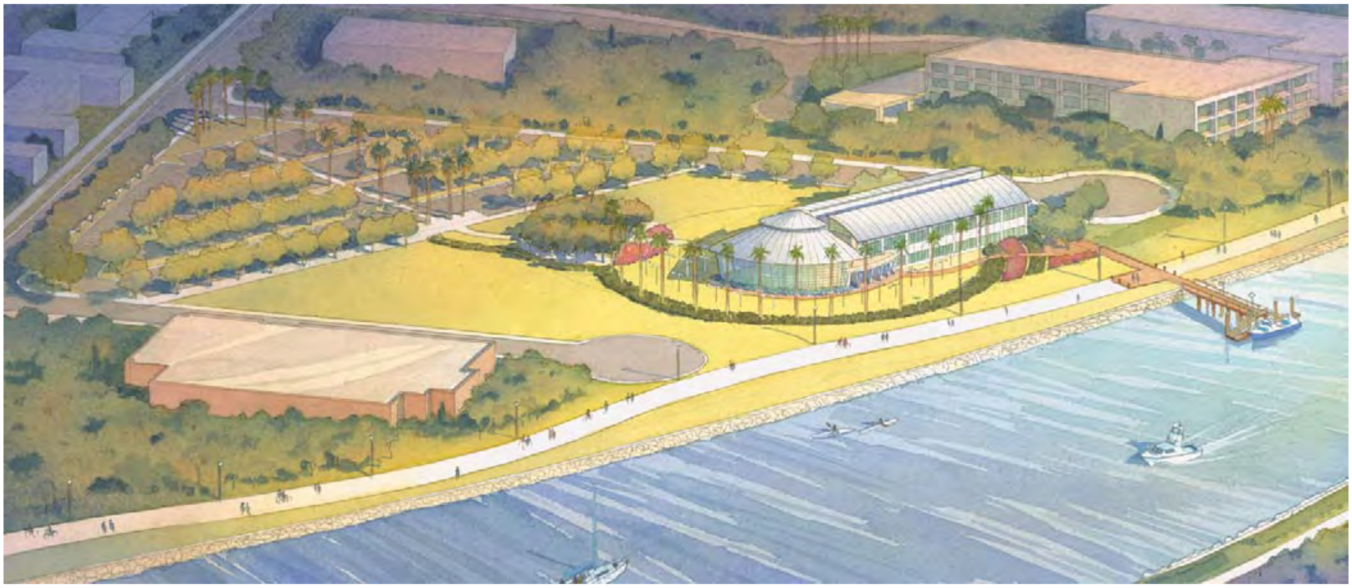
THE CITY OF SAN DIEGO

Annual Receiving Waters Monitoring Report for the Point Loma Ocean Outfall 2001



Ocean Monitoring Program

Metropolitan Wastewater Department

Environmental Monitoring and Technical Services Division

THE CITY OF SAN DIEGO

June 30, 2002

Mr. John Robertus
Executive Officer
Regional Water Quality Control Board
San Diego Region
9771 Clairemont Mesa Blvd. Suite B
San Diego, CA 92124

Attention: POTW Compliance Unit

Dear Sir:

Enclosed is the 2001 Annual Receiving Waters Monitoring Report for NPDES Permit No. CA0107409, Order No. 95-106 for the City of San Diego Point Loma Wastewater Treatment Plant, Point Loma Ocean Outfall. This report contains data summaries and statistical analyses for the various portions of the ocean monitoring program, including water quality, sediment characteristics, benthic infauna, demersal fishes and megabenthic invertebrates, and bioaccumulation of contaminants in fish tissues.

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 assure 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 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,

ALAN C. LANGWORTHY
Deputy Metropolitan Wastewater Director

dp
Enclosure

cc: U.S. Environmental Protection Agency, Region 9
State Water Resources Control Board
Department of Health Services, San Diego County

The City of San Diego

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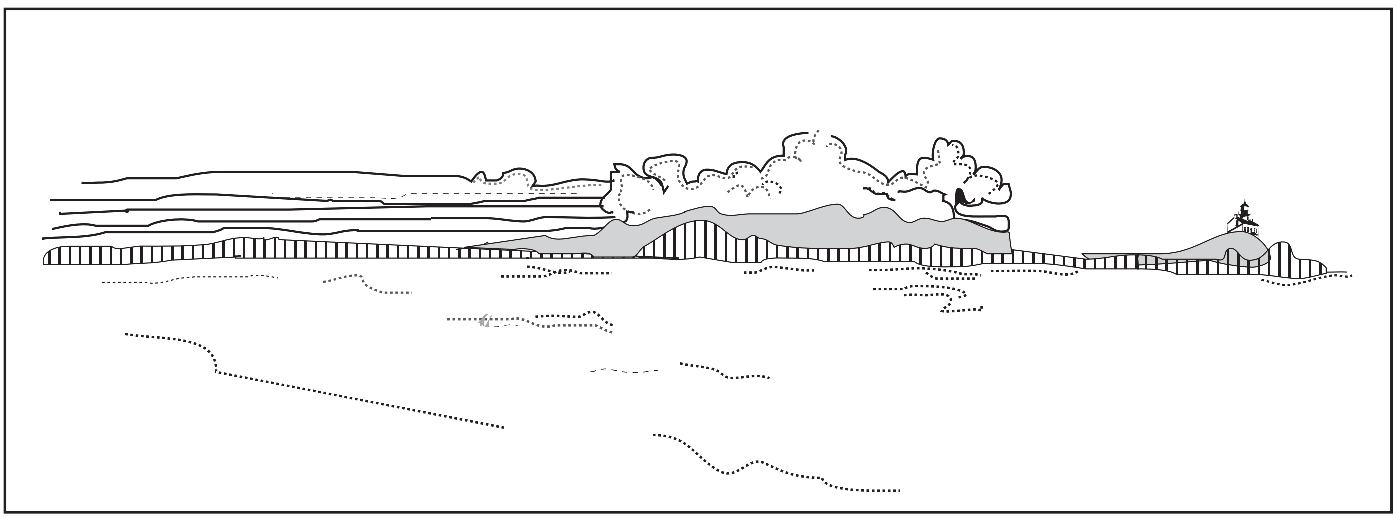

Prepared by:

The City of San Diego

Ocean Monitoring Program

Metropolitan Wastewater Department

Environmental Monitoring and Technical Services Division

June 2002

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Acknowledgments: We are grateful to the personnel of the City's Marine Biology Laboratory for their assistance in the collection and processing of all samples and for discussions of the results. The completion of this report would not have been possible without their continued efforts and contributions. We would also like to acknowledge the City's Microbiology and Chemistry laboratories for providing the bacteriological and chemistry data analyzed herein. Reviews of the various chapters were provided by R. Duggan, A. Feit, R. Gartman, A. Groce, D. Ituarte, D. James, M. Lilly, D. O'Donohue, E. Nester, D. Pasko, T. Stebbins, W. Storms and R. Velarde.

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Executive Summary

Executive Summary

During 2001, the City of San Diego's Ocean Monitoring program was mandated by National Pollutant Discharge Elimination System (NPDES) Permit No. CA0107409, Order No. 95-106 issued by the California Regional Water Quality Control Board, San Diego Region, the United States Environmental Protection Agency (EPA) and City Ordinance O-18206. The permit, which was issued on November 9, 1995, specifies the terms and conditions that allowed discharge of treated effluent from the Point Loma Wastewater Treatment Plant into the Pacific Ocean via the Point Loma Ocean Outfall (PLOO).

The Ocean Monitoring Program is designed to assess the impact of wastewater discharged through the outfall on the marine environment off San Diego. The main objectives of the program are to provide data that satisfy the requirements of the NPDES permit, demonstrate compliance with the California Ocean Plan, track movement and dispersion of the wastewater field, and identify any biological or chemical changes associated with wastewater discharge. These data are used to document the effects of the PLOO on water quality, sediments, and the marine biota. The study area is centered around the discharge site, located approximately 7.2 km offshore of the Point Loma Wastewater Treatment Plant at a depth of about 94m (310 ft). Shoreline monitoring extends north to Ocean Beach and south to Imperial Beach. Offshore monitoring is conducted in an area on the coastal shelf from La Jolla to Imperial Beach, and from the 9m (30 ft) depth contour seaward to a depth of 116m (380 ft).

The City's receiving monitoring efforts are divided into several major components, which include analyses of water quality, sediment quality, benthic infauna, demersal fish and invertebrate communities, and bioaccumulation of contaminants in fish tissues. The water quality portion includes sampling along the shoreline and in adjacent offshore waters to detect and monitor bacterial indicators of the wastewater plume. Data regarding various physical and chemical oceanographic parameters are also collected. Benthic monitoring includes sampling and analyses of soft-bottom infaunal communities and their associated sediments, as well as demersal fish and megabenthic invertebrate communities in the region. This is supplemented by bioaccumulation analyses to determine whether or not contaminants are present in the tissues of "local" fish species. A general overview and a brief summary for each component of the monitoring program are included below.

After eight years of wastewater discharge, the evidence indicates that the PLOO has had only a minimal effect on the local marine environment. For example, there has been 100% compliance with California Ocean Plan bacterial water-contact standards in the Point Loma kelp bed since the outfall was extended in 1993. In addition, there has been no evidence that the waste field has affected any of the shoreline sampling sites during this time. Evidence of elevated bacterial concentrations attributable to the discharge of wastewater in 2001 was generally restricted to sites adjacent to the outfall and at depths at or below 140 ft. There has also been no apparent change to any physical or chemical parameter (e.g., pH and dissolved oxygen) that could be attributed to wastewater discharge.

Analysis of benthic conditions indicates that some changes which may be expected near an ocean outfall have occurred off Point Loma, although these have been restricted to a small, localized region near the discharge site. These include increases in concentrations of sediment sulfides, biochemical oxygen demand (BOD) and coarse sediment particles in the vicinity of outfall pipe. Differences between reference and near-ZID stations with respect to certain benthic assemblage descriptors (i.e., species diversity, infaunal abundance, populations of the brittle star *Amphiodia urtica* and ITI values) were also indicative of changed conditions near the outfall, although most of these parameters are still characteristic of natural environmental conditions. Other indicators of potential impacts, such as abundances of pollution-sensitive amphipods (small shrimp-like crustaceans) and concentrations of various sediment contaminants such as trace metals and pesticides, have shown no effects related to the discharge of wastewater. Consequently, there is presently no evidence of significant long-term impacts on sediment quality or benthic infaunal communities in the region. Furthermore, analyses of demersal fish and invertebrate communities also reveal no spatial or temporal patterns that can be attributed to the PLOO. The lack of evidence from either fish pathology (e.g., fin rot, tumors, lesions) or bioaccumulation analysis also suggests that the San Diego fish community remains healthy and is not adversely affected by anthropogenic sources.

General Introduction

Chapter 1: General Introduction

INTRODUCTION

Treated effluent from the City of San Diego's Point Loma Wastewater Treatment Plant is discharged under the terms and conditions set forth in Order No.95-106, National Pollutant Discharge Elimination System (NPDES) Permit No. CA0107409. This permit was issued on November 9, 1995 by the California Regional Water Quality Control Board (RWQCB), San Diego Region, in conjunction with the United States Environmental Protection Agency (EPA). The permit defines the requirements for monitoring the receiving water environment around the Point Loma Ocean Outfall (PLOO), including the sampling plan, compliance criteria, laboratory analyses, statistical analyses and reporting guidelines.

The City's Ocean Monitoring Program is based on the NPDES permit requirements and is designed to monitor and assess the impact of wastewater discharged through the PLOO on the marine environment. The major objectives of the program are to provide data that satisfy the requirements of the permit, demonstrate compliance with the California Ocean Plan, track movement and dispersion of the wastewater field, and identify any biological or chemical changes associated with wastewater discharge.

BACKGROUND

The City of San Diego began operation of the wastewater treatment plant and original ocean outfall in 1963, at which time treated effluent was discharged approximately 3.9 km offshore of Point Loma at a depth of about 60 m (200 ft). From 1963 to 1985, the plant operated as a primary treatment facility, removing approximately 60% of the total suspended solids (TSS) by gravity separation. Since then, considerable improvements have been made to the treatment process. For example, the City began upgrading the process to advance primary treatment (APT) in mid-1985, with full APT status being achieved by July of 1986. This improvement involved the addition of chemical coagulation to the treatment process, and resulted in an increased TSS removal of about 75%. Since 1986, treatment has been further enhanced with the addition of several more sedimentation basins, aerated grit removal, and refinements in chemical treatment. These enhancements have resulted in consistently lower mass emissions from the plant, with TSS removals of greater than 80%. In addition, the PLOO was extended 3.3 km further offshore in the early 1990s in order to prevent intrusion of the wastewater plume into nearshore waters and to comply with California Ocean Plan water contact sports standards. Construction of the new deepwater outfall pipe was completed in November 1993 at which time discharge was terminated at the original site. The outfall presently extends approximately 7.2 km offshore to a depth of 94 m (310 ft), where the pipeline splits into a Y-shaped multiport diffuser system. The two diffuser legs extend an additional 762 m to the north and south, each terminating at a depth of about 98 m (320 ft) near the edge of the continental shelf.

The average daily flow of effluent through the PLOO was 175 million gallons per day (MGD) during 2001, ranging from a minimum of 151 MGD to a maximum of 226 MGD. This represents little change (an increase of approximately 0.6%) from the average flow of about 174 MGD during 2000. TSS removal averaged about 85% during 2001 (see City of San Diego 2002b).

RECEIVING WATERS MONITORING

Prior to 1994, the City conducted an extensive ocean monitoring program around the original PLOO discharge site. This program was subsequently modified and expanded with the construction and operation of the deeper outfall. Data from the last year of regular monitoring near the original inshore site are presented in City of San Diego (1995b), while the results of a three-year recovery study for that area are summarized in City of San Diego (1998). From 1991 through 1993, the City also conducted a voluntary predischarge study in the vicinity of the new site in order to collect baseline data prior to the discharge of effluent in these deeper waters (City of San Diego 1995a, 1995b). Results of monitoring for the extended PLOO from 1994 through 2000 are available in previous monitoring reports (e.g., City of San Diego 2001b). Additionally, the City has participated in a number of regional and other monitoring efforts throughout the Southern California Bight that have provided useful background information for the entire region (e.g., SCBPP 1998, Bight'98 Steering Committee 1998**,** City of San Diego 1999, 2000, 2001a).

The PLOO sampling area presently extends from La Jolla southward to Imperial Beach, and from the shoreline seaward to a depth of about 116 m (380 ft). Fixed sites are arranged in a grid surrounding the outfall, and are monitored in accordance with a prescribed sampling schedule. The monitoring program is divided into the following major components, each comprising a separate chapter in this report: (1) Water Quality; (2) Sediment Characteristics; (3) Benthic Infauna; (4) Demersal Fishes and Megabenthic Invertebrates; (5) Bio-accumulation of Contaminants in Fish Tissues. Sampling includes monthly seawater measurements of bacteriological, chemical and physical parameters in order to document water quality conditions in the area. Benthic sediment samples are collected quarterly to monitor changes in infaunal macroinvertebrate communities and sediment conditions (e.g., sediment grain size and chemistry). Trawl surveys are conducted quarterly at eight offshore stations and semiannually at several inshore stations in order to describe communities of demersal fish and large, bottom-dwelling invertebrates in the region. Additionally, liver and muscle tissue samples are collected from selected species of fish and analyzed to document the bioaccumulation of chemical constituents that may have ecological or human health implications.

This report presents the results of PLOO monitoring from January through December 2001. In addition, comparisons are made with the results from previous years in order to examine long-term patterns of change in the region. The raw data, detailed methodologies, and other pertinent information are compiled in reports that are submitted to the EPA and the RWQCB throughout the year. These include monthly receiving water reports, and quarterly benthic, trawl and outfall monitoring reports. Detailed information concerning station locations, sampling equipment, analytical techniques and quality assurance procedures are included in annual Quality Assurance Manuals for the City's Ocean Monitoring Program (e.g., City of San Diego 2002a).

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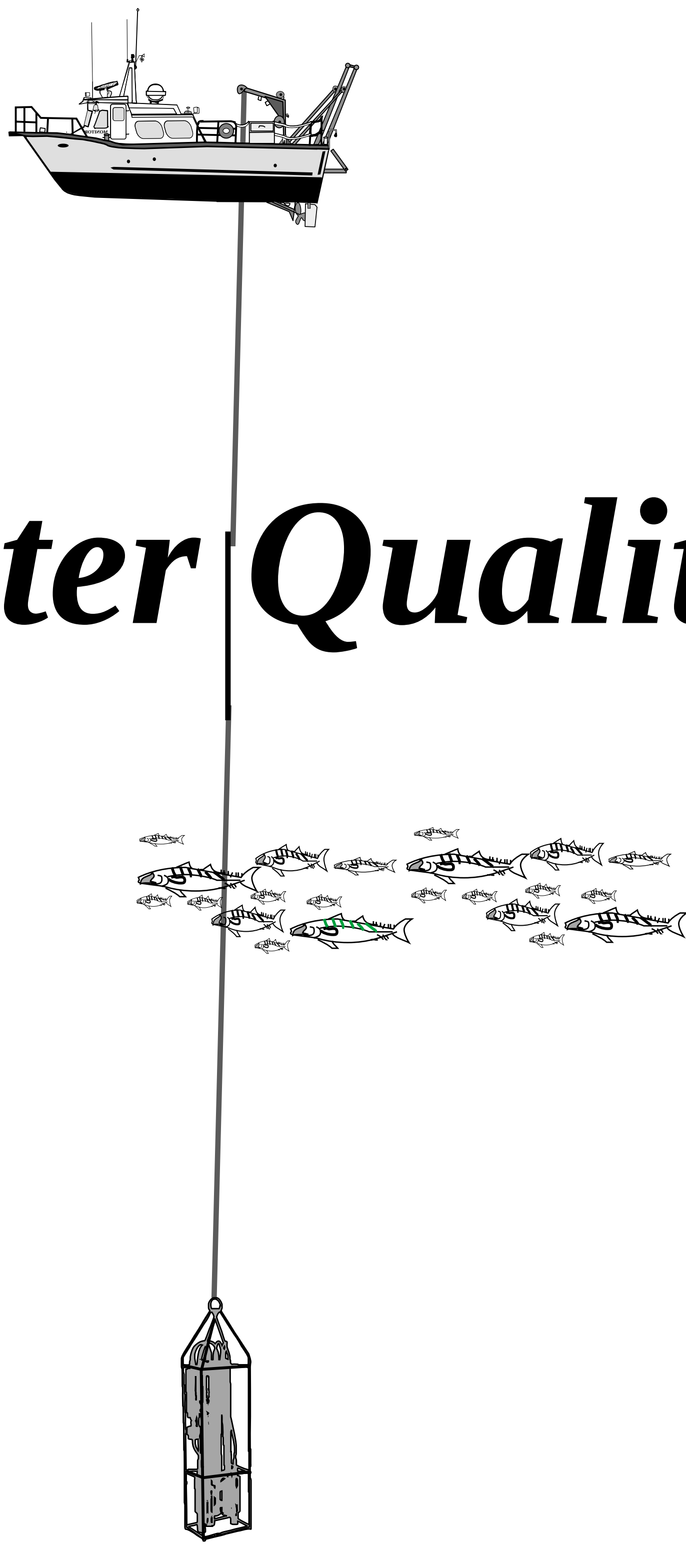
Water Quality



Chapter 2. Water Quality

INTRODUCTION

The City of San Diego's Ocean Monitoring Program includes sampling of various water quality parameters along the shoreline and in the adjacent offshore waters near the Point Loma Ocean Outfall (PLOO). This portion of the program is designed to track the movement and dispersion of wastewater discharged through the outfall, determine compliance with California Ocean Plan bacterial water-contact standards, and monitor the physical/chemical parameters that may be affected by the discharge. Concentrations of coliform bacteria at different depths and locations can provide valuable information on the dispersion and movement of wastewater fields (Pickard and Emery 1990). Monitoring of physical parameters yields information on changes in oceanographic conditions such as water column stratification and upwelling, which may influence movement of the wastewater plume. Changes in such parameters can also help to identify effects associated with large-scale oceanographic events such as plankton blooms and El Niño-La Niña oscillations.

This chapter presents analyses, discussion and summaries of water quality monitoring conducted during 2001 in the vicinity of the Point Loma Ocean Outfall. The raw data are compiled in Monthly Receiving Waters Monitoring Reports that are submitted to the Regional Water Quality Control Board (RWQCB).

MATERIALS & METHODS

Field Sampling

The City of San Diego monitors water quality at a total of 58 stations which encompass an area of approximately 316 km^2 (Figure 2.1). These stations are located along the shore and in adjacent offshore waters and were selected based on their proximity to public recreational waters, the Point Loma kelp bed, and to the PLOO discharge site. Monitoring activities are subdivided into three main components that vary in the specifics and frequency of sampling: (1) shoreline water quality monitoring; (2) kelp bed water quality monitoring; (3) monthly offshore water quality monitoring. The sampling regime for each of these components is described below.

Shore stations – Water quality conditions were monitored at nine shore stations (D1-D9), which range from Imperial Beach to Ocean Beach (see Figure 2.1). These stations were sampled weekly from May through October and once every other week from November through April in compliance with NPDES permit requirements. During these times seawater samples were collected from the surf zone in sterile 250-mL bottles. These samples were subsequently transported to the City's Marine Microbiology Laboratory and analyzed for the presence of total coliform, fecal coliform and enterococcus bacteria. Additional samples were taken as required to verify high bacterial counts. In addition to the bacterial assessment, visual observations of water color and clarity, surf height, materials of sewage origin, human or animal activity, and weather conditions were recorded in the field.

Kelp stations – Water quality conditions were monitored five times per month at eight stations located in the Point Loma kelp bed and at three stations located further seaward (see Figure 2.1). Sampling on one of the five days was carried out in conjunction with the monthly water quality sampling (see below). The eight kelp stations are sampled according to NPDES permit specifications in order to monitor water quality compliance within the kelp bed. These stations include three sites (stations C4, C5 and C6) located along the inshore edge of the kelp bed paralleling the 30-ft depth contour, and five sites (stations A1, A6, A7, C7 and C8) located near the offshore edge of the kelp bed along the 60-ft depth contour. Sampling at three sites (stations A11, A13 and A17) located seaward of the kelp bed began on March 30, 1999 in response to a small incidental

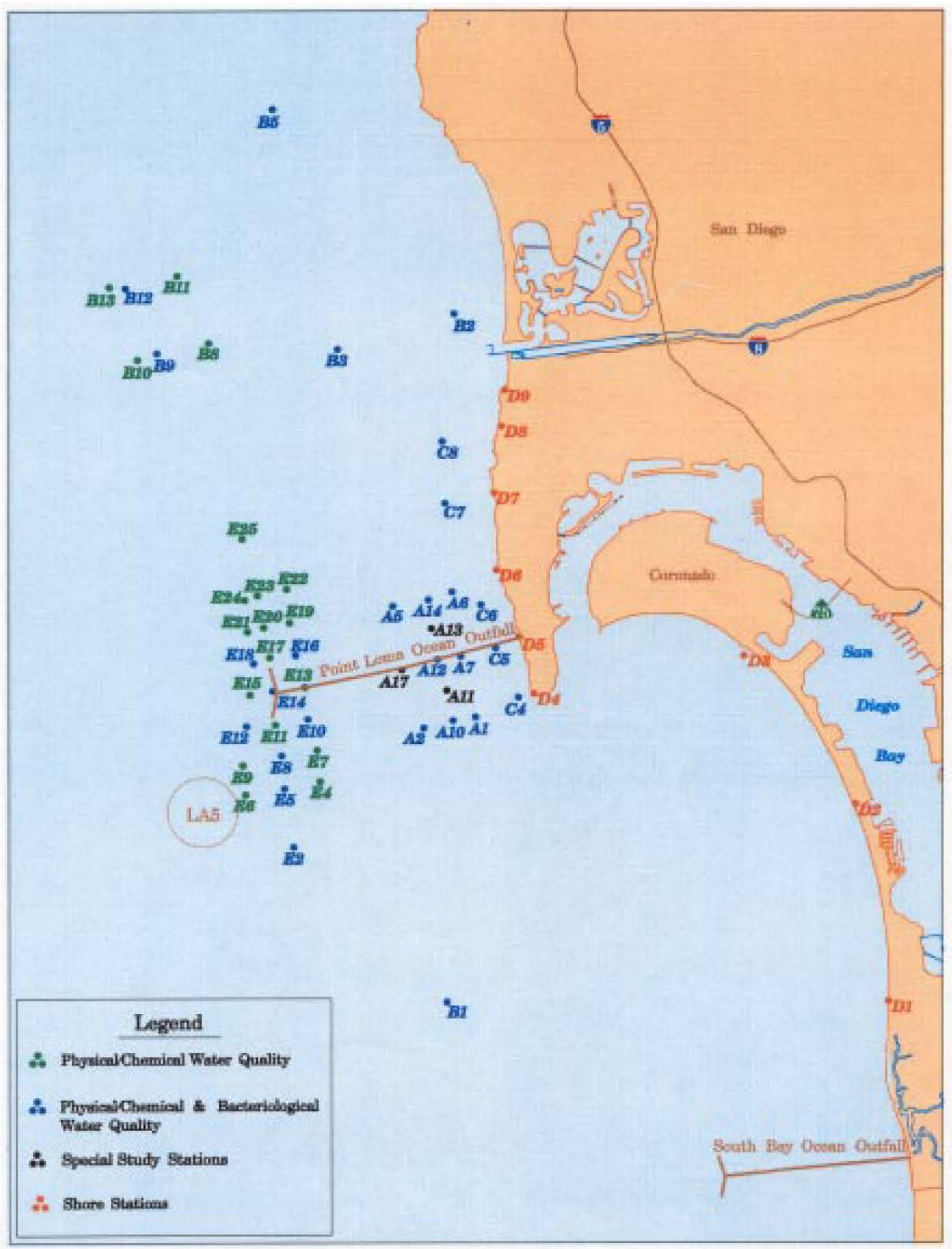


Figure 2.1
Water quality stations surrounding the City of San Diego Point Loma Ocean Outfall.

discharge of treated effluent near the original inshore outfall diffusers. In order to ensure that water quality is appropriately documented in this area, these special study stations were added to the normal weekly kelp bed sampling array at this time.

Routine monitoring at the eight sites within the kelp bed consists of collecting seawater samples at discrete depths for bacteriological analyses (i.e., total coliforms, fecal coliforms, enterococcus) and generating water column profiles of temperature and transmissivity data. In contrast, the three additional sites are monitored for concentrations of total coliforms, fecal coliforms and enterococci at bottom depths only. Visual observations of weather and water conditions are recorded at all stations. All water samples were collected using Van Dorn bottles arrayed at the required depths and messenger-tripped in series. Aliquots for bacteriological analyses were drawn from these bottles into sterile sample bottles for processing at the City's Marine Microbiology Laboratory. Water temperature and transmissivity profiles were taken using a Sea-Bird conductivity, temperature and depth instrument (CTD). The CTD instrumentation is fully described in the City of San Diego's Quality Assurance Manual (City of San Diego 2002a).

Monthly offshore stations – Monthly water quality sampling was conducted at a total of 46 stations which are arranged in a grid surrounding the PLOO discharge site, and range in depth from 30 to 380 ft (see Figure 2.1). These sites include the 11 kelp stations described above plus 35 additional offshore stations. Monitoring at all sites consisted of CTD water column profiles of temperature, salinity, density, dissolved oxygen, pH, chlorophyll *a* and transmissivity. Visual observations of weather and water conditions were also recorded at all stations. Seawater samples for the analysis of indicator bacteria, suspended solids and oil and grease concentrations were collected at 27 of the stations. These water samples were collected at discrete depth intervals using a series of Van Dorn bottles or a rosette sampler with Niskin bottles. Aliquots for bacteriological analyses were drawn from these bottles into sterile sample containers for processing at the City's Marine Microbiology Laboratory. Samples for oil and grease and suspended solids analyses were stored in separate containers and returned to the City's Wastewater Chemistry Laboratory for processing.

Laboratory Analyses

All bacteriological analyses were run within six hours of sample collection and conformed to the membrane filtration techniques outlined in the City's Quality Assurance Manual (City of San Diego 2002a). The Marine Microbiology Laboratory follows guidelines issued by the EPA Water Quality Office, Water Hygiene Division and the California State Department of Health Services, Water Laboratory Approval Group with respect to sampling and analytical procedures. Bordner et al. (1978) and Greenberg et al. (1992) are referred to for standard methodologies.

Colony counting, calculation of results, and the verification and reporting of all data follow guidelines established by the EPA in Bordner et al. (1978). According to these guidelines, plates with bacterial counts that fall outside the permissible counting limits were given ">", "<", or "e" (estimated) qualifiers. However, these counts were treated as discrete values in subsequent statistical analyses.

Quality assurance tests were performed routinely on water samples to insure that sampling variability did not exceed acceptable limits. Duplicate and split field samples were generally collected each week and processed by laboratory personnel to measure intra-sample and inter-analyst variability, respectively. The results of these procedures were reported in City of San Diego (2002a).

Data Analyses

Annual, monthly and station mean values were calculated for each physical, chemical and bacteriological parameter and then analyzed for seasonal and spatial changes within the sampling area. Contour plots of CTD profile and bacterial data were generated to identify changes in water mass and to track dispersion of the waste field. Voxel Analyst, a volumetric modeling software package, was used to interpolate and plot the data. A review of these plots indicated that data for the months of February, April, August and December best illustrated the varied oceanographic conditions surrounding the PLOO. Data for oil and grease samples were generally below the detection limit of 2.0 mg/L and are not presented.

RESULTS & DISCUSSION

Physical and Chemical Parameters

During 2001, changes in most of the physical and chemical parameters corresponded to seasonal patterns in oceanographic conditions (see Figures 2.2 - 2.6, Table 2.1). Typical winter conditions existed from January through March and later in December when surface water temperatures were low and wind and surf were relatively high. These conditions resulted in a mixed water column with little thermal stratification. For example, the difference between average surface and bottom water temperatures during these months was less than 5 °C. Conditions began to change in March with the intrusion of a cold, deepwater mass into the area. Consequently, by April, average bottom temperatures decreased 1.4 °C, from a seasonal high of 11.4 °C in January to 10 °C in April. Similarly, average DO levels near the bottom fell from a high of 5.2 mg/L (January) to a low of 3.2 mg/L (April). Surface temperatures increased in May, and then peaked in June and August, with surface waters exceeding 20°C. These conditions gave rise to a shallow, seasonal thermocline which lasted through October, interrupted only in July by a slight decrease in surface and mid-water temperatures. Thermal stratification broke down completely by December,

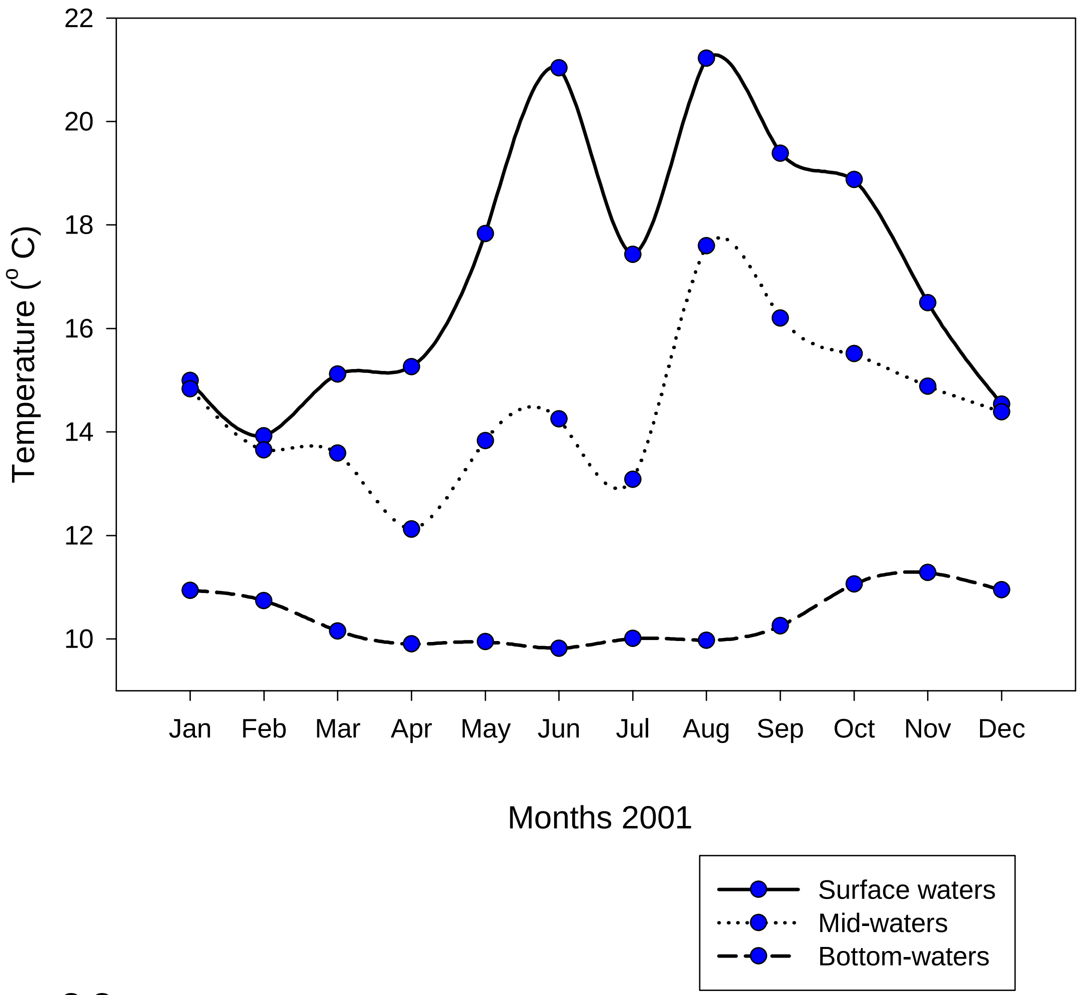


Figure 2.2

Mean monthly temperatures (° C) for surface (<5 ft), mid-water (mean of 35 - 60 ft depths) and bottom waters (>260 ft) for 2001. Means are calculated from temperature profile data of PLOO offshore stations.

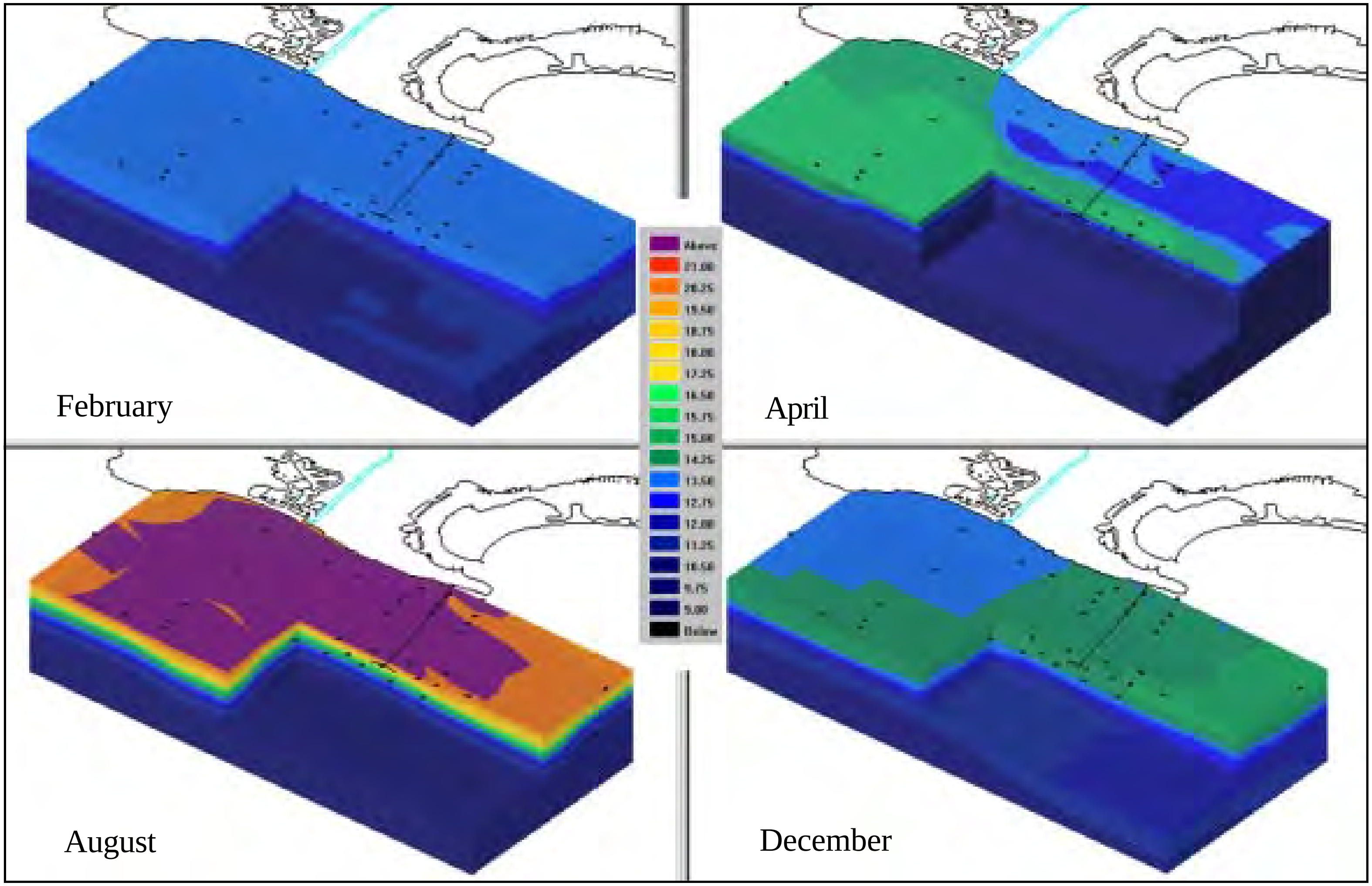


Figure 2.3

Three-dimensional plots of temperature (° C) profile data for February, April, August and December 2001. The values between sampling sites were interpolated using the Metric method.

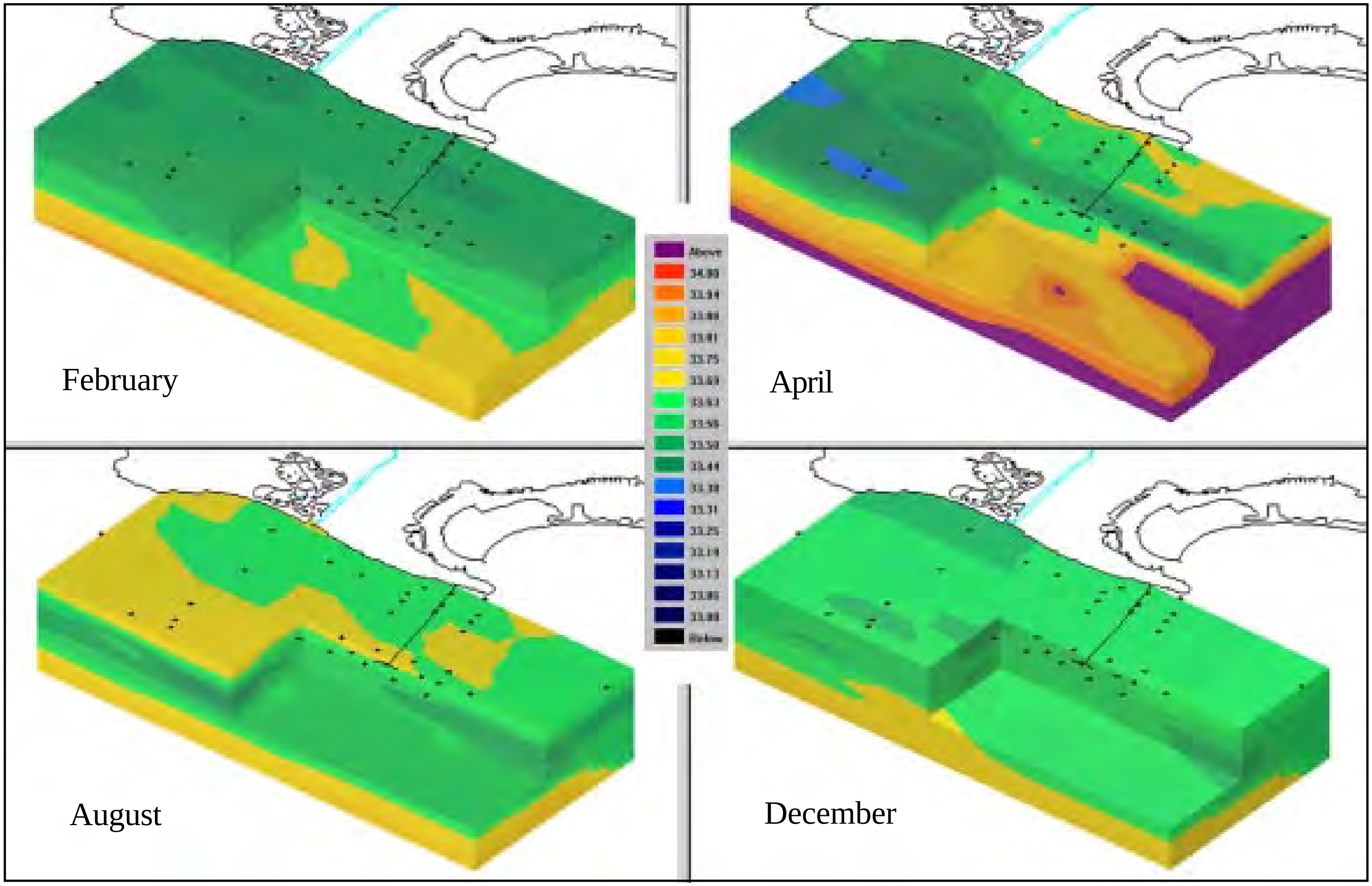


Figure 2.4
Three-dimensional plots of salinity (ppt) profile data for February, April, August and December 2001. The values between sampling sites were interpolated using the Metric method.

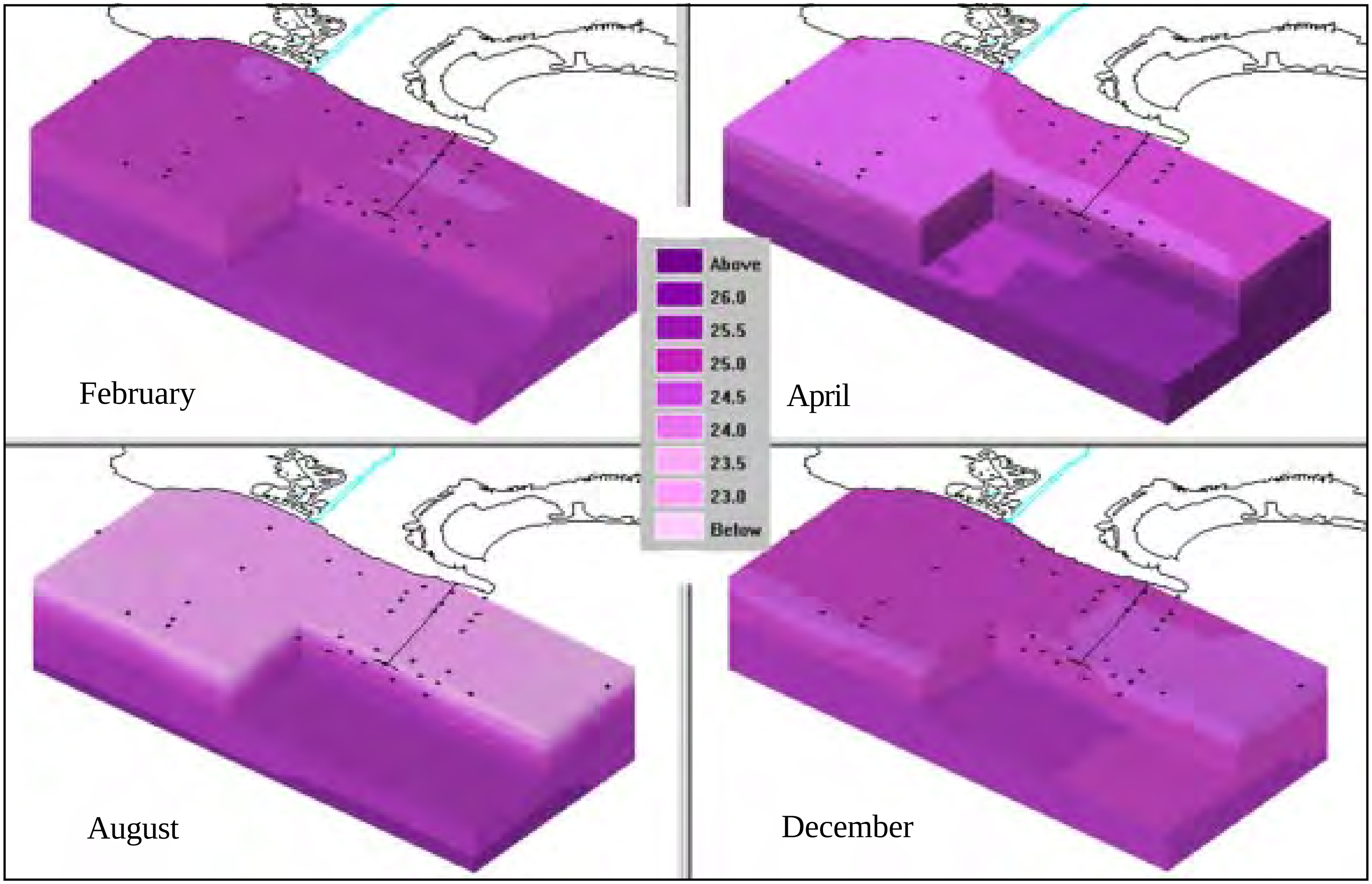


Figure 2.5
Three-dimensional plots of density (σ/theta) profile data for February, April, August and December 2001. The values between sampling sites were interpolated using the Metric method.

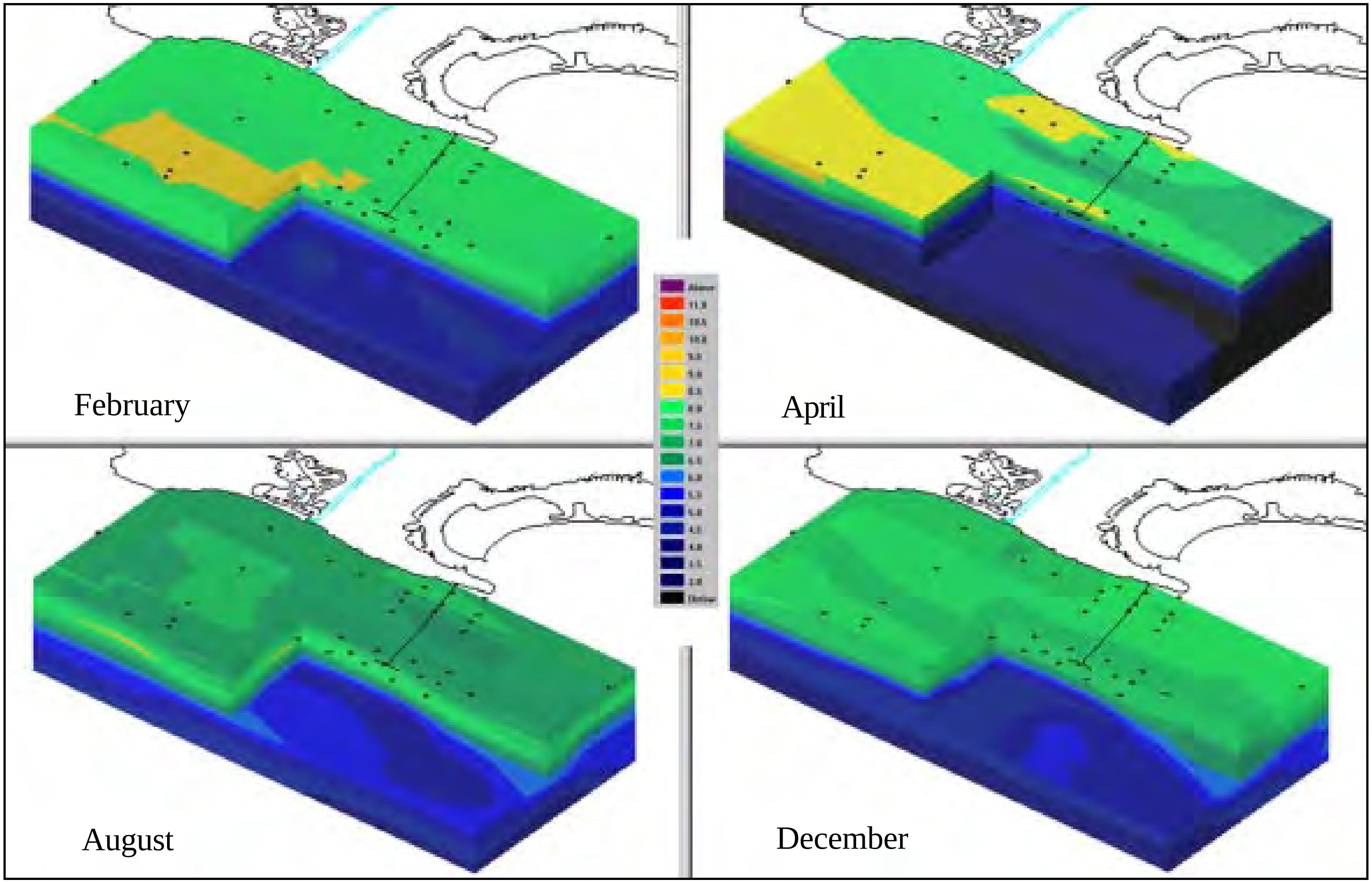


Figure 2.6
Three-dimensional plots of dissolved oxygen (mg/L) profile data for February, April, August and December 2001. The values between sampling sites were interpolated using the Metric method.

Table 2.1

Monthly mean values of temperature (° C), salinity (ppt), density (sigma/theta), dissolved oxygen (mg/L), pH and transmissivity (%) for top (<5 ft), mid-depth (mean of 35 - 60 ft data) and bottom (>260 ft) waters at all PLOO stations during 2001.

		Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Temp	*Top*	15.1	14.0	15.1	14.8	17.7	20.7	17.4	21.3	19.2	18.9	16.5	14.5
	Mid	14.8	13.6	13.6	12.1	13.8	14.2	13.1	17.6	16.2	15.5	14.9	14.4
	Bot	11.4	10.9	10.4	10.0	10.1	10.0	10.2	10.2	10.4	11.3	11.5	11.3
Sal	*Top*	33.6	33.5	33.4	33.5	33.6	33.7	33.5	33.7	33.6	33.6	33.5	33.6
	Mid	33.6	33.6	33.5	33.7	33.6	33.6	33.6	33.7	33.6	33.6	33.5	33.6
	Bot	33.7	33.7	33.9	34.0	33.8	33.8	33.8	33.7	33.8	33.7	33.7	33.7
Dens	*Top*	24.8	25.1	24.8	24.9	24.3	23.5	24.3	23.4	23.9	24.0	24.5	25.0
	Mid	24.9	25.1	25.1	25.5	25.1	25.1	25.3	24.3	24.6	24.7	24.9	25.0
	Bot	25.7	25.8	26.0	26.1	26.0	26.0	25.9	25.9	25.9	25.7	25.7	25.7
DO	*Top*	7.8	8.4	8.3	8.3	8.0	8.3	9.7	7.2	7.6	7.7	8.0	7.9
	Mid	7.8	8.2	7.6	6.3	8.1	8.4	8.3	7.6	7.7	8.0	7.9	7.8
	Bot	5.2	4.7	3.7	3.2	4.4	4.4	4.5	5.1	4.6	4.5	4.8	4.7
pH	*Top*	8.0	8.1	8.1	8.1	8.1	8.1	8.3	8.2	8.1	8.1	8.1	8.1
	Mid	8.0	8.1	8.0	7.9	8.1	8.0	8.1	8.1	8.0	8.0	8.0	8.1
	Bot	7.8	7.8	7.7	7.6	7.7	7.5	7.8	7.8	7.7	7.7	7.8	7.9
XMS	*Top*	87.3	86.2	85.8	81.6	87.5	85.7	77.2	88.2	87.3	88.0	84.5	87.4
	Mid	87.7	86.9	88.5	87.0	88.2	87.7	87.8	89.9	89.2	89.6	87.1	87.6
	Bot	88.2	89.4	90.6	90.3	90.1	90.9	90.8	90.0	90.9	89.7	90.6	91.8

leaving a nearly homogenous water column at the end of the year.

Two plankton blooms were apparent in the coastal waters off Point Loma during the year. These were indicated by the presence of large populations of the dinoflagellates *Prorocentrum* sp and *Lingulodinium polyedrum* in surface water samples from April and July, and to corresponding increases in chlorophyll *a* and TSS concentrations and to a decrease in transmissivity (Figure 2.7, Table 2.2). The proliferations of these dinoflagellate populations were also associated with periods of coastal upwelling in the region, as indicated by decreased water temperatures coincident with notable changes in density and DO at the nearshore stations (see Table 2.1 and Figures 2.3, 2.5, 2.6). Coastal upwelling typically creates oceanographic conditions favorable to the formation of plankton blooms.

Bacteriology

The bacteriological benchmarks for receiving waters discussed in this chapter are 1,000 colony forming units (CFU) per 100 mL for total coliforms and 400 CFU per 100 mL for fecal coliforms. These benchmarks are used as reference points to distinguish elevated coliform values and should not be construed as compliance limits nor as an indicator of health risk. Because total and fecal coliform concentrations showed similar trends during the year, discussion of these indicators herein is generally limited to total coliforms.

Monthly bacterial levels along the shore averaged 2 – 466 CFU/100 mL for total coliforms at stations located along the Point Loma peninsula, and 2 – 6,667 CFU/100 mL at the three southernmost stations (Table 2.3). Generally, elevated bacterial counts

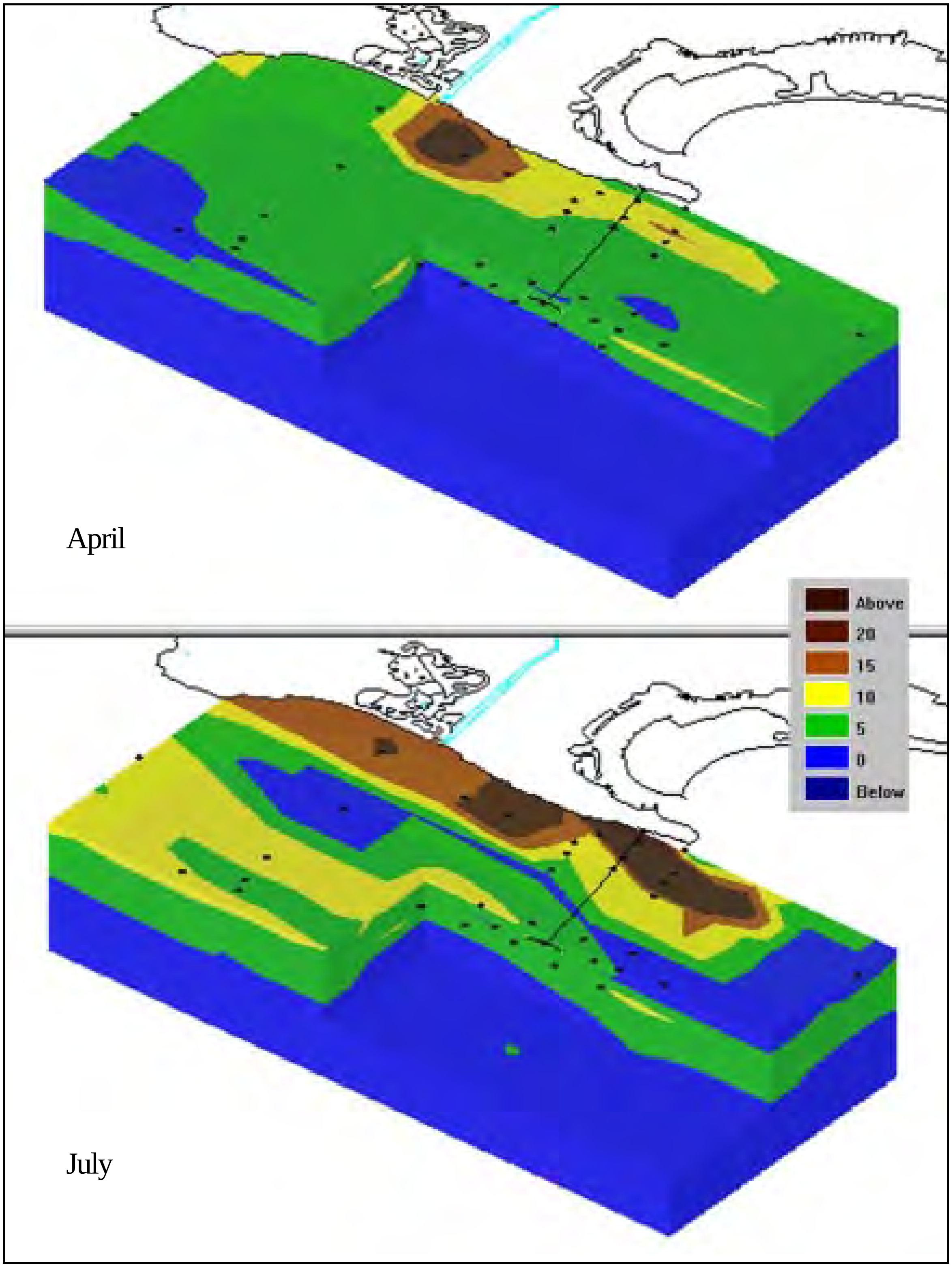


Figure 2.7
Three-dimensional plot of chlorophyll *a* (µg/L) profile data for April and July 2001. The values between sampling sites were interpolated using the Metric method.

Table 2.2

Monthly mean values of total suspended solids and chlorophyll *a* (µg/L) for top (<5 ft), and bottom (>260 ft) waters at all PLOO stations during 2001.

	Chlor		TSS	
	Top	*Bot*	*Top*	*Bot*
Jan	4.0	3.7	3.8	3.8
Feb	2.9	2.3	3.2	2.1
Mar	5.7	3.4	4.4	3.5
Apr	7.5	3.2	5.2	2.3
May	4.6	3.4	3.5	3.2
Jun	4.9	3.0	4.1	3.6
Jul	14.8	3.7	10.8	3.1
Aug	5.2	4.7	2.8	2.7
Sep	6.1	4.8	5.0	5.3
Oct	6.5	5.9	5.9	9.0
Nov	7.1	5.8	5.2	3.1
Dec	6.6	4.4	6.6	6.9

appeared to be associated with shore-based sources and winter storms, rather than wastewater discharge via the PLOO. For example, coliform densities were typically higher at shore stations D1 and D2, and occasionally at station D3, than at the more northern stations. This southern area is impacted by flows from the Tijuana River, a known source of bacterial contamination (e.g., see City of San Diego 2002b). As in the past, high coliform densities at these southern sites were more frequent during the rainy season (January - April), probably due to a combination of increased terrestrial runoff and discharge of untreated Mexican sewage into the river at this time of year. In addition to river runoff, various non-point sources of contamination may have impacted stations further north. For example, station D3 had elevated bacterial counts (e.g., total coliform = 2,200 CFU/100 mL) on July 21 when most other stations had relatively low bacterial densities. Further to the north, station D8 had elevated total coliforms of unknown origin in May, August and October. The City has continued a sanitary survey in this area to identify the possible source of these elevated values, but none has been found to date.

Wastewater discharge from the PLOO also appeared to have very limited impact on water quality at the relatively shallow stations located within the Point Loma kelp bed (Table 2.4). For example, all eight kelp stations had coliform values less than 40 CFU/100 mL throughout the year, with there being no indication that the waste field reached these nearshore waters.

In general, elevated bacterial counts in offshore areas were limited to stations in the immediate vicinity of the outfall and to waters deeper than 140 ft (Tables 2.4 and 2.5). The average total coliform density in surface samples at the offshore stations was 12 CFU/100 mL, with no sample exceeding 900 CFU/100 mL. Annual mean bacterial concentrations were also fairly low at the 140-ft and 200-ft depths, and exceeded 1,000 CFU/100 mL for total coliforms only at depths > 260 ft. The highest average total coliform concentration (5,500 CFU/100 mL) occurred at station E14, located nearest the outfall. Finally, only three other sites, stations E10 and E16 along the 290-ft contour and station E18 along the 380-ft contour, averaged total coliform densities greater than 1,000 CFU/100 mL for the year.

Compliance with California Ocean Plan Standards

The California Ocean Plan sets forth four standards for bacterial compliance (see SWRCB 1997): (1) *30-day total coliform standard* – no more than 20% of the samples at a given station in any 30-day period may exceed a concentration of 1,000 CFU per 100 mL; (2) *10,000 total coliform standard* – no single sample, when verified by a repeat sample collected within 48 hours, may exceed a concentration of 10,000 CFU per 100 mL; (3) *60-day fecal coliform standard* – no more than 10% of the samples at a given station in any 60-day period may exceed a concentration of 400 CFU per 100 mL; (4) *30-day geometric mean fecal coliform standard* – the geometric mean of the fecal coliform concentration at any given station in any 30-day period may not exceed 200 CFU per 100 mL. These standards apply only to the shore and kelp bed monitoring sites. Compliance with these standards during 2001 is discussed below.

The eight kelp stations met all California Ocean Plan bacterial water contact standards during the year, while compliance was also relatively high along the shore. All nine shore stations met the 30-day fecal geometric mean standard and five were 100% compliant with the remaining three standards as well.

Table 2.3

Mean total coliform densities (CFU per 100 mL) for shore stations by station, month and year (2001). Stations are listed left to right in order from south to north. Rainfall (inches) was measured at Lindberg Field, San Diego, CA. n= the number of samples.

		Shore Stations									
	rainfall	**D1**	**D2**	**D3**	**D4**	**D5**	**D6**	**D7**	**D8**	**D9**	**All Stations**
Month											
January	3.3	19	4	3	2	3	3	5	29	6	8
February	2.4	6735	6667	452	2	2	2	3	18	2	2060
March	0.6	225	31	37	2	11	2	7	32	9	40
April	0.8	1760	387	101	7	9	2	6	52	4	340
May	0.2	24	7	76	3	19	6	198	200	17	60
June	0.0	60	15	63	3	17	15	76	64	2	30
July	trace	118	76	550	67	32	14	38	113	16	120
August	0.0	40	261	50	88	38	38	50	400	38	120
September	0.0	37	51	27	23	2	3	100	61	35	40
October	0.0	94	4	27	54	7	4	31	466	7	80
November	1.0	36	28	32	3	10	6	2	58	5	20
December	0.5	5	15	2	13	27	2	10	42	4	10
n		37	38	36	35	35	35	35	36	35	
Annual range		2 - 16000	2 - 16000	2 - 2200	2 - 200	2 - 50	2 - 50	2 - 600	2 - 1600	2 - 100	
Annual mean		750	610	140	30	20	10	60	170	10	

Table 2.4

Monthly mean total coliform densities (CFU per 100 mL) for kelp bed and off shore stations.

Month	Total Coliforms Kelp	Total Coliforms Offshore
January	20	2220
February	20	990
March	10	790
April	40	2360
May	6	1110
June	10	1150
July	6	490
August	4	820
September	4	1350
October	8	410
November	20	830
December	20	1160

Only stations D1, D2 and D3 located north of the Tijuana River and station D8 located near Ocean Beach had bacterial concentrations that exceeded any compliance standard and this occurred less than 20% of the time (see Table 2.6). These exceedances can probably be attributed to bacterial contamination associated with increased runoff and riverine input during the rainy season or from other non-point sources. For example, bacterial concentrations at stations D1 and D2 exceeded the 30-day total coliform standard mostly from February to April (Table 2.5), and the 10,000 total coliform standard in February. The relatively high bacterial counts at these two southern sites coincided with periods of heavy rainfall (see Table 2.3), and were probably the result of increased storm runoff and input via the Tijuana River at these times. Station D3 also exceeded the 30-day total and 60-day fecal coliform standards occasionally between July and September. However, the exceedances at this station were caused by elevated bacterial counts on a single day when most other stations had relatively low bacterial densities (see previous section); the low sampling frequency and running average calculation method can result in values that exceed compliance limits in the months following the occurrence of an actual high coliform count. Finally, bacterial counts at station D8 to the north also exceeded the 30-day total coliform standard occasionally between August and November. The source of this contamination is presently unknown and is under investigation.

Table 2.5

Annual mean total coliform for offshore monthly water quality stations by depth (ft).

Depth	Total Coliforms Mean	Total Coliforms Range
5	12	(2-900)
140	465	(2-16000)
200	864	(2-16000)
≥260	2904	(2-16000)

SUMMARY & CONCLUSIONS

The water quality data collected off of Point Loma provide only a broad scale survey of seasonal fluctuations and long term trends for two reasons. First, the offshore stations are widely separated, with adjacent stations being 0.9 km or more apart. Second, because the stations cannot be sampled synoptically, each monthly data point merely represents a snapshot of ocean conditions at each station on a single day of the month.

Similar to previous years, the physical and chemical water quality parameters off San Diego displayed “typical” oceanographic patterns in 2001. For example, there was minimal thermal stratification at the beginning of the year, which was followed by upwelling and plankton blooms in spring and summer. Upwelling was particularly evident in April and July when reduced temperatures, coincident with shifts in density and DO, indicated a change in the water mass off Point Loma. Phytoplankton blooms frequently follow upwelling events which bring cold, deep, nutrient-rich water into the photic zone, these conditions likely precipitated phytoplankton blooms recorded in April and July, as indicated by increased concentrations of chlorophyll *a* and total suspended solids in surface waters surrounding the PLOO. Surface temperatures climbed rapidly in May giving rise to a well stratified upper water column during most of summer and fall. Surface temperatures began to decline in October coincident with a rise in bottom temperatures, resulting in an almost homogeneous water column by the end of the year. None of the

Table 2.6

Summary of compliance with 1997 California Ocean Plan water contact standards for shore stations during 2001. The values are the number of days that each station exceeded the 30-day total and 60-day fecal coliform standards. Stations are listed in order from South to North.

30-Day Total Coliform Standard

Month	# of possible sampling days	D1	D2	D3	D4	D5	D6	D7	D8	D9
		Shore Stations								
January	31	0	0	0	0	0	0	0	0	0
February	28	13	13	0	0	0	0	0	0	0
March	31	19	19	0	0	0	0	0	0	0
April	30	29	29	0	0	0	0	0	0	0
May	31	1	1	0	0	0	0	0	0	0
June	30	0	0	0	0	0	0	0	0	0
July	31	0	0	3	0	0	0	0	0	0
August	31	0	4	4	0	0	0	0	1	0
September	30	0	4	0	0	0	0	0	6	0
October	31	0	0	0	0	0	0	0	23	0
November	30	0	0	0	0	0	0	0	7	0
December	31	0	0	0	0	0	0	0	0	0
Percent compliance 2001		83	81	98	100	100	100	100	90	100

60-Day Fecal Coliform Standard

Month	# of possible sampling days	D1	D2	D3	D4	D5	D6	D7	D8	D9
		Shore Stations								
January	31	0	0	0	0	0	0	0	0	0
February	28	0	0	0	0	0	0	0	0	0
March	31	0	0	0	0	0	0	0	0	0
April	30	0	0	0	0	0	0	0	0	0
May	31	0	0	0	0	0	0	0	0	0
June	30	0	0	0	0	0	0	0	0	0
July	31	0	0	10	0	0	0	0	0	0
August	31	0	0	31	0	0	0	0	0	0
September	30	0	0	18	0	0	0	0	0	0
October	31	0	0	0	0	0	0	0	0	0
November	30	0	0	0	0	0	0	0	0	0
December	31	0	0	0	0	0	0	0	0	0
Percent compliance 2001		100	100	84	100	100	100	100	100	100

changes in the physical and chemical water quality parameters appeared to be related to the wastewater discharge.

The wastewater discharged from the outfall generally remained within the mid to bottom portion of the water column at depths greater than 140 ft. The most apparent increases in bacterial concentrations were observed in the vicinity of the outfall "wye" (i.e., stations E10, E14, E16 and E18). None of the data collected during routine monitoring suggests that the near shore environment was adversely impacted by discharge from the PLOO. In general, stations located in the Point Loma kelp bed exhibited very good water quality with respect to coliform bacteria, and were in compliance with all California Ocean Plan water contact standards throughout 2001. Water quality along the shore was also good, with all impacts more likely attributable to shore based sources rather than the PLOO.

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Sediment Characteristics

Chapter 3. Sediment Characteristics

INTRODUCTION

Sediment conditions can influence the distribution of benthic invertebrates largely by affecting the ability of various species to burrow, build tubes or feed (Gray 1981, Snelgrove and Butman 1994). In addition, species of demersal fish are often associated with specific sediment types that reflect the habitat of their preferred invertebrate prey (Cross and Allen 1993). Important factors affecting the distribution and composition of sediments on the continental shelf include bottom currents, exposure to large waves, proximity to river mouths, sandy beaches, submarine basins, canyons and hills, and the presence and abundance of calcareous organisms (Emery 1960). In fact, the analysis of parameters such as average grain size, sorting coefficient, and the relative percentages of sand, silt and clay can provide useful information on the amount of wave action, current velocity and sediment stability in an area. Thus, changes in these parameters over time are indicative of overall sediment stability and the degree of seasonal import and export of particles associated with storm activity, runoff from rivers and land and other sources.

Municipal wastewater outfalls are one of many factors that can directly influence the composition and distribution of sediments on the continental shelf. This may be due to the discharge and subsequent deposition of organic and inorganic compounds or to the physical structure of the outfall altering the hydrodynamic regime of an area. Among the most common types of compounds that are discharged via wastewater outfalls are trace metals, pesticides and various organic materials. Indicators of organic loading in sediments include measurements of total organic carbon (TOC), total nitrogen (TN), biochemical oxygen demand (BOD), total volatile solids (TVS) and sulfides. Concentrations of BOD, TN and sulfides are often positively correlated with decreasing particle size, since finer particles provide greater surface area for bacterial growth and adsorption. TOC and TVS measurements are considered more direct indicators of carbon imported as fine particulate matter (Anderson et al. 1993).

This chapter presents summaries and analyses of sediment grain size and chemistry data collected during 2001 in the vicinity of the City of San Diego Point Loma Ocean Outfall (PLOO). The major goals of this study are to assess any impact of wastewater discharged through the outfall on the benthic environment in the region by analyzing the spatial and temporal variability of the various sediment parameters, and by determining the presence of sedimentary and chemical footprints near the discharge site.

MATERIALS & METHODS

Field Sampling

Quarterly sediment samples were collected during January, April, July and October of 2001 at 23 stations surrounding the PLOO (Figure 3.1). These stations span the terminus of the outfall and are located along the 290, 320 and 380-ft depth contours (~88–116 m). The 17 "E" stations are located within 8 km of the outfall, while the six "B" stations are located greater than 11 km from the discharge site. Samples for sediment chemistry and particle size analyses were obtained with a 0.1 m^2 chain-rigged van Veen grab. These samples were taken from the top 2 cm of the sediment surface and handled according to United States Environmental Protection Agency guidelines (see USEPA 1987).

Laboratory Analyses

All sediment analyses were performed at the City of San Diego Wastewater Chemistry Laboratory. Particle sizes were determined using a Horiba LA-900 laser analyzer, which measures particles ranging in size from 0 to 10 phi (i.e., sand, silt and clay fractions). Sand was defined as particles ranging in size from 0 to

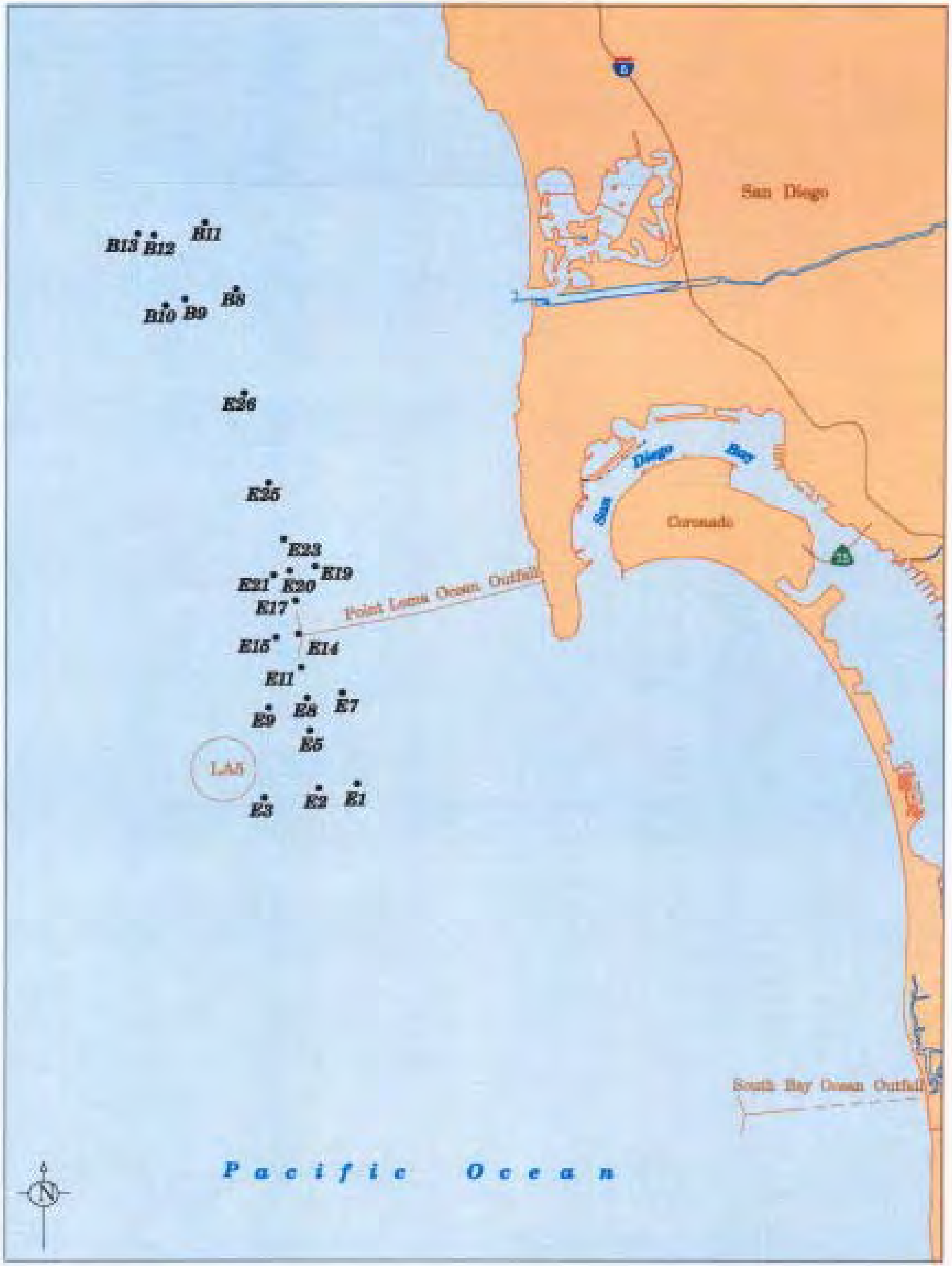

Figure 3.1
Sediment quality stations surrounding the City of San Diego Point Loma Ocean Outfall.

4 phi; silt as particles >4 to 8.0 phi; and clay particles > 8.0 phi. The fraction of coarser sediments (e.g., coarse sand, gravel, shell hash) in each sample was determined by measuring the weight of particles retained on a 1.0 mm mesh sieve (i.e., 0 phi), and then expressed as the percent weight of the total sample sieved. This coarse fraction is represented as percent "Coarse" in Table 1 and Appendix A.1.

Data Analyses

The following particle size parameters were calculated using a normal probability scale (see Folk 1968): median and mean phi size; sorting coefficient (standard deviation); skewness; kurtosis; percent sediment type (i.e., coarse fraction, sand, silt, clay). Sediment chemical parameters that were analyzed include: biochemical oxygen demand (BOD); total organic carbon (TOC); total volatile solids (TVS); total sulfides; total nitrogen (TN); trace metals; chlorinated pesticides (e.g., aldrin, dieldrin, hexachlorocyclohexanes, DDT and derivatives, chlorodane and related compounds); polycyclic aromatic hydrocarbons (PAHs); polychlorinated biphenyl compounds (PCBs). A detailed list of individual constituents sampled is provided in Appendix A.2.

Prior to analysis, the chemical constituent data were generally limited to values above method detection limits (MDLs) and estimated values. Estimated values include parameters determined to be present in a sample with high confidence (i.e., peaks confirmed by mass-spectrometry), but at levels below the MDL. Null values (i.e, constituents with concentrations below the MDL for which there is no estimate) were eliminated from the data. The exclusion of null values, however, is not intended to represent the absence of a particular parameter. Finally, BOD values for all "E" stations during January were not valid due to a failure of the quality control samples, and therefore were not included in analyses.

Concentrations of the organic indicators and trace metals that were measured in sediments off Point Loma during 2001 were compared to values for both the pre-discharge (1991-1993) and previous post-discharge (1994-2000) periods. In addition, sediment concentrations for metals, TOC, TN and pesticides (i.e., DDE and DDT) were compared to median values for the Southern California Bight (SCB). These bight-wide values were based on the respective cumulative distribution function (CDF) for each parameter (see Schiff and Gossett 1998). These reference values are

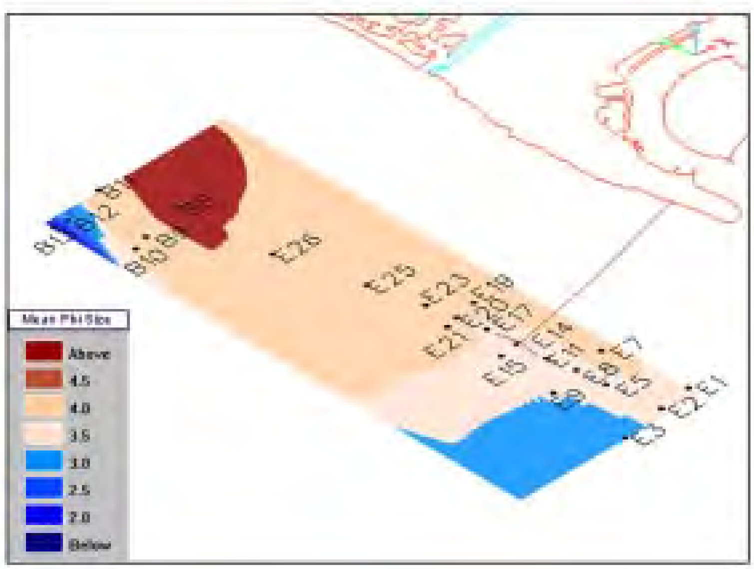

Figure 3.2

Horizontal contour profile of mean phi size data averaged over four quarters for sediment chemistry stations during 2001.

Table 3.1

Summary of particle size parameters at PLOO stations during 2001. Data are expressed as annual means for: phi size (Mean); standard deviation (SD); median phi size (Median); percent sediment particles > 1.0 mm (Coarse); percent sand; percent silt and clay (Fines). Notes on sediment observations for all surveys conducted during the year are also included.

	Phi Size			Percent Composition			Sediment Notes
Stations	Mean	SD	Median	Coarse	Sand	Fines	
290 ft stations							
B11	4.1	2.4	3.9	10.8	41.3	47.9	silt, sand, coarse sand, shell hash, mud, pea gravel
B8	4.7	1.5	4.2	0.0	40.7	59.2	silt, clay
E19	4.2	1.4	3.9	0.0	57.0	42.9	silt, clay
E7	4.1	1.3	3.7	0.0	61.2	38.7	silt, clay
E1	3.8	1.9	3.3	2.2	63.8	34.0	
320 ft stations							
B12	3.0	2.0	2.5	2.9	71.4	25.6	coarse sand, sandy silt, shell hash, pea gravel/mud
B9	4.3	1.6	3.7	0.0	58.5	41.5	silty clay, silt, gravel, mud, pea gravel
E26	4.3	1.5	3.7	0.0	57.9	42.1	silt, shell hash
E25	4.2	1.6	3.8	1.0	57.5	41.4	silt, sand shell hash
E23	4.3	1.5	3.8	0.2	56.6	43.2	sulifides, clay, silt, shell hash
E20	4.1	1.4	3.7	0.0	62.8	37.2	clay, silt, shell hash
E14	3.6	1.6	3.4	4.8	70.5	24.7	clay, silt, sand, gravel, coarse black sand, shell hash
E17	3.9	1.3	3.6	0.5	68.6	30.9	clay, silt, shell hash
E11	3.8	1.3	3.6	0.8	71.8	27.4	silt, shell hash
E8	3.9	1.4	3.5	0.2	66.9	32.9	silt, clay
E5	3.9	1.4	3.5	1.5	69.0	29.5	silty clay, sandy silt, coarse sand, mud balls
E2	3.8	2.2	3.6	8.3	54.1	37.6	clay, silt, fine sand, coarse sand, shell hash
380 ft stations							
B13	2.1	1.7	1.7	6.5	79.7	13.7	coarse sand, shell hash, mud stone, rock, shell hash
B10	4.0	1.5	3.6	1.1	69.5	29.4	silt, clay, fine sand, shell hash
E21	4.1	1.4	3.6	0.0	64.7	35.3	clay, silt, shell hash
E15	3.9	1.4	3.5	0.1	71.8	28.0	coarse black sand, shell hash
E9	3.5	2.5	3.6	15.8	47.4	36.7	silt, sand, coarse black sand, gravel, shell hash
E3	3.3	2.2	3.0	7.0	62.8	30.2	
Area Mean	3.9	1.6	3.5	2.8	62.0	35.2	

presented as the 50% CDF in the tables included herein.

RESULTS & DISCUSSION

Particle Size Distribution

The sediments off Point Loma showed little variation in sediment composition between surveys during 2001 (Appendix A.1). Area sediments were composed predominantly of very fine sand and coarse silt, with a mean particle size of 3.9 phi (Table 3.1, Figure 3.2). Fine sediments (i.e., silt and clay fractions combined) averaged about 35% of the sediments overall, while sands accounted for 62%. Coarser materials such as shell hash and gravel comprised the remaining 3%. Within the monitoring area, the sediments generally became coarser with depth, a trend was most pronounced along the northernmost transect (stations B11, B12 and B13).

North and inshore of the PLOO "wye", the sediments were generally fine, characterized by mean phi >4.0 (Figure 3.2). The finest grained sediments occurred at station B8, which averaged 4.7 phi and 59% fines during the year. Areas where sediments were more coarse included the northern reference sites (stations B12 and B13), and sites located near the southern LA-5 dredged material disposal site and the PLOO. Sediments at the two northern sites contained variable amounts of shell hash and coarse sands (Table 3.1). For example, stations B12 and B13 contained the coarsest sediments throughout the sampling period (74% and 86% sand and coarse materials, respectively). These coarse sediments may be related to the proximity of these northern stations to the continental shelf-slope interface where strong currents and internal waves export fine sediments down the slope leaving shell hash and larger particles behind (see Shepard and Marshall 1978, Boczar-Karakiewicz et al. 1991). Sediments at several sites near LA-5 were also composed of varying amounts of shell hash. For example, station E5 contained a broad range of sediment types from silt and mud balls to coarse sand. The source of coarse sediments at this and other nearby sites is probably the nearby LA-5 disposal site (see Figure 3.1). Barges laden with dredged material from San Diego Bay have been observed making deposits at statsion E5 in the past, and evidence that the main disposal mound has dispersed into areas outside the boundaries of LA-5 has been detected by the United States Geological Survey (Gardner et al. 1998). The relatively coarse sediments at station E14 (i.e., 75% sand, mean phi=3.6) are probably due to its location near the center of the outfall "wye." Visual examination of the sediments at this site have occasionally revealed the presence of large amounts of coarse, black sand that was used as stabilizing material around the outfall pipe (Table 3.1, Appendix A.1). This black sand was also present at stations E9 and E15 during January and July of 2001, indicating the potential spread of this ballast material south and east of the outfall.

Organic Indicators

The general distribution of the various organic indicators off Point Loma in 2001 was similar to that described previously for the region (see Zeng and Khan 1994, City of San Diego1995, 2001). With the exception of total sulfides and BOD, concentrations of organic indicators were generally higher north or south of the PLOO and lower near the point of discharge (Figure 3.3). For example, concentrations of TVS, TOC and TN were highest at several of the northern "B" stations, followed by the southern stations (E1-E9), with the lowest values at points near the PLOO (E11-E17) (Table3.2). Additionally, while TOC concentrations were generally less than the median value (i.e., 50% CDF) for the Southern California Bight, TN concentrations were higher than the median value at many sites north and south of the outfall. Although, the highest average BOD value occurred nearest the outfall (i.e., station E14), two northern reference stations (B11 and B13) also averaged relatively high concentrations. In contrast, mean sulfide concentrations were highest at two southern stations

Table 3.2

Concentrations of organic loading indicators at PLOO stations during 2001, including BOD (mg/L), sulfides (ppm), total nitrogen (%wt); TOC (%wt); TVS (%wt). CDF =cumulative distribution functions (see text); * = not determined. MDL = method detection limit. Pre = pre-discharge mean values. Post = post-discharge mean values. Values that exceed the median CDF are indicated in bold type.

Station	BOD	Sulfides	TN	TOC	TVS
290 ft stations					
B11	392	1.4	**0.081**	**0.778**	4.00
B8	360	0.7	**0.072**	**0.757**	3.06
E19	307	2.0	**0.057**	0.597	2.62
E7	318	3.8	0.050	0.522	2.36
E1	267	7.0	**0.051**	0.575	2.55
320 ft stations					
B12	340	0.5	**0.055**	0.486	3.09
B9	299	0.5	**0.054**	0.581	2.81
E26	329	0.9	**0.053**	0.573	2.66
E25	284	0.9	**0.052**	0.548	2.56
E23	305	1.3	0.050	0.527	2.47
E20	288	3.0	0.047	0.505	2.32
E14	479	9.8	0.044	0.445	2.09
E17	312	2.3	0.041	0.422	1.97
E11	352	1.8	0.039	0.409	2.20
E8	271	1.9	0.038	0.419	2.44
E5	264	11.9	0.034	0.434	2.37
E2	305	5.3	0.047	0.547	2.63
380 ft stations					
B13	439	0.7	**0.071**	0.511	3.66
B10	351	1.1	**0.053**	0.554	2.77
E21	298	1.6	0.048	0.508	2.42
E15	274	0.8	0.046	0.498	2.44
E9	285	0.7	0.046	0.547	2.75
E3	226	3.8	**0.071**	0.311	2.18
Area Mean	319	2.8	0.052	0.524	2.63
Pre	236	4.0	0.039	0.532	2.38
Post	301	4.6	0.053	0.639	2.63
MDL	2	0.05	0.005	0.005	*
50% CDF	*	*	0.050	0.597	*

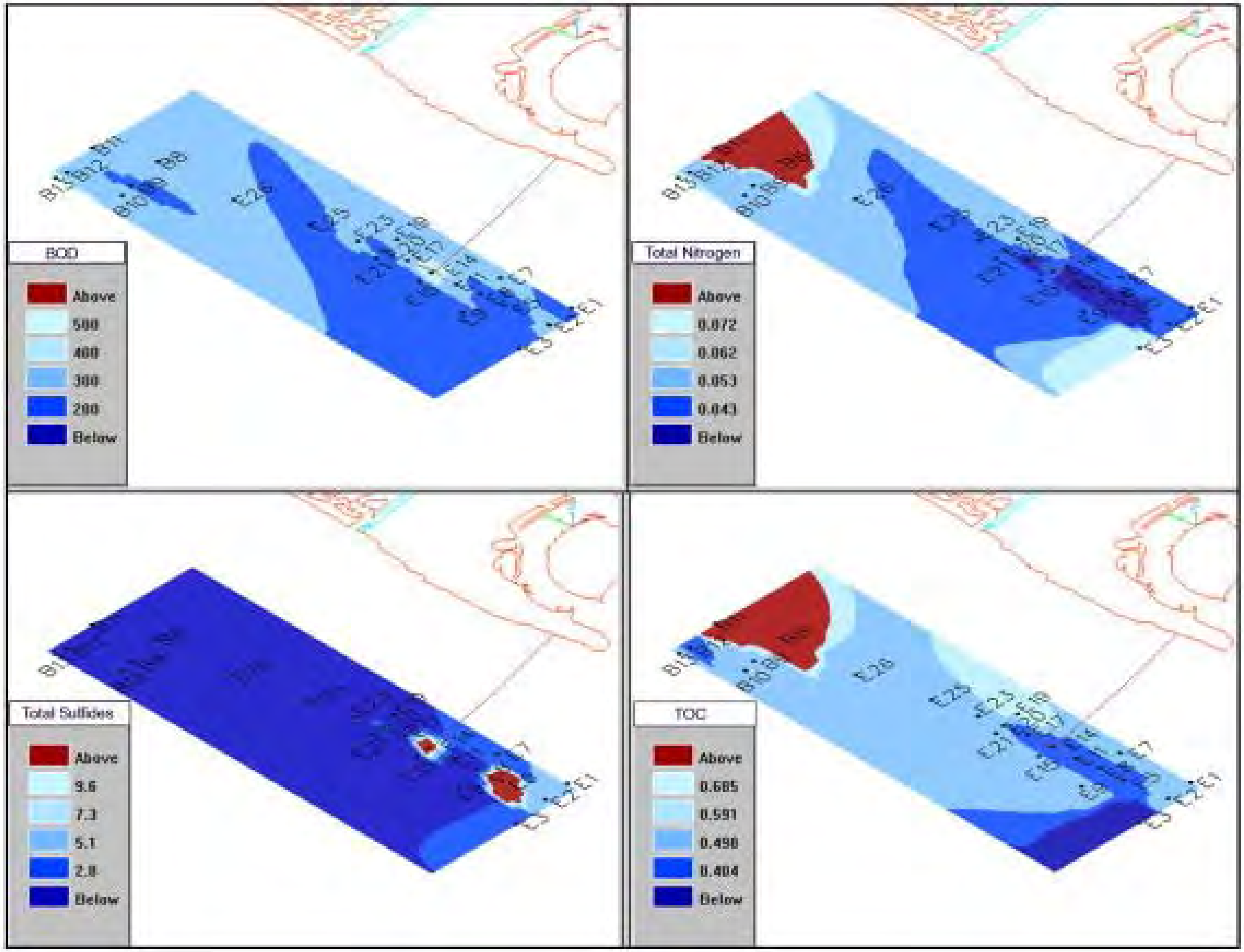

Figure 3.3

Horizontal contour profiles of mean organic loading indicators for sediment chemistry stations during 2001. The profiles include BOD (biochemical oxygen demand), total nitrogen, total sulfides and TOC (total organic carbon).

Table 3.3

Concentrations of trace metals (ppm) detected at each station during 2001. CDF = cumulative distribution function (see text). MDL = method detection limit. NA = not available. Pre = pre-discharge mean values. Post = post-discharge mean values. Values that exceed the median CDF are indicated in bold type.

Station	Al	Sb	As	Be	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Se	Tl	Zn
290 ft stations															
B11	**12975**	**6.3**	4.7	nd	0.14	26	11	**22200**	2.0	129.3	nd	8.5	**0.30**	nd	40
B8	**13743**	**3.9**	2.8	**0.37**	nd	22	11	15925	1.8	130.5	0.01	9.1	0.25	nd	39
E19	**12290**	**1.3**	3.4	nd	nd	19	10	13800	4.2	117.0	0.01	8.1	0.18	nd	31
E7	**11465**	**1.4**	3.1	nd	nd	16	10	12875	1.8	106.3	0.00	8.0	0.18	4.3	29
E1	**11150**	nd	3.3	nd	nd	15	12	13725	2.1	106.4	0.02	7.7	0.20	nd	32
320 ft stations															
B12	7888	**4.4**	**4.9**	nd	**0.34**	26	9	**21550**	1.3	68.5	0.00	6.0	0.23	nd	33
B9	**11290**	**1.3**	3.3	nd	nd	22	9	16525	3.0	109.4	0.01	8.3	0.25	nd	34
E26	**11460**	**1.8**	2.9	nd	0.14	18	9	13050	1.4	113.9	nd	7.2	0.21	nd	29
E25	**10170**	nd	3.0	nd	nd	17	10	11950	nd	97.1	0.01	7.4	0.20	nd	26
E23	**9718**	**1.9**	2.5	nd	nd	17	9	11875	1.9	95.7	0.01	7.3	0.21	nd	26
E20	**9778**	**1.5**	2.9	**0.36**	nd	16	8	11250	1.3	99.2	0.00	6.1	0.17	nd	25
E14	7688	nd	3.7	**0.29**	nd	15	10	10300	1.5	85.8	0.01	5.1	0.14	nd	23
E17	8533	nd	2.5	nd	nd	14	8	9930	1.4	84.0	0.01	6.3	0.11	nd	22
E11	7998	**1.9**	2.7	**0.28**	0.27	12	8	9870	nd	76.3	0.01	7.0	0.12	nd	22
E8	8963	nd	2.5	nd	nd	14	11	10948	nd	91.0	0.01	6.4	0.14	nd	25
E5	**10175**	nd	2.5	**0.30**	nd	15	11	12725	nd	98.2	0.01	7.2	0.14	nd	28
E2	**13943**	**3.1**	3.6	**0.42**	nd	17	**15**	16725	3.3	121.9	0.03	8.1	0.23	nd	37
380 ft stations															
B13	7240	**6.1**	**11.1**	nd	0.24	31	7	**23200**	2.8	72.0	nd	5.7	**0.33**	nd	34
B10	8748	**1.4**	2.8	nd	0.16	19	8	13925	1.9	81.9	nd	5.2	0.22	nd	27
E21	**9623**	**1.8**	2.5	nd	nd	16	10	11225	1.7	87.3	0.00	7.5	0.18	nd	25
E15	8370	**1.8**	2.6	**0.35**	nd	14	10	10425	nd	83.1	0.00	5.0	0.21	nd	23
E9	8585	**1.4**	3.1	nd	nd	17	**14**	12950	3.5	78.1	0.01	6.7	0.24	nd	41
E3	**11710**	**3.8**	2.8	nd	nd	13	**14**	14225	1.9	112.6	**0.04**	4.3	0.09	nd	32
Area mean	10152	2.0	3.4	0.10	0.05	18	10	13964	1.7	97.6	0.01	6.9	0.20	0.2	30
Pre	NA	0.3	2.5	0.33	0.99	17	8	13023	2.2	NA	0.01	6.4	0.18	7.3	28
Post	10422	1.9	3.7	0.32	0.27	18	10	14191	2.1	100.1	0.02	7.7	0.24	0.3	32
MDL	5	5	0.08	0.20	0.5	3	2	3	5.0	0.5	0.03	3.0	0.11	10	4.0
50% CDF	9400	0.2	4.8	0.26	0.29	34	12	16800	10.2	NA	0.04	16.3	0.29	NA	56

(E1 ad E5) as well as near the outfall (E14). Average sulfide values ranged from 7.0 to 11.9 ppm, with station E5 having the highest sulfide concentration of 33.5 ppm in April. Sulfide concentrations at station E14 ranged between 8.4 and 17.7 ppm for the year. Additionally, region-wide mean values of organic indicators during 2001 were similar to those of 2000, and have changed little over the past several years (Table 3.2; Appendix A.3).

Trace Metals

Sediments concentrations of trace metals were generally low off Point Loma in 2001 (Table 3.3, Figure 3.4). Most of the metals detected during the year occurred at levels less than the median values for the Southern California Bight. A few metals occurred at concentrations near or below the MDLs (e.g., antimony, beryllium, cadmium, lead, mercury and selenium), while thallium was only detected at station E7, and silver and tin were not detected at all. This pattern is similar to that seen in previous years (Appendix A.4).

Metal concentrations were generally lower near the outfall than in areas to the north or south (Table 3.3, Figure 3.4), although this pattern was inconsistent. The low values at station E14 and other nearby sites may be

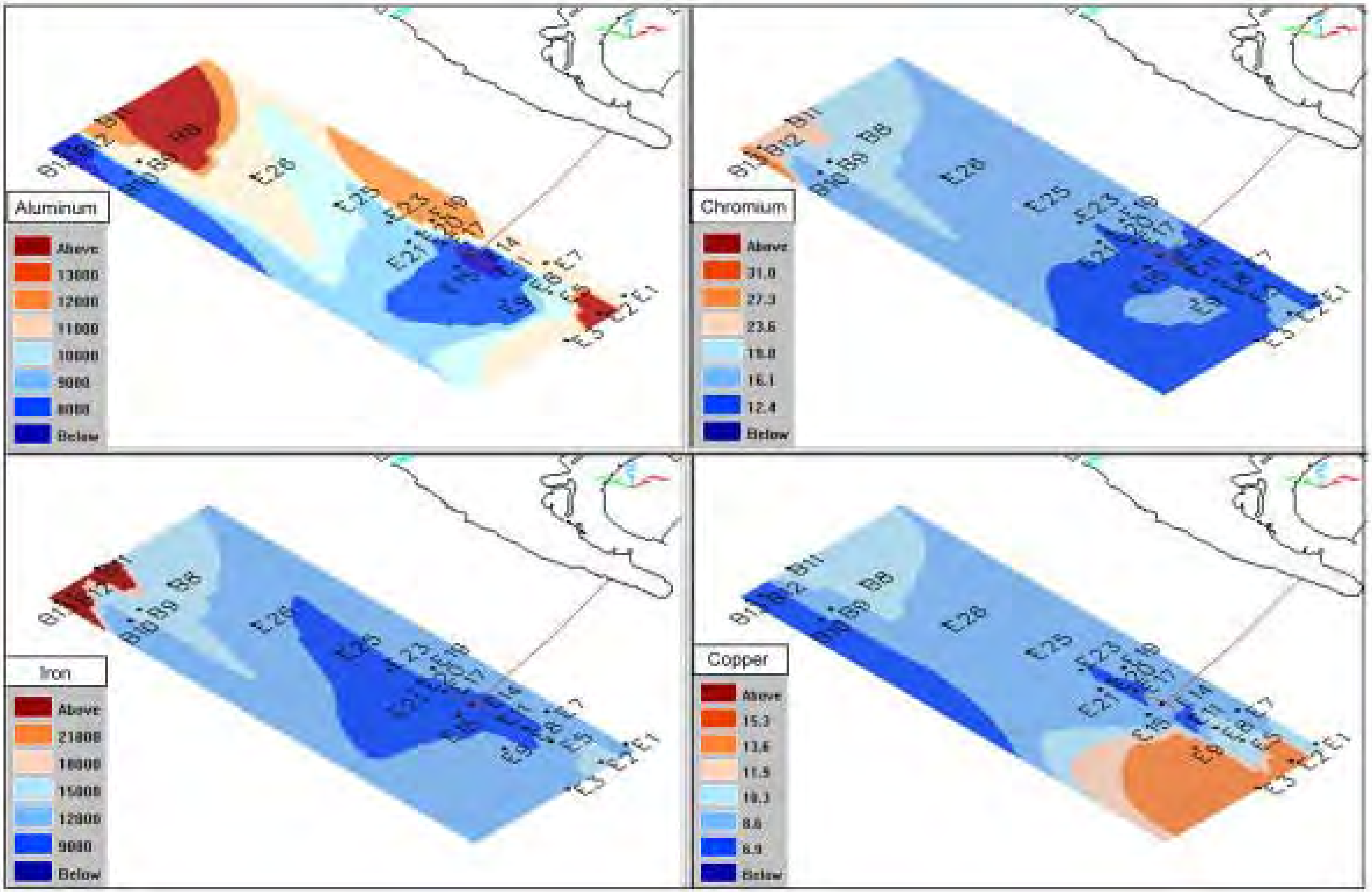

Figure 3.4

Horizontal contour profiles of four trace metals (aluminum, chromium, iron and copper) for sediment chemistry stations during 2001. The profiles represent mean concentrations (ppm) averaged over four quarters.

Table 3.4

Concentrations (ppt) of p,p-DDE and p,p-DDT detected at each PLOO station during 2001. Total-DDT is the mean of all DDE and DDT derivatives for all surveys. CDF = cumulative distribution function (see text). MDL = method detection limit; values below MDL are designated as 'nd". Values that exceed the median CDF are indicated in bold type.

	p,p-DDE				p,p-DDT				Total
Station	**Jan**	**Apr**	**Jul**	**Oct**	**Jan**	**Apr**	**Oct**	**Jul**	**DDT**
290 ft stations									
B11	nd	**1500**	nd	nd	nd	nd	nd	nd	250
B8	nd	**1800**	nd	**1700**	nd	nd	nd	nd	583
E19	nd	nd	nd	440	nd	nd	nd	nd	73
E7	nd	nd	nd	410	nd	2700	nd	nd	518
E1	nd	**1500**	nd	640	nd	nd	nd	nd	357
320 ft stations									
B12	nd	nd	nd	nd	nd	nd	nd	nd	nd
B9	1000	nd	nd	330	3800	nd	nd	nd	855
E26	nd	1180	nd	905	nd	nd	nd	nd	348
E25	nd	**1300**	nd	405	nd	nd	nd	nd	284
E23	nd	1100	nd	330	nd	nd	nd	nd	238
E20	nd	nd	nd	390	nd	nd	nd	nd	65
E14	nd	nd	nd	nd	nd	nd	nd	nd	nd
E17	nd	nd	nd	830	nd	nd	nd	nd	138
E11	nd	355	nd	420	nd	nd	nd	nd	129
E8	nd	950	nd	290	nd	nd	nd	nd	207
E5	**1400**	nd	nd	360	nd	nd	nd	nd	293
E2	**1600**	**1400**	nd	350	2300	nd	nd	nd	942
380 ft stations									
B13	nd	nd	nd	200	nd	nd	nd	nd	33
B10	nd	nd	nd	920	nd	nd	nd	nd	153
E21	nd	945	nd	370	nd	nd	nd	nd	219
E15	nd	nd	nd	690	nd	nd	nd	nd	115
E9	1100	500	nd	300	nd	nd	nd	nd	317
E3	nd	240	nd	nd	nd	nd	nd	nd	40
MDL	550	550	550	550	410	410	410	410	410
50%CDF	1200	1200	1200	1200	na	na	na	na	10000

partially related to the presence of coarse sediments or relatively high sulfide concentrations. For example, metal concentrations are typically low in coarse sediments (see Eganhouse and Venkatesan 1993, Manahan 2000), while sulfides are known to react readily with many metals (see Clesceri et al. 1998). However, concentrations of a number of metals were highest at some stations with coarse sediments (e.g., the northern reference stations and the southernmost stations near the LA-5 disposal site). Northern station B13, for example, had the coarsest sediments and the largest concentrations of arsenic, chromium, selenium and iron, along with high concentrations of antimony and cadmium. Additionally high concentrations of aluminum, copper mercury and zinc were found in sediments near the LA-5 disposal site. In contrast, high concentrations of aluminum and manganese were measured at station B8, a site which has consistently had the highest percentage of silt and clay in the region. Clays consist largely of aluminum silicates, while manganese and iron are commonly associated with clay minerals (Manahan 2000).

Pesticides, PAHs and PCBs

DDT was the only pesticide detected in sediments sampled off Point Loma in 2001, though it was detected inconsistently (i.e., mostly in April and October) (Table 3.4). DDE, the final metabolic degradation product of DDT and the most prevalent form detected, had a distribution similar to that of the metals and organic indicators: increased levels to the north and south of the outfall pipe (compare Table 3.4 and Figures 3.3 and 3.4). Stations with p,p-DDE values higher than the median CDF for the Southern California Bight included northern stations E25, B8, B9 and B11, and southern stations E1, E2, E5 and E7. All values for total DDT were well below the 50% CDF value (10,000 ppt) for the Bight. Finally, no pesticides were detected near the outfall (i.e., station E14) and there were no patterns related to proximity to the PLOO.

Polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyl compounds (PCBs) were generally present at concentrations near or below method detection limits (MDL) during 2001 (see Appendix A.5 and A.6). Except for the occurrence of PCBs at station B11, and PAHs at station E21, these contaminants were primarily found at the southern stations E1, E2, E3, E5 and E9. Concentrations of both contaminants have been previously reported as relatively high in the area surrounding the LA-4 and LA-5 dredge disposal sites (see Anderson et al. 1993, City of San Diego 2000, 2001). There were no patterns that coincided with proximity to the PLOO.

SUMMARY

There were few temporal changes in shelf sediments off Point Loma during 2001 which may reflect the lack of storm activity and runoff affecting sediment input and resuspension during the year. The outer shelf was composed predominantly of very fine sands and coarse silt, and became slightly coarser with increasing depth. The coarsest sediments occurred at several of the northern reference stations, the southernmost stations near the LA-5 dredged material disposal site and other stations located near the outfall. Stations located near the outfall, and between the outfall and LA-5 contained variable amounts of ballast sand, coarse particles and shell hash which reflects the multiple sources of sediments within the region such as outfall construction, dredge disposal, Pleistocene deposits and recent detrital deposits.

The various indicators of organic loading demonstrated trends similar to previous years. The highest concentrations of several indicators occurred in sediments at the northern reference sites and sites near the LA-5 disposal site, while some of the lowest values were detected at stations near the PLOO. Only BOD and sulfide concentrations exhibited any apparent discharge effect, with values of both indicators typically higher nearest the outfall at station E14. However, similarly high BOD values were also detected at one of the northern reference stations (B13), while higher concentrations of sulfides were found near the LA-5 disposal site. Overall, sulfide values in 2001 were lower than previous post-discharge years and similar to those measured during the pre-discharge period.

Trace metals occurred in the highest concentrations at sites characterized by coarse sediments. This included the northern reference stations and stations near the LA-5 disposal site. The highest copper concentrations were found at stations near LA-5, and are probably associated with the disposal of dredged sediments from San Diego Bay. Such sediments often contain residues of copper-tainted antifouling paint, 70% of which may originate at Navy berths in the bay (Schiff and Cross 1992). The trace metals data did not indicate any clear trend of increasing concentrations with decreasing particle sizes. Generally, the accumulation of fine particles greatly influences the content of organic materials and metals in sediments (Eganhouse and Venkatesan 1993). Most metals occurred in concentrations well below the median values for sediments in the Southern California Bight.

DDE is the final metabolic degradation product of DDT, and is the most abundant derivative in the environment (Eganhouse and Venkatesan 1993). Its wide distribution is a result of the nearly unrestricted use of DDT from the early 1950s through 1971, and an indication of the inherent stability of DDT derivatives. A change in chemical analysis reporting methods (see Methods and Materials section) resulted in an increase in the overall detection rate of p,p-DDE. Stations with reportable values were therefore more widespread within the sampling region during 2001 than in previous years (e.g., CSD 2001). However, there were still no patterns related to proximity to the PLOO.

Values for PAHs and PCBs were generally near or below detection limits at all sampling sites. When detected, however, both PAHs and PCBs were typically found at stations located near the LA-5 dredge materials disposal site (i.e, stations E1, E2, E3, E5 and E9). Historically, concentrations of PAHs and PCBs have been higher at these southern stations than elsewhere off San Diego, and are most likely the result of misplaced deposits of dredged material that were originally destined for LA-5. Previous studies of PCBs in this area have been attributed to the deposits at LA-5 (Anderson et al. 1993). There were no patterns that coincided with proximity to the PLOO.

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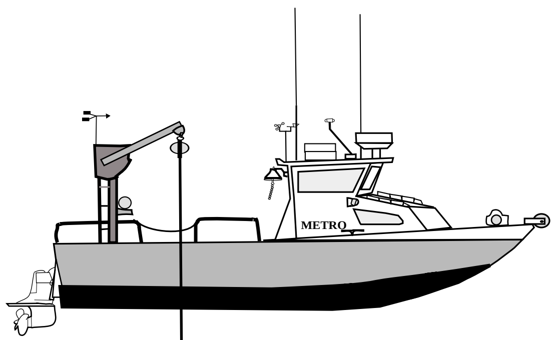
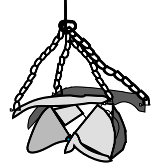


Benthic Infauna



Chapter 4. Benthic Infauna

INTRODUCTION

A major portion of the City of San Diego's Ocean Monitoring Program is designed to monitor the effects of the Point Loma Ocean Outfall (PLOO) on the local marine biota. Part of this program includes surveys of soft-bottom macrofaunal communities (i.e., benthic infauna) and their associated sediments and megafauna (i.e., demersal fish, megabenthic invertebrates). Assessment of changes in benthic community structure is a primary component of many marine monitoring programs, based largely on the premise that such changes may be correlated with the alteration of environmental conditions (Pearson and Rosenberg 1978). The data from such programs are used to document both existing conditions and changes in these conditions over time. However, in order to determine whether changes are related to anthropogenic or natural events, it is important to have documentation of background or reference conditions for an area. Such information is available for the PLOO discharge area (e.g., City of San Diego 1995) and the San Diego region in general (e.g., see City of San Diego 1995, 1999).

This chapter presents analyses and interpretation of the macrofaunal data collected during 2001 at fixed stations surrounding the PLOO discharge site off San Diego, California. Included are descriptions and comparisons of the soft-bottom infaunal assemblages in the area and analysis of benthic community structure.

MATERIALS & METHODS

Collection and Processing of Samples

Quarterly benthic samples were collected during January, April, July and October of 2001 at 21 stations surrounding the Point Loma Ocean Outfall (Figure 4.1). These stations are located along the 290, 320 and 380-ft depth contours (~88-116 m) and span the terminus of the outfall. The 15 "E" stations are located within 8 km north or south of the outfall, while the six "B" stations are located greater than 11 km north of the discharge site.

Samples for benthic community analysis were collected from two replicate 0.1 m^2 van Veen grabs per station during each survey. The criteria established by the United States Environmental Protection Agency (USEPA) to ensure the consistency of grab samples were followed with regard to sample disturbance and depth of penetration (USEPA 1987). All samples were sieved aboard ship through a 1.0 mm mesh screen. Organisms retained on the screen were relaxed for 30 minutes in a magnesium sulfate solution and then fixed in buffered formalin (see City of San Diego 2002). After a minimum of 72 hours, each sample was rinsed with fresh water and transferred to 70% ethanol. All organisms were sorted from the debris into major taxonomic groups by a subcontractor (MEC Analytical Systems, Inc., Carlsbad, California). The biomass for each sample was measured as the wet weight in grams for each of the following major groups: Polychaeta (Annelida), Crustacea (Arthropoda), Mollusca, Ophiuroidea (Echinodermata), non-ophiuroid Echinodermata, and all other phyla combined (e.g., Cnidaria, Platyhelminthes, Phoronida, Sipuncula, etc.). Values for ophiuroids (i.e., brittle stars) and all other echinoderms were combined to give a total echinoderm biomass. After biomassing, all animals were identified to species or the lowest taxon possible and enumerated by City of San Diego marine biologists.

Statistical Analyses

The following benthic community structure parameters were calculated for each station: (1) species richness (number of species per grab); (2) total number of species per station (i.e., cumulative of two replicate samples); (3) abundance (number of individuals per grab); (4) biomass (grams per grab, wet weight); (5) Shannon diversity index (H' per grab); (6) Pielou's

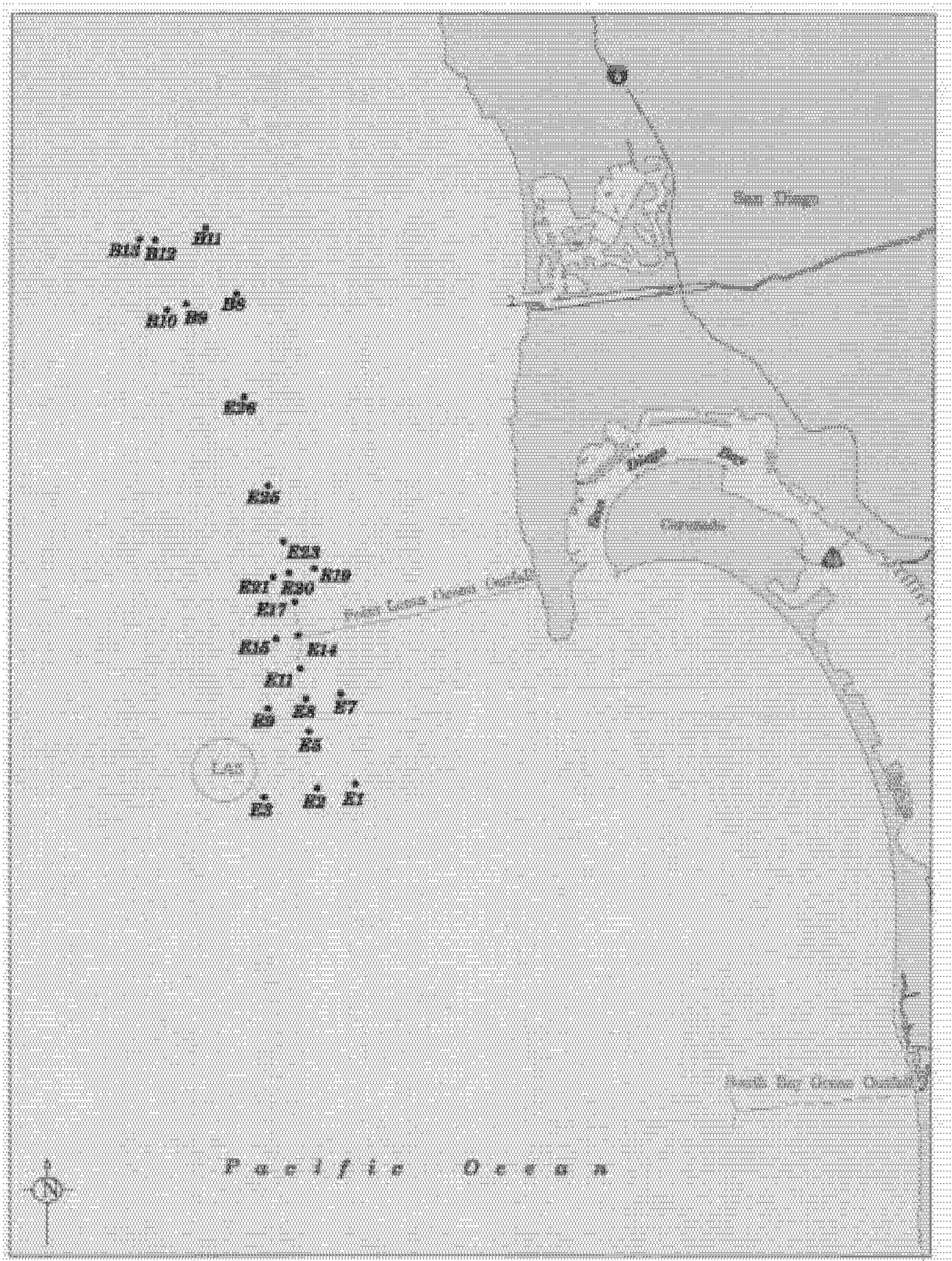


Figure 4.1
Benthic infauna stations surrounding the City of San Diego Point Loma Ocean Outfall.

evenness index (J' per grab); (7) Swartz dominance index (minimum number of species accounting for 75% of the abundance in each grab; see Swartz 1978); (8) Infaunal Trophic Index (ITI per grab; see Word 1980).

Ordination (principal coordinates) and classification (hierarchical agglomerative clustering) analyses were performed to examine spatio-temporal patterns in the overall similarity of benthic assemblages in the region during 2001. These analyses were performed using Ecological Analysis Package (EAP) software (see Smith 1982, Smith et al. 1988). The macrofaunal abundance data were square-root transformed and standardized by the species mean values greater than zero. Prior to analysis the data set was reduced by excluding any taxon that was represented by less than 10 individuals over all samples. The effect of such reductions on the outcome of subsequent analyses is negligible (see Smith et al. 1988).

A BACIP (Before-After-Control-Impact-Paired) statistical model was used to test the null hypothesis (H_0) that there were no changes in various community parameters due to operation of the Point Loma outfall (see Bernstein and Zalinski 1983, Stewart-Oaten et al. 1986, 1992, Osenberg et al. 1994). Briefly, the BACIP model tests differences between control (reference) and impact sites at times before (i.e., July 1991-October 1993) and after (i.e., January 1994-October 2001) an "impact" event (i.e., the onset of discharge). The analyses presented in this report are based on 2.5 years (10 quarterly surveys) of "Before Impact" data and eight years (32 quarterly surveys) of "After Impact" data. The "E" stations, located within 8 km of the outfall, are the most likely to be affected by the discharge. Station E14 was selected as the "impact" site for all analyses; this station is located nearest the Zone of Initial Dilution (ZID) and is probably the site most susceptible to impact. In contrast, the "B" stations are located farther from the outfall (>11 km) and are the obvious candidates for reference or "control" sites. However, benthic communities differed between the "B" and "E" stations prior to discharge (Smith and Riege 1994, City of San Diego 1995). Thus, two stations (E26 and B9) were selected to represent separate control sites in the BACIP tests. Station E26 is located ~8 km from the outfall and is considered the "E" station least likely to be impacted. Previous analyses suggested that station B9 was one of the most appropriate "B" stations for comparison with the "E" stations (Smith and Riege 1994, City of San Diego 1995). Six dependent variables were analyzed, including three community parameters (number of species, infaunal abundance, ITI) and abundances of three taxa that are considered sensitive to organic enrichment. These indicator taxa included ophiuroids in the genus *Amphiodia* (mostly *A. urtica*) and amphipods in the genera *Ampelisca* and *Rhepoxynius*.

All BACIP analyses were initially interpreted using a conventional Type I error rate of **a** = 0.05. However, the substantial spatial and temporal variation inherent in many biological communities may often lead to an increased chance of Type II error, i.e., falsely concluding that no impact has occurred when it actually has (e.g., Underwood 1990, Fairweather 1991, Otway 1995, Otway et al. 1996). One possible solution to this problem is to increase the probability of Type I error (i.e., falsely concluding that an impact has occurred) by changing the **a** from 0.05 to 0.10, thereby increasing the power of the tests and making the detection of "impacts" less conservative (Otway 1995, Otway et al. 1996). Consequently, all non-significant results at **a** = 0.05 were also interpreted using the higher Type I error rate of **a** = 0.10.

RESULTS

Community Parameters

Number of Species

A total of 647 infaunal taxa was identified during the 2001 PLOO surveys. Since the mean number of species per sample (Species Richness) and the cumulative number of species per site undergo similar patterns of change, only species richness is discussed herein. There was little change in species richness between 2000 and 2001 (Figure 4.2). During 2001, annual values averaged from 69 to 127 species per 0.1 m^2 sample (Table 4.1). As in previous years, the number of species was highest at stations generally characterized by coarser sediments. These sites

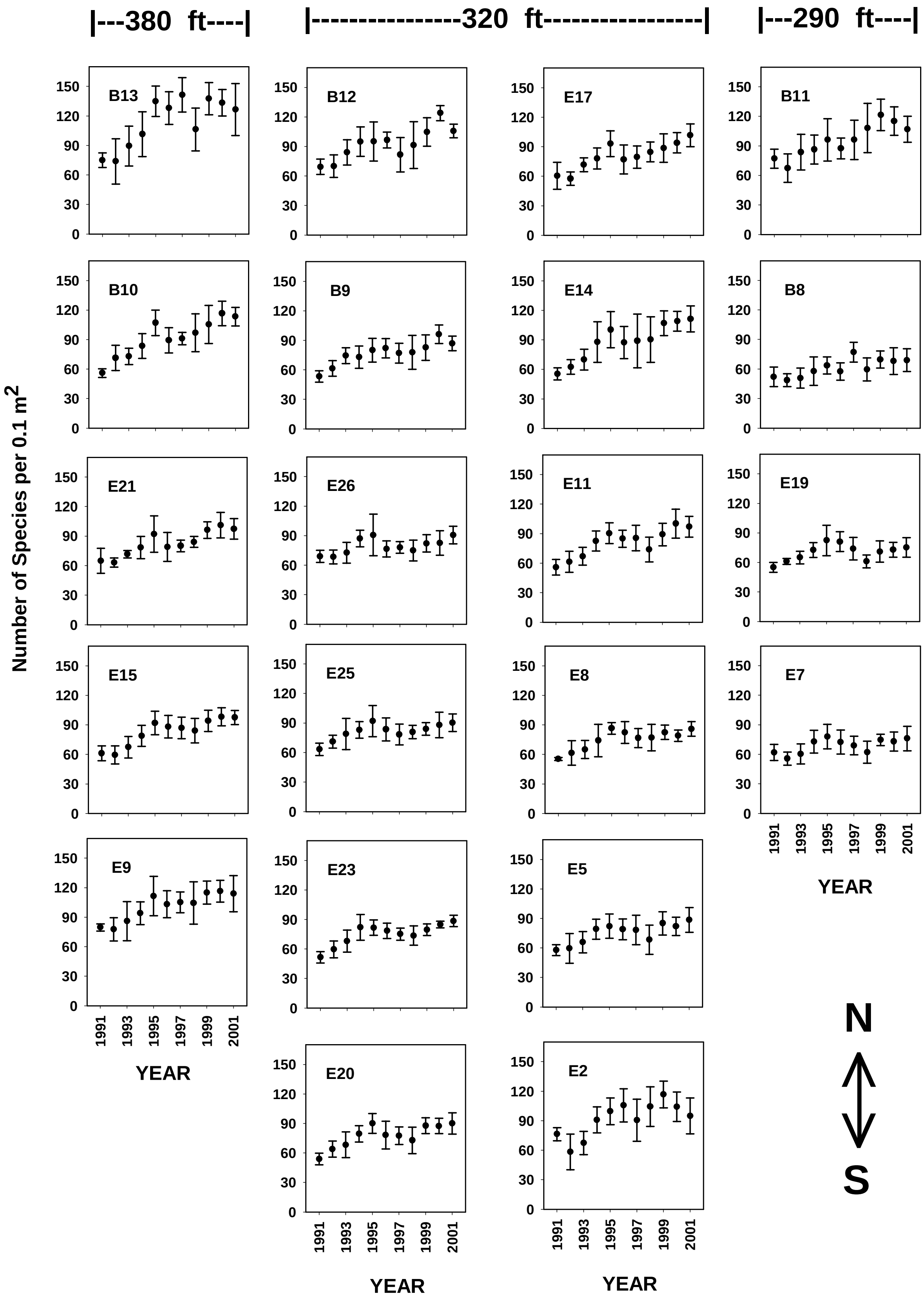


Figure 4.2

Number of species at the PLOO benthic stations from 1991-2001. Data are expressed as annual means ± 1 SD (n=4 for 1991; n=8 for each year from 1992-2001).

Table 4.1

Benthic infaunal community parameters at PLOO stations sampled during 2001. Data are expressed as annual means for: (1) species richness, no. species/0.1 m^2 (SR); (2) total no. species per site (Tot Spp); (3) abundance, no. of individuals/0.1 m^2 (Abun); (4) biomass, g/0.1 m^2; (5) diversity (H'); (6) evenness (J'); (7) Swartz dominance, no. species comprising 75% of a community by abundance (Dom); (8) infaunal trophic index (ITI).

	SR	Tot Spp	Abun	Biomass	H'	J'	Dom	ITI
290 ft stations								
B11	107	151	520	5.0	3.3	0.7	31	78
B8	69	98	348	8.1	3.0	0.7	14	89
E19	75	105	307	7.5	3.6	0.8	24	87
E7	76	109	326	4.8	3.4	0.8	21	89
320 ft stations								
B12	106	149	427	6.2	3.8	0.8	32	79
B9	87	121	316	9.2	3.7	0.8	28	83
E26	91	127	365	6.7	3.7	0.8	25	83
E25	90	126	366	6.7	3.7	0.8	26	86
E23	88	120	327	5.6	3.8	0.9	30	87
E20	90	123	354	7.5	3.7	0.8	28	87
E17	102	138	414	6.6	3.9	0.9	33	84
E14	111	152	577	3.8	3.8	0.8	28	74
E11	97	133	347	4.8	4.0	0.9	33	83
E8	86	117	342	4.6	3.7	0.8	28	88
E5	89	123	335	6.0	3.7	0.8	29	87
E2	95	133	302	4.9	3.9	0.9	35	87
380 ft stations								
B13	127	181	428	6.2	4.1	0.8	44	80
B10	113	154	372	4.5	4.2	0.9	42	78
E21	97	134	378	8.5	3.9	0.9	34	89
E15	98	133	382	4.2	3.9	0.9	31	86
E9	114	161	375	4.4	4.2	0.9	41	86
All Stations	96	133	376	6.0	3.8	0.8	30	84

included most of the "B" stations to the north (i.e., B10, B11, B12, B13), station E9 located near the LA-5 dredged material disposal site to the south, and station E14 located nearest the discharge site. In contrast, the fewest species occurred at northern station B8, which was characterized by the finest sediments in the region (see Chapter 3, Appendix B).

Polychaete worms were the most diverse of the taxa, comprising more than half the species (46-59%) at nearly all sites (Figure 4.3). Crustaceans represented the second most diverse taxon, accounting for 16-26% of the species at the different sites. Molluscs comprised 6-16% of the species per site, echinoderms accounted for 5-9%, and all remaining taxa represented 4-9%.

Infaunal Abundance

Mean abundance per station during 2001 ranged from 302 to 577 animals per sample (Table 4.1). The largest number of animals occurred at stations E14 and B11, both of which averaged over 500 animals per 0.1 m^2. Abundance was also relatively high at stations B13, B12 and E17 where annual averages were above 400 animals per grab. The remaining stations all averaged between 302 and 382 animals per sample. Overall,

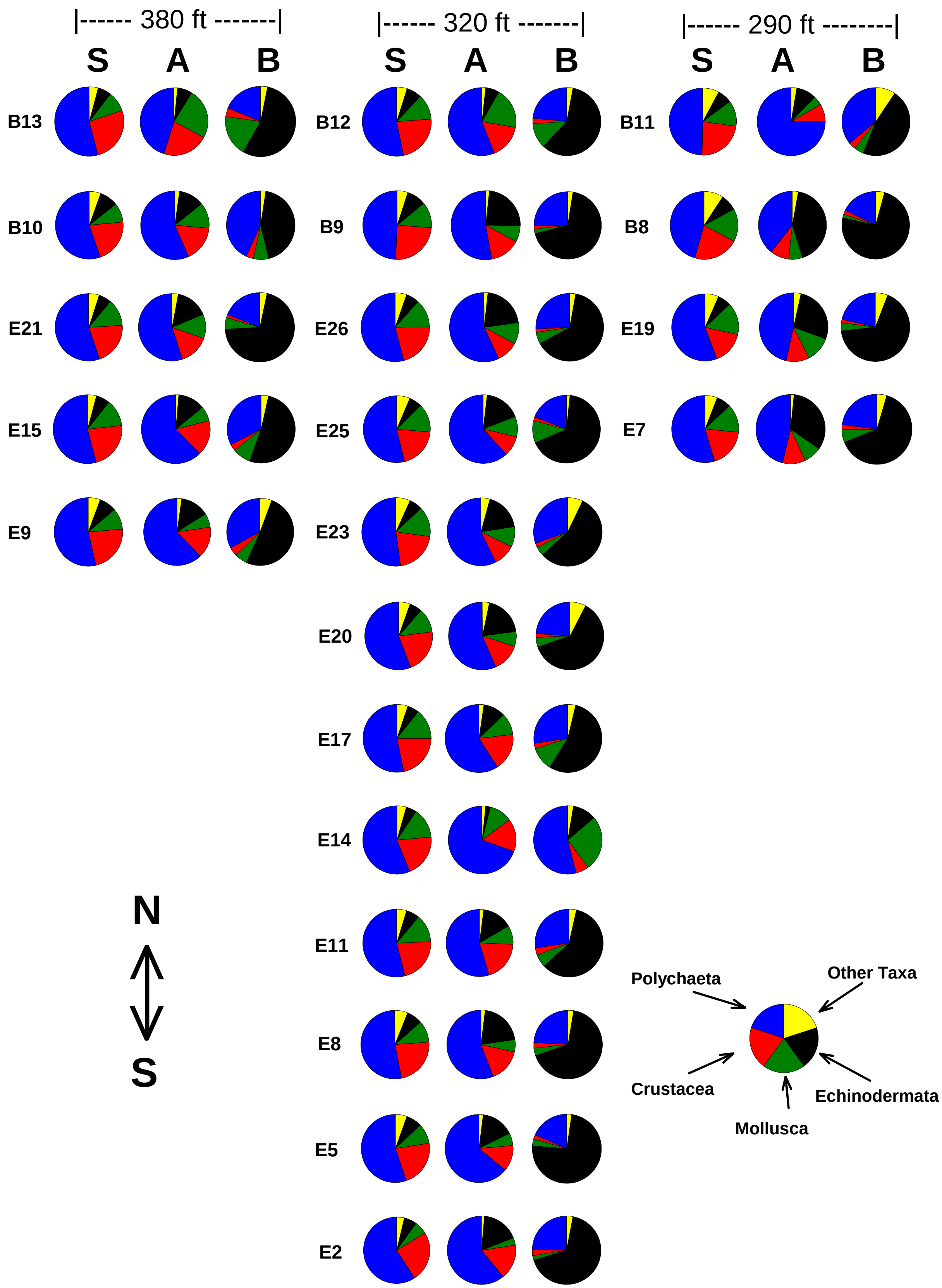


Figure 4.3
Mean percent composition of major taxa at the PLOO benthic stations during 2001. S = number of species; A = abundance; B = biomass.

mean abundances during 2001 were slightly lower at most stations than in 2000 (Figure 4.4).

Polychaetes were the most abundant organisms at most sites during the year, accounting for 39-75% of the animals (Figure 4.3). The only exception to this pattern occurred at station B8 where echinoderms (i.e., mostly ophiuroids) were co-dominants. Crustaceans comprised 8-22% of the assemblages, while echinoderms accounted for 2-42%, molluscs for 3-24%, and all other phyla combined for 1-4%. These values were generally similar to those reported for 2000 (see City of San Diego 2001).

Biomass
Mean biomass ranged from 3.8 to 9.2 g per 0.1 m^2 during 2001 (Table 4.1). These values are generally similar to those observed during previous years (e.g., City of San Diego 2001). Relatively high biomass values are typically due to the collection of large motile organisms such as sea urchins, sea stars, crabs and snails. Biomass composition has changed very little over the past few years (e.g., City of San Diego 2001). Echinoderms, represented mostly by ophiuroids, continue to account for most of the benthic biomass, comprising nearly 50% or more at most stations (Figure 4.3). The major exception to this pattern occurred at station E14 located nearest the outfall, where the benthic biomass was composed of 54% polychaetes and only 11% echinoderms. Overall, echinoderms comprised 11-74% of the biomass at a station, polychaetes 18-54%, crustaceans 1-6%, molluscs 2-26%, and the remaining taxa 2-9%.

Species Diversity and Dominance
Species diversity (H') varied little among stations during 2001 and was similar to that observed before discharge began. Average diversity values ranged from 3.0 to 4.2 during the year (Table 4.1). The highest diversity (H' 4.0) occurred at two of the northernmost stations (B10 and B13), station E9 located just north of the LA-5 dredge disposal site, and station E11 located just south of the PLOO discharge. Diversity was lowest (H' < 3.7) at stations along the 290-ft depth contour.

Species dominance was expressed as the Swartz 75% dominance index, the minimum number of species comprising 75% of a community by abundance. Consequently, lower index values (i.e., fewer species) indicate higher dominance. Benthic assemblages around the PLOO during 2001 were characterized by relatively high numbers of evenly distributed species, with no patterns associated with distance from the outfall. Dominance averaged 30 species per station during the past year compared to 28 species in 2000 and 19-32 species in previous years (see Table 4.1 and City of San Diego 2001). Evenness (J') values have also remained stable over time, with mean values ranging from 0.7 to 0.9 during 2001 (Table 4.1).

Infaunal Trophic Index (ITI)
Annual ITI values averaged from 74 to 89 per station in 2001 (Table 4.1). These values were slightly lower than those during 2000 which ranged from 76 to 93 (see City of San Diego 2001). The highest average values occurred at stations E21, E7 and B8, while the lowest value of 74 occurred at station E14 located nearest the discharge. Although lower ITI values have occurred at this near-ZID station since discharge began, the relatively "high" values (> 60) at this and all other sites are considered characteristic of undisturbed sediments or "normal" environmental conditions (see Bascom et al. 1979).

Dominant Species

The dominant taxa occurring off Point Loma during 2001 are listed in Table 4.2. The most abundant species was the ophiuroid *Amphiodia urtica*. Based on species level identifications, this brittle star averaged about 34 animals per 0.1 m^2. However, since juveniles cannot be identified to species and are usually recorded at the generic or familial level (i.e., *Amphiodia* sp or Amphiuridae, respectively), this number underestimates actual populations of *A. urtica*. The only other species of *Amphiodia* that occurred in the area was *A. digitata*, which accounted for about 7% of ophiuroids in the genus *Amphiodia* that could be identified to species (i.e., *A. urtica* = about 93%). Other amphiurid brittle stars accounted for less than 5% of the total. If the values for these taxa are adjusted accordingly, then the estimated population size for *A. urtica* at depths of 290-380 ft off Point Loma is about 52 animals per sample.

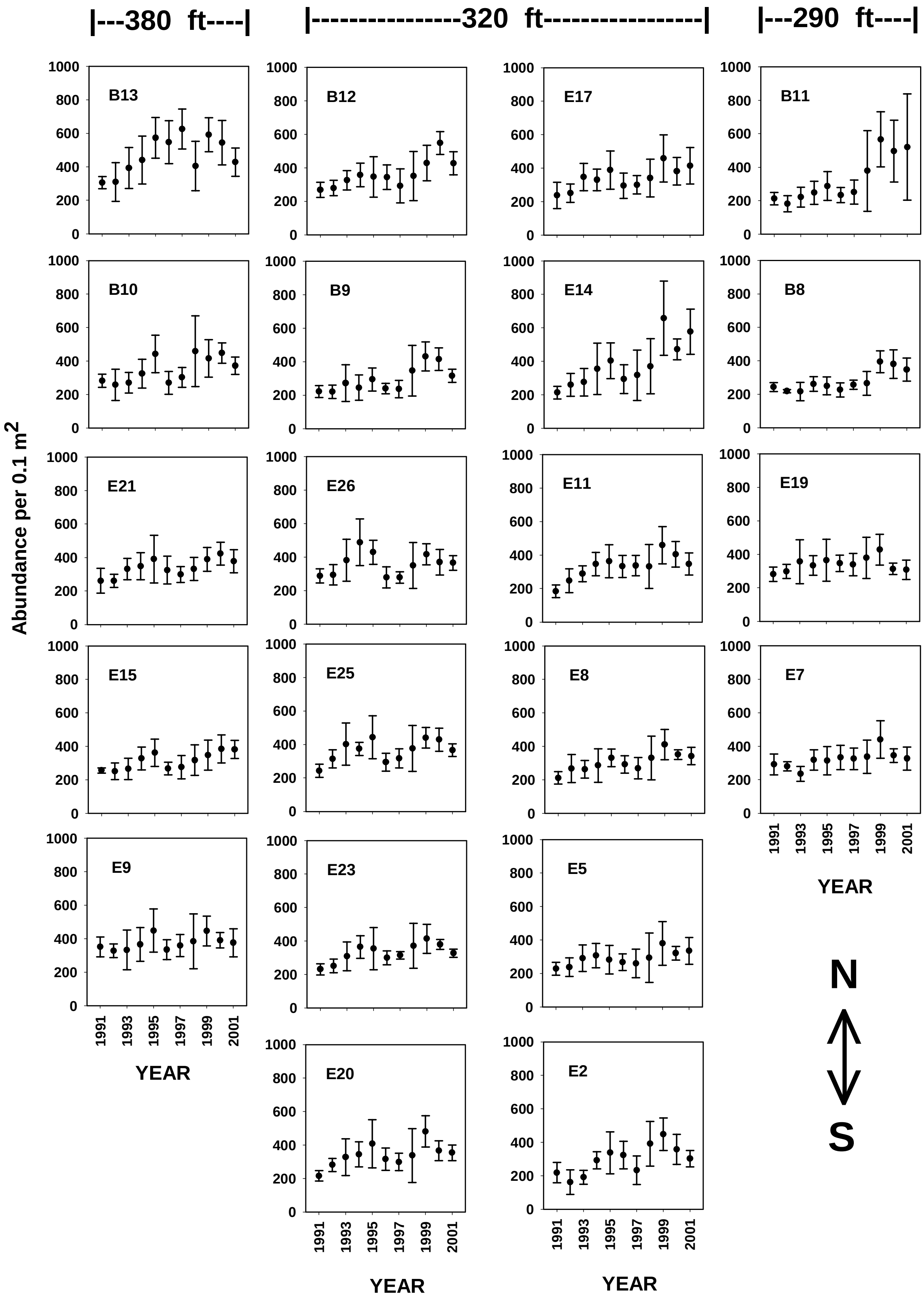


Figure 4.4

Abundance of infaunal organisms at the PLOO benthic stations from 1991-2001. Data are expressed as annual means ± 1 SD (n=4 for 1991; n=8 for each year from 1992-2001).

Table 4.2

Dominant macroinvertebrates at PLOO benthic stations sampled during 2001. Included are the 10 most abundant taxa overall and per occurrence, and the 10 most widely occurring taxa. Data are expressed as: (1) MS = mean number per 0.1 m^2 over all samples; (2) MO = mean number per 0.1 m^2 per occurrence; and (3) PO = percent occurrence.

Species	Higher taxa	MS	MO	PO
Top 10 Species per Survey				
1. *Amphiodia urtica*	Echinodermata: Ophiuroidea	33.5	35.7	94%
2. *Myriochele* sp M	Polychaeta: Oweniidae	32.8	34.9	94%
3. *Proclea* sp A	Polychaeta: Terebellidae	28.2	28.9	98%
4. *Amphiodia* sp †	Echinodermata: Ophiuroidea	15.6	15.6	100%
5. *Chaetozone hartmanae*	Polychaeta: Cirratulidae	10.6	10.7	99%
6. *Myriochele gracilis*	Polychaeta: Oweniidae	8.8	9.0	98%
7. *Polycirrus* sp A	Polychaeta: Terebellidae	7.7	7.8	99%
8. *Paradiopatra parva*	Polychaeta: Onuphidae	7.3	7.4	99%
9. *Parvilucina tenuisculpta*	Mollusca: Bivalvia	6.8	7.2	94%
10. *Euphilomedes carcharodonta*	Crustacea: Ostracoda	6.0	7.4	81%
Top 10 Species per Occurrence				
1. *Caecum crebricinctum*	Mollusca: Gastropoda	4.9	46.1	11%
2. *Amphiodia urtica*	Echinodermata: Ophiuroidea	33.5	35.7	94%
3. *Myriochele* sp M	Polychaeta: Oweniidae	32.8	34.9	94%
4. *Proclea* sp A	Polychaeta: Terebellidae	28.2	28.9	98%
5. *Amphiodia* sp †	Echinodermata: Ophiuroidea	15.6	15.6	100%
6. *Chaetozone hartmanae*	Polychaeta: Cirratulidae	10.6	10.7	99%
7. *Myriochele gracilis*	Polychaeta: Oweniidae	8.8	9.0	98%
8. *Polycirrus* sp A	Polychaeta: Terebellidae	7.7	7.8	98%
9. *Paradiopatra parva*	Polychaeta: Onuphidae	7.3	7.4	99%
10. *Euphilomedes carcharodonta*	Crustacea: Ostracoda	6.0	7.4	81%
Top 10 Widespread Species				
1. *Amphiodia* sp †	Echinodermata: Ophiuroidea	15.6	15.6	100%
2. Maldanidae †	Polychaeta: Maldanidae	4.2	4.2	100%
3. *Chaetozone hartmanae*	Polychaeta: Cirratulidae	10.6	10.7	99%
4. *Polycirrus* sp A	Polychaeta: Terebellidae	7.7	7.8	99%
5. *Paradiopatra parva*	Polychaeta: Onuphidae	7.3	7.4	99%
6. *Spiophanes fimbriata*	Polychaeta: Spionidae	5.0	5.0	99%
7. Amphiuridae †	Echinodermata: Ophiuroidea	4.7	4.8	99%
8. *Proclea* sp A	Polychaeta: Terebellidae	28.2	28.9	98%
9. *Myriochele gracilis*	Polychaeta: Oweniidae	8.8	9.0	98%
10. *Clymenura gracilis*	Polychaeta: Maldanidae	4.3	4.5	98%

† = unidentified juveniles and/or damaged specimens

Polychaetes of several families were also dominant members of benthic assemblages in the area. The most abundant polychaete was the oweniid *Myriochele* sp M, which averaged about 33 animals per 0.1 m^2. The terebellid *Proclea* sp A occurred in similar numbers, averaging approximately 28 individuals per grab. In addition, seven other polychaetes were among the 10 most abundant and 10 most widely occurring taxa during 2001. The remaining dominant species included the bivalve mollusc *Parvilucina tenuisculpta*, and the ostracod crustacean *Euphilomedes carcharodonta*. Finally, the gastropod *Caecum crebricinctum* occurred in relatively high densities at a small number of sites characterized by coarse sediments (e.g., stations B12 and B13).

Many of these abundant taxa were also dominant prior to and during the first seven years of outfall operation (e.g., City of San Diego 1999, 2001). For example, *A. urtica* has been the first or second most abundant and among the most commonly occurring taxa along the outer shelf since sampling began. In contrast, population densities of some numerically dominant polychaetes have been far more cyclical. For example, while *Myriochele* sp M and *Proclea* sp A were the most abundant polychaetes during 2001, their numbers have varied considerably over time (see Figure 4.5). Such variation can have significant effects on other descriptive statistics (e.g., dominance, diversity, abundance) and specific indicies such as ITI which use the abundance of "indicator" species (e.g., *Myriochele* sp M) in their equations.

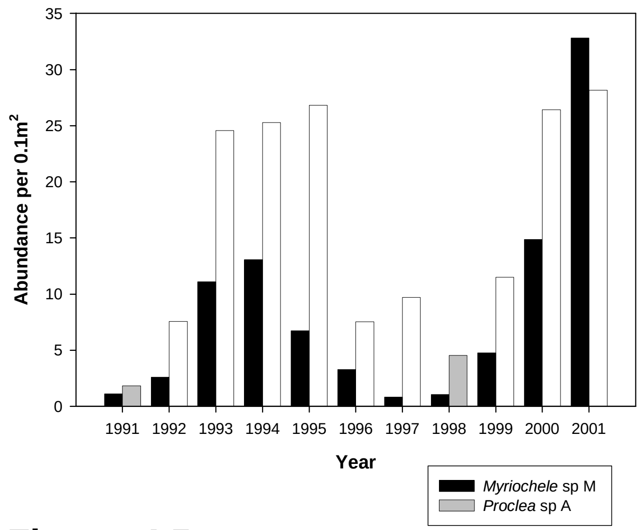


Figure 4.5

Average annual abundance of *Myriochele* sp M and *Proclea* sp A at the PLOO benthic stations from 1991-2001 (n=84 for 1991; n=168 for each year from 1992-2001).

BACIP Analyses

Significant differences were found between the "impact" site (station E14) and the "control" sites (stations E26 and B9) in seven out of twelve BACIP t-tests (Table 4.3). For example, there has been a net change in the mean difference between impact and control sites for species richness, ITI values and ophiuroid abundance (*Amphiodia* spp). The difference in species richness may be due to the increased variability and higher numbers of species at the impact site (Figure 4.6a). Results for *Amphiodia* populations mostly reflect a decrease in the number of these ophiuroids collected at the impact site since discharge began (Figure 4.6c). Similarly, the difference in ITI is due to a decrease in index values at station E14 since the outfall began operation (Figure 4.6e). These decreased ITI values may in part be explained by the lower numbers of *Amphiodia*. The results for infaunal abundances were more ambiguous (Figure 4.5b). Although a significant change was indicated between the impact site and station B9, no such pattern was found regarding the second "control" site (E26). Finally, there was no net change in the average difference between impact and control sites in numbers of phoxocephalid or ampeliscid amphipods (Figure 4.6d).

Classification of Benthic Assemblages

Classification of sites discriminated between seven habitat-related types of benthic assemblages off Point Loma during 2001 (Figure 4.7). The dominant species comprising each group are listed in Table 4.4. Overall, the distribution and structure of these assemblages were similar to that observed in previous years (e.g., City of San Diego 2001), with most sites segregating along gradients of sediment grain size and depth (see Appendix B).

The first split in the dendrogram separated the sites into two primary clusters, groups A-C versus groups D-G (see split 1 in Figure 4.7). Groups A, B and C represent assemblages that occurred in relatively fine sediments at sites located along the 290-ft or 320-ft depth contours. Sediments at these sites averaged at least 40% silt and clay and contained little or no extremely coarse particles (Table 4.5). These assemblages averaged fewer species and lower abundances than those included in groups D-G (Table 4.4).

Groups A, B and C separated from each other according to depth and differences in sediment composition. All four surveys of station B8 comprised group A, which is located along the 290-ft depth contour and was characterized by sediments with the highest average percent fines of any site. Group A had the lowest average species richness and was dominated overwhelmingly by the ophiuroid *Amphiodia urtica*, followed by the oweniid

Table 4.3

Results of BACIP t-tests for number of species, infaunal abundance, ITI, and the abundance of several representative taxa around the Point Loma Ocean Outfall (1991- 2001). Impact site (I) = near-ZID station E14; Control sites (C) = far-field station E26 or reference station B9. Before Impact period = July 1991 to October 1993 (n=10); After Impact period = January 1994 to October 2001 (n=32). Critical t value = 1.684 for α = 0.05 (one-tailed t-tests, n-2 = 40). H_0: ns = not significant (accept H_0); * = significant, $p < 0.05$ (reject H_0).

Variable	Comparison C vs I	Before Impact $\overline{\Delta}_b$	Before Impact $S^2_{\Delta b}$	After Impact $\overline{\Delta}_a$	After Impact $S^2_{\Delta a}$	t	H_0
Number of species	E26 vs E14	9.9	3.3	18.3	4.4	-3.044	*
	B9 vs E14	8.6	5.4	19.1	5.2	-3.222	*
Infaunal abundance	E26 vs E14	76.7	678.8	118.8	460.6	-1.250	ns
	B9 vs E14	75.0	349.7	142.2	539.2	-2.255	*
ITI	E26 vs E14	2.6	0.4	6.7	0.6	-3.997	*
	B9 vs E14	4.5	0.5	6.5	0.6	-1.797	*
Amphiodia spp	E26 vs E14	12.2	6.8	37.0	14.7	-5.346	*
	B9 vs E14	12.7	11.5	31.2	15.7	-3.555	*
Ampelisca spp	E26 vs E14	3.3	0.7	4.5	0.6	-1.042	ns
	B9 vs E14	3.8	0.8	4.4	0.5	-0.496	ns
Rhepoxynius spp	E26 vs E14	2.6	0.4	2.8	0.1	-0.279	ns
	B9 vs E14	2.8	0.2	3.1	0.2	-0.506	ns

polychaete *Myriochele* sp M and the terebellid polychaete *Proclea* sp A (Table 4.4). Groups B and C contained sites with similar sediment composition that separated according to depth. Group B included sites along the 290-ft contour while sites in group C were located along the 320-ft contour. Numerically dominant organisms revealed only subtle differences in assemblage structure between groups B and C. For example, although *Amphiodia urtica* and *Proclea* sp A were the two most abundant species in both groups, group B contained higher numbers of the ophiuroids and lower numbers of the terebellid worms. Two other polychaetes, *Myriochele* sp M and the cirratulid *Chaetozone hartmanae*, were also less abundant in group B than in group C.

Cluster groups D, E, F and G represent assemblages that occur at sites typically characterized by coarser sediments. For example, the stations in these groups had sediments that averaged less than 40% fines and contained large particles such as shell hash, gravel or coarse black sand (Table 4.5, Appendix B). The first split in this group separated groups D and E located near the discharge, from the more distant sites of groups F and G (split 2, Figure 4.7). Group D separated from group E based on relative distance from the discharge. Samples from nine sites surrounding the outfall terminus comprised group D. *Proclea* sp A and *Amphiodia urtica* were the two most abundant species in this group. Group E included only those samples collected nearest the outfall at station E14 and was dominated by *Myriochele* sp M., followed by the ostracod *Euphilomedes carcharodonta* and the terebellid polychaete *Polycirrus* sp A. This assemblage also included the polychaete *Capitella capitata*, an opportunistic species which, when present in high numbers, is considered an indicator of organic enrichment. The

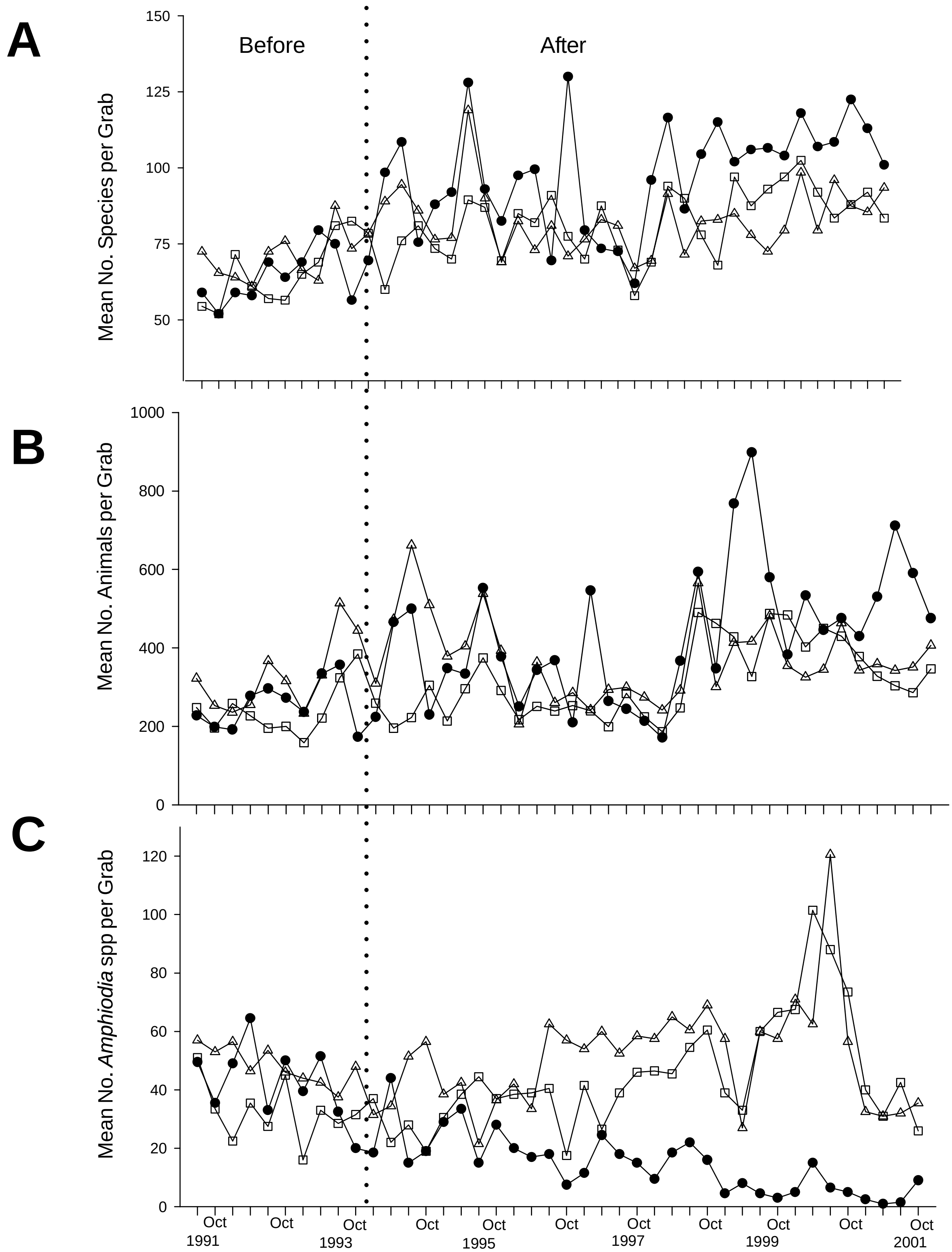


Figure 4.6

Comparison of several parameters at "impact" site (station E14) and "control" sites (stations E26, B9) used in BACIP analyses (see Table 4.3). Data for each station are expressed as quarterly means per 0.1 m^2 (n=2). (A) Number of infaunal species; (B) infaunal abundance; (C) abundance of *Amphiodia* spp (Ophiuroidea); (D) abundance of *Ampelisca* spp (Amphipoda); (E) infaunal trophic index (ITI).

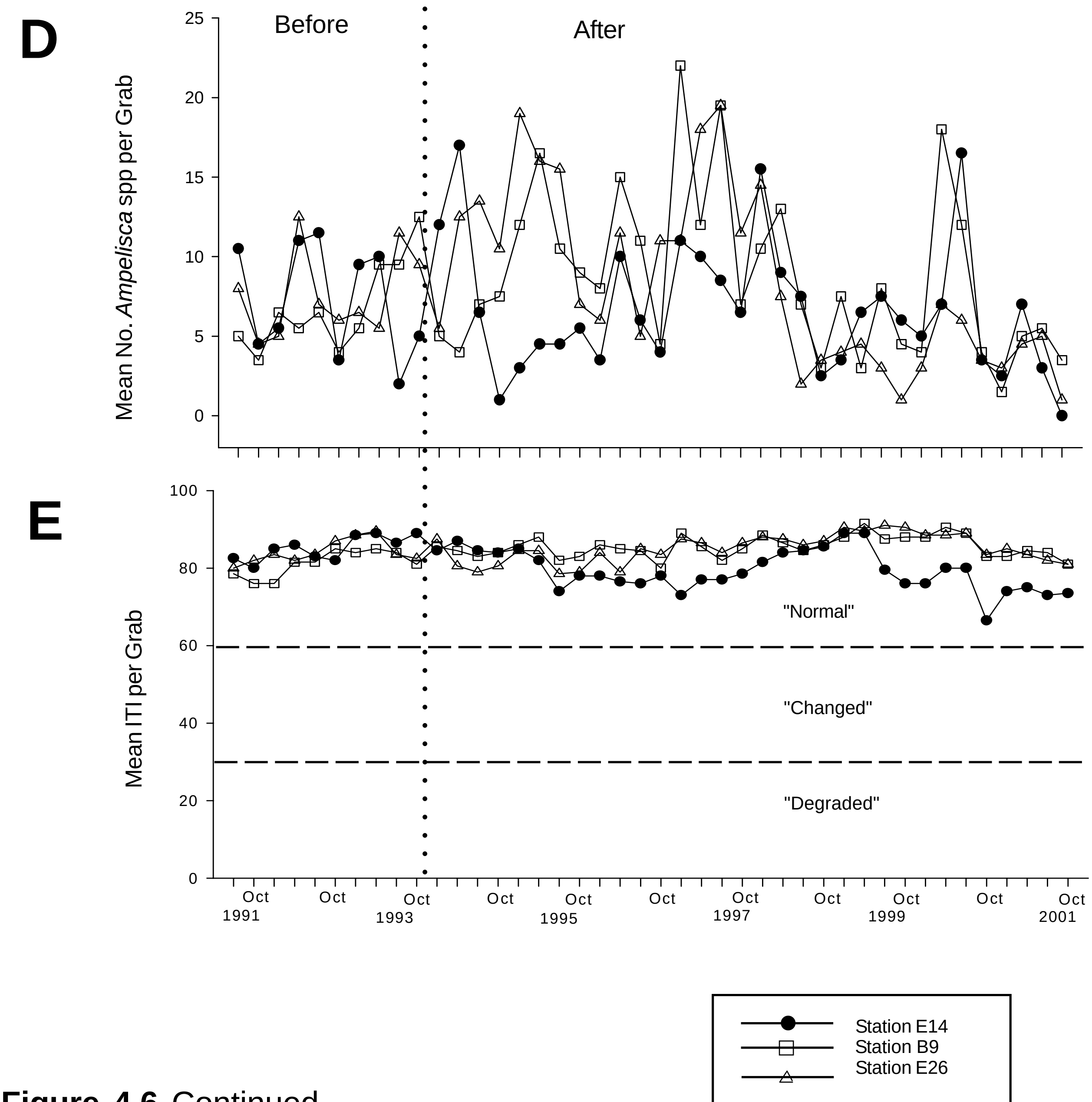


Figure 4.6 Continued

ophiuroid *Amphiodia urtica* was also present, but in considerably lower numbers than at other stations with similar sediments along the 320-ft depth contour.

Groups F and G contained the northern reference sites, exclusive of B8, and two southern stations located near the LA-5 disposal site. These two groups separated in split four of the dendrogram, with differences in sediment composition likely explaining the dissimilarity between the assemblages. Group F consisted of samples with finer sediments than those included in group G, and incorporated three northern stations (B9, B10 and B11) and two southern stations (E2, E9). The three most abundant species in this assemblage were *Myriochele* sp M, *Amphiodia urtica* and the cirratulid polychaete *Chaetozone hartmanae*. Group G comprised all samples from two of the northern reference stations, B12 and B13, which were characterized by the coarsest sediments in the area. These sites averaged the most species per sample and were dominated by species typical of coarse sediment habitats, including the gastropod *Caecum crebricinctum*, the polychaete *Myriochele* sp M, and the bivalve *Huxleyia munita*.

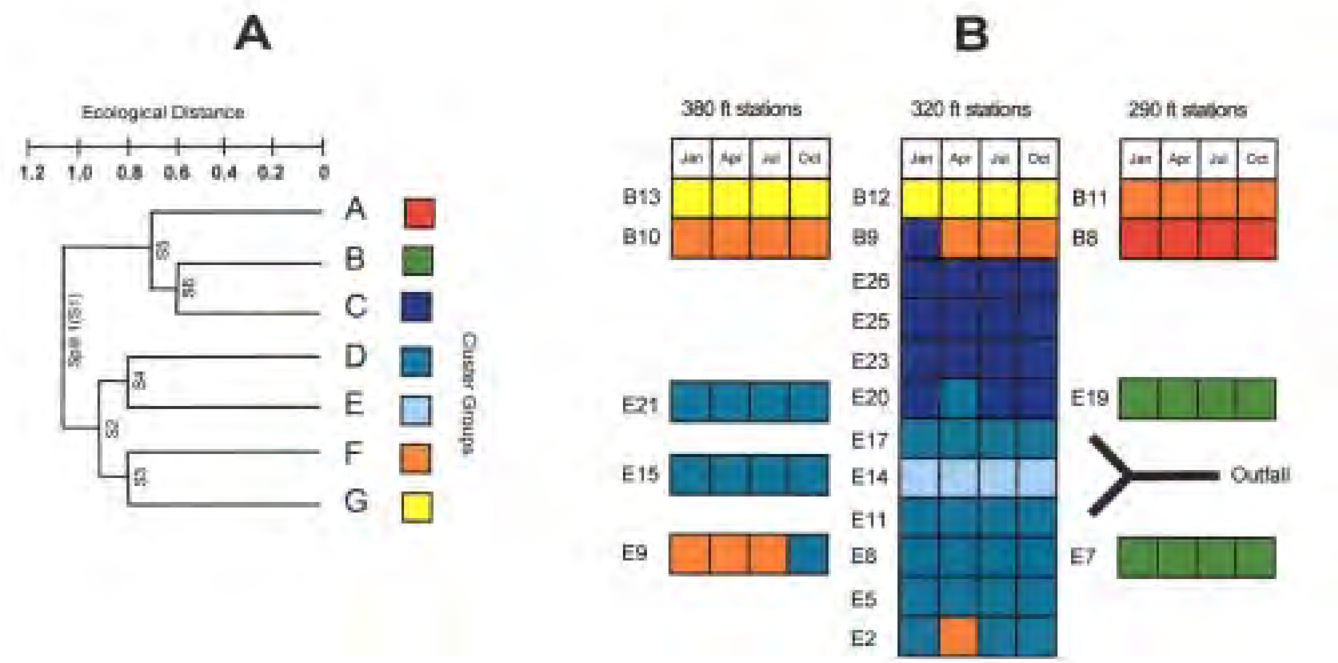


Figure 4.7
Results of pattern analyses of macrofaunal abundance data during 2001: (A) dendrogram of major cluster groups or assemblages; (B) quarterly distribution of stations among cluster groups.

DISCUSSION & SUMMARY

Benthic communities around the Point Loma Ocean Outfall continue to be dominated by ophiuroid-polychaete based assemblages, with few major changes having occurred since monitoring began (see City of San Diego 1995, 2001). Polychaete worms continue to dominate the fauna in numbers of species and abundance, while ophiuroids comprise the largest biomass fraction. Although many assemblages were dominated by similar species, the relative abundance of these species varied between sites. *Amphiodia urtica* was the most abundant and one of the most widespread benthic invertebrates in the region, being a dominant or co-dominant species in five of the seven assemblages described herein. Two species of polychaetes, the oweniid *Myriochele* sp M and the terebellid *Proclea* sp A, were also abundant at many sites. Assemblages similar to those surrounding the PLOO have been described for other areas in the Southern California Bight (SCB) by Barnard and Ziesenhenne (1961), Jones (1969), Fauchald and Jones (1979), Thompson et al. (1987, 1992, 1993), Zmarzly et al. (1994), Diener and Fuller (1995), and Bergen et al. (1998, 2001).

Although variable, benthic communities off Point Loma have generally remained similar between years in terms of the number of species, number of individuals, biomass, and dominance (City of San Diego 1995, 2001). In addition, values for these parameters are similar to those described for other sites throughout the SCB (e.g., Thompson et al. 1992, Bergen et al. 1998, 2001). In spite of this overall stability, comparisons of pre- and post-discharge data do indicate some general trends. There has been an overall increase in the number of species and infaunal abundances since discharge began. However, the increase in species has been most pronounced nearest the outfall, a pattern opposite that expected if environmental degradation were occurring. In addition, increases in abundance at most stations have been accompanied by decreases in dominance, patterns also inconsistent with predicted pollution effects. Whatever the cause, it seems clear

Table 4.4

Summary of the most abundant taxa comprising cluster groups A-G from the 2001 infaunal survey of PLOO benthic stations. Data are expressed as mean abundance per sample (no./0.1m^2) and represent the ten most abundant taxa in each group. Values for the three most abundant taxa (bolded) in each cluster group are underlined.

		Cluster Group						
Species/Taxa	Higher Taxa	A (n=4)	B (n=8)	C (n=16)	D (n=29)	E (n=4)	F (n=15)	G (n=8)
Amphiodia urtica	Echinodermata, Ophiuroidea	90.3	63.7	43.4	31.6	3.5	21.1	0.5
Rhepoxynius bicuspidatus	Crustacea, Amphipoda	8.0	7.8	5.3	6.1	4.0	2.5	0.4
Myriochele gracilis	Polychaeta, Oweniidae	5.4	7.9	11.4	8.8	14.3	8.8	3.6
Pectinaria californiensis	Polychaeta,Pectinariidae	1.3	7.2	3.2	1.8	3.3	2.0	2.5
Parvilucina tenuisculpta	Mollusca, Bivalvia	2.5	9.5	9.6	4.3	17.0	6.9	4.5
***Amphiodia* sp**	Echinodermata, Ophiuroidea	48.9	20.4	16.8	14.5	3.3	13.1	5.8
Sternaspis fossor	Polychaeta, Sternaspidae	9.0	4.8	6.6	5.2	4.3	9.4	0.8
Spiophanes fimbriata	Polychaeta, Spionidae	6.6	4.9	7.4	3.5	1.9	6.4	3.1
***Myriochele* sp M**	Polychaeta, Oweniidae	47.9	6.1	17.3	10.7	103.5	80.7	38.0
***Proclea* sp A**	Polychaeta, Terebellidae	16.5	29.7	37.6	41.0	23.3	10.1	3.4
***Polycirrus* sp A**	Polychaeta, Terebellidae	0.9	4.6	5.9	10.5	30.5	3.7	4.1
Chaetozone hartmanae	Polychaeta, Cirratulidae	1.0	3.8	11.7	11.6	19.3	14.8	3.8
Paradiopatra parva	Polychaeta, Onuphidae	3.1	4.6	8.3	7.4	8.0	7.7	8.9
Mediomastus sp	Polychaeta, Capitellidae	4.5	1.6	3.4	3.8	12.0	3.4	3.4
Amphiuridae	Echinodermata, Ophiuroidea	5.4	8.0	3.8	4.9	2.3	5.2	2.6
Euphilomedes producta	Crustacea, Ostracoda	0.5	0.5	0.5	4.7	7.0	5.0	6.5
Capitella capitata (=spp complex)	Polychaeta, Capitellidae	.	.	<0.1	0.7	18.3	0.2	0.2
Euphilomedes carcharodonta	Crustacea, Ostracoda	.	1.8	1.0	8.3	39.6	0.7	7.6
Chloeia pinnata	Polychaeta, Amphinomidae	0.3	1.8	0.6	1.2	12.8	1.6	7.9
Amphiodia digitata	Echinodermata, Ophiuroidea	0.5	.	0.5	1.0	0.4	4.4	13.5
Fauveliopsis sp SD1	Polychaeta, fauveliopsidae	.	.	.	.	.	0.9	7.8
Huxleyia munita	Mollusca, Bivalvia	.	.	.	2.6	2.5	1.4	17.3
Urothoe varvarini	Crustacea, Amphipoda	.	.	.	<0.1	.	0.8	10.9
Caecum crebricinctum	Mollusca, Gastropoda	.	.	.	.	.	0.1	51.8
Mean number of species per sample		68.9	75.6	89.7	93.7	111.3	107.9	116.1
Mean number of individuals per sample		347.8	316.8	349.7	356.8	577.0	402.1	427.3

Table 4.5

Average sediment composition and depth for groups A-G derived from cluster analysis of macrofaunal abundance data for the PLOO stations in 2001. Data are expressed as means over all stations in each group (see Figure 4.6); Fines = silt + clay; CSF=coarse sieved fraction (i.e., particles > 1.0 mm); ranges in parentheses are for individual replicate samples.

Cluster Group	Depth (ft)	Mean Phi	CSF (%)	Sand (%)	Fines (%)
A	**292**	**4.7**	**0**	**40.7**	**59.3**
(n=4)	(289-294)	(4.6-4.8)		(39.0-41.9)	(58.1-61.0)
B	**291**	**4.2**	**0**	**59.1**	**40.8**
(n=8)	(287-294)	(3.7-4.5)		(48.6-78.2)	(21.8-51.3)
C	**320**	**4.2**	**0.3**	**58.2**	**41.5**
(n=16)	(317-324)	(3.9-4.5)	(0-4.2)	(51.9-70.6)	(29.4-48.1)
D	**338**	**3.9**	**1.5**	**66.9**	**31.6**
(n=29)	(317-383)	(3.4-4.2)	(0-15.3)	(47.9-81.2)	(17.6-41.7)
E	**320**	**3.6**	**4.8**	**70.5**	**24.7**
(n=4)	(318-321)	(3.2-3.9)	(1.4-7.3)	(62.4-87.1)	(11.5-32.3)
F	**341**	**3.9**	**7.5**	**53.5**	**39.0**
(n=15)	(289-388)	(3.1-4.5)	(0-20.5)	(37.8-77.1)	(22.9-52.8)
G	**349**	**2.6**	**4.7**	**75.5**	**19.7**
(n=8)	(319-382)	(1.3-3.9)	(1.5-9.4)	(60.5-93.1)	(2.8-36.5)

that benthic communities around the PLOO are not numerically dominated by a few pollution tolerant species. There also was no pattern in total biomass that would suggest an outfall effect. However, there has been a shift in biomass composition near the outfall, with the relative contribution of echinoderms decreasing and that of polychaetes increasing since the onset of discharge.

Other changes near the outfall may also suggest some effects coincident with anthropogenic activities. For example, the increased variability in number of species and infaunal abundance at near-ZID station E14 since discharge began may be indicative of community destabilization (see Warwick and Clarke 1993, Zmarzly et al. 1994). Also indicative of organic enrichment or disturbance was a decrease in the infaunal trophic index (ITI) at station E14 after discharge began. However, ITI values at this and all other sites are still characteristic of undisturbed areas. Finally, the instability or patchiness of sediments near the PLOO and the corresponding shifts in assemblages suggest that changes in this area may be related to localized physical disturbance (e.g., shifting sediment types) associated with the structure of the outfall pipe as well as to organic enrichment associated with the discharge of effluent.

Populations of some indicator taxa revealed changes that correspond to organic enrichment near the outfall, while populations of others revealed no evidence of impact. For example, there has been a significant change in the difference between ophiuroid (*Amphiodia* spp) populations that occur near the outfall (i.e., station E14) and those present at reference sites. This difference is due mostly to a decrease in numbers of ophiuroids near the outfall as compared to those at the “control” sites during the post-discharge period. Although changes in *Amphiodia* populations at E14 are likely to be related to organic enrichment, they may also be due in part to increased predation pressure from fish living near the outfall pipe. Whether or not these changes are related to enrichment, predation, changing sediment composition or some other factor, abundances of *Amphiodia* off Point Loma are still within the range of those occurring naturally in the SCB. Recent increases in populations of the bivalve *Parvilucina tenuisculpta*, the ostracod *Euphilomedes carcharodonta* and the polychaete *Capitella* "*capitata*" also suggest a slight enrichment effect near the outfall, although densities of these organisms are still characteristic of natural environmental conditions (see Stebbins and Groce 2001). In addition, natural population fluctuations of these and other resident organisms (e.g. *Myriochele* sp M and *Proclea* sp A) are common off San Diego (Zmarzly et al. 1994, Stebbins and Pasko in prep). Further complicating the picture, patterns of change in populations of pollution sensitive amphipods (i.e., *Rhepoxynius, Ampelisca*) have shown no outfall-related effects.

While it is difficult to detect specific effects of the Point Loma Ocean Outfall on the offshore benthos, it is possible to see some changes occurring near the discharge site (i.e., at station E14). Perhaps because of the minimal extent of these changes, it is not possible at this time to determine whether any effect is due to the physical structure of the outfall or to organic enrichment associated with the discharge of effluent. Such impacts have spatial and temporal dimensions that vary depending on a range of biological and physical factors. In addition, abundances of soft-bottom invertebrates exhibit substantial spatial and temporal variability that may mask the effects of any disturbance event (Morrisey et al. 1992a, 1992b, Otway 1995). The effects associated with the discharge of advanced primary treated (APT) and secondary treated sewage may also be negligible or difficult to detect in areas subjected to strong currents that facilitate the dispersion of the wastewater plume (see Diener and Fuller 1995). The high level of wastewater treatment (APT), combined with an increased minimum dilution factor of 204:1 (vs. 113:1 at the old outfall), and the deepwater location of the discharge may decrease the chances that the PLOO will significantly impact the nearby benthos. The minimal impact reported for the original shallower discharge area off Point Loma supports this conclusion (e.g., Zmarzly et al. 1994). Although some changes in benthic assemblages have appeared near the outfall, assemblages in the near-ZID area and beyond are still similar to those observed prior to discharge and to natural indigenous communities characteristic of the southern California outer continental shelf.

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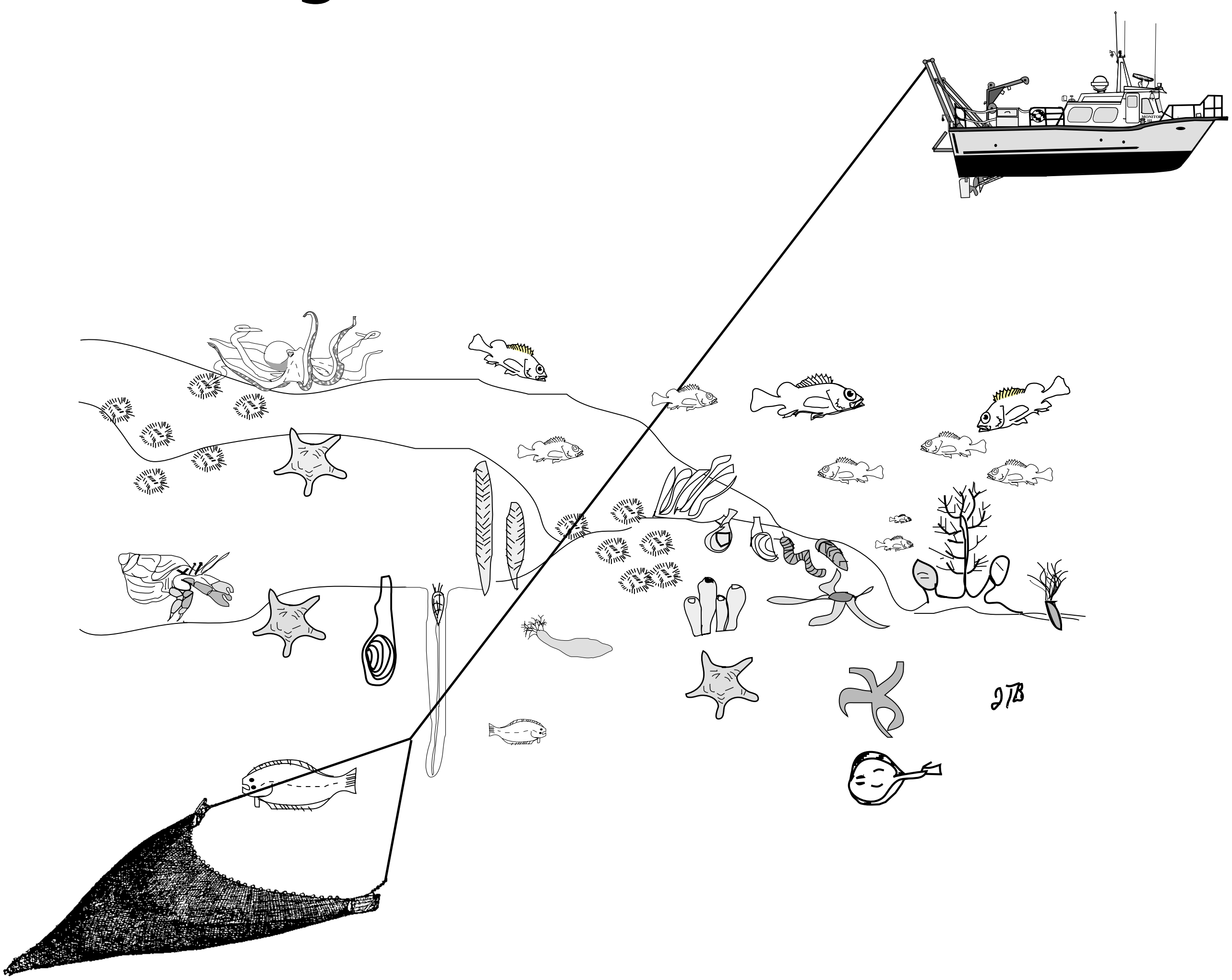
Demersal Fishes and Megabenthic Invertebrates



Chapter 5. Demersal Fishes and Megabenthic Invertebrates

INTRODUCTION

Demersal fishes and megabenthic invertebrates are conspicuous components of soft-bottom habitats of the mainland shelves and slopes off southern California. More than 100 species of fish inhabit the Southern California Bight (SCB) (Allen 1982, Love et al. 1986, Allen et al. 1998), while the invertebrate fauna consists of more than 200 species (Allen et al. 1998). For the Point Loma region off San Diego, the most common trawl-caught fishes include Pacific sanddab, longfin sanddab, Dover sole, hornyhead turbot, California tonguefish, plainfin midshipman and yellowchin sculpin. The common trawl-caught invertebrates include relatively large species such as sea urchins and sea stars.

Bottom dwelling fish and invertebrate communities have become an important focus of monitoring programs throughout the world. For example, these organisms have been sampled extensively on the SCB mainland shelf for more than 30 years, primarily by programs associated with municipal wastewater and power plant discharges (Cross and Allen 1993). Although much is known about the condition of these assemblages (e.g, Allen et al. 1998), additional studies are useful in documenting community structure and stability, and may provide insight into the effects associated with anthropogenic and natural influences.

The City of San Diego's Ocean Monitoring Program was designed to monitor the effects of the Point Loma Ocean Outfall (PLOO) on the local marine biota. This chapter presents analyses and interpretation of demersal fish and megabenthic invertebrate data collected under this program during 2001. A long-term analysis of changes in these communities from January 1992 through October 2001 is also presented.

MATERIALS & METHODS

Sampling

A total of 38 trawls were performed during four surveys off Point Loma in 2001. These surveys were conducted at three inshore stations (SD1, SD3, SD6) during January and July and at eight offshore stations (SD7 - SD14) during January, April, July and October (Figure 5.1). The inshore stations are located along the 200-ft (~ 60 m) depth contour, while the offshore stations are located along the 330-ft (~100 m) contour. The trawling area extends from about eight km north to nine km south of the outfall. Demersal fishes and megabenthic invertebrates were collected at each station using a 7.6 m Marinovich otter trawl with a 1.3 cm cod-end mesh (Mearns and Allen 1978). A single trawl was performed at each site during a survey. The net was towed for 10 minutes (bottom time) at 2.5 knots following a predetermined heading. The methodology for locating stations and trawling are described in the City's Quality Assurance Manual (City of San Diego 2002).

Trawl catches were brought on board for sorting and inspection. All fishes and invertebrates were identified to the lowest taxon possible and enumerated aboard ship by staff marine biologists. Animals that could not be identified in the field were returned to the laboratory for further identification. Total abundance and biomass (wet weight, kg) were recorded for each fish species, and each individual was inspected for the presence of external parasites and physical anomalies (e.g., tumors, fin erosion, discoloration). Each fish was individually measured or size-classed to the nearest centimeter according to protocols described in City of San Diego (2002). Invertebrate biomass was generally measured as a composite wet weight (kg) of all species combined due to the small size of most organisms. However, when larger species were collected, they were weighed separately. In addition,

Figure 5.1
Otter trawl station locations surrounding the City of San Diego Point Loma Ocean Outfall.

Table 5.1

Demersal fish species collected in 38 trawls off Point Loma, San Diego during 2001. Data for each species are expressed as: (1) mean abundance per haul (MAH); (2) percent abundance (PA); (3) frequency of occurrence (FO).

Species	MAH	PA	FO	Species	MAH	PA	FO
Pacific sanddab	174	63	100	Slender sole	<1	<1	13
Yellowchin sculpin	27	10	92	Spotfin sculpin	<1	<1	11
Longfin sanddab	22	8	84	Unidentified rockfish	<1	<1	11
Longspine combfish	14	5	82	Shiner perch	<1	<1	5
Plainfin midshipman	7	3	89	Squarespot rockfish	<1	<1	5
Dover sole	6	2	84	Bluespotted poacher	<1	<1	5
California tonguefish	5	2	89	Flag rockfish	<1	<1	5
Pink seaperch	4	2	61	Pygmy poacher	<1	<1	5
Stripetail rockfish	3	1	58	Bigfin eelpout	<1	<1	3
California scorpionfish	2	1	61	Blackbelly eelpout	<1	<1	3
Bigmouth sole	2	1	71	Curlfin sole	<1	<1	3
English sole	1	<1	45	Unidentified flatfish	<1	<1	3
Bay goby	1	<1	42	Greenspotted rockfish	<1	<1	3
Roughback sculpin	1	<1	29	Greenstriped rockfish	<1	<1	3
Hornyhead turbot	1	<1	29	Lingcod	<1	<1	3
Shortspine combfish	1	<1	26	Pacific argentine	<1	<1	3
White croaker	1	<1	16	Pacific hagfish	<1	<1	3
Halfbanded rockfish	1	<1	16	Red bortula	<1	<1	3
California lizardfish	<1	<1	21	Specklefin midshipman	<1	<1	3
Greenblotched rockfish	<1	<1	21	Spotted ratfish	<1	<1	3
California skate	<1	<1	16	Starry rockfish	<1	<1	3
Spotted cuskeel	<1	<1	16				

Table 5.2

Summary of demersal fish community parameters sampled during 2001. Data are expressed as (1) total number of species; (2) mean number of species; (3) mean abundance; (4) mean diversity (H'); (5) mean biomass (BM) (kg, wet weight).

	Number of Species				
Station	Total	Mean	Abund	H'	BM
Inshore (n=2)					
SD1	17	13	190	1.7	5.9
SD3	19	14	126	2.0	5.1
SD6	15	13	194	1.8	4.4
Offshore (n=4)					
SD7	22	12	175	1.3	4.7
SD8	21	11	140	1.1	2.8
SD9	17	12	344	1.2	5.6
SD10	25	14	336	1.0	4.8
SD11	20	13	389	1.5	5.8
SD12	26	13	279	1.1	6.1
SD13	22	13	409	1.0	4.6
SD14	20	12	285	0.9	4.1

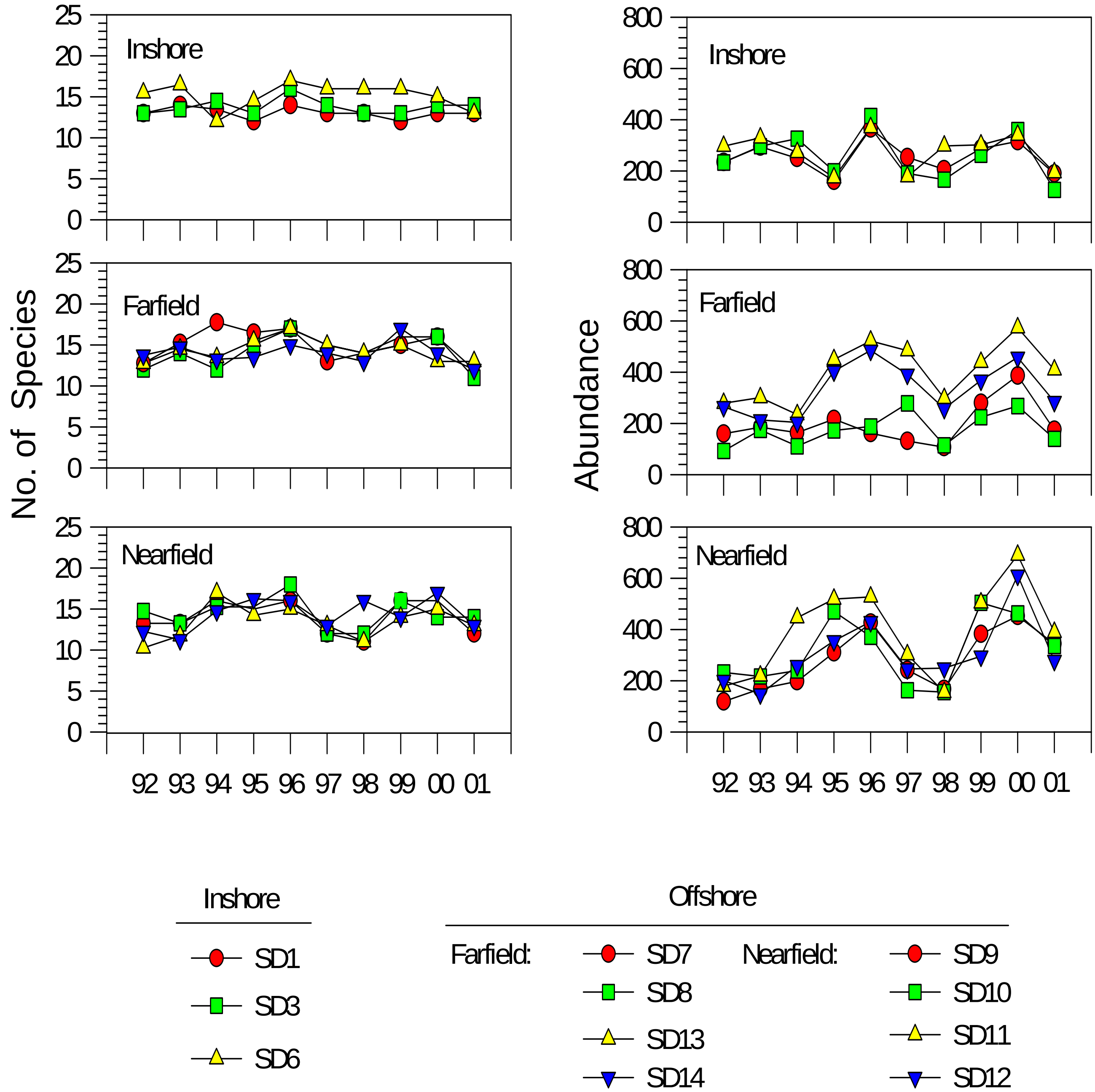


Figure 5.2

Annual mean number of fish species and abundance per station, 1992 through 2001. Inshore stations, n=2; offshore stations, n=4.

when the echinoid *Lytechinus pictus* was collected in large numbers, its abundance was estimated by multiplying the total number of individuals per 1.0 kg subsample by the total biomass.

Data Analyses

The community patterns present in 2001 were evaluated, and then compared to those from 1992 through 2000 for a long-term analysis. For spatial comparisons, the region was divided into inshore and offshore areas based on the proximity of the trawling sites to the PLOO. Stations SD1, SD3 and SD6 represented the inshore region, while stations SD7 - SD14 comprised the offshore sites. The eight offshore stations were further divided into two subgroups for the long-term comparisons: (1) "nearfield" stations (SD9, SD10, SD11, SD12), located within 1.2 km of

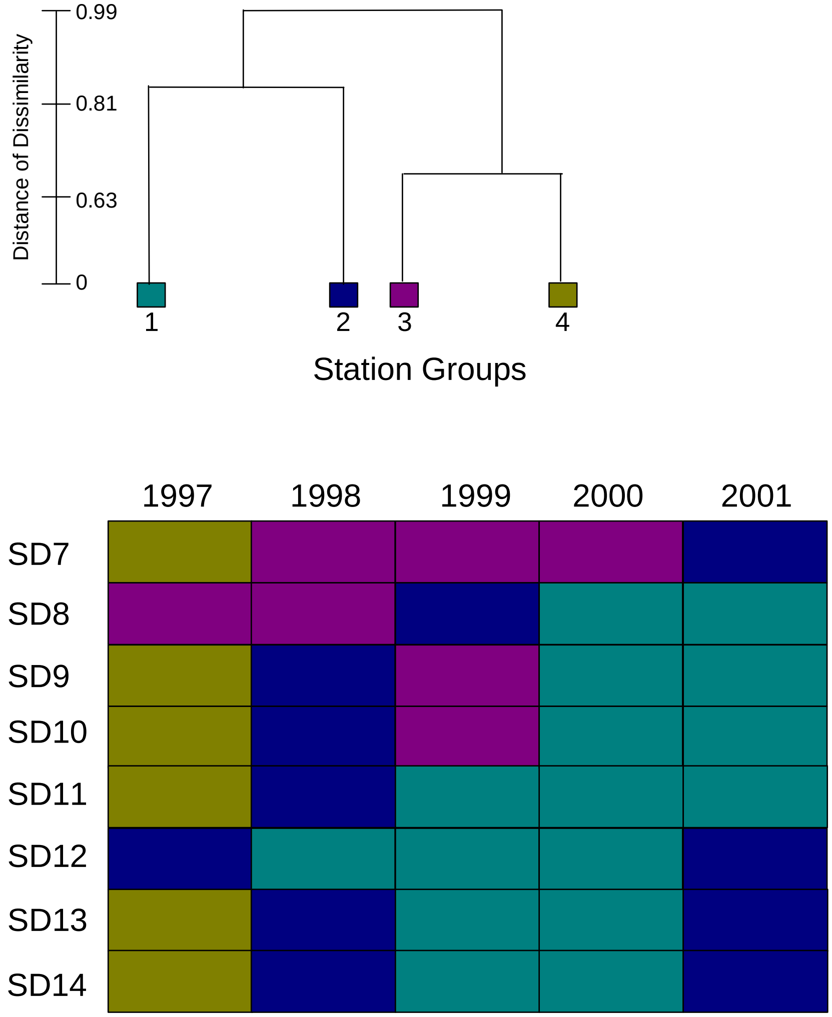


Figure 5.3

Classification analyses of demersal fish collected from offshore stations sampled during October from 1997 through 2001. Data are presented as a dendrogram of major station groups and a matrix showing distribution over time.

the outall; (2) "farfield" stations (SD7, SD8, SD13, SD14), located from 5 - 9 km from the outfall.

The mean abundance per haul (number per species/ total number of trawls), percent abundance (number per species/total number caught), and frequency of occurrence (number of occurrences for each species/ total number of trawls) were calculated for each fish and invertebrate species collected in 2001. In addition, the following parameters were calculated by station for both the fish and invertebrate communities: (1) species richness (number of species); (2) abundance (number of individuals); (3) Shannon diversity index (H'); (4) biomass (wet weight; in kg.).

Ordination (principal coordinates) and classification (hierarchical agglomerative clustering) analyses were performed on data from the offshore stations to examine spatio-temporal patterns in the similarity of demersal fish assemblages. Data were limited to the past five years (1997-2001) and to species that occurred more than four times to facilitate data handling. In addition, analyses were run using data collected from the October surveys only in order to exclude any seasonal effects. The total abundance per trawl for each species was used in these analyses, using data which were square-root transformed and standardized by species mean of values greater than zero. All analyses were performed using Ecological

Table 5.3

Summary of the main station cluster groups for October, 1997-2001. Data include number of hauls, mean number of species, mean number of individuals, as well as the distribution of abundant and frequently occurring fish species in each group.

	SG1	SG2	SG3	SG4
Number of hauls	16	11	7	6
Mean no. of species per haul	15	13	16	11
Mean no. of individuals per haul	490	220	387	306
Species		**Mean Abundance**		
Pacific sanddab	244.8	120.4	159.6	118.0
Yellowchin sculpin	78.9	33.5	40.6	80.7
Longspine combfish	57.4	5.4	8.3	—
Longfin sanddab	45.3	29.2	32.6	63.7
Stripetail rockfish	11.1	1.7	6.9	0.7
California tonguefish	9.8	3.7	11.6	7.3
Dover sole	8.6	1.1	0.7	—
Plainfin midshipman	7.7	7.1	3.6	1.5
Pink seaperch	4.3	1.4	8.6	1.3
English sole	4.3	1.5	1.3	0.7
California lizardfish	3.8	3.5	0.4	0.3
California scorponfish	3.3	1.2	0.3	0.8
Bigmouth sole	3.1	0.8	1.4	1.8
Halfbanded rockfish	2.5	3.5	94.7	0.7
Pacific argentine	1.1	0.6	4.7	15
Bay goby	0.7	1.2	2.0	6.3
Hornyhead turbot	0.4	0.8	1.3	1.0
Roughback sculpin	0.1	0.2	4.0	4.7

Analysis Package (EAP) software (see Smith 1982, Smith et al. 1988).

RESULTS & DISCUSSION

Fish Community

Forty-one species of fish were identified for the area surrounding the Point Loma Ocean Outfall in 2001, with a total catch of 10,441 individuals (Table 5.1 and Appendix C). The Pacific sanddab was the dominant species, accounting for 63% of all fish captured during the year and occurring in 100% of the trawls. Other frequently occurring species included yellowchin sculpin, longfin sanddab, longspine combfish, plainfin midshipman, Dover sole, California tonguefish, pink seaperch, stripetail rockfish, California scorpionfish and bigmouth sole. Each of these 10 species was present in more than half of the trawls.

The fishes captured ranged in length from 3 to 98 cm (Appendix C). The common species mentioned above were small fish, with lengths up to 25 cm. In contrast, species that averaged more than 30 cm in length were caught relatively infrequently. These larger fish included Pacific hagfish, spotted ratfish, California skate, red brotula and lingcod.

Fish species richness varied little among the trawl stations in 2001, averaging from 11 to 14 species per station (Table 5.2). Diversity (H') also showed little variation, with values ranging between 0.9 and 2.0 per station. In comparison, abundance and biomass were highly variable, averaging 126 to 409 fish and 2.8 to 6.1 kg per station, respectively. A large part of this variability was due to larger hauls of fish (mostly Pacific sanddabs) at offshore stations SD9, SD10, SD11, and SD13.

Table 5.4

Megabenthic invertebrate species collected in 38 trawls off Point Loma, San Diego during 2001. Data for each species are expressed as: (1) mean abundance per haul (MAH); (2) percent abundance (PA); (3) frequency of occurrence (FO).

Species	MAH	PA	FO	Species	MAH	PA	FO
Lytechinus pictus	1506	94	84	PORIFERA	<1	<1	8
Acanthoptilum sp	53	3	76	*Stylatula elongata*	<1	<1	8
Allocentrotus fragilis	8	1	21	*Tritonia diomedea*	<1	<1	8
Astropecten verrilli	6	<1	87	*Amphichondrius granulatus*	<1	<1	5
Loligo opalescens	4	<1	68	*Elthusa vulgrais*	<1	<1	5
Parastichopus californicus	4	<1	71	*Florometra serratissima*	<1	<1	5
Philine auriformis	2	<1	24	*Hemisquilla ensigera californiensis*	<1	<1	5
Luidia foliolata	2	<1	63	*Protula superba*	<1	<1	5
Sicyonia ingentis	1	<1	26	*Virgularia agassizii*	<1	<1	5
Thesea sp B	1	<1	42	*Antiplanes catalinae*	<1	<1	3
Rossia pacifica	1	<1	53	*Armina californica*	<1	<1	3
Pleurobranchaea californica	1	<1	47	*Astropecten ornatissimus*	<1	<1	3
Octopus rubescens	1	<1	34	*Calliostoma turbinum*	<1	<1	3
Ophiura luetkenii	1	<1	34	*Crossata californica*	<1	<1	3
Luidia asthenosoma	<1	<1	29	Doridoida	<1	<1	3
Megasurcula carpenteriana	<1	<1	26	*Heptacarpus stimpsoni*	<1	<1	3
Paguristes turgidus	<1	<1	18	*Heptacarpus tenuissimus*	<1	<1	3
Cancellaria crawfordiana	<1	<1	13	*Lepidozona sinudentata*	<1	<1	3
Ophiothrix spiculata	<1	<1	13	*Loxorhynchus grandis*	<1	<1	3
Platymera gaudichaudii	<1	<1	13	*Metacrangon spinosissima*	<1	<1	3
Neocrangon zacae	<1	<1	11	*Neosimnia barbarensis*	<1	<1	3
Nymphon pixellae	<1	<1	11	*Paguristes bakeri*	<1	<1	3
Schmittius politus	<1	<1	11	*Paguristes ulreyi*	<1	<1	3
Spatangus californicus	<1	<1	11	*Panulirus interruptus*	<1	<1	3
Arctonoe pulchra	<1	<1	8	*Paralithodes sp*	<1	<1	3
Crangon alaskensis	<1	<1	8	*Platydoris macfarlandi*	<1	<1	3
Luidia armata	<1	<1	8	*Podochela lobifrons*	<1	<1	3
*Metridium senile**	<1	<1	8	*Polinices draconis*	<1	<1	3
Ophiopholis bakeri	<1	<1	8	Stomatopoda	<1	<1	3

* Species complex

Species richness has remained relatively stable between 1992 and the present, with numbers ranging from 10 to 18 species per haul (Figure 5.2). In contrast, abundances have been highly variable, with annual values averaging between 93 and 690 individuals per station. The numbers of individuals collected at most stations in 2001 were lower than the two previous years. These large differences reflect population fluctuations of the common species, and generally correspond to changing oceanographic conditions. For example, abundances at the nearfield and farfield stations were relatively low during the El Niño years of 1992-1993 and 1997-1998. The warmer waters associated with these El Niño conditions corresponded to lower numbers of cooler water species such as the Pacific sanddab (Karinen et al. 1985).

Ordination and classification of sites discriminated between four major cluster groups, or groups of stations with similar types of demersal fish assemblages between 1997 and 2001 (Figure 5.3). The main differences between these groups reflect changes in the offshore fish populations, especially Pacific sanddabs, that coincide with large-scale fluctuations in oceanographic conditions (e.g., water

Table 5.5

Megabenthic invertebrate community parameters sampled during 2001. Data are expressed as (1) total number of species; (2) mean number of species; (3) mean abundance (Abund); (4) mean diversity (H'); (5) mean biomass (BM) (kg, wet weight).

	Number of Species				
Station	Total	Mean	Abund	H'	BM
Inshore (n=2)					
SD1	17	10	166	1.0	0.6
SD3	12	7	27	1.4	0.1
SD6	12	8	15	1.7	0.1
Offshore (n=4)					
SD7	20	10	1618	0.2	5.0
SD8	26	13	3230	0.1	9.0
SD9	23	10	3399	0.1	8.0
SD10	18	9	3467	0.1	9.7
SD11	23	12	1869	0.4	7.5
SD12	20	11	959	0.6	3.6
SD13	20	11	413	0.6	6.8
SD14	16	10	102	1.2	4.6

temperatures) associated with events such as El Niño and La Niña. Station group 1 represents the dominant assemblage type in the region, accounting for 40% of the samples analyzed. This assemblage was present primarily from 1999 through 2001 when water temperatures were relatively cool. Trawl catches at these times were characterized by relatively large numbers of fish per trawl (Table 5.3), which consisted mostly of Pacific sanddabs and other common species such as longspine combfish, yellowchin sculpins and longfin sanddabs. Station groups 2, 3 and 4 represent transitional assmeblages following the arrival of the 1997/1998 El Niño. These groups were characterized by moderate catches of the common demersal species of fish.

Parasitism and Physical Abnormalities

The presence of any physical abnormalities or parasites on local fishes were rare in 2001. Although collected on very few fish overall (< 3% of all fish captured), parasites were found on fish collected during every survey at both the near and farfield stations. The copepod *Phrixocephalus cincinnatus,* an eye parasite, was found on 2.1% (n = 220) of the Pacific sanddabs collected during the year. In addition, unidentified parasites were found on two bigmouth soles, one longfin sanddab and one bay goby. The cymothoid isopod *Elthusa vulgaris*, was also present during the year; however it is unknown which fish were parasitized, since the isopods became detached from their hosts while still in the trawl net. Although *E. vulgaris* occurs on a variety of fish species off of southern California, it is especially common on sanddabs and California lizardfish, where it may reach infestation rates of 3% and 80%, respectively (Brusca 1978, 1981).

Invertebrate Community

A total of 60,641 megabenthic invertebrates, representing 58 taxa, were collected during the 2001 trawl surveys. The sea urchin *Lytechinus pictus* comprised 94% of all animals collected, it was captured in 84% of the trawls at an average abundance of 1,506 individuals per haul (Table 5.4). Other common invertebrates (> 50% of the trawls) included the sea pen *Acanthoptilum* sp, the sea stars *Astropecten verrilli* and *Luidia foliolata,* the squids *Loligo opalescens* and *Rossia pacifica,* and the sea cucumber *Parastichopus californicus*. Other invertebrates occurred relatively infrequently or in low numbers.

The structure of the trawl-caught invertebrate assemblages was highly variable during 2001 (Table 5.5). Average species richness ranged from 7 to 13 species per trawl, while abundances averaged from 15 to 3,467 individuals per trawl. The highest abundance values occurred at the offshore stations where very large hauls of *L. pictus* were collected. Average biomass ranged from 0.1 to 9.7 kg. High biomass values were due either to large hauls of *L. pictus* or occasional catches of large invertebrates such as sea cucumbers, sea urchins or sea anemones. Species diversity was low for the assemblages (H' < 2.0), generally reflecting the high numerical dominance of *L. pictus*.

Invertebrate species richness varied somewhat over time at most stations (Figure 5.4). These fluctuations were smaller at the inshore stations than at the offshore

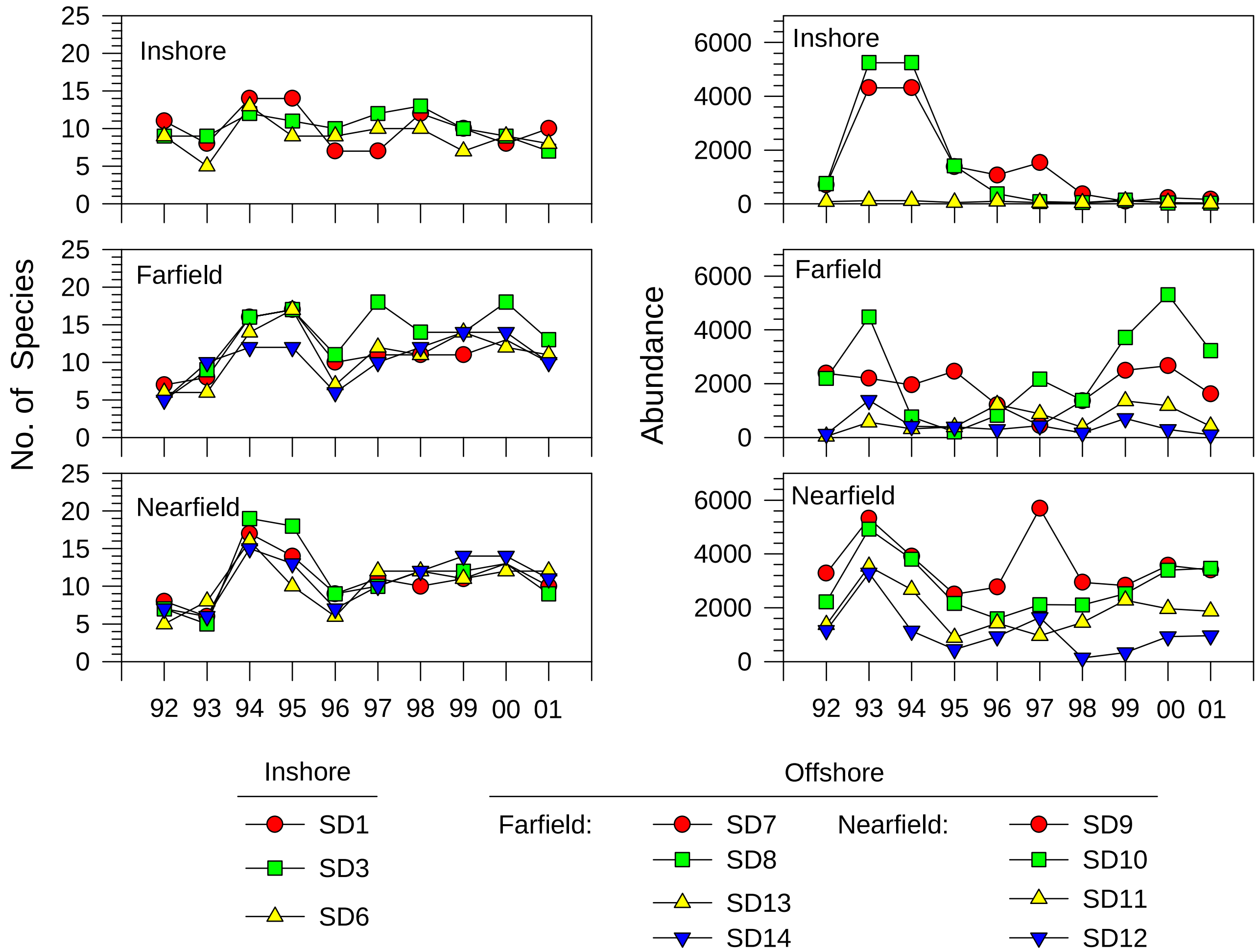


Figure 5.4
Annual mean number of species and abundance of megabenthic invertebrates sampled at the inshore (n=2) and the offshore (n=4) stations, 1992 through 2001.

sites. Changes in the number of species at the nearfield offshore stations were similar to those that occurred at the farfield stations. Abundance was also highly variable over time and among stations. For example, stations SD6, SD13 and SD14 had relatively small catches of invertebrates during all eight years, while the other stations demonstrated large peaks in abundance at various times. These fluctuations typically reflect changes in echinoderm populations, especially that of *L. pictus*.

SUMMARY & CONCLUSIONS

Fish and megabenthic invertebrate communities are inherently variable and may be influenced by both anthropogenic and natural factors. Anthropogenic factors include effects associated with treated wastewater discharge, dredged materials disposal, man-made relief (e.g., pipelines, artificial reefs) and storm drain runoff. Natural factors include such things as prey availability (Cross et al. 1985), differences in bottom relief and sediment structure (Helvey and Smith 1985), and changes in water temperature, such as those stemming from large scale oceanographic events like El Niño (Karinen et al. 1985). These factors can influence the recruitment and migratory patterns of fish (Murawski 1993). Additional patterns of fish and invertebrate population fluctuations may be due to the mobile nature of many species (e.g., fish schools or urchin aggregations).

Pacific sanddabs continued to dominate the fish community off Point Loma, as they have since 1992.

This species occurred at most stations and accounted for 63% of the annual catch in 2001. Additional common species included the yellowchin sculpin, longfin sanddab, longspine combfish, plainfin midshipman, Dover sole, California tonguefish, pink seaperch, stripetail rockfish, bigmouth sole and California scorpionfish.

The structure of the fish community off Point Loma has varied over time. Whereas species richness has remained relatively stable, abundances have fluctuated substantially. These changes reflect different numbers of the common species, and generally correspond with changing oceanographic conditions. For example, the warmer water temperatures associated with the El Niño conditions present in 1992-1993 and 1997-1998 correspond to lower numbers of cooler water species such as the Pacific sanddab (Karinen et al. 1985).

Invertebrate assemblages off Point Loma continued to be dominated by the sea urchin *Lytechinus pictus* during 2001. Other frequently occurring species included the sea pen *Acanthoptilum* sp, the sea stars *Astropecten verrilli* and *Luidia foliolata*, the squids *Loligo opalescens* and *Rossia pacifica,* and the sea cucumber *Parastichopus californicus*. Most of these species have consistently dominated invertebrate catches during previous years (e.g., City of San Diego 2000, 2001). Large fluctuations in populations of these species contribute greatly to the high overall variability in abundance and biomass of these assemblages.

In summary, no specific or direct effects of the Point Loma outfall were detected in either the fish or invertebrate communities during 2001. Despite high variability in both communities, the patterns of abundance, biomass, and number of species were similar at stations near the outfall and at stations farther away. In addition, no changes were found in the nearfield assemblages that corresponded with the initiation of the discharge at the end of 1993. Furthermore, fish populations appeared to be healthy off Point Loma, as indicated by lack of fin rot, tumors and other physical abnormalities.

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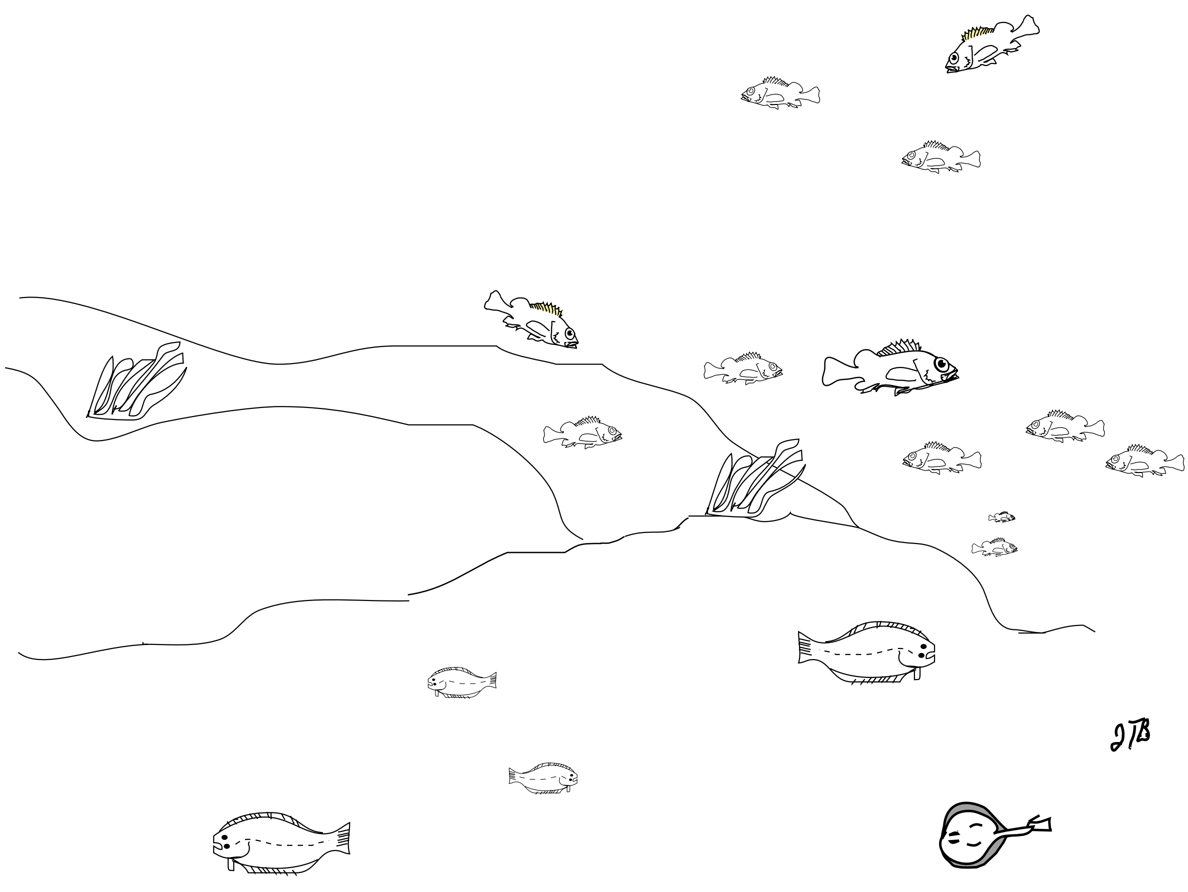
Tissue Burden



Chapter 6: Bioaccumulation of Contaminants in Fish Tissues

INTRODUCTION

The bioaccumulation of contaminants in fish tissues may indicate exposure to pollution. In addition, contaminant concentrations in fish tissues are often related to those found in the environment (Schiff and Allen 1997), and are therefore useful in biomonitoring programs. Bioaccumulation is the process of biological uptake and retention of chemical contaminants derived from various exposure pathways (Tetra Tech 1985). Bottom dwelling (i.e., demersal) fish can accumulate pollutants through any of the following three exposure routes: (1) adsorption or absorption of dissolved chemical constituents from the water; (2) ingestion of pollutant-containing suspended particulate matter or sediment particles and subsequent assimilation into body tissues; (3) ingestion and assimilation of pollutants from food sources. Once a contaminant becomes incorporated into a fish's tissues, it may resist normal metabolic excretion and accumulate.

The City of San Diego Ocean Monitoring Program includes extensive sampling of demersal fish communities to detect effects that may be associated with the discharge of effluent from the Point Loma Ocean Outfall (see Chapter 5). In addition, target fish are collected semiannually using otter trawl and rig fishing techniques in order to assess the accumulation of various contaminants in their tissues. Species are targeted for analysis based upon their ecological (i.e., trawl catch) or commercial (i.e., rig fishing catch) significance. Liver and muscle tissues are dissected from these fish and then analyzed for contaminants as specified in the City's NPDES permit. Analyses are performed on liver tissues because contaminants are typically the most concentrated in this tissue. For example, the high lipid content of liver tissues makes the detection of hydrophobic organochlorines (e.g., pesticides, PCBs) more likely. In contrast, muscle tissues are important because they are the tissues in fish that are most often subject to human consumption. Consequently, analysis of these tissues is used to address issues more pertinent to human health concerns. This chapter presents the results of the bioaccumulation analyses of fishes collected off San Diego, California during 2001.

MATERIALS & METHODS

Collection

Fish were collected during April and October 2001 at trawl stations SD7-SD14 and rig fishing stations RF1 and RF2 (Figure 6.1). Trawl-caught fish were collected, measured and weighed following established guidelines as described in Chapter 5 of this report, although additional trawls were performed when insufficient numbers of target species were obtained from the initial trawl. The species targeted at the two rig fishing locations were considered representative of a typical sport fisher's catch. These fish were collected using rod and reel, and then measured and weighed following standard procedures. Only fish > 11 cm in standard length were retained for analysis. After collection, fish were sorted into composite samples that contained a minimum of three fish each. Fish were then wrapped in aluminum foil, labeled, put in ziplock bags, and placed on dry ice for transport to a freezer at the Marine Biology Laboratory. The species that were analyzed from each station are summarized in Table 6.1.

Dissection and Chemical Analyses

All dissections were performed according to standard techniques for tissue analysis (City of San Diego 2002). Each fish was partially defrosted and then cleaned with a paper towel to remove loose scales and excess mucus prior to dissection. The standard length (cm) and weight (g) of the fish used in each composite sample were recorded (Appendix D). Liver and muscle tissues were removed from all fish. These procedures were carried out on Teflon

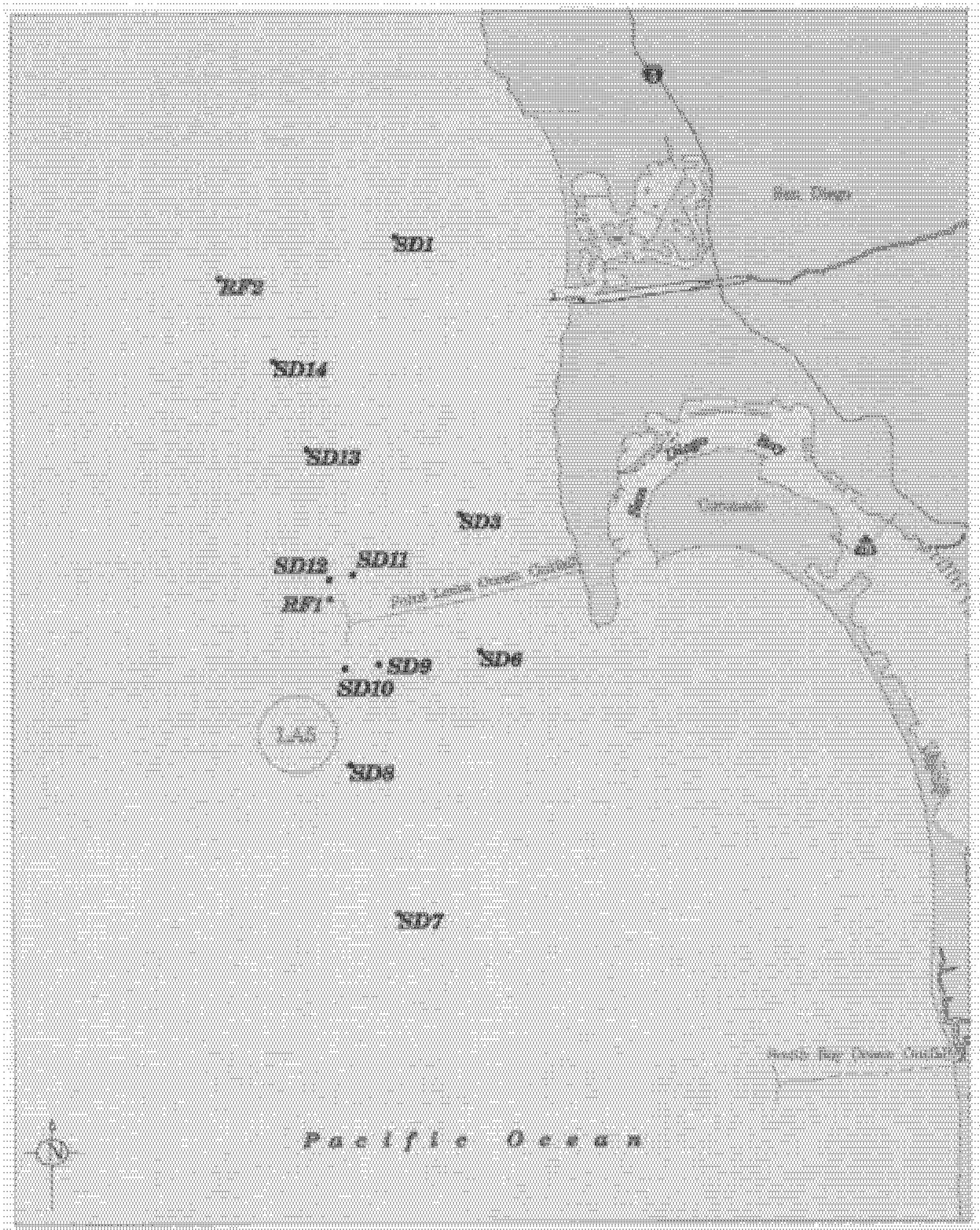


Figure 6.1
Otter trawl and rig fishing stations surrounding the City of San Diego Point Loma Ocean Outfall.

Table 6.1

Species collected at each PLOO trawl and rig fishing station during April and October 2001; ns = samples not collected due to insufficient numbers of fish.

Station	Rep1	Rep2	Rep3
April 2001			
SD7	Longfin sanddab	Ca. scorpionfish	Ca. scorpionfish
SD8	Vermilion rockfish	Greenblotched rockfish	Mixed rockfish
SD9	Longfin sanddab	Longfin sanddab	Longfin sanddab
SD10	Dover sole[1]	Mixed sanddabs[1]	Ca. scorpionfish
SD11	Longfin sanddab	Ca. scorpionfish	Ca. scorpionfish
SD12	Ca. scorpionfish	Ca. scorpionfish	Ca. scorpionfish
SD13	Longfin sanddab	Ca. scorpionfish	Ca. scorpionfish
SD14	Ca. scorpionfish	Ca. scorpionfish	Ca. scorpionfish
RF1	Copper rockfish	Vermilion rockfish	Vermilion rockfish
RF2	Bocaccio	Mixed rockfish	Mixed rockfish
October 2001			
SD7	Longfin sanddab	Longfin sanddab	Longfin sanddab
SD8	Pacific sanddab	Pacific sanddab	Greenspotted rockfish
SD9	Longfin sanddab	Ca. scorpionfish	Longfin sanddab
SD10	English sole	English sole	Pacific sanddab
SD11	Pacific sanddab	Ca. scorpionfish	Longfin sanddab
SD12	Longfin sanddab	Greenblotched rockfish	Ca. scorpionfish
SD13	Longfin sanddab	Ca. scorpionfish	Greenspotted rockfish
SD14	Longfin sanddab	Pacific sanddab	Ca. scorpionfish
RF1	Vermilion rockfish	Vermilion rockfish	Copper rockfish
RF2	Starry rockfish	Mixed rockfish	ns

[1] No metals were analyzed for these samples (see Methods).

pads that were cleaned between samples. Dissected tissues were then placed in glass jars, sealed, labeled and stored in a freezer at -20^{o} C prior to chemical analyses. All tissue samples were subsequently delivered to the City of San Diego Wastewater Chemistry Laboratory within seven days following dissection.

Tissue samples were analyzed for the permit-required chemical constituents. These constituents are listed in Appendix D along with a summary of all those detected at each station during the year. Due to insufficient tissue volume, however, some samples were analyzed for a reduced set of parameters (see Table 6.1). A detailed description of the analytical protocols may be obtained from the City's Wastewater Chemistry Laboratory.

Data Treatment

Prior to analysis, the chemical constituent data were generally limited to values above method detection limits (MDLs) and estimated values. Estimated values include parameters determined to be present in a sample with high confidence (i.e., peaks confirmed by mass-spectrometry), but at levels below the MDL. Null values (i.e, constituents with concentrations below the MDL for which there is no estimate) were eliminated from the data. The exclusion of null values, however, is not intended to represent the absence of a particular parameter.

RESULTS

Contaminants in Trawl-Caught Species

Distribution among Species

Detection rates for metals were highly variable in liver tissues sampled from fish collected during 2001 (Table 6.2). Rates exceeded 65% for aluminum, cadmium, copper, iron, manganese, mercury, selenium and zinc. With the exception of cadmium and mercury, these metals were detected in all eight species of fish. In contrast, arsenic and chromium were detected in less than half of the samples, and lead, nickel and silver were each detected in only one sample. Except for silver, all of the metals detected in liver samples during 2001 were also found in local sediments (see Chapter 3). Most of these metals have also been detected previously at low levels in Point Loma effluent samples (e.g., City of San Diego 2001b).

DDT occurred in all of the liver tissues sampled in 2001, at concentrations ranging from 52 to 23,366 ppb (Table 6.3). The highest liver tDDT value (23,366 ppb) occurred in a California scorpionfish composite sample; muscle tissues from this fish also had a very high concentration of 830 ppb (Appendix D). The high detection rate of DDT was likely due to the prevalence of this pesticide in sediments of the Southern California Bight (see Mearns et al. 1991). For example, DDT was also detected at all of the PLOO sediment stations during the year, including those far away from the outfall (see Chapter 3). However, DDT has generally not been detected in effluent samples from the Point Loma Wastewater Treatment Plant (e.g., City of San Diego 2001b).

Other pesticides also detected in fish liver tissues include: hexachlorobenzene (HCB), nonachlor (trans and cis), chlordane (alpha), lindane (as BHC), heptachlor and mirex. HCB occurred in 96% of the liver samples at concentrations less than 10 ppb; trans-nonachlor occurred in 92% of the samples with concentrations less than 30 ppb; chlordane occurred in 56% of the samples with concentrations of 20 ppb or less. Lindane, heptachlor and mirex occurred in less than 10% of the samples with most concentrations below 10 ppb. Although detection rates for these pesticides are substantially higher than in previous years (see City of San Diego 1996 - 2001a), they do not necessarily represent increases in the prevalence of pesticides in the fish collected during 2001. Instead, the increase reflects recent changes in the reporting methods for such compounds (i.e., lower MDLs and inclusion of estimated values; see Materials and Methods, Data Treatment section). None of these pesticides were found in local sediments (see Chapter 3) and they are generally not detected in effluent samples from the Point Loma Wastewater Treatment Plant (e.g., City of San Diego 2001b).

Total PCBs are reported in Table 6.3 as the sum of all congeners measured in each sample, while each congener is listed separately in Appendix D. PCBs were detected in all liver tissues sampled from all eight species of fish, with concentrations ranging from 82 ppb to 2,978 ppb. PCBs were also found in sediment samples collected from 6 out of 23 stations in 2001. These stations were generally located near the LA-5 dredged material dumpsite (Chapter 3). PCBs are typically not detected in effluent samples from the Point Loma Treatment Plant (e.g., City of San Diego 2001b).

Distribution among Stations

Spatial patterns were assessed for all of the frequently occurring metals found in fish liver tissues (Figure 6.2). Concentrations of these metals varied substantially across all stations, probably due in part to physiological differences between fish species. However, comparisons between nearfield (SD9-SD12) and farfield (SD7-SD8, SD13-SD14) sites were made for the California scorpionfish and longfin sanddab samples. No relationship between metal concentrations in liver tissues and proximity to the outfall was evident based on these comparisons, despite the fact that some of these metals have been found in Point Loma effluent samples and in sediments near the PLOO (e.g., Chapter 3 and City of San Diego 2001b).

Spatial patterns were also assessed for frequently occurring pesticides, as well as total PCB (Figure 6.3). DDT, trans-nonachlor, HCB and PCBs were detected at both the nearfield and farfield stations,

Table 6.2

Metals detected in liver samples from fish collected at PLOO trawl stations during 2001. Values are expressed as parts per million (ppm). N = number of detected values, nd = not detected.

	Al	As	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Se	Ag	Zn
Ca. Scorpionfish													
N (out of 18)	14	5	18	2	18	18	1	17	16	nd	18	1	18
Min	9.7	1.4	0.7	1.8	12.5	66	2.6	0.29	0.060	.	0.58	3.4	79.3
Max	29.0	6.8	6.4	2.8	51.0	392	2.6	0.86	0.556	.	1.04	3.4	161.0
Avg	19.7	3.3	3.5	2.3	28.8	231	2.6	0.46	0.248	.	0.79	3.4	119.4
Longfin sanddab													
N (out of 15)	12	14	15	5	15	15	nd	15	9	nd	15	nd	15
Min	5.1	2.4	0.7	0.4	3.6	70	.	0.61	0.010	.	0.61	.	19.0
Max	34.0	14.4	3.1	4.2	18.4	237	.	1.19	0.119	.	3.22	.	27.1
Avg	18.4	7.6	1.9	1.6	9.6	170	.	0.90	0.070	.	1.86	.	22.8
Pacific sanddab													
N (out of 5)	3	1	5	2	5	5	nd	5	2	1	5	nd	5
Min	3.5	5.4	1.1	1.1	2.0	56	.	0.76	0.016	2.3	0.29	.	18.0
Max	32.4	5.4	2.0	4.5	12.6	93	.	1.04	0.080	2.3	0.82	.	23.0
Avg	16.2	5.4	1.7	2.8	5.5	76	.	0.88	0.048	2.3	0.64	.	20.4
Greenblotched rockfish													
N (out of 2)	2	1	2	1	2	2	nd	2	2	nd	2	nd	2
Min	17.0	1.6	0.9	1.1	3.9	67	.	0.92	0.114	.	2.18	.	54.5
Max	17.9	1.6	3.8	1.1	22.2	107	.	1.04	0.146	.	3.05	.	66.8
Avg	17.5	1.6	2.3	1.1	13.0	87	.	0.98	0.130	.	2.62	.	60.7
Greenspotted rockfish													
N (out of 2)	2	nd	2	nd	2	2	nd	2	2	nd	2	nd	2
Min	15.7	.	1.8	.	11.7	87	.	0.97	0.054	.	2.37	.	65.4
Max	31.6	.	2.0	.	16.4	190	.	0.97	0.349	.	2.87	.	72.8
Avg	23.7	.	1.9	.	14.1	139	.	0.97	0.202	.	2.62	.	69.1
English sole													
N (out of 2)	1	1	1	nd	2	2	nd	2	nd	nd	2	nd	2
Min	24.7	1.8	0.4	.	6.2	141	.	0.67	.	.	1.39	.	44.9
Max	24.7	1.8	0.4	.	9.3	195	.	0.96	.	.	2.42	.	58.6
Avg	24.7	1.8	0.4	.	7.7	168	.	0.82	.	.	1.91	.	51.8
Vermilion rockfish													
N (out of 1)	1	nd	nd	nd	1	1	nd	1	nd	nd	1	nd	1
Min	22.4	.	.	.	21.5	173	.	0.67	.	.	1.31	.	33.9
Max	22.4	.	.	.	21.5	173	.	0.67	.	.	1.31	.	33.9
Avg	22.4	.	.	.	21.5	173	.	0.67	.	.	1.31	.	33.9
Mixed rockfish													
N (out of 1)	1	nd	1	nd	1	1	nd	1	nd	nd	1	nd	1
Min	23.0	.	4.9	.	17.8	203	.	0.78	.	.	2.15	.	56.6
Max	23.0	.	4.9	.	17.8	203	.	0.78	.	.	2.15	.	56.6
Avg	23.0	.	4.9	.	17.8	203	.	0.78	.	.	2.15	.	56.6
ALL SPECIES													
% Detect	78	48	96	22	100	100	2	98	67	2	100	2	100

although in highly variable concentrations. As with metals, this variability may be partially due to physiological differences between fish species. Intraspecific comparisons of HCB, trans-nonachlor and total DDT in both California scorpionfish and longfin sanddabs demonstrated no substantial differences between the nearfield and farfield sites. The highest PCB value was detected in a Pacific sanddab sample collected at station SD8. This station is located near the LA-5 dredged material dumpsite, an area with elevated PCBs in the sediments (see Chapter 3).

Table 6.3

Chlorinated pesticides, PCBs and lipids detected in liver samples from fish collected at PLOO trawl stations during 2001. HCB = hexachlorobenzene, Chlor = Chlordane, BHC = Lindane. Values are expressed as parts per billion (ppb) for all parameters except lipids, which are presented as percent weight (% wt). N = number of detected values, nd = not detected.

			Nonachlor				Hetpa-			
	tDDT	HCB	Trans	Cis	Chlor	BHC	achlor	Mirex	tPCB	Lipids
Ca. Scorpionfish										
N (out of 18)	18	17	18	1	9	1	nd	1	18	18
Min	442.85	0.8	6.7	13	3.2	29.5	.	1.9	149.8	6
Max	23366	8.1	28.0	13	15.0	29.5	.	1.9	2281	38
Avg	2127.731	2.7	15.1	13	8.3	29.5	.	1.9	566.4	20
Longfin sanddab										
N (out of 15)	15	15	14	1	10	nd	1	4	15	15
Min	350.1	1.4	4.2	6.9	5.1	.	1.3	1.2	234.1	7
Max	1268	7.7	24.0	6.9	20.0	.	1.3	6.5	1610	33
Avg	787.2033	3.4	12.5	6.9	10.5	.	1.3	3.1	788.2	18
Pacific sanddab										
N (out of 5)	5	5	5	1	4	nd	nd	1	5	5
Min	410.7	6.2	7.3	7.6	5.9	.	.	1.1	166.8	10
Max	1844.7	8.3	28.0	7.6	9.6	.	.	1.1	2978	40
Avg	875.78	7.3	15.8	7.6	8.0	.	.	1.1	917.9	28
Greenblotched rockfish										
N (out of 2)	2	2	2	nd	1	nd	nd	nd	2	2
Min	612.6	1.8	7.2	.	4.4	.	.	.	384.3	9
Max	749.5	2.8	13.0	.	4.4	.	.	.	1175	12
Avg	681.05	2.3	10.1	.	4.4	.	.	.	779.7	11
Greenspotted rockfish										
N (out of 2)	2	2	2	nd	1	nd	nd	nd	2	2
Min	258.1	3.5	5.8	.	5.8	.	.	.	251.6	13
Max	961.3	4.0	20.0	.	5.8	.	.	.	545.3	13
Avg	609.7	3.8	12.9	.	5.8	.	.	.	398.5	13
English sole										
N (out of 2)	2	2	nd	nd	nd	nd	nd	nd	2	2
Min	89.1	1.5	.	.	.	.	.	.	85.4	8
Max	192.2	1.8	.	.	.	.	.	.	95.3	15
Avg	140.65	1.7	.	.	.	.	.	.	90.35	12
Dover sole										
N (out of 1)	1	nd	nd	nd	nd	nd	nd	nd	1	1
Min	52	.	.	.	.	.	.	.	81.8	6
Max	52	.	.	.	.	.	.	.	81.8	6
Avg	52	.	.	.	.	.	.	.	81.8	6
Vermilion rockfish										
N (out of 1)	1	1	1	nd	1	nd	nd	nd	1	1
Min	498.5	3.1	6.4	.	3.6	.	.	.	152	18
Max	498.5	3.1	6.4	.	3.6	.	.	.	152	18
Avg	498.5	3.1	6.4	.	3.6	.	.	.	152	18
Mixed rockfish										
N (out of 1)	1	1	1	nd	nd	nd	nd	nd	1	1
Min	247.7	3.0	4.7	.	.	.	.	.	201.6	19
Max	247.7	3.0	4.7	.	.	.	.	.	201.6	19
Avg	247.7	3.0	4.7	.	.	.	.	.	201.6	19
Mixed sanddabs										
N (out of 1)	1	1	1	nd	1	nd	nd	1	1	1
Min	750.7	2.3	11.0	.	6.0	.	.	3.3	541.3	14
Max	750.7	2.3	11.0	.	6.0	.	.	3.3	541.3	14
Avg	750.7	2.3	11.0	.	6.0	.	.	3.3	541.3	14
ALL SPECIES										
% Detect	100	96	92	6	56	2	2	15	100	

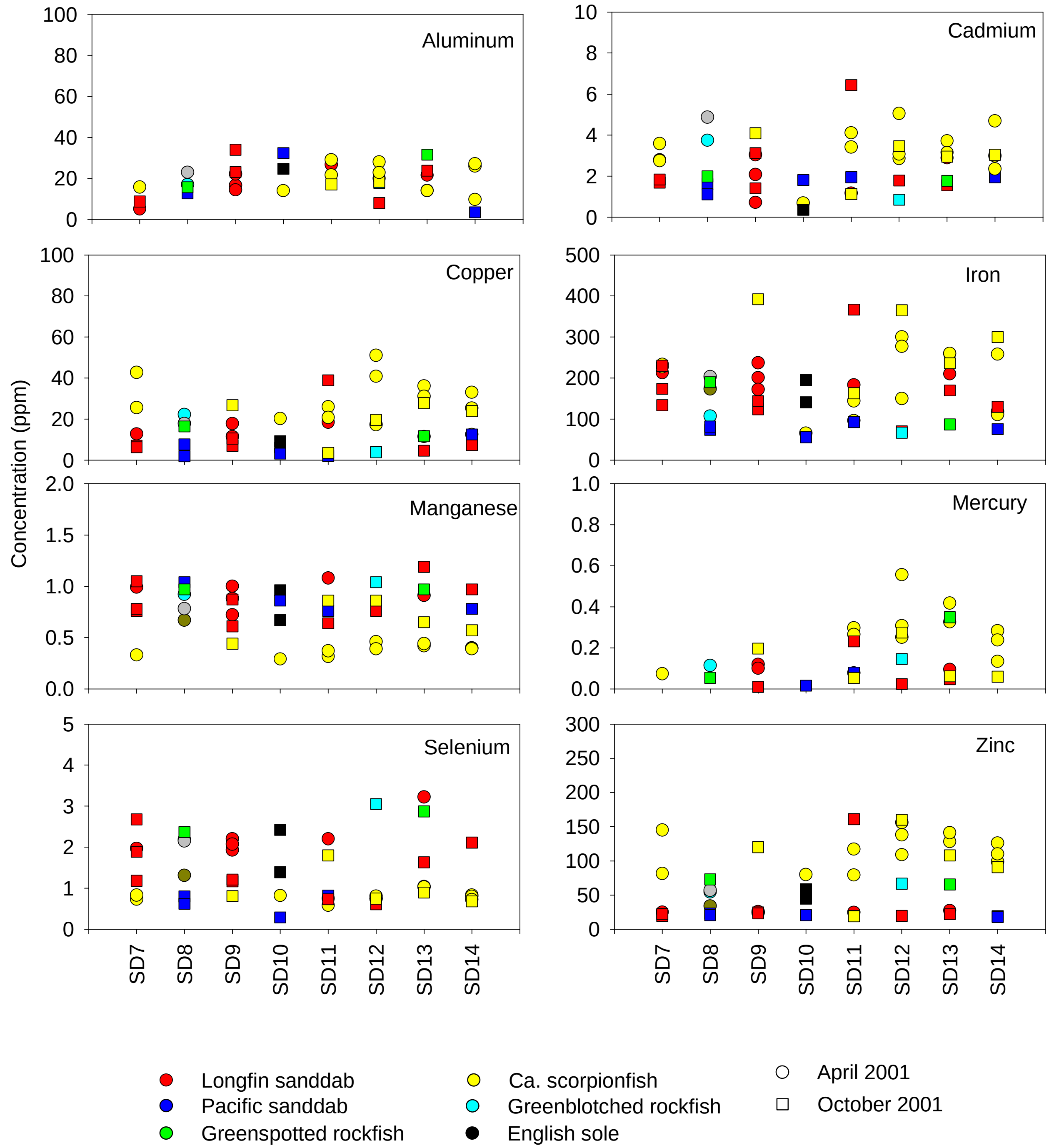


Figure 6.2
Concentrations of metals detected frequently in liver tissues of fish collected at PLOO trawl stations during 2001.

Contaminants in Rig-Caught Fish

The United States Food and Drug Administration (FDA) has set limits for mercury and total DDT that may be present in seafood sold for human consumption. In addition, there are also international standards for acceptable concentrations of various metals (see Mearns et al. 1991). Concentrations of applicable constituents found in muscle tissue samples collected at the rig fishing stations during 2001 were compared to these limits and standards (Table 6.4). While many of metals occurred frequently in fish off Point Loma, only arsenic and selenium occurred at concentrations close to or higher than international

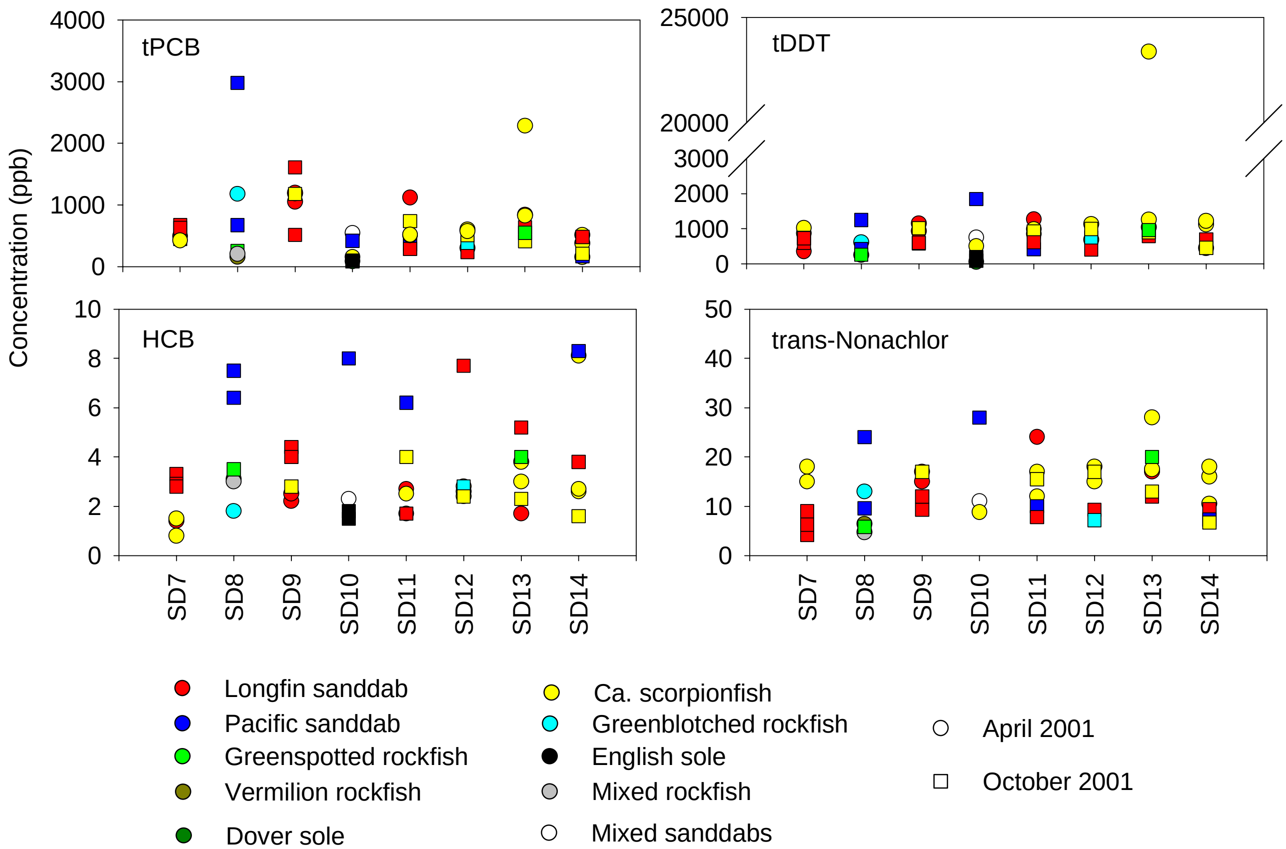


Figure 6.3

Concentrations of frequently detected chlorinated pesticides and total PCB detected in liver tissues of fish collected at PLOO trawl stations during 2001.

standards. In addition, concentrations of DDT in muscle tissue samples from two species exceeded the California EPA screening level for DDT (100 ppb), but were substantially less than the FDA action limit of 5,000 ppb. The concentrations of metals, DDT and total PCB in liver samples from various rockfish collected at station RF1 were compared to concentrations in samples from fish collected at station RF2. Most of these concentrations were found to be similar at the nearfield and farfield sites (Figure 6.4).

SUMMARY & DISCUSSION

Tissue bioaccumulation studies are useful in determining the presence of various contaminants in demersal fishes. It is well established that various pollutants can affect the behavior, fecundity and mortality rates of fishes (McCain et al. 1978, Gossett et al. 1983, Moller 1985, Thomas 1988, 1989, Hose et al. 1989). However, little is known about the concentrations at which contaminants must be present in order to precipitate these effects.

During 2001, demersal fish off Point Loma were characterized by contaminant values that were within the range of those reported for other fish assemblages in the Southern California Bight (SCB) (Mearns et al. 1991). In addition, concentrations of these contaminants in fish tissues were generally similar to those reported previously by the City of San Diego (City of San Diego 1996 - 2001a).

The frequent occurrence of both metals and chlorinated hydrocarbons in the tissues of fish off Point Loma may be due to many factors. For example, Mearns et al. (1991) described several contaminants, including arsenic, mercury, DDT and PCBs as ubiquitous in the SCB. In fact, many metals occur naturally in the environment, although little information is available on their background levels in fish tissues. Furthermore, Brown et al. (1986)

Table 6.4

Maximum and mean concentrations of various metals and total DDT present in muscle tissues of fish collected at the rig fishing stations during 2000. Values are expressed as parts per million (ppm). Data for each species are compared to United States FDA action limits and median international standards.

	Metals (ppm)						Pesticides (ppb)	
	As	**Cr**	**Cu**	**Hg**	**Se**	**Zn**	**tDDT**	**Chlor**
Bocaccio								
N (out of 1)	1	nd	1	1	1	1	1	nd
Min	**1.50**	.	1.79	0.06	0.18	3.35	9.9	.
Max	**1.50**	.	1.79	0.06	0.18	3.35	9.9	.
Avg	**1.50**	.	1.79	0.06	0.18	3.35	9.9	.
Copper rockfish								
N (out of 2)	1	nd	2	2	2	2	2	1
Min	**2.70**	.	3.21	0.20	**0.37**	3.83	23.8	0.7
Max	**2.70**	.	4.79	0.44	**0.47**	4.86	**217.3**	0.7
Avg	**2.70**	.	4.00	0.32	**0.42**	4.35	**120.6**	0.7
Starry rockfish								
N (out of 1)	nd	1	1	1	1	1	1	1
Min	.	0.42	5.88	0.20	**0.45**	1.85	**118.8**	1.3
Max	.	0.42	5.88	0.20	**0.45**	1.85	**118.8**	1.3
Avg	.	0.42	5.88	0.20	**0.45**	1.85	**118.8**	1.3
Vermilion rockfish								
N (out of 4)	3	1	4	4	4	4	4	nd
Min	**1.90**	0.33	1.92	0.02	0.20	1.97	6.25	.
Max	**3.10**	0.33	6.59	0.05	**0.44**	5.24	11.6	.
Avg	**2.33**	0.33	4.60	0.03	0.27	3.60	9.2	.
Mixed rockfish								
N (out of 3)	1	nd	2	3	3	3	3	nd
Min	**4.10**	.	5.31	0.02	0.16	2.37	4.5	.
Max	**4.10**	.	5.59	0.09	0.21	3.88	36.6	.
Avg	**4.10**	.	5.45	0.06	0.19	3.12	19.2	.
All Species								
% Detect	55	18	91	100	100	100	100	18
US FDA Action Level **				1.0			5000	300
Median International Standard*	1.4	1.0	20.0	0.5	0.3	70.0	5000	100
Cal EPA screening level							100	

*From Table 2.3 in Mearns et al. (1991). All international standards are for shellfish, but are often applied to fish. All limits apply to the sale of seafood for human consumption.

** From Table 3-4 in Kyle 1998. Standards are for limits in commercial fin fish.

determined that no areas of the SCB are sufficiently free of chemical contaminants to be considered reference sites. This conclusion was supported by more recent work on PCBs and DDTs (e.g., Allen et al. 1998).

Other factors that affect the accumulation and distribution of contaminants include the physiology and life history of different fish species. Exposure to contaminants can vary greatly between species and even among individuals of the same species depending on migration habits (Otway 1991). For example, fish may be exposed in one highly contaminated area and then move into one that is less so. In addition, differences in feeding habits, age, reproductive status and sex can affect the amount of contaminants a fish will retain (e.g., Connell 1987, Evans et al. 1993). These factors make comparisons of contaminant

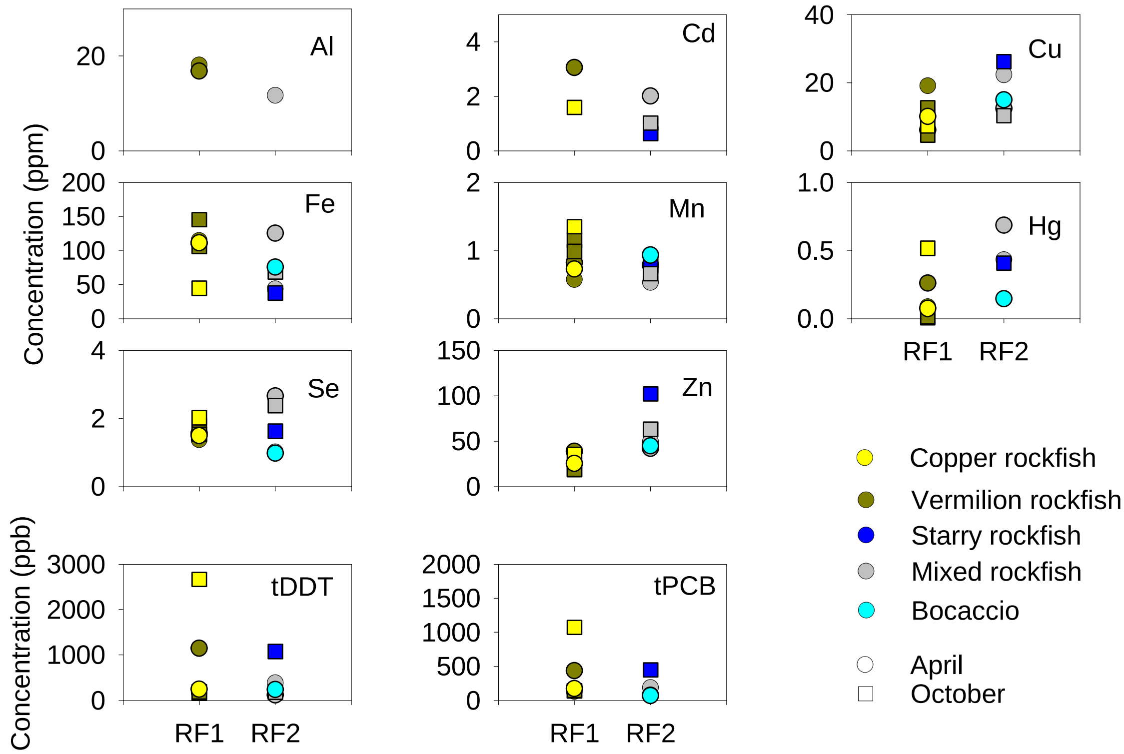


Figure 6.4

Concentrations of frequently detected metals (in ppm), total DDT (ppb) and total PCB (ppb) in liver tissues of fish collected at PLOO rig fishing stations during 2001.

concentrations among species and between stations very difficult.

Where intraspecific comparisons among stations were made, there was no evidence that local fish populations were affected by the discharge of waste water from the Point Loma Ocean Outfall. This is supported by the lack of any clear spatial pattern among contaminants detected in trawl-caught fish, especially those contaminants which were also detected in effluent samples. In addition, muscle tissue samples collected from sport fish in the area were found to be within FDA human consumption limits for both mercury and DDT. Finally, there was no indication of poor fish health in the region, such as the occurrence of fin rot or other physical anomalies (see Chapter 5).

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Appendices

APPENDIX A

2001 PLOO Stations

Sediment Characteristics

"Supplemental Data"

APPENDIX A

Appendix A.1

Mean particle size for statistics for PLOO sediment stations, January 2001.

	Phi					Percent Composition				Sediment Type
Station	Mean	Std Dev	Median	Skewness	Kurtosis	Coarse	Sand	Silt	Clay	(Folk 1968)
290 ft stations										
B11	3.4	2.9	3.7	0.0	1.1	17.8	39.1	37.8	5.3	very fine sand
B8	4.7	1.6	4.2	0.4	1.1	0.0	41.5	53.3	5.1	coarse silt
E19	4.5	1.5	4.0	0.5	1.2	0.0	48.8	47.0	4.1	coarse silt
E7	4.1	1.4	3.7	0.4	1.5	0.0	60.2	36.4	3.3	coarse silt
E1	4.1	1.7	3.6	0.5	1.0	1.7	61.2	32.5	4.5	coarse silt
320 ft stations										
B12	3.2	2.2	2.8	0.4	1.3	3.0	70.7	22.2	4.2	very fine sand
B9	4.3	1.7	3.8	0.5	1.1	0.0	56.1	39.2	4.7	coarse silt
E26	4.0	1.4	3.4	0.8	1.3	0.0	67.0	29.7	3.3	coarse silt
E25	4.3	1.6	3.8	0.5	1.3	0.0	56.9	38.1	5.1	coarse silt
E23	4.5	1.7	3.9	0.5	1.1	0.0	51.9	42.4	5.7	coarse silt
E20	4.3	1.5	3.8	0.5	1.3	0.0	58.4	37.8	3.8	coarse silt
E14	3.9	1.9	3.6	0.2	2.0	5.3	62.4	28.8	3.5	very fine sand
E17	4.1	1.5	3.6	0.5	1.5	0.0	63.9	32.4	3.8	coarse silt
E11	3.9	1.4	3.5	0.5	1.6	0.0	67.8	29.3	2.9	very fine sand
E8	3.9	1.4	3.6	0.5	1.5	0.8	67.7	28.5	2.9	very fine sand
E5	3.9	1.5	3.4	0.6	1.5	0.0	67.6	28.6	3.7	very fine sand
E2	3.9	2.5	3.5	0.2	1.1	9.7	48.6	36.0	5.7	very fine sand
380 ft stations										
B13	1.3	1.6	0.6	0.8	1.4	9.4	81.5	7.6	1.5	medium sand
B10	4.1	1.7	3.5	0.6	1.4	2.0	68.7	24.2	5.0	coarse silt
E21	4.2	1.6	3.6	0.6	1.3	0.0	61.8	34.3	3.8	coarse silt
E15	3.9	1.4	3.2	0.8	1.5	0.0	70.5	26.1	3.4	very fine sand
E9	3.2	2.7	3.5	-0.1	1.4	20.5	43.2	32.1	4.2	very fine sand
E3	2.8	2.5	2.7	0.2	1.2	15.3	58.1	23.0	3.6	fine sand

Note: Coarse was determined separately from sand, silt and clay (see Materials and Methods: Laboratory Analysis).

APPENDIX A

Appendix A.1

Mean particle size for statistics for PLOO sediment stations, April 2001.

	Phi					Percent Composition				Sediment Type
Station	Mean	Std Dev	Median	Skewness	Kurtosis	Coarse	Sand	Silt	Clay	(Folk 1968)
290 ft stations										
B11	4.2	2.3	3.9	0.1	1.1	7.6	47.2	40.6	4.6	coarse silt
B8	4.7	1.5	4.2	0.4	1.1	0.0	40.5	55.1	4.4	coarse silt
E19	4.3	1.4	4.0	0.5	1.5	0.0	52.5	44.0	3.4	coarse silt
E7	4.3	1.4	3.9	0.5	1.4	0.0	55.4	41.1	3.5	coarse silt
E1	3.4	2.1	3.0	0.3	1.3	1.3	69.8	24.7	4.1	very fine sand
320 ft stations										
B12	3.4	2.1	3.0	0.3	1.3	1.5	69.5	24.9	4.1	very fine sand
B9	4.2	1.6	3.7	0.5	1.3	0.0	60.1	35.8	4.1	coarse silt
E26	4.3	1.5	3.9	0.5	1.2	0.0	54.9	41.5	3.6	coarse silt
E25	4.2	1.5	3.8	0.5	1.3	0.0	58.4	38.4	3.2	coarse silt
E23	4.0	1.5	3.7	0.4	1.5	0.0	62.3	34.4	3.2	coarse silt
E20	4.0	1.3	3.7	0.5	1.6	0.0	63.6	33.4	2.9	coarse silt
E14	3.2	1.0	3.2	0.3	2.0	1.4	87.1	10.1	1.4	very fine sand
E17	3.8	1.3	3.5	0.5	1.7	0.0	69.1	28.3	2.6	very fine sand
E11	3.8	1.0	3.6	0.5	2.8	0.6	77.9	19.3	2.2	very fine sand
E8	3.8	1.4	3.5	0.5	1.5	0.0	68.3	29.0	2.7	very fine sand
E5	3.6	1.0	3.3	0.8	2.0	0.0	76.8	20.8	2.4	very fine sand
E2	3.3	2.8	3.7	-0.1	1.2	17.4	39.7	38.6	4.3	very fine sand
380 ft stations										
B13	2.6	2.1	2.3	0.3	1.5	5.3	74.9	16.6	3.2	fine sand
B10	4.1	1.6	3.6	0.5	1.4	1.8	65.3	28.7	4.2	coarse silt
E21	4.2	1.4	3.8	0.5	2.0	0.0	61.0	35.7	3.3	coarse silt
E15	3.9	1.3	3.5	0.6	2.0	0.0	75.3	21.9	2.8	very fine sand
E9	3.1	2.6	3.6	-0.1	2.1	18.0	48.2	30.4	3.4	very fine sand
E3	3.0	2.0	2.5	0.4	1.6	5.7	70.9	20.5	2.9	very fine sand

Note: Coarse was determined separately from sand, silt and clay (see Materials and Methods: Laboratory Analysis).

APPENDIX A

Appendix A.1

Mean particle size for statistics for PLOO sediment stations, July 2001.

	Phi					Percent Composition				Sediment Type
Station	Mean	Std Dev	Median	Skewness	Kurtosis	Coarse	Sand	Silt	Clay	(Folk 1968)
290 ft stations										
B11	4.4	2.3	4.0	0.1	1.5	8.2	41.1	45.0	5.7	coarse silt
B8	4.8	1.6	4.3	0.5	1.1	0.0	39.0	55.2	5.8	coarse silt
E19	4.5	1.5	4.0	0.5	1.2	0.0	48.6	47.5	3.8	coarse silt
E7	4.3	1.5	3.9	0.5	1.3	0.0	53.6	42.4	4.0	coarse silt
E1	3.8	1.7	3.1	0.6	1.3	3.4	67.8	25.1	3.6	very fine sand
320 ft stations										
B12	1.6	1.7	0.9	0.7	1.1	4.2	84.9	9.3	1.5	medium sand
B9	4.4	1.7	3.9	0.4	1.1	0.0	53.2	42.4	4.4	coarse silt
E26	4.5	1.7	3.9	0.5	1.1	0.0	52.1	42.9	4.9	coarse silt
E25	4.2	1.6	3.8	0.5	1.2	0.0	57.9	37.8	4.3	coarse silt
E23	4.3	1.5	3.8	0.5	1.3	0.0	56.0	40.3	3.7	coarse silt
E20	4.2	1.5	3.8	0.5	1.3	0.0	58.5	37.9	3.6	coarse silt
E14	3.6	1.7	3.4	0.1	2.4	7.3	67.8	22.6	2.4	very fine sand
E17	4.0	1.4	3.7	0.4	1.4	2.0	62.0	33.2	2.8	coarse silt
E11	3.9	1.7	3.9	0.2	1.7	1.3	60.4	34.2	4.1	very fine sand
E8	4.1	1.6	3.6	0.5	1.4	0.0	62.4	33.8	3.8	coarse silt
E5	4.0	1.6	3.5	0.5	1.4	0.0	63.9	32.3	3.7	coarse silt
E2	3.8	1.6	3.3	0.5	1.5	3.2	69.7	23.4	3.7	very fine sand
380 ft stations										
B13	1.4	0.8	1.5	0.0	1.3	4.0	93.1	2.4	0.4	medium sand
B10	4.1	1.6	3.6	0.5	1.4	0.6	66.9	28.9	3.6	coarse silt
E21	4.1	1.5	3.4	0.7	1.3	0.0	65.6	30.1	4.3	coarse silt
E15	4.1	1.6	3.6	0.5	1.4	0.0	62.9	32.6	4.5	coarse silt
E9	4.1	2.3	3.8	0.1	1.2	9.6	50.5	34.6	5.3	coarse silt
E3	3.4	2.2	3.0	0.3	1.4	4.6	66.9	24.4	4.1	very fine sand

Note: Coarse was determined separately from sand, silt and clay (see Materials and Methods: Laboratory Analysis).

APPENDIX A

Appendix A.1

Mean particle size for statistics for PLOO sediment stations, October 2001.

	Phi					Percent Composition				Sediment Type
Station	Mean	Std Dev	Median	Skewness	Kurtosis	Coarse	Sand	Silt	Clay	(Folk 1968)
290 ft stations										
B11	4.5	2.3	4.0	0.2	1.3	9.4	37.8	47.4	5.4	coarse silt
B8	4.6	1.5	4.2	0.4	1.1	0.0	41.9	53.6	4.5	coarse silt
E19	3.7	1.1	3.5	0.5	2.4	0.0	78.2	19.9	1.9	very fine sand
E7	3.7	1.0	3.4	0.7	2.1	0.0	75.7	22.4	1.9	very fine sand
E1	4.0	2.0	3.6	0.3	1.0	2.2	56.4	37.4	3.9	coarse silt
320 ft stations										
B12	3.9	2.0	3.5	0.4	1.2	3.0	60.5	31.1	5.4	very fine sand
B9	4.2	1.4	3.6	0.7	1.4	0.0	64.4	31.9	3.6	coarse silt
E26	4.3	1.4	3.8	0.6	1.4	0.0	57.5	39.1	3.5	coarse silt
E25	4.1	1.6	3.7	0.4	1.4	4.2	56.9	35.6	3.4	coarse silt
E23	4.3	1.5	3.9	0.5	1.3	0.6	56.2	39.6	3.6	coarse silt
E20	3.9	1.2	3.5	0.7	1.8	0.0	70.6	26.8	2.6	very fine sand
E14	3.7	1.7	3.6	0.1	2.2	5.3	64.6	27.5	2.6	very fine sand
E17	3.6	1.1	3.4	0.5	2.7	0.0	79.4	18.5	2.0	very fine sand
E11	3.4	1.1	3.3	0.4	2.0	1.2	81.2	15.8	1.8	very fine sand
E8	3.8	1.3	3.5	0.5	1.6	0.0	69.2	28.4	2.4	very fine sand
E5	4.0	1.6	3.7	0.2	3.8	6.0	67.7	23.6	2.6	coarse silt
E2	4.1	1.8	3.7	0.3	1.2	2.8	58.3	35.2	3.7	coarse silt
380 ft stations										
B13	3.0	2.2	2.5	0.3	1.6	7.5	69.3	19.9	3.3	very fine sand
B10	3.9	1.1	3.6	0.6	3.6	0.0	77.1	19.9	3.0	very fine sand
E21	3.9	1.2	3.5	0.6	1.8	0.0	70.2	26.9	2.9	very fine sand
E15	3.8	1.1	3.6	0.5	2.8	0.6	78.5	18.3	2.5	very fine sand
E9	3.6	2.4	3.6	0.0	1.6	15.3	47.9	32.8	3.9	very fine sand
E3	4.1	1.9	3.7	0.3	1.1	2.4	55.4	38.1	4.2	coarse silt

Note: Coarse was determined separately from sand, silt and clay (see Materials and Methods: Laboratory Analysis).

APPENDIX A

Appendix A.2

Sediment chemistry constituents analyzed during 2001.

Chlorinated Pesticides			
Aldrin	BHC, Delta isomer	Heptachlor epoxide	p,p-DDD
Alpha (cis) Chlordane	BHC, Gamma isomer	Hexachlorobenzene	p,p-DDE
Gamma (trans) Chlordane	Cis Nonachlor	Mirex	p,p-DDT
Alpha Endosulfan	Dieldrin	o,p-DDD	Oxychlordane
Beta Endosulfan	Endrin	o,p-DDE	Trans Nonachlor
BHC, Alpha isomer	Heptachlor	o,p-DDT	Toxaphene
BHC, Beta isomer			

Polycyclic Aromatic Hydrocarbons			
1-methylnaphthalene	Acenaphthene	Benzo(e)pyrene	Fluorene
1-methylphenanthrene	Acenaphthylene	Benzo(G,H,I)perylene	Indeno(1,2,3-CD)pyrene
2,3,5-trimethylnaphthalene	Anthracene	Benzo(K)fluoranthene	Naphthalene
2,6-dimethylnaphthalene	Benzo(A)anthracene	Biphenyl	Perylene
2-methylnaphthalene	Dibenzo(A,H)anthracene	Chrysene	Phenanthrene
3,4-benzo(B)fluoranthene	Benzo(A)pyrene	Fluoranthene	Pyrene

Metals			
Aluminum	Chromium	Manganese	Silver
Antimony	Copper	Mercury	Thallium
Arsenic	Iron	Nickel	Tin
Beryllium	Lead	Selenium	Zinc
Cadmium			

PCB Congeners			
PCB 18	PCB 81	PCB 126	PCB 169
PCB 28	PCB 87	PCB 128	PCB 170
PCB 37	PCB 99	PCB 138	PCB 177
PCB 44	PCB 101	PCB 149	PCB 180
PCB 49	PCB 105	PCB 151	PCB 183
PCB 52	PCB 110	PCB 153/168	PCB 187
PCB 66	PCB 114	PCB 156	PCB 189
PCB 70	PCB 118	PCB 157	PCB 194
PCB 74	PCB 119	PCB 158	PCB 201
PCB 77	PCB 123	PCB 167	PCB 206

Organic Indicators			
	BOD	Total Solids	
	Total Nitrogen	Total Sulfides	
	Total Organic Carbon	Total Volatile Solids	

APPENDIX A

Appendix A.3

Mean annual concentrations of indicators of organic loading for PLOO monitoring stations from 1991 through 2001.Data for each year are pooled over all stations, and include: BOD (mg/L); sulfides (ppm); TN (%wt); TOC (%wt); TVS (%wt). Organic indicators not analyzed are designated as "ns".

	Pre-discharge			Post-discharge							
Indicator	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
BOD	230	207	270	249	320	278	302	316	325	300	319
Sulfides	0.4	9.1	2.4	3.2	3.2	3.8	5.9	5.7	9.0	3.0	2.8
TN	ns	0.044	0.033	0.050	0.040	0.059	0.056	0.056	0.054	0.058	0.052
TOC	ns	0.530	0.533	0.813	0.652	0.805	0.741	0.531	0.514	0.528	0.524
TVS	2.53	2.25	2.35	2.40	2.65	2.67	2.62	2.58	2.78	2.74	2.63

APPENDIX A

Appendix A.4

Summary of annual mean concentrations of trace metals (ppm) for PLOO monitoring stations from 1991 to 2001. Data for each year are pooled over all stations. Values below detection limits are designated as "nd". Missing values (–) represent metals not analyzed.

	Pre-discharge			Post-discharge							
Metal	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Al	–	–	–	9689	10426	9744	10603	11487	11560	9714	10152
Sb	nd	nd	0.25	nd	1.02	2.04	2.53	3.93	0.46	1.04	1.96
As	1.98	2.58	2.98	3.72	3.95	3.77	3.85	3.91	3.88	3.37	3.45
Be	0.77	0.21	0.01	0.03	0.17	0.18	0.33	0.74	0.72	nd	0.10
Cd	0.15	0.28	2.54	1.71	0.02	nd	0.04	0.01	0.08	0.01	0.05
Cr	21.6	12.1	18.3	20.3	19.9	20.2	19.1	15.4	16.4	14.8	17.8
Cu	8.7	5.9	7.9	10.2	9.7	9.3	10.8	8.9	8.6	9.4	10.1
Fe	–	–	13023	13874	14946	13871	13677	14391	14864	13938	13964
Pb	3.09	2.87	0.74	4.21	2.05	2.25	1.11	2.84	0.57	1.71	1.69
Mn	–	–	–	–	–	92.0	95.1	105.0	103.0	108.0	97.6
Hg	0.017	0.021	0.004	0.011	0.007	0.030	0.032	0.021	0.005	0.007	0.009
Ni	8.2	4.2	6.9	8.5	7.3	8.3	7.9	7.9	7.7	7.2	6.9
Se	0.16	0.10	0.28	0.23	0.24	0.23	0.28	0.23	0.22	0.25	0.20
Ag	nd	0.28	nd	nd	0.08	0.06	nd	nd	nd	nd	nd
Tl	nd	1.5	13.1	nd	0.3	nd	nd	0.5	0.1	nd	0.2
Sn	–	–	–	nd	nd	2.1	4.4	nd	nd	nd	nd
Zn	33.9	21.7	27.5	31.5	31.7	29.0	36.0	33.4	33.2	30.6	29.6

Appendix A

Appendix A.5

Concentrations for PAH (ppb) in PLOO sediments during 2001. MDL = method detection limit. Undetectable values are indicated by “nd”.

Polycylic Aromatic Hydocarbons

Station	QTR	Anthracene	Benzo(A) anthracene	Benzo(A) pyrene	Benzo(E) pyrene	Benzo(G,H,I) perylene	Benzo(K) fluoranthene	Chrysene
E2	January	55.7	78.4	78.0	54.1	29.2	nd	129.0
E3	January	nd	nd	21.6	nd	nd	nd	27.1
E1	April	nd	45.6	55.0	39.2	25.9	13.9	43.1
E2	April	nd	47.1	36.3	29.4	nd	nd	46.5
E3	April	nd	44.3	60.7	44.3	31.5	28.8	79.7
E9	April	nd	32.8	nd	nd	nd	nd	36.5
E1	July	nd	18.4	57.7	40.2	37.1	12.6	25.3
E2	July	nd	nd	22.5	nd	nd	nd	27.1
E3	July	nd	nd	21.7	nd	nd	nd	nd
E1	October	nd	nd	17.6	12.3	nd	nd	12.2
E3	October	nd	nd	nd	nd	nd	nd	nd
E21	October	nd	nd	36.6	74.0	132.0	47.1	nd
	MDL	35	23	18	18	25	20	21

Polycylic Aromatic Hydocarbons

Station	QTR	Fluoranthene	Indeno(1,2,3-CD) Pyrene	Perylene	Phenanthrene	Pyrene	3,4-benzo(B) fluoranthene
E2	January	148.0	nd	18.2	111.0	174.0	146.0
E3	January	nd	nd	nd	nd	nd	37.4
E1	April	62.0	19.9	9.6	nd	110.0	65.4
E2	April	56.8	nd	nd	nd	64.7	57.4
E3	April	nd	28.6	nd	nd	35.2	86.2
E9	April	nd	nd	nd	nd	nd	nd
E1	July	23.0	30.7	nd	nd	60.2	66.2
E2	July	nd	nd	nd	nd	nd	nd
E3	July	nd	nd	nd	nd	nd	27.4
E1	October	nd	nd	nd	nd	nd	nd
E3	October	nd	nd	nd	nd	43.0	nd
E21	October	nd	113.0	52.2	nd	nd	48.2
	MDL	39	22	18	37	27	27

Appendix A

Appendix A.6

Annual mean concentrations of PCB (ppt, parts per trillion) in PLOO sediments during 2001. MDL = method detection limit. Undetectable values are indicated by “nd”.

Polycylic		Station					
Biphenyls	**MDL**	**B11**	**E1**	**E2**	**E3**	**E5**	**E9**
PCB101	2600	nd	1300	1275	nd	nd	1050
PCB105	2600	nd	nd	248	nd	nd	233
PCB110	2900	nd	863	1475	nd	nd	475
PCB118	2700	nd	200	1000	nd	nd	575
PCB138	3000	nd	965	1258	238	nd	575
PCB149	2500	nd	250	775	105	nd	145
PCB151	2500	nd	80	275	nd	nd	nd
PCB153/168	2600	165	195	550	78	125	nd
PCB156	2900	193	nd	nd	nd	nd	nd
PCB158	2600	nd	nd	170	nd	nd	120
PCB180	2600	nd	723	190	45	220	1500
PCB187	2700	nd	nd	165	nd	nd	nd
PCB189	2300	173	nd	nd	nd	nd	nd
PCB52	3100	nd	90	750	75	nd	475
PCB70	2700	nd	nd	325	nd	nd	158
PCB74	2700	128	nd	nd	nd	nd	nd
PCB77	2100	170	nd	nd	nd	nd	nd
PCB87	2800	nd	nd	425	nd	nd	183
PCB99	2500	nd	nd	325	nd	nd	158

APPENDIX B

2001 PLOO Stations

Benthic Infauna

“Supplemental Data”

APPENDIX B. Station characteristics for PLOO benthic infaunal cluster groups A-G during 2001 (see Chapter 4).

Cluster Group	Station	Survey	Depth (m)	Depth (ft)	Mean Phi	CSF (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Sediment Notes "Field Observations"	Sediment Notes "Lab Observations (Grunge)"
A	B8	Jan, 2001	89.3	293	4.7	0	41.5	53.3	5.1	58.5	silt/clay	
A	B8	Apr, 2001	88.1	289	4.7	0	40.5	55.1	4.4	59.5	"silt"	
A	B8	Jul, 2001	89.0	292	4.8	0	39	55.2	5.8	61	"silt, silt and clay, sandy silt"	
A	B8	Oct, 2001	89.6	294	4.6	0	41.9	53.6	4.5	58.1	"silt"	
(n = 4)		**MEAN =**	**89.0**	**292**	**4.7**	**0**	**40.7**	**54.3**	**5**	**59.3**		
B	E19	Jan, 2001	89.6	294	4.5	0	48.8	47	4.1	51.2		
B	E19	Apr, 2001	87.5	287	4.3	0	52.5	44	3.4	47.5	silt/clay	
B	E19	Jul, 2001	88.4	290	4.5	0	48.6	47.5	3.8	51.3	"silt, silt and clay, sandy silt"	
B	E19	Oct, 2001	89.0	292	3.7	0	78.2	19.9	1.9	21.8	silt w/ clay	
B	E7	Jan, 2001	89.6	294	4.1	0	60.2	36.4	3.3	39.7		
B	E7	Apr, 2001	88.1	289	4.3	0	55.4	41.1	3.5	44.6	silt/clay	
B	E7	Jul, 2001	87.8	288	4.3	0	53.6	42.4	4	46.4	"silt, silt and clay, sandy silt"	
B	E7	Oct, 2001	88.4	290	3.7	0	75.7	22.4	1.9	24.3	"silt"	
(n = 8)		**MEAN =**	**88.6**	**291**	**4.2**	**0**	**59.1**	**37.6**	**3.2**	**40.8**		
C	B9	Jan, 2001	98.8	324	4.3	0	56.1	39.2	4.7	43.9	silty clay and gravel	mud/pea gravel
C	E20	Jan, 2001	98.5	323	4.3	0	58.4	37.8	3.8	41.6		
C	E20	Jul, 2001	97.3	319	4.2	0	58.5	37.9	3.6	41.5	silt w/ clay and shell hash	shell hash
C	E20	Oct, 2001	97.6	320	3.9	0	70.6	26.8	2.6	29.4	silt w/ clay	
C	E23	Jan, 2001	97.6	320	4.5	0	51.9	42.4	5.7	48.1		
C	E23	Apr, 2001	97.0	318	4	0	62.3	34.4	3.2	37.6	"silt"	
C	E23	Jul, 2001	97.0	318	4.3	0	56	40.3	3.7	44	silt w/ clay and shell hash	shell hash
C	E23	Oct, 2001	97.9	321	4.3	0.6	56.2	39.6	3.6	43.2	"silt"	
C	E25	Jan, 2001	97.6	320	4.3	0	56.9	38.1	5.1	43.1		
C	E25	Apr, 2001	97.3	319	4.2	0	58.4	38.4	3.2	41.6	"silt"	
C	E25	Jul, 2001	96.6	317	4.2	0	57.9	37.8	4.3	42.1	silt and sand	shell hash
C	E25	Oct, 2001	98.2	322	4.1	4.2	56.9	35.6	3.4	39	"silt"	
C	E26	Jan, 2001	98.5	323	4	0	67	29.7	3.3	33		
C	E26	Apr, 2001	97.3	319	4.3	0	54.9	41.5	3.6	45.1	"silt"	
C	E26	Jul, 2001	98.2	322	4.5	0	52.1	42.9	4.9	47.8	"silt, silt and clay, sandy silt"	shell hash
C	E26	Oct, 2001	97.6	320	4.3	0	57.5	39.1	3.5	42.6	silt w/ shell hash	
(n = 16)		**MEAN =**	**97.7**	**320**	**4.2**	**0.3**	**58.2**	**37.6**	**3.9**	**41.5**		

APPENDIX B. Station characteristics for PLOO benthic infaunal cluster groups A-G during 2001 (see Chapter 4).

Cluster Group	Station	Survey	Depth (m)	Depth (ft)	Mean Phi	CSF (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Sediment Notes "Field Observations"	Sediment Notes "Lab Observations (Grunge)"
D	E11	Jan, 2001	97.0	318	3.9	0	67.8	29.3	2.9	32.2		shell hash
D	E11	Apr, 2001	97.0	318	3.8	0.6	77.9	19.3	2.2	21.5	"silt"	
D	E11	Jul, 2001	97.3	319	3.9	1.3	60.4	34.2	4.1	38.3	silt w/ shell hash	shell hash
D	E11	Oct, 2001	97.6	320	3.4	1.2	81.2	15.8	1.8	17.6	"silt"	shell hash
D	E15	Jan, 2001	115.2	378	3.9	0	70.5	26.1	3.4	29.5		coarse black sand/shell hash
D	E15	Apr, 2001	116.8	383	3.9	0	75.3	21.9	2.8	24.6	"silt"	
D	E15	Jul, 2001	115.2	378	4.1	0	62.9	32.6	4.5	37.1	"silt, silt and clay, sandy silt"	
D	E15	Oct, 2001	115.5	379	3.8	0.6	78.5	18.3	2.5	20.8	"silt"	
D	E17	Jan, 2001	97.3	319	4.1	0	63.9	32.4	3.8	36.1		shell hash
D	E17	Apr, 2001	97.0	318	3.8	0	69.1	28.3	2.6	30.9	silt/clay/shell hash	shell hash
D	E17	Jul, 2001	97.0	318	4	2	62	33.2	2.8	36	"silt, silt and clay, sandy silt"	shell hash
D	E17	Oct, 2001	97.9	321	3.6	0	79.4	18.5	2	20.5	"silt"	
D	E2	Jan, 2001	97.3	319	3.9	9.7	48.6	36	5.7	41.7	fine sand/clay/shell hash	coarse sand/shell hash
D	E2	Jul, 2001	97.3	319	3.8	3.2	69.7	23.4	3.7	27.1	"silt, silt and clay, sandy silt"	coarse sand/shell hash
D	E2	Oct, 2001	97.0	318	4.1	2.8	58.3	35.2	3.7	38.9	silty clay/coarse sand	coarse sand/shell hash
D	E20	Apr, 2001	97.6	320	4	0	63.6	33.4	2.9	36.3	"silt"	
D	E21	Jan, 2001	116.8	383	4.2	0	61.8	34.3	3.8	38.1		
D	E21	Apr, 2001	115.5	379	4.2	0	61	35.7	3.3	39	"silt"	
D	E21	Jul, 2001	115.2	378	4.1	0	65.6	30.1	4.3	34.4	silt w/ clay and shell hash	
D	E21	Oct, 2001	115.2	378	3.9	0	70.2	26.9	2.9	29.8	silt w/ clay	
D	E5	Jan, 2001	97.3	319	3.9	0	67.6	28.6	3.7	32.4		
D	E5	Apr, 2001	97.6	320	3.6	0	76.8	20.8	2.4	23.2	sandy silt	coarse sand/mud balls
D	E5	Jul, 2001	97.0	318	4	0	63.9	32.3	3.7	36	"silt, silt and clay, sandy silt"	
D	E5	Oct, 2001	97.3	319	4	6	67.7	23.6	2.6	26.2	silty clay	
D	E8	Jan, 2001	97.0	318	3.9	0.8	67.7	28.5	2.9	31.4		
D	E8	Apr, 2001	97.9	321	3.8	0	68.3	29	2.7	31.7	silt and clay	
D	E8	Jul, 2001	97.0	318	4.1	0	62.4	33.8	3.8	37.6	"silt, silt and clay, sandy silt"	
D	E8	Oct, 2001	96.6	317	3.8	0	69.2	28.4	2.4	30.8	"silt"	
D	E9	Oct, 2001	115.9	380	3.6	15.3	47.9	32.8	3.9	36.7	"silt"	
(n = 29)		**MEAN =**	**103.0**	**338**	**3.9**	**1.5**	**66.9**	**28.4**	**3.2**	**31.6**		
E	E14	Jan, 2001	97.0	318	3.9	5.3	62.4	28.8	3.5	32.3	silt w/sand and gravel	coarse black sand/shell hash
E	E14	Apr, 2001	97.9	321	3.2	1.4	87.1	10.1	1.4	11.5	sandy silt and shell hash	small amt. Black sand
E	E14	Jul, 2001	97.6	320	3.6	7.3	67.8	22.6	2.4	25	sand/silt/clay/shell hash	coarse sand/shell hash
E	E14	Oct, 2001	97.6	320	3.7	5.3	64.6	27.5	2.6	30.1	"silt"	
(n = 4)		**MEAN =**	**97.5**	**320**	**3.6**	**4.8**	**70.5**	**22.3**	**2.5**	**24.7**		

APPENDIX B. Station characteristics for PLOO benthic infaunal cluster groups A-G during 2001 (see Chapter 4).

Cluster Group	Station	Survey	Depth (m)	Depth (ft)	Mean Phi	CSF (%)	Sand (%)	Silt (%)	Clay (%)	Fines (%)	Sediment Notes "Field Observations"	Sediment Notes "Lab Observations (Grunge)"
F	B10	Jan, 2001	116.8	383	4.1	2	68.7	24.2	5	29.2	fine sand/silty clay/shell hash	shell hash
F	B10	Apr, 2001	116.8	383	4.1	1.8	65.3	28.7	4.2	32.9	sandy silt	shell hash
F	B10	Jul, 2001	118.3	388	4.1	0.6	66.9	28.9	3.6	32.5	"silt, silt and clay, sandy silt"	shell hash
F	B10	Oct, 2001	117.4	385	3.9	0	77.1	19.9	3	22.9	sandy silt w/shell hash	shell hash
F	B11	Jan, 2001	89.0	292	3.4	17.8	39.1	37.8	5.3	43.1	sand w/shell hash	coarse sand/pea gravel/shell hash
F	B11	Apr, 2001	88.7	291	4.2	7.6	47.2	40.6	4.6	45.2	silty sand	coarse sand, shell hash
F	B11	Jul, 2001	88.1	289	4.4	8.2	41.1	45	5.7	50.7	sandy silt w/shell hash	coarse sand/gravel
F	B11	Oct, 2001	88.4	290	4.5	9.4	37.8	47.4	5.4	52.8	sandy silt w/shell hash	pea gravel/shell hash
F	B9	Apr, 2001	98.5	323	4.2	0	60.1	35.8	4.1	39.9	"silt"	
F	B9	Jul, 2001	98.5	323	4.4	0	53.2	42.4	4.4	46.8	"silt, silt and clay, sandy silt"	
F	B9	Oct, 2001	98.2	322	4.2	0	64.4	31.9	3.6	35.5	silt (sulfide odor)	
F	E2	Apr, 2001	97.3	319	3.3	17.4	39.7	38.6	4.3	42.9	silty sand and gravel	coarse sand
F	E9	Jan, 2001	114.6	376	3.2	20.5	43.2	32.1	4.2	36.3	sandy silt w/gravel	coarse black sand/shell hash
F	E9	Apr, 2001	115.2	378	3.1	18	48.2	30.4	3.4	33.8	silty sand	coarse sand
F	E9	Jul, 2001	115.9	380	4.1	9.6	50.5	34.6	5.3	39.9	silty sand	coarse black sand
(n = 15)		**MEAN =**	**104.1**	**341**	**3.9**	**7.5**	**53.5**	**34.6**	**4.4**	**39**		
G	B12	Jan, 2001	97.6	320	3.2	3	70.7	22.2	4.2	26.3	sandy silt w/ shell hash	coarse sand/shell hash
G	B12	Apr, 2001	97.6	320	3.4	1.5	69.5	24.9	4.1	29		shell hash
G	B12	Jul, 2001	97.3	319	1.6	4.2	84.9	9.3	1.5	10.8	sandy silt w/ shell hash	shell hash
G	B12	Oct, 2001	97.6	320	3.9	3	60.5	31.1	5.4	36.5	sandy silt w/ shell hash	shell hash/pea gravel
G	B13	Jan, 2001	116.5	382	1.3	9.4	81.5	7.6	1.5	9.1	sand w/shell hash	coarse sand/shell hash/rock
G	B13	Apr, 2001	115.5	379	2.6	5.3	74.9	16.6	3.2	19.8	sand w/shell hash	shell hash
G	B13	Jul, 2001	114.3	375	1.4	4	93.1	2.4	0.4	2.8	sandy silt w/ shell hash	coarse sand/shell hash
G	B13	Oct, 2001	115.9	380	3	7.5	69.3	19.9	3.3	23.2	sandy silt w/ shell hash	coarse sand/shell hash
(n = 8)		**MEAN =**	**106.5**	**349**	**2.6**	**4.7**	**75.5**	**16.7**	**2.9**	**19.7**		

Fines = silt + clay; CSF = coarse sieved fraction (particles > 1.0 mm in diameter)

Sediment notes in quotes (e.g., "silt") = general default descriptions such as "most stations = silt"

APPENDIX C

2001 PLOO Stations

Demersal Fishes and Megabenthic Invertebrates

"Supplemental Data"

Appendix C.

Summary of demersal fish species captured in 38 trawls off of Point Loma, San Diego during 2001. Data depicts total abundance (N) and minimum, maximum and mean length.

			LENGTH		
Taxon/Species	**Common Name**	**N**	**Min**	**Max**	**Mean**
MYXINIFORMIS					
Myxinidae					
Myxini	Pacific hagfish	1	52	52	52
CHIMAERIFORMIS					
Chimaeridae					
Hydrolagus colliei	spotted ratfish	1	40	40	40
RAJIFORMES					
Rajidae					
Raja inornata	California skate	9	16	98	46
OSMERIFORMES					
Argentinidae					
Argentina sialis	Pacific argentine	1	3	3	3
AULOPIFORMES					
Synodontidae					
Synodus lucioceps	California lizardfish	16	17	35	26
OPHIDIIFORMES					
Ophidiidae					
Chilara taylori	spotted cuskeel	6	11	21	15
Bythitidae					
Brosmophycis marginata	red brotula	1	37	37	37
BATRACHOIDIFORMES					
Batrachoididae					
Porichthys myriaster	specklefin midshipman	1	29	29	29
Porichthys notatus	plainfin midshipman	272	5	22	9
SCORPAENIFORMES					
Scorpaenidae	(juv. rockfish unid.)	4	5	6	6
Scorpaena guttata	California scorpionfish	80	13	25	19
Sebastes contellatus	starry rockfish	1	30	30	30
Sebastes chlorostictus	greenspotted rockfish	1	9	9	9
Sebastes elongatus	greenstriped rockfish	1	7	7	7
Sebastes hopkinsi	squarespot rockfish	3	14	19	16
Sebastes rosenblatti	greenblotched rockfish	15	7	31	15
Sebastes rubrivinctus	flag rockfish	2	4	7	6
Sebastes saxicola	stripetail rockfish	110	4	14	8
Sebastes semicinctus	halfbanded rockfish	26	8	17	11
Hexagrammidae					
Ophiodon elongatus	lingcod	1	47	47	47
Zaniolepis frenata	shortspine combfish	21	8	19	13
Zaniolepis latipinnis	longspine combfish	544	5	19	11

Appendix C (continued).

Taxon/Species	Common Name	LENGTH N	Min	Max	Mean
Cottidae					
Chitonotus pugetensis	roughback sculpin	35	6	17	9
Icelinus quadriseriatus	yellowchin sculpin	1034	3	9	6
Icelinus tenuis	spotfin sculpin	12	6	9	8
Agonidae					
Odontopyxis trispinosa	pygmy poacher	2	7	9	8
Xeneretmus triacanthus	bluespotted poacher	2	12	13	13
PERCIFORMES					
Sciaenidae					
Genyonemus lineatus	white croaker	38	18	27	21
Embiotocidae					
Cymatogaster aggregata	shiner perch	7	9	12	11
Zalembius rosaceus	pink seaperch	168	5	15	7
Zoarcidae					
Lycodes cortezianus	bigfin eelpout	1	21	21	21
Lycodopsis pacifica	blackbelly eelpout	1	17	17	17
Gobiidae					
Lepidogobius lepidus	bay goby	42	5	7	7
PLEURONECTIFORMES	(juv. flatfish unid.)	1	4	4	4
Paralichthyidae					
Citharichthys sordidus	Pacific sanddab	6594	3	21	8
Citharichthys xanthostigma	longfin sanddab	832	4	18	12
Hippoglossina stomata	bigmouth sole	63	12	23	16
Pleuronectidae					
Eopsetta exilis	slender sole	18	9	15	11
Microstomus pacificus	Dover sole	223	5	22	11
Pleuronectes vetulus	English sole	26	9	25	18
Pleuronichthys verticalis	hornyhead turbot	20	8	24	14
Cynoglossidae					
Symphurus atricauda	California tonguefish	204	9	16	13

Taxonomic arrangement from Nelson 1994.

APPENDIX D

2001 PLOO Stations

Bioaccumulation of Contaminants in Fish Tissues

"Supplemental Data"

April 2001

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF1	1	Copper rockfish	Liver	Hexachlorobenzene	2.9	E	ug/kg	
RF1	1	Copper rockfish	Liver	Aluminum	10.8		mg/kg	2.6
RF1	1	Copper rockfish	Liver	Copper	10		mg/kg	0.76
RF1	1	Copper rockfish	Liver	Iron	111		mg/kg	1.3
RF1	1	Copper rockfish	Liver	Lipids	20.6		wt%	
RF1	1	Copper rockfish	Liver	Manganese	0.725		mg/kg	0.23
RF1	1	Copper rockfish	Liver	Mercury	0.073		mg/kg	0.012
RF1	1	Copper rockfish	Liver	o,p-DDE	2.5	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 101	7.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 105	2.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 110	6	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 118	15		ug/kg	13.3
RF1	1	Copper rockfish	Liver	PCB 128	3.1	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 138	21		ug/kg	13.3
RF1	1	Copper rockfish	Liver	PCB 149	7.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 151	2.6	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 153/168	30		ug/kg	13.3
RF1	1	Copper rockfish	Liver	PCB 156	2.2	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 158	1.8	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 170	5.3	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 177	1.9	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 180	11	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 183	3.1	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 187	11	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 194	3.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 201	4.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 206	4.4	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 28	1.8	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 37	1.7	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 49	2.1	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 66	3.1	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 70	2.8	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 74	2.5	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 87	3	E	ug/kg	
RF1	1	Copper rockfish	Liver	PCB 99	9.9	E	ug/kg	
RF1	1	Copper rockfish	Liver	p,p-DDD	5.9	E	ug/kg	
RF1	1	Copper rockfish	Liver	p,p-DDE	230		ug/kg	13.3
RF1	1	Copper rockfish	Liver	p,p-DDT	5	E	ug/kg	
RF1	1	Copper rockfish	Liver	Selenium	1.49		mg/kg	0.17
RF1	1	Copper rockfish	Liver	Total Solids	41.5		wt%	0.4
RF1	1	Copper rockfish	Liver	Zinc	25.5		mg/kg	0.58
RF1	1	Copper rockfish	Muscle	Hexachlorobenzene	1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	Aluminum	4.3		mg/kg	2.6
RF1	1	Copper rockfish	Muscle	Arsenic	2.7		mg/kg	1.4
RF1	1	Copper rockfish	Muscle	Copper	3.21		mg/kg	0.76
RF1	1	Copper rockfish	Muscle	Iron	2		mg/kg	1.3
RF1	1	Copper rockfish	Muscle	Lipids	0.395		wt%	
RF1	1	Copper rockfish	Muscle	Mercury	0.442		mg/kg	0.012
RF1	1	Copper rockfish	Muscle	o,p-DDE	0.2	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF1	1	Copper rockfish	Muscle	PCB 101	0.6	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 105	0.3	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 118	1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 138	1.2	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 149	0.4	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 151	0.2	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 153/168	1.8		ug/kg	1.33
RF1	1	Copper rockfish	Muscle	PCB 156	0.1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 177	0.2	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 180	0.7	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 187	0.6	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 194	0.2	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 206	0.3	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 52	0.1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 66	0.1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 70	0.1	E	ug/kg	
RF1	1	Copper rockfish	Muscle	PCB 99	0.4	E	ug/kg	
RF1	1	Copper rockfish	Muscle	p,p-DDD	0.3	E	ug/kg	
RF1	1	Copper rockfish	Muscle	p,p-DDE	23		ug/kg	1.33
RF1	1	Copper rockfish	Muscle	p,p-DDT	0.3	E	ug/kg	
RF1	1	Copper rockfish	Muscle	Selenium	0.37		mg/kg	0.13
RF1	1	Copper rockfish	Muscle	Total Solids	22.7		wt%	0.4
RF1	1	Copper rockfish	Muscle	Zinc	3.83		mg/kg	0.58
RF1	2	Vermilion rockfish	Liver	Hexachlorobenzene	2.2	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	Aluminum	18.1		mg/kg	2.6
RF1	2	Vermilion rockfish	Liver	Copper	19.1		mg/kg	0.76
RF1	2	Vermilion rockfish	Liver	Iron	114		mg/kg	1.3
RF1	2	Vermilion rockfish	Liver	Lipids	20.5		wt%	
RF1	2	Vermilion rockfish	Liver	Manganese	0.57		mg/kg	0.23
RF1	2	Vermilion rockfish	Liver	Mercury	0.0855		mg/kg	0.012
RF1	2	Vermilion rockfish	Liver	PCB 101	7.9	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 105	3.7	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 110	5.9	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 118	10	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 128	2.1	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 138	16		ug/kg	13.3
RF1	2	Vermilion rockfish	Liver	PCB 149	6.6	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 151	2	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 153/168	24		ug/kg	13.3
RF1	2	Vermilion rockfish	Liver	PCB 156	1.7	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 158	1.4	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 170	4.2	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 177	1.3	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 180	8.9	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 187	9.1	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 194	3	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 206	3.8	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 49	1.2	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 66	1.7	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 70	1.5	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 74	1.4	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF1	2	Vermilion rockfish	Liver	PCB 87	1.6	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	PCB 99	8.3	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	p,p-DDD	4.8	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	p,p-DDE	160		ug/kg	13.3
RF1	2	Vermilion rockfish	Liver	p,p-DDT	4	E	ug/kg	
RF1	2	Vermilion rockfish	Liver	Selenium	1.37		mg/kg	0.18
RF1	2	Vermilion rockfish	Liver	Total Solids	42.5		wt%	0.4
RF1	2	Vermilion rockfish	Liver	Zinc	26.5		mg/kg	0.58
RF1	2	Vermilion rockfish	Muscle	Hexachlorobenzene	0.2	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	Aluminum	14.3		mg/kg	2.6
RF1	2	Vermilion rockfish	Muscle	Copper	6.59		mg/kg	0.76
RF1	2	Vermilion rockfish	Muscle	Iron	2.85		mg/kg	1.3
RF1	2	Vermilion rockfish	Muscle	Lipids	0.57		wt%	
RF1	2	Vermilion rockfish	Muscle	Mercury	0.018		mg/kg	0.012
RF1	2	Vermilion rockfish	Muscle	PCB 101	0.5	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 118	0.4	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 138	0.7	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 149	0.3	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 153/168	1	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 180	0.4	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 187	0.4	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 206	0.2	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	PCB 99	0.3	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	p,p-DDD	0.2	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	p,p-DDE	8.3		ug/kg	1.33
RF1	2	Vermilion rockfish	Muscle	p,p-DDT	0.2	E	ug/kg	
RF1	2	Vermilion rockfish	Muscle	Selenium	0.24		mg/kg	0.13
RF1	2	Vermilion rockfish	Muscle	Total Solids	21.9		wt%	0.4
RF1	2	Vermilion rockfish	Muscle	Zinc	3.56		mg/kg	0.58
RF1	3	Vermilion rockfish	Liver	Hexachlorobenzene	2.5	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	Aluminum	16.8		mg/kg	2.6
RF1	3	Vermilion rockfish	Liver	Arsenic	2.6		mg/kg	1.4
RF1	3	Vermilion rockfish	Liver	Cadmium	3.06		mg/kg	0.34
RF1	3	Vermilion rockfish	Liver	Alpha (cis) Chlordane	8.8	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	Copper	6.1		mg/kg	0.76
RF1	3	Vermilion rockfish	Liver	Iron	110		mg/kg	1.3
RF1	3	Vermilion rockfish	Liver	Lipids	18.4		wt%	
RF1	3	Vermilion rockfish	Liver	Manganese	0.82		mg/kg	0.23
RF1	3	Vermilion rockfish	Liver	Mercury	0.259		mg/kg	0.012
RF1	3	Vermilion rockfish	Liver	o,p-DDE	13	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 101	29		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 105	11	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 110	17		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 118	44		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 123	4.1	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 128	5.4	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 138	58		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 149	18		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 151	7.7	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 153/168	80		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 156	7	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF1	3	Vermilion rockfish	Liver	PCB 158	4.9	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 170	11	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 177	4.5	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 180	31		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 183	9.3	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 187	32		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	PCB 194	8.8	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 206	6	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 49	3.1	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 66	6.7	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 70	4.3	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 74	3.7	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 87	5.6	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	PCB 99	21		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	p,p-DDD	16		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	p,p-DDE	1100		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	p,p-DDT	17		ug/kg	13.3
RF1	3	Vermilion rockfish	Liver	Selenium	1.57		mg/kg	0.17
RF1	3	Vermilion rockfish	Liver	Total Solids	40.2		wt%	0.4
RF1	3	Vermilion rockfish	Liver	Trans Nonachlor	14	E	ug/kg	
RF1	3	Vermilion rockfish	Liver	Zinc	38.7		mg/kg	0.58
RF1	3	Vermilion rockfish	Muscle	Hexachlorobenzene	0.3	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	Aluminum	8.5		mg/kg	2.6
RF1	3	Vermilion rockfish	Muscle	Arsenic	3.1		mg/kg	1.4
RF1	3	Vermilion rockfish	Muscle	Copper	5.85		mg/kg	0.76
RF1	3	Vermilion rockfish	Muscle	Iron	3.9		mg/kg	1.3
RF1	3	Vermilion rockfish	Muscle	Lipids	0.55		wt%	
RF1	3	Vermilion rockfish	Muscle	Mercury	0.0355		mg/kg	0.012
RF1	3	Vermilion rockfish	Muscle	PCB 101	0.6	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 105	0.2	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 118	0.8	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 138	1.1	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 149	0.4	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 153/168	1.6		ug/kg	1.33
RF1	3	Vermilion rockfish	Muscle	PCB 180	0.7	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 187	0.5	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 206	0.3	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 66	0.1	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 70	0.1	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 74	0.1	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	PCB 99	0.5	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	p,p-DDD	0.3	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	p,p-DDE	11		ug/kg	1.33
RF1	3	Vermilion rockfish	Muscle	p,p-DDT	0.3	E	ug/kg	
RF1	3	Vermilion rockfish	Muscle	Selenium	0.21		mg/kg	0.13
RF1	3	Vermilion rockfish	Muscle	Total Solids	22.1		wt%	0.4
RF1	3	Vermilion rockfish	Muscle	Zinc	3.61		mg/kg	0.58
RF2	1	Bocaccio	Liver	Aluminum	18		mg/kg	2.6
RF2	1	Bocaccio	Liver	Copper	14.9		mg/kg	0.76
RF2	1	Bocaccio	Liver	Iron	75.2		mg/kg	1.3
RF2	1	Bocaccio	Liver	Lipids	5.09		wt%	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF2	1	Bocaccio	Liver	Manganese	0.93		mg/kg	0.23
RF2	1	Bocaccio	Liver	Mercury	0.144		mg/kg	0.012
RF2	1	Bocaccio	Liver	o,p-DDE	4.6	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 101	6.2	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 110	3.9	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 118	8.3	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 138	9.2	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 149	5.2	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 153/168	13.4		ug/kg	13.3
RF2	1	Bocaccio	Liver	PCB 180	3.8	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 187	6.7	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 206	3	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 66	2	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 70	1	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 74	1.4	E	ug/kg	
RF2	1	Bocaccio	Liver	PCB 99	3.5	E	ug/kg	
RF2	1	Bocaccio	Liver	p,p-DDD	4.9	E	ug/kg	
RF2	1	Bocaccio	Liver	p,p-DDE	220		ug/kg	13.3
RF2	1	Bocaccio	Liver	p,p-DDT	3.5	E	ug/kg	
RF2	1	Bocaccio	Liver	Selenium	0.98		mg/kg	0.26
RF2	1	Bocaccio	Liver	Total Solids	30.5		wt%	0.4
RF2	1	Bocaccio	Liver	Zinc	44.8		mg/kg	0.58
RF2	1	Bocaccio	Muscle	Hexachlorobenzene	0.1	E	ug/kg	
RF2	1	Bocaccio	Muscle	Arsenic	1.5		mg/kg	1.4
RF2	1	Bocaccio	Muscle	Copper	1.79		mg/kg	0.76
RF2	1	Bocaccio	Muscle	Lipids	0.02		wt%	
RF2	1	Bocaccio	Muscle	Mercury	0.058		mg/kg	0.012
RF2	1	Bocaccio	Muscle	PCB 101	0.5	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 105	0.4	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 110	0.4	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 114	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 118	0.6	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 128	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 138	0.8	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 149	0.6	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 151	0.4	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 153/168	1.4		ug/kg	1.33
RF2	1	Bocaccio	Muscle	PCB 156	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 158	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 177	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 180	0.2	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 183	0.4	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 187	0.5	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 194	0.2	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 206	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 66	0.2	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 70	0.1	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 87	0.3	E	ug/kg	
RF2	1	Bocaccio	Muscle	PCB 99	0.4	E	ug/kg	
RF2	1	Bocaccio	Muscle	p,p-DDE	9.7		ug/kg	1.33
RF2	1	Bocaccio	Muscle	p,p-DDT	0.2	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value	Units	MDL
RF2	1	Bocaccio	Muscle	Selenium	0.18	mg/kg	0.13
RF2	1	Bocaccio	Muscle	Total Solids	21.1	wt%	0.4
RF2	1	Bocaccio	Muscle	Zinc	3.35	mg/kg	0.58
RF2	2	Mixed rockfish	Liver	Aluminum	11.7	mg/kg	2.6
RF2	2	Mixed rockfish	Liver	Copper	22.3	mg/kg	0.76
RF2	2	Mixed rockfish	Liver	Iron	43.6	mg/kg	1.3
RF2	2	Mixed rockfish	Liver	Lipids	7.08	wt%	
RF2	2	Mixed rockfish	Liver	Manganese	0.53	mg/kg	0.23
RF2	2	Mixed rockfish	Liver	Mercury	0.431	mg/kg	0.012
RF2	2	Mixed rockfish	Liver	PCB 101	10 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 105	5.5 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 110	2.5 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 118	19	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	PCB 128	2.7 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 138	29	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	PCB 149	8.2 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 151	2.4 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 153/168	42	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	PCB 156	3.1 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 158	2.8 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 177	2.1 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 180	15	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	PCB 183	4.9 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 187	15	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	PCB 194	3.8 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 206	3.9 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 66	0.9 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 70	1.2 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 74	1.7 E	ug/kg	
RF2	2	Mixed rockfish	Liver	PCB 99	9.2 E	ug/kg	
RF2	2	Mixed rockfish	Liver	p,p-DDD	5.2 E	ug/kg	
RF2	2	Mixed rockfish	Liver	p,p-DDE	370	ug/kg	13.3
RF2	2	Mixed rockfish	Liver	p,p-DDT	6.7 E	ug/kg	
RF2	2	Mixed rockfish	Liver	Selenium	1.02	mg/kg	0.13
RF2	2	Mixed rockfish	Liver	Total Solids	33.4	wt%	0.4
RF2	2	Mixed rockfish	Liver	Trans Nonachlor	5.3 E	ug/kg	
RF2	2	Mixed rockfish	Liver	Zinc	49.5	mg/kg	0.58
RF2	2	Mixed rockfish	Muscle	Copper	5.31	mg/kg	0.76
RF2	2	Mixed rockfish	Muscle	Iron	5.9	mg/kg	1.3
RF2	2	Mixed rockfish	Muscle	Lipids	0.11	wt%	
RF2	2	Mixed rockfish	Muscle	Mercury	0.088	mg/kg	0.012
RF2	2	Mixed rockfish	Muscle	PCB 101	0.4 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 105	0.5 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 110	0.4 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 114	0.3 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 118	1 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 123	0.1 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 128	0.2 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 138	1.3 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 149	0.7 E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 151	0.3 E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF2	2	Mixed rockfish	Muscle	PCB 153/168	2.2		ug/kg	1.33
RF2	2	Mixed rockfish	Muscle	PCB 156	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 157	0.1	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 158	0.3	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 170	0.4	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 177	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 180	0.7	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 183	0.4	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 187	0.6	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 189	0.1	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 194	0.3	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 206	0.3	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 28	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 37	0.1	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 66	0.1	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 70	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 74	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 77	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 87	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	PCB 99	0.6	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	p,p-DDD	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	p,p-DDE	16		ug/kg	1.33
RF2	2	Mixed rockfish	Muscle	p,p-DDT	0.2	E	ug/kg	
RF2	2	Mixed rockfish	Muscle	Selenium	0.2		mg/kg	0.13
RF2	2	Mixed rockfish	Muscle	Total Solids	21.2		wt%	0.4
RF2	2	Mixed rockfish	Muscle	Zinc	3.88		mg/kg	0.58
RF2	3	Mixed rockfish	Liver	Hexachlorobenzene	2.7	E	ug/kg	
RF2	3	Mixed rockfish	Liver	Arsenic	3.8		mg/kg	1.4
RF2	3	Mixed rockfish	Liver	Cadmium	2.01		mg/kg	0.34
RF2	3	Mixed rockfish	Liver	Copper	12.4		mg/kg	0.76
RF2	3	Mixed rockfish	Liver	Iron	125		mg/kg	1.3
RF2	3	Mixed rockfish	Liver	Lipids	6.36		wt%	
RF2	3	Mixed rockfish	Liver	Manganese	0.78		mg/kg	0.23
RF2	3	Mixed rockfish	Liver	PCB 101	5.6	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 110	3.2	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 118	6.2	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 138	7.8	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 149	3.6	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 151	1	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 153/168	11.8	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 180	4	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 187	4.5	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 194	1.2	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 206	2.7	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 28	1.7	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 37	2.6	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 44	1.3	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 49	2.4	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 66	2.7	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 70	2.8	E	ug/kg	
RF2	3	Mixed rockfish	Liver	PCB 74	3	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
RF2	3	Mixed rockfish	Liver	PCB 99	4	E	ug/kg	
RF2	3	Mixed rockfish	Liver	p,p-DDD	2.1	E	ug/kg	
RF2	3	Mixed rockfish	Liver	p,p-DDE	110		ug/kg	13.3
RF2	3	Mixed rockfish	Liver	p,p-DDT	3	E	ug/kg	
RF2	3	Mixed rockfish	Liver	Selenium	2.66		mg/kg	0.43
RF2	3	Mixed rockfish	Liver	Total Solids	29.5		wt%	0.4
RF2	3	Mixed rockfish	Liver	Zinc	41.8		mg/kg	0.58
RF2	3	Mixed rockfish	Muscle	Copper	5.59		mg/kg	0.76
RF2	3	Mixed rockfish	Muscle	Iron	3.5		mg/kg	1.3
RF2	3	Mixed rockfish	Muscle	Lipids	0.02		wt%	
RF2	3	Mixed rockfish	Muscle	Mercury	0.02		mg/kg	0.012
RF2	3	Mixed rockfish	Muscle	PCB 101	0.2	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 118	0.2	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 138	0.4	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 153/168	0.4	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 180	0.1	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 187	0.3	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 206	0.3	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	PCB 99	0.1	E	ug/kg	
RF2	3	Mixed rockfish	Muscle	p,p-DDE	4.5		ug/kg	1.33
RF2	3	Mixed rockfish	Muscle	Selenium	0.16		mg/kg	0.13
RF2	3	Mixed rockfish	Muscle	Total Solids	20.3		wt%	0.4
RF2	3	Mixed rockfish	Muscle	Zinc	3.1		mg/kg	0.58
SD7	1	Longfin sanddab	Muscle	Aluminum	6.1		mg/kg	2.6
SD7	1	Longfin sanddab	Muscle	Arsenic	10		mg/kg	1.4
SD7	1	Longfin sanddab	Muscle	Copper	5.46		mg/kg	0.76
SD7	1	Longfin sanddab	Muscle	Iron	7.8		mg/kg	1.3
SD7	1	Longfin sanddab	Muscle	Lipids	0.08		wt%	
SD7	1	Longfin sanddab	Muscle	Mercury	0.053		mg/kg	0.012
SD7	1	Longfin sanddab	Muscle	PCB 138	0.3	E	ug/kg	
SD7	1	Longfin sanddab	Muscle	PCB 153/168	0.4	E	ug/kg	
SD7	1	Longfin sanddab	Muscle	PCB 180	0.2	E	ug/kg	
SD7	1	Longfin sanddab	Muscle	PCB 187	0.1	E	ug/kg	
SD7	1	Longfin sanddab	Muscle	PCB 206	0.1	E	ug/kg	
SD7	1	Longfin sanddab	Muscle	p,p-DDE	1.5		ug/kg	1.33
SD7	1	Longfin sanddab	Muscle	Selenium	0.56		mg/kg	0.13
SD7	1	Longfin sanddab	Muscle	Total Solids	19		wt%	0.4
SD7	1	Longfin sanddab	Muscle	Zinc	2.68		mg/kg	0.58
SD7	1	Longfin sanddab	Liver	Hexachlorobenzene	1.4	E	ug/kg	
SD7	1	Longfin sanddab	Liver	Aluminum	5.1		mg/kg	2.6
SD7	1	Longfin sanddab	Liver	Arsenic	13.1		mg/kg	1.4
SD7	1	Longfin sanddab	Liver	Cadmium	2.8		mg/kg	0.34
SD7	1	Longfin sanddab	Liver	Copper	12.8		mg/kg	0.76
SD7	1	Longfin sanddab	Liver	Iron	213		mg/kg	1.3
SD7	1	Longfin sanddab	Liver	Lipids	7.24		wt%	
SD7	1	Longfin sanddab	Liver	Manganese	0.99		mg/kg	0.23
SD7	1	Longfin sanddab	Liver	o,p-DDE	5.2	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 101	8.7	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 105	11	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 110	11	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 118	45		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD7	1	Longfin sanddab	Liver	PCB 123	3.2	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 128	11	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 138	80		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	PCB 151	9.8	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 153/168	116		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	PCB 156	6.6	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 158	5.6	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 167	3.1	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 170	19		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	PCB 177	5.1	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 180	43		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	PCB 183	13	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 187	42		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	PCB 194	13	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 206	9.7	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 66	2.8	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 70	1.5	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 74	2.8	E	ug/kg	
SD7	1	Longfin sanddab	Liver	PCB 99	26		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	p,p-DDD	1.8	E	ug/kg	
SD7	1	Longfin sanddab	Liver	p,p-DDE	340		ug/kg	13.3
SD7	1	Longfin sanddab	Liver	p,p-DDT	3.1	E	ug/kg	
SD7	1	Longfin sanddab	Liver	Selenium	1.97		mg/kg	0.43
SD7	1	Longfin sanddab	Liver	Total Solids	25.4		wt%	0.4
SD7	1	Longfin sanddab	Liver	Zinc	25		mg/kg	0.58
SD7	2	Ca. scorpionfish	Muscle	Hexachlorobenzene	0.1	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	Aluminum	13		mg/kg	2.6
SD7	2	Ca. scorpionfish	Muscle	Copper	9.15		mg/kg	0.76
SD7	2	Ca. scorpionfish	Muscle	Iron	16.8		mg/kg	1.3
SD7	2	Ca. scorpionfish	Muscle	Lipids	0.52		wt%	
SD7	2	Ca. scorpionfish	Muscle	Mercury	0.124		mg/kg	0.012
SD7	2	Ca. scorpionfish	Muscle	PCB 101	1.1	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 105	0.5	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 110	0.5	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 118	2.4		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	PCB 128	0.2	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 138	3.3		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	PCB 149	0.7	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 151	0.4	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 153/168	4.4		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	PCB 156	0.3	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 158	0.3	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 170	0.8	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 177	0.4	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 180	1.8		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	PCB 183	0.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 187	2.1		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	PCB 194	0.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 206	0.5	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 52	0.3	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 66	0.4	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD7	2	Ca. scorpionfish	Muscle	PCB 70	0.1	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 74	0.2	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	PCB 99	1.2	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	p,p-DDD	0.5	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	p,p-DDE	41		ug/kg	1.33
SD7	2	Ca. scorpionfish	Muscle	p,p-DDT	0.2	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	Selenium	0.2		mg/kg	0.13
SD7	2	Ca. scorpionfish	Muscle	Total Solids	20.9		wt%	0.4
SD7	2	Ca. scorpionfish	Muscle	Trans Nonachlor	0.5	E	ug/kg	
SD7	2	Ca. scorpionfish	Muscle	Zinc	3.97		mg/kg	0.58
SD7	2	Ca. scorpionfish	Liver	Hexachlorobenzene	0.8	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	Aluminum	15.8		mg/kg	2.6
SD7	2	Ca. scorpionfish	Liver	Cadmium	2.75		mg/kg	0.34
SD7	2	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	11	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	Copper	25.5		mg/kg	0.76
SD7	2	Ca. scorpionfish	Liver	Iron	227		mg/kg	1.3
SD7	2	Ca. scorpionfish	Liver	Lipids	7.98		wt%	
SD7	2	Ca. scorpionfish	Liver	Mercury	0.073		mg/kg	0.012
SD7	2	Ca. scorpionfish	Liver	PCB 101	17		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 105	9.3	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 110	6.1	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 118	41		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 123	3.1	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 128	6.9	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 138	61		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 149	10	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 151	7.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 153/168	84		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 156	5.8	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 158	4.8	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 170	17		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 177	6.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 180	37		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 183	11	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 187	37		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	PCB 194	11	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 206	7.4	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 28	2.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 66	6	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 70	1.8	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 74	3.6	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 87	3.3	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	PCB 99	19		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	p,p-DDD	7.2	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	p,p-DDE	850		ug/kg	13.3
SD7	2	Ca. scorpionfish	Liver	p,p-DDT	3.7	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	Selenium	0.73		mg/kg	0.13
SD7	2	Ca. scorpionfish	Liver	Total Solids	40.6		wt%	0.4
SD7	2	Ca. scorpionfish	Liver	Trans Nonachlor	18	E	ug/kg	
SD7	2	Ca. scorpionfish	Liver	Zinc	81.3		mg/kg	0.58
SD7	3	Ca. scorpionfish	Muscle	Aluminum	7		mg/kg	2.6

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD7	3	Ca. scorpionfish	Muscle	Arsenic	2.2		mg/kg	1.4
SD7	3	Ca. scorpionfish	Muscle	Copper	8.71		mg/kg	0.76
SD7	3	Ca. scorpionfish	Muscle	Iron	11.2		mg/kg	1.3
SD7	3	Ca. scorpionfish	Muscle	Lipids	0.09		wt%	
SD7	3	Ca. scorpionfish	Muscle	Mercury	0.146		mg/kg	0.012
SD7	3	Ca. scorpionfish	Muscle	PCB 101	0.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 118	0.5	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 138	0.8	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 153/168	1.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 156	0.1	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 177	0.1	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 180	0.6	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 183	0.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 187	0.6	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 194	0.1	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 206	0.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 66	0.1	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	PCB 99	0.3	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	p,p-DDD	0.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	p,p-DDE	12		ug/kg	1.33
SD7	3	Ca. scorpionfish	Muscle	p,p-DDT	0.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Muscle	Selenium	0.28		mg/kg	0.13
SD7	3	Ca. scorpionfish	Muscle	Total Solids	20.5		wt%	0.4
SD7	3	Ca. scorpionfish	Muscle	Zinc	4.33		mg/kg	0.58
SD7	3	Ca. scorpionfish	Liver	Hexachlorobenzene	1.5	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	Aluminum	15.8		mg/kg	2.6
SD7	3	Ca. scorpionfish	Liver	Cadmium	3.59		mg/kg	0.34
SD7	3	Ca. scorpionfish	Liver	Copper	42.7		mg/kg	0.76
SD7	3	Ca. scorpionfish	Liver	Iron	233		mg/kg	1.3
SD7	3	Ca. scorpionfish	Liver	Lipids	13.6		wt%	
SD7	3	Ca. scorpionfish	Liver	Manganese	0.33		mg/kg	0.23
SD7	3	Ca. scorpionfish	Liver	PCB 101	15		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 105	8.5	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 110	0.7	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 118	37		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 123	3.5	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 128	9.7	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 138	63		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 149	8.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 151	6.8	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 153/168	86		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 156	7.5	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 158	4.4	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 170	21		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 177	6.8	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 180	40		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 183	12	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 187	39		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	PCB 194	12	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 206	7.4	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 49	1.8	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD7	3	Ca. scorpionfish	Liver	PCB 66	5.2	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 70	1.4	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 74	2.7	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 87	2.6	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	PCB 99	19		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	p,p-DDD	11	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	p,p-DDE	1000		ug/kg	13.3
SD7	3	Ca. scorpionfish	Liver	p,p-DDT	5.9	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	Selenium	0.83		mg/kg	0.13
SD7	3	Ca. scorpionfish	Liver	Total Solids	39.9		wt%	0.4
SD7	3	Ca. scorpionfish	Liver	Trans Nonachlor	15	E	ug/kg	
SD7	3	Ca. scorpionfish	Liver	Zinc	145		mg/kg	0.58
SD8	1	Vermilion rockfish	Muscle	Hexachlorobenzene	0.05		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	Aluminum	5.8		mg/kg	2.6
SD8	1	Vermilion rockfish	Muscle	Alpha (cis) Chlordane	0.05		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	Copper	4.78		mg/kg	0.76
SD8	1	Vermilion rockfish	Muscle	Iron	4.9		mg/kg	1.3
SD8	1	Vermilion rockfish	Muscle	Lipids	0.13		wt%	
SD8	1	Vermilion rockfish	Muscle	Mercury	0.0515		mg/kg	0.012
SD8	1	Vermilion rockfish	Muscle	PCB 101	0.4	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 118	0.5	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 138	0.55		ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 149	0.15		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	PCB 153/168	0.8	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 156	0.1		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	PCB 180	0.35		ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 187	0.25		ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 194	0.15		ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 206	0.2	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 44	0.05		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	PCB 66	0.1	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 70	0.1	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 74	0.1	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	PCB 77	0.05		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	PCB 99	0.3	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	p,p-DDD	0.2	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	p,p-DDE	12		ug/kg	1.33
SD8	1	Vermilion rockfish	Muscle	p,p-DDT	0.2	E	ug/kg	
SD8	1	Vermilion rockfish	Muscle	Selenium	0.23		mg/kg	0.13
SD8	1	Vermilion rockfish	Muscle	Total Solids	21.3		wt%	0.4
SD8	1	Vermilion rockfish	Muscle	Zinc	3.18		mg/kg	0.58
SD8	1	Vermilion rockfish	Liver	Hexachlorobenzene	3.1	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	Aluminum	22.4		mg/kg	2.6
SD8	1	Vermilion rockfish	Liver	Alpha (cis) Chlordane	3.6	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	Copper	21.5		mg/kg	0.76
SD8	1	Vermilion rockfish	Liver	Iron	173		mg/kg	1.3
SD8	1	Vermilion rockfish	Liver	Lipids	18.3		wt%	
SD8	1	Vermilion rockfish	Liver	Manganese	0.67		mg/kg	0.23
SD8	1	Vermilion rockfish	Liver	o,p-DDE	2.6	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 101	13	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 105	4.1	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD8	1	Vermilion rockfish	Liver	PCB 110	6.8	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 118	17		ug/kg	13.3
SD8	1	Vermilion rockfish	Liver	PCB 138	20		ug/kg	13.3
SD8	1	Vermilion rockfish	Liver	PCB 149	8.9	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 153/168	26		ug/kg	13.3
SD8	1	Vermilion rockfish	Liver	PCB 170	4.4	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 180	11	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 183	3.2	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 187	11	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 194	3	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 206	3.8	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 28	1.2	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 66	2.7	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 70	2.9	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 74	2.1	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 87	2.4	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	PCB 99	8.5	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	p,p-DDD	9.3	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	p,p-DDE	480		ug/kg	13.3
SD8	1	Vermilion rockfish	Liver	p,p-DDT	6.6	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	Selenium	1.31		mg/kg	0.43
SD8	1	Vermilion rockfish	Liver	Total Solids	42.2		wt%	0.4
SD8	1	Vermilion rockfish	Liver	Trans Nonachlor	6.4	E	ug/kg	
SD8	1	Vermilion rockfish	Liver	Zinc	33.9		mg/kg	0.58
SD8	2	Greenblotched rockfish	Liver	Hexachlorobenzene	1.8	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	Aluminum	17		mg/kg	2.6
SD8	2	Greenblotched rockfish	Liver	Cadmium	3.75		mg/kg	0.34
SD8	2	Greenblotched rockfish	Liver	Copper	22.2		mg/kg	0.76
SD8	2	Greenblotched rockfish	Liver	Iron	107		mg/kg	1.3
SD8	2	Greenblotched rockfish	Liver	Lipids	9.48		wt%	
SD8	2	Greenblotched rockfish	Liver	Manganese	0.92		mg/kg	0.23
SD8	2	Greenblotched rockfish	Liver	Mercury	0.114		mg/kg	0.012
SD8	2	Greenblotched rockfish	Liver	PCB 101	77		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 105	34		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 110	45		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 118	140		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 123	10	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 128	27		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 138	180		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 149	43		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 151	10	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 153/168	200		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 156	18		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 157	6	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 158	13	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 167	4.8	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 170	30		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 177	9	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 180	71		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 18	1.7	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 183	20		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD8	2	Greenblotched rockfish	Liver	PCB 187	80		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 194	23		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 206	8.7	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 28	0.8	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 44	2.8	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 49	5.4	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 52	10	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 66	6.1	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 70	7.4	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 74	7.3	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	PCB 87	21		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	PCB 99	63		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	p,p-DDD	7.6	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	p,p-DDE	590		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	p,p-DDT	15		ug/kg	13.3
SD8	2	Greenblotched rockfish	Liver	Selenium	2.18		mg/kg	0.43
SD8	2	Greenblotched rockfish	Liver	Total Solids	29.8		wt%	0.4
SD8	2	Greenblotched rockfish	Liver	Trans Nonachlor	13	E	ug/kg	
SD8	2	Greenblotched rockfish	Liver	Zinc	54.5		mg/kg	0.58
SD8	3	Mixed rockfish	Muscle	Hexachlorobenzene	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	Aluminum	6.2		mg/kg	2.6
SD8	3	Mixed rockfish	Muscle	Alpha (cis) Chlordane	0.3	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	Copper	3.97		mg/kg	0.76
SD8	3	Mixed rockfish	Muscle	Iron	8.65		mg/kg	1.3
SD8	3	Mixed rockfish	Muscle	Lipids	1.44		wt%	
SD8	3	Mixed rockfish	Muscle	Mercury	0.0685		mg/kg	0.012
SD8	3	Mixed rockfish	Muscle	o,p-DDE	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 101	1.1	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 110	0.8	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 118	1.4		ug/kg	1.33
SD8	3	Mixed rockfish	Muscle	PCB 138	1.4		ug/kg	1.33
SD8	3	Mixed rockfish	Muscle	PCB 149	0.7	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 151	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 153/168	2		ug/kg	1.33
SD8	3	Mixed rockfish	Muscle	PCB 180	0.6	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 187	0.6	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 194	0.1	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 206	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 49	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 66	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 70	0.2	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 74	0.1	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 87	0.3	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	PCB 99	0.7	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	p,p-DDD	0.4	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	p,p-DDE	15		ug/kg	1.33
SD8	3	Mixed rockfish	Muscle	p,p-DDT	0.4	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	Selenium	0.2		mg/kg	0.13
SD8	3	Mixed rockfish	Muscle	Total Solids	20.4		wt%	0.4
SD8	3	Mixed rockfish	Muscle	Trans Nonachlor	0.4	E	ug/kg	
SD8	3	Mixed rockfish	Muscle	Zinc	3.14		mg/kg	0.58

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD8	3	Mixed rockfish	Liver	Hexachlorobenzene	3	E	ug/kg	
SD8	3	Mixed rockfish	Liver	Aluminum	23		mg/kg	2.6
SD8	3	Mixed rockfish	Liver	Cadmium	4.87		mg/kg	0.34
SD8	3	Mixed rockfish	Liver	Copper	17.8		mg/kg	0.76
SD8	3	Mixed rockfish	Liver	Iron	203		mg/kg	1.3
SD8	3	Mixed rockfish	Liver	Lipids	19.4		wt%	
SD8	3	Mixed rockfish	Liver	Manganese	0.78		mg/kg	0.23
SD8	3	Mixed rockfish	Liver	o,p-DDE	4.2	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 101	17		ug/kg	13.3
SD8	3	Mixed rockfish	Liver	PCB 105	5.4	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 110	13	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 118	23		ug/kg	13.3
SD8	3	Mixed rockfish	Liver	PCB 128	3.1	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 138	26		ug/kg	13.3
SD8	3	Mixed rockfish	Liver	PCB 149	11	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 151	2.5	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 153/168	28		ug/kg	13.3
SD8	3	Mixed rockfish	Liver	PCB 156	2.9	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 158	2.7	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 170	3	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 177	1.9	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 180	8	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 183	3	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 187	9.6	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 194	3.3	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 206	4	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 44	1.9	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 49	2.1	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 52	4.1	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 66	3.6	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 70	3.5	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 74	2.2	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 87	4.8	E	ug/kg	
SD8	3	Mixed rockfish	Liver	PCB 99	12	E	ug/kg	
SD8	3	Mixed rockfish	Liver	p,p-DDD	7.1	E	ug/kg	
SD8	3	Mixed rockfish	Liver	p,p-DDE	230		ug/kg	13.3
SD8	3	Mixed rockfish	Liver	p,p-DDT	6.4	E	ug/kg	
SD8	3	Mixed rockfish	Liver	Selenium	2.15		mg/kg	0.43
SD8	3	Mixed rockfish	Liver	Total Solids	36.1		wt%	0.4
SD8	3	Mixed rockfish	Liver	Trans Nonachlor	4.7	E	ug/kg	
SD8	3	Mixed rockfish	Liver	Zinc	56.6		mg/kg	0.58
SD8		Greenblotched rockfish	Muscle	Aluminum	12.2		mg/kg	2.6
SD8		Greenblotched rockfish	Muscle	Copper	9.59		mg/kg	0.76
SD8		Greenblotched rockfish	Muscle	Iron	6.7		mg/kg	1.3
SD8		Greenblotched rockfish	Muscle	Lipids	0.04		wt%	
SD8		Greenblotched rockfish	Muscle	Mercury	0.146		mg/kg	0.012
SD8		Greenblotched rockfish	Muscle	PCB 101	1.4		ug/kg	1.33
SD8		Greenblotched rockfish	Muscle	PCB 105	0.8	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 110	0.8	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 118	2.4		ug/kg	1.33
SD8		Greenblotched rockfish	Muscle	PCB 128	0.6	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD8		Greenblotched rockfish	Muscle	PCB 138	2.8		ug/kg	1.33
SD8		Greenblotched rockfish	Muscle	PCB 149	0.6	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 153/168	3.2		ug/kg	1.33
SD8		Greenblotched rockfish	Muscle	PCB 156	0.3	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 158	0.2	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 170	0.4	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 177	0.1	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 180	1.2	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 183	0.3	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 187	1	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 194	0.3	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 201	0.2	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 206	0.3	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 70	0.1	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 74	0.2	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 87	0.3	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	PCB 99	1.1	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	p,p-DDE	7.9		ug/kg	1.33
SD8		Greenblotched rockfish	Muscle	p,p-DDT	0.1	E	ug/kg	
SD8		Greenblotched rockfish	Muscle	Selenium	0.2		mg/kg	0.13
SD8		Greenblotched rockfish	Muscle	Total Solids	20.8		wt%	0.4
SD8		Greenblotched rockfish	Muscle	Zinc	3.39		mg/kg	0.58
SD9	1	Longfin sanddab	Liver	Hexachlorobenzene	2.2	E	ug/kg	
SD9	1	Longfin sanddab	Liver	Aluminum	16.6		mg/kg	2.6
SD9	1	Longfin sanddab	Liver	Arsenic	6.8		mg/kg	1.4
SD9	1	Longfin sanddab	Liver	Cadmium	2.08		mg/kg	0.34
SD9	1	Longfin sanddab	Liver	Alpha (cis) Chlordane	12	E	ug/kg	
SD9	1	Longfin sanddab	Liver	Copper	14.6		mg/kg	0.76
SD9	1	Longfin sanddab	Liver	Iron	201		mg/kg	1.3
SD9	1	Longfin sanddab	Liver	Lipids	16.7		wt%	
SD9	1	Longfin sanddab	Liver	Manganese	0.72		mg/kg	0.23
SD9	1	Longfin sanddab	Liver	Mercury	0.107		mg/kg	0.012
SD9	1	Longfin sanddab	Liver	o,p-DDE	20		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 101	21		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 105	22		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 110	19		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 118	98		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 123	8.1	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 128	18		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 138	210		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 149	17		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 151	14		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 153/168	172		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 156	11	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 157	4.8	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 158	12	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 167	6.5	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 170	35		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 177	10	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 180	65		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 183	23		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD9	1	Longfin sanddab	Liver	PCB 187	120		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 194	44		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 201	25		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 206	18		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	PCB 66	7.7	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 70	3.2	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 74	7	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 87	1.8	E	ug/kg	
SD9	1	Longfin sanddab	Liver	PCB 99	58		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	p,p-DDD	13	E	ug/kg	
SD9	1	Longfin sanddab	Liver	p,p-DDE	970		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	p,p-DDT	18		ug/kg	13.3
SD9	1	Longfin sanddab	Liver	Selenium	1.93		mg/kg	0.43
SD9	1	Longfin sanddab	Liver	Total Solids	37.7		wt%	0.4
SD9	1	Longfin sanddab	Liver	Trans Nonachlor	17	E	ug/kg	
SD9	1	Longfin sanddab	Liver	Zinc	23.9		mg/kg	0.58
SD9	1	Longfin sanddab	Muscle	Hexachlorobenzene	0.05		ug/kg	1.33
SD9	1	Longfin sanddab	Muscle	Aluminum	11.3		mg/kg	2.6
SD9	1	Longfin sanddab	Muscle	Arsenic	8.2		mg/kg	1.4
SD9	1	Longfin sanddab	Muscle	Copper	7.91		mg/kg	0.76
SD9	1	Longfin sanddab	Muscle	Iron	9.4		mg/kg	1.3
SD9	1	Longfin sanddab	Muscle	Lipids	0.06		wt%	
SD9	1	Longfin sanddab	Muscle	Mercury	0.0595		mg/kg	0.012
SD9	1	Longfin sanddab	Muscle	PCB 118	0.4	E	ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 138	0.85		ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 153/168	1.1		ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 180	0.25		ug/kg	1.33
SD9	1	Longfin sanddab	Muscle	PCB 183	0.15		ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 187	0.4		ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 194	0.2	E	ug/kg	
SD9	1	Longfin sanddab	Muscle	PCB 206	0.4	E	ug/kg	
SD9	1	Longfin sanddab	Muscle	p,p-DDE	5.7		ug/kg	1.33
SD9	1	Longfin sanddab	Muscle	Selenium	0.54		mg/kg	0.13
SD9	1	Longfin sanddab	Muscle	Total Solids	19.4		wt%	0.4
SD9	1	Longfin sanddab	Muscle	Zinc	2.46		mg/kg	0.58
SD9	2	Longfin sanddab	Liver	Hexachlorobenzene	2.2	E	ug/kg	
SD9	2	Longfin sanddab	Liver	Aluminum	14.4		mg/kg	2.6
SD9	2	Longfin sanddab	Liver	Arsenic	13		mg/kg	1.4
SD9	2	Longfin sanddab	Liver	Cadmium	3.04		mg/kg	0.34
SD9	2	Longfin sanddab	Liver	Alpha (cis) Chlordane	5.1	E	ug/kg	
SD9	2	Longfin sanddab	Liver	Copper	11.4		mg/kg	0.76
SD9	2	Longfin sanddab	Liver	Iron	172		mg/kg	1.3
SD9	2	Longfin sanddab	Liver	Lipids	14.8		wt%	
SD9	2	Longfin sanddab	Liver	Manganese	0.88		mg/kg	0.23
SD9	2	Longfin sanddab	Liver	Mercury	0.119		mg/kg	0.012
SD9	2	Longfin sanddab	Liver	Mirex	6.5	E	ug/kg	
SD9	2	Longfin sanddab	Liver	o,p-DDE	16		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	o,p-DDT	3	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 101	19		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 105	31		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 110	22		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD9	2	Longfin sanddab	Liver	PCB 118	110		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 123	8.8	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 128	28		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 138	220		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 149	18		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 151	17		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 153/168	220		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 156	14		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 157	4.9	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 158	16		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 167	8.3	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 170	42		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 177	10	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 180	81		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 183	27		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 187	120		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 194	43		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 201	27		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 206	21		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	PCB 28	1.4	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 66	6.5	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 70	1.8	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 74	6.2	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 87	1.7	E	ug/kg	
SD9	2	Longfin sanddab	Liver	PCB 99	57		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	p,p-DDD	11	E	ug/kg	
SD9	2	Longfin sanddab	Liver	p,p-DDE	1100		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	p,p-DDT	16		ug/kg	13.3
SD9	2	Longfin sanddab	Liver	Selenium	2.2		mg/kg	0.43
SD9	2	Longfin sanddab	Liver	Total Solids	32.3		wt%	0.4
SD9	2	Longfin sanddab	Liver	Trans Nonachlor	15	E	ug/kg	
SD9	2	Longfin sanddab	Liver	Zinc	24.6		mg/kg	0.58
SD9	2	Longfin sanddab	Muscle	Aluminum	5.2		mg/kg	2.6
SD9	2	Longfin sanddab	Muscle	Arsenic	7.8		mg/kg	1.4
SD9	2	Longfin sanddab	Muscle	Iron	3		mg/kg	1.3
SD9	2	Longfin sanddab	Muscle	Lipids	0.04		wt%	
SD9	2	Longfin sanddab	Muscle	Mercury	0.064		mg/kg	0.012
SD9	2	Longfin sanddab	Muscle	PCB 118	0.5	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 138	0.7	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 153/168	0.8	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 180	0.4	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 187	0.4	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 206	0.4	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	PCB 99	0.2	E	ug/kg	
SD9	2	Longfin sanddab	Muscle	p,p-DDE	4.1		ug/kg	1.33
SD9	2	Longfin sanddab	Muscle	Selenium	1.05		mg/kg	0.43
SD9	2	Longfin sanddab	Muscle	Total Solids	18.7		wt%	0.4
SD9	2	Longfin sanddab	Muscle	Zinc	2.38		mg/kg	0.58
SD9	3	Longfin sanddab	Liver	Hexachlorobenzene	2.5	E	ug/kg	
SD9	3	Longfin sanddab	Liver	Aluminum	22.1		mg/kg	2.6
SD9	3	Longfin sanddab	Liver	Arsenic	14.4		mg/kg	1.4

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD9	3	Longfin sanddab	Liver	Cadmium	0.72		mg/kg	0.34
SD9	3	Longfin sanddab	Liver	Alpha (cis) Chlordane	14		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	Copper	17.8		mg/kg	0.76
SD9	3	Longfin sanddab	Liver	Iron	237		mg/kg	1.3
SD9	3	Longfin sanddab	Liver	Lipids	15.7		wt%	
SD9	3	Longfin sanddab	Liver	Manganese	1		mg/kg	0.23
SD9	3	Longfin sanddab	Liver	Mercury	0.1		mg/kg	0.012
SD9	3	Longfin sanddab	Liver	o,p-DDE	18		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 101	20		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 105	32		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 110	23		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 118	110		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 123	9	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 128	27		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 138	250		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 149	19		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 151	15		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 153/168	198		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 156	14		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 157	5.4	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 158	14		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 167	8.1	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 170	39		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 177	8.6	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 180	76		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 183	24		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 187	120		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 194	51		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 201	25		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 206	21		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	PCB 28	2.8	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 66	8.2	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 70	2.5	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 74	7.4	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 87	1.7	E	ug/kg	
SD9	3	Longfin sanddab	Liver	PCB 99	63		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	p,p-DDD	13	E	ug/kg	
SD9	3	Longfin sanddab	Liver	p,p-DDE	870		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	p,p-DDT	21		ug/kg	13.3
SD9	3	Longfin sanddab	Liver	Selenium	2.07		mg/kg	0.43
SD9	3	Longfin sanddab	Liver	Total Solids	28.8		wt%	0.4
SD9	3	Longfin sanddab	Liver	Trans Nonachlor	15	E	ug/kg	
SD9	3	Longfin sanddab	Liver	Zinc	25.7		mg/kg	0.58
SD9	3	Longfin sanddab	Muscle	Aluminum	8.8		mg/kg	2.6
SD9	3	Longfin sanddab	Muscle	Arsenic	9.4		mg/kg	1.4
SD9	3	Longfin sanddab	Muscle	Copper	5.64		mg/kg	0.76
SD9	3	Longfin sanddab	Muscle	Iron	8.9		mg/kg	1.3
SD9	3	Longfin sanddab	Muscle	Lipids	0.09		wt%	
SD9	3	Longfin sanddab	Muscle	Mercury	0.071		mg/kg	0.012
SD9	3	Longfin sanddab	Muscle	PCB 118	0.6	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 138	1	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD9	3	Longfin sanddab	Muscle	PCB 153/168	1.2	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 170	0.3	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 180	0.7	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 187	0.6	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 194	0.2	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	PCB 206	0.4	E	ug/kg	
SD9	3	Longfin sanddab	Muscle	p,p-DDE	5.3		ug/kg	1.33
SD9	3	Longfin sanddab	Muscle	Selenium	0.6		mg/kg	0.13
SD9	3	Longfin sanddab	Muscle	Total Solids	19		wt%	0.4
SD9	3	Longfin sanddab	Muscle	Zinc	2.45		mg/kg	0.58
SD10	1	Dover sole	Muscle	Hexachlorobenzene	0.2	E	ug/kg	
SD10	1	Dover sole	Muscle	Aluminum	10.6		mg/kg	2.6
SD10	1	Dover sole	Muscle	Arsenic	3.1		mg/kg	1.4
SD10	1	Dover sole	Muscle	Copper	6.19		mg/kg	0.76
SD10	1	Dover sole	Muscle	Iron	9.3		mg/kg	1.3
SD10	1	Dover sole	Muscle	Lipids	0.15		wt%	
SD10	1	Dover sole	Muscle	PCB 101	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 110	0.2	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 118	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 138	0.5	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 149	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 153/168	0.8	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 170	0.1	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 180	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 187	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 194	0.1	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 206	0.2	E	ug/kg	
SD10	1	Dover sole	Muscle	PCB 99	0.3	E	ug/kg	
SD10	1	Dover sole	Muscle	p,p-DDE	2.6		ug/kg	1.33
SD10	1	Dover sole	Muscle	Selenium	0.41		mg/kg	0.13
SD10	1	Dover sole	Muscle	Total Solids	17.8		wt%	0.4
SD10	1	Dover sole	Muscle	Zinc	3.01		mg/kg	0.58
SD10	1	Dover sole	Liver	Lipids	6.1		wt%	
SD10	1	Dover sole	Liver	PCB 101	4.9	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 118	6.5	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 138	12	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 149	5.6	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 151	2.9	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 153/168	16.6		ug/kg	13.3
SD10	1	Dover sole	Liver	PCB 177	0.9	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 180	8.5	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 187	8.5	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 194	4.4	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 206	5.8	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 66	1.1	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 70	0.9	E	ug/kg	
SD10	1	Dover sole	Liver	PCB 99	3.2	E	ug/kg	
SD10	1	Dover sole	Liver	p,p-DDE	52		ug/kg	13.3
SD10	2	Mixed sanddab	Muscle	Aluminum	3.6		mg/kg	2.6
SD10	2	Mixed sanddab	Muscle	Arsenic	5.7		mg/kg	1.4
SD10	2	Mixed sanddab	Muscle	Copper	4.21		mg/kg	0.76

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD10	2	Mixed sanddab	Muscle	Iron	5.3		mg/kg	1.3
SD10	2	Mixed sanddab	Muscle	Lipids	0.04		wt%	
SD10	2	Mixed sanddab	Muscle	Mercury	0.0585		mg/kg	0.012
SD10	2	Mixed sanddab	Muscle	PCB 118	0.2	E	ug/kg	
SD10	2	Mixed sanddab	Muscle	PCB 138	0.3	E	ug/kg	
SD10	2	Mixed sanddab	Muscle	PCB 153/168	0.4	E	ug/kg	
SD10	2	Mixed sanddab	Muscle	PCB 206	0.1	E	ug/kg	
SD10	2	Mixed sanddab	Muscle	p,p-DDE	2.1		ug/kg	1.33
SD10	2	Mixed sanddab	Muscle	Selenium	1.57		mg/kg	0.5
SD10	2	Mixed sanddab	Muscle	Total Solids	18.2		wt%	0.4
SD10	2	Mixed sanddab	Muscle	Zinc	2.25		mg/kg	0.58
SD10	2	Mixed sanddab	Liver	Hexachlorobenzene	2.3	E	ug/kg	
SD10	2	Mixed sanddab	Liver	Alpha (cis) Chlordane	6	E	ug/kg	
SD10	2	Mixed sanddab	Liver	Lipids	13.7		wt%	
SD10	2	Mixed sanddab	Liver	Mirex	3.3	E	ug/kg	
SD10	2	Mixed sanddab	Liver	o,p-DDE	17		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	o,p-DDT	4.7	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 101	13	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 105	10	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 110	10	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 118	53		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 123	3.2	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 128	10	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 138	89		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 149	8.7	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 151	9	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 153/168	106		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 156	7.7	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 158	5.8	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 167	3.2	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 170	22		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 177	5.4	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 180	41		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 183	13	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 187	54		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 194	16		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	PCB 201	10	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 206	11	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 28	1.3	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 52	3.1	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 66	4.2	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 70	2.5	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 74	3.2	E	ug/kg	
SD10	2	Mixed sanddab	Liver	PCB 99	26		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	p,p-DDD	12	E	ug/kg	
SD10	2	Mixed sanddab	Liver	p,p-DDE	700		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	p,p-DDT	17		ug/kg	13.3
SD10	2	Mixed sanddab	Liver	Trans Nonachlor	11	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	Aluminum	12.4		mg/kg	2.6
SD10	3	Ca. scorpionfish	Muscle	Arsenic	2.2		mg/kg	1.4
SD10	3	Ca. scorpionfish	Muscle	Copper	8.75		mg/kg	0.76

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD10	3	Ca. scorpionfish	Muscle	Iron	9.5		mg/kg	1.3
SD10	3	Ca. scorpionfish	Muscle	Lipids	1.56		wt%	
SD10	3	Ca. scorpionfish	Muscle	Mercury	0.079		mg/kg	0.012
SD10	3	Ca. scorpionfish	Muscle	o,p-DDE	0.3	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 101	0.4	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 105	0.1	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 110	0.3	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 118	0.5	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 138	0.6	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 149	0.3	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 151	0.1	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 153/168	1	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 177	0.1	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 180	0.4	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 187	0.4	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 206	0.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 52	0.1	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 66	0.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	PCB 99	0.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	p,p-DDD	0.6	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	p,p-DDE	17		ug/kg	1.33
SD10	3	Ca. scorpionfish	Muscle	p,p-DDT	0.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Muscle	Selenium	0.203		mg/kg	0.13
SD10	3	Ca. scorpionfish	Muscle	Total Solids	20.4		wt%	0.4
SD10	3	Ca. scorpionfish	Muscle	Zinc	4.68		mg/kg	0.58
SD10	3	Ca. scorpionfish	Liver	Aluminum	14		mg/kg	2.6
SD10	3	Ca. scorpionfish	Liver	Cadmium	0.69		mg/kg	0.34
SD10	3	Ca. scorpionfish	Liver	Copper	20.2		mg/kg	0.76
SD10	3	Ca. scorpionfish	Liver	Iron	65.5		mg/kg	1.3
SD10	3	Ca. scorpionfish	Liver	Lipids	24.2		wt%	
SD10	3	Ca. scorpionfish	Liver	Manganese	0.29		mg/kg	0.23
SD10	3	Ca. scorpionfish	Liver	o,p-DDE	8.7	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 101	10	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 105	3.8	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 110	4.9	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 118	15		ug/kg	13.3
SD10	3	Ca. scorpionfish	Liver	PCB 138	18		ug/kg	13.3
SD10	3	Ca. scorpionfish	Liver	PCB 149	5.8	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 151	2	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 153/168	28		ug/kg	13.3
SD10	3	Ca. scorpionfish	Liver	PCB 156	2.8	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 177	2.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 180	14		ug/kg	13.3
SD10	3	Ca. scorpionfish	Liver	PCB 183	3.9	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 187	12	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 194	3.8	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 206	4.2	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 49	2.1	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 66	3.4	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 70	1.7	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 74	1.7	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD10	3	Ca. scorpionfish	Liver	PCB 87	1.9	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	PCB 99	8.6	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	p,p-DDD	13	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	p,p-DDE	470		ug/kg	13.3
SD10	3	Ca. scorpionfish	Liver	p,p-DDT	5.4	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	Selenium	0.82		mg/kg	0.16
SD10	3	Ca. scorpionfish	Liver	Total Solids	48.7		wt%	0.4
SD10	3	Ca. scorpionfish	Liver	Trans Nonachlor	8.8	E	ug/kg	
SD10	3	Ca. scorpionfish	Liver	Zinc	79.8		mg/kg	0.58
SD11	1	Longfin sanddab	Liver	Hexachlorobenzene	2.7	E	ug/kg	
SD11	1	Longfin sanddab	Liver	Aluminum	26.7		mg/kg	2.6
SD11	1	Longfin sanddab	Liver	Arsenic	7.2		mg/kg	1.4
SD11	1	Longfin sanddab	Liver	Cadmium	1.17		mg/kg	0.34
SD11	1	Longfin sanddab	Liver	Alpha (cis) Chlordane	20		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	Chromium	0.36		mg/kg	0.3
SD11	1	Longfin sanddab	Liver	Copper	18.4		mg/kg	0.76
SD11	1	Longfin sanddab	Liver	Iron	183		mg/kg	1.3
SD11	1	Longfin sanddab	Liver	Lipids	18.2		wt%	
SD11	1	Longfin sanddab	Liver	Manganese	1.08		mg/kg	0.23
SD11	1	Longfin sanddab	Liver	Mercury	0.0775		mg/kg	0.012
SD11	1	Longfin sanddab	Liver	o,p-DDE	29		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 101	24		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 105	16		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 110	19		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 118	93		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 123	8.1	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 128	18		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 138	240		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 149	19		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 151	14		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 153/168	174		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 156	11	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 157	4.8	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 158	8.9	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 167	6.4	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 170	40		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 177	11	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 180	75		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 183	23		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 187	130		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 194	53		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 201	27		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 206	19		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	PCB 28	2.7	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 66	8.6	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 70	3.5	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 74	7.3	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 87	2.2	E	ug/kg	
SD11	1	Longfin sanddab	Liver	PCB 99	60		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	p,p-DDD	11	E	ug/kg	
SD11	1	Longfin sanddab	Liver	p,p-DDE	1200		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD11	1	Longfin sanddab	Liver	p,p-DDT	28		ug/kg	13.3
SD11	1	Longfin sanddab	Liver	Selenium	2.2		mg/kg	0.43
SD11	1	Longfin sanddab	Liver	Total Solids	43.1		wt%	0.4
SD11	1	Longfin sanddab	Liver	Trans Nonachlor	24		ug/kg	20
SD11	1	Longfin sanddab	Liver	Zinc	24.6		mg/kg	0.58
SD11	1	Longfin sanddab	Muscle	Aluminum	6.9		mg/kg	2.6
SD11	1	Longfin sanddab	Muscle	Arsenic	6.9		mg/kg	1.4
SD11	1	Longfin sanddab	Muscle	Copper	4.08		mg/kg	0.76
SD11	1	Longfin sanddab	Muscle	Iron	4.8		mg/kg	1.3
SD11	1	Longfin sanddab	Muscle	Lipids	0.06		wt%	
SD11	1	Longfin sanddab	Muscle	Mercury	0.046		mg/kg	0.012
SD11	1	Longfin sanddab	Muscle	PCB 118	0.3	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	PCB 138	0.8	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	PCB 153/168	1	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	PCB 187	0.5	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	PCB 194	0.2	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	PCB 206	0.4	E	ug/kg	
SD11	1	Longfin sanddab	Muscle	p,p-DDE	5.7		ug/kg	1.33
SD11	1	Longfin sanddab	Muscle	Selenium	1.32		mg/kg	0.43
SD11	1	Longfin sanddab	Muscle	Total Solids	19.3		wt%	0.4
SD11	1	Longfin sanddab	Muscle	Zinc	2.63		mg/kg	0.58
SD11	2	Ca. scorpionfish	Liver	Hexachlorobenzene	2.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	Aluminum	29		mg/kg	2.6
SD11	2	Ca. scorpionfish	Liver	Cadmium	4.11		mg/kg	0.34
SD11	2	Ca. scorpionfish	Liver	Copper	26		mg/kg	0.76
SD11	2	Ca. scorpionfish	Liver	Iron	96.2		mg/kg	1.3
SD11	2	Ca. scorpionfish	Liver	Lipids	27.2		wt%	
SD11	2	Ca. scorpionfish	Liver	Manganese	0.315		mg/kg	0.23
SD11	2	Ca. scorpionfish	Liver	Mercury	0.297		mg/kg	0.012
SD11	2	Ca. scorpionfish	Liver	PCB 101	31		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 105	9.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 110	8.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 118	51		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 123	3.6	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 128	9.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 138	97		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 149	7.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 151	6.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 153/168	78		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 156	7.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 157	2.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 158	5	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 170	17		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 177	4.9	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 180	29		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 183	11	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 187	52		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 194	14		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	PCB 206	7.4	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 66	8.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 70	2.7	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD11	2	Ca. scorpionfish	Liver	PCB 74	4.9	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 87	3.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	PCB 99	30		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	p,p-DDD	9.7	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	p,p-DDE	970		ug/kg	13.3
SD11	2	Ca. scorpionfish	Liver	p,p-DDT	8.1	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	Selenium	0.58		mg/kg	0.13
SD11	2	Ca. scorpionfish	Liver	Total Solids	53.5		wt%	0.4
SD11	2	Ca. scorpionfish	Liver	Trans Nonachlor	17	E	ug/kg	
SD11	2	Ca. scorpionfish	Liver	Zinc	117		mg/kg	0.58
SD11	2	Ca. scorpionfish	Muscle	Hexachlorobenzene	0.1	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	Aluminum	13		mg/kg	2.6
SD11	2	Ca. scorpionfish	Muscle	Copper	3.35		mg/kg	0.76
SD11	2	Ca. scorpionfish	Muscle	Iron	10.3		mg/kg	1.3
SD11	2	Ca. scorpionfish	Muscle	Lipids	0.55		wt%	
SD11	2	Ca. scorpionfish	Muscle	Mercury	0.182		mg/kg	0.012
SD11	2	Ca. scorpionfish	Muscle	PCB 101	0.9	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 105	0.6	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 110	0.4	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 118	1.9		ug/kg	1.33
SD11	2	Ca. scorpionfish	Muscle	PCB 123	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 138	1.8		ug/kg	1.33
SD11	2	Ca. scorpionfish	Muscle	PCB 151	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 153/168	3.2		ug/kg	1.33
SD11	2	Ca. scorpionfish	Muscle	PCB 156	0.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 158	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 170	0.6	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 177	0.4	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 180	1.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 183	0.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 187	1.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 189	0.4	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 194	0.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 201	0.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 206	0.6	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 28	0.1	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 44	0.1	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 49	0.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 66	0.4	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 70	0.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 74	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 77	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 87	0.3	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	PCB 99	0.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	p,p-DDD	0.5	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	p,p-DDE	33		ug/kg	1.33
SD11	2	Ca. scorpionfish	Muscle	p,p-DDT	0.2	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	Selenium	0.24		mg/kg	0.13
SD11	2	Ca. scorpionfish	Muscle	Total Solids	20.9		wt%	0.4
SD11	2	Ca. scorpionfish	Muscle	Trans Nonachlor	0.8	E	ug/kg	
SD11	2	Ca. scorpionfish	Muscle	Zinc	3.05		mg/kg	0.58

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD11	3	Ca. scorpionfish	Liver	Hexachlorobenzene	1.7	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	Aluminum	21.6		mg/kg	2.6
SD11	3	Ca. scorpionfish	Liver	Cadmium	3.41		mg/kg	0.34
SD11	3	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	7.9	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	Copper	20.7		mg/kg	0.76
SD11	3	Ca. scorpionfish	Liver	Iron	144		mg/kg	1.3
SD11	3	Ca. scorpionfish	Liver	Lipids	18.8		wt%	
SD11	3	Ca. scorpionfish	Liver	Manganese	0.37		mg/kg	0.23
SD11	3	Ca. scorpionfish	Liver	Mercury	0.265		mg/kg	0.012
SD11	3	Ca. scorpionfish	Liver	o,p-DDE	7.7	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 101	20		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 105	8	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 110	6.9	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 118	46		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 123	4.1	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 128	9	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 138	100		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 149	8.3	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 151	6.8	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 153/168	78		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 156	7.6	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 158	5.4	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 167	1.2	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 170	23		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 177	5.8	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 180	38		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 183	13	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 187	58		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 194	20		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	PCB 206	9.5	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 44	1.6	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 49	3	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 66	7.4	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 70	2.4	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 74	4.2	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 87	3.1	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	PCB 99	24		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	p,p-DDD	9.4	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	p,p-DDE	820		ug/kg	13.3
SD11	3	Ca. scorpionfish	Liver	p,p-DDT	5.1	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	Selenium	0.75		mg/kg	0.13
SD11	3	Ca. scorpionfish	Liver	Total Solids	42.1		wt%	0.4
SD11	3	Ca. scorpionfish	Liver	Trans Nonachlor	12	E	ug/kg	
SD11	3	Ca. scorpionfish	Liver	Zinc	79.3		mg/kg	0.58
SD11	3	Ca. scorpionfish	Muscle	Aluminum	7.8		mg/kg	2.6
SD11	3	Ca. scorpionfish	Muscle	Arsenic	2.2		mg/kg	1.4
SD11	3	Ca. scorpionfish	Muscle	Copper	8.07		mg/kg	0.76
SD11	3	Ca. scorpionfish	Muscle	Iron	7.8		mg/kg	1.3
SD11	3	Ca. scorpionfish	Muscle	Lipids	0.05		wt%	
SD11	3	Ca. scorpionfish	Muscle	Mercury	0.127		mg/kg	0.012
SD11	3	Ca. scorpionfish	Muscle	PCB 101	0.4	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD11	3	Ca. scorpionfish	Muscle	PCB 118	0.6	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 138	1	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 151	0.2	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 153/168	1.8		ug/kg	1.33
SD11	3	Ca. scorpionfish	Muscle	PCB 180	0.8	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 183	0.3	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 187	0.7	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 194	0.3	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 206	0.4	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	PCB 99	0.3	E	ug/kg	
SD11	3	Ca. scorpionfish	Muscle	p,p-DDE	14		ug/kg	1.33
SD11	3	Ca. scorpionfish	Muscle	Selenium	0.22		mg/kg	0.13
SD11	3	Ca. scorpionfish	Muscle	Total Solids	20.5		wt%	0.4
SD11	3	Ca. scorpionfish	Muscle	Zinc	4.84		mg/kg	0.58
SD12	1	Ca. scorpionfish	Liver	Hexachlorobenzene	2.8	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	Aluminum	19.9		mg/kg	2.6
SD12	1	Ca. scorpionfish	Liver	Cadmium	2.86		mg/kg	0.34
SD12	1	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	8.6	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	Copper	40.8		mg/kg	0.76
SD12	1	Ca. scorpionfish	Liver	Iron	300		mg/kg	1.3
SD12	1	Ca. scorpionfish	Liver	Lipids	27.1		wt%	
SD12	1	Ca. scorpionfish	Liver	Manganese	0.44		mg/kg	0.23
SD12	1	Ca. scorpionfish	Liver	Mercury	0.556		mg/kg	0.012
SD12	1	Ca. scorpionfish	Liver	PCB 101	36		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 105	10	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 110	11	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 118	56		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 123	5.3	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 128	11	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 138	110		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 149	11	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 151	9.4	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 153/168	90		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 156	8.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 158	6	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 170	21		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 177	6.6	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 180	38		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 183	13	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 187	66		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 194	17		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	PCB 206	8.8	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 28	2	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 49	4	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 66	9.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 70	3.5	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 74	5.3	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 87	4.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	PCB 99	33		ug/kg	13.3
SD12	1	Ca. scorpionfish	Liver	p,p-DDD	9.6	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	p,p-DDE	880		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD12	1	Ca. scorpionfish	Liver	p,p-DDT	7.7	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	Selenium	0.74		mg/kg	0.13
SD12	1	Ca. scorpionfish	Liver	Total Solids	48.7		wt%	0.4
SD12	1	Ca. scorpionfish	Liver	Trans Nonachlor	16	E	ug/kg	
SD12	1	Ca. scorpionfish	Liver	Zinc	156		mg/kg	0.58
SD12	1	Ca. scorpionfish	Muscle	Hexachlorobenzene	0.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	Aluminum	10.9		mg/kg	2.6
SD12	1	Ca. scorpionfish	Muscle	Copper	4.77		mg/kg	0.76
SD12	1	Ca. scorpionfish	Muscle	Iron	12		mg/kg	1.3
SD12	1	Ca. scorpionfish	Muscle	Lipids	0.88		wt%	
SD12	1	Ca. scorpionfish	Muscle	Mercury	0.275		mg/kg	0.012
SD12	1	Ca. scorpionfish	Muscle	PCB 101	0.9	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 105	0.4	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 110	0.5	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 118	1.8		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	PCB 128	0.2	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 138	2.4		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	PCB 149	0.5	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 151	0.4	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 153/168	3.8		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	PCB 158	0.2	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 177	0.3	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 180	1.6		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	PCB 183	0.4	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 187	1.5		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	PCB 194	0.4	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 206	0.5	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 66	0.2	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 70	0.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 74	0.1	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	PCB 99	0.8	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	p,p-DDD	0.3	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	p,p-DDE	34		ug/kg	1.33
SD12	1	Ca. scorpionfish	Muscle	Selenium	0.28		mg/kg	0.13
SD12	1	Ca. scorpionfish	Muscle	Total Solids	22.6		wt%	0.4
SD12	1	Ca. scorpionfish	Muscle	Trans Nonachlor	0.5	E	ug/kg	
SD12	1	Ca. scorpionfish	Muscle	Zinc	4.11		mg/kg	0.58
SD12	2	Ca. scorpionfish	Liver	Hexachlorobenzene	2.6	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	Aluminum	28		mg/kg	2.6
SD12	2	Ca. scorpionfish	Liver	Arsenic	3		mg/kg	1.4
SD12	2	Ca. scorpionfish	Liver	Cadmium	3.07		mg/kg	0.34
SD12	2	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	10	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	Copper	51		mg/kg	0.76
SD12	2	Ca. scorpionfish	Liver	Iron	277		mg/kg	1.3
SD12	2	Ca. scorpionfish	Liver	Lipids	36.1		wt%	
SD12	2	Ca. scorpionfish	Liver	Manganese	0.46		mg/kg	0.23
SD12	2	Ca. scorpionfish	Liver	Mercury	0.251		mg/kg	0.012
SD12	2	Ca. scorpionfish	Liver	o,p-DDE	6	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 101	24		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 105	5.5	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 110	6.8	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD12	2	Ca. scorpionfish	Liver	PCB 118	34		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 138	47		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 149	5.4	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 151	4.3	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 153/168	48		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 156	6.7	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 158	2.6	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 170	7.4	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 177	2.1	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 180	21		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 183	5.8	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 187	28		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	PCB 194	6.8	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 206	5.5	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 66	6.3	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 70	4.6	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 74	4.1	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 87	2.6	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	PCB 99	18		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	p,p-DDD	8	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	p,p-DDE	660		ug/kg	13.3
SD12	2	Ca. scorpionfish	Liver	p,p-DDT	5.5	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	Selenium	0.75		mg/kg	0.13
SD12	2	Ca. scorpionfish	Liver	Total Solids	47.6		wt%	0.4
SD12	2	Ca. scorpionfish	Liver	Trans Nonachlor	15	E	ug/kg	
SD12	2	Ca. scorpionfish	Liver	Zinc	138		mg/kg	0.58
SD12	2	Ca. scorpionfish	Muscle	Aluminum	10.8		mg/kg	2.6
SD12	2	Ca. scorpionfish	Muscle	Copper	5.9		mg/kg	0.76
SD12	2	Ca. scorpionfish	Muscle	Iron	9.8		mg/kg	1.3
SD12	2	Ca. scorpionfish	Muscle	Lipids	0.16		wt%	
SD12	2	Ca. scorpionfish	Muscle	Mercury	0.204		mg/kg	0.012
SD12	2	Ca. scorpionfish	Muscle	PCB 101	0.3	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 118	0.5	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 138	0.5	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 153/168	1	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 180	0.3	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 187	0.4	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 194	0.2	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 206	0.4	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	PCB 99	0.2	E	ug/kg	
SD12	2	Ca. scorpionfish	Muscle	p,p-DDE	9.5		ug/kg	1.33
SD12	2	Ca. scorpionfish	Muscle	Selenium	0.19		mg/kg	0.13
SD12	2	Ca. scorpionfish	Muscle	Total Solids	21.9		wt%	0.4
SD12	2	Ca. scorpionfish	Muscle	Zinc	3.44		mg/kg	0.58
SD12	3	Ca. scorpionfish	Liver	Hexachlorobenzene	2.4	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	Aluminum	22.8		mg/kg	2.6
SD12	3	Ca. scorpionfish	Liver	Cadmium	5.05		mg/kg	0.34
SD12	3	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	7.5	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	Copper	17.2		mg/kg	0.76
SD12	3	Ca. scorpionfish	Liver	Iron	150		mg/kg	1.3
SD12	3	Ca. scorpionfish	Liver	Lipids	37.6		wt%	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD12	3	Ca. scorpionfish	Liver	Manganese	0.39		mg/kg	0.23
SD12	3	Ca. scorpionfish	Liver	Mercury	0.307		mg/kg	0.012
SD12	3	Ca. scorpionfish	Liver	o,p-DDE	9.2	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 101	38		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 105	11	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 110	14		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 118	54		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 123	5.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 128	9.7	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 138	97		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 149	11	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 151	6.7	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 153/168	84		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 156	8.9	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 158	5.6	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 170	20		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 177	5.2	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 180	34		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 183	11	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 187	58		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 194	13	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 201	14		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	PCB 206	8.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 28	2.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 52	3.2	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 66	9.3	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 70	5.3	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 74	5.5	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 87	5.8	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	PCB 99	31		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	p,p-DDD	13	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	p,p-DDE	1100		ug/kg	13.3
SD12	3	Ca. scorpionfish	Liver	p,p-DDT	9.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	Selenium	0.805		mg/kg	0.17
SD12	3	Ca. scorpionfish	Liver	Total Solids	54.6		wt%	0.4
SD12	3	Ca. scorpionfish	Liver	Trans Nonachlor	18	E	ug/kg	
SD12	3	Ca. scorpionfish	Liver	Zinc	109		mg/kg	0.58
SD12	3	Ca. scorpionfish	Muscle	Aluminum	3.9		mg/kg	2.6
SD12	3	Ca. scorpionfish	Muscle	Copper	4.93		mg/kg	0.76
SD12	3	Ca. scorpionfish	Muscle	Iron	10		mg/kg	1.3
SD12	3	Ca. scorpionfish	Muscle	Lipids	0.98		wt%	
SD12	3	Ca. scorpionfish	Muscle	Mercury	0.156		mg/kg	0.012
SD12	3	Ca. scorpionfish	Muscle	PCB 101	0.5	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 118	0.9	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 138	1.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 153/168	1.8		ug/kg	1.33
SD12	3	Ca. scorpionfish	Muscle	PCB 180	0.7	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 183	0.2	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 187	0.6	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 194	0.2	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	PCB 206	0.4	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD12	3	Ca. scorpionfish	Muscle	PCB 99	0.4	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	p,p-DDE	21		ug/kg	1.33
SD12	3	Ca. scorpionfish	Muscle	p,p-DDT	0.1	E	ug/kg	
SD12	3	Ca. scorpionfish	Muscle	Selenium	0.24		mg/kg	0.13
SD12	3	Ca. scorpionfish	Muscle	Total Solids	23.7		wt%	0.4
SD12	3	Ca. scorpionfish	Muscle	Zinc	4.39		mg/kg	0.58
SD13	1	Longfin sanddab	Liver	Hexachlorobenzene	1.7	E	ug/kg	
SD13	1	Longfin sanddab	Liver	Aluminum	21.5		mg/kg	2.6
SD13	1	Longfin sanddab	Liver	Arsenic	7.6		mg/kg	1.4
SD13	1	Longfin sanddab	Liver	Cadmium	2.89		mg/kg	0.34
SD13	1	Longfin sanddab	Liver	Alpha (cis) Chlordane	11	E	ug/kg	
SD13	1	Longfin sanddab	Liver	Copper	11.5		mg/kg	0.76
SD13	1	Longfin sanddab	Liver	Iron	210		mg/kg	1.3
SD13	1	Longfin sanddab	Liver	Lipids	13.6		wt%	
SD13	1	Longfin sanddab	Liver	Manganese	0.91		mg/kg	0.23
SD13	1	Longfin sanddab	Liver	Mercury	0.094		mg/kg	0.012
SD13	1	Longfin sanddab	Liver	o,p-DDE	23		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 101	13	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 105	17		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 110	14		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 118	78		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 123	6.9	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 128	15		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 138	160		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 149	12	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 151	12	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 153/168	146		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 156	9.6	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 157	4.5	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 158	9	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 167	6.2	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 170	30		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 177	8	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 180	53		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 183	18		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 187	95		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 194	37		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 201	22		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 206	17		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	PCB 66	5	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 70	2.1	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 74	4.7	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 87	0.9	E	ug/kg	
SD13	1	Longfin sanddab	Liver	PCB 99	38		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	p,p-DDD	8.8	E	ug/kg	
SD13	1	Longfin sanddab	Liver	p,p-DDE	990		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	p,p-DDT	17		ug/kg	13.3
SD13	1	Longfin sanddab	Liver	Selenium	3.22		mg/kg	0.65
SD13	1	Longfin sanddab	Liver	Total Solids	34.6		wt%	0.4
SD13	1	Longfin sanddab	Liver	Trans Nonachlor	17	E	ug/kg	
SD13	1	Longfin sanddab	Liver	Zinc	27.1		mg/kg	0.58

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD13	1	Longfin sanddab	Muscle	Aluminum	7		mg/kg	2.6
SD13	1	Longfin sanddab	Muscle	Arsenic	9.4		mg/kg	1.4
SD13	1	Longfin sanddab	Muscle	Copper	6.44		mg/kg	0.76
SD13	1	Longfin sanddab	Muscle	Iron	9.7		mg/kg	1.3
SD13	1	Longfin sanddab	Muscle	Lipids	0.03		wt%	
SD13	1	Longfin sanddab	Muscle	PCB 118	0.4	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	PCB 138	0.9	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	PCB 153/168	1.2	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	PCB 183	0.2	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	PCB 187	0.5	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	PCB 206	0.4	E	ug/kg	
SD13	1	Longfin sanddab	Muscle	p,p-DDE	7.7		ug/kg	1.33
SD13	1	Longfin sanddab	Muscle	Selenium	0.57		mg/kg	0.13
SD13	1	Longfin sanddab	Muscle	Total Solids	19.3		wt%	0.4
SD13	1	Longfin sanddab	Muscle	Zinc	2.75		mg/kg	0.58
SD13	2	Ca. scorpionfish	Liver	Hexachlorobenzene	3.8	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	Aluminum	14.1		mg/kg	2.6
SD13	2	Ca. scorpionfish	Liver	Arsenic	6.8		mg/kg	1.4
SD13	2	Ca. scorpionfish	Liver	Cadmium	3.71		mg/kg	0.34
SD13	2	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	15		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	Cis Nonachlor	13	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	Copper	36.1		mg/kg	0.76
SD13	2	Ca. scorpionfish	Liver	Iron	259		mg/kg	1.3
SD13	2	Ca. scorpionfish	Liver	Lipids	36.9		wt%	
SD13	2	Ca. scorpionfish	Liver	Manganese	0.42		mg/kg	0.23
SD13	2	Ca. scorpionfish	Liver	Mercury	0.326		mg/kg	0.012
SD13	2	Ca. scorpionfish	Liver	o,p-DDE	720		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 101	220		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 105	80		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 110	88		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 118	240		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 123	22		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 128	28		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 138	280		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 149	47		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 151	24		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 153/168	220		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 156	19		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 157	6.5	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	PCB 158	19		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 167	6.7	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	PCB 170	36		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 177	10	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	PCB 180	67		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 183	21		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 187	92		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 194	28		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 206	12	E	ug/kg	
SD13	2	Ca. scorpionfish	Liver	PCB 28	26		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 44	30		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 49	64		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD13	2	Ca. scorpionfish	Liver	PCB 52	60		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 66	160		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 70	53		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 74	100		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 87	42		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	PCB 99	180		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	p,p-DDD	480		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	p,p-DDE	22100		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	p,p-DDT	66		ug/kg	13.3
SD13	2	Ca. scorpionfish	Liver	Selenium	1.04		mg/kg	0.13
SD13	2	Ca. scorpionfish	Liver	Total Solids	47.5		wt%	0.4
SD13	2	Ca. scorpionfish	Liver	Trans Nonachlor	28		ug/kg	20
SD13	2	Ca. scorpionfish	Liver	Zinc	128		mg/kg	0.58
SD13	2	Ca. scorpionfish	Muscle	Hexachlorobenzene	0.1	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	Aluminum	10.1		mg/kg	2.6
SD13	2	Ca. scorpionfish	Muscle	Alpha (cis) Chlordane	0.4	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	Copper	5.75		mg/kg	0.76
SD13	2	Ca. scorpionfish	Muscle	Iron	9.85		mg/kg	1.3
SD13	2	Ca. scorpionfish	Muscle	Lipids	0.37		wt%	
SD13	2	Ca. scorpionfish	Muscle	Mercury	0.119		mg/kg	0.012
SD13	2	Ca. scorpionfish	Muscle	o,p-DDE	30		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 101	5.5		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 105	3.2		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 110	3.4		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 118	8.9		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 119	0.2	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 123	0.8	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 128	1	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 138	6.4		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 149	1.6		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 151	0.9	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 153/168	8.2		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 156	0.7	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 158	0.7	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 170	1.1	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 177	0.5	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 180	2.4		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 183	0.7	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 187	2.1		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 194	0.5	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 206	0.4	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 28	0.8	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 44	0.7	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	PCB 49	1.6		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 52	2.4		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 66	4.1		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 70	1.4		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 74	2.6		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 87	1.7		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	PCB 99	4.9		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	p,p-DDD	16		ug/kg	1.33

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD13	2	Ca. scorpionfish	Muscle	p,p-DDE	830		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	p,p-DDT	1.5		ug/kg	1.33
SD13	2	Ca. scorpionfish	Muscle	Selenium	0.39		mg/kg	0.13
SD13	2	Ca. scorpionfish	Muscle	Total Solids	21.5		wt%	0.4
SD13	2	Ca. scorpionfish	Muscle	Trans Nonachlor	0.9	E	ug/kg	
SD13	2	Ca. scorpionfish	Muscle	Zinc	3.06		mg/kg	0.58
SD13	3	Ca. scorpionfish	Liver	Hexachlorobenzene	3	E	ug/kg	
SD13	3	Ca. scorpionfish	Liver	Aluminum	14		mg/kg	2.6
SD13	3	Ca. scorpionfish	Liver	BHC, Alpha isomer	29.5		ug/kg	20
SD13	3	Ca. scorpionfish	Liver	Cadmium	3.15		mg/kg	0.34
SD13	3	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	7.2		ug/kg	
SD13	3	Ca. scorpionfish	Liver	Copper	31		mg/kg	0.76
SD13	3	Ca. scorpionfish	Liver	Iron	260		mg/kg	1.3
SD13	3	Ca. scorpionfish	Liver	Lipids	21		wt%	
SD13	3	Ca. scorpionfish	Liver	Manganese	0.44		mg/kg	0.23
SD13	3	Ca. scorpionfish	Liver	Mercury	0.418		mg/kg	0.012
SD13	3	Ca. scorpionfish	Liver	o,p-DDE	7.25		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 101	46		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 105	22		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 110	20.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 118	91.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 119	2.65		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 123	9.05		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 128	18.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 138	135		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 149	12.9		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 151	10.8		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 153/168	116		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 156	12.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 157	4.95		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 158	10.7		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 167	6		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 170	25		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 177	10		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 180	44		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 183	14.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 187	65.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 194	19		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 206	10.2		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 28	4.35		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 37	3.75		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 44	1.9		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 52	6.4		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 66	17		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 70	7.75		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 74	10.6		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 77	4.55		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	PCB 87	11		ug/kg	
SD13	3	Ca. scorpionfish	Liver	PCB 99	47.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	p,p-DDD	13.5		ug/kg	13.3
SD13	3	Ca. scorpionfish	Liver	p,p-DDE	1230		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD13	3	Ca. scorpionfish	Liver	p,p-DDT	7.95		ug/kg	
SD13	3	Ca. scorpionfish	Liver	Selenium	1.03		mg/kg	0.17
SD13	3	Ca. scorpionfish	Liver	Total Solids	45.2		wt%	0.4
SD13	3	Ca. scorpionfish	Liver	Trans Nonachlor	17.5		ug/kg	
SD13	3	Ca. scorpionfish	Liver	Zinc	141		mg/kg	0.58
SD13	3	Ca. scorpionfish	Muscle	Hexachlorobenzene	0.2	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	Aluminum	9.3		mg/kg	2.6
SD13	3	Ca. scorpionfish	Muscle	Copper	5.71		mg/kg	0.76
SD13	3	Ca. scorpionfish	Muscle	Iron	13.7		mg/kg	1.3
SD13	3	Ca. scorpionfish	Muscle	Lipids	0.67		wt%	
SD13	3	Ca. scorpionfish	Muscle	Mercury	0.133		mg/kg	0.012
SD13	3	Ca. scorpionfish	Muscle	PCB 101	0.7	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 105	0.4	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 110	0.5	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 118	1.6		ug/kg	1.33
SD13	3	Ca. scorpionfish	Muscle	PCB 128	0.2	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 138	1.9		ug/kg	1.33
SD13	3	Ca. scorpionfish	Muscle	PCB 149	0.3	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 151	0.3	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 153/168	2.6		ug/kg	1.33
SD13	3	Ca. scorpionfish	Muscle	PCB 156	0.2	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 177	0.3	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 180	1	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 183	0.4	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 187	1	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 194	0.3	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 206	0.4	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 87	0.2	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	PCB 99	0.8	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	p,p-DDD	0.3	E	ug/kg	
SD13	3	Ca. scorpionfish	Muscle	p,p-DDE	30		ug/kg	1.33
SD13	3	Ca. scorpionfish	Muscle	Selenium	0.27		mg/kg	0.13
SD13	3	Ca. scorpionfish	Muscle	Total Solids	22.2		wt%	0.4
SD13	3	Ca. scorpionfish	Muscle	Zinc	3.74		mg/kg	0.58
SD14	1	Ca. scorpionfish	Liver	Hexachlorobenzene	2.6	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	Aluminum	26		mg/kg	2.6
SD14	1	Ca. scorpionfish	Liver	Cadmium	4.69		mg/kg	0.34
SD14	1	Ca. scorpionfish	Liver	Alpha (cis) Chlordane	4.4	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	Copper	33		mg/kg	0.76
SD14	1	Ca. scorpionfish	Liver	Iron	258		mg/kg	1.3
SD14	1	Ca. scorpionfish	Liver	Lipids	24		wt%	
SD14	1	Ca. scorpionfish	Liver	Manganese	0.4		mg/kg	0.23
SD14	1	Ca. scorpionfish	Liver	Mercury	0.282		mg/kg	0.012
SD14	1	Ca. scorpionfish	Liver	o,p-DDE	3.4	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 101	17		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	PCB 105	9.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 110	8.9	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 118	42		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	PCB 123	3.6	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 128	4.9	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 138	57		ug/kg	13.3

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD14	1	Ca. scorpionfish	Liver	PCB 149	8.9	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 151	5.7	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 153/168	72		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	PCB 156	5.6	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 158	4.3	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 170	13	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 177	4.8	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 180	29		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	PCB 183	9	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 187	33		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	PCB 194	9.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 206	4.8	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 66	6.4	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 70	1.5	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 74	3.5	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 87	3	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	PCB 99	19		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	p,p-DDD	11	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	p,p-DDE	1100		ug/kg	13.3
SD14	1	Ca. scorpionfish	Liver	p,p-DDT	5.9	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	Selenium	0.83		mg/kg	0.13
SD14	1	Ca. scorpionfish	Liver	Total Solids	48.6		wt%	0.4
SD14	1	Ca. scorpionfish	Liver	Trans Nonachlor	16	E	ug/kg	
SD14	1	Ca. scorpionfish	Liver	Zinc	126		mg/kg	0.58
SD14	1	Ca. scorpionfish	Muscle	Aluminum	5.1		mg/kg	2.6
SD14	1	Ca. scorpionfish	Muscle	Copper	6.15		mg/kg	0.76
SD14	1	Ca. scorpionfish	Muscle	Iron	8.4		mg/kg	1.3
SD14	1	Ca. scorpionfish	Muscle	Lipids	0.8		wt%	
SD14	1	Ca. scorpionfish	Muscle	Mercury	0.167		mg/kg	0.012
SD14	1	Ca. scorpionfish	Muscle	PCB 101	0.3	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 105	0.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 118	0.6	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 138	0.7	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 149	0.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 153/168	1.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 177	0.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 180	0.5	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 183	0.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 187	0.4	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 194	0.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 206	0.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 66	0.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	PCB 99	0.2	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	p,p-DDD	0.1	E	ug/kg	
SD14	1	Ca. scorpionfish	Muscle	p,p-DDE	15		ug/kg	1.33
SD14	1	Ca. scorpionfish	Muscle	Selenium	0.19		mg/kg	0.13
SD14	1	Ca. scorpionfish	Muscle	Total Solids	21.8		wt%	0.4
SD14	1	Ca. scorpionfish	Muscle	Zinc	3.53		mg/kg	0.58
SD14	2	Ca. scorpionfish	Liver	Hexachlorobenzene	2.7	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	Aluminum	27.1		mg/kg	2.6
SD14	2	Ca. scorpionfish	Liver	Cadmium	2.99		mg/kg	0.34

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD14	2	Ca. scorpionfish	Liver	Copper	25.3		mg/kg	0.76
SD14	2	Ca. scorpionfish	Liver	Iron	118		mg/kg	1.3
SD14	2	Ca. scorpionfish	Liver	Lipids	16.8		wt%	
SD14	2	Ca. scorpionfish	Liver	Manganese	0.395		mg/kg	0.23
SD14	2	Ca. scorpionfish	Liver	Mercury	0.238		mg/kg	0.012
SD14	2	Ca. scorpionfish	Liver	PCB 101	19		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 105	10	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 110	8.7	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 118	50		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 123	5.3	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 128	11	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 138	76		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 149	10	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 151	8.8	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 153/168	98		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 156	8.5	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 157	3.1	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 158	5.1	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 167	2.2	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 170	18		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 177	7.7	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 180	46		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 183	14		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 187	46		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 194	15		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	PCB 206	7.4	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 28	1.5	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 44	1.1	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 66	6.4	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 70	2.9	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 74	3.2	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 87	3.4	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	PCB 99	20		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	p,p-DDD	8.5	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	p,p-DDE	1200		ug/kg	13.3
SD14	2	Ca. scorpionfish	Liver	p,p-DDT	5.7	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	Selenium	0.797		mg/kg	0.13
SD14	2	Ca. scorpionfish	Liver	Total Solids	52		wt%	0.4
SD14	2	Ca. scorpionfish	Liver	Trans Nonachlor	18	E	ug/kg	
SD14	2	Ca. scorpionfish	Liver	Zinc	98.7		mg/kg	0.58
SD14	2	Ca. scorpionfish	Muscle	Aluminum	5.9		mg/kg	2.6
SD14	2	Ca. scorpionfish	Muscle	Arsenic	2.2		mg/kg	1.4
SD14	2	Ca. scorpionfish	Muscle	Copper	1.95		mg/kg	0.76
SD14	2	Ca. scorpionfish	Muscle	Iron	8.3		mg/kg	1.3
SD14	2	Ca. scorpionfish	Muscle	Lipids	1.11		wt%	
SD14	2	Ca. scorpionfish	Muscle	Mercury	0.0955		mg/kg	0.012
SD14	2	Ca. scorpionfish	Muscle	PCB 101	0.2	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	PCB 118	0.4	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	PCB 138	0.4	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	PCB 153/168	0.8	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	PCB 180	0.3	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD14	2	Ca. scorpionfish	Muscle	PCB 187	0.3	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	PCB 99	0.1	E	ug/kg	
SD14	2	Ca. scorpionfish	Muscle	p,p-DDE	10		ug/kg	1.33
SD14	2	Ca. scorpionfish	Muscle	Selenium	0.18		mg/kg	0.13
SD14	2	Ca. scorpionfish	Muscle	Total Solids	21.6		wt%	0.4
SD14	2	Ca. scorpionfish	Muscle	Zinc	3.86		mg/kg	0.58
SD14	3	Ca. scorpionfish	Liver	Hexachlorobenzene	8.1		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	Aluminum	9.7		mg/kg	2.6
SD14	3	Ca. scorpionfish	Liver	Arsenic	3.5		mg/kg	1.4
SD14	3	Ca. scorpionfish	Liver	Cadmium	2.35		mg/kg	0.34
SD14	3	Ca. scorpionfish	Liver	Copper	12.5		mg/kg	0.76
SD14	3	Ca. scorpionfish	Liver	Iron	111		mg/kg	1.3
SD14	3	Ca. scorpionfish	Liver	Lipids	17.8		wt%	
SD14	3	Ca. scorpionfish	Liver	Manganese	0.39		mg/kg	0.23
SD14	3	Ca. scorpionfish	Liver	Mercury	0.134		mg/kg	0.012
SD14	3	Ca. scorpionfish	Liver	PCB 101	8.95		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 105	3.5		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 110	4.4		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 118	18		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	PCB 128	0.6		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	PCB 138	20.5		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	PCB 149	4.6	E	ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 151	2.95		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 153/168	33		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	PCB 156	2.5		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 177	1.95		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 180	12	E	ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 183	3.1	E	ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 187	12	E	ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 194	2.65		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 206	3.15		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 49	1.15		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 66	2.8		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 70	2.1		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 74	1.55		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 87	2		ug/kg	
SD14	3	Ca. scorpionfish	Liver	PCB 99	6.9		ug/kg	
SD14	3	Ca. scorpionfish	Liver	p,p-DDD	5.4		ug/kg	
SD14	3	Ca. scorpionfish	Liver	p,p-DDE	435		ug/kg	13.3
SD14	3	Ca. scorpionfish	Liver	p,p-DDT	2.45		ug/kg	
SD14	3	Ca. scorpionfish	Liver	Selenium	0.72		mg/kg	0.13
SD14	3	Ca. scorpionfish	Liver	Total Solids	45.1		wt%	0.4
SD14	3	Ca. scorpionfish	Liver	Trans Nonachlor	10.5		ug/kg	
SD14	3	Ca. scorpionfish	Liver	Zinc	110		mg/kg	0.58
SD14	3	Ca. scorpionfish	Muscle	Aluminum	12.9		mg/kg	2.6
SD14	3	Ca. scorpionfish	Muscle	Copper	9.16		mg/kg	0.76
SD14	3	Ca. scorpionfish	Muscle	Iron	10.1		mg/kg	1.3
SD14	3	Ca. scorpionfish	Muscle	Lipids	0.16		wt%	
SD14	3	Ca. scorpionfish	Muscle	Mercury	0.151		mg/kg	0.012
SD14	3	Ca. scorpionfish	Muscle	PCB 101	0.1	E	ug/kg	
SD14	3	Ca. scorpionfish	Muscle	PCB 118	0.3	E	ug/kg	

Station	Rep	Species	Tissue	Parameter	Value		Units	MDL
SD14	3	Ca. scorpionfish	Muscle	PCB 138	0.3	E	ug/kg	
SD14	3	Ca. scorpionfish	Muscle	PCB 153/168	0.4	E	ug/kg	
SD14	3	Ca. scorpionfish	Muscle	PCB 180	0.2	E	ug/kg	
SD14	3	Ca. scorpionfish	Muscle	PCB 187	0.2	E	ug/kg	
SD14	3	Ca. scorpionfish	Muscle	p,p-DDE	5.4		ug/kg	1.33
SD14	3	Ca. scorpionfish	Muscle	Selenium	0.18		mg/kg	0.13
SD14	3	Ca. scorpionfish	Muscle	Total Solids	22.8		wt%	0.4
SD14	3	Ca. scorpionfish	Muscle	Zinc	4.56		mg/kg	0.58