4	1.3	1.1	0.2	-				-
Hermissenda crassicornis	-	-	-	<.1	-	-	0.3	0.3	-	0.1	0.3	<.1			0.3	-	-	-	-	-				<.1
Holothuroidea unid. a	-	-	-	0.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Ischnochitonidae	-	-	0.8	0.1	-	<.1	-	-	-	-	-	<.1			-	-	-	-	-	-				-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-				-
Leucandra heathi	-	-	-	0.3	-	-	-	-	-	-	0.6	0.4			-	-	-	-	-	-				-
Leucilla nuttingi	-	-	0.3	-	-	-	-	-	-	0.3	-	0.3			-	-	-	-	-	-				-
Lottia instabilis	-	-	-	0.6	1.0	1.1	2.1	1.3	2.9	5.2	5.3	5.2			3.2	1.6	3.9	1.4	0.4	0.5				0.2
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	<.1	<.1	0.3				-
Majidae	-	0.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Mimulus foliatus	-	0.1	-	-	-	-	-	-	-	-	-	-			-	-	0.3	-	-	-				-
Mitra idae	0.5	2.0	0.9	2.3	1.6	1.0	3.8	3.1	1.3	0.9	1.8	3.2			1.3	1.7	2.7	0.4	1.2	0.8				0.2
Mopalia spp.	0.3	-	-	<.1	0.1	0.2	0.1	0.2	0.3	0.1	-	<.1			-	<.1	0.1	-	-	-				-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.2	0.1				-
Nemertea unid.	-	-	-	<.1	0.1	<.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Ocenebra spp.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-				-
Octopus spp.	-	-	-	-	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Ophioplocus spp.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	0.1	-	0.2	0.1				0.2
Ophiothrix spp.	-	-	-	-	-	0.3	-	-	-	-	-	-			<.1	0.3	0.3	1.8	0.3	-				-
Ophiuroidea unid.	0.3	0.4	-	0.1	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Orthasterias koehleri	0.8	0.6	<.1	0.3	0.3	0.6	0.4	0.3	-	0.1	0.2	<.1			0.2	0.3	0.3	0.3	0.3	-				<.1
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	<.1	-	-				-
Phidiana hiltoni	-	-	-	<.1	-	-	-	-	-	<.1	<.1	<.1			0.3	0.2	<.1	<.1	<.1	0.4				-
Phragmatopoma californica	-	-	0.3	1.9	6.3	12.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Pisaster brevispinus	-	0.3	-	0.1	-	-	-	-	-	<.1	-	-			-	<.1	-	-	-	-				-
Pisaster/Henricia (juv.)	-	-	-	0.6	0.4	-	-	-	-	-	0.2	-			0.1	-	-	-	0.1	-				-
Pista spp.	1.3	0.9	0.3	-	-	0.8	1.1	2.1	-	-	-	0.8			-	0.5	<.1	0.3	0.1	-				-
Pododesmus cepio	-	0.6	-	<.1	0.3	0.3	0.1	0.6	-	0.8	0.2	0.3			<.1	-	0.3	-	-	-				<.1
Pseudomelatoma torosa	-	-	-	-	0.3	-	0.3	-	0.2	0.4	0.4	0.5			0.1	<.1	0.1	<.1	<.1	0.3				-
Pugettia spp.	-	-	<.1	1.1	0.3	<.1	0.8	0.3	0.7	0.6	<.1	0.7			-	0.3	1.3	0.4	-	0.1				<.1
Pyura haustor	-	-	-	-	-	0.4	0.7	0.8	0.9	2.3	0.2	6.3			0.7	0.5	0.6	1.5	0.3	0.4				-
Sabellidae	1.5	-	-	-	-	-	-	<.1	-	-	-	-			-	-	<.1	<.1	-	-				-
Serpulidae unid.	0.3	-	-	4.4	4.9	-	2.7	-	3.0	0.7	0.4	0.6			-	5.0	2.6	5.2	2.1	1.5				-
Serpulorbis squamigerus	0.5	2.0	2.4	4.9	6.0	17.9	13.6	14.2	21.0	35.1	57.6	79.3			16.9	20.5	37.9	25.5	7.9	5.9				1.4
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Strongylocentrotus purpuratus	11.8	11.8	0.7	0.8	-	0.3	0.9	0.6	-	0.7	<.1	0.3			0.1	0.3	0.2	0.7	0.5	-				<.1
Stylasterias forreri	-	0.3	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-				-
Tegula pulligo	0.5	2.9	-	1.6	1.1	1.0	1.2	0.3	-	0.3	1.8	0.4			0.9	0.2	0.3	0.2	0.4	-				-
Triopha catalinae	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	-	-	0.2	-	-				-
Triopha maculata	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-				-
tunicate, solitary unid.	-	-	-	-	-	<.1	-	-	-	-	-	-			-	-	-	-	0.4	-				-

F4 – Invertebrate Abundance on Subtidal Benthic Stations (Fixed Quadrat Method)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – Field's Cove Station FC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Counted Regardless of Size																								
Acmaea mitra													0.5	0.9	0.5	0.7	0.8	0.4	1.2	1.8	1.3	1.3	0.6	1.6
Acmaeid unid. a													-	<.1	-	-	-	-	-	-	-	-	-	-
Aeolidiella oliviae													-	-	-	-	<.1	-	-	-	-	-	-	-
Aldisa sanguinea													-	-	-	0.2	-	-	-	-	-	-	-	-
Alia carinata													-	2.3	1.4	3.8	0.7	1.6	0.3	1.3	-	8.3	0.1	-
Alia spp.													0.4	0.4	<.1	-	1.5	-	0.3	1.3	0.8	-	-	0.2
Alpheus clamator													-	-	-	-	0.1	-	0.1	-	-	0.3	-	-
Amphissa spp.													0.8	1.3	0.8	1.5	0.9	1.1	0.7	1.4	0.5	6.0	1.2	0.6
Anisodoris nobilis													0.1	-	-	<.1	-	-	-	-	-	-	<.1	-
Anthopleura artemisia													-	<.1	-	-	-	-	-	-	-	-	-	-
Anthopleura elegantissima													-	<.1	-	-	-	-	-	-	-	-	0.1	<.1
Anthozoa unid.													0.8	0.1	0.7	0.2	0.2	0.1	0.6	0.2	0.3	-	0.3	0.2
Asterina miniata													-	-	0.2	<.1	<.1	-	-	0.3	0.3	0.3	<.1	0.2
Asterina miniata (juv.)													-	-	-	-	-	-	-	<.1	0.5	-	-	-
Balanophyllia elegans													-	0.4	<.1	0.3	0.2	0.1	<.1	-	-	-	-	-
Balanus spp.													-	<.1	-	-	-	-	-	-	-	-	-	-
Balanus/Tetraclita spp.													-	0.1	2.8	1.6	0.2	0.1	-	1.6	2.8	0.3	2.3	0.3
Barnacles (juv.)													-	-	-	-	-	-	-	1.5	-	-	-	-
Boltenia villosa													-	<.1	-	0.2	-	-	-	-	-	-	-	-
Brachyura unid. b (juv.)													0.1	-	-	-	-	-	-	-	-	-	-	-
Cactosoma arenaria													-	0.6	0.3	0.3	-	-	-	-	-	-	-	-
Cadlina flavomaculata													-	-	<.1	0.2	0.1	-	-	-	-	-	-	-
Cadlina luteomarginata													-	-	0.1	-	-	0.1	-	-	-	-	-	0.3
Calliostoma ligatum													1.6	0.8	1.0	0.8	0.4	-	<.1	0.3	0.3	-	0.2	0.1
Callistochiton crassicostatus													-	-	-	-	<.1	0.1	0.1	-	-	-	-	-
Cancer productus (juv.)													-	-	-	-	-	-	-	-	-	-	<.1	-
Cancer spp.													-	-	<.1	-	<.1	-	<.1	-	-	0.3	-	-
Chama spp.													-	-	<.1	-	-	-	-	-	-	-	-	-
Chromodoris macfarlandi													-	-	-	-	-	-	-	<.1	-	-	-	-
Cirratulidae/Terebellidae unid.													-	-	<.1	-	-	-	-	-	-	-	-	-
Clavularia spp.													4.9	-	1.1	2.1	1.6	3.1	2.8	-	<.1	-	0.1	-
Corynactis californica													-	-	-	-	-	-	-	-	-	-	<.1	-
Crassedoma giganteum													-	-	-	-	0.1	-	-	-	-	-	-	-
Crepidula spp.													0.1	-	0.1	-	<.1	-	0.2	-	-	0.5	-	<.1
Cryptochiton stelleri													-	<.1	-	<.1	-	-	-	-	-	-	<.1	<.1
Cryptolithodes sitchensis													-	-	<.1	<.1	-	0.1	-	<.1	-	-	<.1	<.1
Cucumaria spp.													-	0.3	<.1	0.6	0.4	-	-	-	0.3	-	-	<.1
Dendropoma lituella													0.3	-	-	0.8	0.8	1.8	0.2	1.0	-	-	0.3	-
Diaulula sandiegensis													-	<.1	<.1	-	<.1	-	-	-	-	-	<.1	-
Diodora aspera													-	0.2	<.1	0.4	<.1	-	0.1	<.1	-	-	-	<.1
Doridacea unid.													-	-	-	-	-	-	<.1	-	-	-	-	-
Doriopsilla albopunctata													-	-	<.1	0.2	<.1	0.1	<.1	<.1	-	-	-	0.1
Epiactis prolifera													0.6	0.5	0.6	1.0	0.2	0.5	0.6	-	0.3	-	1.5	0.8
Eudistylia polymorpha													-	<.1	-	-	-	-	-	-	-	-	-	-
Eupentacta quinquesemita													-	-	0.1	-	0.1	-	-	<.1	-	-	-	-
Fissurella volcano													0.3	0.7	0.5	0.9	0.6	0.3	1.6	0.6	0.8	0.5	0.6	0.5

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – Field's Cove Station FC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Counted Regardless of Size (continued)																								
Fusinus luteopictus													0.4	0.9	0.9	0.5	0.6	0.3	<.1	0.5	0.8	1.3	0.5	0.3
Grapsidae (juv.)													-	-	<.1	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata													-	-	-	-	-	-	-	0.3	0.3	-	-	-
Haliotis rufescens													-	-	-	-	0.2	-	-	-	-	-	-	<.1
Haliotis spp. (juv.)													0.3	<.1	-	-	<.1	0.1	0.2	-	-	-	-	0.1
Henricia leviuscula													-	<.1	-	0.3	0.3	0.1	<.1	0.3	-	0.3	<.1	0.1
Hermissenda crassicornis													0.1	-	0.2	<.1	0.2	0.1	0.3	<.1	-	-	0.2	<.1
Homalopoma spp.													3.0	4.0	2.5	3.9	3.4	2.9	2.9	3.6	2.3	6.5	2.9	4.1
Hopkinsia rosacea													-	-	-	-	-	0.1	-	-	-	-	0.3	0.3
Idotea spp.													-	-	-	-	-	-	-	<.1	-	-	-	<.1
Ischnochitonidae													-	-	-	-	-	0.1	-	-	-	1.0	-	-
Lacuna spp.													0.1	0.6	0.1	0.8	-	-	0.2	0.3	-	-	-	-
Lepidozona spp.													-	-	-	-	-	-	-	<.1	-	-	-	<.1
Leptasterias spp.													1.3	1.2	1.3	2.2	1.2	1.1	1.0	1.5	-	1.0	0.6	1.7
Leucandra heathi													0.4	1.0	0.3	1.3	<.1	-	-	1.0	-	-	0.1	0.8
Leucilla nuttingi													1.0	1.2	1.2	0.3	1.8	1.0	-	-	0.8	-	0.8	0.4
Lissothuria nutriens													0.6	0.6	2.4	1.5	2.4	2.1	1.1	<.1	-	1.3	1.0	0.9
Lithopoma gibberosum													-	-	-	-	-	-	-	-	-	-	<.1	-
Lithopoma gibberosum (juv.)													-	-	-	-	-	-	<.1	-	-	-	<.1	0.1
Lophopanopeus spp.													0.1	0.1	0.3	<.1	0.1	0.3	-	-	-	0.3	0.1	0.3
Lottia instabilis													-	<.1	-	-	-	-	-	-	-	-	-	<.1
Lottia ochracea													0.1	0.3	0.6	0.3	0.9	-	0.4	0.3	2.8	-	0.6	0.6
Loxorhynchus spp.													-	-	-	-	-	-	<.1	-	-	-	<.1	-
Mimulus foliatus													-	-	-	<.1	-	-	-	<.1	-	0.3	-	-
Mitra idae													-	-	-	<.1	<.1	0.1	-	0.3	0.3	-	<.1	<.1
Modiolus spp.													-	-	-	-	<.1	-	0.1	-	-	-	-	-
Mopalia lignosa													-	-	-	-	-	-	-	-	0.3	-	-	<.1
Mopalia spp.													-	-	-	-	-	-	-	-	-	0.3	-	-
Natantia unid.													0.1	-	-	-	-	-	-	-	-	-	-	-
Nereididae unid.													0.1	-	-	-	-	0.1	0.2	-	-	-	-	-
Ocenebra lurida													-	0.1	-	-	-	-	-	0.3	0.3	-	<.1	<.1
Ocenebra spp.													0.8	0.2	0.3	-	-	0.1	-	-	-	-	<.1	<.1
Ophiothrix spiculata													0.9	0.5	0.2	0.3	0.3	-	0.2	0.3	-	0.3	<.1	0.3
Ophiuroidea unid.													-	-	-	-	-	-	-	<.1	-	-	-	-
Pagurus spp.													4.3	4.9	5.1	6.9	3.1	1.3	5.7	2.9	1.3	1.5	0.9	3.4
Paraxanthias taylori													-	-	<.1	<.1	-	-	-	-	-	0.3	-	-
Pelecypoda unid. boring													21.1	4.6	14.1	10.9	8.8	14.3	9.5	3.7	5.0	5.8	5.3	3.2
Petrolisthes spp.													0.1	-	-	-	<.1	0.4	-	-	-	0.3	-	-
Phidiana hiltoni													-	-	-	-	-	-	0.1	<.1	-	-	0.3	0.3
Phragmatopoma californica													0.4	1.8	2.1	2.7	1.6	1.3	0.9	3.2	2.5	-	5.1	4.2
Phyllochaetopterus prolifica													-	-	0.3	0.8	0.1	-	0.6	0.4	1.0	-	0.5	0.2
Pisaster giganteus													-	-	-	-	-	-	-	-	0.3	-	-	-
Pisaster/Henricia (juv.)													0.1	-	0.2	-	0.3	0.8	0.2	<.1	-	-	0.1	-
Pista spp.													0.1	-	0.1	0.5	0.6	0.5	0.2	-	0.8	0.3	0.4	0.7
Platyhelminthes unid.													-	-	-	-	-	0.1	-	-	-	-	-	-
Pododesmus cepio													0.1	-	-	-	<.1	-	<.1	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – Field's Cove Station FC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	2	4	4	3	4	2	3	3	1	1	4	4
Counted Regardless of Size (continued)																								
Pseudomelatoma torosa													0.1	0.3	0.1	<.1	<.1	-	-	-	-	-	-	0.1
Pugettia producta													-	0.2	0.1	-	-	0.1	0.2	<.1	-	-	-	0.1
Pugettia richii													1.3	1.6	1.3	1.8	1.1	0.4	1.1	0.8	0.3	2.0	0.8	0.9
Pyura haustor													-	-	0.1	<.1	<.1	-	-	-	-	-	-	-
Sabellidae													-	-	-	<.1	-	-	-	0.5	-	-	0.1	-
Scyra acutifrons													-	-	-	-	-	-	-	-	-	0.3	-	-
Serpula vermicularis													-	-	-	-	-	-	-	0.2	0.5	-	-	-
Serpulidae unid.													-	-	-	-	0.1	-	0.1	-	-	-	0.1	0.1
Serpulorbis squamigerus													0.6	0.4	0.8	1.0	0.4	0.4	0.3	0.9	-	0.3	0.2	0.3
Spirobranchus spinosus													0.1	0.1	0.6	0.8	1.7	1.4	1.4	0.5	0.5	0.8	1.3	1.1
Strongylocentrotus purpuratus													-	-	-	0.4	0.4	-	0.2	0.6	-	1.5	0.3	0.6
Strongylocentrotus spp.													0.6	-	0.5	0.7	0.3	0.4	0.6	0.5	0.8	-	0.3	0.2
Styela montereyensis													-	0.1	-	-	-	-	-	-	-	-	-	-
Tegula brunnea													1.3	6.1	3.9	7.9	4.6	2.9	3.3	4.5	1.0	2.5	3.8	6.0
Tegula montereyi													-	<.1	-	-	0.2	-	<.1	-	-	-	-	-
Tegula pulligo													-	-	-	<.1	-	-	-	<.1	-	-	-	-
Tethya aurantia													-	-	-	-	0.1	0.1	<.1	-	-	-	-	-
Tetraclita rubescens													-	-	-	-	0.6	-	3.7	0.4	-	-	0.1	-
Themiste pyroides													6.6	2.6	5.8	2.8	4.2	3.4	2.6	2.3	2.0	-	2.0	1.0
Tonicella lineata													0.3	0.2	0.3	0.2	0.3	-	<.1	0.3	1.0	0.3	0.4	0.9
Tricolia pulloides													-	0.2	-	-	<.1	-	0.3	-	-	-	-	-
tunicate, solitary unid.													0.1	0.3	0.3	0.9	0.3	-	0.1	-	-	-	0.2	<.1
Coverage Based on # of 1" Squares																								
Abiet./Sertularella/Sertularia spp.													-	-	<.1	-	-	-	-	-	-	-	-	-
Barentsia spp.													-	-	0.6	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)													4.5	2.1	1.1	1.3	1.1	1.9	0.6	1.2	0.3	1.0	1.2	1.4
Bryozoa, unid. (erect)													-	-	-	<.1	-	-	-	-	<.1	-	-	-
Bryozoa, unid. (foliose)													-	-	-	-	-	-	-	<.1	-	-	-	-
Didemnum/Trididemnum spp.													2.4	1.4	1.6	0.8	1.0	0.4	0.6	0.3	0.5	1.0	0.4	0.3
Eurystomella bilabiata													1.6	0.9	1.3	0.3	1.3	1.3	2.5	0.5	0.8	-	0.3	-
Hydroida													0.4	-	<.1	-	0.1	-	-	-	-	-	-	-
Hymenamphiastra cyanocrypta													<.1	-	-	-	<.1	-	-	<.1	0.3	-	<.1	<.1
Microporella californica													-	-	-	-	-	-	-	-	-	0.3	-	-
Porifera unid. (encrusting)													6.5	3.3	5.5	2.3	2.3	1.6	1.3	1.3	2.0	5.0	1.0	1.8
Salmacina tribranchiata													7.0	2.3	1.3	1.1	1.4	0.8	0.9	0.3	0.3	-	0.2	0.2
Spirorbis spp.													1.8	0.3	0.5	0.5	0.2	<.1	0.1	<.1	<.1	0.5	<.1	<.1
tunicates, colonial/social unid.													3.6	3.9	4.0	2.3	2.9	2.3	1.8	1.5	2.3	4.8	1.5	1.4

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Acmaea mitra	-	0.5	0.5	0.1	0.2	0.3	0.8	0.5	0.3	1.0	0.9	0.6	0.6	0.8	0.5	0.8	0.2	0.8	2.6	2.8				3.0
Acmaeid unid. a	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.1	-	-	-				-
Acmaeidae unid.	0.5	0.2	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-				-
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Aeolidiella oliviae	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-				-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-				-
Alia carinata	-	5.0	10.3	4.9	13.2	7.8	5.0	3.8	5.9	6.0	6.5	4.1	1.8	2.7	1.2	1.5	0.8	0.3	0.4	-				-
Alia spp.	-	1.3	-	6.9	-	-	1.0	-	1.1	2.1	1.3	0.2	-	-	<.1	0.8	1.5	<.1	0.8	-				-
Amphissa spp.	-	0.3	-	1.6	1.5	1.6	1.3	1.0	1.8	1.7	2.4	2.4	0.8	0.1	0.3	0.3	0.3	0.3	0.3	-				-
Amphissa versicolor	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Anisodoris nobilis	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-				-
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-				<.1
Anthopleura elegantissima	-	-	-	-	-	-	-	-	-	-	-	<.1	0.2	0.3	0.3	0.2	0.3	0.4	0.4	0.5				0.2
Anthozoa unid.	2.8	0.9	-	0.1	-	-	-	0.3	0.3	0.2	0.2	0.6	0.8	0.1	0.1	0.3	0.1	<.1	-	-				-
Aphrodita spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-				-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Archidoris montereyensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Asterina miniata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	<.1	-	0.1				-
Balanophyllia elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-				-
Balanus spp.	-	-	-	-	-	<.1	-	-	-	0.6	-	-	-	-	-	-	-	-	-	0.1				-
Balanus/Tetraclita spp.	-	-	-	-	0.5	-	-	-	0.3	-	<.1	4.3	2.9	1.1	0.9	0.8	10.9	1.1	<.1	1.1				3.9
Bittium eschrichtii	-	-	2.3	0.4	0.3	1.3	0.6	-	-	-	-	<.1	-	-	<.1	0.3	0.4	0.3	0.6	-				-
Bittium spp.	-	<.1	-	1.2	-	-	-	-	-	0.2	-	-	<.1	0.1	-	0.4	-	-	-	-				0.2
Boltenia villosa	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-				-
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.3	-				-
Cactosoma arenaria	-	0.7	0.3	1.1	1.1	0.3	1.2	1.3	0.9	0.5	0.9	0.9	-	<.1	-	0.3	-	-	-	-				-
Cadlina flavomaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-				-
Cadlina luteomarginata	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Calliostoma ligatum	0.3	<.1	0.4	0.3	-	0.5	0.4	0.3	0.3	0.9	0.6	0.4	0.2	<.1	-	-	<.1	-	-	-				-
Calliostoma supragranosum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-				-
Callistochiton crassicostatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-				-
Cancer antennarius	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Cancer antennarius (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	-				-
Cancer spp.	-	-	<.1	0.1	<.1	-	-	-	-	-	-	0.1	-	-	<.1	-	<.1	-	-	-				-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Clavelina huntsmani	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Crassedoma giganteum	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	<.1	<.1	-	-	-	-				-
Crepidula spp.	-	-	-	0.3	-	-	-	0.2	0.9	0.8	0.5	0.4	<.1	-	0.1	-	-	-	-	-				-
Cryptolithodes sitchensis	-	-	-	0.4	0.3	0.2	0.3	<.1	0.2	<.1	<.1	-	-	-	-	-	-	-	-	-				-
Cucumaria spp.	2.8	0.3	-	<.1	-	-	<.1	-	-	-	0.1	0.1	0.3	<.1	0.1	-	-	-	-	-				-
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Dendropoma lituella	-	-	-	-	0.3	-	0.9	-	<.1	0.2	0.6	0.1	-	0.3	0.1	-	<.1	1.1	0.3	1.0				0.3
Diaulula sandiegensis	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-				-
Diodora aspera	-	-	-	-	-	-	-	-	<.1	<.1	-	-	<.1	-	-	0.3	0.1	0.2	0.4	-				-
Diopatra ornata	-	-	<.1	<.1	-	<.1	<.1	-	<.1	<.1	0.1	0.3	0.2	0.2	0.1	<.1	0.3	0.4	0.6	-				-
Doriopsilla albopunctata	-	-	-	<.1	-	-	0.2	-	-	0.1	0.1	-	-	-	-	-	0.2	0.1	-	-				<.1

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Epiactis prolifera	2.0	2.5	1.3	0.8	1.8	0.8	1.3	1.2	0.6	0.6	0.8	0.5	0.8	0.3	0.6	<.1	-	<.1	0.1	-				0.2
Eudistylia polymorpha	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Eupentacta quinquesemita	-	-	-	-	-	-	-	-	0.1	0.1	<.1	-	-	-	<.1	-	-	-	-	0.1				-
Fissurella volcano	-	0.3	-	0.3	0.4	0.2	0.2	<.1	0.3	1.2	1.4	0.7	1.2	1.7	2.4	1.8	0.8	1.3	3.8	0.8				0.6
Flabellina trilineata	-	-	-	-	-	0.2	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-				-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	<.1	-	-	-				-
Halcampa decemtentaculata	-	-	-	-	0.2	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Haliotis rufescens	0.3	<.1	-	<.1	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	<.1	-				-
Haliotis spp.	-	-	-	-	-	-	-	<.1	0.3	0.1	-	-	-	-	-	-	-	-	-	-				-
Haliotis spp. (juv.)	-	-	<.1	-	-	-	-	-	-	-	<.1	0.3	-	-	-	<.1	-	-	<.1	0.4				-
Henricia leviuscula	-	-	0.2	-	0.2	-	0.3	0.4	0.3	-	-	-	-	-	-	-	-	-	-	-				-
Heptacarpus spp.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Hermissenda crassicornis	-	-	-	-	-	<.1	-	-	0.1	0.1	<.1	<.1	<.1	-	-	-	-	0.2	-	-				-
Hiatella arctica	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Hiatella spp.	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Hipponix spp.	-	-	-	-	-	-	-	-	-	-	-	0.1	-	<.1	-	-	-	-	-	-				-
Homalopoma spp.	-	0.4	-	0.1	-	-	0.6	1.4	1.3	1.1	2.3	1.7	<.1	-	0.1	-	-	-	-	-				-
Ischnochitonidae	-	-	0.2	0.1	0.3	-	<.1	<.1	0.4	0.2	<.1	0.2	<.1	0.4	-	0.2	<.1	0.2	0.1	-				0.2
Isopoda unid.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Lacuna spp.	-	-	-	-	0.2	0.2	-	0.3	0.6	0.2	0.1	0.9	0.3	0.9	0.8	0.9	0.2	0.9	0.5	0.1				-
Laila cockerelli	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-				-
Lepidozona spp.	-	-	-	-	-	-	-	-	0.2	0.1	<.1	0.1	<.1	0.3	-	<.1	0.2	-	-	-				0.2
Leptasterias hexactis	4.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Leptasterias spp.	-	0.9	0.8	1.1	3.2	1.3	1.4	1.1	0.5	1.1	0.8	0.3	-	-	-	-	-	-	-	-				-
Leucandra heathi	-	-	-	0.1	-	<.1	-	0.2	-	0.2	-	<.1	-	-	0.2	-	<.1	-	-	-				-
Leucilla nuttingi	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-				-
Lissothuria nutriens	-	-	0.2	0.2	-	0.3	-	0.3	0.5	0.7	0.7	1.1	0.3	1.0	2.9	1.6	0.8	1.8	3.6	1.1				1.6
Lithopoma gibberosum	-	-	-	-	<.1	-	-	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	-				-
Lophopanopeus spp.	-	<.1	0.2	0.4	0.7	0.2	0.6	-	0.5	0.2	0.1	0.1	0.2	<.1	0.1	-	-	<.1	0.1	0.3				-
Lottia instabilis	-	-	-	-	-	-	<.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-				-
Lottia ochracea	-	0.2	0.6	0.7	0.2	<.1	0.3	-	1.5	2.9	1.8	1.9	2.0	0.9	0.6	0.8	1.5	0.9	1.5	0.8				<.1
Lottia spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-				-
Loxorhynchus spp.	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Majidae	-	1.0	0.7	0.3	<.1	-	0.6	0.2	-	-	-	-	0.2	-	-	-	-	-	-	-				-
Megatebennus bimaculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-				-
Melibe leonina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-				-
Mimulus foliatus	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-				-
Mitra idae	-	-	-	0.1	-	-	-	-	0.4	0.1	<.1	<.1	<.1	-	0.2	-	-	-	-	-				-
Mopalia lignosa	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-				-
Mopalia muscosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-				<.1
Mopalia spp.	-	<.1	-	-	-	<.1	-	-	-	0.2	-	0.1	-	0.1	-	-	<.1	-	0.1	-				-
Myxicola infundibulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Nereididae unid.	-	-	-	-	-	-	-	-	<.1	<.1	-	-	<.1	0.1	<.1	<.1	-	-	0.1	-				-
Nitidiscala spp.	1.3	-	-	-	0.2	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-	-	-	-	-	-	0.2	<.1	-	-	-	-	-	-	-	-	-	-	-				-
Ocenebra foveolata	-	-	-	-	-	-	-	-	0.1	<.1	-	-	0.3	<.1	-	-	-	-	-	-				-
Ocenebra interfossa	-	-	<.1	-	-	<.1	-	0.2	-	0.1	<.1	-	-	<.1	-	-	-	-	-	-				-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Ocenebra lurida	-	-	0.1	-	-	0.2	<.1	0.5	0.4	<.1	0.5	0.4	-	-	-	-	-	-	-	-				-
Ocenebra spp.	-	-	-	0.1	0.3	<.1	<.1	-	<.1	0.3	0.1	0.5	-	0.1	0.1	<.1	-	-	-	-				-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-				-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				0.7
Ophioplocus esmarki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	<.1	-				-
Ophiothrix spiculata	-	-	0.1	0.4	-	0.6	<.1	-	-	0.3	0.2	0.3	0.4	<.1	0.2	0.3	0.3	1.9	0.4	1.4				0.2
Ophiuroidea unid.	-	-	<.1	-	-	-	-	-	-	-	-	-	0.4	-	0.1	-	-	-	-	-				0.2
Pagurus spp.	2.0	3.8	8.7	13.3	10.3	21.2	12.7	11.4	11.4	12.4	7.7	7.1	4.9	3.7	0.8	2.9	1.9	0.3	1.5	0.1				<.1
Parastichopus parvimensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-				-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	<.1	0.4	0.2	<.1	-	-	-	-	-	-	-				-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-				-
Pelecypoda unid. boring	-	1.3	1.6	3.6	1.1	1.4	1.8	1.9	2.0	3.8	4.1	5.2	10.3	9.6	9.0	12.4	10.6	6.9	12.5	3.5				2.8
Petrolisthes spp.	-	-	<.1	-	-	-	-	-	<.1	0.2	<.1	-	-	-	-	<.1	-	-	-	-				-
Phascolosoma agassizii	-	-	-	0.3	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-				-
Phidiana hiltoni	-	-	-	<.1	<.1	-	-	-	-	<.1	<.1	0.2	0.2	0.5	0.6	0.5	0.4	0.6	0.8	1.0				-
Phragmatopoma californica	-	<.1	0.3	0.1	1.4	0.4	0.8	0.2	1.8	2.6	3.1	4.8	22.6	14.9	9.3	5.3	2.9	3.0	2.4	1.5				45.8
Phyllochaetopterus prolifica	-	-	-	0.3	0.3	1.0	0.2	0.3	0.8	0.2	1.3	1.6	1.8	2.4	1.3	1.0	1.1	4.1	1.0	1.1				0.7
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	<.1	-	-				-
Pisaster ochraceus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-				-
Pisaster/Henricia (juv.)	-	0.2	1.0	2.6	1.4	1.9	1.4	2.0	1.4	0.8	0.6	0.2	-	-	-	-	-	-	<.1	-				-
Pista spp.	0.5	0.8	0.4	1.2	0.7	0.3	0.9	0.4	2.1	1.8	1.0	1.5	0.7	0.5	0.9	1.2	2.2	2.6	2.4	7.0				5.3
Pista/Streblosoma spp.	3.0	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Pododesmus cepio	-	-	-	-	-	-	-	-	-	-	-	0.2	-	<.1	0.1	<.1	-	0.3	-	-				-
Polychaeta unid.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	-	-	-	-	-				-
Pseudomelatoma torosa	-	<.1	-	0.3	0.2	0.3	0.2	0.3	0.4	1.6	0.6	0.5	0.5	0.2	0.1	<.1	-	-	<.1	-				-
Psolus chitonoides	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Pugettia producta	-	<.1	0.1	0.4	<.1	0.3	0.2	0.3	0.8	0.2	0.3	-	<.1	0.6	<.1	0.3	-	-	-	-				-
Pugettia richii	-	-	0.9	2.2	1.9	1.4	4.3	1.3	1.7	3.3	1.6	1.3	0.5	0.8	0.2	0.8	-	0.6	0.7	-				<.1
Pugettia spp.	0.3	0.3	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Pycnopodia helianthoides	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	<.1	-	<.1	-	<.1	-	-	-	-				-
Pyura haustor	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-				-
Rostanga pulchra	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-				-
Sabellidae	2.3	<.1	-	-	-	-	-	-	-	0.1	-	<.1	-	<.1	<.1	0.4	0.1	-	-	-				-
Scyra acutifrons	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Serpula vermicularis	-	-	-	-	-	-	-	0.2	0.2	0.2	<.1	-	-	<.1	0.2	0.2	<.1	0.5	0.3	0.1				<.1
Serpulidae unid.	-	-	-	-	-	-	-	-	-	<.1	0.2	-	0.3	0.1	<.1	-	<.1	0.3	0.6	-				-
Serpulorbis squamigerus	-	-	-	0.1	0.2	0.3	0.4	0.4	0.5	0.7	1.4	1.5	0.7	1.0	0.8	0.3	0.2	0.2	0.3	0.1				0.3
Sipuncula unid.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Sphaeromatidae unid.	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-				-
Spirobranchus spinosus	-	-	-	-	-	-	-	-	<.1	-	-	0.2	0.5	0.5	0.2	0.3	0.3	1.3	1.9	0.9				1.3
Spirontocaris spp.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Stenoplax heathiana	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-				-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-				-
Strongylocentrotus franciscanus	-	-	-	-	-	-	-	-	-	-	0.1	-	0.6	-	0.2	-	0.1	-	-	-				-
Strongylocentrotus purpuratus	-	-	-	-	<.1	<.1	-	-	<.1	-	-	-	0.2	0.2	0.3	0.6	1.8	1.4	3.6	3.4				7.9

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	3	4	5	4	5	3	4	4	3	4	4	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Strongylocentrotus spp.	-	-	-	-	-	0.3	0.2	-	-	<.1	0.1	0.5	0.4	<.1	0.9	0.9	0.1	0.6	0.9	-				-
Styela montereyensis	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Tectura paleacea	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-				-
Tegula brunnea	1.0	1.8	3.9	2.1	2.9	3.5	2.1	3.2	5.9	7.0	9.8	13.1	23.3	6.4	0.3	1.3	2.3	0.2	0.5	-				0.2
Tegula montereyi	-	-	-	<.1	-	-	<.1	-	-	-	0.2	0.3	<.1	-	<.1	-	-	-	-	-				-
Tegula pulligo	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Tethya aurantia	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-				-
Tetraclita rubescens	-	-	-	-	0.5	1.0	<.1	-	-	0.2	-	0.7	-	-	0.1	-	0.4	0.2	-	-				-
Themiste pyroides	-	0.6	0.3	1.5	1.1	1.0	0.9	1.8	2.1	1.9	2.2	2.6	1.8	1.1	0.6	0.5	0.2	<.1	0.4	0.5				-
Tonicella lineata	-	0.2	0.2	0.1	0.2	<.1	0.2	<.1	0.2	0.5	0.3	0.7	0.3	0.4	0.2	-	<.1	<.1	<.1	-				-
Tricolia pulloides	-	0.4	-	-	-	-	<.1	-	1.2	1.9	0.8	1.4	1.1	1.9	1.1	0.2	0.2	-	-	-				-
Triopha catalinae	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-				-
Triopha maculata	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	<.1	-	-	-	-	-				-
Tubulanus polymorphus	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Tubulanus sexlineatus	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-				-
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	0.5	-	-	-	-	-				-
tunicate, solitary unid.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-	<.1	<.1	0.1	<.1	0.3				<.1
Coverage Based on # of 1° Squares																								
Abiet./Sertularella/Sertularia spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				<.1
Aglaophenia spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Bryozoa, unid. (encrusting)	-	0.8	0.3	0.8	1.0	0.8	0.8	1.6	0.9	1.1	1.0	1.0	0.2	1.1	0.6	0.4	0.6	0.3	0.2	0.3				<.1
Bryozoa, unid. (foliose)	-	-	-	-	-	-	<.1	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-				-
Didemnum/Tridemnum spp.	-	1.3	1.5	1.4	1.9	1.1	1.2	<.1	0.4	0.3	1.5	1.3	0.8	0.4	0.5	0.4	0.9	0.5	0.2	<.1				-
Dodecaceria fewkesi	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	<.1	0.1	0.3	<.1	<.1	<.1	-	<.1	-	-	-				-
Hydroida	-	-	-	-	-	-	-	0.2	-	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-				-
Leucosolenia spp.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-				-
Porifera unid. (encrusting)	-	1.3	<.1	0.9	0.8	0.5	0.3	0.3	0.7	1.0	0.4	0.5	<.1	0.4	0.3	0.3	0.3	0.1	0.3	<.1				0.5
Porifera unid. b (yellow)	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Porifera unid. c (orange)	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
Salmacina tribranchiata	-	-	<.1	0.3	0.2	0.5	0.4	0.4	1.1	1.0	0.4	0.4	0.3	0.2	0.3	-	0.1	0.1	0.3	-				-
Spirorbis spp.	-	2.5	0.1	0.2	0.7	0.3	0.8	0.6	0.9	1.4	0.9	0.9	0.4	0.5	0.6	0.2	0.1	0.3	<.1	<.1				0.3
tunicate, colonial unid. a (white)	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				-
tunicates, colonial/social unid.	0.8	1.2	1.1	1.2	1.6	0.8	1.4	0.8	0.6	0.7	0.9	1.3	0.8	1.4	1.4	1.0	1.5	0.6	0.6	<.1				0.2

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 3 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Acmaea mitra	1.0	0.6	0.7	0.6	0.5	0.6	1.0	1.4	1.5	3.3	0.7	0.3	0.5	1.0	0.9	1.4	1.6	0.7	2.6	3.0	1.9	2.0	-	2.0
Acmaeid unid. a	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.5	0.1	-	-	-	-	-	0.1	-
Aegires albopunctatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	<.1	-	0.1	-	-	-
Aeolidiacea unid. a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Alia carinata	-	3.0	11.9	8.3	8.3	6.7	1.6	3.8	4.7	5.3	9.4	4.7	2.0	1.1	2.8	3.8	1.7	0.3	2.1	-	-	0.8	-	<.1
Alia spp.	0.5	-	-	2.8	-	<.1	1.0	0.4	1.3	1.6	1.2	0.1	-	0.2	0.3	0.2	0.8	0.3	1.4	0.1	0.5	0.3	-	-
Alpheus clamator	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphipoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Amphissa columbiana	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphissa spp.	-	-	-	0.8	2.2	1.3	1.1	0.8	1.8	1.7	2.6	1.4	0.6	-	0.4	0.5	<.1	0.3	0.1	-	-	0.1	-	-
Amphissa versicolor	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ancula pacifica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Anisodoris nobilis	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	-	-	0.3	-	-	-
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Anthopleura elegantissima	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.3	0.3	0.3	0.2	<.1	0.4	0.4	0.6	0.6	0.4	0.4
Anthozoa unid.	-	0.2	0.5	0.2	<.1	-	-	-	0.1	0.6	0.3	0.4	0.3	0.3	0.1	<.1	<.1	<.1	<.1	-	0.1	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Archidoris montereyensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.1	-	-	-	<.1
Asterina miniata	-	-	0.2	<.1	<.1	<.1	0.4	<.1	-	-	-	-	-	-	<.1	<.1	0.1	-	-	-	-	-	-	-
Asterina miniata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Babakina festiva	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Balanophyllia elegans	-	-	-	-	-	-	-	-	-	-	<.1	0.1	-	-	<.1	-	-	-	-	-	-	-	-	-
Balanus aquila	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Balanus spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.5	<.1	-	-	<.1	0.1	-	-	-	-	-
Balanus/Tetraclita spp.	-	-	-	-	-	0.2	-	1.1	0.2	0.6	0.2	0.1	2.8	6.3	5.8	8.4	6.1	5.3	2.3	2.9	-	10.0	0.8	4.9
Barnacles (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	-	-	-	-	-	-
Bittium eschrichtii	-	-	1.1	0.5	0.5	0.3	-	<.1	-	<.1	<.1	-	-	-	0.4	-	-	<.1	-	-	-	0.1	-	-
Bittium spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	0.3	-	-	-	0.3	-	-	-	-	-
Boltenia villosa	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.2	<.1	0.1	-	-	-	-	-	-	-	-
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Cactosoma arenaria	-	-	1.9	2.5	2.9	1.7	2.3	2.2	1.2	1.1	1.4	0.6	0.3	-	<.1	<.1	-	-	-	-	-	-	-	-
Cadlina flavomaculata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Calliostoma annulatum	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	0.2	-	0.2	-	<.1	-	-	0.2	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Callistochiton crassicostatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Cancer antennarius (juv.)	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Cancer productus (juv.)	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	0.5	-	0.2	-	-	-	-	-	<.1	<.1	-	0.1	-	-	<.1	<.1	-	-	-	0.1	-	-
Chama spp.	-	-	-	-	-	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-
Chelyosoma productum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	-
Clavularia spp.	-	-	-	-	-	-	-	1.9	0.8	0.6	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Conus californicus	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Crassedoma giganteum	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	<.1	-	-	-	-	-	-
Crepidula spp.	-	-	-	-	-	0.2	<.1	0.4	<.1	0.1	0.6	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Cryptolithodes sitchensis	-	-	<.1	0.1	0.6	0.4	0.2	-	0.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Cucumaria spp.	-	0.3	-	0.2	-	-	<.1	-	-	0.1	0.1	-	0.2	0.1	0.1	-	-	-	-	-	-	-	-	-
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.2	-	-	<.1	-	-	0.1	-	-
Dendropoma lituella	-	-	-	-	-	-	0.9	-	<.1	0.3	0.3	-	-	-	0.5	0.2	-	-	-	-	-	0.5	0.1	-
Diaulula sandiegensis	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1
Diodora aspera	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	0.1	-	-	-	-	0.1	-	-	-	-	-
Diopatra ornata	0.3	-	-	-	-	<.1	0.3	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	0.1	0.1	-	<.1
Doriopsilla albopunctata	-	-	-	<.1	-	-	-	-	-	<.1	0.1	-	-	-	-	<.1	0.2	<.1	<.1	0.3	-	-	-	0.2
Epiactis prolifera	1.0	3.8	2.5	2.8	2.6	1.4	0.8	2.3	0.7	1.4	1.1	1.5	1.1	0.7	0.8	0.4	-	<.1	-	0.1	-	-	0.3	0.3
Erato vitellina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Eudistylia polymorpha	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	-	<.1	<.1	-	<.1	-	-	0.1	-	<.1	-	-	-	-	-	-	-	-
Fissurella volcano	-	<.1	<.1	-	<.1	-	-	-	<.1	0.8	1.4	0.4	0.8	1.6	2.4	1.2	0.5	0.5	2.4	1.9	0.9	1.6	1.8	0.5
Flabellina trilineata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Fusinus luteopictus	-	-	-	<.1	-	<.1	-	-	-	0.1	0.8	0.8	0.2	0.2	<.1	0.1	<.1	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-
Halcampa decemtentaculata	-	<.1	1.3	0.1	<.1	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-
Haliotis rufescens	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Haliotis spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliotis spp. (juv.)	-	-	-	-	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	-	0.1	-	-	-	-
Henricia leviuscula	1.0	-	-	<.1	-	-	0.3	0.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Heptacarpus spp.	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	0.2	-	-	-	0.1	<.1	0.2	0.1	-	-	<.1	-	0.1	-	-	<.1	0.1	-	-	-	-
Hiatella arctica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Hipponix spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Homalopoma spp.	0.3	<.1	0.4	0.8	0.6	1.6	2.4	1.8	2.3	3.1	4.2	2.6	0.3	-	-	-	-	-	-	-	-	-	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Irus lamellifer	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	0.3	0.1	0.2	0.2	0.3	0.3	0.1	0.4	0.3	0.3	0.2	0.2	0.4	0.1	0.3	<.1	0.1	-	0.1	-	-	-
Kelletia kelletii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Lacuna spp.	-	0.3	0.2	-	-	0.3	0.7	0.4	2.2	0.9	<.1	0.6	0.6	0.8	0.6	2.1	0.6	0.4	0.6	0.8	-	1.1	-	-
Lepidozona spp.	-	-	-	-	-	<.1	-	-	-	<.1	0.1	-	-	<.1	-	<.1	-	<.1	0.1	0.3	-	0.4	-	-
Leptasterias spp.	0.5	1.8	0.7	1.6	2.4	1.9	1.4	1.8	0.8	1.4	0.8	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Leucandra heathi	-	-	-	-	-	-	0.3	-	-	0.3	0.1	<.1	<.1	-	0.2	-	-	-	-	-	-	-	-	-
Leucilla nuttingi	-	-	-	-	-	-	-	-	-	0.3	<.1	0.3	-	<.1	-	-	0.2	-	0.4	-	-	-	-	-
Lissothuria nutriens	-	-	0.3	0.1	0.2	<.1	<.1	0.1	0.3	0.6	0.4	0.7	0.6	2.8	1.9	0.3	0.8	0.4	1.0	0.8	0.1	0.3	0.3	0.1
Lithopoma gibberosum	-	-	-	<.1	-	<.1	-	<.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Lophopanopeus spp.	-	-	<.1	0.8	0.3	<.1	0.3	0.1	0.1	0.2	0.1	0.1	-	-	<.1	<.1	0.1	-	-	-	-	-	-	-
Lottia instabilis	-	-	-	0.1	-	-	-	-	-	-	0.1	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	-	0.5	0.9	0.9	0.3	1.1	1.0	1.1	2.6	3.5	2.2	1.7	1.9	1.7	1.6	2.6	1.3	1.6	1.6	0.9	1.0	0.3	0.9	0.3

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Lottia spp.	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxorhynchus crispatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-
Majidae	-	<.1	0.3	0.5	0.2	-	0.7	-	-	0.1	-	-	-	0.1	-	-	-	-	-	-	-	0.1	-	-
Megabalanus californicus	-	-	-	-	-	-	-	-	-	0.1	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-
Megatebennus bimaculatus	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	<.1	<.1	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mitra idae	-	-	-	-	-	-	-	0.1	-	0.1	0.2	0.2	-	<.1	-	-	<.1	-	-	-	-	-	-	-
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.1	-	0.1	-	-	-
Mopalia lignosa	-	-	-	-	-	<.1	-	0.1	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mopalia muscosa	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.3	0.1	-	-	-	<.1	-	-	-	-	-
Mopalia spp.	-	-	-	<.1	<.1	-	-	-	-	0.1	-	<.1	<.1	-	-	-	-	0.1	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus galloprovincialis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Myxicola infundibulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-
Nereididae unid.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-
Nitidiscala spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Norrisia norrisi (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Ocenebra foveolata	-	-	-	<.1	-	-	-	-	-	-	<.1	-	0.2	-	-	-	-	-	-	-	-	-	-	-
Ocenebra interfossa	-	-	-	-	-	-	-	-	-	-	0.2	0.2	-	-	0.1	-	-	-	-	-	-	-	-	-
Ocenebra lurida	-	-	0.3	0.2	0.3	0.4	0.5	0.2	0.2	0.2	0.6	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Ocenebra spp.	-	-	<.1	0.3	-	-	<.1	-	<.1	0.2	0.2	0.3	0.3	0.2	<.1	<.1	-	-	<.1	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	2.5
Ophioplocus esmarki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	0.1	-	0.9	-	-	-	-
Ophiothrix spiculata	-	-	0.1	-	0.3	<.1	0.2	-	-	0.2	0.1	0.4	<.1	<.1	1.1	0.4	0.8	1.6	1.1	0.5	1.1	0.1	0.4	3.1
Ophiuroidea unid.	-	-	-	-	-	-	-	-	0.2	<.1	0.1	<.1	<.1	-	-	0.1	<.1	-	<.1	-	-	0.3	1.0	-
Pagurus spp.	-	1.6	6.1	5.4	7.8	17.4	12.0	5.6	7.1	8.2	5.6	6.2	3.4	1.7	1.9	1.4	2.8	1.9	1.0	0.8	1.9	0.4	0.1	-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	<.1	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	-	1.1	4.4	1.8	2.3	2.0	3.5	5.6	4.7	6.3	7.6	7.8	12.7	13.9	13.4	5.6	12.3	10.1	8.9	3.1	1.3	28.9	6.6	1.8
Petrolisthes spp.	-	-	-	-	0.3	-	-	-	-	-	-	<.1	-	-	-	0.1	-	<.1	-	-	-	-	-	-
Phidiana hiltoni	-	<.1	-	-	-	-	-	-	-	0.2	0.5	0.1	<.1	0.4	0.3	0.4	0.1	0.4	0.4	0.1	0.4	0.1	-	-
Phragmatopoma californica	-	0.8	7.6	4.3	2.3	2.8	3.3	5.5	12.4	20.6	14.7	3.2	12.3	2.8	2.4	1.7	1.3	4.3	5.8	5.4	7.4	8.3	38.3	146.1
Phyllochaetopterus prolifica	-	-	0.1	-	0.2	-	0.4	0.2	0.8	0.6	0.5	0.4	1.3	0.5	2.5	1.0	1.1	2.1	0.9	-	-	1.9	0.1	0.3
Pisaster brevispinus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.8	-
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	<.1	<.1	0.1	<.1	-	0.1	-	-	-
Pisaster ochraceus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	<.1	1.8	2.1	2.6	1.7	2.0	1.1	1.0	1.0	0.6	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-
Pista spp.	-	<.1	<.1	<.1	<.1	-	-	-	0.2	0.2	<.1	-	-	-	-	-	0.1	0.4	0.1	0.1	0.6	0.5	-	0.3
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	0.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	-	-	-	-	-	-	-	-	<.1	0.3	1.4	1.5	1.3	0.6	0.9	0.4	-	<.1	-	0.1	-	-	-
Polychaeta unid.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Polyplacophora unid. a	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Pseudomelatoma torosa	-	-	-	-	0.2	-	0.2	0.5	0.4	0.5	0.9	0.5	0.2	-	-	-	-	-	-	-	-	-	-	-
Pugettia producta	-	-	0.1	0.2	0.2	0.2	<.1	<.1	0.3	0.1	0.2	0.2	0.2	<.1	0.2	<.1	<.1	<.1	<.1	-	0.4	0.5	-	<.1
Pugettia richii	-	-	0.4	0.8	3.4	2.3	3.6	1.1	0.3	1.2	0.9	0.8	-	0.3	0.6	0.7	0.1	0.1	0.7	0.4	1.1	0.5	0.1	-
Pugettia spp.	-	<.1	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Pycnopodia helianthoides	-	-	0.1	<.1	<.1	0.3	0.2	-	<.1	<.1	-	<.1	-	-	-	0.1	<.1	<.1	<.1	-	-	-	-	-
Rostanga pulchra	-	-	-	-	-	-	<.1	0.1	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Sabellidae	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-
Serpula vermicularis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	0.4	-	-	0.1	-
Serpulidae unid.	-	0.3	0.8	-	-	-	-	-	<.1	-	<.1	-	0.8	0.2	0.3	-	-	0.8	0.9	-	-	0.4	0.4	0.2
Serpulorbis squamigerus	-	<.1	0.1	0.4	0.3	<.1	0.2	0.1	0.4	0.9	1.8	1.8	2.0	1.8	1.0	0.9	0.4	0.2	0.5	0.3	-	0.6	0.5	0.7
Sphaeromatidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Spirobranchus spinosus	-	-	<.1	-	0.2	-	-	0.1	0.3	0.1	<.1	0.4	0.5	1.3	0.9	0.5	0.5	1.3	2.7	1.3	1.8	1.6	2.4	1.6
Stenoplax heathiana	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus franciscanus	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	0.6	-	-	0.1	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	-	-	-	<.1	-	-	-	<.1	0.5	-	0.4	0.7	1.2	0.4	1.9	2.9	1.1	0.4	0.5	1.6
Strongylocentrotus spp.	-	-	<.1	-	<.1	-	0.3	-	-	<.1	0.9	0.6	-	0.8	0.8	-	<.1	0.4	<.1	-	0.5	-	-	-
Tectura paleacea	-	-	-	-	-	<.1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tegula brunnea	0.5	2.3	4.2	5.5	3.0	4.4	2.9	5.6	8.6	10.6	13.6	9.8	12.5	1.9	0.6	0.3	3.0	0.6	0.4	-	0.9	0.5	-	-
Tegula montereyi	-	0.2	-	-	-	-	-	<.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Tegula pulligo	-	-	-	<.1	-	-	-	-	-	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Tethya aurantia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Tetraclita rubescens	-	0.5	<.1	-	<.1	-	-	-	0.8	0.2	0.5	2.1	0.7	0.1	0.8	3.0	3.6	2.0	6.3	2.9	8.0	-	5.6	-
Themiste pyroides	-	<.1	1.1	0.5	0.5	0.5	0.7	1.6	2.1	2.2	1.9	0.9	1.6	0.7	0.4	0.3	0.3	<.1	-	-	-	0.1	0.1	0.1
Tonicella lineata	0.3	0.3	0.3	0.6	0.3	0.4	0.2	0.9	0.9	0.9	1.7	0.7	<.1	0.1	<.1	0.2	0.3	-	0.2	0.1	0.3	-	-	0.2
Tricolia pulloides	-	-	0.1	-	0.2	0.8	0.3	0.6	4.1	1.8	0.3	0.2	<.1	<.1	1.0	0.7	0.4	0.2	0.2	-	-	0.4	-	-
Triopha maculata	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Tritonia festiva	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Xanthidae unid.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	<.1	-	-	-	-	-	-	-	-	-	-	0.3	0.2	0.1	-	-	0.2	-	-	0.1	-	-	<.1
Coverage Based on # of 1° Squares																								
Abiet./Sertularella/Sertularia spp.	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Archidistoma psammion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-
Bryozoa, unid. (encrusting)	-	0.2	<.1	0.8	0.9	1.0	0.6	1.0	0.6	1.2	1.1	1.1	0.9	3.8	0.7	0.8	0.8	0.4	<.1	<.1	0.4	0.3	0.4	<.1
Bryozoa, unid. (erect)	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Didemnum/Tridemnum spp.	0.3	0.3	-	-	<.1	<.1	-	<.1	0.1	0.3	0.2	<.1	<.1	0.4	0.4	0.9	0.3	0.4	0.6	0.1	<.1	-	-	-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	0.3	0.3	0.3	1.2	0.2	0.6	<.1	<.1	-	-	-	-	0.1	-	-
Haliclona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-
Hydroida	-	-	<.1	-	-	-	-	-	0.2	0.9	<.1	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-
Leucetta losangelensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Leucosolenia spp.	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Membranipora spp.	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Metandrocarpa taylori	-	-	-	-	-	-	-	-	-	-	-	-	-	3.9	0.2	-	-	0.2	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 3 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	3	4	4	3	3	3	4	4	5	5	4	3	4	4	4	4	4	4	2	2	2	2	4
Coverage Based on # of 1° Squares (continued)																								
Porifera unid. (encrusting)	-	0.2	0.1	0.9	1.3	1.0	1.1	0.9	1.1	1.1	0.6	0.9	0.8	1.4	0.2	0.5	0.6	0.9	0.3	0.4	1.1	1.4	0.8	0.4
Porifera unid. c (orange)	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Salmacina tribranchiata	-	-	<.1	0.8	0.8	1.3	0.6	1.6	1.1	1.3	0.4	0.3	<.1	0.6	0.3	0.3	<.1	<.1	<.1	0.1	0.3	-	0.3	0.3
Spirorbis spp.	-	-	<.1	0.6	0.7	1.2	0.6	0.6	0.9	1.0	1.0	1.4	1.1	0.5	0.9	0.1	0.5	0.4	<.1	<.1	0.1	0.5	0.1	<.1
bryozoan unid. b	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
epiphytic bryozoan (sq.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1
tunicates, colonial/social unid.	-	1.2	0.3	0.8	0.7	1.0	1.2	1.4	2.3	2.2	1.4	1.0	0.8	1.9	1.1	0.9	0.4	0.3	0.5	0.1	0.5	0.1	0.4	0.2

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 4 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Acmaea mitra	0.5	0.5	0.9	0.5	0.9	0.7	1.7	0.4	1.6	2.0	0.7	0.9			1.7	2.2	1.3	1.3	3.4	4.9	1.5	0.5	1.3	1.2
Aegires albopunctatus	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Aeolidia papillosa	-	-	-	-	-	<.1	<.1	<.1	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Alia carinata	-	1.3	1.1	0.7	1.9	0.7	1.1	1.5	1.7	2.5	0.4	3.5			0.4	0.8	1.5	0.3	0.5	0.1	-	3.3	0.1	-
Alia spp.	-	-	-	1.2	0.8	0.3	0.1	0.5	0.2	<.1	0.6	0.3			0.8	-	0.4	0.2	0.3	0.8	0.3	-	-	-
Amphissa spp.	-	0.3	1.2	0.7	1.0	1.0	0.8	0.9	2.1	1.1	2.0	4.1			0.5	0.3	<.1	0.4	0.4	0.5	0.5	0.4	-	<.1
Amphissa versicolor	-	-	-	0.1	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Anisodoris nobilis	-	-	-	-	<.1	-	-	-	-	<.1	-	-			<.1	<.1	-	<.1	-	-	-	-	-	-
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	<.1
Anthopleura elegantissima	0.3	0.3	0.2	0.3	0.3	0.2	0.3	0.1	0.3	0.3	0.3	0.5			0.5	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.9	0.4
Anthozoa unid.	0.8	1.0	-	0.4	0.2	-	-	<.1	-	0.4	0.4	0.2			-	0.1	<.1	0.3	0.4	0.3	0.3	-	-	-
Aphrodita spp.	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	0.1	-	<.1	-	-	-	-	-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-			-	-	0.6	-	<.1	-	-	-	-	-
Archidoris montereyensis	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Asterina miniata	0.3	-	0.3	0.2	<.1	-	0.2	0.3	-	<.1	-	-			0.1	0.1	0.2	-	<.1	0.1	-	-	-	-
Balanophyllia elegans	0.3	-	0.1	0.1	0.3	0.3	0.2	0.3	0.4	0.7	0.8	0.6			0.2	0.2	0.1	0.3	-	-	-	-	-	-
Balanus aquila	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Balanus spp.	-	-	-	<.1	-	-	-	-	-	<.1	-	<.1			1.5	-	-	-	0.3	-	-	-	-	-
Balanus/Tetraclita spp.	-	-	-	-	-	<.1	0.2	<.1	-	0.2	1.1	<.1			0.5	0.6	0.9	0.4	0.6	0.9	8.5	-	0.3	2.4
Bittium eschrichtii	-	-	0.3	0.2	0.2	-	-	-	-	0.1	-	-			0.2	1.1	<.1	0.1	0.3	0.3	-	-	-	-
Bittium spp.	-	-	-	-	-	-	0.1	0.4	-	-	-	0.3			-	-	0.9	0.1	-	-	-	-	0.3	-
Boltenia villosa	-	-	-	-	-	-	<.1	0.3	-	-	<.1	<.1			-	-	0.2	<.1	-	0.1	0.3	-	0.1	-
Cactosoma arenaria	-	-	2.4	3.1	1.9	2.9	2.1	1.8	0.4	0.5	0.2	<.1			-	-	-	-	-	-	-	-	-	-
Cadlina flavomaculata	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	0.8	-	0.1	0.3	0.4	0.3	0.3	0.3	<.1	0.5	0.5	0.5			-	<.1	-	<.1	-	-	-	-	-	-
Calliostoma spp.	-	-	-	-	-	-	-	-	-	<.1	-	<.1			<.1	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Cancer antennarius (juv.)	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	<.1	-	-	-	<.1	-	<.1	-	-	<.1			-	0.2	-	-	0.3	0.1	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-			0.2	-	<.1	-	-	-	-	-	-	<.1
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	-	-			0.4	1.6	-	-	<.1	-	-	-	1.3	-
Clavularia spp.	-	-	-	-	-	-	-	2.3	0.7	4.0	1.4	4.4			-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	<.1	-	-	-	-	-	-	0.1	0.2	-			-	-	-	-	-	-	-	-	-	-
Conus californicus	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Crassedoma giganteum	-	-	<.1	-	-	-	-	-	-	<.1	0.2	0.3			0.3	<.1	0.1	0.1	<.1	-	-	-	-	-
Crepidula spp.	-	-	0.4	-	-	1.4	0.6	0.6	0.5	0.7	1.2	0.2			<.1	-	-	-	-	-	-	-	-	-
Cryptolithodes sitchensis	-	-	-	<.1	0.2	0.3	0.1	0.2	0.2	0.2	<.1	<.1			-	<.1	-	-	<.1	0.1	-	-	-	-
Cucumaria spp.	-	-	<.1	0.3	<.1	0.3	0.4	0.3	0.4	1.1	0.4	0.4			-	-	0.1	-	-	-	-	-	-	-
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	<.1	0.2	-			<.1	-	0.1	-	<.1	0.3	-	-	-	0.1
Dendropoma lituella	-	-	-	0.2	-	1.8	3.8	1.7	2.2	0.9	0.6	0.9			0.3	-	1.0	1.1	1.9	2.5	1.3	0.4	-	-
Diadumene spp.	-	-	<.1	-	-	-	-	-	-	-	-	0.3			-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	-	0.3	<.1	-	-	-	-	-	-	<.1	-	-			-	-	-	-	0.2	-	-	-	-	-
Diodora aspera	-	-	-	-	-	-	-	-	-	-	0.1	-			<.1	<.1	0.3	0.1	0.1	-	-	-	-	<.1
Diopatra ornata	-	-	-	-	-	-	-	0.1	-	<.1	0.1	0.3			0.1	0.1	-	0.2	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	0.3	0.1	<.1	-	0.1	0.1	0.1	0.3	0.4	-			-	0.4	<.1	0.2	<.1	0.4	0.3	0.1	0.1	0.4

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Epiactis prolifera	3.5	1.8	1.4	1.5	0.6	0.3	0.7	1.5	<1	1.0	0.9	0.8			0.2	0.4	0.1	-	-	-	-	-	-	0.4
Eudistylia polymorpha	-	-	-	<1	-	-	-	-	-	-	-	-			-	-	-	-	<1	0.1	-	0.1	0.3	-
Eupentacta quinquesemita	-	-	-	-	0.2	-	<1	<1	-	<1	0.2	<1			-	0.1	-	-	<1	-	-	-	0.1	-
Fissurella volcano	-	0.3	-	<1	0.3	-	-	<1	0.1	0.3	0.5	0.3			1.3	1.4	<1	1.1	1.8	0.9	-	-	1.4	0.3
Flabellina trilineata	-	-	-	<1	-	<1	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	<1	0.2	0.2	1.2			0.6	0.3	0.1	-	-	-	-	-	-	-
Grapsidae (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<1	-	-	-	-	-	-
Halcampa decemtentaculata	-	-	-	0.2	-	-	-	-	<1	0.1	-	-			<1	<1	-	-	-	-	-	-	-	-
Haliotis rufescens	-	-	<1	-	<1	-	<1	-	-	<1	-	<1			-	-	-	<1	<1	0.3	-	-	-	-
Haliotis spp.	-	-	-	-	<1	-	-	<1	<1	<1	-	-			-	-	-	-	-	-	-	-	-	-
Haliotis spp. (juv.)	-	-	-	-	-	-	-	-	-	-	0.2	-			-	<1	-	-	0.1	-	0.3	-	-	-
Henricia leviuscula	-	-	0.4	<1	0.3	0.8	0.2	0.3	<1	<1	-	-			-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	<1	-	0.1	-	0.3	-	<1			0.3	0.2	-	<1	0.2	-	-	-	-	-
Hippolytidae unid.	-	-	<1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Homalopoma spp.	2.0	3.3	4.8	2.6	3.7	2.3	4.6	3.3	3.9	3.4	5.9	4.9			0.2	<1	-	<1	-	-	-	-	-	-
Idotea spp.	-	-	-	<1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	<1	0.2	0.2	0.3	-	0.2	0.2	0.2	0.1	1.0			0.2	0.2	<1	0.7	0.3	0.5	1.3	-	-	-
Lacuna marmorata	-	-	0.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	-	-	-	0.3	0.2	0.2	0.4	0.9	1.0	0.1	0.8			1.2	0.6	0.4	0.4	1.2	0.4	0.3	-	-	-
Laila cockerelli	-	-	-	-	-	-	-	-	-	<1	-	-			-	-	-	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	-	-	-	0.2	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	<1	0.1	0.2	0.1	-			<1	-	-	-	-	-	-	0.1	-	<1
Leptasterias hexactis	0.8	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	-	-	0.6	0.3	1.1	1.5	1.3	1.4	0.1	0.5	0.3	<1			-	-	-	-	-	-	-	-	-	-
Leucandra heathi	0.5	-	-	0.2	-	0.2	0.2	-	0.2	1.0	0.8	0.8			-	-	-	-	-	-	-	-	-	-
Leucilla nuttingi	-	-	-	-	<1	0.2	0.2	-	-	0.3	0.6	0.4			-	-	-	0.3	-	-	-	-	-	-
Lissothuria nutriens	-	-	<1	0.3	0.3	<1	<1	0.4	<1	0.3	1.3	0.9			2.2	1.9	0.4	0.3	0.7	0.3	-	-	0.6	0.1
Lithopoma gibberosum	-	0.3	0.5	0.3	0.3	-	<1	0.1	0.2	-	<1	0.2			-	<1	-	-	-	-	0.5	-	-	-
Lithopoma gibberosum (juv.)	-	-	-	-	-	-	-	-	-	-	-	<1			-	-	-	0.2	<1	0.1	-	-	-	-
Lophopanopeus spp.	-	-	0.3	0.2	0.2	0.3	0.1	-	<1	0.1	-	0.2			<1	0.3	0.1	0.1	0.1	-	-	0.1	-	-
Lottia instabilis	-	-	0.2	-	-	-	0.2	0.3	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Lottia ochracea	0.5	1.0	-	-	0.3	0.3	0.7	0.2	1.3	2.2	1.4	0.9			1.1	1.3	0.6	0.5	1.1	1.6	0.8	0.1	0.3	0.1
Loxorhynchus crispatus	-	-	-	-	-	-	<1	-	-	<1	-	-			-	-	-	-	-	-	-	-	-	-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	-	<1	-	<1			-	-	<1	-	-	-	-	-	-	-
Majidae	-	-	<1	0.3	0.2	-	-	0.3	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Megabalanus californicus	-	-	-	-	-	-	-	-	-	<1	-	-			0.3	-	-	-	-	-	-	-	-	-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	0.1	-	-
Micrura verrilli	-	-	-	-	-	-	-	<1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	<1	-	<1	<1	<1	-	-	-	-			-	-	0.1	-	-	-	-	-	-	-
Mitra idae	-	-	0.2	-	<1	0.3	<1	<1	<1	0.2	0.2	<1			-	0.1	-	-	<1	0.1	-	-	-	-
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	<1	-			<1	-	-	-	-	-	-	-	-	-
Mopalia muscosa	-	-	-	-	-	-	-	-	-	-	-	-			<1	<1	-	<1	-	-	-	-	-	-
Mopalia spp.	-	-	-	<1	-	-	<1	-	-	-	-	<1			<1	0.1	-	-	<1	-	-	-	-	-
Myxicola infundibulum	-	-	-	-	-	-	-	-	-	0.4	0.1	-			-	<1	-	-	-	-	-	-	-	-
Nassarius mendicus	-	-	-	-	-	-	-	-	-	<1	-	-			-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	<1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1	-	-	-	-
Nitidiscala spp.	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	<.1	-	-	-	-	-	-	-	<.1	-			-	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Norrisia norrisi (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Ocenebra foveolata	-	-	-	-	-	<.1	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Ocenebra interfossa	-	-	<.1	-	-	-	<.1	<.1	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Ocenebra lurida	-	-	0.3	0.4	0.7	<.1	0.4	0.2	0.5	0.3	0.4	0.2			-	0.1	<.1	-	-	-	-	-	-	-
Ocenebra spp.	-	0.5	<.1	0.1	-	<.1	-	0.1	<.1	0.3	0.3	0.3			0.2	<.1	-	<.1	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	4.4	3.3
Ophioplocus esmarki	-	-	<.1	0.3	0.3	-	-	<.1	-	-	-	-			-	0.1	0.2	0.2	<.1	-	0.3	0.1	0.4	0.2
Ophiothrix spiculata	-	-	-	0.4	0.3	0.2	<.1	0.3	0.1	<.1	0.6	0.9			1.1	2.3	2.0	2.8	5.0	2.8	1.0	1.0	3.9	0.6
Ophiuroidea unid.	-	-	-	-	-	-	-	0.3	-	-	-	-			0.1	-	0.1	-	-	-	-	-	0.1	<.1
Pachycheles spp.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Pagurus spp.	1.3	-	1.9	5.4	9.1	13.7	9.9	7.1	7.5	7.9	8.1	4.8			1.3	6.6	3.3	0.9	2.9	1.1	0.5	0.8	0.8	0.1
Paracerceis cordata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.4	-
Parastichopus parvimensis	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.1	-
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	0.1	<.1			-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	<.1	-	-	-	-	-	-	-	-	-			0.2	<.1	-	<.1	<.1	0.1	-	-	-	-
Pelecypoda unid. boring	0.5	5.8	5.9	8.3	8.9	3.2	4.1	5.8	5.6	7.1	4.9	5.8			9.4	7.5	3.1	8.1	3.9	10.9	13.3	1.8	3.4	1.0
Petrolisthes spp.	-	-	-	<.1	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	-	-	-	-	-	<.1	0.1	0.1	0.2			0.1	0.2	0.4	0.4	0.3	0.4	-	1.0	0.1	-
Phragmatopoma californica	-	0.8	16.2	35.1	19.5	13.2	19.9	66.8	55.7	131.5	57.3	8.9			1.7	3.0	2.1	6.3	6.8	13.5	40.0	35.8	71.6	268.3
Phyllochaetopterus prolifica	-	1.5	0.3	0.8	1.1	1.1	2.2	2.4	2.8	2.3	1.8	1.7			1.8	0.4	0.6	1.8	0.9	1.5	1.0	0.6	0.6	1.1
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	0.1	-	0.2	0.3	-	0.1	-	-
Pisaster spp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Pisaster/Henricia (juv.)	-	-	0.2	1.2	1.6	1.4	1.6	1.3	-	0.6	-	<.1			<.1	-	-	-	-	-	-	-	-	-
Pista spp.	-	-	0.2	0.1	-	0.3	<.1	<.1	0.1	0.1	0.1	-			-	<.1	0.3	0.2	0.3	1.8	2.8	0.8	-	0.8
Pista/Streblosoma spp.	0.3	1.0	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	0.3	-	-	-
Pododesmus cepio	-	-	-	-	-	-	-	-	-	<.1	0.3	1.2			1.3	1.1	1.3	0.1	-	-	0.3	-	-	-
Polynoidae	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Polyplacophora unid. a	-	-	0.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pseudomelatoma torosa	0.3	0.3	<.1	0.2	0.3	0.7	0.9	1.3	0.5	1.3	1.5	1.0			-	0.3	0.2	-	-	-	-	0.1	-	-
Psolus chitonoides	-	-	-	-	-	-	0.2	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pugettia producta	0.3	-	-	0.2	-	-	<.1	0.1	0.1	0.1	<.1	0.2			0.4	<.1	0.4	<.1	-	-	-	-	-	-
Pugettia richii	-	-	0.2	1.5	1.9	3.0	1.4	1.4	0.8	1.0	0.8	0.5			1.0	0.9	1.5	0.9	1.0	0.5	0.3	1.6	0.5	0.2
Pugettia spp.	-	-	0.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pycnopodia helianthoides	-	-	<.1	-	<.1	-	-	<.1	<.1	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Pyura haustor	-	-	-	-	<.1	0.2	0.1	0.1	0.2	0.1	0.2	<.1			<.1	<.1	-	-	-	-	-	-	-	-
Rostanga pulchra	-	-	-	-	-	-	-	<.1	-	-	-	0.2			<.1	-	-	-	-	-	-	-	-	-
Sabellidae	0.3	-	-	<.1	-	-	<.1	-	-	-	0.2	<.1			0.4	<.1	-	-	0.4	-	-	-	-	-
Scyra acutifrons	-	-	-	-	-	-	-	-	-	-	-	-			0.2	<.1	-	<.1	-	-	-	-	-	-
Searlesia dira	-	0.5	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – North Diablo Cove Station NDC 4 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Station/Surveys	1	1	4	5	3	3	4	4	4	6	4	3	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Serpula vermicularis	-	-	-	<.1	-	-	-	0.1	-	<.1	<.1	-			-	0.1	<.1	0.3	0.1	0.1	-	-	0.1	<.1
Serpulidae unid.	-	0.3	0.3	-	-	<.1	-	<.1	-	0.1	<.1	0.3			<.1	0.1	<.1	0.3	0.6	0.5	0.5	-	2.3	0.1
Serpulorbis squamigerus	0.3	-	-	0.4	0.5	0.3	0.3	0.3	0.3	0.9	1.7	2.0			1.4	1.5	1.3	1.1	0.7	0.4	0.3	0.4	0.6	0.9
Sipuncula unid.	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Sphaeromatidae unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	<.1	0.4	-	-	-	-
Spirobranchus spinosus	-	-	-	-	-	<.1	<.1	-	-	0.2	-	0.3			1.8	2.0	2.1	2.6	2.4	2.4	1.8	0.3	2.3	1.6
Strongylocentrotus franciscanus	-	-	-	-	-	-	-	-	-	-	0.3	-			-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	-	0.2	0.2	-	-	<.1	-	-			1.3	2.1	1.5	1.9	2.1	3.3	2.3	0.5	2.0	7.6
Strongylocentrotus spp.	-	-	-	-	-	0.3	<.1	-	-	0.1	0.3	0.8			1.1	1.1	0.8	0.8	1.4	0.4	-	-	-	-
Styela montereyensis	-	-	0.1	-	-	-	-	-	-	<.1	-	-			-	-	-	-	<.1	-	-	-	-	-
Tegula brunnea	1.0	5.5	4.5	3.6	3.5	3.6	3.9	6.9	7.6	6.0	5.1	8.3			0.9	1.8	3.1	0.4	0.6	0.1	-	0.8	0.1	0.1
Tegula montereyi	0.3	-	<.1	<.1	-	-	<.1	-	<.1	-	-	0.5			-	-	-	-	-	-	-	-	-	-
Tegula pulligo	-	-	<.1	-	-	-	-	-	-	0.2	-	0.2			-	<.1	0.1	<.1	-	-	-	-	-	-
Tethya aurantia	-	0.3	<.1	<.1	-	-	-	-	0.1	0.2	0.2	0.3			0.2	0.1	-	0.2	0.1	-	-	-	-	-
Tetraclita rubescens	-	-	0.6	-	-	-	-	-	-	-	1.7	0.2			2.3	0.6	-	1.1	0.1	1.1	-	2.4	1.5	-
Themiste pyroides	-	1.3	0.8	1.4	0.4	0.9	0.5	1.4	1.6	1.9	0.9	1.2			0.3	0.1	<.1	0.3	-	0.3	-	-	0.1	<.1
Tonicella lineata	0.5	0.3	0.6	0.6	0.7	0.4	0.6	0.3	1.3	0.9	1.1	0.3			0.4	0.4	0.1	0.3	0.2	0.4	0.3	-	-	-
Tricolia pulloides	-	-	<.1	<.1	0.3	0.6	0.3	0.6	1.6	1.8	-	1.0			1.2	0.6	0.4	<.1	0.2	-	-	-	-	-
Tricolia spp.	-	-	-	-	-	-	-	-	-	-	-	-			0.1	-	-	-	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	0.1	-	-	-	-
Triopha maculata	-	-	-	-	-	-	<.1	-	<.1	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Tubulanus polymorphus	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	-	-	<.1	-	-	-	0.1	<.1	<.1	-	0.5			0.3	0.1	-	<.1	<.1	0.1	-	0.1	-	-
Coverage Based on # of 1" Squares																								
Abiet./Sertularella/Sertularia spp.	-	-	<.1	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Acarnus erithacus	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	1.3	0.8	0.2	1.1	0.7	0.9	1.2	1.3	1.5	1.3	1.5	2.2			2.0	1.6	1.5	1.0	0.6	1.1	4.3	1.3	2.0	0.1
Bryozoa, unid. (erect)	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (foliose)	-	-	-	-	-	-	-	<.1	-	0.2	<.1	<.1			<.1	-	-	-	-	-	-	-	-	-
Didemnum/Trididemnum spp.	3.8	3.0	0.9	3.5	2.2	3.1	2.6	0.7	1.1	0.8	0.6	0.8			0.5	0.3	0.6	0.9	0.3	<.1	0.3	0.5	-	<.1
Dodecaceria fewkesi	-	0.5	-	-	-	-	-	-	-	-	-	-			-	0.7	-	<.1	<.1	-	<.1	-	-	-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	<.1	<.1	-	-	-	-	0.1	-	-
Hydroida	-	-	0.2	-	-	-	0.1	0.1	-	<.1	0.1	<.1			-	-	-	-	-	-	-	-	-	-
Hymenamphiastra cyanocrypta	-	-	-	-	-	-	-	-	-	<.1	0.2	<.1			1.1	1.3	0.9	1.1	0.4	1.0	2.0	1.1	-	-
Leucosolenia spp.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Plumularia spp.	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	0.5	0.5	1.0	1.5	1.7	1.6	0.5	1.1	0.8	1.3	0.8			1.9	1.6	1.2	0.9	0.9	0.4	0.5	1.1	0.9	0.1
Porifera unid. b (yellow)	0.8	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Porifera unid. c (orange)	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Salmacina tribranchiata	-	-	0.1	1.2	0.5	0.7	0.6	0.8	1.0	1.2	0.6	0.8			0.1	0.2	<.1	0.1	0.1	0.1	0.3	0.1	-	<.1
Spirorbis spp.	-	0.3	-	0.5	0.7	0.7	1.6	1.1	1.4	1.3	1.2	1.1			0.6	0.3	0.3	<.1	<.1	<.1	<.1	<.1	0.5	<.1
Tricellaria spp.	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	1.3	7.8	2.3	2.3	1.8	0.9	1.1	0.8	1.1	1.5	1.1	0.5			0.9	1.0	0.6	0.1	0.8	0.3	0.3	0.4	1.3	0.2

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 2 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size																								
Acanthodoris lutea	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Acmaea mitra	0.3	0.5	-	0.2	0.1	<.1	0.7	0.1	2.4	1.9	0.3	2.7	2.9	2.8	1.9	1.1	1.0	1.1	1.2	1.5	0.5	0.9	-	0.1
Acmaeid unid. a	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alia carinata	-	4.9	5.0	1.9	1.7	1.6	1.0	2.6	0.5	1.4	4.0	1.5	1.3	1.8	1.1	2.4	10.4	0.9	0.3	-	4.3	0.6	-	-
Alia spp.	1.8	-	-	1.9	<.1	-	0.6	0.8	1.3	3.7	0.6	1.6	0.3	0.4	0.3	0.5	-	0.3	0.6	0.3	0.1	-	-	-
Alpheus clamator	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Amphissa spp.	2.0	-	0.2	1.0	0.5	0.3	0.6	0.4	-	0.7	0.4	0.3	-	0.5	1.4	2.1	1.6	1.4	0.6	0.4	-	-	-	0.1
Amphissa versicolor	-	2.1	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anisodoris nobilis	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-	-
Anthopleura artemisia	-	-	-	<.1	<.1	0.2	0.1	<.1	0.2	0.3	0.1	0.1	<.1	-	-	-	-	0.1	0.3	-	-	-	-	0.1
Anthopleura elegantissima	-	<.1	-	<.1	0.2	-	<.1	0.1	<.1	<.1	0.2	0.1	-	<.1	0.1	-	0.2	0.2	-	-	-	-	-	-
Anthozoa unid.	1.0	-	-	0.5	0.4	-	-	-	0.2	0.3	-	-	0.1	<.1	-	-	-	<.1	-	0.1	-	-	-	<.1
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	0.2	<.1	-	-	-	0.1	-
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.3	0.6	0.1	-	-	-	-	-
Aplysia vaccaria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Asterina miniata	0.3	0.2	0.1	0.2	0.2	0.4	0.2	0.1	<.1	<.1	-	-	-	0.2	<.1	0.2	0.3	0.3	<.1	0.1	-	-	-	-
Balanophyllia elegans	1.0	0.4	0.2	0.4	0.6	0.1	0.3	0.5	0.5	1.3	0.3	-	<.1	0.1	0.1	<.1	-	-	-	0.3	-	-	0.4	-
Balanus aquila	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Balanus spp.	-	-	-	-	-	-	-	-	-	0.3	-	<.1	0.8	-	-	2.7	-	-	-	-	0.1	-	-	-
Balanus/Tetraclita spp.	-	-	-	-	-	-	-	-	<.1	-	0.3	0.5	4.2	4.7	10.6	2.4	3.1	0.3	<.1	0.4	0.1	2.0	-	0.3
Barnacles (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7	3.1	-	-	-	-	-	-	-	-	-
Berthella californica	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Bittium eschrichtii	-	0.2	<.1	0.7	-	0.6	<.1	-	0.5	0.2	-	-	-	0.2	0.7	1.4	0.2	1.1	1.3	-	-	-	-	-
Bittium spp.	1.3	-	-	-	0.1	-	-	-	-	0.5	0.3	0.4	0.2	0.7	0.3	0.8	3.5	0.3	-	-	-	-	-	-
Boltenia villosa	-	-	-	-	<.1	-	-	-	-	-	-	-	0.3	0.2	-	0.1	-	-	-	0.4	0.3	0.3	-	0.1
Brachyura unid. b (juv.)	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cactosoma arenaria	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Cadlina flavomaculata	-	-	-	-	<.1	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Cadlina modesta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Calliostoma annulatum	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	0.3	<.1	<.1	<.1	<.1	-	<.1	0.2	-	0.8	<.1	-	0.1	<.1	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer antennarius (juv.)	-	-	-	<.1	-	<.1	<.1	<.1	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-
Cancer productus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Cancer spp.	-	-	-	0.4	<.1	<.1	<.1	<.1	-	<.1	-	-	-	0.3	0.3	<.1	-	<.1	-	-	-	-	-	-
Ceratostoma foliatum	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	<.1	-	-	-	-	-	0.2	0.3	0.5	0.1	0.1	0.4	-	-	-	0.4	-	-	-	-
Clavelina huntsmani	-	-	-	-	-	-	-	-	0.1	-	0.4	0.5	1.1	5.0	-	0.1	0.1	-	0.2	1.1	-	-	-	-
Clavularia spp.	-	-	-	-	-	-	<.1	0.7	0.4	0.9	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	<.1	0.2	-	-	-	-	-	-	-	-	-	-	<.1	0.3	<.1	-	-	-	-	-	-	-	-
Conus californicus	-	<.1	0.2	0.2	<.1	0.1	-	<.1	<.1	0.2	0.3	0.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-
Crangon spp.	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crangon stylirostris	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Crassedoma giganteum	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Crepidula spp.	0.3	-	1.8	1.5	1.8	0.6	0.9	1.0	0.5	0.8	0.7	0.8	0.6	0.1	0.2	-	-	-	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	-	-	-	-
Cryptolithodes sitchensis	-	-	-	0.2	0.1	0.2	0.3	0.1	<.1	<.1	-	0.2	-	<.1	-	-	-	0.3	-	0.1	-	-	-	-
Cucumaria spp.	-	-	<.1	<.1	-	-	-	-	-	<.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	0.1	-
Dendropoma lituella	-	-	-	0.2	0.9	-	0.4	<.1	0.3	1.4	<.1	0.1	1.3	2.1	4.1	0.2	-	-	1.5	-	-	-	-	0.3
Diadumene spp.	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diodora aspera	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-
Diopatra ornata	-	0.9	<.1	-	<.1	0.1	<.1	-	<.1	<.1	0.1	0.4	0.1	0.3	0.2	0.4	<.1	0.3	0.8	-	0.5	0.3	0.1	0.1
Doridacea unid.	-	-	-	<.1	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	0.2	<.1	<.1	-	-	-	0.2	0.3	<.1	<.1	-	<.1	-	<.1	-	-	<.1	0.3	-	0.1	-	<.1
Epiactis prolifera	0.3	0.2	0.5	0.5	0.2	0.3	0.1	0.1	0.1	<.1	-	0.2	<.1	-	0.2	-	-	-	<.1	-	-	-	-	-
Erato vitellina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Eudistylia polymorpha	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-	<.1	<.1	-	0.1	-	-	-	0.1	-	-
Fissurella volcano	-	-	-	<.1	-	-	0.1	-	<.1	0.2	<.1	-	-	0.2	0.1	0.3	<.1	<.1	0.2	0.3	-	0.1	0.5	<.1
Flabellina trilineata	-	-	-	-	-	<.1	-	0.1	-	-	0.1	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Gastropoda, neopic unid. a	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Glans subquadrata	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata	-	-	-	<.1	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	<.1	-	-	0.1	0.1	-	-	<.1
Haliotis rufescens	-	-	-	-	-	-	<.1	-	<.1	0.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1
Haliotis spp.	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Haliotis spp. (juv.)	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Henricia leviuscula	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	<.1	<.1	-	-	-	0.1	-	-	-	<.1
Hiatella arctica	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.2	-	-	-	-	-	-	-	-
Hiatella spp.	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hipponix spp.	-	-	-	-	-	-	<.1	0.4	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Holothuroidea unid. a	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Homalopoma spp.	0.3	0.8	0.9	0.5	1.0	0.5	0.3	0.7	1.0	2.0	1.9	3.6	3.3	2.7	0.4	<.1	0.4	-	<.1	0.3	-	-	-	-
Hopkinsia rosacea	-	-	<.1	<.1	-	-	-	0.2	0.5	<.1	-	0.1	0.1	-	-	-	-	<.1	-	-	-	0.1	-	-
Idotea spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	0.2	<.1	0.2	0.2	0.2	0.3	0.4	0.8	0.9	0.1	0.4	0.4	0.3	0.2	0.8	-	0.4	0.9	0.8	0.3	-	0.1	<.1
Isopoda unid.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Lacuna spp.	0.5	-	-	0.2	-	0.1	-	0.5	0.5	0.3	0.4	0.2	0.1	0.8	0.4	1.0	0.6	0.2	0.3	0.1	-	-	-	-
Laila cockerelli	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lamellaria diegoensis	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Leptasterias hexactis	1.3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	-	1.3	0.6	0.4	0.5	0.4	0.4	<.1	-	<.1	0.2	0.3	0.2	-	-	-	-	-	-	-	-	-	-	-
Leucandra heathi	-	-	-	1.0	0.1	-	-	-	0.1	0.2	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Leucilla nuttingi	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	0.1	0.1	-	-	-	-	-	-
Lissothuria nutriens	0.3	-	-	<.1	<.1	-	-	<.1	-	<.1	-	-	0.2	<.1	0.3	0.4	0.3	0.3	<.1	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Lithopoma gibberosum	-	0.2	0.2	<.1	<.1	0.1	<.1	-	<.1	0.4	<.1	0.2	0.4	<.1	0.1	<.1	-	-	0.3	0.1	-	-	-	-
Lithopoma gibberosum (juv.)	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	<.1	0.3	<.1	-	-	-	-	<.1
Lophopanopeus spp.	-	0.2	<.1	0.3	0.3	0.2	0.6	0.4	<.1	-	0.3	<.1	0.1	0.1	-	0.2	-	<.1	0.1	-	0.1	-	-	-
Lottia asmi	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lottia instabilis	-	-	0.7	1.1	0.8	1.6	0.8	1.2	0.6	0.5	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Lottia ochracea	0.3	0.3	1.0	1.7	0.8	0.8	0.9	0.3	2.3	2.9	0.2	2.7	2.3	2.7	1.0	1.4	0.3	0.9	0.8	0.3	0.1	-	0.3	<.1
Lottia spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-
Loxorhynchus crispatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	-	-
Majidae	3.3	0.8	0.5	0.2	<.1	-	0.4	0.2	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Megabalanus californicus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Melanella thersites	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-
Melibe leonina	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-
Micrura verrilli	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	<.1	<.1	0.2	<.1	-	-	<.1	-	-	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-
Mitra idae	0.3	-	0.3	0.2	0.2	<.1	0.1	0.1	0.2	<.1	0.1	0.3	0.3	<.1	<.1	-	0.3	<.1	<.1	0.1	0.1	-	0.3	<.1
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Mopalia lignosa	-	-	-	-	-	-	-	0.3	-	-	<.1	<.1	-	0.1	-	-	-	-	-	-	-	-	-	-
Mopalia muscosa	-	-	-	-	-	-	0.1	-	-	<.1	-	-	-	-	-	<.1	-	0.2	0.1	0.1	-	-	-	-
Mopalia spp.	-	-	-	<.1	<.1	<.1	-	-	-	-	<.1	-	-	<.1	-	0.3	-	-	0.1	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Myxicola infundibulum	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	0.3	-	<.1
Nassarius mendicus	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	<.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Nereididae unid.	-	-	-	-	-	-	-	-	-	0.1	-	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-
Nitidiscala spp.	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	-	0.1	<.1	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Ocenebra circumtexta	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ocenebra foveolata	-	-	-	-	-	-	-	-	-	0.2	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-
Ocenebra interfossa	-	-	0.1	-	0.1	0.1	0.1	-	-	-	0.2	-	-	-	0.5	<.1	-	-	-	-	-	-	-	-
Ocenebra lurida	-	-	-	-	<.1	-	-	-	<.1	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-
Ocenebra spp.	0.3	-	0.2	0.4	<.1	0.1	<.1	0.3	0.1	0.2	0.2	-	0.1	0.2	-	0.3	-	-	-	-	-	-	-	-
Octopus spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-
Olivella biplicata	-	-	-	-	-	-	-	0.1	<.1	<.1	0.2	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.4
Ophioplocus esmarki	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Ophiothrix spiculata	-	-	0.1	0.1	0.2	-	0.3	-	0.2	1.0	0.2	-	0.7	<.1	0.5	3.1	1.2	2.9	4.8	2.6	0.3	1.6	4.0	0.6
Ophiuroidea unid.	-	0.3	-	-	<.1	-	<.1	-	-	-	<.1	-	0.2	0.1	-	-	-	0.5	0.6	-	-	0.5	-	0.4
Pagurus spp.	4.3	13.3	3.6	5.8	11.5	16.8	15.3	12.1	8.4	14.0	4.1	7.6	7.8	6.6	8.9	6.0	9.0	5.8	4.3	1.4	4.4	0.8	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	0.2	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	2.8	2.1	5.7	5.6	6.7	4.6	4.9	7.9	12.5	15.5	5.1	12.4	16.4	15.1	18.4	15.4	7.5	13.3	12.4	5.6	2.5	7.4	2.0	1.3
Phascolosoma agassizii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Phidiana hiltoni	-	-	-	<.1	-	-	-	<.1	-	-	-	-	<.1	0.4	0.3	-	0.2	-	-	0.3	0.1	0.1	-	-
Phragmatopoma californica	-	<.1	0.6	0.5	<.1	0.1	0.3	1.3	0.9	<.1	0.4	2.5	4.5	2.8	1.4	1.1	1.6	1.0	2.0	0.6	3.8	3.1	6.6	53.4
Phyllochaetopterus prolifica	-	0.5	2.2	2.2	3.2	0.7	1.4	2.4	2.8	3.0	0.8	4.4	6.1	9.2	6.4	9.0	3.7	2.8	2.8	1.3	0.9	1.8	2.3	0.7

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	0.2	<.1	<.1	-	-	0.1	-	-
Pisaster/Henricia (juv.)	0.3	<.1	0.2	<.1	<.1	<.1	<.1	<.1	0.1	0.2	-	0.2	-	<.1	<.1	-	<.1	-	-	-	-	-	-	-
Pista spp.	-	-	0.4	0.9	0.9	0.2	0.7	0.3	0.4	0.8	0.3	0.2	-	0.3	0.6	0.4	0.7	1.3	2.7	5.0	4.3	1.6	1.3	4.2
Pista/Streblosoma spp.	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Pododesmus cepio	-	-	-	-	0.1	-	0.1	0.3	1.4	1.3	0.2	0.4	0.3	1.0	1.5	0.5	<.1	0.3	0.2	-	-	-	-	-
Polychaeta unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-
Polynoidae	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Pseudomelatoma torosa	-	<.1	0.4	0.7	1.0	0.6	1.2	0.8	0.9	1.0	0.5	0.4	0.6	0.3	0.1	0.1	-	-	-	-	-	0.1	-	-
Pugettia producta	-	-	0.1	0.2	0.4	0.3	0.8	0.1	0.5	0.3	0.3	0.1	<.1	0.8	0.3	0.2	<.1	<.1	-	-	-	-	-	-
Pugettia richii	-	-	0.4	2.1	2.3	1.4	3.4	1.2	0.7	1.3	0.6	0.7	0.9	1.6	1.0	1.5	0.8	0.6	0.7	0.1	-	-	-	-
Pugettia spp.	0.8	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	0.1
Pycnopodia helianthoides	-	-	-	0.2	0.3	-	-	<.1	-	-	-	-	-	0.1	-	<.1	-	0.1	-	-	-	0.1	-	-
Pyura haustor	-	-	-	<.1	<.1	-	-	-	-	0.1	-	-	0.1	0.3	<.1	<.1	-	-	-	-	-	-	-	-
Rictaxis punctocaelatus	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.3	-	<.1
Rostanga pulchra	-	-	-	-	-	-	<.1	-	0.3	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sabellidae	0.5	<.1	0.1	-	-	-	-	-	0.5	0.6	<.1	<.1	0.3	0.3	0.6	0.2	0.1	<.1	0.3	0.6	-	0.1	-	1.2
Scyra acutifrons	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Serpula vermicularis	-	-	<.1	-	-	-	-	-	-	-	-	0.1	-	0.5	0.4	0.3	0.3	-	0.3	0.4	0.3	1.0	0.5	-
Serpulidae unid.	0.5	<.1	0.4	0.1	0.2	0.1	0.2	<.1	0.5	0.2	0.2	0.4	0.3	0.7	0.4	0.3	-	0.3	1.0	0.6	0.6	2.1	-	0.2
Serpulorbis squamigerus	-	<.1	<.1	0.3	0.1	0.1	0.2	0.3	0.4	1.2	1.6	1.5	1.3	1.2	1.2	1.0	1.1	0.5	0.4	0.3	0.3	0.3	0.5	1.2
Sipuncula unid.	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sphaeromatidae unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Spirobranchus spinosus	-	-	-	<.1	-	-	-	-	-	-	-	0.2	0.6	0.7	0.4	0.6	0.6	0.7	0.4	0.5	-	0.5	0.4	0.4
Stenoplax heathiana	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-
Stenoplax spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus franciscanus	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	0.1	-
Strongylocentrotus purpuratus	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	0.4	0.2	0.1	0.5	-	0.1	-	1.4	0.9
Strongylocentrotus spp.	-	0.2	0.3	<.1	0.2	0.1	<.1	<.1	0.3	0.3	0.1	0.6	0.3	0.5	0.6	0.4	0.3	1.0	0.2	0.8	0.3	0.1	0.1	-
Styela montereyensis	-	-	0.1	0.2	0.2	-	-	-	-	<.1	-	-	-	0.2	0.3	-	0.1	-	-	-	-	0.1	-	<.1
Tectura persona	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tegula brunnea	1.8	2.6	7.8	7.4	5.5	2.6	1.3	2.4	2.3	2.4	2.8	5.0	2.9	2.7	0.7	0.9	9.3	1.2	0.8	-	1.5	0.3	-	-
Tegula montereyi	-	-	0.2	<.1	0.3	-	-	0.1	-	-	-	0.3	0.1	<.1	-	-	-	-	-	-	-	-	-	-
Tegula pulligo	0.3	-	<.1	<.1	<.1	-	-	-	0.1	<.1	<.1	<.1	<.1	-	0.1	0.1	<.1	<.1	-	-	-	-	-	-
Terebellidae unid.	0.8	-	0.1	<.1	0.1	<.1	0.1	-	<.1	0.4	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	-	-	-	-	-	-	-	-	<.1	0.4	-	4.9	2.5	-	<.1	-	-	-	-	-	-	-	-	-
Themiste pyroides	-	1.8	3.4	2.2	2.2	1.7	1.9	2.6	2.2	2.0	1.7	1.2	1.4	0.8	0.8	1.3	0.4	0.1	0.4	-	-	-	-	-
Tonicella lineata	-	<.1	<.1	0.2	<.1	<.1	0.2	<.1	0.4	0.9	0.6	0.6	1.3	1.7	0.3	0.3	0.3	-	0.3	0.4	-	-	-	-
Tricolia pulloides	-	0.3	<.1	0.2	<.1	0.3	0.3	-	0.7	0.9	0.1	0.7	0.4	0.6	0.4	0.8	0.8	<.1	-	0.3	-	-	-	-
Tricolia spp.	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triopha catalinae	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Triopha maculata	-	-	-	-	-	<.1	-	-	-	0.4	<.1	<.1	0.3	0.1	0.1	<.1	<.1	-	-	-	-	-	-	-
Tritonia festiva	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-
Tubulanus polymorphus	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tubulanus sexlineatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 2 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	4	4	5	6	6	5	5	4	4	4	4	4	4	4	2	2	2	2	4
Counted Regardless of Size (continued)																								
Urticina coriacea	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urticina crassicornis	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urticina spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.8	-	-	-	-	-	-	-	-	-	-
Xanthidae unid.	0.3	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	<.1	-	<.1	<.1	-	-	-	-	0.4	-	0.1	0.5	0.5	0.3	0.4	0.3	-	-	-	-	-	-	-
Coverage Based on # of 1° Squares																								
Abiet./Sertularella/Sertularia spp.	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	5.0	1.4	0.7	1.3	1.8	1.6	2.9	2.2	2.3	1.1	0.3	1.0	2.0	1.4	0.8	0.4	0.7	0.3	0.1	<.1	0.9	1.0	0.1	0.1
Bryozoa, unid. (erect)	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (foliose)	-	-	0.8	<.1	<.1	0.2	<.1	0.2	<.1	<.1	<.1	<.1	<.1	<.1	-	-	-	<.1	<.1	-	-	-	-	-
Chthamalus fissus	-	-	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Didemnum/Tridemnum spp.	1.8	0.3	0.3	0.3	<.1	-	-	-	<.1	0.4	<.1	<.1	0.8	1.1	0.5	0.8	0.6	<.1	0.1	<.1	<.1	-	-	-
Euherdmania claviformis	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurystomella bilabiata	-	-	0.2	0.2	-	-	-	-	-	0.3	<.1	0.1	0.4	-	-	<.1	-	-	-	-	-	0.3	-	-
Hydroida	-	-	-	<.1	-	-	-	-	<.1	<.1	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-
Hymenamphiastra cyanocrypta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-
Leucosolenia spp.	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	0.4	0.7	0.8	0.9	0.7	0.5	0.7	0.7	0.5	0.2	0.3	0.1	0.3	0.3	<.1	0.3	<.1	<.1	<.1	<.1	0.3	<.1	<.1
Porifera unid. c (orange)	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salmacina tribranchiata	-	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	0.1	-	-
Spirorbis spp.	-	2.1	0.4	0.5	0.4	0.4	1.1	1.4	0.6	0.3	<.1	0.4	0.7	0.9	1.3	0.3	0.4	0.3	0.1	<.1	0.4	0.4	<.1	<.1
Tricellaria spp.	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, colonial unid. a (white)	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, colonial unid. b (yellow)	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, colonial unid. c (orange)	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	-	1.9	1.7	2.6	2.9	1.9	2.0	1.4	1.3	1.5	0.4	0.5	0.6	0.9	0.6	0.3	0.4	0.3	0.3	<.1	0.1	0.1	0.3	<.1

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 3 at -4m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size																								
Acanthodoris lutea	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	0.1	-	-	-	-
Acmaea mitra	1.0	1.2	0.7	0.6	1.3	1.0	2.4	1.2	3.9	3.5	1.5	2.6			1.1	1.9	1.5	3.2	1.9	2.1	1.0	0.9	0.4	0.1
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	<.1	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	<.1	-	<.1			-	-	-	-	-	-	-	-	-	-
Alia carinata	-	-	0.6	<.1	0.4	0.3	0.6	1.1	0.2	3.0	0.7	2.4			0.7	0.7	<.1	1.2	0.8	-	0.3	0.1	-	-
Alia spp.	0.5	-	0.1	<.1	-	-	0.3	0.3	0.5	0.3	1.8	0.2			-	0.4	0.2	-	0.2	0.3	-	-	-	-
Alpheus clamator	-	-	-	-	-	-	-	0.2	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Alpheus spp.	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Amphissa spp.	0.3	0.2	-	0.1	0.3	0.9	0.7	1.2	0.6	1.4	1.9	2.0			1.6	1.6	0.9	0.5	0.8	0.5	-	-	-	0.1
Amphissa versicolor	-	-	0.5	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Anisodoris nobilis	-	-	<.1	-	-	-	<.1	-	-	0.2	-	-			<.1	<.1	-	<.1	-	-	-	0.1	-	<.1
Anthopleura artemisia	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	<.1	0.3	0.1	0.3	-	0.3	0.2
Anthopleura elegantissima	0.3	0.4	0.6	0.4	0.6	0.5	0.4	0.4	0.4	0.5	0.5	0.7			0.9	0.6	0.4	0.8	0.8	0.9	1.3	0.5	0.5	1.3
Anthozoa unid.	-	-	0.2	1.0	4.5	-	<.1	0.3	0.2	0.3	0.6	0.3			0.3	0.5	0.2	0.6	0.9	0.9	-	0.1	0.5	0.2
Aplysia californica	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	0.1	0.4	<.1
Aplysia californica egg mass	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	1.9	-	-	-	-
Ascidia spp.	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Asterina miniata	0.3	0.5	0.5	0.5	0.5	0.8	0.7	0.3	<.1	-	-	-			-	<.1	0.1	<.1	-	-	-	-	-	-
Asterina miniata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	<.1	-	-	-	-	-
Balanophyllia elegans	1.0	2.1	2.7	3.8	4.7	5.3	5.8	4.9	5.5	4.5	3.6	2.6			2.0	1.9	1.7	4.3	4.3	4.6	9.0	11.0	5.1	9.4
Balanus aquila	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Balanus spp.	-	0.2	<.1	<.1	<.1	-	<.1	-	-	-	0.1	-			-	-	-	-	0.6	-	-	-	-	-
Balanus/Tetraclita spp.	-	-	-	-	-	<.1	<.1	0.2	<.1	-	-	-			0.2	-	-	0.3	-	7.5	-	-	0.3	-
Barleeia spp.	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Barnacles (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.4	-	-	-	-	-
Bittium eschrichtii	-	-	0.4	-	-	0.2	0.2	-	<.1	-	-	0.3			<.1	0.1	<.1	<.1	0.2	-	-	-	-	-
Bittium spp.	-	<.1	-	0.2	-	-	-	0.4	-	-	-	0.1			0.4	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	-	-	-	-	-	-	-	<.1	0.3	0.1			<.1	<.1	-	0.3	0.1	0.3	-	0.4	0.6	0.2
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1	-	-	-	-
Cactosoma arenaria	-	0.5	1.2	0.9	0.8	0.8	0.8	0.9	0.1	0.3	0.2	0.2			-	-	-	-	-	-	-	-	-	-
Cadlina flavomaculata	-	-	0.1	<.1	-	-	-	-	<.1	0.1	0.1	<.1			<.1	0.1	-	<.1	<.1	-	-	-	-	-
Cadlina luteomarginata	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	0.1
Cadlina modesta	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Calliostoma annulatum	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	0.3	0.5	<.1	0.3	0.7	0.2	0.3	0.3	1.0	0.8	0.7			0.1	<.1	-	-	-	-	-	-	-	-
Calliostoma spp.	-	-	-	-	-	-	-	-	-	-	-	0.1			-	-	-	-	-	-	-	-	-	-
Callistochiton crassicostatus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	-	-	-	-	-	<.1	<.1	-	<.1			-	-	-	0.1	-	-	-	-	-	-
Cancer antennarius (juv.)	-	<.1	-	-	-	-	0.1	-	-	-	-	<.1			-	-	-	-	<.1	-	-	-	-	-
Cancer spp.	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-			0.1	<.1	-	-	0.1	-	-	-	-	<.1
Chelyosoma productum	-	-	-	-	-	-	-	-	0.1	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	0.2	-	-	<.1	-			<.1	-	0.1	-	0.2	-	-	-	-	0.2
Clavelina huntsmani	-	-	-	-	-	-	-	-	1.0	-	-	-			-	-	-	-	-	-	-	-	-	-
Clavularia spp.	-	-	-	-	-	-	-	4.2	0.9	1.7	2.5	5.7			0.6	1.7	0.4	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	0.3	-	0.2	-	-	-	-	-	-	-	-	<.1			-	-	<.1	-	0.2	0.4	0.3	0.1	0.3	0.4
Conus californicus	-	-	<.1	-	0.1	-	-	<.1	-	0.2	0.3	0.3			<.1	-	-	0.1	<.1	0.1	-	-	-	0.1

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Corynactis californica	-	-	-	-	-	-	0.3	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Crassedoma giganteum	-	-	-	-	-	-	-	-	-	0.2	0.3	-			<.1	<.1	-	-	-	-	-	-	-	-
Crepidula spp.	-	-	0.3	0.4	1.0	1.3	1.2	1.2	1.1	0.4	1.1	0.3			0.1	0.1	-	0.1	-	-	-	-	-	-
Cryptochiton stelleri	-	-	-	-	-	-	<.1	-	-	-	-	-			-	-	-	0.2	-	0.1	-	0.1	-	<.1
Cryptolithodes sitchensis	-	-	-	-	-	<.1	-	-	<.1	-	<.1	<.1			-	-	<.1	-	<.1	-	-	-	-	-
Cucumaria spp.	-	0.6	1.3	1.7	1.1	1.3	0.7	0.6	0.6	1.0	0.9	0.4			0.8	0.4	-	-	<.1	0.3	0.3	-	-	<.1
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	<.1	-	-	-	-	-	0.1	-
Dendropoma lituella	-	-	7.9	26.3	13.9	10.1	14.3	17.5	18.5	17.6	13.3	7.7			17.4	19.3	12.4	3.8	3.5	3.6	-	0.8	-	-
Dendropoma spp.	1.8	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Diadumene spp.	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Diaulula sandiegensis	-	-	-	-	-	-	<.1	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Diodora aspera	-	-	-	<.1	-	-	-	-	<.1	0.3	-	0.2			-	-	<.1	-	0.1	-	-	-	-	-
Diopatra ornata	0.3	0.8	1.2	2.0	0.6	0.3	0.2	0.2	0.2	0.2	0.4	0.4			0.1	0.2	0.2	0.7	0.4	0.5	1.0	0.6	1.6	0.4
Discurria insessa	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	0.4	0.4	<.1	<.1	0.2	<.1	0.3	0.5	0.4	0.2			0.4	0.4	0.3	0.5	0.4	0.4	-	0.1	-	0.6
Epiactis prolifera	1.3	2.7	3.1	2.4	1.7	0.9	0.5	0.3	0.2	0.2	0.6	0.1			<.1	<.1	<.1	<.1	-	0.3	-	0.1	-	-
Erato vitellina	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Eudistylia polymorpha	-	-	-	<.1	-	-	-	-	-	-	-	-			0.6	-	-	<.1	-	-	-	-	-	0.3
Eupentacta quinquesemita	0.3	-	-	<.1	-	0.3	<.1	-	0.1	<.1	<.1	0.2			0.1	0.1	-	-	<.1	-	-	-	0.1	-
Fissurella volcano	-	-	-	<.1	-	<.1	0.3	-	0.2	0.2	0.1	0.2			<.1	<.1	-	<.1	<.1	0.1	-	-	-	<.1
Flabelliderma essenbergae	-	-	-	-	-	-	-	-	-	-	-	-			0.1	-	-	-	-	-	-	-	-	-
Flabellina trilineata	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	0.2	<.1	-	-	-	-	-	-
Glans subquadrata	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata	-	-	<.1	<.1	<.1	-	0.1	0.3	<.1	0.1	-	0.2			-	-	-	<.1	0.1	-	-	-	-	-
Haliotis rufescens	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Haliotis spp.	-	-	-	-	-	-	<.1	-	-	0.1	-	-			-	-	-	-	-	-	-	-	-	-
Haliotis spp. (juv.)	-	-	-	-	-	-	-	-	-	-	<.1	-			-	-	<.1	-	-	-	-	-	-	-
Henricia leviuscula	-	-	-	-	-	-	<.1	0.2	-	<.1	-	-			-	-	-	-	-	-	0.3	-	-	-
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	<.1	-	-	-	-	-	-	-	-
Hermissenda crassicornis	-	-	-	-	<.1	-	0.1	-	<.1	<.1	-	-			0.1	<.1	<.1	-	<.1	0.1	-	-	0.6	0.4
Homalopoma spp.	0.5	2.6	5.2	4.2	5.7	5.2	5.0	4.7	3.0	4.3	4.1	3.7			2.3	0.6	-	-	-	0.1	-	-	-	-
Hopkinsia rosacea	-	-	-	-	-	-	-	-	0.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Idotea spp.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Ischnochitonidae	-	-	-	0.2	<.1	0.2	<.1	<.1	0.4	0.3	0.1	0.1			0.2	<.1	<.1	0.2	<.1	0.1	-	-	-	-
Isopoda unid.	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Lacuna spp.	-	0.6	-	-	-	-	<.1	<.1	<.1	0.3	0.1	-			0.5	0.4	1.0	0.4	<.1	-	-	-	-	-
Laila cockerelli	-	-	-	-	-	-	-	-	0.1	<.1	0.2	-			<.1	-	<.1	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	<.1	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-	-	-	-	-
Lepidozona cooperi	-	-	-	-	-	-	-	-	-	-	1.0	-			-	-	-	-	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	<.1	-	0.2	-	-	-	-	-
Leptasterias spp.	-	-	0.1	0.1	-	0.2	0.1	<.1	-	-	-	-			-	<.1	-	-	<.1	-	-	-	-	-
Leucandra heathi	-	<.1	0.5	3.0	2.0	1.8	1.4	0.2	0.4	1.0	1.3	1.2			-	0.1	-	-	-	-	-	-	-	-
Leucilla nuttingi	0.5	<.1	0.4	1.4	1.8	1.3	1.7	1.1	2.1	0.8	4.0	1.4			<.1	1.1	1.0	0.4	-	-	-	-	-	0.3
Lissothuria nutriens	-	-	0.1	<.1	-	-	<.1	-	0.4	0.4	<.1	0.2			0.2	0.3	0.1	-	-	-	-	-	-	-
Lithopoma gibberosum	-	<.1	-	0.2	0.5	0.3	0.6	0.5	0.5	0.2	0.2	0.4			<.1	<.1	<.1	-	<.1	0.3	0.3	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Lithopoma gibberosum (juv.)	-	-	-	-	-	-	-	-	-	-	-	0.3			<.1	-	-	0.1	<.1	0.1	0.3	-	-	-
Lophopanopeus spp.	-	-	-	-	-	0.3	0.5	<.1	<.1	0.2	0.1	0.1			0.2	-	-	-	<.1	-	-	-	-	-
Lottia asmi	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Lottia instabilis	-	0.2	1.5	0.8	0.5	0.6	0.8	-	-	-	-	0.1			<.1	0.1	-	-	<.1	-	-	-	-	-
Lottia ochracea	0.3	0.3	0.2	<.1	0.7	0.3	0.4	0.3	1.7	1.3	0.4	0.6			1.1	0.6	0.1	0.3	0.2	0.1	-	-	-	<.1
Loxorhynchus crispatus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1	-	-	-	-
Majidae	-	-	0.4	<.1	-	0.3	-	-	-	-	-	0.3			0.1	-	-	-	-	-	-	-	-	-
Megabalanus californicus	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	0.1	-	-	0.1	0.3	-	-	-
Mitra idae	-	0.3	0.2	0.3	0.4	0.3	0.3	0.3	0.5	0.3	0.3	0.3			0.1	0.2	0.2	0.1	0.4	0.6	0.5	0.3	0.8	0.7
Mopalia spp.	-	-	<.1	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Myxicola infundibulum	-	-	<.1	-	-	-	0.1	1.0	0.1	<.1	0.3	0.2			0.3	<.1	-	-	0.2	-	-	-	-	0.1
Nassarius mendicus	-	-	-	<.1	<.1	-	-	-	-	0.1	-	-			-	-	-	-	-	-	-	-	-	-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	0.3	-			-	-	-	-	-	-	-	-	-	-
Nemertea unid.	-	-	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Nitidiscala spp.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Norrisia norrisi	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	0.1	0.3	-	-	-
Norrisia norrisi (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Ocenebra foveolata	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-	-	-	-	-
Ocenebra interfossa	-	-	-	-	-	<.1	-	0.2	-	<.1	-	<.1			-	<.1	-	-	-	-	-	-	-	-
Ocenebra lurida	-	-	-	-	-	-	0.3	<.1	0.1	-	-	<.1			0.1	<.1	-	<.1	-	-	-	-	-	-
Ocenebra spp.	-	-	-	-	-	-	<.1	-	-	<.1	-	0.2			0.1	-	-	-	-	-	0.3	-	-	-
Ophiactis simplex	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	23.4
Ophioplocus esmarki	-	-	-	<.1	<.1	-	0.1	0.2	-	-	-	<.1			-	-	-	0.2	0.1	-	0.3	-	0.1	0.1
Ophiothrix spiculata	-	-	<.1	-	-	<.1	<.1	-	-	-	0.3	0.2			1.6	1.9	1.3	0.4	0.1	0.6	-	0.3	1.0	0.4
Ophiuroidea unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Pagurus spp.	-	3.8	2.0	3.5	4.5	10.7	11.0	10.3	6.0	8.6	8.0	5.0			5.2	2.8	4.9	4.9	4.2	5.5	0.8	1.1	0.1	0.3
Paracyathus stearnsii	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	0.3	<.1
Parastichopus parvimensis	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	0.1
Paraxanthias taylori	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-	-	-	-	-
Pelecypoda unid.	-	-	-	-	-	-	-	-	<.1	-	-	-			<.1	<.1	-	-	-	-	-	-	-	-
Pelecypoda unid. boring	1.5	20.5	21.7	24.2	21.3	19.3	15.0	27.0	33.0	26.5	29.6	34.0			28.5	22.8	17.1	17.6	7.4	16.3	5.8	6.6	3.6	14.4
Phidiana hiltoni	-	-	-	-	-	-	-	-	<.1	<.1	0.3	<.1			0.2	-	-	-	-	-	-	0.1	0.1	-
Phragmatopoma californica	-	1.7	40.3	32.5	22.1	15.6	4.4	0.9	9.4	2.8	4.3	11.2			7.2	3.0	1.3	1.1	2.4	0.6	0.5	8.5	12.8	25.3
Phragmatopoma spp.	1.5	20.5	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Phyllochaetopterus prolifica	-	1.6	5.5	6.5	2.6	9.0	9.0	12.1	4.8	7.7	12.9	12.6			4.0	2.3	1.5	2.3	2.5	2.3	0.3	2.9	0.8	0.8
Pisaster brevispinus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	0.1	-	-	-	-	-
Pisaster giganteus	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	0.1	<.1	0.2	-	0.3	-	-	<.1
Pisaster/Henricia (juv.)	-	-	0.1	-	<.1	0.2	0.2	-	-	-	<.1	-			-	<.1	-	<.1	-	-	-	-	-	-
Pista spp.	-	1.4	0.4	<.1	0.3	1.0	0.7	0.8	0.9	1.8	0.5	0.7			0.6	1.1	0.9	1.7	2.3	3.0	4.3	3.0	0.5	2.3
Pista/Streblosoma spp.	1.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Placiphorella velata	-	-	-	-	-	-	<.1	-	-	-	-	<.1			-	-	-	-	-	-	-	-	-	-
Platyhelminthes unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	<.1	-	-	-	-	-	-
Pododesmus cepio	-	0.3	-	-	<.1	-	<.1	-	0.3	0.2	0.3	0.2			-	0.2	0.3	0.1	-	-	-	-	-	<.1
Polychaeta unid.	-	0.2	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Counted Regardless of Size (continued)																								
Polynoidae	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Prosthecerneus bellostriatus	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Pseudoceros montereyensis	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Pseudomelatoma torosa	-	0.2	0.9	0.8	0.5	0.6	1.8	0.8	1.2	1.1	1.3	0.9			0.6	0.3	0.6	0.3	0.3	0.3	-	-	0.1	<.1
Pugettia producta	-	-	-	-	-	<.1	0.4	-	<.1	0.3	0.3	0.1			<.1	0.2	-	-	<.1	-	-	-	-	-
Pugettia richii	-	-	0.3	<.1	0.7	0.8	1.7	1.5	1.3	1.8	0.4	0.2			0.8	0.8	0.4	0.1	0.8	0.5	1.0	0.9	0.8	0.3
Pugettia spp.	-	<.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	0.1	-	-	-	-	-	-
Pycnopodia helianthoides	-	<.1	<.1	-	-	-	-	-	-	-	-	<.1			-	-	0.3	<.1	<.1	-	-	-	-	-
Pycnopodia helianthoides (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-	-	-	-	-
Pyura haustor	-	0.3	0.5	0.7	0.6	0.5	0.5	0.4	0.4	0.1	0.4	0.5			0.6	0.7	0.4	0.3	0.3	-	-	-	-	0.2
Rostanga pulchra	-	-	-	-	-	-	-	-	0.2	-	-	<.1			<.1	-	-	-	-	-	-	-	-	-
Sabellidae	-	-	0.3	<.1	<.1	-	-	-	0.4	0.8	1.1	3.2			0.3	0.3	0.7	0.3	0.9	1.6	1.3	0.4	0.1	1.7
Serpula vermicularis	-	0.7	0.7	1.5	1.5	1.1	1.1	0.9	0.8	0.6	0.9	1.3			0.5	0.7	0.4	<.1	0.1	0.4	-	0.3	0.6	0.3
Serpulidae unid.	1.0	0.7	5.6	0.5	-	0.3	0.2	-	0.3	0.5	0.4	0.2			0.6	0.4	0.3	0.3	0.4	0.6	-	-	-	0.2
Serpulorbis squamigerus	-	-	0.3	0.4	0.4	0.6	0.6	0.6	0.6	1.0	1.2	1.5			0.8	0.8	0.4	0.3	<.1	0.6	-	0.3	0.3	0.5
Sipuncula unid.	2.3	0.4	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Spirobranchus spinosus	-	-	0.8	0.2	0.4	-	<.1	0.3	0.2	0.5	0.4	0.4			0.4	0.4	<.1	0.2	0.3	0.1	-	0.5	-	0.1
Strongylocentrotus franciscanus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	-	0.2	0.3	<.1	-	-	<.1	-			-	0.3	0.2	<.1	0.9	1.0	1.8	0.4	1.6	8.4
Strongylocentrotus spp.	-	-	-	-	-	0.3	<.1	-	0.1	<.1	0.8	0.4			0.4	0.3	0.6	0.3	0.2	1.0	-	-	-	-
Styela montereyensis	0.5	<.1	0.2	<.1	-	-	-	-	<.1	-	<.1	-			0.2	0.3	<.1	-	0.1	-	-	-	-	<.1
Stylochus spp.	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Tegula brunnea	1.3	3.5	5.8	4.7	3.5	4.0	3.2	2.3	1.1	1.4	2.1	3.6			0.8	1.4	2.6	0.2	1.1	0.3	-	0.9	-	-
Tegula montereyi	-	0.4	0.3	0.5	0.2	0.2	0.3	-	-	<.1	0.4	0.6			<.1	<.1	-	-	-	-	-	0.3	-	-
Tegula pulligo	-	<.1	0.2	<.1	<.1	<.1	0.2	-	<.1	<.1	0.2	0.3			<.1	<.1	0.3	-	<.1	0.1	-	-	-	-
Terebellidae unid.	-	-	0.2	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Tethya aurantia	-	-	-	-	-	-	-	-	-	-	-	-			-	0.1	<.1	-	-	-	-	0.3	-	<.1
Tetraclita rubescens	-	<.1	-	-	<.1	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Themiste pyroides	-	1.3	2.2	1.2	1.0	1.2	1.0	1.1	1.3	1.5	1.4	1.2			0.9	1.5	1.0	0.4	0.6	0.6	0.3	0.1	0.3	<.1
Tonicella lineata	0.3	<.1	0.6	0.3	0.4	0.4	0.3	0.7	0.9	0.5	0.5	0.8			0.6	0.2	0.1	0.1	<.1	0.3	-	-	-	-
Tricolia pulloides	-	-	-	-	-	-	<.1	-	0.3	0.8	-	0.4			<.1	-	0.9	-	-	0.3	-	-	-	-
Triopha catalinae	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Triopha maculata	-	-	-	-	<.1	-	-	-	-	0.1	-	<.1			0.1	<.1	-	-	-	-	-	-	-	-
Tritonia festiva	-	<.1	0.1	-	<.1	<.1	-	<.1	<.1	-	<.1	-			-	-	-	<.1	-	-	-	-	-	-
Trivia californiana	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-	-	-	-	-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-	-	-	-	-
Williamia peltoides	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	0.4	-	<.1	<.1	-	-	-	<.1	<.1	0.4	0.5			<.1	0.2	0.1	-	0.1	-	-	0.1	-	<.1
yellow-gilled porostome	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-	-	-	-	-
Coverage Based on # of 1" Squares																								
Abiet./Sertularella/Sertularia spp.	-	-	-	-	-	0.2	<.1	-	-	-	-	<.1			-	-	-	-	-	-	-	-	-	-
Barentsia spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1	-	-	-	-
Bryozoa, unid. (encrusting)	0.8	0.6	0.3	0.7	0.5	1.2	0.9	1.0	1.0	0.8	1.3	1.2			1.3	0.9	0.4	0.6	0.8	0.3	0.5	0.6	0.4	0.3
Bryozoa, unid. (erect)	-	-	<.1	-	-	-	-	-	-	<.1	-	-			-	<.1	-	<.1	-	-	<.1	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Diablo Cove Station SDC 3 at -4m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	3	5	6	6	3	6	3	6	6	4	5	ns	ns	4	4	4	4	4	2	1	2	2	4
Coverage Based on # of 1° Squares (continued)																								
Bryozoa, unid. (foliose)	-	-	0.1	-	-	-	-	<.1	<.1	<.1	0.3	<.1			<.1	<.1	<.1	<.1	<.1	-	-	-	-	-
Chthamalus fissus	-	-	-	-	-	-	-	-	-	-	-	-			-	1.5	-	-	-	-	-	-	-	-
Cliona spp.	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-	-	-	-	-
Didemnum/Tididemnum spp.	2.3	-	0.5	1.3	1.4	0.7	0.3	0.4	0.6	0.4	0.9	0.8			0.3	0.3	0.2	0.1	0.3	<.1	0.5	-	-	<.1
Dodecaceria fewkesi	-	0.5	0.4	0.1	0.9	0.9	0.9	0.5	0.4	0.7	0.6	0.5			-	-	<.1	-	-	-	-	-	-	-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	-	-	0.2			-	-	-	-	-	-	-	0.3	-	-
Hydroida	-	1.3	0.5	-	-	-	<.1	<.1	<.1	<.1	<.1	<.1			<.1	<.1	-	-	-	-	-	-	-	-
Hymenamphiastra cyanocrypta	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.1	0.3	0.3	0.1	<.1	0.2
Leucosolenia spp.	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
Porifera unid. (encrusting)	-	0.2	0.2	0.7	0.8	0.8	1.9	1.5	1.7	1.4	2.3	0.8			1.5	2.0	0.8	0.3	0.3	0.1	-	1.1	-	0.3
Salmacina tribranchiata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	0.1	<.1	-	-	0.5	-	<.1
Spirorbis spp.	-	-	-	<.1	0.2	<.1	1.0	0.8	0.6	0.6	0.6	0.4			0.8	0.6	0.3	<.1	0.1	<.1	<.1	<.1	<.1	<.1
Tricellaria spp.	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
epiphytic bryozoan (sq.)	-	-	-	-	-	-	-	-	-	-	-	-			-	0.2	-	-	-	-	-	-	-	-
tunicate, colonial unid. a (white)	2.8	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	2.8	3.4	2.5	2.1	2.3	2.4	2.3	2.5	2.3	2.6	3.1	2.2			2.0	1.6	1.4	0.4	0.6	0.8	1.0	1.1	0.1	<.1

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 1 at -3m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size																								
Acmaea mitra	1.0	0.6	0.8	0.5	0.4	-	0.8	0.6	2.8	2.2	0.3	0.7	0.2	0.4	0.1	0.2	0.2	0.8	0.9	1.0	2.0	-	1.1	0.8
Acmaeid unid. a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Aeolidia papillosa	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Aldisa sanguinea	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Alia carinata	-	3.9	8.6	2.7	2.3	3.8	1.4	0.7	2.3	2.7	0.8	1.4	0.8	0.9	1.4	0.2	1.6	1.4	1.1	0.3	-	1.3	-	0.6
Alia spp.	5.0	-	-	2.0	-	0.6	0.6	0.2	0.3	1.0	0.8	0.3	0.2	0.3	1.1	0.2	-	-	0.6	0.5	0.1	-	-	0.2
Alpheus spp.	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amphissa spp.	-	0.1	0.6	0.8	<.1	<.1	0.7	0.5	0.5	0.8	0.4	0.8	0.2	0.6	0.4	0.4	1.4	0.5	0.8	0.5	0.9	0.5	0.1	0.8
Amphissa versicolor	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anisodoris nobilis	-	0.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthopleura artemisia	-	0.1	-	-	-	<.1	-	0.2	-	<.1	0.1	0.2	<.1	0.2	0.3	<.1	-	-	0.1	-	-	-	0.1	0.2
Anthopleura elegantissima	0.3	0.4	0.4	0.7	0.8	0.3	0.3	0.6	0.5	0.8	0.6	0.5	0.4	0.3	0.4	0.3	0.4	0.3	0.3	0.4	0.4	-	0.6	0.8
Anthozoa unid.	0.3	-	-	<.1	-	-	-	-	-	-	-	<.1	<.1	<.1	-	-	<.1	0.2	-	-	-	-	-	-
Archidoris montereyensis	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Asterina miniata	0.5	0.6	0.5	1.1	1.3	0.8	1.3	1.3	0.2	<.1	-	0.4	0.3	0.3	0.1	<.1	0.3	0.3	0.4	0.4	0.6	0.5	0.1	0.2
Asterina miniata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	0.5	-	-
Balanophyllia elegans	0.8	1.6	0.5	0.6	1.5	0.8	0.9	0.8	0.7	1.1	-	0.2	<.1	0.9	0.6	0.6	1.0	0.8	0.4	1.4	0.5	0.3	0.8	1.0
Balanus spp.	6.3	-	-	1.4	-	-	-	-	-	<.1	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-
Balanus/Tetraclita spp.	-	-	0.9	0.9	-	0.3	8.3	1.8	4.3	2.5	4.1	-	0.2	0.4	1.9	0.3	11.7	6.8	-	5.3	4.9	5.5	0.8	8.1
Barnacles (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.9	3.1	-	7.5	-	-	-
Bittium eschrichtii	-	-	<.1	-	0.2	-	-	-	-	0.1	-	0.4	-	-	<.1	<.1	-	-	0.2	-	-	-	-	-
Bittium spp.	0.5	-	-	0.1	-	-	-	-	-	<.1	-	-	0.3	0.2	<.1	-	-	-	-	-	-	-	-	-
Boltenia villosa	-	-	-	-	-	-	-	-	-	-	-	<.1	0.3	-	-	-	-	-	-	-	-	-	-	<.1
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Cadlina flavomaculata	-	-	<.1	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma canaliculatum	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calliostoma ligatum	-	-	-	<.1	0.3	-	-	<.1	<.1	0.1	0.3	0.2	-	0.3	0.5	0.2	<.1	<.1	0.4	0.1	0.3	-	0.1	0.3
Calliostoma spp.	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Cancer antennarius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Cancer antennarius (juv.)	-	-	-	-	-	-	<.1	-	<.1	0.1	-	-	-	-	0.1	<.1	-	<.1	0.1	0.1	0.3	-	-	-
Cancer productus (juv.)	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-
Cancer spp.	-	-	-	-	0.3	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	0.3	-	-	-	-	-
Chelyosoma productum	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	-	-	-	0.1	-
Cirratulidae/Terebellidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Clavelina huntsmani	-	-	-	-	-	-	-	-	-	-	-	-	0.6	2.6	2.2	0.6	0.4	-	1.3	-	-	-	-	-
Clavularia spp.	-	-	-	-	-	-	<.1	-	2.2	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-
Cnemidocarpa finmarkiensis	-	-	-	-	-	-	-	-	<.1	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Crangon stylirostris	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula adunca	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crepidula spp.	-	-	-	-	-	-	0.2	-	0.3	1.0	-	0.7	0.8	1.6	0.4	0.4	0.4	0.3	0.4	0.6	0.8	0.5	-	1.4
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1
Cryptolithodes sitchensis	-	-	<.1	0.5	<.1	0.3	0.2	0.3	0.3	0.4	-	0.4	0.2	-	0.2	<.1	-	<.1	0.4	0.5	0.6	-	-	0.1
Cucumaria spp.	-	0.3	-	-	<.1	<.1	0.5	<.1	-	0.1	-	<.1	-	-	0.3	0.4	0.4	-	-	-	-	-	-	-
Dendrodoris spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Dendropoma lituella	-	-	49.2	81.1	101.7	66.2	92.7	52.6	89.0	66.5	30.1	61.6	56.3	77.3	49.3	92.8	41.6	14.8	19.5	16.6	2.0	2.5	4.6	1.0
Dendropoma spp.	50.8	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size (continued)																								
Diodora aspera	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diopatra ornata	-	-	-	<.1	-	<.1	0.2	-	-	0.2	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-
Discurria insessa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Doridacea unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-
Doriopsilla albopunctata	-	-	-	<.1	0.2	-	-	0.2	-	0.3	0.5	0.4	0.3	0.1	-	0.2	0.1	-	-	-	-	0.3	-	0.3
Epiactis prolifera	1.0	1.3	1.4	0.3	0.3	0.4	0.3	<.1	0.2	0.7	1.1	0.8	0.8	0.6	0.4	0.8	0.7	0.2	<.1	0.4	0.3	-	0.4	0.5
Eudistylia polymorpha	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eupentacta quinquesemita	-	-	-	<.1	-	-	<.1	-	-	-	0.1	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Fissurella volcano	-	0.4	-	-	-	-	<.1	-	<.1	-	0.1	-	-	<.1	-	0.2	-	-	-	-	-	-	-	-
Fusinus luteopictus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Gammaridea unid.	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gastropoda, neopic unid. a	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Halcampa decemtentaculata	0.8	-	-	0.4	0.3	0.3	<.1	0.2	0.2	0.5	-	2.0	0.8	0.6	0.8	1.0	0.6	0.2	<.1	-	0.1	-	0.1	0.4
Haliotis rufescens	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Haliotis spp. (juv.)	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Henricia leviuscula	0.5	-	0.5	<.1	-	-	-	-	-	-	-	<.1	-	0.2	0.1	-	0.4	-	-	-	0.1	0.3	0.1	0.3
Hermissenda crassicornis	-	-	-	-	-	<.1	-	-	<.1	<.1	-	<.1	-	0.4	-	-	0.1	<.1	0.1	-	-	-	-	0.3
Homalopoma spp.	-	-	-	-	-	-	0.5	-	0.2	1.1	0.5	2.8	2.7	5.4	5.9	4.2	4.1	3.9	5.2	5.9	5.8	6.0	4.1	8.3
Hopkinsia rosacea	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1
Ischnochitonidae	-	-	0.2	<.1	-	<.1	0.2	0.2	0.2	0.5	-	0.3	<.1	-	0.1	-	-	<.1	-	0.4	-	-	-	-
Lacuna spp.	-	-	-	<.1	-	0.2	<.1	-	0.4	<.1	0.3	0.3	-	-	0.2	<.1	<.1	0.2	0.3	-	0.3	-	-	-
Laila cockerelli	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lebbeus lagunae	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	0.1	-	-	-
Leptasterias hexactis	6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Leptasterias spp.	-	3.1	4.0	2.1	3.8	4.4	2.7	1.5	1.1	0.5	0.5	1.6	0.8	0.5	0.1	0.5	1.2	0.5	0.9	0.8	1.1	2.3	0.5	1.9
Leucandra heathi	-	-	-	-	-	-	-	-	0.5	0.4	-	0.3	-	<.1	<.1	-	-	<.1	-	-	0.3	-	-	-
Leucilla nuttingi	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	0.6	-	-	-	-	-
Lissothuria nutriens	-	-	-	-	-	-	<.1	<.1	<.1	<.1	-	-	<.1	-	<.1	-	-	0.3	0.2	-	-	0.3	0.1	-
Lithopoma gibberosum	0.3	0.1	<.1	0.3	0.3	-	0.2	-	-	<.1	-	0.2	0.4	0.4	<.1	<.1	-	-	-	-	0.3	0.5	-	<.1
Lithopoma gibberosum (juv.)	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	0.2	-	-	0.1	-	0.5	-	0.1
Lophopanopeus spp.	-	0.6	0.7	1.9	0.4	0.8	0.8	<.1	0.4	0.3	0.3	-	0.3	<.1	0.2	0.2	0.1	0.2	0.4	0.4	0.3	-	0.4	0.4
Lottia instabilis	-	-	-	-	-	-	-	-	-	0.3	0.1	0.7	-	0.5	0.8	0.3	0.5	0.4	0.2	-	-	-	-	0.6
Lottia ochracea	0.5	0.3	0.3	0.4	0.3	0.4	<.1	0.4	1.4	0.6	0.8	0.3	0.6	0.5	0.3	<.1	0.2	1.1	0.6	0.6	1.8	-	1.4	1.3
Lottia strigatella	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loxorhynchus crispatus	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Majidae	4.8	1.3	1.4	0.9	-	0.8	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manania spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Micrura verrilli	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Mimulus foliatus	-	-	-	0.1	-	1.0	-	-	0.2	<.1	-	-	-	0.3	0.2	0.3	-	-	<.1	-	0.3	-	-	-
Mitra idae	-	-	-	-	-	-	-	-	<.1	0.2	-	<.1	<.1	<.1	-	-	-	0.2	<.1	0.1	-	-	0.1	0.3
Modiolus spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Mopalia lignosa	-	-	-	-	-	-	-	0.2	<.1	<.1	-	-	0.2	<.1	<.1	-	-	-	-	-	0.3	-	-	<.1
Mopalia muscosa	-	-	-	-	<.1	-	-	-	-	0.2	-	-	<.1	<.1	<.1	<.1	-	-	0.1	-	0.1	-	-	-
Mopalia spp.	-	0.3	<.1	-	<.1	-	-	-	-	-	-	0.2	-	-	0.2	-	-	-	-	-	0.1	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size (continued)																								
Myxicola infundibulum	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	0.1	-	-	-	-	-	-	-	-	-
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	0.1	-	-	-	-
Nitidiscala spp.	-	-	-	-	-	<1	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-
Nitidiscala/Opalia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-
Ocenebra foveolata	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ocenebra interfossa	-	-	0.3	-	-	-	-	-	<1	0.3	-	-	-	<1	-	0.2	-	-	0.1	-	-	-	-	-
Ocenebra lurida	-	-	-	0.1	<1	<1	0.3	<1	-	<1	0.1	0.3	-	0.1	0.3	-	0.1	<1	<1	-	0.3	0.3	0.3	0.6
Ocenebra spp.	0.3	0.4	0.3	0.1	-	0.3	-	<1	0.3	0.1	0.1	-	0.4	0.1	0.3	0.3	0.1	-	0.4	-	-	-	-	<1
Opalia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-
Ophioplocus esmarki	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1
Ophiothrix spiculata	0.3	-	0.2	0.1	0.2	<1	0.4	-	<1	<1	-	<1	-	-	-	<1	-	-	<1	-	0.1	-	-	-
Pagurus spp.	1.5	1.5	7.8	12.6	14.6	23.8	17.6	6.6	11.8	8.9	7.9	7.8	4.8	3.7	5.5	7.1	7.6	6.8	7.6	2.8	4.8	8.5	4.4	5.9
Pelecypoda unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-
Pelecypoda unid. boring	-	0.3	0.3	0.3	0.3	0.3	2.1	1.7	1.1	2.3	0.3	0.3	0.9	0.8	1.1	2.4	1.4	0.3	0.6	-	0.5	1.3	0.1	<1
Phascolosoma agassizii	-	-	-	-	-	<1	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phidiana hiltoni	-	-	-	0.2	-	-	-	-	-	0.2	-	-	-	0.2	<1	-	-	-	-	-	0.1	0.8	-	<1
Phragmatopoma californica	-	2.5	34.3	6.8	8.9	10.7	7.5	2.1	8.8	56.7	40.0	21.8	76.8	117.1	88.0	33.2	44.9	8.3	6.0	6.9	7.4	13.8	10.8	44.1
Phyllochaetopterus prolifica	-	-	0.3	0.6	1.3	1.8	3.3	1.3	0.9	1.9	1.0	1.1	1.3	-	1.0	0.7	1.3	1.0	1.4	0.5	-	0.8	-	0.4
Pisaster giganteus	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	<1
Pisaster/Henricia (juv.)	-	0.5	2.3	4.3	2.8	4.1	3.2	0.7	<1	<1	0.9	0.3	-	0.3	0.5	0.7	0.9	0.4	1.0	0.4	0.5	0.5	0.3	-
Pista spp.	-	0.1	<1	0.3	<1	0.8	1.2	<1	0.9	1.3	0.5	0.3	-	-	-	-	0.3	<1	0.3	0.3	0.5	-	-	0.4
Placiphorella velata	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	<1	-	-	-	-	-
Pododesmus cepio	-	-	-	-	-	-	-	-	-	-	-	<1	<1	0.1	0.1	<1	<1	-	0.1	0.1	0.1	-	-	-
Polynoidae	-	-	-	-	<1	-	<1	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-
Porcellanidae unid.	0.3	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pseudomelatoma torosa	0.5	-	0.2	0.1	<1	0.3	0.8	0.4	0.4	0.7	0.4	1.0	0.7	0.9	0.8	0.8	0.8	0.3	0.8	0.6	0.1	0.5	-	0.1
Pugettia producta	-	-	-	<1	-	0.3	0.5	-	0.5	0.2	0.1	<1	<1	0.1	0.4	<1	0.1	<1	0.1	0.1	0.1	-	0.3	0.1
Pugettia richii	-	-	<1	3.8	1.9	3.4	3.0	0.4	0.7	1.8	0.5	0.8	0.9	0.8	1.3	1.4	0.9	0.6	1.1	0.1	0.4	0.8	0.1	0.8
Pugettia spp.	1.0	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	<1	-	-	-	-	-
Pycnopodia helianthoides	-	0.1	0.2	<1	-	-	-	0.2	-	<1	0.4	<1	0.2	0.1	<1	<1	<1	-	<1	0.1	-	-	-	<1
Pyura haustor	-	-	<1	-	<1	0.3	0.3	<1	<1	0.4	-	-	-	<1	-	0.4	0.3	-	-	0.1	-	-	-	-
Rostanga pulchra	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	-	-	-	-	-	-	-
Sabellidae	-	-	-	-	-	-	-	-	-	0.5	-	-	<1	0.3	0.1	-	0.1	-	<1	-	-	-	-	<1
Serpula vermicularis	-	0.1	-	-	-	-	0.2	-	-	<1	-	-	<1	0.5	<1	<1	0.3	<1	<1	0.3	0.4	-	-	-
Serpulidae unid.	5.0	1.4	0.6	0.4	0.3	<1	0.2	-	0.5	0.3	0.1	0.2	<1	<1	0.1	-	-	0.8	1.2	2.1	0.4	-	-	0.1
Serpulorbis squamigerus	1.0	0.9	1.3	1.9	2.8	0.6	0.3	0.4	1.3	3.1	2.9	1.3	1.5	1.8	1.6	1.4	0.7	0.6	0.8	0.6	-	-	-	-
Spirobranchus spinosus	-	-	-	-	-	0.3	-	-	<1	0.3	0.4	0.4	0.2	-	-	-	<1	0.3	0.4	0.6	0.5	-	-	0.3
Strongylocentrotus franciscanus	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strongylocentrotus purpuratus	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	<1	-	-	-	-	<1
Strongylocentrotus spp.	-	-	<1	-	<1	-	-	-	-	0.1	-	-	-	<1	0.1	-	-	<1	-	0.1	-	-	-	<1
Styela montereyensis	-	-	-	-	-	0.2	-	-	0.3	0.1	-	-	-	-	-	-	<1	-	-	-	0.1	-	0.1	0.1
Tectura fenestrata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-
Tectura paleacea	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tectura persona	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tegula brunnea	2.5	4.1	5.1	4.1	5.2	2.5	2.8	2.8	5.1	7.4	8.5	4.4	3.3	4.1	4.3	1.8	6.0	6.7	6.0	4.8	6.5	4.8	6.1	9.0

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 1 at -3m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	3	3	3	3	3	5	2	3	3	4	4	3	4	3	4	2	2	1	2	4
Counted Regardless of Size (continued)																								
Tegula montereyi	-	-	-	<.1	0.2	-	-	-	-	-	-	<.1	-	-	-	-	0.1	<.1	-	-	-	-	0.1	-
Tegula pulligo	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	<.1	-	-	<.1	-	0.1	-	-	-	-
Terebellidae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Tetraclita rubescens	-	5.4	2.7	2.0	9.6	2.3	7.3	1.9	1.7	3.3	-	-	-	-	1.7	2.3	7.2	6.1	8.4	-	-	-	0.8	-
Themiste pyroides	-	-	0.2	0.1	<.1	0.3	0.3	0.3	-	0.1	-	<.1	0.2	0.1	<.1	0.4	0.3	-	0.2	0.1	0.1	-	-	-
Tonicella lineata	0.5	-	<.1	1.0	0.8	0.2	0.8	1.0	1.1	0.9	1.4	0.5	0.3	0.4	0.3	0.4	0.5	<.1	0.9	0.6	1.3	0.3	0.5	1.4
Tricolia pulloides	-	0.8	-	0.4	-	0.3	-	0.5	2.6	0.4	0.1	0.5	0.3	0.3	0.6	0.4	0.1	0.2	-	0.3	-	-	-	-
Triopha maculata	-	-	-	-	-	-	0.2	-	0.2	<.1	0.1	<.1	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-
Tubulanus sexlineatus	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Urticina coriacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.2	0.3	0.3	0.3	0.1	-	-	-
Xanthidae unid.	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, solitary unid.	-	-	0.2	0.4	0.3	-	-	-	<.1	0.4	-	0.3	0.8	0.8	0.4	0.8	0.9	-	0.4	-	-	0.3	-	0.8
Coverage Based on # of 1° Squares																								
Abiet./Sertularella/Sertularia spp.	0.3	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aglaophenia spp.	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Archidistoma spp.	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa, unid. (encrusting)	4.3	0.5	1.0	1.4	1.9	1.1	1.5	0.9	1.7	1.4	1.4	1.9	4.3	2.6	2.1	1.8	1.3	1.8	2.1	1.8	0.8	0.5	0.6	1.4
Bryozoa, unid. (erect)	-	0.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Bryozoa, unid. (foliose)	-	-	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	0.1	-	-	-	<.1	-	-	-	-	-
Cauloramphus spiniferum	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cliona spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.4	-	-	-	-	-	-	-
Didemnum/Trididemnum spp.	1.5	-	-	<.1	0.7	<.1	<.1	-	-	<.1	0.4	0.4	0.6	0.8	1.0	1.1	0.8	0.7	0.1	0.1	-	-	-	0.6
Dodecaceria fewkesi	-	-	-	<.1	-	-	-	-	-	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	-	0.1	-	-	0.1	-	<.1	-	<.1	<.1	-	0.1	-	-	<.1
Hydroida	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	<.1	-	-	-	0.1	-	-	-	-
Hymenamphiastra cyanocrypta	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.3	-	-	-	-	-	-	-
Leucosolenia eleanor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Leucosolenia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-
Obelia spp.	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Perophora annectens	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2
Porifera unid. (encrusting)	-	1.1	1.4	1.4	2.4	1.9	4.6	0.5	0.9	2.5	0.8	0.9	1.3	1.4	1.3	1.8	0.9	1.4	2.0	1.3	0.8	1.0	0.6	1.4
Porifera unid. c (orange)	3.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ritterella pulchra	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salmacina tribranchiata	-	-	-	<.1	-	-	-	-	0.3	-	-	0.3	0.4	1.0	0.6	0.9	1.0	0.6	1.1	-	0.3	<.1	0.1	0.5
Spirorbis spp.	2.0	0.1	<.1	0.6	<.1	0.9	0.5	0.5	1.2	1.0	0.4	0.3	<.1	0.3	0.1	0.3	<.1	<.1	<.1	<.1	0.1	<.1	<.1	<.1
tunicate, colonial unid. a (white)	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicate, colonial unid. c (orange)	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tunicates, colonial/social unid.	1.0	1.3	0.8	1.3	1.3	1.8	2.7	0.2	0.3	2.0	1.6	1.1	1.2	2.1	1.0	1.1	1.3	0.9	0.8	0.4	0.5	0.3	0.4	2.3

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 2 at -6m

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size																								
Acmaea mitra	1.5	0.5	1.4	1.4	0.6	1.3	0.8	0.4	0.8	0.9	0.3	0.8			<.1	0.8	0.4	0.5	0.3	0.6				0.8
Aegires albopunctatus	-	-	-	-	-	-	-	-	-	<.1	-	<.1			-	-	-	-	-	-				-
Aeolidia papillosa	-	-	-	-	-	-	-	-	<.1	-	-	-			-	<.1	-	-	-	-				-
Aldisa sanguinea	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-				-
Alia carinata	-	0.4	2.8	0.5	1.1	3.3	0.9	-	0.3	0.4	-	-			-	-	-	-	0.1	0.1				0.2
Alia spp.	2.5	0.6	-	-	-	-	-	-	0.2	0.7	-	-			-	-	0.2	-	0.1	-				-
Alpheus clamator	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-				-
Amphissa spp.	0.5	0.1	0.8	1.9	2.3	2.2	1.7	0.7	1.0	0.5	<.1	0.5			0.3	1.5	0.9	0.4	1.3	2.6				0.9
Amphissa versicolor	-	1.3	1.2	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Anisodoris nobilis	-	-	<.1	-	0.3	-	-	-	-	0.2	-	-			-	0.2	-	-	-	-				-
Anthopleura artemisia	-	-	0.2	0.1	-	-	-	-	-	0.1	-	-			-	-	-	-	-	-				-
Anthopleura elegantissima	0.3	0.3	0.3	0.5	0.8	0.8	0.6	0.7	0.4	0.8	0.5	0.5			0.7	0.3	0.3	0.4	0.4	0.4				0.6
Anthopleura xanthogrammica	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1				-
Anthozoa unid.	-	-	-	0.4	-	-	-	0.3	0.2	<.1	0.3	0.4			-	-	<.1	-	<.1	-				<.1
Archidoris montereyensis	-	-	-	-	-	-	-	-	-	-	0.3	-			-	-	-	-	-	-				-
Ascidia ceratodes	-	-	-	-	-	-	0.2	-	-	-	-	-			-	-	-	-	-	-				-
Asterina miniata	1.0	1.5	1.3	1.8	1.8	2.2	1.4	1.5	0.3	0.5	0.2	0.5			0.6	0.5	0.6	0.6	1.1	0.6				0.5
Asterina miniata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Asteroidea unid.	-	-	0.3	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Balanophyllia elegans	14.3	16.0	35.4	41.7	53.8	52.3	61.9	67.7	73.5	63.5	65.3	56.7			50.5	45.0	66.1	42.5	42.6	47.6				18.7
Balanus aquila	-	-	-	-	-	-	-	-	-	0.1	-	-			0.2	0.3	-	0.2	0.3	0.3				<.1
Balanus nubilus	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-				-
Balanus spp.	11.0	-	0.5	<.1	0.1	-	-	-	-	0.2	0.2	0.3			-	-	<.1	0.4	0.1	-				-
Balanus/Tetraclita spp.	-	-	0.6	6.3	0.1	0.5	0.7	2.9	0.6	0.1	0.7	1.2			13.6	1.3	0.4	1.3	-	2.4				1.0
Barnacles (juv.)	-	-	-	-	-	-	-	-	-	-	1.1	-			-	-	-	3.8	-	3.8				-
Bittium eschrichtii	-	0.1	0.4	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Boltenia villosa	-	-	-	0.3	0.1	0.3	0.1	-	0.3	1.7	1.3	1.3			0.5	-	0.3	0.6	<.1	0.1				0.3
Brachyura unid. b (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1				-
Cactosoma arenaria	-	-	0.3	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Cadlina flavomaculata	-	-	-	-	-	<.1	-	-	-	-	-	<.1			<.1	-	-	-	-	-				0.2
Cadlina modesta	-	-	-	-	-	-	-	-	-	0.1	-	0.2			-	-	-	-	-	-				-
Calliostoma annulatum	-	-	-	-	-	-	-	-	-	<.1	<.1	-			-	-	-	-	<.1	-				-
Calliostoma canaliculatum	-	-	-	-	-	<.1	-	-	<.1	-	-	-			-	-	-	<.1	-	-				-
Calliostoma ligatum	-	0.3	-	0.4	0.6	0.7	0.5	0.3	<.1	0.7	1.1	1.3			0.8	1.0	0.6	1.3	1.3	1.5				1.5
Calliostoma spp.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Cancer antennarius	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Cancer antennarius (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	0.1	-	-	-				-
Cancer productus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-				-
Cancer spp.	-	-	-	0.1	-	-	-	<.1	-	<.1	-	<.1			-	-	-	-	-	-				-
Ceratostoma foliatum	-	-	-	0.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Chelyosoma productum	-	-	-	<.1	-	-	0.3	-	-	0.2	0.2	0.3			0.2	0.5	0.3	-	<.1	-				-
Chelyosoma spp.	-	-	-	0.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Cirratulidae/Terebellidae unid.	-	-	-	-	0.5	0.5	0.2	0.3	<.1	0.2	-	0.2			-	-	<.1	-	0.1	-				-
Clavelina huntsmani	-	-	-	<.1	-	0.6	-	1.7	1.4	0.2	2.1	3.8			-	-	0.1	0.8	-	0.3				-
Clavularia spp.	-	-	-	-	-	-	-	-	0.8	0.2	-	-			-	-	3.1	-	-	-				-
Cnemidocarpa finmarkiensis	-	-	<.1	-	0.4	0.3	0.2	0.3	0.3	0.6	0.9	0.4			0.4	-	-	0.5	<.1	-				<.1

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Corynactis californica	12.5	13.9	18.9	18.1	17.5	12.8	18.0	9.5	12.2	16.5	19.1	23.6			31.1	24.4	36.1	15.5	10.4	10.1				9.8
Crassedoma giganteum	-	-	-	-	-	-	-	-	-	0.1	-	-			-	<.1	<.1	-	0.1	0.1				-
Crepidula spp.	-	-	-	<.1	0.5	0.2	0.2	<.1	0.2	0.1	0.2	0.7			0.6	0.9	0.4	0.5	0.5	0.4				<.1
Cryptochiton stelleri	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Cryptolithodes sitchensis	0.3	-	0.3	0.1	-	0.2	-	<.1	0.3	0.2	-	0.2			0.1	-	<.1	<.1	<.1	0.5				0.2
Cucumaria spp.	-	-	0.5	0.6	0.3	0.3	1.0	1.2	1.9	1.8	9.1	2.1			2.3	0.5	0.3	-	0.3	0.1				0.7
Dendrodoris spp.	-	-	-	-	-	-	-	-	0.2	<.1	-	-			-	-	-	-	-	-				-
Dendropoma lituella	-	1.0	195.3	206.1	249.1	243.3	225.5	173.8	108.6	89.9	66.0	87.6			25.3	19.0	12.5	6.8	4.4	2.6				3.3
Dendropoma spp.	102.8	65.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Diaulula sandiegensis	-	-	-	-	-	-	-	-	<.1	<.1	-	-			-	-	-	-	-	-				<.1
Diodora aspera	-	-	-	-	-	-	-	-	-	-	-	0.3			-	0.2	<.1	-	-	0.1				-
Diopatra ornata	-	-	-	-	0.1	-	-	-	-	-	-	<.1			-	-	-	0.3	<.1	0.1				-
Dirona albolineata	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-				-
Doridacea unid.	-	-	-	-	-	0.2	-	<.1	-	-	-	-			-	-	0.2	-	-	-				-
Doriopsilla albopunctata	0.3	-	0.2	1.4	0.5	<.1	0.1	<.1	0.5	0.5	0.8	0.8			0.6	0.5	0.3	0.3	0.2	0.1				0.8
Epiactis prolifera	1.3	0.8	0.9	0.6	1.8	1.0	1.7	1.2	0.9	1.3	1.7	2.4			1.5	0.8	0.8	0.7	0.6	0.8				1.2
Erato vitellina	-	-	-	-	-	-	-	-	-	-	-	-			-	0.2	-	-	<.1	-				-
Eudistylia polymorpha	0.3	0.3	<.1	0.3	0.4	<.1	-	-	<.1	0.2	<.1	0.4			0.5	<.1	<.1	<.1	-	-				-
Eupentacta quinquesemita	-	-	-	-	-	0.2	0.5	0.3	0.5	0.1	0.3	0.3			0.2	<.1	0.3	<.1	0.3	0.1				-
Fissurella volcano	-	0.1	-	-	-	-	-	-	-	<.1	-	-			-	-	0.2	-	<.1	0.3				<.1
Flabellina iodinea	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Flabellina trilineata	-	-	-	-	0.4	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Fusinus luteopictus	-	-	-	<.1	-	-	<.1	-	-	-	-	-			0.4	0.2	0.3	0.2	0.5	-				<.1
Halcampa decemtentaculata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				<.1
Haliotis rufescens	0.3	-	-	-	-	0.2	<.1	-	-	<.1	-	-			-	-	-	-	-	0.3				-
Haliotis spp.	-	-	-	-	-	-	-	<.1	-	-	-	-			-	-	-	-	-	-				-
Haliotis spp. (juv.)	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	0.2	<.1	0.1	-				0.3
Henricia leviuscula	1.0	-	0.3	<.1	-	0.5	0.2	0.2	-	<.1	0.3	0.5			0.6	0.7	0.2	0.7	0.2	-				0.2
Heptacarpus spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Hermissenda crassicornis	-	-	<.1	0.2	-	<.1	0.1	0.4	0.2	0.2	<.1	-			<.1	0.2	<.1	<.1	-	0.3				0.3
Homalopoma spp.	0.5	2.5	2.3	2.8	3.1	1.5	1.3	1.3	1.0	0.8	2.6	2.8			3.1	6.1	4.6	5.4	5.6	6.6				4.3
Idotea spp.	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Ischnochiton spp.	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Ischnochitonidae	-	-	0.3	0.3	-	-	<.1	-	0.3	0.1	-	<.1			-	-	0.1	-	-	0.3				-
Lacuna spp.	-	-	-	0.6	-	-	0.2	-	-	-	-	-			-	<.1	<.1	0.2	<.1	-				0.3
Laila cockerelli	-	-	-	-	-	-	-	-	<.1	-	-	0.2			-	-	0.1	-	-	-				-
Lamellaria diegoensis	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Lepidozona spp.	-	-	-	-	-	-	-	-	-	-	-	0.2			-	<.1	-	0.2	<.1	-				0.2
Leptasterias hexactis	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Leptasterias spp.	-	0.5	0.8	1.1	1.1	0.9	0.8	0.3	0.3	0.5	2.3	2.5			0.9	2.1	0.4	0.8	0.6	0.6				0.9
Leucandra heathi	0.3	-	<.1	0.3	-	0.6	0.6	-	1.3	0.6	1.5	0.9			0.3	0.3	0.6	-	-	-				-
Leucilla nuttingi	-	-	-	<.1	1.0	0.9	1.0	0.7	5.2	3.4	2.6	1.8			2.8	1.9	0.7	-	0.4	0.8				0.2
Lirularia spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Lissothuria nutriens	-	-	-	-	-	-	<.1	-	-	-	0.2	-			-	-	-	-	-	-				-
Lithopoma gibberosum	-	0.3	1.6	1.1	0.1	0.3	0.2	<.1	<.1	<.1	0.2	<.1			0.1	0.3	0.1	<.1	-	0.1				-
Lithopoma gibberosum (juv.)	-	-	-	-	-	-	-	-	-	-	-	<.1			-	<.1	-	-	-	-				0.3

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Lophopanopeus spp.	-	-	-	0.3	0.9	-	0.1	<.1	-	-	-	-			-	0.3	0.1	<.1	0.2	0.1				-
Lottia instabilis	-	-	-	<.1	-	0.4	0.4	0.5	0.5	1.0	0.5	0.7			1.3	0.8	0.1	0.5	-	-				0.3
Lottia ochracea	0.3	0.8	0.8	0.5	-	0.7	0.2	0.2	0.2	0.4	-	-			<.1	0.3	0.2	<.1	0.4	-				0.3
Loxorhynchus crispatus	-	-	-	-	-	<.1	-	<.1	-	-	-	-			<.1	-	-	-	-	-				-
Loxorhynchus spp.	-	-	-	-	-	-	-	-	<.1	-	-	0.2			<.1	-	<.1	-	0.1	-				-
Majidae	1.5	0.5	1.6	0.7	-	-	-	0.3	-	-	-	-			-	-	-	-	-	-				-
Megabalanus californicus	-	-	-	-	-	-	-	-	-	0.1	-	-			-	-	-	-	-	-				-
Megathura crenulata	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Mimulus foliatus	-	0.1	<.1	0.1	-	0.2	0.3	-	-	-	-	0.2			<.1	0.2	0.1	-	0.2	-				<.1
Mitra idae	0.5	0.4	<.1	0.4	0.6	0.3	0.3	0.4	0.4	0.5	0.2	0.4			0.6	0.7	0.5	0.6	0.8	0.5				0.3
Mopalia lignosa	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-				-
Mopalia muscosa	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1				-
Mopalia spp.	-	-	-	-	-	-	-	<.1	-	<.1	-	0.2			-	-	0.2	-	<.1	-				-
Myxicola infundibulum	-	-	-	0.8	-	0.3	0.4	0.6	0.3	0.8	1.0	0.7			0.4	0.2	0.3	<.1	<.1	0.1				-
Nassarius mendicus	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	<.1	-				-
Natantia unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Nemertea unid.	-	-	-	-	-	-	-	-	0.2	-	-	-			<.1	-	0.1	-	-	-				-
Nereididae unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	0.1	-				-
Nitidiscala spp.	-	-	-	-	-	-	-	-	-	-	-	<.1			<.1	-	-	-	-	-				-
Nitidiscala/Opalia spp.	-	-	-	-	-	-	-	0.2	-	-	-	-			-	-	-	-	-	-				-
Ocenebra foveolata	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-				-
Ocenebra interfossa	-	-	-	-	-	0.2	-	0.2	-	-	-	-			-	-	<.1	-	-	-				-
Ocenebra lurida	1.0	-	0.8	0.7	0.8	1.0	0.7	0.5	0.2	-	0.5	<.1			0.3	<.1	-	<.1	-	0.5				-
Ocenebra spp.	-	-	0.8	1.3	0.9	<.1	0.1	0.2	0.2	0.1	0.3	<.1			0.5	0.4	0.3	<.1	0.3	-				-
Ophioplocus esmarki	-	-	<.1	0.2	-	-	0.1	-	-	-	-	0.2			-	-	-	-	0.2	-				-
Ophiothrix spiculata	-	-	0.3	0.9	0.9	<.1	0.1	0.5	-	<.1	<.1	0.3			0.3	0.8	0.9	0.5	1.3	0.8				<.1
Ophiothrix spp.	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Ophiuroidea unid.	-	-	-	<.1	0.3	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Orthasterias koehleri	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0.1				-
Pagurus spp.	7.0	0.5	7.3	5.3	10.9	7.8	17.3	4.6	2.0	7.3	3.7	5.5			3.8	6.5	6.0	4.9	6.8	4.9				6.7
Paracyathus stearnsii	-	-	-	-	0.4	<.1	0.2	<.1	-	<.1	-	-			-	<.1	0.2	0.3	0.1	0.3				-
Pelecypoda unid.	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Pelecypoda unid. boring	0.5	2.5	2.8	4.3	3.8	4.0	3.3	4.4	0.9	1.4	1.8	0.8			1.2	0.3	0.9	2.5	1.1	0.4				0.2
Petrolisthes spp.	-	-	-	0.1	-	-	-	-	-	-	-	-			-	-	<.1	-	0.1	-				-
Phascolosoma agassizii	-	-	-	0.8	-	-	-	<.1	-	-	0.2	-			-	-	-	-	-	-				-
Phidiana hiltoni	-	0.1	-	0.1	-	-	-	<.1	-	0.4	-	-			0.1	0.3	-	-	0.1	-				-
Phragmatopoma californica	-	4.3	17.3	19.8	15.1	16.1	35.4	24.8	43.8	93.8	109.8	67.8			37.1	16.8	11.1	8.2	6.2	8.6				4.8
Phyllochaetopterus prolifica	-	-	2.6	1.6	3.4	4.3	5.1	5.8	4.5	6.1	5.8	4.1			1.7	<.1	0.4	0.9	1.6	1.1				2.3
Pisaster giganteus	-	-	-	-	-	<.1	-	-	0.2	0.1	-	0.2			-	-	<.1	-	<.1	0.1				-
Pisaster ochraceus	-	-	-	-	-	-	-	0.3	-	-	-	-			-	-	-	-	-	-				<.1
Pisaster/Henricia (juv.)	-	-	0.4	0.4	0.8	1.2	0.8	0.3	0.2	0.7	0.7	0.8			0.7	0.6	0.8	0.2	0.5	0.1				-
Pista spp.	-	-	0.7	0.1	0.3	0.5	0.7	-	0.5	0.9	0.8	0.8			0.8	0.8	0.3	0.4	0.6	0.9				0.8
Pista/Streblosoma spp.	0.3	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Placiphorella velata	-	-	-	-	-	-	<.1	-	<.1	-	-	-			-	-	-	-	-	-				-
Pododesmus cepio	0.3	-	-	-	-	-	-	-	-	0.5	0.3	-			<.1	0.2	0.4	-	-	-				-
Polyplacophora unid. a	-	-	<.1	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Counted Regardless of Size (continued)																								
Porcellanidae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Pseudomelatoma torosa	-	0.1	-	-	-	<.1	<.1	-	<.1	<.1	0.3	0.2			0.2	0.8	0.5	0.6	0.3	0.3				0.3
Pugettia producta	-	0.1	<.1	-	0.1	-	-	-	-	0.2	-	0.3			-	-	-	-	-	-				<.1
Pugettia richii	-	-	0.5	2.6	3.3	1.8	2.7	1.1	0.7	1.6	0.9	1.9			2.3	2.6	2.7	1.5	2.8	1.9				0.9
Pugettia spp.	-	-	0.2	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Pycnogonida unid.	-	-	-	-	-	-	-	-	-	-	0.2	-			-	-	-	-	-	-				-
Pycnopodia helianthoides	-	-	0.2	-	-	-	-	-	-	-	-	-			-	-	-	<.1	-	-				-
Pyura haustor	-	-	0.4	1.6	3.0	3.3	2.6	1.6	1.5	3.1	3.7	2.9			2.1	1.1	0.9	0.7	0.3	0.6				0.4
Rostanga pulchra	-	-	-	<.1	-	-	-	<.1	0.2	-	-	-			<.1	-	-	-	<.1	-				-
Sabellidae	0.3	-	0.2	0.6	-	0.3	0.4	-	-	0.8	1.3	1.4			0.4	1.5	0.4	0.2	-	-				0.2
Scyra acutifrons	-	-	-	-	-	-	-	-	<.1	0.1	<.1	-			<.1	0.4	-	-	-	-				-
Searlesia dira	-	0.1	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Serpula vermicularis	-	-	-	1.8	3.3	3.4	3.6	7.2	6.8	6.7	7.5	6.3			2.3	1.8	1.9	1.4	1.1	1.4				1.0
Serpulidae unid.	10.5	0.5	1.8	2.2	1.1	1.5	0.6	1.3	3.2	2.3	1.1	0.8			0.5	-	0.2	0.3	0.4	1.9				-
Serpulorbis squamigerus	1.5	1.0	2.8	7.6	9.0	8.0	7.3	8.4	10.1	15.7	20.0	19.3			12.7	9.7	10.2	6.5	6.8	5.9				2.7
Sipuncula unid.	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Sphaeromatidae unid.	-	-	-	-	-	-	-	-	-	-	-	-			-	-	<.1	-	-	-				-
Spirobranchus spinosus	-	-	<.1	1.3	0.5	0.3	1.8	0.9	2.8	1.5	1.7	2.5			1.1	0.8	1.9	2.9	2.5	2.9				3.4
Strongylocentrotus franciscanus	0.8	0.1	-	<.1	-	-	-	-	-	0.1	<.1	-			-	-	-	-	-	-				-
Strongylocentrotus purpuratus	0.3	0.4	0.2	0.3	-	<.1	0.1	0.2	0.3	0.2	-	-			0.1	-	-	0.3	-	-				-
Strongylocentrotus spp.	-	-	-	<.1	0.3	0.3	0.5	0.2	0.3	0.5	-	0.8			0.5	1.2	0.3	0.3	0.4	0.6				0.2
Styela montereyensis	1.3	0.4	0.2	0.9	1.3	0.8	1.4	0.9	1.0	2.1	2.5	2.5			1.8	1.2	0.5	0.3	0.1	0.4				0.6
Styela spp.	-	-	-	-	-	-	-	-	0.2	-	-	-			-	-	-	-	-	-				-
Tectura persona	0.5	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Tegula brunnea	1.0	3.3	2.4	3.0	6.3	3.6	3.1	2.8	3.3	3.4	4.8	5.1			2.4	2.6	1.0	6.6	1.9	3.9				7.7
Tegula montereyi	-	-	-	<.1	-	-	0.2	-	-	-	0.4	-			0.1	<.1	0.2	0.2	0.1	-				0.2
Tegula pulligo	0.8	-	<.1	0.4	0.6	0.3	0.4	<.1	-	<.1	<.1	0.3			0.1	<.1	<.1	0.6	0.2	-				-
Terebellidae unid.	0.5	0.1	0.3	-	-	0.3	0.4	0.3	0.2	0.2	<.1	-			-	-	-	-	-	-				-
Tethya aurantia	-	-	-	-	-	-	0.1	-	-	-	-	-			-	-	-	-	-	0.1				0.2
Tetraclita rubescens	-	0.9	0.2	0.8	-	<.1	0.6	-	1.2	3.4	0.2	0.3			-	-	0.4	-	0.9	1.1				-
Themiste pyroides	-	0.1	0.5	0.6	0.4	1.8	0.2	0.9	0.3	0.6	0.3	0.6			0.4	0.8	0.4	0.2	<.1	0.4				<.1
Tonicella lineata	4.8	1.5	2.4	3.8	4.3	3.1	2.1	1.7	1.5	1.1	0.7	0.8			1.2	0.7	0.8	0.6	1.2	0.9				0.9
Tricolia pulloides	-	-	0.7	0.3	-	-	0.1	0.2	0.3	0.1	-	0.2			-	-	-	-	0.8	0.1				0.5
Tricolia spp.	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Triopha catalinae	-	-	-	<.1	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Triopha maculata	-	-	-	-	-	-	-	-	0.2	-	0.2	<.1			<.1	<.1	<.1	<.1	0.3	-				-
Tritonia festiva	-	-	-	-	-	-	-	-	-	<.1	-	-			-	-	-	-	-	-				-
Trivia californiana	-	-	-	-	-	-	-	-	-	0.1	-	-			-	-	-	-	-	-				-
Tubulanus polymorphus	-	-	-	<.1	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Tubulanus sexlineatus	-	-	-	-	-	-	-	-	<.1	-	-	-			-	-	-	-	-	-				-
Urticina lofotensis	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	<.1	-	-	-				-
Urticina spp.	-	-	-	-	-	-	-	-	-	-	-	-			-	<.1	-	-	-	-				-
tunicate, solitary unid.	-	0.9	0.3	<.1	-	-	0.2	0.3	0.3	0.7	1.3	1.4			1.8	2.1	0.8	1.6	0.4	-				0.6
Coverage Based on # of 1* Squares																								
Abiet./Sertularella/Sertularia spp.	5.5	-	-	<.1	-	-	<.1	-	-	0.1	<.1	0.2			<.1	<.1	<.1	-	-	<.1				-

(continued)

Subtidal Fixed Quadrat - Annual Invertebrate Mean Abundance/m^2 – South Control Station SC 2 at -6m (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Stations * Surveys	1	2	3	4	2	3	4	3	3	5	3	3	ns	ns	4	3	4	3	4	2	ns	ns	ns	3
Coverage Based on # of 1° Squares (continued)																								
Aglaophenia spp.	-	-	-	-	0.3	<.1	<.1	-	-	0.2	0.3	<.1			<.1	-	-	-	-	-				-
Bryozoa, unid. (encrusting)	18.5	6.3	1.8	4.1	2.9	4.3	5.1	5.3	3.4	6.7	5.8	6.6			3.9	3.6	6.0	4.0	3.6	4.1				3.8
Bryozoa, unid. (erect)	-	0.1	-	0.5	0.4	0.6	0.3	0.3	<.1	0.3	0.9	0.9			1.4	1.3	2.6	2.0	0.9	0.6				0.3
Bryozoa, unid. (foliose)	-	-	<.1	0.3	1.0	0.5	0.5	0.8	0.8	0.9	1.2	0.9			0.6	0.2	<.1	<.1	0.1	-				<.1
Cliona spp.	-	-	-	-	-	-	-	-	-	-	-	0.3			-	-	-	-	-	-				-
Didemnum/Tridemnum spp.	1.3	0.5	0.8	1.3	2.0	2.0	2.2	0.2	0.3	0.7	2.0	1.7			1.3	1.4	1.1	0.8	0.8	1.0				1.9
Dodecaceria fewkesi	-	-	-	-	-	-	-	0.5	-	<.1	-	-			-	-	-	-	-	-				-
Eurystomella bilabiata	-	-	-	-	-	-	-	-	-	0.1	0.8	0.6			-	-	-	<.1	-	-				-
Hydroid, thecate unid. a	-	0.3	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Hydroida	-	-	0.8	-	-	0.3	1.3	0.8	2.5	2.0	0.2	<.1			0.3	<.1	0.1	<.1	0.3	0.5				-
Hymenamphiastra cyanocrypta	-	-	-	<.1	0.4	0.8	0.3	0.2	0.2	0.3	0.9	1.3			1.7	2.0	3.8	1.4	2.6	2.3				2.4
Leucosolenia eleanor	-	-	-	-	-	-	-	-	-	-	-	-			<.1	-	-	-	-	-				-
Leucosolenia spp.	-	-	-	<.1	-	-	-	-	-	0.2	-	0.2			-	0.2	-	-	-	-				-
Metandrocarpa taylori	-	-	-	-	-	-	-	-	-	-	-	<.1			-	-	-	-	-	-				-
Obelia spp.	-	-	-	-	-	<.1	-	-	-	-	-	-			-	-	-	-	-	-				-
Phidolopora pacifica	-	-	<.1	<.1	-	-	-	-	0.4	0.3	0.2	0.3			0.4	<.1	<.1	<.1	<.1	-				0.5
Phidolopora spp.	1.0	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Porifera unid. (encrusting)	-	0.1	1.1	1.7	1.9	3.9	3.3	3.3	2.8	5.4	4.2	4.1			3.8	2.3	3.3	1.2	1.8	1.3				1.8
Porifera unid. c (orange)	0.8	-	-	-	-	-	-	-	-	-	-	-			-	0.7	-	-	-	-				-
Salmacina tribranchiata	-	-	<.1	0.2	0.3	0.2	0.2	0.3	<.1	0.1	0.7	0.3			0.6	0.5	0.4	0.2	<.1	0.1				0.6
Spirorbis spp.	-	-	-	0.4	0.9	1.8	1.4	1.0	1.2	0.8	0.3	0.3			0.3	<.1	<.1	<.1	<.1	<.1				<.1
Tricellaria spp.	0.8	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
Tubularia spp.	-	-	-	-	-	-	-	-	-	-	-	0.5			-	-	-	-	-	-				-
epiphytic bryozoan (sq.)	-	-	-	-	-	-	-	-	-	-	-	-			0.6	1.4	-	-	-	-				-
tunicate, colonial unid. b (yellow)	0.3	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-				-
tunicates, colonial/social unid.	-	0.3	0.8	1.6	1.5	1.7	2.7	0.8	1.1	3.1	2.1	3.8			1.0	1.8	1.6	1.3	1.3	1.0				1.1

F5 – Fish Abundance on Subtidal Fish Observation Transects

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – Field's Cove Station FC - Midwater

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	18
Damalichthys vacca																								0.2
Damalichthys vacca (juv.)																								0.1
Embiotoca jacksoni																								<.1
Embiotoca lateralis																								<.1
Oxyjulis californica																								10.8
Oxyjulis californica (juv.)																								5.4
Rhacochilus toxotes																								<.1
Sebastes atrovirens																								<.1
Sebastes atrovirens (yoy)																								<.1
Sebastes melanops (yoy)																								2.1
Sebastes mystinus (yoy)																								0.3
Sebastes paucispinis (juv.)																								0.2
Sebastes serranoides/S. flavidus (yoy)																								4.3
Triakis semifasciata																								<.1

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – Field's Cove Station FC - Benthic

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	18
Artedius spp.																								0.2
Aulorhynchus flavidus (juv.)																								<.1
Cebidichthys violaceus																								0.1
Cottidae unid. a																								<.1
Damalichthys vacca																								2.9
Damalichthys vacca (juv.)																								1.4
Embiotoca jacksoni																								1.6
Embiotoca jacksoni (juv.)																								1.4
Embiotoca lateralis																								1.6
Embiotoca lateralis (juv.)																								0.9
Embiotocidae unid. (juv.)																								<.1
Gibbonsia spp.																								0.2
Hypsurus caryi																								0.5
Hypsurus caryi (juv.)																								0.5
Oxyjulis californica																								14.5
Oxyjulis californica (juv.)																								9.2
Oxylebius pictus																								1.2
Oxylebius pictus (juv.)																								<.1
Rhacochilus toxotes																								<.1
Scorpaenichthys marmoratus																								0.2
Sebastes atrovirens																								0.2
Sebastes chrysomelas																								0.6
Sebastes chrysomelas (juv.)																								<.1
Sebastes chrysomelas/S. carnatus (yoy)																								0.1
Sebastes melanops																								0.5
Sebastes melanops (yoy)																								3.5
Sebastes mystinus																								0.1
Sebastes mystinus (juv.)																								<.1
Sebastes mystinus (yoy)																								0.3
Sebastes paucispinis (juv.)																								5.9
Sebastes rastrelliger																								0.1
Sebastes serranoides/S. flavidus (yoy)																								9.7
Semicossyphus pulcher																								0.1
Triakis semifasciata																								<.1

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – North Diablo Cove Station NDC - Midwater

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	11	18	16	18	16	6	14	11	11	18	15	18	10	16	23	18	24	12	21	15	9	9	12	18
Atherinidae unid.	-	0.2	-	-	-	-	-	-	-	0.6	-	6.3	-	3.1	5.2	-	8.3	-	7.8	7.8	17.5	74.2	2.1	5.7
Atherinopsis californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41.3	39.9	4.0	1.4
Atractoscion nobilis (Sciaenidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Aulorhynchus flavidus	-	0.3	0.6	4.8	0.1	0.3	<.1	0.2	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Brachyistius frenatus	0.1	0.3	0.4	0.3	-	<.1	<.1	-	-	0.4	-	<.1	-	<.1	<.1	<.1	0.3	0.1	1.2	<.1	0.2	-	-	<.1
Brachyistius frenatus (juv.)	-	-	-	<.1	-	-	-	-	-	<.1	<.1	-	-	-	-	-	<.1	-	-	<.1	0.4	0.2	-	0.3
Chromis punctipinnis	-	-	-	-	-	-	-	-	-	-	1.0	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Chromis punctipinnis (juv.)	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Cymatogaster aggregata	-	-	-	-	-	-	-	0.1	-	-	-	<.1	-	-	1.3	-	-	-	-	-	-	-	-	-
Cymatogaster aggregata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	21.9	<.1	6.4	-	-	-	-	-	-	-	-	-
Damalichthys vacca	<.1	0.1	0.2	0.2	<.1	0.2	0.2	<.1	0.2	0.3	<.1	0.2	0.2	1.1	0.4	0.4	0.9	0.2	5.0	0.3	0.6	0.1	0.3	1.1
Damalichthys vacca (juv.)	-	-	-	-	-	-	<.1	-	<.1	-	<.1	<.1	-	0.3	<.1	<.1	<.1	<.1	1.6	-	<.1	0.5	-	-
Embiotoca jacksoni	-	-	<.1	-	<.1	-	<.1	<.1	-	-	-	-	<.1	<.1	0.2	0.1	0.2	<.1	0.1	-	-	-	<.1	0.2
Embiotoca jacksoni (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-
Embiotoca lateralis	0.1	0.5	0.6	0.3	0.2	-	0.2	-	0.4	0.4	-	<.1	-	-	<.1	<.1	0.2	0.1	-	-	<.1	-	-	0.3
Embiotoca lateralis (juv.)	-	<.1	-	-	-	0.3	0.1	<.1	-	<.1	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	<.1
Embiotocidae unid. (juv.)	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gibbonsia spp.	-	-	-	-	-	-	-	<.1	-	-	-	-	-	0.2	-	-	<.1	-	-	-	<.1	-	-	-
Girella nigricans	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.5	0.3	0.4	-	0.3	0.8	-	-	<.1	0.8
Hermosilla azurea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0
Heterostichus rostratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Hexagrammos decagrammus	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypsurus caryi	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medialuna californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	0.3	<.1	0.2	0.7	0.1	-	-	-	-	-
Myliobatis californica	-	-	-	-	-	-	-	-	-	-	-	<.1	0.1	-	0.3	<.1	0.1	-	<.1	<.1	<.1	0.3	-	<.1
Oxyjulis californica	1.6	3.4	3.6	8.1	22.0	0.2	2.2	3.1	6.2	6.9	6.8	8.3	14.8	20.3	10.7	6.3	5.0	7.1	11.6	4.3	9.8	1.0	2.3	3.3
Oxyjulis californica (juv.)	-	<.1	0.7	7.0	-	-	-	0.6	-	0.1	2.5	0.5	7.1	-	2.4	1.4	2.2	18.4	8.6	0.4	<.1	3.2	3.8	2.4
Paralabrax clathratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	0.1	0.3	<.1	-	0.3	0.3
Paralabrax clathratus (juv.)	-	-	-	-	-	-	-	4.2	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Phanerodon atripes	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Phanerodon furcatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Phanerodon spp.	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhacochilus toxotes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	-	-	-	-	<.1
Scomber japonicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Sebastes atrovirens	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	<.1	-	<.1	<.1	-	-	-	<.1
Sebastes atrovirens (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	-	-	-	-	-	-	-
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	-	0.2	3.8	<.1	-
Sebastes caurinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.7	-	-	-
Sebastes chrysomelas/S. carnatus (juv.)	-	0.7	18.0	-	-	5.3	4.3	1.0	4.3	0.2	<.1	0.2	-	<.1	-	0.6	-	-	-	-	-	-	-	-
Sebastes chrysomelas/S. carnatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	31.7	51.0	0.6	-	-
Sebastes melanops (juv.)	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-	-	0.2	-	-	-	-	-	-	-	-
Sebastes melanops (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Sebastes mystinus	1.0	1.1	1.3	0.9	0.9	1.3	2.1	0.8	0.3	0.2	0.1	<.1	-	<.1	<.1	-	-	-	-	-	-	-	-	-
Sebastes mystinus (juv.)	2.5	6.8	3.7	4.2	7.4	0.8	0.1	-	0.2	0.1	0.7	-	0.2	0.3	0.1	2.9	0.1	-	-	-	-	-	-	-
Sebastes paucispinis (juv.)	-	1.0	-	12.2	-	-	-	-	0.2	-	<.1	0.3	-	-	-	0.4	-	0.3	0.3	-	-	-	-	-
Sebastes rastrelliger	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes serranoides	<.1	-	0.3	3.8	-	-	0.1	<.1	-	<.1	0.2	0.1	-	0.5	0.1	<.1	<.1	-	<.1	-	-	-	-	<.1

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – North Diablo Cove Station NDC - Midwater (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	11	18	16	18	16	6	14	11	11	18	15	18	10	16	23	18	24	12	21	15	9	9	12	18
Sebastes serranoides/S. flavidus (juv.)	0.5	7.0	-	12.2	0.5	1.0	-	-	2.7	1.9	4.0	25.6	3.9	0.9	1.9	5.2	<.1	-	0.1	<.1	-	-	-	-
Sebastes serranoides/S. flavidus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.8	<.1	0.1	0.2	-	-	4.3
Sebastes spp. (juv.)	-	0.1	<.1	0.6	<.1	<.1	-	<.1	-	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-	-	-	-	-
Semicossyphus pulcher	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.2	0.8	0.1	-	-	<.1	-	-	-	<.1	<.1
Semicossyphus pulcher (juv.)	-	-	-	-	-	-	-	-	-	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Trachurus symmetricus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.1
Triakis semifasciata	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	<.1	<.1	<.1	0.2	<.1	0.3
larval/post-larval fish, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35.4	-	1.0	-	-	-	0.2	-

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – North Diablo Cove Station NDC - Benthic

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	11	17	16	18	15	6	14	11	11	18	15	18	10	15	23	18	24	12	21	15	9	9	12	18
Anoplarchus purpurescens	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius lateralis	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius spp.	-	-	0.1	<.1	<.1	0.3	0.2	0.2	0.3	0.1	<.1	<.1	0.1	<.1	<.1	0.3	<.1	0.1	0.2	0.1	<.1	<.1	-	-
Atherinidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	-	-	-	-	-	-	-
Atherinopsis californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.8	0.2	-	-
Atractoscion nobilis (Sciaenidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4
Aulorhynchus flavidus	1.3	-	0.4	2.8	-	0.1	-	<.1	-	-	-	-	-	<.1	<.1	-	-	-	<.1	<.1	-	-	-	-
Aulorhynchus flavidus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Brachyistius frenatus	0.4	<.1	1.4	1.5	0.1	0.5	0.4	0.2	-	0.8	-	<.1	-	0.2	0.5	0.2	0.3	0.2	0.4	0.4	-	0.3	-	-
Brachyistius frenatus (juv.)	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Cebidichthys violaceus	<.1	<.1	0.5	0.2	0.3	-	0.2	0.5	0.3	0.1	<.1	0.1	<.1	<.1	0.4	0.6	0.4	0.2	<.1	0.3	0.3	0.3	0.1	0.1
Cephaloscyllium ventriosum	-	<.1	-	-	-	-	<.1	<.1	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromis punctipinnis	-	-	-	-	-	-	-	-	-	-	0.2	<.1	-	-	-	-	-	<.1	<.1	-	-	-	-	-
Chromis punctipinnis (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Clinidae unid.	-	-	-	-	-	0.3	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coryphopterus nicholsi	-	-	-	<.1	0.4	0.5	<.1	<.1	-	-	0.1	2.1	3.8	9.2	4.0	4.4	4.9	3.8	2.6	1.9	1.8	2.0	0.9	0.9
Coryphopterus nicholsi (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	0.1	-
Cottidae unid. a	0.1	0.3	0.6	0.6	0.6	0.3	0.5	0.4	0.6	0.5	0.4	0.4	<.1	<.1	<.1	0.1	<.1	-	<.1	0.3	<.1	0.2	-	<.1
Cymatogaster aggregata	0.1	-	-	-	0.3	-	-	0.4	-	-	-	0.5	37.3	-	-	-	-	-	-	-	-	-	-	-
Cymatogaster aggregata (juv.)	-	-	-	-	-	-	-	-	-	<.1	-	4.4	-	-	7.3	-	-	-	-	-	-	-	-	-
Damalichthys vacca	0.2	<.1	0.2	0.7	0.8	0.8	0.8	0.4	1.4	2.9	2.2	1.9	2.6	2.4	4.1	2.9	2.8	2.6	10.7	1.8	1.9	1.5	2.5	7.6
Damalichthys vacca (juv.)	<.1	-	-	<.1	-	-	0.2	<.1	-	1.6	0.3	2.2	0.5	0.8	1.9	1.2	0.9	1.3	3.0	4.2	0.3	3.8	0.3	3.2
Embiotoca jacksoni	0.5	0.2	0.6	0.6	1.1	0.8	0.9	1.6	1.2	3.4	2.8	2.6	2.2	3.7	2.9	2.8	3.0	1.1	3.8	2.8	3.6	2.5	3.3	5.9
Embiotoca jacksoni (juv.)	-	<.1	<.1	0.1	<.1	-	<.1	0.1	-	0.5	0.3	0.8	0.2	0.6	0.9	0.7	0.6	0.3	0.9	1.0	0.3	0.7	0.5	1.5
Embiotoca lateralis	3.7	3.4	2.3	3.0	3.3	3.1	2.5	1.7	2.6	4.4	3.8	1.1	1.0	1.4	1.6	1.5	1.4	0.5	1.1	1.5	1.6	0.2	1.6	2.1
Embiotoca lateralis (juv.)	0.7	1.4	0.1	0.6	0.7	0.4	0.6	0.6	0.3	1.2	1.3	0.5	0.5	1.9	0.7	0.4	0.8	<.1	0.3	<.1	0.2	0.5	<.1	0.5
Embiotocidae	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Embiotocidae unid. (juv.)	-	-	<.1	0.2	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	-	-	<.1	-	-	-	-
Engraulis mordax	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gibbonsia spp.	0.7	0.4	0.7	0.7	1.0	0.6	0.5	0.7	0.4	0.9	1.0	0.9	0.5	0.3	0.6	1.1	2.1	0.9	1.5	1.1	0.4	1.1	0.2	0.3
Girella nigricans	-	-	-	-	-	-	-	-	-	-	<.1	0.5	<.1	4.3	2.1	2.8	1.5	0.3	2.0	1.7	0.8	1.7	0.7	5.1
Gobiesocidae unid. a	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-
Gobiesox maeandricus	-	-	<.1	-	-	-	<.1	<.1	<.1	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-
Halichoeres semicinctus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Halichoeres semicinctus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Hermosilla azurea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Heterostichus rostratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Heterostichus rostratus (juv.)	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Hexagrammos decagrammus	0.5	0.8	0.6	0.4	0.7	<.1	0.3	0.9	0.3	0.2	0.1	<.1	-	<.1	-	-	-	-	<.1	<.1	-	-	-	-
Hexagrammos decagrammus (juv.)	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hyperprosopon anale	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Hypsurus caryi	-	<.1	-	-	<.1	-	-	<.1	-	3.6	0.1	<.1	0.3	0.3	<.1	0.7	-	<.1	<.1	-	-	-	-	0.3
Hypsurus caryi (juv.)	-	-	-	-	-	-	-	-	-	0.2	<.1	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-
Jordania zanope	-	<.1	<.1	<.1	<.1	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medialuna californiensis	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.8	0.1	0.5	0.1	0.4	-	<.1	0.2	-	-
Myliobatis californica	-	-	-	-	-	-	-	-	-	-	-	0.4	0.1	0.9	1.4	0.4	<.1	-	0.2	-	0.1	0.3	0.5	<.1
Ophiodon elongatus	<.1	0.2	0.2	<.1	0.3	0.3	0.2	-	-	<.1	-	-	-	0.1	<.1	<.1	-	<.1	-	-	<.1	-	<.1	<.1

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – North Diablo Cove Station NDC - Benthic (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	11	17	16	18	15	6	14	11	11	18	15	18	10	15	23	18	24	12	21	15	9	9	12	18
Ophiodon elongatus (juv.)	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orthonopias triacis	0.4	0.3	<.1	<.1	0.2	-	0.2	<.1	0.2	<.1	-	0.1	<.1	-	-	-	-	-	-	-	-	-	-	-
Oxyjulis californica	11.3	3.0	5.8	17.9	13.9	13.1	17.7	6.3	34.1	18.7	23.5	47.0	46.9	52.4	38.7	24.9	24.3	26.3	25.2	23.9	26.6	15.0	7.2	16.0
Oxyjulis californica (juv.)	-	-	1.9	19.0	1.0	-	5.1	2.0	0.8	3.5	10.8	23.5	13.3	11.5	15.9	5.9	3.6	54.6	18.0	2.4	0.5	6.0	6.3	5.6
Oxylebius pictus	0.8	1.4	1.2	2.4	5.1	1.8	2.8	2.7	2.3	2.2	2.4	2.7	2.1	3.0	2.4	2.5	2.5	1.0	0.9	0.9	1.7	1.2	0.8	1.0
Oxylebius pictus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-
Paralabrax clathratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.2	0.9	1.5	0.5	0.6	1.3	0.8
Paralabrax clathratus (juv.)	-	-	-	-	-	-	-	7.1	-	<.1	-	-	-	-	-	-	-	-	0.3	-	-	-	0.2	-
Phanerodon atripes	0.1	-	-	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.1
Phanerodon furcatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-	-	<.1
Phanerodon spp.	-	-	<.1	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae/Stichaeidae unid.	-	-	-	-	-	-	-	-	0.1	<.1	0.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Pleuronichthys coenosus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-
Rhacochilus toxotes	<.1	-	<.1	<.1	<.1	-	-	0.1	-	0.1	0.2	-	-	0.2	0.6	0.2	0.1	-	0.4	0.2	0.1	-	0.3	0.8
Rhacochilus toxotes (juv.)	-	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Scorpaenichthys marmoratus	0.3	0.3	0.9	0.7	1.5	0.3	1.1	0.9	0.8	0.5	1.0	1.0	0.5	0.5	0.4	0.6	0.2	0.1	0.2	<.1	0.3	<.1	0.2	0.1
Scorpaenichthys marmoratus (juv.)	-	-	<.1	-	-	-	-	-	-	-	0.1	-	-	-	<.1	-	<.1	-	<.1	-	-	-	<.1	<.1
Sebastes atrovirens	<.1	-	<.1	<.1	<.1	<.1	0.2	0.3	<.1	0.1	0.1	0.2	-	0.2	<.1	<.1	0.2	-	0.1	0.3	0.3	-	0.2	0.4
Sebastes atrovirens (juv.)	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.6	<.1	0.4	<.1	-	<.1	0.2	-	-	-	<.1
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	16.5	0.9	0.8	0.1	0.3	<.1
Sebastes auriculatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Sebastes carnatus	-	-	-	<.1	<.1	-	-	<.1	<.1	-	-	-	-	<.1	-	<.1	0.1	<.1	<.1	-	0.2	-	-	-
Sebastes carnatus (juv.)	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Sebastes caurinus (juv.)	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Sebastes caurinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-
Sebastes chrysomelas	0.9	2.5	2.2	3.1	4.3	1.4	2.7	4.7	2.6	2.5	2.4	2.2	2.0	1.2	1.2	1.5	1.5	0.5	0.7	1.6	0.8	0.8	1.0	1.4
Sebastes chrysomelas (juv.)	-	0.2	<.1	0.2	<.1	-	-	-	-	-	-	-	-	<.1	-	-	0.1	<.1	<.1	0.2	0.4	0.5	<.1	0.5
Sebastes chrysomelas/S. carnatus (juv.)	-	3.0	9.3	0.7	0.7	4.5	1.5	1.5	2.5	0.5	<.1	0.9	0.1	<.1	<.1	1.1	<.1	<.1	0.1	0.3	-	-	-	-
Sebastes chrysomelas/S. carnatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	1.9	22.4	5.8	2.8	4.9	-
Sebastes melanops	-	-	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-
Sebastes melanops (juv.)	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-	2.6	-	-	-	-	-	-	-	-
Sebastes melanops (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.2	-	-	-	<.1
Sebastes mystinus	1.6	1.1	1.1	1.6	1.7	2.6	5.2	1.6	1.1	1.1	0.5	0.4	0.2	0.6	0.1	1.1	<.1	-	-	-	-	-	-	-
Sebastes mystinus (juv.)	6.2	9.6	4.4	19.0	9.0	2.4	0.2	-	2.1	2.9	1.0	0.4	2.2	0.6	2.0	9.1	0.2	-	-	-	-	-	-	-
Sebastes paucispinis (juv.)	-	0.7	-	7.2	-	0.5	-	-	<.1	0.1	-	0.8	-	-	-	0.4	-	0.1	0.1	-	-	<.1	-	<.1
Sebastes rastrelliger	<.1	0.2	<.1	0.1	0.6	0.3	0.6	0.6	0.8	0.5	0.8	1.0	0.7	1.1	1.3	1.0	0.3	0.4	0.4	0.4	0.2	0.2	<.1	0.1
Sebastes rastrelliger (juv.)	-	-	-	<.1	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Sebastes serranoides	-	0.1	-	-	0.1	-	<.1	-	<.1	<.1	0.4	0.4	<.1	1.3	0.6	<.1	0.2	<.1	0.1	<.1	0.2	-	<.1	<.1
Sebastes serranoides/S. flavidus (juv.)	2.9	10.0	0.4	26.0	<.1	0.9	<.1	-	4.6	5.8	1.2	8.2	5.3	1.9	3.1	5.7	0.2	-	0.1	-	-	-	-	<.1
Sebastes serranoides/S. flavidus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.2	0.6	0.7	0.3	-	<.1	2.6
Sebastes spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes spp. (juv.)	-	<.1	0.2	2.1	0.1	-	-	0.5	0.1	1.1	0.1	0.5	1.0	1.6	<.1	-	-	-	-	-	-	-	-	-
Semicossyphus pulcher	-	-	-	-	-	-	-	-	-	-	-	-	0.4	5.9	3.8	1.9	0.4	0.5	0.7	1.0	0.7	-	0.7	0.5
Semicossyphus pulcher (juv.)	-	-	-	-	-	-	-	-	-	0.3	2.8	3.0	2.9	-	-	-	-	-	<.1	-	-	-	-	<.1
Torpedo californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – North Diablo Cove Station NDC - Benthic (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	11	17	16	18	15	6	14	11	11	18	15	18	10	15	23	18	24	12	21	15	9	9	12	18
Trachurus symmetricus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3
Triakis semifasciata	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.2	<.1	<.1	0.1	-	0.3	<.1	<.1	0.2	-	0.3
Urolophus halleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	<.1	0.2	-	0.1
Xererpes fucorum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-
Xiphister spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Diablo Cove Station SDC - Midwater

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	14	6	16	12	18	18	15	15	10	16	24	18	24	15	21	15	9	9	12	18
Atherinidae unid.	-	-	-	-	-	-	-	0.7	6.3	11.5	-	-	-	-	-	-	1.0	-	1.5	2.6	43.1	13.4	8.6	2.8
Atherinopsis californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13.3	26.8	-	0.7
Atractoscion nobilis (Sciaenidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3
Aulorhynchus flavidus	0.1	<.1	2.4	0.8	12.7	0.5	<.1	-	-	0.2	0.1	0.2	<.1	0.9	<.1	<.1	<.1	<.1	1.0	0.1	3.4	<.1	-	-
Aulorhynchus flavidus (juv.)	-	-	-	-	-	-	-	-	-	-	1.4	-	-	-	-	-	-	-	0.2	0.1	1.4	-	-	-
Brachyistius frenatus	0.4	0.1	0.2	0.4	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	0.3	0.5	0.3	3.1	1.4	<.1	0.2
Brachyistius frenatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.1	-	-	-
Chromis punctipinnis (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Cymatogaster aggregata	-	-	-	-	-	-	-	0.2	1.9	-	-	-	19.8	-	-	-	-	-	-	-	-	-	-	-
Cymatogaster aggregata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	68.3	-	5.3	-	-	-	-	-	-	-	-	-
Damalichthys vacca	<.1	<.1	0.3	0.3	0.3	<.1	0.3	-	0.1	<.1	0.2	-	-	<.1	1.2	<.1	0.2	0.2	0.3	0.3	0.2	0.4	0.3	0.5
Damalichthys vacca (juv.)	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-	-	-	-	1.7	-	-
Embiotoca jacksoni	<.1	-	-	<.1	<.1	-	-	-	<.1	-	<.1	-	-	-	<.1	-	-	<.1	0.1	-	-	-	0.3	-
Embiotoca lateralis	0.2	-	0.3	0.7	<.1	0.2	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Embiotoca lateralis (juv.)	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Embiotocidae unid. (juv.)	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-
Engraulis mordax	-	-	-	<.1	-	-	-	-	-	-	-	4.2	-	-	-	<.1	-	143.1	-	-	-	-	-	-
Gibbonsia spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	-	-
Girella nigricans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
Heterostichus rostratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Heterostichus rostratus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-
Hexagrammos decagrammus	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypsurus caryi	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medialuna californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-
Myliobatis californica	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	<.1	0.3	0.2	0.3	<.1	-	<.1	-	<.1	-	<.1
Oxyjulis californica	3.5	5.5	27.1	21.9	4.0	6.6	6.7	4.3	5.0	3.8	8.4	0.9	25.5	14.6	10.8	15.4	9.7	10.4	5.2	2.5	13.3	9.2	5.9	7.6
Oxyjulis californica (juv.)	1.5	0.1	0.6	23.2	12.6	-	<.1	2.0	3.3	<.1	3.4	2.8	2.6	5.3	0.3	0.2	5.8	10.7	22.6	3.9	4.2	2.5	24.6	3.3
Paralabrax clathratus	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2	0.1
Paralabrax clathratus (juv.)	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
Phanerodon furcatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	0.1	-	-	-	-	-	-	-	-
Phanerodon spp.	-	-	-	0.2	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhacochilus toxotes	<.1	<.1	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes atrovirens	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	0.4	-	-	<.1
Sebastes atrovirens (juv.)	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	-	-	-
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	10.1	0.6	0.8	2.2	0.1	-
Sebastes caurinus (juv.)	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes caurinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	-	-	-
Sebastes chrysomelas/S. carnatus (juv.)	-	0.1	5.9	0.1	-	27.8	6.5	1.3	0.4	0.7	<.1	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-
Sebastes chrysomelas/S. carnatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	2.7	8.1	8.3	0.8	-	-
Sebastes mystinus	-	1.4	-	<.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes mystinus (juv.)	-	2.0	<.1	2.4	<.1	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes paucispinis (juv.)	-	1.9	-	17.4	-	0.1	-	-	<.1	0.1	0.2	-	-	-	-	0.1	-	-	-	<.1	-	-	-	-
Sebastes rastrelliger	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes serranoides	-	<.1	<.1	0.2	-	-	<.1	<.1	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-	-
Sebastes serranoides/S. flavidus (juv.)	0.3	8.0	-	44.7	<.1	0.2	<.1	-	3.0	2.5	0.3	<.1	5.9	-	0.9	0.1	-	-	-	-	-	-	-	-

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Diablo Cove Station SDC - Midwater (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	14	6	16	12	18	18	15	15	10	16	24	18	24	15	21	15	9	9	12	18
Sebastes serranoides/S. flavidus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	<.1	-	-	0.2	-	1.7
Sebastes spp. (juv.)	<.1	-	0.4	4.7	0.8	-	-	0.9	-	-	<.1	-	0.2	-	-	-	-	-	-	-	-	-	-	-
Semicossyphus pulcher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Trachurus symmetricus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-	-
Triakis semifasciata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	0.2
larval/post-larval fish, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19.4	-	4.8	-	-	-	1.3	-

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Diablo Cove Station SDC - Benthic

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	14	6	16	11	18	18	15	15	10	16	24	18	24	15	21	15	9	9	12	18
Anoplarchus purpurescens	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius lateralis	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Artedius spp.	-	-	0.6	0.1	0.2	0.3	<.1	<.1	0.3	0.1	<.1	0.1	<.1	<.1	<.1	<.1	0.1	0.2	0.3	0.1	0.3	0.3	0.2	0.1
Atherinidae unid.	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Atherinopsis californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-
Atractoscion nobilis (Sciaenidae)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Aulorhynchus flavidus	<.1	-	9.0	1.6	0.1	1.1	2.4	4.1	<.1	0.2	4.0	1.2	0.4	7.2	<.1	4.3	0.1	<.1	9.6	0.2	0.3	0.3	-	1.8
Aulorhynchus flavidus (juv.)	-	-	-	-	-	-	-	-	-	-	0.6	-	-	6.3	3.2	0.6	2.1	0.2	1.0	5.0	0.3	-	<.1	-
Brachyistius frenatus	0.3	-	0.2	0.7	<.1	<.1	0.1	-	-	-	-	-	-	<.1	0.5	<.1	0.1	-	0.4	<.1	0.3	1.1	-	<.1
Brachyistius frenatus (juv.)	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	<.1	<.1	-	-
Cebidichthys violaceus	-	-	<.1	0.1	-	0.4	<.1	-	0.2	<.1	<.1	<.1	0.3	0.3	0.1	0.2	0.1	<.1	<.1	-	<.1	-	-	-
Cephaloscyllium ventriosum	-	-	-	0.1	<.1	0.7	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chilara taylori	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Chirolophis nugator	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Citharichthys spp.	0.1	-	-	1.2	0.4	1.3	0.2	0.1	1.1	1.7	0.6	5.1	7.0	2.7	0.3	1.9	1.3	0.4	9.4	0.3	3.2	1.5	0.5	0.9
Citharichthys spp. (juv)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	<.1	-	<.1	-	-	-	0.5
Citharichthys stigmaeus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Coryphopterus nicholsi	0.1	-	-	-	-	-	-	-	<.1	<.1	<.1	0.1	0.4	0.8	<.1	0.9	0.6	0.2	0.1	<.1	-	0.8	0.1	<.1
Coryphopterus nicholsi (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	0.2
Cottidae unid. a	0.7	0.6	0.3	0.7	0.6	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.2	0.1	<.1	0.1	<.1	-	0.1	0.1	<.1	0.2	0.1	0.1
Cymatogaster aggregata	-	-	-	-	-	-	-	-	-	-	-	0.1	4.2	<.1	<.1	<.1	-	-	-	-	-	-	-	-
Cymatogaster aggregata (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	18.1	-	-	-	-	-	-	-	-	-
Damalichthys vacca	0.2	<.1	0.4	0.8	0.7	0.6	0.2	0.6	0.3	0.6	1.4	0.5	<.1	0.1	2.9	0.6	0.5	0.8	1.6	0.3	1.8	4.1	1.3	2.6
Damalichthys vacca (juv.)	-	<.1	-	-	-	-	0.1	<.1	0.1	0.8	<.1	0.4	0.4	<.1	3.2	0.6	<.1	0.3	-	-	0.7	10.6	-	<.1
Embiotoca jacksoni	0.3	0.1	1.0	1.0	1.1	0.2	0.8	0.6	0.7	0.7	1.4	1.1	0.4	<.1	1.0	0.5	0.4	0.5	0.6	0.2	1.4	2.5	1.0	1.7
Embiotoca jacksoni (juv.)	<.1	-	<.1	0.1	0.3	0.3	0.4	-	0.4	1.0	0.4	0.2	1.9	0.3	0.3	0.3	0.3	<.1	<.1	<.1	<.1	0.8	<.1	0.3
Embiotoca lateralis	0.4	0.4	1.1	2.3	0.7	0.4	1.0	1.1	0.5	0.6	1.0	0.1	<.1	<.1	0.4	<.1	<.1	0.3	0.1	0.1	1.1	0.8	0.4	0.4
Embiotoca lateralis (juv.)	<.1	0.3	<.1	0.5	<.1	-	0.3	<.1	<.1	0.5	0.2	0.3	0.4	0.2	0.4	<.1	<.1	<.1	-	-	-	0.3	-	0.1
Embiotocidae unid. (juv.)	<.1	-	-	0.2	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-
Engraulis mordax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.3	-	-	-	-	-	-
Gibbonsia spp.	0.7	1.2	0.7	0.6	1.3	0.8	1.2	1.5	0.8	0.8	0.4	0.3	0.4	0.5	0.5	0.7	1.1	0.6	0.9	0.4	0.2	0.3	<.1	<.1
Girella nigricans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	-	-	-	<.1
Gobiesocidae unid. a	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Gobiesox maeandricus	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Halichoeres semicinctus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Heterostichus rostratus	<.1	<.1	-	-	<.1	-	-	-	0.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-	<.1	-	-
Heterostichus rostratus (juv.)	-	-	-	-	<.1	-	-	1.1	0.2	-	-	-	-	-	-	-	0.5	<.1	-	-	-	0.2	<.1	-
Hexagrammos decagrammus	0.3	0.4	0.9	0.5	0.7	0.2	0.2	0.1	0.3	0.2	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexagrammos decagrammus (juv.)	<.1	<.1	<.1	-	-	-	-	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Hypsurus caryi	<.1	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	<.1	0.1	-	-	-	-	0.2	-	-	<.1
Hypsurus caryi (juv.)	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	<.1	-	-	-	-	-	<.1	-	-
Lethops connectens	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Medialuna californiensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-
Myliobatis californica	-	-	-	-	-	-	-	-	<.1	-	-	-	1.5	<.1	0.3	0.5	0.9	-	0.5	<.1	-	0.2	<.1	<.1
Neoclinus stephensae	-	-	-	-	-	-	-	<.1	<.1	-	-	0.2	-	-	-	-	<.1	<.1	<.1	-	<.1	0.2	-	<.1
Ophiodon elongatus	-	0.1	0.2	<.1	<.1	0.5	0.2	0.3	<.1	-	0.1	<.1	-	-	<.1	-	-	<.1	-	-	<.1	0.1	<.1	0.2

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Diablo Cove Station SDC - Benthic (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	14	6	16	11	18	18	15	15	10	16	24	18	24	15	21	15	9	9	12	18
Orthonopias triacis	0.2	0.3	0.2	<.1	<.1	0.1	<.1	-	0.1	0.2	0.1	-	-	-	-	-	<.1	-	-	-	-	-	-	<.1
Oxyjulis californica	1.5	0.3	6.7	22.5	8.6	6.9	9.9	9.7	25.6	8.1	8.6	15.9	28.3	27.1	27.8	17.4	24.5	12.2	8.2	8.9	16.0	15.4	4.9	12.3
Oxyjulis californica (juv.)	5.2	0.8	0.1	23.6	2.8	10.1	0.9	1.8	9.9	9.3	18.0	13.5	8.2	10.1	2.1	7.6	11.2	6.3	6.5	1.9	-	2.5	0.6	0.6
Oxylebius pictus	0.3	0.6	0.8	0.7	1.7	1.6	0.9	1.6	1.0	0.4	0.5	0.4	0.1	0.3	0.4	0.4	0.3	<.1	0.1	0.2	0.3	1.8	0.9	0.9
Paralabrax clathratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.3	0.1
Paralabrax clathratus (juv.)	<.1	-	-	-	-	-	-	5.8	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Paralichthyidae unid. (juv.)	-	-	-	-	-	-	-	-	0.2	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paralichthys californicus	-	-	-	-	-	-	-	-	-	<.1	-	<.1	<.1	-	<.1	-	-	-	<.1	-	-	-	-	-
Phanerodon atripes	<.1	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Phanerodon furcatus	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Phanerodon furcatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.1	<.1	-	-	-	-	-	-	-	-
Phanerodon spp.	-	-	-	2.0	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae/Stichaeidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Platichthys stellatus	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Platyrhinoidis triseriata	-	-	-	-	-	-	<.1	<.1	-	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-
Pleuronectidae unid.	-	<.1	-	-	-	0.1	-	-	-	<.1	-	-	-	<.1	<.1	-	-	-	-	-	-	-	<.1	-
Pleuronichthys coenosus	<.1	-	-	<.1	<.1	-	<.1	<.1	<.1	<.1	0.1	-	<.1	<.1	<.1	0.2	0.2	<.1	0.1	<.1	0.2	0.3	0.2	<.1
Pleuronichthys coenosus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Raja inornata	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Raja spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rhacochilus toxotes	<.1	0.1	<.1	<.1	0.2	-	<.1	-	-	-	0.2	<.1	<.1	0.1	-	<.1	-	-	<.1	<.1	0.3	0.7	0.1	0.2
Sciaenidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Scorpaena guttata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1
Scorpaenichthys marmoratus	0.2	0.6	0.7	0.2	0.4	0.1	0.3	0.4	0.4	0.2	0.8	0.4	0.3	0.6	0.5	0.3	0.3	<.1	0.1	<.1	-	<.1	0.3	0.1
Scorpaenichthys marmoratus (juv.)	-	<.1	<.1	<.1	<.1	0.1	<.1	-	-	<.1	-	-	-	-	-	<.1	-	-	-	<.1	-	-	-	<.1
Sebastes atrovirens	<.1	<.1	-	-	<.1	<.1	<.1	0.4	<.1	0.1	<.1	-	-	-	-	0.1	-	0.2	0.3	0.3	0.5	0.5	0.2	0.1
Sebastes atrovirens (juv.)	-	-	-	<.1	-	-	-	-	-	-	<.1	-	-	0.3	0.4	0.5	<.1	-	-	-	-	0.3	-	<.1
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	13.7	2.1	5.0	3.0	2.0	-
Sebastes auriculatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1
Sebastes auriculatus (juv.)	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes auriculatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
Sebastes carnatus	-	-	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes carnatus (juv.)	0.1	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes caurinus (juv.)	0.1	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes caurinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	0.1	-	-	-
Sebastes chrysomelas	0.2	0.5	1.4	1.0	1.0	0.3	0.9	1.0	1.3	0.3	0.7	0.4	0.3	0.4	0.4	0.2	0.3	<.1	0.1	<.1	<.1	0.3	0.2	0.5
Sebastes chrysomelas (juv.)	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	<.1	-	<.1
Sebastes chrysomelas/S. carnatus (juv.)	-	4.9	12.7	2.8	0.2	33.1	11.4	3.3	5.4	3.6	0.2	0.1	1.0	-	0.3	1.1	<.1	-	<.1	0.1	-	-	-	-
Sebastes chrysomelas/S. carnatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.7	18.8	4.0	5.1	0.8	-
Sebastes melanops (juv.)	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	1.8	-	-	-	-	-	-	-	-
Sebastes melanops (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	<.1
Sebastes miniatus (juv)	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	0.1	<.1	-	-	-	-	<.1	-	-
Sebastes miniatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-
Sebastes mystinus	-	-	-	0.1	0.3	0.3	<.1	-	<.1	<.1	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Sebastes mystinus (juv.)	0.1	1.2	-	5.1	<.1	<.1	<.1	-	<.1	0.4	-	0.1	-	-	-	0.3	-	-	-	-	-	-	-	-

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Diablo Cove Station SDC - Benthic (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	14	6	16	11	18	18	15	15	10	16	24	18	24	15	21	15	9	9	12	18
Sebastes paucispinis (juv.)	-	0.2	0.4	18.5	-	0.1	-	-	0.1	<.1	0.4	0.5	0.3	-	-	0.4	-	-	-	-	-	-	-	-
Sebastes rastrelliger	<.1	0.3	0.5	0.4	0.6	0.1	0.7	0.4	0.7	0.5	1.0	0.3	0.2	0.5	0.5	0.3	0.5	0.3	0.1	<.1	0.5	0.4	0.2	0.2
Sebastes rastrelliger (juv.)	-	-	-	<.1	-	-	<.1	<.1	<.1	<.1	-	-	-	-	0.1	<.1	-	-	<.1	0.2	-	-	-	-
Sebastes serranoides	-	-	-	<.1	0.2	-	-	-	0.2	<.1	<.1	<.1	-	-	-	<.1	-	-	-	-	-	-	-	-
Sebastes serranoides/S. flavidus (juv.)	0.9	3.9	0.1	55.4	0.3	-	0.2	-	1.7	2.6	0.5	1.2	2.4	0.1	1.9	0.7	-	-	-	-	-	0.3	-	-
Sebastes serranoides/S. flavidus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-	0.9	-	0.5	-	10.7
Sebastes spp. (juv.)	<.1	-	0.1	2.4	2.0	2.6	0.2	3.8	<.1	-	-	0.1	2.0	0.1	<.1	0.1	-	-	-	-	-	-	-	-
Semicossyphus pulcher	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	<.1	<.1	<.1	-	-	<.1	<.1	<.1
Semicossyphus pulcher (juv.)	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-
Seriphus politus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-
Stichaeidae unid.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Syngnathus spp.	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Triakis semifasciata	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	<.1	-	-	-	-	-	-	<.1
Urolophus halleri	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	0.3	-	-	<.1	-	-
Xererpes fucorum	-	-	<.1	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xiphister spp.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
larval/post-larval fish, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5.2	-	0.4	0.3	-	-	-	-	3.1	-

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Control Station SC - Midwater

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	16	6	14	11	9	14	10	10	10	16	23	18	18	11	20	15	9	9	12	18
Atherinidae unid.	-	-	-	-	-	-	-	5.6	-	23.9	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Aulorhynchus flavidus	0.1	-	3.5	4.7	1.8	13.8	48.7	-	-	-	9.3	0.3	<.1	9.8	-	<.1	-	<.1	6.5	4.2	3.5	-	-	-
Aulorhynchus flavidus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	9.0	-	-	<.1
Brachyistius frenatus	<.1	<.1	<.1	0.2	-	-	<.1	<.1	-	<.1	-	<.1	-	0.1	0.4	0.1	<.1	-	<.1	<.1	-	-	-	-
Brachyistius frenatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-
Damalichthys vacca	0.1	0.1	0.2	0.3	<.1	<.1	<.1	<.1	<.1	0.1	-	1.8	-	0.1	0.1	0.5	0.5	0.1	0.8	<.1	0.3	<.1	0.2	<.1
Damalichthys vacca (juv.)	-	<.1	-	<.1	-	-	-	-	-	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	-
Embiotoca jacksoni	<.1	-	<.1	<.1	<.1	-	-	-	<.1	<.1	-	-	-	<.1	<.1	0.1	-	-	-	-	-	-	-	-
Embiotoca jacksoni (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Embiotoca lateralis	0.3	0.7	0.4	0.8	0.3	0.1	0.2	0.1	0.2	0.2	-	<.1	<.1	-	<.1	0.1	<.1	<.1	-	<.1	-	<.1	<.1	<.1
Embiotoca lateralis (juv.)	-	0.2	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-	<.1	-
Engraulis mordax	-	-	-	-	-	-	3.1	-	-	-	-	-	-	-	-	3.3	-	-	-	-	-	-	-	-
Gibbonsia spp.	-	-	-	-	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	<.1	<.1	-	-
Heterostichus rostratus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Heterostichus rostratus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Hexagrammos decagrammus	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hypsurus caryi (juv.)	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Lethops connectens	-	-	<.1	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiodon elongatus	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxyjulis californica	8.8	1.2	3.8	2.3	4.0	0.4	6.8	2.4	19.9	16.1	10.3	31.0	12.5	6.5	24.8	4.9	6.3	15.2	14.2	4.3	2.4	3.4	2.9	9.0
Oxyjulis californica (juv.)	43.3	-	0.3	7.8	0.3	-	-	3.6	-	1.9	2.6	5.5	1.7	2.5	0.4	2.2	1.3	22.6	3.4	-	1.7	1.3	1.3	6.6
Oxylebius pictus	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paralabrax clathratus (juv.)	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phanerodon furcatus (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Rhacochilus toxotes	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-
Sardinops sagax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2
Sebastes atrovirens	-	-	-	<.1	-	0.1	<.1	-	-	-	-	-	-	<.1	<.1	-	-	-	<.1	<.1	<.1	-	-	0.1
Sebastes atrovirens (juv.)	-	-	-	-	-	-	0.1	-	0.4	-	-	-	-	-	0.3	0.3	-	-	-	-	-	-	-	-
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-	-	0.3	<.1	-
Sebastes caurinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	<.1	-	-	-	-	-
Sebastes chrysomelas/S. carnatus (juv.)	-	0.3	14.2	-	-	13.2	8.5	3.3	0.2	-	-	-	-	-	0.1	2.3	0.3	-	-	-	-	-	-	-
Sebastes chrysomelas/S. carnatus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.7	21.5	10.5	3.6	-	-
Sebastes melanops	-	<.1	-	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	0.1	-	-	-	<.1	-	-
Sebastes melanops (juv.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-
Sebastes melanops (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	<.1	-	-	-	0.4
Sebastes mystinus	0.9	2.8	2.2	4.7	1.1	2.8	3.2	2.7	0.7	1.3	1.0	2.5	1.2	2.8	0.6	0.7	1.8	0.5	0.1	<.1	0.3	0.5	0.6	0.2
Sebastes mystinus (juv.)	5.8	11.8	7.4	10.0	2.4	0.9	<.1	-	-	1.8	0.6	1.1	0.8	-	2.8	4.1	4.0	-	-	-	-	-	-	-
Sebastes mystinus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	0.1
Sebastes paucispinis (juv.)	-	1.4	0.2	19.0	-	31.4	-	-	-	0.1	<.1	<.1	-	-	<.1	0.2	-	-	<.1	-	-	<.1	-	<.1
Sebastes rastrelliger	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes serranoides	-	0.3	<.1	5.7	0.1	0.1	<.1	<.1	0.3	0.1	0.3	0.3	<.1	<.1	<.1	0.1	<.1	-	<.1	<.1	0.1	<.1	-	<.1
Sebastes serranoides/S. flavidus (juv.)	0.8	12.6	<.1	20.9	0.7	-	<.1	-	1.3	6.7	3.4	2.4	0.3	<.1	2.0	1.6	-	-	<.1	-	-	-	-	-
Sebastes serranoides/S. flavidus (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.6	-	-	<.1	-	-	3.5
Sebastes spp. (juv.)	-	-	0.1	-	-	0.3	-	0.2	-	0.8	3.6	0.2	0.8	0.5	<.1	-	-	-	-	-	-	-	-	-
Trachurus symmetricus	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
larval/post-larval fish, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.3	-	8.3	-	-	-	-	-

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Control Station SC - Benthic

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	16	6	14	11	9	14	10	10	10	16	23	18	18	11	20	15	9	9	12	18
Anarrhichthys ocellatus	-	-	-	<.1	<.1	-	-	<.1	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-
Artedius spp.	<.1	<.1	<.1	<.1	0.2	-	<.1	0.2	<.1	<.1	0.1	0.2	0.1	<.1	0.1	0.2	0.2	0.4	<.1	0.3	0.2	0.1	<.1	0.1
Aulorhynchus flavidus	<.1	<.1	3.1	4	4.4	0.8	11.3	-	-	1.2	-	<.1	-	<.1	2.9	0.4	0.7	-	1.1	1.1	0.8	<.1	0.9	0.5
Brachyistius frenatus	0.7	-	0.4	0.9	0.8	0.1	0.4	0.2	<.1	0.1	0.2	<.1	-	0.4	0.1	0.3	0.1	<.1	1.3	0.1	0.3	0.2	-	-
Cebidichthys violaceus	-	0.2	0.1	<.1	<.1	-	<.1	<.1	<.1	<.1	-	<.1	0.2	<.1	0.2	0.3	0.3	0.1	0.2	0.2	0.3	0.1	<.1	<.1
Cephaloscyllium ventriosum	-	-	-	-	-	0.1	0.4	0.3	<.1	1.1	0.3	0.3	0.3	-	-	-	-	-	-	<.1	0.3	-	-	0.3
Chirolophis nugator	-	<.1	-	<.1	-	-	<.1	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-	-
Citharichthys spp.	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	<.1	-	-	-	-	-
Clinidae unid.	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Coryphopterus nicholsi	0.6	0.9	0.2	0.3	0.4	0.6	1.7	<.1	0.2	0.3	0.3	1.4	1.7	1.5	1.2	0.5	2.1	0.3	0.2	<.1	0.3	0.2	0.4	0.6
Cottidae unid.	0.2	0.2	0.6	0.6	0.5	0.4	0.5	0.4	0.4	0.5	0.5	0.1	0.3	0.5	0.1	0.4	<.1	<.1	<.1	0.2	<.1	<.1	-	<.1
Cymatogaster aggregata	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-	-	-	-	-	-	-
Damalichthys vacca	0.8	0.2	0.6	1.1	0.5	0.9	0.9	0.3	0.9	2	0.4	3.6	1.1	0.9	0.7	1.2	1.3	0.3	1.9	0.5	0.9	2.3	0.7	0.8
Embiotoca jacksoni	0.6	0.4	0.9	1.4	1.7	1	1.9	1.3	1.4	2.7	2.7	2.3	1.9	1.6	1.8	1.4	2.6	0.8	1.7	1.4	1.2	2.3	0.8	0.8
Embiotoca lateralis	6.3	6	4.9	5.7	3.6	4.1	3.3	2.5	3	4	3.1	2.8	1.6	2.3	2.7	3	4.2	2.7	4	2.9	3.4	4.1	1.1	1.7
Embiotocidae	-	-	0.2	0.1	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-
Engraulis mordax	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gibbonsia spp.	0.1	0.5	0.5	0.6	0.5	0.6	0.3	0.3	0.3	0.5	0.2	0.2	0.5	0.3	0.2	0.4	0.8	0.3	0.5	0.3	0.2	0.1	<.1	<.1
Gobiesocidae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	<.1	-	-	-	-	-
Gobiesox maeandricus	-	-	-	0.1	-	-	-	-	-	-	<.1	0.1	-	<.1	<.1	-	<.1	<.1	<.1	-	-	-	-	-
Heterostichus rostratus	-	-	-	<.1	<.1	-	-	-	<.1	<.1	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-
Hexagrammos decagrammus	0.9	1.1	1	0.8	1.5	0.5	0.7	0.6	0.3	0.7	0.5	0.6	0.3	0.5	0.4	0.9	0.6	0.4	0.3	0.4	0.1	0.1	0.2	0.1
Hypsurus caryi	0.1	0.1	-	0.4	-	-	-	0.1	0.3	0.2	0.3	0.2	0.2	0.4	0.3	<.1	<.1	-	<.1	-	-	-	-	-
Jordania zanope	-	-	<.1	<.1	<.1	0.1	-	<.1	-	-	-	-	-	-	<.1	<.1	<.1	-	<.1	<.1	-	-	-	-
Myliobatis californica	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-
Neoclinus spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Ophiodon elongatus	<.1	0.1	0.5	0.3	0.6	-	0.1	-	0.2	0.1	0.3	0.2	0.2	<.1	0.1	0.2	<.1	0.1	<.1	0.2	-	0.1	-	0.1
Orthonopias triacis	0.2	0.3	0.2	0.1	0.3	-	0.3	0.5	0.3	0.8	0.5	0.4	0.3	0.3	0.4	0.3	0.4	0.3	0.2	0.1	-	0.3	-	<.1
Oxyjulis californica	25.3	1.4	7.1	23.8	4.6	3.8	24	29.4	44.7	29.1	21.3	49.9	13.5	25.9	23.4	2.5	15.8	34.8	30.2	15.4	13.9	8.8	12.4	49.9
Oxylebius pictus	1.2	1.8	2.1	2.2	3.8	4.4	4	3.9	3.6	3.7	3.8	3.9	4	4.6	3.5	4.6	5	2.2	1.6	2.2	2.3	3	2.4	2.1
Paralabrax clathratus	-	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paralichthys californicus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-
Phanerodon atripes	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phanerodon spp.	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pholididae unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	<.1	-	-	-	-	-
Pholididae/Stichaeidae unid.	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleuronectidae unid.	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pleuronichthys spp.	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Porichthys notatus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Rhacochilus toxotes	<.1	-	<.1	<.1	<.1	-	0.3	<.1	0.2	<.1	<.1	-	<.1	0.1	<.1	<.1	0.2	0.2	0.2	0.3	<.1	0.3	0.5	0.3
Scorpaenichthys marmoratus	-	0.5	0.7	0.9	1.1	0.6	0.8	0.5	0.5	0.6	1.3	0.9	0.8	0.8	0.8	0.9	0.7	0.3	0.3	0.4	0.4	0.4	0.1	<.1
Sebastes atrovirens	-	<.1	<.1	0.2	<.1	<.1	0.2	0.2	0.3	0.2	0.2	0.6	0.2	0.6	0.3	0.3	0.4	0.3	0.6	0.8	0.3	0.5	0.2	0.7
Sebastes atrovirens (yoy)	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	0.3	-	3.3	<.1	0.4	0.2	0.9	<.1
Sebastes auriculatus	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes carnatus	-	-	-	<.1	-	0.2	<.1	<.1	-	-	0.3	<.1	<.1	<.1	<.1	-	-	0.1	<.1	-	-	-	<.1	-
Sebastes caurinus	-	-	-	-	-	-	-	-	0.2	-	<.1	-	-	-	-	<.1	<.1	-	-	-	-	-	-	-

(continued)

Subtidal Fish Observations - Annual Fish Mean Abundance/50m transect – South Control Station SC - Benthic (continued)

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
# Replicates	12	18	16	18	16	6	14	11	9	14	10	10	10	16	23	18	18	11	20	15	9	9	12	18
Sebastes chrysomelas	0.8	1.7	1.4	2	2.2	2.3	2.6	3.9	2.2	2.9	2.6	3.2	2.8	2.5	1.9	2.9	2.6	1.7	2.1	2.2	2.2	1.8	0.8	1.3
Sebastes chrysomelas/S. carnatus	-	1.1	5.5	0.8	0.5	8.8	1.1	0.4	1.4	1	0.2	<.1	0.9	0.2	0.6	1.6	0.8	0.9	1.9	12.9	0.4	4.5	0.3	<.1
Sebastes melanops	<.1	0.2	<.1	<.1	<.1	-	<.1	<.1	-	0.1	-	<.1	-	<.1	<.1	<.1	0.2	<.1	-	<.1	<.1	0.2	-	0.1
Sebastes melanops (juv.)	-	-	-	-	-	-	-	-	<.1	-	-	<.1	-	-	-	2.1	-	2.9	0.3	0.4	-	<.1	-	3.9
Sebastes miniatus	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-
Sebastes mystinus	1.3	1.6	3.3	7.4	1.6	2	1.5	2.8	0.8	1.9	2.7	1.8	2.5	1.6	1.3	0.7	1.6	0.9	0.1	0.6	0.5	0.7	0.5	0.5
Sebastes mystinus (juv.)	12.7	15.9	6.9	33.6	10.1	6.3	0.7	-	2.3	2.1	2.2	2.6	6.5	1	6.6	11.8	6.7	0.3	<.1	<.1	-	-	-	5
Sebastes nebulosus	-	-	<.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sebastes paucispinis (juv.)	-	0.2	0.1	10.7	-	5.1	-	-	-	-	-	0.6	<.1	-	-	<.1	-	-	-	-	-	-	<.1	0.5
Sebastes pinniger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-	-	-	-
Sebastes rastrelliger	0.1	<.1	0.1	0.2	0.3	0.3	0.4	0.3	0.5	0.2	0.5	1.1	0.4	1.2	0.8	0.7	0.3	0.2	<.1	0.2	0.4	-	0.3	0.1
Sebastes serranoides	0.4	<.1	0.3	0.2	0.3	0.6	0.4	0.1	0.2	0.4	0.2	0.2	0.3	0.3	<.1	0.2	0.2	0.1	0.1	0.4	-	<.1	<.1	<.1
Sebastes serranoides/S. flavidus (juv.)	1.8	13.8	0.1	46.3	0.7	0.5	<.1	<.1	4.6	7	1.9	7.3	4.2	0.1	0.6	1.6	-	0.6	<.1	0.3	-	<.1	-	6.2
Sebastes spp.	<.1	<.1	<.1	1.2	-	0.8	-	0.8	-	0.3	0.4	0.4	<.1	<.1	<.1	-	<.1	<.1	<.1	-	-	-	-	0.1
Semicossyphus pulcher	-	-	-	-	-	-	-	-	-	0.2	-	<.1	<.1	0.2	<.1	-	<.1	0.1	0.2	-	-	-	-	-
Urolophus halleri	-	-	-	-	-	-	-	-	-	<.1	-	-	-	<.1	-	-	<.1	<.1	<.1	-	-	-	-	-
larval/post-larval fish, unid.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<.1	-	-	-	-	-

Appendix G

RWMP Temperature Data Summaries

Table G1. Monthly mean temperatures (°C) for RWMP Intertidal Control Stations January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station NC 1+.6m	**North Control**											
Mean	–	–	10.70	10.97	11.00	12.17	14.50	13.75	14.13	13.68	13.38	11.49
Variance	–	–	0.67	1.39	1.11	1.69	1.04	0.64	0.55	0.51	0.86	0.23
N	0	0	212	786	835	867	946	979	989	1031	977	611
Station NC 2+.6m												
Mean	–	–	10.72	10.94	11.02	12.17	14.47	13.70	14.11	13.66	13.39	11.50
Variance	–	–	0.38	1.32	1.09	1.67	1.03	0.67	0.56	0.50	0.85	0.23
N	0	0	799	889	960	984	1060	1083	1091	1152	1070	686
Station NC 3+.6m												
Mean	–	–	10.75	10.82	11.00	12.09	14.49	–	–	–	–	–
Variance	–	–	0.37	1.19	1.08	1.69	1.12	–	–	–	–	–
N	0	0	1033	1115	1204	1239	1256	0	0	0	0	0
Station SC 1+.6m	**South Control**											
Mean	12.37	11.48	10.59	10.45	10.55	11.56	13.63	13.03	13.92	13.44	13.28	11.78
Variance	0.33	0.50	0.38	0.75	1.06	1.74	1.11	0.44	0.42	0.35	0.63	0.25
N	1092	938	1023	990	1075	1096	1181	1200	1183	1251	1165	1160
Station SC 1-V+.6m	**(new station deployed Jul 15, 1999)**											
Mean	–	–	–	–	–	–	15.96	15.73	15.06	14.51	13.63	11.63
Variance	–	–	–	–	–	–	1.75	0.93	0.76	1.09	0.90	0.37
N	0	0	0	0	0	0	515	979	989	1031	977	642

Note: – indicates that no temperature data were recorded for the period due to equipment failure or unit not deployed (e.g. SC1-V Jan-Jun).

Table G2. Monthly mean temperatures for RWMP Intertidal Diablo Cove Stations January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station NDC 1+.6m	**North Diablo Cove**											
Mean	–	11.45	11.61	14.12	15.20	17.28	19.85	19.21	19.75	18.05	17.17	15.10
Variance	–	2.76	2.61	11.03	11.40	7.11	2.88	1.64	1.59	4.70	3.90	3.80
N	0	126	1158	1115	1204	1239	1332	1324	1311	1335	1276	1283
Station NDC 2+.6m												
Mean	15.41	12.84	11.64	14.84	15.82	18.02	20.25	19.34	20.09	18.43	17.49	15.12
Variance	3.14	4.09	3.11	10.66	11.07	6.22	2.73	1.41	1.20	4.79	4.03	3.59
N	941	804	874	855	930	946	1026	1050	1053	1128	1038	949
Station NDC 3+.6m												
Mean	15.68	13.44	11.83	15.11	16.44	18.59	20.15	19.15	20.18	18.59	17.48	15.19
Variance	3.31	4.88	3.82	9.29	9.81	4.72	2.29	1.16	1.28	5.29	4.13	3.90
N	1251	1100	1173	1131	1218	1253	1356	1350	1329	1362	1293	1208
Station SDC 1+.6m	**South Diablo Cove**											
Mean	17.39	16.59	16.22	16.30	17.60	18.49	19.67	18.74	19.47	17.85	17.34	17.15
Variance	5.55	5.85	5.53	4.66	3.76	2.93	2.43	1.60	1.90	7.26	5.02	4.61
N	1264	1065	1186	1140	1226	1267	1370	1362	1336	1369	1300	355
Station SDC 2+.6m												
Mean	–	–	–	–	–	17.90	19.62	18.82	19.40	17.65	16.67	15.41
Variance	–	–	–	–	–	2.64	2.83	1.87	1.71	6.81	2.36	2.11
N	0	0	0	0	0	734	1069	1095	1101	1160	1087	289
Station SDC 3+.6m												
Mean	15.70	13.81	13.59	14.78	16.17	17.26	18.62	17.90	18.46	16.86	16.05	14.82
Variance	0.87	1.82	1.37	2.17	2.58	1.86	1.69	1.26	1.33	4.77	1.46	0.57
N	1114	966	1052	1010	1099	1111	1205	1221	1209	1268	1192	319

Note: – indicates that no temperature data were recorded for the period due to equipment failure.

Table G3. Monthly mean temperatures for RWMP Intertidal Field's Cove and South Diablo Point Stations from January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station FC 1+.6m	**Field's Cove**											
Mean	13.13	11.69	10.82	11.09	11.33	12.68	15.81	15.41	15.78	14.46	14.46	12.74
Variance	0.50	0.77	0.56	1.70	1.89	2.24	1.55	1.19	0.70	1.13	1.15	1.10
N	1223	1065	1158	1115	1204	1239	1332	1324	1311	1335	1276	1283
Station FC 2+.6m												
Mean	13.11	11.66	10.79	11.15	11.30	12.63	15.69	15.27	15.75	14.42	14.49	12.76
Variance	0.49	0.81	0.55	1.69	1.88	2.19	1.47	0.99	0.61	1.06	1.16	1.07
N	987	829	911	889	960	984	1060	1083	1091	1152	1070	1059
Station FC 3+.6m												
Mean	13.10	11.65	10.79	11.11	11.24	12.58	15.61	15.29	15.74	14.40	14.55	12.86
Variance	0.49	0.80	0.55	1.57	1.78	2.21	1.48	1.07	0.60	1.01	1.10	1.03
N	971	823	898	878	948	973	1047	1067	1083	1143	1055	1046
Station SDP 1+.6m	**South Diablo Point**											
Mean	–	–	–	–	–	17.18	18.42	17.64	18.33	16.83	16.00	15.08
Variance	–	–	–	–	–	1.74	1.52	1.12	1.33	4.64	1.46	0.78
N	0	0	0	0	0	676	1452	1434	1388	1414	1356	1367
Station SDP 2+.6m												
Mean	14.78	12.77	12.26	12.94	13.53	14.84	15.67	16.76	15.88	14.57	15.22	14.09
Variance	0.80	1.16	0.87	1.10	1.48	2.19	2.37	1.33	1.75	1.52	0.84	0.74
N	1223	1065	1158	1114	1204	1239	1332	1324	1311	1335	1276	1283

Note: – indicates that no temperature data were recorded for the period due to equipment failure.

Table G4. Monthly mean temperatures for RWMP Subtidal Control and Field's Cove Stations from January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station NC 1-3m	**North Control**											
Mean	12.38	11.46	10.65	10.74	10.75	11.75	13.91	12.80	14.04	13.54	13.35	11.86
Variance	0.35	0.52	0.40	1.15	1.02	1.63	1.08	0.37	0.59	0.37	0.77	0.35
N	2232	2016	2232	2160	2232	2160	2231	1875	2160	2232	2158	2232
Station FC 1-3m	**Field's Cove**											
Mean	13.17	11.70	10.39	11.17	11.14	12.25	14.85	14.19	15.36	14.22	14.40	12.23
Variance	0.48	0.82	0.49	1.48	1.62	1.91	1.13	0.50	0.43	0.71	1.07	0.34
N	2232	2016	551	1618	2232	2160	2232	2228	2160	2232	2160	1189
Station SC 1-3m	**South Control**											
Mean	12.48	11.58	10.66	10.46	10.55	11.46	13.45	12.66	14.04	13.51	13.29	11.84
Variance	0.30	0.49	0.41	0.69	1.05	1.68	1.09	0.38	0.41	0.33	0.62	0.25
N	2232	2016	2232	2160	2232	2160	2232	2228	2160	2231	2160	2232
Station SC 2-6m												
Mean	–	–	–	–	–	–	12.10	11.95	13.65	13.19	13.22	11.68
Variance	–	–	–	–	–	–	0.81	0.33	0.45	0.30	0.62	0.17
N	0	0	0	0	0	0	821	2232	2160	2232	2160	1191

Table G5. Monthly mean temperatures for RWMP Subtidal North Diablo Cove Stations from January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station NDC 2-3m	**North Diablo Cove**											
Mean	–	–	–	–	–	17.84	19.52	18.26	19.59	18.03	17.59	15.74
Variance	–	–	–	–	–	4.92	2.33	1.07	1.50	4.84	4.46	4.08
N	0	0	0	0	0	1476	2226	2232	2160	2232	2160	2232
Station NDC 3-3m												
Mean	16.50	14.69	11.33	–	–	–	19.47	18.10	19.68	18.05	17.91	15.64
Variance	3.88	6.04	1.85	–	–	–	2.82	1.16	2.21	6.08	4.91	3.94
N	2232	2016	189	0	0	0	1763	2232	2160	2230	2160	1623
Station NDC 4-4m												
Mean	15.71	13.10	11.70	13.78	15.05	16.97	18.58	17.26	18.75	16.78	17.34	15.16
Variance	3.43	3.98	3.11	6.86	7.93	5.06	2.74	1.86	1.89	4.18	4.11	3.31
N	2232	2016	2232	2160	2232	2160	2232	2232	2160	2231	2160	1624
Station NDC 5-8m												
Mean	17.83	13.46	12.73	12.80	13.36	16.18	18.05	–	–	–	–	–
Variance	4.18	6.51	3.61	6.80	8.97	7.18	5.21	–	–	–	–	–
N	2232	2016	2232	2160	2232	2160	473	0	0	0	0	0
Station NDC 6-3m												
Mean	11.26	11.05	11.17	12.36	13.92	–	–	–	–	–	–	–
Variance	1.03	1.03	1.02	2.00	1.08	–	–	–	–	–	–	–
N	2042	2160	2232	2160	1339	0	0	0	0	0	0	0

Table G6. Monthly mean temperatures for RWMP Subtidal South Diablo Cove Stations from January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Station SDC 1-3m	**South Diablo Cove**											
Mean	16.66	14.63	14.48	13.80	13.48	14.23	15.68	15.17	17.11	15.99	16.64	16.00
Variance	4.35	2.96	3.80	6.31	7.59	7.95	6.68	5.64	5.23	5.75	4.42	3.64
N	2232	2016	2232	2160	2232	2160	2232	2231	2160	2231	2160	2232
Station SDC 4-4m												
Mean	15.67	14.12	13.89	13.36	13.48	14.23	13.58	12.88	14.85	14.47	15.49	14.99
Variance	5.06	2.24	3.50	5.91	7.59	7.95	4.42	3.97	5.21	3.49	4.94	4.19
N	2232	2016	2232	2160	2232	2160	1622	2231	2160	2232	2160	2232
Station SDC 5-10m												
Mean	13.04	12.36	10.92	–	–	–	–	–	–	–	–	–
Variance	1.75	1.21	0.46	–	–	–	–	–	–	–	–	–
N	2232	2016	191	0	0	0	0	0	0	0	0	0

Table G7. Monthly mean temperatures for RWMP Subtidal Intake Cove Stations from January through December 1999

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32/32	Intake Cove											
Mean	12.41	11.48	10.58	9.96	9.85	10.59	12.08	11.12	–	–	–	–
Variance	0.15	0.36	0.24	0.17	0.73	1.05	0.70	0.14	–	–	–	–
N	1840	2016	2232	2160	2232	2160	2232	1697	0	0	0	0

Appendix H

Supplemental Temperature Data Summaries

SUPPLEMENTAL TEMPERATURE DATA SUMMARIES

Additional temperature monitoring in Field's Cove was done starting in the Summer and Fall of 1997 to document the extent and magnitude of delta-T° north of Diablo Cove. There were 13 additional intertidal and six additional subtidal temperature recorders installed and deployed in at the stations shown in **Figures H-1** (intertidal) and **H-2** (subtidal). Two stations monitored under the RWMP are also shown in **Figure H-1.**

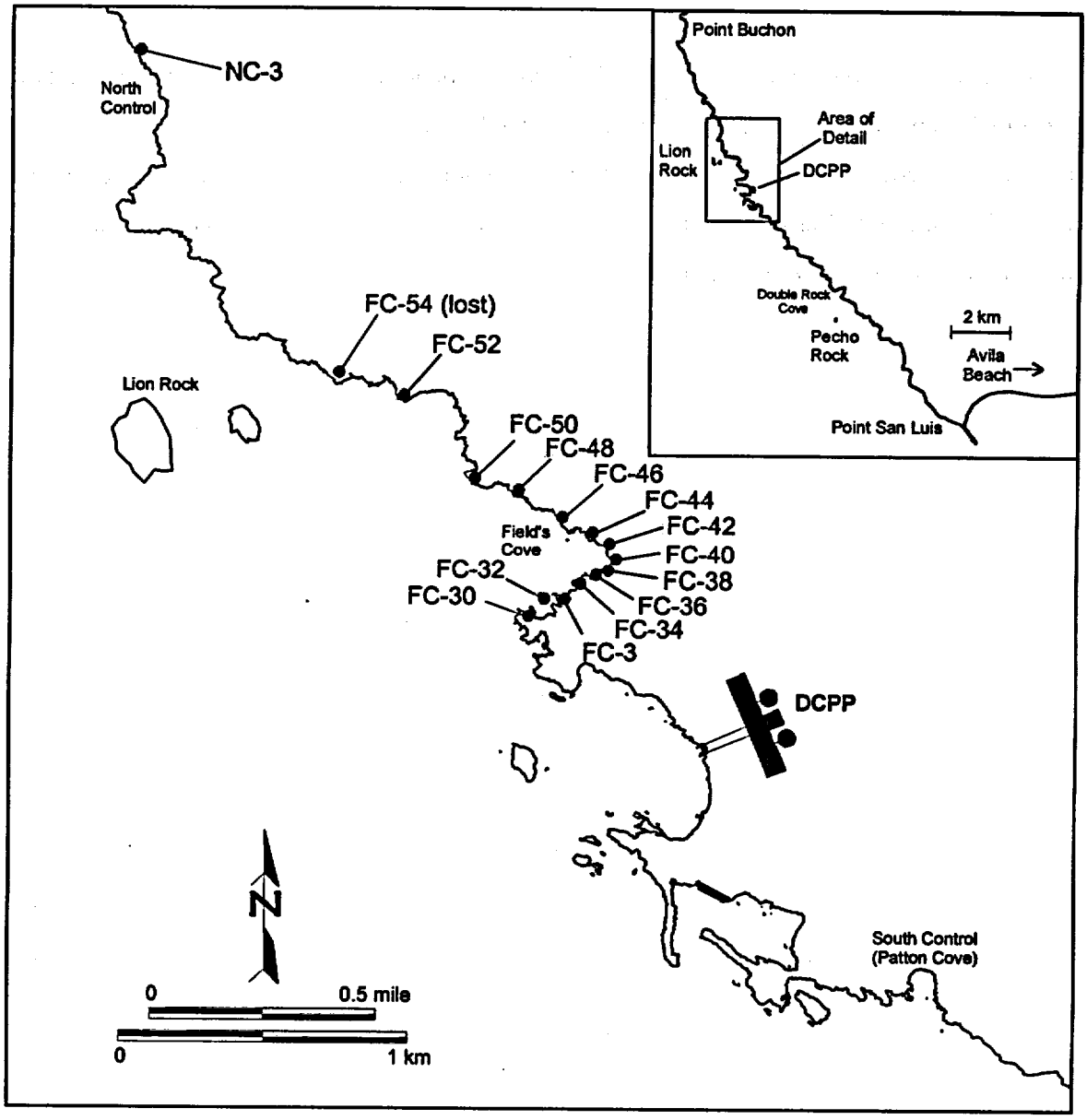


Figure H-1. Locations of supplemental intertidal temperature recorders.

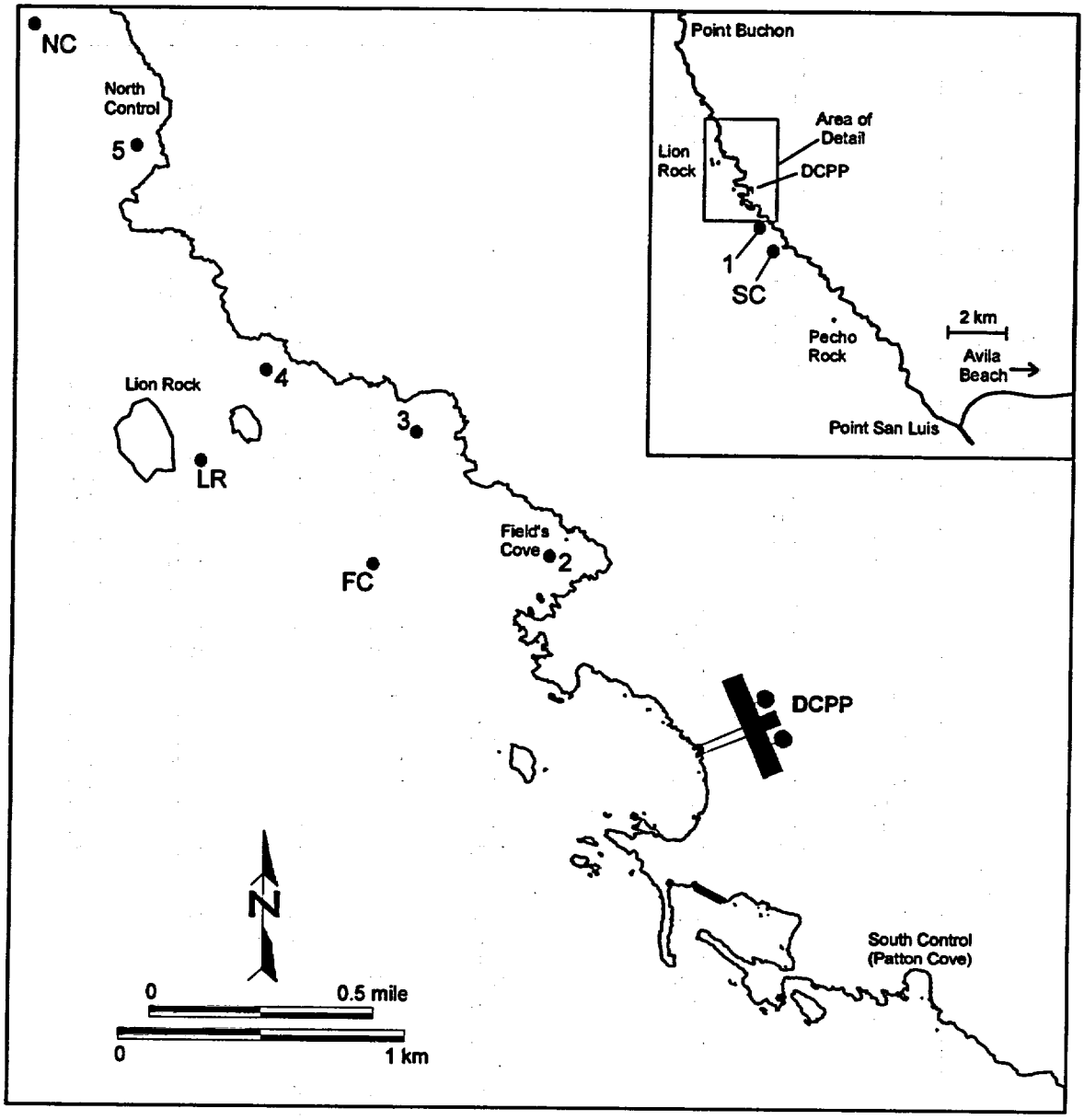


Figure H-2. Locations of supplemental subtidal temperature recorders.

Table H-3a. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
7/1/1997		12.40	13.56		12.67		12.62	13.71	
7/2/1997		12.00	13.03		12.59		12.09	13.18	
7/3/1997		11.90	12.98		12.11		11.92	13.04	
7/4/1997		12.31	12.78		12.50		12.21	12.88	
7/5/1997		12.74	13.25		13.02		12.69	13.32	
7/6/1997		12.59	13.05		12.29		12.10	13.18	
7/7/1997		11.61	11.06		11.37		11.55	11.12	
7/8/1997		14.00	14.10		14.58		14.99	13.20	
7/9/1997		14.19	14.73		14.78		14.93	14.12	
7/10/1997		13.64	14.56		14.21		13.93	13.85	
7/11/1997		13.02	13.85		13.84		13.96	13.11	
7/12/1997		14.25	15.16		14.97		14.90	14.44	
7/13/1997		14.76	15.86		15.28		15.11	15.17	
7/14/1997		14.33	15.93		15.17		14.89	14.99	
7/15/1997		14.00							
7/16/1997	13.01	13.16				12.93			12.77
7/17/1997	12.42	12.56				12.35	12.70	13.51	12.26
7/18/1997	11.93	12.20				11.65	12.08	12.88	11.77
7/19/1997	12.69	12.86				13.49	13.79	13.08	12.48
7/20/1997	13.24	13.27				13.66	14.09	13.82	13.18
7/21/1997	13.86	13.69				14.58	14.78	14.05	13.53
7/22/1997	14.20	14.14				14.19	14.58	13.98	13.77
7/23/1997	14.61	14.61				14.48	15.10	14.94	14.16
7/24/1997	14.01	14.52						14.78	13.18
7/25/1997	15.19	15.07						15.11	14.73
7/26/1997	15.46	15.27	17.01		16.62	16.31	16.56	15.32	15.07
7/27/1997	15.58	15.39	17.12		16.67	16.63	16.73	15.70	15.39
7/28/1997	15.62	15.55	16.99		16.51	16.34	16.41	15.75	15.43
7/29/1997	15.77	15.72	17.06		16.90	17.20	17.04	15.62	15.60
7/30/1997	16.37	16.17	17.95		16.91	16.84	16.78	16.46	16.13
7/31/1997	16.26	16.07	17.54		16.27	16.39	16.31	16.35	15.77
8/1/1997	15.90	15.70	17.25		15.80	15.76	15.91	16.02	15.29
8/2/1997	15.35	15.17	16.90		15.36	15.22	15.38	15.44	14.73
8/3/1997	14.79	14.70	16.41		15.17	15.09	15.10	14.99	14.53
8/4/1997	15.02	14.91	16.64		15.57	15.43	15.41	15.03	14.47
8/5/1997	15.19	15.00	16.56		15.05	14.60	14.86	15.25	14.15
8/6/1997	13.79	13.69	15.42		14.20	13.72	14.05	14.51	13.27
8/7/1997									16.98
8/8/1997									
8/9/1997	15.73		16.92		16.12	16.08	16.49	15.36	
8/10/1997	16.30		17.61		17.04	16.91	17.37	16.42	
8/11/1997	16.36		17.73		16.46	16.41	16.59	16.36	
8/12/1997	16.00		17.47		16.26	16.22	16.45	15.87	
8/13/1997	16.26		17.61		16.42	16.27	16.42	16.01	
8/14/1997	15.97		17.50		16.21	16.25	16.16	15.91	
8/15/1997	16.18		17.92		17.43	17.87	17.36	16.54	
8/16/1997	16.33		18.17		17.87	17.85	18.07	16.96	
8/17/1997	16.32		18.21		17.50	17.54	17.51	16.78	
8/18/1997	16.45		18.18		17.55	17.80	17.59	16.84	
8/19/1997	16.89		18.63		18.14	18.11	18.26	16.95	
8/20/1997	17.90		20.01		18.82	18.42	18.86	18.53	
8/21/1997	14.47		19.16		18.62	18.06	18.22	14.90	
8/22/1997	17.96		16.37		14.82	14.56	14.69	15.19	
8/23/1997	16.64		17.82		16.08	15.96	15.97	16.91	15.66
8/24/1997	15.62		17.09		15.44	15.70	15.65	16.27	15.22
8/25/1997	14.78		16.72		15.03	15.18	15.13	15.95	14.82
8/26/1997	14.80		16.77		15.14	15.28	15.09	15.71	14.73
8/27/1997	14.93		16.92		15.31	15.46	15.46	15.98	14.99
8/28/1997	14.79		16.76		15.52	15.67	15.58	15.68	14.98
8/29/1997	14.93	14.67	16.37		15.10	15.17	15.10	15.66	14.66
8/30/1997	15.53	15.40	16.59		16.26	16.66	16.39	15.61	15.59
8/31/1997	16.31	16.13	17.61		17.33	17.11	17.38	16.47	16.20
9/1/1997	16.17	15.96	17.70		17.18	17.03	17.09	16.07	15.92
9/2/1997	16.31	16.09	17.82		17.29	17.09	17.21	16.24	15.99
9/3/1997	16.60	16.31	18.22		17.62	17.61	17.44	16.99	16.46

Table H-3a (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
9/4/1997	16.61	16.28	18.15		17.36	17.18	17.23	16.87	16.19
9/5/1997	17.20	16.88	18.38		18.14	17.79	17.88	16.71	16.52
9/6/1997	17.40	17.03	18.52		18.05	17.97	18.01	17.05	16.75
9/7/1997	17.60	17.28	18.55		18.07	17.84	17.97	17.21	16.91
9/8/1997	16.99	16.55	18.42		17.49	17.46	17.40	17.34	16.73
9/9/1997	16.40	15.99	17.98		16.92	16.93	16.78	17.21	16.32
9/10/1997	15.32	14.90	16.82		15.39	15.52	15.64	16.30	15.29
9/11/1997	14.20	14.11	15.83		14.63	14.78	14.81	15.14	14.38
9/12/1997	14.49	14.51	15.80		14.99	14.91	14.90	14.68	14.12
9/13/1997	15.28	15.22	16.55		16.16	16.45	16.18	15.33	15.11
9/14/1997	16.39	16.31	17.55		16.86	17.01	16.99	16.35	16.13
9/15/1997	15.92	15.30	17.37		16.00	15.78	16.06	16.15	15.50
9/16/1997	15.07	14.94	16.50		15.56	15.40	15.53	15.32	14.82
9/17/1997	15.12	15.16	16.88		16.38	16.56	16.45	15.21	15.03
9/18/1997	15.45	15.43	17.21		16.21	16.18	16.29	15.45	15.29
9/19/1997	15.71	15.67	17.20		16.30	16.27	16.36	15.70	15.54
9/20/1997	16.25	16.23	17.76		17.36	17.45	17.38	16.16	15.99
9/21/1997	16.78	16.61	18.45		17.50	17.35	17.50	16.69	16.33
9/22/1997	16.73	16.42	18.15		17.52	17.57	17.50	16.76	16.31
9/23/1997	16.82	16.78	18.38		18.52	18.35	18.48	16.86	16.85
9/24/1997	16.92	16.73	18.03		17.56	17.25	17.35	16.70	16.66
9/25/1997	16.52	16.30	16.68		16.80	16.48	16.53	16.17	16.00
9/26/1997	16.16	15.93	16.77		16.60	16.39	16.42	16.03	15.92
9/27/1997	15.93	15.57	15.94		16.12	15.71	15.75	15.61	15.49
9/28/1997	15.78	15.54	15.71		15.79	15.97	15.74	15.25	15.23
9/29/1997	16.89	16.85	17.68		17.56	17.83	17.71	16.69	16.76
9/30/1997	17.35	17.03	18.70		18.48	18.43	18.42	17.53	17.32
10/1/1997	17.59	17.43	19.28		18.75	18.82	18.71	17.40	17.18
10/2/1997	18.34	18.12	19.43		18.82	18.79	18.80	17.93	17.90
10/3/1997	17.48	17.18	17.55		17.43	17.40	17.40	16.76	16.68
10/4/1997	17.51	17.11	17.58		17.29	17.49	17.27	16.78	16.69
10/5/1997	17.18	16.67	17.04		17.06	17.11	17.03	16.56	16.52
10/6/1997	16.49	16.16	16.82		16.73	16.94	16.72	16.38	16.40
10/7/1997	14.83	14.21	15.11		15.10	14.98	14.96	14.98	14.82
10/8/1997	14.85	14.64	15.01		14.73	14.83	14.81	14.15	14.06
10/9/1997	15.74	15.44	16.40		16.44	16.34	16.28	15.23	15.24
10/10/1997		15.71	16.25		16.05	16.15	16.00	15.63	15.63
10/11/1997		15.46	16.48		15.81	15.80	15.71	15.42	15.35
10/12/1997		15.01	16.03		15.37	15.56	15.46	14.89	14.80
10/13/1997		15.13	16.77		16.45	16.62	16.58	15.11	15.11
10/14/1997		15.60	17.54		18.06	17.61	18.05	15.70	15.59
10/15/1997		15.87	17.92		18.27	18.05	18.33	16.16	16.09
10/16/1997		16.37	18.46		18.60	18.66	18.60	16.77	16.65
10/17/1997		16.01	18.06		17.64	17.49	17.55	16.54	16.19
10/18/1997		15.58	17.29		17.12	17.34	17.24	15.81	15.70
10/19/1997		15.83	17.36		17.18	17.15	17.21	15.99	16.00
10/20/1997		16.12	17.76		17.83	17.81	17.83	16.37	16.58
10/21/1997		16.25	17.83		17.44	17.23	17.34	16.42	16.22
10/22/1997									15.87
10/23/1997									
10/24/1997									
10/25/1997									
10/26/1997									
10/27/1997									
10/28/1997	16.36								16.68
10/29/1997	16.77								16.58
10/30/1997	16.71		17.50		17.22	17.12	16.93		16.03
10/31/1997	16.91		16.84		16.76	16.63	16.52		16.25
11/1/1997	17.17		16.94		16.78	16.90	16.65		16.68
11/2/1997	17.48		17.73		17.38	17.63	17.21		17.15
11/3/1997	17.87		18.57		18.18	18.38	18.18		17.78
11/4/1997	18.01		19.20		19.33	19.72	19.44		17.81
11/5/1997	17.80		19.37		18.93	19.34	19.03		17.51
11/6/1997	17.68		18.63		18.25	18.57	18.30		17.29
11/7/1997	17.18		18.18		17.82	18.00	17.75		16.75

Table H-3a (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
11/8/1997	17.27		17.86		17.30	17.63	17.38		17.02
11/9/1997	18.20		18.20		18.50	19.01	18.60		17.92
11/10/1997	18.04		19.63		19.24	19.55	19.29		17.75
11/11/1997	18.02		18.29		18.07	18.34	18.14		17.57
11/12/1997	17.61		18.77		18.32	18.54	18.26		17.42
11/13/1997	17.63		18.56		18.14	18.33	18.04		17.30
11/14/1997	17.61		17.76		17.49	17.97	17.67		17.31
11/15/1997	17.51		17.78		17.49	18.00	17.65		17.25
11/16/1997	17.38		18.00		17.69	17.87	17.58		17.12
11/17/1997	17.25		18.15		17.59	17.86	17.47		17.08
11/18/1997	17.41		18.54		18.26	18.91	18.48		17.78
11/19/1997	17.10		18.81		18.26	18.88	18.65		17.17
11/20/1997	17.04		17.82		17.41	17.96	17.58		16.71
11/21/1997	17.04		18.06		17.60	18.28	17.76		16.89
11/22/1997	17.25		18.20		18.79	19.12	18.95		17.04
11/23/1997	17.32		18.29		18.47	18.41	18.62		17.03
11/24/1997	17.31		18.22		17.67	18.30	17.79		17.09
11/25/1997	17.13		18.23		17.71	18.20	17.77		17.04
11/26/1997	16.97		18.16		18.02	18.27	17.86		16.81
11/27/1997	16.89		17.23		17.36	17.58	17.13		16.72
11/28/1997	16.75		17.60		17.42	17.58	17.43		16.65
11/29/1997	16.61		17.49		17.24	17.42	17.14		16.76
11/30/1997	16.62		17.06		17.10	17.32	17.00		16.55
12/1/1997	16.56		16.96		17.19	17.21	16.84		16.51
12/2/1997	16.44		17.42		18.24	17.78	17.33		16.71
12/3/1997	16.16		18.09		18.94	18.55	18.02		16.51
12/4/1997	16.05		18.16		18.30	17.30	17.69		16.25
12/5/1997	16.11		17.32		17.51	17.08	16.95		16.19
12/6/1997	16.24		17.39		17.27	16.83	16.99		16.37
12/7/1997	16.79		17.48		17.25	17.07	16.98		16.38
12/8/1997	16.68		16.82		17.06	17.16	16.80		16.10
12/9/1997	16.50		16.44		16.78	16.78	16.48		16.22
12/10/1997	16.82		17.26		17.26	17.32	16.92		16.42
12/11/1997	16.93				17.87	18.12	17.67		16.99
12/12/1997	16.17				17.92	17.78	17.63		16.53
12/13/1997	16.15				18.08	17.93	17.89		16.46
12/14/1997	16.45				17.55	17.08	17.32		16.37
12/15/1997	16.35				17.13	16.92	16.94		15.93
12/16/1997	16.13				17.48	17.18	17.23		15.72
12/17/1997	15.93				16.93	16.60	16.63		15.74
12/18/1997	15.91				16.54	16.47	16.33		15.67
12/19/1997	15.78				16.39	16.36	16.06		15.62
12/20/1997	15.66				16.40	16.27	16.20		15.58
12/21/1997	15.78				16.11	16.36	15.90		15.37
12/22/1997	15.69				16.10	16.09	15.69		15.42
12/23/1997	15.62				16.20	16.24	15.84		15.27
12/24/1997	15.40				15.90	16.03	15.62		15.27
12/25/1997	15.56				16.12	16.09	15.79		15.39
12/26/1997	15.70				16.29	16.30	16.04		15.46
12/27/1997	15.71				16.74	16.68	16.68		15.64
12/28/1997	15.88				17.24	16.97	17.04		15.71
12/29/1997	15.92				17.21	16.80	16.88		15.74
12/30/1997	15.84				16.81	16.56	16.69		15.71
12/31/1997	15.77				16.94	16.54	16.82		15.57
1/1/1998	15.57				17.36	17.23	17.32		15.71
1/2/1998	15.57				17.39	17.74	17.36		15.54
1/3/1998	15.55				16.34	16.62	16.06		15.53
1/4/1998	15.45				16.58	16.99	16.34		15.31
1/5/1998	15.37				15.96	16.54	15.68		15.31
1/6/1998					16.43	16.91	16.18		
1/7/1998					16.85	17.27	16.78		
Mean	16.16	15.16	17.18		16.73	16.86	16.54	15.59	15.89

Table H-3b. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
5/22/1998	10.65		12.42		11.57	11.13	11.37	12.09	
5/23/1998	10.69		12.30	11.59	11.50	11.10	11.33	11.96	
5/24/1998	11.11		12.69	11.59	11.94	11.54	11.64	12.19	
5/25/1998	11.81		13.34	12.11	13.18	12.70	12.74	12.79	
5/26/1998	11.62		13.23	13.32	13.04	12.62	12.86	13.19	
5/27/1998	12.13		13.63	13.23	13.92	13.33	13.84	12.88	
5/28/1998	12.23		14.10	14.24	13.75	13.66	13.95	12.91	
5/29/1998	11.97		13.72	14.52	13.49	12.78	13.03	13.09	
5/30/1998	11.24		12.94	13.62	12.29	11.88	12.25	12.33	
5/31/1998	11.62		13.36	12.57	12.83	12.16	12.61	12.19	
6/1/1998	11.59		13.28	12.97	12.78	12.40	12.52	12.73	
6/2/1998	11.76		13.70	12.67	13.38	12.78	12.82	13.10	
6/3/1998	13.08		14.05	13.78	14.27	13.89	14.07	13.32	
6/4/1998	12.64		14.24	14.59	13.69	13.15	13.36	13.67	
6/5/1998	11.51		13.51	13.86	12.87	12.30	12.20	12.85	
6/6/1998	12.01		13.38	13.95	13.61	13.36	13.30	12.86	
6/7/1998	13.02		14.04	14.29	14.65	14.20	14.43	13.30	
6/8/1998	12.28		14.31	14.79	13.70	13.09	13.22	13.59	
6/9/1998	12.05		14.10	14.15	13.95	13.27	13.40	13.27	
6/10/1998	12.13		13.95	14.33	13.92	13.21	13.35	13.10	
6/11/1998	12.17		13.88	14.18	13.92	13.15	13.32	13.44	
6/12/1998	12.72		14.11	13.99	14.33	13.60	14.08	13.45	
6/13/1998	12.58		14.46	14.58	14.31	13.76	13.81	13.72	
6/14/1998	12.18		14.29	14.47	13.75	13.40	13.63	14.00	
6/15/1998	13.19		14.45	13.66	14.36	13.61	14.10	13.31	
6/16/1998	13.34		14.27	14.61	14.52	13.71	14.12	13.68	
6/17/1998	13.55		14.32	14.67	14.36	13.58	14.02	14.09	
6/18/1998	13.35		14.68	14.42	14.55	13.86	14.13	13.99	
6/19/1998	13.04		14.55	14.97	14.49	14.01	14.11	13.67	
6/20/1998	12.70		14.00	15.04	13.99	13.32	13.56	13.58	
6/21/1998	13.00		14.55	14.02	14.68	14.10	14.41	13.78	
6/22/1998	13.09		14.79	15.13	14.68	13.80	14.16	13.83	
6/23/1998	12.34		14.43	15.38	13.85	13.10	13.15	13.27	
6/24/1998	12.34		14.31	14.40	14.01	13.30	13.51	13.34	
6/25/1998	12.44	12.84	14.48	14.14	14.13	14.03	13.70	13.49	
6/26/1998	12.13	12.65	14.36	14.28	13.55	13.15	13.12	13.38	
6/27/1998	12.04	12.08	13.54	13.62	13.06	12.40	12.65	13.00	
6/28/1998	11.84	12.15	13.88	13.25	12.60	12.08	12.17	13.08	
6/29/1998	11.21	11.85	13.28	12.56	12.06	11.97	11.90	12.79	
6/30/1998	11.11	11.49	12.93	11.86	11.80	11.77	11.70	12.45	
7/1/1998	10.68	11.16	12.30	11.68	11.25	11.29	11.37	11.92	
7/2/1998	10.40	10.83	11.92	10.96	10.92	10.95	11.06	11.59	
7/3/1998	11.00	11.21	12.62	10.86	12.32	11.54	11.82	11.61	
7/4/1998	11.37	11.60	12.83	12.63	12.75	11.86	12.55	11.81	
7/5/1998	11.82	12.01	13.61	13.33	13.94	13.10	13.41	12.72	
7/6/1998	12.64	12.86	15.10	14.47	14.88	13.48	14.18	13.73	
7/7/1998	12.83	12.92	14.58	14.93	14.53	13.54	13.90	13.45	
7/8/1998	12.59	12.83	14.42	15.12	13.84	13.12	13.13	13.08	
7/9/1998	11.90	12.34	14.12	14.14	13.22	12.38	12.53	12.97	
7/10/1998	11.70	12.15	13.98	13.49	12.94	12.35	12.31	13.05	
7/11/1998	11.73	12.15	13.53	13.07	12.01	11.76	11.69	13.18	
7/12/1998	13.37	13.09	13.93	11.68	13.35	12.75	12.73	12.78	
7/13/1998	14.18	13.87	15.04	13.92	14.77	14.43	14.48	13.95	
7/14/1998	14.26	14.47	15.46	15.61	14.60	13.80	14.28	14.56	
7/15/1998	14.00	14.16	15.38	14.85	14.39	13.52	13.93	14.57	
7/16/1998	13.92	14.12	15.54	14.47	14.41	13.38	13.93	14.52	
7/17/1998	14.27	14.25	15.45	14.44	14.45	13.55	13.99	14.31	
7/18/1998	14.68	14.47	15.48	14.74	15.40	14.97	15.25	14.55	
7/19/1998	15.56	15.57	16.90	16.10	16.68	16.24	16.53	15.71	
7/20/1998	16.17	16.47	17.60	17.27	16.92	16.31	16.53	16.33	
7/21/1998	16.12	16.23	17.49	17.43	16.56	15.72	16.31	16.23	
7/22/1998	16.22	16.40	17.81	17.21	16.86	16.03	16.56	16.53	
7/23/1998	16.29	16.46	17.78	17.75	16.83	16.15	16.32	16.47	
7/24/1998	16.52	16.75	18.11	17.60	17.54	16.86	16.99	16.89	
7/25/1998	16.86	17.00	18.46	18.25	17.97	17.18	17.49	16.94	

Table H-3b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
7/26/1998	17.07	17.41	18.86	18.63	18.00	17.42	17.65	17.88	
7/27/1998	16.69	16.94	18.15	17.98	16.68	16.25	16.16	17.79	
7/28/1998	15.41	15.33	16.25	16.28	15.16	14.51	14.74	15.45	
7/29/1998	14.57	14.79	15.99	14.87	14.98	14.94	14.76	15.17	
7/30/1998	15.09	15.32	16.86	15.19	16.19	15.57	15.63	16.12	
7/31/1998	14.96	15.30	17.10	16.26	15.88	15.72	15.65	16.73	
8/1/1998	14.48	14.86	16.37	16.09	15.31	15.05	15.10	16.13	
8/2/1998	15.32	15.44	16.47	15.22	16.48	16.24	16.27	15.39	
8/3/1998	16.15	16.21	17.25	16.94	16.77	16.10	16.54	15.93	
8/4/1998	16.14			17.69					
8/5/1998	15.51			17.52					
8/6/1998	15.31			16.83					
8/7/1998	15.22			16.72					
8/8/1998	14.96			16.64					
8/9/1998	15.02			16.19					
8/10/1998	16.11			16.56					
8/11/1998	16.59			17.40					
8/12/1998	16.57			18.17					
8/13/1998	10.26			17.90					
8/14/1998	17.46			16.44					
8/15/1998	17.27	17.15	18.81	18.77	18.28	17.57	17.83	17.50	
8/16/1998	17.52	17.47	18.77	19.07	18.35	17.62	18.05	17.47	
8/17/1998	17.05	17.15	18.55	18.04	17.61	17.07	17.33	17.41	
8/18/1998	16.55	16.62	17.71	16.95	16.57	16.36	16.35	16.88	
8/19/1998	16.49	16.65	17.95	17.29	17.03	16.95	16.81	16.99	
8/20/1998	15.89	15.85	17.80	16.73	16.42	16.27	16.29	17.11	
8/21/1998	14.99	14.98	16.46	15.18	15.27	14.91	14.98	15.87	
8/22/1998	14.95	14.90	16.12	15.42	15.29	14.82	14.87	15.18	
8/23/1998	14.86	14.67	15.63	14.31	14.48	14.25	14.27	14.92	
8/24/1998	15.03	14.20	15.58	15.94	15.18	14.56	14.71	14.33	
8/25/1998	15.65	15.43	16.69	16.55	16.00	15.38	15.46	15.24	
8/26/1998	15.76	15.92	17.05	16.71	16.26	15.43	15.81	15.82	
8/27/1998	16.11	16.10	17.27	17.44	16.81	16.08	16.32	15.96	
8/28/1998	16.16	16.25	17.72	17.22	17.08	16.33	16.59	16.44	
8/29/1998	15.75	15.51	16.95	15.85	15.95	15.39	15.52	15.98	
8/30/1998	15.52	15.46	17.09	16.73	16.47	15.86	15.92	16.01	
8/31/1998	15.69	15.65	17.26	16.89	16.64	15.90	16.00	16.24	
9/1/1998	15.87	15.66	17.41	17.05	16.87	16.35	16.28	16.52	
9/2/1998	15.72	15.62	17.06	17.03	16.63	16.03	16.24	16.28	
9/3/1998	15.59	15.30	16.79	16.96	16.40	15.72	16.12	16.04	
9/4/1998	15.86	15.36	16.76	17.14	16.51	16.04	16.21	15.50	
9/5/1998	16.05	16.13	17.17	17.19	16.72	16.33	16.41	16.13	
9/6/1998	16.40	16.51	17.72	18.34	17.60	17.26	17.20	16.63	
9/7/1998	16.73	16.79	17.75	18.99	18.29	17.68	17.88	16.62	
9/8/1998	17.29	17.34	17.85	18.54	17.97	17.62	17.68	16.67	
9/9/1998	15.80	16.18	16.96	16.29	16.29	15.86	16.25	16.30	
9/10/1998	15.50	15.43	15.86	15.68	15.47	15.16	15.27	15.27	
9/11/1998	16.29	16.06	16.92	17.70	16.98	16.45	16.66	15.53	
9/12/1998	16.40	16.49	17.66	17.70	17.48	17.03	17.15	16.46	
9/13/1998	16.38	16.06	17.00	17.49	17.07	16.94	16.96	16.06	
9/14/1998	16.84	16.82	17.39	18.16	17.48	17.48	17.37	16.39	
9/15/1998	16.97	17.16	18.12	18.80	18.14	17.74	17.80	17.05	
9/16/1998	16.64	16.68	17.76	18.38	17.81	17.11	17.49	17.06	
9/17/1998	16.32	16.36	17.62	17.11	16.92	16.50	16.76	16.81	
9/18/1998	14.92	15.23	16.10	15.10	15.13	15.20	15.43	16.01	
9/19/1998	14.37	14.54	14.96	14.31	14.27	14.23	14.38	14.90	
9/20/1998	15.04	14.58	15.08	15.97	15.38	15.50	15.57	14.35	
9/21/1998	15.45	15.52	16.58	17.15	16.49	15.87	16.13	15.39	
9/22/1998	15.56	15.63	16.06	16.43	16.07	16.14	15.96	15.60	
9/23/1998	15.79	15.92	16.36	16.57	16.22	15.96	15.99	15.80	
9/24/1998	15.81	15.91	16.99	17.27	16.68	16.48	16.46	16.04	
9/25/1998	15.35	15.74	16.86	16.84	16.10	15.66	15.73	15.87	
9/26/1998	15.71	15.52	16.92	17.75	17.27	16.85	17.00	15.74	
9/27/1998	16.24	16.09	17.13	17.66	17.19	16.92	17.09	16.27	
9/28/1998	16.08	16.14	17.67	17.50	17.13	17.07	17.01	16.73	

Table H-3b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
9/29/1998	15.49	15.55	16.84	16.92	16.13	15.75	15.84	16.03	
9/30/1998	15.15	15.58	16.92	17.36	16.45	15.63	15.79	15.61	
10/1/1998	14.78	15.19	16.14	16.20	15.38	14.80	15.07	15.20	
10/2/1998	14.53	15.00	16.04	15.65	15.40	15.08	15.13	15.27	
10/3/1998	14.02	14.30	15.23	14.86	14.40	14.50	14.50	14.71	
10/4/1998	13.67	13.94	14.75	14.30	13.89	13.68	13.96	14.03	
10/5/1998	14.11	14.18	15.33	15.45	14.80	14.37	14.54	13.97	
10/6/1998	14.69	14.70	15.78	16.71	15.90	15.46	15.70	14.53	
10/7/1998	14.79	15.10	16.05	16.79	16.09	15.61	15.58	15.15	
10/8/1998	14.56	14.75	16.49	15.96	15.86	14.94	15.26	15.25	
10/9/1998	13.38	13.91	14.53	13.86	13.90	13.56	13.92	14.11	
10/10/1998	12.97	12.99	13.47	13.09	12.78	12.57	12.77	12.97	
10/11/1998	13.21	13.42	14.32	14.32	14.06	13.44	13.54	13.07	
10/12/1998	13.71	13.47	15.03	15.75	15.55	14.61	15.16	14.03	
10/13/1998	13.85	14.21	14.88	14.80	14.62	14.03	14.31	14.30	
10/14/1998	13.17	13.43	14.32	13.52	13.50	13.11	13.43	13.62	
10/15/1998	12.63	12.91	13.45	13.16	12.91	12.41	12.72	12.93	
10/16/1998	12.73	12.67	13.27	13.24	12.81	12.65	12.70	12.63	
10/17/1998	13.87	13.80	14.77	15.05	14.62	14.85	14.49	13.65	
10/18/1998	14.08	14.20	15.41	15.41	15.19	14.45	14.81	14.67	
10/19/1998	13.67	13.71	14.80	15.43	14.66	14.11	14.30	13.82	
10/20/1998	13.79	13.86	14.91	15.57	14.89	14.89	14.48	13.87	
10/21/1998	14.46	14.35	15.72	16.35	15.87	15.62	15.56	14.68	
10/22/1998		13.00	14.14	14.00	14.13		14.76	14.85	
10/23/1998		14.48	15.69	15.16	15.41		14.95	14.79	
10/24/1998		14.35	15.47	17.01	16.12		15.74	14.36	
10/25/1998		14.41	14.73	14.96	15.03		14.71	14.41	
10/26/1998		14.15	14.29	14.76	14.54		14.29	14.18	
10/27/1998		14.38	15.28	15.66	15.30		15.23	14.49	
10/28/1998		14.39	15.39	15.59	15.27		15.08	14.64	
10/29/1998		14.38	15.02	15.01	14.96		14.63	14.54	
10/30/1998		13.87	14.02	14.24	14.67		14.20	13.91	
10/31/1998		13.72	14.28	14.26	14.13		13.98	13.60	
11/1/1998		13.65	14.43	14.36	14.39		13.92	13.64	
11/2/1998		12.96	13.32	13.48	13.63		13.50	13.12	
11/3/1998		12.94	13.50	13.28	13.32		13.03	13.10	
11/4/1998		12.64	13.23	13.19	13.07		12.85	12.90	
11/5/1998		11.94	12.38	12.35	12.46		12.14	12.12	
11/6/1998		11.54	11.84	11.81	12.03		11.68	11.63	
11/7/1998		11.99	12.65	12.96	12.74		12.62	12.08	
11/8/1998		12.68	13.28	13.37	13.12		13.09	12.82	
11/9/1998		12.34	13.15	13.15	12.89		12.68	12.56	
11/10/1998		12.39	13.08	14.56	13.90		13.80	12.55	
11/11/1998		12.59	13.41	13.72	13.30		13.40	12.81	
11/12/1998		12.42	12.91	12.94	12.95		12.71	12.67	
11/13/1998		12.54	13.07	13.13	13.07		12.76	12.69	
11/14/1998		12.65	13.81	13.73	13.60		12.92	12.87	
11/15/1998		12.64	13.64	13.68	13.81		13.02	12.83	
11/16/1998		12.59	13.36	13.38	13.16		12.95	12.75	
11/17/1998		12.88	13.72	13.91	13.48		13.38	13.04	
11/18/1998		12.79	13.06	13.10	13.05		12.95	12.87	
11/19/1998		12.42	12.73	12.75	12.68		12.57	12.54	
11/20/1998		12.59	13.44	13.80	13.52		12.99	12.36	
11/21/1998		12.66	13.37	13.48	13.43		13.09	12.73	
11/22/1998		12.74	12.85	13.01	13.26		13.11	12.91	
11/23/1998		13.01	13.18	13.32	13.59		13.22	13.08	
11/24/1998		13.16	13.17	13.37	14.02		13.37	13.35	
11/25/1998		12.97	13.07	13.14	13.32		13.15	12.90	
11/26/1998		13.04	13.11	13.19	13.36		13.35	12.94	
11/27/1998		13.05	12.99	13.05	13.18		13.47	13.04	
11/28/1998		13.03	13.04	13.06	13.27		13.42	13.03	
11/29/1998		12.75	13.67	13.91	13.56		13.73	12.87	
11/30/1998				14.38	14.11		14.11	13.46	
12/1/1998				13.41	13.48		13.71	13.38	
12/2/1998				13.09	13.14		13.22	13.05	

Table H-3b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
12/3/1998				13.01	13.06		13.10	13.01	
12/4/1998				12.74	12.81		12.72	12.65	
12/5/1998				12.42	12.51		12.39	12.35	
12/6/1998				11.99	12.16		12.18	12.00	
12/7/1998				12.21	12.07		12.01	11.79	
12/8/1998				12.27	12.34		12.15	11.69	
12/9/1998				11.94	12.02		11.92	11.67	
12/10/1998				12.39	12.29		12.03	11.79	
12/11/1998				12.37	12.32		12.08	11.99	
12/12/1998				12.51	12.33		12.13	11.89	
12/13/1998				12.94	12.74		12.30	12.05	
12/14/1998				11.97	12.38		11.88		
12/15/1998				12.01	12.29		11.89		
12/16/1998				12.17	12.60		12.05		
12/17/1998				12.12	12.24		12.29		
12/18/1998				12.38	12.33		12.36		
12/19/1998				12.16	12.48		12.23		
12/20/1998				11.71	12.23		11.55		
12/21/1998				11.29	11.05		11.10		
12/22/1998				11.68	11.15		11.38		
12/23/1998				12.54	12.02		11.84		
12/24/1998				12.41	12.06		11.92		
12/25/1998				12.70	12.21		11.97		
12/26/1998				12.45	12.06		11.81		
12/27/1998				12.54	11.95		11.63		
12/28/1998					12.12		12.03		
Mean	14.23	14.36	15.10	14.80	14.43	14.57	14.16	14.19	

Table H-3c. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
7/14/1999	14.92	14.53	15.89	16.05	15.41	14.97	15.32	14.63	14.40
7/15/1999	15.47	15.12	16.36	16.70	16.21	15.72	16.05	15.39	15.41
7/16/1999	15.52	15.13	16.63	16.24	15.77	15.02	15.62	15.66	15.15
7/17/1999	14.52	14.28	16.18	15.10	14.77	14.13	14.66	15.32	14.13
7/18/1999	13.80	13.76	15.67	14.84	14.23	13.63	14.06	14.84	13.69
7/19/1999	13.59	13.48	15.54	14.96	14.18	13.57	13.91	14.68	13.57
7/20/1999	13.67	13.58	15.46	14.58	13.94	13.71	13.98	14.87	13.82
7/21/1999	13.65	13.60	15.56	14.29	14.01	13.73	13.96	14.98	13.82
7/22/1999	13.90	13.79	15.59	15.06	14.23	13.84	14.02	14.85	13.90
7/23/1999	14.06	14.03	15.76	14.51	14.39	14.29	14.44	15.24	14.36
7/24/1999	13.17	12.96	14.88	13.25	13.36	13.32	13.71	14.85	13.48
7/25/1999	12.46	11.99	13.33	12.33	12.33	11.82	12.48	13.39	11.91
7/26/1999	12.57	12.22	13.83	13.67	12.97	12.25	12.58	12.44	11.80
7/27/1999	12.51	12.41	14.44	14.02	13.01	12.21	12.75	12.86	12.17
7/28/1999	12.49	12.31	14.49	13.55	12.96	12.49	12.81	13.39	12.75
7/29/1999	12.38	11.99	14.12	12.63	12.47	12.55	12.63	13.74	12.61
7/30/1999	12.36	11.87	14.08	12.03	12.14	12.27	12.62	14.06	12.30
7/31/1999	11.90	11.56	13.85	11.85	11.63	11.75	12.15	13.44	11.94
8/1/1999	12.05	11.94	13.67	12.40	11.99	11.90	12.18	13.00	11.67
8/2/1999	12.42	12.37	14.04	13.10	12.61	12.06	12.58	13.29	11.64
8/3/1999	12.29	12.13	14.08	12.19	12.03	11.73	12.19	13.61	11.37
8/4/1999	11.94	11.62	13.76	11.98	11.67	11.13	11.73	12.84	11.27
8/5/1999	11.97	11.69	13.70	13.94	12.57	11.83	12.06	12.12	11.58
8/6/1999	12.58	12.30	14.48	14.85	13.50	13.05	13.09	12.98	12.52
8/7/1999	13.22	12.96	15.09	15.00	14.13	13.32	13.66	13.60	12.81
8/8/1999	13.33	12.70	15.14	14.58	13.25	12.53	13.00	13.95	12.68
8/9/1999	12.84	12.40	14.62	13.37	12.54	12.22	12.56	13.53	12.30
8/10/1999	13.07	12.51	14.89	15.53	14.11	13.59	13.76	13.26	12.78
8/11/1999	13.10	12.73	15.37	14.22	13.45	13.03	13.39	14.00	12.82
8/12/1999	13.25	13.01	15.23	12.88	13.02	12.60	13.10	14.32	12.47
8/13/1999	12.99	12.57	14.68	12.80	12.68	12.06	12.66	13.59	12.00
8/14/1999	12.67	12.47	14.02	13.22	12.74	12.32	12.59	12.84	11.97
8/15/1999	12.90	12.73	14.30	13.76	13.13	12.67	12.84	13.21	12.35
8/16/1999	13.31	13.01	14.78	13.54	13.21	12.72	13.06	13.79	12.75
8/17/1999	13.67	13.24	15.08	14.36	13.38	12.70	13.05	13.98	12.63
8/18/1999	13.31	12.82	15.11	13.24	12.92	12.61	12.91	14.22	12.63
8/19/1999	12.92	12.58	14.66	13.64	13.17	12.44	12.88	13.49	12.32
8/20/1999	12.98	12.68	14.43	13.76	13.08	12.56	12.71	12.98	12.18
8/21/1999	13.15	12.77	14.36	13.58	13.10	12.16	12.70	13.10	11.86
8/22/1999	13.67	13.34	15.03	16.31	14.43	14.80	14.53	12.90	12.95
8/23/1999	14.15	13.91	15.90	16.15	14.96	14.07	14.63	14.10	13.62
8/24/1999	14.06	13.50	15.43	14.80	13.70	13.06	13.52	14.07	13.02
8/25/1999	13.74	13.07	15.01	14.61	13.65	12.77	13.21	13.67	12.59
8/26/1999	13.36	12.69	14.70	14.95	13.74	12.73	13.38	13.08	12.43
8/27/1999	13.16	12.69	14.55	14.09	13.29	12.48	12.92	13.18	12.34
8/28/1999	13.23	12.73	14.69	13.96	13.20	12.42	12.80	13.54	12.06
8/29/1999	13.04	12.69	14.19	13.32	13.06	12.19	12.69	12.98	12.01
8/30/1999	13.12	12.83	14.12	13.30	12.89	12.35	12.73	12.83	12.12
8/31/1999	12.98	12.26	13.34	12.58	12.79	11.66	12.38	12.54	11.72
9/1/1999	12.89	12.22	13.37	13.97	12.93	12.50	12.79	12.14	12.03
9/2/1999	13.62	13.50	15.28	15.40	14.10	13.69	13.91	13.32	13.21
9/3/1999	13.72	13.42	14.93	14.13	13.89	12.86	13.61	13.81	12.96
9/4/1999	13.56	13.23	14.50	14.32	13.78	13.25	13.49	13.44	12.97
9/5/1999	13.79	13.65	14.99	15.26	14.32	13.94	14.07	13.57	13.58
9/6/1999	14.14	13.95	15.39	15.88	14.71	14.45	14.52	13.93	14.16
9/7/1999	14.40	14.24	15.59	15.90	15.08	14.87	14.97	14.31	14.70
9/8/1999	14.84	14.51	15.71	15.42	14.97	14.44	14.71	14.74	14.24
9/9/1999	14.86	14.54	15.77	15.23	14.67	13.89	14.39	14.52	13.94
9/10/1999	14.84	14.42	15.73	15.27	14.58	13.93	14.33	14.39	14.03
9/11/1999	14.81	14.37	15.77	15.71	15.06	14.78	14.82	14.62	14.37
9/12/1999	14.76	14.39	15.72	15.36	14.69	14.25	14.60	14.54	14.04
9/13/1999	14.61	14.17	15.53	14.67	14.35	13.69	14.09	14.63	13.89
9/14/1999	14.12	13.69	15.12	13.76	13.67	13.29	13.52	14.65	13.30
9/15/1999	13.72	13.41	14.46	14.20	13.44	13.04	13.19	13.56	12.93
9/16/1999	13.78	13.38	14.71	14.23	13.74	13.26	13.46	13.28	13.14

Table H-3c (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
9/17/1999	13.70	13.37	14.97	14.68	14.14	13.79	13.94	13.53	13.29
9/18/1999	13.75	13.61	15.09	15.24	14.19	13.75	13.84	13.54	13.31
9/19/1999	14.05	13.96	15.57	15.51	14.63	14.15	14.40	13.83	13.90
9/20/1999	14.66	14.53	15.97	15.91	15.07	14.81	14.75	14.62	14.42
9/21/1999	14.79	14.50	15.66	15.16	14.75	14.00	14.48	14.68	14.01
9/22/1999	14.58	14.12	14.78	14.25	13.93	13.51	14.02	14.14	13.46
9/23/1999	14.42	14.05	14.68	14.55	14.22	13.92	13.95	14.00	13.66
9/24/1999	14.67	14.35	15.05	14.99	14.51	14.25	14.26	14.40	14.15
9/25/1999	14.71	14.40	15.42	15.39	15.10	14.63	14.88	14.42	14.30
9/26/1999	14.56	14.36	14.80	14.66	14.75	14.27	14.65	14.32	14.33
9/27/1999	14.66	14.49	14.64	15.02	14.94	14.77	14.89	14.48	14.68
9/28/1999						15.12			
9/29/1999									
9/30/1999	15.42	15.04		15.35	15.15			15.23	14.48
10/1/1999	15.11	14.52		14.57	14.47			14.64	13.93
10/2/1999	14.44	14.09		14.26	14.09			14.21	13.61
10/3/1999	14.16	13.99		14.42	14.14			14.00	13.57
10/4/1999	14.12	13.96		13.83	13.87			14.15	13.44
10/5/1999	13.86	13.54		13.38	13.33			14.08	13.04
10/6/1999	13.83	13.32		14.05	13.46			14.01	13.01
10/7/1999	13.15	12.70		12.75	12.74			12.82	12.34
10/8/1999	12.80	12.51		12.70	12.69			12.70	12.36
10/9/1999	13.26	13.05		13.35	13.39			12.96	12.65
10/10/1999	14.06	13.91		14.08	14.07			13.50	13.52
10/11/1999	14.49	14.31		14.96	14.58			14.02	14.15
10/12/1999	14.49	14.20		14.55	14.51			14.29	14.09
10/13/1999	14.34	13.98		14.18	14.13			14.12	13.50
10/14/1999	13.87	13.47		13.48	13.28			13.33	12.97
10/15/1999	13.63	13.36		13.86	13.62			13.05	13.17
10/16/1999	13.97	13.66		14.21	14.22			13.64	13.80
10/17/1999	14.12	13.94		14.45	14.27			13.91	13.83
10/18/1999	14.24	14.07		14.95	14.54			14.10	13.86
10/19/1999	14.35	14.10		14.78	14.41			14.18	13.63
10/20/1999	14.35	14.19		14.96	14.27			13.91	13.62
10/21/1999	14.28	13.93		14.46	14.18			13.88	13.65
10/22/1999	14.27	13.87		14.48	14.14			13.68	13.51
10/23/1999	14.12	13.63		13.96	13.65			13.83	13.03
10/24/1999	13.89	13.45		14.29	13.64			13.43	13.11
10/25/1999	13.79	13.40		13.78	13.76			13.37	13.20
10/26/1999	13.73	13.43		13.80	13.75			13.41	13.52
10/27/1999	13.65	13.48		14.14	13.84			13.42	13.46
10/28/1999	13.45	13.35			14.05			13.31	13.37
10/29/1999	12.65	12.36			12.75			12.48	12.34
10/30/1999	12.84	12.54			12.72			12.61	12.86
10/31/1999	13.62	13.43			13.57			13.44	13.53
11/1/1999	13.97	13.71			14.00			13.58	13.70
11/2/1999	13.82	13.51			14.26			13.81	13.76
11/3/1999	13.46	13.27			13.47			13.62	12.73
11/4/1999	13.22	12.95			14.53			12.83	12.93
11/5/1999	13.37	13.33			14.90			13.22	13.45
11/6/1999	13.67	13.64			15.15			13.53	13.56
11/7/1999	13.80	13.64			14.92			13.59	13.77
11/8/1999	13.97	14.00			14.83			14.11	14.07
11/9/1999	13.87	13.86			14.20			14.06	13.91
11/10/1999	13.82	13.79			14.43			13.89	13.97
11/11/1999	13.96	13.89			14.30			13.89	13.80
11/12/1999	14.20	14.01			14.60			14.07	14.06
11/13/1999	14.22	14.13			14.73			14.10	14.03
11/14/1999	14.33	14.26			15.01			14.27	14.39
11/15/1999	14.57	14.47			15.55			14.69	14.86
11/16/1999	14.60	14.50			15.40			14.64	14.66
11/17/1999	14.21	13.99			14.44			14.20	13.86
11/18/1999	13.81	13.46			13.90			13.34	13.40
11/19/1999	13.93	13.82			14.43			13.70	13.90
11/20/1999	13.95	13.84			13.93			13.68	13.55

Table H-3c (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 0.3 meters (2 ft).

Date	SC	1	2	FC	3	LR	4	5	NC
11/21/1999	13.17	12.85			13.09			13.06	12.83
11/22/1999	12.43	12.04			12.11			11.83	11.85
11/23/1999	12.83	12.67			13.01			12.25	12.53
11/24/1999	12.38	12.13			12.56			12.03	12.05
11/25/1999	12.08	11.94			12.37			11.85	11.78
11/26/1999	12.21	11.96			12.51			11.88	11.85
11/27/1999	12.46	12.26			13.72			12.12	12.37
11/28/1999	13.01	12.76			13.95			12.94	13.34
11/29/1999	13.30	13.24			14.05			13.22	13.43
11/30/1999	13.20	13.07			13.94			13.27	13.23
12/1/1999	12.55	12.35			12.60			12.46	12.19
12/2/1999	11.92	11.71			11.82			11.74	11.58
12/3/1999	11.42	11.26			11.50			11.21	11.13
12/4/1999	11.41	11.27			11.60			11.18	11.37
12/5/1999	11.78	11.75			12.07			11.68	11.66
12/6/1999	11.91	11.93			12.06			11.80	11.75
12/7/1999	11.83	11.72			11.84			11.69	11.65
12/8/1999	11.39	11.30			11.60			11.24	11.20
12/9/1999	11.41	11.29			11.62			11.16	11.46
12/10/1999	11.62	11.86			11.97			11.86	11.92
12/11/1999	12.08	12.00			12.21			11.78	11.94
12/12/1999	12.38	12.25			13.07			12.16	12.47
12/13/1999	12.38	12.36			12.86			12.43	12.38
12/14/1999	11.58	11.49			11.71			11.48	11.43
12/15/1999	11.40	11.21			11.51			11.10	11.11
12/16/1999	11.43	11.26			12.22			11.21	11.17
12/17/1999	11.53	11.42			12.79			11.36	11.33
12/18/1999	11.64	11.57			11.99			11.54	11.36
12/19/1999	11.44	11.39			11.78			11.38	11.22
12/20/1999	11.49	11.44			12.85			11.67	11.97
12/21/1999	11.67	11.66			12.56			12.05	11.85
12/22/1999	11.75	11.65			12.55			11.69	11.70
12/23/1999	11.95	11.92			13.39			12.09	12.44
12/24/1999	12.01	11.93			13.36			12.22	12.22
12/25/1999	11.98	11.89			13.27			12.06	12.10
12/26/1999	11.93	11.95			12.82			12.04	12.02
12/27/1999	12.46	12.40			12.81			12.50	12.53
12/28/1999	12.80	12.75			13.25			12.60	12.85
12/29/1999	12.82	12.76			14.08			12.88	12.96
12/30/1999	12.58	12.52			14.45			12.82	12.99
12/31/1999	12.64	12.59			14.54			12.91	12.98
Mean	13.34	13.09	14.91	14.29	13.60	13.27	13.58	13.37	12.97

Table H-4a. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
7/1/1997		12.23				12.33		11.97		
7/2/1997		11.78				12.14		11.47		
7/3/1997		11.73				11.76		11.13		
7/4/1997		12.19				12.18		11.70		
7/5/1997		12.50				12.54		12.24		
7/6/1997		12.48				12.01		11.41		
7/7/1997		11.43				10.94				
7/8/1997		13.90				13.66				
7/9/1997		14.08	14.46			13.90			13.72	
7/10/1997		13.64	14.47			13.48			13.60	
7/11/1997		13.23	13.75			13.41			13.03	
7/12/1997		14.25	14.91			14.06			14.07	
7/13/1997		14.40	15.39			14.43			14.46	
7/14/1997		14.13	15.57			14.24			14.42	
7/15/1997		13.79								
7/16/1997		13.10					12.62			12.71
7/17/1997		12.57				13.72	12.15	12.27	13.44	12.29
7/18/1997		12.16				13.83	11.43	11.58	12.68	11.67
7/19/1997		12.85				13.09	12.73	13.30	12.65	12.42
7/20/1997		13.23				13.82	13.16	13.68	13.41	13.08
7/21/1997		13.85				14.28	13.67	14.33	13.67	13.51
7/22/1997		14.29				14.55	13.61	14.26	13.81	13.74
7/23/1997		14.53					13.96	14.52	14.57	14.02
7/24/1997		14.41							14.38	13.03
7/25/1997	15.19	14.78							14.73	14.53
7/26/1997	15.42	15.04	16.47			15.76	15.22	15.58	14.92	14.85
7/27/1997	15.53	15.19	16.73			15.88	15.51	15.87	15.33	15.19
7/28/1997	15.56	15.34	16.52			15.77	15.59	15.75	15.27	15.17
7/29/1997	15.82	15.47	16.72			16.10	15.96	16.06	15.32	15.44
7/30/1997	16.22	16.02	17.71			16.50	16.11	16.22	16.17	15.90
7/31/1997	16.14	15.89	17.34			16.08	15.84	15.91	16.04	15.57
8/1/1997	15.78	15.41	17.01			15.59	15.22	15.38	15.69	15.09
8/2/1997	15.30	14.91	16.66			15.12	14.80	14.93	15.21	14.58
8/3/1997	14.67	14.59	16.27			15.17	14.75	14.88	14.76	14.42
8/4/1997	14.93	14.81	16.40			15.37	14.86	15.06	14.61	14.34
8/5/1997	15.14	14.71	16.32			14.87	14.28	14.31	15.06	14.06
8/6/1997	13.82	13.46	15.03			13.90	13.46	13.37	14.20	13.20
8/7/1997										16.65
8/8/1997										
8/9/1997	15.78		16.68			15.99	15.77	16.34	15.03	
8/10/1997	16.28		17.33			16.80	16.34	16.99	15.97	
8/11/1997	16.32		17.36			16.19	15.76	16.14	15.68	
8/12/1997	15.98		17.23			15.99	15.47	15.96	15.44	
8/13/1997	16.36		17.44			16.24	15.69	16.12	15.70	
8/14/1997	16.10		17.36			16.14	15.73	15.86	15.56	
8/15/1997	16.18		17.63			16.83	16.69	16.89	16.15	
8/16/1997	16.38		17.96			17.09	16.92	17.16	16.46	
8/17/1997	16.40		17.98			17.01	16.80	16.92	16.37	
8/18/1997	16.48		17.87			17.16	16.82	16.96	16.50	
8/19/1997	16.93		18.20			17.49	17.25	17.61	16.57	
8/20/1997	17.95		19.64			18.54	17.83	18.42	17.87	
8/21/1997	14.40		18.83			18.30	17.28	17.63	14.61	
8/22/1997	17.98		16.10			14.56	14.19	14.07	14.44	
8/23/1997	16.73		17.50			15.85	15.53	15.36	16.59	
8/24/1997	15.71		16.74			15.30	15.18	14.80	15.89	
8/25/1997	14.85		16.44			14.84	14.71	14.39	15.59	
8/26/1997	14.88		16.49			15.02	14.92	14.67	15.42	
8/27/1997	15.04		16.66			15.23	14.95	14.85	15.60	
8/28/1997	14.83		16.42			15.43	15.24	15.09	15.38	
8/29/1997	14.97	14.46	15.98			14.79	14.64	14.53	15.33	
8/30/1997	15.57	15.18	16.18			15.89	15.73	15.78	15.33	
8/31/1997	16.34	15.89	17.16			16.67	16.11	16.46	16.15	
9/1/1997	16.24	15.73	17.22			16.51	15.94	16.31	15.86	
9/2/1997	16.38	15.91	17.27			16.59	16.32	16.52	15.99	

Table H-4a (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
9/3/1997	16.73	16.13	17.84			17.04	16.66	16.70	16.75	
9/4/1997	16.75	16.06	17.87			16.94	16.33	16.56	16.66	
9/5/1997	17.31	16.71	18.13			17.60	16.88	17.34	16.49	
9/6/1997	17.55	16.99	18.30			17.78	17.29	17.50	16.79	
9/7/1997	17.68	17.06	18.23			17.62	17.14	17.39	16.96	
9/8/1997	17.08	16.27	18.00			17.15	16.86	16.89	17.05	
9/9/1997	16.55	15.69	17.73			16.62	16.26	16.22	16.88	
9/10/1997	15.49	14.69	16.58			15.25	15.06	14.96	16.12	
9/11/1997	14.40	14.02	15.62			14.50	14.41	14.35	14.96	
9/12/1997	14.63	14.37	15.60			14.83	14.48	14.61	14.49	
9/13/1997	15.44	15.11	16.38			16.01	15.76	15.89	15.13	
9/14/1997	16.54	15.99	17.34			16.60	16.19	16.46	16.06	
9/15/1997	16.08	15.10	17.11			15.89	15.38	15.74	15.82	
9/16/1997	15.24	14.85	16.22			15.41	15.05	15.27	15.08	
9/17/1997	15.26	15.08	16.68			16.13	15.64	15.99	15.02	
9/18/1997	15.58	15.43	17.08			16.12	15.66	15.96	15.25	
9/19/1997	15.84	15.65	17.01			16.21	15.83	16.09	15.50	
9/20/1997	16.40	16.15	17.49			16.91	16.51	16.84	15.88	
9/21/1997	16.90	16.56	18.05			17.14	16.78	16.83	16.43	
9/22/1997	16.87	16.27	17.68			16.94	16.70	16.75	16.52	
9/23/1997	16.97	16.53	17.99			17.88	17.30	17.83	16.58	
9/24/1997	17.02	16.57	17.91			17.47	16.77	17.14	16.49	
9/25/1997	16.61	16.30	16.59			16.86	16.16	16.38	15.87	
9/26/1997	16.27	15.93	16.67			16.63	16.09	16.26	15.82	
9/27/1997	16.01	15.56	15.84			16.12	15.42	15.65	15.35	
9/28/1997	15.87	15.49	15.62			15.77	15.63	15.51	14.96	
9/29/1997	16.96	16.70	17.57			17.38	17.30	17.35	16.42	
9/30/1997	17.47	16.93	18.53			18.21	17.77	18.00	17.11	
10/1/1997	17.33	17.35	19.08			18.67	18.22	18.34	17.18	
10/2/1997	18.14	18.09	19.28			18.85	18.45	18.68	17.60	17.68
10/3/1997	17.21	17.10	17.45			17.42	17.06	17.23	16.58	16.55
10/4/1997	17.29	17.10	17.46			17.35	17.15	17.15	16.61	16.57
10/5/1997	16.95	16.67	16.95			17.13	16.79	16.93	16.40	16.39
10/6/1997	16.20	16.17	16.73			16.83	16.61	16.64	16.22	16.29
10/7/1997	14.55	14.21	15.00			15.09	14.68	14.84	14.93	14.81
10/8/1997	14.56	14.55	14.86			14.71	14.55	14.63	14.15	14.12
10/9/1997	15.48	15.38	16.24			16.22	15.88	15.98	15.16	15.21
10/10/1997		15.67	16.16			16.10	15.81	15.85	15.54	15.58
10/11/1997		15.47	16.35			15.83	15.49	15.61	15.34	15.31
10/12/1997		15.00	15.92			15.40	15.26	15.31	14.79	14.80
10/13/1997		15.02	16.34			15.94	16.01	15.91	14.97	15.06
10/14/1997		15.47	16.74			16.42	16.37	16.40	15.62	15.52
10/15/1997		15.76	17.13			16.95	17.07	16.89	16.02	16.00
10/16/1997		16.20	18.00			17.91	17.96	17.85	16.55	16.53
10/17/1997		15.89	17.83			17.23	16.87	16.97	16.37	16.10
10/18/1997		15.49	17.16			16.85	16.72	16.83	15.63	15.63
10/19/1997		15.80	17.20			16.93	16.59	16.90	15.73	15.91
10/20/1997		16.11	17.61			17.66	17.21	17.54	16.16	16.44
10/21/1997		16.24	17.72			17.17	16.69	16.93	16.28	16.10
10/22/1997										
10/23/1997										
10/24/1997										
10/25/1997										
10/26/1997										
10/27/1997										
10/28/1997		16.72								16.54
10/29/1997	16.78	16.42								16.46
10/30/1997	16.69	16.15				16.93	16.80	16.86		15.97
10/31/1997	16.86	16.50				16.52	16.32	16.44		16.22
11/1/1997	17.12	16.82				16.65	16.60	16.58		16.62
11/2/1997	17.47	17.17				17.21	17.25	17.08		17.07
11/3/1997	17.75	17.58				18.18	17.87	17.97		17.65
11/4/1997	17.91	17.59				19.44	18.79	19.07		17.67
11/5/1997	17.75	17.40				19.03	18.57	18.81		17.39

Table H-4a (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1997 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
11/6/1997	17.63	17.31				18.30	18.09	18.14		17.19
11/7/1997	17.12	16.76				17.75	17.69	17.68		16.67
11/8/1997	17.21	17.02				17.38	17.25	17.24		16.94
11/9/1997	18.18	17.91				18.60	18.23	18.37		17.79
11/10/1997	18.06	17.67				19.29	19.21	19.20		17.62
11/11/1997	18.00	17.61				18.14	18.07	18.09		17.46
11/12/1997	17.62	17.25				18.26	18.19	18.13		17.32
11/13/1997	17.59	17.37				18.04	18.02	17.96		17.20
11/14/1997	17.56	17.28				17.67	17.66	17.62		17.20
11/15/1997	17.51	17.18				17.65	17.63	17.61		17.14
11/16/1997	17.41	17.13				17.58	17.52	17.53		17.03
11/17/1997	17.31	17.15				17.47	17.54	17.40		17.00
11/18/1997	17.38	17.18				18.48	18.48	18.29		17.63
11/19/1997	17.12	16.95				18.65	18.46	18.55		17.07
11/20/1997	17.05	16.69				17.58	17.54	17.53		16.64
11/21/1997	17.05	16.81				17.76	17.68	17.58		16.80
11/22/1997	17.26	17.01				18.95	18.41	18.74		16.93
11/23/1997	17.31	17.01				18.62	18.02	18.38		16.94
11/24/1997	17.31	17.01				17.79	17.72	17.61		16.98
11/25/1997	17.14	16.86				17.77	17.62	17.68		16.94
11/26/1997	16.99	16.75				17.86	17.54	17.83		16.73
11/27/1997	16.92	16.68				17.13	17.15	17.11		16.64
11/28/1997	16.78	16.50				17.43	17.18	17.30		16.58
11/29/1997	16.64	16.50				17.14	17.03	17.01		16.68
11/30/1997	16.63	16.39				17.00	17.02	16.95		16.49
12/1/1997	16.54	16.36				16.84	16.86	16.78		16.47
12/2/1997	16.41	16.36				17.33	17.31	17.15		16.66
12/3/1997	16.11	15.96				18.02	17.95	17.93		16.47
12/4/1997	16.02	16.57				17.69	17.04	17.62		16.22
12/5/1997	16.09	16.55				16.95	16.63	16.90		16.18
12/6/1997	16.25	16.36				16.99	16.65	16.88		16.34
12/7/1997	16.82					16.98	16.94	16.91		16.35
12/8/1997	16.69					16.80	16.93	16.75		16.09
12/9/1997	16.52					16.48	16.63	16.42		16.20
12/10/1997	16.82					16.92	17.14	16.75		16.39
12/11/1997	16.93					17.67	17.77	17.44		16.92
12/12/1997	16.19					17.63	17.56	17.44		16.52
12/13/1997	16.19					17.89	17.67	17.80		16.46
12/14/1997	16.53					17.32	16.98	17.21		16.38
12/15/1997	16.39					16.94	16.87	16.80		15.96
12/16/1997	16.16					17.23	16.98	17.05		15.74
12/17/1997	15.95					16.63	16.38	16.44		15.77
12/18/1997	15.93					16.33	16.22	16.13		15.70
12/19/1997	15.82					16.06	16.21	15.98		15.64
12/20/1997	15.68					16.20	16.16	16.09		15.61
12/21/1997	15.78					15.90	15.97	15.83		15.21
12/22/1997	15.69					15.69	15.84	15.64		15.46
12/23/1997	15.61					15.84	16.06	15.75		15.32
12/24/1997	15.37					15.62	15.75	15.56		15.32
12/25/1997	15.55					15.79	15.93	15.68		15.43
12/26/1997	15.68					16.04	16.24	15.90		15.50
12/27/1997	15.68					16.68	16.59	16.40		15.67
12/28/1997	15.85					17.04	16.82	16.76		15.72
12/29/1997	15.91					16.88	16.61	16.63		15.76
12/30/1997	15.82					16.69	16.40	16.43		15.73
12/31/1997	15.74					16.82	16.45	16.54		15.61
1/1/1998	15.58					17.32	16.62	16.98		15.72
1/2/1998	15.60					17.36	17.13	17.27		15.56
1/3/1998	15.64					16.06	16.05	15.89		15.55
1/4/1998	15.58					16.34	16.22	16.25		15.34
1/5/1998	15.45					15.68	15.77	15.60		15.33
1/6/1998						16.18	16.05	15.98		
Means	16.34	15.61	16.94			16.38	16.36	16.30	15.51	15.86

Table H-4b. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
5/22/1998			12.31		11.29	11.39	11.13		12.03	
5/23/1998			12.06	11.01	10.88	11.29	11.10		11.90	
5/24/1998			12.50	11.11	10.91	11.76	11.46		12.15	
5/25/1998			13.21	11.50	11.29	12.95	12.53		12.68	
5/26/1998			13.13	12.55	12.13	12.90	12.55		12.93	
5/27/1998			13.35	12.75	12.16	13.64	13.01		12.53	
5/28/1998			14.05	13.04	12.39	13.73	13.53		12.74	
5/29/1998			13.63	13.85	13.36	13.33	12.55		12.89	
5/30/1998			12.85	12.89	12.37	12.14	11.57		12.07	
5/31/1998			13.34	11.85	11.38	12.80	11.94		11.95	
6/1/1998			13.26	12.49	12.13	12.71	12.09		12.40	
6/2/1998			13.55	12.35	11.98	13.21	12.45		12.60	
6/3/1998			13.78	12.79	12.23	13.97	13.36		12.83	
6/4/1998			13.92	13.28	12.72	13.30	12.78		13.33	
6/5/1998			13.09	12.89	12.34	12.50	11.98		12.35	
6/6/1998			12.96	12.18	11.56	13.17	12.74		12.36	
6/7/1998			13.72	12.44	11.92	14.16	13.51		12.82	
6/8/1998			13.99	13.20	12.56	13.41	12.80		13.37	
6/9/1998			14.02	13.15	12.49	13.71	12.92		13.06	
6/10/1998			13.88	13.21	12.61	13.68	12.87		12.84	
6/11/1998			13.72	13.23	12.62	13.68	12.84		13.17	
6/12/1998			13.97	13.19	12.70	13.98	13.32		13.13	
6/13/1998			14.37	13.50	13.09	14.10	13.37		13.52	
6/14/1998			14.19	13.71	13.03	13.70	13.06		13.83	
6/15/1998			14.46	13.31	12.89	14.23	13.38		13.06	
6/16/1998			14.25	13.87	13.42	14.39	13.45		13.52	
6/17/1998			14.23	14.11	13.69	14.18	13.38		13.83	
6/18/1998			14.45	13.85	13.35	14.30	13.48		13.56	
6/19/1998			14.44	13.80	13.11	14.30	13.52		13.22	
6/20/1998			13.88	13.89	13.12	13.82	13.00		13.22	
6/21/1998			14.20	13.30	12.82	14.26	13.53		13.30	
6/22/1998			14.54	13.53	12.79	14.29	13.28		13.37	
6/23/1998			14.28	13.58	12.89	13.59	12.75		13.18	
6/24/1998			14.09	13.37	12.65	13.64	12.83		13.03	
6/25/1998		12.71	14.25	13.18	12.45	13.65	13.29		13.23	
6/26/1998		12.50	13.97	13.19	12.65	13.26	12.72		13.15	
6/27/1998		12.01	13.30	12.51	12.20	12.69	12.07		12.77	
6/28/1998		12.04	13.56	12.13	11.76	12.34	11.85		12.79	
6/29/1998		11.71	12.95	11.95	11.66	11.84	11.65		12.69	
6/30/1998		11.46	12.73	11.54	11.35	11.74	11.52		12.38	
7/1/1998		11.11	12.20	11.38	11.24	11.16	11.19		11.85	
7/2/1998		10.66	11.74	10.84	10.77	10.77	10.89		11.53	
7/3/1998		11.18	12.42	10.67	10.56	11.92	11.37		11.54	
7/4/1998		11.54	12.59	11.53	11.19	12.45	11.74		11.65	
7/5/1998		11.88	13.34	11.93	11.49	13.56	12.67		12.50	
7/6/1998		12.58	14.55	12.78	12.32	14.22	12.99		13.29	
7/7/1998		12.56	13.92	13.27	12.61	13.76	12.83		12.69	
7/8/1998		12.43	13.75	12.83	12.09	13.15	12.46		12.73	
7/9/1998		12.07	13.41	12.40	11.94	12.62	12.00		12.55	
7/10/1998		11.87	13.53	12.02	11.64	12.40	12.02		12.67	
7/11/1998		11.85	13.18	11.96	11.71	11.90	11.68		12.96	
7/12/1998		12.82	13.65	11.44	11.36	13.01	12.52		12.60	
7/13/1998		13.87	14.80	12.74	12.29	14.53	14.04		13.77	
7/14/1998		14.27	15.35	13.91	13.46	14.46	13.66		14.38	
7/15/1998		13.94	15.15	13.87	13.59	14.15	13.40		14.27	
7/16/1998		13.91	15.16	13.50	13.23	14.16	13.28		14.25	
7/17/1998		14.19	15.18	13.74	13.32	14.27	13.52		14.15	
7/18/1998		14.45	15.25	13.92	13.64	15.11	14.65		14.23	
7/19/1998		15.55	16.64	14.60	14.26	16.36	15.92		15.45	
7/20/1998		16.36	17.25	15.72	15.29	16.55	15.86		16.01	
7/21/1998		16.14	17.12	16.02	15.47	16.35	15.61		15.91	
7/22/1998		16.32	17.48	15.87	15.55	16.60	15.92		16.26	
7/23/1998		16.38	17.39	16.17	15.88	16.50	15.93		16.19	
7/24/1998		16.71	17.83	16.11	15.82	17.16	16.57		16.60	

Table H-4b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
7/25/1998		16.99	16.23	16.58	16.28	17.70	16.92		16.75	
7/26/1998		17.24	16.66	17.11	16.83	17.78	17.16		17.68	
7/27/1998		16.51	17.88	17.26	17.06	16.49	15.95		17.55	
7/28/1998		15.05	16.03	15.82	15.56	14.92	14.42		15.24	
7/29/1998		14.60	15.79	14.44	14.21	14.87	14.74		14.99	
7/30/1998		15.00	16.37	14.71	14.29	15.70	15.38		15.79	
7/31/1998		14.98	16.61	15.36	14.78	15.58	15.45		16.49	
8/1/1998		14.47	15.97	15.34	14.69	14.93	14.78		15.71	
8/2/1998		15.10	16.16	14.44	13.88	16.05	15.76		14.87	
8/3/1998		16.17	17.05	15.48	14.96	16.59	15.75		15.59	
8/4/1998				15.88	15.38					
8/5/1998				15.80	15.23					
8/6/1998				15.56	15.06					
8/7/1998				15.43	14.98					
8/8/1998				15.50	15.01					
8/9/1998				15.16	14.82					
8/10/1998				15.11	14.65					
8/11/1998				15.89	15.48					
8/12/1998				16.19	15.65					
8/13/1998				16.04	15.70					
8/14/1998				15.57	16.88					
8/15/1998	17.14	16.99	18.58	17.29	16.95	17.94	17.27	17.64	17.28	
8/16/1998	17.34	17.25	18.59	17.53	16.95	18.00	17.19	17.79	17.15	
8/17/1998	16.95	16.97	18.42	16.88	16.55	17.39	16.71	17.14	17.30	
8/18/1998	16.39	16.48	17.48	16.29	15.90	16.46	16.12	16.09	16.73	
8/19/1998	16.38	16.42	17.83	16.65	16.21	16.87	16.60	16.65	16.85	
8/20/1998	15.67	15.73	17.48	15.88	15.39	16.22	15.90	15.87	16.98	
8/21/1998	14.73	14.85	16.16	14.53	14.18	14.97	14.52	14.53	15.63	
8/22/1998	14.85	14.78	15.94	14.47	14.16	14.86	14.39	14.62	14.94	
8/23/1998	14.81	14.67	15.52	13.96	13.72	14.32	13.98	13.88	14.79	
8/24/1998	14.84	14.40	15.40	14.31	13.91	14.78	14.24	14.51	14.17	
8/25/1998	15.51	15.43	16.47	15.27	14.92	15.71	15.09	15.28	15.15	
8/26/1998	15.65	15.60	16.93	15.59	15.07	16.10	15.29	15.69	15.64	
8/27/1998	16.01	15.89	17.13	16.11	15.60	16.64	15.84	16.19	15.71	
8/28/1998	15.98	16.05	17.44	15.96	15.56	16.70	15.81	16.31	16.18	
8/29/1998	15.54	15.46	16.77	15.11	14.87	15.62	15.06	15.14	15.77	
8/30/1998	15.39	15.47	16.99	15.62	15.22	16.14	15.49	15.65	15.90	
8/31/1998	15.54	15.60	17.13	15.88	15.53	16.42	15.64	15.86	16.15	
9/1/1998	15.66	15.66	17.25	16.06	15.45	16.55	15.99	16.10	16.33	
9/2/1998	15.47	15.56	16.88	15.78	15.29	16.36	15.66	16.04	15.94	
9/3/1998	15.40	15.46	16.62	15.64	15.10	16.18	15.38	15.93	15.69	
9/4/1998	15.67	15.52	16.60	15.53	15.10	16.25	15.40	16.09	15.23	
9/5/1998	15.90	16.07	17.06	16.00	15.64	16.55	15.88	16.25	15.90	
9/6/1998	16.18	16.33	17.60	16.50	16.04	17.27	16.60	17.00	16.34	
9/7/1998	16.53	16.56	17.59	16.61	16.14	17.67	16.84	17.60	16.37	
9/8/1998	17.15	17.03	17.74	16.93	16.46	17.68	17.04	17.53	16.51	
9/9/1998	15.73	16.09	16.79	15.95	15.63	16.18	15.62	16.06	16.20	
9/10/1998	15.35	15.21	15.80	15.15	14.70	15.39	14.88	15.18	15.17	
9/11/1998	16.19	15.80	16.88	16.13	15.56	16.70	15.99	16.43	15.36	
9/12/1998	16.29	16.28	17.55	16.64	16.17	17.19	16.51	16.91	16.34	
9/13/1998	16.26	15.99	16.89	16.30	15.85	16.81	16.41	16.73	15.81	
9/14/1998	16.79	16.54	17.41	16.85	16.49	17.25	16.92	17.22	16.27	
9/15/1998	16.87	16.93	17.73	17.16	16.58	17.71	17.21	17.52	16.87	
9/16/1998	16.43	16.45	17.26	16.64	16.17	17.18	16.62	17.10	16.80	
9/17/1998	16.22	16.30	17.23	16.12	15.67	16.57	16.13	16.28	16.73	
9/18/1998	14.78	15.10	15.82	14.95	14.65	14.98	14.98	15.01	15.95	
9/19/1998	14.26	14.32	14.80	13.98	13.75	14.13	13.98	13.97	14.83	
9/20/1998	14.97	14.50	15.03	14.88	14.48	15.19	15.04	15.35	14.18	
9/21/1998	15.39	15.28	16.34	15.45	15.07	16.11	15.40	15.80	15.25	
9/22/1998	15.49	15.38	16.04	15.51	15.11	15.92	15.66	15.73	15.39	
9/23/1998	15.72	15.57	16.41	15.89	15.56	16.18	15.68	15.84	15.63	
9/24/1998	15.73	15.74	17.03	16.22	15.65	16.59	16.05	16.34	15.86	
9/25/1998	15.30	15.50	16.73	15.75	15.26	16.01	15.43	15.65	15.76	
9/26/1998	15.61	15.46	16.76	16.27	15.75	16.89	16.36	16.74	15.56	

Table H-4b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
9/27/1998	16.09	16.00	17.06	16.52	16.14	16.92	16.55	16.96	16.10	
9/28/1998	16.01	16.10	17.40	16.58	16.06	16.88	16.51	16.69	16.66	
9/29/1998	15.40	15.47	16.53	15.49	15.06	15.86	15.29	15.57	15.80	
9/30/1998	15.05	15.17	16.48	15.40	14.83	16.08	15.19	15.62	15.38	
10/1/1998	14.73	14.93	16.00	14.90	14.46	15.21	14.54	14.98	15.02	
10/2/1998	14.44	14.74	15.91	14.76	14.34	15.18	14.67	14.91	15.15	
10/3/1998	13.97	14.21	15.21	14.23	14.01	14.34	14.22	14.39	14.65	
10/4/1998	13.64	13.79	14.77	13.81	13.50	13.87	13.46	13.91	13.90	
10/5/1998	14.02	13.97	15.31	14.36	13.92	14.70	14.04	14.47	13.78	
10/6/1998	14.54	14.62	15.73	14.85	14.43	15.57	14.85	15.53	14.38	
10/7/1998	14.74	14.80	15.90	14.95	14.55	15.61	14.99	15.23	15.03	
10/8/1998	14.52	14.64	15.91	14.74	14.32	15.36	14.61	14.92	15.11	
10/9/1998	13.36	13.67	14.46	13.58	13.28	13.77	13.41	13.64	14.03	
10/10/1998	12.91	12.90	13.38	12.70	12.46	12.68	12.46	12.65	12.92	
10/11/1998	13.17	12.99	14.13	13.16	12.82	13.71	13.09	13.32	12.96	
10/12/1998	13.59	13.35	14.73	14.15	13.64	14.71	13.99	14.67	13.87	
10/13/1998	13.83	13.90	14.84	14.13	13.83	14.49	13.92	14.19	14.15	
10/14/1998	13.13	13.35	14.23	13.36	13.06	13.46	13.03	13.26	13.56	
10/15/1998	12.62	12.65	13.32	12.62	12.25	12.78	12.33	12.56	12.88	
10/16/1998	12.71	12.56	13.21	12.61	12.40	12.77	12.47	12.55	12.56	
10/17/1998	13.79	13.53	14.62	14.29	13.99	14.50	14.41	14.29	13.47	
10/18/1998	14.00	14.09	15.16	14.26	13.66	14.86	14.09	14.48	14.51	
10/19/1998	13.63	13.56	14.67	13.84	13.41	14.43	13.67	14.05	13.63	
10/20/1998	13.76	13.71	14.82	14.10	13.75	14.61	14.13	14.34	13.77	
10/21/1998	14.31	14.24	15.59	15.17	14.72	15.66	15.16	15.36	14.48	
10/22/1998				13.30	14.98	14.04		14.66	14.63	
10/23/1998				13.77	14.39	15.19		14.79	14.61	
10/24/1998				14.90	14.42	15.79		15.57	14.24	
10/25/1998				14.62	14.48	14.85		14.54	14.35	
10/26/1998				14.38	14.12	14.45		14.06	14.07	
10/27/1998				15.09	14.80	15.15		15.06	14.40	
10/28/1998				14.99	14.69	15.07		14.85	14.57	
10/29/1998				14.55	14.41	14.71		14.49	14.49	
10/30/1998				14.02	13.90	14.24		13.82	13.84	
10/31/1998				13.88	13.62	14.03		13.56	13.51	
11/1/1998				13.75	13.48	14.03		13.69	13.57	
11/2/1998				13.28	13.10	13.37		13.12	13.06	
11/3/1998				13.09	12.79	13.17		12.87	13.02	
11/4/1998				12.59	12.31	12.94		12.70	12.80	
11/5/1998				12.14	11.93	12.13		12.03	12.05	
11/6/1998				11.65	11.53	11.71		11.58	11.58	
11/7/1998				12.55	12.23	12.44		12.36	12.01	
11/8/1998				12.94	12.70	12.93		12.75	12.66	
11/9/1998				12.47	12.25	12.61		12.45	12.46	
11/10/1998				13.00	12.64	13.65		13.67	12.34	
11/11/1998				12.99	12.55	13.08		13.25	12.71	
11/12/1998				12.73	12.59	12.72		12.54	12.59	
11/13/1998				12.86	12.70	12.94		12.60	12.61	
11/14/1998				12.99	12.64	13.26		12.82	12.78	
11/15/1998				12.91	12.56	13.23		12.88	12.75	
11/16/1998				12.94	12.63	12.90		12.80	12.67	
11/17/1998				13.40	13.04	13.42		13.12	12.97	
11/18/1998				12.92	12.82	13.01		12.83	12.81	
11/19/1998				12.44	12.30	12.42		12.42	12.45	
11/20/1998				13.13	12.84	13.26		12.91	12.28	
11/21/1998				13.15	12.88	13.22		12.88	12.66	
11/22/1998				12.88	12.82	13.03		12.88	12.83	
11/23/1998				13.14	13.05	13.19		13.03	13.02	
11/24/1998				13.25	13.22	13.41		13.24	13.31	
11/25/1998				12.98	12.92	13.03		12.91	12.82	
11/26/1998				13.06	13.01	13.25		12.96	12.88	
11/27/1998				12.95	12.94	13.08		13.01	12.98	
11/28/1998				12.98	12.96	13.06		13.03	13.00	
11/29/1998				13.55	13.30	13.22		13.34	12.80	

Table H-4b (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1998 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
11/30/1998				14.01	13.72	13.99		13.91	13.41	
12/1/1998				13.31	13.31	13.45		13.37	13.33	
12/2/1998				12.98	12.95	13.09		13.00	13.00	
12/3/1998				12.92	12.91	12.96		12.98	12.96	
12/4/1998				12.64	12.62	12.50		12.63	12.57	
12/5/1998				12.32	12.30	12.26		12.34	12.28	
12/6/1998				11.90	11.88	11.93		11.94	11.94	
12/7/1998				12.05	11.94	11.80		11.91	11.74	
12/8/1998				12.12	12.03	11.99		11.87	11.64	
12/9/1998				11.80	11.75	11.88		11.66	11.64	
12/10/1998				12.20	12.07	12.10		11.88	11.73	
12/11/1998				12.18	12.11	12.29		12.01	11.93	
12/12/1998				12.17	12.03	12.32		11.93	11.84	
12/13/1998				12.62	12.32	12.65		12.20	11.97	
12/14/1998				11.84	11.79	12.06		11.85	11.83	
12/15/1998				11.86	11.78	11.78		11.83	11.77	
12/16/1998				12.01	11.93	12.17		11.89	11.82	
12/17/1998				11.99	11.93	12.14		11.98	11.92	
12/18/1998				12.17	12.05	12.25		12.03	11.97	
12/19/1998				12.00	11.90	12.09		11.96	11.89	
12/20/1998				11.63	11.64	11.48		11.45	11.33	
12/21/1998				11.16	11.10	10.96		10.92	10.82	
12/22/1998				11.29	11.17	11.13		10.93	10.17	
12/23/1998				11.80	11.49	11.96		11.73	10.60	
12/24/1998				11.79	11.56	12.03		11.78	10.89	
12/25/1998				11.83	11.56	12.10		11.84	11.25	
12/26/1998				11.45	11.18	11.71		11.48	11.11	
12/27/1998				11.45	11.14	11.76		11.46	11.09	
12/28/1998					11.09	11.88		11.72	11.24	
12/29/1998										
Means	15.18	14.67	15.31	13.93	13.57	14.18	14.23	14.12	13.82	

Table H-4c. Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
7/14/1999	14.70	14.36	15.53	14.65	14.14	14.96	14.45	15.25	14.18	14.14
7/15/1999	15.24	14.91	16.03	15.34	14.82	15.70	15.22	15.99	15.00	15.09
7/16/1999	15.36	14.94	16.26	15.14	14.61	15.40	14.74	15.53	15.12	14.76
7/17/1999	14.30	14.06	15.60	14.35	13.88	14.47	13.95	14.39	14.76	13.84
7/18/1999	13.58	13.43	15.09	13.65	13.16	13.84	13.42	13.75	14.09	13.43
7/19/1999	13.41	13.23	15.02	13.59	13.18	13.80	13.38	13.63	13.72	13.30
7/20/1999	13.48	13.35	14.82	13.63	13.15	13.58	13.46	13.54	13.94	13.43
7/21/1999	13.45	13.32	14.93	13.66	13.18	13.72	13.48	13.53	14.09	13.48
7/22/1999	13.76	13.65	15.11	14.06	13.62	14.04	13.67	13.82	14.15	13.68
7/23/1999	13.90	13.79	15.21	14.06	13.63	14.14	14.07	14.09	14.73	14.04
7/24/1999	12.93	12.68	14.43	13.08	12.63	13.12	13.24	12.95	14.62	13.34
7/25/1999	12.33	11.93	13.14	12.12	11.57	12.13	11.77	11.81	13.10	11.82
7/26/1999	12.42	12.08	13.43	12.52	11.94	12.60	11.99	12.24	12.12	11.70
7/27/1999	12.40	12.21	13.87	12.52	12.01	12.68	12.06	12.35	12.36	12.01
7/28/1999	12.27	12.05	13.87	12.44	11.91	12.57	12.15	12.17	12.75	12.42
7/29/1999	12.12	11.74	13.56	12.10	11.72	12.18	12.33	11.78	13.26	12.42
7/30/1999	12.11	11.56	13.60	11.86	11.51	11.97	12.21	11.45	13.55	12.16
7/31/1999	11.76	11.35	13.25	11.43	11.07	11.49	11.67	11.08	12.81	11.77
8/1/1999	11.92	11.75	13.32	11.78	11.50	11.85	11.73	11.42	12.73	11.58
8/2/1999	12.20	12.06	13.55	11.95	11.59	12.16	11.81	11.78	12.72	11.50
8/3/1999	12.14	11.77	13.46	11.60	11.18	11.81	11.64	11.26	12.91	11.27
8/4/1999	11.71	11.28	13.06	11.20	10.80	11.41	11.09	10.93	12.20	11.11
8/5/1999	11.77	11.47	13.17	11.59	11.15	11.96	11.42	11.59	11.71	11.38
8/6/1999	12.23	11.89	13.78	12.14	11.73	12.49	12.20	12.31	12.19	12.01
8/7/1999	12.99	12.67	14.45	12.78	12.13	13.17	12.72	12.77	12.88	12.40
8/8/1999	12.74	12.27	14.27	12.37	11.88	12.61	12.24	12.21	12.56	12.14
8/9/1999	12.47	12.01	13.94	12.12	11.67	12.11	12.02	11.58	12.84	12.03
8/10/1999	12.52	12.12	14.23	12.70	12.08	13.02	12.69	12.81	12.39	12.35
8/11/1999	12.73	12.49	14.61	12.78	12.37	12.97	12.63	12.55	13.36	12.40
8/12/1999	12.92	12.61	14.42	12.41	12.08	12.70	12.49	12.18	13.71	12.29
8/13/1999	12.74	12.27	14.17	12.09	11.68	12.44	12.02	11.83	13.24	11.92
8/14/1999	12.46	12.23	13.70	12.25	11.91	12.47	12.12	12.11	12.61	11.88
8/15/1999	12.70	12.49	13.89	12.33	11.96	12.75	12.38	12.36	12.78	12.18
8/16/1999	13.11	12.71	14.17	12.53	12.16	12.87	12.55	12.53	13.12	12.54
8/17/1999	13.44	12.95	14.56	12.82	12.32	13.02	12.55	12.49	13.31	12.37
8/18/1999	13.00	12.48	14.46	12.49	12.08	12.64	12.52	12.18	13.39	12.42
8/19/1999	12.71	12.28	14.10	12.55	11.92	12.72	12.21	12.34	13.00	12.18
8/20/1999	12.88	12.50	13.90	12.69	12.15	12.85	12.20	12.35	12.68	12.04
8/21/1999	13.01	12.58	13.95	12.46	11.92	12.74	11.88	12.29	12.75	11.80
8/22/1999	13.51	13.19	14.75	13.46	12.92	14.03	13.85	14.10	12.54	12.74
8/23/1999	14.00	13.72	15.52	13.85	13.28	14.13	13.46	13.81	13.81	13.38
8/24/1999	13.70	13.06	14.73	12.81	12.32	13.23	12.79	12.94	13.48	12.72
8/25/1999	13.19	12.64	14.35	12.52	12.02	12.96	12.43	12.61	12.94	12.35
8/26/1999	12.98	12.34	14.10	12.38	11.88	12.81	12.34	12.64	12.53	12.20
8/27/1999	12.70	12.35	14.03	12.20	11.76	12.65	12.18	12.39	12.60	12.12
8/28/1999	12.83	12.44	14.21	12.54	11.92	12.80	12.13	12.24	13.06	11.93
8/29/1999	12.89	12.50	13.82	12.42	11.97	12.73	12.12	12.35	12.73	11.94
8/30/1999	13.04	12.70	13.83	12.44	12.10	12.67	12.19	12.35	12.70	12.07
8/31/1999	12.90	12.20	13.33	12.39	11.86	12.56	11.64	11.99	12.51	11.67
9/1/1999	12.77	12.12	13.20	12.73	12.17	12.78	12.30	12.58	12.00	11.87
9/2/1999	13.51	13.39	14.83	13.48	12.97	13.83	13.08	13.59	13.11	12.95
9/3/1999	13.64	13.34	14.64	13.41	12.86	13.78	12.67	13.32	13.53	12.83
9/4/1999	13.50	13.20	14.33	13.62	13.16	13.67	13.03	13.32	13.16	12.90
9/5/1999	13.73	13.58	14.71	13.90	13.38	14.13	13.61	13.90	13.36	13.44
9/6/1999	14.02	13.83	15.06	14.12	13.62	14.37	13.92	14.28	13.75	14.01
9/7/1999	14.32	14.16	15.34	14.54	14.01	14.83	14.37	14.70	14.17	14.51
9/8/1999	14.68	14.44	15.47	14.73	14.14	14.79	14.19	14.40	14.43	14.17
9/9/1999	14.69	14.37	15.42	14.16	13.58	14.42	13.62	14.08	13.94	13.76
9/10/1999	14.57	14.18	15.29	14.18	13.56	14.28	13.73	14.06	13.79	13.85
9/11/1999	14.66	14.29	15.46	14.75	14.19	14.85	14.33	14.60	14.32	14.28
9/12/1999	14.63	14.28	15.38	14.30	13.74	14.52	14.00	14.35	14.20	14.01
9/13/1999	14.39	13.95	15.10	13.91	13.36	14.11	13.58	13.66	14.16	13.80

Table H-4c (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
9/14/1999	14.02	13.46	14.75	13.44	12.98	13.52	13.21	12.84	14.33	13.25
9/15/1999	13.59	13.16	14.15	13.28	12.68	13.31	12.80	12.97	13.05	12.83
9/16/1999	13.71	13.27	14.41	13.53	13.10	13.58	13.08	13.31	13.17	13.04
9/17/1999	13.64	13.32	14.67	13.71	13.14	13.93	13.47	13.72	13.33	13.16
9/18/1999	13.71	13.53	14.83	13.71	13.21	13.98	13.38	13.73	13.28	13.21
9/19/1999	13.97	13.92	15.25	14.20	13.71	14.43	13.81	14.24	13.64	13.73
9/20/1999	14.53	14.43	15.67	14.63	14.01	14.86	14.35	14.53	14.36	14.27
9/21/1999	14.64	14.37	15.40	14.34	13.82	14.56	13.78	14.23	14.29	13.89
9/22/1999	14.48	14.01	14.66	13.91	13.49	13.78	13.40	13.71	13.83	13.40
9/23/1999	14.30	13.96	14.55	14.20	13.83	14.08	13.79	13.85	13.72	13.58
9/24/1999	14.56	14.26	14.83	14.51	14.05	14.38	14.09	14.14	14.11	14.05
9/25/1999	14.62	14.35	15.32	14.80	14.26	14.94	14.44	14.69	14.27	14.18
9/26/1999	14.47	14.32	14.77			14.66	14.16	14.53	14.23	14.21
9/27/1999	14.50	14.43	14.65			14.82	14.59	14.74	14.38	14.55
9/28/1999							14.97			
9/29/1999										
9/30/1999	15.18	14.73		14.09		14.80			14.80	14.43
10/1/1999	14.68	14.14		13.45		14.14			14.01	13.84
10/2/1999	14.10	13.78		13.21		13.84			13.74	13.55
10/3/1999	13.97	13.81		13.46		13.96			13.59	13.52
10/4/1999	13.94	13.68		13.09		13.67			13.88	13.40
10/5/1999	13.65	13.27		12.58		13.13			13.68	12.99
10/6/1999	13.49	12.98		12.57		13.15			13.46	12.88
10/7/1999	13.01	12.63		12.25		12.64			12.79	12.32
10/8/1999	12.65	12.46		12.44		12.66			12.60	12.33
10/9/1999	13.16	13.02		13.07		13.36			12.89	12.62
10/10/1999	13.91	13.81		13.58		13.94			13.32	13.44
10/11/1999	14.34	14.20		14.20		14.47			13.79	14.05
10/12/1999	14.42	14.14		13.98		14.41			14.04	14.05
10/13/1999	14.26	13.90		13.58		14.05			13.94	13.47
10/14/1999	13.81	13.37		12.89		13.24			13.02	12.94
10/15/1999	13.54	13.31		13.32		13.56			12.95	13.12
10/16/1999	13.83	13.56		13.75		14.06			13.53	13.69
10/17/1999	14.01	13.86		13.65		14.13			13.69	13.74
10/18/1999	14.11	13.94		13.94		14.38			13.92	13.82
10/19/1999	14.16	13.85		13.45		14.14			13.79	13.56
10/20/1999	14.21	13.99		13.59		14.04			13.62	13.60
10/21/1999	14.14	13.78		13.62		14.06			13.61	13.61
10/22/1999	14.17	13.80		13.58		14.01			13.67	13.48
10/23/1999	13.95	13.47		13.07		13.51			13.55	13.01
10/24/1999	13.67	13.26		13.07		13.48			13.21	13.08
10/25/1999	13.70	13.31		13.23		13.65			13.25	13.19
10/26/1999	13.70	13.36		13.43		13.68			13.34	13.47
10/27/1999	13.61	13.38		13.36		13.75			13.34	13.38
10/28/1999	13.43	13.30				13.97			13.23	13.25
10/29/1999	12.65	12.35				12.72			12.48	12.33
10/30/1999	12.83	12.53				12.61			12.60	12.87
10/31/1999	13.61	13.41				13.50			13.44	13.52
11/1/1999	13.96	13.69				13.82			13.57	13.69
11/2/1999	13.82	13.50				14.06			13.81	13.74
11/3/1999	13.46	13.26				13.22			13.62	12.72
11/4/1999	13.22	12.94				14.00			12.82	12.94
11/5/1999	13.37	13.31				14.31			13.20	13.44
11/6/1999	13.66	13.63				14.51			13.50	13.55
11/7/1999	13.81	13.63				14.80			13.59	13.77
11/8/1999	13.97	13.99				14.81			14.12	14.06
11/9/1999	13.87	13.85				14.19			14.06	13.90
11/10/1999	13.82	13.78				14.41			13.89	13.95
11/11/1999	13.96	13.88				14.29			13.89	13.79
11/12/1999	14.20	14.00				14.56			14.07	14.06
11/13/1999	14.23	14.12				14.72			14.10	14.02
11/14/1999	14.33	14.25				14.95			14.26	14.39

Table H-4c (continued). Daily mean temperatures (°C) for Field's Cove subtidal stations during 1999 sample period. Temperature recorders were suspended from buoys at a depth of 3 meters (9 ft), except for FC-5m which was suspended at a depth of 5 meters (16 ft).

Date	SC	1	2	FC	FC-5m	3	LR	4	5	NC
11/15/1999	14.57	14.46				15.42			14.66	14.85
11/16/1999	14.61	14.48				15.30			14.63	14.65
11/17/1999	14.22	13.98				14.43			14.21	13.83
11/18/1999	13.81	13.44				13.86			13.35	13.39
11/19/1999	13.93	13.81				14.39			13.69	13.89
11/20/1999	13.95	13.82				13.92			13.68	13.54
11/21/1999	13.17	12.83				13.07			13.07	12.82
11/22/1999	12.41	12.03				12.08			11.84	11.84
11/23/1999	12.81	12.66				12.95			12.25	12.52
11/24/1999	12.36	12.12				12.43			12.03	12.04
11/25/1999	12.06	11.93				12.21			11.85	11.78
11/26/1999	12.19	11.95				12.28			11.89	11.85
11/27/1999	12.43	12.24				13.30			12.11	12.37
11/28/1999	12.97	12.74				13.60			12.91	13.33
11/29/1999	13.28	13.22				13.90			13.21	13.43
11/30/1999	13.20	13.06				13.83			13.27	13.21
12/1/1999	12.55	12.34				12.58			12.47	12.18
12/2/1999	11.91	11.70				11.81			11.74	11.57
12/3/1999	11.41	11.25				11.48			11.22	11.12
12/4/1999	11.38	11.27				11.57			11.18	11.37
12/5/1999	11.78	11.75				12.06			11.68	11.65
12/6/1999	11.90	11.92				12.06			11.80	11.74
12/7/1999	11.82	11.71				11.83			11.70	11.64
12/8/1999	11.37	11.29				11.58			11.25	11.19
12/9/1999	11.36	11.28				11.61			11.16	11.46
12/10/1999	11.60	11.85				11.96			11.86	11.92
12/11/1999	12.02	12.00				12.16			11.78	11.94
12/12/1999	12.33	12.24				12.97			12.16	12.47
12/13/1999	12.37	12.35				12.84			12.42	12.36
12/14/1999	11.56	11.49				11.70			11.48	11.41
12/15/1999	11.36	11.21				11.49			11.10	11.11
12/16/1999	11.38	11.25				12.06			11.21	11.16
12/17/1999	11.50	11.41				12.64			11.36	11.33
12/18/1999	11.63	11.56				11.88			11.54	11.36
12/19/1999	11.41	11.38				11.67			11.39	11.23
12/20/1999	11.39	11.43				12.56			11.67	11.97
12/21/1999	11.67	11.66				12.51			12.05	11.85
12/22/1999	11.73	11.64				12.48			11.69	11.72
12/23/1999	11.88	11.91				13.12			12.09	12.45
12/24/1999	11.98	11.93				12.95			12.22	12.23
12/25/1999	11.97	11.88				13.06			12.06	12.11
12/26/1999	11.89	11.94				12.79			12.04	12.03
12/27/1999	12.40	12.39				12.80			12.50	12.54
12/28/1999	12.71	12.74				13.23			12.60	12.85
12/29/1999	12.77	12.75				13.93			12.87	12.95
12/30/1999	12.54	12.51				13.94			12.81	12.99
12/31/1999	12.60	12.58				13.73			12.90	12.97
Means	13.21	12.97	14.48	13.22	12.69	13.37	13.00	13.11	13.13	12.88

Appendix I

Dissolved Oxygen Monitoring - 1976–1998

DISSOLVED OXYGEN MONITORING

This section contains summaries of all dissolved oxygen (DO) data taken in the DCPP receiving waters from 1976 - 1998. In late 1998 PG&E and the RWQCB decided to discontinue DO monitoring because previous monitoring showed consistently high levels of DO in all areas. There have been four sampling regimes over the duration of the study as indicated by the station arrays in **Figures I-1 to I-4**. The detailed procedures for data collection, instrument calibration, data storage and analysis are presented at the end of this section. A summary of the methods follows.

DO concentrations have been measured in the vicinity of DCPP from 1976 through 1998. Two methods have been used to determine DO concentrations. From 1976 through August 1996, water samples were collected in the field and then chemically tested in the laboratory. From November 1996 through November 1998, DO concentrations were measured *in situ* at the station with a calibrated, submersible oxygen sensor integrated with a conductivity-temperature-depth (CTD) unit. Compared to the chemical testing method, the CTD unit improved the overall efficiency of collecting and processing dissolved oxygen data. Dissolved oxygen concentrations from both methods are reported in units of mg/l of dissolved oxygen.

To measure DO using the chemical testing procedure, water samples were collected from a boat positioned over each station, using two Frautschy bottles lowered on a hydrographic wire to the middle and bottom depths at each station. Surface water samples were collected in a bucket and carefully transferred to 300 ml glass sample bottles. Following procedure, each sample was chemically preserved with alkaline iodide azide and manganous sulfate. Samples were processed in the lab using the modified Winkler titration method.

The CTD method measured continuos DO concentrations from surface to bottom with a submersible oxygen sensor. Technicians deployed the calibrated sensor from a boat and allowed it to equilibrate for at least three minutes just below the water surface. The CTD unit was slowly lowered to the bottom and retrieved at a rate not exceeding 1 ft per second. The CTD unit stored the data from each station in a digital format. After all stations were sampled, the data were downloaded and processed in accordance with the written procedures. Average DO concentrations were sorted into 0.5 m depth ranges at surface, mid-depth, and bottom strata to compare with data collected using the titration method. For comparison, we summarized data

quarterly and annually at each station using the mean DO concentration form surface, mid-water and bottom depths. A summary of the data from the 1995-1998 period was included in Tenera (1999).

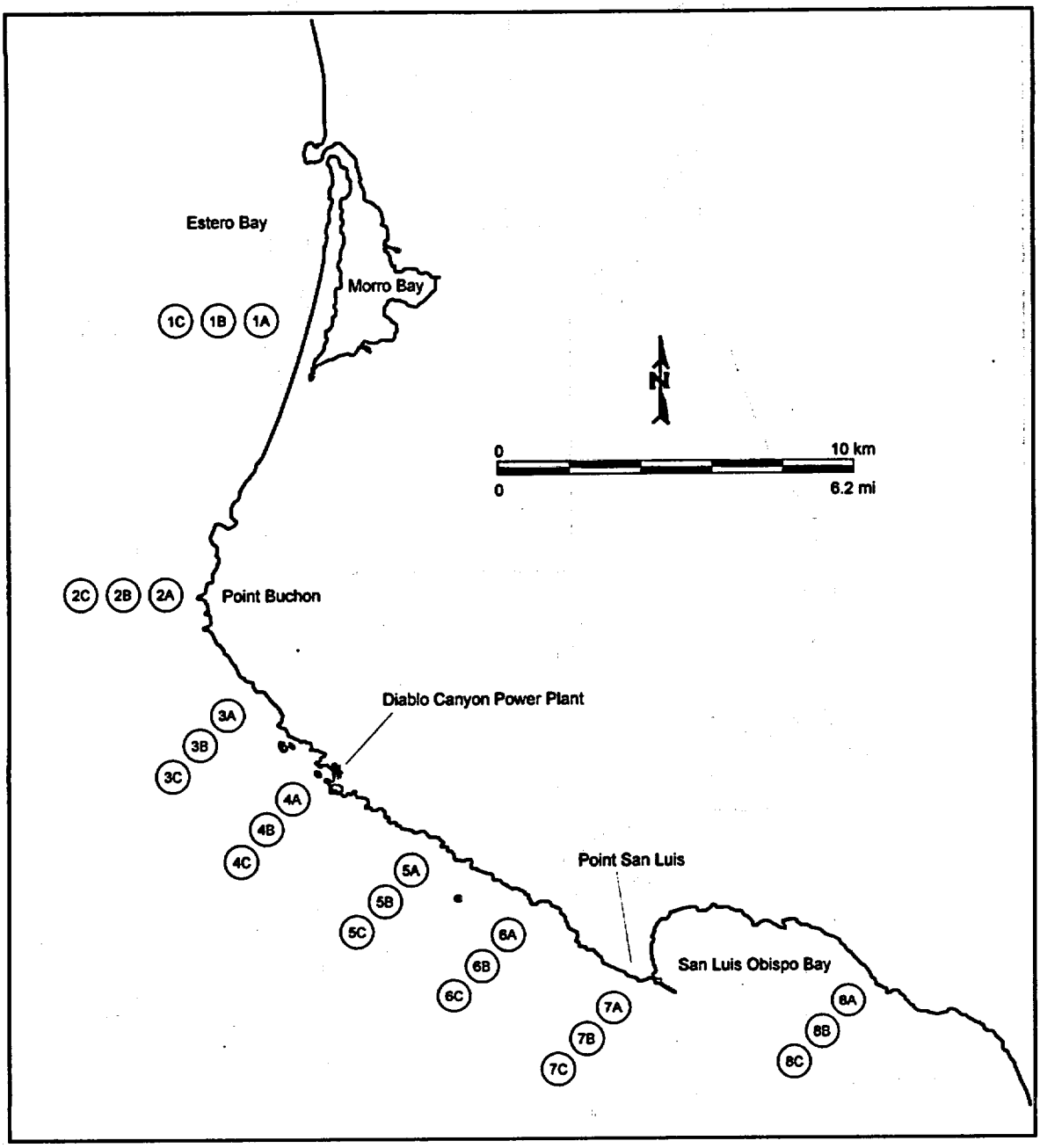


Figure I-1. Dissolved oxygen stations sampled from June 1976 to February 1977.

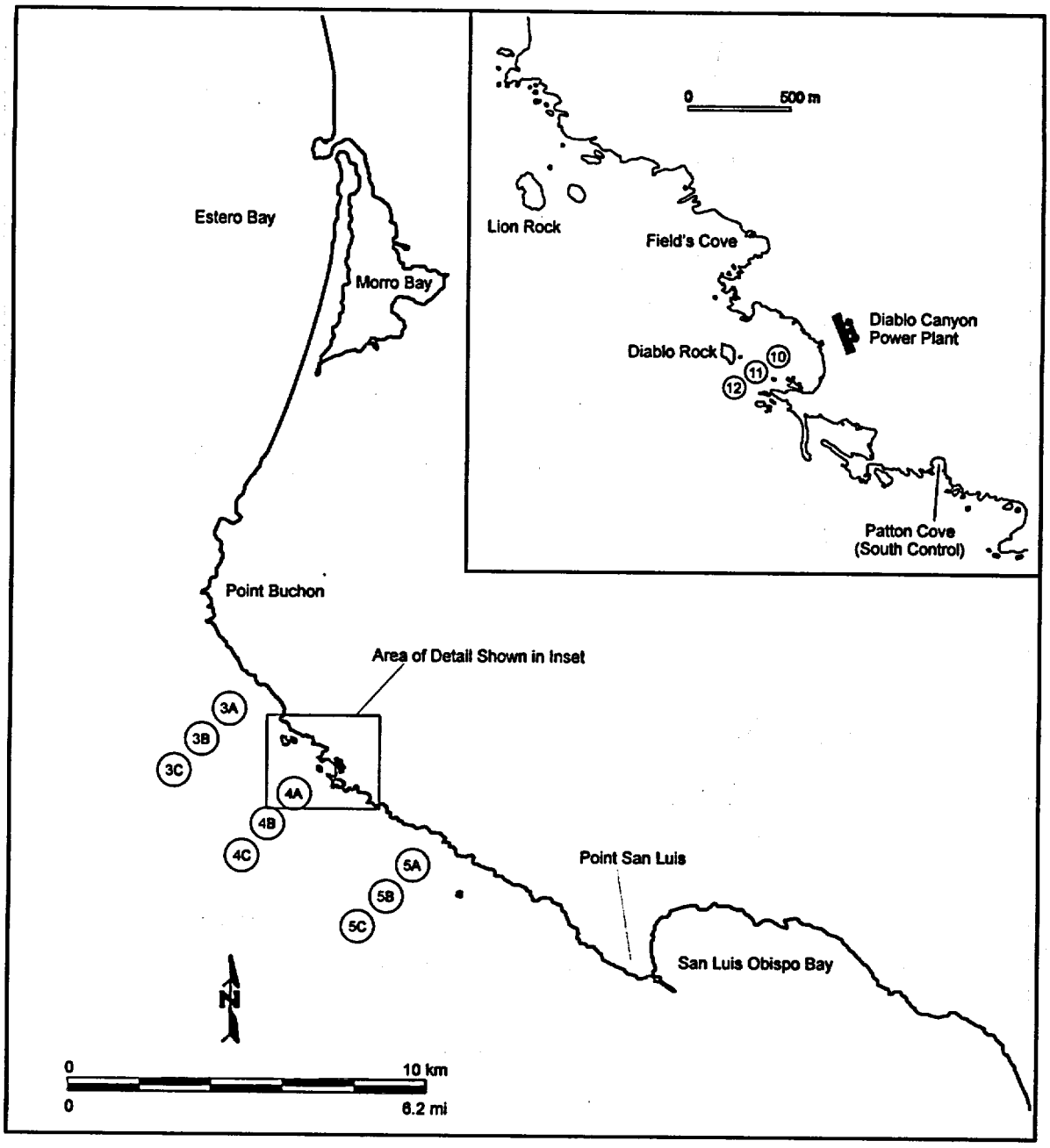


Figure I-2. Dissolved oxygen stations sampled from February 1977 to February 1990.

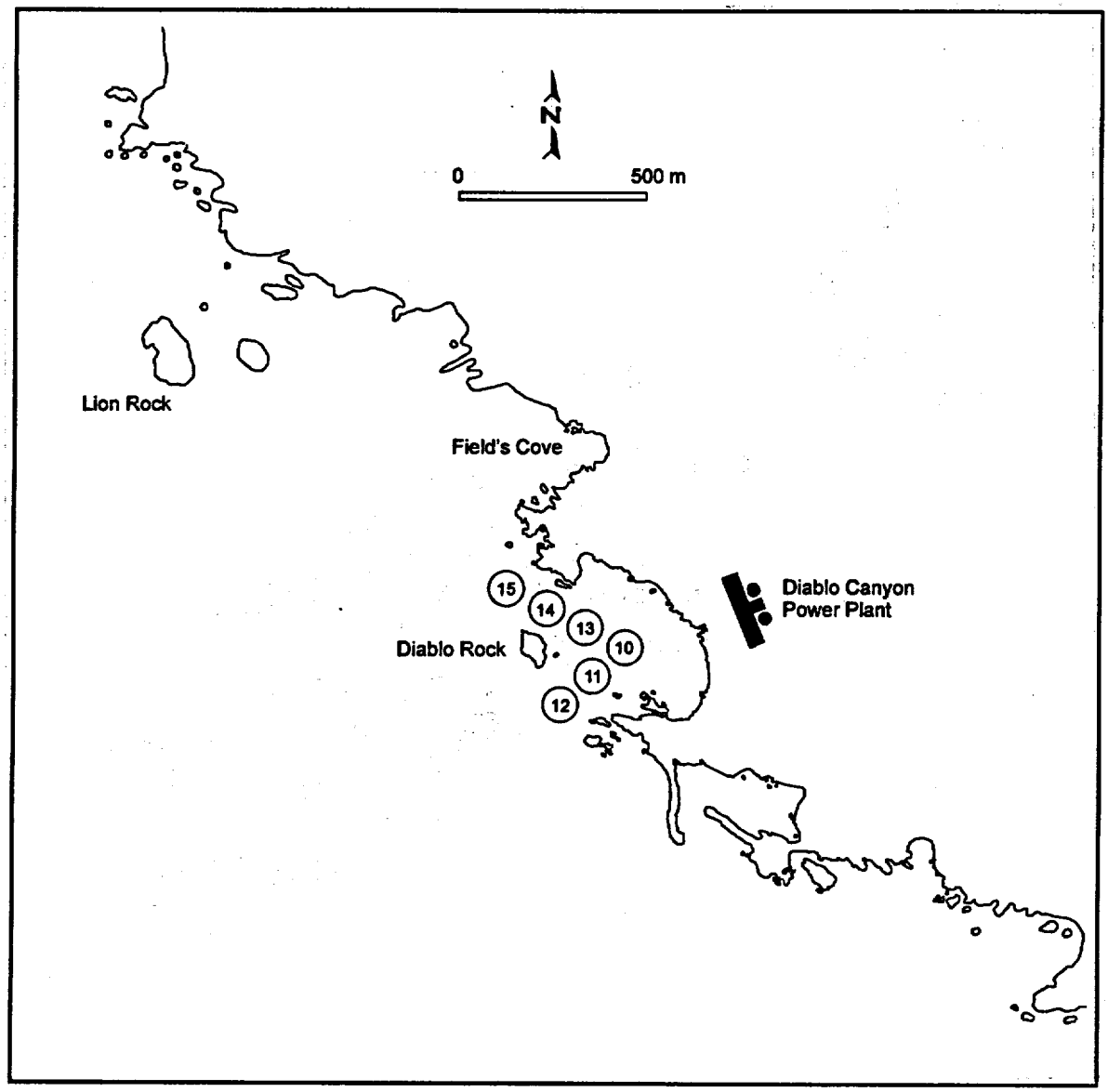


Figure I-3. Dissolved oxygen stations sampled from March 1990 to June 1995.

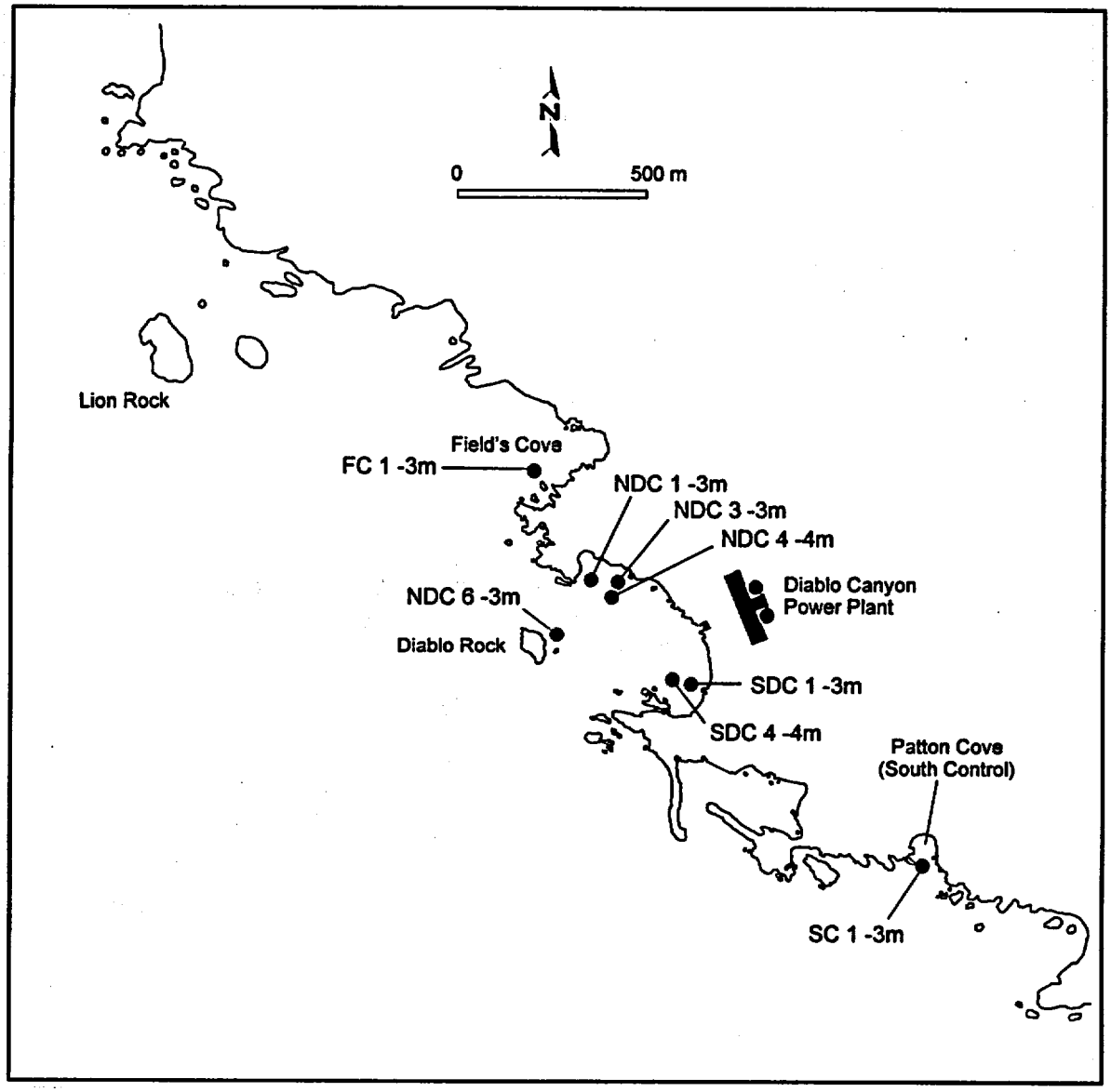


Figure I-4. Dissolved oxygen stations sampled from September 1995 to November 1998.

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
1A	6/21/1976	1103	40	9.9	10.1	8.6
1B	6/21/1976	1131	80	9.9	10.4	7.0
1C	6/21/1976	1150	130	10.1	9.8	7.1
2A	6/21/1976	1255	100	7.7	8.3	6.5
2B	6/21/1976	1242	170	9.2	8.3	6.3
2C	6/21/1976	1228	200	9.6	8.3	7.6
3A	6/22/1976	0622	130	6.8	5.2	5.2
3B	6/22/1976	0632	170	7.2	4.9	4.2
3C	6/22/1976	0645	200	6.6	4.4	5.2
4A	6/22/1976	0735	130	6.0	5.6	4.5
4B	6/22/1976	0725	160	6.0	4.7	4.2
4C	6/22/1976	0710	200	5.8	5.4	4.1
5A	6/22/1976	0810	90	5.9	6.2	5.4
5B	6/22/1976	0820	110	6.1	6.5	5.2
5C	6/22/1976	0827	130	7.0	5.0	4.5
6A	6/22/1976	0900	60	8.4	7.8	5.6
6B	6/22/1976	0855	75	8.3	6.8	6.3
6C	6/22/1976	0845	120	8.2	6.0	6.2
7A	6/22/1976	0915	60	8.4	7.8	6.2
7B	6/22/1976	0925	100	8.4	6.5	6.0
7C	6/22/1976	0930	130	8.0	5.9	5.4
8A	6/22/1976	1005	50	8.4	8.1	7.7
8B	6/22/1976	1000	70	8.7	8.0	7.6
8C	6/22/1976	0950	90	7.9	6.0	5.5
1A	10/7/1976	0755	70	8.4	8.2	8.1
1B	10/7/1976	0809	105	10.0	8.3	9.0
1C	10/7/1976	0816	145	9.2	8.4	7.0
2A	10/7/1976	0900	95	8.6	8.4	7.6
2B	10/7/1976	0851	160	9.0	9.2	8.4
2C	10/7/1976	0842	200	9.2	8.6	8.0
3A	10/6/1976	0845	128	7.8	7.6	7.8
3B	10/6/1976	0905	170	8.6	7.0	6.6
3C	10/6/1976	0915	200	8.3	5.8	7.4
4A	10/6/1976	1010	118	7.6	8.2	7.6
4B	10/6/1976	0955	180	7.8	7.6	6.6
4C	10/6/1976	0940	185	8.2	7.8	6.8
5A	10/6/1976	1030	55	8.0	7.5	6.8
5B	10/6/1976	1042	101	8.4	8.8	7.1
5C	10/6/1976	1050	130	7.2	7.6	6.3
6A	10/7/1976	0930	65	9.8	8.2	7.8
6B	10/7/1976	0937	75	9.4	9.2	8.0
6C	10/7/1976	0945	122	9.4	10.0	7.7
7A	10/7/1976	1021	68	10.4	8.6	7.2
7B	10/7/1976	1014	102	8.8	7.6	7.8
7C	10/7/1976	1005	125	8.6	9.9	8.4
8A	10/7/1976	1048	40	8.6	7.8	6.6
8B	10/7/1976	1038	65	8.7	8.5	8.0
8C	10/7/1976	1033	85	8.4	7.8	7.8

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/23/1977	0710	79	8.0	8.0	7.8
3B	2/23/1977	0720	162	8.0	7.8	8.0
3C	2/23/1977	0733	200	8.0	7.7	6.9
4A	2/23/1977	1022	104	8.0	8.2	7.0
4B	2/23/1977	1033	170	8.1	7.9	6.0
4C	2/23/1977	1047	200	8.0	8.2	6.4
5A	2/24/1977	0655	40	8.0	8.4	8.2
5B	2/24/1977	0700	95	8.0	7.8	6.6
5C	2/24/1977	0707	105	8.4	7.4	6.8
6A	2/24/1977	0753	65	8.2	8.4	7.1
6B	2/24/1977	0743	80	8.2	8.4	7.6
6C	2/24/1977	0730	85	8.0	8.0	7.4
7A	2/24/1977	0826	55	8.2	7.6	7.2
7B	2/24/1977	0818	85	7.2	8.0	7.8
7C	2/24/1977	0808	120	8.0	8.0	6.4
8A	2/24/1977	0859	42	7.8	7.4	8.0
8B	2/24/1977	0850	60	7.8	7.9	7.0
8C	2/24/1977	0841	75	8.2	8.2	6.6
10	2/24/1977	1314	35	8.2	8.2	8.4
11	2/24/1977	1300	75	8.4	8.0	8.2
12	2/24/1977	1250	75	8.2	8.0	7.6
3A	6/15/1977	0835	125	8.4	7.6	6.1
3B	6/15/1977	0845	141	8.0	-	5.0
3C	6/15/1977	0855	197	9.0	6.6	6.1
4A	6/15/1977	0925	125	8.0	7.3	5.4
4B	6/15/1977	0915	164	8.4	-	5.4
4C	6/15/1977	0905	197	7.9	5.8	5.2
5A	6/15/1977	0645	85	-	7.2	5.6
5B	6/15/1977	0655	105	7.6	5.8	4.8
5C	6/15/1977	0700	105	5.8	6.4	4.2
10	6/14/1977	1030	33	6.2	5.2	5.2
11	6/14/1977	1035	66	6.8	6.4	5.6
12	6/14/1977	1045	75	8.0	7.8	6.0
3A	9/13/1977	0819	134	9.0	7.6	6.6
3B	9/13/1977	0829	172	9.0	8.2	7.6
3C	9/13/1977	0837	200	9.0	8.8	8.0
4A	9/13/1977	0905	103	7.8	7.0	7.0
4B	9/13/1977	0856	157	8.8	6.6	6.0
4C	9/13/1977	0847	200	9.2	2.2	7.4
5A	9/13/1977	0950	35	8.6	7.8	7.0
5B	9/13/1977	0957	97	8.2	7.0	5.6
5C	9/13/1977	1004	105	8.8	8.8	6.4
10	9/15/1977	0920	32	6.4	7.0	7.0
11	9/15/1977	0930	54	7.1	6.8	6.8
12	9/15/1977	0935	72	7.0	6.7	6.2

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	2/28/1978	0755	24	7.6	6.0	7.6
11	2/28/1978	0805	50	8.0	8.0	7.8
12	2/28/1978	0812	50	7.6	7.4	6.6
3A	3/1/1978	0921	130	8.0	8.0	6.6
3B	3/1/1978	0930	170	8.0	7.8	6.4
3C	3/1/1978	0939	200	8.2	7.2	6.6
4A	3/1/1978	1018	115	7.8	7.6	6.4
4B	3/1/1978	1009	180	8.2	8.2	6.0
4C	3/1/1978	0958	200	7.0	7.2	5.8
5A	3/1/1978	1137	35	8.2	8.4	8.2
5B	3/1/1978	1144	90	7.8	8.4	7.8
5C	3/1/1978	1150	120	8.4	7.8	8.0
3A	6/20/1978	0715	125	4.6	5.2	4.0
3B	6/20/1978	0725	145	6.4	4.7	3.8
3C	6/20/1978	0735	195	6.0	4.2	3.9
4A	6/20/1978	0810	120	5.9	5.8	3.3
4B	6/20/1978	0800	160	6.4	4.4	3.9
4C	6/20/1978	0745	195	6.3	4.6	3.6
5A	6/21/1978	0600	76	6.0	4.4	4.2
5B	6/21/1978	0610	92	7.0	6.3	4.2
5C	6/21/1978	0620	105	6.7	5.8	5.1
3A	10/10/1978	0830	128	7.9	6.2	4.5
3B	10/10/1978	0838	167	7.6	7.8	6.2
3C	10/10/1978	0846	200	8.1	6.8	5.2
4A	10/10/1978	0920	97	7.0	7.0	6.0
4B	10/10/1978	0910	162	7.4	7.6	5.2
4C	10/10/1978	0900	200	7.4	7.8	7.4
5A	10/10/1978	1010	35	8.0	6.4	7.2
5B	10/10/1978	1017	95	5.8	7.6	5.8
5C	10/10/1978	1025	105	7.9	7.4	6.9
10	10/11/1978	0925	24	58.0	7.0	7.2
11	10/11/1978	0930	54	6.8	6.6	5.2
12	10/11/1978	0935	70	6.2	5.8	4.4

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/21/1979	0825	125	8.3	6.8	6.7
3B	2/21/1979	0850	175	8.2	8.4	7.8
3C	2/21/1979	0905	200	8.1	7.8	6.0
4A	2/21/1979	0955	125	7.9	7.1	4.5
4B	2/21/1979	0945	160	8.0	8.2	7.0
4C	2/21/1979	0935	200	4.2	4.2	6.7
5A	2/22/1979	0915	35	7.4	8.2	6.8
5B	2/22/1979	0925	90	8.2	6.9	5.9
5C	2/22/1979	0935	105	8.3	5.6	6.3
3A	9/27/1979	1611	130	7.5	7.2	7.5
3B	9/27/1979	1600	170	8.3	7.8	5.2
3C	9/27/1979	1547	200	8.8	8.6	6.5
4A	9/27/1979	0951	120	8.5	7.5	6.7
4B	9/27/1979	1010	150	7.8	5.0	6.7
4C	9/27/1979	1022	200	8.4	6.6	6.1
5A	9/27/1979	1302	80	8.3	6.6	5.8
5B	9/27/1979	1253	100	7.9	6.6	6.0
5C	9/27/1979	1238	130	7.8	6.9	6.1
10	9/27/1979	1037	25	7.1	7.0	6.3
11	9/27/1979	1041	70	7.6	7.2	7.2
12	9/27/1979	1044	80	7.7	7.2	6.0

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/26/1980	1055	125	7.9	8.0	7.2
3B	2/26/1980	1103	180	7.0	6.4	6.4
3C	2/26/1980	1112	200	8.2	6.6	6.8
4A	2/26/1980	1150	110	8.4	7.8	7.4
4B	2/26/1980	1138	150	5.8	7.4	7.2
4C	2/26/1980	1130	190	7.0	6.1	7.3
5A	2/27/1980	1105	60	8.4	7.5	7.2
5B	2/27/1980	1115	95	7.4	7.4	7.0
5C	2/27/1980	1121	100	7.8	7.3	7.4
10	not sampled					
11	not sampled					
12	2/28/1980	0920	80	8.2	8.4	7.4
3A	6/18/1980	0950	130	7.8	7.0	5.4
3B	6/18/1980	1000	169	7.6	6.6	5.0
3C	6/18/1980	1010	200	8.0	8.0	5.6
4A	6/18/1980	1040	120	8.0	7.0	4.6
4B	6/18/1980	1030	166	8.0	7.3	4.4
4C	6/18/1980	1020	200	8.2	5.4	4.9
5A	6/19/1980	0740	44	5.8	5.2	5.8
5B	6/19/1980	0749	80	6.0	5.4	4.4
5C	6/19/1980	0757	98	7.0	6.4	4.4
10	6/18/1980	1050	23	7.5	7.2	7.2
11	6/18/1980	1055	55	7.6	7.5	9.4
12	6/18/1980	1100	72	7.9	6.4	6.6
5A	9/11/1980	0813	70	5.6	6.6	5.6
5B	9/11/1980	0821	91	7.4	6.4	5.4
5C	9/11/1980	0829	115	7.0	6.0	5.6
3	not sampled					
4	not sampled					
10	not sampled					
11	not sampled					
12	not sampled					

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	1/14/1981	1053	130	7.8	7.6	7.2
3B	1/14/1981	1105	175	7.4	7.4	7.5
3C	1/14/1981	1115	200	8.0	5.0	7.2
4A	1/14/1981	1154	133	7.6	5.6	7.2
4B	1/14/1981	1140	175	4.8	7.4	6.8
4C	1/14/1981	1133	200	6.4	7.6	5.4
5A	1/15/1981	0845	75	8.0	7.7	7.6
5B	1/15/1981	0856	103	8.4	8.0	8.4
5C	1/15/1981	0912	127	8.6	8.2	8.6
10	1/15/1981	1136	24	8.0	8.6	8.2
11	1/15/1981	1139	54	8.0	8.4	7.2
12	1/15/1981	1143	78	8.2	8.2	8.2
3A	6/16/1981	0935	39	7.2	6.4	4.2
3B	6/16/1981	0947	52.7	8.2	6.6	4.2
3C	6/16/1981	0955	61	10.0	4.7	4.4
4A	6/16/1981	1028	36	6.8	3.0	1.8
4B	6/16/1981	1020	50.3	8.4	4.9	2.7
4C	6/16/1981	1012	61	8.8	6.2	2.7
5A	6/17/1981	0700	16.8	3.7	6.0	4.8
5B	6/17/1981	0710	26.6	4.5	4.3	4.0
5C	6/17/1981	0720	32	4.1	4.0	3.3
10	6/18/1981	0750	6.4	7.0	7.0	6.8
11	6/18/1981	0756	16.8	7.2	5.1	4.1
12	6/18/1981	0801	21.6	6.4	6.0	4.0
3A	9/30/1981	0811	120	5.8	5.2	4.6
3B	9/30/1981	0818	170	6.0	5.6	5.0
3C	9/30/1981	0826	200	6.6	6.2	5.2
4A	9/30/1981	0854	129	5.5	4.9	4.6
4B	9/30/1981	0857	175	5.9	5.8	5.1
4C	9/30/1981	0839	200	5.7	5.3	4.3
5A	9/30/1981	0841	75	8.2	6.0	5.7
5B	9/30/1981	0851	100	6.9	5.7	7.8
5C	9/30/1981	1001	130	6.8	5.4	5.0
10	9/30/1981	0904	10	6.8	7.0	6.4
11	9/30/1981	0910	45	6.3	6.8	5.0
12	9/30/1981	0915	68	5.9	5.6	4.4

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/23/1982	0917	126	7.2	7.4	5.9
3B	2/23/1982	0929	175	5.0	6.0	4.8
3C	2/23/1982	0938	215	6.8	5.8	5.6
4A	2/23/1982	1018	126	6.6	6.5	5.4
4B	2/23/1982	1008	175	6.7	5.4	5.6
4C	2/23/1982	0957	200	6.3	6.6	5.6
5A	2/24/1982	0921	68	7.2	7.6	5.8
5B	2/24/1982	0928	95	7.2	5.4	6.3
5C	2/24/1982	0937	128	8.4	8.4	4.2
10	2/23/1982	1028	35	6.5	5.7	6.3
11	2/23/1982	1034	65	6.9	8.0	6.9
12	2/23/1982	1038	73	8.6	8.0	7.0
3A	6/29/1982	1027	127	8.0	6.4	4.8
3B	6/29/1982	1034	174	8.2	6.8	4.2
3C	6/29/1982	1042	200	8.1	3.4	5.5
4A	6/29/1982	1115	118	7.7	4.0	5.4
4B	6/29/1982	1107	170	8.2	2.4	4.2
4C	6/29/1982	1058	200	8.2	6.6	4.0
5A	6/30/1982	0824	73	7.6	7.4	5.2
5B	6/30/1982	0836	96	8.0	6.8	5.4
5C	6/30/1982	0844	105	8.8	8.6	7.4
10	not sampled					
11	not sampled					
12	not sampled					
3A	9/21/1982	0951	135	7.8	7.5	6.6
3B	9/21/1982	0939	180	7.7	7.2	5.6
3C	9/21/1982	0908	200	7.9	7.0	-
4A	9/21/1982	1619	115	7.8	7.0	6.2
4B	9/21/1982	1611		7.4	7.3	6.2
4C	9/21/1982	1602	200	7.8	7.4	5.4
5A	9/22/1982	0734	75	7.0	8.0	7.0
5B	9/22/1982	0743	95	7.0	8.2	7.2
5C	9/22/1982	0750	126	8.4	7.3	6.0
10	9/21/1982	1020	27	7.5	7.8	7.4
11	9/21/1982	1034	47	8.5	7.6	7.5
12	9/21/1982	1039	70	7.8	6.8	7.2

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/15/1983	0928	140	7.2	7.5	7.2
3B	2/15/1983	0934	162	7.8	7.3	7.0
3C	2/15/1983	0943	200	6.6	7.0	6.7
4A	2/15/1983	0848	120	8.7	7.8	6.8
4B	2/15/1983	0856	174	7.7	7.6	7.0
4C	2/15/1983	0906	198	7.6	7.2	7.0
5A	2/15/1983	0825	60	8.2	8.3	6.2
5B	2/15/1983	0813	90	8.0	8.0	7.6
5C	2/15/1983	0803	120	7.8	6.8	8.0
10	not sampled					
11	not sampled					
12	not sampled					
3A	6/28/1983	1031	125	8.1	7.0	7.0
3B	6/28/1983	1039	175	8.0	8.1	6.1
3C	6/28/1983	1049	200	8.1	7.2	6.0
4A	6/28/1983	1127	115	8.0	7.2	6.4
4B	6/28/1983	1117	175	6.0	7.8	5.8
4C	6/28/1983	1105	200	8.2	6.4	6.2
5A	6/29/1983	0915	73	6.4	4.3	5.8
5B	6/29/1983	0918	88	6.2	5.8	5.8
5C	6/29/1983	0928	98	5.8	6.5	5.8
10	6/29/1983	0835	25	7.8	7.8	7.2
11	6/29/1983	0840	40	7.4	7.4	3.6
12	6/29/1983	0848	75	7.0	6.0	5.8
3A	9/8/1983	0817	125	8.1	7.4	7.3
3B	9/8/1983	0824	168	8.0	7.4	7.2
3C	9/8/1983	0831	225	7.6	7.0	6.2
4A	9/8/1983	0906	125	7.8	7.6	7.2
4B	9/8/1983	0855	178	8.0	7.4	7.0
4C	9/8/1983	0847	210	8.0	7.4	6.8
5A	9/8/1983	0934	64	8.0	7.6	7.3
5B	9/8/1983	0945	90	8.1	7.9	7.6
5C	9/8/1983	0952	112	8.1	8.0	7.6
10	9/8/1983	0914	28	7.4	6.7	7.3
11	9/8/1983	0919	51	7.2	6.0	7.1
12	9/8/1983	0923	62	8.0	6.2	7.2

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/14/1984	0949	125	7.4	7.4	7.2
3B	2/14/1984	1000	170	7.6	6.4	5.6
3C	2/14/1984	1010	200	8.0	7.6	6.8
4A	2/14/1984	1044	115	7.3	7.6	7.4
4B	2/14/1984	1034	175	7.8	7.0	6.3
4C	2/14/1984	1025	200	6.8	7.1	6.1
5A	2/15/1984	0814	20	8.2	8.0	7.0
5B	2/15/1984	0820	90	8.0	7.8	7.4
5C	2/15/1984	0828	113	8.0	7.6	7.6
10	2/15/1984	0748	30	7.8	8.0	7.8
11	2/15/1984	0756	50	8.0	8.0	7.6
12	2/15/1984	0800	70	7.6	7.8	10.2
3A	6/11/1984	0722	120	5.8	4.6	4.8
3B	6/11/1984	0736	170	6.4	4.8	4.8
3C	6/11/1984	0749	220	6.2	5.4	4.3
4A	6/11/1984	0842	118	5.2	5.9	4.0
4B	6/11/1984	0829	140	4.6	5.0	4.4
4C	6/11/1984	0815	200	4.1	3.8	4.2
5A	6/11/1984	0902	56	6.8	3.5	6.8
5B	6/11/1984	0909	90	4.7	5.8	6.2
5C	6/11/1984	0917	110	6.0	4.4	3.2
10	6/11/1984	0950	30	6.9	7.2	5.6
11	6/11/1984	0955	45	6.8	7.0	5.9
12	6/11/1984	0959	65	6.8	6.3	5.3
3A	10/2/1984	1011	130	7.1	7.2	6.8
3B	10/2/1984	1059	160	6.9	5.6	6.7
3C	10/2/1984	1115	200	7.8	7.0	7.2
4A	10/2/1984	1230	115	8.0	6.8	7.8
4B	10/2/1984	1205	170	7.6	7.8	6.4
4C	10/2/1984	1145	200	7.8	7.0	4.4
5A	10/2/1984	0740	60	7.7	7.0	8.2
5B	10/2/1984	0759	100	7.1	7.4	7.0
5C	10/2/1984	0825	125	8.0	6.8	6.6
10	10/2/1984	1240	25	7.6	7.8	7.8
11	10/2/1984	1250	50	8.0	7.8	7.0
12	10/2/1984	1300	65	8.2	7.4	7.2

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/1/1985	1237	110	8.0	7.8	7.4
3B	2/1/1985	1226	165	7.2	7.8	7.8
3C	2/1/1985	1217	215	8.4	8.0	7.6
4A	2/2/1985	0949	110	8.0	8.2	8.0
4B	2/2/1985	0942	160	8.0	8.0	7.2
4C	2/2/1985	0933	200	8.1	8.0	7.2
5A	2/2/1985	0903	50	7.8	8.2	8.0
5B	2/2/1985	0912	100	7.8	7.8	6.7
5C	2/2/1985	0920	150	8.1	8.6	7.8
10	2/2/1985	0959	25	9.2	9.2	9.0
11	2/2/1985	1002	40	9.4	8.8	8.4
12	2/2/1985	1005	60	8.6	8.4	8.0
3A	6/18/1985	0728	127	8.2	8.2	7.6
3B	6/18/1985	0746	170	7.0	6.9	5.6
3C	6/18/1985	0802	220	10.3	4.0	4.3
4A	6/18/1985	0858	120	10.2	7.8	8.1
4B	6/18/1985	0843	195	9.4	6.4	4.4
4C	6/18/1985	0824	200	10.6	5.3	4.6
5A	6/18/1985	1010	60	9.3	9.2	5.7
5B	6/18/1985	1023	90	8.8	7.6	7.6
5C	6/18/1985	1034	105	8.8	7.1	6.8
10	6/18/1985	0914	30	7.6	7.0	6.8
11	6/18/1985	0920	40	8.6	7.6	7.6
12	6/18/1985	0928	70	8.8	6.4	6.2
3A	10/17/1985	-	127	7.5	6.8	6.2
3B	10/17/1985	-	170	6.8	6.8	6.2
3C	10/17/1985	-	220	7.8	7.6	7.4
4A	10/17/1985	-	120	7.7	7.2	5.6
4B	10/17/1985	-	195	7.6	7.6	6.0
4C	10/17/1985	-	200	8.0	7.8	7.0
5A	10/17/1985	-	60	8.0	7.6	6.2
5B	10/17/1985	-	90	8.1	7.8	6.6
5C	10/17/1985	-	105	7.9	6.6	7.0
10	10/17/1985	-	30	7.5	6.4	7.6
11	10/17/1985	-	40	8.6	7.4	7.0
12	10/17/1985	-	70	7.5	7.2	6.8

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	Feb-86	-	127	8.4	7.2	6.4
3B	Feb-86	-	170	8.3	7.4	5.8
3C	Feb-86	-	220	8.2	7.8	6.6
4A	Feb-86	-	120	8.0	7.6	7.4
4B	Feb-86	-	195	8.2	6.8	6.6
4C	Feb-86	-	200	8.2	8.0	6.6
5A	Feb-86	-	60	8.2	8.0	7.8
5B	Feb-86	-	90	8.1	8.0	7.3
5C	Feb-86	-	105	8.0	8.0	7.2
10	Feb-86	-	30	8.0	8.4	8.6
11	Feb-86	-	40	8.2	8.4	8.6
12	Feb-86	-	70	8.6	8.2	8.0
3A	6/16/1986	-	127	8.2	7.5	5.4
3B	6/16/1986	-	170	7.8	6.0	4.7
3C	6/16/1986	-	220	8.0	4.6	4.2
4A	6/16/1986	-	120	8.4	7.6	5.8
4B	6/16/1986	-	195	9.0	5.6	4.6
4C	6/16/1986	-	200	7.9	5.8	4.2
5A	6/16/1986	-	60	6.6	5.2	4.6
5B	6/16/1986	-	90	6.3	7.7	6.2
5C	6/16/1986	-	105	6.0	4.6	4.1
10	6/16/1986	-	30	6.8	5.0	6.5
11	6/16/1986	-	40	6.5	6.4	6.5
12	6/16/1986	-	70	7.3	7.6	5.9
3A	Oct-86	-	127	8.4	5.6	4.9
3B	Oct-86	-	170	8.1	7.0	4.8
3C	Oct-86	-	220	8.8	7.7	5.4
4A	Oct-86	-	120	7.7	6.1	5.1
4B	Oct-86	-	195	8.5	8.3	3.6
4C	Oct-86	-	200	8.6	7.7	4.8
5A	Oct-86	-	60	7.3	7.2	6.8
5B	Oct-86	-	90	8.3	7.8	6.2
5C	Oct-86	-	105	8.7	6.5	5.8
10	Oct-86	-	30	7.5	7.6	6.8
11	Oct-86	-	40	7.6	7.8	6.1
12	Oct-86	-	70	7.7	6.4	6.1

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	Feb-87	-	127	8.1	8.1	8.2
3B	Feb-87	-	170	8.2	8.0	8.0
3C	Feb-87	-	220	7.9	7.2	7.0
4A	Feb-87	-	120	8.2	8.2	8.2
4B	Feb-87	-	195	8.6	8.0	8.2
4C	Feb-87	-	200	8.2	7.7	6.3
5A	Feb-87	-	60	8.7	7.8	6.6
5B	Feb-87	-	90	8.2	7.8	7.2
5C	Feb-87	-	105	7.7	7.8	6.8
10	Feb-87	-	30	7.7	7.6	7.8
11	Feb-87	-	40	7.6	7.8	8.0
12	Feb-87	-	70	7.6	8.4	8.2
3A	Jun-87	-	127	7.0	6.8	5.7
3B	Jun-87	-	170	8.6	5.6	5.5
3C	Jun-87	-	220	8.8	6.7	5.1
4A	Jun-87	-	120	6.8	6.4	5.5
4B	Jun-87	-	195	6.6	5.8	6.6
4C	Jun-87	-	200	6.8	6.2	4.5
5A	Jun-87	-	60	6.6	4.4	5.4
5B	Jun-87	-	90	7.2	6.6	5.7
5C	Jun-87	-	105	7.1	6.1	5.3
10	Jun-87	-	30	7.8	6.8	6.2
11	Jun-87	-	40	7.6	6.1	5.2
12	Jun-87	-	70	7.4	6.2	5.7
3A	10/20/1987	-	127	7.9	7.5	6.4
3B	10/20/1987	-	170	8.1	7.6	6.4
3C	10/20/1987	-	220	8.2	6.8	6.0
4A	10/20/1987	-	120	7.6	7.4	6.8
4B	10/20/1987	-	195	8.0	7.2	6.8
4C	10/20/1987	-	200	7.8	7.1	6.4
5A	10/20/1987	-	60	8.2	8.0	6.6
5B	10/20/1987	-	90	7.7	8.0	6.6
5C	10/20/1987	-	105	8.1	7.8	7.6
10	10/20/1987	-	30	7.2	7.4	7.5
11	10/20/1987	-	40	7.3	7.2	7.6
12	10/20/1987	-	70	7.2	7.8	7.6

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	Feb-88	-	127	9.0	8.6	8.6
3B	Feb-88	-	170	8.6	7.2	6.7
3C	Feb-88	-	220	8.4	6.8	6.4
4A	Feb-88	-	120	8.2	8.8	8.6
4B	Feb-88	-	195	9.0	8.2	8.0
4C	Feb-88	-	200	9.0	8.0	7.0
5A	Feb-88	-	60	9.2	8.8	8.6
5B	Feb-88	-	90	8.8	8.4	8.3
5C	Feb-88	-	105	8.9	8.4	7.4
10	Feb-88	-	30	7.8	8.1	8.3
11	Feb-88	-	40	7.8	8.2	8.8
12	Feb-88	-	70	8.0	8.8	8.8
3A	Jun-88	-	127	8.0	6.6	5.0
3B	Jun-88	-	170	9.4	5.4	5.0
3C	Jun-88	-	220	9.6	5.4	4.4
4A	Jun-88	-	120	7.2	5.8	6.2
4B	Jun-88	-	195	7.2	5.0	4.3
4C	Jun-88	-	200	7.8	6.0	4.2
5A	Jun-88	-	60	9.6	7.8	5.6
5B	Jun-88	-	90	8.6	6.0	5.2
5C	Jun-88	-	105	6.8	5.0	4.4
10	Jun-88	-	30	8.2	8.0	7.5
11	Jun-88	-	40	7.6	7.4	6.9
12	Jun-88	-	70	8.0	6.5	7.9
3A	Oct-88	-	127	7.0	6.4	4.6
3B	Oct-88	-	170	6.2	5.4	4.5
3C	Oct-88	-	220	7.0	7.0	6.0
4A	Oct-88	-	120	6.8	4.8	5.3
4B	Oct-88	-	195	4.8	4.6	4.2
4C	Oct-88	-	200	5.0	5.2	4.4
5A	Oct-88	-	60	7.4	4.8	5.6
5B	Oct-88	-	90	6.6	4.6	4.4
5C	Oct-88	-	105	4.4	4.0	4.2
10	Oct-88	-	30	6.4	5.8	3.8
11	Oct-88	-	40	4.3	6.6	4.2
12	Oct-88	-	70	6.6	6.4	2.9

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	Feb-89	-	127	8.0	8.4	8.8
3B	Feb-89	-	170	8.0	8.4	8.0
3C	Feb-89	-	220	7.6	7.4	8.3
4A	Feb-89	-	120	8.8	8.8	8.8
4B	Feb-89	-	195	8.0	7.4	8.4
4C	Feb-89	-	200	7.6	7.4	8.0
5A	Feb-89	-	60	8.9	8.4	6.2
5B	Feb-89	-	90	8.4	9.0	8.6
5C	Feb-89	-	105	7.7	8.5	7.6
10	Feb-89	-	30	8.4	7.4	8.6
11	Feb-89	-	40	8.2	8.2	8.4
12	Feb-89	-	70	9.0	8.4	9.0
3A	Jun-89	-	127	9.6	7.0	4.3
3B	Jun-89	-	170	12.0	4.3	3.4
3C	Jun-89	-	220	10.0	7.6	5.0
4A	Jun-89	-	120	6.2	5.6	6.0
4B	Jun-89	-	195	12.8	5.2	6.4
4C	Jun-89	-	200	9.4	6.3	4.5
5A	Jun-89	-	60	13.3	9.2	7.5
5B	Jun-89	-	90	10.4	8.2	7.8
5C	Jun-89	-	105	12.8	7.2	6.2
10	Jun-89	-	30	5.2	6.6	6.2
11	Jun-89	-	40	6.2	5.8	8.6
12	Jun-89	-	70	7.4	6.6	8.8
3A	10/10/1989	-	127	7.8	7.2	6.8
3B	10/10/1989	-	170	8.2	7.4	6.5
3C	10/10/1989	-	220	8.4	7.6	6.2
4A	10/10/1989	-	120	8.6	7.4	7.0
4B	10/10/1989	-	195	8.8	7.8	6.6
4C	10/10/1989	-	200	8.8	7.0	6.2
5A	10/10/1989	-	60	8.0	7.6	7.0
5B	10/10/1989	-	90	8.1	7.8	7.6
5C	10/10/1989	-	105	9.0	6.8	7.0
10	10/10/1989	-	30	7.6	7.4	7.6
11	10/10/1989	-	40	7.5	8.0	7.8
12	10/10/1989	-	70	8.2	8.4	8.0

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
3A	2/23/1990	-	127	8.8	8.0	8.0
3B	2/23/1990	-	170	8.6	7.6	6.7
3C	2/23/1990	-	220	8.4	7.2	5.8
4A	2/23/1990	-	120	7.8	8.0	7.4
4B	2/23/1990	-	195	7.8	7.0	6.8
4C	2/23/1990	-	200	8.4	6.6	5.4
5A	2/23/1990	-	60	8.0	7.6	7.6
5B	2/23/1990	-	90	6.9	7.8	7.4
5C	2/23/1990	-	105	8.2	7.2	6.6
10	2/23/1990	-	30	7.8	7.6	ND
11	2/23/1990	-	40	7.5	5.0	7.8
12	2/23/1990	-	70	7.5	6.6	8.0
10	3/3/1990	-	30	5.7	6.0	6.0
11	3/3/1990	-	40	5.6	6.0	5.6
12	3/3/1990	-	70	7.4	5.4	7.3
13	3/3/1990	-	25	7.0	7.7	7.4
14	3/3/1990	-	30	7.0	7.6	7.2
15	3/3/1990	-	40	6.5	7.9	7.2
10	6/19/1990	-	30	7.2	6.0	5.8
11	6/19/1990	-	40	7.0	5.8	4.4
12	6/19/1990	-	70	7.0	5.2	5.6
13	6/19/1990	-	25	7.8	7.4	5.6
14	6/19/1990	-	30	6.8	7.0	7.1
15	6/19/1990	-	40	7.4	7.2	6.0
10	10/3/1990	-	30	7.2	6.0	5.8
11	10/3/1990	-	40	7.0	5.8	4.4
12	10/3/1990	-	70	7.0	5.2	5.6
13	10/3/1990	-	25	7.8	7.4	5.6
14	10/3/1990	-	30	6.8	7.0	7.1
15	10/3/1990	-	40	7.4	7.2	6.0

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	3/3/1991	-	30	5.7	6.0	6.0
11	3/3/1991	-	40	5.6	6.0	5.6
12	3/3/1991	-	70	7.4	5.4	7.3
13	3/3/1991	-	25	7.0	7.7	7.4
14	3/3/1991	-	30	7.0	7.6	7.2
15	3/3/1991	-	40	6.5	7.9	7.2
10	6/11/1991	-	30	7.4	6.8	6.8
11	6/11/1991	-	40	6.9	6.2	6.8
12	6/11/1991	-	70	7.2	8.2	7.6
13	6/11/1991	-	25	6.4	7.2	6.6
14	6/11/1991	-	30	6.0	7.4	7.4
15	6/11/1991	-	40	6.0	7.5	6.2
10	10/3/1991	-	30	7.4	7.0	7.2
11	10/3/1991	-	40	6.8	7.0	7.0
12	10/3/1991	-	70	7.2	7.8	6.8
13	10/3/1991	-	25	7.2	7.2	7.4
14	10/3/1991	-	30	7.4	7.4	7.6
15	10/3/1991	-	40	7.2	7.2	7.4

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	2/19/1992	-	30	6.8	8.0	8.2
11	2/19/1992	-	40	7.4	8.0	7.2
12	2/19/1992	-	70	7.4	6.6	6.8
13	2/19/1992	-	25	7.0	7.2	8.0
14	2/19/1992	-	30	7.4	9.0	6.8
15	2/19/1992	-	40	6.6	8.0	8.0
10	6/29/1992	-	30	7.7	7.8	7.6
11	6/29/1992	-	40	8.0	8.0	7.8
12	6/29/1992	-	70	6.7	7.6	7.1
13	6/29/1992	-	25	7.8	7.7	7.8
14	6/29/1992	-	30	7.7	7.9	8.0
15	6/29/1992	-	40	7.8	7.9	7.7
10	10/12/1992	-	30	6.7	6.7	7.1
11	10/12/1992	-	40	7.2	7.1	7.0
12	10/12/1992	-	70	7.0	7.1	6.6
13	10/12/1992	-	25	7.0	7.0	6.5
14	10/12/1992	-	30	6.9	7.3	6.8
15	10/12/1992	-	40	7.0	7.5	7.1

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	2/1/1993	-	30	7.8	8.2	8.0
11	2/1/1993	-	40	7.8	7.9	7.9
12	2/1/1993	-	70	7.7	7.8	7.9
13	2/1/1993	-	25	7.8	8.0	7.7
14	2/1/1993	-	30	8.2	8.0	8.3
15	2/1/1993	-	40	7.9	8.1	8.0
10	6/24/1993	-	30	7.8	7.2	5.4
11	6/24/1993	-	40	7.0	6.4	5.0
12	6/24/1993	-	70	6.8	5.6	4.8
13	6/24/1993	-	25	7.8	7.8	6.7
14	6/24/1993	-	30	7.7	7.4	7.4
15	6/24/1993	-	40	7.6	6.6	6.4
10	10/6/1993	-	30	7.0	6.6	6.6
11	10/6/1993	-	40	6.8	6.6	6.2
12	10/6/1993	-	70	6.7	7.0	6.0
13	10/6/1993	-	25	6.6	6.6	5.8
14	10/6/1993	-	30	6.6	6.6	6.2
15	10/6/1993	-	40	6.6	6.4	6.0

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	2/16/1994	-	30	7.2	6.6	8.0
11	2/16/1994	-	40	7.4	8.2	8.1
12	2/16/1994	-	70	7.4	8.6	7.8
13	2/16/1994	-	25	7.4	7.6	8.2
14	2/16/1994	-	30	7.5	7.9	8.2
15	2/16/1994	-	40	7.4	8.3	8.4
10	6/9/1994	-	30	7.1	6.9	4.5
11	6/9/1994	-	40	7.2	6.4	4.2
12	6/9/1994	-	70	7.0	4.8	4.0
13	6/9/1994	-	25	7.1	6.2	4.6
14	6/9/1994	-	30	6.9	7.3	6.4
15	6/9/1994	-	40	6.8	6.2	6.0
10	10/18/1994	-	30	7.1	7.0	6.9
11	10/18/1994	-	40	6.8	7.1	6.7
12	10/18/1994	-	70	7.2	7.2	7.0
13	10/18/1994	-	25	7.0	7.2	7.0
14	10/18/1994	-	30	7.0	7.0	7.2
15	10/18/1994	-	40	7.0	7.4	7.0

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
10	2/9/1995	-	30	7.4	7.7	8.2
11	2/9/1995	-	40	7.4	7.5	8.1
12	2/9/1995	-	70	7.6	7.8	8.1
13	2/9/1995	-	25	7.2	7.6	7.6
14	2/9/1995	-	30	7.4	7.6	7.9
15	2/9/1995	-	40	8.0	8.0	8.1
10	6/22/1995	-	30	6.9	6.7	5.3
11	6/22/1995	-	40	7.0	6.5	5.4
12	6/22/1995	-	70	7.0	5.5	5.3
13	6/22/1995	-	25	6.7	6.6	6.6
14	6/22/1995	-	30	6.4	6.3	6.1
15	6/22/1995	-	40	5.6	6.0	5.8
FC 1-3m	9/28/1995	-	10	7.7	7.7	7.9
NC 1-3m	9/28/1995	-	10	7.1	8.2	8.3
NDC 3-3m	9/28/1995	-	10	6.8	7.2	7.4
NDC 4-4m	9/28/1995	-	15	6.5	7.4	7.4
NDC 6-3m	9/28/1995	-	10	6.7	6.2	7.1
SC 1-3m	9/28/1995	-	10	7.1	7.8	7.5
SDC 1-3m	9/28/1995	-	10	7.4	8.0	8.0
SDC 4-4m	9/28/1995	-	15	6.9	7.8	7.8
FC 1-3m	12/7/1995	-	10	6.8	6.7	6.8
NC 1-3m	12/7/1995	-	10	7.9	7.7	7.8
NDC 3-3m	12/7/1995	-	10	7.0	7.2	7.3
NDC 4-4m	12/7/1995	-	15	7.1	6.9	6.8
NDC 6-3m	12/7/1995	-	10	7.0	6.5	7.0
SC 1-3m	12/7/1995	-	10	7.3	7.1	7.4
SDC 1-3m	12/7/1995	-	10	6.7	6.7	5.8
SDC 4-4m	12/7/1995	-	15	6.7	6.5	5.4

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
FC 1-3m	3/7/1996	-	10	8.2	8.0	8.0
NC 1-3m	3/7/1996	-	10	8.4	8.4	8.6
NDC 3-3m	3/7/1996	-	10	7.6	7.5	7.4
NDC 4-4m	3/7/1996	-	15	7.3	7.3	7.4
NDC 6-3m	3/7/1996	-	10	7.3	7.5	7.4
SC 1-3m	3/7/1996	-	10	8.9	8.7	8.8
SDC 1-3m	3/7/1996	-	10	8.2	8.0	8.1
SDC 4-4m	3/7/1996	-	15	7.8	7.6	7.4
FC 1-3m	6/21/1996	-	10	7.0	7.0	6.8
NC 1-3m	6/21/1996	-	10	7.2	7.4	7.3
NDC 3-3m	6/21/1996	-	10	7.5	6.8	6.9
NDC 4-4m	6/21/1996	-	15	7.3	6.3	6.7
NDC 6-3m	6/21/1996	-	10	7.0	6.8	6.6
SC 1-3m	6/21/1996	-	10	7.6	6.4	7.3
SDC 1-3m	6/21/1996	-	10	7.5	7.1	6.1
SDC 4-4m	6/21/1996	-	15	7.5	7.1	4.5
FC 1-3m	8/23/1996	-	10	7.2	6.9	6.8
NC 1-3m	8/23/1996	-	10	7.1	7.5	7.2
NDC 3-3m	8/23/1996	-	10	7.5	7.1	6.7
NDC 4-4m	8/23/1996	-	15	7.5	6.5	6.2
NDC 6-3m	8/23/1996	-	10	6.9	7.0	6.5
SC 1-3m	8/23/1996	-	10	7.9	7.2	7.5
SDC 1-3m	8/23/1996	-	10	6.0	6.9	6.3
SDC 4-4m	8/23/1996	-	15	7.7	6.7	5.9
FC 1-3m	12/19/1996	-	10	9.1	9.2	9.2
NC 1-3m	12/19/1996	-	10	9.2	9.7	9.7
NDC 3-3m	12/19/1996	-	10	8.2	8.8	9.4
NDC 4-4m	12/19/1996	-	15	7.4	8.6	9.3
NDC 6-3m	12/19/1996	-	10	7.3	7.2	7.1
SC 1-3m	12/19/1996	-	10	8.8	9.9	9.8
SDC 1-3m	12/19/1996	-	10	7.3	7.6	8.4
SDC 4-4m	12/19/1996	-	15	7.8	7.7	7.1

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
FC 1-3m	3/28/1997	-	10	9.5	8.6	8.6
NC 1-3m	3/28/1997	-	10	9.3	9.6	9.7
NDC 3-3m	3/28/1997	-	10	8.8	8.6	8.6
NDC 4-4m	3/28/1997	-	15	7.8	8.5	8.5
NDC 6-3m	3/28/1997	-	10	6.8	8.2	6.5
SC 1-3m	3/28/1997	-	10	9.7	9.9	9.9
SDC 1-3m	3/28/1997	-	10	8.3	8.3	7.8
SDC 4-4m	3/28/1997	-	15	8.0	7.8	7.7
FC 1-3m	6/26/1997	-	10	8.3	8.4	8.3
NC 1-3m	6/26/1997	-	10	8.9	9.7	9.7
NDC 3-3m	6/26/1997	-	10	8.0	7.7	7.5
NDC 4-4m	6/26/1997	-	15	7.9	7.5	7.4
NDC 6-3m	6/26/1997	-	10	7.1	6.8	6.7
SC 1-3m	6/26/1997	-	10	10.2	10.5	9.9
SDC 1-3m	6/26/1997	-	10	9.1	7.7	7.5
SDC 4-4m	6/26/1997	-	15	7.2	7.0	7.2
FC 1-3m	not sampled					
NC 1-3m	not sampled					
NDC 3-3m	not sampled					
NDC 4-4m	not sampled					
NDC 6-3m	not sampled					
SC 1-3m	not sampled					
SDC 1-3m	not sampled					
SDC 4-4m	not sampled					
FC 1-3m	11/3/1997	-	10	7.5	7.5	7.4
NC 1-3m	11/3/1997	-	10	7.8	7.7	7.7
NDC 3-3m	11/3/1997	-	10	7.1	7.3	7.4
NDC 4-4m	11/3/1997	-	15	7.2	7.4	7.5
NDC 6-3m	11/3/1997	-	10	6.7	6.9	7.1
SC 1-3m	11/3/1997	-	10	7.9	7.9	7.9
SDC 1-3m	11/3/1997	-	10	7.0	7.1	7.1
SDC 4-4m	11/3/1997	-	15	7.0	7.0	7.3

Station	Collection Date	Time	Station Depth (ft)	Dissolved Oxygen (mg/l) Surface	Mid-Water	Bottom
FC 1-3m	3/2/1998	-	10	8.6	8.6	8.5
NC 1-3m	3/2/1998	-	10	9.0	9.0	9.0
NDC 3-3m	3/2/1998	-	10	7.8	8.0	7.9
NDC 4-4m	3/2/1998	-	15	7.5	8.0	8.0
NDC 6-3m	3/2/1998	-	10	6.9	8.2	7.8
SC 1-3m	3/2/1998	-	10	9.0	9.0	9.0
SDC 1-3m	3/2/1998	-	10	7.7	7.7	7.7
SDC 4-4m	3/2/1998	-	15	7.6	7.6	7.0
FC 1-3m	4/27/1998	-	10	8.2	8.3	8.4
NC 1-3m	4/27/1998	-	10	9.0	9.1	8.9
NDC 3-3m	4/27/1998	-	10	7.8	7.2	7.0
NDC 4-4m	4/27/1998	-	15	7.4	6.9	6.8
NDC 6-3m	4/27/1998	-	10	6.9	6.8	6.8
SC 1-3m	4/27/1998	-	10	8.0	8.6	9.0
SDC 1-3m	4/27/1998	-	10	6.8	6.8	6.7
SDC 4-4m	4/27/1998	-	15	7.2	6.6	6.0
FC 1-3m	9/11/1998	-	10	8.1	8.2	8.1
NC 1-3m	9/11/1998	-	10	8.6	8.5	8.5
NDC 3-3m	9/11/1998	-	10	7.6	7.8	7.4
NDC 4-4m	9/11/1998	-	15	7.6	7.7	7.4
NDC 6-3m	9/11/1998	-	10	6.9	6.9	7.0
SC 1-3m	9/11/1998	-	10	9.1	9.1	9.3
SDC 1-3m	9/11/1998	-	10	7.3	7.0	7.2
SDC 4-4m	9/11/1998	-	15	7.2	7.3	7.1
FC 1-3m	11/9/1998	-	10	9.8	8.7	8.8
NC 1-3m	11/9/1998	-	10	8.0	7.8	7.8
NDC 3-3m	11/9/1998	-	10	8.8	9.2	8.8
NDC 4-4m	11/9/1998	-	15	7.7	8.3	8.3
NDC 6-3m	11/9/1998	-	10	7.5	7.5	7.5
SC 1-3m	11/9/1998	-	10	10.4	10.4	10.5
SDC 1-3m	11/9/1998	-	10	7.9	7.9	7.8
SDC 4-4m	11/9/1998	-	15	7.7	7.8	7.1

PROCEDURE FOR DISSOLVED OXYGEN DETERMINATION

DCPP-NPG PROCEDURE BIO-C4 Revised 8/13/98
(UNCONTROLLED COPY –
DO NOT USE TO PERFORM WORK)

1. SCOPE

1.1 The purpose of this procedure is to define the steps involved in determining the amount of dissolved oxygen in a sample of liquid. Dissolved oxygen measurements may be needed for laboratory test monitoring or oceanographic studies. Refer to EV1.DC1 for NPDES sampling stations and sampling frequency. Revision bars are not included in this procedure because the rewrite requires revision bars on most paragraphs.

2. DISCUSSION

The objective is to document the amount of dissolved oxygen in test solutions. There are no upper or lower limits. NPDES permit required dissolved oxygen measurements can be done using the Winkler titration method or by using a conductivity, temperature, depth recorder (CTD) with a dissolved oxygen sensor traceable to the National Institute of Standards and Technology (NIST). A list of equipment is included in Attachment 6.1

3. RESPONSIBILITIES

3.1 The Senior Environmental Coordinator is responsible for assuring that Dissolved Oxygen Measurements are performed in accordance with written procedures.

3.2 Investigating biologists are responsible for measuring dissolved oxygen in accordance with written procedures.

4. INSTRUCTIONS

4.1 Data Recording

4.1.1 Sequence data sheets are obtained from the Data Coordinator in accordance with BIO A-1, Data Management for NPDES Receiving Water Monitoring. The Dissolved Oxygen Measurements data sheet (Form 69-20028) is used for recording data when samples are taken for Winkler Titrations. The CTD Field Deployment Sheet (Form 69-20098) is used when dissolved oxygen is measured with a Seabird CTD unit.

4.1.2 When Winkler titrations are used, record the chemical manufacturer and batch number, initials, and type of use on the Dissolved Oxygen Winkler Titration Log (Form 69-20029).

4.2 Winkler Titration Method of Dissolved Oxygen Measurement

NOTE: Use fresh standardized sodium thiosulfate for titrations. Dispose of used and unused sodium thiosulfate in the appropriate hazardous waste accumulation container at the end of the titrations.

4.2.1 Field Sample Collection

a. Upon arriving at each station (see station location map in Attachment 6.2), collect surface water in a bucket with a minimum of water agitation.

b. Rinse sample bottles gently and thoroughly twice with water from the sample to be collected.

c. Fill the bottle with the sample. Take care not to introduce air bubbles into the sample.

d. When filling a sample bottle from surface water, allow the water to flow gently over the neck into the interior of the bottle.

e. Preserve the sample immediately (Step 4.2.2).

f. Collect midwater and bottom samples by lowering water sampling bottles on a line to the correct depth. Then use a messenger to close the submerged bottles, capturing water samples at the required depths.

g. After the water bottles are retrieved, carefully fill the appropriate dissolved oxygen sample water bottles with the collected water.

h. When filling a sample bottle from a submersible sampling bottle, allow the hose to extend to the bottom of the sample bottle and gently allow the bottle to fill. Allow at least 50 ml of sample to over flow from the bottle.

i. Preserve the samples immediately (Step 4.2.2).

j. Record station number, and date and time that the samples were collected on the Dissolved Oxygen Measurements data sheet (Form 69-20028).

4.2.2 Sample Preservation

a. Preserve samples immediately after sample collection. This is particularly necessary when samples have been taken from below 33 feet, where pressure affects dissolved gasses.

b. Add the contents of the manganous sulfate (first) and alkaline iodide azide (second) powder pillows. Allow the powders to sink. Cap the bottle, ensuring that no air becomes trapped in the bottle and shake the bottle vigorously.

c. Do NOT add sulfuric acid or sulfamic acid powder until just prior to beginning titrations.

d. Shield samples from direct sunlight.

e. Samples can be stored for 4 to 8 hours without refrigeration.

f. Samples may be stored for periods up to 48 hours if stored at 4 degrees Centigrade. This practice should be used only when absolutely necessary. Do NOT allow samples to freeze.

4.2.3 Sample and Apparatus Preparation

NOTE: Best practice is to allow the sample to warm to room temperature prior to adding sulfuric acid or sulfamic acid.

a. Add approximately 2 milliliters (ml) of concentrated sulfuric acid or powdered sulfamic acid to the sample. Cap the bottle, ensuring that no air becomes trapped in the bottle. Shake the bottle vigorously. The precipitate should dissolve.

b. Allow samples to sit at room temperature for approximately 20 minutes. Dissolution of the precipitate will proceed at a slower

rate in chilled samples, and stratification of the sample may occur during warming.

c. Ensure that all precipitate has dissolved before proceeding.

d. Ensure that the titration burette is clear and free from contamination. If it is empty, rinse the burette and reservoir bottle several times with sodium thiosulfate before filling the reservoir bottle and burette for titration. Make certain that the burette is vertical and that the meniscus lies evenly at the zero mark when the burette is filled.

e. Use fresh standardized sodium thiosulfate solution for titrations. Store it in a cool and dark location, such as a dark bottle in a refrigerator.

4.2.4 Sample Titration

a. Shake the sample vigorously to ensure that no stratification has occurred.

b. Gently pour 100 ml of the sample into a graduated cylinder. Do not agitate the sample at this point.

c. Gently pour the sample from the graduated cylinder into the titration dish, place a stirring magnet in the dish, and place the dish on the magnetic stirrer. Turn the magnetic stirrer on and adjust the RPM's until the sample is being adequately stirred.

d. Begin adding sodium thiosulfate slowly to the sample while it is being stirred. When the sample changes to a straw yellow color, add 5 ml of starch indicator solution. This will turn the sample deep blue.

e. Continue to add sodium thiosulfate solution until the sample begins to turn colorless. Approach the titration end-point slowly and cautiously. When the sample first becomes and remains colorless, turn the stopcock to stop the flow of sodium thiosulfate solution.

f. If the end-point is passed, repeat the titration.

g. Read the burette to the nearest 0.05 ml. Record this value on Form 69-20028.

h. Repeat Steps 4.2.4.a through 4.2.4.g to ensure that the end-point is correct.

i. If the readings are within .1 ml of each other, record the mean of the two. If they are not within .1 ml of each other, repeat the titration with the final portion of the sample and record the mean of the two closest readings.

j. The dissolved oxygen content in milligrams per liter (mg/l) equals twice the amount of sodium thiosulfate used in the titration for a sample of 100 ml. Multiply the mean value (calculated in Step 4.2.4.i) by 2. Record this value on Form 69-20028.

4.2.5 Equipment Cleanup

a. Clean all sample handling glassware.

b. If the titration apparatus will not be used for several weeks, dispose of the sodium thiosulfate solution in the appropriate waste

accumulation container. Rinse the burette and reservoir bottle with distilled or deionized water.

4.3 Use of a CTD (Conductivity, Temperature, Depth) Instrument for Dissolved Oxygen Measurement

NOTE: Refer to Seacat SBE 19-03 operating manual for additional information and specifications.

4.3.1 Pre-deployment preparation

a. Record pre-deployment data on Form 69-20098 (CTD Field Deployment Sheet).

b. Ensure that CTD is configured with dissolved oxygen apparatus (pump and sensor). Check calibration records to ensure that the dissolved oxygen sensor has been calibrated by the manufacturer (SeaBird Electronics, Bellvue, WA) within the past 30 days, and that the unit has been calibrated for temperature, conductivity, and depth within the last year. Note on Form 69-20098 CTD calibration date and 0_2 Sensor Calib. date.

c. Install six (6) new D-cell batteries in CTD unit. Check batteries with a voltmeter before installing.

d. Check that the anode on the conductivity cell guard has not been eroded away. Check that all hardware and external fittings are secure.

e. Turn the external magnetic switch off (slide towards connector end cap).

f. Remove the dummy cover from the CTD profiler's bulkhead connector I/O port. Install the SEACAT test cable to the CTD profiler's bulkhead connector I/O port. Mate the 4-pin SEACAT test cable to the computer's serial port (the serial port must be an IBM Asynchronous Communications Adapter, or equal). Run the TERM19 program (CTD Data Acquisition Software, Version 4.032, Sea-Bird Electronics, Inc., 1993) by typing **CD\SEASOFT(CR)** to change to the profiler subdirectory, and **TERM19(CR)** to automatically establish communications with the CTD. The CTD is now in command mode and may be queried for various responses.

g. Check the date and time (Pacific Standard Time) by entering the **DS(CR)** command. [NOTE: If the board-mounted internal lithium battery has been removed, disconnected, or exhausted, reset the date and time with the ST command.]

h. Initialize the memory by using the **F8** (Init Log) command. Retype **TERM19(CR)** at **C:\SEASOFT**. Note memory initialized on Form 69-20098.

i. Check the instrument's time, date, and pre-deployment condition by using the **F3** (status) command. Ensure that all settings match the output below: (Items with * are variable)

SEACAT PROFILER V3.0c SN 1505 (current date)* (current time)* strain gauge pressure sensor:
S/N = 160015,
range = 150 psia,

tc = 251
clk = 32768.* (last 3 digits variable)
iop = 187*
vmain = 8.2* Note this value for battery voltage on Form 69-20098.
vlith = 5.8*
mode = PROFILE;
ncasts = 0;
sample rate = 1 scan every 0.5 seconds;
minimum raw conductivity frequency for pump turn on = 3506 hertz;
Note this value for pump frequency on Form 69-20098.
pump delay = 40 seconds;
samples = 0;
free = 87063*;
lwait = 0 msec;
SW1 = C0;
battery cutoff = 5.8 volts;
number of voltages sampled = 4
logdata = NO

NOTE: Refer to Seacat SBE 19-03 operating manual for instructions to change the above settings if the settings are incorrect. Use F3 to ensure that changes are accepted.

j. Use QS(CR) to return CTD profiler to sleep conditions.

****

CAUTION: If this step is omitted, and the magnetic switch is turned on before auto power-down (about 2 minutes later) the CTD will not collect data!

****

k. Remove the SEACAT test cable and put a light coating of silicon grease on the dummy cover and install it on the CTD profiler's bulkhead connector I/O port. Note on Form 69-20098 that the dummy cover is on.

l. Remove the distilled-water filled tubing looped end-to-end around the conductivity cell and the 'soaker' bottle over the plastic pH electrode. Note on Form 69-20098 that the conductivity tubing and the soaker bottle is off.

4.3.2 In Situ Determination of Dissolved Oxygen from Research Vessel with CTD

At each station (see station location map in Attachment 6.2), measure dissolved oxygen using the following steps:

a. Record cast # (start with "0"), date, station number, and person's initials collecting the data on the field data sheet (Form 69-20098).

b. Secure CTD with DO probe to the end of deployment line.

c. Turn the CTD switch to the ON position and record time.

d. Submerge the unit underwater at the surface for at least four (4) minutes to polarize the oxygen sensor and to insure that the tubing and pump fills with water.

e. After the initial four minutes, lower the CTD slowly through the water column until it is near or at the bottom. Raise the CTD slowly and bring it back aboard the boat.

f. Turn the switch to the OFF position and record time. Note on Form 69-20098 that the CTD switch is off.

g. Return unit to lab for data downloading after all stations have been sampled (see Attachment 6.2).

h. Rinse the Unit with freshwater outside. Swab tygon tubing with Triton X-100 soap and rinse tubing with freshwater.

4.3.3 Post-deployment calibration check

a. Place CTD unit in water bath.

b. Turn switch to ON to record water bath temperature. Leave unit on for 30 seconds.

c. Record test tank temperature on CTD Field Deployment data sheet in the "post-deployment" section, based on Fluke calibration corrections for the temperature probe.

d. After data has been processed (see Section 4.3.4), record the test tank temperature from the CTD and compare to temperature measured with the Fluke electronic probe. Temperatures should be within 0.2°C. If not, then have instrument serviced and re-run field measurements with calibrated instrument

e. Replace the distilled water-filled tygon tubing.

4.3.4 Processing CTD Dissolved Oxygen Data

a. Reference instructions in the manufacturer's operation manual for standard methods of processing oxygen sensor data (CTD Data Acquisition Software, Version 4.032, Sea-Bird Electronics, Inc., 1993)

b. Remove the dummy cover from the CTD profiler's bulkhead connector I/O port. Install the SEACAT test cable to the CTD profiler's bulkhead connector I/O port. Mate the 4-pin SEACAT test cable to the computer's serial port.(the serial port must be an IBM Asynchronous Communications Adapter, or equal). Run the TERM19 program (CTD Data Acquisition Software, Version 4.032, Sea-Bird Electronics, Inc., 1993) by typing **CD\SEASOFT(CR)** to change to the profiler subdirectory, and **TERM19(CR)** to automatically establish communications with the CTD. The CTD is now in command mode and may be queried for various responses.

c. Prior to processing data, generate a new calibration file (*.con) by running the CTD Calibration Coefficient program (seacon.exe).

1. Ensure that instrument configuration is set to SBE 19 Seacat Profiler.

2. Select the most recent calibration file from the configuration file menu.

3. Select **F10** to change calibration coefficients for temperature, conductivity, oxygen (current), oxygen (temperature), pH, and pressure.

4. Check the calibration parameters for each variable to ensure that they are set to the most recent manufacturer's values. Reset if necessary.

5. Save to filename (MMDDYY) [date that data were recorded] and exit the program. **NOTE:** Refer to Seacat SBE 19-03 operating manual for additional information.

d. Run program TERM19 (Seasoft software).

e. Convert raw data into *.hex format. Save file as MMDDYY (program will append filenames with cast #).

f. Copy files into c:\seasoft\data directory. Also copy new calibration files into the same directory.

g. Configure the DATCNV setup as follows:

Raw data file = variable (select from menu)

Configuration file = (most recent)

Input data file path = c:\seasoft\data

Output data file path = c:\seasoft\data

DATCNV Format = ASCII

DATCNV Variables -
0=scan number;
1=pressure;
2=temperature (°C);
3=conductivity;
4=oxygen, current;
5= oxygen, temperature (°C)

Output cast select = Both down cast and up cast

scans to skip over = 0

Output Water Bottle Data = NO

Water Bottle Data Set-up = N/A

h. Convert *.hex file to *.cnv <F10> and output to the file. Press ESC to exit the program.

i. Run Filter program (filter.exe). Set parameters as follows:

Input data file path = c:\seasoft\data

Output data file path = c:\seasoft\data

Low pass filter A = 0.500

Low pass filter B = 0.050

Run the *.cnv file <F10> and overwrite the file <CR>. Exit Filter.

j. Run CTD Data Alignment program (alignctd.exe). Set parameters as follows:

Input data file path = c:\seasoft\data

Output data file path = c:\seasoft\data

seconds to advance conductivity relative to pressure = 0.000

seconds to advance temperature relative to pressure = 0.500

seconds to advance oxygen relative to pressure = 4.000

Run the *.cnv file <F10> and overwrite the file <CR>. Exit Filter.

k. Run Compute Oxygen Program (derive.exe). Set parameters as follows:

Input data file path = c:\seasoft\data

Output data file path = c:\seasoft\data

Input variables = (same as previously set by DATCNV)

Variables to be derived = 1) depth, salt water [m], and set latitude to 35.012; 2) oxygen [mg per liter].

Variable coefficients = 1) time for doc/dt = 2.00; time for descent rate = 2.00

Exit program.

l. Go to C:\SEASOFT\DATA directory and delete test file [*.cnv]. Do not delete *.hex or *.con files.

m. Run standard DCPP Processing Program (dcppO2.bat) to create *.cnv files for all casts. Output will be in the C:\seasoft\data directory.

n. Copy all files to network drive for additional analysis and summary as follows:

1. Create an analysis and summary data file using the Excel 7.0 workbook template macro for NPDES quarterly dissolved oxygen sampling.

2. Open converted data for each station (*.cnv) as an Excel 7.0 spreadsheet file. Inspect the data and partition only the usable records to be analyzed, excluding any initial equilibration data or data recorded after the instrument was removed from the water.

3. Copy the partitioned data into the quarterly workbook and run the specified Excel macro module on the down-cast and up-cast measurements, averaging the dissolved oxygen data into 0.5 m depth bins. For -3 m (MLLW) stations, the reported data will be averaged data collected within the 0.00-0.49 m, 1.00-1.49 m, and 2.50-2.99 m depth bins for surface, midwater, and bottom measurements, respectively. For measurements at -4.5 m MLLW stations, use averaged data within the 0.00-0.49 m, 2.50-2.99 m, and 4.00-4.49 m depth bins for surface, midwater, and bottom measurements,

respectively. Analyzed data from each station will be entered and processed on separate worksheets.

4. Save the file in an Excel 7.0 workbook format.

5. For Quarterly NPDES summaries, output and verify dissolved oxygen results on the report worksheet included in the Excel workbook file.

4.4 Reporting

4.4.1 After completion of the quarterly NPDES dissolved oxygen data collection, the task leader shall transmit a copy of the summary data to the Senior Environmental Coordinator and/or the appropriate C&EO staff person.

4.4.2 Report NPDES required dissolved oxygen data from oceanographic stations in the routine Receiving Water Monitoring Reports that are submitted to the Regional Water Quality Control Board.

5. RECORDS

5.1 Original data shall be permanently stored and copies will be sent to Records Management System (RMS) for storage.

6. ATTACHMENTS

6.1 "Equipment List," 07/29/98

6.2 "Station Locations," 06/10/96

6.3 Form 69-20028, "Dissolved Oxygen Measurements Data Sheet," 07/29/98

6.4 Form 69-20029, "Dissolved Oxygen Determination Log," 07/29/98

6.5 Form 69-20098, "CTD Field Deployment Sheet," 07/29/98

7. REFERENCES

7.1 XI1.ID2, "Regulatory Reporting Requirements and Reporting Process."

7.2 EV1.ID4, "NPDES Permits and Monitoring Requirements."

7.3 BIO A-1, "Data Management for NPDES Receiving Water Monitoring."

7.4 EV1.DC1, "NPDES Required Environmental and Oceanographic Studies."

7.5 "A Practical Handbook of Seawater Analysis," by J.D.H. Strickland and T.R. Parsons, Bulletin 167 (Second Edition), Fisheries Research Board of Canada, 1972.

7.6 "Standard Methods for the Examination of Water and Wastewater," 19th Edition, 1995.

8. SPONSOR

James L. Kelly, PG&E

Equipment List

Field Collection of Samples for Winkler Titration method:

- Dissolved Oxygen Measurements data sheet (Form 69-20028)
- Water sampling bottles
- Water sampling bottle stand
- Cable messengers to activate bottle closing mechanism
- Hydrographic wire for lowering sample bottles
- Weight to attach to bottom of line
- Bucket
- One 300 ml dissolved oxygen sample bottle per sample
- One manganous sulfate powder pillow per sample
- One alkaline iodide azide powder pillow per sample

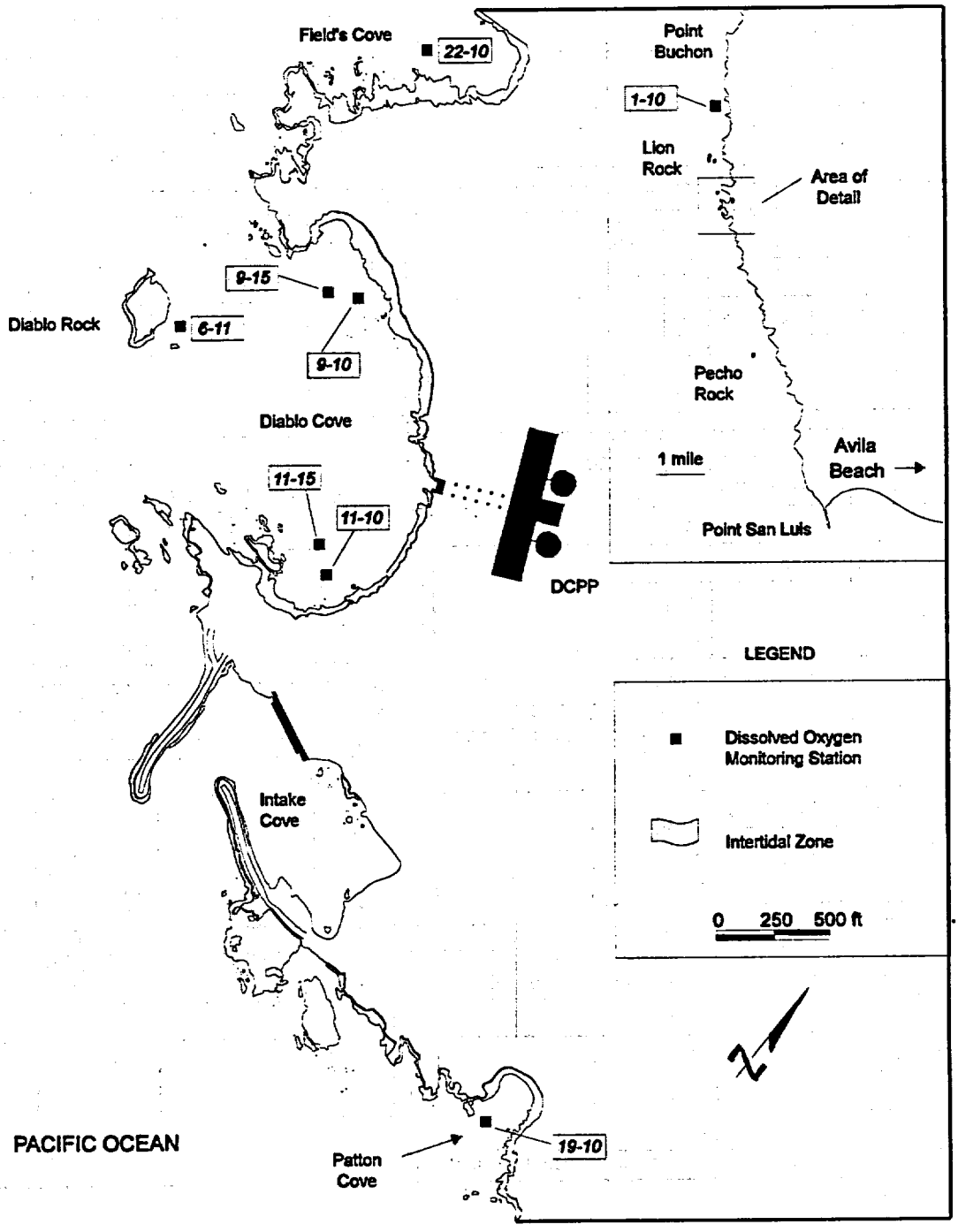
Laboratory Processing of Field Samples Collected for Winkler Titration method:

- Dissolved Oxygen Measurements data sheet (Form 69-20028)
- Dissolved Oxygen Determination Log (Form 69-20029).
- Starch indicator solution
- Winkler titration apparatus filled with sodium thiosulfate
- One 100 ml graduated cylinder
- Concentrated sulfuric acid or sulfamic acid powder
- Magnetic stirrer and magnetic stirring bar
- Titration dish

Field Collection of Samples with SEACAT SBE 19-03 CTD Instrument:

- CTD Field Deployment Sheet (Form 69-20098)
- Wristwatch
- Hydrographic wire for lowering unit
- Conductivity, temperature, depth (CTD) recorder with dissolved oxygen sensor

Station Locations, 1996-1998



Form 69-20028, Dissolved Oxygen Measurements Data Sheet

Location _____ Wind Speed _____

Date _____ Wind Direction _____

Time Reference _____ Air Temperature _____

Sheet _____ of _____ Sea Height _____ Direction _____

Observer _____ Swell Height _____ Direction _____

Station Number	Time	Surface BOD #		Surface $Na_2S_2O_3$ (ml)	Surface DO (mg/l)	Middle BOD #		Middle $Na_2S_2O_3$ (ml)	Middle DO (mg/l)	Bottom BOD #		Bottom $Na_2S_2O_3$ (ml)	Bottom DO (mg/l)
			1				1				1		
Water Depth		Surface Temp	2				2				2		
m.	ft.	°C °F	3*				3*				3*		
			avg.				avg.				avg.		

Station Number	Time	Surface BOD #		Surface $Na_2S_2O_3$ (ml)	Surface DO (mg/l)	Middle BOD #		Middle $Na_2S_2O_3$ (ml)	Middle DO (mg/l)	Bottom BOD #		Bottom $Na_2S_2O_3$ (ml)	Bottom DO (mg/l)
			1				1				1		
Water Depth		Surface Temp	2				2				2		
m.	ft.	°C °F	3*				3*				3*		
			avg.				avg.				avg.		

Station Number	Time	Surface BOD #		Surface $Na_2S_2O_3$ (ml)	Surface DO (mg/l)	Middle BOD #		Middle $Na_2S_2O_3$ (ml)	Middle DO (mg/l)	Bottom BOD #		Bottom $Na_2S_2O_3$ (ml)	Bottom DO (mg/l)
			1				1				1		
Water Depth		Surface Temp	2				2				2		
m.	ft.	°C °F	3*				3*				3*		
			avg.				avg.				avg.		

Station Number	Time	Surface BOD #		Surface $Na_2S_2O_3$ (ml)	Surface DO (mg/l)	Middle BOD #		Middle $Na_2S_2O_3$ (ml)	Middle DO (mg/l)	Bottom BOD #		Bottom $Na_2S_2O_3$ (ml)	Bottom DO (mg/l)
			1				1				1		
Water Depth		Surface Temp	2				2				2		
m.	ft.	°C °F	3*				3*				3*		
			avg.				avg.				avg.		

* Work up a third aliquot only if other two are more than .1ml different.

Comments:

Reviewed By / Date: _____ Copied By / Date: _____

Form 69-20029, Dissolved Oxygen Determination Log

Date of Use	Sodium Thiosulfate Man./Lot#	Manganous Sulfate Man./Lot#	Alkaline Iodide Man./Lot#	Sulfamic Acid Man./Lot#	Starch Indicator Man./Lot#	Use	Initials
	Hach/	Hach/	Hach/	Hach/	Hach/		
	Hach/	Hach/	Hach/	Hach/	Hach/		
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Reviewed By: _____ Date: _____

CC: Files
RMS

Form 69-20098, CTD Field Deployment Sheet

CTD FIELD DEPLOYMENT DATA SHEET

Sequence # _____

PRE-DEPLOYMENT

Date: (MM/DD/YY) _____ Time unit initialized: (24 hour PST) _____

Study Type: NPDES Dissolved Oxygen
(circle one) 316(b) Entrainment
316(b) Nearshore
Other

Pre-deployment checklist

Conductivity Tubing Off: _____ Battery Voltage: _____ Volts CTD Switch OFF: _____
Soaker Bottle Off: _____ Pump Frequency: _____ Hz CTD Calibration Date: / /
Dummy Cover On: _____ Memory Initialized: _____ O_2 Sensor Calib. Date: / /

DEPLOYMENT

Boat Crew: _____

NOTE: *CTD unit must remain just below surface for first 4 minutes of each deployment.*

CAST #	DATE	TIME ON (24 hour PST)	TIME OFF (24 hour PST)	STATION or Lat/Long	RAW DATA FILE NAME (post-deployment)
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

POST-DEPLOYMENT

Calibration Test Tank

Post-Deployment Calibration Check By: _____ Calibrated (Fluke) Temp.: _____ °C

Data Downloaded By / Date: _____ Measured (CTD) Temp.: _____ °C

Reviewed By / Date: _____ Copied By / Date: _____