FINAL REPORT

SANTA MONICA BAY SEAFOOD CONTAMINATION STUDY

FOR SUBMITTAL TO

SANTA MONICA BAY RESTORATION PROJECT

SUBMITTED BY

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EXECUTIVE SUMMARY

Growing public concern about pollution in the coastal waters off southern California prompted the Santa Monica Bay Restoration Project to conduct a study on the contamination of seafood in and around Santa Monica Bay. The study provides information for management decisions regarding subsistence, recreational, and commercial fisheries in the study area, and consumption of local seafood.

The objectives of the study were to 1) compile and review available historical data on seafood contamination, and 2) collect white croaker (*Genyonemus lineatus*) and yellow rock crab (*Cancer anthonyi*) from various sites in Santa Monica Bay and chemically analyze their edible tissues for selected trace contaminants (chlorinated organics and metals). The data collected in this study (Objective 2) were compared to existing historical data to determine temporal trends in contamination. The data will also be used in an upcoming Santa Monica Bay Restoration Project contract to calculate the risk from consuming contaminated seafood.

In the historical review, data were collected from peer-reviewed papers, gray literature reports, and unpublished sources on chemical contamination of edible fishes and invertebrates caught in the Santa Monica Bay study area. The database contains contaminant concentrations in the edible tissues of 22 species of fish, three species of crustaceans, and two species of mollusks for the past two decades.

Bottom-dwelling fish and invertebrates collected on or near the Palos Verdes Shelf usually have the highest muscle concentrations of chlorinated hydrocarbons in the Southern California Bight. The concentration of chlorinated hydrocarbons in pelagic fish, which roam throughout the Southern California Bight, is more uniform among areas. White croaker muscle samples had the highest DDT and PCB levels for teleosts at every location in surveys conducted in 1975, 1980, 1981, 1987, and in the current study. The high contamination levels in white croaker may be due to the high lipid content of croaker muscle tissue or their tendency to feed in outfall areas where sediments have high levels of contaminants.

The concentrations of total PCB and total DDT in coastal marine sediments off southern California have declined since the mid-1970s, especially on the Palos Verdes Shelf. Temporal trends in contamination levels of animals are difficult to assess because there are

tissue concentrations of PCB in white croaker have declined on the Palos Verdes Shelf, but a trend is not apparent for fish collected in Santa Monica Bay. Tissue concentrations of DDT in white croaker have declined in Santa Monica Bay and on the Palos Verdes Shelf, but not at other coastal sites. Data from other fish species collected on the Palos Verdes Shelf also suggest a decrease in tissue contamination levels of PCB and DDT from the mid-1970s to the early 1980s. Temporal trends in the concentration of trace organics in yellow rock crab are difficult to assess because few data have been collected. The concentration of PCBs in yellow rock crab collected off Dana Point in 1976 were 10 times higher than in 1990, but the concentration of DDT has not changed appreciably.

In the seafood sampling study, muscle tissue concentrations of PCB, DDT, DDMU (metabolite of DDT), hexachlorocyclohexane (HCH), hexachlorobenzene (HCB), and chlordane in white croaker were significantly higher on the Palos Verdes Shelf than elsewhere. Levels were lowest off Dana Point (reference site), and intermediate in Santa Monica Bay. The concentrations of HCH, HCB, and chlordane in white croaker muscle tissue were quite low compared to the concentrations of PCB and DDT. The concentrations of PCB and DDT in muscle tissue of yellow rock crab were significantly higher on the Palos Verdes Shelf than off Dana Point.

Polychlorinated dibenzodioxins (PCDD) were detected in white croaker from two sites in Santa Monica Bay, although the concentrations were quite low. Polychlorinated dibenzofurans (PCDF) were detected in all composites; concentrations in Santa Monica Bay were an order of magnitude higher than concentrations at Dana Point.

The distribution of selenium concentrations in tissues was more uniform among the sites compared to the distribution of trace organic contaminants.

The PCB concentration in white croaker collected off White Point was more than 75 times greater than the PCB concentration in yellow rock crab from the same site; the DDT concentration was nearly 1000 times greater. The difference in tissue concentrations of chlorinated hydrocarbons between white croaker and yellow rock crab is probably due to differences in feeding habits.

Concentrations of DDMU, HCB, HCH, and chlordane in yellow rock crab muscle tissue are quite low (10 and 1000 times lower than white croaker) and virtually the same for samples collected off White Point and Dana Point. The concentrations of HCH and chlordane were higher at Dana Point and HCB at White Point; DDMU was similar at both sites. Arsenic and lead concentrations in muscle tissue of yellow rock crab were similar at White Point and Dana Point. Selenium concentrations were significantly higher at Dana Point. Selenium was the only contaminant in the entire study that was higher in crabs than in white croaker.

The Dana Point site sampled in this and other studies is appropriate as a reference site for contamination studies in the Southern California Bight. Consistently low values have been reported in animal tissue samples from this area for the last 15 years.

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INTRODUCTION

During the past two decades, there has been growing concern about the level of contamination in seafood caught in the coastal waters of the Southern California Bight. Numerous studies have documented the concentration of contaminants in seafood organisms (Castle and Woods 1972, MacGregor 1972, SCCWRP 1973, Young *et al.* 1976, 1988, Puffer *et al.* 1981, 1982, Stout and Beezhold 1981, CSWRCB 1982, Gossett *et al.* 1983, Brown *et al.* 1986, Malins *et al.* 1987, Thompson *et al.* 1987, MBC 1988, Pollock *et al.* 1990, 1991a,b, CDHS 1991, and Mearns *et al.* 1991).

The objectives of the study were to 1) compile and review available historical data on seafood contamination, and 2) collect white croaker (*Genyonemus lineatus*) and yellow rock crab (*Cancer anthonyi*) from various sites in Santa Monica Bay and chemically analyze their edible tissues for selected trace contaminants (chlorinated organics and metals). The data collected in this study (Objective 2) were compared to existing historical data to determine temporal trends in contamination. The data will also be used in an upcoming Santa Monica Bay Restoration Project contract to calculate the risk from consuming contaminated seafood.

Mearns *et al.* (1991) summarized historical and current levels of contaminants in marine organisms collected off southern California. In 1987, the California Department of Health Services (CDHS) Office of Health Hazard Assessment [now California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA)] conducted the a Comprehensive Fish Study that examined contamination levels in the edible tissues of fish caught in the area bounded by Point Dume, Dana Point, and Catalina Island (Pollock *et al.* 1990, 1991a,b). The study had several sites in Santa Monica Bay. As a result of this study, the California Environmental Protection Agency suggested that the consumption of several species of fish be eliminated or reduced.

The Santa Monica Bay Restoration Project (SMBRP), a part of the U.S. Environmental Protection Agency's (EPA) National Estuary Program, began a study of seafood contamination in the Santa Monica Bay study area that would supplement the OEHHA Comprehensive Fish Study. The objectives of the SMBRP study were: 1) to compile and review historical data on seafood contamination in the study area and 2) to collect and chemically analyze the edible tissue of white croaker (*Genyonemus lineatus*) and yellow rock crab (*Cancer anthonyi*) caught in the study area.

Data generated during the historical review will provide perspective for the results of the white croaker and yellow rock crab analyses and will also identify a suitable reference site. Data generated during the collection and analyses of white croaker and yellow rock crab will provide additional, and particularly important, data on chemicals of concern at specific sites within the Santa Monica Bay study area sufficient to do quantitative human risk assessments. The entire study will provide information for management decisions regarding subsistence, recreational, and commercial fisheries in the study area and consumption of local seafood.

The SMBRP study consists of the following tasks:
1) Compilation and analysis of existing data on anthropogenic chemical contamination of the edible portion of seafood (fishes and invertebrates) in the Santa Monica Bay study area;
2) Collection of white croaker and yellow rock crab from the specified sites;
3) Dissection of the edible tissues of these organisms and analysis for contaminant levels;
4) Analysis of muscle tissues for a suite of chlorinated hydrocarbons and trace metals; and
5) Deposition of tissue samples in an archive collection.

The California State Water Resources Control Board (CSWRCB) awarded the contract for this study to the Southern California Coastal Water Research Project (Tasks 2 and 3) and to University of California, Santa Cruz (Tasks 4 and 5). Task 1 (literature review and data analysis) was subcontracted to MBC Applied Environmental Sciences.

METHODS

Review of Historical Data

Data on anthropogenic chemical contamination of the edible portion of edible fishes and invertebrates from Santa Monica Bay have been collected by a number of agencies during the past two decades. Much of this information has been published in peer-reviewed papers and gray literature reports, but some data are unreported. Eighteen agencies were contacted to determine the existence and availability of seafood contaminant data for southern California (MBC 1991). Mearns *et al.* (1991) summarized much of the historical information on seafood contamination levels for southern California; it served as the basis for the historical review. More recent data were added when they were available.

Dr. Alan J. Mearns [National Oceanic and Atmospheric Administration, National Ocean Service (NOS), Seattle, WA] provided a computer database from NOS files that covers the sampling effort (MBC 1991). The Environmental Monitoring Division of the City of Los Angeles provided a computer database on recent seafood contamination levels from their monitoring in Santa Monica Bay. Dr. G.A. Pollock (Staff Toxicologist, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, Sacramento, CA) provided the raw data on contaminant levels in white croaker collected in 1987 by the then California Department of Health Services (Pollock *et al.* 1991a).

1990 Study Area

White croaker and yellow rock crab were collected from 11 sites along the southern California coast in September 1990 (Table 1, Figure 1). Ten of the sites were located in the Santa Monica Bay study area (Point Dume to Point Fermin); a reference site was located off Dana Point about 80 km south. At each site, 20 white croaker were collected. Twenty additional white croaker were collected from Malibu and 20 more from El Segundo.

1990 Target Species

White croaker and yellow rock crab were the target species for this study. White croaker was chosen because its historically high level of chlorinated hydrocarbon contamination prompted the California Department of Health Services to issue health warnings about its consumption in 1985. Yellow rock crab was chosen because it is an invertebrate seafood species that is commonly caught in Santa Monica Bay.

White croaker were collected by hook-and-line and by 7.6-m otter trawl. Twenty rock crabs were collected from White Point and from Dana Point. Rock crabs were collected by baited crab traps. Fish and crabs were brought aboard ship and emptied into a clean tub for sorting. White croaker and yellow rock crab were sorted from the catch tub and placed in clean buckets for processing. Individual fish and crabs were wrapped in aluminum foil, labelled with species identification, location, and date, and placed in ice chests on dry ice. Samples were returned to the laboratory and stored in a freezer at -20°C.

Tissue Compositing and Preparation

Fish and crabs were partially thawed before processing. Each individual was measured and weighed in the laboratory prior to dissection (Appendix A). The standard length (SL) (anterior portion of head to base of tail) of each white croaker was measured to the nearest millimeter (Appendix B). The carapace width of each yellow rock crab was measured to the nearest millimeter (Appendix B). Wet whole body weights of both species were measured to the nearest 0.1 g.

The compositing of edible tissue samples followed the guidelines established by OEHHA in their Comprehensive Fish Study of 1987. The 20 specimens from each station were ranked according to length and divided into quartiles of five individuals each. One individual out of five in each of the quartiles was selected at random to constitute the first composite of tissue samples. A second individual from each quartile was selected to constitute the second composite of tissue samples. Five composites of four individuals each were obtained for each 20 specimens. An equal portion of muscle tissue was removed from each individual.

All dissections took place in a MAC 10 2448 Clean Work Station with laminar airflow and Class 100 HEPA filter. Dissection of semi-thawed organisms was performed on acid and solvent cleaned Teflon sheets using two sets of cleaned scalpels with carbon-steel blades and two sets of cleaned Teflon tipped forceps. Skin tissue of white croaker was assumed to be elevated in trace constituents and the first scalpel was used to cut it away. A U-shaped incision was made and the skin was peeled back. The second scalpel was used to cleanly excise the muscle tissue. Tissue samples were manipulated with Teflon tipped forceps. Care was taken to prevent contamination of the muscle tissue by other tissues and body fluids. Excised tissues were stored in the pre-cleaned glass jars and frozen at -20°C until they were shipped to the analytical laboratory.

The claws and legs of the rock crabs were removed from the body and cracked with a pre-cleaned stainless steel nut cracker. Muscle tissue was excised from the claws and legs with a pre-cleaned scalpel. Teflon tipped forceps were used to manipulate the tissue samples. Care was taken to prevent contamination of the muscle tissue by other tissues and body fluids. Excised tissues were stored in the pre-cleaned glass jars and frozen at -20°C until they were shipped to the analytical laboratory.

At the analytical laboratory, 55 composites of white croaker and 10 composites of yellow rock crab were homogenized with a Brinkman polytron blender equipped with a titanium blade. The blade assembly was carefully cleaned after each composite to minimize sample cross contamination. The blade assembly was solvent rinsed between each sample and the hexane rinse was checked on a gas chromatograph between each site. Homogenized composites were divided into three portions and sealed in pre-cleaned glass jars. Portion #

1 was used by the UCSC Trace Organics Facility for polychlorinated dibenzo-*p*-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), organochlorine, and metals analysis. Portion #2 was sent to the California Department of Fish and Game (CDFG), Water Pollution Control Laboratory (WPCL) for duplicate analyses as part of the quality assurance (QA) program. Portion #3 was frozen at -20°C and archived for possible future analysis.

Chemical Analyses

Organochlorines. Fifty-five composites of white croaker and 10 composites of yellow rock crab were analyzed for total PCB (ΣPCB), total DDT (ΣDDT), DDMU, hexachlorobenzene (HCB), hexachlorocyclohexane (HCH), and chlordane using a modification of EPA Method 8080 (Appendix A). Samples were extracted in methylene chloride:hexane (1:1), concentrated on a rotary evaporator, and redissolved in hexane. Following liquid chromatography, extracts were analyzed with high resolution gas chromatography (HRGC). Ten percent of the samples were analyzed as duplicates and an additional 10% were duplicated by WPCL. Additional QA procedures included the use of Optima grade chemicals, proper cleaning and checking of glassware, procedural blanks, external standards, internal standards, and matrix spikes.

Studies of contaminant levels in seafood quantify ΣPCB levels as mixtures of Aroclors (e.g., 1242, 1248, 1254, 1260) and as individual congeners (Mearns et al. (1991). This is partly as a result of changing technology. Pollock *et al.* (1991a) used the sum of Aroclors 1254 and 1260 to represent ΣPCB. In this study, Aroclors 1242, 1254, and 1260 were summed and presented as ΣPCB. Aroclor 1242 is typically found at extremely low levels relative to Aroclors 1254 and 1260; however, in our study, 1242 occurred in white croaker composites from Palos Verdes. The PCB data for white croaker are presented both ways for comparison to the 1987 data (Appendix C; see Jarman *et al.* 1991 for complete methods).

Several pesticides and their metabolites were found in tissues of white croaker and yellow rock crab in 1990. In this report, ΣDDT is the sum of *p,p'*-DDE, *p,p'*-DDD, *p,p'*-DDT, *o,p'*-DDE, *o,p'*-DDD, and *o,p'*-DDE. DDMU, a DDT metabolite, is presented separately as is hexachlorobenzene (HCB). Hexachlorocyclohexane (HCH) is the sum of α-HCH, β-HCH, and Γ-HCH. Chlordane is the sum of oxychlordane, trans-nonachlor, cis-nonachlor, trans-chlordane, and cis-chlordane.

<u>PCDD and PCDF</u>. Six composites of white croaker muscle were analyzed for polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) with high resolution gas chromatography-high resolution mass spectrometry (HRGC/HRMS) (EPA method 8290) by Alta Analytical Laboratories at El Dorado Hills, CA (Appendix A). Samples were scanned for all tetra through octa congeners. Detection limits ranged from 0.15 to 4.3 pptr. Quality Assurance procedures included method blanks and the use of isotopically labeled internal standards in all samples. Recoveries were calculated for all labeled compounds.

<u>Selenium and Arsenic</u>. Fifty-five white croaker and 10 yellow rock crab tissue composites were analyzed for selenium; 10 yellow rock crab composites were analyzed for arsenic by WPCL (Appendix A). Tissues were analyzed by a modified EPA method 7741. Tissue was dry ashed in a Thermolyne ashing furnace at 500°C for 990 min. The residues were dissolved by heating in a mixture of water and concentrated hydrochloric acid for 10 min, and analyzed on a Varian spectra 30 atomic absorption spectrophotometer with a vapor generation accessory (VGA) model 76. Detection limits were 20 ppb wet weight. Ten percent of the samples were analyzed as duplicates and an additional 10% were duplicated by CDFG Moss Landing Marine Laboratory. Additional QA procedures included procedural blanks, external standards, and internal standards.

<u>Lead</u>. Ten rock crab tissue composites were analyzed for lead by a modification of EPA method 7421 at the UCSC Trace Metals Analytical Facility (Appendix A). Tissue was digested in hot (60-70°C) concentrated nitric acid for 4 hr. The sample was dried, 1 N nitric acid was added, and the sample was cooled and then analyzed on a deuterium corrected PE 5000 Graphite Furnace Atomic Absorption Spectrophotometer with pyloric coated graphite tubes and the L'Vov platform. Detection limits were 2 ppb. All samples were analyzed in duplicate.

<u>Lipid and Moisture</u>. Tissue percent lipid was determined gravimetrically after evaporating the solvent (hexane) from 1 ml of tissue extract (Appendix A). Tissue percent moisture was determined gravimetrically by drying 1.0-1.5 g of tissue to a constant weight at 40°C (Appendix A).

The raw data on contaminant levels in white croaker and yellow rock crab collected in 1990 are presented in Appendix A (Jarman *et al.* 1991). [Note that Jarman *et al.* (1991; Appendix A) mistakenly use *Cancer antennarius* as the name for yellow rock crab.]

Units for the concentration data presented in this report are:

$\mu g\ g^{-1}$	parts per million	ppm
$ng\ g^{-1}$	parts per billion	ppb
$pg\ g^{-1}$	parts per trillion	pptr

Definition of Chemical Terms

Aroclor. Trade name of commercial polychlorinated biphenyl (PCB) mixture manufactured by Monsanto Corporation from 1930 to 1977. The product name is characterized by four digit numbers (e.g., 1242, 1254, 1260). The first two digits indicate that the mixture contains the biphenyl molecule with 12 carbons. The last two digits give the weight percent (w/w) of chlorine in the mixture (e.g., Aroclor 1242 contains biphenyls with approximately 42% chlorine).

Chlordane. Insecticidal chlorohydrocarbon that is a contact poison and fumigant. Technical grade chlordane contains 60-75% of the *cis* and *trans* isomers, which differ in the position of chlorine atoms, and 25-40% of chlordene, heptachlor, nonachlor, and other organochlorine compounds. The lethal dose (LD_{50}) of technical chlordane is 283 mg/kg; the lethal dose of *cis* and *trans*-chlordane is 500 mg/kg. The EPA cancelled registrations of pesticides containing this compound with the exception of use in subsurface ground insertion for termite control and the dipping of roots or tops of non-food plants (*Federal Register*, Vol. 40, p. 28850, July 9, 1975).

DDD. Dichlorodiphenyldichloroethane is a nondegradable insecticidal chlorohydrocarbon that is a derivative of DDT (one chlorine atom has been replaced by hydrogen). It is a component of technical grade DDT and has two isomers, *p,p'*-DDD and *o,p'*-DDD. Technical DDD and *p,p'*-DDD have lethal doses (LD_{50}) of 113 mg/kg; *o,p'*-DDD has a toxic dose (TD_{LO}) of 10,000 mg/kg.

DDE. Dichlorodiphenyldichloroethene is the main metabolic degradation product of DDT. It is noninsecticidal and has two isomers, *p,p'*-DDE and *o,p'*-DDE each with a lethal dose (LD_{50}) of 880 mg/kg.

DDMU. Dichlorodiphenylmonochloroethene that is a DDT metabolite.

DDT. Dichlorodiphenyltrichloroethane is a polychlorinated nondegradable pesticide. Technical grades of DDT are mixtures of *p,p'*-DDT (primary isomer) and *o,p'*-DDT (secondary isomer) and several similar compounds. It is highly persistent, accumulates in aquatic organisms, and is a potential human carcinogen. Toxic poisoning may occur by ingestion or by absorption through skin or respiratory tract; lethal dose (LD_{50}) of *p,p'*-DDT is 113 mg/kg; toxic dose (TD_{LO}) of *o,p'*-DDT is 1,000 mg/kg.

HCB. Hexachlorobenzene is also known as perchlorobenzene, but should not be confused with benzene hexachloride or hexachlorocyclohexane. It is used as a selective fungicide and in organic synthesis. The lethal dose (LD_{50}) is 10,000 mg/kg.

HCH. Hexachlorocyclohexane is an organochlorine insecticide that has four isomers that vary in the position of chlorine atoms: α-HCH, β-HCH, δ-HCH, and Γ-HCH (lindane). [Note: δ-HCH was not quantified in this study.] Lindane is the only isomer with insecticidal properties; it is a contact, stomach, and respiratory poison with a toxicity somewhat greater than of DDT. The lethal dose (LD_{50}) is 76 mg/kg. It is listed as a carcinogen (*Second Annual Report on Carcinogens*, NTP 81-43, Dec. 1981 pp. 152-154).

Lead. Toxic heavy metal that exists in nature mainly as lead sulfide and lead carbonate. It is used extensively in alloys, storage batteries, coverings for electrical cable, in water and noise proofing, in antiknock agents (tetraethyl lead and tetramethyl lead), in paints, and in high quality glass. It enters the aquatic environment through precipitation, lead dust aerial fallout, erosion and leaching of soil, municipal and industrial waste discharges, and runoff of aerial fallout deposits from streets and other surfaces.

Nonachlor. See chlordane.

Oxychlordane. Metabolite of chlordane where two hydrogen atoms have been replaced by oxygen; LD_{50} is 457 mg/kg.

PCB. Polychlorinated biphenyls are derivatives of the compound biphenyl in which one to 10 of the hydrogen atoms have been replaced by chlorine. Theoretically, there are 209 individual PCB congeners that vary in the number and position of chlorine substitutes in the biphenyl molecule. PCBs are among the most persistent and widely distributed pollutants in the ecosystem. They were used in industry predominantly in capacitors and transformers, hydraulic fluid, plasticizers, adhesives, and fire retardants. They are listed as carcinogens by the EPA (*Second Annual Report on Carcinogens*, NTP 81-43, Dec. 1981, pp. 206-209).

PCDD. Polychlorinated dibenzodioxins are derivatives of dibenzodioxin where hydrogen atoms have been replaced by chlorine. There are 75 PCDD isomers that vary in the degree of chlorination (4-8 chlorine atoms/molecule) and toxicity. Tetrachlorodibenzodioxin (TCDD) is the best known and most studied. PCDDs occur as trace impurities in various aromatic compounds such as chlorophenols, herbicides, and PCBs. They enter the environment through accidental release during chlorophenol production, aerial application of phenoxy herbicides, and disposal of wastes.

PCDF. Polychlorinated dibenzofurans are derivatives of dibenzofuran where hydrogen atoms have been replaced by chlorine. There are 135 PCDF isomers that vary in the degree of chlorination (4-8 chlorine atoms/molecule); toxicity similar to PCDD. PCDFs are also found in trace quantities in chlorophenols, herbicides, and PCBs.

Selenium. Highly toxic metal that is present in soil as elemental selenium or as basic ferric selenate or calcium selenate. It is recognized as a metabolic requirement in trace amounts, but toxic when ingested in excess amounts. It is present in plating, plastic, metal-working, and chemical effluents and is also generated by burning fossil fuels.

Statistical Analyses

Censorship of Data. Contaminant data may be censored, i.e., observations below (or above) some measurement may not be known. In chemical analyses, the mass of the contaminant in the sample may be below the sensitivity of the instrument and the analytical methods, and therefore cannot be detected. The Trace Organics Facility, University of California at Santa Cruz had a minimal detection limit of 0.05 ppb for PCBs and pesticides. The instrument could detect levels of 1.2 pg/μl at 10 times the background noise. Instrument detection limits were applied to samples depending on the amount of sample extracted and the volume of extract shot to determine the sample detection limits.

The California OEHHA study used a method detection limit (MDL) based on standard deviations determined from repeated analyses of fish tissues spiked with low contaminant concentrations (Federal Register Vol. 49(209):198-199, October 26, 1984) (Pollock *et al.* 1991a). The MDL is about three times the standard deviation; variable results for the spiked samples can result in relatively high MDLs. The MDL was 38 ppb for DDTs and 50 ppb for PCBs.

Most statistical analyses require uncensored data because truncation (censoring) violates the assumption of continuous distribution. However, contaminant concentration data below the minimum or method detection limit may be meaningless from a risk assessment perspective. Some censoring of the data may therefore be acceptable. Data may be censored by using the minimal or method detection limit as the minimal value in the data set, by using half the minimal value, or some mix of the two (Pollock *et al.* 1991a). Pollock *et al.* (1991a) used the method detection limit as a minimum when the contaminant was detected in most of the samples, and they used half the limit when all contaminant values were below the limit. This report uses the minimal detection limit of 0.05 ppb in the 1990 data as the minimal value for statistical analysis, which is 750 to 1,000 times lower than the method detection limits used in Pollock *et al.* (1991a). However, to statistically compare contaminant levels in white croaker tissues between 1987 and 1990, the 1990 (and 1987) data were censored below the method detection limits of Pollock *et al.* (1991a) (Appendices C-2b, C-2c, C-2d, C-2e).

Data Summary. Recent studies of contaminant levels for seafood organisms have summarized data in different ways. Mearns *et al.* (1991) presented data in ppm and summarized the data by medians, arithmetic mean, standard deviation, and range. Pollock *et al.* (1991a) presented data in ppb and summarized the data by arithmetic mean, geometric mean, and 95% confidence limit. In this report, we summarize previous data by arithmetic mean, standard deviations and range. However, we present the arithmetic mean and standard deviation, geometric mean, and 95% confidence limit of ΣPCB and ΣDDT concentrations in white croaker from 1987 and 1990 (Appendices C-2b, C-2c, C-2d, C-2e). This allows the 1990 data to be compared to Mearns *et al.* (1991) and Pollock *et al.* (1991a).

Statistics. Statistical tests were conducted on white croaker and yellow rock crab data to determine differences among sites in 1990, and on white croaker data to determine temporal differences between 1987 and 1990 at selected sites. Tests applied to 1990 data included analysis of variance (ANOVA) for site analyses on white croaker, and t-tests for site analysis on yellow rock crab. The temporal analysis for white croaker data from 1987 and 1990 also used a t-test.

Prior to conducting each analysis, the data were first tested for homogeneity (equality) of variance using Box-Andersen, Tukey jackknife, and Levine median tests (Pimentel and Smith 1990). Homogeneity or heterogeneity of variance was accepted if the Box-Andersen and jackknife tests agreed. If these tests produced opposite results, Levine's median test was used as the tie-breaker.

If variances were homogeneous (nonsignificant differences), then the data were tested by ANOVA or t-tests without transformation. If variances were heterogeneous (significant differences), then the data were transformed to produce homogeneous variances. Data transformations included log(x), log(x + 1), log(100x), ln(x + 0.1), square-root (x + 0.5), and reciprocal (1/x) (Sokal and Rohlf 1969). The transformed data were used in the ANOVA or t-tests.

If ANOVA test indicated that there were significant differences among mean contaminant concentrations among sites, a Student-Newman-Keuls test was used to identify, *a posteriori*, sites that differed significantly from each other. Sites were arranged by untransformed means from lowest to highest and a line was drawn under sites that were not significantly different.

Temporal changes in contaminant levels of white croaker since the early 1970s or 1980s were also presented graphically by region. Lines were drawn connecting mean levels at one site through time. These lines are not regression lines.

RESULTS

Review of Historical Data

The first studies of contamination in seafood off southern California were done by university and California Department of Fish and Game (CDFG) researchers in the late 1960s and early 1970s (Mearns *et al.* 1991). The most numerous and extensive surveys of seafood contamination from 1973 to 1981 were completed by Southern California Coastal Water Research Project (SCCWRP). From 1984 to 1986, the National Marine Fisheries Service (NMFS) conducted studies in southern California as part of the NOAA Benthic Surveillance Study (Malins *et al.* 1987, Varanasi *et al.* 1989). The California Regional Water Quality Control Board (CRWQCB), Los Angeles Region, sponsored a study in 1985 (Risebrough 1987). The California Department of Health Services collected and analyzed seafood organisms from Point Dume to Dana Point in 1986-87 (CDHS 1991, Pollock *et al.* 1990, 1991a,b).

Data on contamination of seafood organisms have also been collected since the early 1980s by the City of Los Angeles' Hyperion Treatment Plant (J. Dorsey, Environmental Monitoring Division City of Los Angeles, personal communication) and the County Sanitation Districts of Los Angeles County (R.P. Ghirelli, California Regional Water Quality Control Board, Los Angeles Region, Monterey Park, letter to P.F. Bontadelli, California Department of Fish and Game, Sacramento). County Sanitation Districts of Los Angeles County also conducted a seafood contamination study (Smokler *et al.* 1979). Outside of the Santa Monica Bay study area, data were collected in the late 1980s by the County Sanitation Districts of Orange County (CSDOC 1991) and the Port of San Diego (SDDHS 1990).

The 1973-1979 SCCWRP database provided by the National Ocean Service of NOAA contains seafood contamination data from 33 stations in southern California including Point Dume, Palos Verdes Shelf, Orange County (Huntington Beach/Newport Beach), Laguna Beach, Dana Point, La Jolla, Point Loma, Santa Barbara Island, Santa Catalina Island, and Cortez Bank (MBC 1991). The 1980-1981 SCCWRP database includes samples from Santa Monica, Venice, Marina del Rey, Redondo Beach, and White Point, Cabrillo Beach, Navy Mole, Queen Mary, Belmont Pier, and Orange County (MBC 1991). The database includes contaminant concentrations in muscle tissue of mollusks (5 species), crustaceans (3 species), echinoderms (1 species), and fish (30 species) covering seven classes, 25 families, and 39 species (MBC 1991). Croakers (Sciaenidae) are the most extensively sampled family (5 species). There are data on 10 trace metals and five trace organics (various DDTs and PCBs). The database also includes information on length, wet weight, dry weight, percent lipid content, and sex of the organisms as well as the number of individuals per composite.

The 1984-1986 data base from the NMFS studies in southern California provides contaminant information on surface sediments, liver tissue, bile, and stomach contents of three bottom-feeding fish: barred sand bass (*Paralabrax nebulifer*) , white croaker, and hornyhead turbot (*Pleuronichthys verticalis*). Samples were collected in Santa Monica Bay (two sites), San Pedro Canyon, Seal Beach, Long Beach, San Pedro outer harbor, Dana Point, Mission Bay, outside San Diego Bay, and two sites in San Diego Bay (Varanasi *et al.* 1989). There are concentration data for 18 polynuclear aromatic hydrocarbons (PAHs), PCBs, 14 organochlorine insecticides, and 16 trace metals. Also documented are the prevalences of several putatively pollution-related liver and kidney lesions in the target fish species.

The California Regional Water Quality Control Board, Los Angeles Region measured contaminant levels in surface sediments and liver and white muscle tissue of kelp bass (*Paralabrax clathratus*), black perch (*Embiotoca jacksoni*), and white croaker in 1985 (Risebrough 1987). Kelp bass were collected at Palos Verdes, Point Dume, Santa Catalina Island, Santa Barbara Island, and Anacapa Island. Black perch were collected at Santa Catalina Island and white croaker were collected near the Hyperion outfall and at several piers in the San Pedro Bay. Data are presented for PCBs, DDTs, and 10 organochlorine insecticides.

The 1986-87 surveys by the California Department of Health Services examined the concentrations of selected trace metals and chlorinated hydrocarbons in seafood organisms collected from Point Dume to Dana Point and offshore to Catalina Island (CDHS 1991, Pollock *et al.* 1990, 1991a,b). In the Comprehensive Survey, 15 species of fish were collected from 24 sites; nearly 4000 fish were collected and approximately 1000 chemical analyses were performed on composite samples (Pollock *et al.* 1991a). White croaker was generally the most contaminated species; California corbina (*Menticirrhus undulatus*), queenfish (*Seriphus politus*), surfperches (Embiotocidae), and California scorpionfish (*Scorpaena guttata*) were moderately contaminated at some sites. Pacific bonito (*Sarda chiliensis*), chub (Pacific) mackerel (*Scomber japonicus*), California halibut (*Paralichthys californicus*), Pacific sanddab (*Citharichthys sordidus*), Pacific barracuda (*Sphyraena argentea*), opaleye (*Girella nigricans*), and halfmoon (*Medialuna californiensis*) usually had the lowest levels of contaminants.

There have been many more surveys of contaminants in marine sediments and organisms off southern California that did not examine seafood species. Mearns *et al.* (1991) summarized data from 6,000 to 8,000 trace contaminant analyses of sediment samples in the Southern California Bight from 1969 to present. Analyses of sediment core samples extend the data back 50 to 100 years. Contaminant levels have also been monitored in bivalve mollusks from 1971 to the present in "Mussel Watch" surveys (Mearns *et al.* 1991). One of the longest data time-series is for DDT in northern lampfish (*Stenobrachius leucopsarus*), a small mesopelagic species, that runs from 1940 to 1971 (MacGregor 1974). Concentrations of PCBs, DDTs, PAHs, other organochlorine pesticides, and 16 trace metals were measured in liver tissue and bile from hornyhead turbot at two locations in Santa Monica Bay between 1984 and 1986 (Varanasi *et al.* 1989).

Santa Monica Bay Data

The database compiled for Santa Monica Bay comprises contaminant concentrations in the edible tissues of 22 species of fish, three species of crustaceans, and two species of mollusks measured between 1970 and 1990 (Appendices C-3, C-4, and C-5; SCCWRP 1973, unpubl. data, Young *et al.* 1978, Schafer *et al.* 1982, Gossett *et al.* 1983, Risebrough 1987, CSDLAC 1988, CDHS 1991, Pollock *et al.* 1991a, Jarman *et al.* 1991).

1990 White Croaker Survey

Total PCB. The mean concentration of ΣPCB (sum of Aroclors 1242, 1254, and 1260) in composites of white croaker muscle was highest on the Palos Verdes Shelf, lowest at Dana Point, and intermediate in Santa Monica Bay (Figure 2, Table 2). Aroclor 1254 was the dominant PCB mixture at all sites (Figure 2). Individual composites ranged from 5 ppb in fish collected off Santa Monica to 1,464 ppb in fish collected off Palos Verdes South (Appendix A). The mean ΣPCB concentration for composites of white croaker from the three Palos Verdes Shelf stations were significantly higher than means at the remaining stations (Table 3). Means at the Palos Verdes stations ranged from 731 ppb to 866 ppb, 33-38 times the mean concentration at Dana Point and 3-11 times mean concentrations elsewhere in Santa Monica Bay. Fish captured near the Hyperion 7-mile outfall had the highest concentrations in Santa Monica Bay (Table 2).

Total DDT. The mean concentration of ΣDDT (sum of *o,p'*-DDE, *p,p'*-DDE, *o,p'*-DDT, *p,p'*-DDT, *o,p'*-DDD and *p,p'*-DDD) in composites of white croaker muscle was highest on the Palos Verdes Shelf, lowest at Dana Point, and intermediate in Santa Monica Bay (Figure 3, Table 4). Most of the ΣDDT at all sites was *p,p'*-DDE (Figure 3). Individual composites ranged from 16 ppb in fish collected off Santa Monica to 18,336 ppb in fish collected off Palos Verdes South (Appendix A). The mean total DDT concentration for composites of white croaker from the three Palos Verdes Shelf stations were significantly higher than means at the remaining stations (Table 3). Means at the Palos Verdes stations ranged from 97 ppb to 112 ppb, 118-144 times the mean concentration at Dana Point and 22-92 times the mean concentrations elsewhere in Santa Monica Bay. Fish captured off Hermosa Beach had the highest concentrations in Santa Monica Bay (Table 4).

DDMU. The mean concentration of DDMU (metabolite of DDT) in composites of white croaker muscle was lowest at Dana Point, highest on the Palos Verdes Shelf, and intermediate in Santa Monica Bay (Table 5). Individual composites ranged from 0.6 ppb in fish collected off Dana Point to 1,225 ppb in fish collected off Palos Verdes South (Appendix A). The mean DDMU concentration for composites of white croaker from the three Palos Verdes Shelf stations were significantly higher than means at the remaining stations (Table 3). Means at the Palos Verdes stations ranged from 26 ppb to 29 ppb, 192-212 times the mean concentrations at Dana Point and from 21-85 times the mean concentrations elsewhere in Santa Monica Bay. DDMU was not included in the calculation of ΣDDT because few previous surveys reported DDMU concentrations. On average, DDMU was about 6% of total DDT.

Hexachlorocyclohexane. The mean concentration of hexachlorocyclohexane (sum of α-, β-, and Γ-HCH) in composites of white croaker muscle was highest on the Palos Verdes Shelf, lowest at Dana Point, and intermediate in Santa Monica Bay (Table 6). Individual composites ranged from <0.05 ppb (detection limit) in fish collected off Point Dume to 1.38 ppb in fish collected off Palos Verdes North (Appendix A). The mean HCH concentration for composites of white croaker from the three Palos Verdes Shelf stations were 4-7 times the mean concentrations at Dana Point and 1-4 times the mean concentrations elsewhere in Santa Monica Bay. Although the mean concentration of fish collected at the Palos Verdes stations differed significantly from fish collected off Dana Point, they were not significantly different from fish collected at the remaining stations (Table 3). Fish captured off Malibu and El Segundo had the highest HCH concentrations in Santa Monica Bay (Table 6).

Hexachlorobenzene. The mean concentration of hexachlorobenzene (HCB) in composites of white croaker muscle was highest on the Palos Verdes Shelf and low at the remaining stations (Table 7). Individual composites ranged from <0.05 ppb (detection limit) in fish collected at most stations in Santa Monica Bay to 0.36 ppb in fish collected off Palos Verde South and White Point (Appendix A). Mean concentrations at the Palos Verdes stations were significantly higher than the other stations (Table 3).

Chlordane. The mean concentration of chlordane (sum of oxychlordane, *trans*-nonachlor, *cis*-nonachlor, *trans*-chlordane, and *cis*-chlordane) in composites of white croaker muscle was highest in fish from the Palos Verdes Shelf, lowest in fish from Dana Point, and intermediate in fish from Santa Monica Bay (Table 8). Individual composites ranged from

1.6 ppb in fish from Dana Point to 29 ppb in fish from White Point (Appendix A). The mean chlordane concentration for composites of white croaker from the three Palos Verdes Shelf stations were significantly higher than those at the remaining stations (Table 3). Mean concentrations at the Palos Verdes stations ranged from 17 ppb to 19 ppb, 8-9 times the mean concentrations at Dana Point and 2-5 times the mean concentrations elsewhere in Santa Monica Bay. Fish captured near the Hyperion 7-mile outfall had the highest chlordane concentrations in Santa Monica Bay (Table 8).

Polychlorinated Dibenzodioxins and Dibenzofurans. Six composites of white croaker muscle tissue were analyzed for tetra through octa chlorinated dibenzo-*p*-dioxins (PCDD) and chlorinated dibenzofurans (PCDFs). Two composites were from Malibu, two were from El Segundo, and two were from Dana Point. The most toxic PCDD and PCDF isomers are reported in (Appendix A). Tetrachloro dibenzo-*p*-dioxin isomers were detected in two composites (Malibu and El Segundo) and heptachloro dibenzo-*p*-dioxin isomers were detected in one composite (Malibu); concentrations were <1 pptr. [OCDD is not considered in this discussion. It was detected in all the composites, but it was also detected in the method blank and spiked recoveries of ^{13}C labeled compound were quite low (Appendix A).] Tetra-, penta-, and hexachloro dibenzofurans were detected in all composites. Total PCDFs ranged from 12 to 27 pptr in the composites from Santa Monica Bay and <1 pptr in the composites from Dana Point.

Selenium. The mean concentration of selenium in composites of white croaker muscle was highest at White Point, intermediate at Palos Verdes North and South and at the Hyperion 7-mile outfall, and low at the remaining stations (Figure 4, Table 9). Individual composite ranged from 220 ppb in fish collected off Santa Monica to 1,400 ppb in fish collected off White Point (Appendix A). The mean selenium concentration for composites of white croaker from the three Palos Verdes Shelf stations ranged from three to four times the mean concentrations at Dana Point and from one to five times the mean concentrations elsewhere in Santa Monica Bay. Fish captured near the Hyperion 7-mile outfall had the highest selenium concentrations in Santa Monica Bay away from the Palos Verdes Shelf (Table 9). Mean concentrations at White Point were significantly higher than the remaining stations (Table 3). Mean concentrations at the Hyperion outfall station did not differ significantly from those at Palos Verdes North and South, but all of these stations were significantly different from the remaining stations.

1990 Yellow Rock Crab Survey

Total PCB. The mean concentration of ΣPCB (sum of Aroclors 1242, 1254, and 1260) in composites of yellow rock crab muscle was significantly higher at White Point than at Dana Point (Table 10). Concentrations were three times higher in individuals collected off White Point compared to individuals collected off Dana Point (Figure 5, Table 11). Aroclor 1254 was the dominant PCB mixture at both sites. Individual composites ranged from about 1 ppb in crabs collected off Dana Point to 15 ppb in crabs collected off White Point (Appendix A).

Total DDT. The mean concentration of ΣDDT (sum of *o,p'*-DDE, *p,p'*-DDE, *o,p'*-DDT, *p,p'*-DDT, *o,p'*-DDD, and *p,p'*-DDD) in composites of yellow rock crab muscle was significantly higher at White Point than at Dana Point (Table 10). Concentrations were 10 times higher among individuals collected off White Point compared to individuals collected off Dana Point (Figure 6, Table 12). Most total DDT at both sites was *p,p'*-DDE. Individual composites ranged from about 1 ppb in crabs collected off Dana Point to 62 ppb in crabs collected off White Point (Appendix A).

DDMU. The mean concentration of DDMU (metabolite of DDT) was not significantly different among yellow rock crabs collected at White Point and Dana Point (Table 10). Individual composites ranged from 0 to 1.0 ppb at both sites (Table 13, Appendix A).

Hexachlorocyclohexane. The mean concentration of HCH (sum of α-, β-, δ-, and Γ-HCH) was significantly higher among yellow rock crabs collected at Dana Point than at White Point (Table 10). Individual composites ranged from <0.05 ppb (detection limit) at both sites to 0.25 ppb at Dana Point (Table 14, Appendix A).

Hexachlorobenzene. The mean concentration of hexachlorobenzene (HCB) in composites of yellow rock crab muscle was significantly higher among individuals collected at White Point than at Dana Point (Table 10). Individual composites ranged from 0.01 ppb at both sites to 0.05 ppb at White Point (Table 15; Appendix A).

Chlordane. The mean concentration of chlordane (sum of oxychlordane, *trans*-nonachlor, *cis*-nonachlor, *trans*-chlordane, and *cis*-chlordane) was significantly higher for yellow rock crabs collected off Dana Point than off White Point (Table 10). Individual composites ranged from 0.05 ppb to 0.31 ppb at Dana Point (Table 16, Appendix A).

Selenium. The mean concentration of selenium in composites of yellow rock crab muscle was significantly higher among individuals collected off Dana Point compared to individuals collected off White Point (Figure 7, Table 10). Individual composites ranged from 1.8 ppm at White Point to 3.7 ppm at Dana Point (Table 17, Appendix A).

Arsenic. The mean concentration of arsenic in composites of yellow rock crab muscle was not significantly different among individuals collected at White Point and Dana Point (Table 10). Individual composites ranged from 8.2 ppm at Dana Point to 18 ppm at White Point (Table 18, Appendix A).

Lead. The mean concentration of lead in composites of yellow rock crab muscle was not significantly different between White Point and Dana Point, although concentrations were more than two times higher among individuals collected off White Point (Figure 8, Table 10). Individual composites ranged from 5.5 ppb at Dana Point to 28.4 ppb at White Point (Table 19, Appendix A).

DISCUSSION

Spatial and Temporal Trends for White Croaker

PCBs. The concentration of ΣPCB in muscle tissue of white croaker is generally higher on the Palos Verdes Shelf than at other coastal locations in the Southern California Bight (Gossett *et al.* 1983, Mearns *et al.* 1991; Appendix C-4). In 1980, the concentration of ΣPCB in white croaker muscle tissue collected at sportfishing sites near Los Angeles was highest in Long Beach Harbor (410 ppb) and lowest at Santa Monica Pier (14 ppb) (Gossett *et al.* 1983). Within the Santa Monica Bay study area, the highest concentrations occurred in fish collected off White Point (220 ppb) (Gossett *et al.* 1983). However, the highest concentration between Point Dume and Dana Point in 1987 occurred in fish collected off Malibu (552 ppb; Appendices C-1 and C-2b) (Pollock *et al.* 1991a) Concentrations among fish collected off Point Vicente (498 ppb) were next highest and concentrations among fish collected off Dana Point (1 ppb) were lowest.

In 1984, the concentration of PCBs in liver tissue of white croaker collected near Los Angeles was highest in Cerritos Channel in Long Beach Harbor (23,000 ppb) and lowest off Dana Point (900 ppb). Within the Santa Monica Bay study area, the highest levels occurred in fish collected off White Point (7,500 ppb) and lowest levels occurred in fish collected near the Hyperion outfall (4,100 ppb) (Malins *et al.* 1987). In a 1986 survey of white croaker caught from fishing piers, ΣPCB concentrations were highest among fish collected at Cabrillo Pier (363 ppb) and lowest among fish collected at Hueneme Pier (29 ppb) (Risebrough *et al.* 1987).

In the present study, the concentration of ΣPCB in the muscle tissue of white croaker from the Palos Verdes Shelf was significantly higher than elsewhere, and was more than 30 times higher than the concentration in fish caught off Dana Point (Table 3). The concentration of ΣPCB in fish caught in Santa Monica Bay was about six times greater than the concentration in fish caught off Dana Point.

The concentrations in fish reflect the PCB contamination of the sediments. In 1985, sediments on the Palos Verdes Shelf had nearly 50 times the ΣPCB concentration compared to sediments off Dana Point. Sediments in Santa Monica Bay had six times the ΣPCB concentration of sediments off Dana Point (Mearns *et al.* 1991). Apparently, sediments on the Palos Verdes Shelf serve as a reservoir of PCBs. The CSDLAC outfall at White Point may not be the exclusive source of PCBs on the Palos Verdes Shelf; white croaker and other species collected at other sites also have high tissue levels of ΣPCB (Appendix C-4; Mearns *et al.* 1991).

The concentration of PCBs in coastal marine sediments off southern California has declined since the mid-1970s. Sediment concentrations on the Palos Verdes Shelf declined four-fold from 1977 to 1985 (Mearns *et al.* 1991). Tissue levels in white croaker from Santa Monica Bay have generally remained constant since 1980, except that concentrations decreased significantly at Malibu between 1987 and 1990 (Figure 9, Table 20). The decrease in ΣPCB concentrations at Malibu, while statistically significant, is suspect. Pollock *et al.* (1991a) pointed out that the high results for fish collected off Malibu in 1987 were surprising and difficult to reconcile with historical data; they suggested resampling the site. Between 1987 and 1990, tissue levels did not change at Point Dume, Santa Monica, or Marina del Rey (Table 20).

On the Palos Verdes Shelf, the concentration of PCBs in fish muscle tissue decreased sharply from 1975 to 1980 (Figure 10). In 1975, the mean concentration of ΣPCB in the muscle of white croaker from the Palos Verdes Shelf was 2,780 ppb wet weight (Young *et al.* 1978). In the last decade, average muscle concentrations have ranged from 383 ppb in 1980 (Schafer *et al.* 1982) to 1,726 ppb in the present study. Concentrations increased significantly at White Point and Palos Verdes North between 1987 and 1990 (Table 20); however, an increase at Palos Verdes South during this period (Figure 10) was not statistically significant. Between 1980 and 1987 in San Pedro Bay, concentrations have decreased in Los Angeles Harbor, increased at Cabrillo Pier between 1981 and 1986 before dropping in 1987, and decreased slightly at Belmont Pier and Pier J (Figure 11). Tissue levels increased significantly at Dana Point between 1987 and 1990 (Table 20).

Seasonal differences in lipid content related to the reproductive cycle, and the migration patterns of fishes, probably contribute to this variability. Fish collected before or early in the spawning season have high lipid levels and high concentrations of lipid soluble contaminants such as PCBs. Fish collected after spawning have low lipid levels and correspondingly low concentrations of lipid soluble contaminants (Cross 1986).

<u>DDTs</u>. The concentrations of ΣDDT and DDMU in muscle tissue of white croaker have generally been higher on the Palos Verdes Shelf than at other coastal locations in the Southern California Bight (Gossett *et al.* 1983, Mearns *et al.* 1991; Appendix C-5). This pattern is similar to the pattern of PCB concentrations in white croaker, but the decline of DDT concentration with distance from Palos Verdes is much greater than the decline in PCB concentrations (cf. Figures 2 and 3).

In 1980, the concentration of ΣDDT in white croaker muscle tissue collected at sportfishing sites near Los Angeles was highest (7,500 ppb) among fish collected near the Whites Point outfall and lowest (59 ppb) among fish collected at Santa Monica Pier (Gossett *et al.* 1983). In 1984, the concentration of ΣDDT in white croaker liver samples was highest off White Point (100,000 ppb) and lowest off Dana Point (1,500 ppb) (Malins *et al.* 1987). Within Santa Monica Bay, the lowest concentrations occurred in fish collected near the Hyperion outfall (6,600 ppb) (Malins *et al.* 1987). In a 1986 survey of white croaker caught from fishing piers, DDT concentrations were highest at Cabrillo Pier (4,498 ppb) and lowest at Hueneme Pier (39 ppb) (Risebrough *et al.* 1987). However, the highest concentrations between Point Dume and Dana Point in 1987 occurred in fish collected at Palos Verdes South (2,673 ppb) and the lowest concentrations (below method detection limit of 38 ppb) occurred in fish collected off Belmont Pier, Laguna Beach, and Dana Point (Appendices C-1 and C-2d; Pollock *et al.* 1991a).

In the present study, the concentration of ΣDDT in muscle tissue of white croakers collected on the Palos Verdes Shelf was 25-85 times higher than the concentration in fish collected in Santa Monica Bay (Table 4). The ΣDDT concentrations in fish reflect the DDT contamination of the sediments. In 1982, the DDT concentration in sediments from the Palos Verdes Shelf was about 200 times higher than the concentration in sediments from Santa Monica Bay (Brown *et al.* 1986). A reservoir of DDT lies buried in the sediments on the Palos Verdes Shelf (Stull *et al.* 1986).

Temporal trends in levels of ΣDDT in fish muscle are difficult to assess due to the variability of the data (Appendix C-5). The mean concentration of ΣDDT in muscle tissue in Santa Monica Bay declined from 573 ppb in 1981 to 271 ppb in 1990 (Figure 12). From 1981 to 1987, tissue levels in white croaker declined at Marina del Rey (Figure 12). From 1987 to 1990, levels decreased significantly at Malibu, increased significantly at Marina del Rey, and remained constant at Point Dume and Santa Monica (Table 21). The decrease in ΣDDT concentrations at Malibu, while statistically significant, is suspect. Pollock *et al.* (1991a) pointed out that the high results for fish collected off Malibu in 1987 were surprising and difficult to reconcile with historical data; they suggested resampling the site.

On the Palos Verdes Shelf, ΣDDT concentrations in tissue decreased from 1975 to 1980 (Figure 13). In 1975, ΣDDT concentrations in muscle tissue of white croaker ranged from 5,230 ppb to 176,400 ppb with a mean of 39,000 ppb (Young *et al.* 1978; Appendix C-5). In 1980, the mean concentration was 7,629 ppb (Schafer *et al.* 1982). DDT levels increased significantly at Palos Verdes North, Palos Verdes South, and White Point between 1987 and 1990 (Table 21). However, the highest recent mean concentration occurred at White Point in 1988 (26,560 ppb; CSDLAC 1988). The average concentration for fish collected at the three sites on the Palos Verdes Shelf in 1990 was 11,580 ppb.

Between 1980 and 1987, ΣDDT levels generally decreased in white croaker from San Pedro Bay (Figure 14). However, levels at Cabrillo Pier increased between 1981 and 1986 before decreasing in 1987. Levels at Belmont Pier decreased from 1981 to 1987. Mean ΣDDT concentrations in fish caught off Dana Point declined about two-fold from 1981 to 1990 (Gossett *et al.* 1983, Mearns *et al.* 1991; Appendix C-5). However, ΣDDT levels at Dana Point increased significantly between 1987 and 1990 (Table 21). These data agree with the decreasing trend in ΣDDT levels in kelp bass muscle from 1971 to 1985 (Smokler 1979, CSDLAC 1988). Discharge of DDT to the ocean was banned in the early 1970s. Since then, the most contaminated sediments have been buried by 0.3 to 0.6 m of natural particles and recent effluents (Stull *et al.* 1986). Declines in the concentration of DDT in surface sediments has decreased its availability to marine organisms, which is reflected in lower DDT levels in the fish.

Other Pesticides. Although the concentrations of HCH, HCB, and chlordane in white croaker muscle tissue are quite low, the distribution patterns are similar to the distribution patterns of ΣPCB and ΣDDT. In 1990, concentrations of HCB and chlordane were significantly higher at the Palos Verdes stations than at the remaining stations (Table 3). Lindane was significantly higher at the Palos Verdes stations than at Dana Point. Levels in the present study are somewhat higher than levels measured in white croaker by Risebrough (1987). In 1985, white croaker collected near Cabrillo Pier in Los Angeles Harbor had the highest concentrations of HCH (72 pptr) and HCB (121 pptr). The lowest concentration of HCH occurred in fish from Santa Monica Pier in Santa Monica Bay (4 pptr) and the lowest concentration of HCB occurred in fish from Hueneme Pier north of Santa Monica Bay (37 pptr) (Risebrough 1987).

PCDD and PCDF. White croaker from Malibu, El Segundo, and Dana Point were analyzed for dibenzo-*p*-dioxins (PCDD) and chlorinated dibenzofurans (PCDFs). Tetrachloro dibenzo-*p*-dioxin isomers were detected in two composites (Malibu and El Segundo) and heptachloro dibenzo-*p*-dioxin isomers were detected in one composite (Malibu); concentrations were <1 pptr. OCDD was detected in all the composites, but it was also detected in the method blank and spiked recoveries of ^{13}C labeled compound were quite low (Appendix A). Tetra-, penta-, and hexachloro dibenzofurans were detected in all composites. Total PCDFs ranged from 12 to 27 pptr in the composites from Santa Monica Bay and <1 pptr in the composites from Dana Point.

Selenium. Selenium concentrations in white croaker collected off White Point during the present study (1,216 ppb) are about one-third the concentrations reported for white croaker collected off White Point in 1986 (3,420 ppb; Pollock *et al.* 1991a. The concentrations of selenium in white croakers collected from White Point were significantly higher than at the other Palos Verdes sites and the Hyperion 7-mile outfall; concentrations at these sites were higher than at the remaining sites (Table 3). Compared to the trace organic contaminants, the distribution of selenium concentrations in white croakers is more uniform throughout the Southern California Bight.

Spatial and Temporal Trends for Yellow Rock Crab

Trace Organics. The concentrations of ΣPCB and ΣDDT in muscle tissue of yellow rock crab were significantly higher at White Point than at Dana Point (Table 10). The ΣPCB concentration in yellow rock crab collected off White Point was about 75 times less than the ΣPCB concentration in white croaker from the same area. The ΣDDT concentration in yellow rock crab was about 1000 times less than the ΣDDT concentration in white croaker. The difference in tissue concentrations of chlorinated hydrocarbons between white croaker and yellow rock crab is probably due to differences in trophic position.

Temporal trends in the concentration of trace organics in yellow rock crab are difficult to assess because few data have been collected in the last 15 years. The concentration of PCBs in yellow rock crab collected off Dana Point in 1976 (32 ppb) were 10 times greater than in 1990 (3 ppb) (Appendix C-4). The concentration of DDT in yellow rock crab from Dana Point did not change appreciably from 1976 (5 ppb) to 1990 (3 ppb) (Appendix C-5).

Other pesticides. Concentrations of DDMU, HCB, HCH, and chlordane in yellow rock crab muscle tissue were quite low. Although concentrations of DDMU were not significantly different between White Point and Dana Point, concentrations of HCB, HCH, and chlordane were significantly higher among crabs collected at White Point (Table 10). Concentrations of DDMU were 10 times lower, and concentrations of chlordane were 1000 times lower, in yellow rock crab collected off White Point compared to concentrations in white croaker from the same site. Concentrations of HCB and HCH are low in both species.

Trace Metals. Selenium concentrations in muscle tissue of yellow rock crab were significantly higher among crabs collected at Dana Point compared to crabs collected at White Point (Table 10). Concentrations in crabs were nearly twice as high as concentrations in white croaker. Selenium is the only contaminant examined in this study that occurred in higher concentrations in yellow rock crab than in white croaker. Arsenic and lead concentrations in muscle tissue of yellow rock crab were not significantly different between Dana Point and White Point (Table 10).

Spatial and Temporal Trends for Other Species

Giant Rock Scallop. Giant rock scallop (*Crassedoma giganteum*) tissue was collected and analyzed for ΣDDT and ΣPCB from 1974 to 1976. The concentration of ΣPCB was highest on the Palos Verdes Shelf (14 ppb) and lowest at Point Dume (3 ppb), Catalina Island (3 ppb), and Dana Point (2 ppb) (Appendix C-4). Total ΣDDT was highest on the Palos Verdes Shelf (150 ppb) and lowest (1 ppb) at Catalina Island and Dana Point (4 ppb) (Young *et al.* 1978; Appendix C-5).

Black Abalone. In 1976, the concentration of ΣPCB was similar for black abalone (*Haliotis cracherodii*) collected on the Palos Verdes Shelf (22 ppb) and at Catalina Island (24 ppb) (Young *et al.* 1978; Appendix C-4). The concentration of ΣDDT was 1 ppb in abalone collected on the Palos Verdes Shelf and at Catalina Island (Young *et al.* 1978; Appendix C-5).

Ridgeback Rock Shrimp. Concentrations of ΣPCB and ΣDDT in ridgeback rock shrimp (*Sicyonia ingentis* = ridgeback prawn) were 16 ppb at Santa Catalina Island in 1976 and 61 ppb the Palos Verdes Shelf in 1980 (Young *et al.* 1978, Schafer *et al.* 1982; Appendix C-4). The concentration of ΣDDT was 4 ppb at Santa Catalina Island in 1976 and 327 ppb on the Palos Verdes Shelf in 1980 (Young *et al.* 1978, Schafer *et al.* 1982; Appendix C-5).

California Spiny Lobster. The concentration of ΣPCB in California spiny lobster (*Panulirus interruptus*) was 97 ppb in animals collected on the Palos Verdes Shelf and 10 ppb in animals collected at Catalina Island in 1975 and 1976 (Young *et al.* 1978; Appendix C-4). The concentration of ΣDDT was 563 ppb on the Palos Verdes Shelf and 3 ppb at Santa Catalina Island (Young *et al.* 1978; Appendix C-5).

Spiny Dogfish. In 1981, the ΣPCB concentration in spiny dogfish (*Squalus acanthias*) captured off White Point was 7,380 ppb and the ΣDDT concentration was 93,657 ppb (Gossett *et al.* 1983; Appendices C-4 and C-5). These concentrations were about twice as high as concentrations in individuals collected from other areas on the Palos Verdes Shelf. Except for a few composites of white croaker, chlorinated hydrocarbon concentrations in dogfish muscle were higher than for any other species in the historical database.

California Lizardfish. Among California lizardfish (*Synodus lucioceps*) collected in Santa Monica Bay, the ΣPCB concentration was 97 ppb and the ΣDDT concentration was 17 ppb in 1981 (Gossett *et al.* 1983; Appendices C-4 and C-5).

California Scorpionfish. In 1975, the ΣPCB concentration in California scorpionfish (*Scorpaena guttata*) muscle was high on the Palos Verdes Shelf (573 ppb) and low at Catalina Island (43 ppb). From 1975 to 1981, the ΣPCB concentration declined more than an order of magnitude at Palos Verdes to 44-66 ppb (Young *et al.* 1978, Schafer *et al.* 1982). In 1987, the concentrations of PCBs were greater than the method detection limit (50 ppb) only at Horseshoe Kelp (152 ppb; Appendix C-4; Pollock *et al.* 1991a). In 1975, the ΣDDT concentration in California scorpionfish muscle was high on the Palos Verdes Shelf

(3,573 ppb) and low at Catalina Island (97 ppb). From 1975 to 1981, the concentration of ΣDDT declined by about an order of magnitude to 266-759 ppb (Young *et al.* 1978, Schafer *et al.* 1982). In 1987, the concentration of DDT was higher at Horseshoe Kelp (267 ppb), followed by White Point (196 ppb) (Appendix C-5; Pollock *et al.* 1991a).

Bocaccio. In 1980 and 1981, the ΣPCB concentration in bocaccio (*Sebastes paucispinis*) muscle was 20 ppb in Santa Monica Bay and 149 ppb on the Palos Verdes Shelf. the ΣDDT concentration was 58 ppb in Santa Monica Bay and 1,057 ppb on the Palos Verdes Shelf (Gossett *et al.* 1983, SCCWRP, unpubl. data; Appendices C-4 and C-5).

Rockfish Species. In 1987, the concentrations of PCBs in various rockfish species (*Sebastes* spp.) were below the method detection limit (50 ppb) at all sites (Appendix C-4; Pollock *et al.* 1991a). The concentration of DDTs was highest at Point Vicente (82 ppb) on the Palos Verdes Shelf (Appendix C-5; Pollock *et al.* 1991a).

Sablefish. In 1978, the concentration of ΣDDT in sablefish (*Anoplopoma fimbria*) collected in Santa Monica Bay was 191 ppb and the concentration ΣPCBs was 188 ppb (SCCWRP, unpubl. data; Appendices C-4 and C-5).

Kelp Bass. In 1981, the concentration of ΣPCB in kelp bass (*Paralabrax clathratus*) was 42 ppb (Gossett *et al.* 1983; Appendix C-4). In 1987, the concentrations of PCBs were below the method detection limit (50 ppb) at all sites (Pollock *et al.* 1991a; Appendix C-4). The concentration of ΣDDT in muscle tissue of kelp bass collected off White Point was 12,000 ppb in 1972, 260 ppb in 1976 (Smokler *et al.* 1979), and 285 ppb in 1981. In 1987, the concentration of ΣDDT was highest at White Point (135 ppb), and high at the remaining stations on the Palos Verdes Shelf and at Horseshoe Kelp (Pollock *et al.* 1991a; Appendix C-5).

Barred Sand Bass. The concentration of ΣPCB was 52 ppb and the concentration of ΣDDT concentrations was 770 ppb in barred sand bass (*Paralabrax nebulifer*) collected at Belmont Pier in 1981 (Gossett *et al.* 1983). In 1987, ΣPCB concentrations were above the method detection limit (50 ppb) only at Pier J (67 ppb) (Pollock *et al.* 1991a; Appendix C-4). In the same year, ΣDDT concentrations were greater than the method detection limit of 38 ppb at all sites except Marina del Rey, Huntington Beach, and Emma and Eva Oil Platforms (Pollock *et al.* 1991a; Appendix C-5). The highest concentrations occurred in fish collected at Dana Point (95 ppb) and Pier J (91 ppb).

Black Croaker. Total ΣPCB levels in black croaker (*Cheilotrema saturnum*) were higher than the method detection limit (50 ppb) only in Los Angeles Harbor (Pollock *et al.* 1991a; Appendix C-4). The highest concentrations occurred in fish caught off Pier J (78 ppb; Queen Mary). Concentrations were lower than the limit at all Palos Verdes and Santa Monica Bay sites. Total DDT levels were lower than the method detection limit (38 ppb) at all Santa Monica Bay sites, but were higher at Palos Verdes N, Horseshoe Kelp, Los Angeles/Long Beach Harbor Breakwater, and Belmont Pier (Pollock *et al.* 1991a; Appendix C-5). The concentration in fish collected off the breakwater (360 ppb) was 3.5 times higher than at the next highest station (Horseshoe Kelp).

California Corbina. In 1981, California corbina (*Menticirrhus undulatus*) collected at Belmont Pier had ΣPCB concentrations of 149 ppb and ΣDDT concentrations of 33 ppb (Gossett *et al.* 1983). In 1987, ΣPCB levels were above the method detection limit (50 ppb) only at Redondo Pier (105 ppb) and Newport Pier (120 ppb) (Pollock *et al.* 1991a; Appendix C-4). Concentrations of ΣDDT were above the method detection limit at Redondo Pier, Huntington Beach, and Newport Pier; the highest levels occurred in fish collected at Newport Pier (90 ppb) (Pollock *et al.* 1991a; Appendix C-5).

Queenfish. In 1981, queenfish (*Seriphus politus*) collected at Belmont Pier had a ΣPCB concentration of 58 ppb and ΣDDT concentration of 33 ppb (Gossett *et al.* 1983). In 1987, ΣPCB levels were highest at Malibu Pier (412 ppb) (four times higher than Cabrillo Pier, the next highest site). The only other site with a concentration above the method detection limit was Los Angeles/Long Beach Breakwater (Pollock et al. 1991a; Appendix C-4). ΣDDT levels were below the method detection limit (38 ppb) among fish collected at Marina del Rey, Short Bank, Palos Verdes N, Laguna Beach, and Emma and Eva Oil Platforms (Pollock *et al.* 1991a; Appendix C-5). The highest concentrations of ΣDDT occurred in fish collected at Cabrillo Pier (244 ppb), Los Angeles/Long Beach Harbor Breakwater (191 ppb), and Malibu Pier (113 ppb).

Black Perch. The median concentrations of ΣDDT in muscle tissues of black perch (*Embiotoca jacksoni*) collected off White Point ranged from 25,000 ppb in 1972 to 2,900 ppb in 1975 (Smokler *et al.* 1979).

Surfperch Species. In 1987, ΣPCB concentrations in various surfperches (*Embiotoca* spp.) were higher than the method detection limit (50 ppb) only at Los Angeles/Long Beach

Harbor Breakwater, Cabrillo Pier, Pier J, and Belmont Pier in Los Angeles and Long Beach harbors (Pollock *et al.* 1991a; Appendix C-4). The highest concentrations (193 ppb) occurred among fish collected at Pier J. The highest concentrations of ΣDDT also occurred at these sites and at Palos Verdes N (Pollock *et al.* 1991a; Appendix C-5); the highest concentration (153 ppb) was found among fish collected at Cabrillo Pier.

Opaleye. PCBs and DDTs were not detected in opaleye (*Girella nigricans*) from White Point and Twin Harbor (Catalina Island) in 1987 (Pollock *et al.* 1991a; Appendices C-4 and C-5).

Halfmoon. PCBs and DDTs were not detected in halfmoon (*Medialuna californiensis*) from Twin Harbor (Catalina Island) in 1987 (Pollock *et al.* 1991a; Appendices C-4 and C-5).

Pacific Barracuda. In 1981, the concentrations of DDT and PCB in Pacific barracuda (*Sphyraena argentea*) caught off White Point were 190 ppb and 47 ppb (Gossett *et al.* 1983). In 1987, concentrations of PCBs and DDTs were below method detection limits (50 ppb and 38 ppb) at all sites (Pollock *et al.* 1991a; Appendices C-4 and C-5).

Pacific Bonito. In 1981, the concentration of ΣPCB in muscle tissue of Pacific bonito (*Sarda chiliensis*) was 22 ppb off Laguna Beach (Gossett *et al.* 1983). The ΣPCB concentration was 29 ppb in bonito from coastal Los Angeles in 1980-81 (Schafer *et al.* 1982). In 1987, the concentration of PCBs was below the method detection limit (50 ppb) at all sites (Pollock *et al.* 1991a; Appendix C-4). In 1981, the concentration of ΣDDT was 116 ppb at White Point and 62 ppb at Laguna Beach (Gossett *et al.* 1983). The ΣDDT concentration was 184 ppb in bonito from coastal Los Angeles in 1980-81 (Schafer *et al.* 1982). In 1987, the concentration of ΣDDT was highest among bonito from Cabrillo Pier (73 ppb) and Malibu Pier (62 ppb) (Pollock *et al.* 1991a; Appendix C-5).

Chub (Pacific) Mackerel. The concentration of ΣPCB was 12 ppb in muscle tissue of chub mackerel (*Scomber japonicus*) caught off White Point and 15 ppb in fish caught in Santa Monica Bay in 1981, the lowest concentrations for all fish species in the early 1980s. The ΣPCB concentration was 34 ppb in fish caught off Laguna Beach and 26 ppb in fish caught off coastal Los Angeles (Schafer *et al.* 1982, Gossett *et al.* 1983). In 1987, the concentration of ΣPCB was below the method detection limit (50 ppb) at all sites (Pollock *et al.* 1991a; Appendix C-4). The concentration of ΣDDT in chub mackerel caught off White Point was

44 ppb in 1981, among the lowest concentrations for all fish species in the early 1980s. The concentration of ΣDDT in fish caught in Santa Monica Bay was 57 ppb. The concentration of ΣDDT in fish caught off Laguna Beach and coastal Los Angeles was about 130 ppb (Schafer *et al.* 1982, Gossett *et al.* 1983). In 1987, the concentration of ΣDDT were above the method detection limit (38 ppb) only at Twin Harbor (57 ppb; Catalina Island) and Belmont Pier (41 ppb) (Pollock *et al.* 1991a; Appendix C-5).

California Halibut. Concentrations of ΣPCB were 154 ppb in California halibut (*Paralichthys californicus*) from Los Angeles Harbor and 32 ppb Newport Bay in 1980 (Appendix C-4; MBC and SCCWRP 1980, Mearns and Young 1980). Concentrations were 62 ppb in fish collected at Belmont Pier and 52 ppb in fish collected at Cabrillo Pier in 1981 (Gossett *et al.* 1983). Concentrations in 1987 were below the method detection limit (50 ppb) at all sites (Pollock *et al.* 1991a). In 1980, ΣDDT levels were 626 ppb in fish from Newport Bay and 391 ppb in fish from Los Angeles Harbor (Appendix C-5; MBC and SCCWRP 1980, Mearns and Young 1980). In 1981, concentrations were 158 ppb in fish from Cabrillo Pier and 131 ppb in fish from Belmont Pier. In 1987, concentrations were below the method detection limit (38 ppb) at all sites (Pollock *et al.* 1991a), but only fish from Dana Point and Santa Monica Bay were analyzed.

Pacific Sanddab. In 1975, the concentration of ΣPCB in muscle tissue was 474 ppb in Pacific sanddab (*Citharichthys sordidus*) caught on the Palos Verdes Shelf and 26 ppb in fish caught off Dana Point (Young *et al.* 1978, SCCWRP, unpubl. data). In 1978, the ΣPCB concentration in fish caught in Santa Monica Bay was 115 ppb (SCCWRP, unpubl. data). In 1987, PCB concentrations were below the method detection limit (50 ppb) at all sites (Pollock *et al.* 1991a; Appendix C-4). In 1975, the concentration of ΣDDT was 5,976 ppb in fish caught on the Palos Verdes Shelf, among the highest levels measured for any teleost (Young *et al.* 1978). In 1985-86, ΣDDT levels in the muscle of sanddabs collected off Orange County were 6-32 ppb (CSDOC 1990). In 1987, DDT concentrations were below the method detection limit (38 ppb) at all sites (Pollock *et al.* 1991a; Appendix C-5).

English Sole. Total PCB in English sole [*Pleuronectes* (=*Parophrys*) *vetulus*] was 905 ppb in fish from Santa Monica Bay and 45 ppb in fish from Rincon in 1977 (Appendix C-4; SCCWRP, unpubl. data). Total DDT was 1,713 ppb in fish from Santa Monica Bay and 80 ppb in fish from Rincon (Appendix C-5; SCCWRP, unpubl. data).

Dover Sole. The concentration of ΣPCB in Dover sole (*Microstomus pacificus*) from the Palos Verdes Shelf was 3,166 ppb in 1977 and 278 ppb in 1980. Total PCB concentrations in Santa Monica Bay ranged from 107 to 233 ppb in 1977 (SCCWRP, unpubl. data; Appendix C-4). The concentration of ΣDDT in fish collected in Santa Monica Bay ranged from 313 to 3,079 ppb in 1977 (SCCWRP, unpubl. data). Dover sole taken from the Palos Verdes Shelf had a mean muscle ΣDDT concentration of 7,172 ppb in 1980 (Schafer *et al.* 1982) and 1,930 ppb in 1986 (CDHS 1991).

CONCLUSIONS

Bioaccumulation and biomagnification of trace organic contaminants depends on their hydrophobicity and bioavailability, and the organism's metabolism, growth, trophic position, and exposure (Clark *et al.* 1990). Bottom-dwelling fish and invertebrates collected on the Palos Verdes Shelf usually have the highest muscle concentrations of chlorinated hydrocarbons in the Southern California Bight (Appendices C-4 and C-5). Low concentrations occur in bottom-dwelling animals collected off Dana Point and intermediate concentrations occur in bottom-dwelling animals in Santa Monica Bay. In the mid to late 1970s, ΣPCB concentrations in Pacific sanddab from the Palos Verdes Shelf were 18 times higher than fish from Dana Point and ΣDDT concentrations in sanddab were 50 times higher than fish from Santa Monica Bay. Total PCB concentrations in Dover sole from the Palos Verdes Shelf were 19 times higher than fish from Santa Monica Bay and ΣDDT concentrations up to 20 times higher than fish from Santa Monica Bay (Young *et al.* 1978, SCCWRP, unpubl. data).

In 1990, concentrations of ΣPCB, ΣDDT, DDMU, HCB, and chlordane in muscle tissue were significantly higher among white croaker collected on the Palos Verdes Shelf than elsewhere. Concentrations of HCH were significantly higher at Dana Point. The mean concentration of ΣPCBs in white croaker from the Palos Verdes Shelf was three to 13 times higher than the concentration in fish caught in Santa Monica Bay and 31 to 39 times greater than the concentration in fish caught off Dana Point. The mean concentration of ΣDDT in white croaker from the Palos Verdes Shelf was 22 to 92 times greater than the concentration in fish caught in Santa Monica Bay and 118 to 144 times higher than the concentration in fish caught off Dana Point. Concentrations of DDMU, HCH, HCB, chlordane, and selenium in white croaker muscle tissue were highest in samples from the Palos Verdes Shelf, moderate in samples from Santa Monica Bay, and low in samples from Dana Point.

White croaker had the highest DDT and PCB levels among teleosts at every location in surveys conducted in 1975, 1980, 1981, 1987, and in the present study (Young *et al.* 1978, Schafer *et al.* 1982, Gossett *et al.* 1983, SCCWRP, unpubl. data, Pollock *et al.* 1991a). The high contamination levels white croaker may be due to the high lipid content of croaker muscle tissue (Risebrough 1987) or the tendency of the fish to feed in outfall areas where sediments contain high levels of contaminants (MBC 1988). The high contamination levels in several species of flatfish from the Palos Verdes Shelf and in Santa Monica Bay may be due to their habit of feeding on benthic invertebrates (Allen 1982) closely associated with contaminated bottom sediments.

The concentration of chlorinated hydrocarbons in pelagic fish, which swim throughout the Southern California Bight, is generally less than in bottom-dwelling fish and more uniform among areas. Total PCB and DDT concentrations in chub mackerel and Pacific bonito were similar between species and among areas in 1981 and 1987 (Schafer *et al.* 1982, Gossett *et al.* 1983, Pollock *et al.* 1991a).

Few elasmobranchs have been analyzed for chlorinated hydrocarbons, but spiny dogfish from the Palos Verdes Shelf contain much higher levels of ΣDDT and ΣPCB than other animals in the long-term database (Schafer *et al.* 1982, Gossett *et al.* 1983). Although shark liver contains high concentrations of lipids, shark muscle tissue has a low lipid content (Moyle and Cech 1982). The high contaminant levels in spiny dogfish are probably the result of its the trophic position near the top of the foodweb (Mearns 1982). In most of the other species, PCB concentrations did not exceed 200 ppb and DDT concentrations did not exceed 700 ppb from 1975 to the present.

Compared to fishes, ΣDDT and ΣPCB concentrations in invertebrates were extremely low. California spiny lobster had the highest mean ΣPCB and ΣDDT levels among the invertebrates sampled from the Palos Verdes Shelf in 1976 (Young *et al.* 1978). However, ΣPCB concentrations in most invertebrates were less than 60 ppb and ΣDDT concentrations were less than 330 ppb.

In the present study, the concentrations of ΣDDT and ΣPCB in yellow rock crab muscle were similar to other invertebrates from the Palos Verdes Shelf. Concentrations of ΣPCB, ΣDDT, and HCB were significantly higher at White Point than at Dana Point. Concentrations of HCH, chlordane, and selenium were higher at Dana Point. Concentrations of arsenic, lead, and DDMU were not significantly different between sites.

Yellow rock crabs from White Point contained nearly four times more ΣPCB and 10 times more ΣDDT in samples compared to crabs from Dana Point. The concentrations of HCB, HCH, chlordane, DDMU, and arsenic in yellow rock crab muscle were similar in animals collected off White Point and Dana Point. Selenium was 26% higher in crabs from Dana Point and lead was more than twice as high in crabs from White Point.

Temporal trends in contamination levels of animals collected in the Santa Monica Bay study area are difficult to assess because, for most species, there are few data available, and the data do exist are variable. The most data are available for white croaker. The concentration of ΣPCB in muscle tissue of white croaker from the Palos Verdes Shelf has changed little since 1975 (Figure 9). Mean ΣPCB levels ranged from 383 to 2,780 ppb between 1975 and 1981 (Young *et al.* 1978, Schafer *et al.* 1982, Gossett *et al.* 1983), and from 1,180 to 1,455 ppb between 1988 and 1990 (CSDLAC 1988, Pollock *et al.* 1991a). The concentrations of ΣDDT in muscle tissue of white croaker from the Palos Verdes Shelf has declined somewhat since 1975 (Figure 10). Mean DDT levels ranged from 7,629 to 39,000 ppb between 1975 and 1980 (Young *et al.* 1978, Schafer *et al.* 1982), and from 11,577 to 26,560 ppb between 1988 and 1990 (CSDLAC 1988, Pollock *et al.* 1991a).

Data from other fish species collected on the Palos Verdes Shelf suggest a decrease in tissue contamination levels from the mid-1970s to the early 1980s. Total PCB concentrations in Dover sole decreased from 3,166 ppb in 1977 to 278 ppb in 1980 (SCCWRP, unpubl. data, Schafer *et al.* 1982). Total PCB concentrations in California scorpionfish dropped from 573 ppb in 1975 to 44 ppb in 1980 (Young *et al.* 1978, Schafer *et al.* 1982). Total DDT concentrations had similar declines during that period. Temporal trends in contaminant levels in yellow rock crab cannot be assessed because of the paucity of data.

The Dana Point site sampled in this and other studies is appropriate as a reference site for contamination studies in the Southern California Bight. Consistently low values have been reported in animal tissue samples from this area for the last 15 years.

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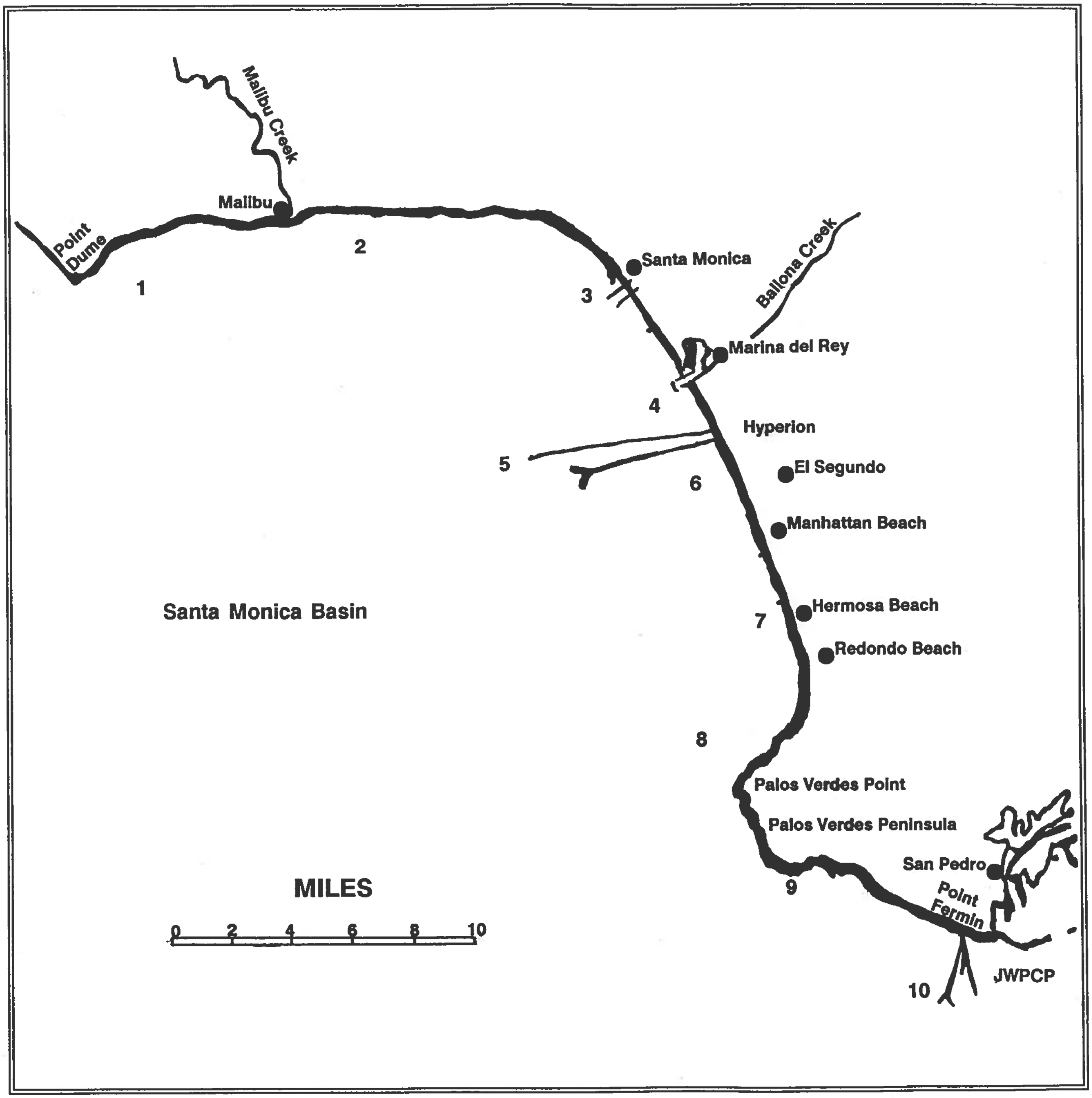


Figure 1. Map of 1990 survey study sites.

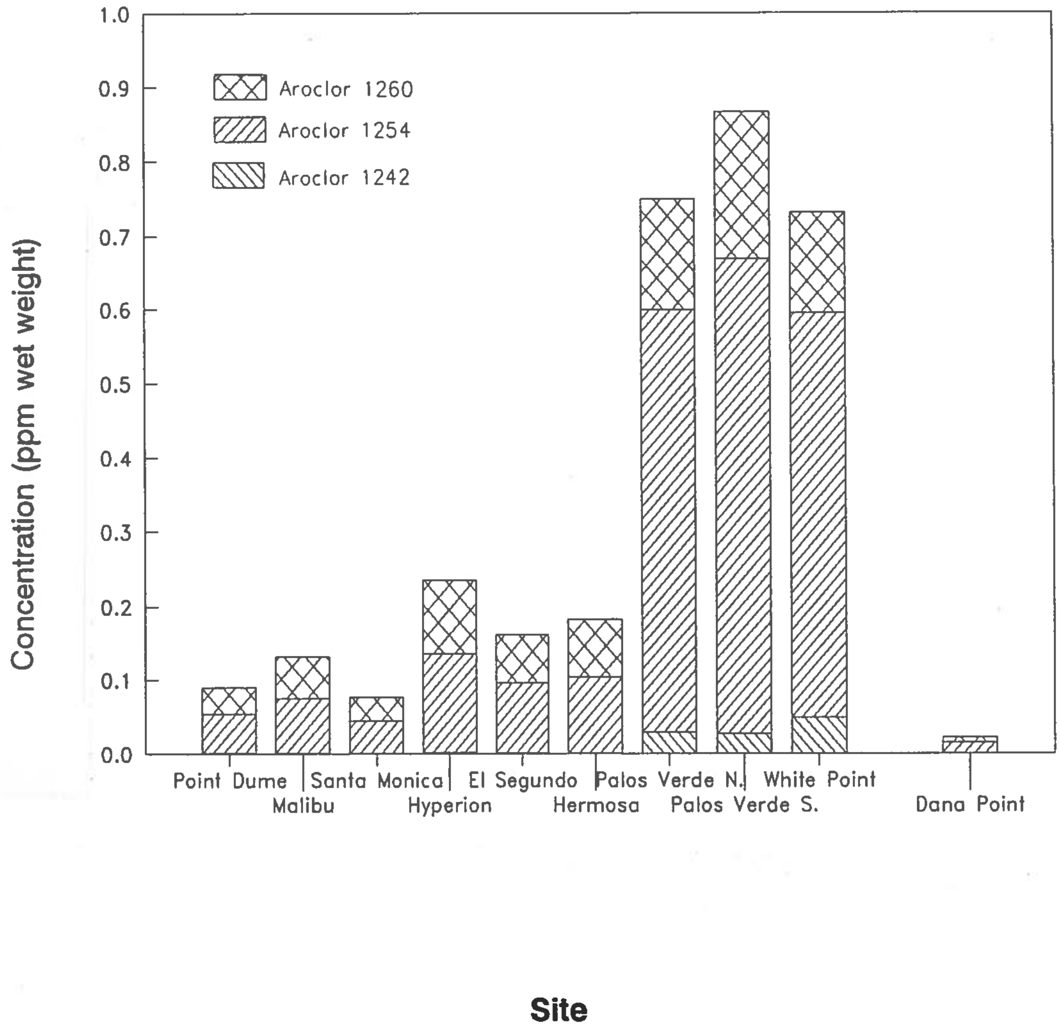


Figure 2. **Mean concentration of total PCB (Aroclors 1242 + 1254 + 1260) in composites of muscle tissue of white croaker (*Genyonemus lineatus*) collected from coastal sites in southern California in fall 1990.**

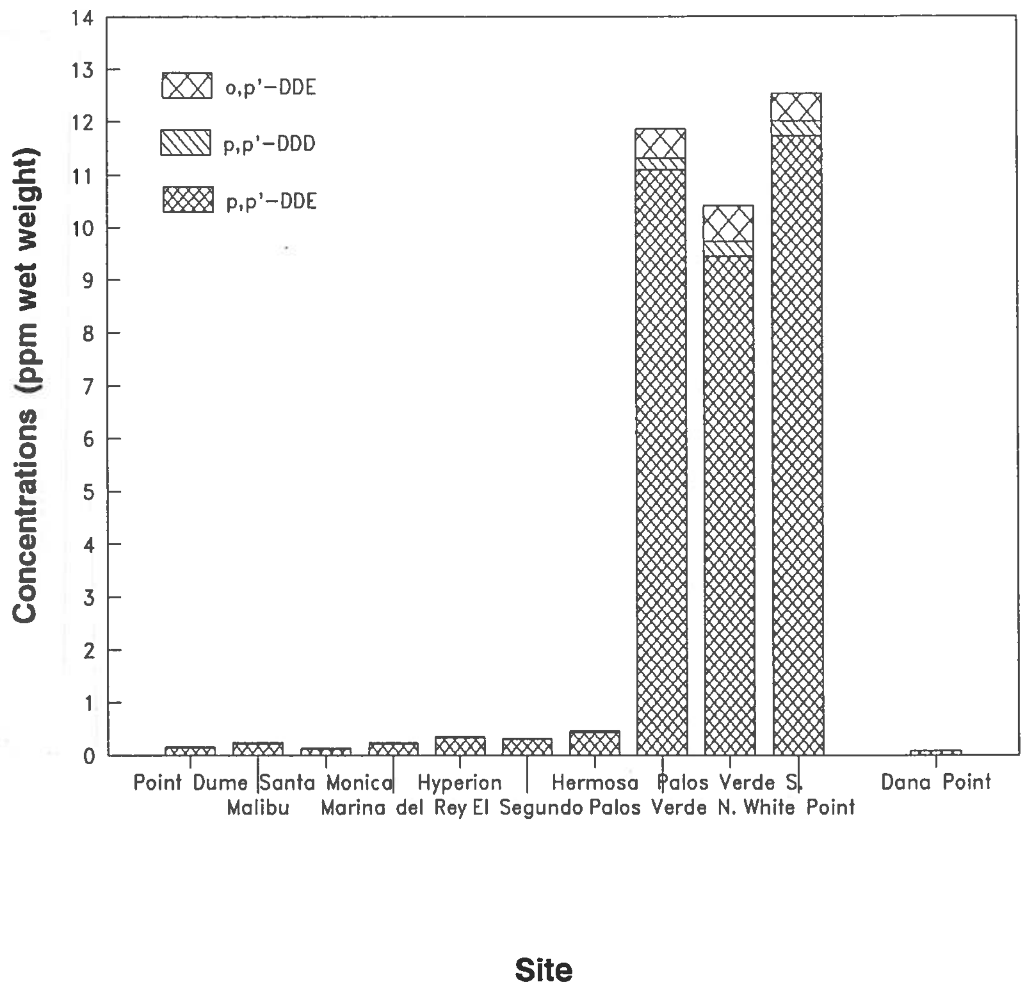


Figure 3. **Mean concentration of total DDT (DDT + DDE + DDD) in composites of muscle tissue of white croaker** ***(Genyonemus lineatus)*** **collected from coastal sites in southern California in fall 1990.**

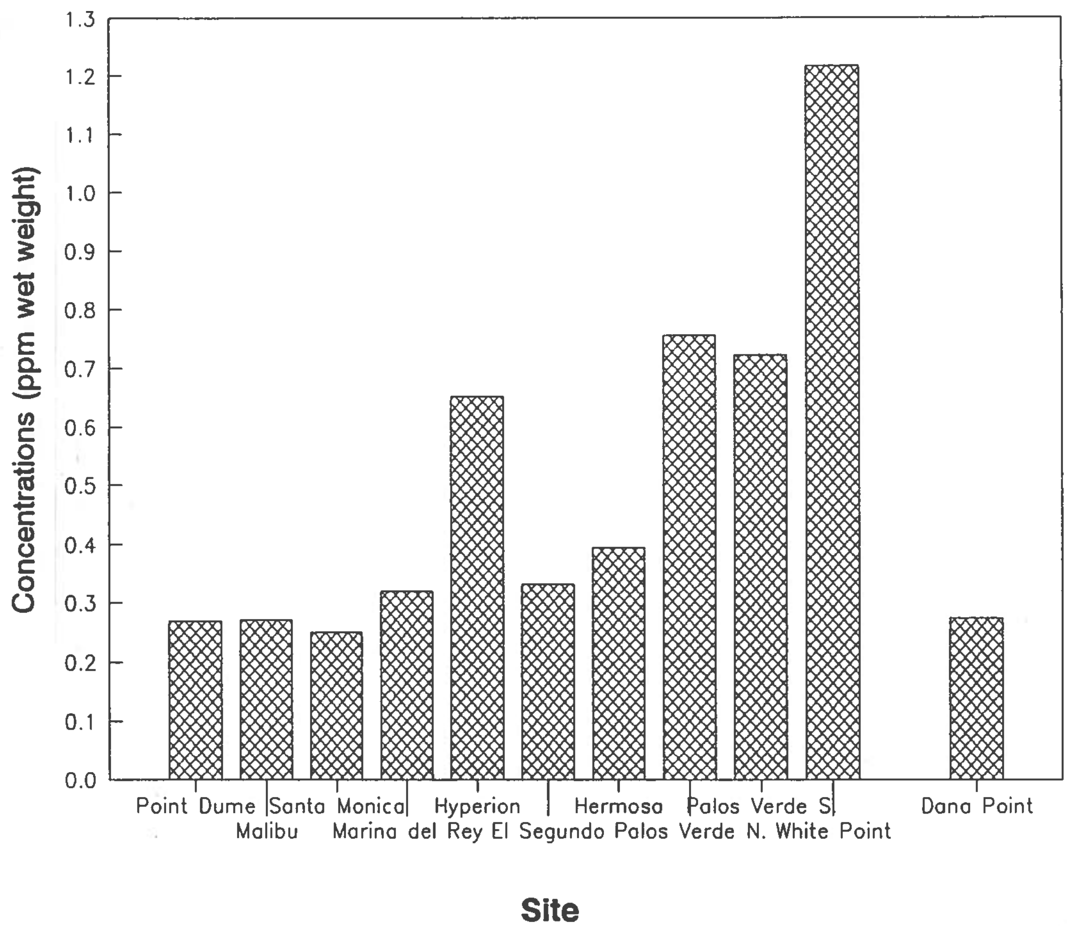


Figure 4. **Mean concentration of selenium in composites of muscle tissue of white croaker *(Genyonemus lineatus)* collected from coastal sites in southern California in fall 1990.**

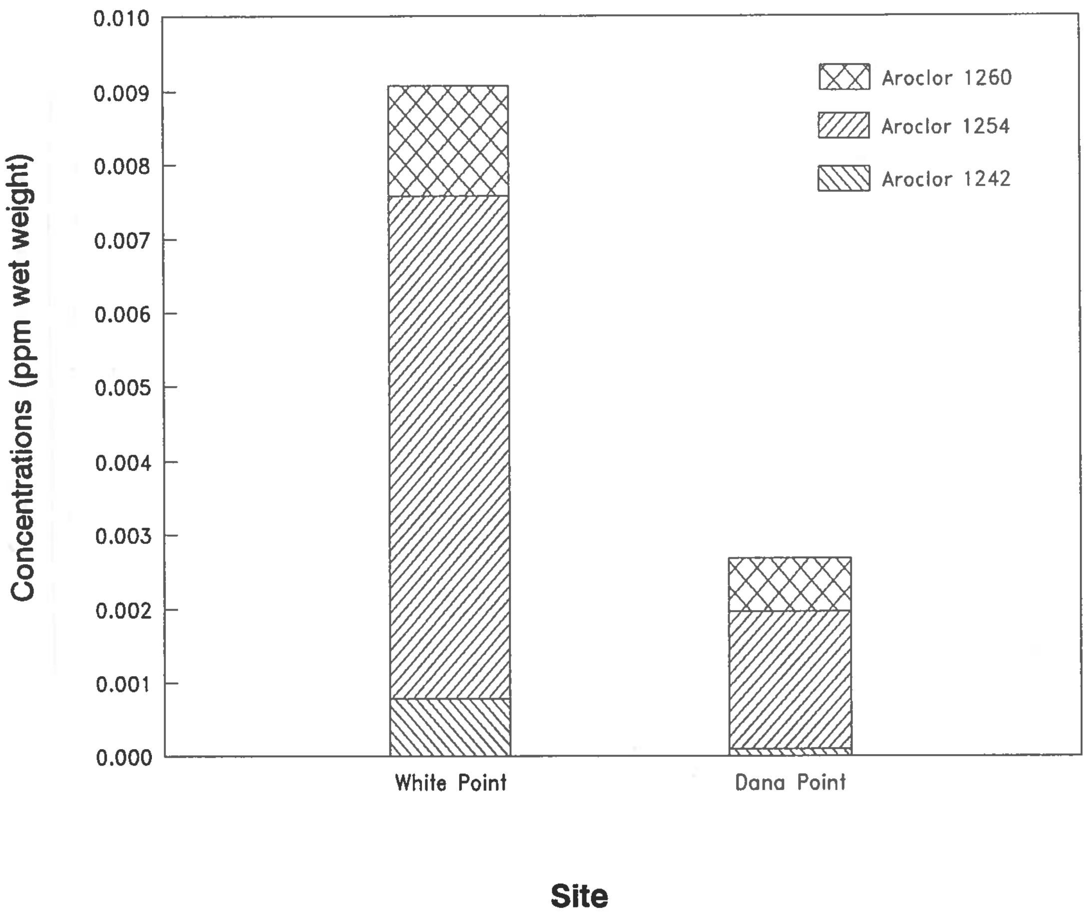


Figure 5. **Mean concentration of total PCB (Aroclors 1242 + 1254 + 1262) in composites of muscle tissue of yellow rock crab *(Cancer anthonyi)* collected from White Point and Dana Point in southern California in fall 1990.**

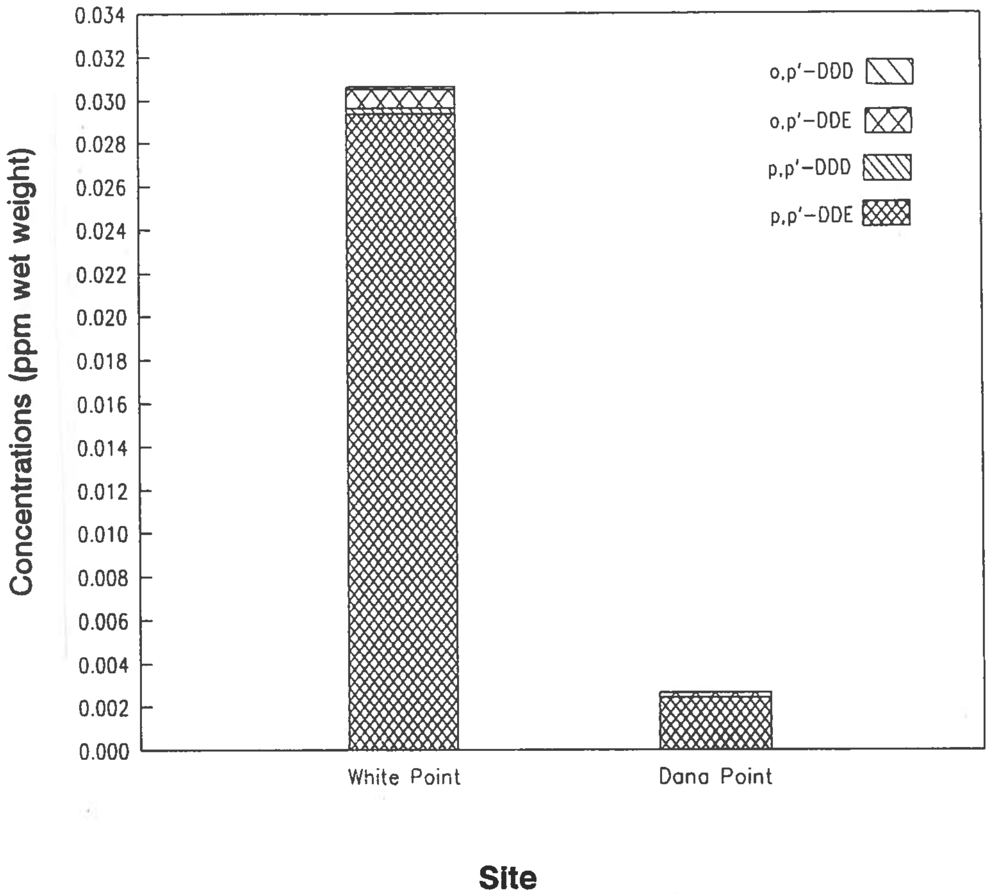


Figure 6. **Mean concentration of total DDT (DDT + DDE + DDD) in composites of muscle tissue of yellow rock crab *(Cancer anthonyi)* collected from White Point and Dana Point in southern California in fall 1990.**

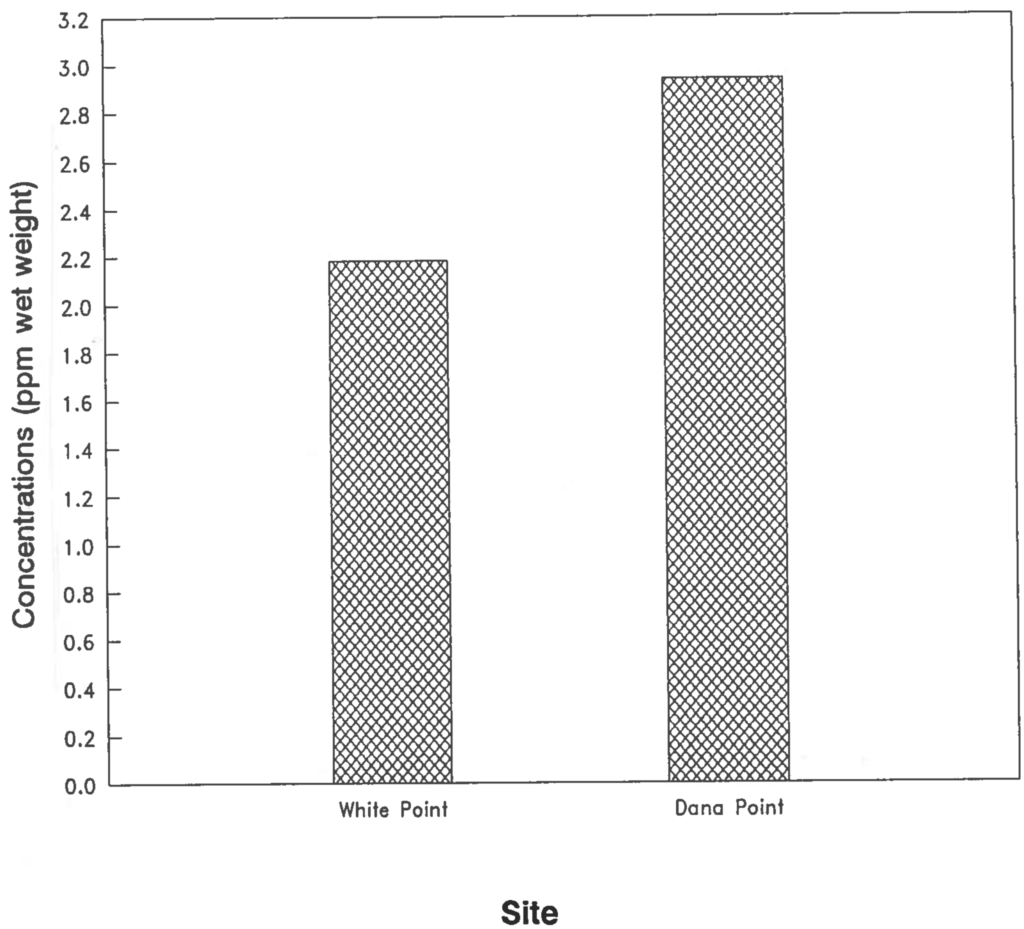


Figure 7. **Mean concentration of selenium in composites of muscle tissue of yellow rock crab *(Cancer anthonyi)* collected from White Point and Dana Point in southern California in fall 1990.**

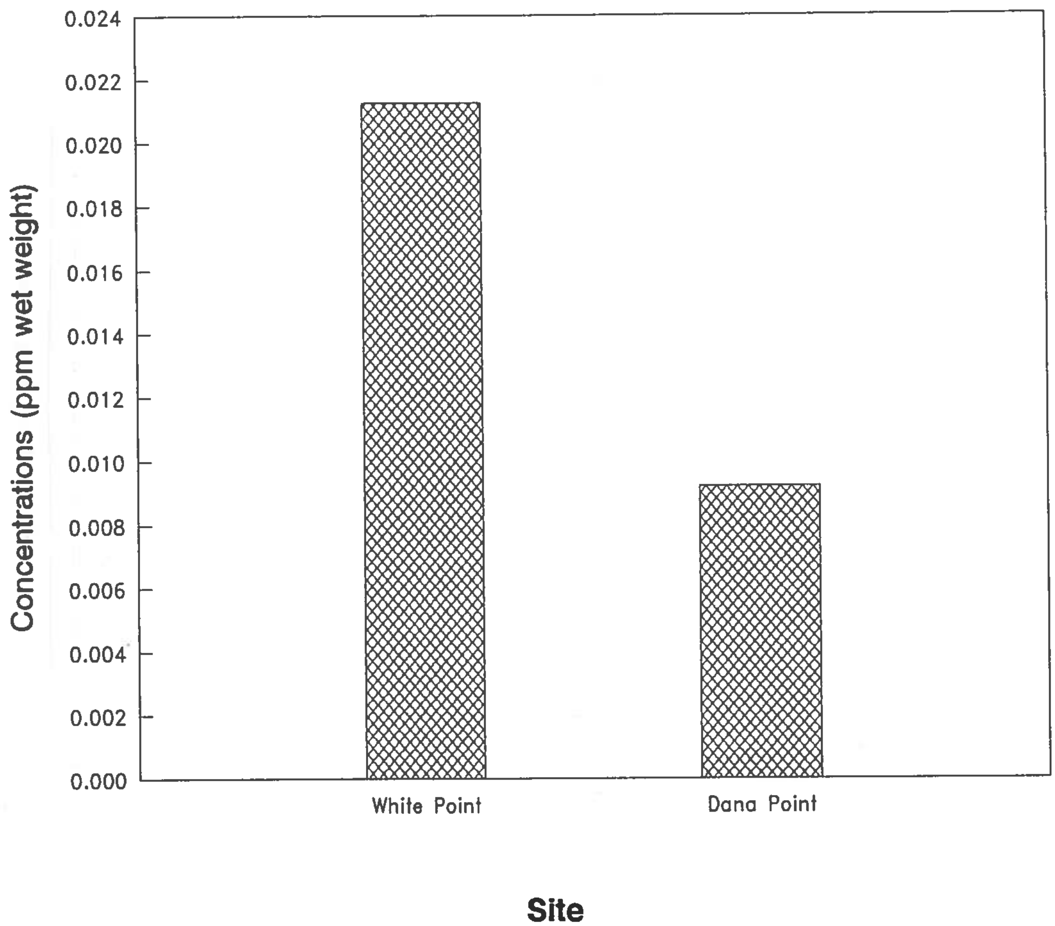


Figure 8. **Mean concentration of lead in muscle tissue of yellow rock crab *(Cancer anthonyi)* collected from White Point and Dana Point in southern California in fall 1990.**

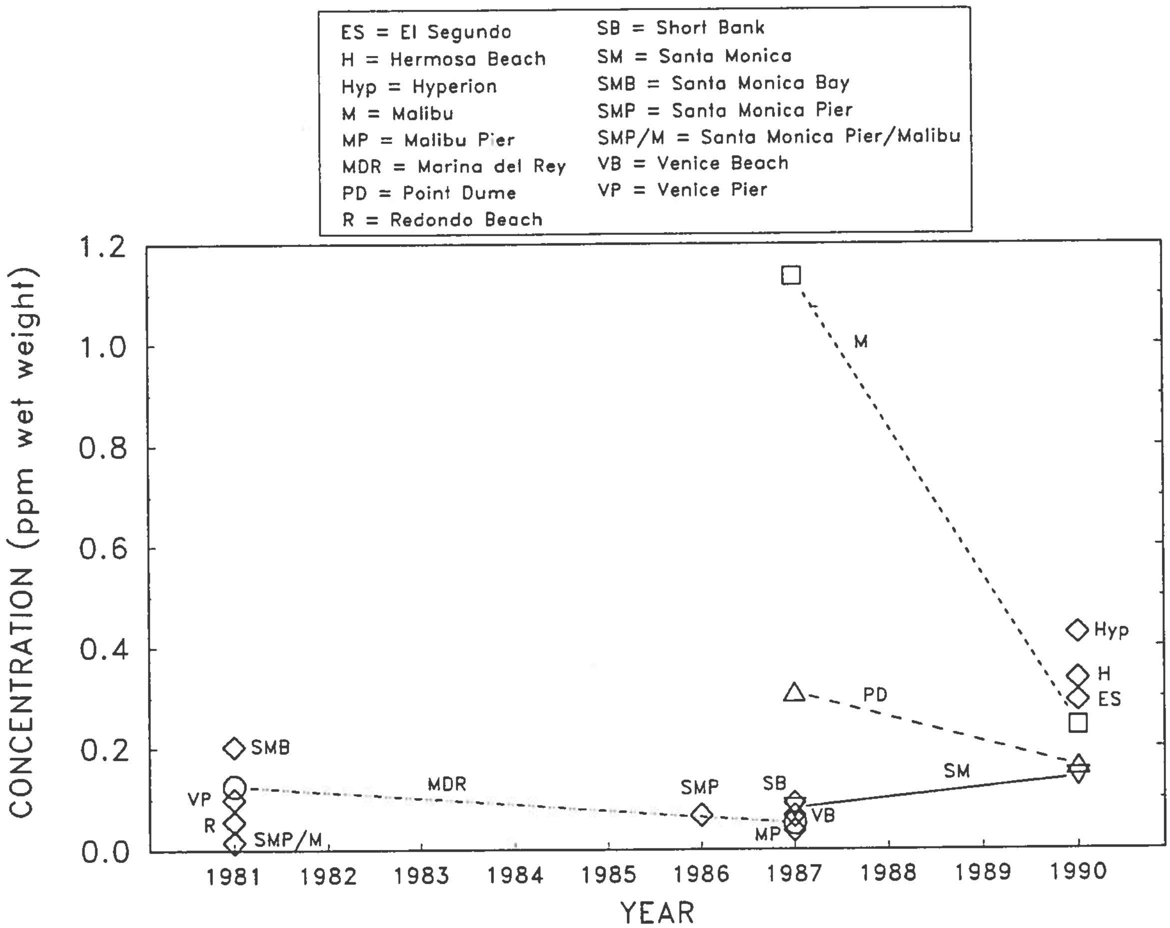


Figure 9. Mean concentration of total PCBs (Aroclors) in muscle tissue of white croaker (Genyonemus lineatus) collected from Santa Monica Bay from 1981 to 1990 (data from Gossett et al. 1983, Risebrough 1987, Jarman et al. 1991, Pollock et al. 1991a).

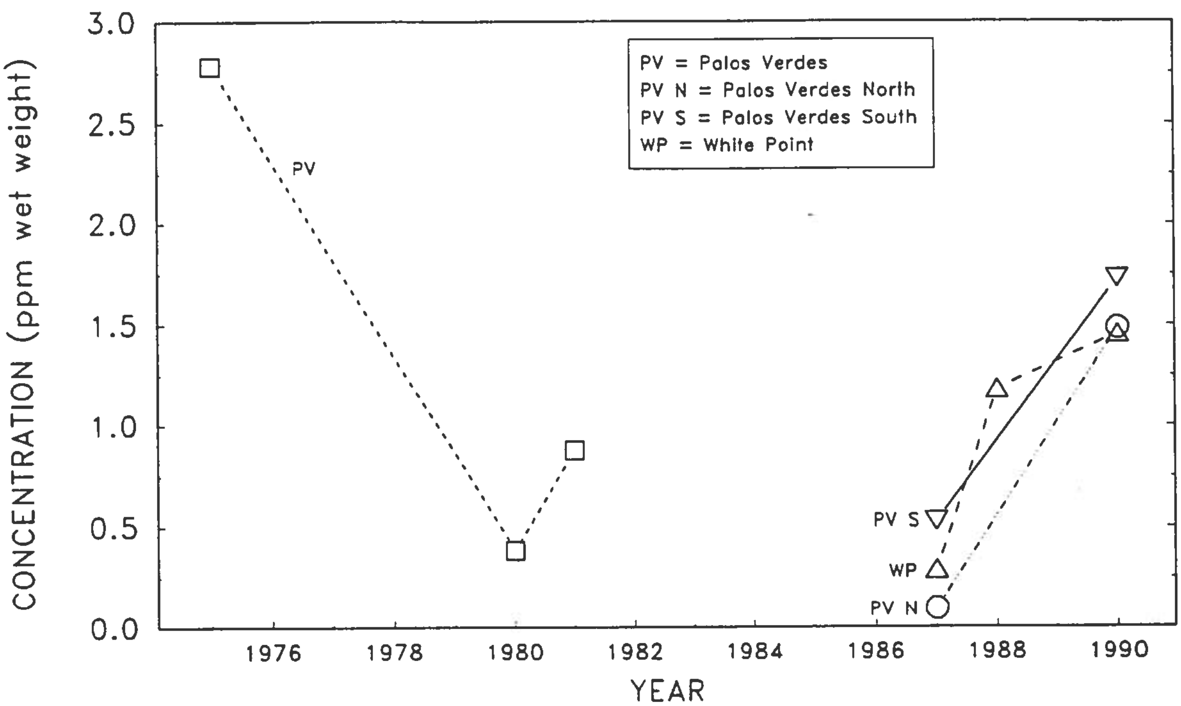


Figure 10. Mean concentration of total PCBs (Aroclors) in muscle tissue of white croaker (Genyonemus lineatus) **collected from the Palos Verdes Shelf from 1975 to 1990 (data from Young et al. 1978, Schafer et al. 1982, Gossett et al. 1983, Risebrough 1987, CSDLAC 1988, Jarman et al. 1991, Pollock et al. 1991a).**

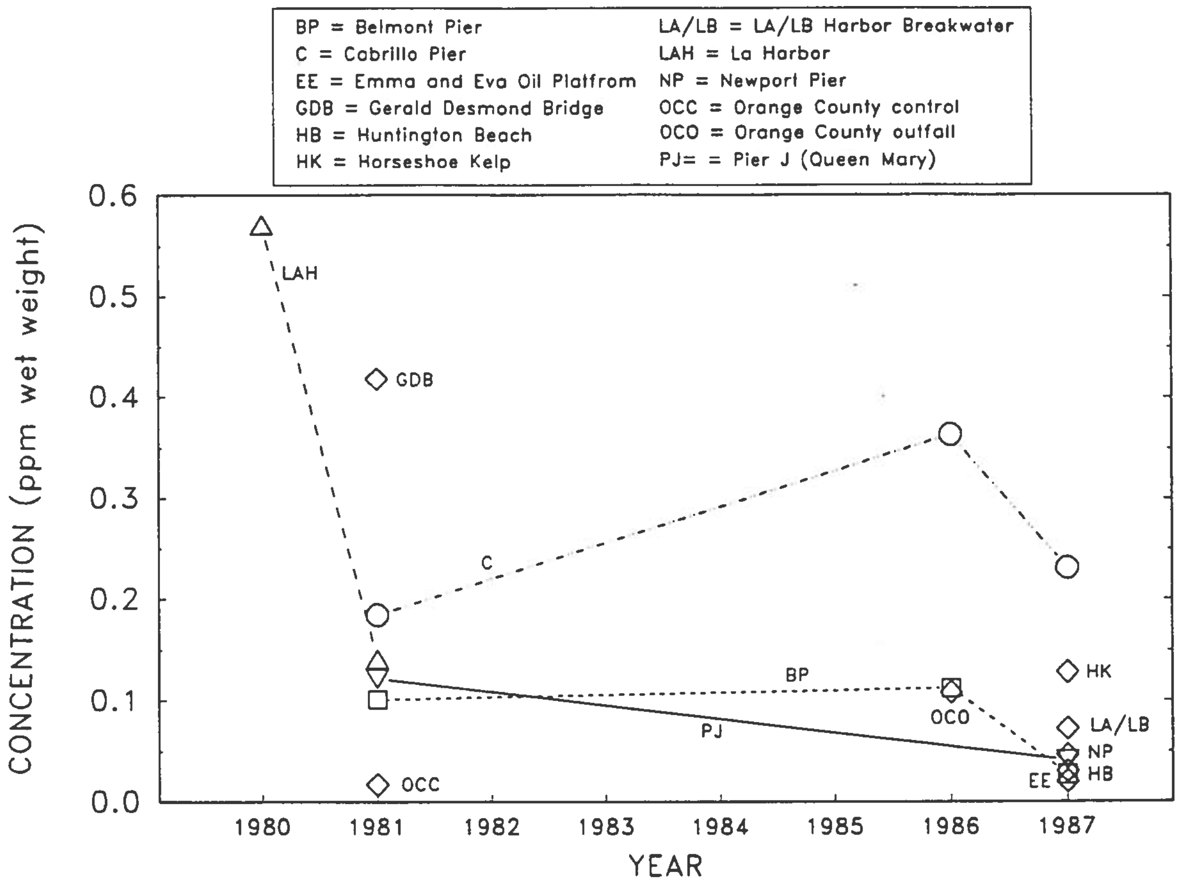


Figure 11. Mean concentration of total PCBs (Aroclors) in muscle tissue of white croaker (*Genyonemus lineatus*) **collected from San Pedro Bay from 1980 to 1990 (data from Mearns and Young 1980, Gossett et al. 1983, Risebrough 1987, CSDOC 1990, Jarman et al. 1991, Pollock et al. 1991a).**

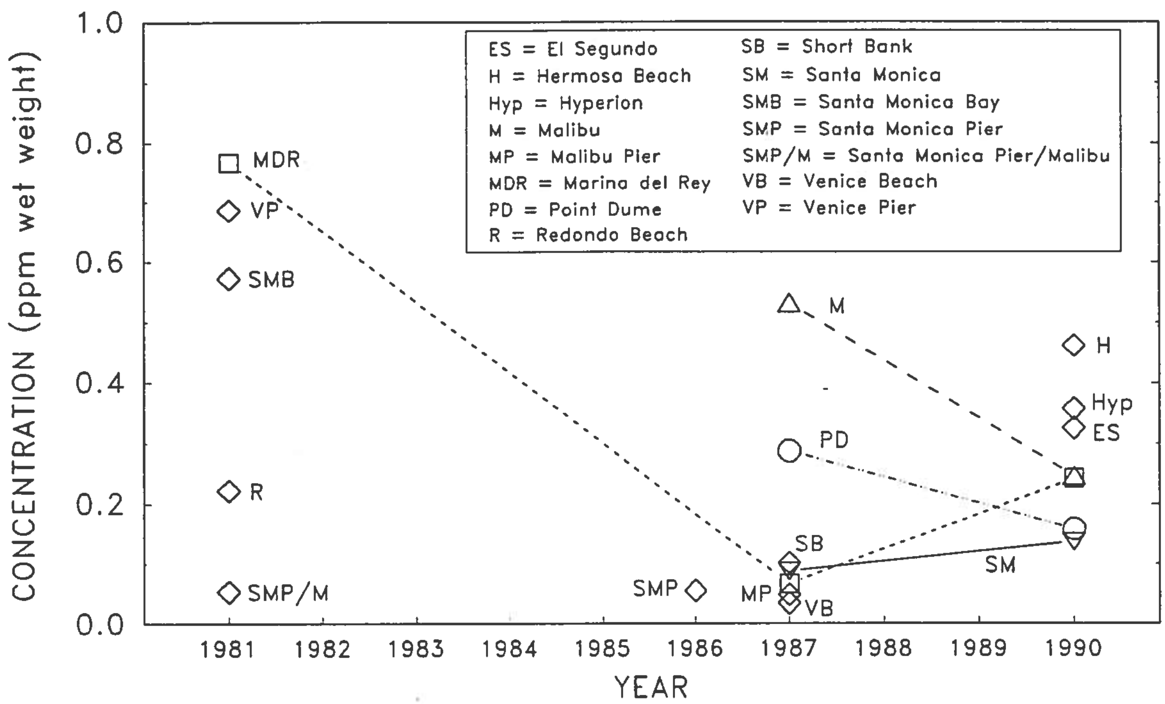


Figure 12. Mean concentration of total DDT (DDT+DDE+DDD) in muscle tissue of white croaker (Genyonemus lineatus) **collected from Santa Monica Bay from 1981 to 1990 (data from Gossett et al. 1983, Risebrough 1987, Jarman et al. 1991, Pollock et al. 1991a).**

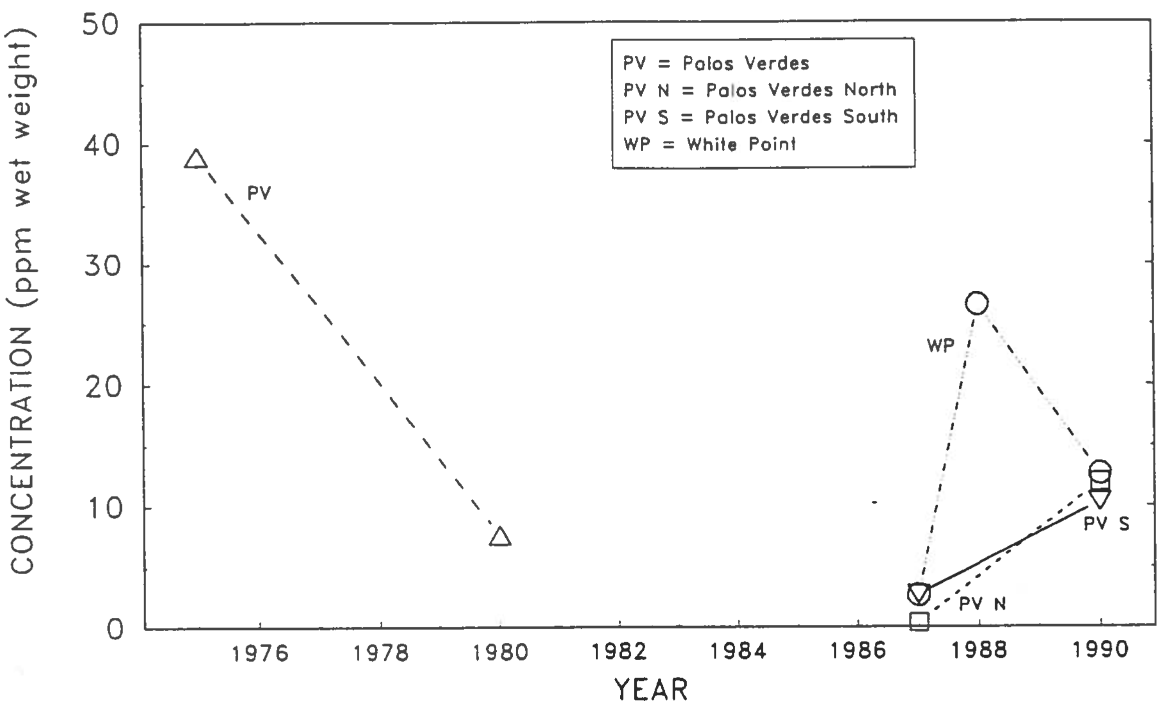


Figure 13. Mean concentration of total DDT (DDT+DDE+DDD) in muscle tissue of white croaker (Genyonemus lineatus) **collected from the Palos Verdes Shelf from 1975 to 1990 (data from Young et al. 1978, Schafer et al. 1982, Gossett et al. 1983, Risebrough 1987, CSDLAC 1988, Jarman et al. 1991, Pollock et al. 1991a).**

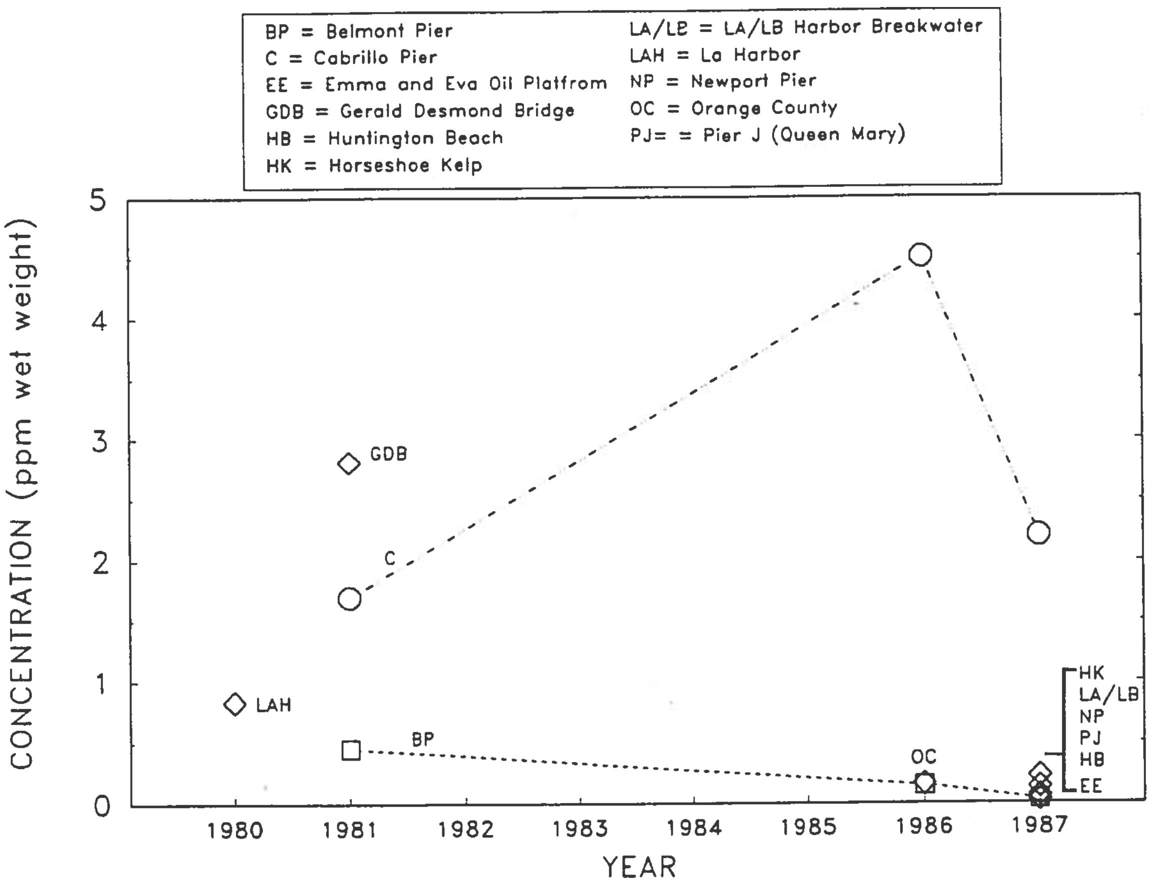


Figure 14. Mean concentration total of DDT (DDT+DDE+DDD) in muscle tissue of white croaker (Genyonemus lineatus) **collected from San Pedro Bay from 1980 to 1990 (data from Mearns and Young 1980, Gossett et al. 1983, Risebrough 1987, CSDOC 1990, Jarman et al. 1991, Pollock et al. 1991a).**

Table 1. Sampling stations (sta) and Loran C coordinates of white croaker (*Genyonemus lineatus*) and yellow rock crab (*Cancer anthonyi*) collections in the Santa Monica Bay study area. The number of individuals (ind) and the number of composites (com) are presented for each station.

Sta	Location	Loran C	White croaker		Rock crab	
			Ind	Com	Ind	Com
1	Point Dume	28128.1-41223.3	20	5	-	
2	Malibu	28146.5-41196.8	40	10	-	
3	Santa Monica	28168.5-41141.6	20	5	-	
4	Marina del Rey	28172.8-41116.7	20	5	-	
5	Hyperion 7-mi outfall	28161.3-41116.7	20	5	-	
6	El Segundo	28171.5-41135.8	40	10	-	
7	Hermosa Beach	28172.0-41093.1	20	5	-	
8	Palos Verdes North	28169.0-41079.9	20	5	-	
9	Palos Verdes South	28167.8-41063.2	20	5	-	
10	White Point	28176.9-41033.9	20	5	20	5
11	Dana Point[1]	28157.5-40775.7	20	5	20	5
	Total		260	65	40	10

[1]Reference site.

Table 2. Concentrations of total PCBs (Aroclors 1242+1254+1260) in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990

Location	Concentration (ppm wet weight)			
	Mean*	S.D.*	Min	Max
Point Dume	0.090	0.023	0.059	0.118
Malibu	0.131	0.041	0.093	0.193
Santa Monica	0.077	0.069	0.005	0.187
Marina del Rey	0.139	0.095	0.055	0.300
Hyperion	0.235	0.050	0.178	0.308
El Segundo	0.162	0.061	0.111	0.237
Hermosa	0.183	0.084	0.052	0.279
Palos Verde N.	0.749	0.208	0.513	0.960
Palos Verde S.	0.866	0.483	0.314	1.464
White Point	0.731	0.162	0.545	0.987
Dana Point	0.023	0.010	0.012	0.036

* n=5

Table 3. Results of ANOVA and Student-Newman-Keuls (SNK) analyses on contaminant levels in edible muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990. (The first line of datqa for each pesticide is the untransformed means in ppb; the second line is the transformed means required to meet the ANOVA assumption of homogeneity of variances.)

Contaminant/ Transformation	Site										
	DP	SM	PD	MDR	PD	ES	HB	H	WP	PVN	PVS
PCB	23	77	90	139	131	162	183	235	731	749	866
square root	4.7	8.0	9.5	11.3	11.4	12.6	13.1	15.3	26.9	27.2	28.4
	DP	SM	PD	MDR	M	ES	H	HB	PVS	PVN	WP
DDT	87	137	159	243	246	325	357	461	10255	11904	12574
square root	8.9	10.8	12.6	15.1	15.3	17.9	18.7	20.5	97.4	108.0	111.5
	DP	SM	PD	MDR	ES	M	H	HB	PVS	PVN	WP
DDMU	4	10	10	14	15	17	17	36	768	807	849
square root	1.9	3.0	3.2	3.7	3.9	4.1	4.1	5.8	26.3	28.2	29.0
	H	ES	HB	MDR	SM	DP	PD	M	PVN	WP	PVS
HCB	0.05	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.19	0.24	0.26
reciprocal	NA	NA	NA	19.3	18.0	16.4	16.1	15.9	7.8	4.6	4.6
	DP	PD	MDR	H	SM	HB	ES	M	WP	PVS	PVN
Lindane	0.27	0.38	0.63	0.64	0.65	0.71	0.77	0.77	0.97	1.18	1.30
	DP	PD	SM	HB	M	ES	MDR	H	PVS	PVN	WP
Chlordane	2.3	3.6	5.3	6.7	6.8	9.2	9.8	10.2	17.1	18.7	19.3
	SM	PD	M	DP	MDR	ES	HB	H	PVS	PVN	WP
Selenium	250	268	270	274	320	332	394	652	722	756	1216
natural log	5.46	5.59	5.60	5.61	5.77	5.79	5.97	6.45	6.56	6.63	7.09

Sites are Point Dume (PD), Malibu (M), Santa Monica (SM), Marina del Rey (MDR), Hyperion (H), El Segundo (ES), Hermosa Beach (HB), Palos Verdes North (PVN), Palos Verdes South (PVS), White Point (WP), and Dana Point (DP).
All ANOVA p values were <0.0005
NA = All values below MDT of 0.05 ppb

Table 4. Concentrations of total DDT (DDT+DDE+DDD) in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean**	S.D.**	Min	Max
Point Dume	0.159	0.035	0.110	0.193
Malibu	0.246	0.145	0.149	0.497
Santa Monica	0.137	0.110	0.016	0.303
Marina del Rey	0.243	0.139	0.106	0.442
Hyperion	0.357	0.106	0.258	0.500
El Segundo	0.325	0.081	0.262	0.420
Hermosa Beach	0.461	0.295	0.116	0.898
Palos Verdes N.	11.904	3.775	7.647	16.069
Palos Verdes S.	10.255	5.182	4.190	18.336
White Point	12.574	2.961	9.172	16.562
Dana Point	0.087	0.064	0.034	0.188

** n = 5, except for Palos Verdes S. where n = 4.

Table 5. Concentrations of DDMU in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
Pt. Dume	0.010	0.002	0.007	0.011
Malibu	0.017	0.006	0.009	0.024
Santa Monica	0.010	0.007	0.001	0.017
Marina del Rey	0.010	0.002	0.008	0.031
Hyperion	0.017	0.005	0.009	0.022
El Segundo	0.015	0.003	0.011	0.019
Hermosa	0.036	0.019	0.013	0.064
Palos Verdes N.	0.807	0.224	0.507	1.053
Palos Verdes S.	0.768	0.519	0.219	1.225
White Point	0.849	0.209	0.597	1.170
Dana Pt.	0.005	0.005	0.001	0.011

* n = 5, except for Palos Verdes S. where n = 4.

Table 6. Concentrations of lindane in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight)			
	Mean*	S.D.*	Min	Max
Point Dume	0.0004	0.0002	0.0002	0.0007
Malibu	0.0008	0.0003	0.0004	0.0010
Santa Monica	0.0006	0.0004	0.0003	0.0011
Marina del Rey	0.0006	0.0004	0.0004	0.0013
Hyperion	0.0006	0.0003	0.0001	0.0009
El Segundo	0.0008	0.0004	0.0005	0.0015
Hermosa	0.0007	0.0004	0.0003	0.0012
Palos Verde N.	0.0013	0.0002	0.0010	0.0015
Palos Verde S.	0.0012	0.0004	0.0007	0.0015
White Point	0.0010	0.0003	0.0004	0.0013
Dana Point	0.0003	0.0001	0.0002	0.0005

* n = 5, except for Palos Verdes S. where n = 4.
Note: 0.0000 is < 0.00005

Table 7. Concentrations of HCB in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight)			
	Mean*	S.D.*	Min	Max
Point Dume	0.0001	0.0000	0.0000	0.0001
Malibu	0.0001	0.0000	0.0000	0.0001
Santa Monica	0.0001	0.0000	0.0000	0.0001
Marina del Rey	0.0000	0.0000	0.0000	0.0001
Hyperion	0.0000	0.0000	0.0000	0.0000
El Segundo	0.0000	0.0000	0.0000	0.0000
Hermosa	0.0000	0.0000	0.0000	0.0000
Palos Verde N.	0.0002	0.0001	0.0000	0.0003
Palos Verde S.	0.0003	0.0001	0.0001	0.0004
White Point	0.0002	0.0001	0.0001	0.0004
Dana Point	0.0001	0.0000	0.0000	0.0001

* n = 5, except for Palos Verdes S. where n = 4.
Note: 0.0000 is < 0.00005

Table 8. Concentrations of chlordane in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight)			
	Mean*	S.D.*	Min	Max
Point Dume	0.004	0.001	0.002	0.005
Malibu	0.007	0.004	0.004	0.013
Santa Monica	0.005	0.002	0.003	0.007
Marina del Rey	0.010	0.006	0.006	0.019
Hyperion	0.010	0.003	0.005	0.013
El Segundo	0.009	0.003	0.004	0.012
Hermosa	0.007	0.004	0.002	0.012
Palos Verde N.	0.019	0.005	0.013	0.025
Palos Verde S.	0.017	0.008	0.007	0.024
White Point	0.019	0.007	0.011	0.029
Dana Point	0.002	0.001	0.002	0.003

* n = 5, except for Palos Verdes S. where n = 4.

Table 9. Concentrations of selenium in muscle tissue of white croaker (*Genyonemus lineatus*) from southern California in November 1990.

Location	Concentration (ppm wet weight)			
	Mean*	S.D.*	Min	Max
Point Dume	0.268	0.032	0.230	0.310
Malibu	0.270	0.016	0.250	0.290
Santa Monica	0.250	0.024	0.220	0.280
Marina del Rey	0.320	0.027	0.280	0.350
Hyperion	0.652	0.191	0.440	0.940
El Segundo	0.332	0.065	0.270	0.420
Hermosa	0.394	0.053	0.350	0.480
Palos Verde N.	0.756	0.045	0.720	0.810
Palos Verde S.	0.723	0.163	0.570	1.000
White Point	1.216	0.185	0.980	1.400
Dana Point	0.274	0.017	0.260	0.300

* n = 5, except for Palos Verdes S. where n = 4.

Table 10. Results of t-tests comparing concentrations of contaminants in muscle tissue of yellow rock crab (*Cancer anthonyi*) between White Point and Dana Point, California in 1990.

Contaminant	Concentration (ppb) White Point Mean	White Point S.D.	Dana Point Mean	Dana Point S.D.	Trans- formation	t	p	greater
a) Metals								
Arsenic	13.3	4.0	13.0	3.8	None	0.025	n.s.	-
Lead	22.1	5.0	9.4	3.6	None	0.289	n.s.	-
Selenium	2.2	0.3	2.9	0.5	None	-3.265	*	Dana Point
b) Chlorinated hydrocarbons								
PCBs	9.1	5.5	2.7	0.8	Log(x)	5.038	***	White Point
DDTs	30.8	22.0	2.9	1.9	Log(x)	3.837	**	White Point
DDMU	0.35	0.39	0.37	0.43	None	-0.148	n.s.	-
HCB	0.24	0.09	0.06	0.02	Log(100x)	7.400	***	White Point
Lindane	0.17	0.03	0.25	0.09	None	-18.559	****	Dana Point
Chlordane	0.31	0.08	0.34	0.07	None	-6.960	****	Dana Point

n.s. = not significant
* = 0.02 > p > 0.01
** = 0.01 > p > 0.002
*** = 0.002 > p > 0.001
**** = 0.001 > p

Table 11. Concentrations of total PCBs (Aroclors 1242+1254+1260) in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean	S.D.	Min	Max
White Point	0.009	0.006	0.002	0.015
Dana Point	0.003	0.001	0.001	0.003

*n=5

Table 12. Concentrations of total DDT (DDT+DDE+DDD) in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean	S.D.*	Min	Max
White Point	0.031	0.022	0.008	0.062
Dana Point	0.003	0.002	0.001	0.005

* n = 5

Table 13. Concentrations of DDMU in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
White Point	0.0003	0.0004	0.0000	0.0010
Dana Point	0.0003	0.0005	0.0000	0.0010

* n = 5
Note: 0.0000 is < 0.00005

Table 14. Concentrations of lindane in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
White Point	0.0001	0.0001	0.0000	0.0002
Dana Point	0.0001	0.0001	0.0000	0.0003

* n = 5
Note: 0.0000 is < 0.00005

Table 15. Concentrations of HCB in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
White Point	0.00002	0.00002	0.00000	0.00005
Dana Point	0.00001	0.00001	0.00001	0.00002

* n = 5
Note: 0.00000 is < 0.000005

Table 16. Concentrations of chlordane in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
White Point	0.0002	0.0001	0.0001	0.0003
Dana Point	0.0002	0.0001	0.0001	0.0003

* n = 5

Table 17. Concentrations of selenium in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

Location	Concentration (ppm wet weight) Mean*	S.D.*	Min	Max
White Point	2.180	0.335	1.800	2.600
Dana Point	2.940	0.513	2.400	3.700

* n = 5

Table 18. Concentrations of arsenic in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

	Concentration (ppm wet weight)			
Location	Mean*	S.D.*	Min	Max
White Point	13.280	3.986	9.400	18.000
Dana Point	13.040	3.809	8.200	17.000

* n = 5

Table 19. Concentrations of lead in muscle tissue of yellow rock crab (*Cancer anthonyi*) from southern California in November 1990.

	Concentration (ppm wet weight)			
Location	Mean*	S.D.*	Min	Max
White Point	0.021	0.005	0.017	0.029
Dana Point	0.009	0.003	0.006	0.013

* n = 5

Table 20. Results of t-test comparisons between arithmetic mean concentrations of total PCBs (Aroclors 1242+1254+1260) in edible muscle tissue of white croaker (Genyonemus lineatus) **from southern California in 1987 and 1990 (Jarman et al. 1991, Pollock et al. 1991a).**

Site	1987		1990		Trans-			
	Mean	SD	Mean	SD	form.	t	p	Greater
Point Dume	309	196	89	23	log	2.574	ns	
Malibu	552	169	130	41	log	7.074	**	1987
SM/VenicePiers '87								
Santa Monica '90	81	78	76	69	none	0.113	ns	
Marina del Rey	51	31	138	95	none	1.963	ns	
Palos Verdes Northwest '87								
Palos Verdes North '90	94	52	721	202	log	3.675	*	1990
Point Vicente '87								
Palos Verdes South '90	526	88	839	478	recip.	0.512	ns	
White Point	288	167	683	142	none	4.024	**	1990
Dana Point	1	2	22	10	log	7.759	**	1990

ns = Nonsignificant
* = Significant at the 0.05 level
** = Significant at the 0.01 level
Transform. = Transformation
recip. = Reciprocal Transformation

Table 21. Results of t-test comparisons between arithmetic mean concentrations of total DDTs (DDT+DDE+DDD) in edible muscle tissue of white croaker (Genyonemus lineatus) **from southern California in 1987 and 1990 (Jarman et al. 1991, Pollock et al. 1991a).**

Site	1987		1990		Trans-			
	Mean	SD	Mean	SD	form.	t	p	Greater
Point Dume	287	224	159	35	recip.	0.092	ns	
Malibu	532	206	246	145	none	2.538	*	1987
SM/VenicePiers '87								
Santa Monica '90	87	74	137	110	none	0.845	ns	
Marina del Rey	66	38	243	139	log	2.232	*	1990
Palos Verdes Northwest '87								
Palos Verdes North '90	355	186	11904	3775	log	7.033	**	1990
Point Vicente '87								
Palos Verdes South '90	2673	472	10196	6237	log	4.535	*	1990
White Point	2625	1791	12574	2961	none	6.428	**	1990
Dana Point	6	4	88	64	log	6.043	**	1990

ns = Nonsignificant
* = Significant at the 0.05 level
** = Significant at the 0.01 level
Transform. = Transformation
recip. = Reciprocal transformation

APPENDIX A

Santa Monica Bay seafood contamination study analytical results, June 1991

Section 1

Methods

Lead Methods

Ten rock crab tissue composites were analyzed for lead concentrations using a modification of EPA method 7421 at the UCSC Trace Metals Analytical Facility. Tissue was digested in hot (60-70°C) concentrated nitric acid for four hours. The sample was brought to dryness, 1N nitric acid was added, and the sample was then cooled and analyzed on a deuterium corrected PE 5000 Graphite Furnace Atomic Absorption Spectrophotometer, with pyloric coated graphite tubes and the L'Vov platform. Detection limits were 2 ng/g. All Samples were analytzed in duplicate.

PCDDS and PCDF Methods

Six white croaker tissue composites were analyzed for PCDDs and PCDFs using high resolution gas chromatography-high resolution mass spectrometry (HRGC/HRMS)- EPA method 8290. These sample were analyzed at Alta Analytical laboratories, El Dorado hills CA. Samples were scanned for all tetra through octa congeners. Detection limits ranged from 0.15 to 4.3 pg/g (ppt). QA procedures included method blanks and use of isotopically labeled internal standards in all samples. Recoveries were calculated for all labeled compounds.

Percent lipid and percent moisture in White Croaker

Location	Sample Number	%Lipid	% Moisture
Pt. Dume	1,1	1.88	77.1
	1,2	1.09	78.5
	1,3	1.82	78.6
	1,3dup	1.58	
	1,4	1.43	79.0
	1,5	2.12	77.6
Malibu	2,1	1.46	78.7
	2,2	2.02	76.9
	2,3	2.05	79.0
	2,4	1.34	76.1
	2,5	1.59	77.0
Santa Monica	3,1	3.38	76.2
	3,2	1.25	77.7
	3,3	1.48	77.6
	3,4	1.04	79.7
	3,5	1.05	77.5
Marina Del Rey	4,1	0.93	78.1
	4,2	1.09	78.0
	4,2 dup	1.49	
	4,3	1.04	79.1
	4,4	0.81	80.4
	4,5	2.15	78.2
Hyperion	5,1	1.73	79.0
	5,2	1.36	81.0
	5,3	1.59	78.7
	5,4	1.34	77.0
	5,5	0.66	81.0
El Segundo	6,1	3.41	77.0
	6,2	1.19	78.5
	6,3	1.33	78.6
	6,4	2.08	76.5
	6,5	0.85	77.9
	6,5 dup	0.78	
Hermosa	7,1	0.78	79.5
	7,2	2.20	78.9
	7,3	2.52	77.5
	7,4	1.15	79.5
	7,5	1.14	79.6

Percent lipid and percent moisture in Yellow Rock Crab

Location	Sample Number	%Lipid	% Moisture
White Pt.	12,1	0.110	82.9
	12,2	0.028	77.3
	12,3	0.043	75.2
	12,4	0.008	75.1
	12,4 dup	0.045	
	12,5	0.015	78.4
Dana Pt.	13,1	0.213	83.8
	13,2	0.205	83.0
	13,3	0.273	86.7
	13,4	0.083	81.5
	13,5	0.100	84.6

Polychlorinated Biphenyls in White Croaker
Concentrations reported as ng/g (ppb) of the wet weight

Location	Pt. Dume					
	1,1	1,2	1,3	1,3dup	1,4	1,5
IUPAC Congener #						
7,9	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	0.07	<0.05	0.03	0.09	0.03	0.13
15,17	0.05	<0.05	0.03	0.10	0.03	0.13
27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
16,32	<0.05	0.05	0.04	0.10	<0.05	<0.05
26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
31	0.16	0.13	0.10	0.19	0.07	0.12
28	0.41	0.28	0.28	0.40	0.22	0.55
33,20,53	<0.05	<0.05	0.07	0.12	<0.05	<0.05
22	<0.05	<0.05	0.08	0.13	<0.05	<0.05
45	<0.05	0.17	0.10	0.19	0.07	<0.05
46	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
49	0.98	0.92	1.11	1.14	0.74	1.39
47,75,48	1.22	1.08	1.35	1.49	0.99	1.71
44	0.42	0.40	0.42	0.48	0.29	0.51
59,42,37	<0.05	0.18	1.97	0.20	0.96	1.55
41,64	0.43	0.37	0.42	0.55	0.27	0.40
96	<0.05	<0.05	0.02	0.02	<0.05	<0.05
40	0.10	0.10	0.13	0.18	0.09	0.14
67	<0.05	<0.05	<0.05	<0.05	<0.05	0.28
63	<0.05	<0.05	<0.05	<0.05	<0.05	0.10
74	0.67	0.70	0.71	0.79	0.58	1.00
70	0.82	0.75	0.63	0.73	0.50	0.71
66,95	2.23	2.46	2.39	2.78	1.82	3.31
91	0.26	0.34	0.29	0.36	0.25	0.35
101	2.78	4.40	3.64	4.06	2.99	4.53
99	2.43	3.90	3.32	3.74	2.84	3.93
119	0.15	0.20	0.29	0.24	0.17	0.18
97	0.84	1.11	1.17	1.15	0.83	1.23
136	0.85	1.29	1.26	0.99	0.96	1.06
110	2.08	3.06	2.86	2.72	2.24	3.26
82,151	0.27	0.46	0.42	0.37	0.32	0.41
135	0.91	1.35	1.38	1.25	0.97	1.14
107	0.53	0.79	0.86	0.76	0.61	0.71
149	2.11	3.77	3.01	3.29	2.75	3.46
118	3.14	5.55	4.52	4.94	3.80	5.50
134	0.28	0.30	0.33	0.28	0.29	0.30
146	1.05	1.91	1.64	1.70	1.36	1.54
153	6.70	14.83	10.19	11.35	9.75	11.61
132	0.93	1.58	1.42	1.45	1.19	1.37
105	0.83	1.70	1.11	1.24	0.99	1.77
105+132	@N/A	@N/A	@N/A	@N/A	@N/A	@N/A
141	0.38	0.88	0.65	0.65	0.64	0.72
137	0.12	0.27	0.24	0.23	0.20	0.21
176	0.35	0.59	0.56	0.57	0.46	0.53
138	3.19	6.70	4.55	5.03	4.45	5.55
158	0.50	1.04	0.76	0.89	0.66	0.78
129,178	1.08	1.98	1.23	1.80	1.50	1.64
187	1.71	3.65	2.55	2.95	2.48	2.84
183	0.43	1.08	0.73	0.80	0.71	0.78
128,167	1.31	2.40	1.81	1.93	1.67	2.14
185	0.16	0.36	0.29	0.28	0.26	0.29
174	0.45	1.04	0.70	0.81	0.80	0.85
177	0.54	1.02	0.75	0.87	0.77	0.86
156,171	1.50	3.09	2.15	2.33	2.27	2.73
173,157	0.23	0.43	0.33	0.36	0.32	0.38
172	0.16	0.31	0.24	0.17	0.25	0.27
180	1.34	3.92	2.31	2.63	2.60	2.90
193	0.25	0.46	0.39	0.52	0.38	0.69
191	0.03	0.10	0.05	0.08	0.06	0.07
170,190	0.88	2.14	1.34	1.49	1.52	1.72
199	0.47	1.12	0.74	0.90	0.82	0.96
196,203	0.58	1.66	0.98	1.17	1.12	1.31
189	0.03	0.04	0.04	0.03	0.04	0.05
195	0.16	0.64	0.43	0.49	0.31	0.34
194	0.34	0.90	0.56	0.63	0.65	0.77
206	0.45	0.94	0.66	0.84	0.74	0.91
Sum of Congeners	50.3	90.9	72.7	78.0	64.7	84.7
Aroclor 1242	1.8	0.8	1.1	2.4	0.9	2.4
Aroclor 1254	37.7	64.2	52.9	55.4	43.8	65.5
Aroclor 1260	19.6	52.6	32.3	36.2	35.5	39.8

@N/A Congeners Separated

Polychlorinated Biphenyls in White Croaker (cont.)

Location	Santa Monica				
	3,1	3,2	3,3	3,4	3,5
IUPAC Congener #					
7,9	<0.05	<0.05	<0.05	<0.05	0.01
6	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	0.09
19	<0.05	<0.05	<0.05	<0.05	0.03
18	<0.05	<0.05	<0.05	<0.05	0.26
15,17	<0.05	<0.05	<0.05	<0.05	<0.05
27	<0.05	<0.05	<0.05	<0.05	0.04
16,32	<0.05	<0.05	<0.05	<0.05	<0.05
26	<0.05	<0.05	<0.05	<0.05	0.09
25	<0.05	<0.05	<0.05	<0.05	0.25
31	0.26	0.05	0.11	0.10	0.18
28	0.57	0.12	0.36	0.30	0.11
33,20,53	0.14	<0.05	<0.05	0.09	0.17
22	0.21	<0.05	0.11	<0.05	0.57
45	0.29	0.02	0.17	0.13	1.05
46	<0.05	<0.05	<0.05	<0.05	0.19
49	1.45	0.67	1.42	1.35	<0.05
47,75,48	1.77	0.74	<0.05	1.58	0.44
44	0.67	0.06	0.51	0.33	0.11
59,42,37	1.72	0.13	1.86	0.92	0.15
41,64	2.12	0.08	2.02	1.20	0.66
96	<0.05	<0.05	<0.05	<0.05	0.08
40	0.22	0.04	<0.05	0.08	0.08
67	<0.05	<0.05	<0.05	<0.05	<0.05
63	<0.05	<0.05	<0.05	<0.05	<0.05
74	1.00	0.43	1.27	0.66	0.22
70	1.22	0.44	0.85	0.60	<0.05
66,95	3.50	1.26	4.09	2.16	0.28
91	0.39	0.15	0.49	0.24	0.11
101	4.17	1.78	6.47	3.02	0.16
99	3.33	1.73	6.60	2.87	0.16
119	0.21	0.11	0.36	0.17	0.13
97	1.22	0.46	1.75	0.85	0.03
136	0.86	0.33	1.40	0.70	<0.05
110	2.82	0.24	4.59	2.17	0.20
82,151	0.37	0.14	0.66	0.30	0.10
135	1.22	0.60	1.85	0.91	0.06
107	0.68	0.32	1.30	0.60	0.09
149	3.14	1.64	5.85	2.55	0.06
118	4.38	2.31	9.15	4.00	0.07
134	0.27	0.26	0.37	0.29	<0.05
146	1.34	0.78	3.08	1.26	0.02
153	9.44	5.58	23.34	9.37	0.19
132	1.25	<0.05	2.23	1.01	0.08
105	1.21	0.21	2.91	1.06	0.03
105+132	@N/A	@N/A	@N/A	@N/A	@N/A
141	0.55	0.31	1.30	0.58	0.03
137	0.19	0.09	0.42	0.18	0.06
176	0.50	0.22	0.91	0.40	0.04
138	4.62	2.16	11.20	4.45	0.08
158	0.48	0.28	1.22	0.52	0.19
129,178	1.33	0.77	2.85	1.26	0.06
187	2.20	1.35	5.39	2.18	0.06
183	0.58	0.37	1.57	0.58	0.03
128,167	1.90	0.24	4.23	1.65	0.15
185	0.23	0.13	0.43	0.23	0.04
174	0.67	0.38	1.53	0.64	0.02
177	0.72	0.28	1.54	0.66	0.02
156,171	2.41	1.08	2.17	0.92	0.04
173,157	0.31	0.18	0.67	0.29	<0.05
172	0.21	0.13	0.47	0.21	<0.05
180	1.97	1.27	6.07	2.24	0.03
193	0.80	0.10	1.09	0.29	<0.05
191	0.05	0.03	0.12	0.05	<0.05
170,190	1.29	0.68	3.54	1.29	0.03
199	0.60	0.40	1.49	0.61	0.01
196,203	0.77	0.52	2.06	0.80	0.02
189	0.04	0.02	0.05	0.03	<0.05
195	0.20	0.13	0.56	0.21	<0.05
194	0.47	0.30	1.17	0.47	0.01
206	0.56	0.40	1.19	0.54	0.02
Sum of Congeners	75.1	32.5	138.4	62.1	7.5
Aroclor 1242	1.7	0.3	0.7	0.7	2.8
Aroclor 1254	52.3	17.2	103.6	45.0	1.9
Aroclor 1260	28.3	17.1	82.3	30.2	0.6

@N/A Congeners Separated

Polychlorinated Biphenyls in White Croaker (cont.)

Location	Hyperion				
	5,1	5,2	5,3	5,4	5,5
IUPAC Congener #					
7,9	<0.05	<0.05	<0.05	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	<0.05
19	<0.05	<0.05	<0.05	<0.05	<0.05
18	<0.05	<0.05	<0.05	<0.05	<0.05
15,17	<0.05	<0.05	<0.05	<0.05	<0.05
27	<0.05	<0.05	<0.05	<0.05	<0.05
16,32	<0.05	<0.05	<0.05	<0.05	<0.05
26	<0.05	<0.05	<0.05	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05
31	0.22	0.62	0.26	0.63	0.19
28	0.66	1.45	0.85	1.38	0.53
33,20,53	<0.05	<0.05	<0.05	<0.05	<0.05
22	<0.05	<0.05	<0.05	<0.05	<0.05
45	<0.05	<0.05	<0.05	<0.05	<0.05
46	<0.05	<0.05	<0.05	<0.05	<0.05
49	2.77	4.55	3.36	<0.05	1.91
47,75,48	3.73	5.06	4.13	<0.05	2.40
44	0.84	1.55	1.02	3.48	0.81
59,42,37	0.35	<0.05	0.35	<0.05	0.29
41,64	0.74	0.95	0.62	2.13	1.20
96	0.02	<0.05	<0.05	<0.05	<0.05
40	0.13	<0.05	<0.05	<0.05	<0.05
67	0.39	<0.05	<0.05	<0.05	<0.05
63	0.29	<0.05	<0.05	<0.05	<0.05
74	2.90	4.74	3.09	4.61	1.98
70	1.80	4.14	2.22	4.44	1.12
66,95	8.28	12.14	9.46	17.18	4.96
91	1.02	1.29	1.09	1.92	0.57
101	12.12	13.30	10.53	10.49	7.40
99	11.60	10.69	9.82	9.52	7.12
119	0.57	1.36	0.48	0.66	0.33
97	3.84	4.76	3.62	3.79	2.00
136	2.14	2.06	2.01	1.81	1.14
110	5.94	5.38	4.47	3.12	5.40
82,151	0.93	0.82	0.74	0.74	0.58
135	3.14	3.35	2.95	2.84	1.54
107	1.89	1.70	1.61	1.63	1.20
149	9.55	9.36	7.91	7.33	4.90
118	18.05	16.99	14.94	16.01	10.29
134	0.35	0.38	0.33	0.31	0.33
146	4.58	3.73	3.49	3.23	2.19
153	32.21	25.03	22.30	22.09	17.33
132	3.99			1.39	4.17
105	3.01			1.68	1.84
105+132	@N/A	14	12	@N/A	@N/A
141	2.72	2.78	1.99	2.04	1.38
137	0.78	0.75	0.62	0.60	0.51
176	1.62	1.52	1.27	1.13	0.73
138	17.26	13.19	11.41	10.97	8.74
158	3.25	2.88	2.23	2.15	1.67
129,178	4.97	4.83	3.82	3.48	2.32
187	7.90	6.61	5.23	7.10	4.09
183	2.77	2.27	1.62	2.59	1.35
128,167	3.52	2.33	1.92	0.93	3.22
185	0.96	1.23	0.77	1.41	0.44
174	2.78	2.76	2.00	2.14	1.45
177	2.23	1.93	1.58	1.44	1.08
156,171	8.06	6.79	5.06	5.46	3.89
173,157	1.10	0.98	.81	0.75	0.56
172	0.78	0.71	0.51	0.53	0.34
180	10.47	8.62	5.80	7.35	5.11
193	1.06	0.73	0.60	0.55	0.68
191	0.25	0.21	0.15	1.18	0.13
170,190	5.54	4.39	3.22	3.88	2.68
199	2.45	2.36	1.61	2.11	1.31
196,203	3.46	3.27	2.10	3.00	2.12
189	0.06	0.07	0.05	0.09	0.04
195	1.37	1.25	0.85	1.33	0.76
194	2.01	1.83	1.12	1.96	1.08
206	1.82	1.50	1.14	1.83	1.13
Sum of Congeners	227.2	225.2	181.1	188.4	130.6
Aroclor 1242	1.4	4.0	1.7	4.1	1.2
Aroclor 1254	168.0	139.2	120.8	129.4	109.1
Aroclor 1260	138.3	112.6	78.3	101.8	67.4

@N/A Congeners Separated

Polychlorinated Biphenyls in White Croaker (cont.)

Location	Hermosa				
	7,1	7,2	7,3	7,4	7,5
IUPAC Congener #					
7,9	<0.05	<0.05	<0.05	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	<0.05
19	<0.05	<0.05	<0.05	<0.05	<0.05
18	<0.05	<0.05	<0.05	<0.05	<0.05
15,17	<0.05	<0.05	<0.05	<0.05	<0.05
27	<0.05	<0.05	<0.05	<0.05	<0.05
16,32	<0.05	<0.05	<0.05	<0.05	<0.05
26	<0.05	<0.05	<0.05	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05
31	0.15	0.27	0.21	0.13	0.28
28	0.35	0.85	0.75	0.45	0.86
33,20,53	<0.05	<0.05	<0.05	<0.05	<0.05
22	<0.05	<0.05	<0.05	<0.05	<0.05
45	<0.05	<0.05	<0.05	<0.05	<0.05
46	<0.05	<0.05	<0.05	<0.05	<0.05
49	<0.05	6.64	3.77	1.66	3.40
47,75,48	<0.05	6.23	3.49	1.65	3.53
44	1.80	0.47	0.23	0.67	0.84
59,42,37	0.84	0.14	0.08	0.56	0.34
41,64	<0.05	0.06	0.13	0.87	0.50
96	0.38	<0.05	0.02	0.05	0.02
40	1.44	0.37	0.15	0.18	0.11
67	2.24	1.93	0.61	0.42	0.40
63	0.52	0.47	0.33	0.17	0.36
74	1.12	2.27	3.14	1.62	3.56
70	0.87	1.60	1.98	1.08	2.68
66,95	4.94	5.59	8.19	4.39	8.25
91	0.76	1.18	0.90	0.42	0.77
101	1.91	9.14	12.20	6.81	10.71
99	1.95	9.75	15.04	8.06	12.04
119	0.19	0.87	0.90	0.85	0.61
97	0.55	2.08	2.79	2.50	2.75
136	0.42	1.93	2.45	2.17	2.58
110	0.47	1.66	1.61	4.91	3.53
82,151	0.12	0.79	0.98	0.80	0.81
135	0.52	2.75	3.28	2.05	2.22
107	0.36	1.91	2.51	1.64	1.90
149	1.33	7.12	9.48	4.34	5.58
118	3.87	13.87	21.27	11.04	17.02
134	0.43	0.70	0.73	0.42	0.42
146	0.81	4.00	5.66	2.61	3.46
153	5.00	28.30	41.36	21.65	29.02
132				3.55	1.59
105				1.45	1.30
105+132	0.89	1.8	2.5	@N/A	@N/A
141	0.33	1.81	2.51	1.29	1.70
137	0.06	0.55	1.00	0.43	0.58
176	0.27	1.03	1.45	0.76	0.87
138	2.44	10.58	16.47	10.08	11.64
158	0.43	1.85	3.18	2.07	2.37
129,178	0.85	3.58	4.54	1.46	3.05
187	2.11	5.74	8.40	4.41	5.05
183	0.83	1.72	2.81	1.48	1.72
128,167	0.64	1.07	1.59	4.12	0.76
185	0.35	0.62	0.79	0.54	0.52
174	0.34	1.99	2.63	1.26	1.42
177	0.27	1.06	1.42	1.12	1.12
156,171	1.35	5.45	7.80	4.47	5.13
173,157	0.10	1.36	1.20	0.66	0.55
172	0.39	0.85	0.72	0.19	0.27
180	1.31	6.75	10.37	4.87	6.10
193	0.22	1.29	1.06	0.37	0.64
191	0.30	0.39	0.24	0.15	0.16
170,190	1.10	3.14	5.23	2.87	3.45
199	0.50	1.54	2.36	1.09	1.25
196,203	0.70	2.12	3.51	1.62	1.91
189	0.05	0.05	0.05	0.04	0.04
195	0.14	0.54	1.42	0.72	0.76
194	0.48	1.17	1.94	0.93	1.05
206	0.90	1.64	2.16	1.17	1.08
Sum of Congeners	50.7	172.6	231.6	137.4	174.7
Aroclor 1242	1.0	1.7	1.3	0.8	1.8
Aroclor 1254	27.0	96.6	142.4	108.3	136.0
Aroclor 1260	23.9	85.5	135.6	67.9	83.0

@N/A Congeners Separated

Polychlorinated Biphenyls in White Croaker (cont.)

Location	Palos Verde S.					
	9,1	9,1 dup	9,2	9,3	9,4	9,5
IUPAC Congener #						
7,9	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
18	1.48	1.48	1.10	1.85	0.52	0.67
15,17	1.11	1.11	0.83	1.35	0.39	0.52
27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
16,32	1.10	1.11	1.40	1.25	0.30	0.42
26	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
31	3.37	3.63	0.27	5.08	1.02	1.36
28	12.00	12.94	25.00	14.90	2.83	4.44
33,20,53	3.15	3.35	1.80	4.30	0.89	1.40
22	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
45	3.69	3.87	9.40	4.05	0.77	1.39
46	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
49	39.00	40.66	45.00	40.62	7.92	15.98
47,75,48	37.44	39.35	23.00	38.91	7.84	13.76
44	20.68	21.78	24.00	23.06	4.26	7.89
59,42,37	7.79	7.91	8.90	8.02	1.87	2.97
41,64	26.22	27.57	32.00	28.37	5.40	10.42
96	0.48	0.51	0.54	0.48	0.11	<0.05
40	4.04	3.70	4.80	4.18	0.55	1.08
67	39.43	31.79	38.00	42.11	0.80	7.52
63	3.21	3.33	4.30	3.47	0.83	<0.05
74	29.39	30.93	35.00	30.78	7.02	12.11
70	43.86	48.53	65.00	53.06	8.73	15.65
66,95	92.31	97.76	112.00	93.03	18.64	36.52
91	9.49	10.26	11.00	9.93	1.98	3.57
101	79.08	83.46	110.00	72.89	17.92	29.22
99	57.73	60.62	66.00	49.37	15.72	21.86
119	2.97	3.13	2.80	2.61	0.87	1.28
97	22.61	23.63	30.00	21.79	5.18	9.43
136	15.87	18.27	14.50	14.67	4.05	6.14
110	58.82	63.59	66.00	55.15	13.00	23.12
82,151	6.40	6.88	12.00	5.80	1.50	2.20
135	15.76	17.02	17.00	14.68	3.61	5.83
107	9.11	9.79	11.00	7.86	2.69	3.52
149	33.94	35.65	40.00	29.61	8.28	12.32
118	81.10	86.72	97.00	67.76	22.40	31.02
134	1.77	1.96	4.80	1.71	0.66	0.86
146	13.08	13.79	15.00	10.94	4.08	5.06
153	82.65	85.35	100.00	65.94	29.54	32.24
132						
105						
105+132	61	65.0208	80.00	53	14	21
141	8.66	9.26	10.00	7.52	2.24	2.82
137	2.16	2.30	2.80	1.82	0.72	0.84
176	6.76	6.59	5.00	6.16	1.39	2.07
138	46.21	47.83	56.00	37.24	13.94	16.74
158	9.95	10.79	12.00	8.53	2.89	3.64
129,178	13.10	14.08	13.00	11.14	3.81	4.55
187	13.78	14.30	17.00	10.48	4.97	4.92
183	5.49	5.78	6.20	4.32	1.71	1.82
128,167	20.25	21.28	23.00	16.49	5.61	7.25
185	4.74	4.58	4.00	3.35	0.83	0.96
174	6.98	7.49	8.80	5.95	1.84	2.17
177	5.97	6.29	7.20	5.00	1.62	1.96
156,171	23.68	21.80	35.00	22.05	5.75	6.76
173,157	2.65	3.02	3.40	2.26	0.61	0.78
172	1.81	1.93	2.40	1.54	0.32	0.32
180	15.50	15.93	38.00	11.86	5.68	5.04
193	11.51	5.54	1.40	10.12	1.20	1.78
191	0.87	0.88	0.78	0.80	0.17	0.19
170,190	9.08	9.53	15.00	6.89	3.72	3.95
199	3.35	3.47	4.30	2.54	1.16	0.96
196,203	4.40	4.54	5.80	3.18	1.60	1.28
189	0.60	0.60	0.51	0.62	0.07	0.10
195	1.96	2.00	2.50	1.45	0.62	0.53
194	3.00	3.08	4.10	2.31	1.04	0.88
206	1.72	1.77	2.50	1.13	0.71	0.52
Sum of Congeners	1145.3	1191.1	1390.1	1067.3	280.4	415.6
Aroclor 1242	38.3	39.9	14.1	53.2	12.4	16.4
Aroclor 1254	870.7	935.3	1014.3	764.9	220.3	336.9
Aroclor 1260	221.4	230.1	435.9	169.9	81.7	79.5

@N/A Congeners Separated

Polychlorinated Biphenyls in White Croaker (cont.)

Location	Dana Pt.					
	11,1	11,2	11,3	11,3 dup	11,4	11,5
IUPAC Congener #						
7,9	<0.05	<0.05	<0.05	0.04	<0.05	<0.05
6	<0.05	<0.05	<0.05	0.06	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	0.03	<0.05	<0.05
19	<0.05	<0.05	<0.05	0.03	<0.05	<0.05
18	<0.05	<0.05	<0.05	0.02	0.01	0.02
15,17	<0.05	<0.05	<0.05	0.01	0.01	0.01
27	<0.05	<0.05	<0.05	0.00	<0.05	<0.05
16,32	<0.05	<0.05	<0.05	0.01	<0.05	<0.05
26	<0.05	<0.05	<0.05	0.02	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
31	0.10	0.03	0.06	0.06	<0.05	0.03
28	0.16	0.09	0.08	0.11	<0.05	0.08
33,20,53	0.02	0.02	<0.05	0.02	0.03	0.05
22	0.04	0.03	<0.05	0.02	0.03	0.02
45	0.04	0.03	<0.05	0.04	0.06	0.02
46	0.03	0.02	<0.05	0.02	<0.05	0.01
49	0.54	0.37	0.28	0.35	<0.05	0.22
47,75,48	0.49	0.11	0.27	0.51	<0.05	0.18
44	0.24	0.16	0.10	0.15	0.10	0.09
59,42,37	0.09	0.06	0.04	0.06	0.04	0.04
41,64	0.29	0.16	0.10	0.15	0.09	0.09
96	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
40	0.04	0.07	0.02	0.05	0.02	0.01
67	0.13	0.06	0.09	0.11	<0.05	0.06
63	0.06	0.04	0.03	0.04	<0.05	0.02
74	0.56	0.37	0.23	0.39	0.17	0.15
70	0.38	0.14	0.11	0.17	0.14	0.15
66,95	1.44	1.10	0.66	1.06	0.48	0.49
91	0.14	0.07	0.05	0.08	0.04	0.03
101	1.80	1.30	0.83	1.43	0.56	0.53
99	1.60	1.30	0.92	1.55	0.61	0.52
119	0.09	0.64	<0.05	2.06	<0.05	<0.05
97	0.50	0.32	0.24	0.41	0.17	0.16
136	0.48	0.26	0.24	0.43	0.19	0.17
110	1.23	0.80	0.53	0.94	0.40	0.36
82,151	3.20	1.02	1.50	1.50	1.20	0.92
135	0.59	0.42	0.33	0.57	0.33	0.28
107	0.30	0.19	0.18	0.32	0.15	0.10
149	1.14	0.95	0.65	1.12	0.48	0.44
118	2.22	1.83	1.39	2.30	0.91	0.74
134	0.20	0.18	0.19	0.21	0.19	0.18
146	0.58	0.42	0.40	0.71	0.30	0.24
153	4.09	3.60	2.70	2.00	1.72	1.37
132	0.70	0.29	0.21	0.40	0.16	0.14
105	0.37	0.40	0.30	0.54	0.20	0.16
105+132	@N/A	@N/A	@N/A	@N/A	@N/A	@N/A
141	0.28	0.15	0.16	0.29	0.11	0.10
137	0.08	0.03	0.06	0.11	0.04	0.05
176	0.20	0.07	0.12	0.23	0.10	0.06
138	1.87	1.60	1.23	2.21	0.79	0.63
158	0.29	0.12	0.17	0.37	0.12	0.08
129,178	0.51	1.20	0.32	0.76	0.29	0.16
187	0.86	0.71	0.58	1.06	0.42	0.34
183	0.25	0.19	0.17	0.30	0.11	0.09
128,167	0.75	0.59	0.48	0.85	0.34	0.28
185	0.11	0.03	0.05	0.12	0.05	0.03
174	0.26	0.16	0.14	0.27	0.11	0.09
177	0.24	0.14	0.13	0.27	0.11	0.08
156,171	0.28	0.48	0.17	0.91	0.32	0.08
173,157	0.08	0.02	0.07	0.07	0.09	0.04
172	0.09	0.01	0.06	0.11	0.08	0.04
180	0.81	0.67	0.51	0.99	0.39	0.27
193	0.21	0.17	0.14	0.17	0.17	0.04
191	0.02	0.06	0.01	0.02	<0.05	<0.05
170,190	0.53	0.42	0.34	0.62	0.22	0.18
199	0.22	0.03	0.14	0.25	0.11	0.09
196,203	0.28	0.21	0.18	0.33	0.14	0.11
189	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
195	0.12	0.09	0.07	0.13	0.05	0.04
194	0.19	0.16	0.11	0.21	0.08	0.07
206	0.17	0.12	0.09	0.18	0.08	0.06
Sum o Congeners	32.6	24.3	18.2	30.9	13.1	11.1
Aroclor 1242	0.7	0.2	0.4	0.6	0.1	0.4
Aroclor 1254	23.8	18.9	13.8	23.5	9.4	7.8
Aroclor 1260	11.7	9.4	7.5	14.1	5.4	3.9

@N/A Congeners Separated

Polychlorinated Biphenyls in Yellow Rock Crab (Cont.)

Location	Dana Pt.				
	13.1	13.2	13.3	13.4	13.5
IUPAC Congener #					
7,9	<0.05	<0.05	<0.05	<0.05	<0.05
6	<0.05	<0.05	<0.05	<0.05	<0.05
5,8	<0.05	<0.05	<0.05	<0.05	<0.05
19	<0.05	<0.05	<0.05	<0.05	<0.05
18	<0.05	<0.05	<0.05	<0.05	<0.05
15,17	<0.05	<0.05	<0.05	<0.05	<0.05
27	<0.05	<0.05	<0.05	<0.05	<0.05
16,32	<0.05	<0.05	<0.05	<0.05	<0.05
26	<0.05	<0.05	<0.05	<0.05	<0.05
25	<0.05	<0.05	<0.05	<0.05	<0.05
31	<0.05	0.01	0.02	0.02	0.03
28	0.05	0.07	0.06	<0.05	<0.05
33,20,53	<0.05	<0.05	<0.05	<0.05	<0.05
22	<0.05	<0.05	<0.05	<0.05	<0.05
45	<0.05	<0.05	<0.05	<0.05	<0.05
46	<0.05	<0.05	<0.05	<0.05	<0.05
49	<0.05	<0.05	0.11	0.05	0.07
47,75,48	<0.05	<0.05	0.05	<0.05	0.04
44	0.03	0.04	0.04	0.01	0.02
59,42,37	<0.05	0.01	0.01	<0.05	<0.05
41,64	<0.05	0.05	0.04	<0.05	0.01
96	<0.05	<0.05	<0.05	<0.05	<0.05
40	<0.05	<0.05	<0.05	<0.05	<0.05
67	<0.05	<0.05	<0.05	<0.05	<0.05
63	0.03	0.01	<0.05	0.04	0.04
74	0.07	0.11	0.13	0.06	0.10
70	0.04	0.06	0.06	0.02	0.02
66,95	0.10	0.16	0.15	0.06	0.10
91	<0.05	0.01	0.01	<0.05	0.01
101	0.12	0.16	0.16	0.06	0.14
99	0.12	0.12	0.13	0.05	0.13
119	<0.05	<0.05	0.16	<0.05	<0.05
97	0.06	0.08	0.08	0.03	0.05
136	<0.05	<0.05	<0.05	<0.05	<0.05
110	0.03	0.09	0.08	0.02	0.05
82,151	0.08	0.09	0.10	0.04	0.10
135	0.02	0.03	0.03	<0.05	0.03
107	0.03	0.03	0.03	<0.05	0.03
149	0.08	0.09	0.10	0.05	0.10
118	0.27	0.29	0.28	0.12	0.26
134	<0.05	<0.05	<0.05	<0.05	<0.05
146	0.07	0.06	0.06	0.03	0.07
153	0.30	0.32	0.31	0.15	0.37
132	0.09	0.11	0.11	0.04	0.09
105	<0.05	<0.05	<0.05	<0.05	<0.05
105+132	@N/A	@N/A	@N/A	@N/A	@N/A
141	0.02	0.02	0.02	<0.05	0.02
137	0.05	0.03	0.05	0.25	0.06
176	0.02	0.02	0.02	<0.05	0.02
138	0.17	0.21	0.19	0.09	0.19
158	<0.05	0.02	0.02	<0.05	<0.05
129,178	0.04	0.05	0.04	<0.05	0.04
187	0.08	0.08	0.08	0.04	0.09
183	0.02	0.02	0.02	0.01	0.02
128,167	0.08	0.08	0.09	0.04	0.08
185	<0.05	<0.05	<0.05	<0.05	<0.05
174	0.02	0.02	0.02	<0.05	0.02
177	0.02	0.02	0.02	0.01	0.02
156,171	0.04	0.05	0.05	<0.05	0.04
173,157	<0.05	<0.05	<0.05	<0.05	<0.05
172	<0.05	<0.05	<0.05	<0.05	<0.05
180	0.05	0.05	0.05	0.02	0.05
193	<0.05	<0.05	<0.05	<0.05	<0.05
191	<0.05	<0.05	<0.05	<0.05	<0.05
170,190	0.03	0.04	0.05	0.01	0.03
199	0.02	0.02	0.01	<0.05	0.01
196,203	0.02	0.02	0.02	<0.05	0.01
189	<0.05	<0.05	<0.05	<0.05	<0.05
195	<0.05	<0.05	<0.05	<0.05	<0.05
194	<0.05	0.01	<0.05	<0.05	<0.05
206	<0.05	<0.05	<0.05	<0.05	<0.05
Sum of Congeners	2.3	2.8	3.0	1.3	2.6
Aroclor 1242	0.0	0.1	0.1	0.1	0.2
Aroclor 1254	1.9	2.3	2.2	0.9	2.0
Aroclor 1260	0.7	0.9	0.9	0.3	0.8

@N/A Congeners Separated

Pesticides in White Croaker
Concentrations in ng/g (ppb) of the wet weight

Location	Pt. Dume					
	1,1	1,2	1,3	1,3dup	1,4	1,5
p,p'-DDE	97.20	180.60	160.29	200.88	126.20	170.39
p,p'-DDD	4.84	3.66	5.61	6.59	2.90	5.16
p,p'-DDT	0.76	0.74	0.71	1.19	<0.05	<0.05
o,p'-DDE	6.29	7.21	7.42	8.09	5.01	7.24
o,p'-DDD	0.45	0.46	0.38	0.66	0.10	<0.05
o,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DDMU	11.40	7.68	10.46	13.74	7.49	11.18
HCB	0.08	0.06	<0.05	0.04	0.05	0.09
A-HCH	0.11	0.30	0.22	0.41	<0.05	<0.05
B-HCH	<0.05	0.10	0.12	0.20	<0.05	0.02
G-HCH	<0.05	0.09	0.04	0.13	<0.05	0.61
Oxychlordane	0.15	0.12	0.08	0.20	0.05	<0.05
Trans-nonachlor	1.07	1.57	1.26	1.80	0.86	0.86
Cis-nonachlor	0.82	1.29	0.96	1.15	0.51	0.96
Trans-chlordane	0.55	0.80	0.51	0.59	0.27	0.55
Cis-chlordane	0.93	1.31	0.92	1.09	0.46	1.02

Pesticides in White Croaker (Cont.)

Location	Santa Monica				
	3,1	3,2	3,3	3,4	3,5
p,p'-DDE	153.49	68.27	283.54	105.35	4.04
p,p'-DDD	6.49	3.27	5.95	3.84	8.56
p,p'-DDT	2.35	0.48	1.07	0.62	1.83
o,p'-DDE	10.78	2.57	12.42	6.01	0.43
o,p'-DDD	0.74	0.57	0.46	0.30	0.65
o,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05
DDMU	15.41	6.21	16.94	8.90	0.59
HCB	0.10	<0.05	<0.05	0.05	0.00
A-HCH	0.69	0.12	0.20	0.37	0.57
B-HCH	0.29	0.09	0.14	0.10	0.19
G-HCH	0.15	0.04	0.03	0.11	0.15
Oxychlordane	0.19	0.09	0.24	0.17	0.20
Trans-nonachlor	1.71	1.33	2.46	1.16	0.80
Cis-nonachlor	1.19	0.65	1.92	0.93	2.26
Trans-chlordane	1.35	0.48	0.89	0.69	0.93
Cis-chlordane	1.85	0.73	1.62	1.08	1.82

Pesticides in White Croaker (Cont.)

Location	Hyperion				
	5,1	5,2	5,3	5,4	5,5
p,p'-DDE	477.13	271.81	417.83	279.78	249.60
p,p'-DDD	9.69	6.34	9.86	7.49	3.33
p,p'-DDT	1.03	0.58	1.12	0.68	0.44
o,p'-DDE	10.69	7.39	10.20	9.64	4.69
o,p'-DDD	1.15	0.86	1.13	1.24	<0.05
o,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05
DDMU	22.07	14.39	20.71	17.65	8.66
HCB	0.01	<0.05	<0.05	<0.05	<0.05
A-HCH	0.44	0.40	0.53	0.42	0.01
B-HCH	0.15	0.20	0.19	0.20	0.06
G-HCH	0.09	0.13	0.13	0.18	<0.05
Oxychlordane	0.25	0.11	0.23	0.16	0.08
Trans-nonachlor	5.54	4.40	4.81	4.73	1.66
Cis-nonachlor	3.01	2.06	2.09	1.82	1.15
Trans-chlordane	1.37	1.91	1.40	1.46	0.51
Cis-chlordane	2.78	3.20	2.58	2.70	1.16

Pesticides in White Croaker (Cont.)

Location	Hermosa				
	7,1	7,2	7,3	7,4	7,5
p,p'-DDE	102.51	362.51	532.37	292.92	827.86
p,p'-DDD	5.53	12.26	18.83	9.32	22.83
p,p'-DDT	0.56	0.76	2.98	1.28	2.53
o,p'-DDE	6.77	14.41	20.00	16.79	41.81
o,p'-DDD	0.38	3.13	4.06	0.69	2.47
o,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05
DDMU	12.66	31.45	42.63	26.43	64.41
HCB	<0.05	<0.05	<0.05	0.05	<0.05
A-HCH	0.23	0.55	0.73	0.22	0.38
B-HCH	0.05	0.20	0.28	0.15	0.15
G-HCH	0.06	0.12	0.22	0.07	0.13
Oxychlordane	0.06	0.18	0.34	0.13	0.15
Trans-nonachlor	0.93	4.04	6.15	2.06	3.37
Cis-nonachlor	0.27	1.71	2.54	1.33	1.51
Trans-chlordane	0.27	0.40	1.09	0.32	0.49
Cis-chlordane	0.39	1.73	2.21	0.86	1.12

Pesticides in White Croaker (Cont.)

Location	Palos Verde S.					
	9,1	9,1 dup	9,2	9,3	9,4	9,5
p,p'-DDE	10400.00	15941.44	9700.00	17040.29	3911.38	6162.65
p,p'-DDD	276.79	283.45	$N/A	367.20	77.99	140.43
p,p'-DDT	8.95	10.44	$N/A	11.25	5.38	9.14
o,p'-DDE	863.51	824.77	$N/A	862.86	182.79	336.34
o,p'-DDD	39.18	41.06	$N/A	54.53	12.31	22.04
o,p'-DDT	<0.05	<0.05	$N/A	<0.05	<0.05	<0.05
DDMU	1197.80	1282.29	$N/A	1225.31	218.81	431.00
HCB	0.33	0.31	$N/A	0.36	0.14	0.19
A-HCH	0.84	1.02	$N/A	0.82	0.42	0.66
B-HCH	0.47	0.44	$N/A	0.44	0.14	0.23
G-HCH	0.22	0.27	$N/A	0.22	0.10	0.14
Oxychlordane	0.39	0.46	$N/A	0.40	0.22	0.41
Trans-nonachlor	8.33	8.62	$N/A	7.36	2.39	4.02
Cis-nonachlor	4.76	4.60	$N/A	4.27	1.48	2.88
Trans-chlordane	5.11	4.90	$N/A	5.84	1.28	3.06
Cis-chlordane	5.20	5.38	$N/A	5.76	1.67	3.68

$N/A not analyzed

Pesticides in White Croaker (Cont.)

Location	Dana Pt.					
	11,1	11,2	11,3	11,3 dup	11,4	11,5
p,p'-DDE	180.74	102.27	67.31	82.39	31.00	34.15
p,p'-DDD	3.65	2.16	1.19	0.99	0.87	1.18
p,p'-DDT	0.84	1.02	0.82	0.86	0.56	0.82
o,p'-DDE	2.05	2.23	1.04	1.44	0.90	0.93
o,p'-DDD	0.23	0.32	0.16	0.09	0.16	0.19
o,p'-DDT	<0.05	<0.05	<0.05	0.08	<0.05	<0.05
DDMU	11.47	3.96	1.65	2.47	1.18	1.38
HCB	0.07	0.09	0.04	0.06	0.06	0.05
A-HCH	<0.05	0.05	0.31	0.25	0.20	<0.05
B-HCH	0.08	0.11	0.09	0.05	0.07	0.05
G-HCH	<0.05	<0.05	0.08	0.06	0.05	<0.05
Oxychlordane	0.06	0.08	0.05	0.06	0.05	0.03
Trans-nonachlor	1.28	1.94	1.05	1.57	0.96	0.86
Cis-nonachlor	0.49	0.64	0.52	0.46	0.36	0.33
Trans-chlordane	0.22	0.24	0.13	0.15	0.16	0.11
Cis-chlordane	0.43	0.52	0.34	0.34	0.30	0.23

Pesticides in Yellow Rock Crab (Cont.)

Location	Dana Pt.				
	13,1	13,2	13,3	13,4	13,5
p,p'-DDE	1.30	3.14	4.97	1.30	1.30
p,p'-DDD	<0.05	0.02	<0.05	<0.05	<0.05
p,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05
o,p'-DDE	0.00	0.65	0.48	0.06	0.04
o,p'-DDD	<0.05	<0.05	<0.05	<0.05	0.04
o,p'-DDT	<0.05	<0.05	<0.05	<0.05	<0.05
DDMU	0.00	0.98	0.67	0.08	0.00
HCB	0.02	0.02	0.02	0.01	0.01
A-HCH	<0.05	0.25	0.07	0.14	0.23
B-HCH	<0.05	<0.05	<0.05	<0.05	<0.05
G-HCH	<0.05	<0.05	<0.05	<0.05	<0.05
Oxychlordane	<0.05	0.08	0.20	<0.05	0.08
Trans-nonachlor	0.05	0.09	0.06	0.09	0.19
Cis-nonachlor	<0.05	0.02	0.04	<0.05	0.04
Trans-chlordane	<0.05	<0.05	<0.05	<0.05	<0.05
Cis-chlordane	<0.05	<0.05	<0.05	<0.05	<0.05

Results

Selenium

Selenium concentrations for White Croaker tissue (page2).

Sample Number	Location	% Water	Selenium
7-1	Hermosa	78.5	0.35
7-2	Hermosa	76.1	0.36
7-3	Hermosa	77.6	0.41
7-4	Hermosa	76.2	0.37
7-5	Hermosa	78.8	0.48
8-1	Palos Verde N.	76.5	0.72
8-2	Palos Verde N.	78.1	0.81
8-3	Palos Verde N.	77.7	0.72
8-4	Palos Verde N.	75.9	0.8
8-5	Palos Verde N.	76.5	0.73
9-1	Palos Verde S.	74.5	0.66
	Replicate	76	0.69
9-2	Palos Verde S.	75.3	0.7
9-3	Palos Verde S.	75.8	1
9-4	Palos Verde S.	78.5	0.57
9-5	Palos Verde S.	77.2	0.68
10-1	White Pt.	75.5	1.2
10-2	White Pt.	77.7	1.4
10-3	White Pt.	78.7	1.4
10-4	White Pt.	77.1	1.1
10-5	White Pt.	77.3	0.98
11-1	Dana Pt.	77.3	0.26
	Replicate	77.2	0.25
11-2	Dana Pt.	77.9	0.27
11-3	Dana Pt.	77.8	0.3
11-4	Dana Pt.	78.3	0.28
11-5	Dana Pt.	77.8	0.26

Results

Lead

Section 3

Organochlorine Methods

QA/QC Data

External Laboratory Correspondence

Analytical Procedures for Pesticides and PCBs

Principle of Method

The sample was extracted with methylene chloride:hexane (1:1), cleaned up and separated on deactivated Florisil. Extracts were analyzed by capillary column geas chromatography/electron capture detector (GC/ECD). This method has been used for over ten years in the monitoring of peregrine falcons.

Procedure Details

A 10 g (accurately weighed) aliquot of the sample was ground with anhydrous sodium sulfate until free flowing. The mixture was extracted with a mixture of methylene chloride and hexane (1:1). The eluate was concentrated on a rotovap just to dryness. The residue was brought up to 25 ml with hexane and mixed. A one ml aliquot was taken for lipid determination (removal of solvent and weighing of residue). The remaining aliquot was cleaned up and separated into two fractions on a 0.5% water-deactivated Florisil PR grade column as follows:

A chromatographic glass column (1 cm i.d x 30 cm) was filled with Florisil (mesh 60-100) to a level of 27 cm and topped with 1 cm sodium sulfate. Hexane (100 ml) was immediately added as a pre-sample column wash. The sample extract (less than 0.20 g of lipid) in 2-3 ml hexane was introduced onto the column and three fractions were eluted successively. Flow through the column was approximately 3-4 ml/min.

FRACTION 1: eluted with 65-70 ml hexane (volume predetermined by preliminary test elution to obtain at least 90% of p,p'-DDE eluting into the hexane fraction) contains HCB, mirex, PCBs, o,p'-DDT (50%), o,p'-DDE, and p,p'-DDE.

FRACTION 2: eluted with 50 ml 30% methylene chloride/hexane (v/v), contains the HCH compounds, .chlordane compounds and metabolites, p,p'-DDD, p,p'-DDT, o,p'-DDT, and toxaphene.

Each fraction was reduced to a low volume on a rotovap and then transferred to 4 ml teflon lined glass vials. The final volume of extract to be analyzed was determined by optimizing the detection of compounds of interest (*i.e.*: sample volume can be reduced down to 50 µls to increase sensitivity).

Organochlorine analyses were performed using a Hewlett-Packard concentrations of the congeners in the standard to the concentration of the same congeners in the total Aroclor mixtures. The congeners used to determine Aroclor concentrations were: Aroclor 1242-18, 15(17), and 31 (it should be noted that these three congeners cannot discriminate between Aroclors 1016, 1221, 1232, 1242, or 1248); Aroclor 1254- 110, 118, and 105; Aroclor 1260- 183, 180, 170 (Draper *et al.*, 1991). This provides a way to compare current congener specific data to the concentrations of Aroclor mixtures that have been reported previously.

Appendix II

QA/QC Data

External Laboratory Correspondence

Concentrations of Organochlorine compounds in NIST
Standard Reference Sample Organics in mussel tissue, 1974
Concentrations reported as ng/g (ppb) wet weight
NIST Concentrations 7 June 91 (non-certified)

	NIST		LML #2	LML #1
PCBs				
Congener #				
18	3	+/- 1	1.7	1.7
28	7.6	+/- 0.4	6.2	5.9
44	8	+/- 3	5.4	N/A
52	12	+/- 5	6.5	N/A
66/95	13.6	+/- 0.6	13.7	24.1
101/90	13	+/- 1	11.1	12.6
105	5.6	+/- 0.4	1.8	1.6
118	13.6	+/- 0.6	9.9	13.2
128	1.9	+/- 0.3	2.3	2.6
138/163/164	14	+/- 1	9.3	8.3
153	18	+/- 1	12.5	11.3
180	1.7	+/- 0.2	0.8	0.6
187/159/182	3.7	+/- 0.1	1.9	3.4
Pesticides				
Cis-chlordane	3.2	+/- 0.2	2.1	1.8
Trans-nonachlor	2.6	+/- 0.6	1.2	2.0
Dieldrin	1	+/- 0.5	N/A	N/A
p,p-DDE	5.9	+/- 0.2	8.3	3.8
o,p-DDE	0.72	+/- 0.07	1.1	2.48
p,p-DDD	8.4	+/- 0.4	2.7	3.7
o,p-DDD	2.5	+/- 0.9	2.5	2.1
p,p-DDT	0.3	+/- 0.3	0.8	< 0.15
o,p-DDT	0.4	+/- 0.2	2.5	2.1

N/A Not analyzed

Trace Metals Facility

U.C.S.C

LEAD LEVELS IN SANTA MONICA YELLOW ROCK CRAB (CANCER ANTINARIUS)

ID	SAMPLE	VIAL WT	FW	DW	EXTWT	ABS	DF	ABSxDF	ABSxEXT	ABS-BLK	
A	BLANK-A	32.94			5.23	0.07	1.20	0.09	0.46	0.43 ng	blank value
B	BLANK-B	31.32			5.37	0.04	1.20	0.04	0.24	=blank	
C	BLANK-C	33.25			5.41	0.09	1.20	0.11	0.60		
D	SRM-157	33.62	0.21	0.21	4.90	2.14	5.99	12.81	62.77	62.34	source batch contaminated
E	SRM-157	33.79	0.21	0.21	4.92	2.35	5.99	14.08	69.28	68.85	
F	SRM-157	32.65	0.21	0.21	4.69	2.66	5.99	15.96	74.84	74.41	
G	WP12-1A	32.07	2.05	0.52	5.23	1.93	5.99	11.56	60.46	60.03	
H	WP12-1B	31.20	2.16	0.53	5.15	1.93	5.99	11.56	59.54	59.10	
I	WP12-2A	31.32	2.08	0.70	5.40	1.57	5.99	9.40	50.78	50.35	
J	WP12-2B	31.51	2.38	0.67	5.42	2.09	5.99	12.52	67.85	67.42	
K	WP12-3A	32.59	2.33	0.74	5.33	1.24	5.99	7.43	39.59	39.16	
L	WP12-3B	32.17	2.13	0.67	5.33	1.47	5.99	8.81	46.93	46.50	
M	WP12-4A	32.76	2.20	0.59	5.34	1.36	5.99	8.15	43.50	43.07	
N	WP12-4B	31.80	2.23	0.59	5.31	1.44	5.99	8.63	45.80	45.37	
O	WP12-5	32.12	2.44	0.56	5.38	1.26	5.99	7.55	40.60	40.17	
P	DP13-1A	33.06	2.25	0.39	5.43	2.12	2.00	4.24	23.02	22.59	
Q	DP13-1B	33.06	2.07	0.40	5.35	2.10	2.00	4.20	22.47	22.04	
R	DP13-2A	32.87	2.45	0.49	5.49	2.34	2.00	4.68	25.69	25.26	
S	DP13-2B	32.43	2.09	0.41	5.43	1.96	2.00	3.92	21.29	20.85	
T	DP13-3A	33.59	2.22	0.31	5.42	2.71	2.00	5.42	29.38	28.94	
U	DP13-3B	33.38	2.06	0.29	5.22	3.22	2.00	6.44	33.62	33.18	
V	DP13-4A	32.23	2.25	0.49	5.40	1.37	2.00	2.74	14.80	14.36	
W	DP13-4B	31.39	2.01	0.44	5.38	0.88	2.00	1.76	9.47	9.04	
X	DP13-5	31.47	2.42	0.49	5.59	1.43	2.00	2.86	15.99	15.56	
7/90	SRM-157	29.28	0.23	0.22	2.00	4.49	3.00	13.47	26.94		

NBS SRM-1577a Bovine Liver Pb concentration is 135 ng/g +/- 15ng/g
(range = 120-150 ng/g)

SRM-1577 source batch contaminated (extracts D,E,F)
SRM-1577 7/90 extract from different source batch

WP = White Point
DP = Dana Point

Genine Scelfo
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064
(408) 459-2088

June 3, 1991

Bruce Welden
Monterey County Health Department
1270 Natividad Road
Salinas, CA 93906

Dear Bruce,

Enclosed is the updated data summary for lead levels in *Cancer antinarius* for the Santa Monica Bay Restoration Project including new data for the standard reference material. A different source batch of the SRM 1577a bovine liver was used. It was extracted and analyzed (in triplicate) on 5/16/91 and 5/20/91, respectively. The lead concentration agreed with the certified value (mean = 125.1 ng/g dry wt.) For blank correction, I subtracted the lead concentration of the blanks which was 0.14 ng.

Feel free to call me if there are any questions regarding the data and/or analytical procedures.

Sincerely,

Genine Scelfo

cc: wj
arf

MEAN	SD	%RSD	Pb/FW (ng/g)	MEAN	SD	%RSD
125.10	5.64	4.5				
113.48	1.96	1.7	29.3	28.32	0.94	3.3
			27.4			
86.28	14.35	16.6	24.2	26.27	2.04	7.8
			28.3			
61.16	8.24	13.5	16.8	19.30	2.51	13.0
			21.8			
74.95	1.95	2.6	19.6	19.96	0.40	2.0
			20.4			
71.70			16.5	16.50		
56.51	1.42	2.5	10.0	10.35	0.30	2.9
			10.7			
51.21	0.35	0.7	10.3	10.15	0.16	1.6
			10.0			
103.90	10.53	10.1	13.0	14.57	1.54	10.5
			16.1			
24.93	4.39	17.6	6.4	5.44	0.95	17.4
			4.5			
31.70			6.4	6.4		

COPY

STATE OF CALIFORNIA—RESOURCES AGENCY

GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF FISH AND GAME
FISH AND WILDLIFE
WATER POLLUTION CONTROL LABORATORY
2005 NIMBUS ROAD
RANCHO CORDOVA, CA 95670

May 6, 1991

Mr. Walter M. Jarman
Long Marine Laboratory
Trace Organics Facility
100 Shaffer Road
Santa Cruz, CA 95060

All the analytical results for seleniun, arsenic and the Chlorinated Hydrocarbons Quality Control Samples are complete. All data was completed as part of the Santa Monica Bay Seafood Contamination Study: Analytical Component. All the results are reported on a fresh (wet) weight basis.

Attached are all those results and the Quality Control Charts for fish tissue. Please note that the percent lipid was reanalyzed and the correct values are listed. It was necessary to reanalyze the percent lipid because of a misunderstanding as to the homogenization of the tissue.

Norman L. Morgan
Assistant Laboratory Director

c: B. Welden
K. Regalado
D. Crane

MORGAN/kelly

Santa Monica Bay Seafood Contamination Study

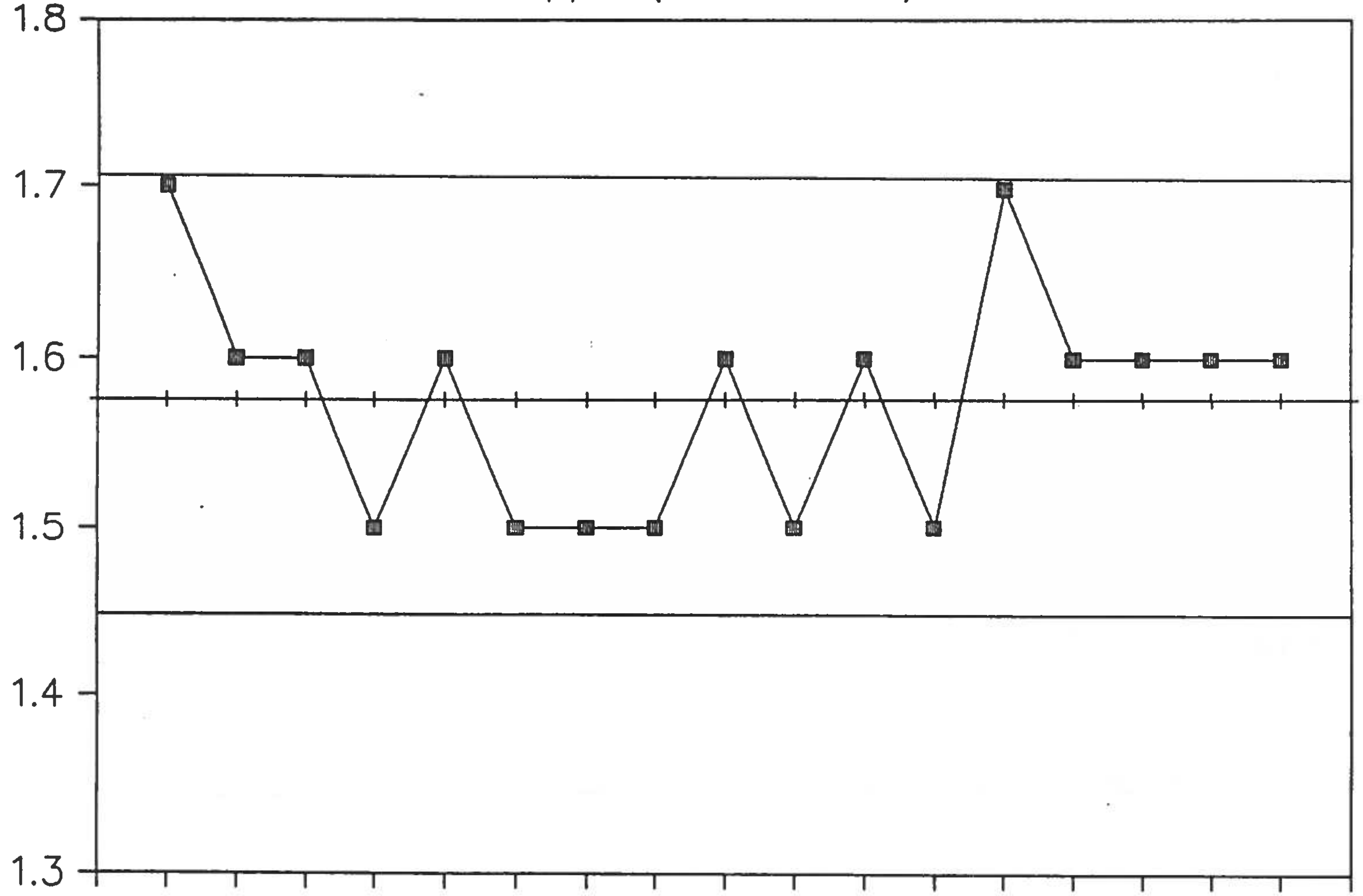
Sample Number	Location	Selenium Fresh Weight ppm (ug/g)	Percent Moisture
9-1	PV South	0.66,0.69	74.5,76.0
9-2	PV South	0.70	75.3
9-3	PV South	1.0	75.8
9-4	PV South	0.57	78.5
9-5	PV South	0.68	77.2
10-1	White Pt.	1.2	75.5
10-2	White Pt.	1.4	77.7
10-3	White Pt.	1.4	78.7
10-4	White Pt.	1.1	77.1
10-5	White Pt.	0.98	77.3
11-1	Dana Pt.	0.26,0.25	77.3,77.2
11-2	Dana Pt.	0.27	77.9
11-3	Dana Pt.	0.30	77.8
11-4	Dana Pt.	0.28	78.3
11-5	Dana Pt.	0.26	77.8
12-1	White Pt.	2.6	80.7
12-2	White Pt.	2.2	75.8
12-3	White Pt.	1.9,2.1 (As - 9.4)	75.9,75.6
12-4	White Pt.	1.8	75.7
12-5	White Pt.	2.4	77.6
13-1	Dana Pt.	2.7	83.1
13-2	Dana Pt.	3.2	82.8
13-3	Dana Pt.	2.7,2.6 (As 8.2)	85.6,85.5
13-4	Dana Pt.	3.7	81.3
13-5	Dana Pt.	2.4	82.9

SANTA MONICA BAY SEAFOOD CONTAMINATION STUDY-WPCL RESULTS

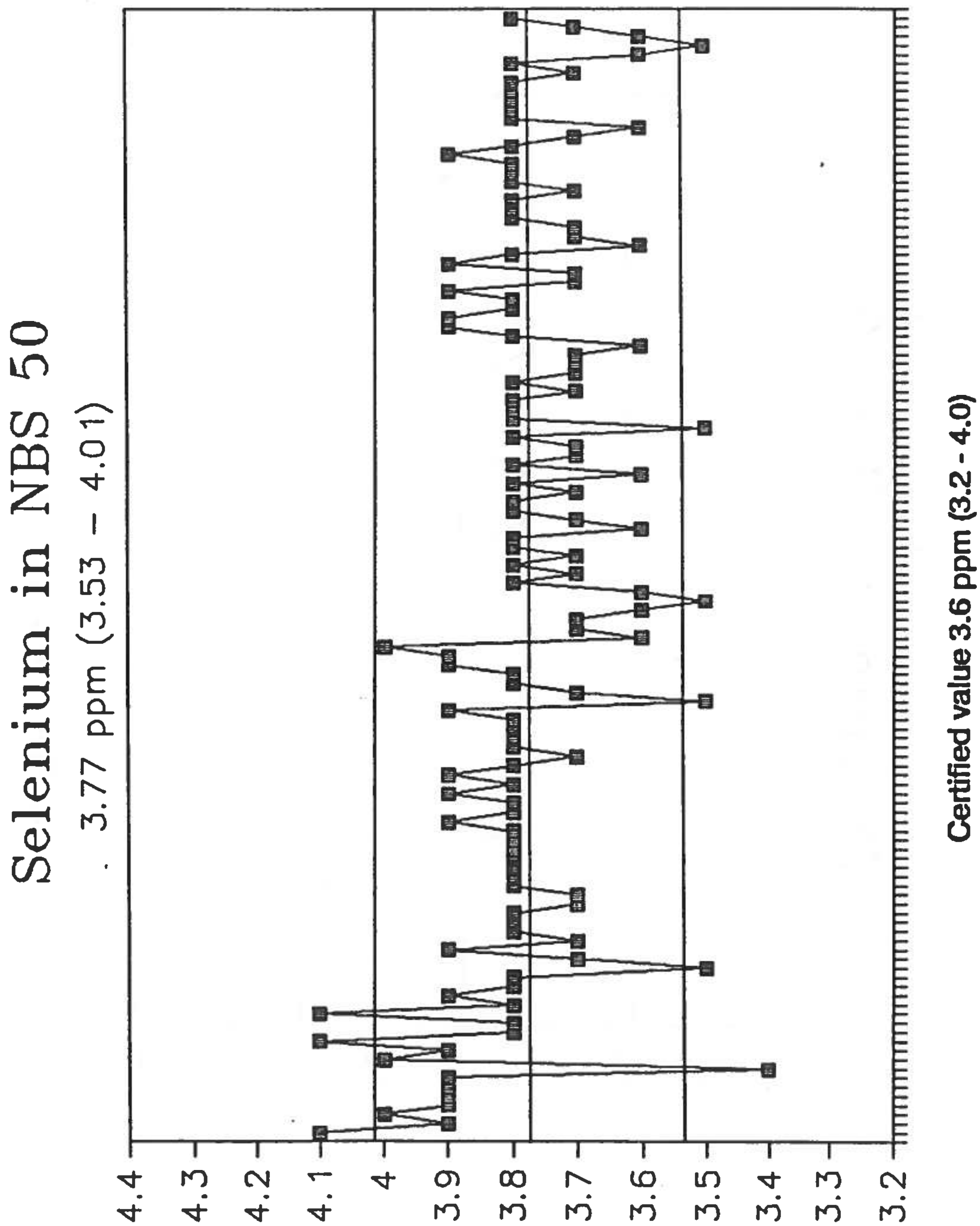
PARAMETER	#1 REP 3 PT. DUME	#2 REP 1 MALIBU	#4 REP 1 MDR	#5 REP 5 HYPERION	#7 REP 4 HERMOSA	#9 REP 2 PV SOUTH	#10 REP 1 WHT POINT
%H2O	76.5	77.7	77.6	78.9	77.2	76.2	75.6
%LIPID	1.31	1.13	0.54	0.22	0.46	2.51	3.11
	------------------------ [ng/g (ppb) wet weight] ------------------------						
o,p'-DDD	0.52	0.47	0.51	0.28	0.57	50.	110.
p,p'-DDD	6.0	4.7	6.0	3.5	11.	550.	1300.
o,p'-DDE	10.	8.5	8.3	8.4	25.	1600.	2100.
p,p'-DDE	240.	120.	190.	200.	670.	17000.	22000.
o,p'-DDT	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
p,p'-DDT	2.8	1.8	3.0	1.3	1.8	22.	44.
cis-chlordane	1.5	1.1	2.6	1.5	0.96	6.6	15.
trans-chlordane	0.98	0.76	1.7	0.80	0.53	4.2	10.
hept. epoxide	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
cis-nonachlor	1.2	0.71	2.3	1.1	1.1	6.5	11.
trans-nonachlor	2.6	1.6	4.8	2.5	3.0	12.	19.
oxychlordane	<0.25	<0.25	0.33	<0.25	<0.25	1.5	1.6
Aroclor 1242	<4.0	<4.0	<4.0	<4.0	<4.0	19.	60.
Aroclor 1254	81.	61.	100.	160.	180.	890.	1200.
Aroclor 1260	60.	50.	79.	100.	120.	320.	340.

Selenium in DORM

1.57 ppm (1.44 – 1.70)



Certified value 1.62 ppm (1.50 - 1.74)


Selenium in NBS 50
3.77 ppm (3.53 – 4.01)
4.4
4.3
4.2
4.1
4
3.9
3.8
3.7
3.6
3.5
3.4
3.3
3.2
Certified value 3.6 ppm (3.2 - 4.0)

Sample Custody Forms

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT

SAMPLE CUSTODY FORM

Project Name: Santa Monica Bay Restor. Proj. Fish Contamination Study

Project Number: 0-074-140-0

Number of Sample Containers: 10

Type of Samples: Yellow rock crab muscle tissue composites

Sample Identification Number	Sample Description
Sam. 12-Reps.1,2,3,4,5	5 jars muscle tissue from White Point (Sta. 10)
Sam. 13-Reps.1,2,3,4,5	5 jars muscle tissue from Dana Point (Sta. 11)

Relinquished by:	Date	Received by:	Date	Comments
Jeffrey Cross	3 Nov 90	[illegible signature]	Nov 3, 90	
[illegible signature]	Nov 5, 90	Wally Jarvis	5 Nov 90	

SANTA MONICA BAY SEAFOOD CONTAMINATION STUDY

SAMPLE CUSTODY FORM

Project Name: Santa Monica Bay Restor. Proj. Fish Contamination Study

Project Number: 0-074-140-0

Number of Sample Containers: 7

Type of samples: White croaker muscle tissue composite - blended

SAMPLE #	SAMPLE DESCRIPTION
Sample #1-Rep. 3	20.10 gr muscle tissue from Pt. Dume
Sample #2-Rep. 1	20.00 gr muscle tissue from Malibu
Sample #4-Rep. 1	20.01 gr muscle tissue from Marina del Rey
Sample #5-Rep. 5	20.23 gr muscle tissue from Hyperion
Sample #7-Rep. 4	20.10 gr muscle tissue from Hermosa Beach
Sample #9-Rep. 2	20.02 gr muscle tissue from Palos Verdes North
Sample #10-Rep. 1	20.11 gr muscle tissue from White Point

RELINQUISHED BY	DATE	RECEIVED BY	DATE	COMMENTS
[signature]	11/16/90	[signature]	11/16/90	
[signature]	11/16/90	[signature]	11/16/90	

SANTA MONICA BAY SEAFOOD CONTAMINATION STUDY

SAMPLE CUSTODY FORM

Project Name: Santa Monica Bay Restor. Proj. Fish Contamination Study

Project Number: 0-074-140-0

Number of Sample Containers: 6

Type of samples: White Croaker Fish Tissue for Dioxin Analysis

SAMPLE #	SAMPLE DESCRIPTION
Sample #2,Reps 8,9	Malibu-Whole sample. Not homogenized
Sample #6,Reps 9,10	El Segundo-Whole sample. Not homogenized
Sample #11, Reps 4 & 5 combined	Dana Pt. -Two replicates combined.
Sample #11, Reps 2 & 3 combined	Dana Pt. -Two replicates combined.

RELINQUISHED BY	DATE	RECEIVED BY	DATE	COMMENTS
K Burns	18 March 91	[illegible]	3/18/91	received frozen

ALTA

April 4, 1991

Alta Batch I.D.: 10289

Mr. Wally Jarman
University of California, Santa Cruz
100 Schaffer Road
Santa Cruz, CA 95060

Dear Mr. Jarman

Enclosed are the results for the six fish samples received at Alta Analytical Laboratory on March 18, 1991. The work was authorized under your Purchase Order #SC-656540. These samples were analyzed using EPA Method 8290 for tetra to octa chlorinated dioxins and furans. Routine turn-around-time was requested for these samples. Generally the recoveries of 13C-OCDD were low, however the signal to noise ratio was graeater than 10:1 as required by Method 8290.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations and copies of the raw data (if requested).

If you have any questions regarding this report please feel free to contact me.

Sincerely,

William J. Luksemburg
Director of HRMS Services

SECTION II.

ALTA

PCDD & PCDF
EPA METHOD 8290

METHOD BLANK
Lab ID: 10289-001-MB

Isotopic Recovery Results

Internal Standard	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	78	0.80	
^{13}C-1,2,3,7,8-PeCDD	69	1.57	
^{13}C-1,2,3,4,7,8-HxCDD	57	1.25	
^{13}C-1,2,3,6,7,8-HxCDD	55	1.24	
^{13}C-1,2,3,4,6,7,8-HpCDD	28	1.05	
^{13}C-OCDD	9.3	0.93	H
^{13}C-2,3,7,8-TCDF	75	0.81	
^{13}C-1,2,3,7,8-PeCDF	74	1.57	
^{13}C-2,3,4,7,8-PeCDF	61	1.59	
^{13}C-1,2,3,4,7,8-HxCDF	76	0.53	
^{13}C-1,2,3,6,7,8-HxCDF	77	0.53	
^{13}C-2,3,4,6,8-HxCDF	25	0.52	
^{13}C-1,2,3,7,8,9-HxCDF	67	0.51	
^{13}C-1,2,3,4,6,7,8-HpCDF	68	0.45	
^{13}C-1,2,3,4,7,8,9-HpCDF	66	0.46	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	71	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** NA **SP-2331:** NA

Analyst: [signature] Page 2 of 2 Reviewer: [initials]

ALTA

PCDD & PCDF
EPA METHOD 8290

LCS RESULTS
Lab ID: 10289-LCS1/LCS2

Isotopic Recovery Results

Internal Standard:	LCS1 % R	LCS2 % R
^{13}C-2,3,7,8-TCDD	79	74
^{13}C-1,2,3,7,8-PeCDD	67	68
^{13}C-1,2,3,4,7,8-HxCDD	45	54
^{13}C-1,2,3,6,7,8-HxCDD	64	60
^{13}C-1,2,3,4,6,7,8-HpCDD	25	29
^{13}C-OCDD	6.5	5.2
^{13}C-2,3,7,8-TCDF	76	71
^{13}C-1,2,3,7,8-PeCDF	72	71
^{13}C-2,3,4,7,8-PeCDF	54	61
^{13}C-1,2,3,4,7,8-HxCDF	65	75
^{13}C-1,2,3,6,7,8-HxCDF	82	74
^{13}C-2,3,4,6,7,8-HxCDF	19	25
^{13}C-1,2,3,7,8,9-HxCDF	50	63
^{13}C-1,2,3,4,6,7,8-HpCDF	69	70
^{13}C-1,2,3,4,7,8,9-HpCDF	54	64
Clean-up Recovery Standard:		
^{37}C-2,3,7,8-TCDD	74	68

Analyst: [signature] Page 2 of 2 Reviewer: [signature]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Sample #2, Rep. 8
Lab ID: 10289-001-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	71	0.77	
^{13}C-1,2,3,7,8-PeCDD	53	1.54	
^{13}C-1,2,3,4,7,8-HxCDD	44	1.26	
^{13}C-1,2,3,6,7,8-HxCDD	43	1.22	
^{13}C-1,2,3,4,6,7,8-HpCDD	19	1.04	H
^{13}C-OCDD	6.4	0.87	H
^{13}C-2,3,7,8-TCDF	64	0.79	
^{13}C-1,2,3,7,8-PeCDF	62	1.60	
^{13}C-2,3,4,7,8-PeCDF	44	1.60	
^{13}C-1,2,3,4,7,8-HxCDF	66	0.54	
^{13}C-1,2,3,6,7,8-HxCDF	68	0.54	
^{13}C-2,3,4,6,7,8-HxCDF	14	0.52	H
^{13}C-1,2,3,7,8,9-HxCDF	62	0.51	
^{13}C-1,2,3,4,6,7,8-HpCDF	59	0.44	
^{13}C-1,2,3,4,7,8,9-HpCDF	61	0.45	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	61	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** 4/05/91 **SP-2331:** NA

Analyst: [signature] **Page 2 of 2** **Reviewer:** [signature]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Sample #2, Rep. 9
Lab ID: 10289-002-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	106	0.77	
^{13}C-1,2,3,7,8-PeCDD	87	1.60	
^{13}C-1,2,3,4,7,8-HxCDD	69	1.26	
^{13}C-1,2,3,6,7,8-HxCDD	85	1.24	
^{13}C-1,2,3,4,6,7,8-HpCDD	74	1.06	
^{13}C-OCDD	50	0.90	
^{13}C-2,3,7,8-TCDF	97	0.78	
^{13}C-1,2,3,7,8-PeCDF	86	1.56	
^{13}C-2,3,4,7,8-PeCDF	81	1.55	
^{13}C-1,2,3,4,7,8-HxCDF	90	0.56	
^{13}C-1,2,3,6,7,8-HxCDF	95	0.50	
^{13}C-2,3,4,6,7,8-HxCDF	74	0.54	
^{13}C-1,2,3,7,8,9-HxCDF	99	0.53	
^{13}C-1,2,3,4,6,7,8-HpCDF	89	0.45	
^{13}C-1,2,3,4,7,8,9-HpCDF	95	0.46	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	81	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** 4/05/91 **SP-2331:** NA

Analyst: [signature] **Page 2 of 2** **Reviewer:** [signature]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Sample #6, Rep. 9
Lab ID: 10289-003-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	76	0.78	
^{13}C-1,2,3,7,8-PeCDD	57	1.57	
^{13}C-1,2,3,4,7,8-HxCDD	45	1.29	
^{13}C-1,2,3,6,7,8-HxCDD	49	1.20	
^{13}C-1,2,3,4,6,7,8-HpCDD	25	1.04	
^{13}C-OCDD	11	0.89	H
^{13}C-2,3,7,8-TCDF	67	0.80	
^{13}C-1,2,3,7,8-PeCDF	63	1.56	
^{13}C-2,3,4,7,8-PeCDF	48	1.59	
^{13}C-1,2,3,4,7,8-HxCDF	67	0.56	
^{13}C-1,2,3,6,7,8-HxCDF	72	0.50	
^{13}C-2,3,4,6,7,8-HxCDF	22	0.51	H
^{13}C-1,2,3,7,8,9-HxCDF	67	0.53	
^{13}C-1,2,3,4,6,7,8-HpCDF	60	0.44	
^{13}C-1,2,3,4,7,8,9-HpCDF	65	0.45	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	71	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** 4/05/91 **SP-2331:** NA

Analyst: [signature] Page 2 of 2 Reviewer: [initials]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Sample #6, Rep. 10
Lab ID: 10289-004-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	77	0.77	
^{13}C-1,2,3,7,8-PeCDD	55	1.59	
^{13}C-1,2,3,4,7,8-HxCDD	41	1.26	
^{13}C-1,2,3,6,7,8-HxCDD	41	1.26	
^{13}C-1,2,3,4,6,7,8-HpCDD	8.1	1.05	H
^{13}C-OCDD	1.0	0.89	H
^{13}C-2,3,7,8-TCDF	69	0.80	
^{13}C-1,2,3,7,8-PeCDF	69	1.57	
^{13}C-2,3,4,7,8-PeCDF	43	1.56	
^{13}C-1,2,3,4,7,8-HxCDF	70	0.54	
^{13}C-1,2,3,6,7,8-HxCDF	76	0.54	
^{13}C-2,3,4,6,7,8-HxCDF	5.2	0.52	H
^{13}C-1,2,3,7,8,9-HxCDF	76	0.52	
^{13}C-1,2,3,4,6,7,8-HpCDF	63	0.45	
^{13}C-1,2,3,4,7,8,9-HpCDF	58	0.45	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	65	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** 4/05/91 **SP-2331:** NA

Analyst: [signature] **Page 2 of 2** **Reviewer:** [signature]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Samp.#11, Rep.4&5
Lab ID: 10289-005-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	92	0.78	
^{13}C-1,2,3,7,8-PeCDD	68	1.62	
^{13}C-1,2,3,4,7,8-HxCDD	50	1.28	
^{13}C-1,2,3,6,7,8-HxCDD	60	1.30	
^{13}C-1,2,3,4,6,7,8-HpCDD	40	1.01	
^{13}C-OCDD	28	0.92	
^{13}C-2,3,7,8-TCDF	83	0.81	
^{13}C-1,2,3,7,8-PeCDF	74	1.58	
^{13}C-2,3,4,7,8-PeCDF	61	1.57	
^{13}C-1,2,3,4,7,8-HxCDF	73	0.54	
^{13}C-1,2,3,6,7,8-HxCDF	79	0.53	
^{13}C-2,3,4,6,7,8-HxCDF	41	0.53	
^{13}C-1,2,3,7,8,9-HxCDF	81	0.54	
^{13}C-1,2,3,4,6,7,8-HpCDF	67	0.46	
^{13}C-1,2,3,4,7,8,9-HpCDF	75	0.46	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	83	NA	

Dates Analyzed:

DB-5: 4/01/91 **DB-225:** 4/05/91 **SP-2331:** NA

Analyst: [signature] Page 2 of 2 Reviewer: [signature]

ALTA

PCDD & PCDF
EPA METHOD 8290

Sample ID: Samp.#11, Rep.2&3
Lab ID: 10289-006-SA

Isotopic Recovery Results

Internal Standard:	% R	Ratio	Qualifier
^{13}C-2,3,7,8-TCDD	98	0.80	
^{13}C-1,2,3,7,8-PeCDD	74	1.55	
^{13}C-1,2,3,4,7,8-HxCDD	57	1.27	
^{13}C-1,2,3,6,7,8-HxCDD	73	1.25	
^{13}C-1,2,3,4,6,7,8-HpCDD	57	1.05	
^{13}C-OCDD	37	0.90	
^{13}C-2,3,7,8-TCDF	92	0.80	
^{13}C-1,2,3,7,8-PeCDF	78	1.57	
^{13}C-2,3,4,7,8-PeCDF	71	1.55	
^{13}C-1,2,3,4,7,8-HxCDF	80	0.53	
^{13}C-1,2,3,6,7,8-HxCDF	84	0.54	
^{13}C-2,3,4,6,7,8-HxCDF	62	0.54	
^{13}C-1,2,3,7,8,9-HxCDF	80	0.53	
^{13}C-1,2,3,4,6,7,8-HpCDF	73	0.46	
^{13}C-1,2,3,4,7,8,9-HpCDF	78	0.45	
Clean-up Recovery Standard:			
^{37}Cl-2,3,7,8-TCDD	90	NA	

Dates Analyzed:

DB-5: 4/01/91 DB-225: 4/05/91 SP-2331: NA

Analyst: [signature] Reviewer: [signature]

Attachment 10-B-1

ALTA Analytical Laboratory

Batch ID: 10289

Sample Log-In Checklist	Yes	No
1. Shipping Container is Intact?	✓	
2. Custody Seals Present?		✓
If yes, are they intact?		
3. Sample Containers Intact?	✓	
4. Method of Preservation:		
Temperature: FROZEN		
5. Chain of Custody Present?	✓	
6. Discrepancies in Chain of Custody?		✓
7. Packing Retained?		✓

Name: Elaine Wong Date: 3-18-91

Comments:

Approval: [signature] Date: 7-18-90 Effective: 7-18-90

Approval: Robert S. Mitzel Date: 7-18-90 Supersedes: NA

APPENDIX B

Size and weight of *Genyonemus lineatus* **and** *Cancer anthonyi* **by station.**

Appendix 2. Size and weight of *Genyonemus lineatus* and *Cancer anthonyi* by station. Mean length and weight are means of the composites; minimum and maximum lengths and weight are for individuals in all composites. Measurements for *G. lineatus* are standard length in millimeters (mm) and whole body weight in grams (g). Measurements for *C. anthonyi* are carapace width in millimeters (mm) and whole body weight in grams (g). Station numbers correspond to Figure 1. N=number of composites.

Species	Station	N	Mean Length (mm)	Minimum Length (mm)	Maximum Length (mm)	Mean Weight (g)	Minimum Weight (g)	Maximum Weight (g)	Sample Weight (g)
Genyonemus lineatus	1	5	265.4	236	296	230.1	160.9	332.4	81.0
Genyonemus lineatus	2	10	256.6	231	286	219.2	153.2	292.4	81.2
Genyonemus lineatus	3	5	263.2	226	282	226.8	126.8	273.9	80.7
Genyonemus lineatus	4	5	250.0	226	279	189.1	142.3	239.4	80.7
Genyonemus lineatus	5	5	245.6	226	271	192.6	138.2	280.2	80.7
Genyonemus lineatus	6	10	255.1	211	301	203.7	123.8	395.2	80.8
Genyonemus lineatus	7	5	265.4	230	299	215.1	161.4	291.4	81.0
Genyonemus lineatus	8	5	256.3	233	276	199.7	152.4	285.5	80.9
Genyonemus lineatus	9	5	234.0	207	267	165.4	106.2	248.3	80.9
Genyonemus lineatus	10	5	231.9	212	253	155.6	125.3	213.8	80.6
Genyonemus lineatus	11	5	258.3	234	287	200.6	145.7	270.9	81.5
Cancer anthonyi	12	5	132.0	119	161	386.0	273.8	803.0	80.8
Cancer anthonyi	13	5	130.5	118	149	333.2	220.7	459.3	80.5

APPENDIX C-1

Raw data on contaminant levels in white croaker (*Genyonemus lineatus*) from California Environmental Protection Agency study (Pollock et al. 1991)

California Environmental Protection Agency — James M. Strock, *Secretary for Environmental Protection*

State of California — Pete Wilson, *Governor*

OFFICE OF ENVIRONMENTAL HEALTH HAZARD ASSESSMENT
Steven A. Book, *Interim Director*

December 6, 1991

James Allen, Ph.D.
MBC
947 Newhall Street
Costa Mesa, CA 92627

Dear Dr. Allen: Jim

I have enclosed a copy of the data on white croaker from the study, "A Study of Chemical Contamination of Marine Fish from Southern California II. Comprehensive Study". This data includes an additional calculation on lipid normalization which was not included in the report.

The data for Cabrillo Pier include the seasonal sampling values. I have indicated on the data sheet which values correspond to the respective season.

Please feel free to call me (916) 327-7319 if you have any problems in understanding the data. Also, let me know if you need less summarized data than is in this dataset.

Sincerely,

Gerald A. Pollock

Gerald A. Pollock, Ph.D.
Staff Toxicologist

Jerry

Enclosures

714 "P" Street, Room 460 • Sacramento, California 95814 • (916) 324-7572

SPECIES	REGION	COMPOSITE	LIPID %	WEIGHT (grams)	TOTAL DDT (ppb)	LIPID NORMALIZED DDT (ppm)	AROCLOR 1254 (ppb)	AROCLOR 1260 (ppb)	TOTAL PCB (ppb)	LIPID NORMALIZED PCB (ppm)	TOTAL CHLORDANE (ppb)	LIPID NORMALIZED CHLORDANE (ppm)
	Malibu Pier											
09	18	CA417	0.28	409.5	21.1	0.75	7.59	6.14	13.7	0.49	2.04	0.07
09	18	CA418	0.15	342.3	10.3	0.68	5.42	6.44	11.9	0.79	1.10	0.07
09	18	CA419	0.19	327.5	10.9	0.57	[illegible]	6.02	13.8	0.72	1.79	0.09
09	[illegible]	CA420	0.44	[illegible]	20.8	0.47	[illegible]	9.74	20.5	0.47	2.79	0.06
09	18	CA421	0.52	[illegible]	19.4	[illegible]	[illegible]	8.60	22.2	0.43	2.90	0.06
	Santa Monica/Venice Piers											
09	19	[illegible]	0.27	295.5	12.6	0.47	[illegible]	5.97	19.2	[illegible]	1.94	0.07
09	19	[illegible]	0.41	240.5	[illegible]	0.28	[illegible]	5.00	15.8	[illegible]	[illegible]	0.06
09	19	[illegible]	0.16	199.3	[illegible]	0.49	[illegible]	[illegible]	12.4	0.77	[illegible]	0.09
09	19	[illegible]	0.34	203.0	[illegible]	0.45	[illegible]	5.57	19.8	0.58	[illegible]	0.10
09	19	[illegible]	0.23	180.0	[illegible]	0.39	9.08	3.24	12.3	0.54	1.64	0.07
	Redondo Piers											
09	20	CA317	0.08	457.0	14.3	1.78	[illegible]	9.24	19.8	2.47	[illegible]	0.11
09	20	CA318	[illegible]	459.3	116.9	2.54	[illegible]	[illegible]	111.8	2.43	[illegible]	0.15
09	20	CA319	[illegible]	[illegible]	100.1	3.71	[illegible]	[illegible]	83.7	[illegible]	[illegible]	0.11
09	20	CA320	[illegible]	[illegible]	162.4	4.06	159.04	[illegible]	212.3	5.31	9.63	0.24
09	20	CA321	1.15	[illegible]	70.5	[illegible]	77.09	[illegible]	99.5	0.87	10.61	0.09
	Newport Pier											
09	[illegible]	CA142	2.10	271.5	149.5	[illegible]	116.87	30.49	[illegible]	0.70	13.36	0.06
09	24	CA143	[illegible]	232.5	119.8	[illegible]	151.16	17.87	[illegible]	0.87	8.90	0.05
09	24	CA144	[illegible]	250.0	122.0	0.71	84.96	28.50	[illegible]	0.66	7.76	0.05
09	24	CA145	1.42	232.5	90.1	0.63	116.85	0.00	[illegible]	0.82	5.94	0.04
09	24	CA146	1.88	202.3	96.7	0.51	80.99	15.15	[illegible]	0.51	7.30	0.04
WHITE CROAKER												
	Point Dume											
10	01	CA742	0.94	199.8	56.0	0.60	61.06	0.09	61.2	0.65	6.25	0.07
10	01	CA743	0.95	194.8	129.3	1.36	196.59	40.80	237.4	2.50	12.56	0.13
10	01	CA744	1.42	187.5	568.2	4.00	390.76	67.80	458.6	3.23	20.51	0.14
10	01	CA745	1.20	189.0	204.0	1.70	186.04	50.70	236.7	1.97	13.14	0.11
10	01	CA746	1.17	158.3	477.2	4.08	445.35	106.71	552.1	4.72	21.26	0.18
	Malibu											
10	02	CA097	1.34	189.5	880.5	6.57	581.54	188.75	770.3	5.75	48.16	0.36
10	02	CA098	1.93	189.0	448.5	2.32	473.37	147.00	620.4	3.21	17.38	0.09
10	02	CA099	1.79	181.8	397.9	2.22	239.82	70.75	310.6	1.74	18.60	0.10
10	02	CA100	2.40	198.5	380.6	1.59	324.90	169.18	494.1	2.06	33.85	0.14
10	02	CA101	1.52	181.5	552.1	3.63	357.48	207.10	564.6	3.71	31.98	0.21

SPECIES	REGION	COMPOSITE	LIPID %	WEIGHT (grams)	TOTAL DDT (ppb)	LIPID NORMALIZED DDT (ppm)	AROCLOR 1254 (ppb)	AROCLOR 1260 (ppb)	TOTAL PCB (ppb)	LIPID NORMALIZED PCB (ppm)	TOTAL CHLORDANE (ppb)	LI NORMAL CHLOR (
	Marina del Rey											
10	03	CA227	0.54	139.3	96.2	1.78	33.15	35.29	68.4	1.27	0.00	
10	03	CA228	0.77	141.8	105.0	1.36	54.16	39.48	93.6	1.22	0.00	
10	03	CA229	0.55	141.5	77.0	1.40	31.46	14.97	46.4	0.84	0.00	
10	03	CA230	0.36	129.5	23.2	0.64	12.29	8.18	20.5	0.57	1.59	
10	03	CA231	0.41	130.0	30.7	0.75	14.35	10.85	25.2	0.61	2.05	
	Short Bank											
10	04	CA232	0.20	194.3	118.5	5.93	71.94	18.95	90.9	4.54	4.17	
10	04	CA233	0.14	195.5	74.4	5.31	51.57	20.12	71.7	5.12	2.84	
10	04	CA234	0.20	187.3	146.9	7.35	94.10	28.50	122.6	6.13	4.87	
10	04	CA235	0.11	186.0	40.3	3.67	28.01	12.50	40.5	3.68	2.30	
10	04	CA236	0.10	179.3	123.4	12.34	115.07	11.15	126.2	12.62	6.59	
	Palos Verdes											
10	05	CA482	0.24	194.0	31.8	1.33	2.54	1.06	3.6	0.15	0.20	(
10	05	CA483	0.45	187.8	403.8	8.97	74.76	34.61	109.4	2.43	5.14	(
10	05	CA484	0.58	179.3	468.4	8.08	81.58	27.12	108.7	1.87	5.93	(
10	05	CA485	0.73	181.8	382.7	5.24	73.10	40.86	114.0	1.56	5.51	(
10	05	CA486	0.52	170.0	486.8	9.36	98.50	36.04	134.5	2.59	7.40	(
	White's Point											
10	07	CA087	0.40	193.0	886.8	22.17	95.72	94.00	189.7	4.74	6.13	(
10	07	CA088	0.47	181.5	2316.2	49.28	215.76	20.75	236.5	5.03	12.76	(
10	07	CA089	0.50	187.8	1265.9	25.32	109.48	22.75	132.2	2.64	7.20	(
10	07	CA090	0.99	155.5	3309.2	33.43	308.58	14.25	322.8	3.26	22.77	(
10	07	CA091	0.70	184.0	5344.8	76.35	516.93	42.75	559.7	8.00	23.79	(
	Huntington Beach											
10	09	CA502	0.22	166.3	27.0	1.23	15.17	7.82	23.0	1.05	1.10	(
10	09	CA503	0.08	153.8	5.0	0.63	6.46	2.56	9.0	1.13	0.15	(
10	09	CA504	0.18	150.0	9.0	0.50	5.03	1.88	6.9	0.38	0.15	(
10	09	CA505	0.27	144.0	36.2	1.34	24.83	11.62	36.5	1.35	1.99	(
10	09	CA506	0.77	123.3	63.2	0.82	47.60	27.22	74.8	0.97	3.61	0
	Laguna Beach											
10	10	CA242	0.28	150.8	17.3	0.62	9.22	3.36	12.6	0.45	0.50	0
10	10	CA243	0.12	129.8	14.7	1.23	8.86	3.28	12.1	1.01	0.24	0
10	10	CA244	0.12	138.8	10.4	0.87	5.68	4.84	10.5	0.88	0.00	0
10	10	CA245	0.20	124.8	19.3	0.97	10.04	6.40	16.4	0.82	0.24	0
10	10	CA246	0.15	117.5	9.6	0.64	5.09	3.33	8.4	0.56	0.24	0

SPECIES	REGION	COMPOSITE	LIPID %	WEIGHT (grams)	TOTAL DDT (ppb)	LIPID NORMALIZED DDT (ppm)	AROCLOR 1254 (ppb)	AROCLOR 1260 (ppb)	TOTAL PCB (ppb)	LIPID NORMALIZED PCB (ppm)	TOTAL CHLORDANE (ppb)	LIPID NORMALIZED CHLORDANE (ppm)
Emma/Eva Oil Platforms												
10	11	CA247	0.16	170.0	49.3	3.08	28.73	11.43	40.2	2.51	1.00	0.06
10	11	CA248	0.08	150.3	5.5	0.69	3.86	1.80	5.7	0.71	0.00	0.00
10	11	CA249	0.22	164.8	20.4	0.93	11.24	6.33	17.6	0.80	0.47	0.02
10	11	CA250	0.13	147.3	12.9	0.99	8.71	3.58	12.3	0.95	0.24	0.02
10	11	CA251	0.19	138.8	25.2	1.33	15.25	8.34	23.6	1.24	0.49	0.03
Horseshoe Kelp												
10	12	CA602	1.03	168.5	212.8	2.07	88.57	9.05	97.6	0.95	3.66	0.04
10	12	CA603	1.95	152.5	314.4	1.61	262.13	11.12	273.2	1.40	5.37	0.03
10	12	CA604	1.17	150.5	174.6	1.49	64.85	12.70	77.5	0.66	3.11	0.03
10	12	CA605	0.68	132.3	233.6	3.43	92.47	21.75	114.2	1.68	3.81	0.06
10	12	CA606	1.04	121.3	175.2	1.69	67.26	9.47	76.7	0.74	3.16	0.03
Point Vicente												
10	14	CA772	0.86	151.5	3133.5	36.44	613.04	0.00	613.0	7.13	1.91	0.02
10	14	CA773	0.87	149.8	2196.0	25.24	484.09	0.00	484.1	5.56	2.54	0.03
10	14	CA774	1.16	141.3	2526.3	21.78	518.54	0.00	518.5	4.47	13.35	0.12
10	14	CA775	1.14	139.8	3211.9	28.17	609.09	0.00	609.1	5.34	16.83	0.15
10	14	CA776	0.90	142.5	2297.5	25.53	404.15	0.00	404.1	4.49	12.23	0.14
Dana Point												
10	15	CA762	0.16	114.3	7.0	0.44	0.00	0.00	0.0	0.00	0.00	0.00
10	15	CA763	0.11	116.8	2.0	0.19	0.00	0.00	0.0	0.00	0.00	0.00
10	15	CA764	0.22	109.8	11.2	0.51	0.00	3.48	3.5	0.16	0.00	0.00
10	15	CA765	0.28	102.8	6.3	0.22	0.00	0.00	0.0	0.00	0.00	0.00
10	15	CA766	0.11	99.0	2.6	0.23	0.00	0.00	0.0	0.00	0.00	0.00
Venice Point												
10	16	CA387	0.40	174.3	19.5	0.49	12.50	7.33	19.8	0.50	1.33	0.03
10	16	CA388	0.40	155.8	71.9	1.80	41.12	48.10	89.2	2.23	5.97	0.15
10	16	CA389	0.26	141.8	46.8	1.80	29.08	16.20	45.3	1.74	2.55	0.10
10	16	CA390	0.55	147.8	42.1	0.77	68.49	0.00	68.5	1.25	3.01	0.05
10	16	CA391	0.60	141.8	58.8	0.98	104.71	0.00	104.7	1.75	4.65	0.08
LA/LB Breakwater												
10	17	CA082	0.18	151.0	87.0	4.83	40.86	20.25	61.1	3.40	7.07	0.39
10	17	CA082	replicate				4.71	1.09	5.8			
10	17	CA083	0.22	147.3	259.9	11.81	44.34	12.50	56.8	2.58	3.29	0.15
10	17	CA084	0.28	139.3	139.2	4.97	179.90	0.00	179.9	6.42	3.42	0.12
10	17	CA085	0.17	136.5	68.0	4.00	15.24	7.00	22.2	1.31	0.49	0.03
10	17	CA086	0.26	131.0	106.5	4.10	27.76	10.75	38.5	1.48	2.49	0.10

	SPECIES	REGION	COMPOSITE	LIPID %	WEIGHT (grams)	TOTAL DDT (ppb)	LIPID NORMALIZED DDT (ppm)	AROCLOR 1254 (ppb)	AROCLOR 1260 (ppb)	TOTAL PCB (ppb)	LIPID NORMALIZED PCB (ppm)	TOTAL CHLORDANE (ppb)	LIPID NORMALIZED CHLORDANE (ppm)
		Malibu Pier											
	10	18	CA407	0.24	179.0	22.6	0.94	11.76	0.88	12.6	0.53	0.49	0.02
	10	18	CA408	0.20	168.0	22.2	1.11	9.43	1.33	10.8	0.54	1.23	0.06
	10	18	CA409	0.70	174.5	13.4	0.19	7.57	0.83	8.4	0.12	0.86	0.01
	10	18	CA410	0.24	164.3	83.9	3.50	77.95	34.19	112.1	4.67	5.61	0.23
	10	18	CA411	0.16	164.0	25.4	1.59	29.14	14.27	43.4	2.71	2.20	0.14
		Santa Monica/Venice Piers											
	10	19	CA677	0.20	182.8	216.3	10.82	157.10	59.92	217.0	10.85	13.06	0.65
	10	19	CA678	0.14	176.3	58.2	4.16	34.77	24.08	58.9	4.20	1.43	0.10
	10	19	CA679	0.18	152.5	42.1	2.34	15.43	9.84	25.3	1.40	1.21	0.07
	10	19	CA680	0.39	149.3	78.6	2.01	48.21	23.04	71.2	1.83	3.67	0.09
	10	19	CA681	0.38	143.5	39.3	1.03	20.05	12.56	32.6	0.86	1.98	0.05
		Cabrillo Pier											
	10	21	CA092	0.42	155.0	122.8	2.92	0.00	14.00	14.0	0.33	0.00	0.00
summer	10	21	CA093	3.54	167.0	556.4	1.57	72.07	38.00	110.1	0.31	0.00	0.00
	10	21	CA094	0.76	156.0	1651.4	21.73	177.83	29.25	207.1	2.72	0.00	0.00
	10	21	CA095	0.85	162.8	631.3	7.43	160.86	75.75	236.6	2.78	0.00	0.00
	10	21	CA096	1.22	168.5	8051.5	66.00	552.79	35.75	588.5	4.82	0.00	0.00
	10	21	CB043	2.54	130.0	465.1	1.83	173.85	13.97	187.8	0.74	14.88	0.06
	10	21	CB044	2.44	149.8	393.3	1.61	180.36	14.62	195.0	0.80	15.31	0.06
	10	21	CB045	2.11	120.8	273.8	1.30	124.86	3.57	128.4	0.61	10.19	0.05
FALL	10	21	CB046	1.60	116.3	311.4	1.95	139.85	3.52	143.4	0.90	6.76	0.04
	10	21	CB047	1.46	106.0	229.2	1.57	127.31	7.57	134.9	0.92	5.31	0.04
	10	21	CB048	1.15	48.3	279.4	2.43	103.03	19.48	122.5	1.07	6.75	0.06
	10	21	CB049	0.61	43.5	229.8	3.77	57.57	0.00	57.6	0.94	3.23	0.05
	10	21	CB050	0.96	47.8	284.0	2.96	0.00	32.66	32.7	0.34	4.40	0.05
	10	21	CB051	1.99	46.8	279.4	1.40	0.00	567.31	567.3	2.85	12.26	0.06
	10	21	CB052	0.79	45.3	179.7	2.27	100.59	4.01	104.6	1.32	3.39	0.04
	10	21	CB053	0.54	145.5	292.0	5.41	218.28	25.63	243.9	4.52	7.49	0.14
WINTER	10	21	CB054	2.50	142.5	349.3	1.40	303.34	29.86	333.2	1.33	12.50	0.05
	10	21	CB055	1.36	136.5	275.1	2.02	357.71	31.70	389.4	2.86	8.29	0.06
	10	21	CB056	1.25	134.0	214.2	1.71	196.83	42.62	239.5	1.92	6.25	0.05
	10	21	CB057	1.17	115.3	208.8	1.78	171.00	24.07	195.1	1.67	5.12	0.04
	10	21	CB058	0.08	129.8	60.6	7.57	25.18	5.87	31.1	3.88	0.25	0.03
	10	21	CB059	0.11	110.8	285.0	25.90	64.07	3.93	68.0	6.18	0.97	0.09
SPRING	10	21	CB060	0.15	115.5	1440.8	96.05	233.11	0.00	233.1	15.54	6.04	0.40
	10	21	CB061	0.09	109.0	121.7	13.52	47.67	3.60	51.3	5.70	0.73	0.08
	10	21	CB062	0.13	114.8	92.1	7.09	34.13	5.34	39.5	3.04	0.58	0.04

Jim, Note that all samples from other sites were collected in summer.

SPECIES	REGION	COMPOSITE	LIPID %	WEIGHT (grams)	TOTAL DDT (ppb)	LIPID NORMALIZED DDT (ppm)	AROCLOR 1254 (ppb)	AROCLOR 1260 (ppb)	TOTAL PCB (ppb)	LIPID NORMALIZED PCB (ppm)	TOTAL CHLORDANE (ppb)	LIPID NORMALIZED CHLORDANE (ppm)
	Pier J (Queen Mary)											
10	22	CA297	0.12	219.0	48.9	4.08	45.43	37.65	83.1	6.92	6.08	0.51
10	22	CA298	0.18	175.0	50.9	2.83	48.80	18.82	67.6	3.76	8.88	0.49
10	22	CA299	0.06	172.5	15.7	2.61	11.31	13.03	24.3	4.06	0.49	0.08
10	22	CA300	0.08	172.0	10.2	1.28	12.91	2.64	15.6	1.94	0.98	0.12
10	22	CA301	0.09	163.8	14.2	1.58	11.84	2.03	13.9	1.54	0.96	0.11
	Belmont Pier											
10	23	CA492	0.09	176.3	12.1	1.35	7.54	4.70	12.2	1.36	0.49	0.05
10	23	CA493	0.13	171.8	29.6	2.28	19.76	9.33	29.1	2.24	2.43	0.19
10	23	CA494	0.19	167.8	35.7	1.88	21.59	9.55	31.1	1.64	2.38	0.13
10	23	CA495	0.14	166.8	33.1	2.36	14.38	16.03	30.4	2.17	1.43	0.10
10	23	CA496	0.18	161.0	30.1	1.67	19.82	11.49	31.3	1.74	2.39	0.13
	Newport Pier											
10	24	CA102	0.36	178.5	67.1	1.86	20.77	13.35	34.1	0.95	1.29	0.04
10	24	CA103	0.44	149.3	55.5	1.26	26.16	21.02	47.2	1.07	1.72	0.04
10	24	CA104	0.31	159.0	89.2	2.88	43.75	27.11	70.9	2.29	2.60	0.08
10	24	CA105	0.50	141.8	57.5	1.15	27.51	23.68	51.2	1.02	2.43	0.05
10	24	CA106	0.30	159.3	50.3	1.68	21.02	6.28	27.3	0.91	1.46	0.05
QUEENFISH												
	Point Dume											
11	01	CA257	0.14	51.5	28.8	2.05	15.06	4.37	19.4	1.39	0.63	0.04
11	01	CA258	0.32	51.8	34.1	1.07	19.08	2.71	21.8	[illegible].68	2.44	0.08
11	01	CA259	0.49	54.5	23.2	0.47	14.60	2.33	16.9	[illegible].35	2.66	0.05
11	01	CA260	[illegible].59	48.5	[illegible]	1.97	51.35	12.69	[illegible]	1.09	5.10	0.09
11	01	CA261	0.44	43.3	[illegible]	0.81	17.35	1.91	[illegible]	[illegible]	[illegible]	0.04
	Malibu											
11	02	CA112	0.35	57.8	33.6	0.96	0.00	0.04	10.0	0.29	0.00	0.00
11	02	CA113	0.20	57.0	57.5	2.88	25.41	[illegible]	29.6	1.48	3.75	0.19
11	02	[illegible]	[illegible].96	51.5	114.5	[illegible].19	26.68	[illegible]	34.6	0.36	[illegible].14	0.04
11	02	[illegible]	[illegible]	45.8	145.5	[illegible]	44.76	[illegible]0.97	125.7	1.46	[illegible]	0.09
11	02	[illegible]16	[illegible]	45.0	[illegible]	1.31	55.11	18.66	[illegible].8	0.59	[illegible]	0.07
	Marina del Rey											
11	03	CA822	0.37	67.0	[illegible].4	0.74	[illegible].07	15.22	[illegible]	0.85	0.48	0.01
11	03	CA823	0.31	[illegible].3	36.7	1.18	[illegible]	5.28	21.0	0.68	1.21	0.04
11	03	CA824	0.53	[illegible]	36.0	0.68	0.00	0.00	0.0	0.00	1.65	[illegible]03
11	03	CA825	0.36	[illegible]	18.0	0.50	1.43	38.30	39.7	[illegible].10	0.41	[illegible]
11	03	CA826	0.38	50.3	21.4	0.56	1.80	41.47	43.3	1.14	0.40	0.01

APPENDIX C-2

Comparisons of concentrations of PCBs and DDTs in edible muscle tissue of white croaker (*Genyonemus lineatus*) from southern California after standardizing for number of congeners (PCB), method detection limits, and summary method (Arithmetic vs. geometric means).

Appendix C-2a. Comparison of arithmetic mean concentrations (ppb wet weight) for two and three congener estimates of total PCBs in edible musle tissue of white croaker (*Genyonemus lineatus*) from southern California in 1990.

Site	2 congeners		3 congeners	
	Mean	SD	Mean	SD
Point Dume	89	23	90	23
Malibu	130	41	131	41
Santa Monica	76	69	77	69
Marina del Rey	138	95	139	95
Hyperion 7-mile Outfall	233	50	235	50
El Segundo	160	60	162	61
Hermosa Beach	181	83	183	84
Palos Verdes North	721	202	749	208
Palos Verdes South	839	478	866	483
White Point	683	142	731	162
Dana Point	22	10	23	10

SD = Standard deviation
2 congeners = Aroclor 1254 and Aroclor 1260
3 congeners = Aroclor 1254, Aroclor 1260, and Aroclor 1242

02

Appendix C-2b. Censored and uncensored arithmetic mean concentrations (ppb wet weight) of total PCBs (two congeners) in edible musle tissue of white croaker (*Genyonemus lineatus*) in southern California in 1987 and 1990.

	1987				1990			
	Uncensored		Censored		Uncensored		Censored	
Site	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Point Dume	309	196	309	196	89	23	89	23
Malibu Pier	37	44	62	28	-	-	-	-
Malibu	552	169	552	169	130	41	130	41
Santa Monica/Venice Piers (1987) Santa Monica (1990)	81	78	89	72	76	69	89	57
Venice Beach	66	34	72	24	-	-	-	-
Marina del Rey	51	31	62	19	138	95	138	95
Hyperion 7-mile Outfall	-	-	-	-	233	50	233	50
Short Bank	90	36	92	33	-	-	-	-
El Segundo	-	-	-	-	160	60	160	60
Hermosa Beach	-	-	-	-	181	83	181	83
Palos Verdes Northwest (1987) Palos Verdes North (1990)	94	52	103	31	721	202	721	202
Point Vicente (1987) Palos Verdes South 1990)	526	88	526	88	839	478	839	478
White Point	288	167	288	167	683	142	683	142
Cabrillo Pier	231	218	238	218	-	-	-	-
Pier J (Queen Mary)	41	32	60	27	-	-	-	-
LA/LB Harbor Breakwater	73	62	80	52	-	-	-	-
Belmont Pier	27	8	50	0	-	-	-	-
Emma/Eva Oil Platforms	20	13	50	0	-	-	-	-
Horseshoe Kelp	128	83	128	83	-	-	-	-
Huntington Beach	30	28	55	11	-	-	-	-
Newport Pier	46	17	54	9	-	-	-	-
Laguna Beach	12	3	50	0	-	-	-	-
Dana Point	1	2	50	0	22	10	50	0

SD = Standard deviation
Uncensored = Original values used to calculate mean
Censored = Original values adjusted to CalEPA MDL of 50 ppb (Pollock et al. 1991)

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Appendix C-2c. Censored and uncensored arithmetic mean concentrations (ppb wet weight) and 95% confidence limits (L1 and L2) for PCBs (two congeners) in edible musle tissue of white croaker (*Genyonemus lineatus*) in southern California in 1987 and 1990.

Site	1987						1990				
	Uncensored			Censored			Uncensored		Censored		
	Mean	L1	L2	Mean	L1	L2	Mean	L2	Mean	L1	L2
Point Dume	245	85	712	245	85	712	87	123	87	62	123
Malibu Pier	24	6	89	60	38	93	-	-	-	-	-
Malibu	530	461	608	530	461	608	126	141	126	113	141
Santa Monica/Venice Piers (1987) Santa Monica (1990)	61	22	169	76	35	161	43	282	79	41	152
Venice Beach	58	26	129	70	47	106	-	-	-	-	-
Marina del Rey	45	20	97	61	44	86	118	258	118	54	258
Hyperion 7-mile Outfall	-	-	-	-	-	-	230	299	230	177	299
Short Bank	85	48	150	85	48	150	-	-	-	-	-
El Segundo	-	-	-	-	-	-	153	239	153	98	239
Hermosa Beach	-	-	-	-	-	-	160	359	160	71	359
Palos Verdes Northwest (1987) Palos Verdes North (1990)	61	10	372	99	62	160	698	1003	698	486	1003
Point Vicente (1987) Palos Verdes South 1990)	521	420	647	521	420	647	716	1640	716	313	1640
White Point	256	130	503	256	130	503	673	865	673	524	865
Cabrillo Pier	137	25	755	175	56	546	-	-	-	-	-
Pier J (Queen Mary)	33	12	88	60	45	80	-	-	-	-	-
LA/LB Harbor Breakwater	40	8	213	70	36	137	-	-	-	-	-
Belmont Pier	26	16	43	50	50	50	-	-	-	-	-
Emma/Eva Oil Platforms	18	8	41	50	50	50	-	-	-	-	-
Horseshoe Kelp	114	60	217	114	60	217	-	-	-	-	-
Huntington Beach	22	7	71	55	44	69	-	-	-	-	-
Newport Pier	45	29	70	55	45	66	-	-	-	-	-
Laguna Beach	13	10	17	50	50	50	-	-	-	-	-
Dana Point	1	1	3	50	50	50	22	37	22	13	37

SD = Standard deviation

Uncensored = Original values used to calculate mean

Censored = Original values adjusted to CalEPA MDL of 50 ppb (Pollock et al. 1991)

Appendix C-2d. Censored and uncensored arithmetic mean concentrations (ppb wet weight) of total DDTs in edible musle tissue of white croaker (*Genyonemus lineatus*) in southern California from 1987 to 1990.

	1987				1990			
	Uncensored		Censored		Uncensored		Censored	
Site	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Point Dume	287	224	287	224	159	35	159	35
Malibu Pier	34	29	47	21	-	-	-	-
Malibu	532	206	532	206	246	145	246	145
Santa Monica/Venice Piers (1987)								
Santa Monica (1990)	87	74	87	74	137	110	141	104
Venice Beach	48	20	52	47	-	-	-	-
Marina del Rey	66	38	71	32	243	139	243	139
Hyperion 7-mile Outfall	-	-	-	-	357	107	357	107
Short Bank	101	43	101	43	-	-	-	-
El Segundo	-	-	-	-	325	81	325	81
Hermosa Beach	-	-	-	-	461	295	461	295
Palos Verdes Northwest (1987)								
Palos Verdes North (1990)	355	186	356	183	11904	3775	11904	3775
Point Vicente (1987)								
Palos Verdes South (1990)	2673	472	2673	472	10196	6237	10196	6237
White Point	2625	1791	2625	1791	12574	2961	12574	2961
Cabrillo Pier	2203	3317	2203	3317	-	-	-	-
Pier J (Queen Mary)	28	20	43	7	-	-	-	-
LA/LB Harbor Breakwater	132	76	132	76	-	-	-	-
Belmont Pier	28	10	38	0	-	-	-	-
Emma/Eva Oil Platforms	23	17	40	5	-	-	-	-
Horseshoe Kelp	222	57	222	57	-	-	-	-
Huntington Beach	28	23	40	5	-	-	-	-
Newport Pier	64	15	64	15	-	-	-	-
Laguna Beach	14	4	38	0	-	-	-	-
Dana Point	6	4	38	0	88	64	88	62

SD = Standard deviation
Uncensored = Original values
Censored = Original values adjusted to CalEPA method detection limit of 38 ppb (Pollock et al. 1991)

Appendix C-2e. Censored and uncensored geometric mean concentrations (ppb wet weight) and 95% confidence limits (L1 and L2) for DDTs in edible musle tissue of white croaker (*Genyonemus lineatus*) in southern California from 1987 to 1990.

	1987						1990					
	Uncensored			Censored			Uncensored			Censored		
Site	Mean	L1	L2	Mean	L1	L2	Mean	L1	L2	Mean	L1	L2
Point Dume	210	65	683	210	65	683	156	116	210	156	116	210
Malibu Pier	28	12	64	46	30	70	-	-	-	-	-	-
Malibu	507	332	775	507	332	775	221	120	407	221	120	407
Santa Monica/Venice Piers (1987)												
Santa Monica (1990)	71	30	165	71	30	165	96	25	372	113	43	299
Venice Beach	45	25	82	51	37	70	-	-	-	-	-	-
Marina del Rey	57	25	133	66	36	120	212	101	447	212	101	447
Hyperion 7-mile Outfall	-	-	-	-	-	-	346	242	495	346	242	495
Short Bank	93	49	176	93	49	176	-	-	-	-	-	-
El Segundo	-	-	-	-	-	-	318	236	429	318	236	429
Hermosa Beach	-	-	-	-	-	-	378	147	977	378	147	977
Palos Verdes Northwest (1987)												
Palos Verdes North (1990)	259	61	1092	268	70	1027	11429	7650	17074	11429	7650	17074
Point Vicente (1987)												
Palos Verdes South 1990)	2642	2126	3284	2642	2126	3284	8650	4325	17298	8650	4325	17298
White Point	2153	879	5275	2153	879	5275	12303	9185	16478	12303	9185	16478
Cabrillo Pier	897	133	6053	897	133	6053	-	-	-	-	-	-
Pier J (Queen Mary)	24	10	57	43	36	52	-	-	-	-	-	-
LA/LB Harbor Breakwater	119	63	224	119	63	224	-	-	-	-	-	-
Belmont Pier	27	16	46	38	38	38	-	-	-	-	-	-
Emma/Eva Oil Platforms	19	7	49	41	36	47	-	-	-	-	-	-
Horseshoe Kelp	218	161	294	218	161	294	-	-	-	-	-	-
Huntington Beach	21	6	70	43	33	57	-	-	-	-	-	-
Newport Pier	64	48	84	64	48	84	-	-	-	-	-	-
Laguna Beach	15	10	21	38	38	38	-	-	-	-	-	-
Dana Point	6	3	12	38	38	38	72	30	175	74	32	173

SD = Standard Deviation
Uncensored = Original values used to calculate mean
Censored = Original values adjusted to CalEPA MDL of 38 ppb (Pollock et al. 1991)

APPENDIX C-3

List of scientific and common names of species examined in tissue contamination studies of Santa Monica Bay.

Taxa	Common Name
MOLLUSCA	
Bivalvia	
Pectinidae	
Crassedoma giganteum (=Hinnites multirugosa)	giant rock scallop (=rock scallop, purple-hinged rock scallop)
Gastropoda	
Hallotidae	
Haliotis cracherodii	black abalone
CRUSTACEA	
Malacostraca	
Sicyoniidae	
Sicyonia ingentis	ridgeback rock shrimp (=ridgeback prawn)
Palinuridae	
Panulirus interruptus	California spiny lobster
Cancridae	
Cancer anthonyi	yellow rock crab (= yellow crab)
VERTEBRATA	
Elasmobranchiomorphi	
Squalidae	
Squalus acanthias	spiny dogfish
Osteichthyes	
Synodontidae	
Synodus lucioceps	California lizardfish
Myctophidae	
Stenobrachius leucopsarus	northern lampfish
Scorpaenidae	
Scorpaena guttata	California scorpionfish
Sebastes spp.	rockfishes, unid.
Sebastes paucispinis	bocaccio
Anoplopomatidae	
Anoplopoma fimbria	sablefish
Serranidae	
Paralabrax clathratus	kelp bass
Paralabrax nebulifer	barred sand bass
Sciaenidae	
Cheilotrema saturnum	black croaker
Genyonemus lineatus	white croaker
Menticirrhus undulatus	California corbina
Seriphus politus	queenfish
Kyphosidae	
Girella nigricans	opaleye
Medialuna californiensis	halfmoon
Embiotocidae	
Embiotocidae, unid.	surfperches, unid.
Embiotoca jacksoni	black perch
Sphyraenidae	
Sphyraena argentea	Pacific barracuda
Scombridae	
Sarda chiliensis	Pacific bonito
Scomber japonicus	chub (= Pacific) mackerel
Bothidae	
Citharichthys sordidus	Pacific sanddab
Paralichthys californicus	California halibut
Pleuronectidae	
Microstomus pacificus	Dover sole
Pleuronectes (= Parophrys) vetulus	English sole
Pleuronichthys verticalis	hornyhead turbot

Names from the following: mollusks, Turgeon 1988; crustaceans, Williams 1989; fish, Robins 1991.

APPENDIX C-4

Concentrations of PCBs in muscle tissue of seafood species from Santa Monica Bay and adjacent areas, 1973-1990 (from Mearns et al. 1991)

Appendix C-4. Concentrations of PCBs in muscle tissue of seafood species from Santa Monica Bay and adjacent areas, 1973-1990 (from Mearns et al. 1991).

Common Name	Site	Year	No. of samples	PCB's (ppm wet weight) Mean	Min	Max	S.D.	Source
giant rock scallop	Santa Catalina Island	1973/74	2	0.003	0.001	0.004	0.002	Young et al. 1978
giant rock scallop	Cortez Bank	1975	8	0.007	0.001	0.011	0.004	Young et al. 1978
giant rock scallop	Palos Verdes	1975/76	9	0.014	0.008	0.020	0.004	Young et al. 1978
giant rock scallop	Dana Point	1976	3	0.002	0.001	0.003	0.001	Young et al. 1978
giant rock scallop	Point Dume	1975–77	3	0.003	0.002	0.004	0.001	Young et al. 1978
black abalone	Palos Verdes	1976	5	0.022	0.004	0.037	0.015	Young et al. 1978
black abalone	Santa Catalina Island	1976	3	0.024	0.006	0.043	0.019	Young et al. 1978
ridgeback rock shrimp	Santa Catalina Island	1976	3	0.016	0.012	0.021	0.005	Young et al. 1978
ridgeback rock shrimp	Palos Verdes	1980	5	0.061	0.039	0.089	0.025	Young et al. 1978
California spiny lobster	Palos Verdes	1976	5	0.097	0.011	0.282	0.110	Young et al. 1978
California spiny lobster	Santa Catalina Island	1977	3	0.010	0.002	0.014	0.007	Young et al. 1978
yellow rock crab	Dana Point	1976	3	0.032	0.020	0.039	0.011	Young et la. 1978
yellow rock crab	White Point	1990	5	0.019	0.007	0.029	0.010	Jarman et al. 1991
yellow rock crab	Dana Point	1990	5	0.005	0.003	0.006	0.001	Jarman et al. 1991
spiny dogfish	Palos Verdes	1980	5	5.120	0.400	14.800	5.744	Schafer et al. 1982
spiny dogfish	Palos Verdes, PV 7.3	1981	1	3.131	–	–	–	Gossett et al. 1983
spiny dogfish	White Point	1981	3	7.380	1.742	14.315	6.719	Gossett et al. 1983
California lizardfish	Santa Monica Bay	1981	5	0.017	0.010	0.023	0.006	Gossett et al. 1983
California scorpionfish	Santa Catalina Island	1974/75	3	0.043	0.008	0.063	0.030	Young et la. 1978
California scorpionfish	Palos Verdes	1975	4	0.573	0.405	0.985	0.276	Young et la. 1978
California scorpionfish	Palos Verdes	1980	4	0.044	0.005	0.093	0.035	Schafer et al. 1982
California scorpionfish	Santa Monica Bay	1981	5	0.129	0.017	0.217	0.073	Gossett et al. 1983
California scorpionfish	White Point	1981	5	0.066	0.026	0.094	0.028	Gossett et al. 1983
California scorpionfish	Point Dume	1987	5	0.013	0.000	0.041	–	Pollock et al 1991
California scorpionfish	Marina del Rey	1987	5	0.001	0.000	0.005	–	Pollock et al 1991
California scorpionfish	Short Bank	1987	5	0.008	0.000	0.010	–	Pollock et al 1991
California scorpionfish	Palos Verdes (NW)	1987	5	0.009	0.005	0.016	–	Pollock et al 1991
California scorpionfish	Redondo Beach	1987	5	0.002	0.000	0.007	–	Pollock et al 1991
California scorpionfish	White Point	1987	5	0.038	0.028	0.052	–	Pollock et al 1991
California scorpionfish	Fourteen Mile Bank	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
California scorpionfish	Huntington Beach	1987	5	0.025	0.008	0.037	–	Pollock et al 1991
California scorpionfish	Emma and Eva Oil Platforms	1987	5	0.001	0.000	0.005	–	Pollock et al 1991
California scorpionfish	Horseshoe Kelp	1987	5	0.152	0.029	0.285	–	Pollock et al 1991
California scorpionfish	Point Vicente	1987	5	0.002	0.000	0.005	–	Pollock et al 1991
California scorpionfish	Venice Beach	1987	5	0.003	0.000	0.009	–	Pollock et al 1991
California scorpionfish	LA/LB Harbor Breakwater	1987	5	0.002	0.000	0.004	–	Pollock et al 1991
California scorpionfish	Redondo Pier	1987	5	0.007	0.006	0.010	–	Pollock et al 1991
rockfishes	Short Bank	1987	15	0.017	0.000	0.050	–	Pollock et al 1991
rockfishes	Palos Verdes (NW)	1987	5	0.012	0.007	0.022	–	Pollock et al 1991
rockfishes	Redondo Beach	1987	5	0.007	0.002	0.013	–	Pollock et al 1991
rockfishes	White Point	1987	10	0.022	0.000	0.076	–	Pollock et al 1991
rockfishes	Fourteen Mile Bank	1987	10	0.002	0.000	0.006	–	Pollock et al 1991
rockfishes	Horseshoe Kelp	1987	5	0.020	0.013	0.023	–	Pollock et al 1991
rockfishes	Twin Harbor, Santa Catalina Is.	1987	5	0.002	0.001	0.005	–	Pollock et al 1991
rockfishes	Point Vicente	1987	10	0.016	0.007	0.022	–	Pollock et al 1991
rockfishes	LA/LB Harbor Breakwater	1987	5	0.021	0.003	0.070	–	Pollock et al 1991
bocaccio	Palos Verdes	1980	7	0.149	0.078	0.382	0.106	SCCWRP
bocaccio	Santa Monica Bay	1981	5	0.020	0.017	0.026	0.004	Gossett et al. 1983
sablefish	Santa Monica Bay (7M)	1978	5	0.188	0.096	0.268	0.062	SCCWRP, unpublished
kelp bass	White Point	1981	5	0.042	0.036	0.060	0.010	Gossett et al. 1983
kelp bass	Point Dume	1987	5	0.008	0.006	0.011	–	Pollock et al 1991
kelp bass	Malibu	1987	5	0.006	0.000	0.009	–	Pollock et al 1991
kelp bass	Marina del Rey	1987	5	0.004	0.000	0.019	–	Pollock et al 1991
kelp bass	Palos Verdes (NW)	1987	5	0.023	0.010	0.049	–	Pollock et al 1991
kelp bass	White Point	1987	5	0.015	0.005	0.025	–	Pollock et al 1991
kelp bass	Huntington Beach	1987	5	0.012	0.008	0.017	–	Pollock et al 1991

Appendix C-4 (Cont).

Common Name	Site	Year	No. of samples	PCB's (ppm wet weight) Mean	Min	Max	S.D.	Source
kelp bass	Laguna Beach	1987	5	0.005	0.000	0.010	–	Pollock et al 1991
kelp bass	Emma and Eva Oil Platforms	1987	5	0.006	0.001	0.010	–	Pollock et al 1991
kelp bass	Horseshoe Kelp	1987	5	0.016	0.008	0.024	–	Pollock et al 1991
kelp bass	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
kelp bass	Point Vicente	1987	5	0.010	0.003	0.018	–	Pollock et al 1991
kelp bass	Dana Point	1987	5	0.016	0.007	0.033	–	Pollock et al 1991
kelp bass	Venice Beach	1987	5	0.010	0.006	0.015	–	Pollock et al 1991
kelp bass	LA/LB Harbor Breakwater	1987	5	0.012	0.006	0.022	–	Pollock et al 1991
barred sand bass	Belmont Pier	1981	3	0.052	0.034	0.069	0.018	Gossett et al. 1983
barred sand bass	Orange County	1981	5	0.021	0.015	0.030	0.006	Gossett et al. 1983
barred sand bass	Marina del Rey	1987	5	0.018	0.007	0.050	–	Pollock et al 1991
barred sand bass	Huntington Beach	1987	5	0.023	0.018	0.029	–	Pollock et al 1991
barred sand bass	Laguna Beach	1987	5	0.036	0.016	0.081	–	Pollock et al 1991
barred sand bass	Emma and Eva Oil Platforms	1987	5	0.016	0.011	0.022	–	Pollock et al 1991
barred sand bass	Horseshoe Kelp	1987	5	0.019	0.017	0.022	–	Pollock et al 1991
barred sand bass	Dana Point	1987	5	0.014	0.004	0.021	–	Pollock et al 1991
barred sand bass	LA/LB Harbor Breakwater	1987	5	0.032	0.020	0.041	–	Pollock et al 1991
barred sand bass	Pier J (Queen Mary)	1987	5	0.067	0.013	0.117	–	Pollock et al 1991
black croaker	Malibu	1987	5	0.001	0.000	0.002	–	Pollock et al 1991
black croaker	Marina del Rey	1987	5	0.034	0.011	0.070	–	Pollock et al 1991
black croaker	Palos Verdes (NW)	1987	5	0.011	0.003	0.021	–	Pollock et al 1991
black croaker	Emma and Eva Oil Platforms	1987	5	0.032	0.015	0.045	–	Pollock et al 1991
black croaker	Horseshoe Kelp	1987	5	0.035	0.009	0.052	–	Pollock et al 1991
black croaker	LA/LB Harbor Breakwater	1987	5	0.058	0.030	0.106	–	Pollock et al 1991
black croaker	Pier J (Queen Mary)	1987	5	0.078	0.021	0.126	–	Pollock et al 1991
black croaker	Belmont Pier	1987	5	0.055	0.021	0.100	–	Pollock et al 1991
black croaker	Newport Pier	1987	5	0.011	0.005	0.018	–	Pollock et al 1991
white croaker	Palos Verdes	1975	10	2.780	0.310	9.950	3.210	Young et al. 1978
white croaker	Los Angeles Harbor	1980	5	0.571	0.361	0.935	0.215	Mearns and Young 1980
white croaker	Palos Verdes	1980	5	0.383	0.232	0.506	0.112	Schafer et al. 1982
white croaker	Belmont Pier	1981	5	0.101	0.055	0.175	0.051	Gossett et al. 1983
white croaker	Cabrillo Pier	1981	5	0.184	0.094	0.256	0.058	Gossett et al. 1983
white croaker	Dana Point	1981	4	0.047	0.012	0.173	0.057	Gossett et al. 1983
white croaker	Gerald Desmond Bridge	1981	5	0.418	0.155	0.642	0.206	Gossett et al. 1983
white croaker	Marina del Rey	1981	5	0.125	0.026	0.399	0.155	Gossett et al. 1983
white croaker	Navy Mole, LAH	1981	7	0.141	0.046	0.386	0.119	Gossett et al. 1983
white croaker	Orange County Control	1981	10	0.017	0.008	0.027	0.007	Gossett et al. 1983
white croaker	Palos Verdes	1981	2	0.876	0.176	1.575	–	Gossett et al. 1983
white croaker	Queen Mary	1981	6	0.122	0.034	0.311	0.103	Gossett et al. 1983
white croaker	Redondo Area Piers	1981	5	0.055	0.029	0.137	0.046	Gossett et al. 1983
white croaker	Santa Monica Bay	1981	5	0.203	0.069	0.334	0.095	Gossett et al. 1983
white croaker	Santa Monica Pier/Malibu	1981	5	0.015	0.009	0.020	0.004	Gossett et al. 1983
white croaker	Venice Pier	1981	5	0.099	0.039	0.224	0.076	Gossett et al. 1983
white croaker	Santa Monica Pier	1986	7	0.067	–	–	–	Risebrough, 1987
white croaker	Hueneme Pier	1986	8	0.029	–	–	0.004	Risebrough, 1987
white croaker	Cabrillo Pier	1986	9	0.363	–	–	0.016	Risebrough, 1987
white croaker	Belmont Pier	1986	9	0.112	–	–	0.012	Risebrough, 1987
white croaker	Orange County Outfall	1986	–	0.108	–	–	–	CSDOC 1990*
white croaker	Point Dume	1987	5	0.309	0.061	0.552	–	Pollock et al 1991
white croaker	Malibu	1987	5	1.135	0.311	3.539	–	Pollock et al 1991
white croaker	Marina del Rey	1987	5	0.051	0.021	0.094	–	Pollock et al 1991
white croaker	Short Bank	1987	5	0.091	0.041	0.126	–	Pollock et al 1991
white croaker	Palos Verdes (NW)	1987	5	0.094	0.004	0.136	–	Pollock et al 1991
white croaker	White Point	1987	5	0.288	0.051	0.529	–	Pollock et al 1991
white croaker	Huntington Beach	1987	5	0.030	0.007	0.075	–	Pollock et al 1991
white croaker	Laguna Beach	1987	5	0.012	0.008	0.016	–	Pollock et al 1991
white croaker	Emma and Eva Oil Platforms	1987	5	0.020	0.006	0.040	–	Pollock et al 1991
white croaker	Horseshoe Kelp	1987	5	0.128	0.077	0.273	–	Pollock et al 1991
white croaker	Point Vicente	1987	5	0.526	0.370	0.595	–	Pollock et al 1991
white croaker	Dana Point	1987	5	0.001	0.000	0.003	–	Pollock et al 1991
white croaker	Venice Beach	1987	5	0.066	0.020	0.089	–	Pollock et al 1991
white croaker	LA/LB Harbor Breakwater	1987	5	0.072	0.011	0.181	–	Pollock et al 1991
white croaker	Malibu Pier	1987	5	0.037	0.008	0.112	–	Pollock et al 1991
white croaker	Santa Monica/Venice Piers	1987	5	0.081	0.025	0.217	–	Pollock et al 1991

Appendix C-4 (Cont).

Common Name	Site	Year	No. of samples	PCB's (ppm wet weight) Mean	Min	Max	S.D.	Source
white croaker	Cabrillo Pier	1987	20	0.231	0.013	0.589	–	Pollock et al 1991
white croaker	Pier J (Queen Mary)	1987	5	0.041	0.014	0.083	–	Pollock et al 1991
white croaker	Belmont Pier	1987	5	0.027	0.012	0.031	–	Pollock et al 1991
white croaker	Newport Pier	1987	5	0.046	0.027	0.071	–	Pollock et al 1991
white croaker	White Point	1988	10	1.180	0.400	2.500	0.725	LACSD Ann Rpt 1988
white croaker	Point Dume	1990	5	0.163	0.109	0.208	0.039	Jarman et al. 1991
white croaker	Malibu	1990	5	0.243	0.169	0.346	0.076	Jarman et al. 1991
white croaker	Santa Monica	1990	5	0.140	0.013	0.325	0.118	Jarman et al. 1991
white croaker	Hyperion	1990	5	0.426	0.308	0.535	0.088	Jarman et al. 1991
white croaker	El Segundo	1990	5	0.292	0.210	0.428	0.106	Jarman et al. 1991
white croaker	Hermosa	1990	5	0.336	0.103	0.511	0.150	Jarman et al. 1991
white croaker	Palos Verde N.	1990	5	1.483	0.987	1.905	0.420	Jarman et al. 1991
white croaker	Palos Verde S.	1990	5	1.726	0.595	2.854	0.966	Jarman et al. 1991
white croaker	White Point	1990	5	1.455	1.054	1.976	0.337	Jarman et al. 1991
white croaker	Dana Point	1990	5	0.043	0.023	0.069	0.019	Jarman et al. 1991
California corbina	Belmont Pier	1981	4	0.149	0.009	0.494	0.232	Gossett et al. 1983
California corbina	Malibu	1987	5	0.004	0.001	0.007	–	Pollock et al 1991
California corbina	Redondo Beach	1987	5	0.021	0.002	0.056	–	Pollock et al 1991
California corbina	Huntington Beach	1987	5	0.048	0.014	0.068	–	Pollock et al 1991
California corbina	Dana Point	1987	5	0.003	0.000	0.005	–	Pollock et al 1991
California corbina	Venice Beach	1987	5	0.029	0.014	0.076	–	Pollock et al 1991
California corbina	Malibu Pier	1987	5	0.016	0.012	0.022	–	Pollock et al 1991
California corbina	Santa Monica/Venice Piers	1987	5	0.016	0.012	0.019	–	Pollock et al 1991
California corbina	Redondo Pier	1987	5	0.105	0.020	0.212	–	Pollock et al 1991
California corbina	Newport Pier	1987	5	0.129	0.096	0.169	–	Pollock et al 1991
queenfish	Cabrillo Pier	1981	5	0.058	0.030	0.095	0.029	Gossett et al. 1983
queenfish	Point Dume	1987	5	0.028	0.017	0.064	–	Pollock et al 1991
queenfish	Malibu	1987	5	0.055	0.009	0.126	–	Pollock et al 1991
queenfish	Marina del Rey	1987	5	0.027	0.000	0.043	–	Pollock et al 1991
queenfish	Short Bank	1987	5	0.009	0.000	0.024	–	Pollock et al 1991
queenfish	Palos Verdes (NW)	1987	5	0.012	0.008	0.019	–	Pollock et al 1991
queenfish	Redondo Beach	1987	5	0.014	0.008	0.020	–	Pollock et al 1991
queenfish	White Point	1987	5	0.025	0.015	0.041	–	Pollock et al 1991
queenfish	Huntington Beach	1987	5	0.026	0.000	0.045	–	Pollock et al 1991
queenfish	Laguna Beach	1987	5	0.020	0.004	0.032	–	Pollock et al 1991
queenfish	Emma and Eva Oil Platforms	1987	5	0.018	0.013	0.031	–	Pollock et al 1991
queenfish	Point Vicente	1987	5	0.020	0.010	0.027	–	Pollock et al 1991
queenfish	Dana Point	1987	5	0.031	0.001	0.077	–	Pollock et al 1991
queenfish	Venice Beach	1987	5	0.033	0.023	0.041	–	Pollock et al 1991
queenfish	LA/LB Harbor Breakwater	1987	5	0.082	0.047	0.067	–	Pollock et al 1991
queenfish	Malibu Pier	1987	5	0.412	0.086	1.119	–	Pollock et al 1991
queenfish	Santa Monica/Venice Piers	1987	5	0.019	0.000	0.059	–	Pollock et al 1991
queenfish	Redondo Piers	1987	5	0.016	0.000	0.030	–	Pollock et al 1991
queenfish	Cabrillo Pier	1987	5	0.105	0.025	0.180	–	Pollock et al 1991
queenfish	Pier J (Queen Mary)	1987	5	0.038	0.017	0.097	–	Pollock et al 1991
queenfish	Belmont Pier	1987	5	0.040	0.022	0.056	–	Pollock et al 1991
queenfish	Newport Pier	1987	5	0.022	0.000	0.036	–	Pollock et al 1991
opaleye	White Point	1987	5	0.000	0.000	0.003	–	Pollock et al 1991
opaleye	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
halfmoon	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
surfperches	Point Dume	1987	5	0.010	0.000	0.014	–	Pollock et al 1991
surfperches	Marina del Rey	1987	5	0.028	0.014	0.051	–	Pollock et al 1991
surfperches	Palos Verdes (NW)	1987	5	0.015	0.005	0.026	–	Pollock et al 1991
surfperches	Redondo Beach	1987	5	0.022	0.013	0.030	–	Pollock et al 1991
surfperches	White Point	1987	5	0.030	0.014	0.047	–	Pollock et al 1991
surfperches	Huntington Beach	1987	5	0.015	0.003	0.034	–	Pollock et al 1991
surfperches	Laguna Beach	1987	5	0.002	0.000	0.007	–	Pollock et al 1991
surfperches	Point Vicente	1987	5	0.020	0.005	0.041	–	Pollock et al 1991
surfperches	Dana Point	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
surfperches	LA/LB Harbor Breakwater	1987	5	0.061	0.049	0.082	–	Pollock et al 1991
surfperches	Malibu Pier	1987	5	0.003	0.000	0.006	–	Pollock et al 1991
surfperches	Redondo Piers	1987	5	0.019	0.017	0.022	–	Pollock et al 1991

Appendix C-4 (Cont).

Common Name	Site	Year	No. of samples	PCB's (ppm wet weight) Mean	Min	Max	S.D.	Source
surfperches	Cabrillo Pier	1987	15	0.076	0.019	0.224	–	Pollock et al 1991
surfperches	Pier J (Queen Mary)	1987	15	0.193	0.059	0.456	–	Pollock et al 1991
surfperches	Belmont Pier	1987	15	0.116	0.031	0.265	–	Pollock et al 1991
surfperches	Newport Pier	1987	5	0.016	0.011	0.024	–	Pollock et al 1991
Pacific barracuda	White Point	1981	5	0.047	0.037	0.060	0.011	Gossett et al. 1983
Pacific barracuda	Fourteen Mile Bank	1987	5	0.016	0.010	0.024	–	Pollock et al 1991
Pacific barracuda	Dana Point	1987	5	0.009	0.002	0.020	–	Pollock et al 1991
Pacific bonito	Coastal	1980/81	5	0.029	0.013	0.056	0.017	Schafer et al. 1982
Pacific bonito	White Point	1981	5	0.022	0.012	0.044	0.013	Gossett et al. 1983
Pacific bonito	Laguna Beach	1981	5	0.019	0.011	0.031	0.008	Gossett et al. 1983
Pacific bonito	Point Dume	1987	5	0.011	0.005	0.019	–	Pollock et al 1991
Pacific bonito	Malibu	1987	5	0.020	0.008	0.029	–	Pollock et al 1991
Pacific bonito	Marina del Rey	1987	5	0.008	0.000	0.025	–	Pollock et al 1991
Pacific bonito	Short Bank	1987	5	0.004	0.000	0.008	–	Pollock et al 1991
Pacific bonito	Palos Verdes (NW)	1987	5	0.007	0.004	0.011	–	Pollock et al 1991
Pacific bonito	Redondo Beach	1987	5	0.018	0.010	0.034	–	Pollock et al 1991
Pacific bonito	White Point	1987	5	0.030	0.002	0.112	–	Pollock et al 1991
Pacific bonito	Fourteen Mile Bank	1987	5	0.002	0.000	0.005	–	Pollock et al 1991
Pacific bonito	Huntington Beach	1987	5	0.017	0.000	0.039	–	Pollock et al 1991
Pacific bonito	Laguna Beach	1987	5	0.004	0.000	0.007	–	Pollock et al 1991
Pacific bonito	Emma and Eva Oil Platforms	1987	5	0.003	0.002	0.005	–	Pollock et al 1991
Pacific bonito	Horseshoe Kelp	1987	5	0.006	0.003	0.009	–	Pollock et al 1991
Pacific bonito	Twin Harbor, Santa Catalina Is.	1987	5	0.010	0.002	0.024	–	Pollock et al 1991
Pacific bonito	Point Vicente	1987	5	0.009	0.007	0.029	–	Pollock et al 1991
Pacific bonito	Dana Point	1987	5	0.000	0.000	0.002	–	Pollock et al 1991
Pacific bonito	Venice Beach	1987	5	0.008	0.005	0.012	–	Pollock et al 1991
Pacific bonito	LA/LB Harbor Breakwater	1987	5	0.006	0.000	0.017	–	Pollock et al 1991
Pacific bonito	Malibu Pier	1987	5	0.019	0.007	0.054	–	Pollock et al 1991
Pacific bonito	Santa Monica/Venice Piers	1987	5	0.012	0.005	0.030	–	Pollock et al 1991
Pacific bonito	Redondo Pier	1987	5	0.006	0.000	0.009	–	Pollock et al 1991
Pacific bonito	Cabrillo Pier	1987	5	0.039	0.019	0.063	–	Pollock et al 1991
Pacific bonito	Pier J (Queen Mary)	1987	5	0.038	0.002	0.121	–	Pollock et al 1991
Pacific bonito	Belmont Pier	1987	5	0.034	0.019	0.050	–	Pollock et al 1991
Pacific bonito	Newport Pier	1987	5	0.002	0.001	0.003	–	Pollock et al 1991
chub mackerel	Santa Monica Bay	1981	5	0.015	0.007	0.023	0.007	Gossett et al. 1983
chub mackerel	Laguna Beach	1981	5	0.034	0.020	0.069	0.022	Gossett et al. 1983
chub mackerel	Coastal	1980/81	6	0.026	0.002	0.065	0.022	Schafer et al. 1982
chub mackerel	White Point	1981	1	0.012	–	–	–	Gossett et al. 1983
chub mackerel	Point Dume	1987	5	0.003	0.000	0.005	–	Pollock et al 1991
chub mackerel	Malibu	1987	5	0.001	0.000	0.005	–	Pollock et al 1991
chub mackerel	Marina del Rey	1987	5	0.008	0.004	0.011	–	Pollock et al 1991
chub mackerel	Short Bank	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
chub mackerel	Palos Verdes (NW)	1987	5	0.006	0.002	0.009	–	Pollock et al 1991
chub mackerel	Redondo Beach	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
chub mackerel	White Point	1987	5	0.019	0.000	0.051	–	Pollock et al 1991
chub mackerel	Fourteen Mile Bank	1987	5	0.001	0.000	0.005	–	Pollock et al 1991
chub mackerel	Huntington Beach	1987	5	0.004	0.000	0.010	–	Pollock et al 1991
chub mackerel	Laguna Beach	1987	5	0.001	0.000	0.004	–	Pollock et al 1991
chub mackerel	Emma and Eva Oil Platforms	1987	5	0.005	0.000	0.012	–	Pollock et al 1991
chub mackerel	Horseshoe Kelp	1987	5	0.008	0.004	0.011	–	Pollock et al 1991
chub mackerel	Twin Harbor, Santa Catalina Is.	1987	5	0.017	0.006	0.024	–	Pollock et al 1991
chub mackerel	Point Vicente	1987	5	0.018	0.003	0.057	–	Pollock et al 1991
chub mackerel	Dana Point	1987	5	0.003	0.001	0.007	–	Pollock et al 1991
chub mackerel	Venice Beach	1987	5	0.003	0.000	0.008	–	Pollock et al 1991
chub mackerel	LA/LB Harbor Breakwater	1987	5	0.004	0.000	0.012	–	Pollock et al 1991
chub mackerel	Malibu Pier	1987	5	0.010	0.003	0.017	–	Pollock et al 1991
chub mackerel	Santa Monica/Venice Piers	1987	5	0.002	0.001	0.004	–	Pollock et al 1991
chub mackerel	Redondo Pier	1987	5	0.003	0.000	0.011	–	Pollock et al 1991
chub mackerel	Cabrillo Pier	1987	5	0.023	0.014	0.049	–	Pollock et al 1991
chub mackerel	Pier J (Queen Mary)	1987	5	0.010	0.002	0.019	–	Pollock et al 1991
chub mackerel	Belmont Pier	1987	5	0.024	0.015	0.041	–	Pollock et al 1991
chub mackerel	Newport Pier	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
Pacific sanddab	Palos Verdes	1975	19	0.474	0.284	1.130	0.211	Young et al. 1978

Appendix C-4 (Cont).

Common Name	Site	Year	No. of samples	PCB's (ppm wet weight) Mean	Min	Max	S.D.	Source
Pacific sanddab	Dana Point	1975	10	0.026	<0.001	0.053	0.016	SCCWRP, unpublished
Pacific sanddab	T2 200	1977	14	0.548	0.051	1.462	0.430	SCCWRP, unpublished
Pacific sanddab	T5 200	1977	5	0.910	0.125	3.159	1.273	SCCWRP, unpublished
Pacific sanddab	Santa Monica Bay (7M)	1978	6	0.115	0.059	0.183	0.050	SCCWRP, unpublished
Pacific sanddab	Orange County Outfall	1985	–	<0.050	–	–	–	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1985	–	<0.050	–	–	–	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1986	–	<0.050	–	–	–	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1986	1	0.020	–	–	–	CSDOC 1990*
Pacific sanddab	White Point	1987	5	0.020	0.001	0.076	–	Pollock et al 1991
Pacific sanddab	Horseshoe Kelp	1987	5	0.013	0.000	0.036	–	Pollock et al 1991
Pacific sanddab	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.001	0.007	–	Pollock et al 1991
California halibut	Los Angeles Harbor	1980	4	0.154	0.127	0.199	0.027	Mearns and Young 1980 *
California halibut	Newport Bay	1980	10	0.032	0.008	0.016	0.030	MBC; SCCWRP 1980
California halibut	Cabrillo Pier	1981	5	0.052	0.049	0.059	0.004	Gossett et al. 1983
California halibut	Belmont Pier	1981	4	0.062	0.023	0.107	0.034	Gossett et al. 1983
California halibut	Point Dume	1987	5	0.009	0.000	0.028	–	Pollock et al 1991
California halibut	Malibu	1987	5	0.002	0.000	0.010	–	Pollock et al 1991
California halibut	Marina del Rey	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
California halibut	Redondo Beach	1987	5	0.003	0.000	0.016	–	Pollock et al 1991
California halibut	Dana Point	1987	5	0.006	0.000	0.008	–	Pollock et al 1991
California halibut	Malibu Pier	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
California halibut	Santa Monica/Venice Piers	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
Dover sole	Gaviota (C2)	1977	5	0.020	0.001	0.048	0.022	SCCWRP, unpublished
Dover sole	Rincon (C3)	1977	6	0.074	0.046	0.127	0.032	SCCWRP, unpublished
Dover sole	Malibu C–18	1977	6	0.271	0.038	0.682	0.226	SCCWRP, unpublished
Dover sole	Santa Monica Bay (A5)	1977	2	0.233	0.126	0.273	0.076	SCCWRP, unpublished
Dover sole	Santa Monica Bay (B4)	1977	6	0.107	0.068	0.162	0.041	SCCWRP, unpublished
Dover sole	Santa Monica Bay	1977	5	0.166	0.070	0.498	0.186	SCCWRP, unpublished
Dover sole	Palos Verdes (T3)	1977	6	3.166	0.681	10.423	3.684	SCCWRP, unpublished
Dover sole	Huntington Beach (T1)	1977	4	0.870	0.493	1.324	0.354	SCCWRP, unpublished
Dover sole	Orange County (T3)	1977	6	0.174	0.100	0.246	0.058	SCCWRP, unpublished
Dover sole	Point Loma, Sunset Cliffs	1977	6	0.170	0.116	0.280	0.068	SCCWRP, unpublished
Dover sole	T–2 –200	1977	6	1.713	1.041	2.557	0.064	SCCWRP, unpublished
Dover sole	Palos Verdes	1980	5	0.278	0.162	0.505	0.133	Schafer et al. 1982
English sole	Rincon (C9)	1977	6	0.045	0.035	0.065	0.011	SCCWRP, unpublished
English sole	Santa Monica Bay	1977	4	0.905	0.769	1.172	0.181	SCCWRP, unpublished

– = Not Available; S.D.= standard deviation

* Units not given in table. Units are from C. Phillips, SAIC, San Diego, pers. comm.

APPENDIX C-5

Concentrations of DDT in muscle tissue of seafood species from Santa Monica Bay and adjacent areas, 1973-1990 (modified from Mearns et al. 1991

Appendix C-5. Concentrations of DDT in muscle tissue of seafood species from Santa Monica Bay and adjacent areas, 1973-1990 (modified from Mearns et al. 1991).

Common Name	Site	Year	No. of samples	DDT (ppm wet weight) Mean	Min	Max	S.D.	Source
giant rock scallop	Santa Catalina Island	1973/74	2	0.001	–	–	–	Young et al. 1978
giant rock scallop	Cortez Bank	1975	8	0.050	0.001	0.181	0.058	Young et al. 1978
giant rock scallop	Palos Verdes	1975/76	9	0.150	0.096	0.225	0.042	Young et al. 1978
giant rock scallop	Dana Point	1976	3	0.004	0.004	0.005	0.001	Young et al. 1978
giant rock scallop	Point Dume	1975/77	3	0.014	0.011	0.016	0.003	Young et al. 1978
black abalone	Palos Verdes	1976	5	0.001	0.001	0.002	0.000	Young et al. 1978
black abalone	Santa Catalina Island	1976	3	0.001	–	–	–	Young et al. 1978
ridgeback rock shrimp	Santa Catalina Island	1976	3	0.004	0.003	0.007	0.002	Young et al. 1978
ridgeback rock shrimp	Palos Verdes	1980	5	0.327	0.272	0.450	0.077	Schafer et al. 1982
California spiny lobster	Palos Verdes	1976	5	0.563	0.058	1.490	0.588	Young et al. 1978
California spiny lobster	Santa Catalina Island	1977	3	0.003	0.001	0.005	0.002	Young et al. 1978
yellow rock crab	Dana Point	1976	3	0.005	0.002	0.009	0.004	Young et al. 1978
yellow rock crab	White Point	1990	5	0.031	0.008	0.062	0.022	Jarman et al. 1991
yellow rock crab	Dana Point	1990	5	0.003	0.001	0.005	0.002	Jarman et al. 1991
spiny dogfish	Palos Verdes	1980	5	–	2.700	200.000	79.228	Schafer et al. 1982
spiny dogfish	Palos Verdes, PV 7.3	1981	1	44.018	–	–	–	Gossett et al. 1983
spiny dogfish	White Point	1981	3	93.657	14.430	200.056	95.749	Gossett et al. 1983
California lizardfish	Santa Monica Bay	1981	5	0.097	0.051	0.162	0.004	Gossett et al. 1983
California scorpionfish	Santa Catalina Island	1974/75	3	0.097	0.034	0.146	0.057	Young et al. 1978
California scorpionfish	Palos Verdes	1975	4	3.573	2.040	5.220	1.409	Young et al. 1978
California scorpionfish	Palos Verdes	1980	4	0.266	0.028	0.764	0.290	Schafer et al. 1982
California scorpionfish	Santa Monica Bay	1981	5	0.535	0.045	1.397	0.521	Gossett et al. 1983
California scorpionfish	White Point	1981	5	0.759	0.194	1.141	0.577	Gossett et al. 1983
California scorpionfish	Point Dume	1987	5	0.014	0.004	0.022	–	Pollock et al 1991
California scorpionfish	Marina del Rey	1987	5	0.009	0.003	0.031	–	Pollock et al 1991
California scorpionfish	Short Bank	1987	5	0.014	0.007	0.020	–	Pollock et al 1991
California scorpionfish	Palos Verdes (NW)	1987	5	0.034	0.016	0.054	–	Pollock et al 1991
California scorpionfish	Redondo Beach	1987	5	0.012	0.009	0.014	–	Pollock et al 1991
California scorpionfish	White Point	1987	5	0.196	0.053	0.358	–	Pollock et al 1991
California scorpionfish	Fourteen Mile Bank	1987	5	0.024	0.016	0.035	–	Pollock et al 1991
California scorpionfish	Huntington Beach	1987	5	0.062	0.015	0.111	–	Pollock et al 1991
California scorpionfish	Emma and Eva Oil Platforms	1987	5	0.017	0.007	0.022	–	Pollock et al 1991
California scorpionfish	Horseshoe Kelp	1987	5	0.267	0.065	0.549	–	Pollock et al 1991
California scorpionfish	Point Vicente	1987	5	0.046	0.015	0.093	–	Pollock et al 1991
California scorpionfish	Venice Beach	1987	5	0.009	0.002	0.021	–	Pollock et al 1991
California scorpionfish	LA/LB Harbor Breakwater	1987	5	0.014	0.005	0.020	–	Pollock et al 1991
California scorpionfish	Redondo Pier	1987	5	0.012	0.003	0.021	–	Pollock et al 1991
rockfishes	Short Bank	1987	15	0.053	0.010	0.131	–	Pollock et al 1991
rockfishes	Palos Verdes (NW)	1987	5	0.071	0.040	0.158	–	Pollock et al 1991
rockfishes	Redondo Beach	1987	5	0.020	0.003	0.037	–	Pollock et al 1991
rockfishes	White Point	1987	10	0.113	0.026	0.383	–	Pollock et al 1991
rockfishes	Fourteen Mile Bank	1987	10	0.017	0.003	0.029	–	Pollock et al 1991
rockfishes	Horseshoe Kelp	1987	5	0.046	0.032	0.065	–	Pollock et al 1991
rockfishes	Twin Harbor, Santa Catalina Is.	1987	5	0.006	0.002	0.008	–	Pollock et al 1991
rockfishes	Point Vicente	1987	10	0.082	0.037	0.118	–	Pollock et al 1991
rockfishes	LA/LB Harbor Breakwater	1987	5	0.047	0.024	0.106	–	Pollock et al 1991
bocaccio	Palos Verdes	1980	7	1.057	0.252	3.940	1.291	SCCWRP
bocaccio	Santa Monica Bay	1981	5	0.058	0.046	0.072	0.010	Gossett et al. 1983
sablefish	Santa Monica Bay (7M)	1978	5	0.191	0.160	0.231	0.027	SCCWRP, unpublished
kelp bass	White Point	1981	5	0.285	0.055	0.446	0.151	Gossett et al. 1983
kelp bass	Point Dume	1987	5	0.013	0.012	0.019	–	Pollock et al 1991
kelp bass	Malibu	1987	5	0.015	0.012	0.017	–	Pollock et al 1991
kelp bass	Marina del Rey	1987	5	0.022	0.001	0.032	–	Pollock et al 1991
kelp bass	Palos Verdes (NW)	1987	5	0.048	0.022	0.095	–	Pollock et al 1991

Appendix C-5 (Cont).

Common Name	Site	Year	No. of samples	DDT (ppm wet weight) Mean	Min	Max	S.D.	Source
kelp bass	White Point	1987	5	0.135	0.069	0.193	–	Pollock et al 1991
kelp bass	Huntington Beach	1987	5	0.019	0.010	0.034	–	Pollock et al 1991
kelp bass	Laguna Beach	1987	5	0.013	0.004	0.020	–	Pollock et al 1991
kelp bass	Emma and Eva Oil Platforms	1987	5	0.012	0.002	0.022	–	Pollock et al 1991
kelp bass	Horseshoe Kelp	1987	5	0.050	0.027	0.092	–	Pollock et al 1991
kelp bass	Twin Harbor, Santa Catalina Is.	1987	5	0.006	0.002	0.014	–	Pollock et al 1991
kelp bass	Point Vicente	1987	5	0.033	0.018	0.055	–	Pollock et al 1991
kelp bass	Dana Point	1987	5	0.022	0.010	0.036	–	Pollock et al 1991
kelp bass	Venice Beach	1987	5	0.022	0.014	0.030	–	Pollock et al 1991
kelp bass	LA/LB Harbor Breakwater	1987	5	0.052	0.016	0.142	–	Pollock et al 1991
barred sand bass	Belmont Pier	1981	3	0.770	0.057	0.100	0.022	Gossett et al. 1983
barred sand bass	Orange County	1981	5	0.061	0.037	0.118	0.032	Gossett et al. 1983
barred sand bass	Marina del Rey	1987	5	0.016	0.008	0.035	–	Pollock et al 1991
barred sand bass	Huntington Beach	1987	5	0.039	0.007	0.056	–	Pollock et al 1991
barred sand bass	Laguna Beach	1987	5	0.050	0.027	0.119	–	Pollock et al 1991
barred sand bass	Emma and Eva Oil Platforms	1987	5	0.022	0.013	0.031	–	Pollock et al 1991
barred sand bass	Horseshoe Kelp	1987	5	0.051	0.037	0.074	–	Pollock et al 1991
barred sand bass	Dana Point	1987	5	0.095	0.009	0.398	–	Pollock et al 1991
barred sand bass	LA/LB Harbor Breakwater	1987	5	0.058	0.030	0.082	–	Pollock et al 1991
barred sand bass	Pier J (Queen Mary)	1987	5	0.091	0.048	0.187	–	Pollock et al 1991
black croaker	Malibu	1987	5	0.005	0.003	0.008	–	Pollock et al 1991
black croaker	Marina del Rey	1987	5	0.027	0.018	0.038	–	Pollock et al 1991
black croaker	Palos Verdes (NW)	1987	5	0.039	0.021	0.073	–	Pollock et al 1991
black croaker	Emma and Eva Oil Platforms	1987	5	0.055	0.018	0.131	–	Pollock et al 1991
black croaker	Horseshoe Kelp	1987	5	0.092	0.038	0.115	–	Pollock et al 1991
black croaker	LA/LB Harbor Breakwater	1987	5	0.360	0.116	0.942	–	Pollock et al 1991
black croaker	Pier J (Queen Mary)	1987	5	0.032	0.011	0.051	–	Pollock et al 1991
black croaker	Belmont Pier	1987	5	0.055	0.033	0.096	–	Pollock et al 1991
black croaker	Newport Pier	1987	5	0.013	0.008	0.017	–	Pollock et al 1991
white croaker	Palos Verdes	1975	10	39.000	5.230	176.400	58.520	Young et al. 1978
white croaker	Los Angeles Harbor	1980	5	0.833	0.336	2.230	0.789	Mearns and Young, 1980
white croaker	Palos Verdes	1980	5	7.629	3.574	13.083	3.470	Schafer et al. 1982
white croaker	Belmont Pier	1981	5	0.453	0.209	0.963	0.311	Gossett et al. 1983
white croaker	Cabrillo Pier	1981	6	1.699	1.102	2.866	0.616	Gossett et al. 1983
white croaker	Dana Point	1981	7	0.185	0.061	0.465	0.160	Gossett et al. 1983
white croaker	Gerald Desmond Bridge	1981	5	2.810	0.559	6.588	2.524	Gossett et al. 1983
white croaker	Marina del Rey	1981	5	0.767	0.116	2.809	1.161	Gossett et al. 1983
white croaker	Palos Verdes	1981	2	–	3.213	21.054	–	Gossett et al. 1983
white croaker	Redondo Area Piers	1981	5	0.222	0.095	0.516	0.168	Gossett et al. 1983
white croaker	Santa Monica Bay	1981	5	0.573	0.167	1.068	0.414	Gossett et al. 1983
white croaker	Santa Monica Pier/Malibu	1981	5	0.053	0.033	0.075	0.017	Gossett et al. 1983
white croaker	Venice Pier	1981	5	0.686	0.126	2.363	0.946	Gossett et al. 1983
white croaker	Santa Monica Pier	1986	7	0.055	–	–	0.000	Risebrough, 1987
white croaker	Hueneme Pier	1986	8	0.039	–	–	0.006	Risebrough, 1987
white croaker	Cabrillo Pier	1986	9	4.498	–	–	0.857	Risebrough, 1987
white croaker	Belmont Pier	1986	9	0.147	–	–	0.002	Risebrough, 1987
white croaker	Orange County Outfall	1986	–	0.160	–	–	–	CSDOC 1990*
white croaker	Point Dume	1987	5	0.287	0.056	0.568	–	Pollock et al 1991
white croaker	Malibu	1987	5	0.532	0.381	0.881	–	Pollock et al 1991
white croaker	Marina del Rey	1987	5	0.066	0.014	0.105	–	Pollock et al 1991
white croaker	Short Bank	1987	5	0.101	0.040	0.147	–	Pollock et al 1991
white croaker	Palos Verdes (NW)	1987	5	0.355	0.032	0.487	–	Pollock et al 1991
white croaker	White Point	1987	5	2.625	0.887	5.345	–	Pollock et al 1991
white croaker	Huntington Beach	1987	5	0.028	0.005	0.063	–	Pollock et al 1991
white croaker	Laguna Beach	1987	5	0.014	0.010	0.019	–	Pollock et al 1991
white croaker	Emma and Eva Oil Platforms	1987	5	0.023	0.006	0.049	–	Pollock et al 1991
white croaker	Horseshoe Kelp	1987	5	0.222	0.175	0.314	–	Pollock et al 1991
white croaker	Point Vicente	1987	5	2.673	2.196	3.212	–	Pollock et al 1991
white croaker	Dana Point	1987	5	0.006	0.002	0.011	–	Pollock et al 1991
white croaker	Venice Beach	1987	5	0.048	0.020	0.072	–	Pollock et al 1991
white croaker	LA/LB Harbor Breakwater	1987	5	0.132	0.068	0.260	–	Pollock et al 1991
white croaker	Malibu Pier	1987	5	0.034	0.013	0.084	–	Pollock et al 1991

Appendix C-5 (Cont).

Common Name	Site	Year	No. of samples	DDT (ppm wet weight) Mean	Min	Max	S.D.	Source
white croaker	Santa Monica/Venice Piers	1987	5	0.087	0.039	0.216	–	Pollock et al 1991
white croaker	Cabrillo Pier	1987	20	2.203	0.123	8.052	–	Pollock et al 1991
white croaker	Pier J (Queen Mary)	1987	5	0.028	0.010	0.051	–	Pollock et al 1991
white croaker	Belmont Pier	1987	5	0.028	0.012	0.036	–	Pollock et al 1991
white croaker	Newport Pier	1987	5	0.064	0.050	0.089	–	Pollock et al 1991
white croaker	White Point	1988	10	26.560	6.600	100.800	29.398	LACSD Ann Rpt 1988
white croaker	Point Dume	1990	5	0.159	0.110	0.193	0.035	Jarman et al. 1991
white croaker	Malibu	1990	5	0.246	0.149	0.496	0.145	Jarman et al. 1991
white croaker	Santa Monica	1990	5	0.137	0.016	0.303	0.110	Jarman et al. 1991
white croaker	Marina del Rey	1990	5	0.243	0.106	0.442	0.139	Jarman et al. 1991
white croaker	Hyperion	1990	5	0.357	0.258	0.500	0.106	Jarman et al. 1991
white croaker	El Segundo	1990	5	0.325	0.262	0.420	0.081	Jarman et al. 1991
white croaker	Hermosa	1990	5	0.461	0.116	0.898	0.295	Jarman et al. 1991
white croaker	Palos Verde N.	1990	5	11.904	7.647	16.069	3.775	Jarman et al. 1991
white croaker	Palos Verde S.	1990	5	10.255	5.207	18.336	5.182	Jarman et al. 1991
white croaker	White Point	1990	5	12.573	9.172	16.562	2.961	Jarman et al. 1991
white croaker	Dana Point	1990	5	0.087	0.033	0.188	0.064	Jarman et al. 1991
California corbina	Belmont Pier	1981	4	0.033	0.020	1.098	0.516	Gossett et al. 1983
California corbina	Malibu	1987	5	0.007	0.003	0.012	–	Pollock et al 1991
California corbina	Redondo Beach	1987	5	0.052	0.005	0.201	–	Pollock et al 1991
California corbina	Huntington Beach	1987	5	0.066	0.015	0.116	–	Pollock et al 1991
California corbina	Dana Point	1987	5	0.010	0.005	0.016	–	Pollock et al 1991
California corbina	Venice Beach	1987	5	0.011	0.009	0.013	–	Pollock et al 1991
California corbina	Malibu Pier	1987	5	0.017	0.010	0.021	–	Pollock et al 1991
California corbina	Santa Monica/Venice Piers	1987	5	0.011	0.008	0.015	–	Pollock et al 1991
California corbina	Redondo Pier	1987	5	0.093	0.014	0.163	–	Pollock et al 1991
California corbina	Newport Pier	1987	5	0.116	0.090	0.150	–	Pollock et al 1991
queenfish	Cabrillo Pier	1981	5	0.238	0.086	0.326	0.094	Gossett et al. 1983
queenfish	Point Dume	1987	5	0.047	0.023	0.114	–	Pollock et al 1991
queenfish	Malibu	1987	5	0.103	0.034	0.164	–	Pollock et al 1991
queenfish	Marina del Rey	1987	5	0.027	0.018	0.037	–	Pollock et al 1991
queenfish	Short Bank	1987	5	0.028	0.013	0.048	–	Pollock et al 1991
queenfish	Palos Verdes (NW)	1987	5	0.050	0.031	0.095	–	Pollock et al 1991
queenfish	Redondo Beach	1987	5	0.026	0.016	0.043	–	Pollock et al 1991
queenfish	White Point	1987	5	0.097	0.062	0.141	–	Pollock et al 1991
queenfish	Huntington Beach	1987	5	0.064	0.000	0.113	–	Pollock et al 1991
queenfish	Laguna Beach	1987	5	0.037	0.006	0.070	–	Pollock et al 1991
queenfish	Emma and Eva Oil Platforms	1987	5	0.035	0.023	0.061	–	Pollock et al 1991
queenfish	Point Vicente	1987	5	0.043	0.021	0.070	–	Pollock et al 1991
queenfish	Dana Point	1987	5	0.078	0.026	0.188	–	Pollock et al 1991
queenfish	Venice Beach	1987	5	0.057	0.030	0.093	–	Pollock et al 1991
queenfish	LA/LB Harbor Breakwater	1987	5	0.191	0.152	0.238	–	Pollock et al 1991
queenfish	Malibu Pier	1987	5	0.113	0.092	0.191	–	Pollock et al 1991
queenfish	Santa Monica/Venice Piers	1987	5	0.055	0.017	0.139	–	Pollock et al 1991
queenfish	Redondo Piers	1987	5	0.050	0.015	0.090	–	Pollock et al 1991
queenfish	Cabrillo Pier	1987	5	0.244	0.083	0.392	–	Pollock et al 1991
queenfish	Pier J (Queen Mary)	1987	5	0.062	0.022	0.169	–	Pollock et al 1991
queenfish	Belmont Pier	1987	5	0.068	0.038	0.099	–	Pollock et al 1991
queenfish	Newport Pier	1987	5	0.073	0.011	0.140	–	Pollock et al 1991
opaleye	White Point	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
opaleye	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
halfmoon	Twin Harbor, Santa Catalina Is.	1987	5	0.000	0.000	0.000	–	Pollock et al 1991
surfperches	Point Dume	1987	5	0.013	0.008	0.017	–	Pollock et al 1991
surfperches	Marina del Rey	1987	5	0.043	0.026	0.080	–	Pollock et al 1991
surfperches	Palos Verdes (NW)	1987	5	0.083	0.022	0.137	–	Pollock et al 1991
surfperches	Redondo Beach	1987	5	0.044	0.023	0.057	–	Pollock et al 1991
surfperches	White Point	1987	5	0.029	0.017	0.048	–	Pollock et al 1991
surfperches	Huntington Beach	1987	5	0.031	0.011	0.065	–	Pollock et al 1991
surfperches	Laguna Beach	1987	5	0.014	0.010	0.017	–	Pollock et al 1991
surfperches	Point Vicente	1987	5	0.051	0.023	0.092	–	Pollock et al 1991

Appendix C-5 (Cont).

Common Name	Site	Year	No. of samples	DDT (ppm wet weight) Mean	Min	Max	S.D.	Source
surfperches	Dana Point	1987	5	0.005	0.004	0.009	–	Pollock et al 1991
surfperches	LA/LB Harbor Breakwater	1987	5	0.056	0.018	0.107	–	Pollock et al 1991
surfperches	Malibu Pier	1987	5	0.008	0.006	0.011	–	Pollock et al 1991
surfperches	Redondo Piers	1987	5	0.035	0.023	0.044	–	Pollock et al 1991
surfperches	Cabrillo Pier	1987	15	0.153	0.042	0.277	–	Pollock et al 1991
surfperches	Pier J (Queen Mary)	1987	15	0.146	0.073	0.960	–	Pollock et al 1991
surfperches	Belmont Pier	1987	15	0.084	0.015	0.158	–	Pollock et al 1991
surfperches	Newport Pier	1987	5	0.023	0.016	0.032	–	Pollock et al 1991
Pacific barracuda	White Point	1981	5	0.190	0.056	0.317	0.101	Gossett et al. 1983
Pacific barracuda	Fourteen Mile Bank	1987	5	0.025	0.009	0.051	–	Pollock et al 1991
Pacific barracuda	Dana Point	1987	5	0.021	0.006	0.037	–	Pollock et al 1991
Pacific bonito	Coastal	1980/81	5	0.184	0.068	0.268	0.089	Schafer et al. 1982
Pacific bonito	White Point	1981	5	0.116	0.051	0.183	0.061	Gossett et al. 1983
Pacific bonito	Laguna Beach, O.C.	1981	5	0.062	0.029	0.124	0.038	Gossett et al. 1983
Pacific bonito	Point Dume	1987	5	0.027	0.013	0.048	–	Pollock et al 1991
Pacific bonito	Malibu	1987	5	0.030	0.016	0.041	–	Pollock et al 1991
Pacific bonito	Marina del Rey	1987	5	0.011	0.005	0.020	–	Pollock et al 1991
Pacific bonito	Short Bank	1987	5	0.015	0.007	0.027	–	Pollock et al 1991
Pacific bonito	Palos Verdes (NW)	1987	5	0.017	0.013	0.025	–	Pollock et al 1991
Pacific bonito	Redondo Beach	1987	5	0.045	0.033	0.081	–	Pollock et al 1991
Pacific bonito	White Point	1987	5	0.047	0.007	0.147	–	Pollock et al 1991
Pacific bonito	Fourteen Mile Bank	1987	5	0.012	0.008	0.016	–	Pollock et al 1991
Pacific bonito	Huntington Beach	1987	5	0.054	0.006	0.116	–	Pollock et al 1991
Pacific bonito	Laguna Beach	1987	5	0.033	0.003	0.087	–	Pollock et al 1991
Pacific bonito	Emma and Eva Oil Platforms	1987	5	0.014	0.012	0.018	–	Pollock et al 1991
Pacific bonito	Horseshoe Kelp	1987	5	0.011	0.006	0.017	–	Pollock et al 1991
Pacific bonito	Twin Harbor,Santa Catalina Isl	1987	5	0.023	0.004	0.050	–	Pollock et al 1991
Pacific bonito	Point Vicente	1987	5	0.025	0.018	0.065	–	Pollock et al 1991
Pacific bonito	Dana Point	1987	5	0.007	0.001	0.011	–	Pollock et al 1991
Pacific bonito	Venice Beach	1987	5	0.025	0.012	0.036	–	Pollock et al 1991
Pacific bonito	LA/LB Harbor Breakwater	1987	5	0.017	0.007	0.024	–	Pollock et al 1991
Pacific bonito	Malibu Pier	1987	5	0.062	0.020	0.172	–	Pollock et al 1991
Pacific bonito	Santa Monica/Venice Piers	1987	5	0.023	0.013	0.040	–	Pollock et al 1991
Pacific bonito	Redondo Pier	1987	5	0.022	0.009	0.032	–	Pollock et al 1991
Pacific bonito	Cabrillo Pier	1987	5	0.073	0.037	0.126	–	Pollock et al 1991
Pacific bonito	Pier J (Queen Mary)	1987	5	0.056	0.003	0.128	–	Pollock et al 1991
Pacific bonito	Belmont Pier	1987	5	0.049	0.036	0.066	–	Pollock et al 1991
Pacific bonito	Newport Pier	1987	5	0.004	0.001	0.007	–	Pollock et al 1991
chub mackerel	Santa Monica Bay	1981	5	0.057	0.024	0.115	0.037	Gossett et al. 1983
chub mackerel	Laguna Beach, O.C.	1981	5	0.129	0.044	0.263	0.086	Gossett et al. 1983
chub mackerel	Coastal	1980/81	6	0.130	0.009	0.401	0.145	Schafer et al. 1982
chub mackerel	White Point	1981	1	0.044	–	–	–	Gossett et al. 1983
chub mackerel	Point Dume	1987	5	0.007	0.003	0.011	–	Pollock et al 1991
chub mackerel	Malibu	1987	5	0.021	0.010	0.041	–	Pollock et al 1991
chub mackerel	Marina del Rey	1987	5	0.021	0.007	0.036	–	Pollock et al 1991
chub mackerel	Short Bank	1987	5	0.014	0.008	0.019	–	Pollock et al 1991
chub mackerel	Palos Verdes (NW)	1987	5	0.016	0.004	0.022	–	Pollock et al 1991
chub mackerel	Redondo Beach	1987	5	0.008	0.006	0.014	–	Pollock et al 1991
chub mackerel	White Point	1987	5	0.028	0.005	0.070	–	Pollock et al 1991
chub mackerel	Fourteen Mile Bank	1987	5	0.007	0.002	0.008	–	Pollock et al 1991
chub mackerel	Huntington Beach	1987	5	0.010	0.004	0.030	–	Pollock et al 1991
chub mackerel	Laguna Beach	1987	5	0.002	0.002	0.003	–	Pollock et al 1991
chub mackerel	Emma and Eva Oil Platforms	1987	5	0.013	0.001	0.026	–	Pollock et al 1991
chub mackerel	Horseshoe Kelp	1987	5	0.018	0.011	0.025	–	Pollock et al 1991
chub mackerel	Twin Harbor, Santa Catalina Isl	1987	5	0.057	0.012	0.096	–	Pollock et al 1991
chub mackerel	Point Vicente	1987	5	0.031	0.006	0.082	–	Pollock et al 1991
chub mackerel	Dana Point	1987	5	0.007	0.001	0.015	–	Pollock et al 1991
chub mackerel	Venice Beach	1987	5	0.013	0.006	0.026	–	Pollock et al 1991
chub mackerel	LA/LB Harbor Breakwater	1987	5	0.009	0.003	0.021	–	Pollock et al 1991
chub mackerel	Malibu Pier	1987	5	0.010	0.003	0.015	–	Pollock et al 1991
chub mackerel	Santa Monica/Venice Piers	1987	5	0.007	0.003	0.013	–	Pollock et al 1991
chub mackerel	Redondo Pier	1987	5	0.012	0.005	0.025	–	Pollock et al 1991

Appendix C-5 (Cont).

Common Name	Site	Year	No. of samples	DDT (ppm wet weight) Mean	Min	Max	S.D.	Source
chub mackerel	Cabrillo Pier	1987	5	0.031	0.013	0.055	–	Pollock et al 1991
chub mackerel	Pier J (Queen Mary)	1987	5	0.021	0.004	0.037	–	Pollock et al 1991
chub mackerel	Belmont Pier	1987	5	0.041	0.025	0.066	–	Pollock et al 1991
chub mackerel	Newport Pier	1987	5	0.008	0.003	0.019	–	Pollock et al 1991
Pacific sanddab	Palos Verdes	1975	19	5.976	3.040	14.000	2.795	Young et al. 1978
Pacific sanddab	Dana Point	1975	10	0.171	0.061	0.430	0.105	SCCWRP, unpublished
Pacific sanddab	T2 200	1977	14	–	4.480	75.278	29.520	SCCWRP, unpublished
Pacific sanddab	T5 200	1977	5	–	1.048	61.095	15.710	SCCWRP, unpublished
Pacific sanddab	Santa Monica Bay (7M)	1978	6	0.107	0.044	0.212	0.059	SCCWRP, unpublished
Pacific sanddab	Orange County Outfall	1985	–	0.016	–	–	–	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1985	–	0.006	–	–	–	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1986	–	0.032	–	–	0.004	CSDOC 1990*
Pacific sanddab	Orange County Outfall	1986	–	0.024	–	–	–	CSDOC 1990*
Pacific sanddab	White Point	1987	5	0.015	0.010	0.024	–	Pollock et al 1991
Pacific sanddab	Horseshoe Kelp	1987	5	0.014	0.009	0.023	–	Pollock et al 1991
Pacific sanddab	Twin Harbor, Santa Catalina Is.	1987	5	0.002	0.001	0.002	–	Pollock et al 1991
California halibut	Los Angeles Harbor	1980	4	0.391	0.336	0.440	0.043	Mearns and Young 1980
California halibut	Newport Bay	1980	10	0.626	0.168	1.170	0.277	MBC; SCCWRP 1980
California halibut	Cabrillo Pier	1981	5	0.158	0.122	0.208	0.037	Gossett et al. 1983
California halibut	Belmont Pier	1981	4	0.131	0.055	0.184	0.060	Gossett et al. 1983
California halibut	Point Dume	1987	5	0.003	0.001	0.005	–	Pollock et al 1991
California halibut	Malibu	1987	5	0.009	0.003	0.025	–	Pollock et al 1991
California halibut	Marina del Rey	1987	5	0.007	0.003	0.014	–	Pollock et al 1991
California halibut	Redondo Beach	1987	5	0.009	0.002	0.023	–	Pollock et al 1991
California halibut	Dana Point	1987	5	0.015	0.002	0.042	–	Pollock et al 1991
California halibut	Malibu Pier	1987	5	0.017	0.006	0.035	–	Pollock et al 1991
California halibut	Santa Monica/Venice Piers	1987	5	0.009	0.002	0.025	–	Pollock et al 1991
Dover sole	Gaviota (C2)	1977	5	0.026	0.021	0.049	0.011	SCCWRP, unpublished
Dover sole	Rincon (C3)	1977	6	0.048	0.033	0.074	0.016	SCCWRP, unpublished
Dover sole	Malibu C–18	1977	6	2.081	0.204	6.372	2.285	SCCWRP, unpublished
Dover sole	Santa Monica Bay (A5)	1977	2	0.313	0.292	0.333	0.029	SCCWRP, unpublished
Dover sole	Santa Monica Bay (B4)	1977	6	1.562	0.505	5.533	1.974	SCCWRP, unpublished
Dover sole	Santa Monica Bay	1977	5	3.079	0.829	12.133	5.062	SCCWRP, unpublished
Dover sole	Palos Verdes (T3)	1977	6	–	6.530	123.764	43.699	SCCWRP, unpublished
Dover sole	Huntington Beach (T1)	1977	4	0.296	0.149	0.526	0.179	SCCWRP, unpublished
Dover sole	Orange County (T3)	1977	6	0.126	0.053	0.222	0.073	SCCWRP, unpublished
Dover sole	Point Loma, Sunset Cliffs	1977	6	0.037	0.020	0.052	0.011	SCCWRP, unpublished
Dover sole	T–2 –200	1977	6	–	8.515	30.706	8.725	SCCWRP, unpublished
Dover sole	Palos Verdes	1980	5	7.172	3.550	12.990	3.580	Schafer et al. 1982
English sole	Rincon (C9)	1977	6	0.080	0.044	0.143	0.041	SCCWRP, unpublished
English sole	Santa Monica Bay	1977	4	1.713	0.495	3.501	1.283	SCCWRP, unpublished

– = Not Available; S.D.= standard deviation

* Units not given in table. Units are from C. Phillips, SAIC, San Diego, pers. comm.