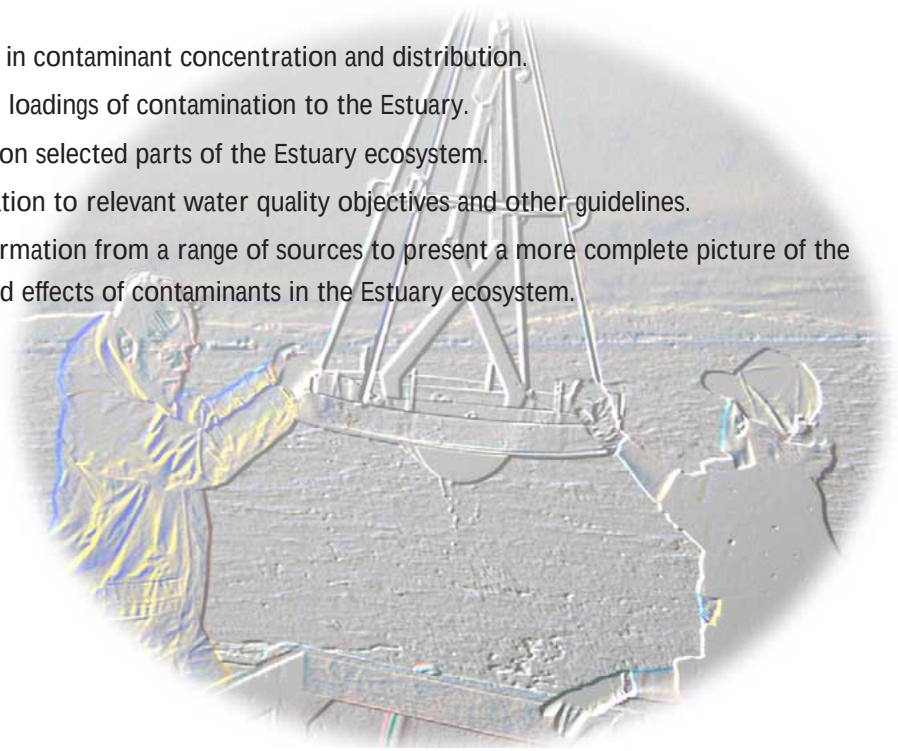
RMP 1999 Monitoring Results
Overview

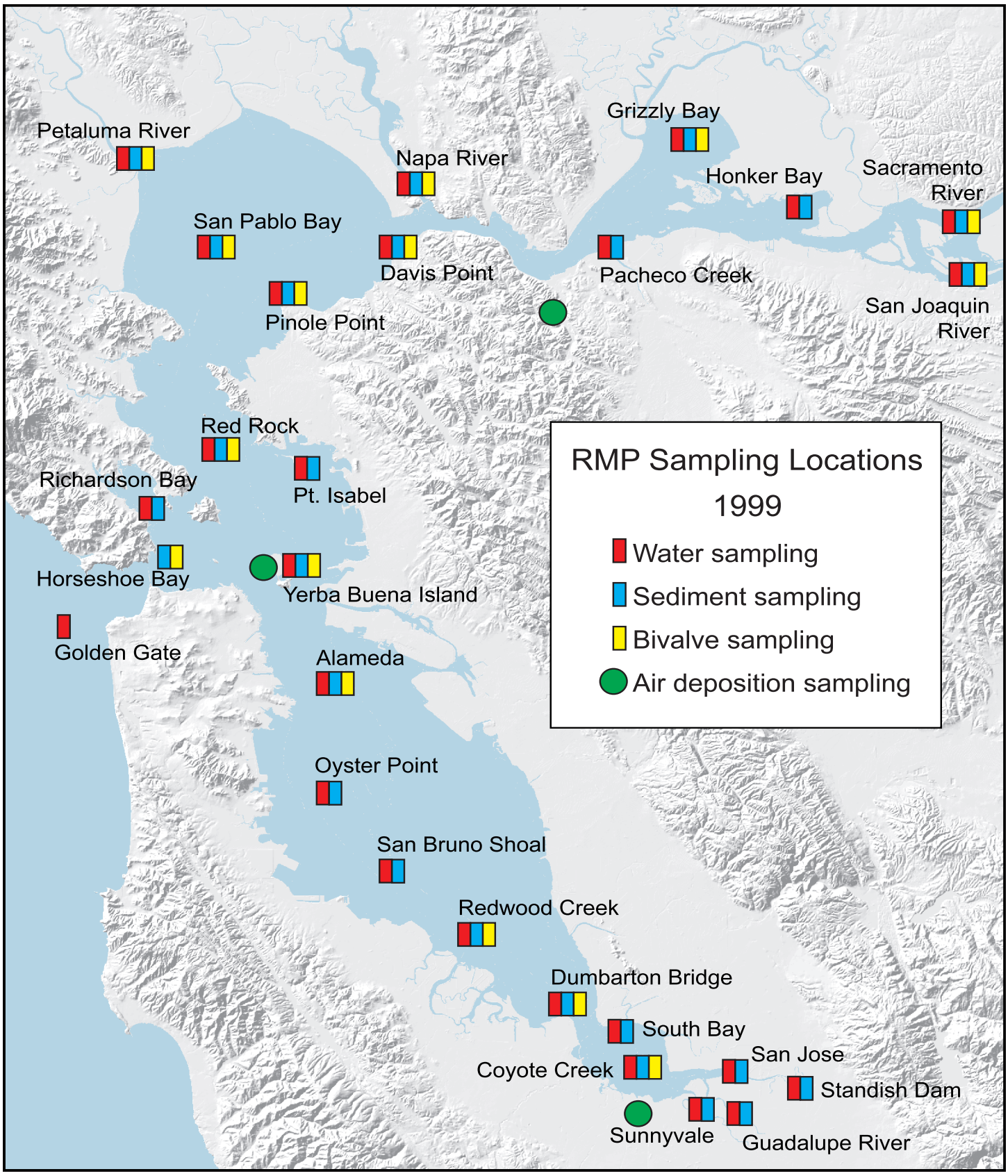
Monitoring Results presents data from the Status and Trends portion of the 1999 San Francisco Estuary Regional Monitoring Program for Trace Substances (RMP). A list of reports on Pilot and Special Studies, as well as other RMP related activities, can be found at the RMP Homepage. These reports provide perspective and insight on important contaminant issues identified by the RMP, and they describe results from projects that took advantage of RMP field operations. For a summary of the conditions of the Estuary see the "Pulse of the Estuary. " A print copy may also be ordered by contacting the San Francisco Estuary Institute (SFEI).

In 1999, the San Francisco Regional Water Quality Control Board (Regional Board) and seventy-three federal, state, and local agencies and companies participated in the RMP as funders and service providers (Table 1.1). Participants also assist in directing the Program through input or participation on the Steering and Technical Review committees.

The RMP's overall goal is to provide data and interpretation that helps to address certain information needs of the Regional Board. In general, these efforts fall under five major objectives which provide a framework for efforts to respond to more specific management questions.

1. Describe patterns and trends in contaminant concentration and distribution.
2. Describe general sources and loadings of contamination to the Estuary.
3. Measure contaminant effects on selected parts of the Estuary ecosystem.
4. Compare monitoring information to relevant water quality objectives and other guidelines.
5. Synthesize and distribute information from a range of sources to present a more complete picture of the sources, distribution, fates, and effects of contaminants in the Estuary ecosystem.

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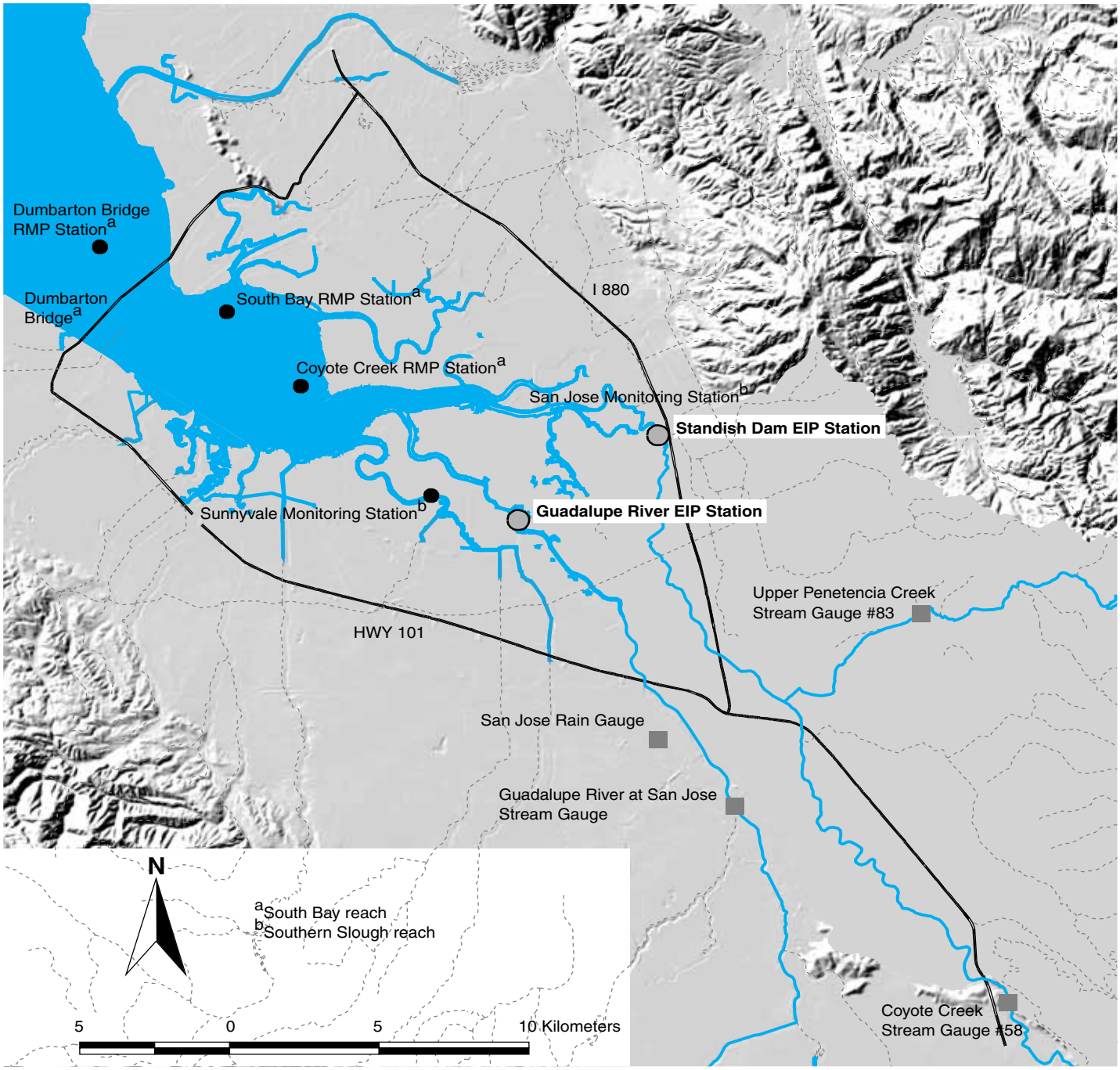
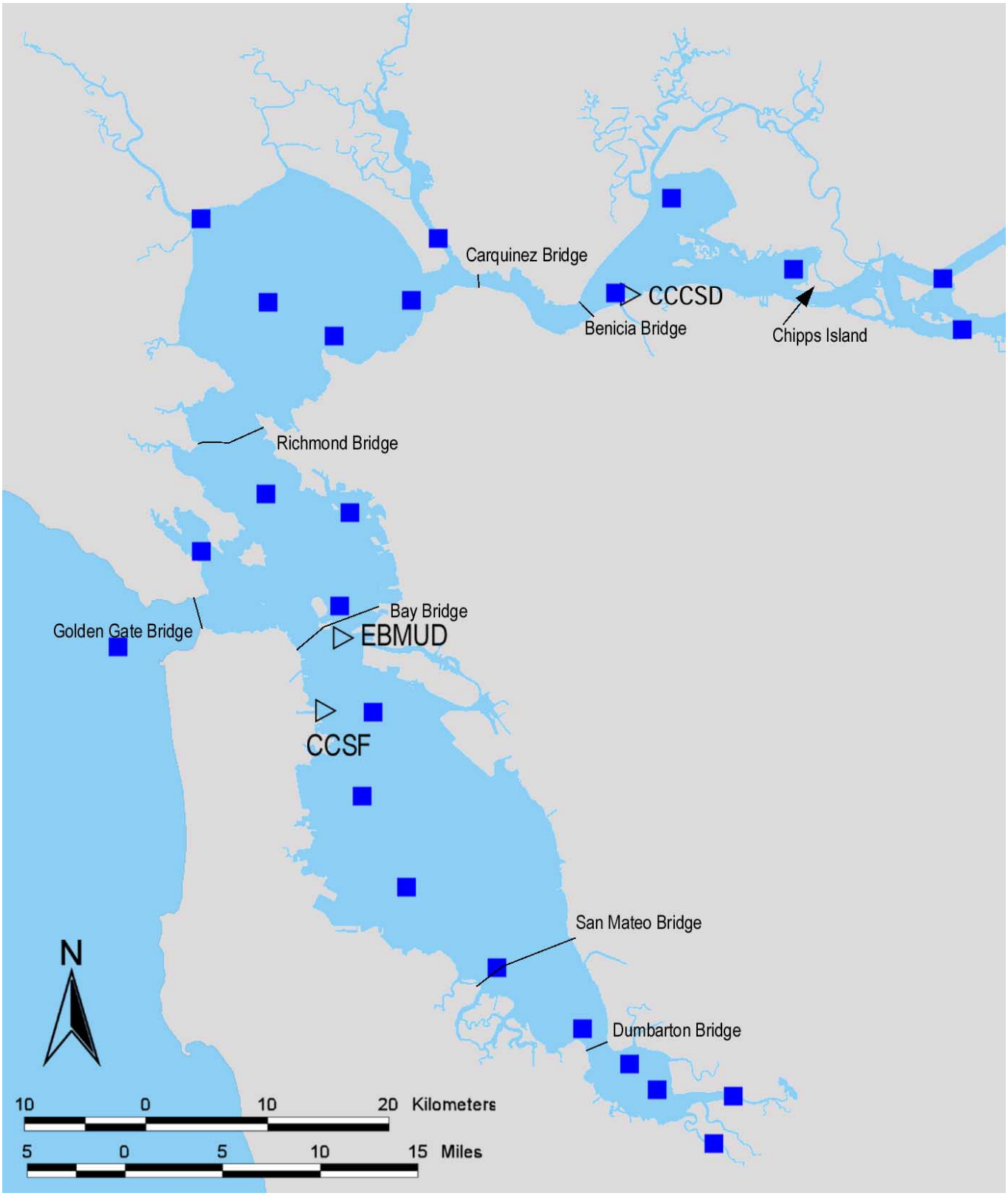
Napa River
Grizzly Bay
Honker Bay
Sacramento River
San Pablo Bay
Davis Point
Pacheco Creek
Pinole Point
San Joaquin River
Red Rock
Richardson Bay
Pt. Isabel
Horseshoe Bay
Yerba Buena Island
Golden Gate
Alameda
Oyster Point
San Bruno Shoal
Redwood Creek
Dumbarton Bridge
South Bay
Coyote Creek
San Jose
Standish Dam
Sunnyvale
Guadalupe River
RMP Sampling Locations
1999
Water sampling
Sediment sampling
Bivalve sampling
Air deposition sampling

Map of Estuary Interface Pilot Study Stations



Bay Area Dischargers Association Local Effects Monitoring Program (LEMP) Stations



RMP Sampling Stations

LEMP Sampling Stations

EBMUD -- East Bay Municipal Utilities District
CCSF -- City and County of San Francisco
CCCSD -- Central Contra Costa Sanitation District

RMP 1999 Monitoring Results

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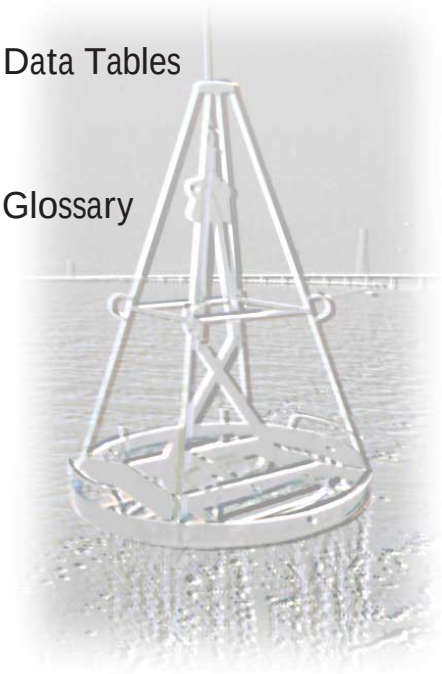

RMP 1999 Monitoring Results

How to use this online PDF report

1999 Results Homepage. The 1999 report is provided as a PDF in two formats: as separate sections or as one PDF file. These PDF versions may be printed as a whole or by specific page ranges (see printing notes below).

Abbreviations. Look to glossary for definitions.

Bookmarks. The bookmark sidebar acts as a floating table of contents. Navigate to anywhere in the document using this sidebar. To reveal hidden contents ▶ click on arrow.

Go to Previous View. Located on top of the tool bar.

Source Data. For each figure with corresponding source data, a table reference number is given at the bottom of the page.

- For downloadable data files (comma separated), navigate from the 1999 Results Homepage.

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3. Click OK (Windows) or Print (Mac OS).

Feedback on the RMP Website and report contents

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Introduction

1.1 Monitoring Design

The RMP sampling design was based on the Bay Protection and Toxic Cleanup Program (BPTCP) Pilot Studies developed by the Regional Board (Flegal *et al.*, 1994). The reasoning behind the original design, with stations located along the "spine" of the Estuary, was to include stations that, in a long-term monitoring program, would indicate spatial and temporal trends in toxicity and chemistry, determine background concentrations for different segments of the Estuary, and assess whether there were high levels of contaminants or toxicity. Several new stations were added in 1994 to fill spatial gaps and to begin monitoring near major tributaries (SFEI, 1995). Additionally, two stations were added in 1994 in the southern-most end of the Estuary in cooperation with the Cities of San Jose (station C-3-0) and Sunnyvale (station C-1-3) and the Regional Board as part of their National Pollutant Discharge Elimination System (NPDES) monitoring.

The RMP station design has provided a picture of the range of conditions found in deeper parts of the Estuary, influenced by riverine, seasonal, and daily natural processes. During the re-design process, options for incorporating more near-shore stations, evaluating overall Estuary condition at statistically representative sites, or conducting intensive embayment studies will be explored.

Five types of samples were collected in the 1999 Status and Trends Program:

1. Conventional water quality and chemistry.
2. Aquatic bioassays.
3. Sediment quality and chemistry.
4. Sediment bioassays.
5. Transplanted, bagged bivalve bioaccumulation, survival, and condition.

Complete listings of all parameters measured in 1999 are included in Table 1.2. For a detailed description of methods of collection and analysis see *Description of Methods*. RMP data included in this report can be obtained by contacting SFEI or by accessing SFEI's on-line data at: http://www.sfei.org/rmp/data.htm.

Locations of the twenty-two RMP, two Southern Slough (C-3-0, C-1-3), and Estuary Interface sampling stations are shown in Figure 1.1; Table 1.3 lists the station names, codes, locations, and sampling dates for all 1999 stations. Water, sediment, or bioaccumulation sampling sites with the same station name may have different station codes as they are situated at slightly different locations (latitude, longitude) due to practical considerations such as sediment type or ability to deploy bivalves. For example, at the South Bay site, BA20 is the water station code and BA21 is the sediment station code.

Sampling occurred during three periods in 1999: during the wet season (January–February), a period of declining Delta outflow (April), and during the dry season (July–September). The rationale for taking seasonal "snapshots" is to relate contaminant data during hydrologically different periods of the year with higher-frequency measurements conducted by the U.S. Geological Survey (USGS) and to evaluate the influence of natural variability on the contaminant signal. As part of the RMP redesign, the use of more intensive data on tides, Delta outflow, salinity gradients, algal blooms, and other parameters will be evaluated in greater detail to minimize the natural noise around any signals of water quality improvement or degradation over time.

Not all parameters were measured at all RMP stations each sampling period. Sampling activities at each station are listed on Table 1.3.

Water and sediment samples were collected from the *R/V David Johnston* chartered through the University of California, Santa Cruz. Each sampling cruise starts with water sampling at all RMP stations. Sediment sampling is then conducted with a separate run though the Estuary. Each complete sampling run requires three to five days. Bivalve monitoring consisted of three parts: deployment of transplants from reference sites, maintenance, and retrieval. Most of this work was conducted aboard the *R/V Questuary*, owned by San Francisco State University. The California Department of Water Resources provided back-up services for bivalve cruises.

The U.S. Geological Survey took monthly measurements of five water quality parameters to supplement RMP monitoring. This additional monitoring was designed to describe the changing spatial patterns of water-quality variability from the lower Sacramento River to the southern limit of the South Bay.

Field sampling and laboratory analysis were coordinated by the RMP prime contractor, Applied Marine Sciences in Livermore, California. In addition, a group of Principal Investigators also participated in the RMP (Table 1.4).

1.2 References

Flegal, A.R., R.W. Risebrough, B. Anderson, J. Hunt, S. Anderson, J. Oliver, M. Stephenson, and R. Packard. 1994. San Francisco Estuary Pilot Regional Monitoring Program: Sediment Studies. San Francisco Bay Regional Water Quality Control Board, State Water Resources Control Board.

SFEI. 1995. 1994 Annual Report: San Francisco Estuary Regional Monitoring Program for Trace Substances. Prepared by the San Francisco Estuary Institute, Richmond, CA. 339p.

Table 1.1. 1999 Program Participants

MUNICIPAL DISCHARGERS:

City of Benicia
Burlingame Waste Water Treatment Plant
City of Calistoga
Central Contra Costa Sanitation District
Central Marin Sanitation Agency
Delta Diablo Sanitation District
East Bay Dischargers Authority
East Bay Municipal Utility District
Fairfield-Suisun Sewer District
City of Hercules
Las Gallinas Valley Sanitation District
Millbrae Waste Water Treatment Plant
Mountain View Sanitary District
Napa Sanitation District
Novato Sanitation District
City of Palo Alto
City of Petaluma
City of Pinole
Rodeo Sanitary District
City of Saint Helena
City and County of San Francisco
City of San Jose/Santa Clara
City of San Mateo
Sausalito/Marin City Sanitation District
Sewerage Agency of Southern Marin
San Francisco International Airport
Sonoma County Water Agency
South Bayside System Authority
City of South San Francisco/San Bruno
City of Sunnyvale
Marin County Sanitary District #5, Tiburon
Union Sanitary District
Vallejo Sanitation and Flood Control District
West County Agency
Town of Yountville

INDUSTRIAL DISCHARGERS:

C & H Sugar Company
Chevron Products Company
Dow Chemical Company
Exxon Company, USA
General Chemical Corporation
Rhone-Poulenc
Shell Martinez Refining Company
TOSCO Refining Company, Avon Refinery
TOSCO Refining Company, S.F. Area Refinery at Rodeo
USS-POSCO Industries

COOLING WATER:

Pacific Gas and Electric

STORMWATER:

Alameda Countywide Clean Water Program
Caltrans
Contra Costa Clean Water Program
Fairfield-Suisun Urban Runoff Management Program
Marin County Stormwater Pollution Prevention Program
City and County of San Francisco
San Mateo Countywide Stormwater Pollution Prevention Program
Santa Clara Valley Urban Runoff Pollution Prevention Program
Vallejo Sanitation and Flood Control District

DREDGERS:

Aeolian Yacht club
Benicia Marina
California Department General Services
Caltrans
Chevron Products Company
Clipper Yacht Harbor
Exxon Company, USA
Galilee Harbor
Glen Cove Marina/Western Waterways
Loch Lomond Marina
Michael Jackson
Port of Oakland
Port of Redwood City
Port of Richmond
Port of San Francisco
San Leandro Marina
San Francisco Parks and Recreation
San Francisco Yacht Club
TOSCO Corporation
US Army Corps of Engineers

Table 1.2. Parameters analyzed in water, sediment, and bivalve tissues during the 1999 RMP Sampling of the San Francisco Estuary.

A. Conventional Water Quality Parameters

Conductivity
Dissolved Organic Carbon
Dissolved Oxygen (DO)
Hardness (when salinity is <5 ‰)
pH (acidity)
Phaeophytin (a chlorophyll degradation product)
Salinity
Temperature
Total Chlorophyll-*a*
Total Suspended Solids
Dissolved Phosphates
Dissolved Silicates
Dissolved Nitrate
Dissolved Nitrite
Dissolved Ammonia

B. Sediment Quality Parameters

% Clay (<4 µm)
% Silt (4 µm–62 µm)
% Sand (63 µm–2 mm)
% Gravel (>2 mm)
% Solids
Hydrogen Sulfide
pH
Total Ammonia
Total Organic Carbon
Total Sulfide
Total Nitrogen

C. Bivalve Tissue Parameters

% Moisture
% Lipid
Bivalve % Survival
Total Volume
Shell Volume
Dry Flesh Weight
Biological Condition Index

D. Trace Elements

	Water	Sediment	Tissue
Aluminum*		1	1
Arsenic	1	1	1
Cadmium*	1	1	1
Chromium	1	1	1
Copper*	1	1	1
Iron*		1	
Lead*	1	1	1
Manganese*		1	
Mercury	1	1	1
Nickel*	1	1	1
Selenium	1	1	1
Silver*	1	1	1
Zinc*	1	1	1
Dibutyltin (DBT)			1
Monobutyltin (MBT)			1
Tributyltin (TBT)			1
Tetrabutyltin (TTBT)			1

* Near-total rather than total concentrations for water. Near-total metals are extracted with a weak acid (pH < 2) for a minimum of one month, resulting in measurements that approximate bioavailability of these metals to Estuary organisms.

Table 1.2 continued on the next page

Table 1.2. (continued). Parameters analyzed in water, sediment, and bivalve tissues during the 1999 RMP Sampling of the San Francisco Estuary.

E. Polycyclic Aromatic Hydrocarbons (PAHs)	Water	Sediment	Tissue
2 rings			
1-Methylnaphthalene	1	1	1
2,3,5-Trimethylnaphthalene	1	1	1
2,6-Dimethylnaphthalene	1	1	1
2-Methylnaphthalene	1	1	1
Biphenyl	1	1	1
Naphthalene	1	1	1
3 rings			
1-Methylphenanthrene	1	1	1
Acenaphthene	1	1	1
Acenaphthylene	1	1	1
Anthracene	1	1	1
Dibenzothiophene	1	1	1
Fluorene	1	1	1
Phenanthrene	1	1	1
4 rings			
Benz(a)anthracene	1	1	1
Chrysene	1	1	1
Fluoranthene	1	1	1
Pyrene	1	1	1
5 rings			
Benzo(a)pyrene	1	1	1
Benzo(b)fluoranthene	1	1	1
Benzo(e)pyrene	1	1	1
Benzo(k)fluoranthene	1	1	1
Dibenz(a,h)anthracene	1	1	1
Perylene	1	1	1
6 rings			
Benzo(ghi)perylene	1	1	1
Indeno(1,2,3-cd)pyrene	1	1	1
Alkylated PAHs			
C1-Chrysenes	1	1	1
C2-Chrysenes	1	1	1
C3-Chrysenes	1	1	1
C4-Chrysenes	1	1	1
C1-Dibenzothiophenes	1	1	1
C2-Dibenzothiophenes	1	1	1
C3-Dibenzothiophenes	1	1	1
C1-Fluoranthenes/Pyrenes	1	1	1
C1-Fluorenes	1	1	1
C2-Fluorenes	1	1	1
C3-Fluorenes	1	1	1
C1-Naphthalenes	1	1	1
C2-Naphthalenes	1	1	1
C3-Naphthalenes	1	1	1
C4-Naphthalenes	1	1	1

E. PAHs (continued)	Water	Sediment	Tissue
C1-Phenanthrenes/Anthracenes	1	1	1
C2-Phenanthrenes/Anthracenes	1	1	1
C3-Phenanthrenes/Anthracenes	1	1	1
C4-Phenanthrenes/Anthracenes	1	1	1

F. Synthetic Biocides	Water	Sediment	Tissue
Cyclopentadienes			
Aldrin	1	1	1
Dieldrin	1	1	1
Endrin	1	1	1
Chlordanes			
alpha-Chlordane	1	1	1
cis-Nonachlor	1	1	1
gamma-Chlordane	1	1	1
Heptachlor	1	1	1
Heptachlor Epoxide	1	1	1
Oxychlordane	1	1	1
trans-Nonachlor	1	1	1
DDTs			
o,p'-DDD	1	1	1
o,p'-DDE	1	1	1
o,p'-DDT	1	1	1
p,p'-DDD	1	1	1
p,p'-DDE	1	1	1
p,p'-DDT	1	1	1
HCHs			
alpha-HCH	1	1	1
beta-HCH	1	1	1
delta-HCH	1	1	1
gamma-HCH	1	1	1
Other			
Diazinon	1		
Mirex	1	1	1
Chlorpyrifos	1		

Table 1.2 continued on the next page

Table 1.2. (continued). Parameters analyzed in water, sediment, and bivalve tissues during the 1999 RMP Sampling of the San Francisco Estuary.

G. PCBs and Related Compounds	Water	Sediment	Tissue
Hexachlorobenzene	•	•	•
PCB 008	•	•	•
PCB 018	•	•	•
PCB 028	•	•	•
PCB 031	•	•	•
PCB 033	•	•	•
PCB 044	•	•	•
PCB 049	•	•	•
PCB 052	•	•	•
PCB 056	•	•	•
PCB 060	•	•	•
PCB 066	•	•	•
PCB 070	•	•	•
PCB 074	•	•	•
PCB 087	•	•	•
PCB 095	•	•	•
PCB 097	•	•	•
PCB 099	•	•	•
PCB 101	•	•	•
PCB 105	•	•	•
PCB 110	•	•	•
PCB 118	•	•	•
PCB 128	•	•	•
PCB 132	•	•	•
PCB 138	•	•	•
PCB 141	•	•	•
PCB 149	•	•	•
PCB 151	•	•	•
PCB 153	•	•	•
PCB 156	•	•	•
PCB 158	•	•	•
PCB 170	•	•	•
PCB 174	•	•	•
PCB 177	•	•	•
PCB 180	•	•	•
PCB 183	•	•	•
PCB 187	•	•	•
PCB 194	•	•	•
PCB 195	•	•	•
PCB 201	•	•	•
PCB 203	•	•	•

Table 1.3. Summary of RMP 1999 sampling stations and activities.

Station Name	Station Code	Type of Sample	Measurements Made	Dates Sampled			Latitude deg	min	sec	Longitude deg	min	sec
Coyote Creek	BA10	water	Q,M,O	2/1	4/13	7/13	37	28	20	122	3	80
	BA10	sediment	Q,M,O,T	2/17		7/28	37	28	20	122	3	80
	BA10	bioaccumulation	M,O,C	4/28		9/14	37	28	20	122	3	80
South Bay	BA20	water	Q,M	2/2	4/13	7/14	37	29	69	122	5	34
	BA21	sediment	Q,M,O,T	2/17		7/27	37	29	69	122	5	34
Dumbarton Bridge	BA30	water	Q,M,O,T	2/2	4/12	7/14	37	30	90	122	8	11
	BA30	sediment	Q,M,O	2/17		7/27	37	30	90	122	8	11
	BA30	bioaccumulation	M,O,C	4/28		9/14	37	30	90	122	8	11
Redwood Creek	BA40	water	Q,M,O	2/1	4/12	7/13	37	33	67	122	12	57
	BA40	bioaccumulation	M,O,C	4/28		9/14	37	33	67	122	12	57
	BA41	sediment	Q,M,O,T	2/17		7/27	37	33	67	122	12	57
San Bruno Shoal	BB15	water	Q,M	2/1	4/12	7/13	37	37	0	122	17	0
	BB15	sediment	Q,M,O,T	2/17		7/27	37	37	0	122	17	0
Oyster Point	BB30	water	Q,M	2/1	4/12	7/13	37	40	20	122	19	75
	BB30	sediment	Q,M,O	2/17		7/27	37	40	20	122	19	75
Alameda	BB70	water	Q,M,O	2/4	4/14	7/16	37	44	66	122	19	30
	BB70	sediment	Q,M,O,T	2/17		7/26	37	44	66	122	19	30
	BB71	bioaccumulation	M,O,C	4/28		9/14	37	44	66	122	19	30
Yerba Buena Island	BC10	water	Q,M,O	2/4	4/14	7/16	37	49	36	122	20	96
	BC10	bioaccumulation	M,O,C	4/28		9/14	37	49	36	122	20	96
	BC11	sediment	Q,M,O,T	2/16		7/26	37	49	36	122	20	96
Golden Gate	BC20	* water	Q,M,O	2/3	4/15	7/15	37	51	81	122	32	20
Horseshoe Bay	BC21	sediment	Q,M,O,T	2/16		7/26	37	49	98	122	28	43
	BC21	bioaccumulation	M,O,C	4/30		9/15	37	49	98	122	28	43
Richardson Bay	BC30	water	Q,M	2/3	4/15	7/15	37	51	81	122	28	66
	BC32	sediment	Q,M,O	2/16		7/26	37	51	81	122	28	66
Point Isabel	BC41	water	Q,M	2/4	4/14	7/16	37	53	30	122	20	55
	BC41	sediment	Q,M,O	2/16		7/26	37	53	30	122	20	55
Red Rock	BC60	water	Q,M,O	2/3	4/14	7/15	37	55	0	122	26	0
	BC60	sediment	Q,M,O,T	2/16		7/23	37	55	0	122	26	0
	BC61	bioaccumulation	M,O,C	4/30		9/15	37	55	0	122	26	0
Petaluma River	BD15	water	Q,M,O	2/8	4/19	7/19	38	6	66	122	29	0
	BD15	sediment	Q,M,O	2/12		7/23	38	6	66	122	29	0
	BD15	bioaccumulation	M,O,C	4/30		9/15	38	6	66	122	29	0
San Pablo Bay	BD20	water	Q,M,O	2/8	4/19	7/19	38	2	92	122	25	19
	BD20	bioaccumulation	M,O,C	4/30		9/15	38	2	92	122	25	19
	BD22	sediment	Q,M,O	2/12		7/23	38	2	92	122	25	19
Pinole Point	BD30	water	Q,M,O,T	2/8	4/19	7/19	38	1	48	122	21	65
	BD30	bioaccumulation	M,O,C	4/30		9/15	38	1	48	122	21	65
	BD31	sediment	Q,M,O	2/12		7/23	38	1	48	122	21	65
Davis Point	BD40	water	Q,M,O	2/8	4/19	7/19	38	3	12	122	16	62
	BD40	bioaccumulation	M,O,C	4/27		9/16	38	3	12	122	16	62
	BD41	sediment	Q,M,O,T	2/12		7/23	38	3	12	122	16	62
Napa River	BD50	water	Q,M,O	2/9	4/20	7/20	38	5	79	122	15	61
	BD50	sediment	Q,M,O,T	2/12		7/23	38	5	79	122	15	61
	BD50	bioaccumulation	M,O,C	4/27		9/16	38	5	79	122	15	61
Pacheco Creek	BF10	water	Q,M	2/10	4/20	7/20	38	3	9	122	5	80
	BF10	sediment	Q,M,O	2/11		7/22	38	3	9	122	5	80
Grizzly Bay	BF20	water	Q,M,O,T	2/9	4/21	7/20	38	6	96	122	2	31
	BF20	bioaccumulation		no bivalves deployed			38	6	96	122	2	31
	BF21	sediment	Q,M,O,T	2/11		7/22	38	6	96	122	2	31
Honker Bay	BF40	water	Q,M	2/9	4/20	7/20	38	4	0	121	56	0
	BF40	sediment	Q,M,O	2/11		7/22	38	4	0	121	56	0
Sacramento River	BG20	water	Q,M,O	2/10	4/21	7/21	38	3	56	121	48	59
	BG20	sediment	Q,M,O,T	2/11		7/22	38	3	56	121	48	59
	BG20	bioaccumulation	M,O,C	5/6		9/21	38	3	56	121	48	59
				no bivalves deployed, *C. fluminea* collected.								
San Joaquin River	BG30	water	Q,M,O,T	2/10	4/21	7/21	38	1	40	121	48	45
	BG30	sediment	Q,M,O,T	2/11		7/22	38	1	40	121	48	45
	BG30	bioaccumulation	M,O,C	5/6		9/21	38	1	40	121	48	45
				no bivalves deployed, *C. fluminea* collected.								
San Jose	C-3-0	water	Q,M,O,T	2/2	4/13	7/14	37	27	85	122	1	60
	C-3-0	sediment	Q,M,O,T	2/18		7/28	37	27	85	122	1	60
Sunnyvale	C-1-3	water	Q,M,T	2/2	4/13	7/14	37	26	8	122	0	64
	C-1-3	sediment	Q,M,O	2/18		7/28	37	26	8	122	0	64
Standish Dam†	BW10	water	Q,M,O	2/11	4/22	7/22	37	27	10	121	55	29
	BW10	sediment	Q,M,O	2/22		7/29	37	27	10	121	55	29
Guadalupe River†	BW15	water	Q,M,O	2/11	4/22	7/22	37	25	34	121	58	45
	BW15	sediment	Q,M,O	2/9		7/29	37	25	34	121	58	45

M = trace elements; O = trace organics; * location dependent on salinity; T = toxicity (aquatic and/or sediment); Q = water and/or sediment quality; C = bivalve condition index; † Estuary Interface Pilot Station

Table 1.4. 1999 RMP contractors and principal investigators

Prime Contractors	Dr. Bob Spies and Dr. Andrew Gunther Applied Marine Sciences, Livermore, CA
Trace Element Chemistry	Dr. Russ Flegal, UC Santa Cruz, CA Dr. Eric Prestbo, Brooks-Rand, Seattle, WA
Trace Organic Chemistry	Dr. Bob Risebrough, Bodega Bay Institute, CA Dr. José Sericano, Texas A&M University, TX Dr. Walter Jarman, UC Santa Cruz, CA
Sediment Trace Metals and Trace Organics	Ms. Diane Griffin East Bay Municipal Utility District, Oakland, CA
Water Hardness	Ms. Lynda Taylor Union Sanitary District, Fremont, CA
Water Toxicity Testing	Dr. Scott Ogle Pacific Eco-Risk Laboratories, Martinez CA
Sediment Toxicity Testing	Mr. John Hunt and Mr. Brian Anderson Marine Pollution Lab, Granite Canyon, CA
Bagged Bivalve Sampling	Mr. David Bell Applied Marine Sciences, Livermore, CA
Bivalve Trace Metals	Mr. Lonnie Butler City and County of San Francisco, CA
Bivalve PAHs and PCBs	Mr. Phil Snyder Central Contra Costa Sanitary District, Martinez, CA
USGS Water Quality	Dr. James Cloern, USGS, Menlo Park, CA
USGS Sediment Transport	Dr. David Schoellhamer, USGS, Sacramento, CA
Pilot Study on Benthic Macrofauna	Dr. Bruce Thompson San Francisco Estuary Institute, Richmond, CA Ms. Heather Peterson Dept. of Water Resources, Sacramento, CA
Fish Contamination Pilot Study	Dr. Jay Davis San Francisco Estuary Institute, Richmond, CA
Estuary Interface Pilot Study	Dr. Rainer Hoenicke San Francisco Estuary Institute, Richmond, CA Mr. Dane Hardin Applied Marine Sciences, Livermore, CA

2.0 Water Monitoring

Jon Leatherbarrow, Sarah Lowe and SFEI Staff

2.1 Background

This chapter presents a graphical and narrative summary of the Regional Monitoring Program (RMP) water-monitoring results for 1999.

Water quality was monitored at twenty-two RMP Base Program stations. Parameters measured included conventional water quality parameters (salinity, temperature, total suspended solids; Figures 2.1-2.3), trace elements, trace organic contaminants, and toxicity (Figures 2.4-2.22). Two additional stations were sampled in 1999 for an Estuary Interface Pilot Study at Standish Dam (BW10) and Guadalupe River (BW15). Water was also sampled at two stations in the southern end of the Estuary in cooperation with the cities of San Jose (C-3-0) and Sunnyvale (C-1-3). In addition, the U.S. Geological Survey monitored conventional water quality parameters at shorter time scales to complement RMP monitoring activities.

Station locations are shown in Figure 1.1 in the *Introduction*. Water samples were collected in February, April, and July. Sampling dates and parameters measured at each station are shown in Table 1.3 in the *Introduction*. For trace elements, dissolved (0.45 µm filtered) and total (arsenic, chromium, mercury, and selenium) or near-total (cadmium, copper, lead, nickel, silver, and zinc) concentrations are presented in Figures 2.4-2.13. Dissolved (1 µm filtered) and total concentrations of trace organic contaminants are also presented in Figures 2.14-2.21. In addition, long-term trends in trace element and trace organics for each Estuary reach are provided in Figures 2.23-2.40. Detailed methods of collection and analysis are included the *Description of Methods*.

In order to compare water monitoring results among the major segments of the Estuary, the RMP stations are separated into six groups based on similarities in geography, water chemistry, and hydrodynamics: the Estuary Interface (BW10 and BW15), Southern Sloughs (C-1-3 and C-3-0), South Bay (seven stations, BA10 through BB70), Central Bay (five stations, BC10 through BC60), Northern Estuary (eight stations, BD15 through BF40), and the Rivers (BG20 and BG30).

2.2 Water Quality Objectives and Criteria

To evaluate the condition of the Estuary in terms of contamination, various guidelines were used for comparative purposes and not for any regulatory purpose. Guidelines were selected based on guidance from the San Francisco Bay Regional Water Quality Control Board (Suer, SFBRWQCB, pers. comm.).

On May 18, 2000 the United States Environmental Protection Agency (EPA) promulgated numeric water quality criteria for priority toxic pollutants for the State of California to fulfill the requirements of section 303(c)(2)(B) of the Clean Water Act (CWA) in the State of California. The EPA proposed this rule to fill a gap left in California's water quality standards policies since 1994, when a State Court recinded the State's water quality control plans. Thus, the State of California has been without numeric water quality criteria for many priority toxic pollutants as required by the CWA, necessitating this action by the EPA. These Federal criteria are legally applicable in the State of California for inland surface waters, enclosed bays and estuaries for all purposes and programs under the CWA.

Water quality guidelines for this report were taken from the EPA's California Toxics Rule (U.S. EPA 2000) and the Regional Water Quality Control Plan for the San Francisco Basin (Basin Plan) (SFBRWQCB 1995). Criteria for the dissolved trace elements and the total organic compounds (dissolved + particulate fractions) were taken from the CTR (Table 2.1). Guideline objectives for water column total trace elements were calculated using the conversion table in the CTR. A criterion for diazinon was not included in the CTR, but a guideline value of 40,000 ppq developed by the California Department of Fish and Game (Menconi and Cox 1994) was used in this report to evaluate the degree of contamination in the Estuary. Chlorpyrifos and mirex are not listed in the CTR but the EPA does have recommended guidelines for them.

After consulting with Regional Board and EPA staff concerning water quality criteria for organic

compounds, we determined that no explicit reference exists in the CTR for the fact that criteria are based on a total recoverable basis. However, it is understood that when these guidelines were developed during the early to mid-80's, analysis methods for chlorinated hydrocarbons and PAHs were performed on a total recoverable basis (Wood, EPA, pers. comm.). The CTR and National Toxics Rule (NTR) both refer to criteria documents required by CWA section 304(a) as the ultimate source of information for individual chemicals. The "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses" includes a section on the Definition of Material of Concern, which states that the definition of the material should be operationally defined within each criterion document. It further states that in the absence of any other operational definition, it is assumed that "total" is implied. The CTR does not include a discussion of "total recoverable vs. dissolved" for organic compounds. Organic compounds should be compared to on a total recoverable basis unless otherwise operationally defined within each criterion document (Suer, SFBRWQCB, pers. comm.).

Different water quality criteria (WQC) apply to saltwater, estuarine, and freshwater portions of the Estuary for the trace elements. As defined by the Basin Plan, sites are defined as 1) freshwater when their salinity is below 5 parts per thousand (ppt) more than 75% of the time; 2) saltwater when their salinity is greater than 5 ppt more than 75% of the time; and 3) estuarine if salinity is intermediate, if estuarine organisms are present for significant periods, or based on an evaluation by the SFBRWQCB.

The Basin Plan specifies that the lower of the freshwater and saltwater objectives apply to estuarine locations. Based on an evaluation by the SFBRWQCB of long-term RMP data (Taylor, SFBRWQCB, pers. comm.), the following 13 stations were classified as estuarine: Sunnyvale (C-1-3), San Jose (C-3-0), South Bay (BA20), Petaluma River (BD15), San Pablo Bay (BD20), Pinole Point (BD30), Davis Point (BD40), Napa River (BD50), Pacheco Creek (BF10), Grizzly Bay (BF20), Honker Bay (BF40), Sacramento River (BG20), and San Joaquin River (BG30).

Fresh water WQC for six trace elements are calculated based on water hardness. When hardness data were unavailable, freshwater criteria were calculated assuming a hardness of 100 mg/L. A hardness value ceiling of 400 mg/L was implemented in this report by recommendation of the Regional Board (Suer, SFBRWQCB, pers. comm.). The bar charts presented in this report show the fresh water criteria for those compounds that are hardness dependent based on a hardness value of 100 mg/L.

For some contaminants, multiple guidelines exist that apply to different target organisms (aquatic life or humans) or different lengths or routes of exposure (e.g., 1 hour or 4 days). For this report, RMP contaminant data were compared to the lowest guideline for each contaminant. In general, trace element concentrations were compared to 4-day average guideline for aquatic life. This is considered appropriate by the SFBRWQCB since RMP data are probably indicative of conditions that persist longer than one day. Trace organic contaminant concentrations were compared to human health criteria based on consumption of organisms only, since RMP stations are all seaward of drinking water intakes in the Delta.

2.3 Aquatic Bioassays

Laboratory bioassays using Estuary water were conducted at six RMP stations (Figure 2.22) during the wet-season sampling (February) and again in the dry-season sampling (July). Bioassays were conducted by exposing Mysids (*Mysidopsis bahi*a) to Estuary water for seven days where percent survival was the endpoint. Detailed methods are included in the *Description of Methods*. Significant toxicity was determined by statistical comparison (t-tests) of field samples with controls.

2.4 Water Trends

The RMP has sampled the waters of the San Francisco Estuary since 1991 to fulfill an important objective of describing spatial and temporal patterns in contaminant concentrations in the Bay. From 1991 to 1992, samples were collected under the State's Bay Protection and Toxic Clean-up Program (BPTCP), which functioned as a Pilot Regional Monitoring Program and a precursor to the current RMP. In addition, several trace elements were measured from 1989 to 1990 as part of a preliminary study of trace element cycling within the San Francisco Estuary (Flegal et al. 1991).

The RMP focuses on temporal trends of contamination by observing variations in contaminant concentrations on seasonal and annual time scales. Total concentrations of several trace elements and organic contaminants were averaged by Bay segment and presented as ranges of concentrations for each RMP sampling date (Figures 2.23-2.40).

2.5 Results and Discussion

2.5.1 Water Quality in the Estuary, 1999

Northern California endured its fifth consecutive wet year in water year 1999, due to winter storms brought on by the effects of La Niña. The resulting hydrologic conditions in the San Francisco Bay region were typical of wet weather years, characterized by above-average precipitation and runoff in the winter and early-spring months, followed by drier conditions throughout the rest of the year. RMP monitoring has been conducted in predominately-wet years (1993-1999), except for the critically dry year of 1994. Therefore, the distribution of contaminants in the Bay in 1999 generally followed similar spatial and temporal patterns found in previous years of RMP monitoring.

Storms began in mid-January following a month long dry spell, and continued into February, providing above-average precipitation to northern California for the month of February (Roos 1999; CDWR 1999). Due to continuous rainfall and runoff in early 1999, the Sacramento-San Joaquin Delta outflows to the Bay were higher than average for the months of February and March (Friend 2000). The average monthly outflows were approximately 2,800 m^3/s and 1,950 m^3/s, respectively, with a peak daily outflow of approximately 4,000 m^3/s on February 11th. At the time of April RMP sampling, Northern Estuary stations in Suisun Bay and the Southern Slough stations were still inundated with freshwater (salinity < 5 ‰) from discharging rivers and streams (Figure 2.1). Although 1999 was an above-average year for precipitation and runoff, a significant reduction in rainfall after the month of April caused conditions to be drier than usual for the remainder of the year (Friend 2000).

Winter storms typically produce excessive stormwater runoff and river discharge, which mobilize and transport loads of suspended sediments and dissolved constituents to the Bay. Concentrations of dissolved organic carbon (DOC) were elevated during February sampling at the River stations, in the Northern Estuary, and at the Estuary Interface (Figure 2.2). High concentrations of DOC in winter conditions indicate the influence of riverine sources on increased concentrations of dissolved contaminants in the Bay, as well as the potential for forming complexes with dissolved metals, such as copper (Kuwabara et al. 1989). Of particular interest is the unusually high DOC concentration measured at the Petaluma River (BD15) in February (10.6 mg/L), which is the 2nd highest DOC concentration measured in RMP history. Although suspended sediment loads are also usually greater in the wet season, concentrations of total suspended solids (TSS) during July sampling were higher than the wet-season concentrations in February at many RMP stations (Figure 2.3). The highest TSS concentrations of 1999 were measured in July at the Southern Slough stations at Sunnyvale (C-1-3, 372 mg/L) and San Jose (C-3-0, 306 mg/L). These concentrations led to the highest summertime Baywide average TSS concentration (95 mg/L) measured since RMP began. Because many trace elements and hydrophobic organic contaminants adsorb onto particle surfaces and partition with dissolved organic material, the speciation and bioavailability of trace contaminants are significantly influenced by the hydrologic conditions in the Bay.

2.5.2 Contaminant Concentrations in Water

Dissolved Trace Elements

Dissolved concentrations of several trace elements, including mercury, copper, nickel, lead, and silver were relatively high during February sampling in 1999 (Figures 2.4-2.13). Peak concentrations of copper (4.5 µg/L), nickel (12 µg/L), lead (0.99 µg/L), and silver (0.012 µg/L) were measured at Petaluma River (BD15) in February. The dissolved concentrations of nickel and lead were the 2nd highest concentrations measured for these contaminants since the beginning of RMP. High dissolved concentrations of these metals are historically found in the Petaluma River, which typically has high DOC concentrations during wet winter seasons. Average concentrations of mercury were also elevated in February in the Estuary Interface (0.019 µg/L) and the Northern Estuary (0.0066 µg/L), mostly because of high concentrations measured in the Guadalupe River (BW15, 0.035 µg/L) and the Petaluma River (BD15, 0.032 µg/L).

As in previous years, high concentrations of dissolved selenium were measured in the southern reaches of the Bay. The average Baywide concentration of dissolved selenium in July (0.85 µg/L) was the highest summertime average ever measured by the RMP because of high concentrations in the Estuary Interface and the Southern Sloughs. In July, the concentration of dissolved selenium in the Guadalupe River (6.4 µg/L) exceeded all measurements from previous years of the RMP.

Total Trace Elements

Relatively high concentrations of most total trace elements coincided with extremely high TSS concentrations in the Southern Sloughs in July (Figures 2.4-2.13). At this time, the average Baywide concentrations of total copper (6.2 µg/L), nickel (11 µg/L), silver (0.028 µg/L), and selenium (0.64 µg/L) were the highest averages measured for dry-season sampling since RMP began.

Except for mercury and selenium, the average concentrations of all other trace elements were highest in the Southern Sloughs in July compared to all other Bay segments in 1999. Elevated concentrations of total copper (30.8 µg/L), nickel (80 µg/L), silver (0.18 µg/L), and zinc (77 µg/L) were measured at Sunnyvale (C-1-3) in July. Total copper and nickel concentrations measured at Sunnyvale were the 2nd highest concentrations ever measured by the RMP for these metals, but they were much lower than concentrations measured in the Guadalupe River (BW15) in April of 1997. This sampling date also provided the highest TSS concentration in RMP history (1,570 mg/L).

Similar to dissolved selenium, total concentrations of selenium were highest in July at the Estuary Interface stations, with an average concentration of 5.4 µg/L. Water sampled from the Guadalupe River also had the highest total selenium concentration ever measured by the RMP (7.2 µg/L).

Organic Contaminants

Highconcentrations of dissolved and total (dissolved + particulate) PAHs and PCBs were measured in the Estuary Interface, Southern Sloughs, and South Bay in 1999 (Figure 2.14, 2.15). Peak concentrations of dissolved and total PAHs (25 ng/L and 290 ng/L, respectively) were measured at San Jose (C-3-0) in July. Similarly, the highest dissolved PCB concentration was measured at San Jose (C-3-0) in July (800 pg/L), and the highest total PCB concentration was found in the Guadalupe River (BW15) in April (7,200 pg/L). Dissolved PAHs were generally higher in July at most stations, while dissolved PCBs were typically highest in February. Because dissolved PAHs and PCBs comprise a relatively small portion of the total concentrations of these compounds (approximately 16% and 31%, respectively), elevated concentrations of total PAHs and PCBs were consistent with high TSS concentrations at several RMP stations: San Jose (C-3-0) in July, Guadalupe River (BW15), San Pablo Bay (BD20), and Davis Point (BD40) in April, and Napa River (BD50) in July.

The organochlorine pesticides DDT, chlordane, HCH, and dieldrin also had higher concentrations in the southern reaches of the Bay (Figures 2.16, 2.17, 2.19, and 2.21). Dissolved and total concentrations of DDTs, chlordanes, and dieldrin, generally showed spatial gradients decreasing from the Estuary Interface to the Central Bay during all seasons, with high pulses measured in the Napa River (BD50) in February. Exceedingly high concentrations were also measured at Guadalupe River (BW15) in April for total DDTs (5,600 pg/L), chlordanes (2,200 pg/L), and dieldrin (320 pg/L).

Concentrations of diazinon and chlorpyrifos, two organophosphate insecticides used extensively for agricultural and urban applications, showed spatial gradients decreasing from the River stations in the Delta to the Central Bay during February sampling (Figure 2.18, 2.20). This seaward gradient indicates the occurrence of a wet-season flush of these pesticides into the bay from the Central Valley. Chlorypyrifos concentrations also decreased along a distinct spatial gradient from the Estuary Interface to the Central Bay during February and April sampling, with elevated concentrations measured at Guadalupe River (BW15) in February (940 pg/L) and at Standish Dam in April (13,000 pg/L). High concentrations of both pesticides were also measured in San Jose (C-3-0) in April [total diazinon (25,000 pg/L) and total chlorpyrifos (11,000 pg/L)]. Unlike PAHs and PCBs, dissolved concentrations of diazinon and chlorpyrifos comprised greater than 80% of the total concentration averaged over the entire Bay.

2.5.3 Contaminant Trends in Water

Seasonal trends have been established for several contaminants, including arsenic, total cadmium, total silver, diazinon, and total dieldrin. Concentra-

tions of arsenic and total cadmium are consistently low in winter and spring and high in late summer in the main reaches of the Bay (Figures 2.23, 2.24). These temporal patterns have also been detected in the Southern Slough stations since 1994 and in the Estuary Interface since 1996. Total silver concentrations are consistently higher during springtime sampling in the Northern Estuary (Figure 2.31). Concentrations of diazinon and total dieldrin are generally higher during the wet season, which coincides with increased surface runoff and discharge from the surrounding tributaries (Figures 2.37, 2.38).

One important seasonal and spatial pattern seen over the years of RMP monitoring is the occurrence of peak concentrations of several dissolved trace elements measured at the Petaluma River (BD15) in the winter-wet season. During periods of increased freshwater flow and runoff, dissolved concentrations of copper, lead, nickel, mercury, silver, and zinc are historically high in the Petaluma River. Since 1997, wet-season concentrations of dissolved nickel and lead at the Petaluma River station have been the highest concentrations of the two metals measured at any RMP station during those years.

Although seasonal variations are readily apparent for some contaminants, analyses of annual and long-term trends are complicated by substantial hydrologic variations that occur from year to year. For example, suspended sediment flow in rivers and estuaries is highly seasonal and episodic in nature. Therefore, the concentrations and loads of particle-associated contaminants are highly dependent on specific factors, such as river discharge, erosion, deposition, and sediment transport at the time of sampling. To determine the extent of water quality improvement or degradation, fluctuations caused by hydrologic and hydrodynamic variability must be accounted for by appropriately characterizing the relationship between these variables and contaminant behavior in the Bay.

2.5.4 Comparison to Water Quality Criteria and Objectives

This section provides a brief overview of how 1999 data compare to relevant water quality guidelines (Table 2.1). Of the ten trace elements measured, concentrations of copper, nickel, mercury, nickel, lead, selenium, and zinc exceeded water quality guidelines on one or more occasions (Table 2.2). Total mercury, copper, and nickel were most frequently above guidelines in the Southern Sloughs, South Bay, and Northern Estuary. Several organic contaminants, such as PCBs, PAHs, DDTs, chlordanes, chlorpyrifos, and dieldrin were also measured above water quality criteria (Table 2.3). The sums of 40 PCB congeners were well above the congener-based PCB criterion of 170 pg/L in all but ten of the samples.

2.5.5 Effects of Contamination on Aquatic Organisms

During the first five years of the RMP study, ambient water toxicity was assessed by determining percent normal development and percent survival of aquatic organisms exposed to water samples from different reaches of the Bay. In 1998, the RMP modified its monitoring strategy in order to allocate more resources for studies on the effects of episodic storm events on water toxicity.

The 1999 RMP Base Program measured water toxicity at six sites located in the northern and southern reaches of the Bay (Figure 2.22). Toxicity tests using *Mysidopsis bahia* indicated that Sunnyvale had significant water toxicity during summer sampling (0% survival).

The Episodic Toxicity Pilot study has conducted aquatic toxicity tests on water sampled from various locations in the Bay from 1996 through 1999 (Gunther and Ogle 2000). The results of the study indicate that significant toxicity occurs due to increased contaminant concentrations in urban and agricultural runoff from episodic events, such as storms or pesticide applications.

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Table 2.1. Water quality guidelines. California Toxics Rule water quality criteria (US EPA, May 18, 2000) are listed except where noted. Dissolved trace element criteria are listed (except for mercury and selenium aquatic life values). Total trace element criteria (not shown) may be calculated using the procedures specified in the proposed California Toxics Rule. Guidelines for organic compounds are listed on a total basis (dissolved + particulate). Units are µg/L. Bold and italicized values are hardness dependent criteria and are calculated for this table using a hardness value of 100 mg/L

Parameter	Aquatic Life				Human Health (10^{-6} risk for carcinogens)	
	Fresh Water		Salt Water		Fresh Water	Salt & Fresh Water
	1-hour	4-day	1-hour	4-day	Water & Organisms	Organisms only
Ag	***3.4***	.	1.9	.	.	.
As	340	150	69	36	.	.
Cd	***4.3***	***2.2***	42	9.3	.	.
Cr VI	16	11	1100	50	.	.
Cu	***13***	***9***	4.8	3.1	1300	.
Hg [A]	2.4	0.012	2.1	0.025	0.05	0.051
Ni	***470***	***52***	74	8	610	4600
Pb	***65***	***2.5***	210	8.1	.	.
Se [B]		5	290	71	.	.
Zn	***120***	***120***	90	81	.	.
Alpha-HCH	.	.	.	.	0.0039	0.013
Acenaphthene	.	.	.	.	1200	2700
Anthracene	.	.	.	.	9600	110000
Benz(a)anthracene	.	.	.	.	0.0044	0.049
Benzo(a)pyrene	.	.	.	.	0.0044	0.049
Benzo(b)fluoranthene	.	.	.	.	0.0044	0.049
Benzo(k)fluoranthene	.	.	.	.	0.0044	0.049
Beta-HCH	.	.	.	.	0.014	0.046
Chlordane	2.4	0.0043	0.09	0.004	0.00057	0.00059
Chlorpyrifos [C]	0.083	0.041	0.011	0.0056	.	.
Chrysene	.	.	.	.	0.0044	0.049
Dibenz(a,h)anthracene	.	.	.	.	0.0044	0.049
Dieldrin	0.24	0.056	0.71	0.0019	0.00014	0.00014
Endosulfan I	0.22	0.056	0.034	0.0087	110	240
Endosulfan II	0.22	0.056	0.034	0.0087	110	240
Endosulfan Sulfate	.	.	.	.	110	240
Endrin	0.086	0.036	0.037	0.0023	0.76	0.81
Fluoranthene	.	.	.	.	300	370
Fluorene	.	.	.	.	1300	14000
Gamma-HCH	0.095	0.08	0.16	.	0.019	0.063
Heptachlor	0.52	0.0038	0.053	0.0036	0.00021	0.00021
Heptachlor Epoxide	0.52	0.0038	0.053	0.0036	0.0001	0.00011
Hexachlorobenzene	.	.	.	.	0.00075	0.00077
Indeno(1,2,3-cd)pyrene	.	.	.	.	0.0044	0.049
p,p'-DDD	.	.	.	.	0.00083	0.00084
p,p'-DDE	.	.	.	.	0.00059	0.00059
p,p'-DDT	1.1	0.001	0.13	0.001	0.00059	0.00059
Pyrene	.	.	.	.	960	11000
Mirex [C]	.	0.001	.	0.001	.	.
Total PCBs	.	0.014	.	0.03	0.00017	0.00017

[A] Mercury Aquatic Life values are from the San Francisco Basin Plan, 1995 and are for total recoverable mercury.

[B] Selenium values are region-specific criteria as outlined in the National Toxics Rule: values are for total recoverable selenium results and the fresh water criteria apply to the whole estuary.

[C] Chlorpyrifos and mirex are not listed in the proposed CTR but EPA criteria do exist for them.

Table 2.2

Summary of trace elements that were above water quality criteria (WQC) and guidelines for 1999 RMP water samples.

WQC used in this comparison are from the EPA--California Toxics Rule (2000) 304(a) Criteria.
Only compounds that were above criteria or guidelines are listed. • = above guideline, - not available (note: these are qualified data and therefore can't be evaluated).

			Dissolved						Total																	
			Cu			Ni			Cu			Hg			Ni			Pb			Se			Zn		
	Code	Station	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul
Estuary	BW10	Standish Dam									•	•					•									
Interface	BW15	Guadalupe River										•	•	•									•			
Southern	C-1-3	Sunnyvale							•	•	•	•	•		•	•	•									•
Sloughs	C-3-0	San Jose							•	•	•	•	•	•	•	•	•			•						
	BA10	Coyote Creek			•				•	•	•			•		•	•									
	BA20	South Bay							•	•	•	•	•		•	•	•									
	BA30	Dumbarton Bridge							•	•	•				•	•	•									
South Bay	BA40	Redwood Creek							•																	
	BB15	San Bruno Shoal																								
	BB30	Oyster Point										•			•											
	BB70	Alameda																								
	BC10	Yerba Buena Island																								
Central	BC20	Golden Gate												-												
Bay	BC30	Richardson Bay																			-					
	BC41	Point Isabel																								
	BC60	Red Rock																								
	BD15	Petaluma River	•	•	•	•			•	•	•	•	•	•	•	•	•									
	BD20	San Pablo Bay							•	•	•	•	•	•	•	•			•							
	BD30	Pinole Point								•			•			•										
Northern	BD40	Davis Point							•	•		•	•			•										
Estuary	BD50	Napa River							•	•	•	•	•		•	•		•				-				
	BF10	Pacheco Creek							•	•	•		•		•	•										
	BF20	Grizzly Bay								•	•		•	•		•	•									
	BF40	Honker Bay							•	•	•	•	•	•	•	•	•									
Rivers	BG20	Sacramento River									•															
	BG30	San Joaquin River									•															

Table 2.3

Summary of trace organic contaminants that were above water quality criteria (WQC) and guidelines for 1999 RMP water samples.

WQC used in this comparison are from the EPA--California Toxics Rule (2000) 304(a) Criteria.

Only compounds that were above criteria or guidelines are listed. ● = above guideline, - not available (note: these are qualified data and therefore can't be evaluated).

			Total PAHs			Total PCBs			Total Chlordanes			Total DDTs			p,p'-DDD			p,p'-DDE			p,p'-DDT			Chlorpyrifos			Dieldrin			Heptachlor epoxide		
		WQC (ppb)	0.031			0.00017			0.00059			0.00059			0.00084			0.00059			0.00059			0.0056			0.00014			0.00011		
	Code	Station	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul	Feb	Apr	Jul
Estuary	BW10	Standish Dam	●	●	●	●	●	●	●	●		●	●	●				●	●	●								●	●			
Interface	BW15	Guadalupe River	●	●	●	●	●	●	●	●		●	●	●				●	●	●		●					●	●				
Southern Sloughs	C-3-0	San Jose	●	●	●	●	●	●	●	●	●	●	●	●				●	●						●			●	●	●	●	
South Bay	BA10	Coyote Creek	●	●	●	●	●	●	●			●	●	●	●			●						-			●					
	BA30	Dumbarton Bridge	●	●	●	●	●	●				●																				
	BA40	Redwood Creek	●	●		●	●	●				●																				
	BB70	Alameda	●	●	●	●	●	●																-								
Central Bay	BC10	Yerba Buena Island			●	●	●	●																-								
	BC20	Golden Gate				●																		-	-							
	BC60	Red Rock			●	●	●	●																								
Northern Estuary	BD15	Petaluma River		●	●	●	●	●					●	●					●													
	BD20	San Pablo Bay		●	●	●	●	●					●						●													
	BD30	Pinole Point		●		●	●						●																			
	BD40	Davis Point		●		●	●						●						●													
	BD50	Napa River	●	●		●	●	●	●			●	●					●									●			●		
	BF20	Grizzly Bay			●	●	●	●					●																			
Rivers	BG20	Sacramento River										●																				
	BG30	San Joaquin River																														

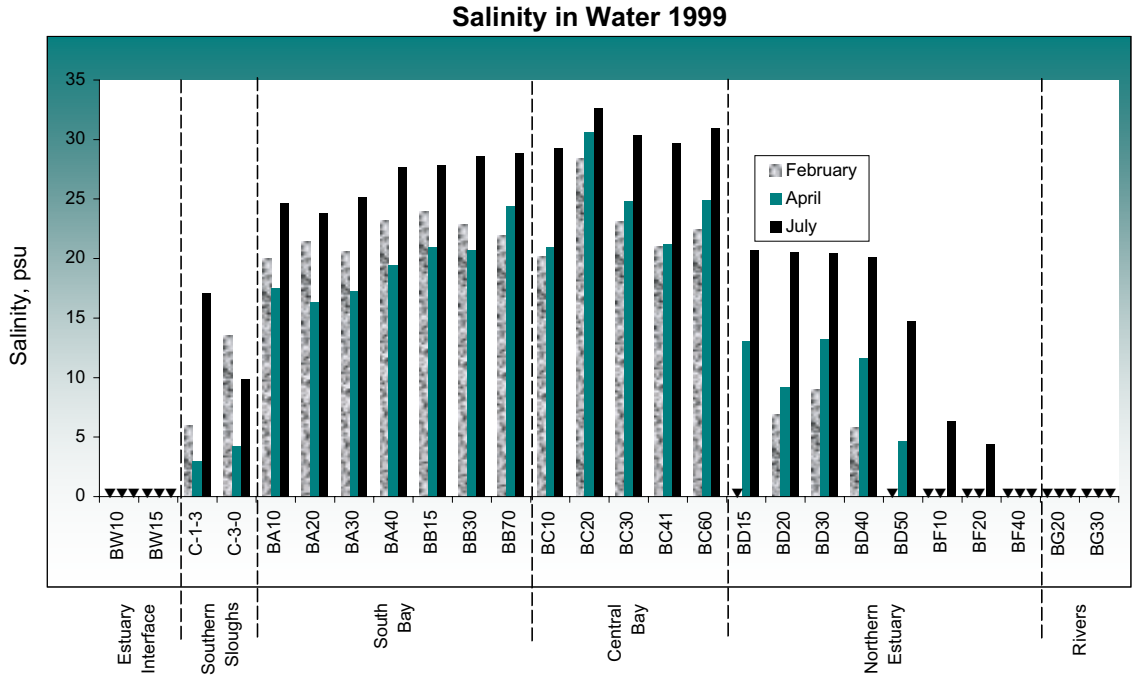

Figure 2.1. Salinity in practical salinity units (psu) at each RMP water station in February, April, and July 1999. ▼ = indicates salinity was < 2 psu. Salinities ranged from below detection to 33 psu. The highest salinity was detected at Golden Gate (BC20) in July.

Source Data: see Data Table 1

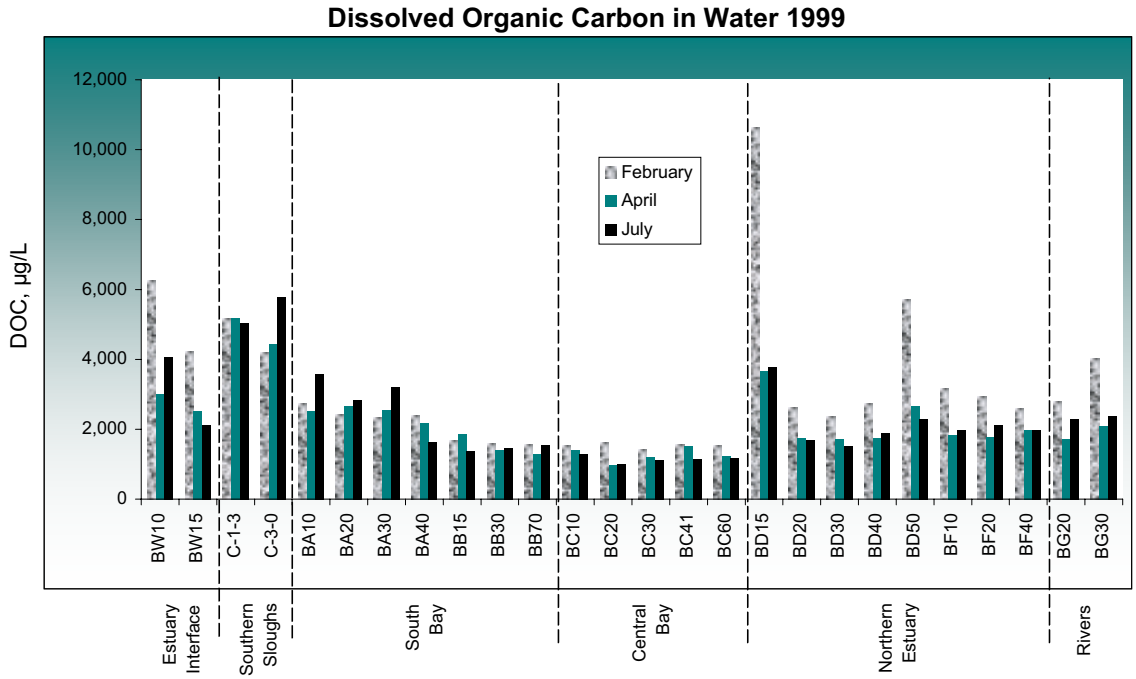

Figure 2.2. Dissolved organic carbon (DOC) in micrograms per liter (µg/L) at each water station in February, April, and July of 1999. DOC ranged from 960 µg/L to 10,600 µg/L. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Southern Sloughs (5,400 µg/L) in July and lowest in the Central Bay (1,100 µg/L) in July.

Source Data: see Data Table 1

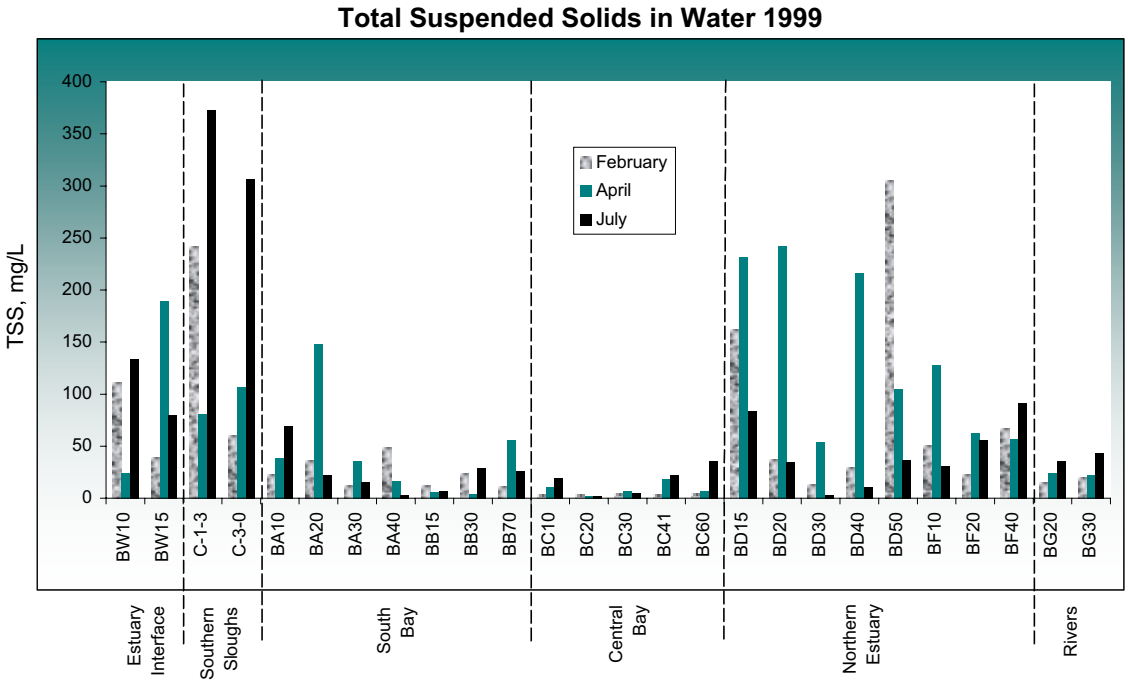

Figure 2.3. Total suspended solids (TSS) in milligrams per liter (mg/L) at each RMP water station in February, April, and July of 1999. TSS concentrations ranged from 1.5 mg/L to 370 mg/L. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (340 mg/L) in July and lowest in the Central Bay (4.0 mg/L) in February.

Source Data: see Data Table 1

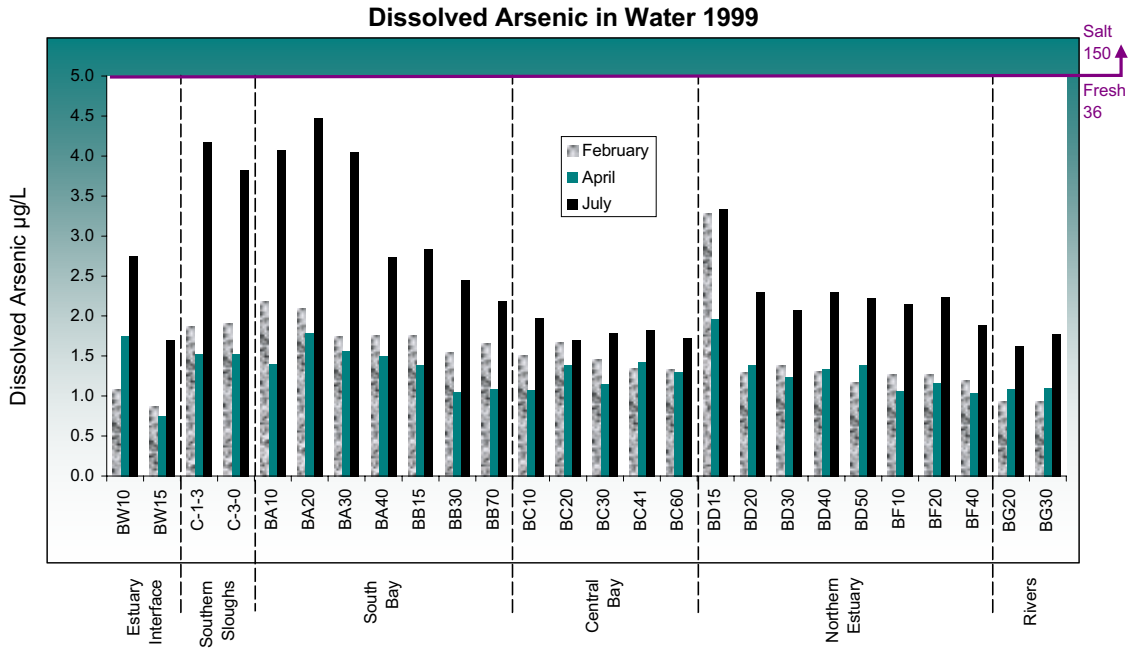

Figure 2.4a. Dissolved arsenic (As) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.74 ppb to 4.5 ppb. The highest concentration was sampled at South Bay (BA20) in July and the lowest at Guadalupe River (BW15) in April. Average concentrations were highest in the Southern Sloughs (4.0 ppb) in July and lowest in the Rivers (0.93 ppb) in February. All samples were below the 4-day average WQC for dissolved arsenic (saltwater 36 ppb, freshwater 150 ppb).

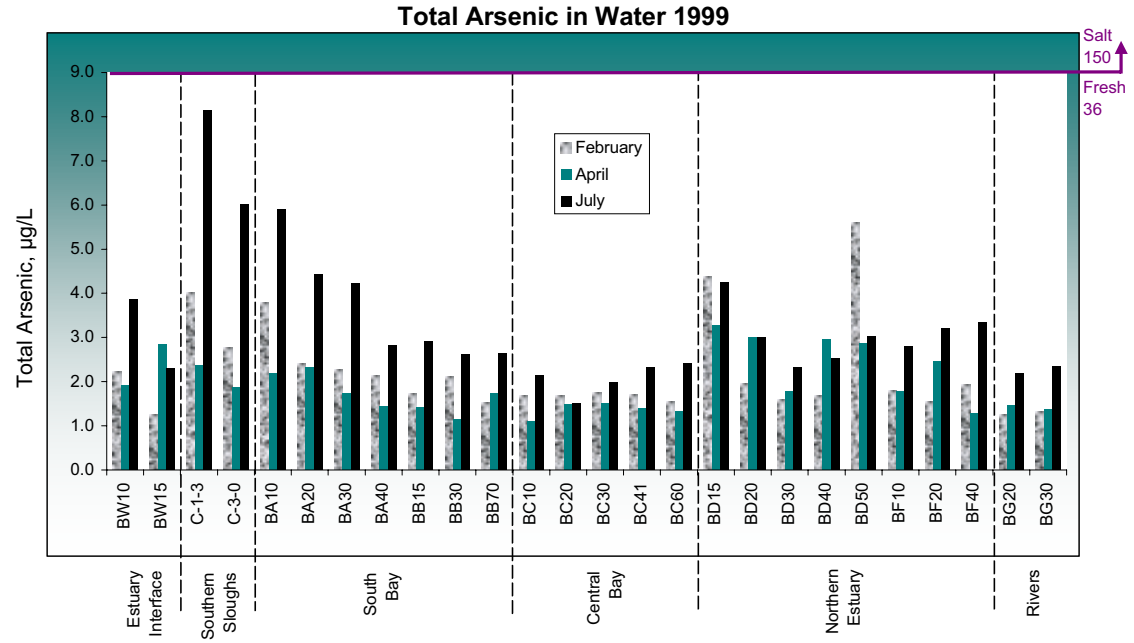

Figure 2.4b. Total arsenic (As) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 1.1 ppb to 8.2 ppb. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Yerba Buena Island (BC10) in April. Average concentrations were highest in the Southern Sloughs (7.1 ppb) in July and lowest in the Rivers (1.3 ppb) in February. All samples were below the 4-day average WQC for total arsenic (saltwater 36 ppb, freshwater 150 ppb).

Source Data: see Data Tables 2 and 3

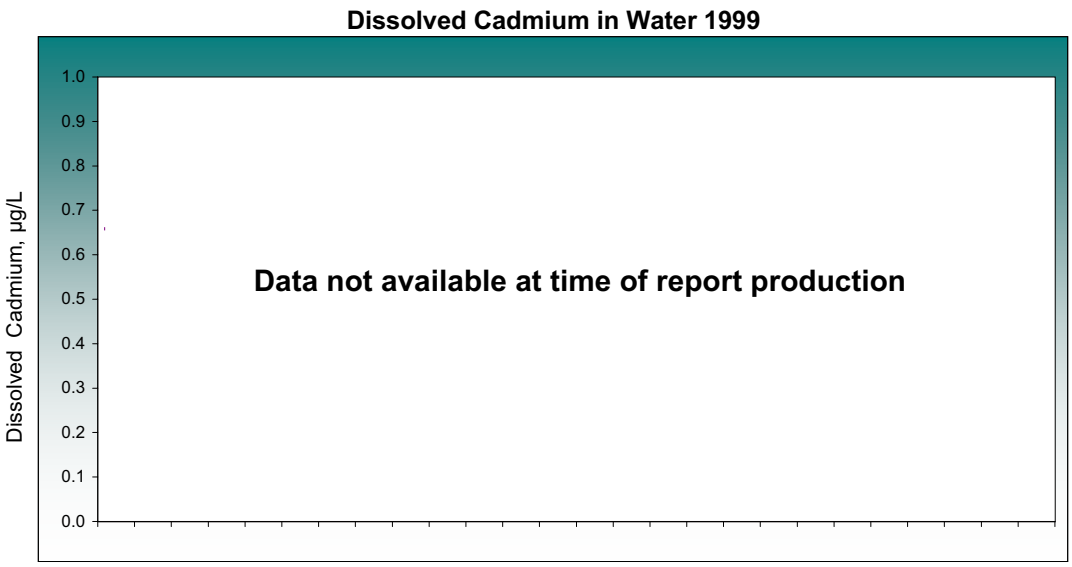

Figure 2.5a. Dissolved cadmium (Cd) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Data for 1999 were not available at time of report production

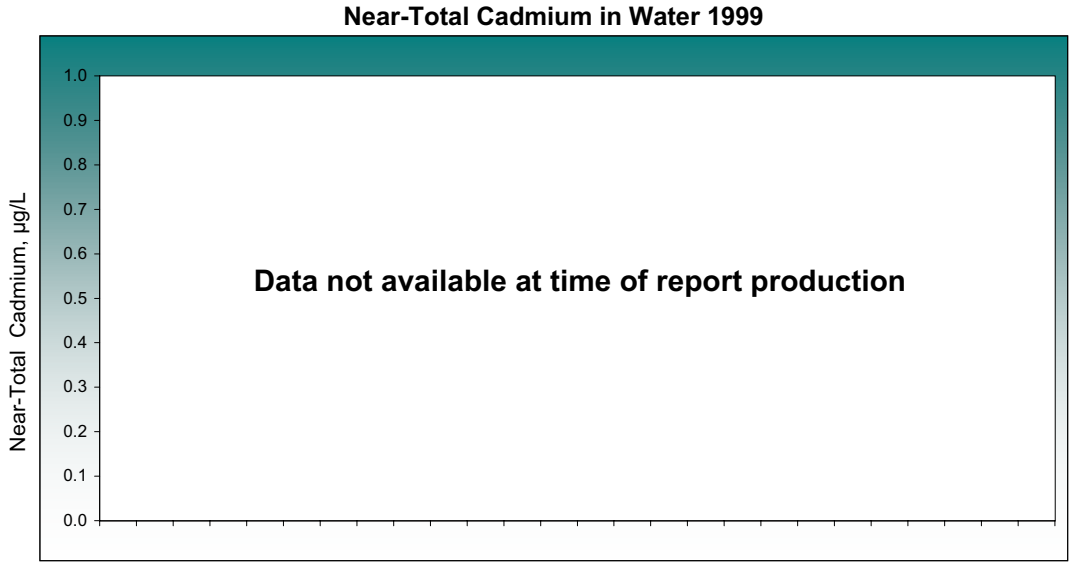

Figure 2.5b. Near-total cadmium (Cd) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Data for 1999 were not available at time of report production.

Source Data: see Data Tables 2 and 3

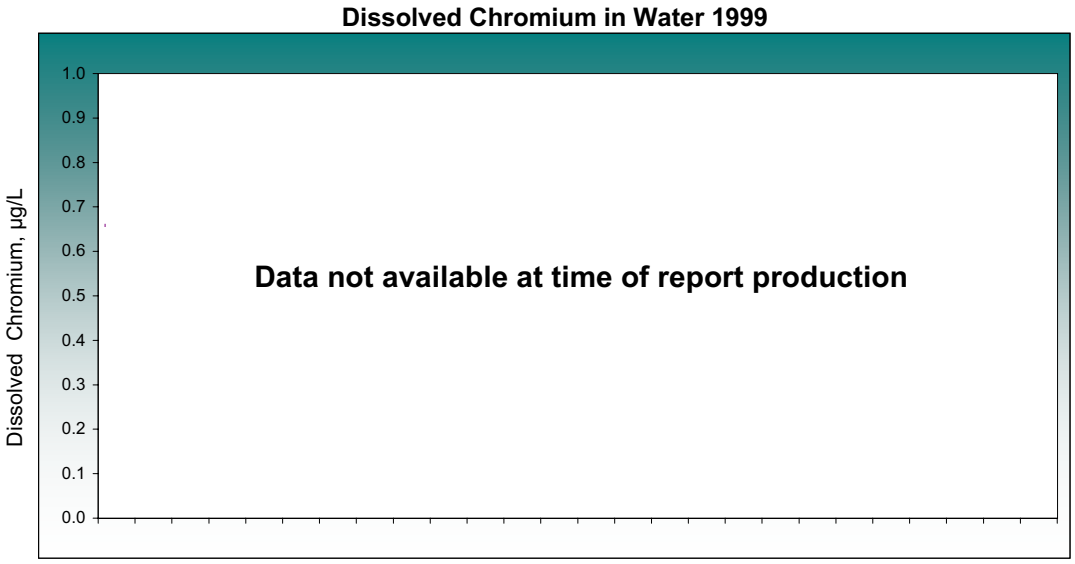

Figure 2.6a. Dissolved chromium (Cr) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Data for 1999 were not available at time of report production

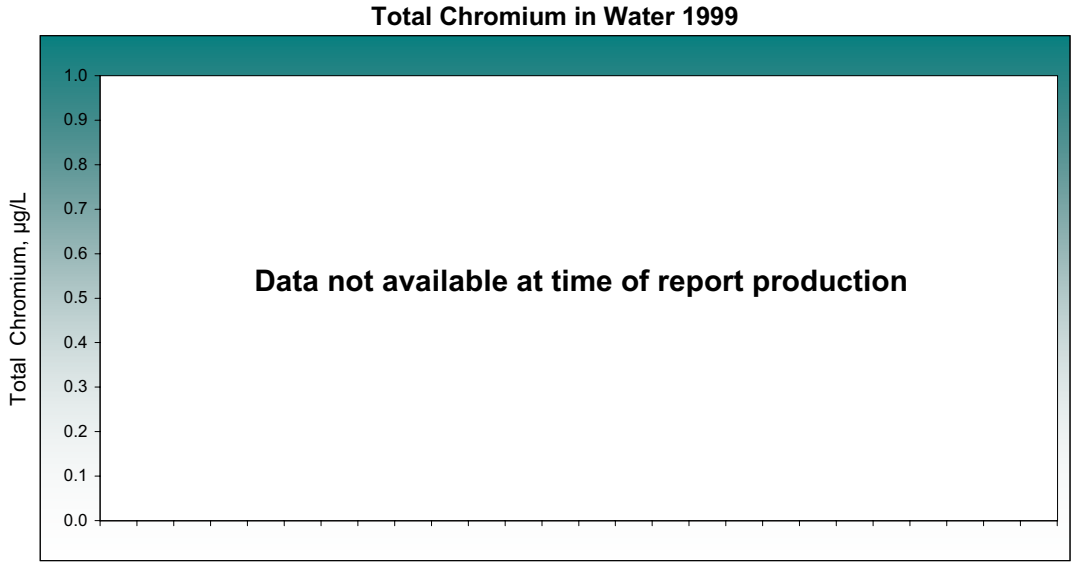

Figure 2.6b. Total chromium (Cr) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Data for 1999 were not available at time of report production.

Source Data: see Data Tables 2 and 3

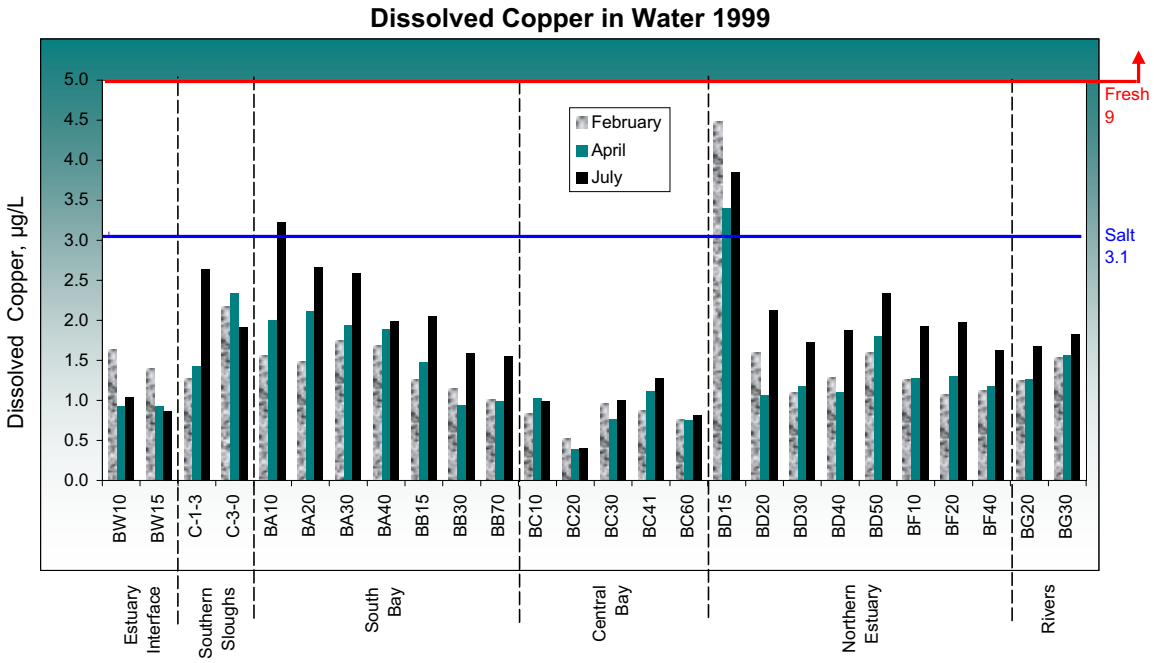

Figure 2.7a. Dissolved copper (Cu) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.39 ppb to 4.5 ppb. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Southern Sloughs (2.3 ppb) in July and lowest in the Central Bay (0.79 ppb) in February. Four samples were above the 4-day average WQC for dissolved copper (saltwater 3.1 ppb, freshwater 9 ppb-hardness dependent).

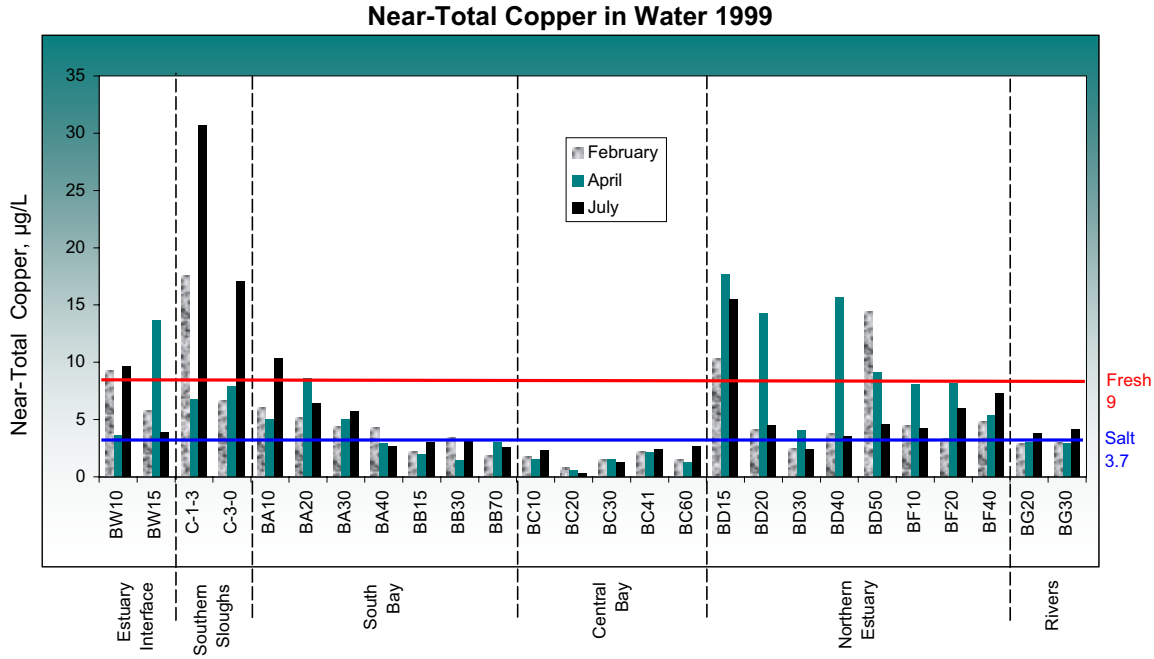

Figure 2.7b. Near-total copper (Cu) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.37 ppb to 31 ppb. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (24 ppb) in July and lowest in the Central Bay (1.4 ppb) in April. Thirty-nine samples were above the 4-day average WQC for total copper (saltwater 3.7 ppb, freshwater 9 ppb-hardness dependent).

Source Data: see Data Tables 2 and 3

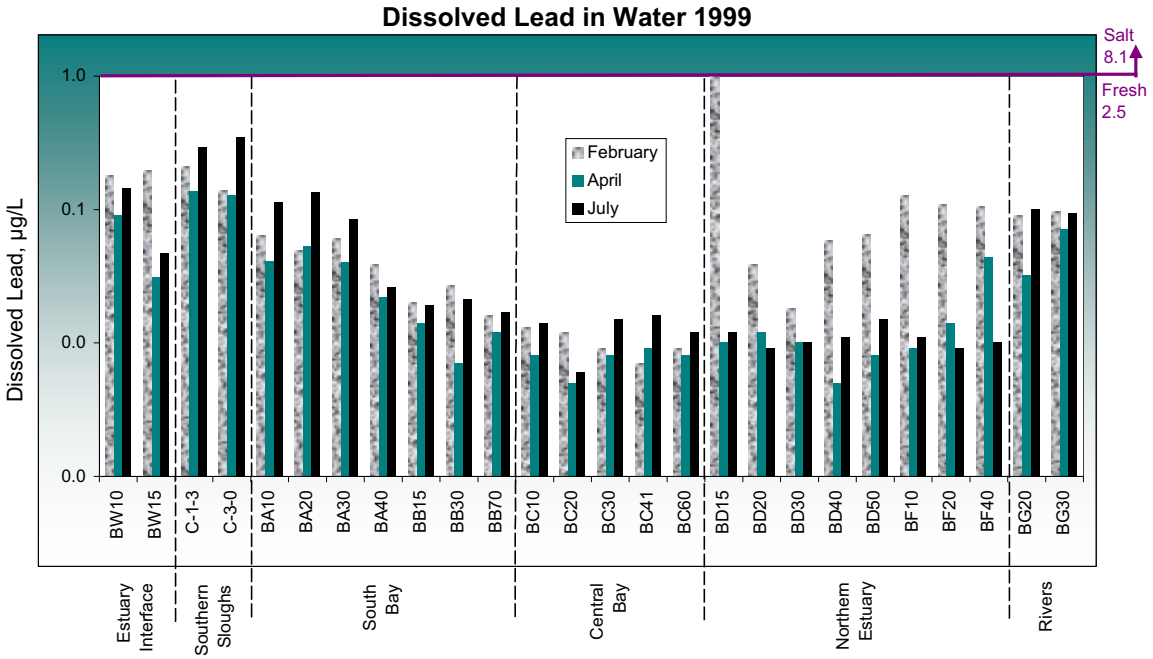

Figure 2.8a. Dissolved lead (Pb) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. Concentrations ranged from 0.005 ppb to 0.99 ppb. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at both Golden Gate (BC20) and Davis Point (BD40) in April. Average concentrations were highest in the Southern Sloughs (0.32 ppb) in July and lowest in the Central Bay (0.0076 ppb) in April. All samples were below the 4-day average WQC for dissolved lead (saltwater 8.1 ppb, freshwater 2.5 ppb-hardness dependent).

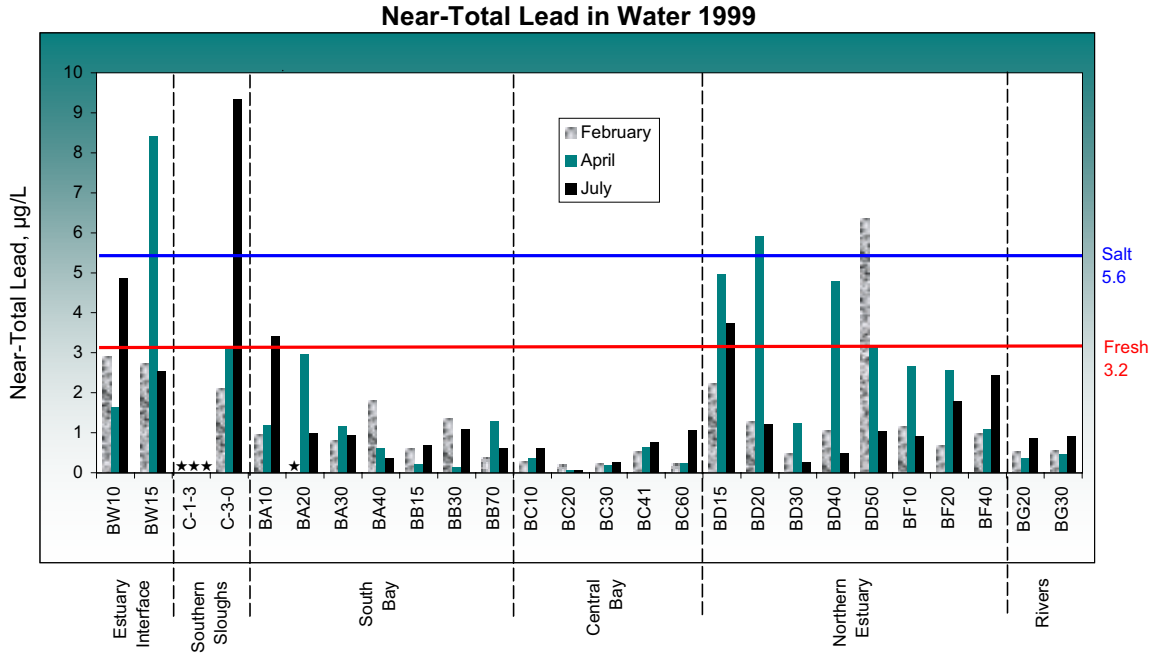

Figure 2.8b. Near-total lead (Pb) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. ★ = not analyzed. Concentrations ranged from 0.073 ppb to 9.3 ppb. The highest concentration was sampled at San Jose (C-3-0) in July and the lowest at Golden Gate (BC20) in April and July. Average concentrations were highest in the Southern Sloughs (9.3 ppb) in July and lowest in the Central Bay (0.30 ppb) in April. Three samples were above the 4-day average WQC for total lead (saltwater 5.6 ppb, freshwater 3.2 ppb-hardness dependent).

Source Data: see Data Tables 2 and 3

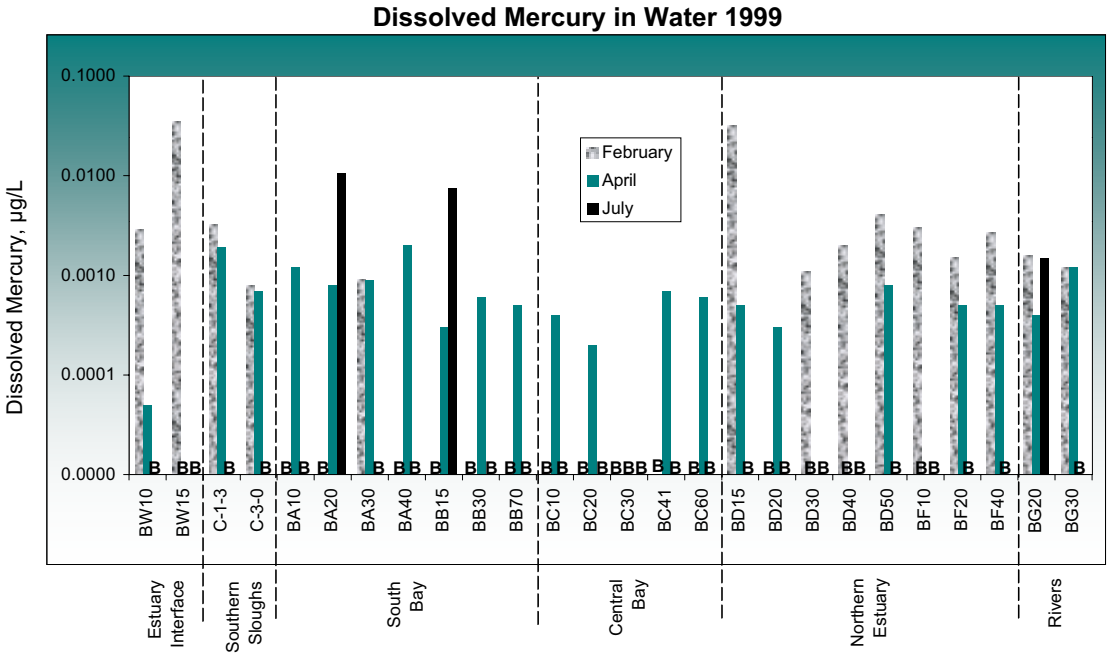

Figure 2.9a. Dissolved mercury (Hg) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. B = blank contamination, >30% of measured concentration. Concentrations ranged from below detection to 0.035 ppb. The highest concentration was sampled at Guadalupe River (BW15) in February. Average concentrations were highest in the Estuary Interface (0.019 ppb) in February. Mercury is compared to guidelines only on the basis of total mercury.

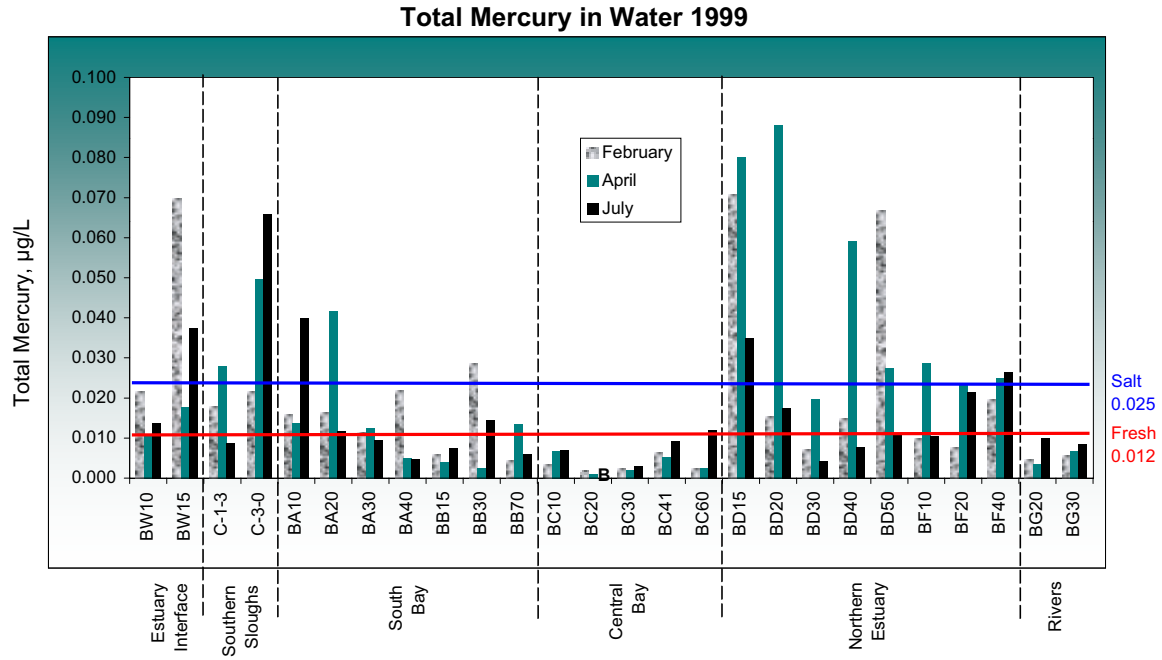

Figure 2.9b. Total mercury (Hg) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. B = blank contamination, >30% of measured concentration. Concentrations ranged from 0.0010 ppb to 0.088 ppb. The highest concentration was sampled at San Pablo Bay (BD20) in April and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Estuary Interface (0.046 ppb) in February and lowest in the Central Bay (0.0033 ppb) in February. Thirty samples were above the 4-day average WQC for total mercury (saltwater 0.025 ppb, freshwater 0.012 ppb).

Source Data: see Data Tables 2 and 3

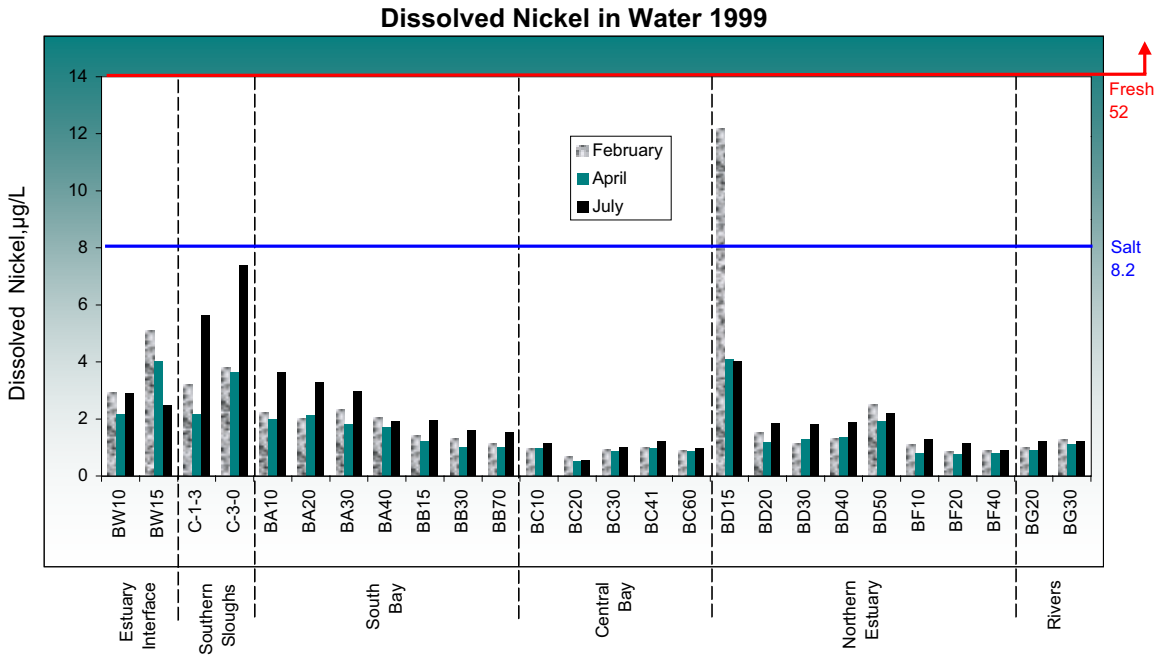

Figure 2.10a. Dissolved nickel (Ni) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.53 ppb to 12 ppb. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Southern Sloughs (6.5 ppb) in July and lowest in the Central Bay (0.85 ppb) in April. One sample was above the 4-day average WQC for dissolved nickel (saltwater 8.2 ppb, freshwater 52 ppb-hardness dependent).

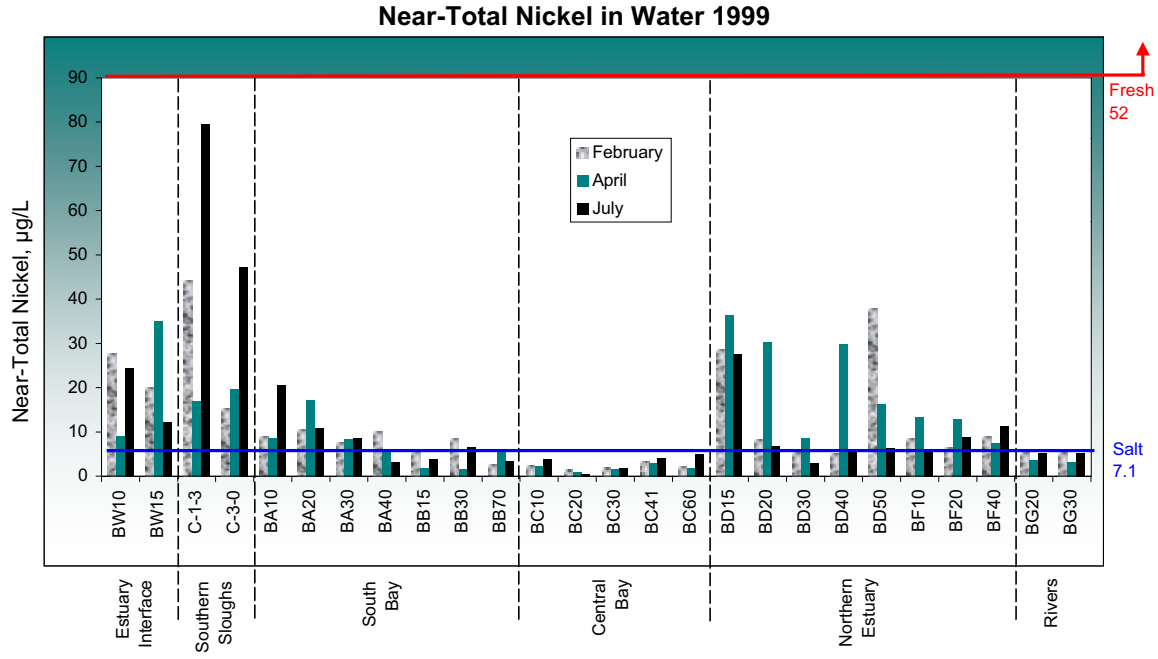

Figure 2.10b. Near-total nickel (Ni) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.47 ppb to 80 ppb. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (63 ppb) in July and lowest in the Central Bay (1.9 ppb) in April. Thirty-four samples were above the 4-day average WQC for total nickel (saltwater 7.1 ppb, freshwater 52 ppb-hardness dependent).

Source Data: see Data Tables 2 and 3

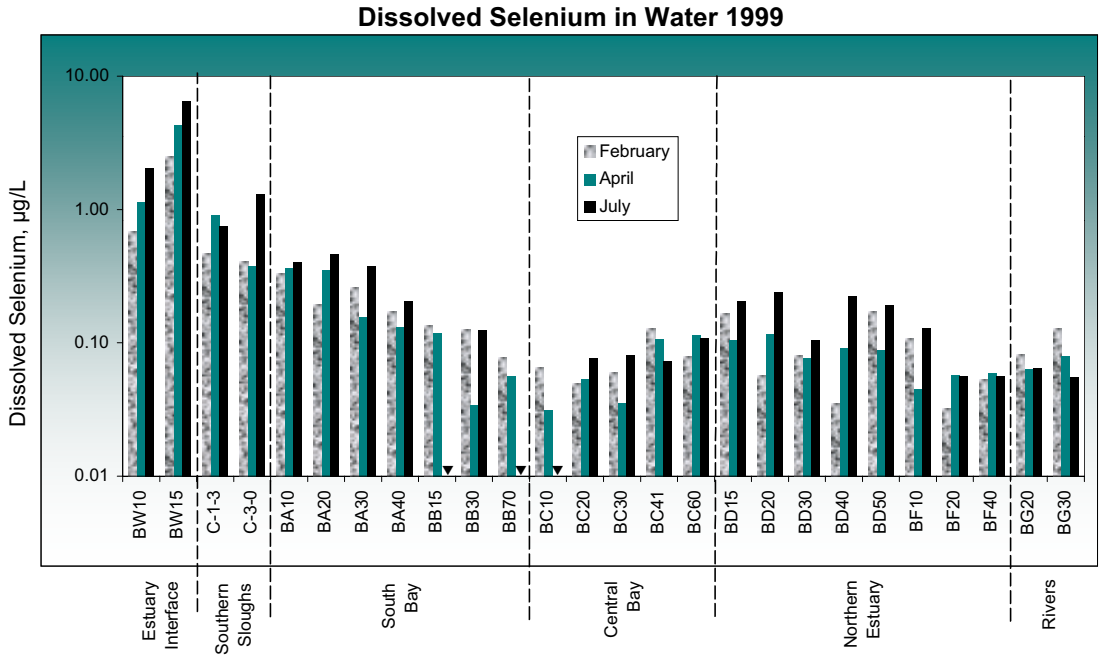

Figure 2.11a. Dissolved selenium (Se) in parts per billion at each RMP water station in February, April, and July of 1999. Note logarithmic scale. ▼ = not detected. Concentrations ranged from below detection to 6.4 ppb. The highest concentration was sampled at Guadalupe River (BW15) in July. Average concentrations were highest in the Estuary Interface (4.2 ppb) in July and lowest in the Rivers (0.060 ppb) in July. Selenium is compared to guidelines only on the basis of total selenium.

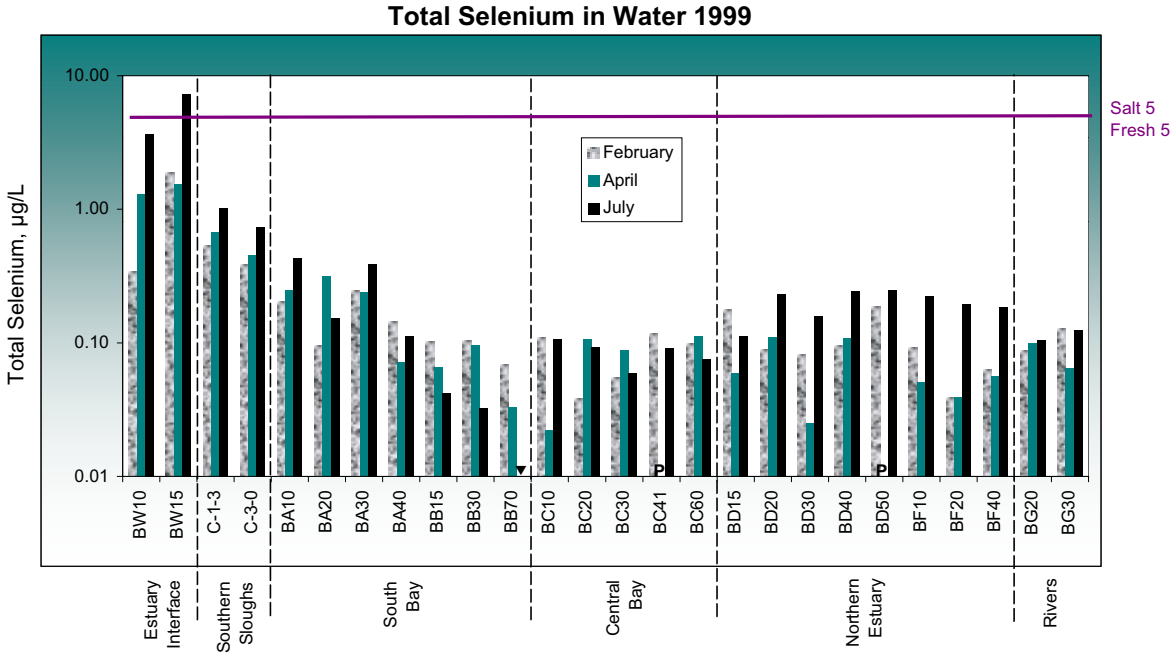

Figure 2.11b. Total selenium (Se) in parts per billion at each RMP water station in February, April, and July of 1999. Note logarithmic scale. ▼ = not detected. **P** = low precision, > 30% of field value. Concentrations ranged from below detection to 7.2 ppb. The highest concentration was sampled at Guadalupe River (BW15) in July. Average concentrations were highest in the Estuary Interface (5.4 ppb) in July and lowest in the Rivers (0.082 ppb) in April. One sample was above the 4-day average WQC for total selenium (saltwater 5 ppb, freshwater 5 ppb).

Source Data: see Data Tables 2 and 3

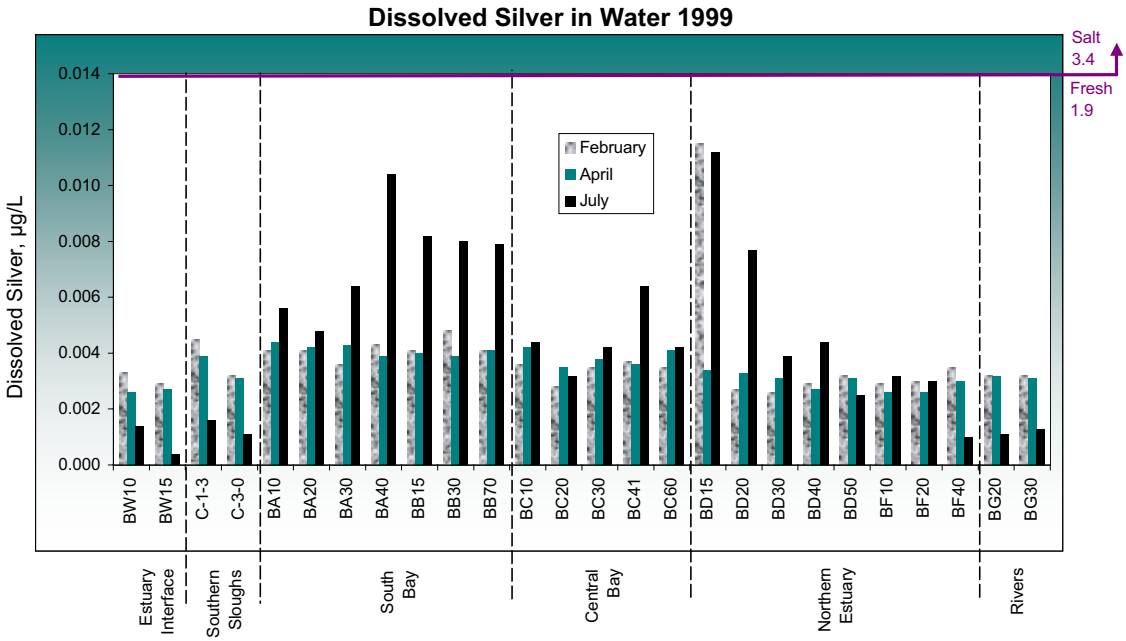

Figure 2.12a. Dissolved silver (Ag) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.0004 ppb to 0.012 ppb. The highest concentration was sampled at Petaluma River (BW15) in February and the lowest at Guadalupe River (BW15) in July. Average concentrations were highest in the South Bay (0.0073 ppb) in July and lowest in the Estuary Interface (0.0009 ppb) in July. All samples were below the 1-hour average WQC for dissolved silver (saltwater 1.9 ppb, freshwater 3.4 ppb-hardness dependent).

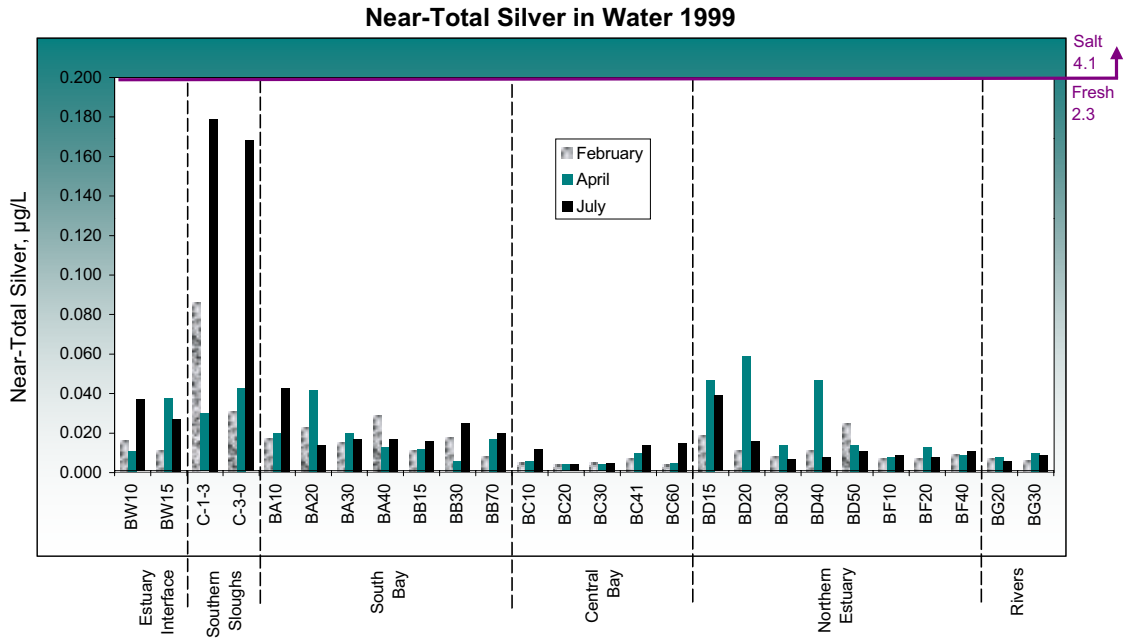

Figure 2.12b. Total silver (Ag) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.004 ppb to 0.18 ppb. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Golden Gate (BC20) during all three seasons, and at Richardson Bay (BC30) in April. Average concentrations were highest in the Southern Sloughs (0.17 ppb) in July and lowest in the Central Bay (0.005 ppb) in February. All samples were below the 1-hour average WQC for total silver (saltwater 2.3 ppb, freshwater 4.1 ppb-hardness dependent).

Source Data: see Data Tables 2 and 3

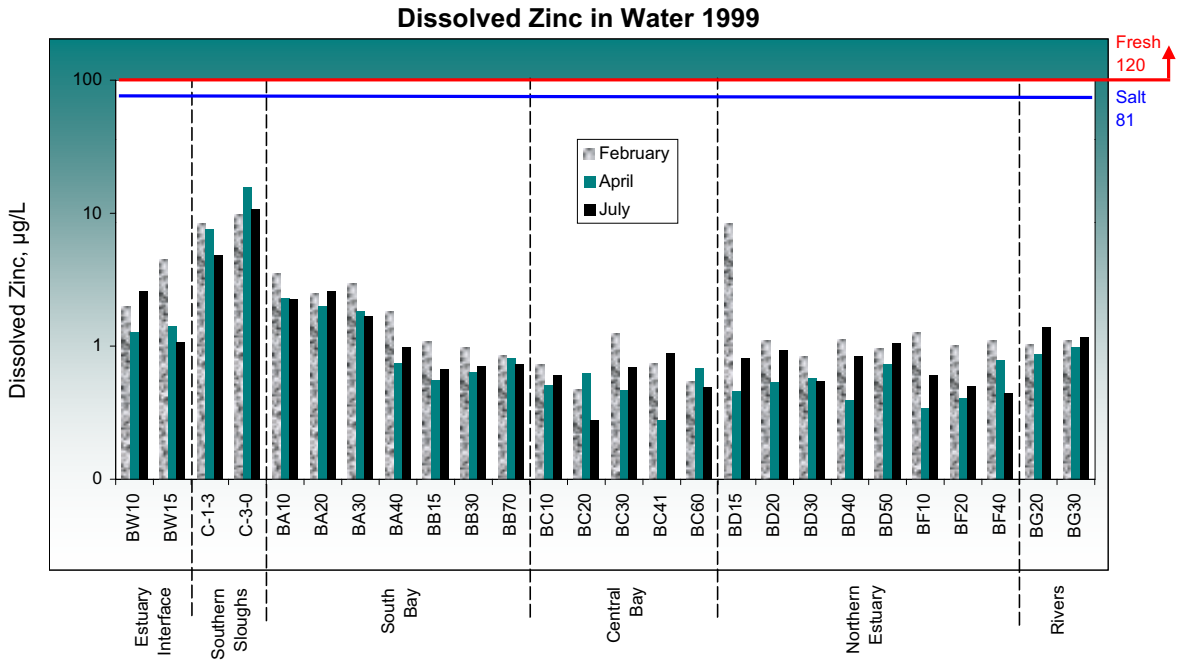

Figure 2.13a. Dissolved zinc (Zn) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. Concentrations ranged from 0.275 ppb to 16 ppb. The highest concentration was sampled at San Jose (C-3-0) in April and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (12 ppb) in April and lowest in the Central Bay (0.51 ppb) in April. All samples were below the 4-day average WQC for dissolved zinc (saltwater 81 ppb, freshwater 120 ppb-hardness dependent).

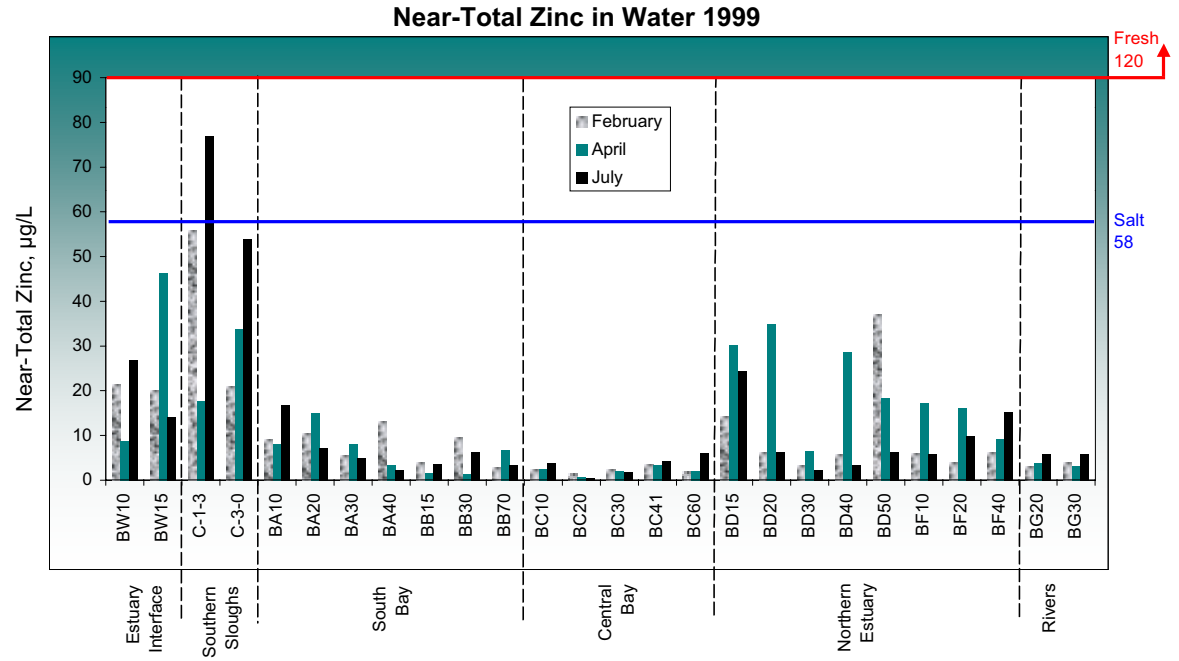

Figure 2.13b. Near-total zinc (Zn) in parts per billion (ppb) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 0.59 ppb to 77 ppb. The highest concentration was sampled at Sunnyvale (C-1-3) in July and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (65 ppb) in July and lowest in the Central Bay (2.2 ppb) in April. One sample was above the 4-day average WQC for total zinc (saltwater 58 ppb, freshwater 120 ppb-hardness dependent).

Source Data: see Data Tables 2 and 3

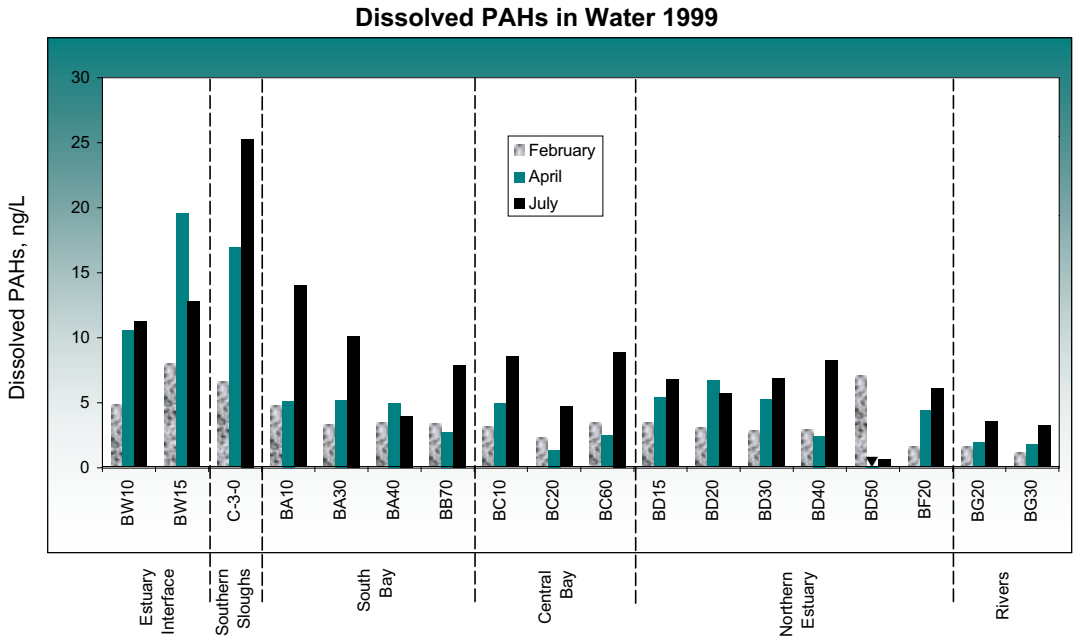

Figure 2.14a. Dissolved PAHs in parts per trillion (ppt) at each RMP water station in February, April, and July of 1999. ▼ = not detected. Concentrations ranged from below detection to 25 ppt. The highest concentration was sampled at San Jose (C-3-0) in July. Average concentrations were highest in the Southern Sloughs (25 ppt) in July and lowest in the Rivers (1.4 ppt) in February. PAHs are compared to guidelines only on the basis of total PAHs.

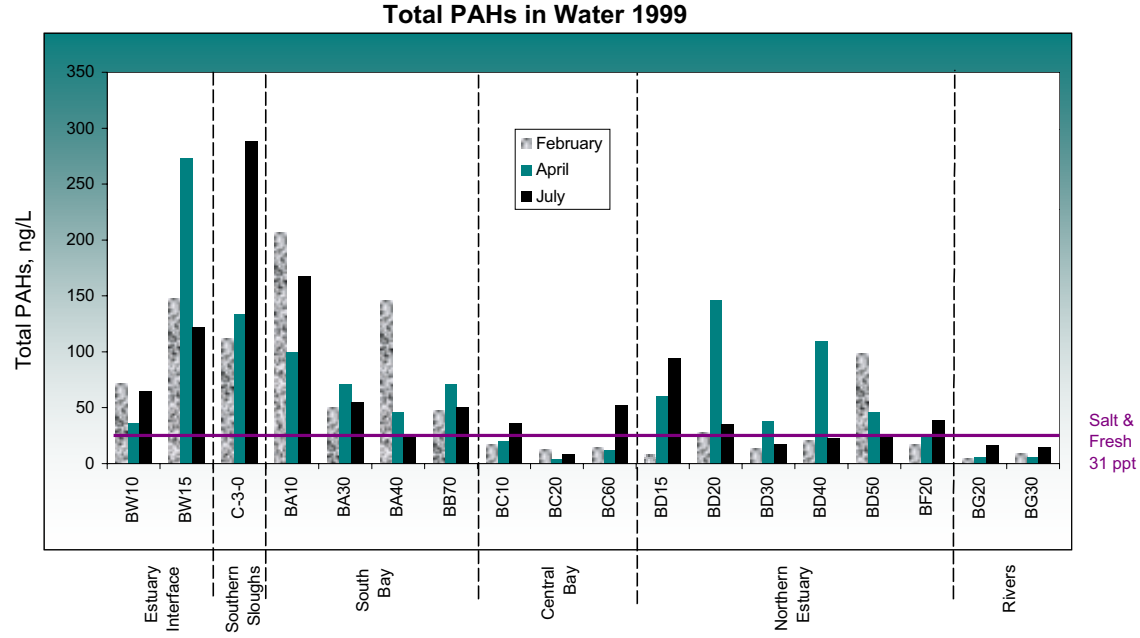

Figure 2.14b. Total PAHs in parts per trillion (ppt) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 3.6 to 290 ppt. The highest concentration was sampled at San Jose (C-3-0) in July and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Southern Sloughs (290 ppt) in July and lowest in the Rivers (5.5 ppt) in April. Thirty-one samples were above the water quality objective for total PAHs from the San Francisco Basin Plan, 1995 (0.031 µg/L).

Source Data: see Data Tables 4 and 5

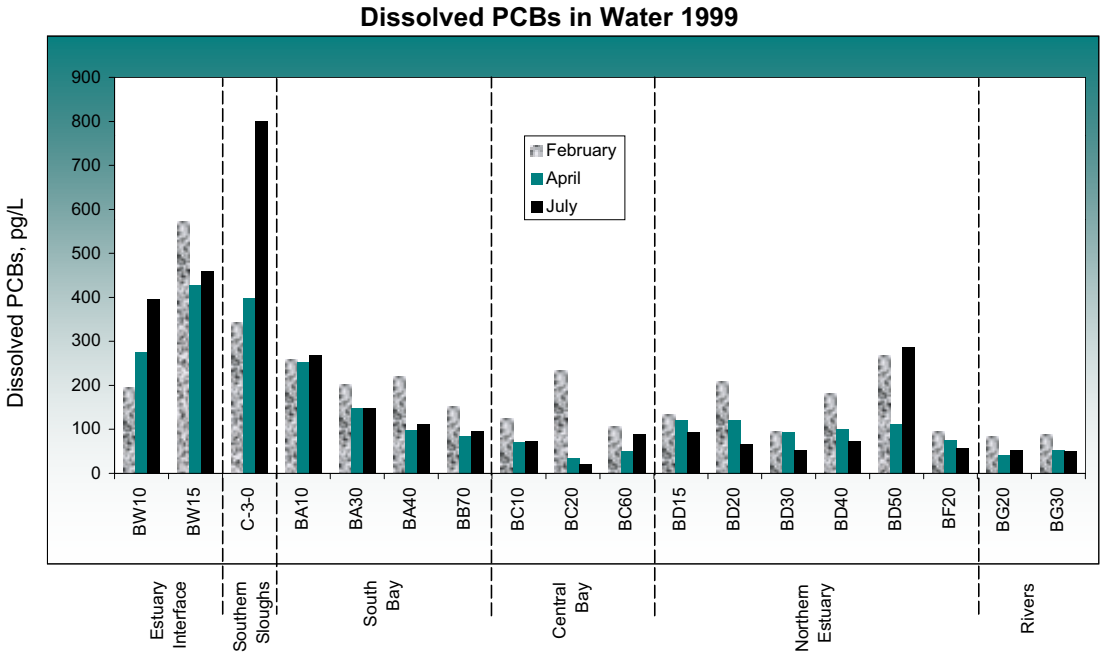

Figure 2.15a. Dissolved PCBs in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 20 ppq to 800 ppq. The highest concentration was sampled at San Jose (C-3-0) in July and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (800 ppq) in July and lowest in the Rivers (47 ppq) in April. PCBs are compared to guidelines only on the basis of total PCBs.

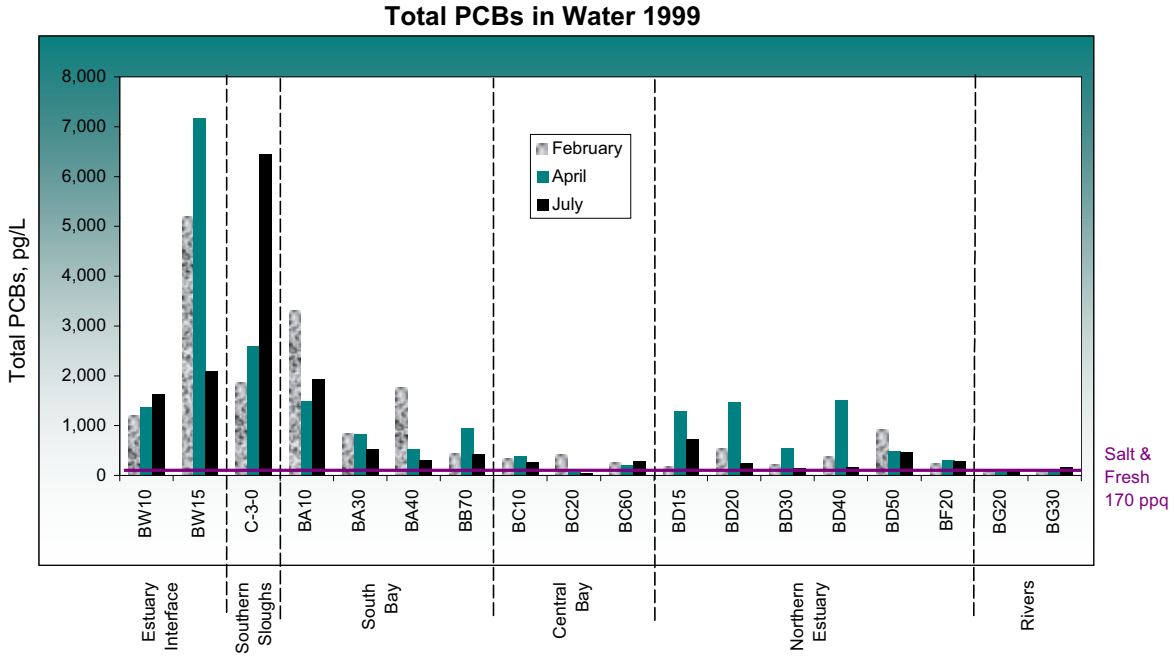

Figure 2.15b. Total PCBs in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 38 ppq to 7,200 ppq. The highest concentration was sampled at Guadalupe River (BW15) in April and the lowest at Golden Gate (BC20) in July. Average concentrations were highest in the Southern Sloughs (6,500 ppb) in July and lowest in the Rivers (75 ppq) in April. Fourty-four samples were above the human health criterion for total PCBs (organisms only criterion, 0.00017 µg/L).

Source Data: see Data Tables 6 and 7

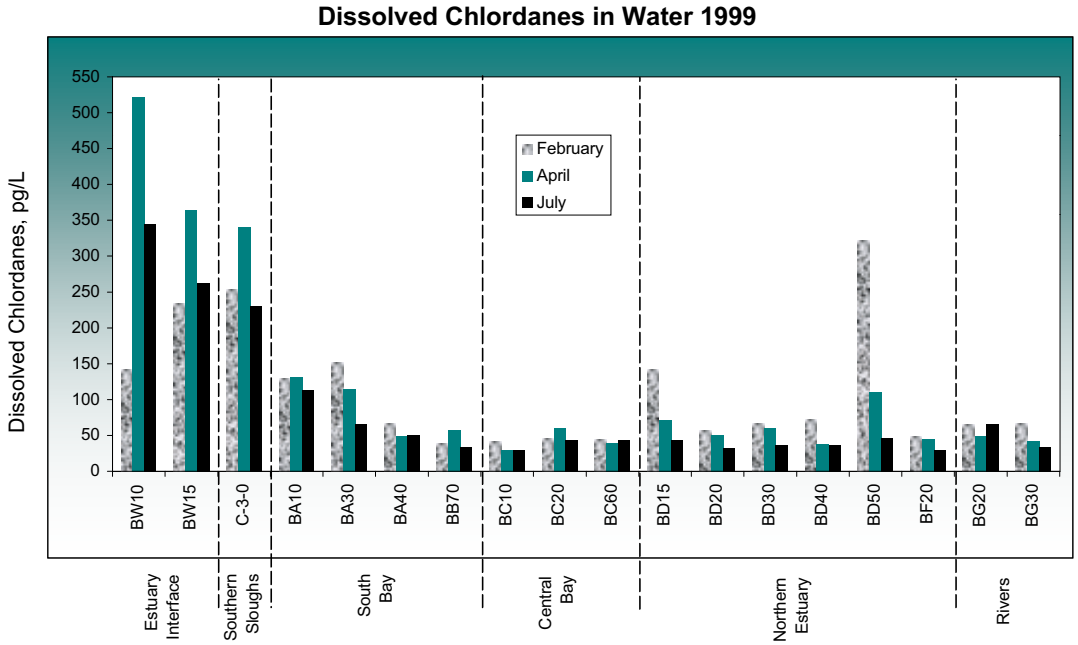

Figure 2.16a. Dissolved Chlordanes in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 29 ppq to 520 ppq. The highest concentration was sampled at Standish Dam (BW10) in April and the lowest at Yerba Buena Island (BC10) in April. Average concentrations were highest in the Esuary Interface (440 ppq) in April and lowest in the Central Bay (44 ppq) in February. Chlordanes are compared to guidelines only on the basis of total chlordanes.

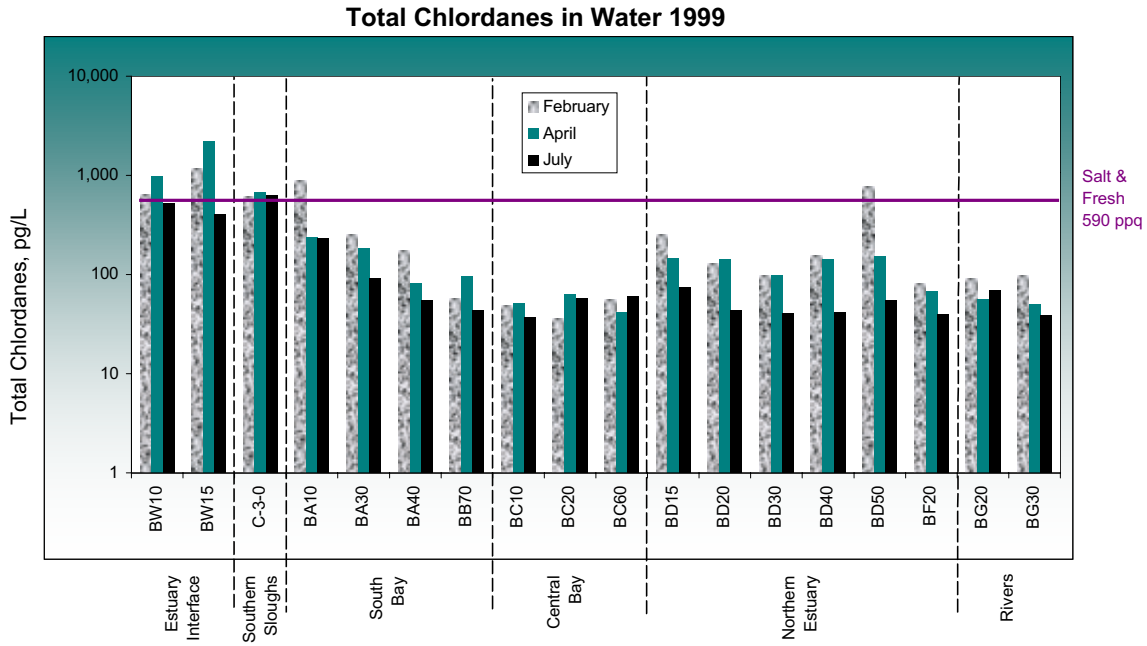

Figure 2.16b. Total Chlordanes in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. Concentrations ranged from 36 ppq to 2,200 ppq. The highest concentration was sampled at Guadalupe River (BW15) in April and the lowest at Golden Gate (BC20) in February. Average concentrations were highest in the Estuary Interface (1,600 ppq) in April and lowest in the Central Bay (47 ppb) in February. Nine samples were above the human health criterion for total chlordanes (organisms only criterion, 0.00059 µg/L).

Source Data: see Data Tables 8 and 9

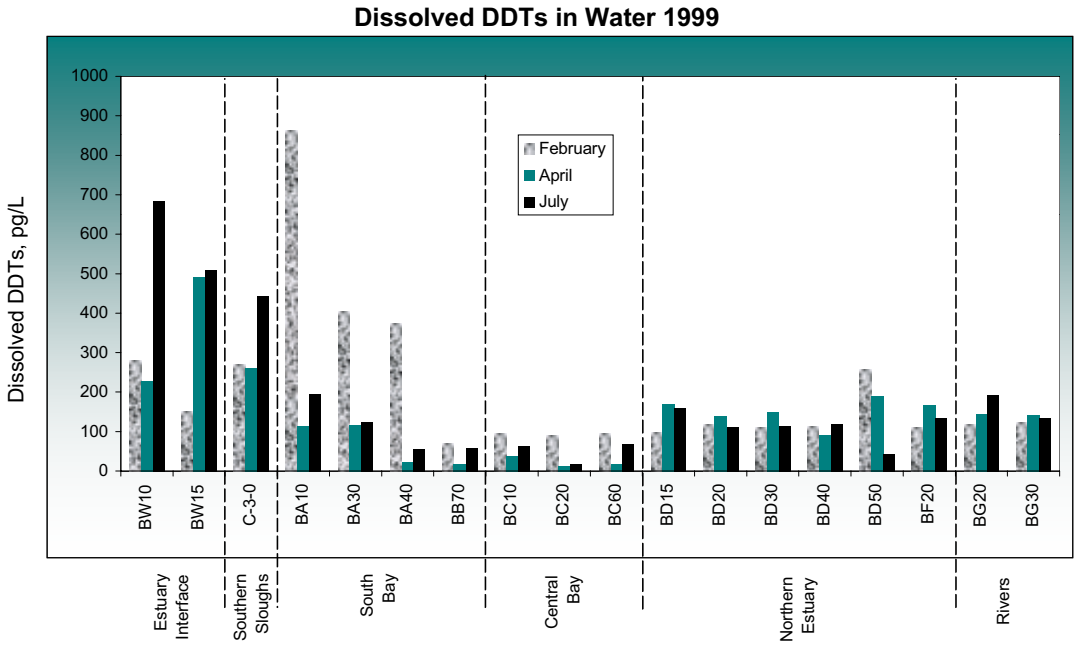

Figure 2.17a. Dissolved DDTs in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 13 ppq to 860 ppq. The highest concentration was sampled at Coyote Creek (BA10) in February and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Estuary Interface (600 ppq) and lowest in the Central Bay (23 ppq) in April. DDTs are compared to guidelines only on the basis of total DDTs.

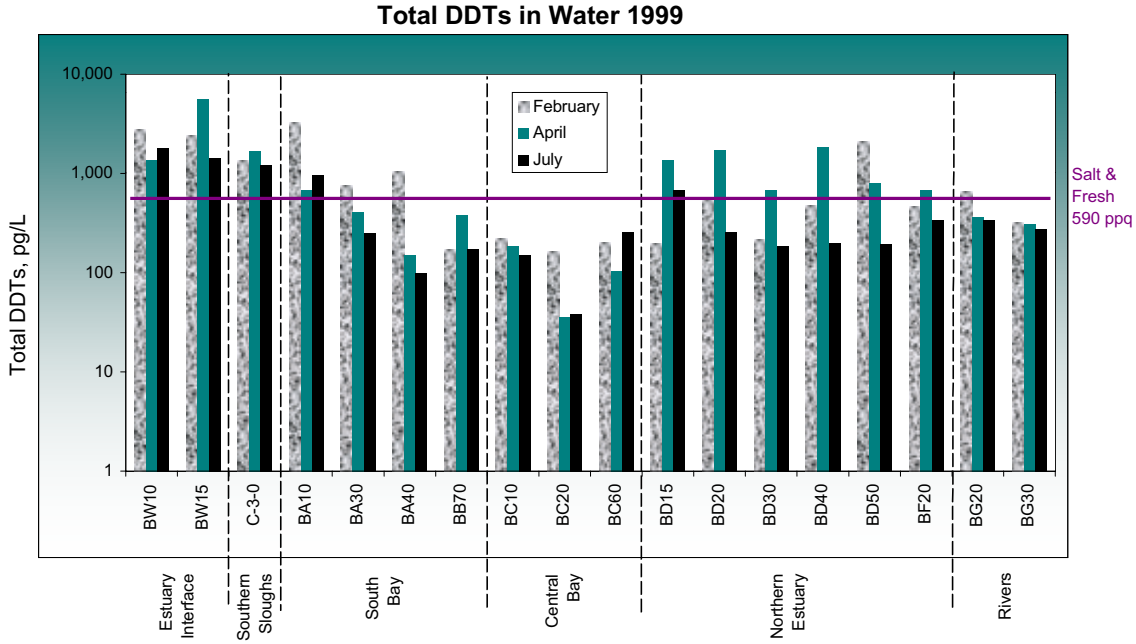

Figure 2.17b. Total DDTs in parts per quadrillion (ppq)at each RMP water station in February, April, and July of 1999. Note logarithmic scale. Concentrations ranged from 36 ppq to 5,600 ppq. The highest concentration was sampled at Guadalupe River (BW15) in April and the lowest at Golden Gate (BC20) in April. Average concentrations were highest in the Estuary Interface (3,500 ppq) in April and lowest in the Central Bay (110 ppq) in April. Twenty-three samples were above the human health criterion for total DDTs (organisms only criterion, 0.00059 µg/L).

Source Data: see Data Tables 8 and 9

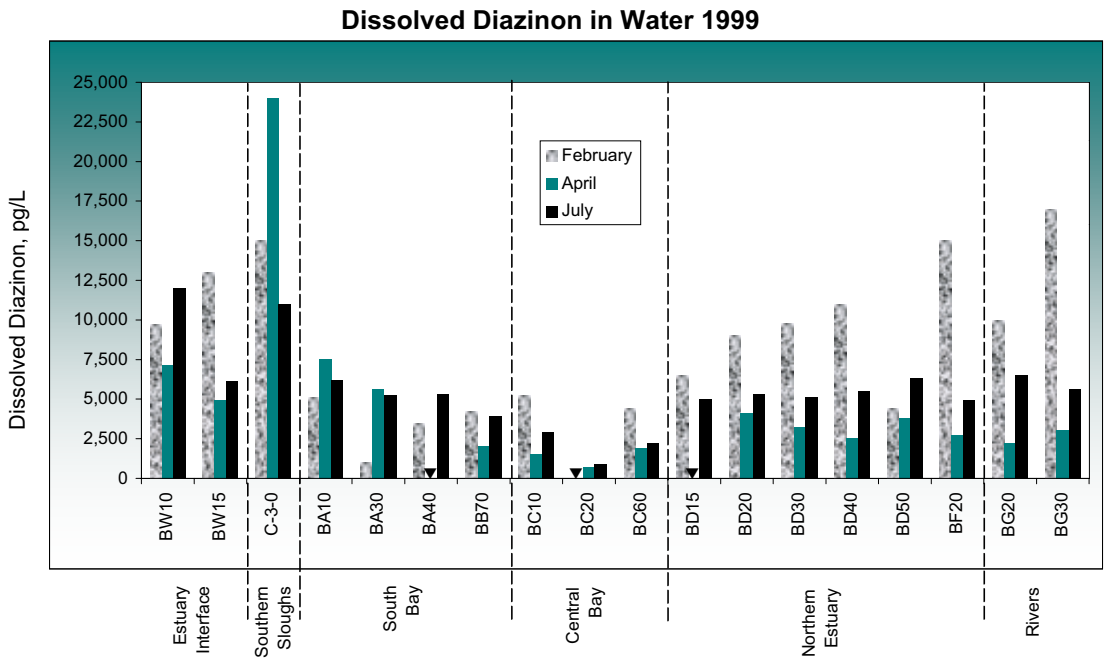

Figure 2.18a. Dissolved Diazinon in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. ▼ = not detected. Concentrations ranged from below detection to 24,000 ppq. The highest concentration was sampled at San Jose (C-3-0) in April. Average concentrations were highest in the Southern Sloughs (24,000 ppq) in April and lowest in the Central Bay (1,400 ppq) in April. Diazinon is compared to guidelines only on the basis of total diazinon.

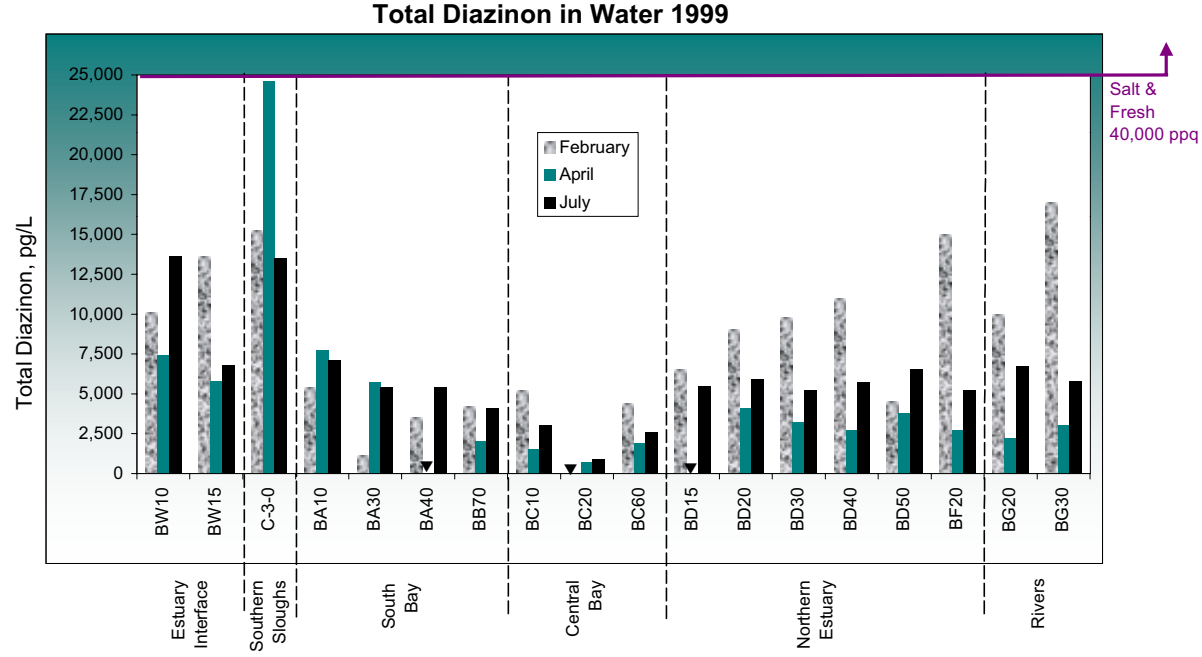

Figure 2.18b. Total Diazinon in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. ▼ = not detected. Concentrations ranged from below detection to 25,000 ppq. The highest concentration was sampled at San Jose (C-3-0) in April. Average concentrations were highest in the Southern Sloughs (25,000 ppq) in April and lowest in the Central Bay (1,400 ppq) in April. All of the samples were below the EPA water quality criterion for total diazinon (40,000 ppq).

Source Data: see Data Tables 8 and 9

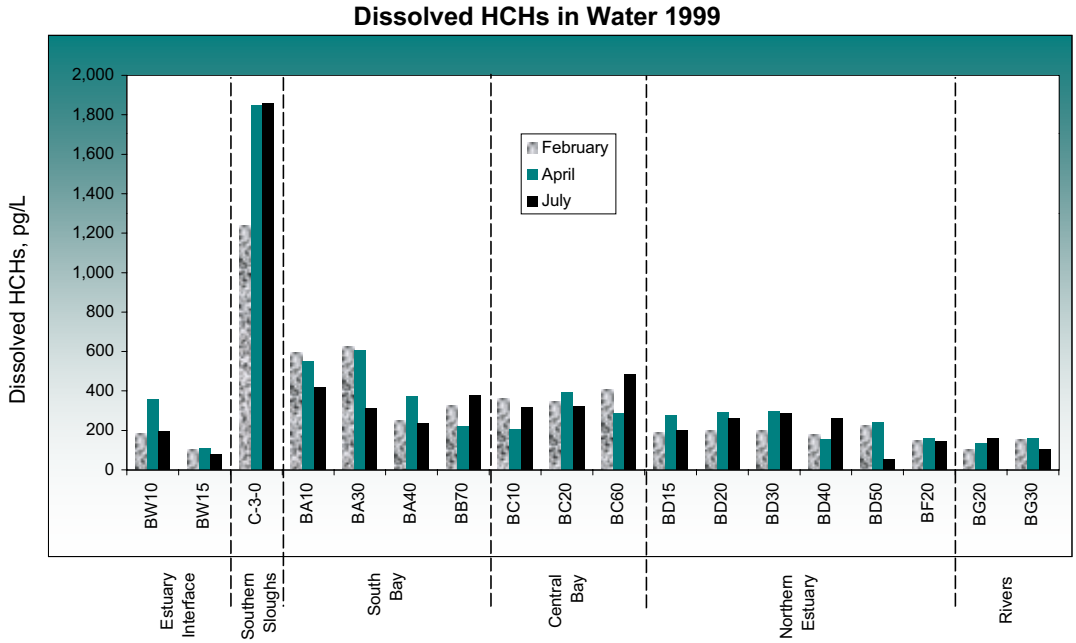

Figure 2.19a. Dissolved HCHs in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 54 ppq to 1,900 ppq. The highest concentration was sampled at San Jose (C-3-0) in July and the lowest at Napa River (BD50) in July. Average concentrations were highest in the Southern Sloughs (1,900 ppq) in July and lowest in the Rivers (130 ppq) in February. There are no water quality criteria for dissolved HCHs.

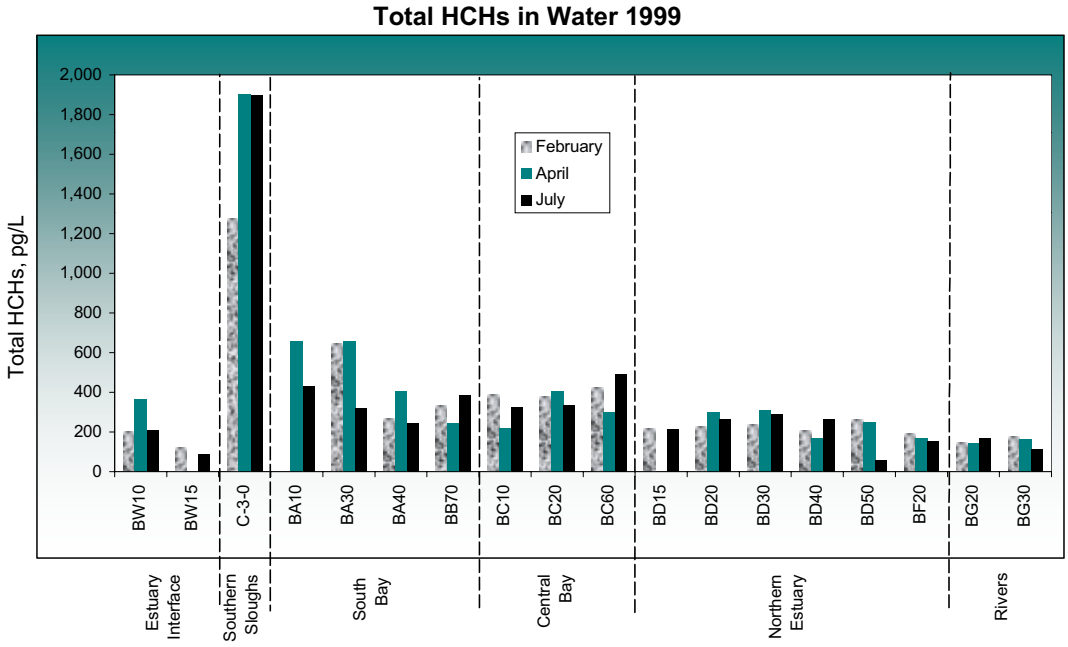

Figure 2.19b. Total HCHs in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 125 ppq to 1,900 ppq. The highest concentration was sampled at San Jose (C-3-0) in April and the lowest at Guadalupe River (BW15) in February. Average concentrations were highest in the Southern Sloughs (1,900 ppq) in April and lowest in the Rivers (140 ppq) in July. Water quality criteria exists only for individual HCH compounds.

Source Data: see Data Tables 8 and 9

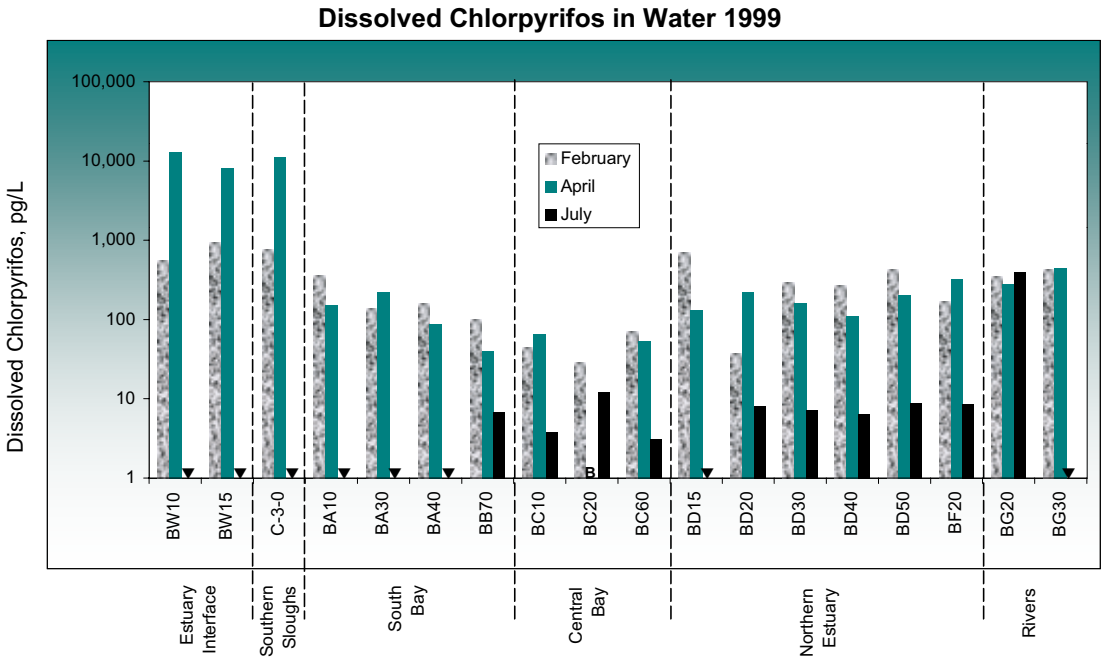

Figure 2.20a. Dissolved Chlorpyrifos in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. ▼ = not detected. B = blank contamination >30% of measured concentration.Concentrations ranged from below detection to 13,000 ppq. The highest concentration was sampled at Standish Dam (BW10) in April. Average concentrations were highest in the Southern Sloughs (11,000 ppq) in April. Chlorpyrifos is compared to guidelines only on the basis of total chlorpyrifos.

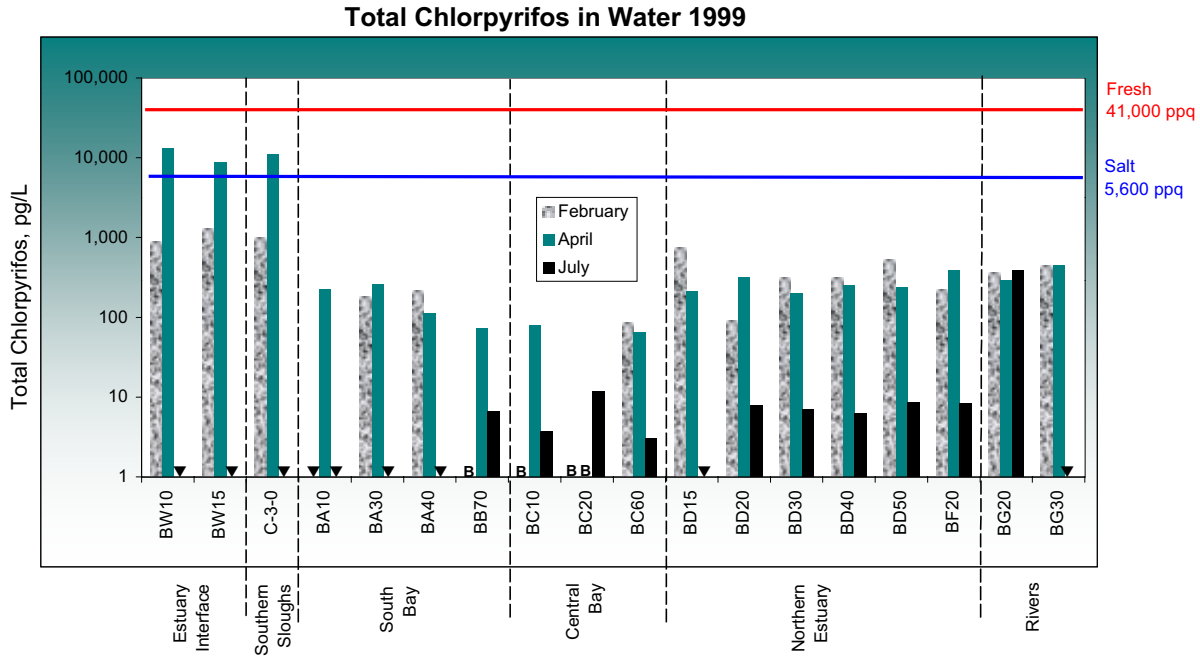

Figure 2.20b. Total Chlorpyrifos in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Note logarithmic scale. ▼ = not detected. B = blank contamination >30% of measured concentration. Concentrations ranged from below detection to 13,300 ppq. The highest concentration was sampled at Standish Dam (BW10) in April. Average concentrations were highest in the Southern Sloughs (11,000 ppq) in April. One sample was above the 4-day WQO for total chlorpyrifos (saltwater 0.0056 ppb, freshwater 0.041 ppb)

Source Data: see Data Tables 8 and 9

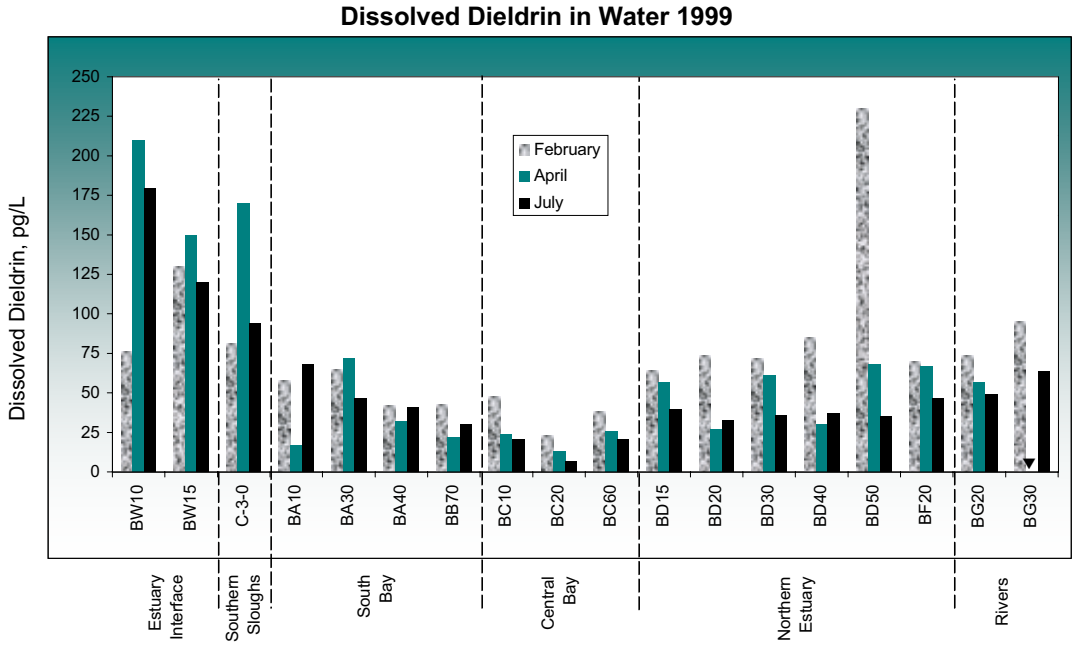

Figure 2.21a. Dissolved Dieldrin in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. ▼ = not detected. Concentrations ranged from below detection to 230 ppq. The highest concentration was sampled at Napa River (BD50) in February. Average concentrations were highest in the Estuary Interface (180 ppq) in April and lowest in the Central Bay (21 ppq) in April. Dieldrin is compared to guidelines only on the basis of total dieldrin.

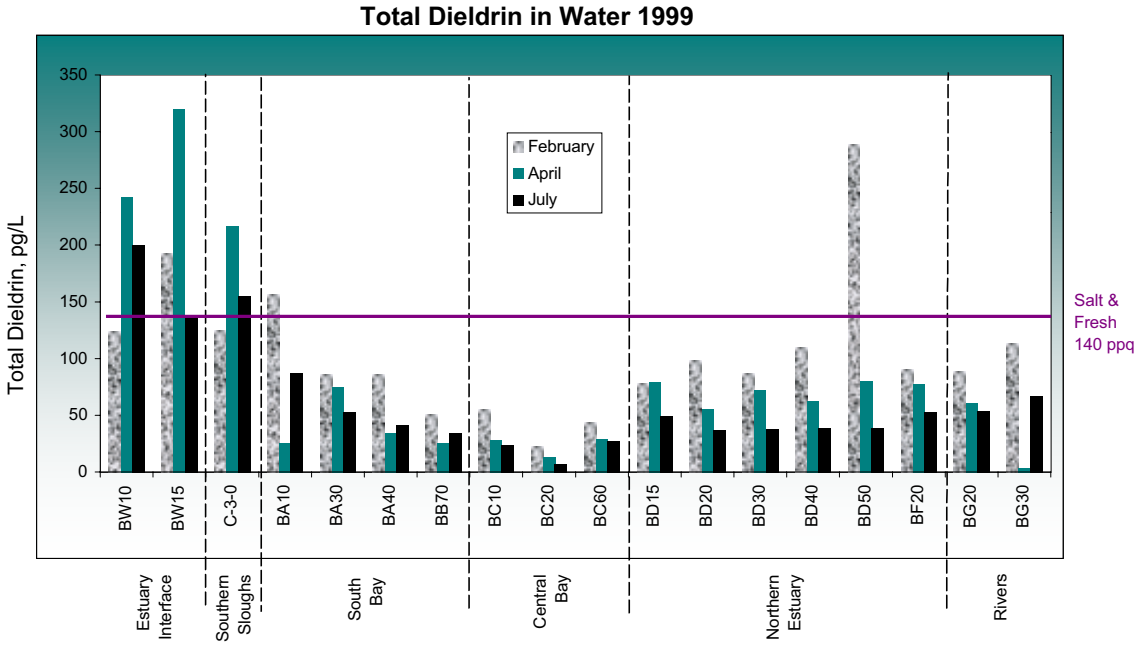

Figure 2.21b. Total Dieldrin in parts per quadrillion (ppq) at each RMP water station in February, April, and July of 1999. Concentrations ranged from 3.7 ppq to 320 ppq. The highest concentration was sampled at Guadalupe River (BW15) in April and the lowest at San Joaquin River (BG30) in April. Average concentrations were highest in the Estuary Interface (280 ppq) and lowest in the Central Bay (19 ppq) in July. Eight samples were above the human health criterion for total dieldrin (organisms only criterion, 0.00014 µg/L).

Source Data: see Data Tables 8 and 9

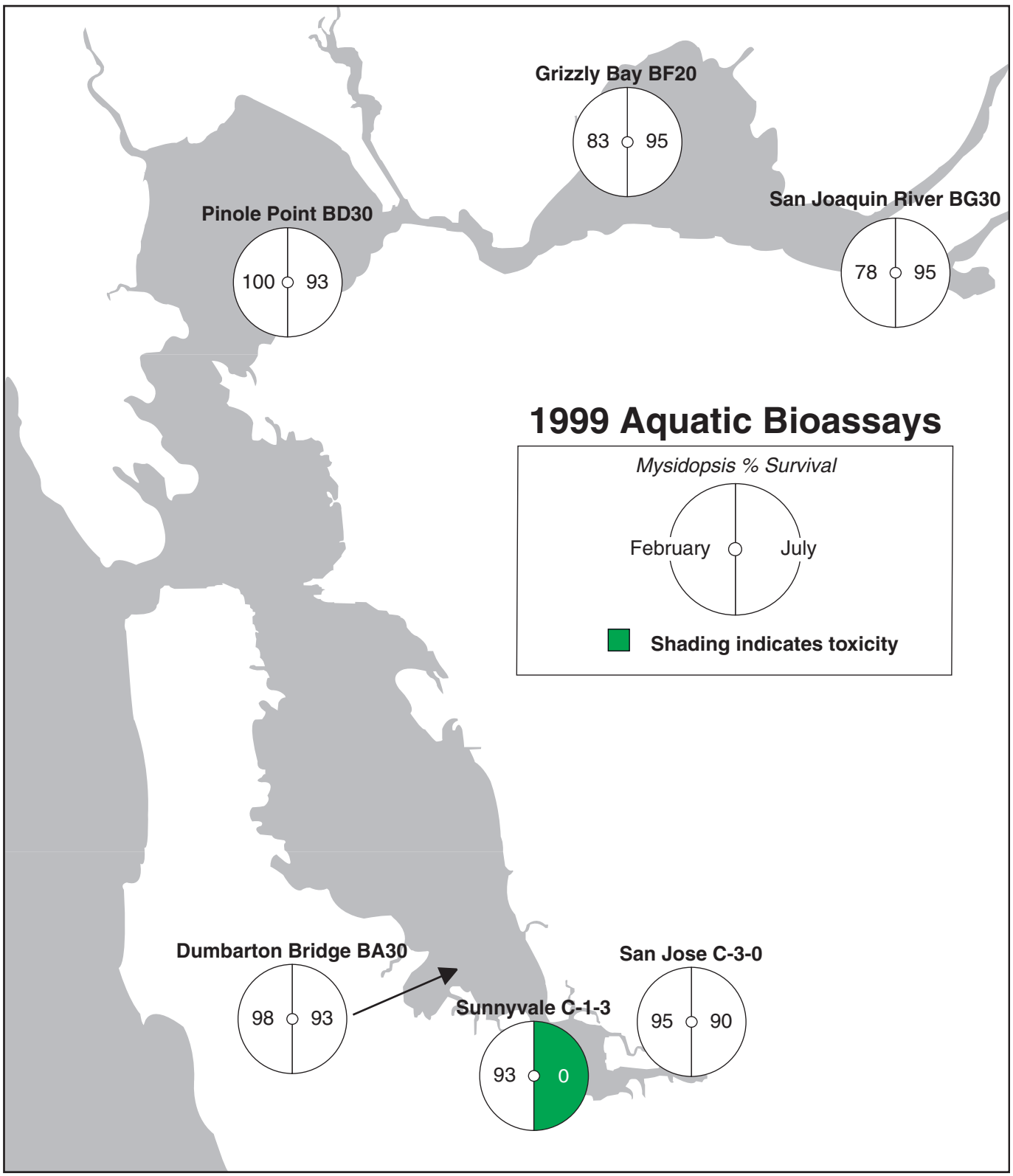

Figure 2.22. Aquatic bioassay results for 1999. Clean artificial seawater was used for control samples. See *Description of Methods* for more information on methods used. Significant toxicity in the seven-day *Mysidopsis* test was observed in July at Sunnyvale (C-1-3). Toxicity was determined by statistical comparison to controls.

Source Data: see Data Table 10

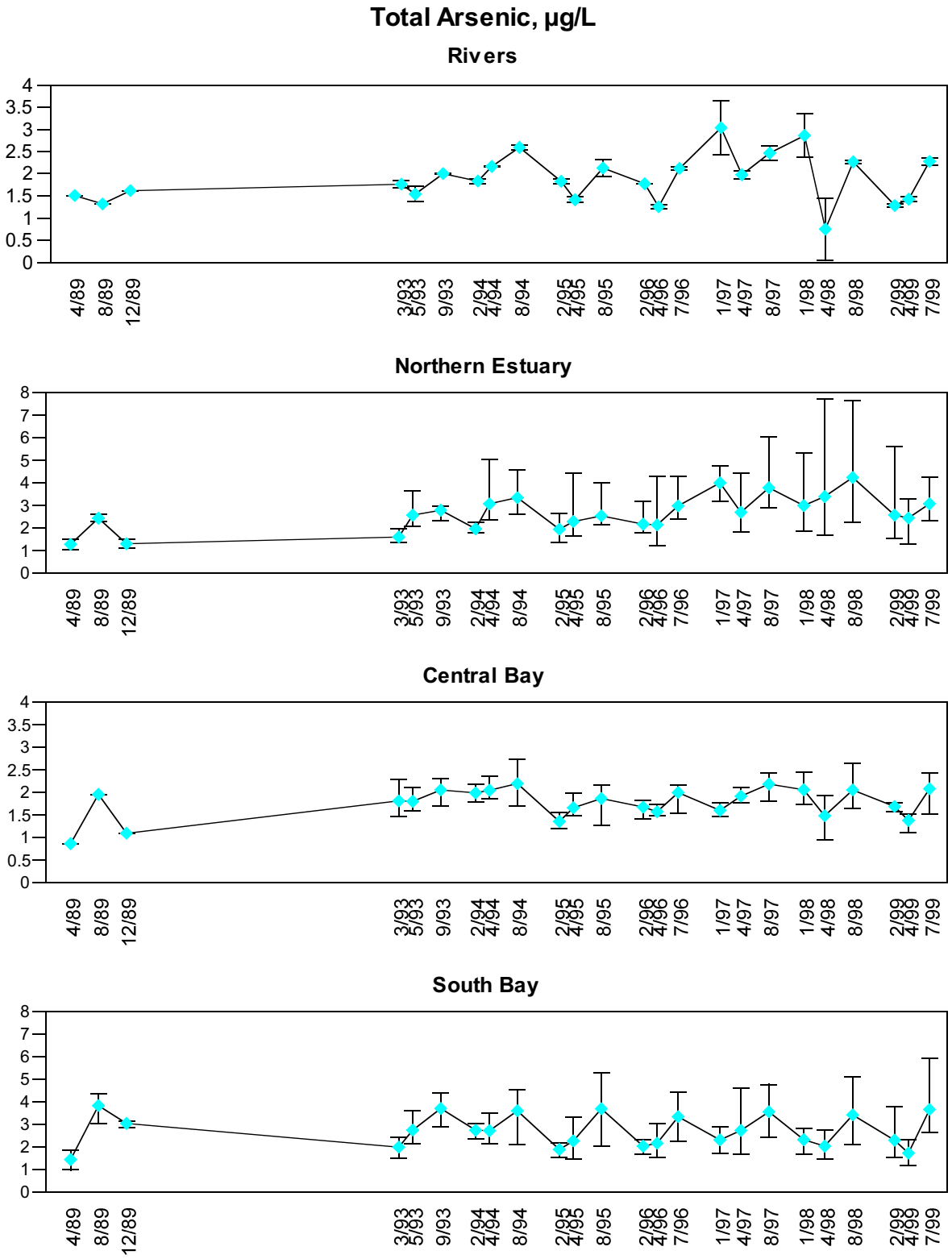

Figure 2.23. Average total arsenic concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values. The sample size varies between sites and between seasons.

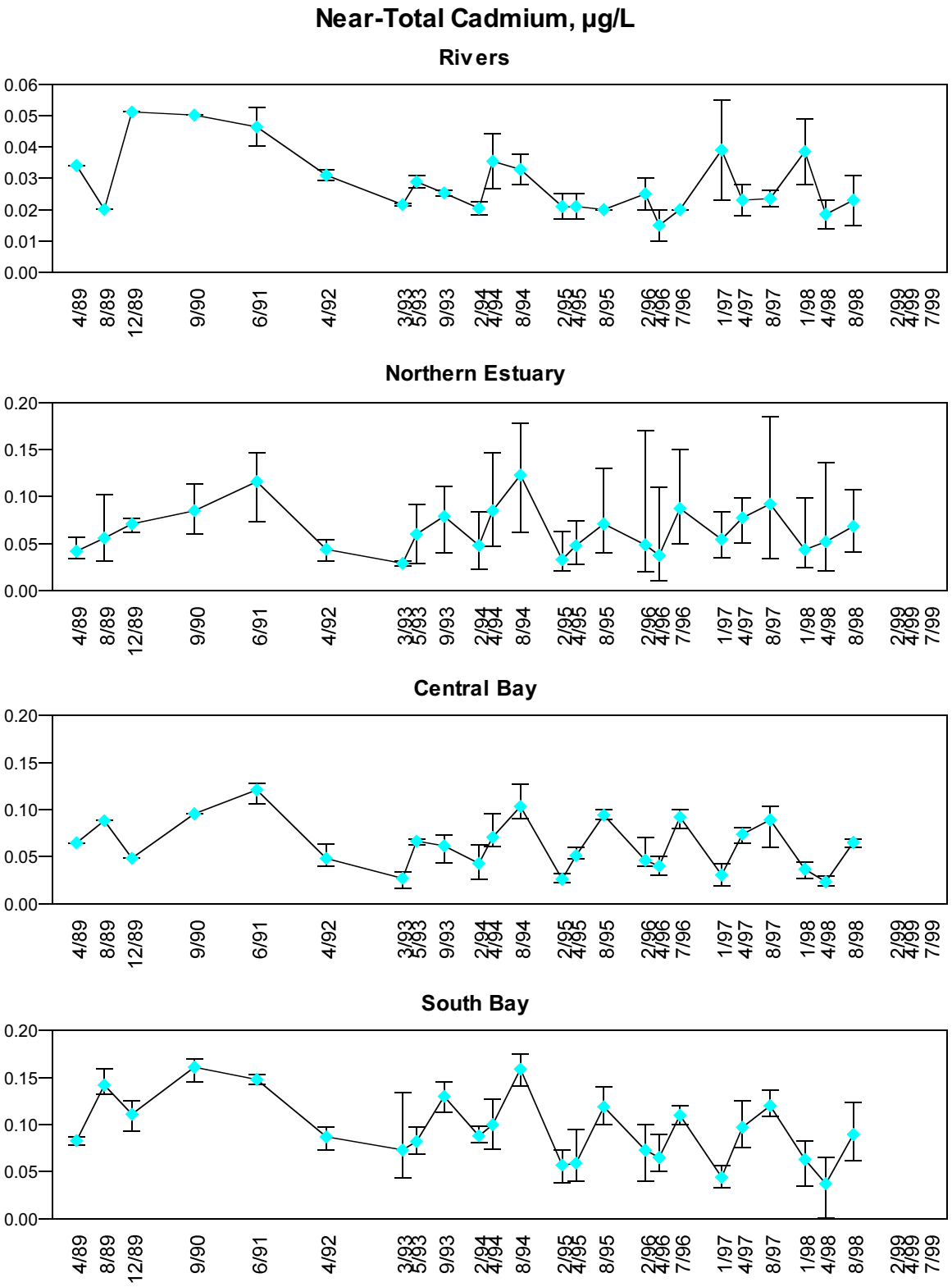

Figure 2.24. Average near-total cadmium concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values. The sample size varies between sites and between seasons. Data for cadmium in 1999 were not available at the time of report production.

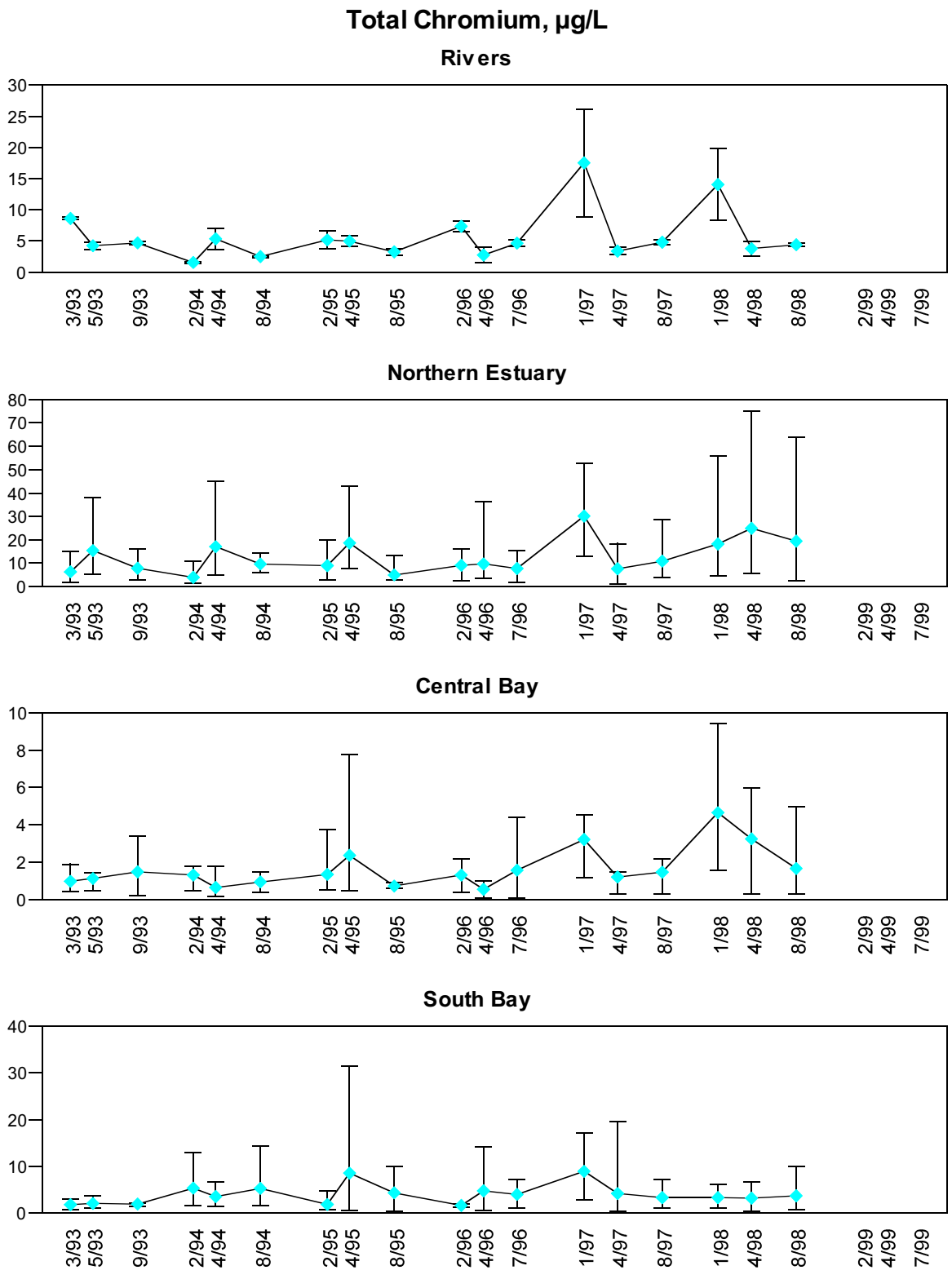

Figure 2.25. Average total chromium concentrations (parts per billion, ppb) in water in each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent range of values. Data for chromium in 1999 were not available at the time of report production.

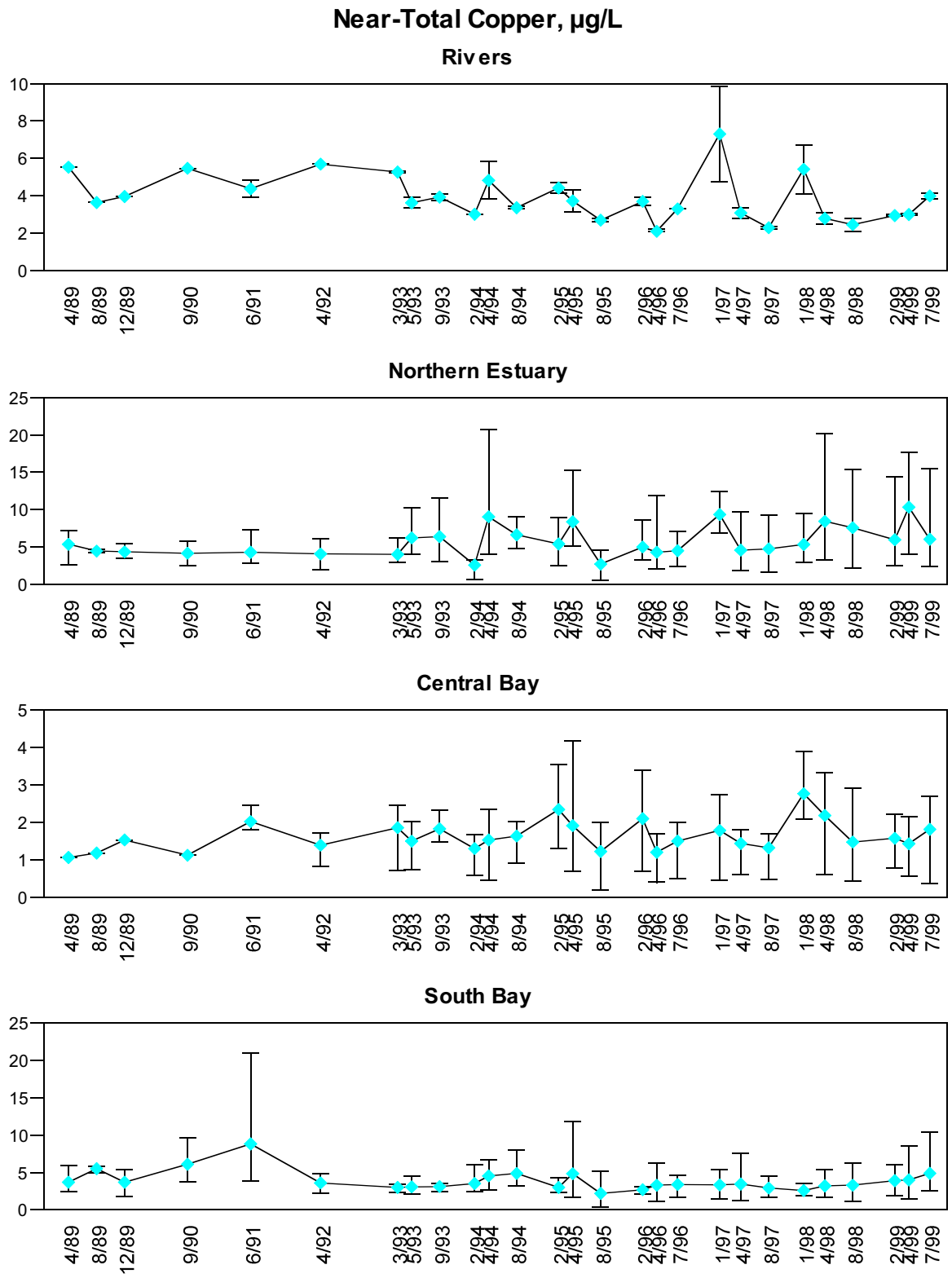

Figure 2.26. Average near-total copper concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values.

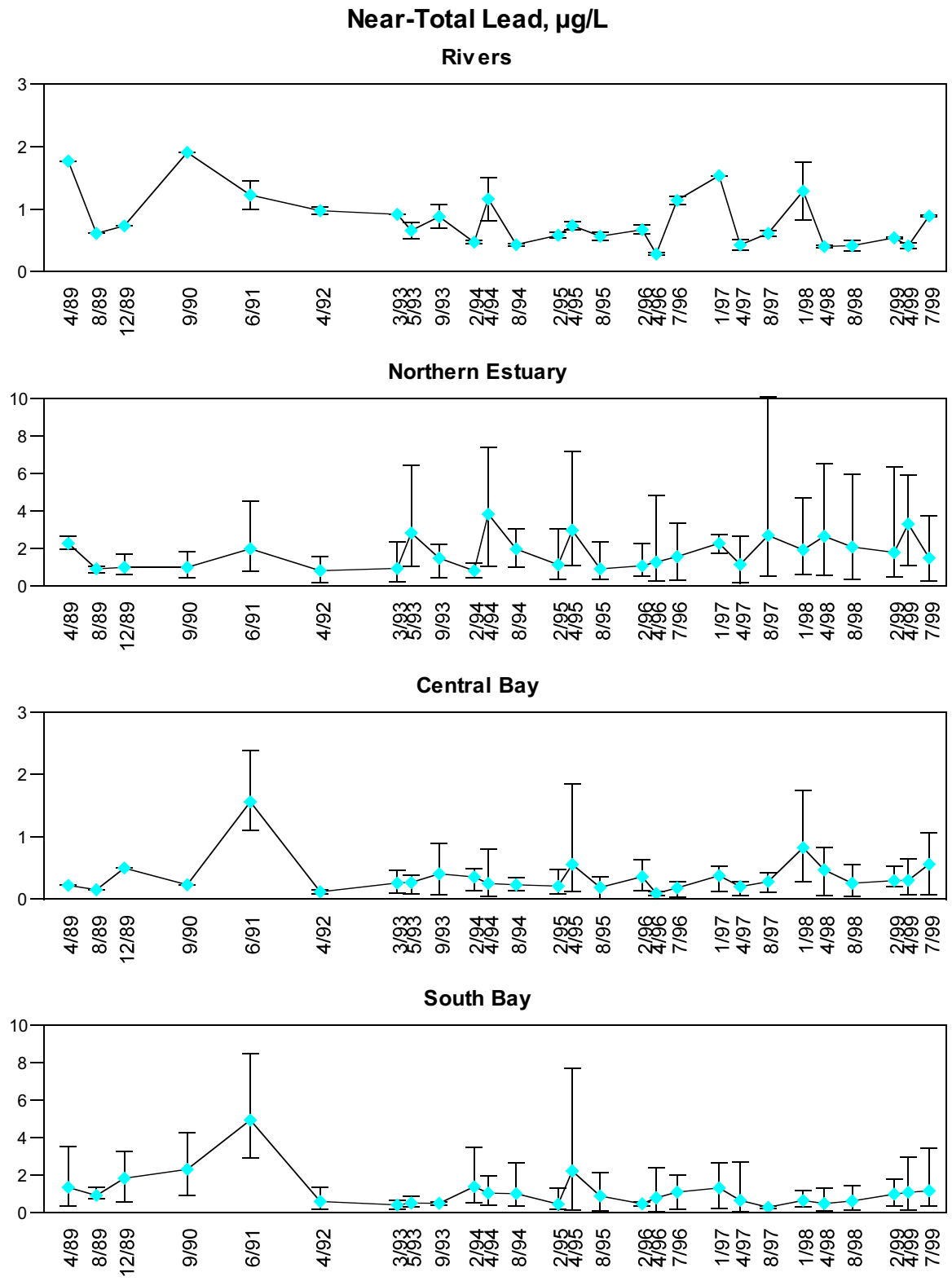

Figure 2.27. Average near-total lead concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values.

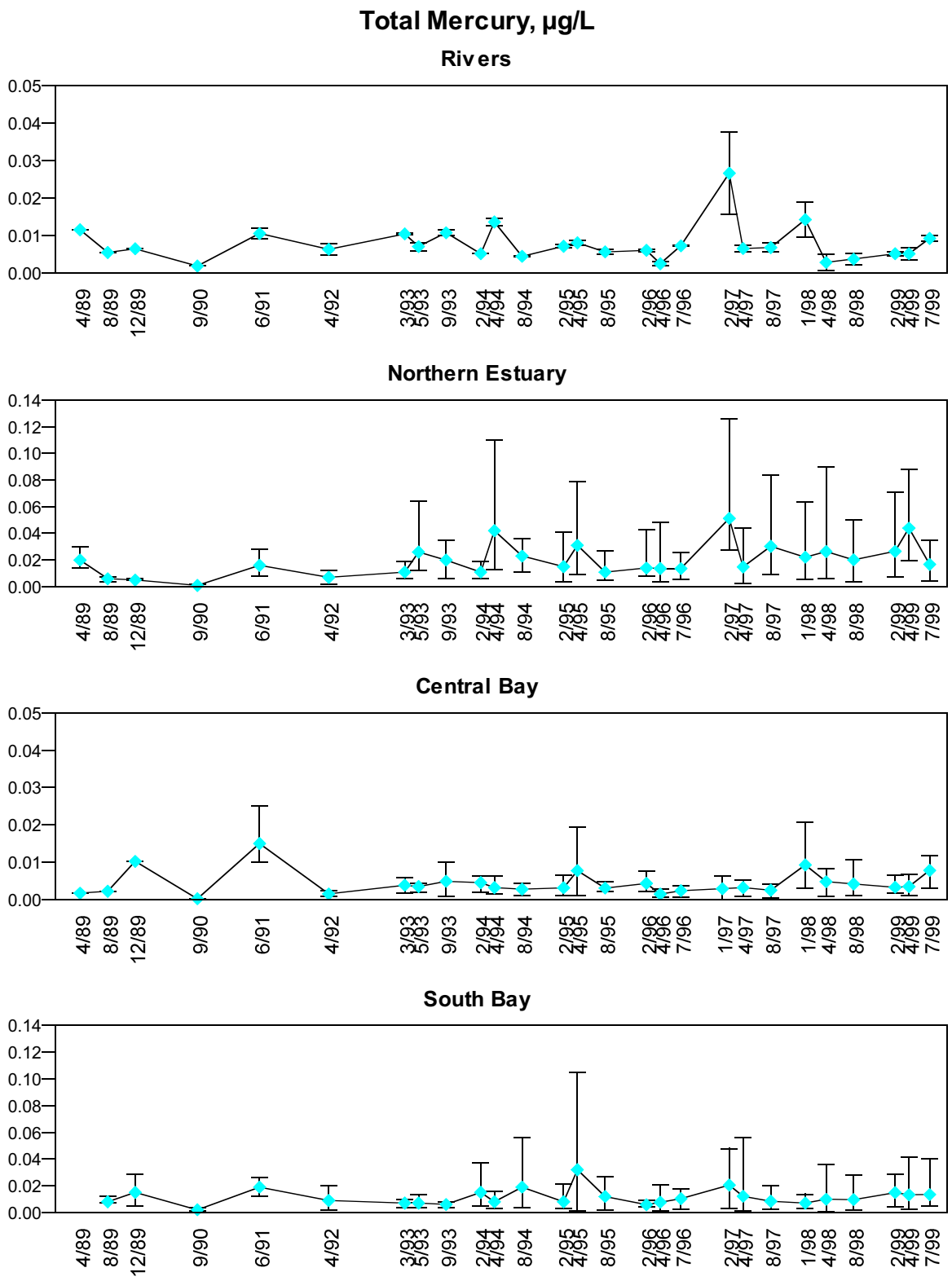

Figure 2.28. Average total mercury concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values.

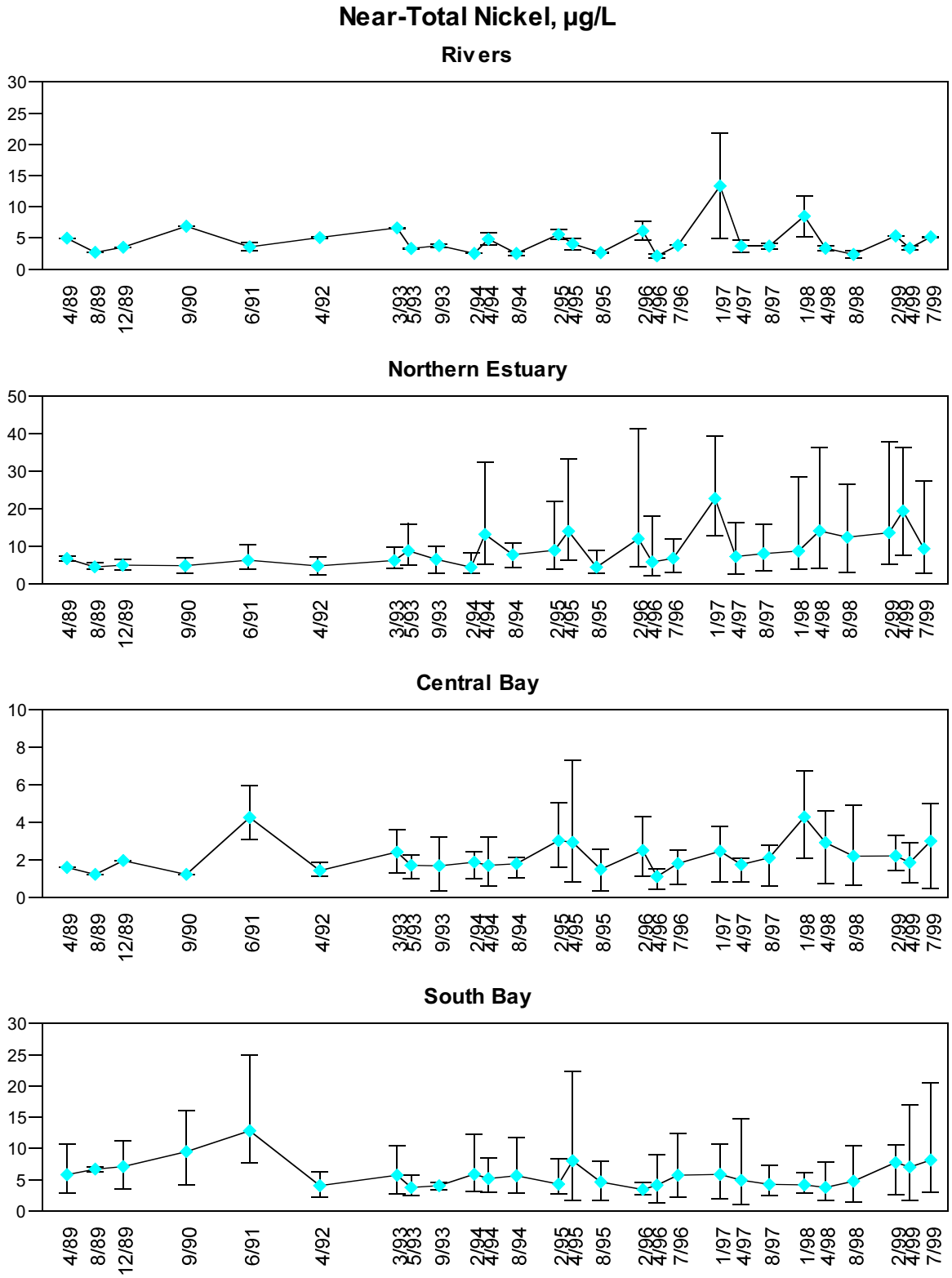

Figure 2.29. Average near-total nickel concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values.

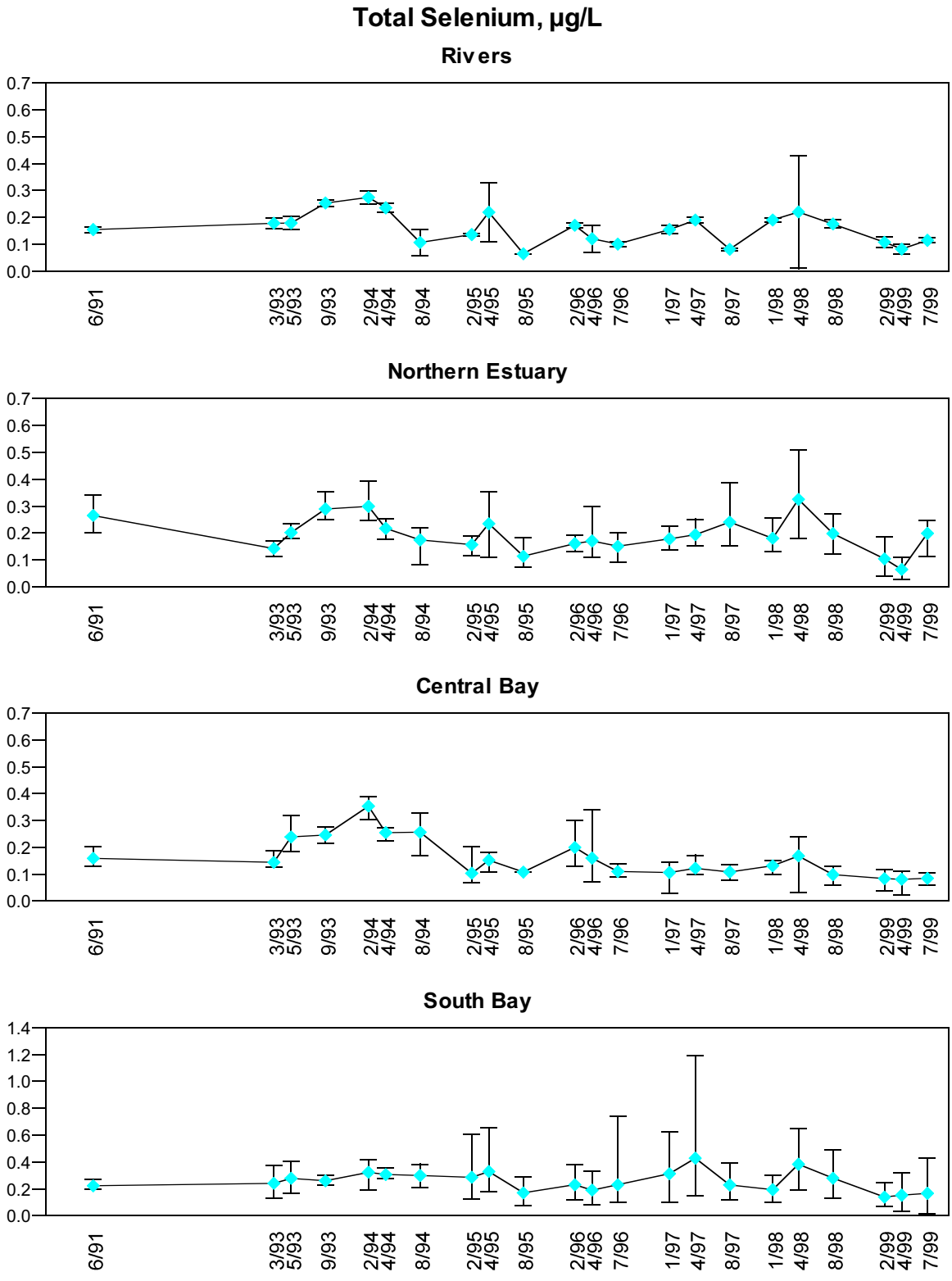

Figure 2.30. Average total selenium concentrations (parts per billion, ppb) in water in each Estuary reach from 1991–1999. The vertical bars represent range of values.

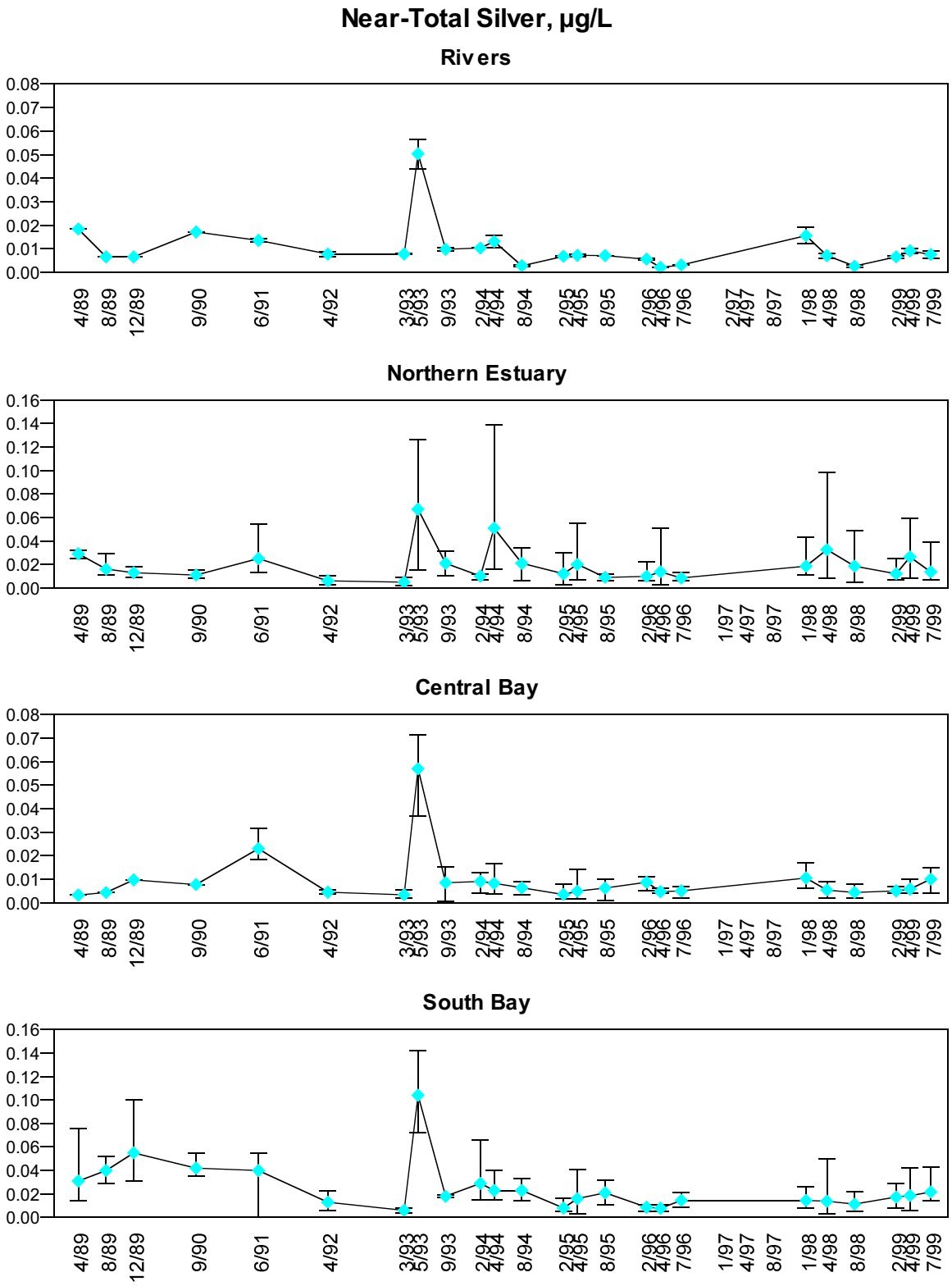

Figure 2.31. Average near-total silver concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values. All 1997 samples were lost due to methodological problems.

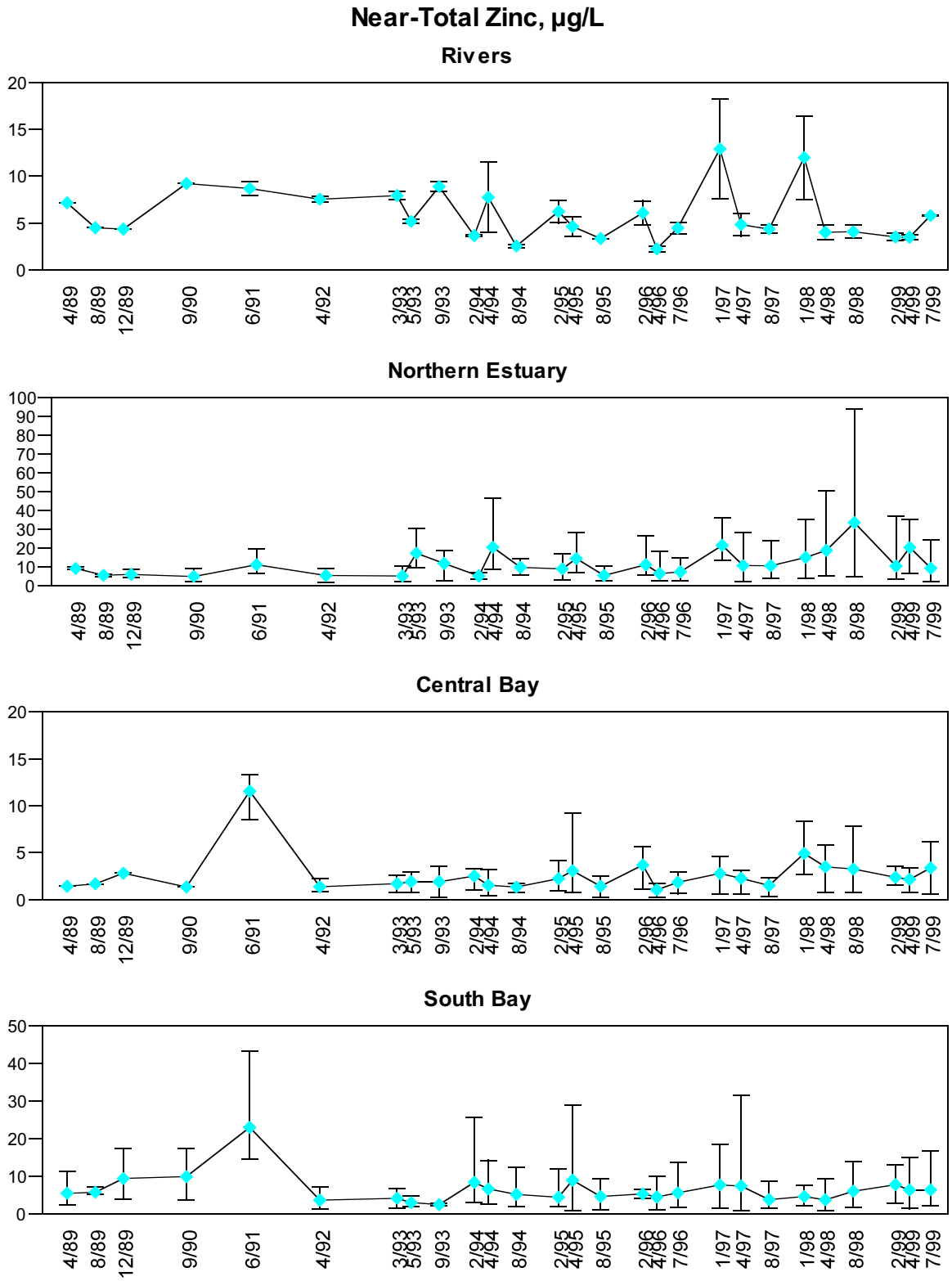

Figure 2.32. Average near-total zinc concentrations (parts per billion, ppb) in water in each Estuary reach from 1989–1999. Note different y-axis scales. The vertical bars represent range of values.

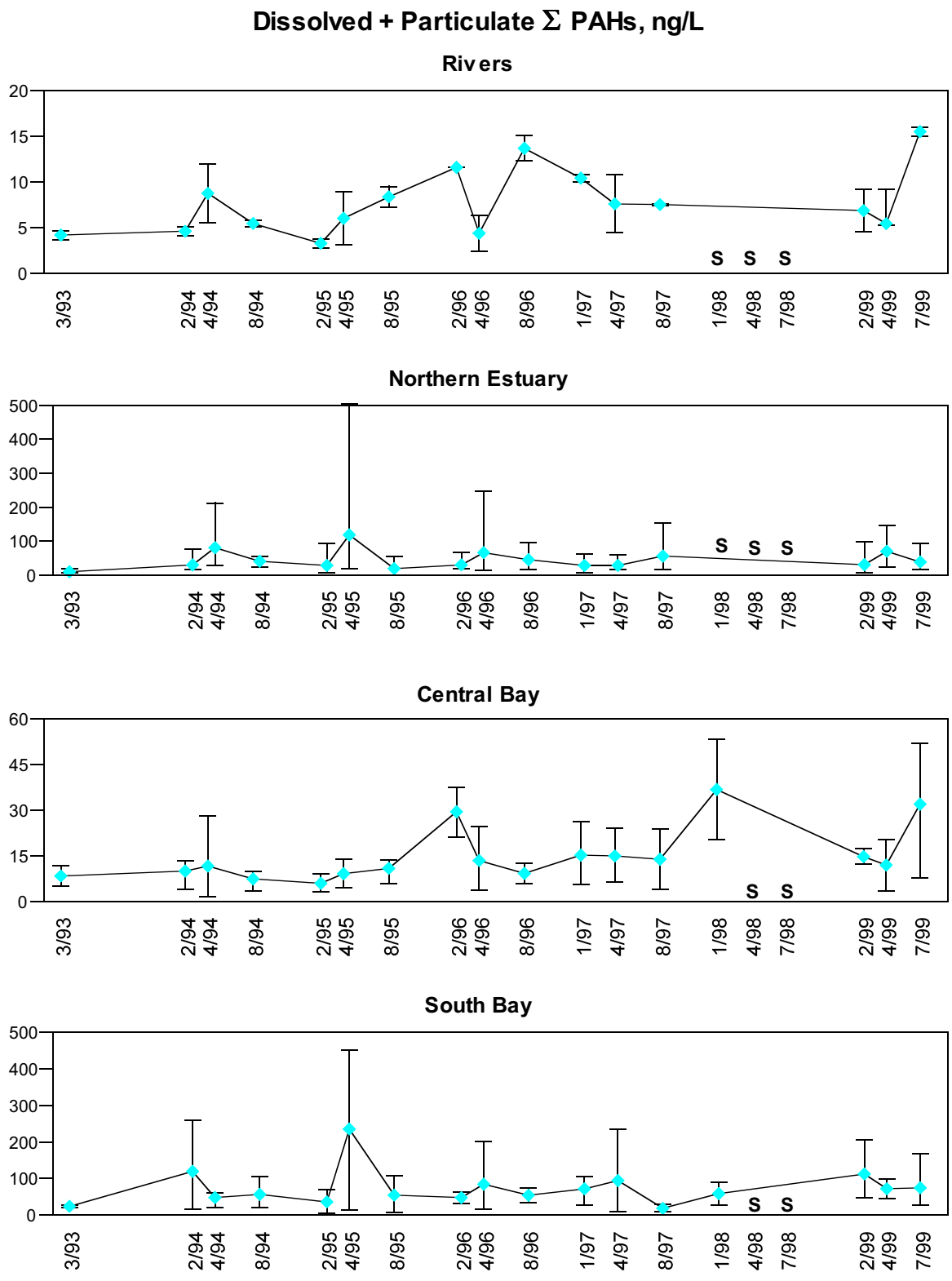

Figure 2.33. Average total (dissolved + particulate) PAH concentrations (parts per trillion, ppt) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

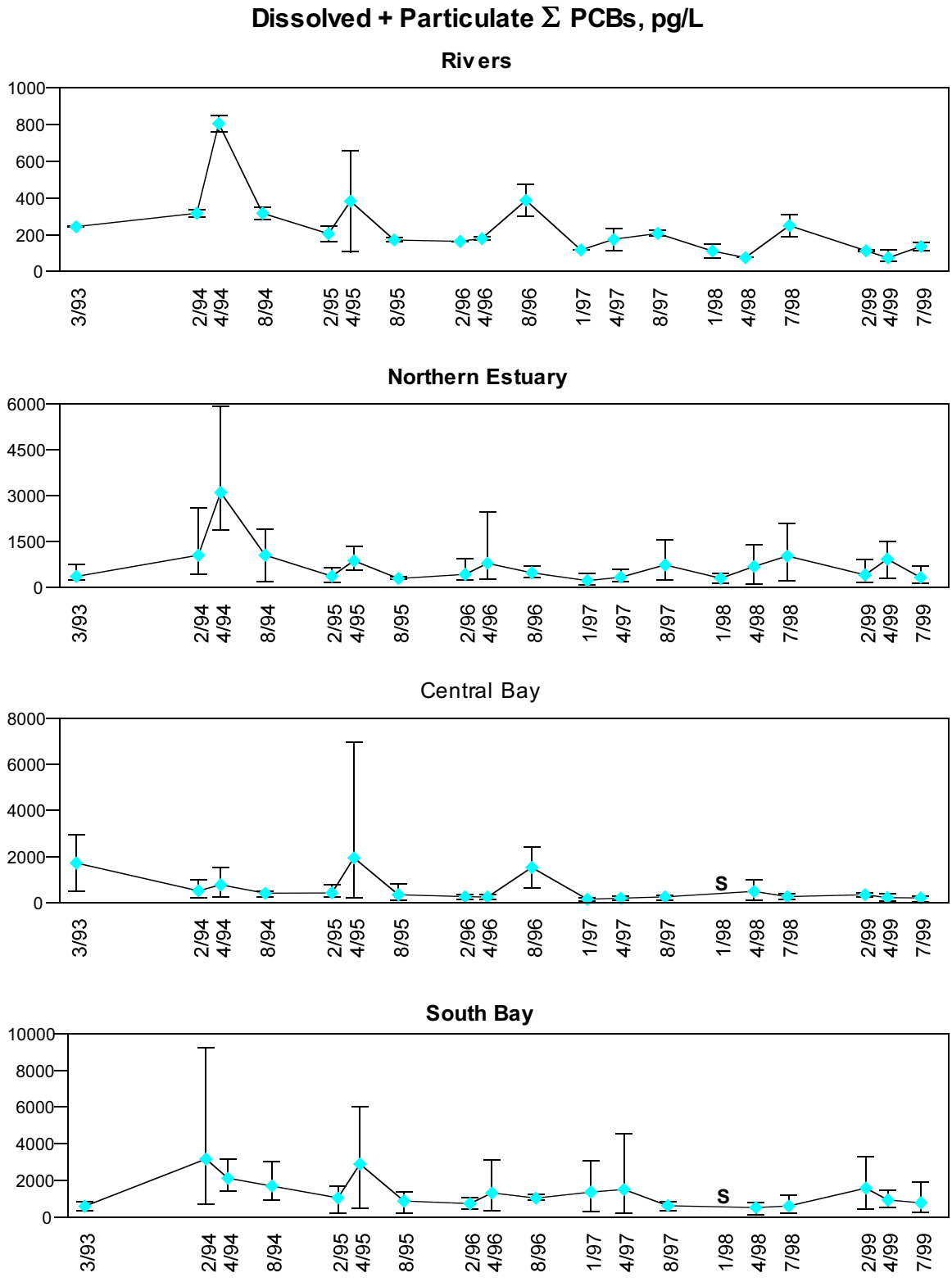

Figure 2.34. Average total (dissolved + particulate) PCB concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

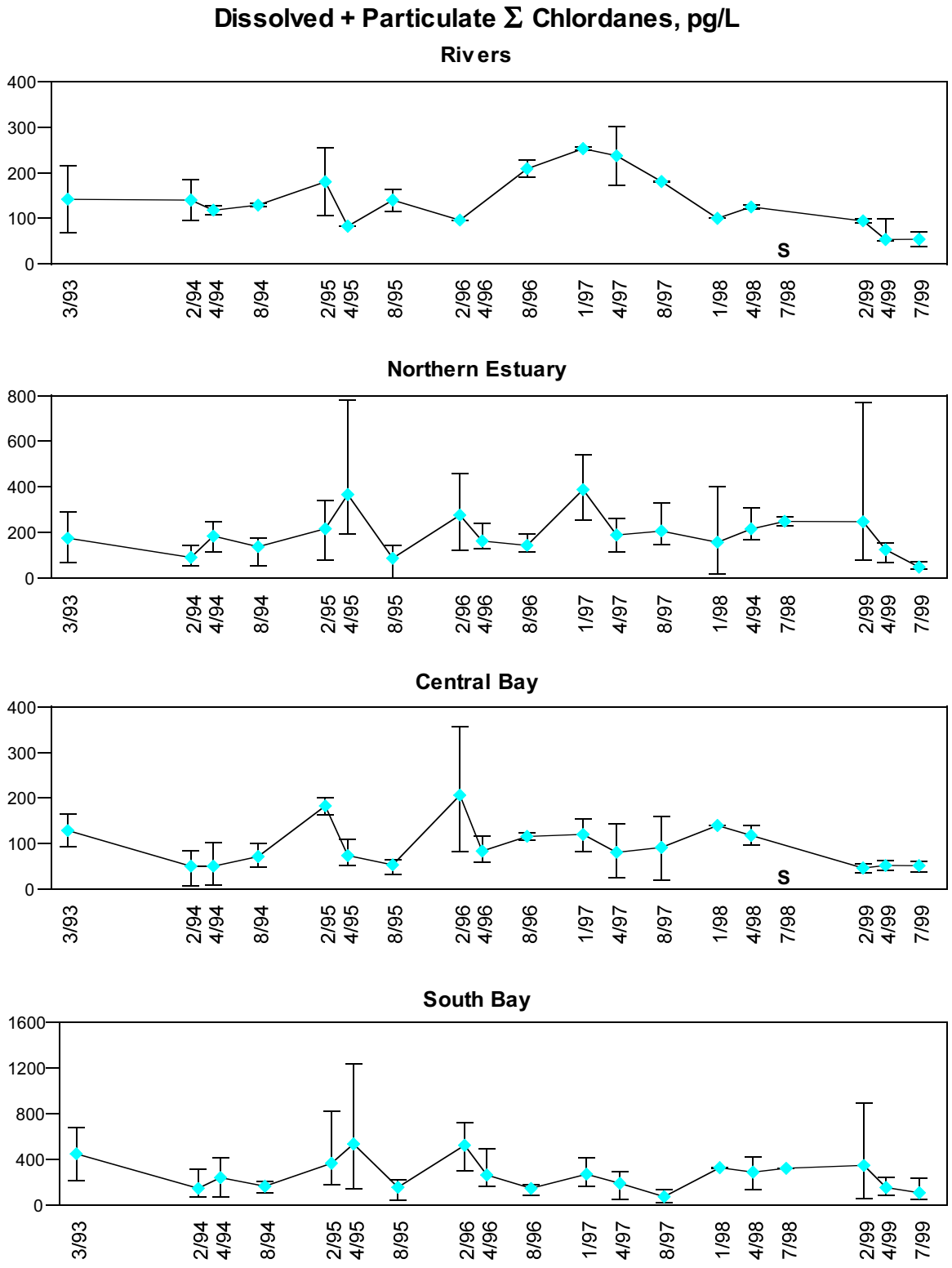

Figure 2.35. Average total (dissolved + particulate) Chlordane concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

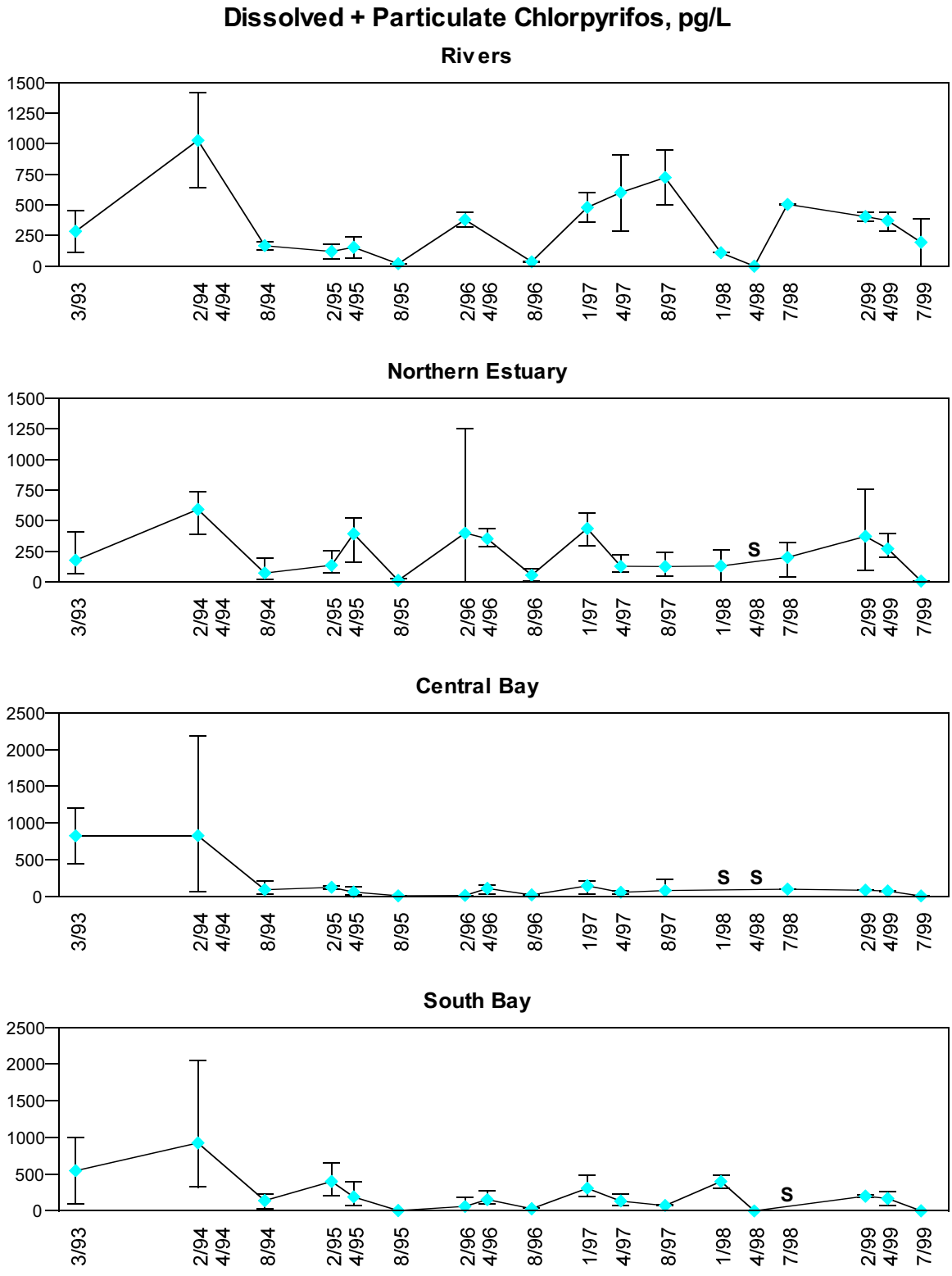

Figure 2.36. Average total (dissolved + particulate) Chlorpyrifos concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

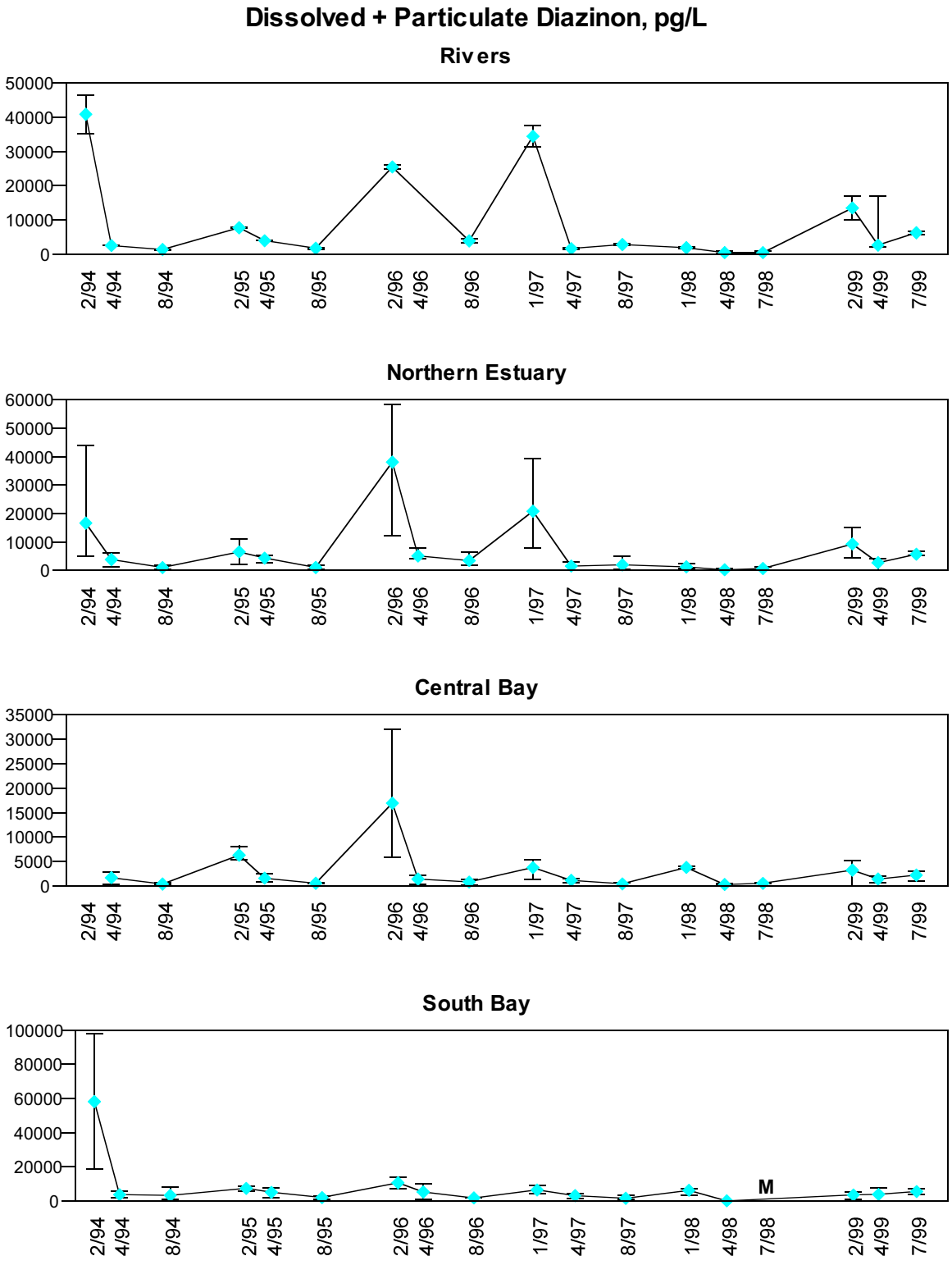

Figure 2.37. Average total (dissolved + particulate) Diazinon concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. Sample size varies between reaches and seasons. The vertical bars represent the range of values. M = matrix interference.

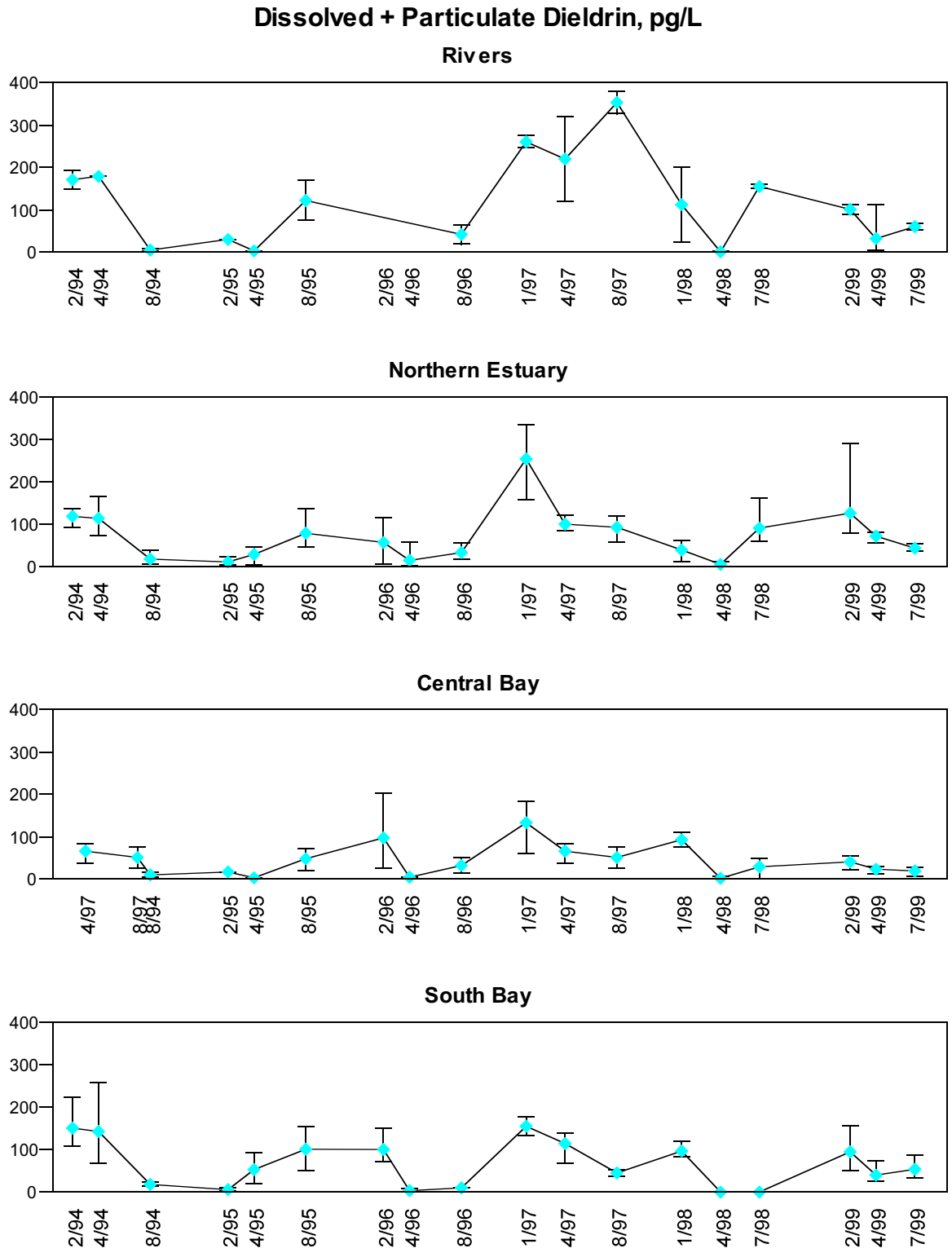

Figure 2.38. Average total (dissolved + particulate) Dieldrin concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. The vertical bars represent the range of values. Sample size varies between reaches and seasons.

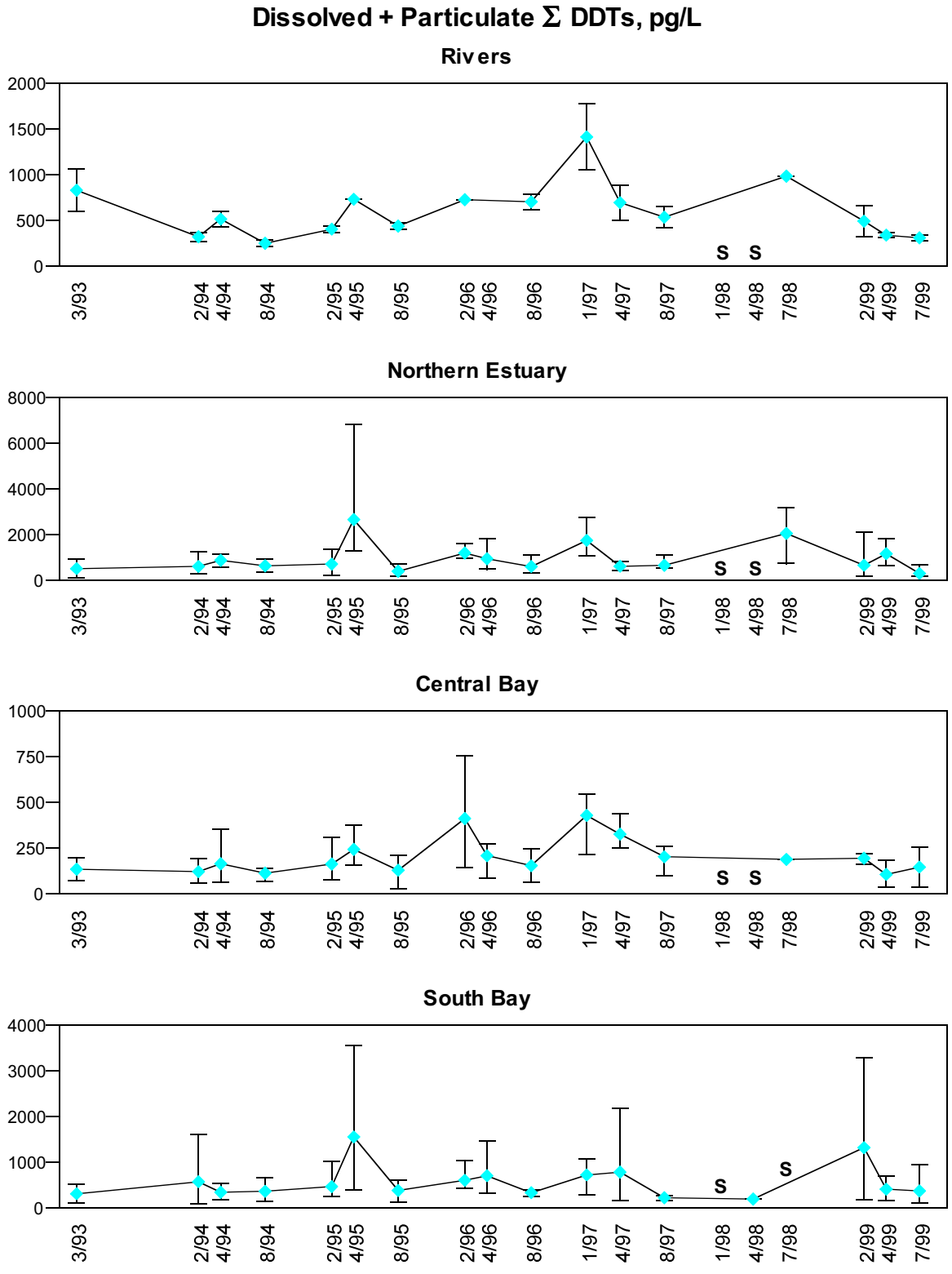

Figure 2.39. Average total (dissolved + particulate) DDT concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

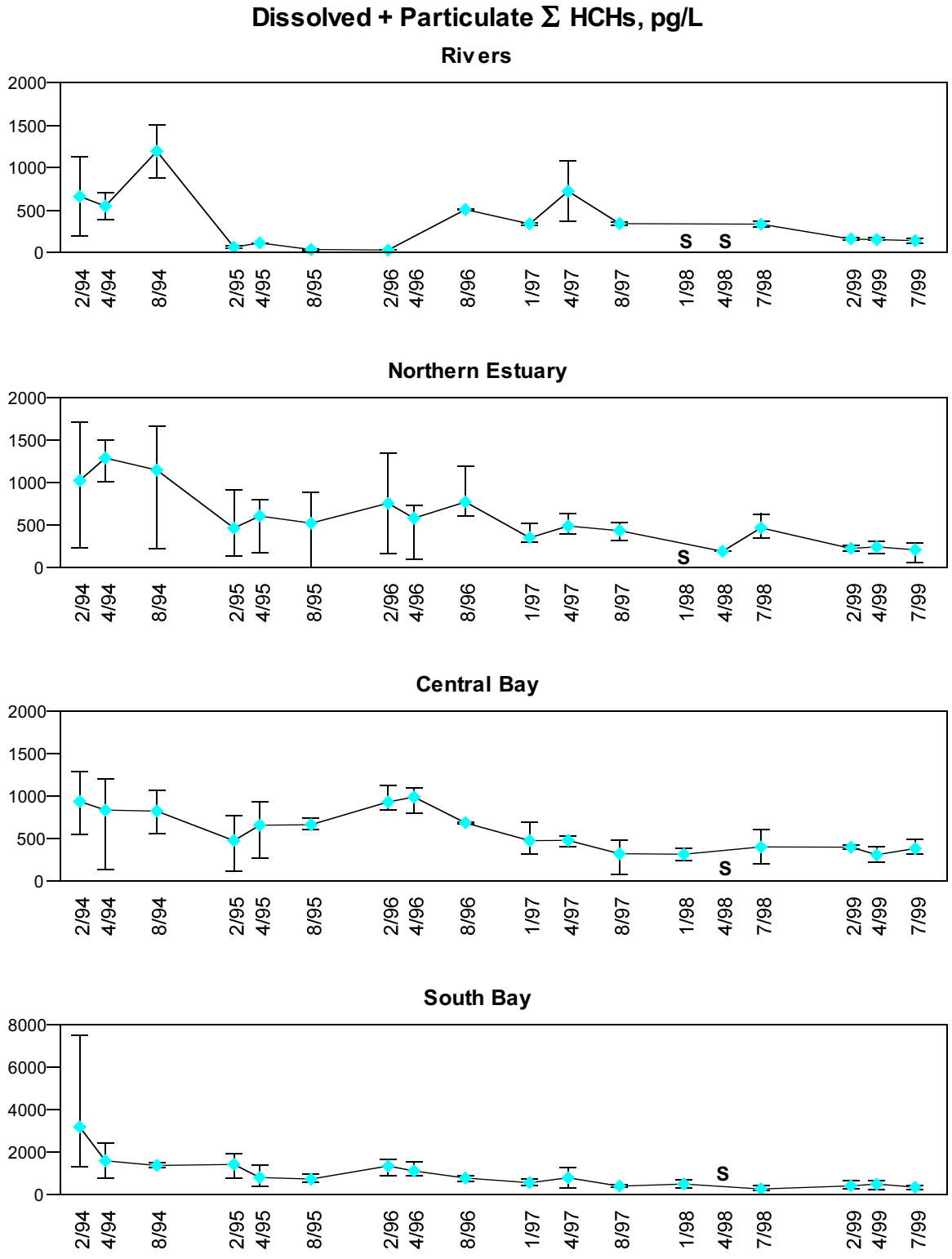

Figure 2.40. Average total (dissolved + particulate) HCH concentrations (parts per quadrillion, ppq) in water for each Estuary reach from 1993–1999. Note different y-axis scales. The vertical bars represent the range of values. Sample size varies between reaches and seasons. S = qualified values represent significant portion of sum.

3.0 Sediment Monitoring

John Ross, Sarah Lowe and SFEI Staff

3.1 Background

Sediments are monitored because they are a fundamental ecosystem component of the Bay, and they play a key role in the adsorption and transport of contaminants. Sediments serve as contaminant sources and sinks, and most contaminants are usually found in concentrations orders of magnitude higher in the upper few centimeters of sediments than in the water column. Information about sediments addresses aspects of all Regional Monitoring Program (RMP) Objectives (listed in the *Introduction*). In this section, patterns and trends in sediment contamination are described (Objective 1) and compared to several sets of sediment quality guidelines (Objective 4), while sediment bioassays address contaminant effects (Objective 3).

Information about sediment contamination is used in making decisions related to many important management issues: the identification of sediment "toxic hot spots" and reference areas; the clean-up of numerous military bases in the region which requires information about background contaminant levels; and the continuous dredging throughout the Estuary which requires testing and comparisons to some reference, or background, concentration. The RMP provides information that may be used by others to assess the condition of Estuary sediments. This information is also used in evaluation and redesign efforts for the RMP.

The geochemistry of sediments is complex, and in order to interpret contaminant concentrations measured in sediments, it is necessary to understand how hydrology (flows) and other non-contaminant sediment properties may affect contaminant concentrations. An overview of Estuary hydrology and water quality is presented in the *Introduction*. Several sediment quality parameters that may affect sediment contaminant concentrations (grain-size, organic carbon, ammonia, and sulfides) were also monitored, and are listed in Table 11.

Sediment contaminant monitoring includes trace elements and trace organic contaminants at 22 RMP Base Program stations. Sediments were also monitored at two stations at the southern end of the Estuary in cooperation with the Regional Board and the cities of San Jose (station C-3-0) and Sunnyvale (station C-1-3). As part of the Estuary Interface Pilot Study, sediments were monitored at two additional stations in the southern end of the Estuary: Standish Dam on Coyote Creek (station BW10) and Alviso Slough on the Guadalupe River (station BW15). For more information see the *1998 Estuary Interface Pilot Study Progress Report* (Leatherbarrow and Hoenicke 2000).

Station locations are shown on Figure 1.1. Sediment samples were collected during the wet season (February) and dry season (July). Sampling dates are shown in Table 1.3 in the *Introduction*. Detailed methods of collection and analysis are included in the *Description of Methods*. Table 1.2 in the *Introduction* lists parameters measured in sediment. Sediment quality parameters, including station depths, and all contaminant concentrations are tabulated in Tables 11-16.

In order to compare sediment results among the major sub-regions of the Estuary, the RMP stations are separated into seven groups of stations (six base program plus Southern Sloughs) in five Estuary segments based subjectively on geography, similarities in sediment types, and patterns of trace contaminant concentrations. Although new Estuary segments are being developed as part of the RMP redesign, the segments used in 1999 are unchanged from previous years: the Southern Sloughs (C-1-3 and C-3-0), South Bay (seven stations, BA10 through BB70), Central Bay (five stations, BC11 through BC60), Northern Estuary (eight stations, BD15 through BF40), and Rivers (BG20 and BG30). In addition, the Estuary Interface Pilot stations (BW10 and BW15) were included for comparative purposes. Stations with coarse sediments (>60% sand: eight stations in the wet season and seven in the dry season) generally have considerably lower contaminant concentrations and were identified on Figures 3.1–3.15.

3.2 Sediment Quality Guidelines

There are currently no Basin Plan objectives or other regulatory criteria for sediment contaminant concentrations in the Estuary. However, several sets of sediment quality guidelines (Table 3.1) may be

used as informal screening tools for sediment contaminant concentrations, but hold no regulatory status.

Sediment quality guidelines developed by Long *et al.* (1995) are based on data compiled from numerous studies in the United States that included sediment contaminant and biological effects information. The guidelines were developed to identify concentrations of contaminants that were associated with biological effects in laboratory, field, or modeling studies. The effects range-low (ERL) value is the concentration equivalent to the lower 10th percentile of the compiled study data, and the effects range-median (ERM) is the concentration equivalent to the 50th percentile of the compiled study data. Sediment concentrations below the ERL are interpreted as being "rarely" associated with adverse effects. Concentrations between the ERL and ERM are "occasionally" associated with adverse effects, and concentrations above the ERM are "frequently" associated with adverse effects. Effects range values for mercury, nickel, total PCBs, and total DDTs have low levels of confidence associated with them. The effects-range values used for chlordanes and dieldrin are from Long and Morgan (1990). There are no effects-range guidelines for selenium, but the Regional Board has suggested guidelines of 1.4 ppm (Wolfenden and Carlin 1992), and 1.5 ppm (Taylor *et al.* 1992).

A set of sediment quality guidelines developed by the Regional Board and introduced in the *1997 RMP Annual Report* were also used. Ambient Sediment Concentration (ASC) values are derived from samples collected between 1991-1996 by the RMP, and the Bay Protection and Toxic Cleanup Program (BPTCP). Samples collected from sites representative of the cleanest portions of the Estuary were used in deriving the "ambient" concentrations. This approach was thought to define contemporary ambient contaminant levels given the fact that virtually no San Francisco Bay sediments in the active layer are free of anthropogenic pollutants. ASCs are used to distinguish between sediment concentrations representing "ambient" versus contaminated conditions. There are different ASC values for sandy (<40% fines) and muddy (>40% fines) sediments. For more information on ASC values see Gandesbery (1998), Gandesbery and Hetzel (1999), or Smith and Riege (1998). Both the Long *et al.* (1995) and the ASC guideline values are shown on the sediment contaminant concentration bar charts for comparative purposes.

The Regional Board is currently undertaking Total Maximum Daily Load (TMDL) processes which will result in the development of proposed sediment targets for certain pollutants on the "Impaired Waters" list (the 303(d) list). A proposed sediment target for mercury of 0.4 mg/kg has already been developed (Abu-Saba and Tang 2000). These target limits could potentially be used as new sediment quality guidelines, specific to the various Estuary segments in the San Francisco Bay.

3.3 Sediment Bioassays

Sediment bioassays are conducted to determine the potential for biological effects from exposure to sediment contamination. Two sediment bioassays were conducted at 14 of the RMP stations (Figure 3.16) in February and again in July of 1999. Sampling dates are listed in Table 1.3 in the *Introduction*. Amphipods (*Eohaustorius estuarius*) were exposed to whole sediment for ten days with percent survival as the endpoint. Larval mussels (*Mytilus galloprovincialis*) were exposed to sediment elutriates (water-soluble fraction) and at the sediment-water interface (SWI) for 48 hours with percent normal development as the endpoint. The control sediment used in the *Eohaustorius* (amphipod) test was from the site near Newport, Oregon where the amphipods were collected. The *Mytilus* (mussel) sediment elutriate test control was clean seawater from Granite Canyon, California. Granite Canyon seawater and Yaquina Bay amphipod home sediment from Northwestern Aquatic Sciences were used as the laboratory control for the *Mytilus* sediment-water interface exposure test. The *Description of Methods* contains detailed methods of collection and testing, and the *QA Tables* contain quality assurance information.

When a sample is found to be toxic, it is interpreted as an indication of the potential for biological effects. However, since sediments are mixtures of numerous contaminants, it is difficult to determine which contaminant(s) may have caused any toxicity observed (see *3.5 Discussion*).

A sample was considered toxic if:

1. There was a significant difference between the laboratory control and test replicates using a t-test, and

2. The difference between the mean endpoint value in the control and the mean endpoint value in the test sample was greater than the 90th percentile minimum significant difference (MSD).

The MSD is a statistic that indicates the difference between the two means that will be considered statistically significant given the observed level of between-replicate variation and the alpha level chosen for the comparison. The 90th percentile MSD value is the difference that 90% of the t-tests will be able to detect as statistically significant. Use of the 90th percentile MSD is similar to establishing statistical power at a level of 0.90, and is a way to insure that statistical significance is determined based on large differences between means, rather than small variation among replicates. MSDs were established by analysis of numerous bioassay results for San Francisco Bay (Anderson and Hunt, unpubl.; Hunt *et al*. 1996). Based on those analyses, the 90th percentile MSD for *Eohaustorius* was 18.8% and for the bivalve larvae test 21%. For the 1999 sediment bioassays, an amphipod bioassay was toxic if it had below 81.2% survival in February and 72.2% in July. A larval bivalve bioassay was toxic it if had below 67% or 68% normal development in February or July, respectively.

3.4 Sediment Trends

Sediment contaminant concentrations have been measured at most of the RMP sites since 1991. Samples were collected by the State's Bay Protection and Toxic Clean-up Program (BPTCP) in 1991 and 1992, and by the RMP since 1993. Combining data from these two programs provides a time-series of 14 sampling events over 9 years. Averages and ranges of concentrations for several trace elements are shown for each major Estuary segment (Figures 3.18–3.27). Arsenic, mercury, and selenium were not measured in 1991 and 1992. Silver for August 1997, and cadmium for July 1999 for the Rivers, Central Bay, and Coarse Sediment Stations are unavailable due to quality control problems in the analyses.

The trends plots for the various Estuary segments contain only muddy sediment samples (<60% sand), except the Rivers plot where one or both stations had coarse sediments in each sampling period. A separate plot is presented for coarse (>60% sand) sediments samples and includes the coarse sediment Rivers samples. Contaminant concentrations were generally lower in the coarse-grained than in the fine-grained samples.

It is important to recognize that contaminant concentration variation seen in the trends plots may be influenced by physical sediment factors as well as proximity to sources. In general, sediments with more silt and clay (percent fines) and higher total organic carbon (TOC) have higher concentrations than sediments with sandy sediments and low TOC. Therefore, some of the variation represented in the plots could be attributable to spatial and temporal variations in sediment type rather than in changes in concentrations over time *per se*.

3.5 Discussion

Bay sediments are evaluated through comparisons to several sets of sediment quality guidelines described in Section 3.2. Although these guidelines hold no regulatory status, they do provide concentration thresholds that are useful in assessing the condition of sediments in the San Francisco Bay.

High contaminant concentrations in sediments usually reflect a proximity to a source, anthropogenic or otherwise, as illustrated by the RMP's Estuary Interface Pilot Study results from Coyote Creek and Guadalupe River in the South Bay (SFEI 1999). Concentrations can vary, however, not only due to proximity to sources, but also because of the complex processes involved in sediment dynamics. For example, sediments with more silt and clay minerals contain higher concentrations of most contaminants than coarser, sandier sediments because of their geochemical properties (Luoma 1990, Horowitz 1991). The strength and magnitude of freshwater inflows, through the transport of sediments and contaminants in both the dissolved and particulate fractions of the flows, may alter sediment type and contaminant distribution, particularly in estuarine regions such as San Francisco Bay (Krone 1979). Relationships such as these should be kept in mind when reading this summary.

3.5.1 Spatial Distributions

Contaminant concentrations tend to be elevated in the Southern Sloughs and South Bay when compared to other bay reaches. Emphasizing this pattern, as in prior years (SFEI 1999, SFEI 2000), is the finding of a gradient in contaminant concentrations across the estuary margin of the south Bay. Contaminant

concentrations in sediment samples from the Central Bay, Northern Estuary, and River reaches tended to be lower than those from the Estuary Interface Pilot Study stations situated upstream from the Southern Sloughs. Further, an intensive, localized study found concentration gradients of arsenic, cadmium, chromium, lead, selenium, zinc, PAHs, and PCBs in creek channels draining into San Leandro Bay (Daum *et al.* 2000).

Average concentrations of chromium, copper, lead, mercury, nickel, selenium, zinc, DDTs and chlordanes were highest in sediment samples from Standish Dam (BW10) and Guadalupe River (BW15), the Estuary Interface sites in the South Bay. Dieldrin was detected only at these two Estuary Interface stations. Southern Slough sediments were found to be highest in concentrations of cadmium, silver, and PCBs. The River and Central Bay reaches in the northern San Francisco Estuary had the lowest average concentrations of all contaminants except for arsenic. As in previous years, arsenic had the highest average concentrations in the Northern Estuary and the lowest in the Southern Sloughs. The majority of individual stations with high contaminant concentration levels were either Southern Slough or Estuary Interface stations.

The Estuary Interface stations of Standish Dam (BW10) and Guadalupe River (BW15) in the South Bay had the highest number of Effects Range exceedances (see Table 3.1). The extensive urbanized watersheds that drain into this section of the Bay are the most likely explanation for this observation. The number of guideline exceedances and sediment contaminant concentrations were lowest at the coarse sediment stations of Sacramento River (BG20), Davis Point (BD41), San Joaquin River (BG30), and Red Rock (BC60).

3.5.2 Trends

Two time scales are included in the current RMP sampling design: seasonal (wet and dry) and yearly. Sediment contamination trends have been observed at both scales. Seasonal variation in some contaminants occurred at some sites, but only nickel (Figure 3.7) and silver (Figure 3.9) exhibited consistent variation throughout the Estuary based on seasonality. Nickel concentrations were higher during the wet season and silver during dry weather sampling.

After normalizing for grain size and total suspended solids (TSS), significant long-term trends have been found at a dozen RMP sites throughout most of the Estuary for one or more contaminants (Thompson and Daum 1999). Chromium and nickel showed significant increases at nine and seven of these stations respectively. Other contaminants had increases or decreases at three or fewer stations. Numerous significant changes in contaminant concentrations with time have been documented at Coyote Creek, Pinole Point, and Petaluma River. Overall, significant long-term (five to eight years) trends have been observed in less than 10% of RMP samples collected through 1997. Coarse sediment stations generally had the lowest range of variation over time for metals, but not organics.

Interestingly, no significant trends were found for the Southern Sloughs and River stations. One possible explanation for this observation may be the inherently dynamic hydrologic conditions in these areas. Time trends analyses require a large enough sample size i.e. enough measurements over time at a given location, to produce statistically significant results. The majority of RMP samples show no significant changes in contaminant concentrations over time. Whether, this is because there are indeed no changes, or because the sample size is too small has not been established.

Sampling sediments at a series of depths can reveal historical trends in contamination levels. Such sampling indicates that most contaminants have dropped from the peak levels observed in the 1960s and 1970s (Venkatesan *et al.* 1999) probably due to improvements in treatment of wastewater, product bans, and other regulatory measures.

A complex set of processes that include deposition, resuspension, mixing and transport, and biogeochemistry are reflected in changes in sediment concentrations with time. The interplay of these processes determines the "active sediment layer" and any burial rates. The actual depth of the active layer was determined to be a key factor in the mass balance, and flux of chlorinated hydrocarbons in sediments (Davis *et al.* 1999). Active mixing combined with low rates of deposition generally account for the long resident times of contaminants in the surface sediments of the Bay.

Recently published United States Geological Survey (USGS) sediment coring studies allow us to place our understanding of sediment contamination trends in the Estuary in a historical context (Van Geen and Luoma, 1999). The earliest evidence of contamination associated with human occupation

and industrialization was found for mercury, in sediments deposited between 1850 and 1880 as a result of gold mining activities. Maximum concentrations were 20 times the baseline (i.e. pre-anthropogenic) concentrations. Silver, lead, copper, and zinc contamination first appeared in the Bay sediment record after 1910. Concentrations of most contaminants have decreased from the peaks observed in the 1960's and 1970's (Hornberger *et al.* 1999).

3.5.3 Sediment Toxicity

Toxicity tests, described in Section 3.3, were conducted to indicate whether sediments were toxic to sensitive organisms. Since these bioassays were conducted using non-resident organisms exposed in laboratory conditions, the results may not necessarily indicate the occurrence of actual ecological impacts.

Bay sediments were toxic to either amphipods or bivalve embryos in 61% of the 1999 RMP samples; 70% of the RMP samples tested between 1991 and 1998 were toxic to these organisms. Patterns of toxicity for the two test organisms vary at the different RMP sites. Sites located near the confluence of tributaries, such as the Sacramento (BG20), San Joaquin (BG30), and Napa River (BD50), show higher incidence of bivalve embryo toxicity, whereas sites in the South Bay exhibit higher incidence of amphipod toxicity. Bioassay results for 1999 show sediments from Davis Point (BD41), Red Rock (BC60), and Horseshoe Bay (BC21) were not toxic to either amphipods or bivalve larvae. Toxicity varies seasonally with sediments usually more toxic during the wet, than dry sampling period. A previously reported increasing trend in toxicity at Yerba Buena Island (BC11) was seen in 1999 for amphipod, but not bivalve embryos. No significant increases or decreases in the incidence of toxicity have been seen at other RMP sites (SFEI 2000).

Sediment or other environmental factors that cause sediment toxicity to the amphipods and bivalve larvae are poorly understood. Analyses using several years of monitoring data, however, suggest that amphipod toxicity is associated with the cumulative effects of mixtures of contaminants (Thompson *et al.* 1999b). Several individual contaminants were identified as probable determinants of toxicity at some sites. For example, toxicity at Grizzly Bay (BF21) was related to covarying patterns of total chlordane, silver and cadmium from 1991 through 1996. Seasonal variation in PAHs at Alameda (BB70) and San Bruno Shoal (BB15) were related with percent survival. For bivalve embryos, toxicity identification evaluations (TIEs) were performed on the sediment elutriates from the Sacramento and San Joaquin rivers and Grizzly Bay in 1997 and 1998, and indicate that dissolved metals (divalent cations) were probably responsible for the observed toxicity. Non-polar organic contaminants were also implicated at the Sacramento River site (Phillips *et al.* 2000). As the above results suggest sediment toxicity at the different RMP stations may be related to different contaminants, and may vary with time.

The cause(s) of sediment toxicity have been the focus of additional sampling and experiments by RMP investigators in 1999. These studies demonstrate the complex nature of sediment toxicity due to the numerous contaminant and non-contaminant factors in estuary sediments. Solid phase sediment toxicity to amphipods has been frequently observed at Redwood Creek (BA41) and Grizzly Bay. Although exposure to pore water from these sites did not produce toxicity, exposure to bulk sediment did, suggesting that the toxicity is associated with ingestion of sediment particles. Amphipods accumulated PAHs, organochlorine pesticides, and PCBs from exposures to both bulk sediment and pore water, but not to levels known to cause mortality. The majority of the accumulation in amphipods was due to the accumulation of PAHs, which may be a key causitive agent. Mixtures of contaminants, however, are also believed to be important agents (Anderson *et al.* 2000).

Sediment elutriates (water soluble fraction) have been observed as being toxic to bivalve larvae at the Sacramento and San Joaquin Rivers, and Grizzly Bay sites since 1993. TIEs conducted to evaluate which contaminants may be responsible show that trace metals, particularly copper, were at least partially responsible for the toxicity, but organic contaminants were also identified as toxic components at the Sacramento River site (Phillips *et al.* 2000).

3.5.4 Assessment of Sediment Quality

Sediment contamination and toxicity results were used to evaluate the sediment quality of the 1999 Regional Monitoring Program samples (Table 3.2).

Sediment contamination was estimated for each site by considering the number of contaminants in a sample that exceeded the San Francisco Estuary Ambient Sediment Concentration (ASC, Smith and Riege 1998), Effects-Range guidelines (ERL and ERM, Long *et al.* 1995), and the mean ERM quotients (Long *et al.* 1998). The number of sediment contaminants above the ERL or ERM guidelines has been used previously to predict potential biological effects (Long *et al.* 1998). Samples with more than four ERM exceedances predicted toxicity in 68% of tests, while more than 89% of samples were toxic when ten to fourteen ERLs were above the guidelines. Based on these results 1999 RMP sediment samples were considered potentially toxic if four or more ERMs, or ten or more ERLs, or if half (22) of the ASC values were exceeded.

ERM values were used to calculate a mean ERM quotient (mERMq) for each sample. Concentrations of nine trace metals – arsenic, cadmium, chromium, copper, mercury, nickel, lead, silver, zinc – total PCBs, total DDTs, low molecular weight PAHs, and high molecular weight PAHs were divided by their respective ERMs, and the quotients for all contaminants summed, then divided by the number of contaminants whose ERMs were used to calculate each sum. The mERMq may be considered a cumulative index of sediment contamination related to adverse biological effects. For example, amphipod toxicity has been found to be significantly, and inversely correlated to mERMq (Thompson *et al.* 1999a), suggesting that contaminants individually present in relatively low concentrations in sediments may act together to adversely influence amphipod survival. Analysis of RMP data from 1991 through 1997 indicate that mERMq values below 0.178 were never toxic to amphipods, but mERMq values above 0.288 were toxic in 64% of tests. The 1999 RMP sediment samples were evaluated for potential adverse ecological effects using these values.

Sediment evaluation showed that 11 of 52 samples had mERMq values above 0.288, suggesting a potential for toxicity (Table 3.2). Toxicity tests reveal that three of these – Grizzly Bay (BF21), Napa River (BD50), and San Jose (C-3-0) – were toxic to either amphipod or bivalve larvae, two were not; and six were not tested. February samples from Standish Dam (BW10), Guadalupe River (BW15), and San Pablo Bay (BD22) were not tested for toxicity, but sediments from these sites had 10 or more ERL exceedances, one or more ERM exceedances, and nine or more exceedances of ASC guidelines, suggesting a potential for negative biological effects. Spatial and temporal differences were observed in sediment quality. Alameda (BB70) being a notable exception, all samples having mERMq values above 0.288 were from Northern Estuary, Southern Sloughs and Estuary Interface stations, with the majority (7 out of 11) sampled during the wet season.

3.6 References

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Table 3.1. Guidelines to evaluate chemical concentrations in sediment (in dry weight).

Effects Range-Low (ERL) and Effects Range-Median (ERM) values from Long et al. (1995, 1998).
Effects Range-Low; values between this and the ERM are in the possible effects range.
Effects Range-Median; values above this are in the probable effects range.

San Francisco Bay Ambient Sediment Concentrations (ASC) from Smith et al. (1998).
Ambient sediment levels from background sediments in the Estuary allows one to assess whether a site has elevated levels or is "degraded".

Background sediment concentrations for selected trace elements in the San Francisco Bay, from Hornberger et al. (1999)
Chromium and Nickel ranges were seen throughout the core. All trace elements, except Ag, measured by ICAPES. Ag measured by GFAAS.

Parameter	unit	ERL	ERM	ASC-sandy <40% fines	ASC-muddy >40% fines	Background Concentrations (Bay wide ranges)	
						Total	Near Total
Arsenic	mg/Kg	8.2	70	13.5	15.3	.	.
Cadmium	mg/Kg	1.2	9.6	0.25	0.33	.	.
Chromium	mg/Kg	81	370	91.4	112	110-170	70-120
Copper	mg/Kg	34	270	31.7	68.1	20 - 55	20 - 41
Mercury	mg/Kg	0.15	0.71	0.25	0.43	.	0.05 - 0.05
Nickel	mg/Kg	20.9	51.6	92.9	112	70-100	50-100
Lead	mg/Kg	46.7	218	20.3	43.2	20 - 40	10 - 20
Selenium	mg/Kg			0.59	0.64		
Silver	mg/Kg	1	3.7	0.31	0.58	0.1 - 0.1	0.1 - 0.1
Zinc	mg/Kg	150	410	97.8	158	60 - 70	50 - 100
Total HPAHs (SFEI)	µg/Kg	1700	9600	256	3060		
Fluoranthene	µg/Kg	600	5100	78.7	514		
Perylene	µg/Kg			24	145		
Pyrene	µg/Kg	665	2600	64.6	665		
Benz(a)anthracene	µg/Kg	261	1600	15.9	244		
Chrysene	µg/Kg	384	2800	19.4	289		
Benzo(b)fluoranthene	µg/Kg			32.1	371		
Benzo(k)fluoranthene	µg/Kg			29.2	258		
Benzo(a)pyrene	µg/Kg	430	1600	18.1	412		
Benzo(e)pyrene	µg/Kg			17.3	294		
Dibenz(a,h)anthracene	µg/Kg	63.4	260	3	32.7		
Benzo(g,h,i)perylene	µg/Kg			22.9	310		
Indeno(1,2,3-c,d)pyrene	µg/Kg			19	382		
Total LPAHs (SFEI)	µg/Kg	552	3160	37.9	434		
1-Methylnaphthalene	µg/Kg			6.8	12.1		
1-Methylphenanthrene	µg/Kg			4.5	31.7		
2,3,5-Trimethylnaphthalene	µg/Kg			3.3	9.8		
2,6,-Dimethylnaphthalene	µg/Kg			5	12.1		
2-Methylnaphthalene	µg/Kg	70	670	9.4	19.4		
Naphthalene	µg/Kg	160	2100	8.8	55.8		
Acenaphthylene	µg/Kg	44	640	2.2	31.7		
Acenaphthene	µg/Kg	16	500	11.3	26.6		
Fluorene	µg/Kg	19	540	4	25.3		
Phenanthrene	µg/Kg	240	1500	17.8	237		
Anthracene	µg/Kg	85.3	1100	9.3	88		
Total PAHs (SFEI)	µg/Kg	4022	44792	211	3390		
p,p'-DDE	µg/Kg	2.2	27				
Total DDTs (SFEI)	µg/Kg	1.58	46.1	1.58	46.1		
Total Chlordanes (SFEI)	µg/Kg	0.5	6	0.42	1.1		
Dieldrin *	µg/Kg	0.02	8	0.18	0.44		
TOTAL PCBs (NIST 18)	µg/Kg			5.9	14.8		
Total PCBs (SFEI)	µg/Kg	22.7	180	8.6	21.6		

* Method detection limit (MDL) is greater than ERL and ASC-sandy guidelines, therefore, conclusions regarding these benchmarks could not be drawn except for Standish Dam (BW10) and Guadalupe River (BW15) stations in February.

Table 3.2. Summary of sediment quality for the RMP in 1999. Number of contaminants above the Ambient Sediment Concentrations (ASC), the Effects Range-Low (ERL) and Effects Range-Median (ERM), results of two laboratory toxicity tests, and the mean ERM quotient (mERMq). . = not tested, * indicates number of exceedances above ASC guidelines for sandy samples

CODE	SITE NAME	DATE	mERMq	No. of ASC above Guidelines	No. of ERL above Guidelines	No. of ERM above Guidelines	Toxic to Amphipods?	Toxic to Bivalves?
BG20	Sacramento River	2/11/99	0.1600	0*	1	1	no	yes
BG30	San Joaquin River	2/11/99	0.1594	2*	2	1	no	yes
BF40	Honker Bay	2/11/99	0.2720	1	8	1	.	.
BF21	Grizzly Bay	2/11/99	0.3245	3	7	1	yes	yes
BF10	Pacheco Creek	2/11/99	0.1761	9*	3	1	.	.
BD50	Napa River	2/12/99	0.3299	5	10	1	yes	yes
BD41	Davis Point	2/12/99	0.1457	0*	1	1	no	no
BD31	Pinole Point	2/12/99	0.2163	0	7	1	.	.
BD22	San Pablo Bay	2/12/99	0.2919	14	10	1	.	.
BD15	Petaluma River	2/12/99	0.2937	1	8	1	.	.
BC60	Red Rock	2/16/99	0.1874	9*	2	1	no	no
BC41	Point Isabel	2/16/99	0.2582	1	7	1	.	.
BC32	Richardson Bay	2/16/99	0.2453	1	7	1	.	.
BC21	Horseshoe Bay	2/16/99	0.2030	29*	11	0	no	no
BC11	Yerba Buena Island	2/16/99	0.2158	1	7	1	yes	no
BB70	Alameda	2/17/99	0.2605	11	10	1	yes	no
BB30	Oyster Point	2/17/99	0.2317	2	5	1	.	.
BB15	San Bruno Shoal	2/17/99	0.2786	4	9	1	yes	no
BA41	Redwood Creek	2/17/99	0.2665	1	6	1	yes	no
BA30	Dumbarton Bridge	2/17/99	0.2450	6	7	1	.	.
BA21	South Bay	2/17/99	0.2743	2	9	1	yes	no
BA10	Coyote Creek	2/17/99	0.1876	26*	3	1	yes	no
C-3-0	San Jose	2/18/99	0.3184	30*	7	1	no	yes
C-1-3	Sunnyvale	2/18/99	0.1683	24*	2	1	.	.
BW10	Standish Dam	2/22/99	0.3658	10	12	2	.	.
BW15	Guadalupe River	2/9/99	0.3843	9	11	2	.	.
BG20	Sacramento River	7/22/99	0.1792	0*	1	1	no	yes
BG30	San Joaquin River	7/22/99	0.1496	1*	1	1	no	yes
BF40	Honker Bay	7/22/99	0.2653	0	6	1	.	.
BF21	Grizzly Bay	7/22/99	0.2843	0	5	1	yes	yes
BF10	Pacheco Creek	7/22/99	0.1819	10*	3	1	.	.
BD50	Napa River	7/23/99	0.2844	0	6	1	yes	no
BD41	Davis Point	7/23/99	0.1554	0*	1	1	no	no
BD31	Pinole Point	7/23/99	0.2723	0	6	1	.	.
BD22	San Pablo Bay	7/23/99	0.2409	1	5	1	.	.
BD15	Petaluma River	7/23/99	0.2622	1	6	1	.	.
BC60	Red Rock	7/23/99	0.1394	0*	2	1	no	no
BC41	Point Isabel	7/26/99	0.2537	0	6	1	.	.
BC32	Richardson Bay	7/26/99	0.2235	1	6	1	.	.
BC21	Horseshoe Bay	7/26/99	0.2225	29*	7	1	no	no
BC11	Yerba Buena Island	7/26/99	0.1865	3	5	0	yes	no
BB70	Alameda	7/26/99	0.3070	6	9	1	no	no
BB30	Oyster Point	7/27/99	0.1880	0	3	1	.	.
BB15	San Bruno Shoal	7/27/99	0.2452	0	5	1	no	no
BA41	Redwood Creek	7/27/99	0.2260	0	4	1	yes	no
BA30	Dumbarton Bridge	7/27/99	0.2479	0	5	1	.	.
BA21	South Bay	7/27/99	0.2404	1	5	1	no	no
BA10	Coyote Creek	7/28/99	0.1588	1	3	0	no	no
C-3-0	San Jose	7/28/99	0.3480	6	9	1	no	no
C-1-3	Sunnyvale	7/28/99	0.1503	17*	4	0	.	.
BW10	Standish Dam	7/29/99	0.3634	4	9	2	.	.
BW15	Guadalupe River	7/29/99	0.3875	3	9	1	.	.

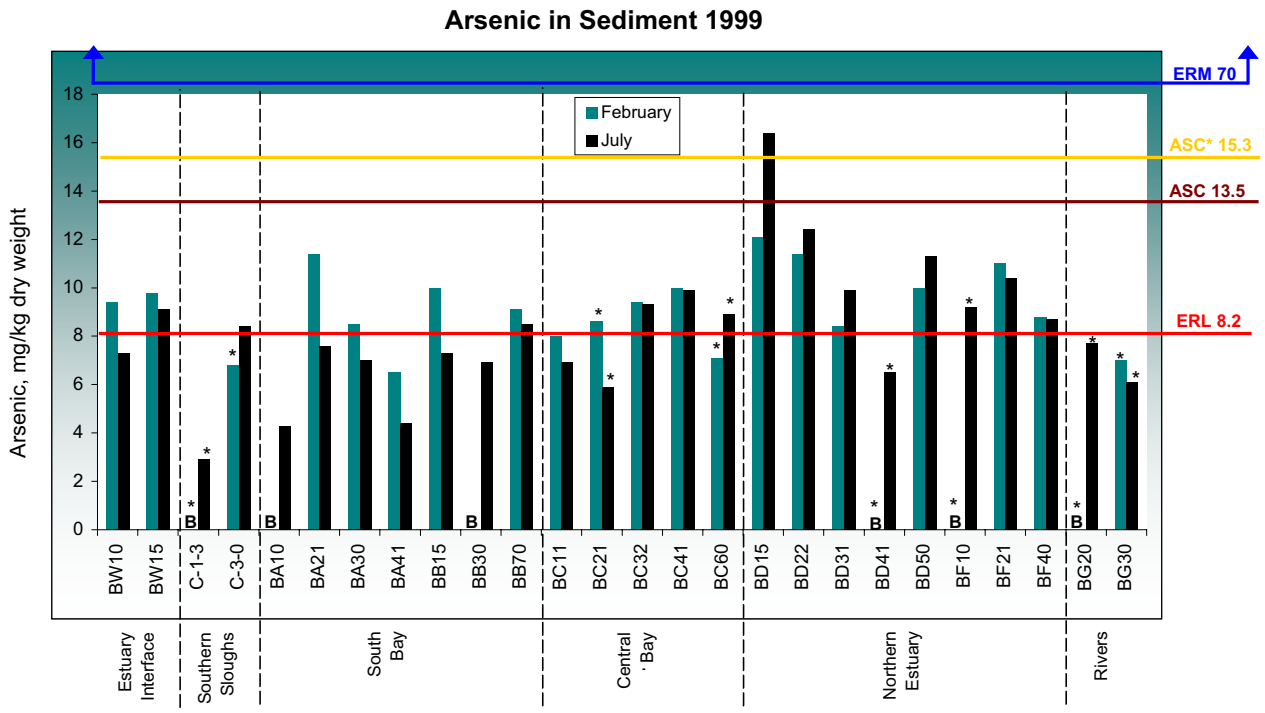

Figure 3.1. Arsenic (As) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. **B** indicates blank contamination. Arsenic concentrations ranged from 2.9 to 16.4 ppm. The highest concentration was sampled at Petaluma River (BD15) and the lowest at Sunnyvale (C-1-3), both in July. Average concentrations were highest (10.6 ppm) in the Northern Estuary and lowest (5.65 ppm) in the Southern Sloughs, both in July.

Source Data: see Data Table 12

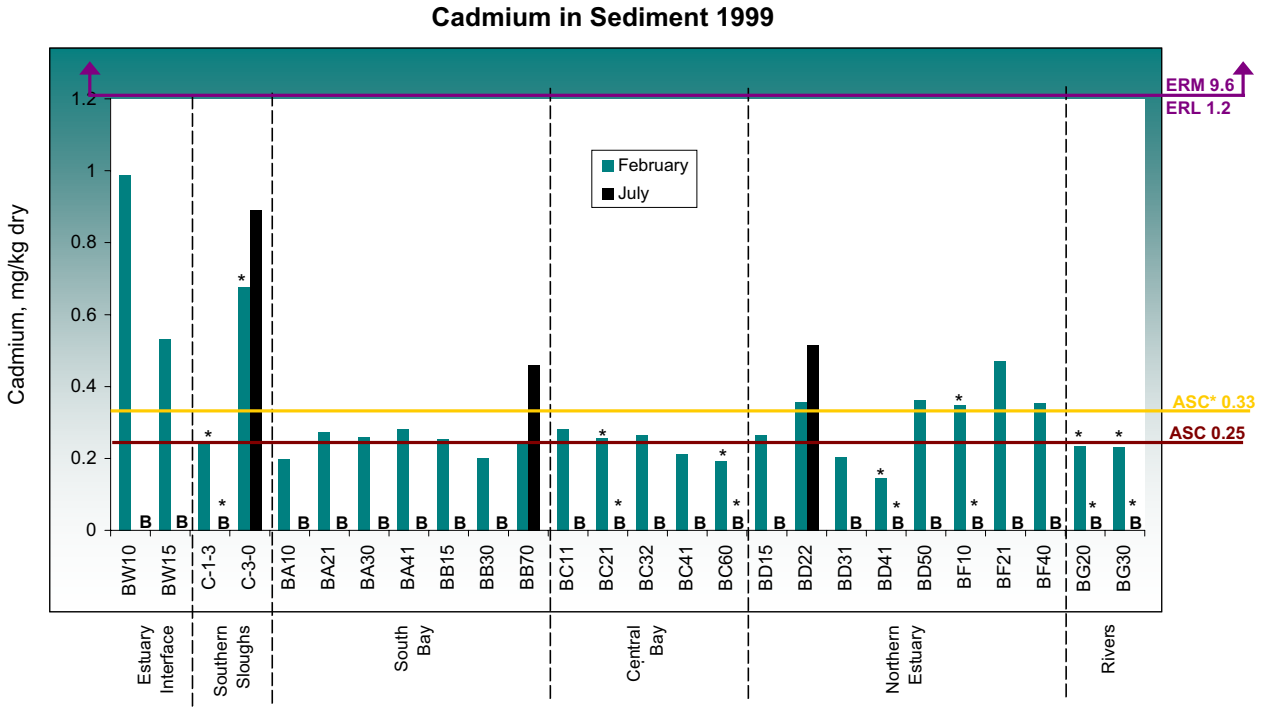

Figure 3.2. Cadmium (Cd) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. **B** indicates blank contamination. Cadmium concentrations ranged from 0.14 to 0.99 ppm. The highest concentration was sampled at Standish Dam (BW10) and the lowest at Davis Point (BD41), both in February. Average concentrations were highest (0.89 ppm) in the Southern Sloughs in July, and lowest (0.23 ppm) in the Rivers in February.

Source Data: see Data Table 12

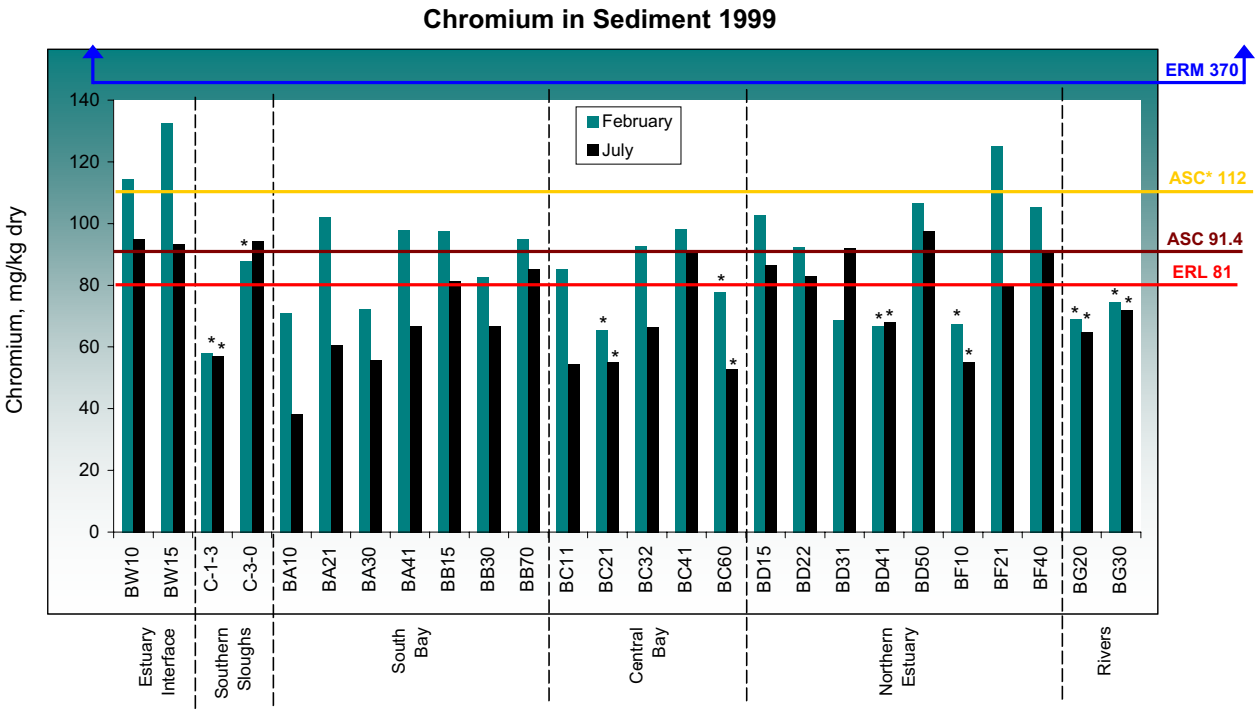

Figure 3.3. Chromium (Cr) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Chromium concentrations ranged from 38.2 to 132.4 ppm. The highest concentration was sampled at Guadalupe River (BW15) in February and the lowest at Coyote Creek (BA10) in July. Average concentrations were highest (123.35 ppm) in the Estuary Interface in February, and lowest (64 ppm) in the Central Bay in July.

Source Data: see Data Table 12

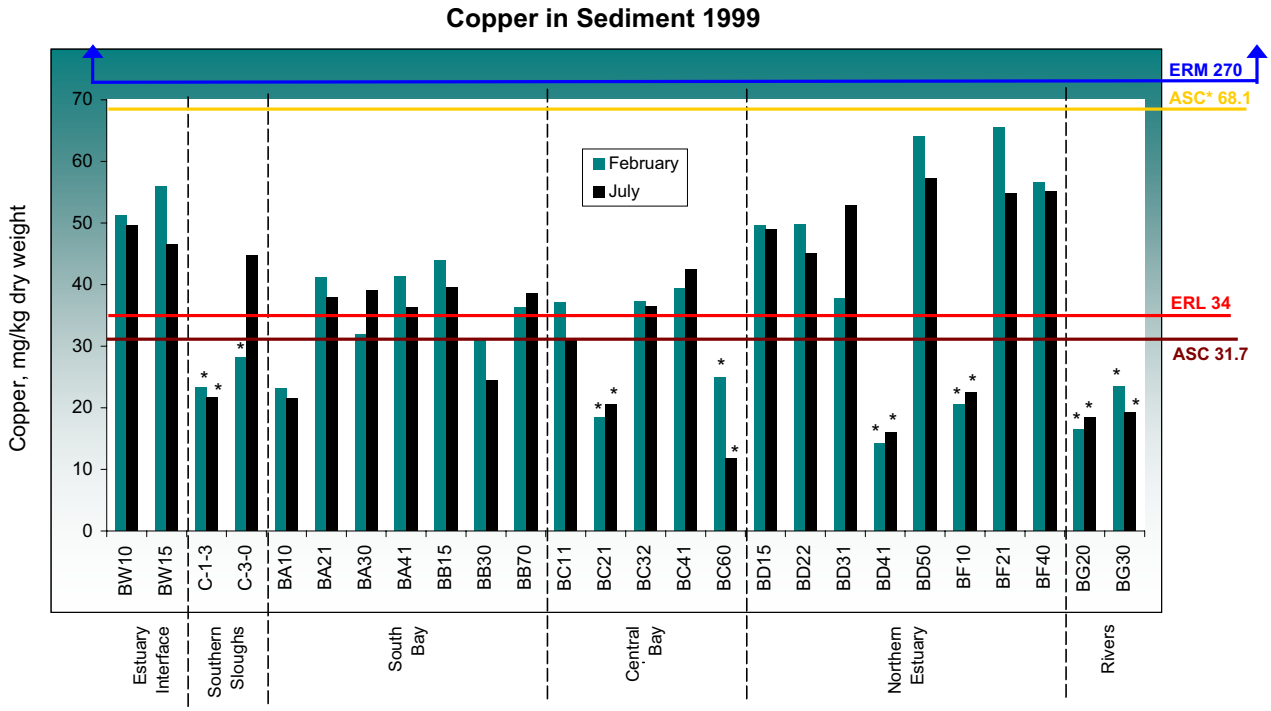

Figure 3.4. Copper (Cu) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Copper concentrations ranged from 11.8 to 65.6 ppm. The highest concentration was sampled at Grizzly Bay (BF21) in February and the lowest at Red Rock (BC60) in July. Average concentrations were highest (53.7 ppm) in the Estuary Interface in February, and lowest (18.9 ppm) in the Rivers in July.

Source Data: see Data Table 12

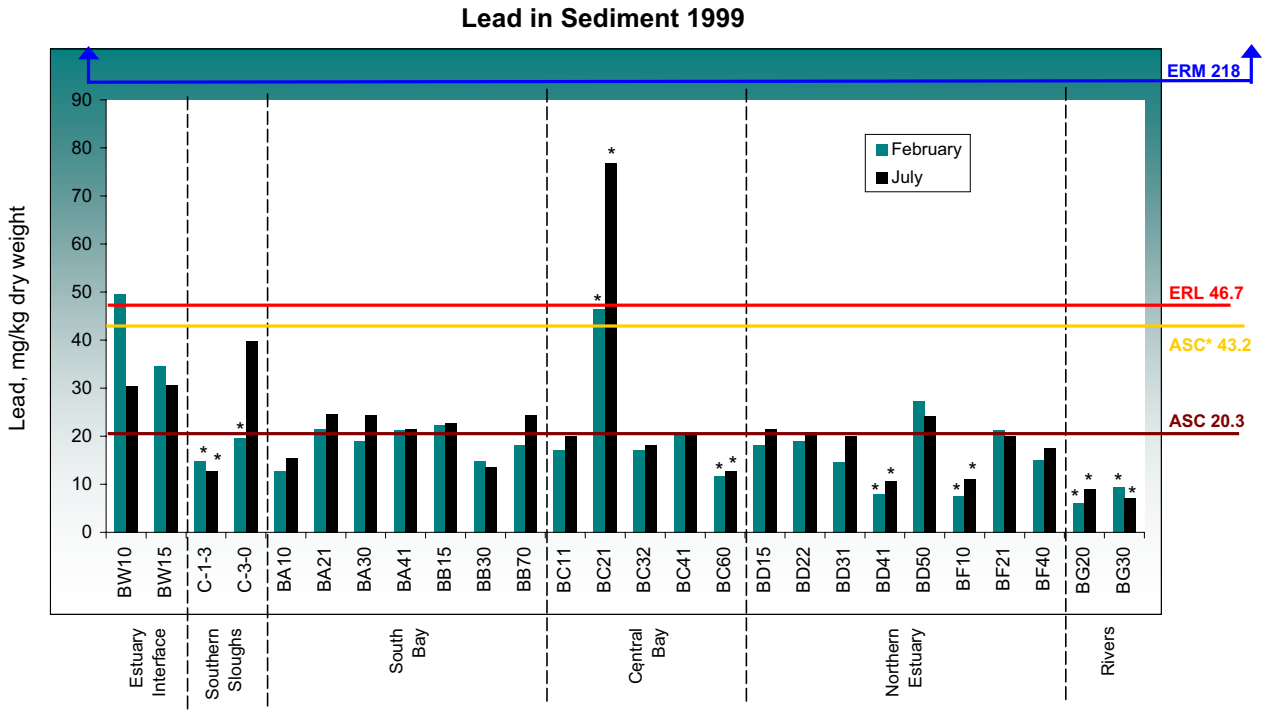

Figure 3.5. Lead (Pb) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Lead concentrations ranged from 6 to 76.8 ppm. The highest concentration was sampled at Horseshoe Bay (BC21) in July and the lowest at Sacramento River (BG20) in February. Average concentrations were highest (42 ppm) in the Estuary Interface and lowest (7.7 ppm) in the Rivers, both in February.

Source Data: see Data Table 12

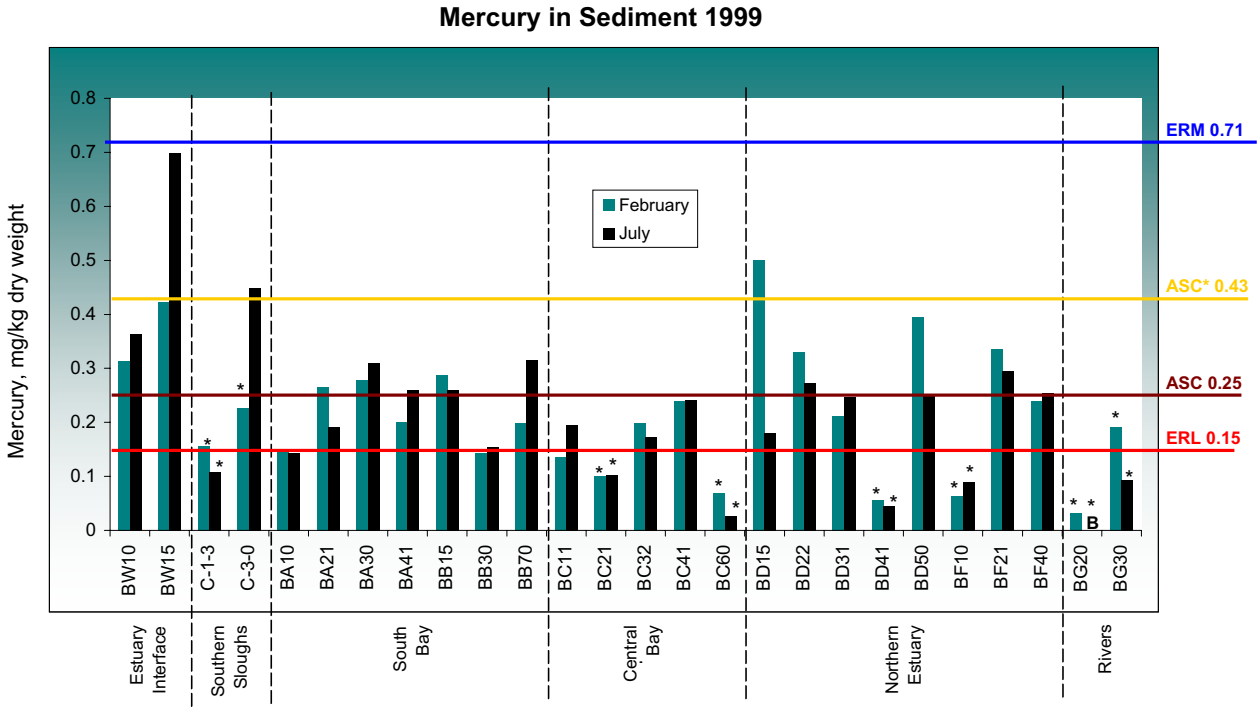

Figure 3.6. Mercury (Hg) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. **B** indicates blank contamination. Mercury concentrations ranged from 0.03 to 0.70 ppm. The highest concentration was sampled at Guadalupe River (BW15) and the lowest at Red Rock (BC60), both in July. Average concentrations were highest (0.53 ppm) in the Estuary Interface and lowest (0.09 ppm) in the Rivers, both in July.

Source Data: see Data Table 12

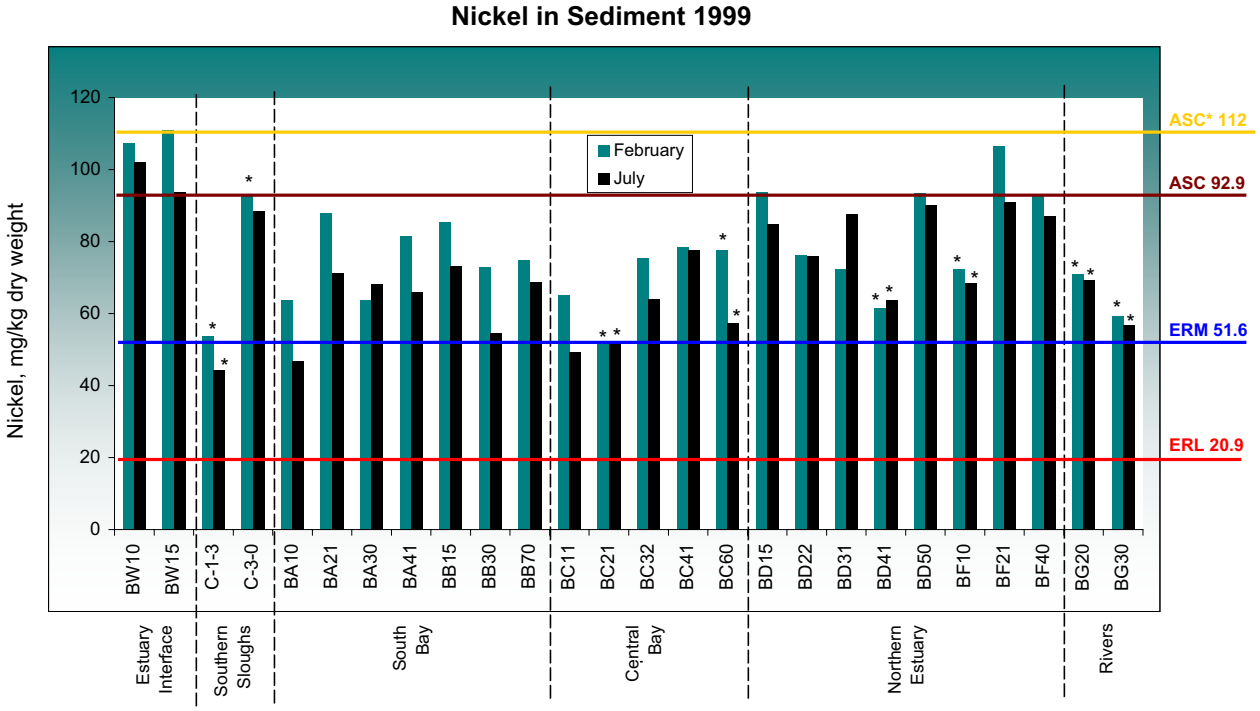

Figure 3.7. Nickel (Ni) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Nickel concentrations ranged from 44.3 to 111 ppm. The highest concentration was sampled at Guadalupe River (BW15) in February and the lowest at Sunnyvale (C-1-3) in July. Average concentrations were highest (109.2 ppm) in the Estuary Interface in February and lowest (59.9 ppm) in the Central Bay in July.

Source Data: see Data Table 12

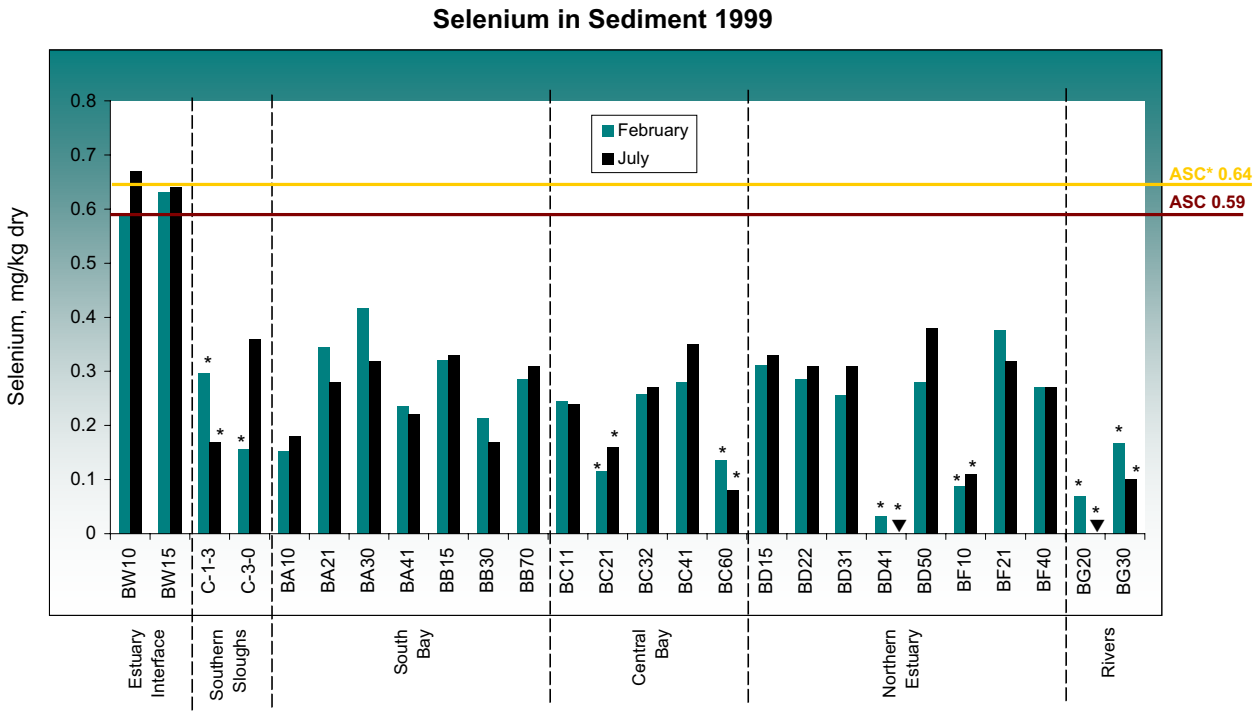

Figure 3.8. Selenium (Se) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Selenium concentrations ranged from not detected (▼) to 0.67 ppm. The highest concentration was sampled at Standish Dam (BW10) in July. Average concentrations were highest (0.65 ppm) in the Estuary Interface and lowest (0.06 ppm) in the Rivers, both in July. There are no ERM and ERL values for selenium.

Source Data: see Data Table 12

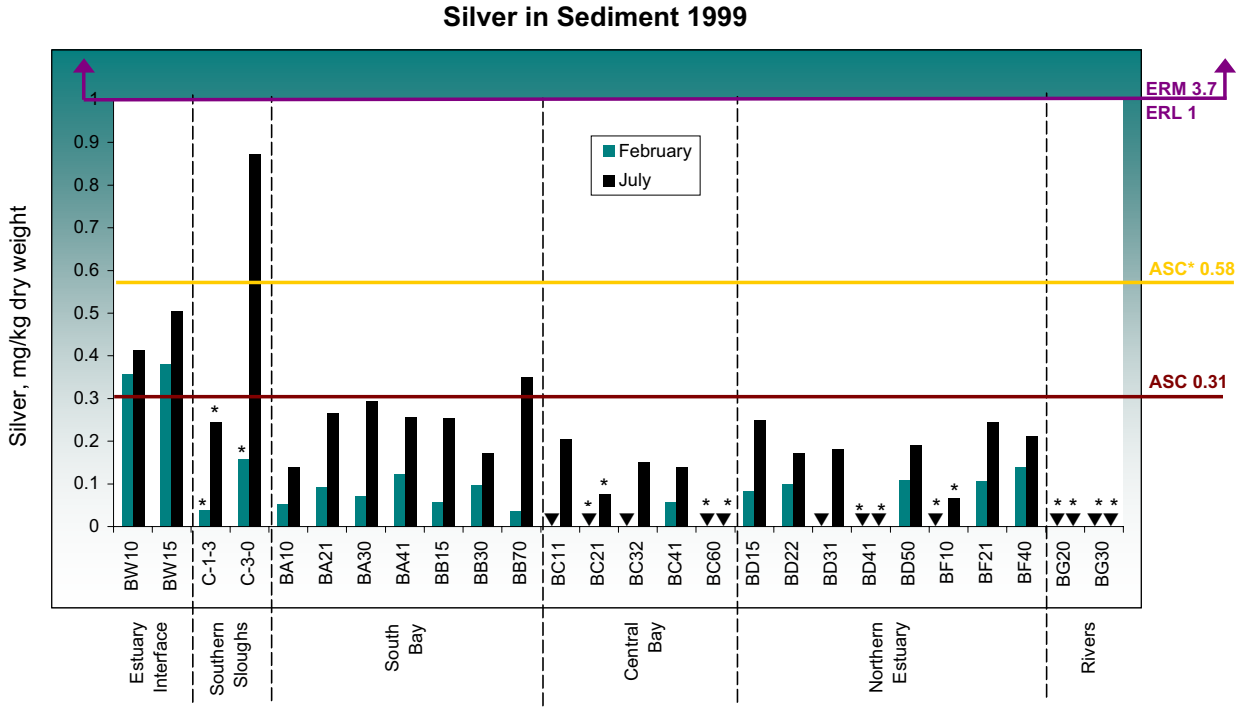

Figure 3.9. Silver (Ag) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Silver concentrations ranged from not detected (▼) to 0.87 ppm. The highest concentration was sampled at San Jose (C-3-0) in July. Average concentrations were highest (0.56 ppm) in the Southern Sloughs in July, and lowest (0.01) in the Central Bay in February.

Source Data: see Data Table 12

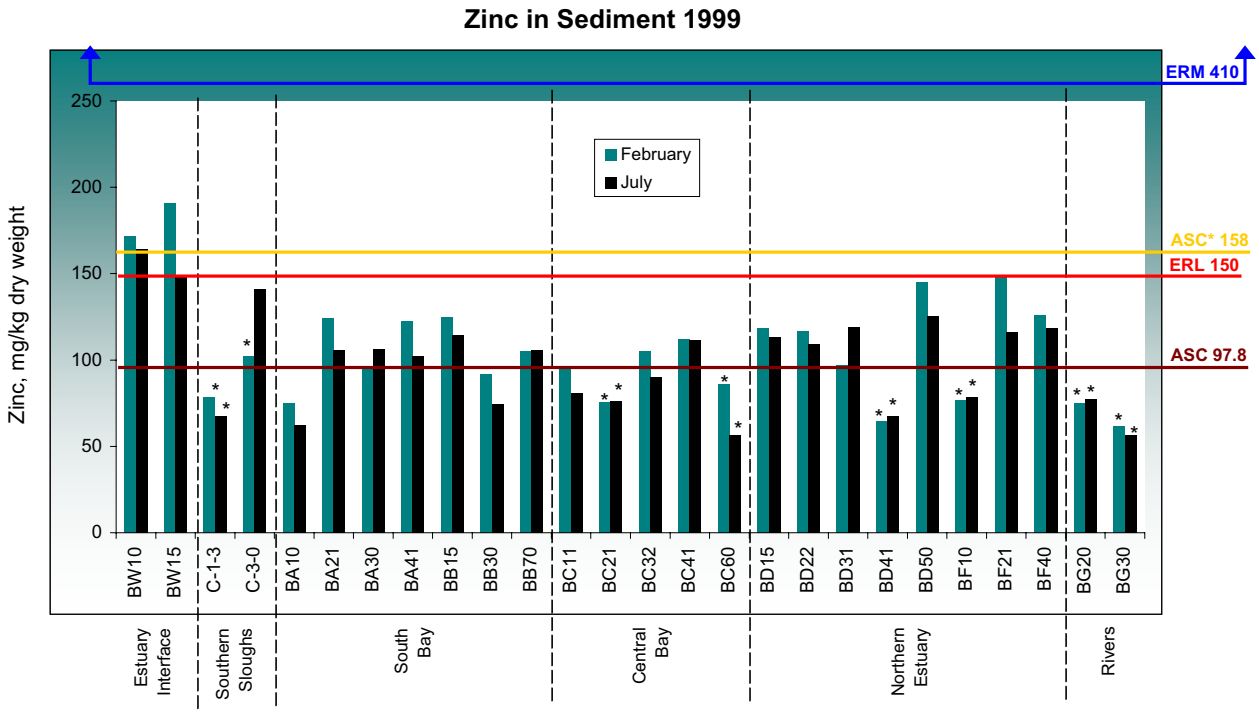

Figure 3.10. Zinc (Zn) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Zinc concentrations ranged from 56.2 to 191 ppm. The highest concentration was sampled at Guadalupe River (BW15) in February and the lowest at Red Rock (BC60) in July. Average concentrations were highest (181.3 ppm) in the Estuary Interface in February and lowest (66.7 ppm) in the Rivers in July.

Source Data: see Data Table 12

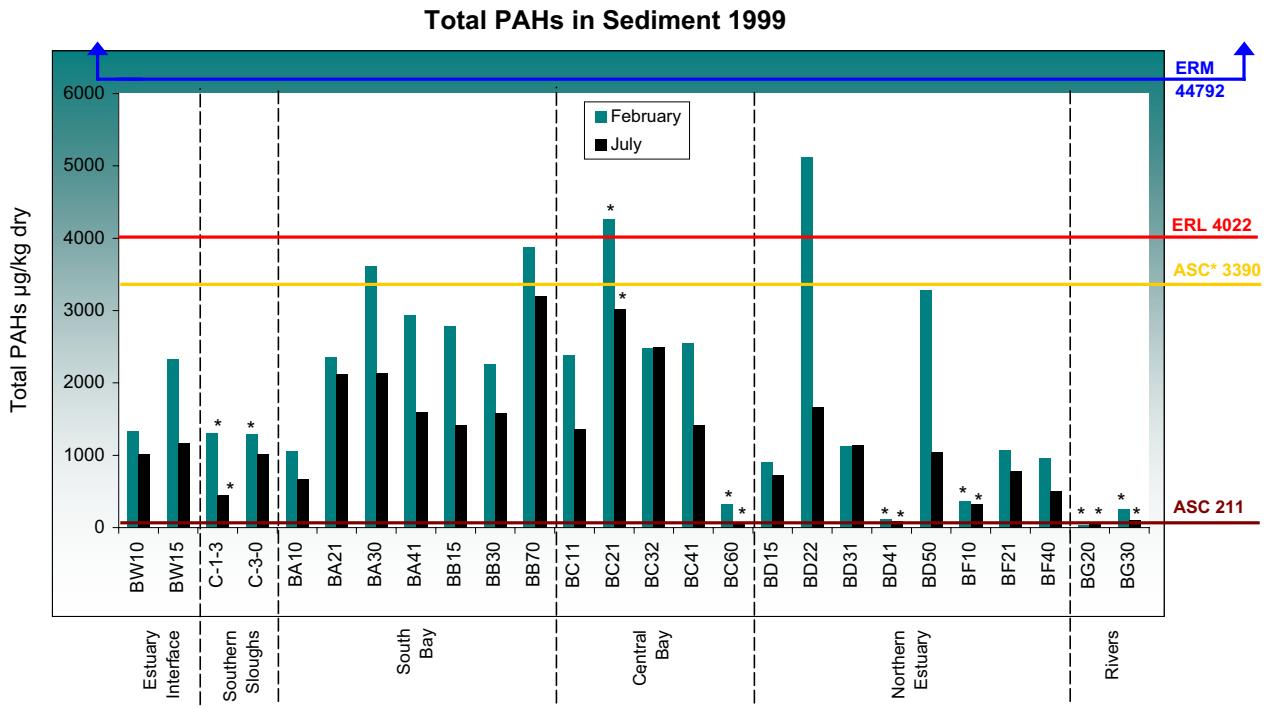

Figure 3.11. Total PAH concentrations in sediments in µg/kg, dry weight at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. Total PAH concentrations ranged between 36.85 and 5116.24 µg/kg. The highest concentration was sampled at San Pablo Bay (BD22) and the lowest at Sacramento River (BG20), both in February. Average concentrations were highest (2695.5 µg/kg) in the South Bay in February, and lowest (83.8 µg/kg) in the Rivers in July.

Source Data: see Data Table 13

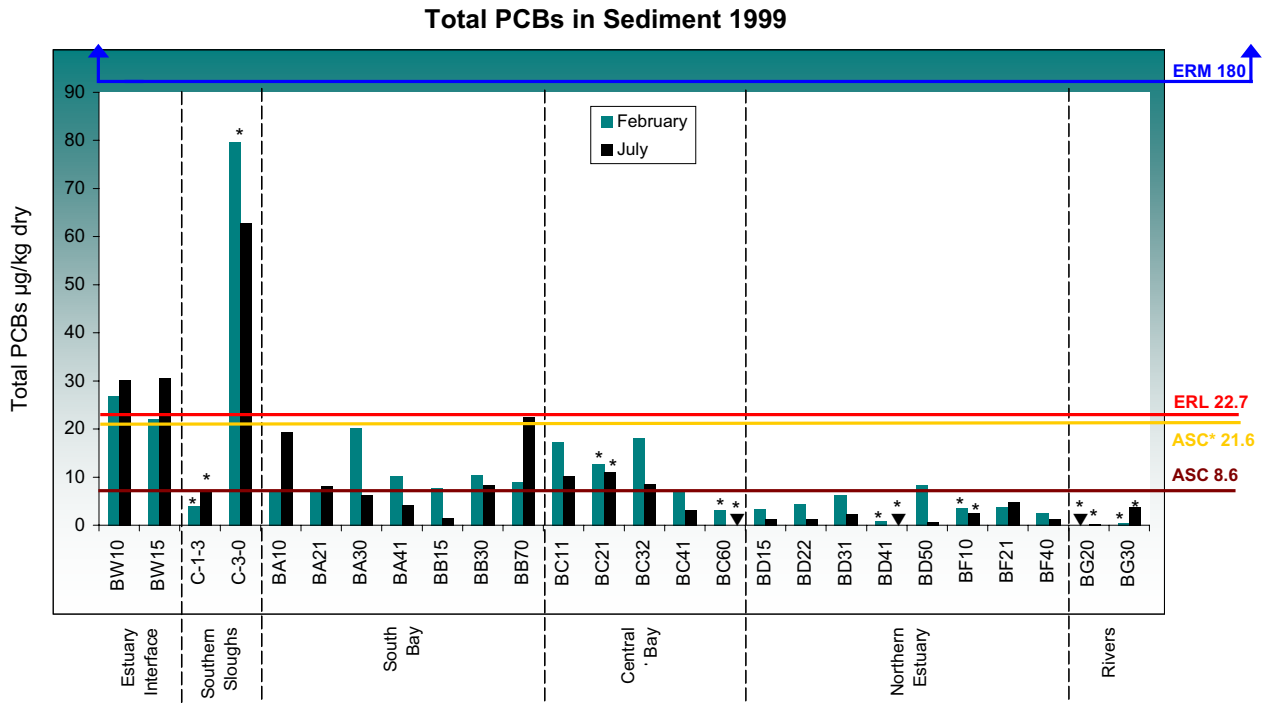

Figure 3.12. Total PCB concentrations in sediments in µg/kg, dry weight at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Total PCB concentrations ranged between not detected (▼) and 79.56 µg/kg. The highest concentration was sampled at San Jose (C-3-0) in February. Average concentrations were highest (41.77 µg/kg) in the Southern Sloughs and lowest (0.45 µg/kg) in the Rivers, both in February.

Source Data: see Data Table 14

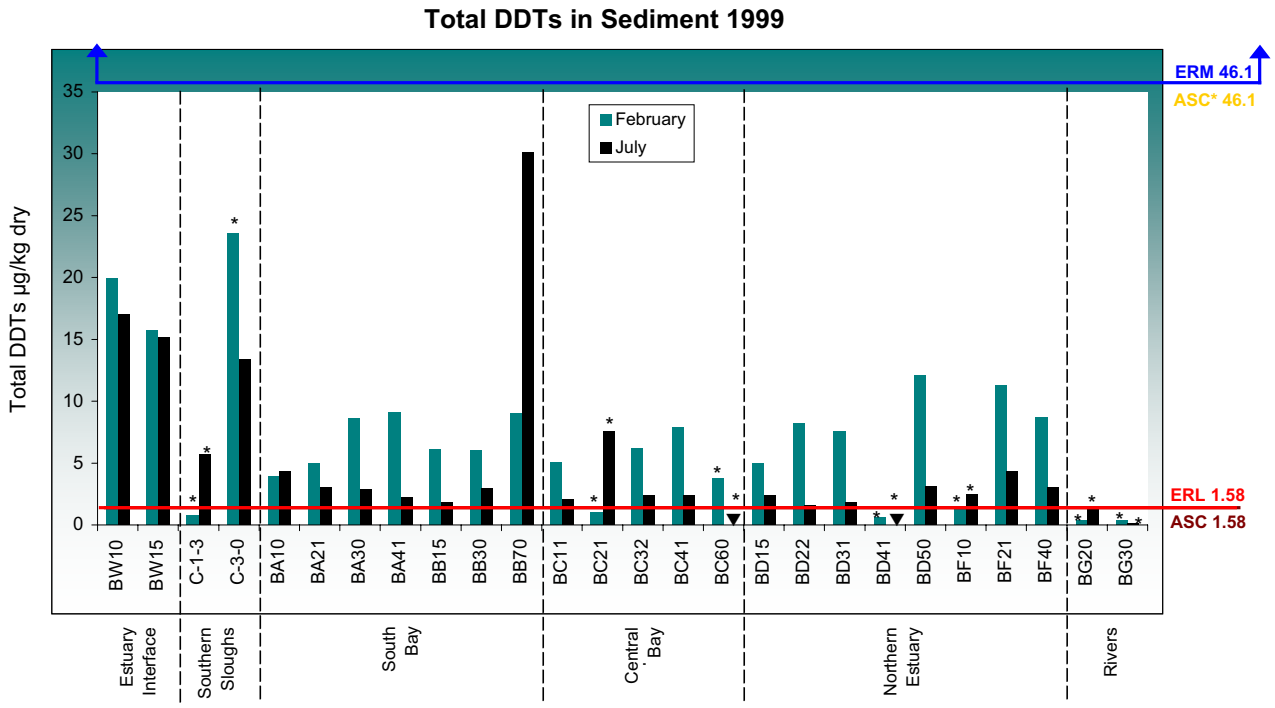

Figure 3.13. Total DDT concentrations in sediments in µg/kg, dry weight at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Total DDT concentrations ranged between not detected (▼) and 30.15 µg/kg. The highest concentration was sampled at Alameda (BB70) in July. Average concentrations were highest (17.84 µg/kg) in the Estuary Interface and lowest (0.39 µg/kg) in the Rivers, both in February.

Source Data: see Data Table 15

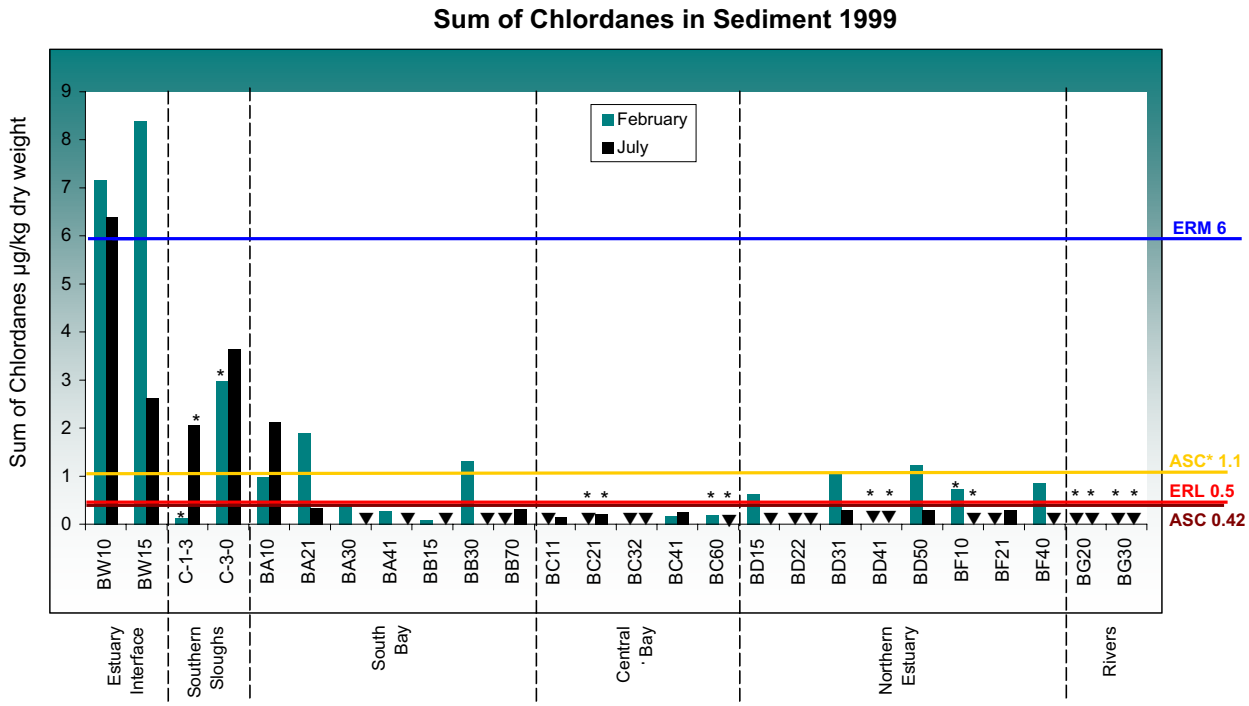

Figure 3.14. Sum of chlordane concentrations in sediments in µg/kg, dry weight at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Chlordane concentrations ranged between not detected (▼) and 8.38 µg/kg. The highest concentration was sampled at Guadalupe River (BW15) in February. Average concentrations were highest (7.77 µg/kg) in the Estuary Interface and lowest (0.18 µg/kg) in the Central Bay, both in February.

Source Data: see Data Table 15

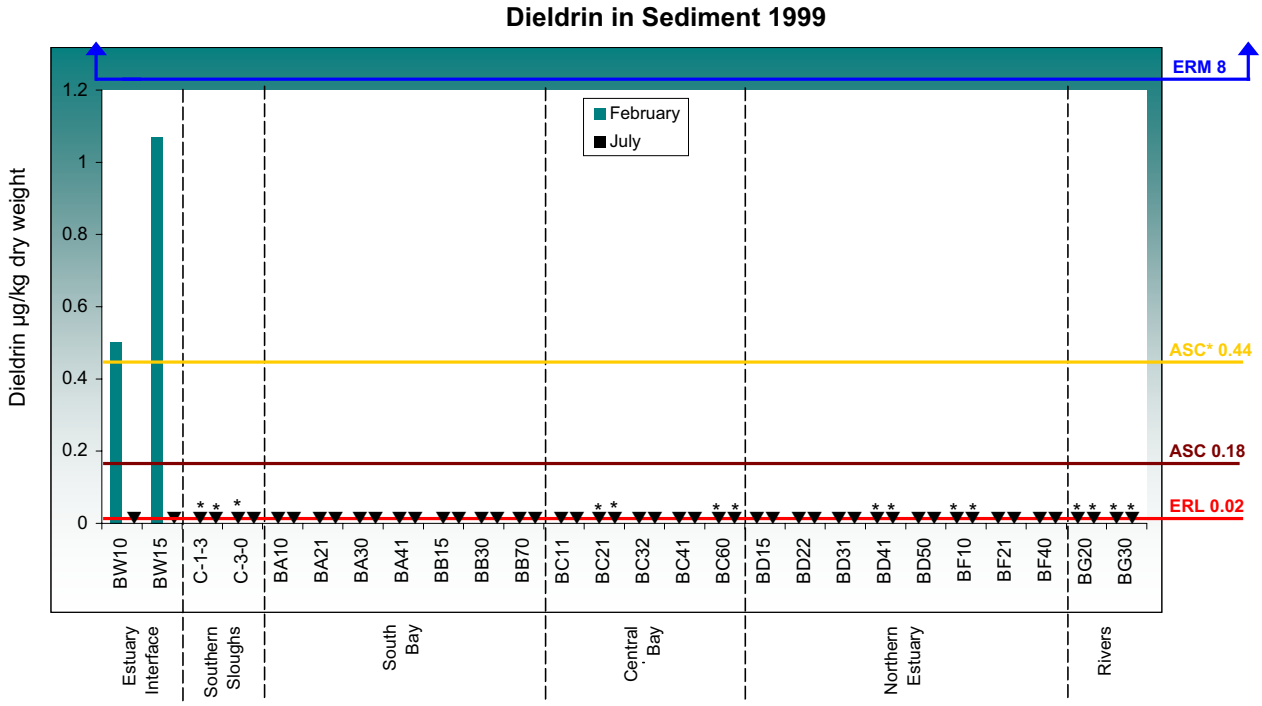

Figure 3.15. Dieldrin concentrations in sediments in µg/kg, dry weight at 26 stations sampled in February and July 1999. * indicates coarse sediment stations. ▼ indicates that analyte was not detected. Dieldrin concentrations ranged between not detected (▼) and 1.07 µg/kg. The highest concentration was sampled at Guadalupe River (BW15) in February. Averages were not calculated because concentrations were below the detection limit for all but two samples.

Source Data: see Data Table 15

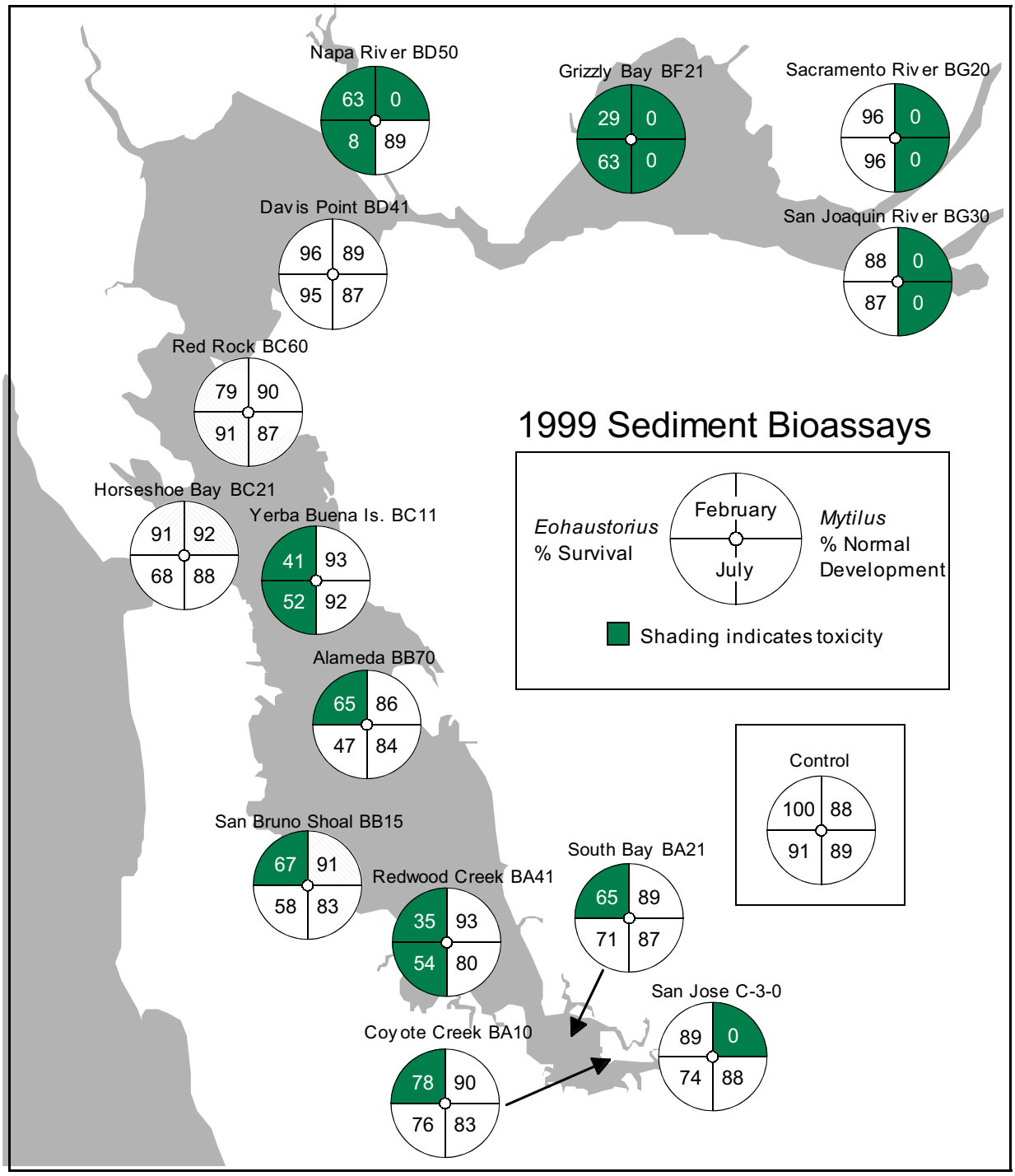

Figure 3.16. Sediment bioassay results for 1999. Sediments were not toxic (see text for definition) to either amphipods or bivalve larvae at Davis Point (BD41), Red Rock (BC60), and Horseshoe Bay (BC21). Amphipod toxicity was observed in both sampling periods at Grizzly Bay (BF21), Napa River (BD50), Yerba Buena Island (BC11), and Redwood Creek (BA41), and only in the wet-sampling period (February) at Alameda (BB70), San Bruno Shoal (BB15), South Bay (BA21), and Coyote Creek (BA10). Sediments at the River stations (BG20, BG30) and San Jose (C-3-0) were not toxic to amphipods. Sediment elutriates were toxic to larval mussels during both sampling periods at Sacramento River (BG20), San Joaquin River (BG30), and Grizzly Bay (BF21), and only in the wet-sampling period (February) at Napa River (BD50) and San Jose (C-3-0). They were not toxic to the larvae at the remaining stations. Sediment conditions that could have influenced toxicity are considered in the *Discussion*.

Source Data: see Data Table 16

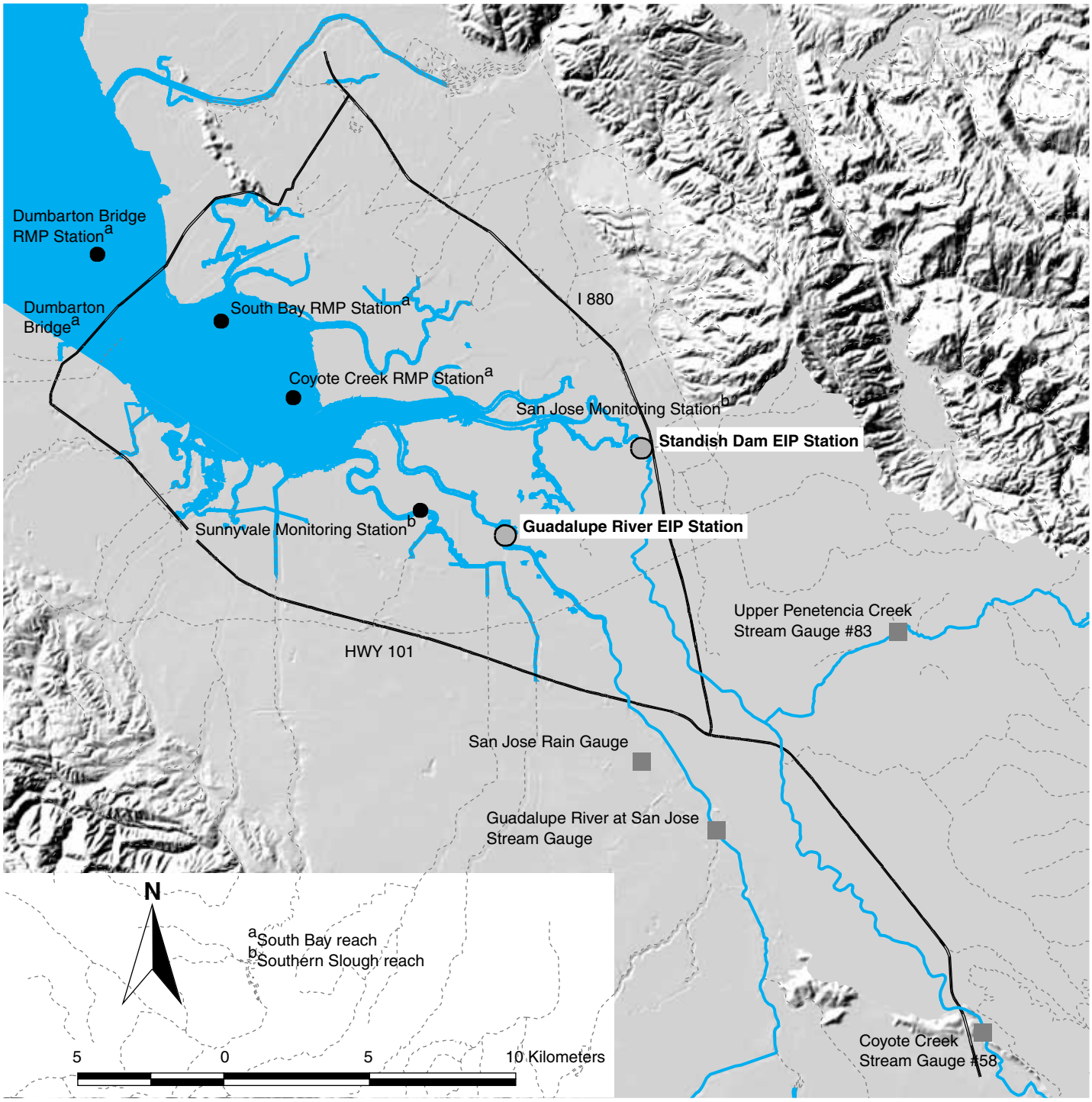

Figure 3.17. Map of the Estuary Interface Pilot Study Stations

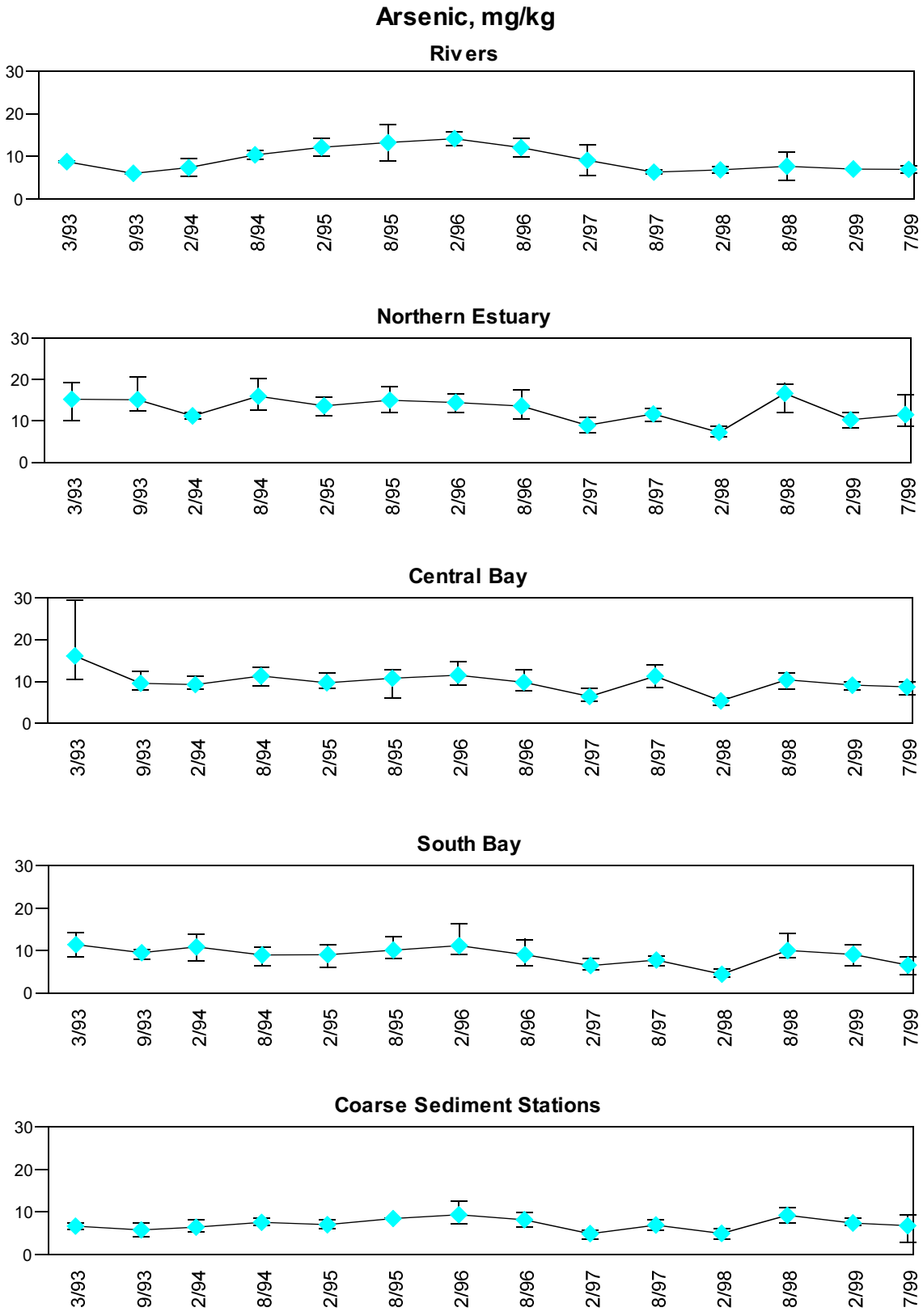

Figure 3.18. Average arsenic concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination, arsenic data for 1999 is incomplete as follows: February data in the South Bay and Coarse Sediment Stations is missing; February Rivers arsenic average consists of only one sample.

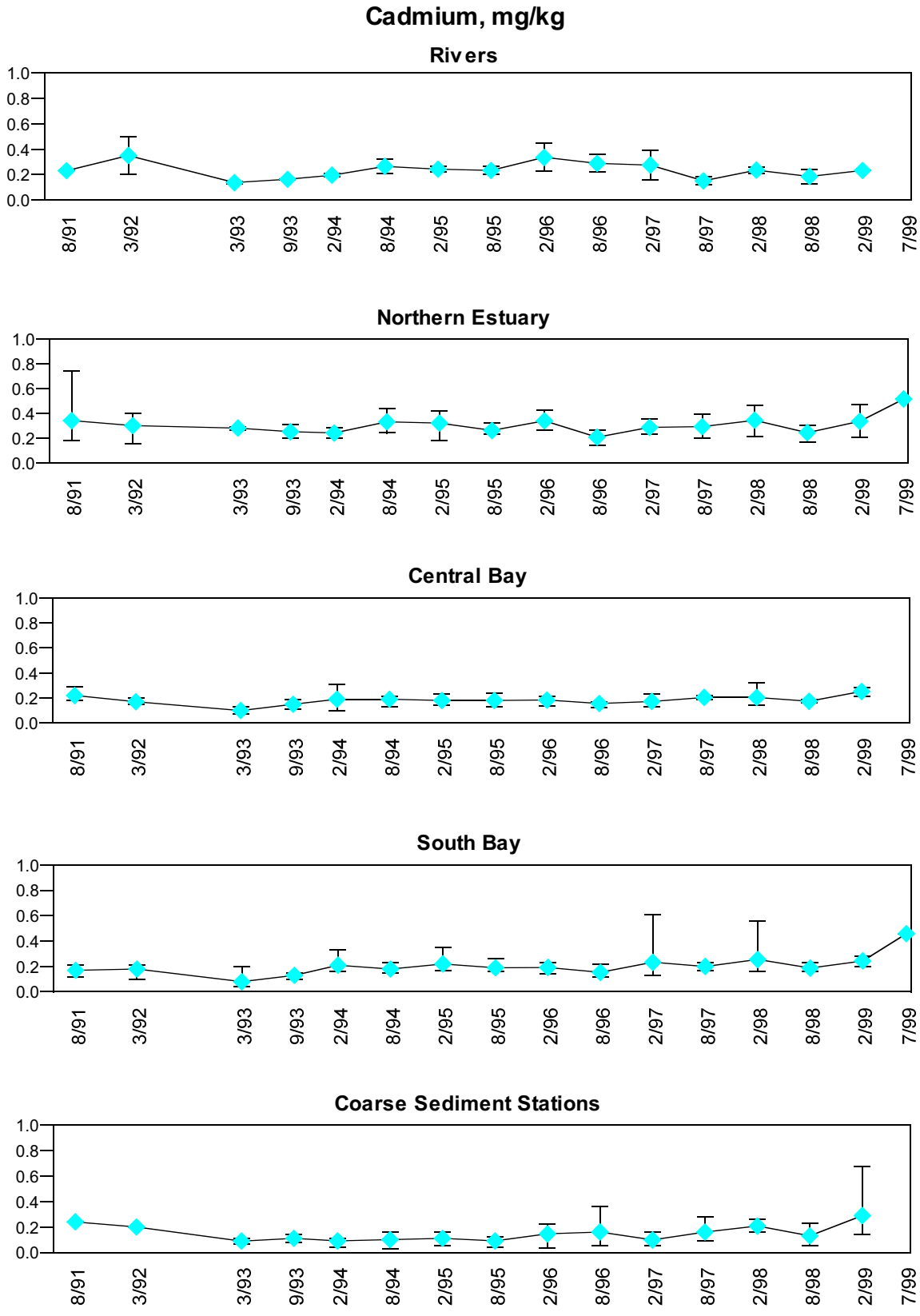

Figure 3.19. Average cadmium concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination there is no data for cadmium in July 1999 for the Rivers, Central Bay and Coarse Sediment Stations; and July 1999 Northern Estuary and South Bay averages consist of only one sample.

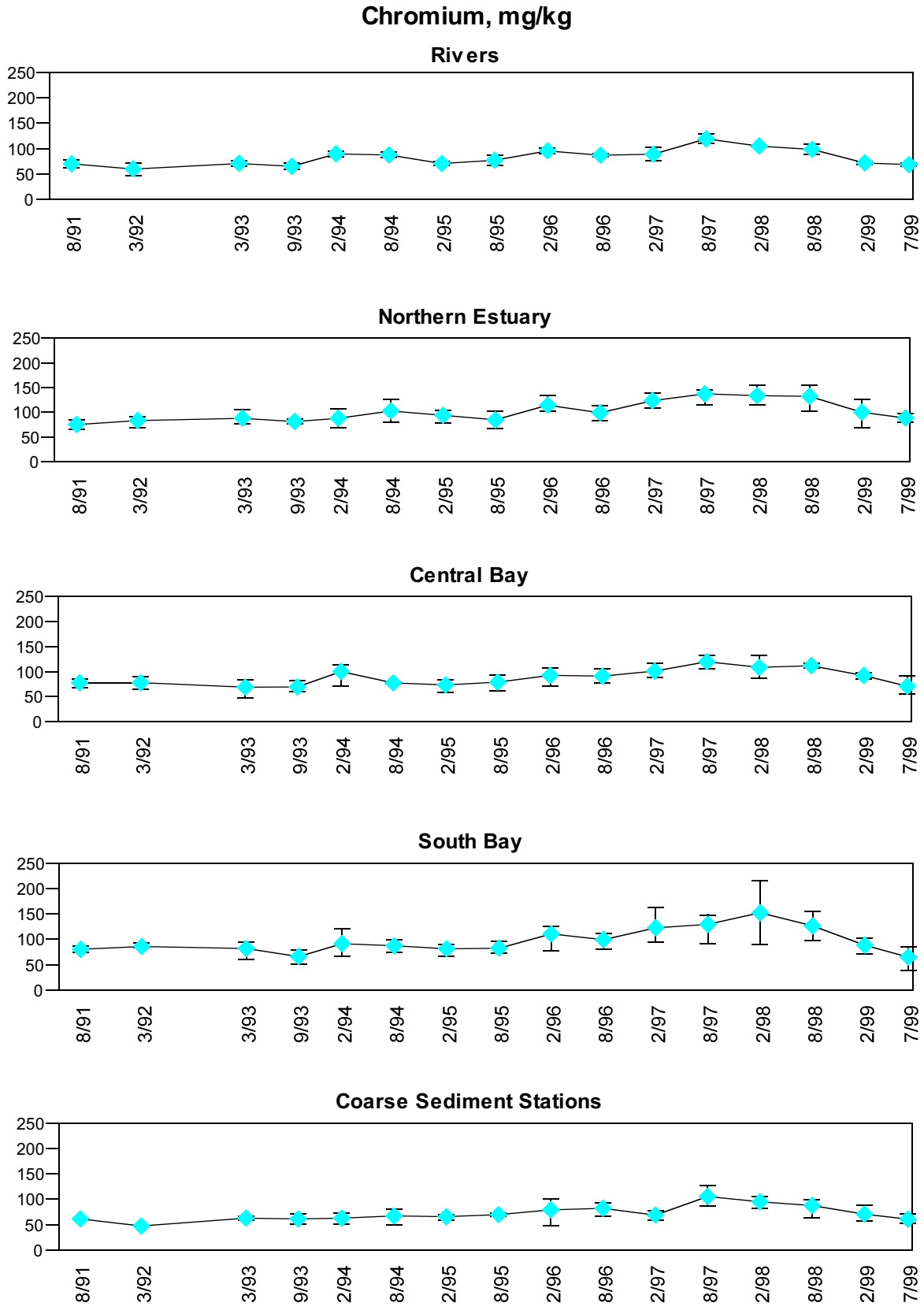

Figure 3.20. Average chromium concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations.

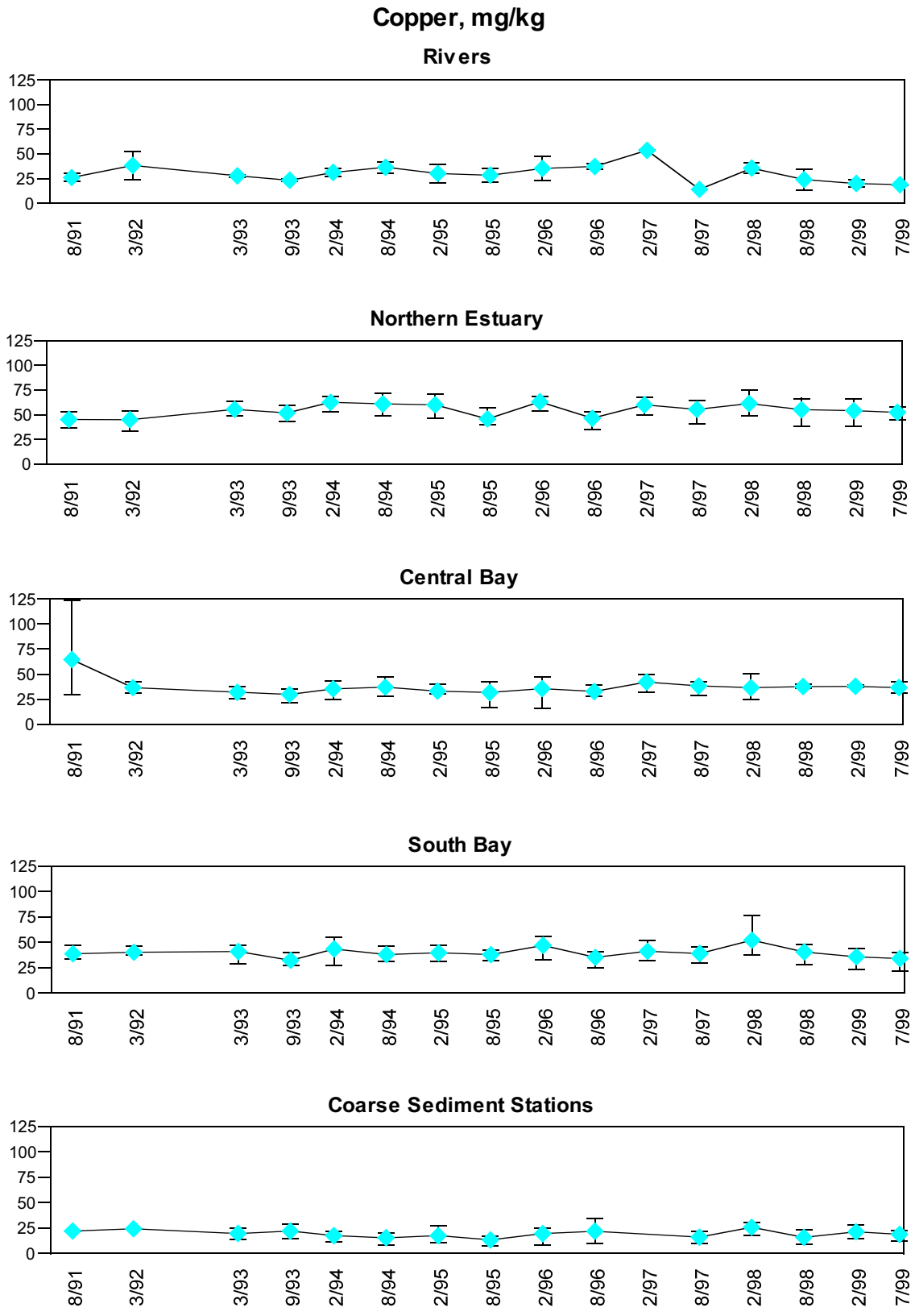

Figure 3.21. Average copper concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to contaminated blanks, copper data for 1997 are incomplete as follows: February data in the Rivers and Northern Estuary are missing; February Central Bay copper average consists of only one sample; Februray and August South Bay data are incomplete; and February Coarse Sediment Station avergae consists of two samples.

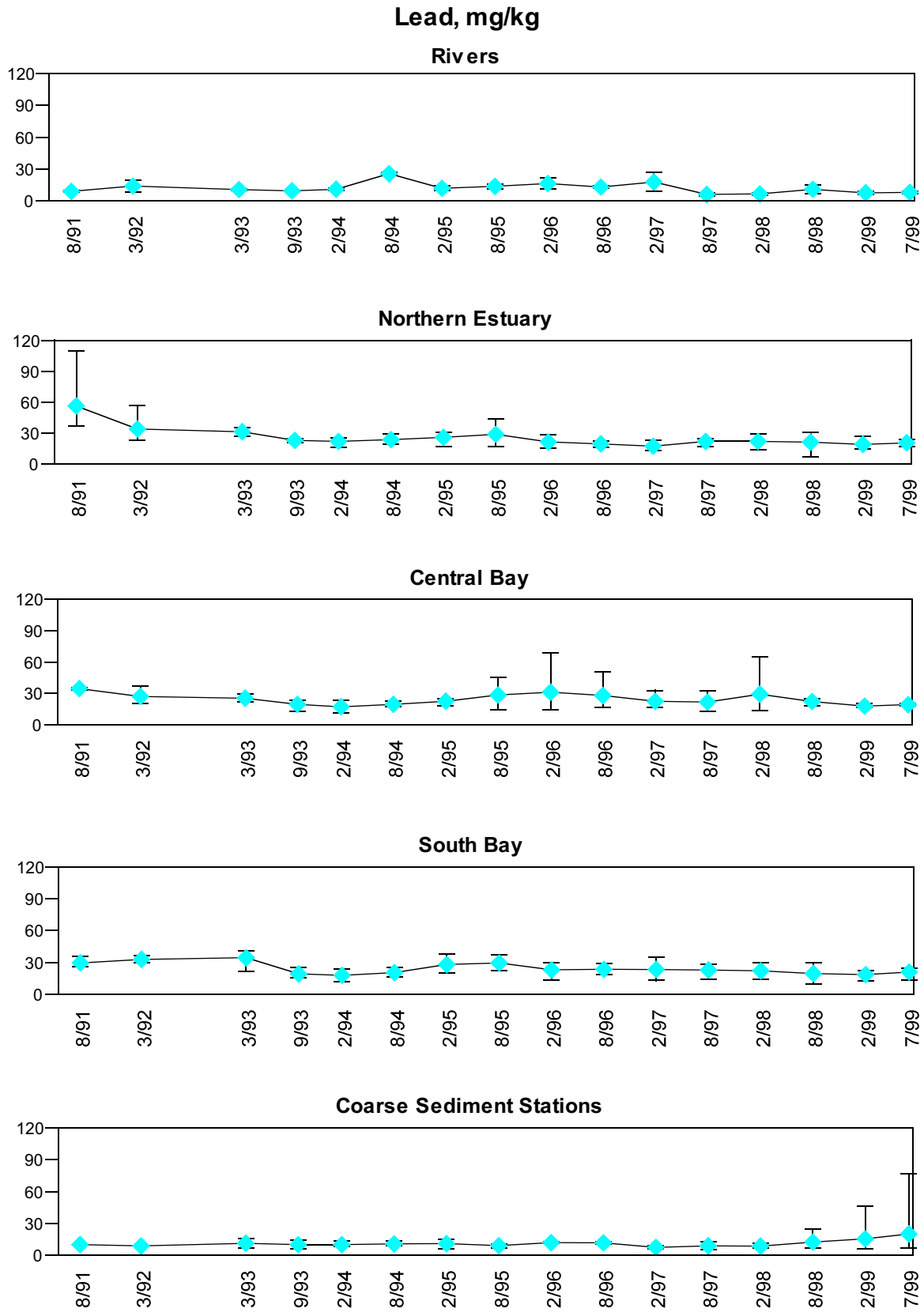

Figure 3.22. Average lead concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations.

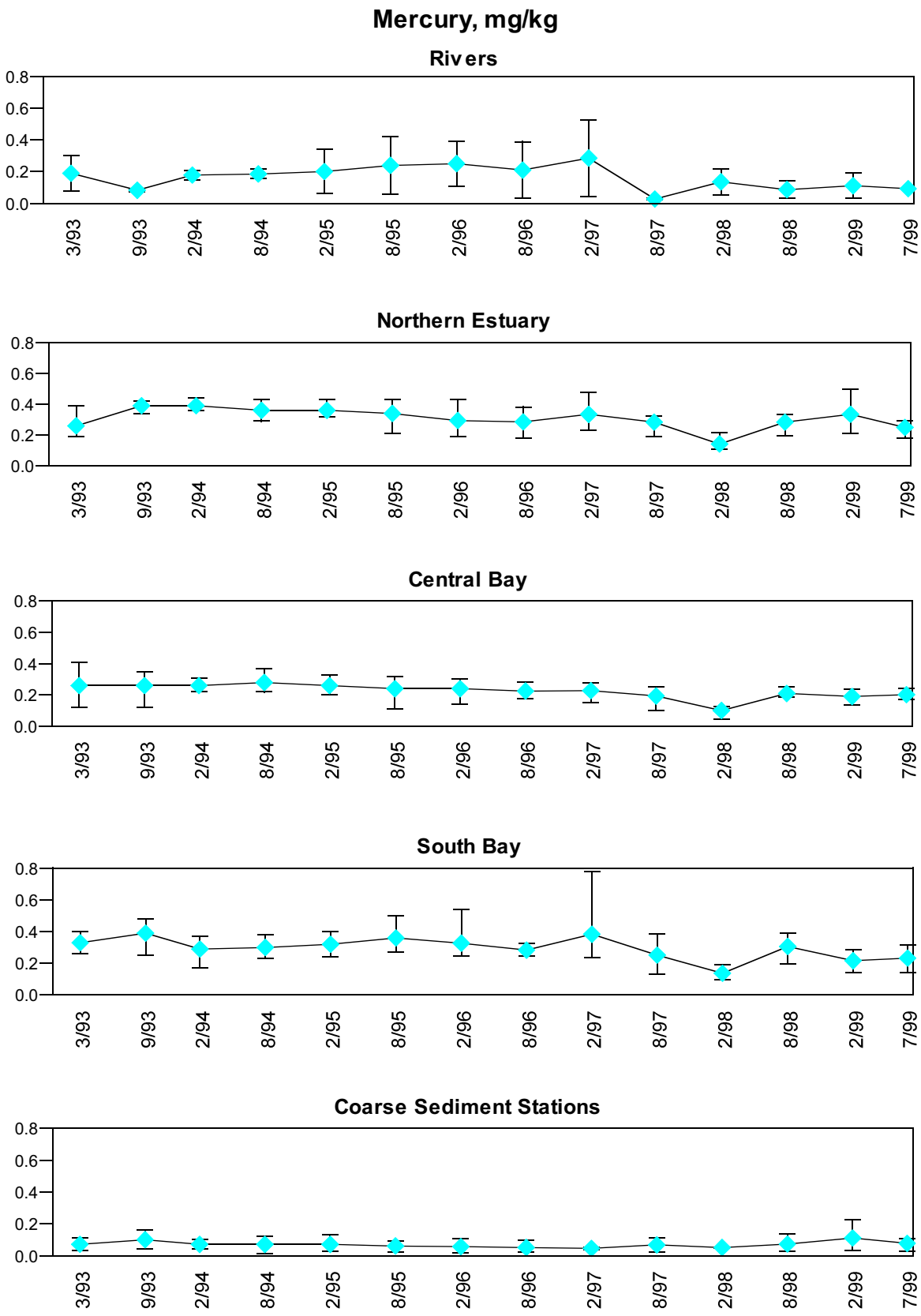

Figure 3.23. Average mercury concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination, mercury data for 1999 is incomplete as follows: July data for Coarse Sediment Stations is incomplete; July Rivers mercury average consists of only one sample.

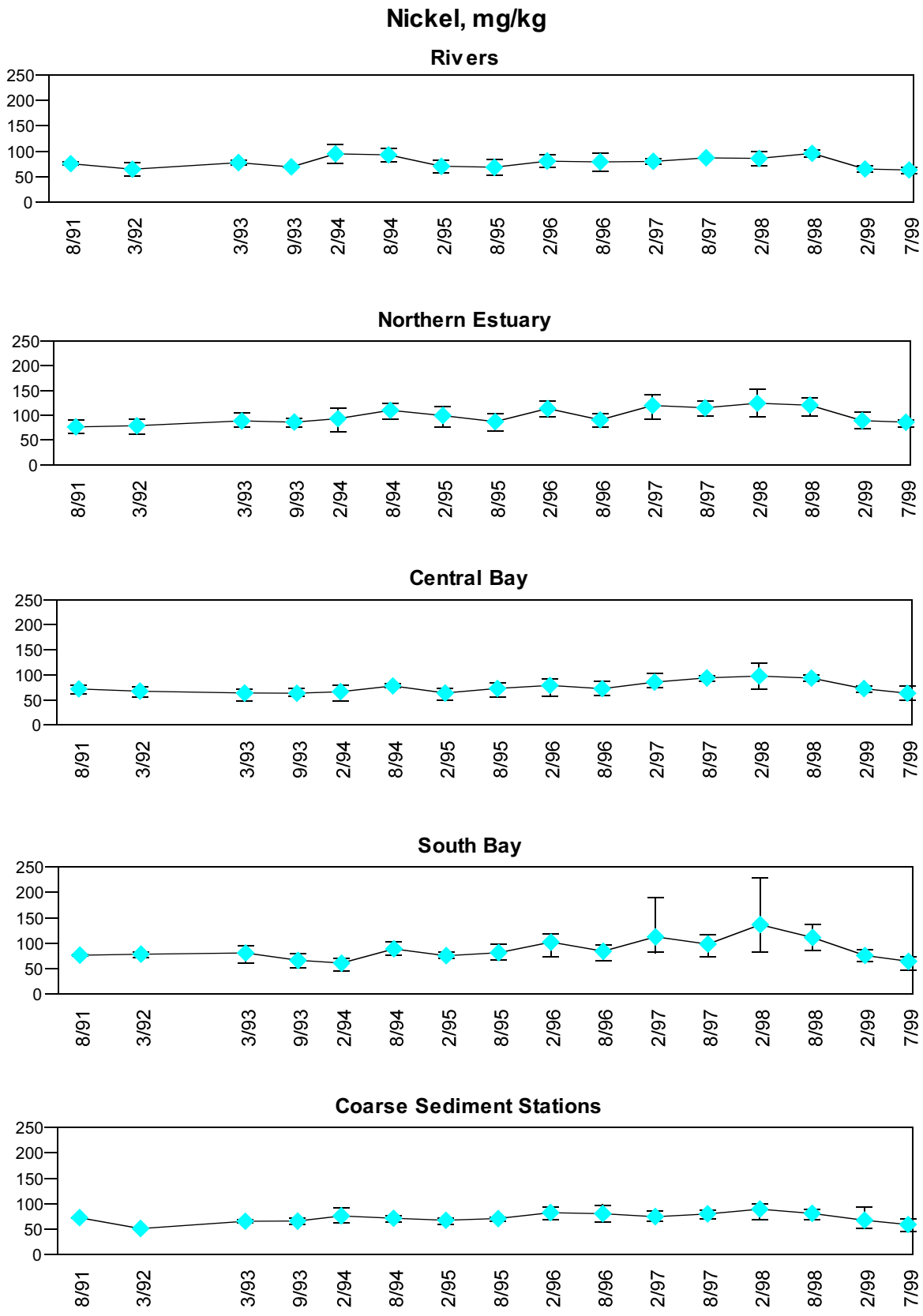

Figure 3.24. Average nickel concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations.

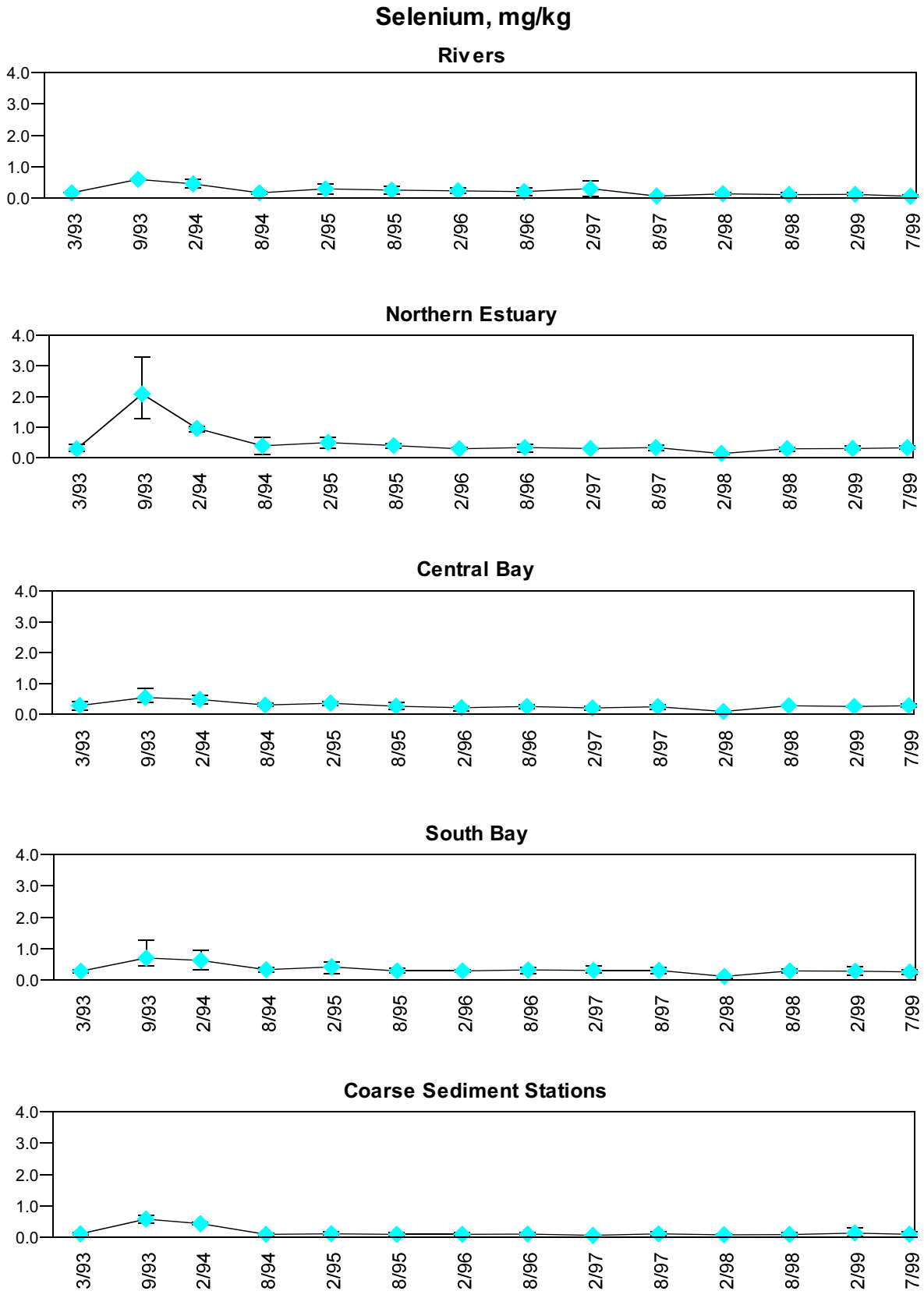

Figure 3.25. Average selenium concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations.

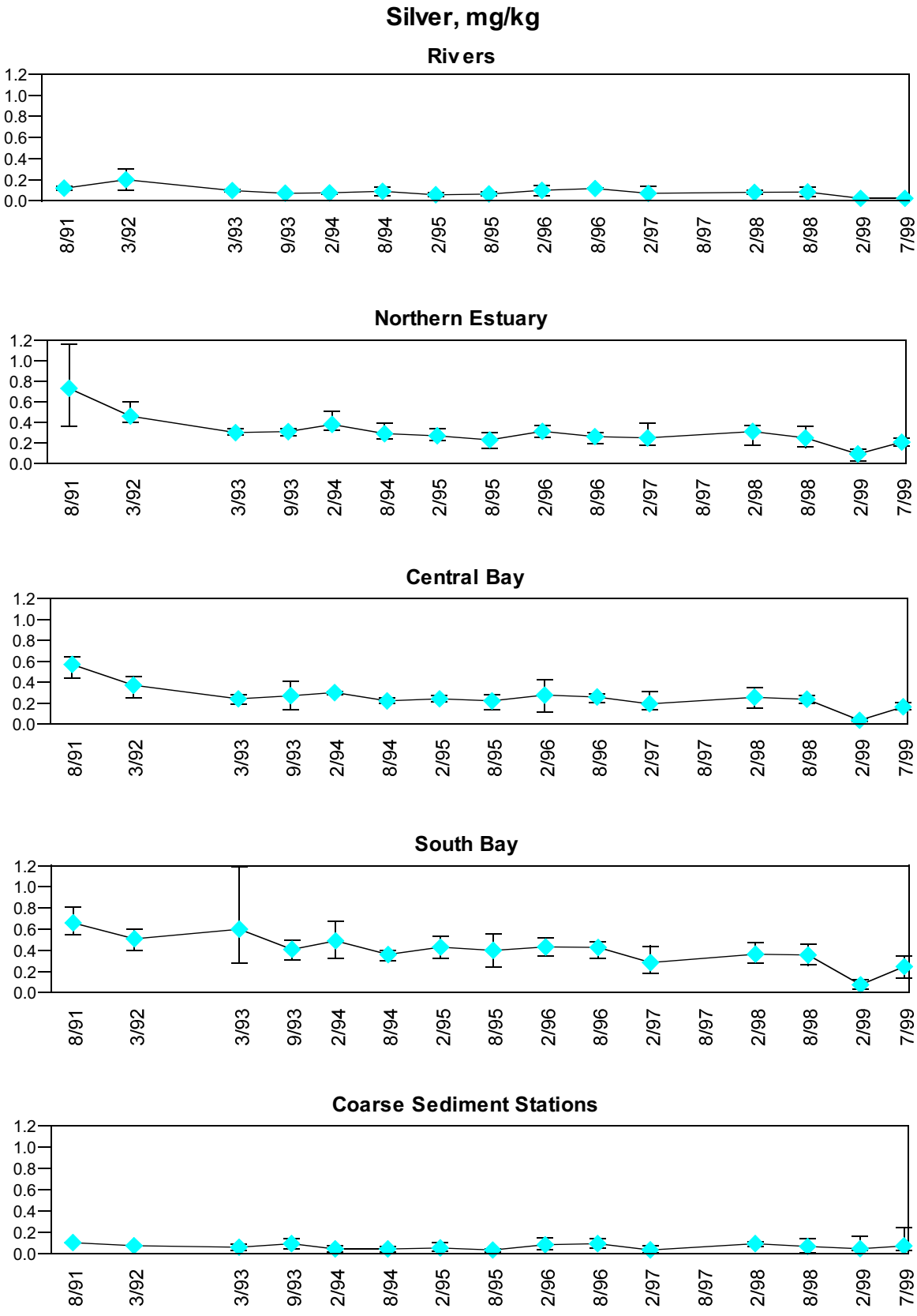

Figure 3.26. Average silver concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. There is no data for silver in August 1997 because the blanks were contaminated.

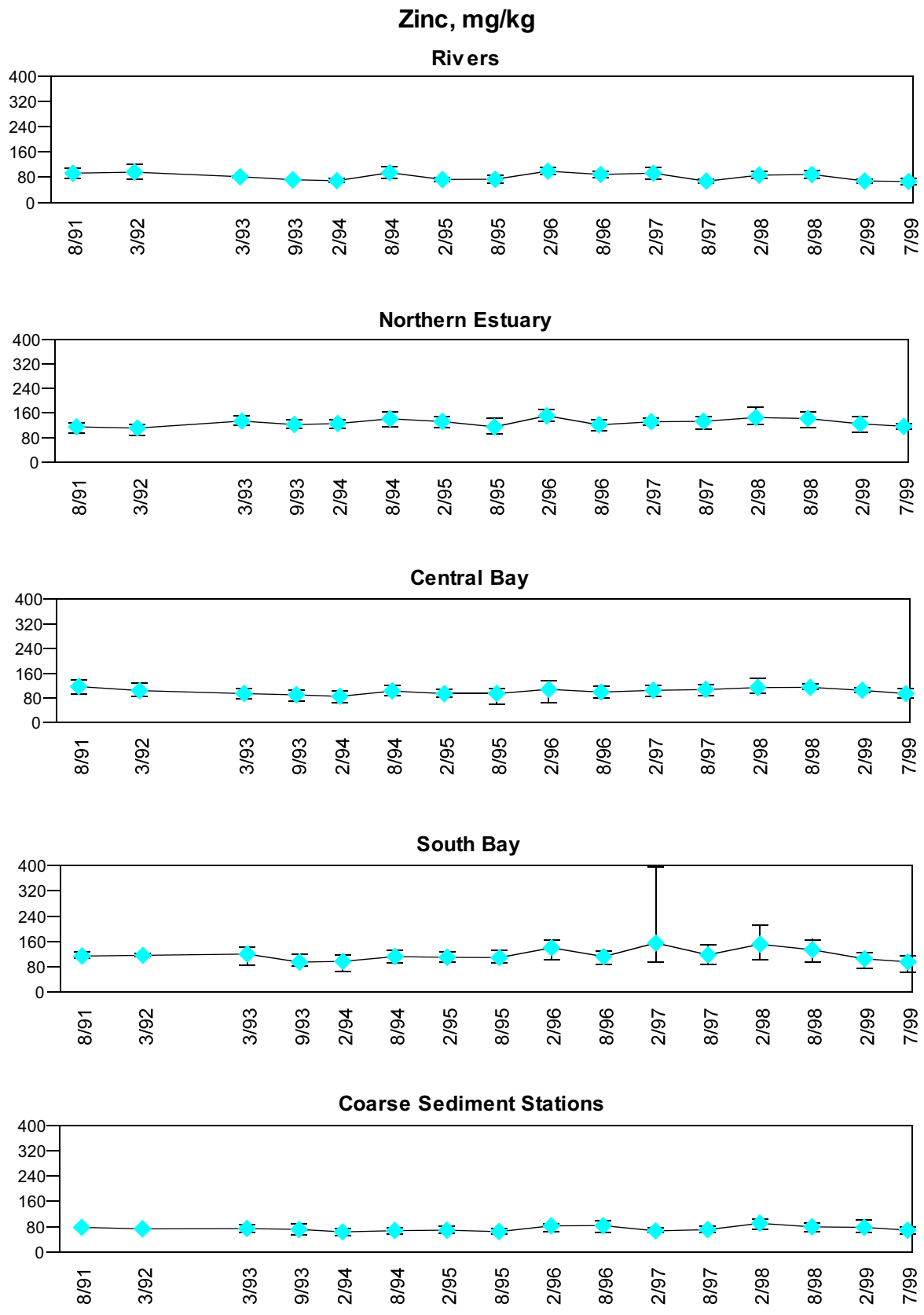

Figure 3.27. Average zinc concentrations in sediments for each Estuary reach from 1991–1999. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations.

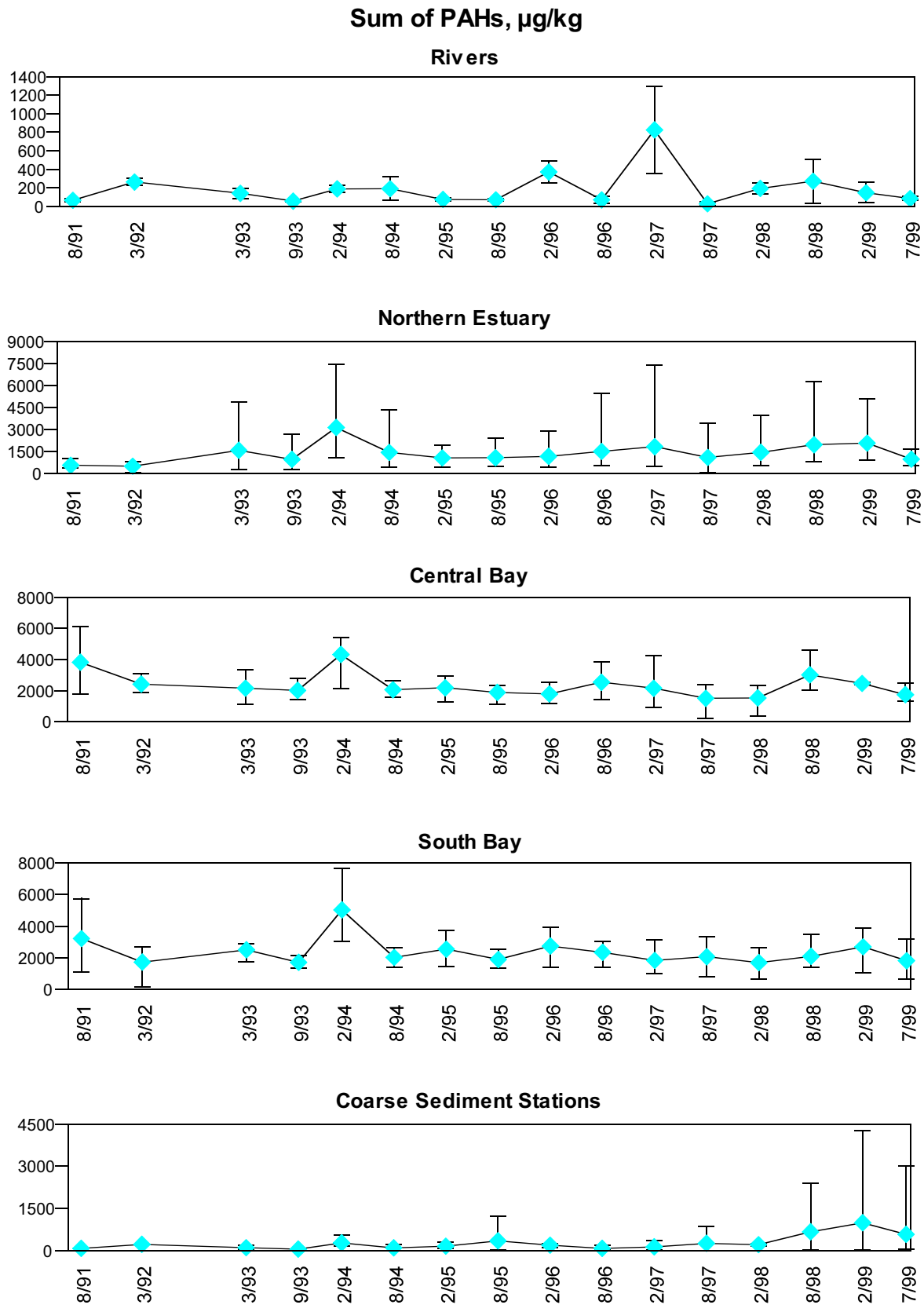

Figure 3.28. Plots of average PAH concentrations in sediments for each Estuary reach from 1991–1999. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons.

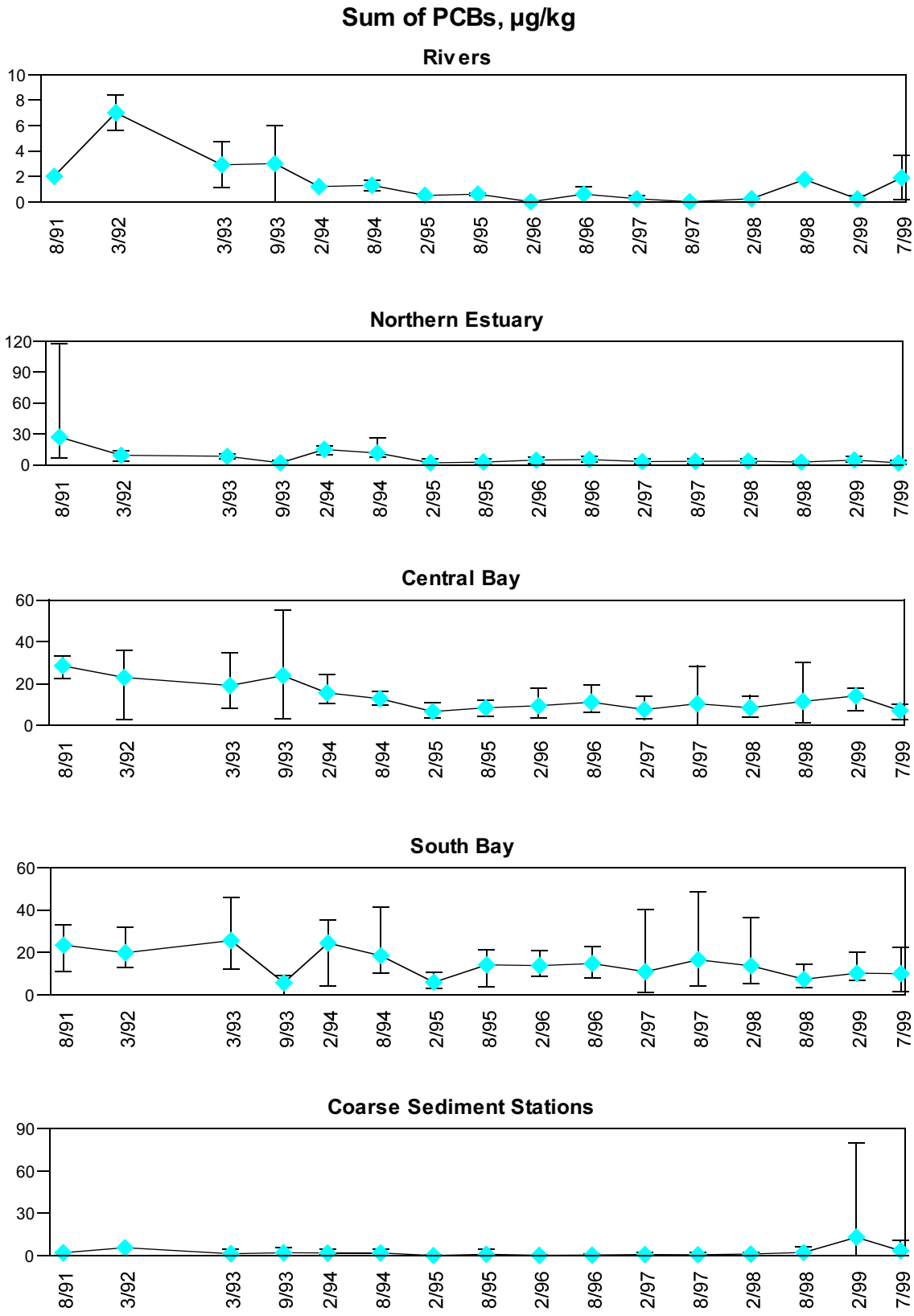

Figure 3.29. Plots of average PCB concentrations in sediments for each Estuary reach from 1991–1999. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons.

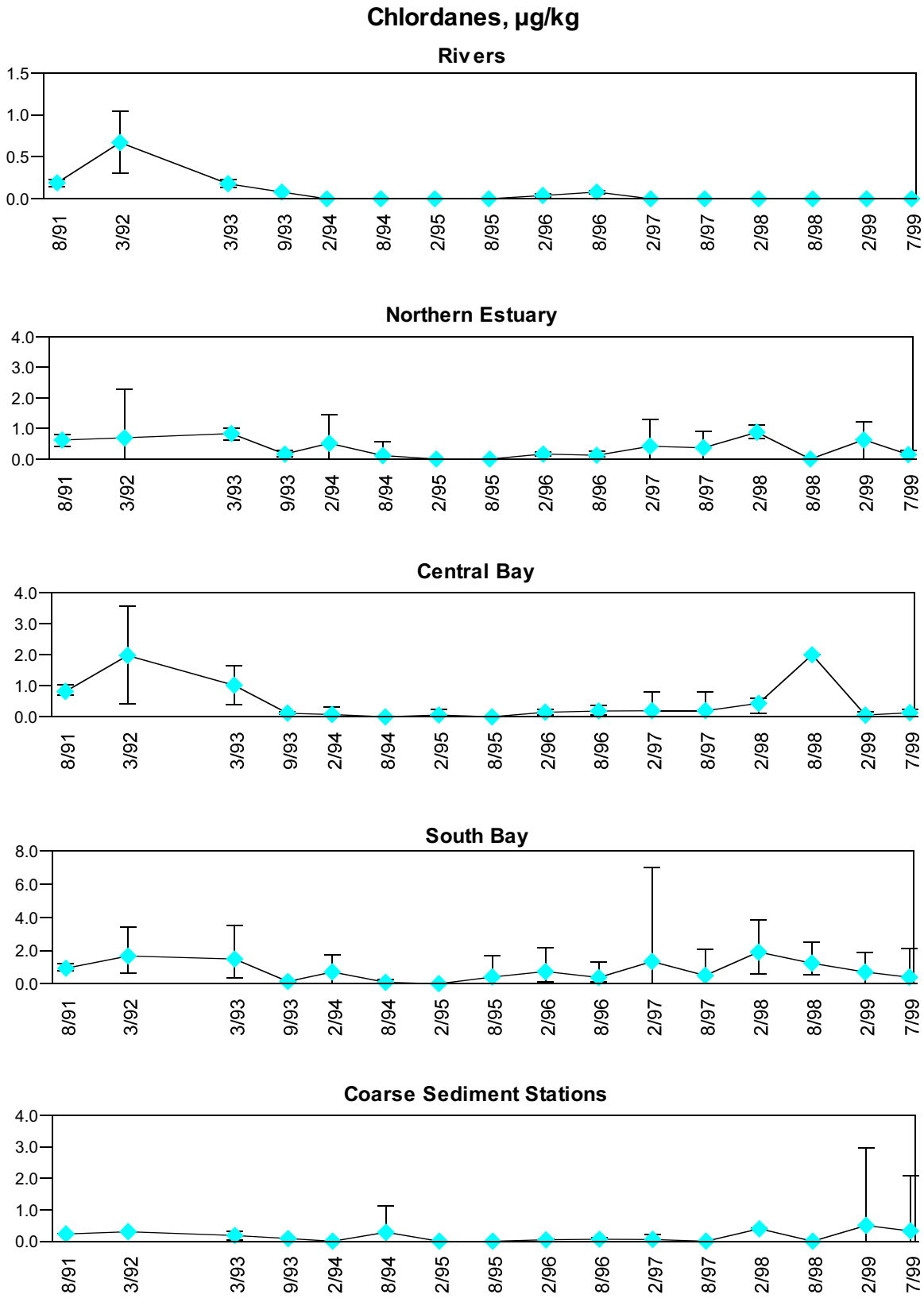

Figure 3.30. Plots of average chlordane concentrations in sediments for each Estuary reach from 1991–1999. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. Chlordanes were not detected for the following reaches and seasons: Rivers: February and August 1998, and February and July 1999; Northern Estuary: August 1998; Coarse Sediment Stations: August 1998.

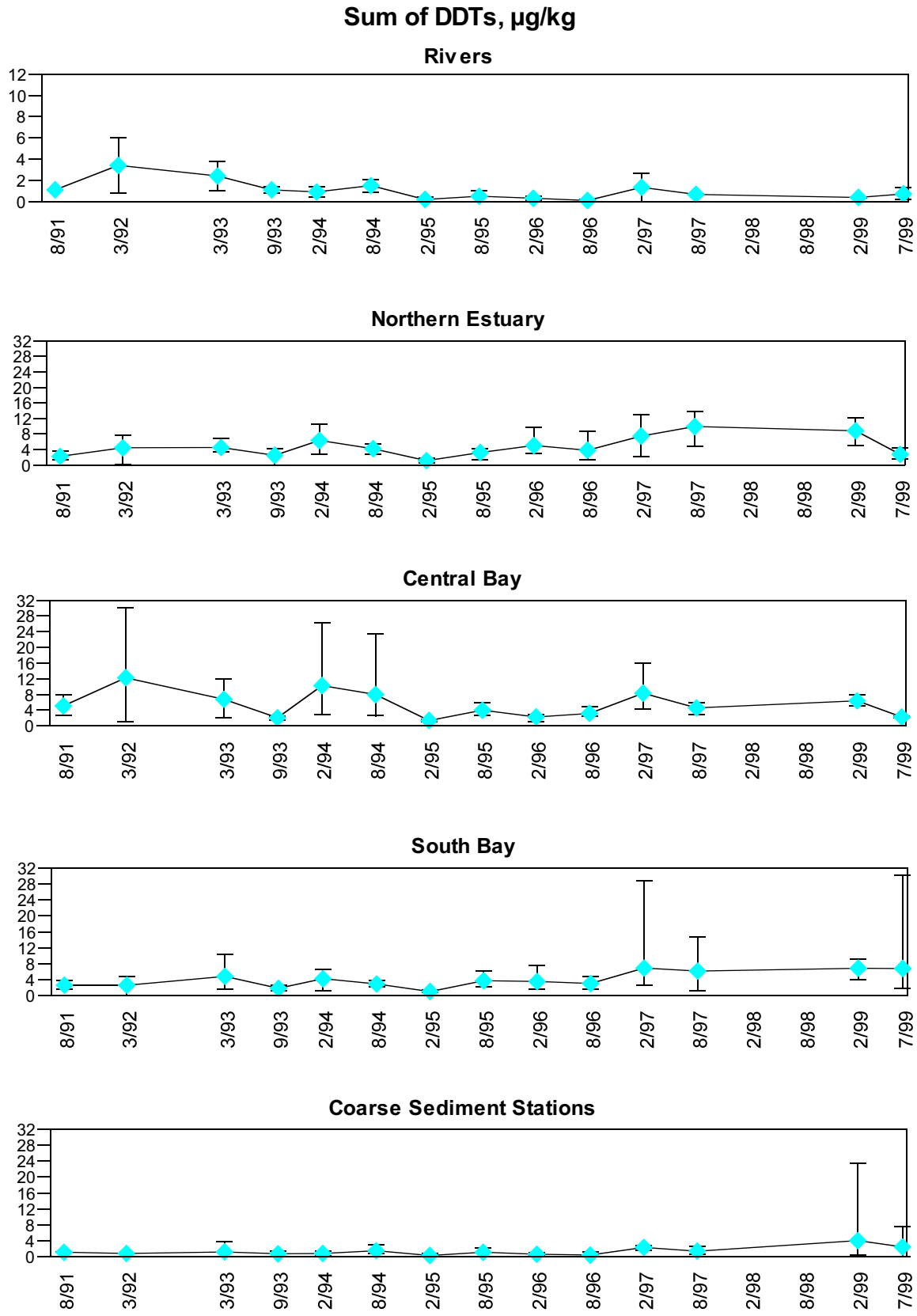

Figure 3.31. Plots of average DDT concentrations in sediments for each Estuary reach from 1991–1999. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. There was no 1998 DDT data to plot due to matrix interference.

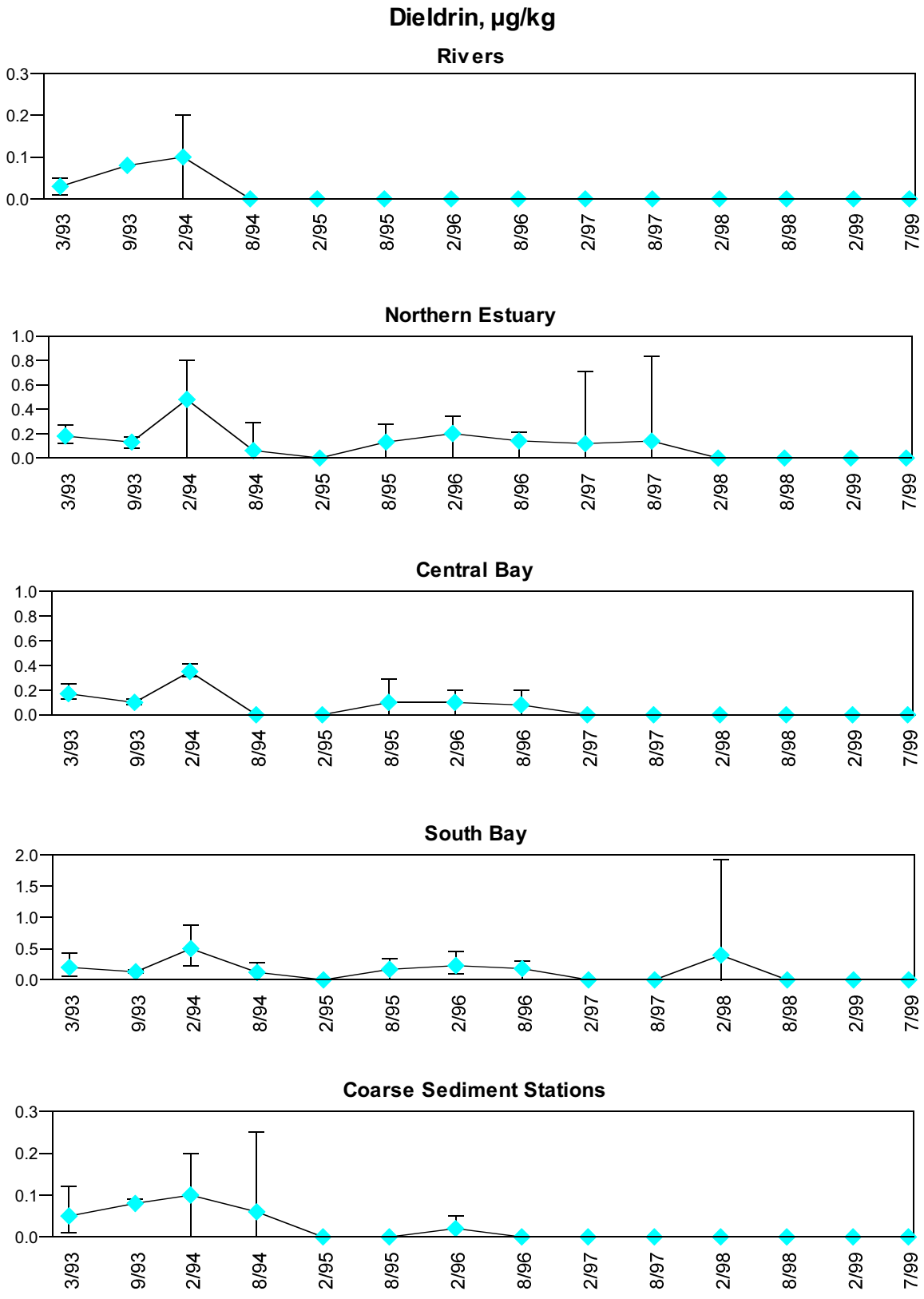

Figure 3.32. Plots of average dieldrin concentrations in sediments for each Estuary reach from 1991–1999. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. Dieldrin was not detected for the following reaches and seasons: Rivers, Central Bay, and Coarse Sediment Stations in February and August 1997 and 1998, and February and July 1999; South Bay in February and August 1997, and February and July 1999; and Northern Estuary in February and August 1998, and February and July 1999.

4.0 Bivalve Monitoring

Nicole David and SFEI Staff

4.1 Background

There are two purposes to monitoring contaminant concentrations in bivalve tissue for the RMP. First, bivalves integrate the bioavailable portion of contaminants in the water column over time, and second, for many contaminants, bivalves are good indicators of contaminant transfer from water into the food web. Bivalves will accumulate certain contaminants in concentrations much greater than those found in ambient water (Vinogradov, 1959). This phenomenon is a result of the limited ability of bivalves to regulate the concentrations of most contaminants in their tissues. Biomonitoring using bivalves has been widely applied by the California State Mussel Watch Program (Phillips, 1988; Rasmussen, 1994) and others (Young *et al.*, 1976; Wu and Levings, 1980; Hummel *et al.*, 1990; Martincic *et al.*, 1992). The RMP is extending the long-term database of the State Mussel Watch Program at several stations in the Bay. For reviews of bioaccumulation monitoring, see Luoma and Linville (1996), and Gunther and Davis (1997).

Mussels and oysters were collected from sites thought to be uncontaminated and transplanted to 14 stations in the Estuary during the wet season (April) and the dry season (September). Contaminant concentrations in tissues, survival, and biological condition were measured before deployment (referred to as time zero (T-0) or background) and at the end of the 90-100 day deployment period. Because of the variability between each individual bivalve organism, composite samples of tissue were made from T-0 organisms and from surviving organisms from each deployment site (up to 45 individuals) for analyses of trace contaminants. A *Corbicula* reference site for the wet and the dry season was not available, since clams could no longer be found at "clean" sites. Consequently, resident specimens were collected from a population in the Sacramento and the San Joaquin rivers. The Grizzly Bay site (BF20) was discontinued.

The effects of high short-term flows of freshwater on the transplanted bivalves west of Carquinez Strait were minimized by deploying the bivalves near the bottom where density gradients tend to maintain higher salinities. All bivalves were kept on ice after collection and deployed within 72 hours. Multiple species were deployed at several stations due to uncertain salinity regimes and tolerances. Detailed sampling and analysis methods are included in the *Description of Methods*. Data are tabulated in the *Data Tables*.

Overall, the bivalve bioaccumulation and condition study objectives for 1999 were met, although T-0 bivalves for the wet season deployment were mistakenly discarded prior to analysis, and accumulation factors could not be calculated.

Aluminum in bivalves is measured as a surrogate for sediment retained in the bivalve gut and is not depicted in the graphs.

4.2 Accumulation Factors

In addition to using the absolute tissue concentrations at the end of each deployment period and comparing them to initial tissue concentrations prior to transplanting the bivalves to the Estuary (T-0), accumulation factors are calculated. The accumulation factors (AFs) indicate accumulation or depuration (loss of constituents from bivalve tissue) during the 90-100 day deployment period of mussels and oysters. The accumulation factor is calculated by dividing the contaminant concentration in transplants by the initial bivalve concentration at T-0. For example, an accumulation factor of 1.0 indicates that the concentration of a specific contaminant remained the same during the deployment period compared to the initial contaminant level prior to transplanting the bivalve sample to the Estuary. An AF less than 1 indicates that the bivalves decreased in contaminant concentration during the deployment period, while an AF above 1 indicates accumulation.

Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and not transplanted from a "clean" site.

4.3 Guidelines

State consumption advisories for the public are issued by the EPA to protect residents from the health risks of consuming contaminated non-com-

mercially caught fish and wildlife. These advisories inform the public that high concentrations of chemical contaminants have been found in local fish and wildlife and include recommendations to limit or avoid consumption of certain fish and wildlife species from specific waterbodies or waterbody types. The EPA is developing guidance documents for estimating risks to human health from the consumption of chemically contaminated, non-commercial fish and wildlife. This report used the recommended tissue screening values (SVs) for use in State fish/shellfish consumption advisory programs for the general adult population* from table 5-2 of EPA document #823-R-95-007 (Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue). Tissue guidelines are generally expressed in wet weight, while the RMP tissue data are reported in dry weight. A wet-to-dry weight conversion factor of 7 was applied to the guideline values for comparative purposes. This value is based on average moisture content in bivalves of 85%. Listed in **Table 4.1** are converted dry weight SVs for those parameters reported by the RMP.

** general adult population: Risk level = 10^{-5} for carcinogens given an average consumption rate of 6.5 g/day for a body weight of 70kgs. The risk level indicates the rate of how often an adverse effect occurs.*

4.4 Biological Condition and Survival

The biological condition (expressed as the ratio of dry tissue weight to shell cavity volume) and survival rates of transplanted bivalves following exposure to Estuary water are evidence that the animals were healthy and capable of bioaccumulation at most sites (Figure 4.17-4.18).

However, the data on survival and condition of the transplants indicate that certain sites are generating physiological stress in the animals at certain times, which confounds the interpretation of bioaccumulation data and interferes with the bivalves' usefulness as biomonitors. During the process of integrating recommendations from the RMP re-design workgroups, bioaccumulation comparisons between the traditionally used *Mytilus californianus* and the hybrid Bay mussel (*Mytilus galloprovincialis* / *trossulus* / *edulis*) are planned. This comparison will help to evaluate reducing potential artifacts introduced by using an open-ocean intertidal mussel as an indicator organism and shifting to a closely related species adapted to more variable estuarine conditions.

4.5 Bivalve Trends

Transplanted bivalves are valuable in assessment of long-term trends because they provide an integrated measure of contamination over a three-month period. This interval is more appropriate for assessment of interannual trends than the "snapshot" represented by RMP water samples or by sediment samples that represent the mixed and highly dynamic sediment layer reflecting approximately 20 years of contaminant deposits. Bivalves have been shown to complement fish tissue contaminant concentration data in detecting relatively quickly any changes in contaminant availability to the food web (Russell and Gobas, 1989).

This section presents plots of RMP bivalve bioaccumulation data for trace elements and trace organics from 1993 to 1999 (Figures 4.19-4.32). Trends for *Corbicula fluminea* are not depicted due to the shift from transplanted to resident organisms. Concentrations in these plots are expressed as net bioaccumulation or depuration during the deployment period (initial concentrations prior to deployment have been subtracted from final concentrations measured after deployment). Presented in this manner, the plots are capable of showing the presence or absence of both trends and accumulation during deployment. In many cases (e.g., arsenic), there was either little accumulation or depuration during deployment. Cadmium in mussels has exhibited a consistent seasonal pattern, with higher concentrations in summer samples, most likely reflecting the prevalence of oceanic influences during the dry season. The trace metals database is fairly noisy, and clear trends are not expected to be discernible for the near future.

Trends for the 1999 wet season could not be calculated due to the loss of T-0 samples and the lack of data for initial tissue concentrations prior to deployment.

4.6 Discussion

Bivalve Monitoring Discussion

Bivalve monitoring is conducted in the San Francisco Estuary for measuring contaminant accumulation in bivalve tissue during the wet and the dry season and to assess the bioavailability of contaminants of

concern throughout the Bay. It is also a valuable tool to indicate long-term contaminant trends.

As currently designed, this program component is unable to compare contaminant bioavailability and accumulation in different segments of the Estuary due to the different bioaccumulation characteristics of the three species deployed in segments with different salinities (see Method Section and RMP Regional Monitoring News Vol. 4, Issue 2 "RMP Bivalve Study Field Methods (or how we do what we do)", by Jordan Gold and David Bell). Available at http://www.sfei.org/rmp/rmp_news/vol_4_issue_2_html/Volume_4_Issue_2.html

The wet season of 1999 mirrored the La Nina effect on the Northern California winter weather. Precipitation was above average except for the months of December 1998 and January 1999. Over the course of the wet season, the estimated statewide runoff was below the runoff for the year 1998 (Water Year 1998-1999) (http://iep.water.ca.gov/report/newsletter/1999spring).

An overall decrease in trace organic tissue concentration was exhibited during the wet season of 1999 compared to the previous year. Assuming that during years of extremely heavy rainfalls (as was the case in 1998), deposits of CHC and PAH compounds are mobilized throughout the watershed, the consistent pattern of lower concentrations in the 1999 wet season reflects less extreme runoff into the Estuary.

Oysters consistently showed a higher PAH concentration and higher accumulation during the entire course of the monitoring program than the two other species. In 1999, the highest concentration was measured at Coyote Creek in the dry season, about 40 times higher than the pre-deployment concentration.

The lipid-normalized data showed lower PAH concentrations in all species for the wet season and mostly lower concentrations for the dry season compared to 1998, although the 1999 concentrations are higher than the updated running mean (1993-1999) of the lipid-normalized data.

Mussels continued showing a consistent decrease in PAH concentrations and were below the running mean from all years combined.

In contrast to 1998, oysters had higher mean accumulation factors for PCBs than mussels and much higher concentrations during the dry season. The highest accumulation was 137 times above the pre-deployment concentration. Eight out of ten overall samples had total PCB concentrations exceeding the proposed California Toxics Rule's implicit tissue guidelines of 70ppb.

The PCB concentration patterns in oysters reflected correspondingly high concentrations in sediment and water at the stations near oyster deployments. Compounds associated with suspended solids have longer residence times in the water and are also a pathway into the food-web for filter-feeding benthic communities. A higher level of contaminant concentrations could also be caused by an intense mixing of the sediment due to strong tidal currents or winds.

As it was apparent in previous years, PCB tissue concentrations were correlated with lipid content of the bivalves. In general, lipid-normalization for trace organics revealed different patterns because of the highly lipid-soluble characteristics of these compounds. For example, the non-normalized PCB mean concentration in mussels increased during the dry season compared to the 1998 dry season, but the lipid-normalized data showed a clear decrease for the mean concentration of PCBs. This shows that a weight loss, for instance due to reproduction, is followed by a distinct decrease in contaminant accumulation.

The lipid-normalized DDT concentrations showed a noticeable decline for both seasons compared to the previous years. In 1999, the lowest lipid-normalized DDT concentrations were observed since the inception of the RMP. Dieldrin concentrations in both wet and dry seasons continued to decline as well.

Other chlorinated pesticides with PBT (persistent, bioaccumulative, and toxic chemicals) characteristics like the sum of chlordanes, decreased in concentration compared to 1998, an El Nino year, but the general lipid-normalized concentration over the years remained unchanged.

Regarding trace metals, clams exceeded the EPA screening value for arsenic at the San Joaquin River in the dry season. Mussel concentrations increased as well, although due to a high initial concentration the increase in concentrations observed in previous years is not reflected in the accumulation factor.

The very high arsenic concentration for the T-0 value from Bodega Head is consistent with previous years' results. Because of the consistent lack of bioaccumulation signals for arsenic, measurements in bivalve tissue for this trace element will be suspended beginning in 2000.

Also consistent with previous years, oysters accumulated cadmium to a higher degree, while the other species did not exhibit any substantial bioaccumulation.

Oysters showed twice as high accumulation factors for copper during the dry season than they did in the previous year.

The 1999 mercury results confirmed that bivalves do not accumulate this trace element to a significant degree and have not been good indicators for bioaccumulation. The monitoring program will discontinue the mercury measurements in bivalves for 2000. It will be replaced with triennial fish measurements.

The running mean concentration for nickel in all species increased slightly compared to 1998, as well as the silver and tributyltin running mean concentration.

Only in oysters did the silver concentration increase noticeably. The mean accumulation factor during the dry season was about 3.5 times higher than in the year before and twice as high as in 1996 and 1997.

The selenium mean accumulation factor in oysters and mussels increased during the dry season, although there is only a slightly noticeable change in selenium concentrations compared to previous years. The above range mean accumulation was caused by lower initial concentrations in bivalves prior to deployment.

Although the use of tributyltins was regulated under the Organotin Antifouling Paint Control Act of 1988, there is no noticeable steady decline in bivalve tissue, and bivalve tissue concentrations may represent equilibrium conditions in the Estuary. They are about 20 times lower than concentrations at which adverse effects in bivalves have been reported. The accumulation factors were highest in *Crassostrea gigas* with 46 times the initial concentration during the dry season.

The T-0 value that was used to determine the accumulation factors for TBT in *Crassostrea gigas* was originally qualified by the laboratory because of the concentration being below the corresponding method detection limit. For calculations, a value equal to ½ method detection limit was used.

Condition, % lipid, and % moisture measurements were made prior to deployment and after the transplants were collected to show natural variables affecting condition, such as weight loss due to reproduction, which can also account for a decrease in contaminant accumulation.

Some water quality parameters in the Estuary were outside optimum levels for the bivalve species and therefore may have affected bioaccumulation at certain times.

In mussels, for example, survival, condition, and percent lipid are significantly positively related to dissolved oxygen and salinity (Hardin & Hoenicke, 1999). The wet season with high freshwater inputs caused an impact and higher mortality rates in *Mytilus californianus*. They are deployed at sites with highest expected salinities because the tolerance of the organism to freshwater exposure is low. Their natural habitat is the ocean's intertidal and they only survive short-term exposure to salinities as low as 5‰.

Other potential effects that dissolved oxygen, salinity, temperature, total suspended solids, and chlorophyll could have on the bioaccumulation of contaminants also confound the ability to describe spatial concentration patterns throughout the Bay.

The San Francisco Estuary exhibits very high spatial and temporal variations in water quality parameters. That is why trends can be compared among sites with the same species only. *Corbicula fluminea* are no longer transplanted from clean reference locations, but resident clams from the Sacramento and San Joaquin Rivers have been analyzed since the 1998 dry season. Due to the use of resident clams, the bioaccumulation factor for *Corbicula* can no longer be calculated.

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Table 4.1. Tissue guidelines used to evaluate bivalve tissue contaminant concentrations (EPA Doc # 823-R-95-007). These guidelines are recommended tissue screening values used in State fish/shellfish consumption advisory programs for the general adult population*. Screening values have been converted to dry weight using a conversion factor of 7, which is based on an 85% average moisture content in bivalves.

* general adult population = Risk level = 10^{-5} for carcinogens given an average consumption rate of 6.5 g/d for body weight of 70Kgs.

Parameter	Screening Value (dry weight)	Units
As	**21**	ppm
Cd	**70**	ppm
Cr	**4.2**	ppm
Se	**350**	ppm
TBT	**2.1**	ppm
Dieldrin	**49**	ppb
Endrin	**21000**	ppb
gamma-HCH	**560**	ppb
Heptachlor Epoxide	**70**	ppb
Hexachlorobenzene	**490**	ppb
Mirex	**14000**	ppb
Total Chlordanes (SFEI)	**560**	ppb
Total DDTs (SFEI)	**2100**	ppb
Total PAHs (SFEI)	**70**	ppb
Total PCBs (SFEI)	**70**	ppb

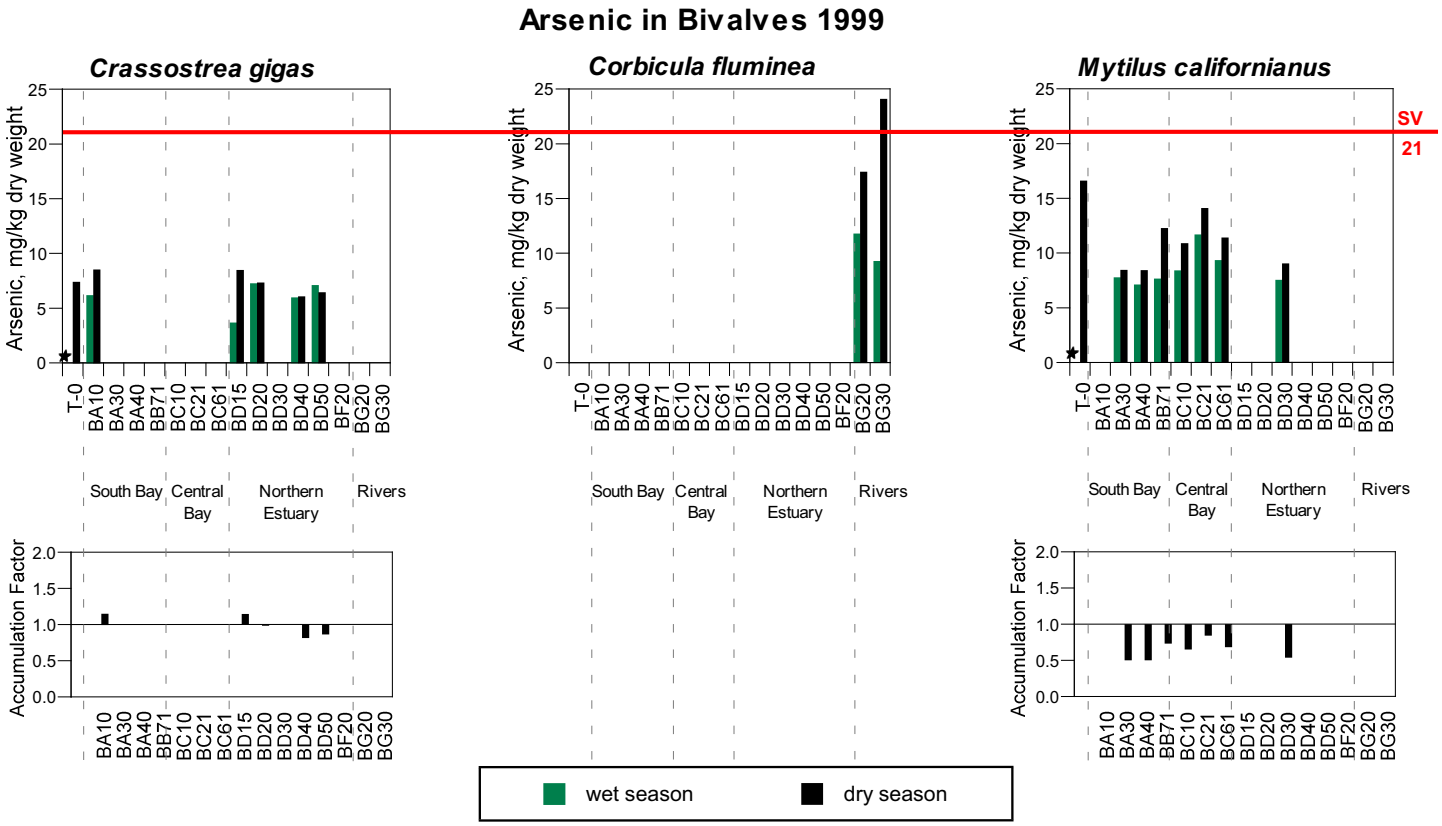


Figure 4.1. Arsenic concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 0.51 (depuration) to 1.2. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C.fluminea*, intermediate in *M. californianus* and lowest in *C. gigas*. The highest measured concentration was in *C. fluminea* at San Joaquin River (BG30) in the dry season. Note high initial concentration in *M. californianus*.

Source Data: see Data Table 19

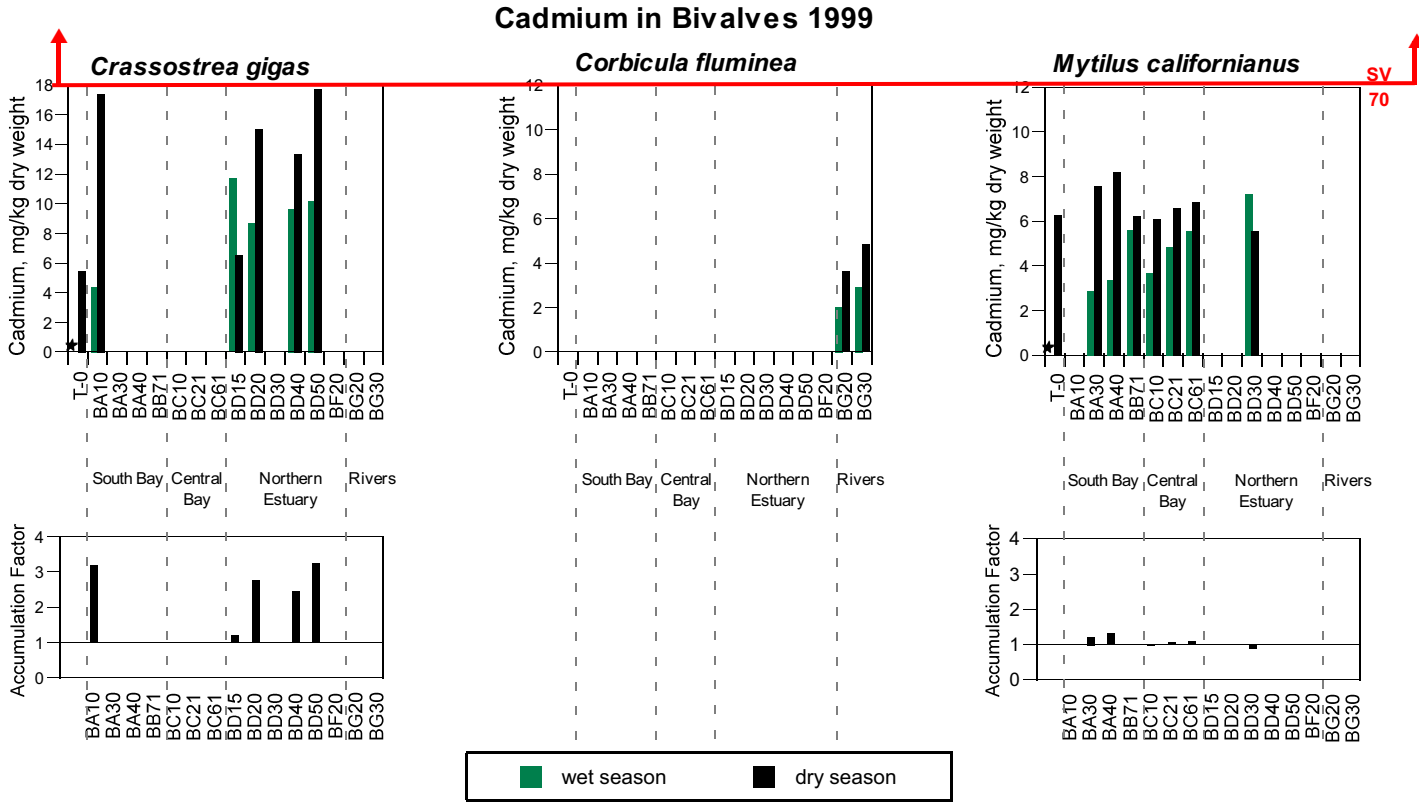


Figure 4.2. Cadmium concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 0.88 (depuration) to 3.24. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. gigas*, intermediate in *M. californianus*, and lowest in *C. fluminea*. The highest measured concentration was in *C. gigas*, at Napa River (BD50) in the dry season.

Source Data: see Data Table 19

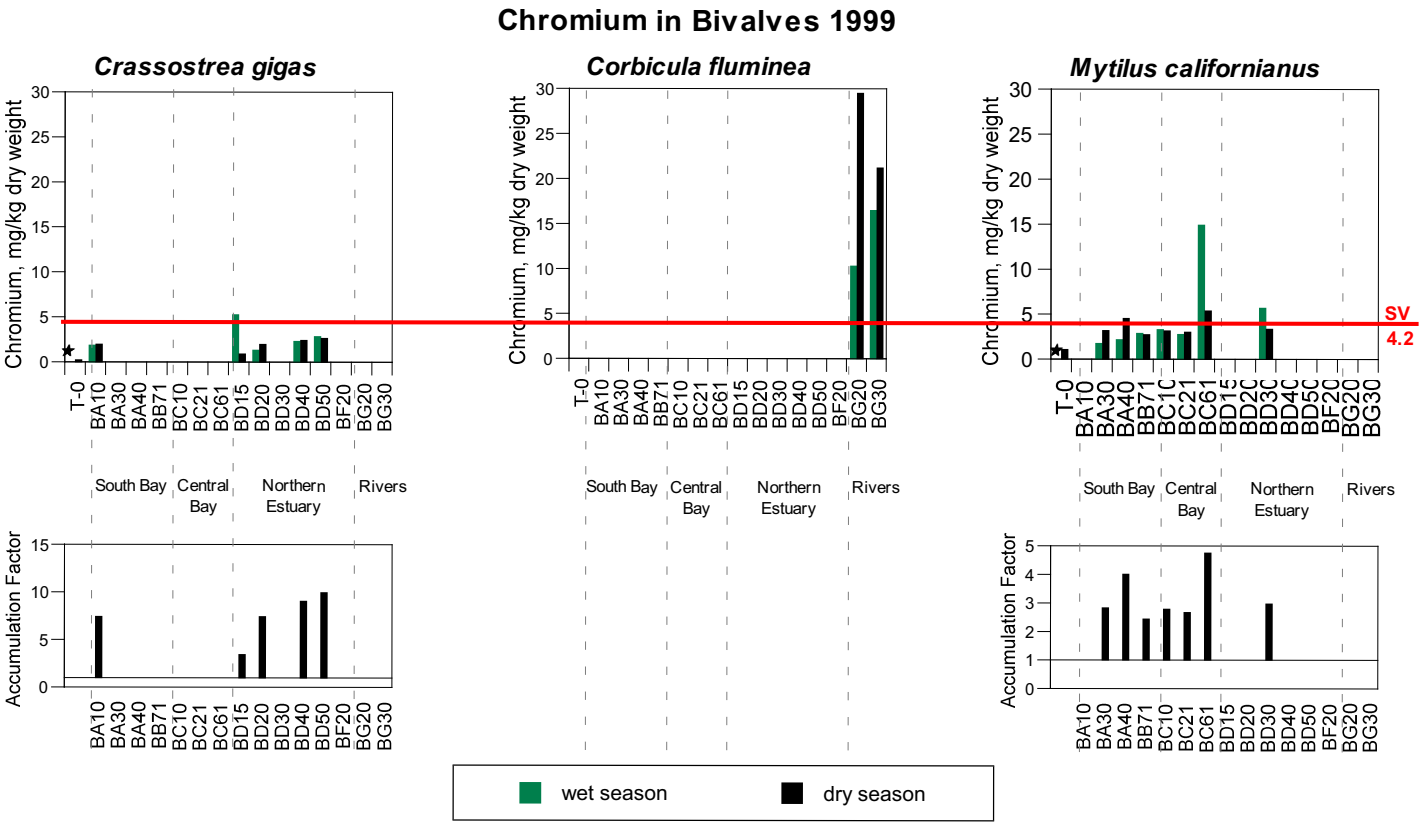


Figure 4.3. Chromium concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 2.46 to 10.00. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. fluminea*, intermediate in *M. californianus*, and lowest in *C. gigas*. The highest measured concentration was in *C. fluminea*, at Sacramento River (BG20) in the dry season.

Source Data: see Data Table 19

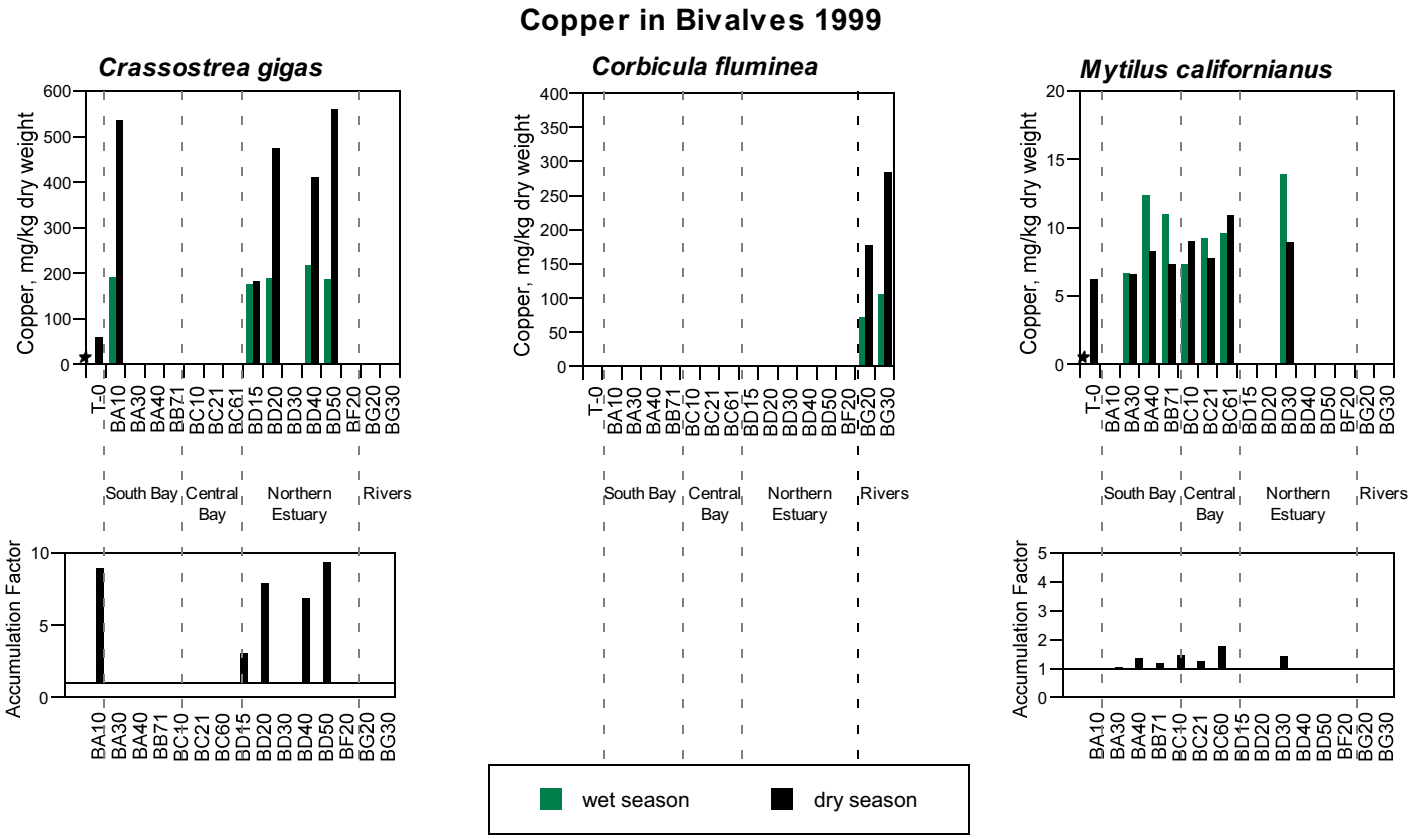


Figure 4.4. Copper concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.06 to 9.35. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. gigas*, intermediate in *C. fluminea*, and lowest in *M. californianus*. The highest measured concentration was in *C. gigas,* at Napa River (BD50) in the dry season.

Source Data: see Data Table 19

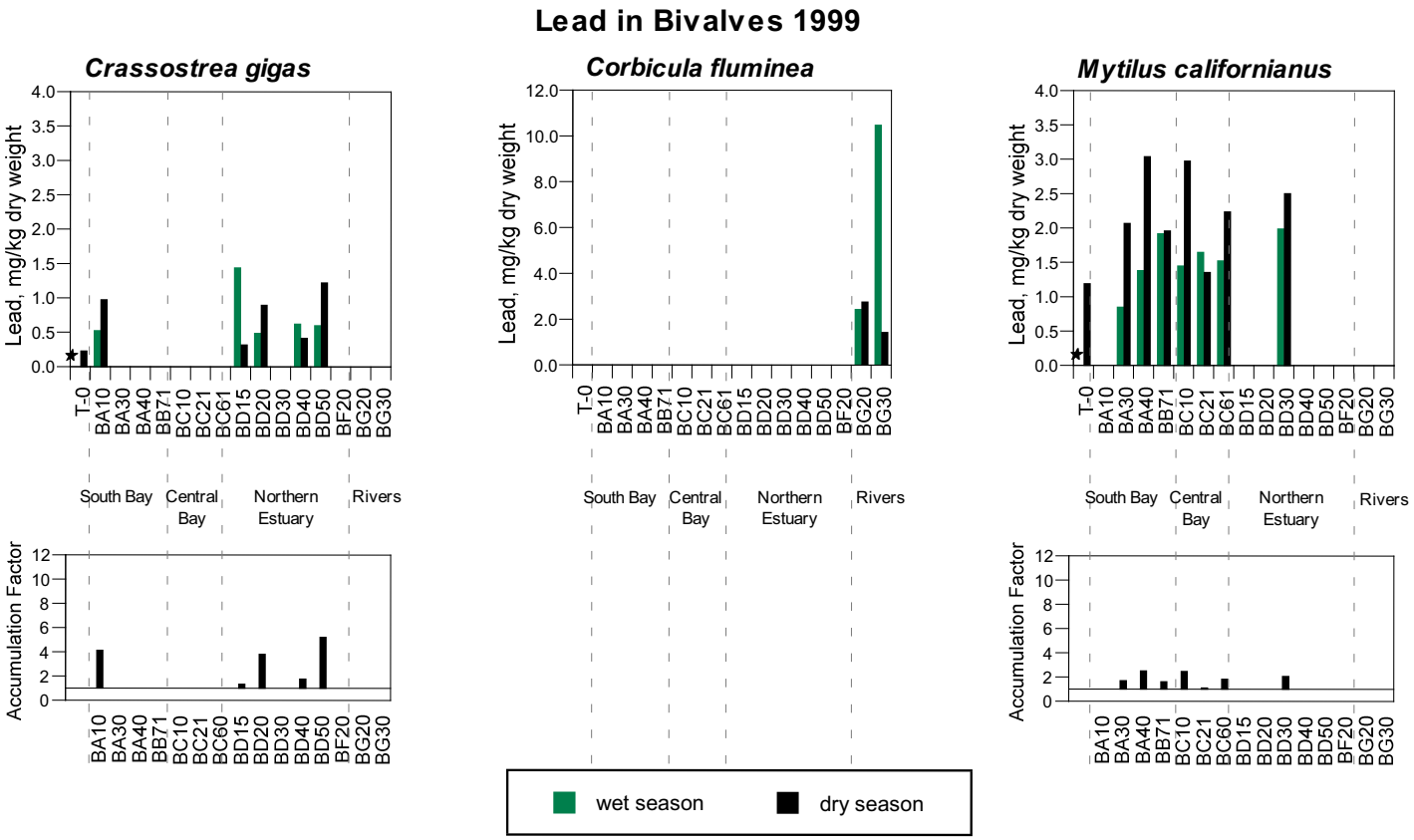


Figure 4.5. Lead concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.14 to 5.24. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. fluminea*, intermediate in *M. californianus,* and lowest in *C. gigas*. The highest measured concentration was in *C. fluminea*, at San Joaquin River (BG30) in the wet season.

Source Data: see Data Table 19

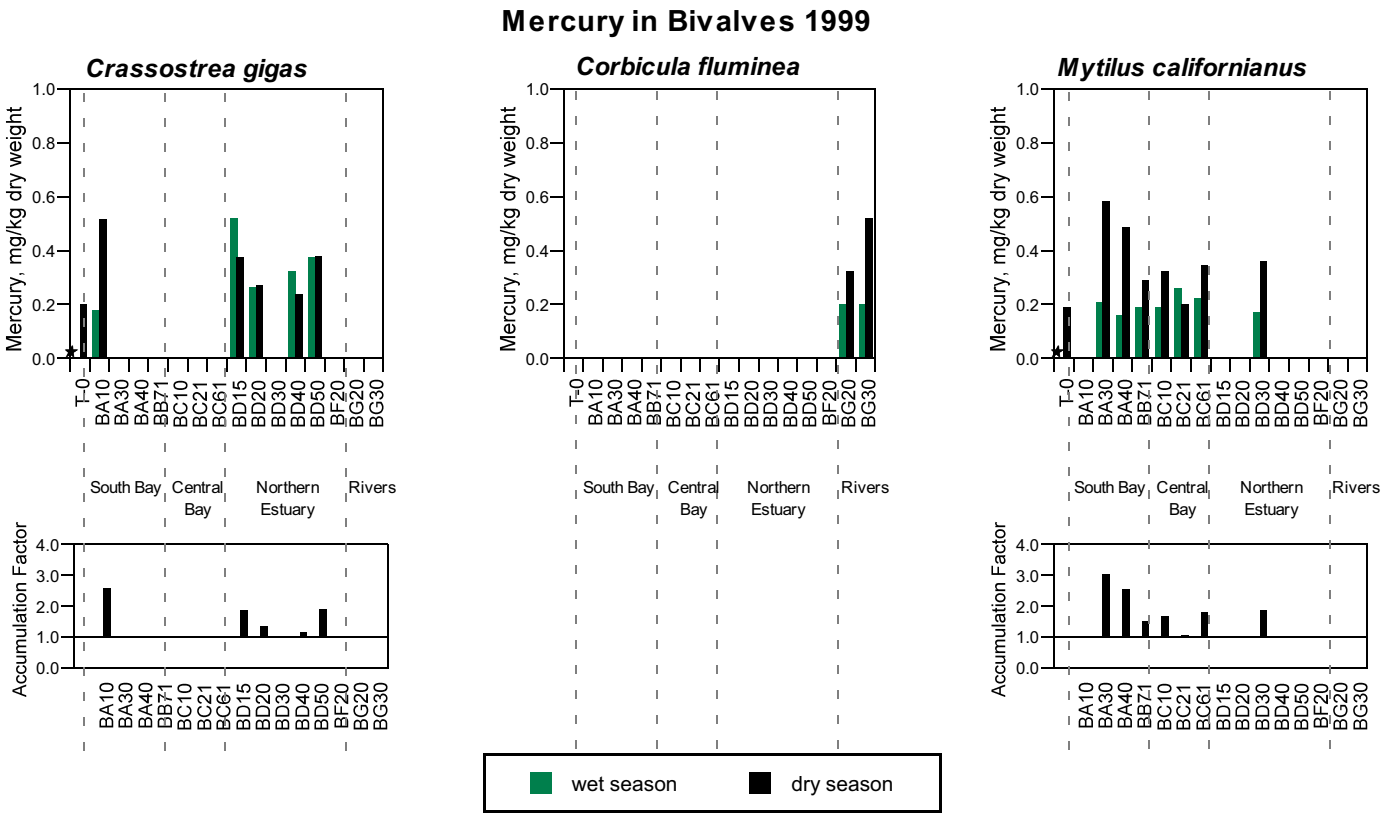


Figure 4.6. Mercury concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.05 to 3.05. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. gigas*, intermediate in *C. fluminea*, and lowest in *M. californianus*. The highest measured concentration was in *M. californianus*, at Dumbarton Bridge (BA30) in the dry season.

Source Data: see Data Table 19

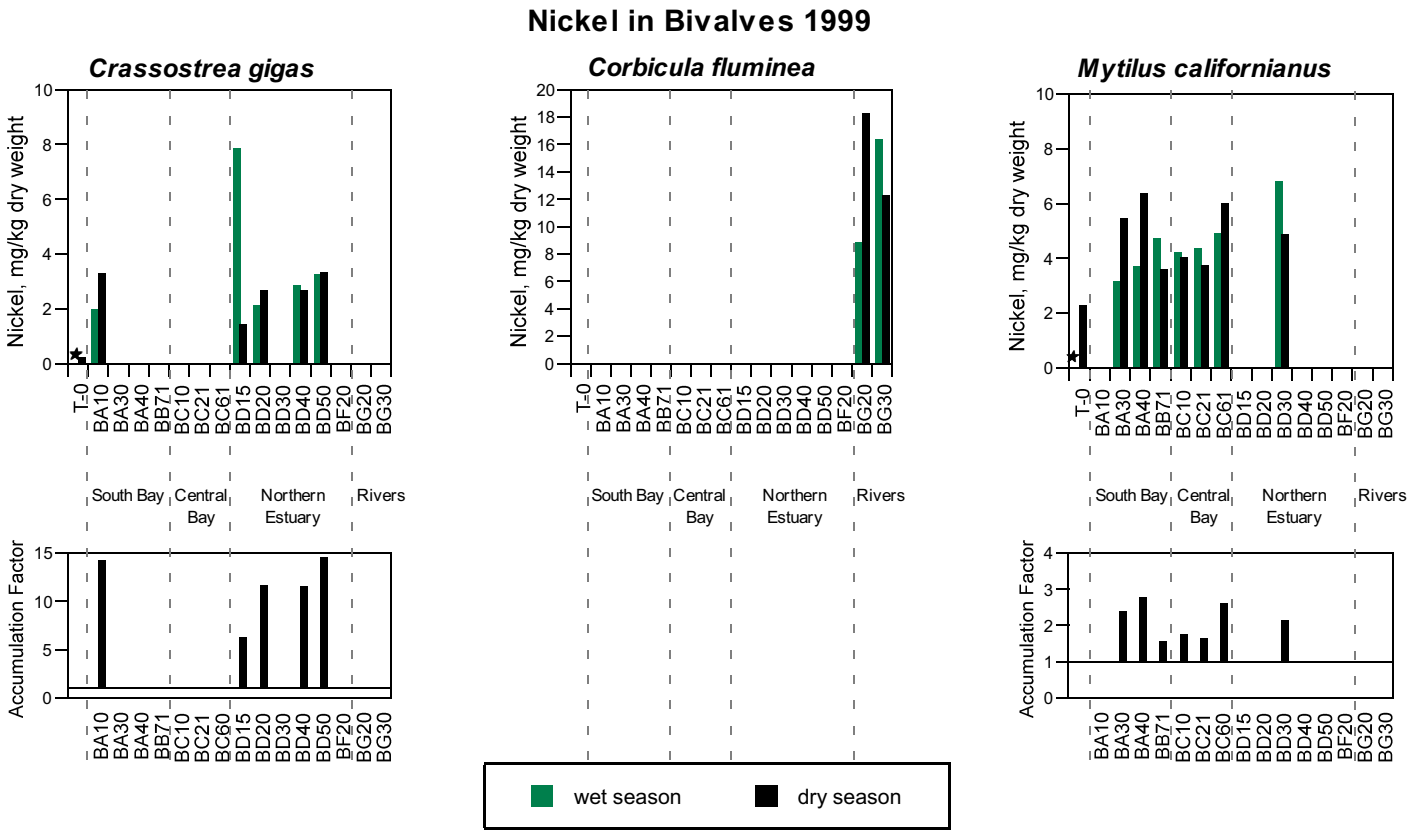


Figure 4.7. Nickel concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.57 to 14.52. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. fluminea*, intermediate in *M. californianus*, and lowest in *C. gigas*. The highest measured concentration was in *C. fluminea*, at Sacramento River (BG20) in the dry season.

Source Data: see Data Table 19

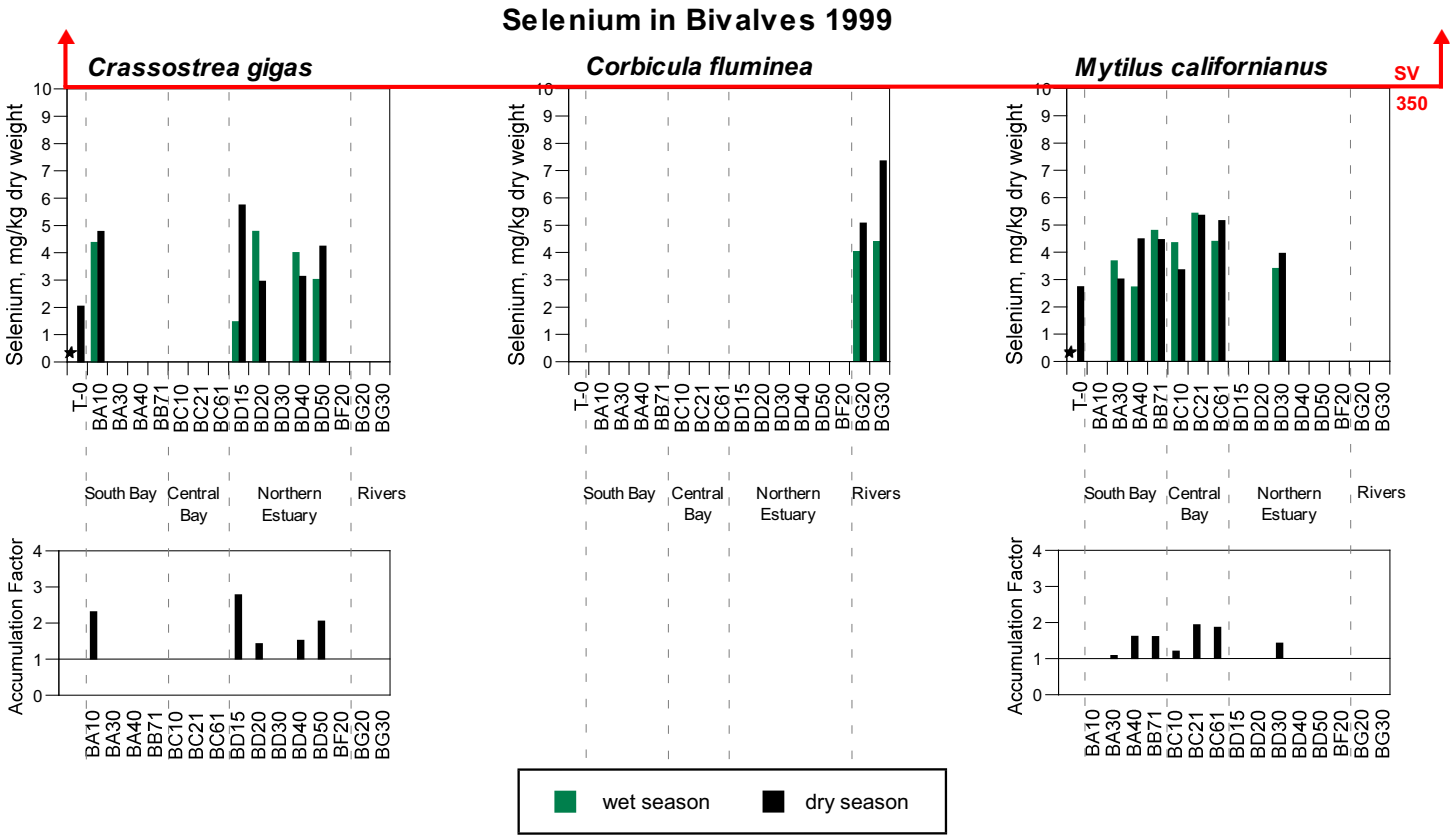


Figure 4.8. Selenium concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.10 to 2.80. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. fluminea*, intermediate in *C. gigas*, and lowest in *M. californianus*. The highest measured concentration was in *C. fluminea*, at San Joaquin River (BG30) in the dry season.

Source Data: see Data Table 19

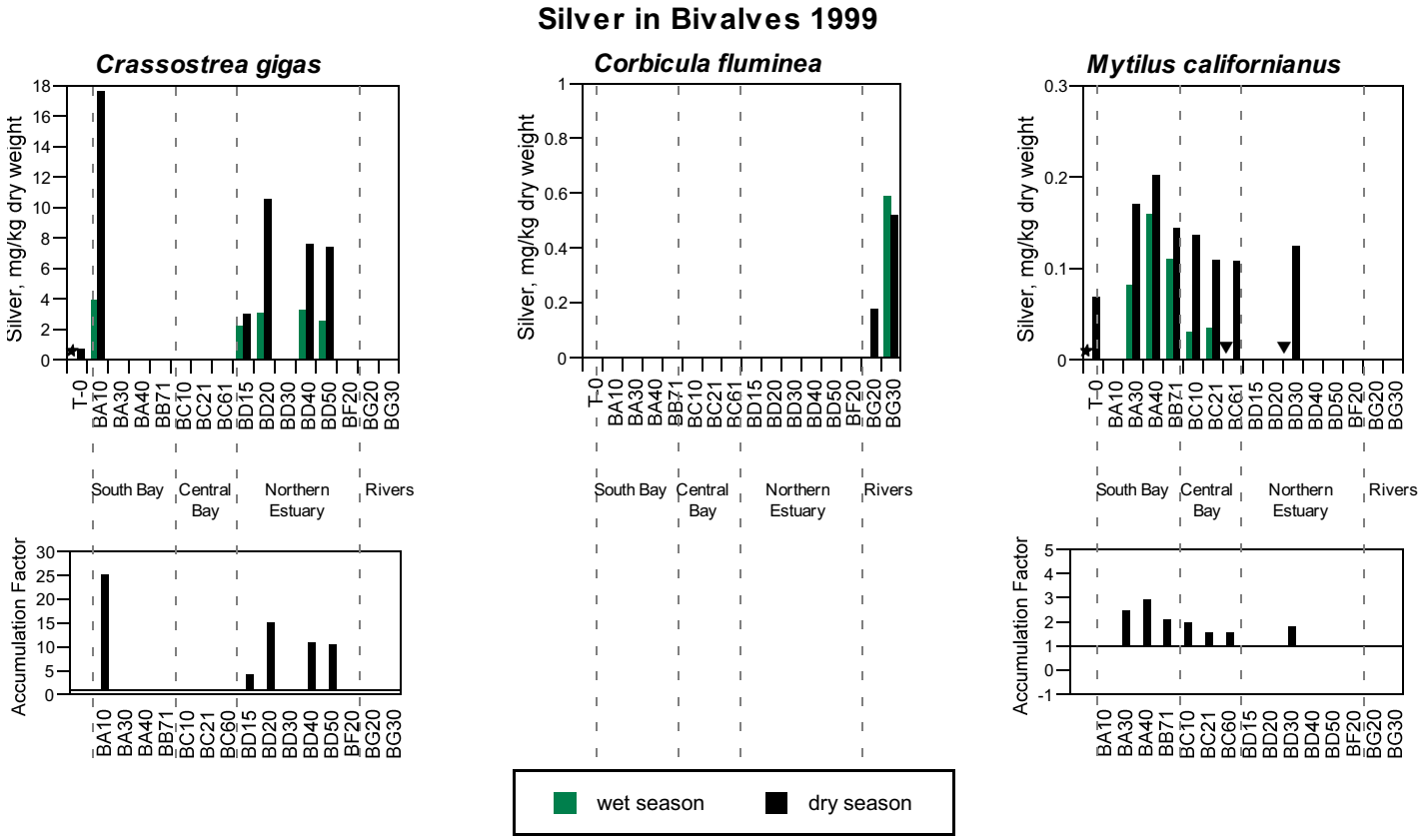


Figure 4.9. Silver concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ▼ = not detected. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.57 to 25.15. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. gigas*, intermediate in *C. fluminea*, and lowest in *M. californianus*. The highest measured concentration was in *C. gigas*, at Coyote Creek (BA10) in the dry season.

Source Data: see Data Table 19

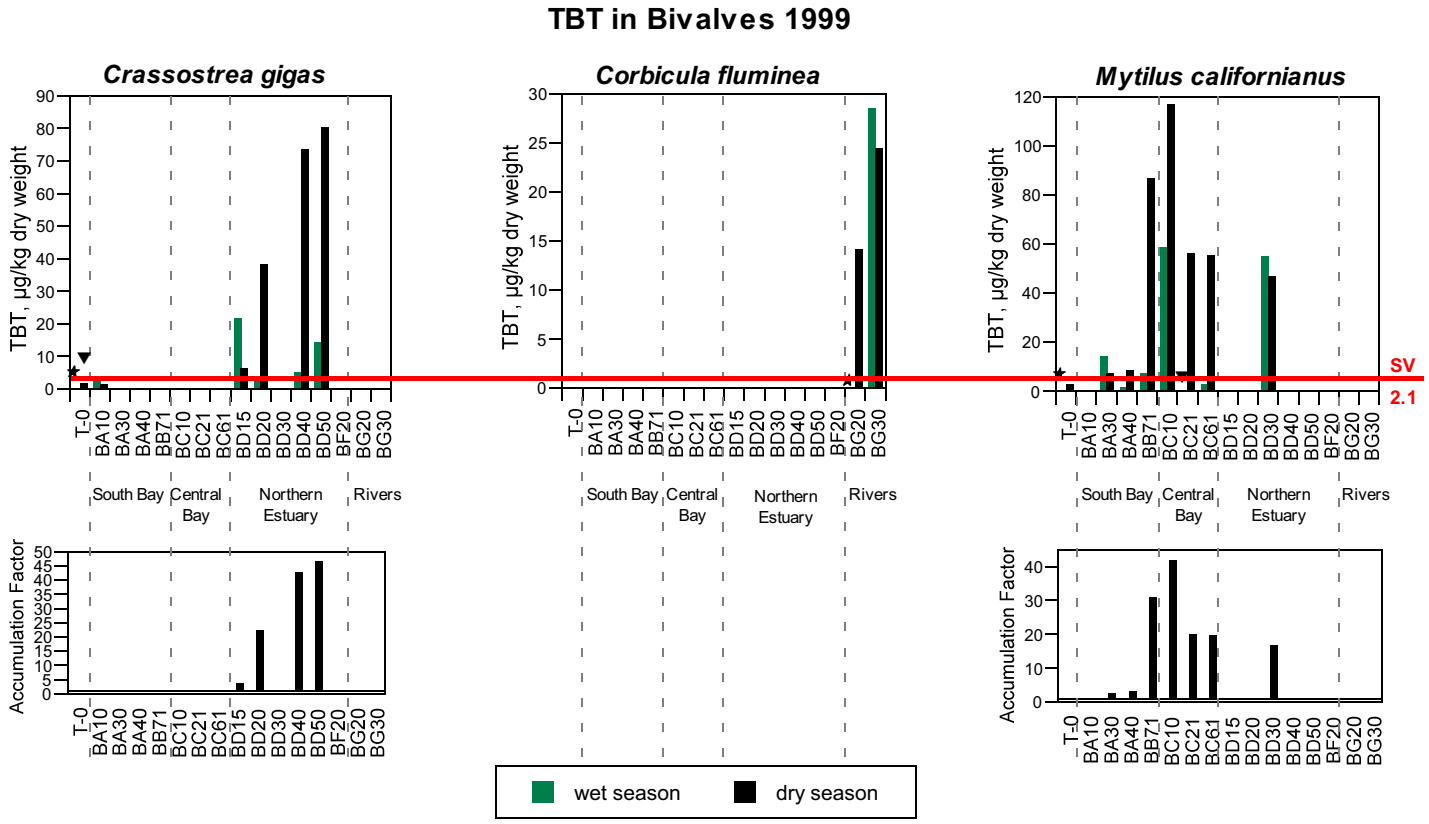


Figure 4.10. Tributyltin concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ▼ = not detected. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 0.88 (depuration) to 46.47. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *M. californianus*, intermediate in *C. fluminea*, and lowest in *C. gigas*. The highest measured concentration was in *M. californianus*, at Yerba Buena Island (BC10) in the dry season.

Source Data: see Data Table 19

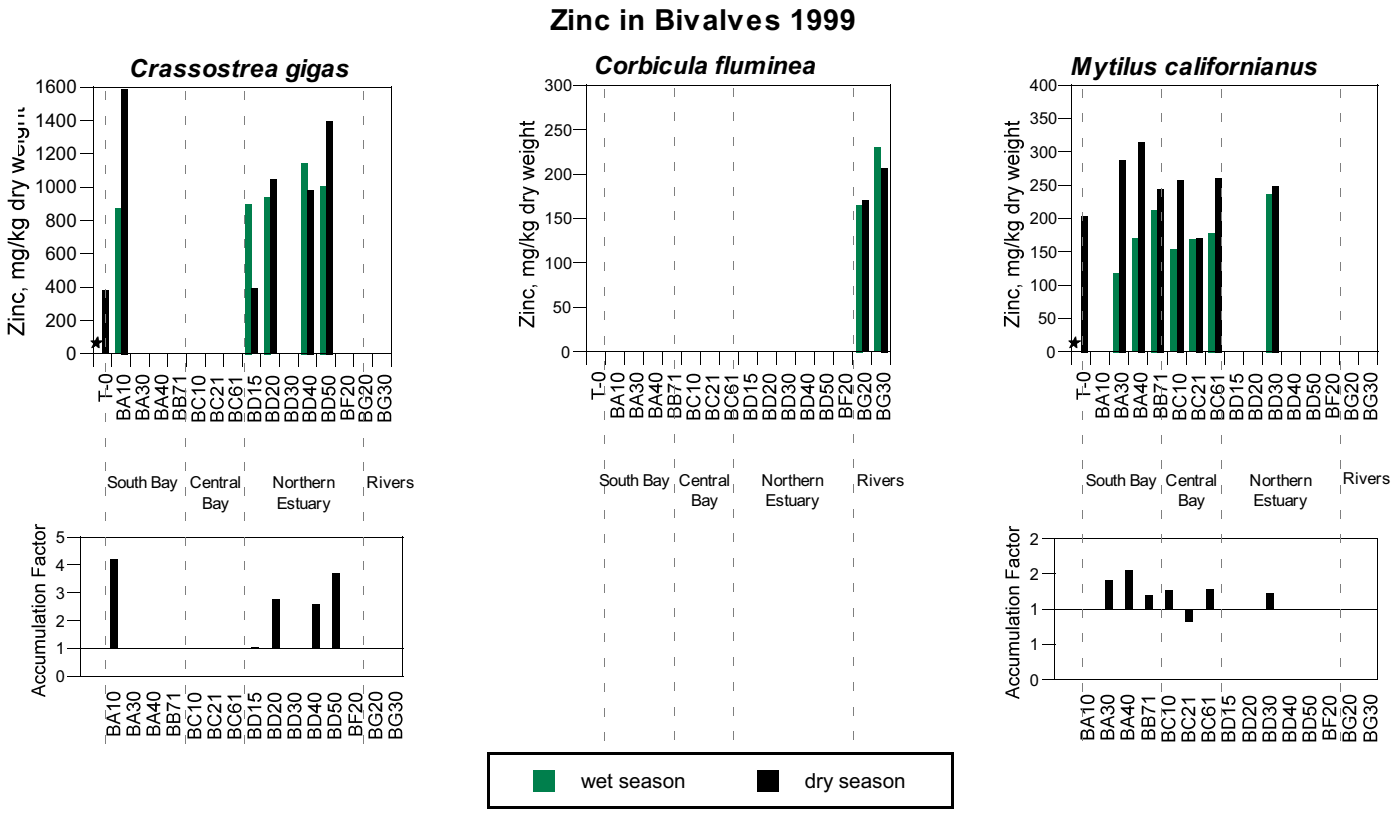


Figure 4.11. Zinc concentrations in parts per million dry weight (ppm) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 samples for *C. gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 0.84 (depuration) to 4.20. Accumulation factors do not apply to *C. fluminea*, since they are collected as resident clams and are not transported from a "clean" site. Median concentrations were highest in *C. gigas*, intermediate in *M. californianus*, and lowest in *C. fluminea*. The highest measured concentration was in *C. gigas*, at Davis Point (BD40) in the wet season.

Source Data: see Data Table 19

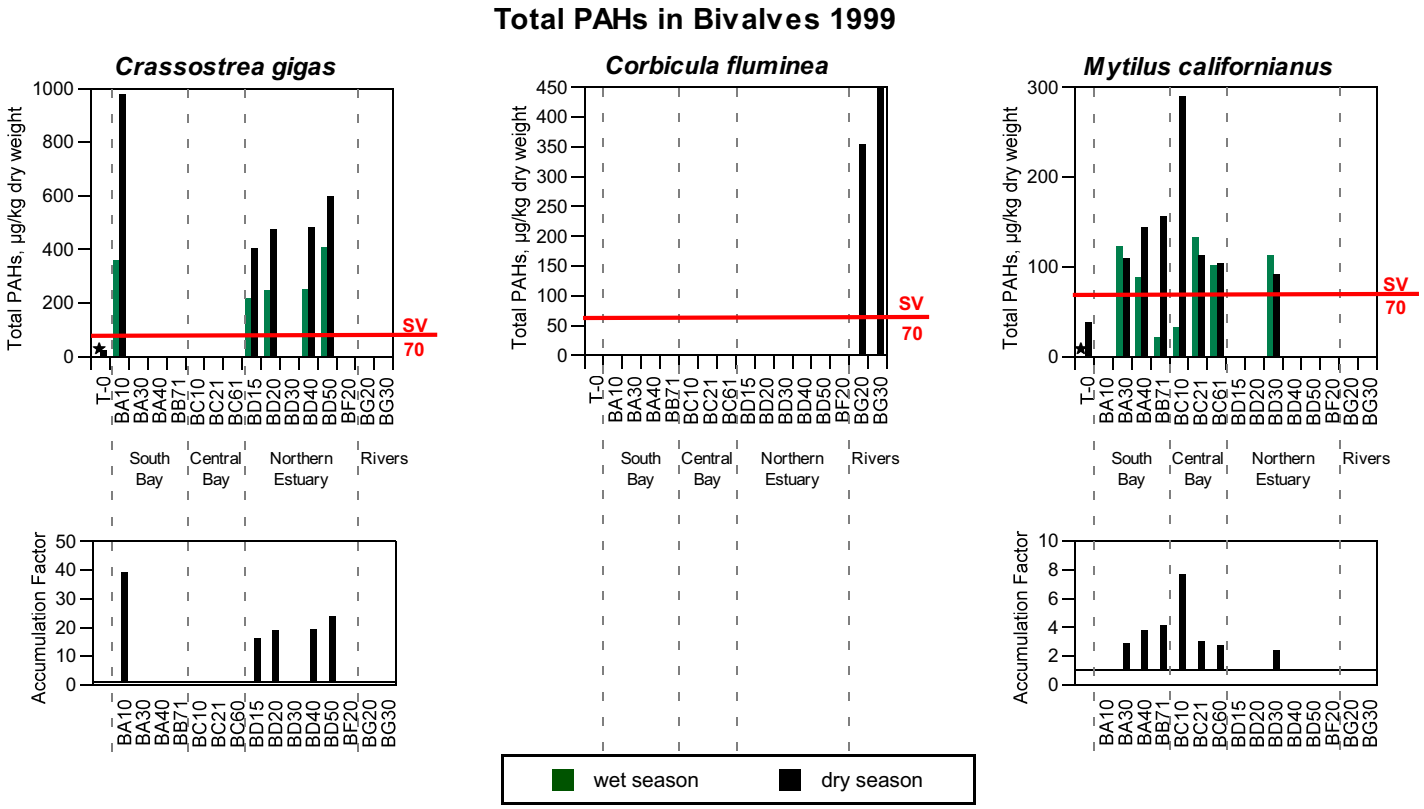


Figure 4.12. Total PAH concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. Bivalves were not deployed at Grizzly Bay (BF20) due to a lack of species from a "clean" source. T-0 (time zero) is the initial concentration before deployment in the Estuary. T-0 values are missing for *Corbicula fluminea* for the dry season because the population at Lake Chabot crashed before sampling. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 2.42 to 39.32. Median concentrations were highest in *C. gigas* during the dry season, intermediate in *C. fluminea*, and lowest in *M. californianus* during the wet season. The highest measured concentration was in *C. gigas*, at Coyote Creek (BA10) in the dry season. 24 out of 26 samples (not including the T-0) exceeded the EPA screening value for PAHs of 70 ppm.

Source Data: see Data Table 20

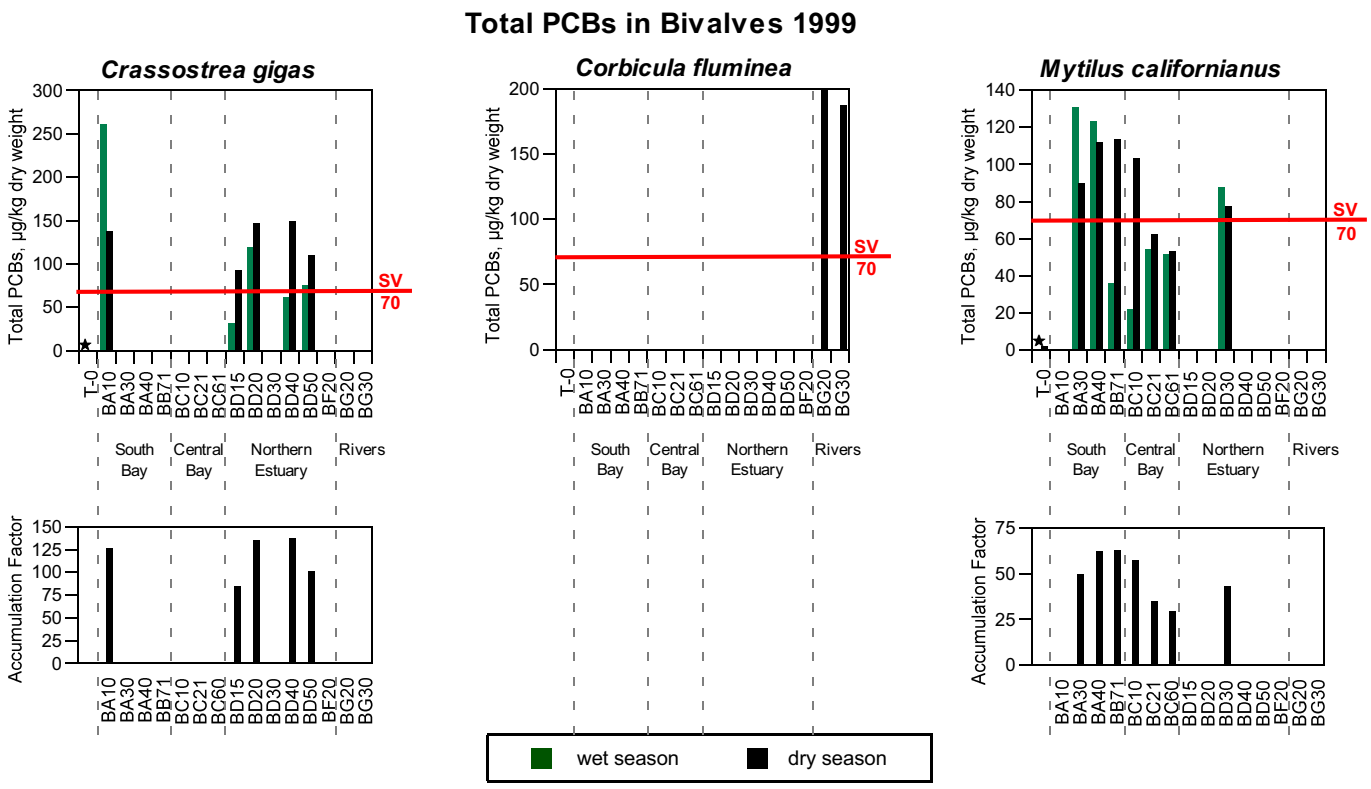


Figure 4.13. Total PCB concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. Bivalves were not deployed at Grizzly Bay (BF20) due to a lack of species from a "clean" source. T-0 values are missing for *Corbicula fluminea* for the dry season because the population at Lake Chabot crashed before sampling. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 29.61 to 137.21. Median concentrations were highest in *C. fluminea* in the dry season, intermediate in *C. gigas*, and lowest in *M. californianus* in the wet season. The highest measured concentration was in *C. gigas*, at Coyote Creek (BA10) in the wet season. 18 out of 26 samples (not including T-0) had total PCB concentrations exceeding the proposed California Toxics Rule's implicit tissue guideline of 70 ppm.

Source Data: see Data Table 21

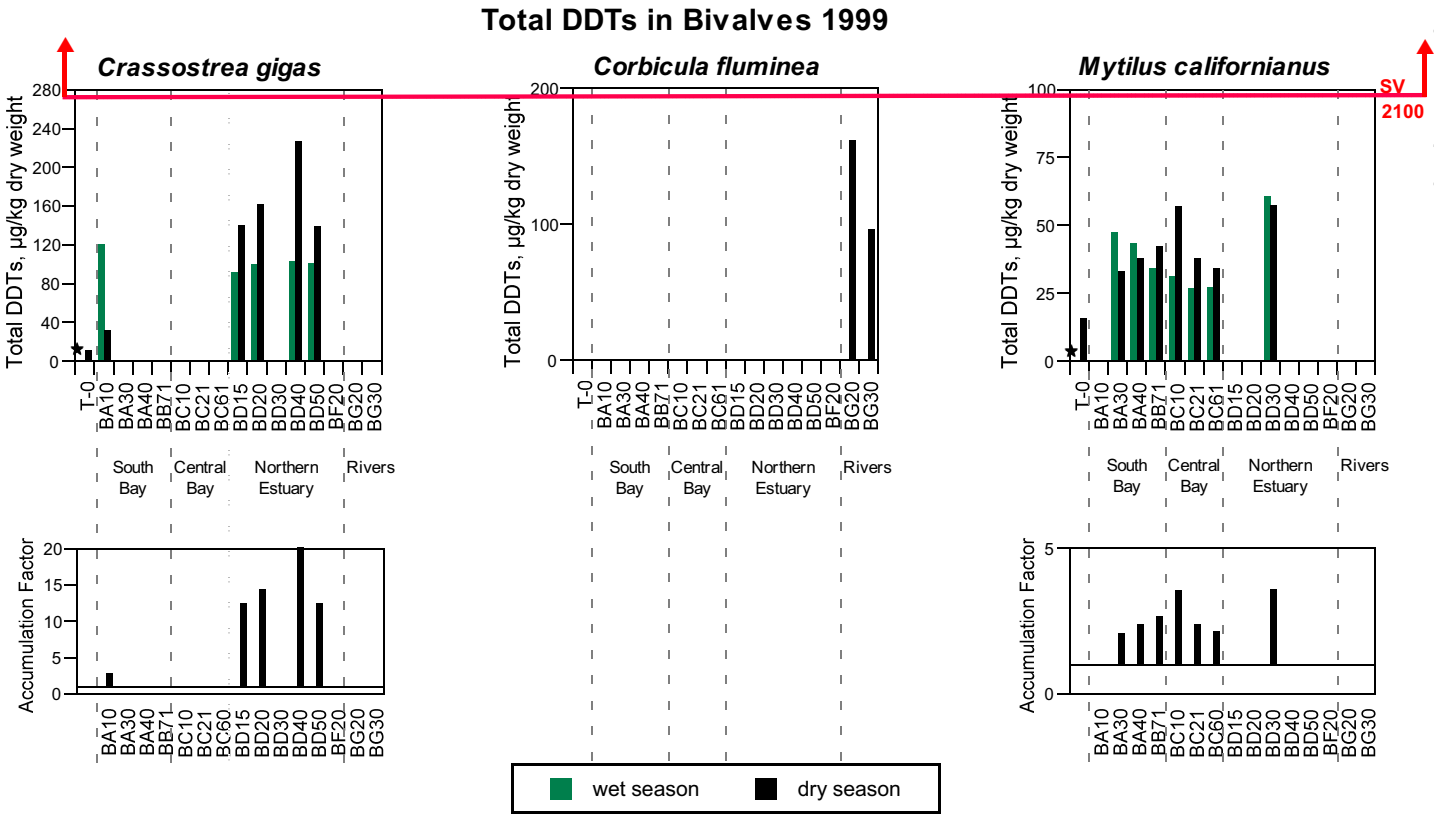


Figure 4.14. Total DDT concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. Bivalves were not deployed at Grizzly Bay (BF20) due to a lack of species from a "clean" source. T-0 values are missing for *Corbicula fluminea* for the dry season because the population at Lake Chabot crashed before sampling. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 2.08 to 20.13. Median concentrations were highest in *C. fluminea*, intermediate in *C. gigas*, and lowest in *M. californianus*. The highest measured concentration was in *C. gigas*, at Davis Point (BD40) in the dry season. None of the samples had total DDT concentrations exceeding the proposed California Toxics Rule's implicit tissue guideline of 2100 ppb.

Source Data: see Data Table 22

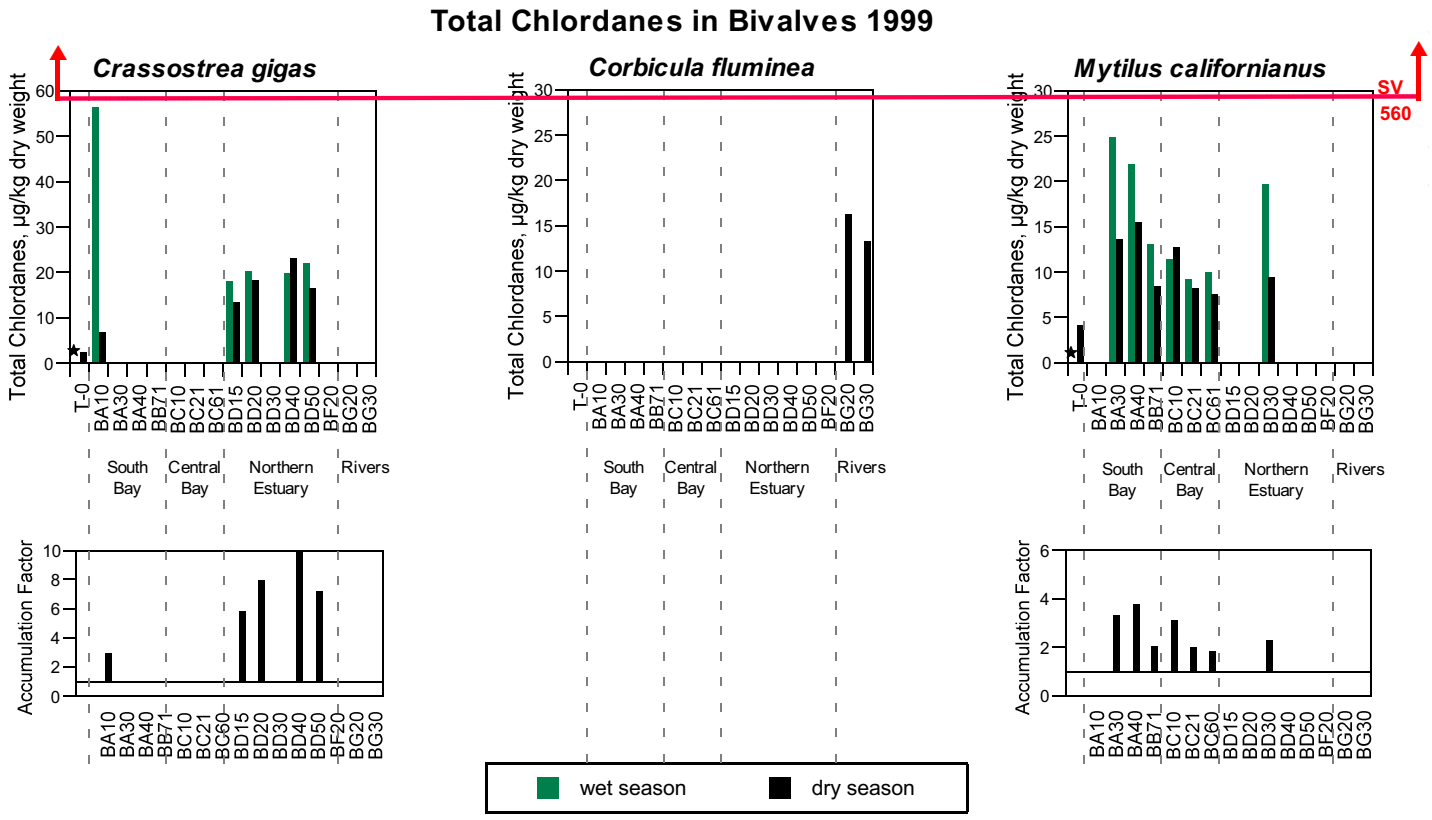


Figure 4.15. Total chlordane concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. Bivalves were not deployed at Grizzly Bay (BF20) due to a lack of species from a "clean" source. T-0 values are missing for *Corbicula fluminea* for the dry season because the population at Lake Chabot crashed before sampling. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.85 to 9.98. Median concentrations were highest in *C. gigas*, intermediate in *C. fluminea*, and lowest in *M. californianus*. The highest measured concentration was in *C. gigas* at Coyote Creek (BA10) in the wet season. None of the samples had total chlordane concentrations exceeding the proposed California Toxics Rule's implicit tissue guideline of 560 ppb.

Source Data: see Data Table 22

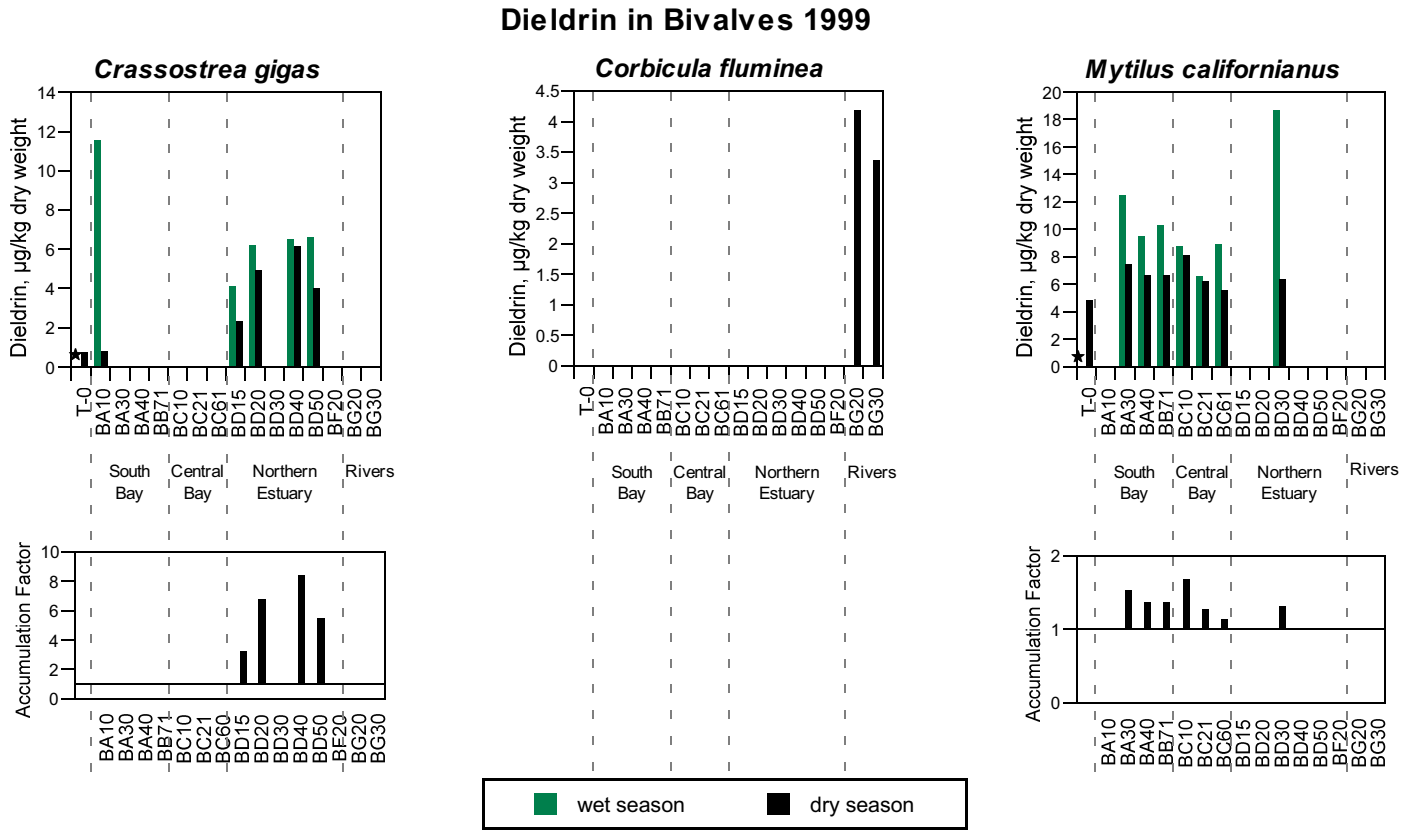
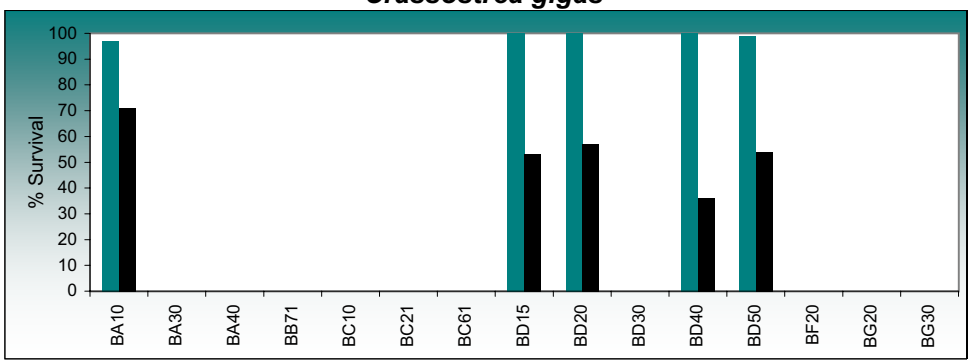


Figure 4.16. Total dieldrin concentrations in parts per billion dry weight (ppb) in three transplanted bivalve species at 15 RMP stations during the wet- and dry-season sampling periods. ★ = not analyzed. Bivalves were not deployed at Grizzly Bay (BF20) due to a lack of species from a "clean" source. T-0 values are missing for *Corbicula fluminea* for the dry season because the population at Lake Chabot crashed before sampling. T-0 samples for *C.gigas* and *M. californianus* were accidentally destroyed. Accumulation factors ranged from 1.07 to 8.45. Median concentrations were highest in *M. californianus*, intermediate in *C. fluminea*, and lowest in *C. gigas*. The highest measured concentration was in *M. californianus* at Pinole Point (BD30) in the wet season.

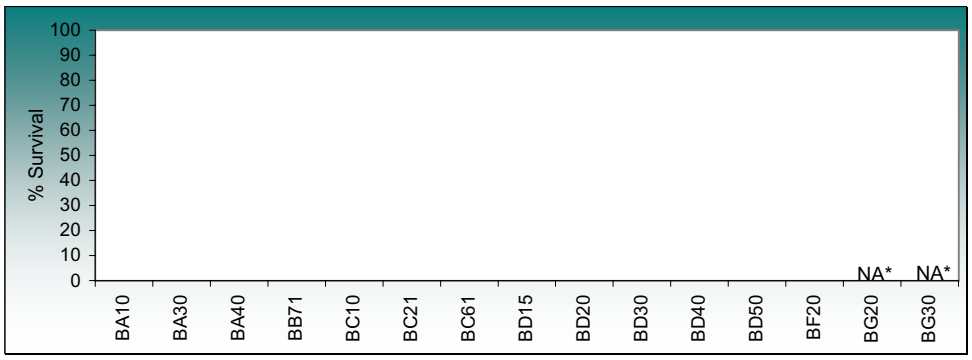
Source Data: see Data Table 22

Bivalve Survival (1999)

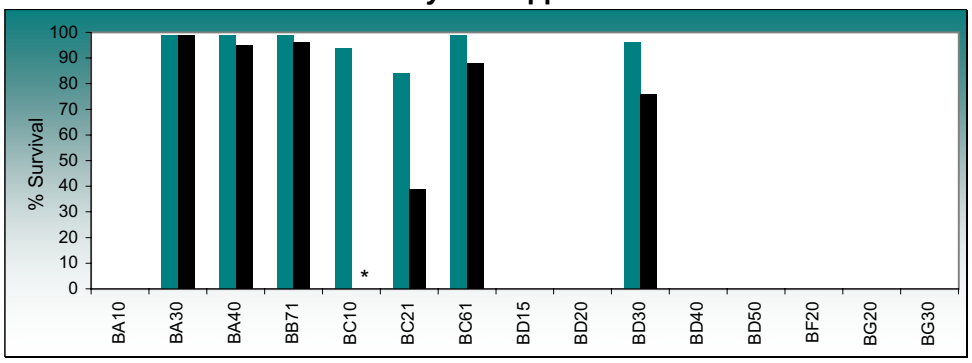
Crassostrea gigas



Corbicula fluminea



***Mytilus* spp.**



Figures 4.17. Percent survival of transplanted bivalves following exposure to Estuary conditions during the wet (April) and dry season (September) of 1999.
* indicates 0% survival and NA* = not available, resident bivalves used.

Source Data: see Data Table 18

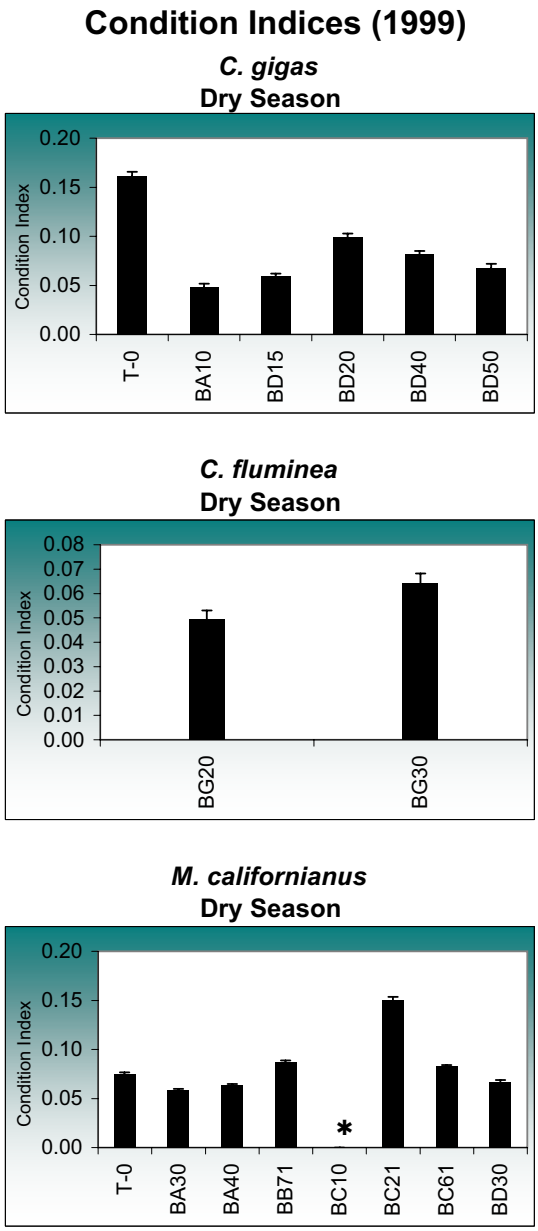


Figure 4.18. Condition indices of three species of bivalve at their original "reference" locations, prior to deployment (T-0), and at the end of their exposure to San Francisco Estuary waters (various locations) during the wet and dry seasons of 1999. ✱ = 0 % survival. Wet season condition indices could not be calculated due to missing T-0 values resulting from the accidental destruction of specimens from Bodega Head and Tomales Bay. A *Corbicula* reference site for the wet and the dry season was not available, since clams could no longer be found at "clean" sites. Consequently, resident specimens were collected from a population in the Sacramento River (BG20) and San Joaquin River (BG30); the Grizzly Bay (BF20) site was discontinued. Bars indicate range of values.

Source Data: see Data Table 18

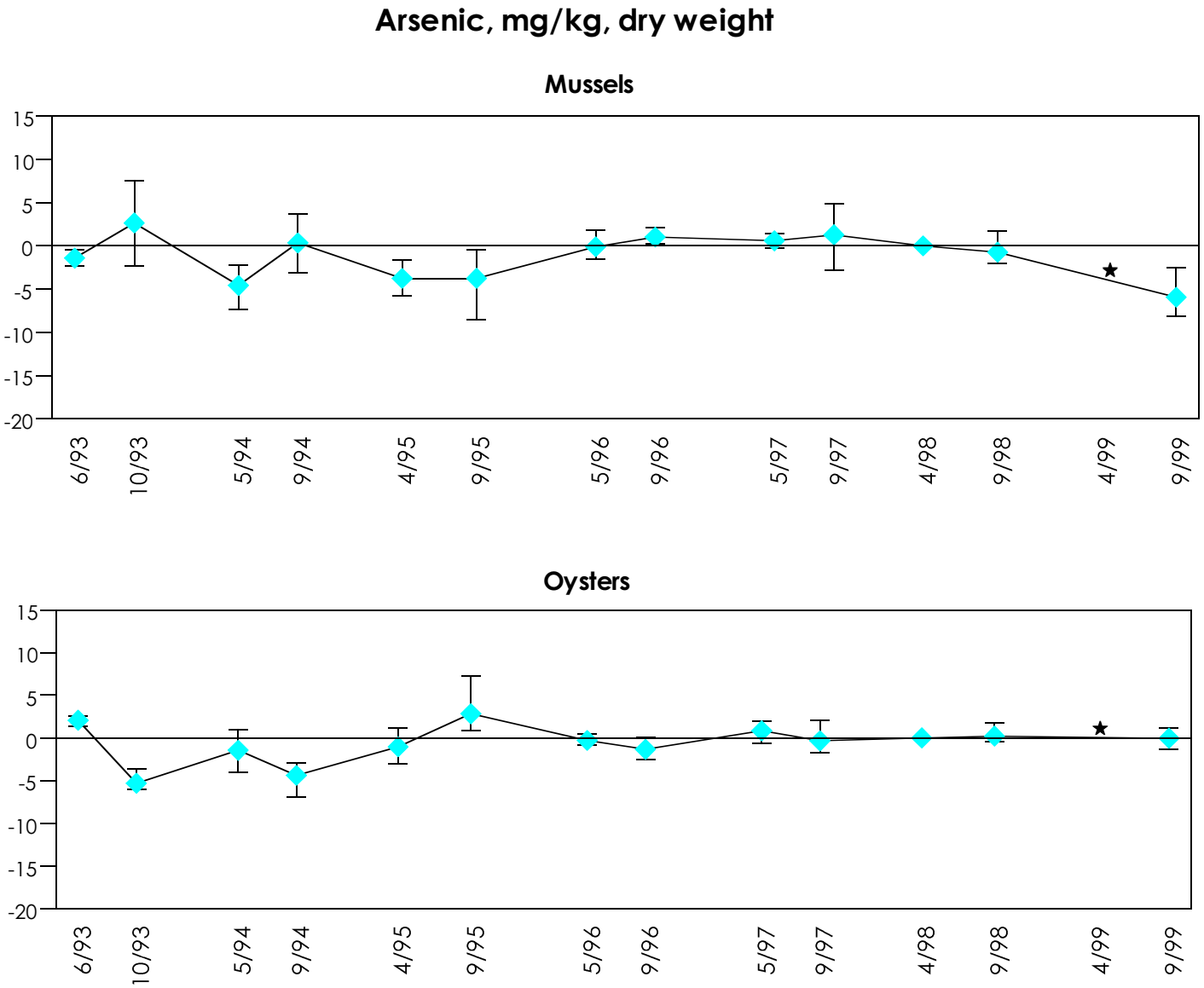


Figure 4.19. Arsenic accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. Note high initial concentration in M. *californianus.* H ❍eans no analyzed data available.

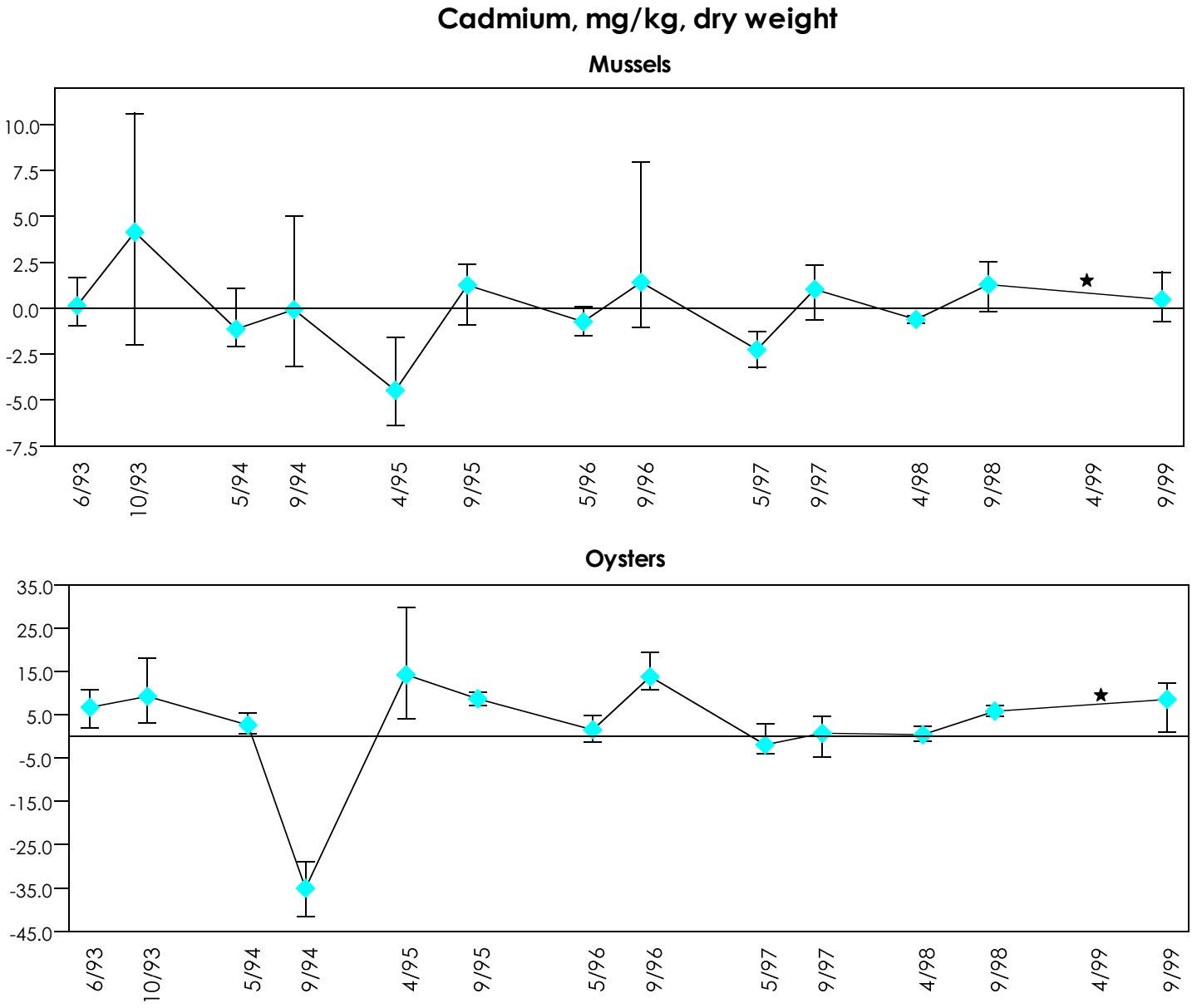


Figure 4.20. Cadmium accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ○eans no analyzed data available.

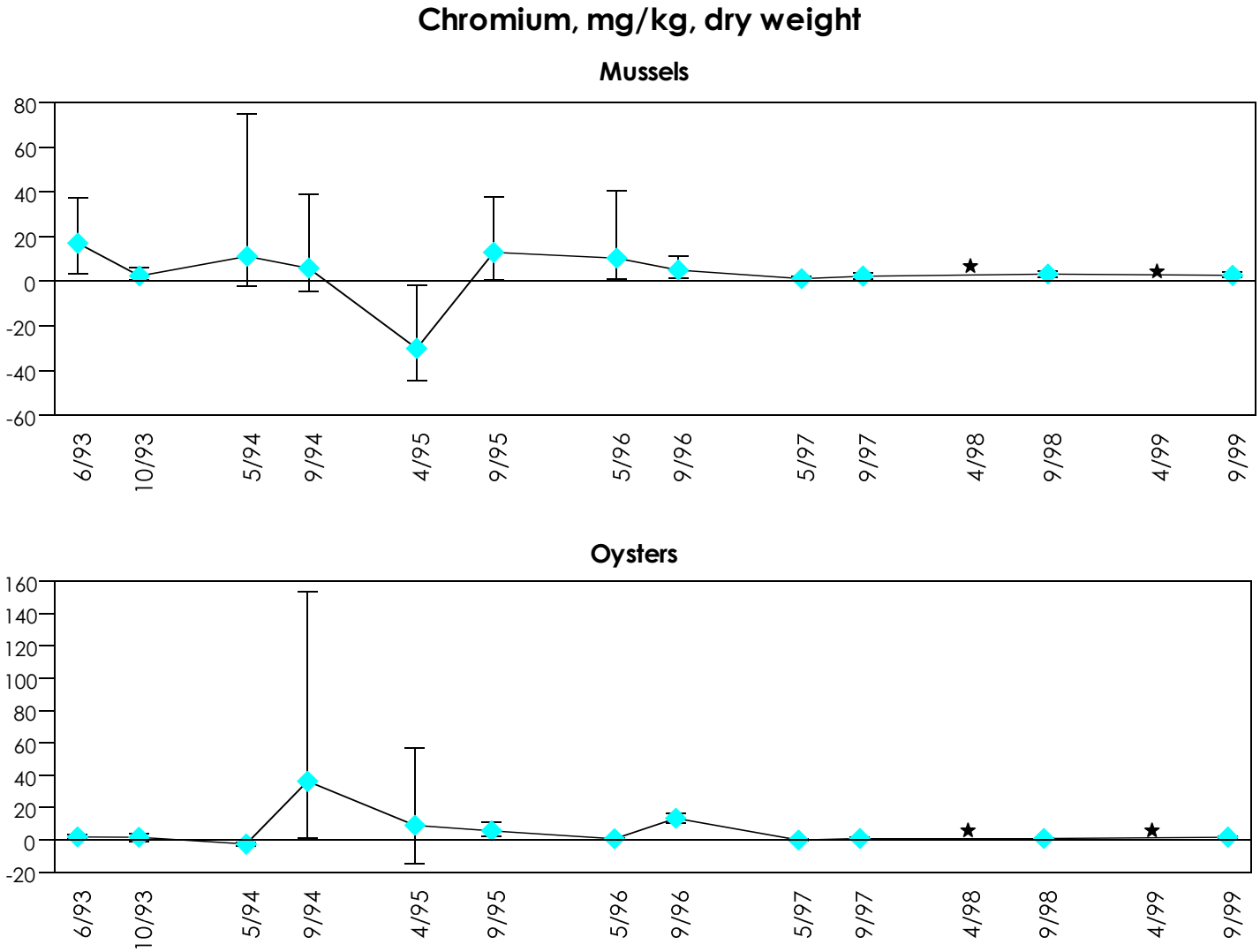


Figure 4.21. Chromium accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍❋ans no analyzed data available.

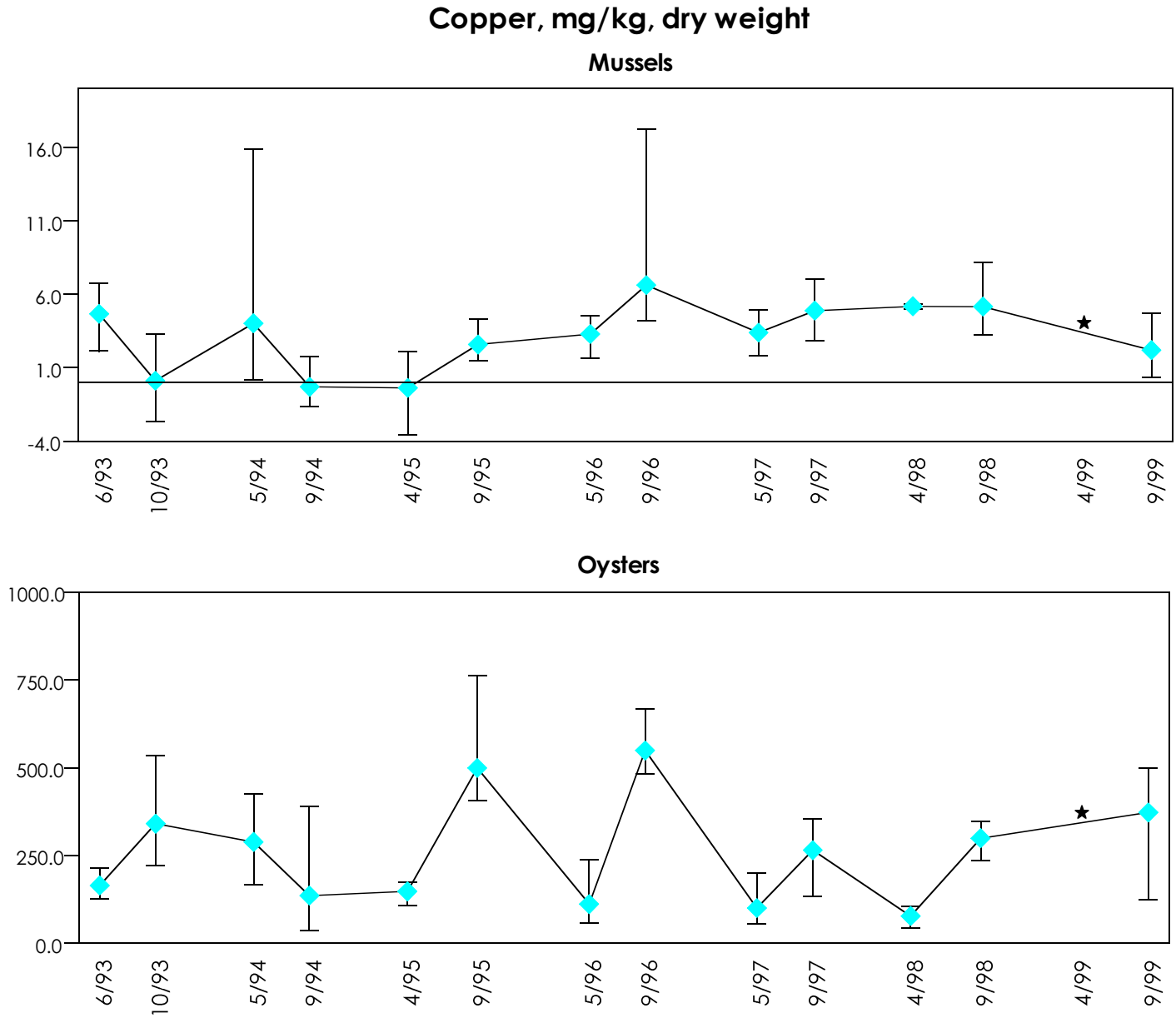


Figure 4.22. Copper accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ○eans no analyzed data available.

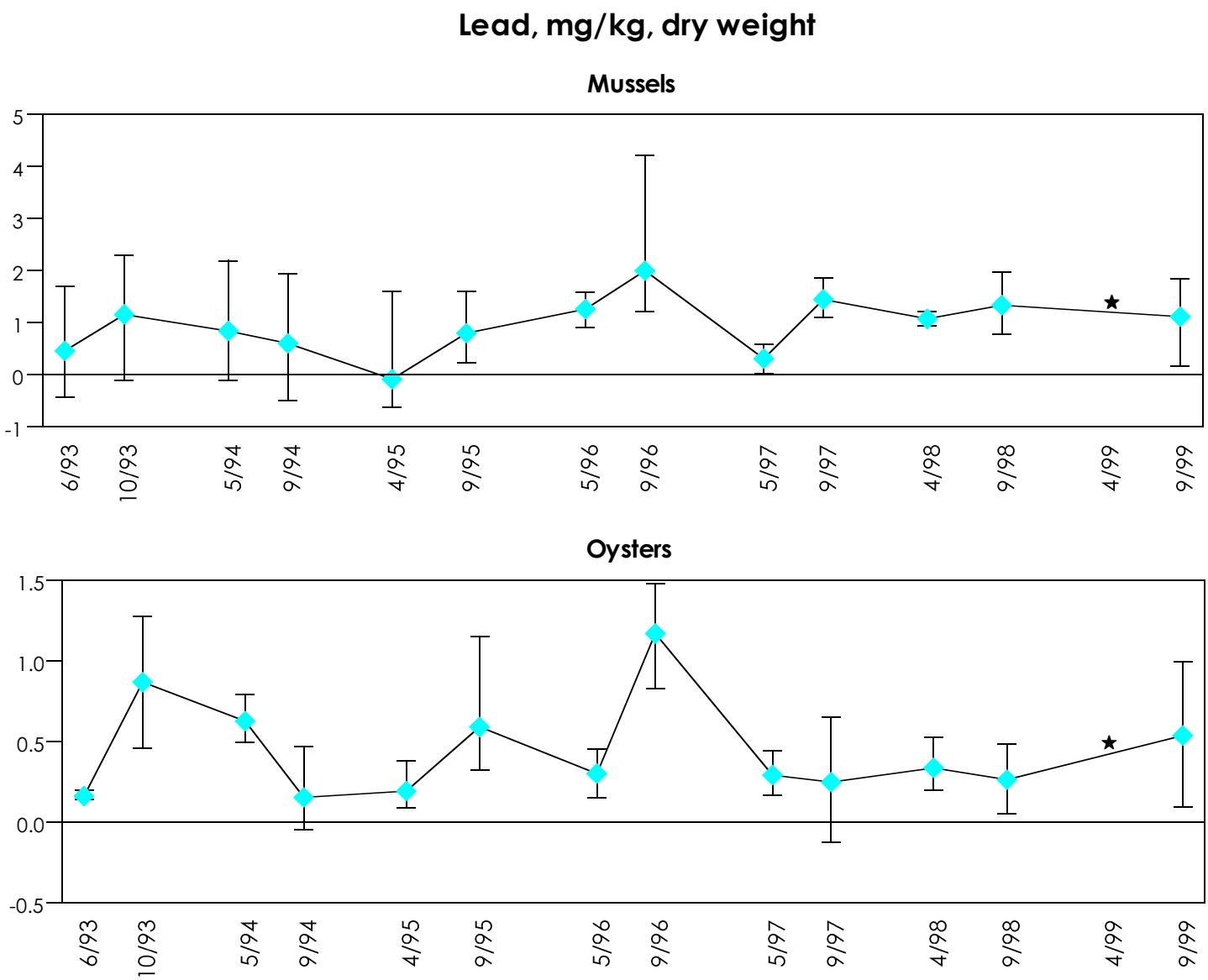


Figure 4.23. Lead accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ○eans no analyzed data available.

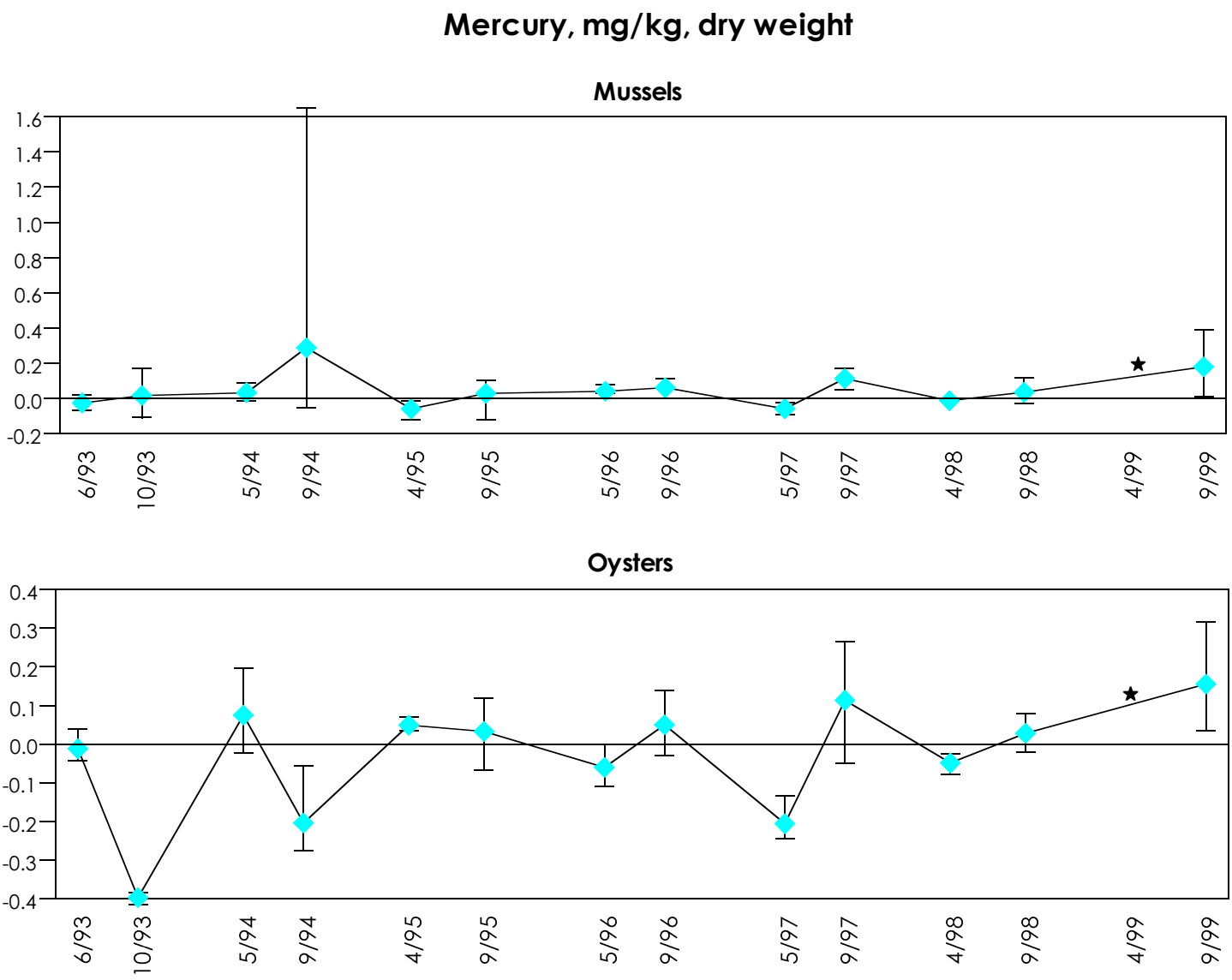


Figure 4.24. Mercury accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍eans no analyzed data available.

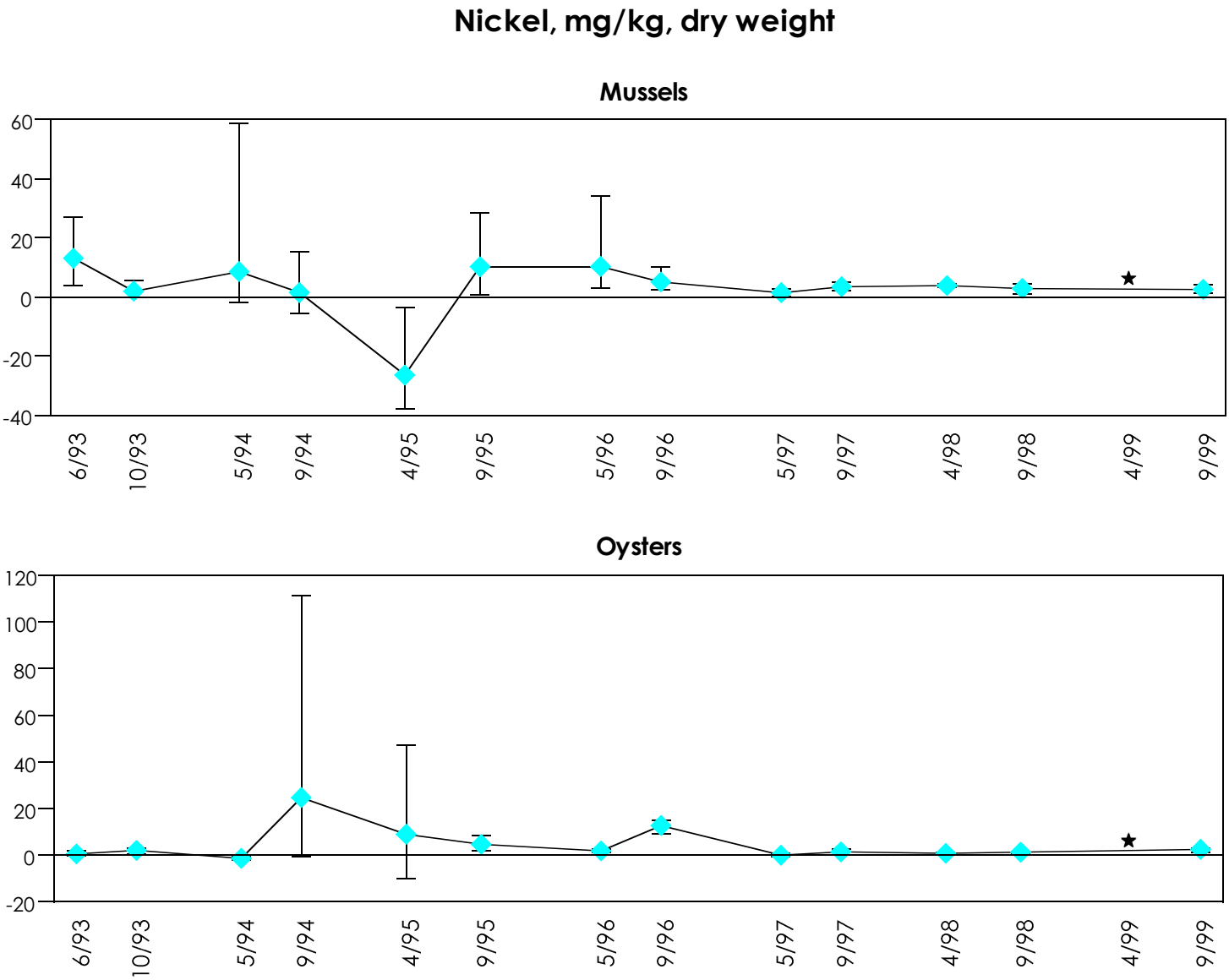


Figure 4.25. Nickel accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍eans no analyzed data available.

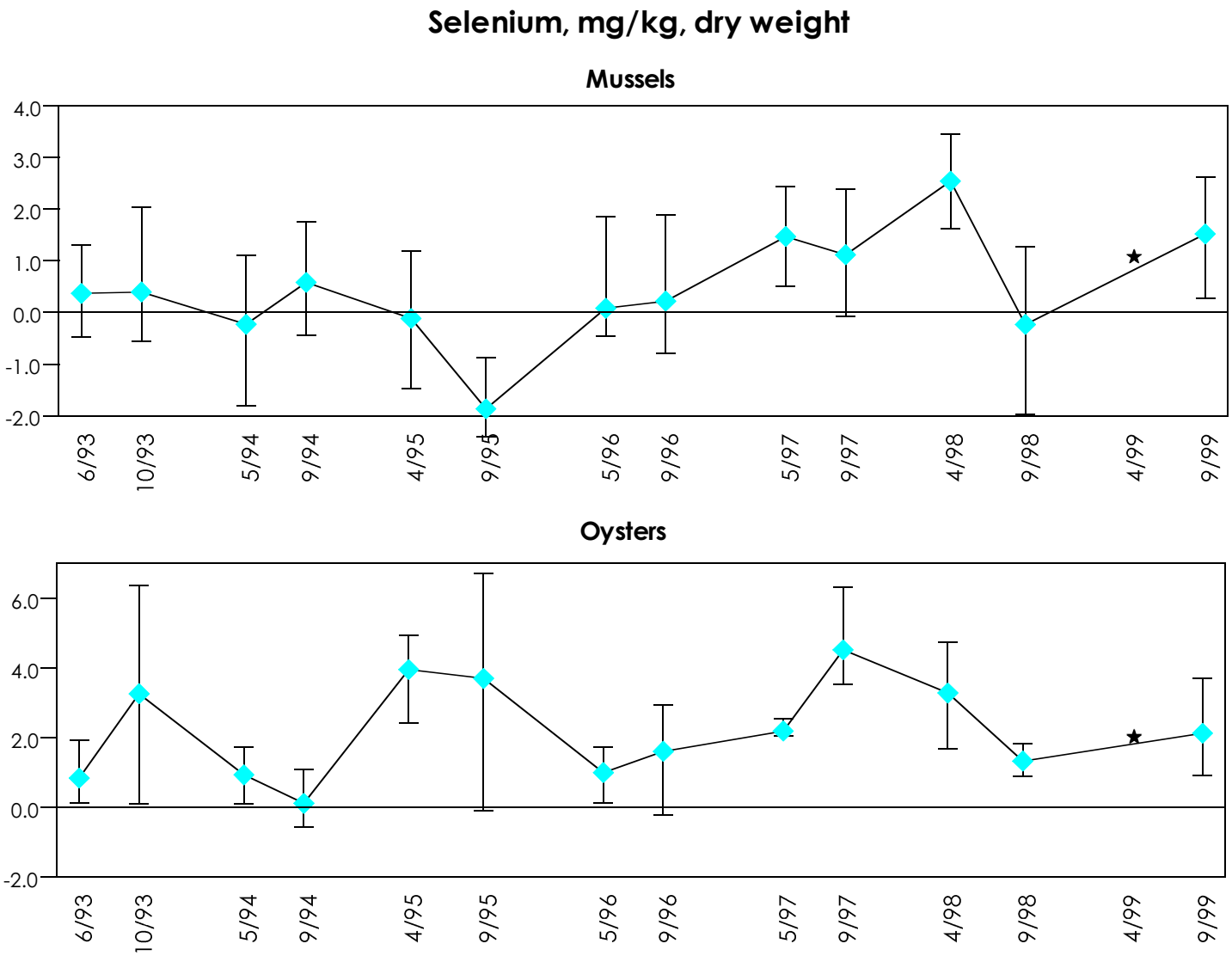


Figure 4.26. Selenium accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍eans no analyzed data available.

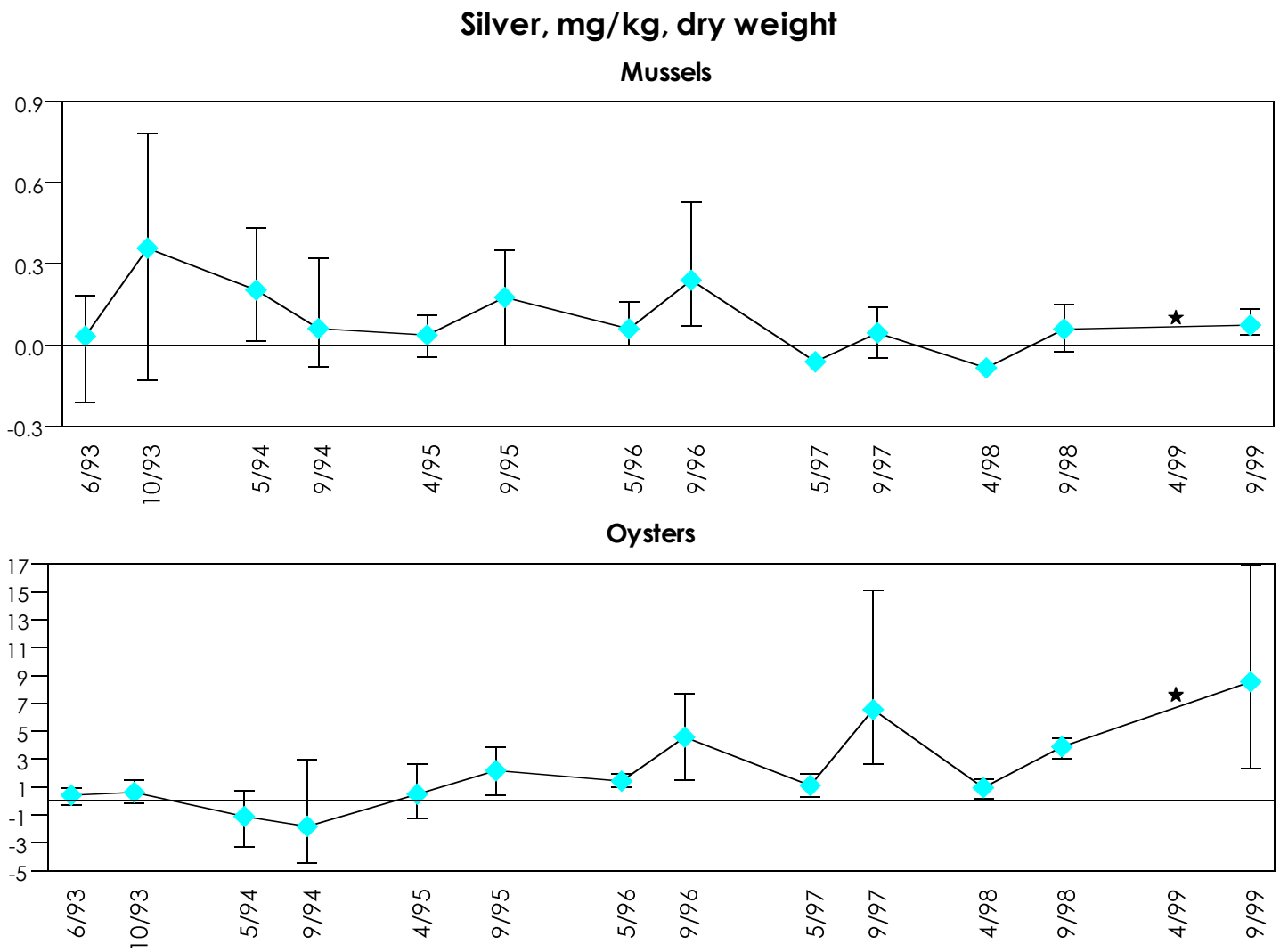


Figure 4.27. Silver accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍eans no analyzed data available.

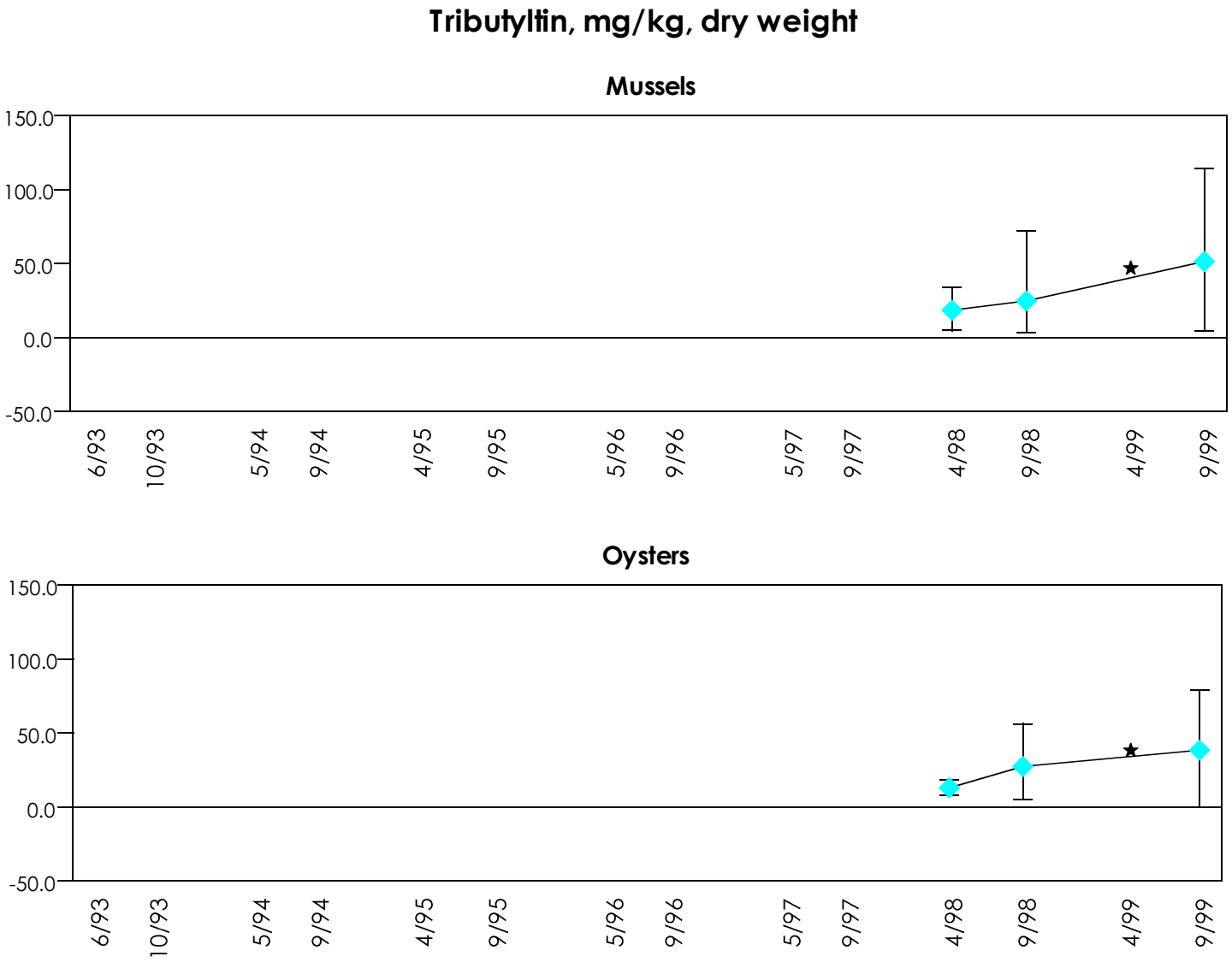


Figure 4.28. Tributyltin accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 4 sampling periods from 1998–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍eans no analyzed data available.

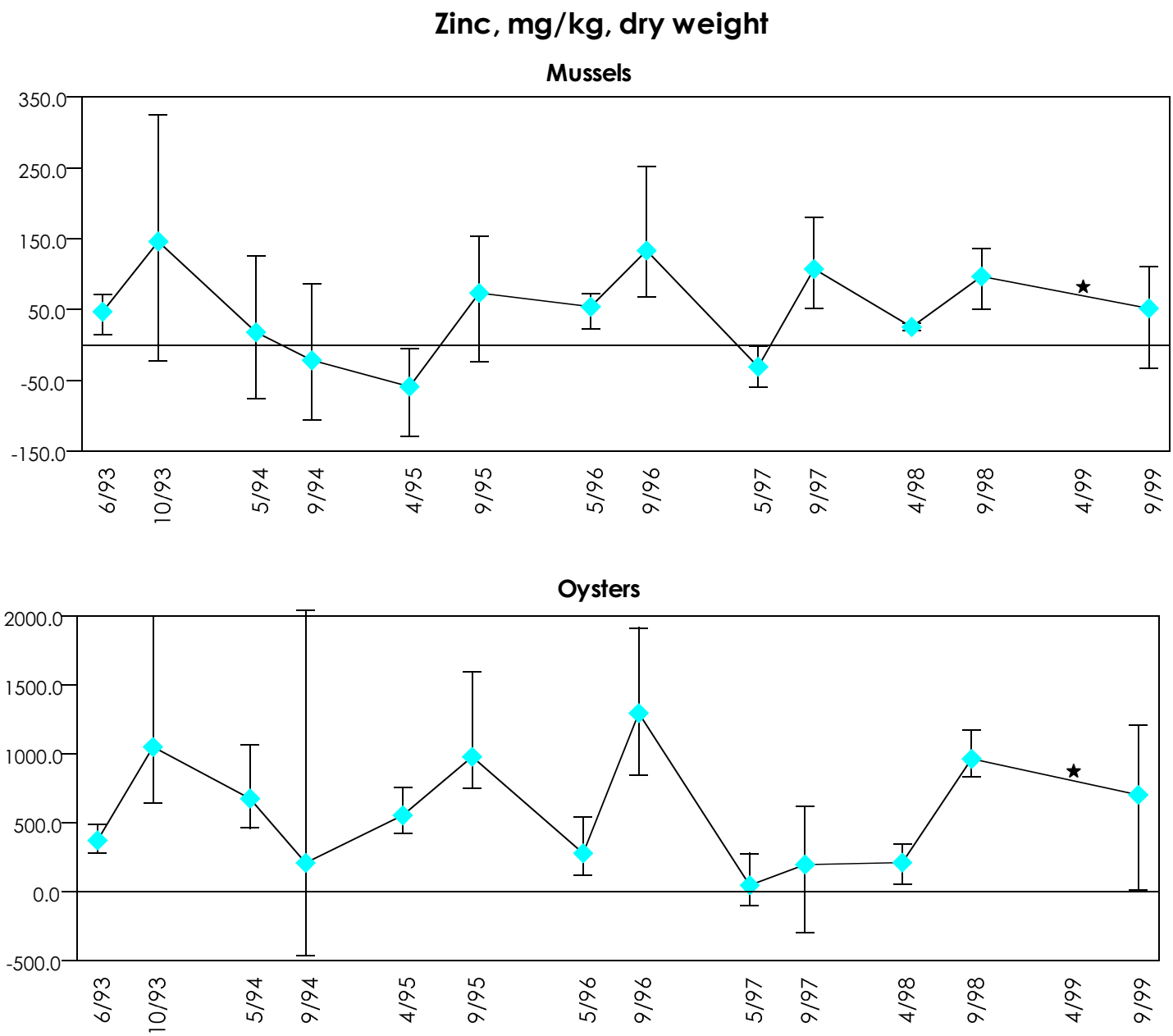


Figure 4.29. Zinc accumulation or depuration in parts per million dry weight (ppm) in two transplanted bivalve species for 14 sampling periods from 1993–1999. Initial (T-0) concentrations are subtracted from tissue concentrations after retrieval to give concentrations accumulated or depurated (negative value) during deployment in the Estuary. Bars indicate the range of values of all stations where species were deployed. Note different Y-axis scales. H ❍❋ans no analyzed data available.

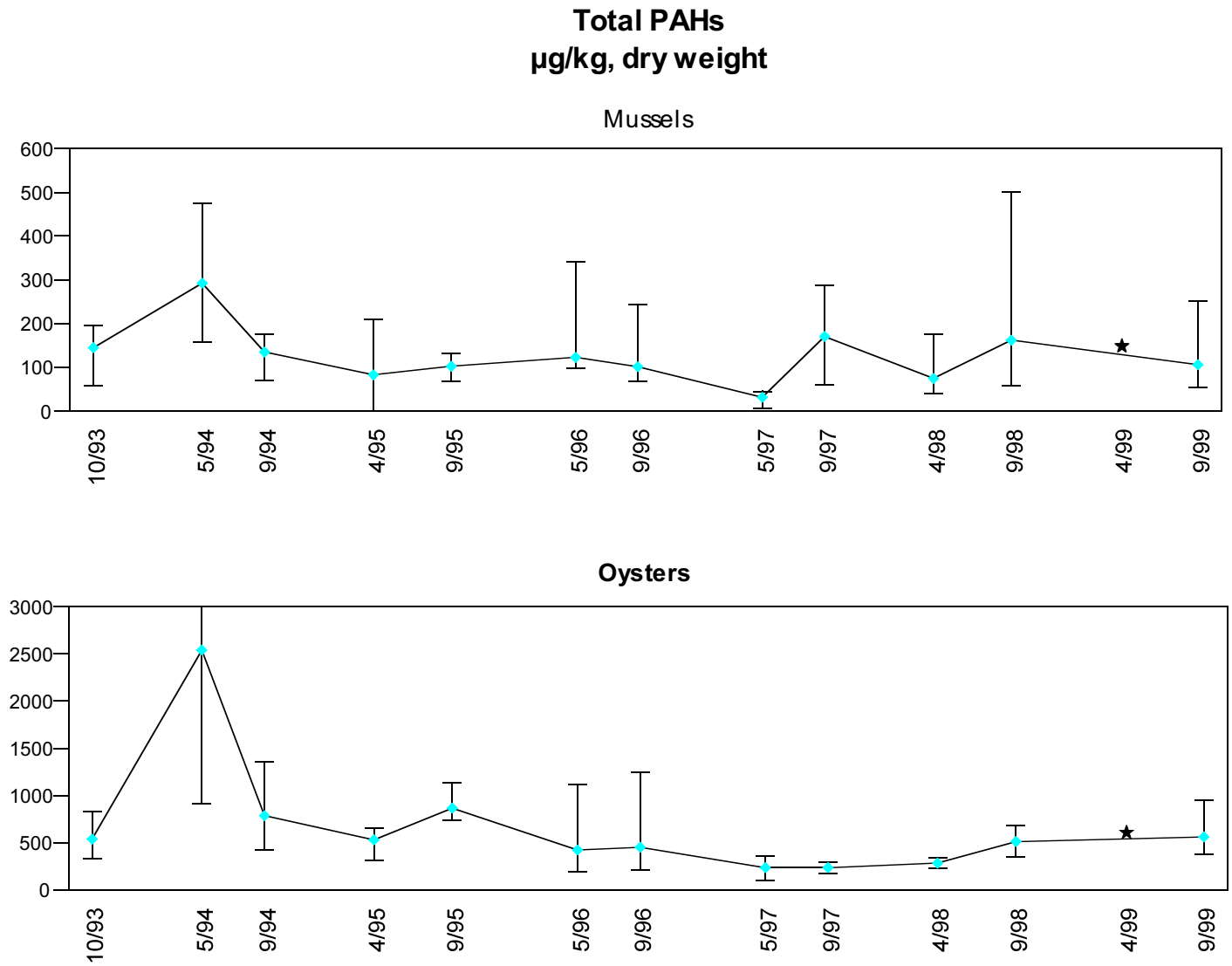


Figure 4.30. Trace organic accumulation or depuration in parts per billion dry weight (ppb) in two species of transplanted bivalves for thirteen sampling periods from 1993–1999 (mean of all stations). Accumulation or depuration was calculated by subtracting initial tissue (T-0) concentrations from concentrations after deployment. Bars indicate range of values within a sampling period.
H Oeans no analyzed data available.

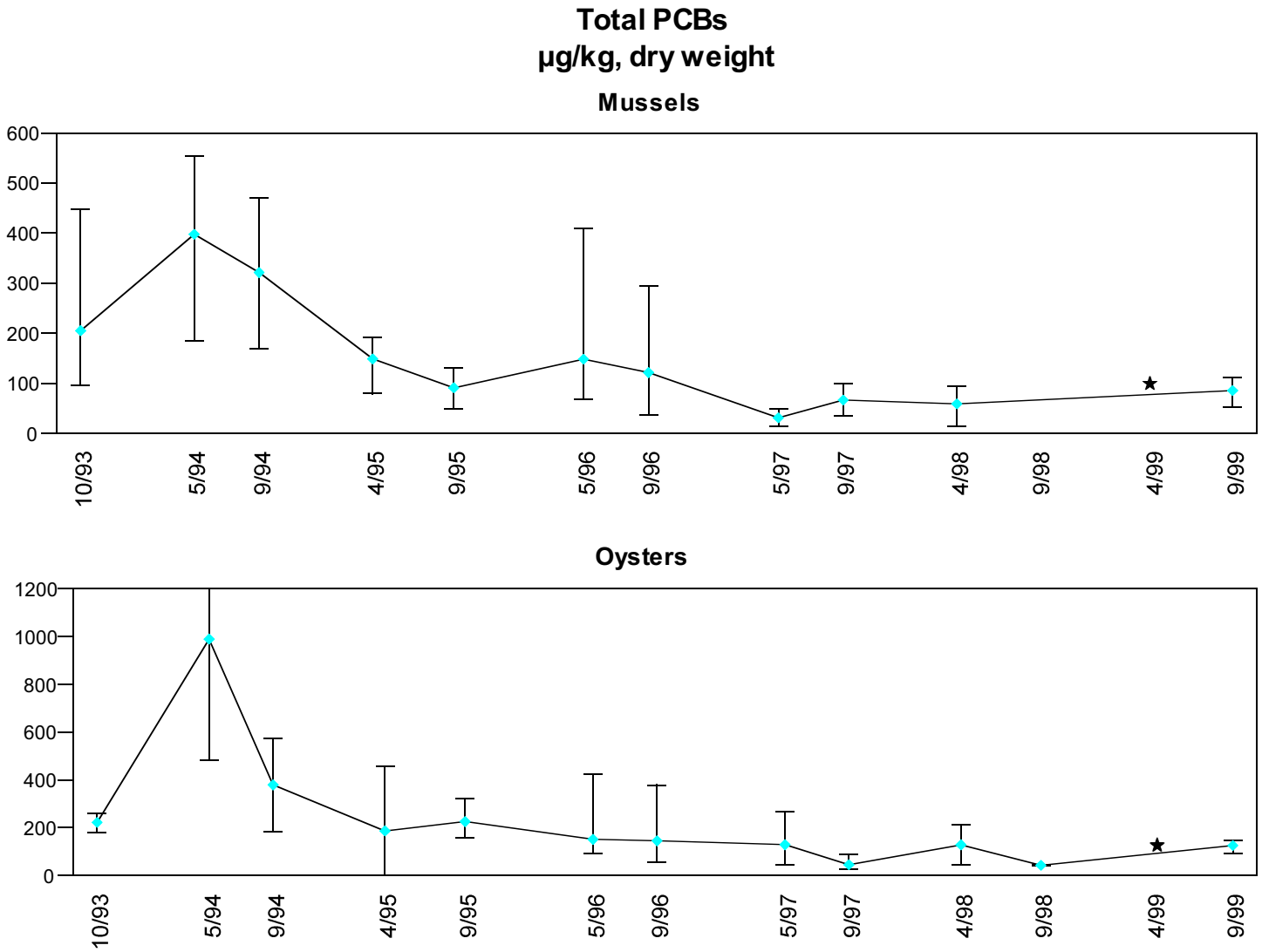


Figure 4.31. Trace organic accumulation or depuration in parts per billion dry weight (ppb) in two species of transplanted bivalves for thirteen sampling periods from 1993–1999 (mean of all stations).
Accumulation or depuration was calculated by subtracting initial tissue (T-0) concentrations from concentrations after deployment. Bars indicate range of values within a sampling period.
H ❍eans no analyzed data available.

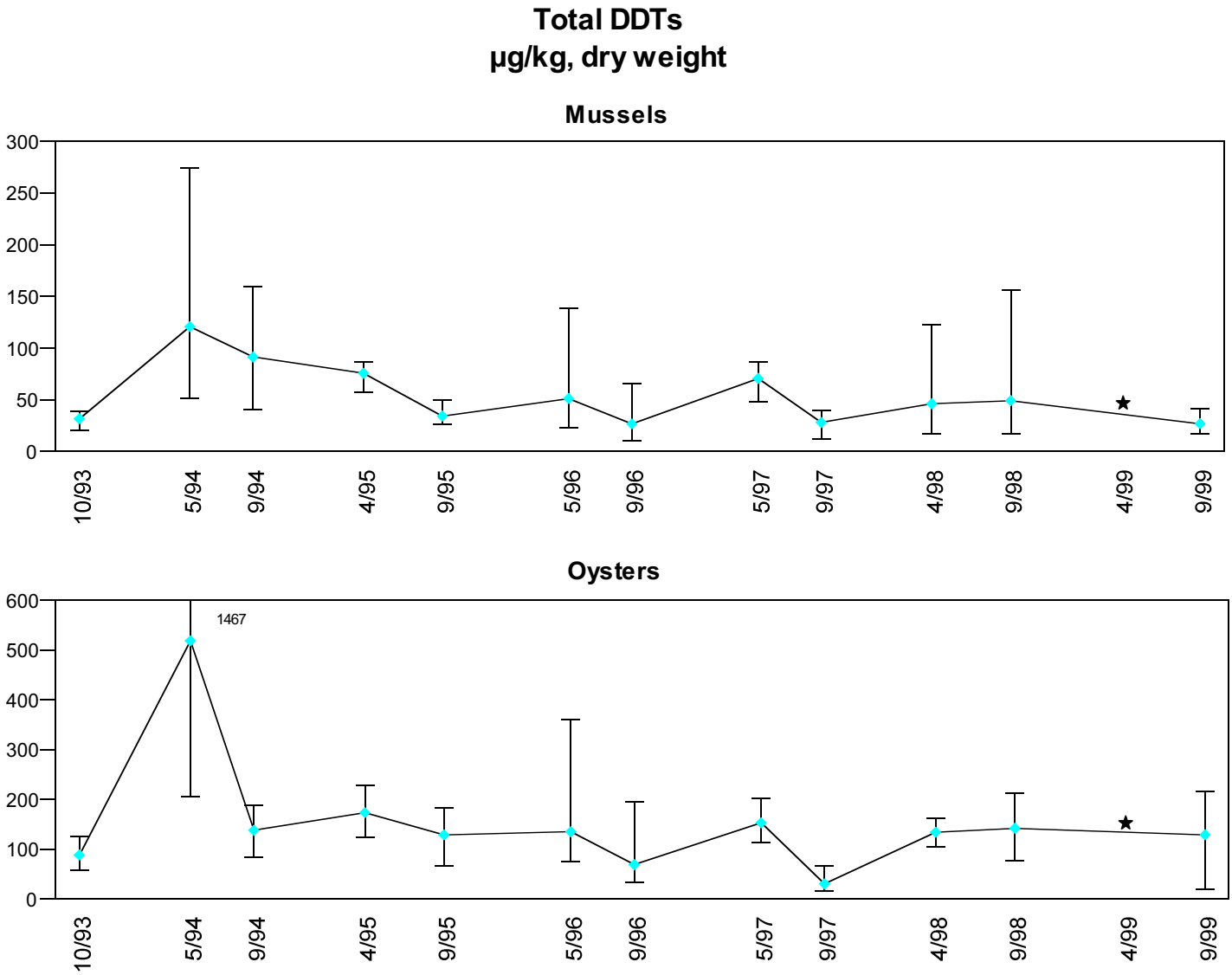


Figure 4.32. DDT accumulation or depuration in parts per billion dry weight (ppb) in two species of transplanted bivalves for thirteen sampling periods from 1993–1999 (mean of all stations).
Accumulation or depuration was calculated by subtracting initial tissue (T-0) concentrations from concentrations after deployment. Bars indicate range of values within a sampling period.
H ❍eans no analyzed data available.

Table 1. Conventional water quality parameters, 1999. NA = not available, ND = not detected, P = low precision (>30% of field value), . = no data.

Station Code	Station	Date	CruiseN	Ammonia	Chlorophyll-a	Conductivity	DO	DOC	Hardness	Nitrate	Nitrite	pH	Phaeophytin	Phosphate	Salinity (by salinometer)	Salinity (by SCT)	Silicates	Temperature	TSS
				mg/L	mg/m^3	µmho	mg/L	ug/L	mg/L	mg/L	mg/L	pH	mg/m^3	mg/L	psu	°/oo	mg/L	°C	mg/L
BG20	Sacramento River	2/10/99	19	0.09	1.2	124	11.1	2787	43	0.27	0.006	6.4	0.9	0.10	ND	0.0	7.38	9.4	14.8
BG30	San Joaquin River	2/10/99	19	0.14	1.0	193	11.2	4024	58	0.53	0.011	7.1	1.3	0.17	ND	0.0	7.89	9.6	19.5
BF40	Honker Bay	2/9/99	19	0.10	2.1	182	11.4	2606	59	0.24	0.007	7.4	1.8	0.12	ND	0.0	3.42	9.7	67.2
BF20	Grizzly Bay	2/9/99	19	0.09	2.4	313	11.1	2943	63	0.36	0.008	7.4	1.3	0.13	ND	0.0	8.14	9.6	22.4
BF10	Pacheco Creek	2/10/99	19	0.11	2.3	310	10.7	3159	70	0.35	0.009	6.9	2.0	0.14	ND	0.0	6.37	9.4	50.2
BD50	Napa River	2/9/99	19	0.13	3.0	1760	9.8	5717	138	1.43	0.014	6.8	7.6	0.26	ND	0.7	8.56	11.1	304.6
BD40	Davis Point	2/8/99	19	0.09	1.3	10070	10.8	2751	1080	0.58	0.007	7.1	1.5	0.13	5.8	5.5	7.76	10.2	29.8
BD30	Pinole Point	2/8/99	19	0.09	2.4	15	10.3	2354	1700	0.34	0.007	7.5	0.8	0.08	9.0	8.3	3.71	10.4	12.8
BD20	San Pablo Bay	2/8/99	19	0.09	2.4	12280	10.5	2630	1260	0.27	0.007	7.6	1.6	0.09	6.9	6.9	3.80	10.2	37.3
BD15	Petaluma River	2/8/99	19	0.35	2.7	3	9.0	10630	310	1.26	0.029	7.3	5.7	0.47	ND	1.4	3.99	10.8	161.8
BC60	Red Rock	2/3/99	19	0.11	0.7	34600	9.0	1525	.	0.31	0.011	7.9	0.4	0.16	22.5	21.2	2.06	11.4	4.7
BC41	Point Isabel	2/4/99	19	0.07	1.2	33700	9.0	1573	.	0.28	0.004	7.9	0.9	0.15	21.0	20.3	1.41	10.4	3.1
BC30	Richardson Bay	2/3/99	19	0.09	0.7	36900	9.3	1429	.	0.18	0.009	7.9	0.5	0.16	23.1	22.6	1.45	10.9	4.0
BC20	Golden Gate	2/3/99	19	0.07	0.9	55800	8.1	1634	.	0.26	0.007	8.0	0.6	0.14	28.4	35.9	1.26	11.1	3.4
BC10	Yerba Buena Island	2/4/99	19	0.13	0.9	28000	9.2	1537	.	0.40	0.011	7.9	0.6	0.18	20.2	16.7	3.70	11.4	3.8
BB70	Alameda	2/4/99	19	0.13	1.3	35900	9.3	1573	.	0.42	0.009	7.9	0.9	0.22	22.0	21.9	2.53	10.8	11.1
BB30	Oyster Point	2/1/99	19	0.15	2.0	34800	9.2	1598	.	0.40	0.012	8.0	1.9	0.26	22.9	31.4	1.58	10.4	23.7
BB15	San Bruno Shoals	2/1/99	19	0.14	2.0	32300	8.8	1670	.	0.48	0.008	7.8	1.2	0.33	24.0	28.8	1.77	10.5	12.5
BA40	Redwood Creek	2/1/99	19	0.19	3.1	28900	8.8	2390	.	0.48	0.013	7.8	1.8	0.45	23.2	25.2	1.19	10.9	48.5
BA30	Dumbarton Bridge	2/2/99	19	0.21	3.0	29300	8.5	2330	.	0.85	0.024	7.9	1.9	0.68	20.6	26.1	1.06	9.8	12.5
BA20	South Bay	2/2/99	19	0.19	3.6	28400	9.1	2426	3880	1.09	0.018	7.9	2.2	0.61	21.4	24.3	3.68	11.3	36.1
BA10	Coyote Creek	2/1/99	19	0.15	4.0	25400	9.1	2751	.	1.19	0.014	7.9	2.0	0.75	20.0	21.7	2.71	11.1	22.8
C-3-0	San Jose	2/2/99	19	0.38	4.7	18550	8.5	4192	2560	2.56	0.067	7.7	2.4	0.28	13.6	15.2	3.91	11.5	59.9
C-1-3	Sunnyvale	2/2/99	19	0.94	1.9	6990	8.2	5177	1200	4.51	0.162	7.6	1.4	0.51	6.0	5.6	4.71	9.7	241.3
BW10	Standish Dam	2/11/99	19	0.09	4.1	553	11.1	6258	192	2.92	0.028	7.6	2.7	0.19	ND	0.0	6.71	8.3	111.6
BW15	Guadalupe River	2/11/99	19	0.04	1.8	683	10.5	4216	288	1.62	0.012	8.1	2.1	0.20	ND	0.1	6.45	11.5	38.8
BG20	Sacramento River	4/21/99	20	0.10	3.4	209	9.0	1706	67	0.10	0.005	7.8	1.6	0.02	ND	0.0	3.70	16.2	24.5
BG30	San Joaquin River	4/21/99	20	0.04	4.1	191	9.2	2078	62	0.22	0.007	7.7	2.1	0.02	ND	0.0	4.04	16.6	21.5
BF40	Honker Bay	4/20/99	20	0.07	3.6	205	9.5	1982	68	0.18	0.008	7.9	2.1	0.02	ND	0.0	4.06	15.9	56.4
BF20	Grizzly Bay	4/21/99	20	0.04	4.2	380	8.4	1766	85	0.20	0.008	8.1	3.0	0.02	ND	0.0	4.20	15.5	62.5
BF10	Pacheco Creek	4/20/99	20	0.07	5.1	1000	9.7	1826	105	0.26	0.011	7.8	6.3	0.02	ND	0.1	4.00	15.9	127.3
BD50	Napa River	4/20/99	20	0.12	4.7	8310	8.1	2654	875	0.40	0.019	7.6	5.1	0.07	4.6	4.6	4.11	17.1	104.5
BD40	Davis Point	4/19/99	20	0.07	12.8	21100	8.9	1754	2100	0.32	0.008	7.8	11.5	0.06	11.6	12.5	2.84	15.0	216.2
BD30	Pinole Point	4/19/99	20	0.05	8.6	23400	9.0	1706	2560	0.28	0.006	7.9	2.4	0.05	13.2	14.0	2.65	15.2	53.4
BD20	San Pablo Bay	4/19/99	20	0.04	17.6	20700	8.7	1730	2390	0.18	0.006	7.9	14.3	0.05	9.2	12.2	2.72	15.6	242.0
BD15	Petaluma River	4/19/99	20	0.03	52.1	16080	8.1	3663	1720	0.22	0.006	8.0	13.0	0.11	13.0	9.5	2.78	21.4	231.1
BC60	Red Rock	4/14/99	20	0.05	4.6	800	9.0	1225	.	0.24	0.003	8.0	1.2	0.04	24.9	24.5	1.24	13.1	6.5
BC41	Point Isabel	4/14/99	20	0.02	23.0	34300	10.6	1501	.	0.01	0.001	8.5	3.3	0.02	21.2	21.2	1.24	16.0	17.7
BC30	Richardson Bay	4/15/99	20	0.04	3.1	39600	8.9	1213	.	0.19	0.004	8.1	0.9	0.04	24.8	24.7	1.25	13.8	6.0
BC20	Golden Gate	4/15/99	20	0.04	4.9	48100	8.8	961	.	0.21	0.004	7.9	2.3	0.03	30.6	30.2	0.67	10.7	1.8
BC10	Yerba Buena Island	4/14/99	20	0.02	6.8	39000	9.0	1381	.	0.01	0.001	7.9	2.1	0.01	20.9	24.0	1.14	12.7	10.5
BB70	Alameda	4/14/99	20	0.05	13.5	38000	9.3	1273	.	0.19	0.004	7.9	7.7	0.04	24.4	23.5	1.03	11.9	55.7
BB30	Oyster Point	4/12/99	20	0.05	2.2	33300	10.1	1393	.	0.17	0.004	7.7	0.5	0.05	20.7	20.3	1.53	11.0	3.9
BB15	San Bruno Shoals	4/12/99	20	0.03	16.9	34100	10.8	1850	.	0.08	0.003	8.4	1.6	0.04	20.9	20.9	0.62	12.2	5.8
BA40	Redwood Creek	4/12/99	20	0.04	18.5	31700	10.4	2162	.	0.20	0.005	8.3	2.3	0.06	19.4	19.3	0.91	12.7	16.0
BA30	Dumbarton Bridge	4/12/99	20	0.07	16.5	28300	9.9	2534	.	0.35	0.008	8.2	3.2	0.08	17.2	17.1	1.14	14.0	35.0
BA20	South Bay	4/13/99	20	0.06	28.2	27300	9.6	2666	2960	0.27	0.012	8.1	8.9	0.07	16.3	16.5	1.29	14.9	147.9
BA10	Coyote Creek	4/13/99	20	0.08	28.4	27900	10.0	2522	.	0.55	0.015	8.0	5.9	0.13	17.5	16.9	1.14	14.7	37.9
C-3-0	San Jose	4/13/99	20	0.33	11.5	3500	8.1	4420	875	3.47	0.090	7.4	5.4	0.18	4.3	2.0	3.09	15.7	106.8
C-1-3	Sunnyvale	4/13/99	20	P	11.0	6900	7.8	5189	650	2.85	0.088	7.5	6.3	0.34	3.0	3.7	2.85	15.2	80.8
BW10	Standish Dam	4/22/99	20	0.05	4.9	1240	8.7	3003	396	2.92	0.057	8.2	2.6	0.03	ND	0.4	3.63	16.6	23.7
BW15	Guadalupe River	4/22/99	20	0.03	12.6	1170	8.6	2510	429	2.26	0.017	7.8	15.0	0.04	ND	0.3	3.86	17.5	188.9
BG20	Sacramento River	7/21/99	21	0.07	3.0	543	8.6	2282	93	0.23	0.011	7.9	1.1	0.06	ND	0.1	4.77	19.9	35.6
BG30	San Joaquin River	7/21/99	21	0.06	3.5	675	8.6	2366	101	0.26	0.010	7.9	1.6	0.06	ND	0.1	4.98	20.5	42.7
BF40	Honker Bay	7/20/99	21	0.04	4.1	3100	9.0	1958	335	0.37	0.005	7.9	3.4	0.07	ND	1.6	2.88	20.0	91.5
BF20	Grizzly Bay	7/20/99	21	0.05	2.8	8620	8.6	2102	827	0.41	0.006	7.9	1.4	0.08	4.4	4.7	1.94	19.3	55.3
BF10	Pacheco Creek	7/20/99	21	0.04	1.6	11630	8.5	1982	.	0.51	0.004	7.9	0.7	0.09	6.4	6.6	2.00	19.6	30.8
BD50	Napa River	7/20/99	21	0.12	2.0	24200	NA	2282	2705	0.33	0.011	7.8	0.7	0.07	14.7	14.8	1.58	19.6	36.4
BD40	Davis Point	7/19/99	21	0.08	1.8	32000	9.0	1886	3640	0.40	0.007	7.8	0.4	0.08	20.0	30.0	1.28	18.6	10.3
BD30	Pinole Point	7/19/99	21	0.11	NA	33500	9.0	1513	3680	0.44	0.013	7.9	NA	0.10	20.4	20.3	1.42	18.5	2.6
BD20	San Pablo Bay	7/19/99	21	0.09	NA	33200	8.3	1694	3780	0.34	0.008	7.9	NA	0.07	20.5	20.6	1.59	18.7	34.5
BD15	Petaluma River	7/19/99	21	0.20	NA	32500	7.1	3771	3790	0.38	0.021	7.6	NA	0.16	20.6	20.2	2.68	21.4	83.6
BC60	Red Rock	7/15/99	21	0.10	2.8	45300	7.0	1153	.	0.29	0.011	7.8	2.4	0.06	30.9	30.2	0.75	15.4	35.0
BC41	Point Isabel	7/16/99	21	0.11	1.7	46300	7.5	1129	.	0.19	0.014	7.9	2.8	0.06	29.6	29.5	0.42	15.9	21.5
BC30	Richardson Bay	7/15/99	21	0.12	2.2	45800	8.0	1117	.	0.28	0.014	7.8	1.1	0.07	30.4	30.3	0.61	16.0	4.6
BC20	Golden Gate	7/15/99	21	0.07	12.9	47100	8.8	997	.	0.23	0.010	8.1	1.7	0.05	32.6	32.8	0.48	13.1	1.5
BC10	Yerba Buena Island	7/16/99	21	0.13	1.8	46200	7.2	1273	.	0.38	0.015	7.9	1.6	0.09	29.3	29.1	1.05	16.5	19.2
BB70	Alameda	7/16/99	21	0.14	1.5	48600	6.8	1549	.	0.41	0.019	7.9	2.4	0.12	28.9	28.7	1.48	19.7	26.2
BB30	Oyster Point	7/13/99	21	0.09	2.1	41800	7.1	1453	.	0.30	0.015	7.9	1.5	0.08	28.6	28.3	1.11	20.2	28.4
BB15	San Bruno Shoal	7/13/99	21	0.06	2.3	42100	7.1	1369	.	0.23	0.013	8.0	0.8	0.09	27.9	27.9	1.37	20.7	6.3
BA40	Redwood Creek	7/13/99	21	0.07	2.1	42200	NA	1633	.	0.35	0.008	8.0	0.5	0.15	27.6	27.6	1.98	21.3	3.2
BA30	Dumbarton Bridge	7/14/99	21	0.09	9.0	42000	6.2	3195	.	0.48	0.027	7.8	0.1	0.23	25.2	25.0	1.14	23.2	14.8
BA20	South Bay	7/14/99	21	0.14	11.1	40200	6.0	2835	4420	0.73	0.040	7.7	0.5	0.36	23.8	23.2	1.25	23.1	21.6
BA10	Coyote Creek	7/13/99	21	0.13	5.8	41000	NA	3579	476	0.56	0.035	7.8	2.1	0.29	24.6	25.1	1.62	24.3	69.5
C-3-0	San Jose	7/14/99	21	0.77	3.7	NA	4.2	5777	1960	4.29	0.236	7.5	5.7	0.12	9.9	9.4	4.46	25.1	306.3
C-1-3	Sunnyvale	7/14/99	21	0.41	228.9	NA	5.1	5021	3230	2.28	0.145	7.6	398	0.55	17.1	15.2	2.20	24.7	372.4
BW10	Standish Dam	7/22/99	21	0.13	562.6	1436	7.8	4072	.	3.01	0.064	8.2	76.3	0.07	ND	0.6	3.93	19.4	133.0
BW15	Guadalupe River	7/22/99	21	0.11	3.1	1304	8.1	2102	489	2.82	0.023	8.0	3.4	0.08	ND	0.5	4.31	20.8	79.5

Table 2. Dissolved concentrations of trace elements in water, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value
NA = not available, ND = not detected.

Station Code	Station	Date	Cruise	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BG20	Sacramento River	2/10/99	19	0.0032	0.93	NA	NA	1.2	b 0.0016	1.0	0.090	0.08	1.0
BG30	San Joaquin River	2/10/99	19	0.0032	0.93	NA	NA	1.5	b 0.0012	1.3	0.097	0.13	1.1
BF40	Honker Bay	2/9/99	19	0.0035	1.19	NA	NA	1.1	b 0.0027	0.9	0.106	0.05	1.1
BF20	Grizzly Bay	2/9/99	19	0.0030	1.27	NA	NA	1.1	b 0.0015	0.9	0.109	0.03	1.0
BF10	Pacheco Creek	2/10/99	19	0.0029	1.27	NA	NA	1.3	b 0.0030	1.1	0.127	0.11	1.3
BD50	Napa River	2/9/99	19	0.0032	1.17	NA	NA	1.6	b 0.0041	2.5	0.065	0.17	1.0
BD40	Davis Point	2/8/99	19	0.0029	1.30	NA	NA	1.3	b 0.0020	1.3	0.058	0.04	1.1
BD30	Pinole Point	2/8/99	19	0.0026	1.38	NA	NA	1.1	b 0.0011	1.1	0.018	0.08	0.8
BD20	San Pablo Bay	2/8/99	19	0.0027	1.29	NA	NA	1.6	B	1.5	0.039	0.06	1.1
BD15	Petaluma River	2/8/99	19	0.0115	3.28	NA	NA	4.5	b 0.0318	12.2	0.991	0.17	8.4
BC60	Red Rock	2/3/99	19	0.0035	1.33	NA	NA	0.8	B	0.9	0.009	0.08	0.5
BC41	Point Isabel	2/4/99	19	0.0037	1.35	NA	NA	0.9	B	1.0	0.007	0.13	0.7
BC30	Richardson Bay	2/3/99	19	0.0035	1.46	NA	NA	1.0	B	0.9	0.009	0.06	1.2
BC20	Golden Gate	2/3/99	19	0.0028	1.67	NA	NA	0.5	B	0.7	0.012	0.05	0.5
BC10	Yerba Buena Island	2/4/99	19	0.0036	1.51	NA	NA	0.8	B	1.0	0.013	0.07	0.7
BB70	Alameda	2/4/99	19	0.0041	1.66	NA	NA	1.0	B	1.1	0.016	0.08	0.9
BB30	Oyster Point	2/1/99	19	0.0048	1.55	NA	NA	1.2	B	1.3	0.027	0.13	1.0
BB15	San Bruno Shoal	2/1/99	19	0.0041	1.76	NA	NA	1.3	B	1.4	0.020	0.14	1.1
BA40	Redwood Creek	2/1/99	19	0.0043	1.76	NA	NA	1.7	B	2.1	0.039	0.17	1.8
BA30	Dumbarton Bridge	2/2/99	19	0.0036	1.75	NA	NA	1.8	b 0.0009	2.3	0.061	0.26	3.0
BA20	South Bay	2/2/99	19	0.0041	2.09	NA	NA	1.5	B	2.0	0.049	0.19	2.5
BA10	Coyote Creek	2/1/99	19	0.0041	2.18	NA	NA	1.6	B	2.2	0.064	0.33	3.5
C-3-0	San Jose	2/2/99	19	0.0032	1.90	NA	NA	2.2	b 0.0008	3.8	0.138	0.41	9.7
C-1-3	Sunnyvale	2/2/99	19	0.0045	1.87	NA	NA	1.3	b 0.0032	3.2	0.210	0.47	8.3
BW10	Standish Dam	2/11/99	19	0.0033	1.08	NA	NA	1.6	b 0.0029	2.9	0.178	0.69	2.0
BW15	Guadalupe River	2/11/99	19	0.0029	0.87	NA	NA	1.4	b 0.0348	5.1	0.197	2.48	4.5
BG20	Sacramento River	4/21/99	20	0.0032	1.08	NA	NA	1.3	0.0004	0.9	0.032	e 0.06	0.9
BG30	San Joaquin River	4/21/99	20	0.0031	1.10	NA	NA	1.6	0.0012	1.1	0.071	0.08	1.0
BF40	Honker Bay	4/20/99	20	0.0030	1.04	NA	NA	1.2	0.0005	0.8	0.044	e 0.06	0.8
BF20	Grizzly Bay	4/21/99	20	0.0026	1.16	NA	NA	1.3	0.0005	0.8	0.014	e 0.06	0.4
BF10	Pacheco Creek	4/20/99	20	0.0026	1.06	NA	NA	1.3	B	0.8	0.009	e 0.05	0.3
BD50	Napa River	4/20/99	20	0.0031	1.39	NA	NA	1.8	b 0.0008	1.9	0.008	0.09	0.7
BD40	Davis Point	4/19/99	20	0.0027	1.34	NA	NA	1.1	B	1.4	0.005	0.09	0.4
BD30	Pinole Point	4/19/99	20	0.0031	1.24	NA	NA	1.2	B	1.3	0.010	0.08	0.6
BD20	San Pablo Bay	4/19/99	20	0.0033	1.39	NA	NA	1.1	0.0003	1.2	0.012	0.12	0.5
BD15	Petaluma River	4/19/99	20	0.0034	1.96	NA	NA	3.4	0.0005	4.1	0.010	0.10	0.5
BC60	Red Rock	4/14/99	20	0.0041	1.30	NA	NA	0.7	0.0006	0.9	0.008	0.11	0.7
BC41	Point Isabel	4/14/99	20	0.0036	1.42	NA	NA	1.1	0.0007	1.0	0.009	0.11	0.3
BC30	Richardson Bay	4/15/99	20	0.0038	1.15	NA	NA	0.8	B	0.9	0.008	e 0.04	0.5
BC20	Golden Gate	4/15/99	20	0.0035	1.38	NA	NA	0.4	0.0002	0.5	0.005	e 0.05	0.6
BC10	Yerba Buena Island	4/14/99	20	0.0042	1.07	NA	NA	1.0	0.0004	1.0	0.008	e 0.03	0.5
BB70	Alameda	4/14/99	20	0.0041	1.08	NA	NA	1.0	b 0.0005	1.0	0.012	e 0.06	0.8
BB30	Oyster Point	4/12/99	20	0.0039	1.05	NA	NA	0.9	0.0006	1.0	0.007	e 0.03	0.6
BB15	San Bruno Shoal	4/12/99	20	0.0040	1.38	NA	NA	1.5	0.0003	1.2	0.014	0.12	0.6
BA40	Redwood Creek	4/12/99	20	0.0039	1.50	NA	NA	1.9	b 0.0020	1.7	0.022	0.13	0.7
BA30	Dumbarton Bridge	4/12/99	20	0.0043	1.56	NA	NA	1.9	b 0.0009	1.8	0.040	0.16	1.8
BA20	South Bay	4/13/99	20	0.0042	1.78	NA	NA	2.1	b 0.0008	2.1	0.053	0.35	2.0
BA10	Coyote Creek	4/13/99	20	0.0044	1.40	NA	NA	2.0	b 0.0012	2.0	0.041	0.36	2.3
C-3-0	San Jose	4/13/99	20	0.0031	1.53	NA	NA	2.3	b 0.0007	3.6	0.127	0.37	15.7
C-1-3	Sunnyvale	4/13/99	20	0.0039	1.52	NA	NA	1.4	b 0.0019	2.2	0.136	0.91	7.6
BW10	Standish Dam	4/22/99	20	0.0026	1.75	NA	NA	0.9	ND	2.2	0.090	1.14	1.3
BW15	Guadalupe River	4/22/99	20	0.0027	0.74	NA	NA	0.9	B	4.0	0.031	4.29	1.4
BG20	Sacramento River	7/21/99	21	0.0011	1.62	NA	NA	1.7	b 0.0015	1.2	0.100	e 0.06	1.4
BG30	San Joaquin River	7/21/99	21	0.0013	1.77	NA	NA	1.8	B	1.2	0.093	e 0.06	1.2
BF40	Honker Bay	7/20/99	21	0.0010	1.89	NA	NA	1.6	B	0.9	0.010	e 0.06	0.4
BF20	Grizzly Bay	7/20/99	21	0.0030	2.24	NA	NA	2.0	B	1.2	0.009	e 0.06	0.5
BF10	Pacheco Creek	7/20/99	21	0.0032	2.15	NA	NA	1.9	B	1.3	0.011	0.13	0.6
BD50	Napa River	7/20/99	21	0.0025	2.22	NA	NA	2.3	B	2.2	0.015	0.19	1.0
BD40	Davis Point	7/19/99	21	0.0044	2.30	NA	NA	1.9	B	1.9	0.011	0.22	0.8
BD30	Pinole Point	7/19/99	21	0.0039	2.07	NA	NA	1.7	B	1.8	0.010	0.11	0.5
BD20	San Pablo Bay	7/19/99	21	0.0077	2.30	NA	NA	2.1	B	1.8	0.009	0.24	0.9
BD15	Petaluma River	7/19/99	21	0.0112	3.34	NA	NA	3.8	B	4.0	0.012	0.21	0.8
BC60	Red Rock	7/15/99	21	0.0042	1.72	NA	NA	0.8	B	1.0	0.012	0.11	0.5
BC41	Point Isabel	7/16/99	21	0.0064	1.83	NA	NA	1.3	B	1.2	0.016	e 0.07	0.9
BC30	Richardson Bay	7/15/99	21	0.0042	1.79	NA	NA	1.0	B	1.0	0.015	e 0.08	0.7
BC20	Golden Gate	7/15/99	21	0.0032	1.70	NA	NA	0.4	B	0.6	0.006	e 0.08	0.3
BC10	Yerba Buena Island	7/16/99	21	0.0044	1.97	NA	NA	1.0	B	1.2	0.014	ND	0.6
BB70	Alameda	7/16/99	21	0.0079	2.19	NA	NA	1.5	B	1.5	0.017	ND	0.7
BB30	Oyster Point	7/13/99	21	0.0080	2.45	NA	NA	1.6	B	1.6	0.021	e 0.13	0.7
BB15	San Bruno Shoal	7/13/99	21	0.0082	2.83	NA	NA	2.0	b 0.0075	2.0	0.019	ND	0.7
BA40	Redwood Creek	7/13/99	21	0.0104	2.74	NA	NA	2.0	B	1.9	0.026	0.21	1.0
BA30	Dumbarton Bridge	7/14/99	21	0.0064	4.05	NA	NA	2.6	B	3.0	0.084	0.37	1.7
BA20	South Bay	7/14/99	21	0.0048	4.47	NA	NA	2.7	b 0.0106	3.3	0.134	0.46	2.6
BA10	Coyote Creek	7/13/99	21	0.0056	4.07	NA	NA	3.2	B	3.6	0.113	0.40	2.3
C-3-0	San Jose	7/14/99	21	0.0011	3.82	NA	NA	1.9	B	7.4	0.344	e 1.31	10.6
C-1-3	Sunnyvale	7/14/99	21	0.0016	4.18	NA	NA	2.6	B	5.6	0.294	0.76	4.9
BW10	Standish Dam	7/22/99	21	0.0014	2.75	NA	NA	1.0	B	2.9	0.144	2.03	2.6
BW15	Guadalupe River	7/22/99	21	0.0004	1.70	NA	NA	0.9	B	2.5	0.047	6.42	1.1

Table 3. Total or near-total ▲ concentrations of trace elements in water, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, NA = not available, ND = not detected
P = low precision (>30% of field value), p = low precision (<30% of field value), e = estimated value.

Station Code	Station	Date	Cruise	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Se	Zn
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
BG20	Sacramento River	2/10/99	19	0.0070	1.25	NA	NA	2.9	b 0.0046	5.3	0.52	0.09	3.1
BG30	San Joaquin River	2/10/99	19	0.0060	1.32	NA	NA	3.0	b 0.0056	5.3	0.56	0.13	3.9
BF40	Honker Bay	2/9/99	19	0.0090	1.93	NA	NA	4.9	b 0.0197	8.9	0.98	0.06	6.1
BF20	Grizzly Bay	2/9/99	19	0.0070	1.55	NA	NA	3.4	b 0.0076	6.5	0.68	0.04	3.9
BF10	Pacheco Creek	2/10/99	19	0.0070	1.80	NA	NA	4.4	b 0.0100	8.5	1.15	0.09	6.0
BD50	Napa River	2/9/99	19	0.0250	5.60	NA	NA	14.4	b 0.0667	38	6.37	0.19	37.1
BD40	Davis Point	2/8/99	19	0.0110	1.69	NA	NA	3.8	b 0.0148	5.2	1.06	0.10	5.7
BD30	Pinole Point	2/8/99	19	0.0080	1.60	NA	NA	2.5	b 0.0071	5.3	0.48	0.08	3.3
BD20	San Pablo Bay	2/8/99	19	0.0110	1.95	NA	NA	4.2	b 0.0155	8.2	1.29	0.09	6.3
BD15	Petaluma River	2/8/99	19	0.0190	4.38	NA	NA	10.3	b 0.0707	29	2.24	0.18	14.3
BC60	Red Rock	2/3/99	19	0.0040	1.56	NA	NA	1.5	b 0.0023	2.1	0.23	0.10	2.0
BC41	Point Isabel	2/4/99	19	0.0070	1.72	NA	NA	2.2	b 0.0065	3.3	0.53	0.12	3.6
BC30	Richardson Bay	2/3/99	19	0.0050	1.76	NA	NA	1.5	b 0.0023	1.9	0.24	0.06	2.4
BC20	Golden Gate	2/3/99	19	0.0040	1.70	NA	NA	0.8	b 0.0018	1.4	0.20	0.04	1.5
BC10	Yerba Buena Island	2/4/99	19	0.0050	1.68	NA	NA	1.8	b 0.0035	2.3	0.29	0.11	2.3
BB70	Alameda	2/4/99	19	0.0080	1.54	NA	NA	1.9	b 0.0044	2.6	0.37	0.07	2.8
BB30	Oyster Point	2/1/99	19	0.0180	2.11	NA	NA	3.4	b 0.0286	8.5	1.35	0.10	9.5
BB15	San Bruno Shoal	2/1/99	19	0.0110	1.73	NA	NA	2.2	b 0.0059	5.7	0.61	0.10	4.0
BA40	Redwood Creek	2/1/99	19	0.0290	2.15	NA	NA	4.3	b 0.0218	10	1.80	0.15	13.1
BA30	Dumbarton Bridge	2/2/99	19	0.0150	2.28	NA	NA	4.4	b 0.0114	7.6	0.81	0.25	5.5
BA20	South Bay	2/2/99	19	0.0230	2.41	NA	NA	5.2	b 0.0163	11	NA	0.10	10.5
BA10	Coyote Creek	2/1/99	19	0.0170	3.79	NA	NA	6.0	b 0.0160	9.0	0.96	0.21	9.1
C-3-0	San Jose	2/2/99	19	0.0310	2.78	NA	NA	6.7	b 0.0216	15	2.10	0.39	21.0
C-1-3	Sunnyvale	2/2/99	19	0.0860	4.02	NA	NA	17.6	b 0.0179	44	NA	0.54	55.9
BW10	Standish Dam	2/11/99	19	0.0160	2.23	NA	NA	9.3	b 0.0216	28	2.92	0.34	21.4
BW15	Guadalupe River	2/11/99	19	0.0110	1.25	NA	NA	5.8	b 0.0698	20	2.72	1.89	20.0
BG20	Sacramento River	4/21/99	20	0.0080	1.48	NA	NA	3.1	0.0035	3.7	0.36	0.10	3.8
BG30	San Joaquin River	4/21/99	20	0.0100	1.37	NA	NA	2.9	b 0.0067	3.0	0.46	e 0.06	3.3
BF40	Honker Bay	4/20/99	20	0.0090	1.30	NA	NA	5.4	b 0.0249	7.5	1.08	e 0.06	9.2
BF20	Grizzly Bay	4/21/99	20	0.0130	2.47	NA	NA	8.2	0.0234	13	2.57	e 0.042	16.2
BF10	Pacheco Creek	4/20/99	20	0.0080	1.79	NA	NA	8.1	b 0.0286	13	2.67	e 0.05	17.3
BD50	Napa River	4/20/99	20	0.0140	2.88	NA	NA	9.2	b 0.0274	16	3.20	P	18.4
BD40	Davis Point	4/19/99	20	0.0470	2.97	NA	NA	15.7	b 0.0590	30	4.79	0.11	28.6
BD30	Pinole Point	4/19/99	20	0.0140	1.78	NA	NA	4.1	b 0.0196	8.7	1.23	e 0.03	6.5
BD20	San Pablo Bay	4/19/99	20	0.0590	3.01	NA	NA	14.3	0.0881	30	5.92	0.11	35.0
BD15	Petaluma River	4/19/99	20	0.0470	3.28	NA	NA	17.7	0.0801	36	4.98	e 0.06	30.2
BC60	Red Rock	4/14/99	20	0.0050	1.34	NA	NA	1.3	0.0025	1.8	0.25	0.11	2.0
BC41	Point Isabel	4/14/99	20	0.0100	1.40	NA	NA	2.2	b 0.0051	2.9	0.64	P	3.4
BC30	Richardson Bay	4/15/99	20	0.0040	1.52	NA	NA	1.5	0.002	1.6	0.19	0.09	2.1
BC20	Golden Gate	4/15/99	20	0.0040	1.49	NA	NA	0.6	b 0.0010	0.78	0.07	0.11	0.8
BC10	Yerba Buena Island	4/14/99	20	0.0060	1.11	NA	NA	1.6	b 0.0068	2.2	0.35	e 0.02	2.5
BB70	Alameda	4/14/99	20	0.0170	1.75	NA	NA	3.0	b 0.0135	5.7	1.29	e 0.03	6.8
BB30	Oyster Point	4/12/99	20	0.0060	1.16	NA	NA	1.5	b 0.0025	1.7	0.13	0.10	1.4
BB15	San Bruno Shoal	4/12/99	20	0.0120	1.42	NA	NA	2.0	b 0.0040	1.8	0.21	0.07	1.7
BA40	Redwood Creek	4/12/99	20	0.0130	1.44	NA	NA	2.9	0.005	5.8	0.61	0.07	3.4
BA30	Dumbarton Bridge	4/12/99	20	0.0200	1.73	NA	NA	5.0	b 0.0124	8.4	1.15	0.24	8.2
BA20	South Bay	4/13/99	20	0.0420	2.32	NA	NA	8.6	b 0.0417	17	2.97	0.32	15.0
BA10	Coyote Creek	4/13/99	20	0.0200	2.20	NA	NA	5.0	0.0136	8.6	1.19	0.25	8.1
C-3-0	San Jose	4/13/99	20	0.0430	1.88	NA	NA	7.9	0.0497	20	3.15	0.45	33.7
C-1-3	Sunnyvale	4/13/99	20	0.0300	2.37	NA	NA	6.8	0.0279	17	NA	0.68	17.7
BW10	Standish Dam	4/22/99	20	0.0110	1.93	NA	NA	3.7	0.0107	9.1	1.65	1.29	8.6
BW15	Guadalupe River	4/22/99	20	0.0380	2.84	NA	NA	13.7	b 0.0176	35	8.42	p,e 1.54	46.3
BG20	Sacramento River	7/21/99	21	0.0060	2.20	NA	NA	3.8	b 0.0100	5.1	0.87	0.10	5.8
BG30	San Joaquin River	7/21/99	21	0.0090	2.36	NA	NA	4.1	b 0.0084	5.2	0.91	0.12	5.8
BF40	Honker Bay	7/20/99	21	0.0110	3.36	NA	NA	7.3	b 0.0265	11	2.43	0.18	15.1
BF20	Grizzly Bay	7/20/99	21	0.0080	3.21	NA	NA	6.1	b 0.0214	8.8	1.81	0.19	9.9
BF10	Pacheco Creek	7/20/99	21	0.0090	2.80	NA	NA	4.3	b 0.0105	5.5	0.92	0.22	5.8
BD50	Napa River	7/20/99	21	0.0110	3.04	NA	NA	4.6	b 0.0111	6.3	1.05	0.25	6.3
BD40	Davis Point	7/19/99	21	0.0080	2.54	NA	NA	3.6	b 0.0076	5.6	0.49	0.24	3.3
BD30	Pinole Point	7/19/99	21	0.0070	2.32	NA	NA	2.4	b 0.0043	2.9	0.27	0.16	2.2
BD20	San Pablo Bay	7/19/99	21	0.0160	3.02	NA	NA	4.5	b 0.0173	6.8	1.21	0.23	6.3
BD15	Petaluma River	7/19/99	21	0.0390	4.25	NA	NA	15.5	b 0.0349	27	3.75	0.11	24.3
BC60	Red Rock	7/15/99	21	0.0150	2.42	NA	NA	2.7	b 0.0118	5.0	1.06	e 0.08	6.1
BC41	Point Isabel	7/16/99	21	0.0140	2.32	NA	NA	2.4	b 0.0093	4.0	0.77	e 0.09	4.3
BC30	Richardson Bay	7/15/99	21	0.0050	1.98	NA	NA	1.3	b 0.0030	1.8	0.27	e 0.06	1.9
BC20	Golden Gate	7/15/99	21	0.0040	1.52	NA	NA	0.4	B	0.47	0.07	e 0.09	0.6
BC10	Yerba Buena Island	7/16/99	21	0.0120	2.14	NA	NA	2.3	b 0.007	3.7	0.63	0.11	3.9
BB70	Alameda	7/16/99	21	0.0200	2.64	NA	NA	2.6	b 0.0061	3.5	0.61	ND	3.4
BB30	Oyster Point	7/13/99	21	0.0250	2.62	NA	NA	3.3	b 0.0144	6.5	1.10	e 0.03	6.4
BB15	San Bruno Shoal	7/13/99	21	0.0160	2.92	NA	NA	3.1	b 0.0074	3.8	0.68	e 0.04	3.6
BA40	Redwood Creek	7/13/99	21	0.0170	2.83	NA	NA	2.7	b 0.0046	3.0	0.36	0.11	2.3
BA30	Dumbarton Bridge	7/14/99	21	0.0170	4.22	NA	NA	5.7	b 0.0094	8.6	0.93	0.39	4.9
BA20	South Bay	7/14/99	21	0.0140	4.43	NA	NA	6.4	b 0.0116	11	0.99	0.15	7.3
BA10	Coyote Creek	7/13/99	21	0.0430	5.91	NA	NA	10.4	b 0.0400	21	3.43	0.43	16.8
C-3-0	San Jose	7/14/99	21	0.1680	6.03	NA	NA	17.1	b 0.0659	47	9.35	e 0.73	53.9
C-1-3	Sunnyvale	7/14/99	21	0.1790	8.15	NA	NA	30.8	b 0.0087	80	NA	1.02	76.9
BW10	Standish Dam	7/22/99	21	0.0370	3.87	NA	NA	9.6	b 0.0137	24	4.88	3.63	27.0
BW15	Guadalupe River	7/22/99	21	0.0270	2.31	NA	NA	3.9	b 0.0373	12	2.54	7.22	14.0

Table 4. Dissolved PAH concentrations in water, 1999. M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PAHS	SUM LPAHS	Biphenyl	Naphthalene	1-Methylnaphthalene	2-Methylnaphthalene	2,6-Dimethylnaphthalene	2,3,5-Trimethylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Dibenzothiophene	Fluorene	Phenanthrene	1-Methylphenanthrene
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
BG20	Sacramento River	2/10/99	19	1.7	0.64	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND	0.23	NA	0.19
BG30	San Joaquin River	2/10/99	19	1.2	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16	NA	ND
BF20	Grizzly Bay	2/9/99	19	1.6	0.55	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	0.18	NA	0.17
BD50	Napa River	2/9/99	19	7.1	2.30	0.12	ND	0.12	0.22	ND	0.16	0.40	ND	ND	0.12	0.78	NA	0.38
BD40	Davis Point	2/8/99	19	3.0	0.68	ND	ND	ND	0.13	ND	ND	0.11	ND	ND	ND	0.27	NA	0.17
BD30	Pinole Point	2/8/99	19	2.9	0.65	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	0.26	NA	0.19
BD20	San Pablo Bay	2/8/99	19	3.1	0.55	ND	ND	ND	0.16	ND	ND	ND	ND	ND	ND	0.22	NA	0.17
BD15	Petaluma River	2/8/99	19	3.5	0.77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.52	NA	0.25
BC60	Red Rock	2/3/99	19	3.5	0.79	ND	ND	ND	0.22	ND	ND	0.21	ND	ND	ND	0.36	NA	ND
BC20	Golden Gate	2/3/99	19	2.4	0.37	ND	ND	ND	0.16	ND	ND	ND	ND	ND	ND	0.21	NA	ND
BC10	Yerba Buena Island	2/4/99	19	3.2	0.80	ND	ND	ND	0.23	ND	ND	0.13	ND	ND	ND	0.24	NA	0.20
BB70	Alameda	2/4/99	19	3.4	0.55	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND	0.21	NA	0.17
BA40	Redwood Creek	2/1/99	19	3.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	ND
BA30	Dumbarton Bridge	2/2/99	19	3.4	0.35	ND	ND	ND	0.24	ND	ND	ND	0.11	ND	ND	ND	NA	ND
BA10	Coyote Creek	2/1/99	19	4.8	0.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	NA	ND
C-3-0	San Jose	2/2/99	19	6.7	1.01	ND	ND	ND	ND	ND	ND	ND	0.20	0.13	ND	0.43	NA	0.25
BW10	Standish Dam	2/11/99	19	4.9	0.55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.24	NA	0.31
BW15	Guadalupe River	2/11/99	19	8.0	0.60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27	NA	0.33
BG20	Sacramento River	4/21/99	20	2.0	0.95	ND	0.19	0.18	ND	ND	ND	ND	ND	ND	ND	ND	0.58	ND
BG30	San Joaquin River	4/21/99	20	1.8	1.09	0.15	0.17	0.13	0.24	ND	ND	ND	ND	ND	ND	ND	0.40	ND
BF20	Grizzly Bay	4/21/99	20	4.4	1.90	ND	0.28	0.15	0.19	ND	ND	ND	ND	ND	ND	ND	0.61	0.67
BD50	Napa River	4/20/99	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD40	Davis Point	4/19/99	20	2.4	0.79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	0.46	ND
BD30	Pinole Point	4/19/99	20	5.3	2.22	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	0.61	1.3	0.18
BD20	San Pablo Bay	4/19/99	20	6.7	2.45	0.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.57	1.3	0.29
BD15	Petaluma River	4/19/99	20	5.4	2.06	ND	0.16	0.13	0.19	ND	ND	0.14	ND	ND	ND	0.22	1.1	0.12
BC60	Red Rock	4/14/99	20	2.5	1.13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.31	0.82	ND
BC20	Golden Gate	4/15/99	20	1.4	0.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.25	0.66	ND
BC10	Yerba Buena Island	4/14/99	20	4.9	3.13	ND	0.29	ND	0.29	ND	ND	0.24	ND	ND	ND	0.40	1.7	0.21
BB70	Alameda	4/14/99	20	2.8	1.32	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22	1.1	ND
BA40	Redwood Creek	4/12/99	20	5.0	3.22	ND	0.46	0.21	0.20	ND	ND	0.23	ND	ND	ND	0.37	1.5	0.25
BA30	Dumbarton Bridge	4/12/99	20	5.2	2.34	ND	0.17	0.17	0.22	ND	ND	0.14	ND	ND	ND	0.30	1.2	0.14
BA10	Coyote Creek	4/13/99	20	5.2	2.10	ND	ND	ND	0.13	ND	ND	ND	ND	ND	0.13	0.48	1.1	0.26
C-3-0	San Jose	4/13/99	20	16.9	9.85	0.35	1.3	1.2	1.7	0.36	0.30	0.48	0.21	ND	0.30	0.70	2.4	0.55
BW10	Standish Dam	4/22/99	20	10.5	5.79	0.17	0.69	0.27	0.36	ND	0.16	0.19	ND	ND	0.61	0.44	2.9	Q
BW15	Guadalupe River	4/22/99	20	19.4	9.14	1.1	0.70	1.0	1.2	0.50	0.45	0.73	ND	0.16	0.29	1.0	1.4	0.61
BG20	Sacramento River	7/21/99	21	3.6	1.70	0.31	ND	0.17	0.38	ND	ND	ND	ND	ND	ND	0.24	0.46	0.14
BG30	San Joaquin River	7/21/99	21	3.3	0.79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	0.60	ND
BF20	Grizzly Bay	7/20/99	21	6.1	1.42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26	0.95	0.21
BD50	Napa River	7/20/99	21	0.63	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD40	Davis Point	7/19/99	21	8.2	4.42	0.35	0.27	0.32	0.61	0.13	ND	0.53	ND	ND	0.21	0.65	1.2	0.15
BD30	Pinole Point	7/19/99	21	6.9	3.58	0.19	0.28	0.34	0.49	ND	ND	0.39	ND	ND	0.19	0.51	1.0	0.19
BD20	San Pablo Bay	7/19/99	21	5.7	2.35	0.26	0.18	0.18	0.33	ND	ND	0.20	ND	ND	0.14	0.34	0.72	ND
BD15	Petaluma River	7/19/99	21	6.8	2.06	0.28	ND	0.19	0.40	ND	ND	0.19	ND	ND	ND	0.25	0.58	0.17
BC60	Red Rock	7/15/99	21	8.9	5.43	0.41	0.19	0.32	0.45	0.17	ND	0.68	ND	ND	0.23	0.99	1.7	0.29
BC20	Golden Gate	7/15/99	21	4.7	3.47	0.36	0.37	0.41	0.73	ND	ND	0.32	ND	ND	ND	0.43	0.85	ND
BC10	Yerba Buena Island	7/16/99	21	8.5	5.09	0.23	0.24	0.43	0.66	0.15	ND	0.74	ND	ND	0.20	0.81	1.4	0.23
BB70	Alameda	7/16/99	21	7.9	4.12	0.18	ND	0.15	0.22	ND	ND	0.72	ND	ND	0.23	0.87	1.6	0.15
BA40	Redwood Creek	7/13/99	21	4.0	1.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND
BA30	Dumbarton Bridge	7/14/99	21	10.2	5.35	0.39	0.15	0.40	0.57	ND	ND	0.56	ND	ND	0.30	0.88	1.9	0.20
BA10	Coyote Creek	7/13/99	21	14.0	6.76	0.32	0.35	0.43	0.60	ND	ND	0.83	ND	ND	0.39	1.2	2.4	0.24
C-3-0	San Jose	7/14/99	21	25.3	16.70	0.85	2.2	1.7	2.1	0.42	ND	2.2	ND	ND	0.74	2.7	3.3	0.49
BW10	Standish Dam	7/22/99	21	11.3	5.33	0.30	ND	0.34	0.53	0.16	ND	0.45	ND	ND	0.32	0.95	1.9	0.38
BW15	Guadalupe River	7/22/99	21	12.8	3.28	ND	ND	ND	ND	ND	ND	0.15	ND	0.13	0.33	0.56	1.7	0.41

Data Table 4 continued on next page

Table 4. Dissolved PAH concentrations in water, 1999 (continued). M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PAHS	SUM HPAHS	Benz(a)anthracene	Chrysene	Pyrene	Benzo(a)pyrene	Benzo(e)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Perylene	Benzo(ghi)perylene	Fluoranthene	Indeno(1,2,3-cd)pyrene
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
BG20	Sacramento River	2/10/99	19	1.7	1.04	0.17	ND	0.27	ND	ND	ND	ND	ND	ND	ND	0.60	ND
BG30	San Joaquin River	2/10/99	19	1.2	1.00	0.14	ND	0.37	ND	ND	ND	ND	ND	ND	ND	0.49	ND
BF20	Grizzly Bay	2/9/99	19	1.6	1.08	0.22	ND	0.35	ND	ND	ND	ND	ND	ND	ND	0.51	ND
BD50	Napa River	2/9/99	19	7.1	4.81	0.61	0.28	1.5	ND	0.15	0.17	ND	ND	ND	ND	2.1	ND
BD40	Davis Point	2/8/99	19	3.0	2.28	0.30	0.13	0.65	ND	ND	ND	ND	ND	ND	ND	1.2	ND
BD30	Pinole Point	2/8/99	19	2.9	2.23	0.29	0.13	0.61	ND	ND	ND	ND	ND	ND	ND	1.2	ND
BD20	San Pablo Bay	2/8/99	19	3.1	2.59	0.33	0.14	0.73	ND	0.12	0.17	ND	ND	ND	ND	1.1	ND
BD15	Petaluma River	2/8/99	19	3.5	2.68	0.24	0.15	0.89	ND	ND	ND	ND	ND	ND	ND	1.4	ND
BC60	Red Rock	2/3/99	19	3.5	2.73	0.29	0.16	0.54	ND	ND	0.14	ND	ND	ND	ND	1.6	ND
BC20	Golden Gate	2/3/99	19	2.4	1.99	0.20	0.19	0.36	ND	ND	0.14	ND	ND	ND	ND	1.1	ND
BC10	Yerba Buena Island	2/4/99	19	3.2	2.41	0.25	0.13	0.53	ND	ND	ND	ND	ND	ND	ND	1.5	ND
BB70	Alameda	2/4/99	19	3.4	2.85	0.29	0.14	0.67	ND	ND	0.15	ND	ND	ND	ND	1.6	ND
BA40	Redwood Creek	2/1/99	19	3.4	3.44	0.46	0.19	0.99	ND	0.23	0.32	0.15	ND	ND	ND	1.1	ND
BA30	Dumbarton Bridge	2/2/99	19	3.4	3.01	0.38	0.15	0.93	ND	0.18	0.27	ND	ND	ND	ND	1.1	ND
BA10	Coyote Creek	2/1/99	19	4.8	4.66	0.61	0.28	1.3	ND	0.33	0.42	0.20	ND	ND	ND	1.3	0.22
C-3-0	San Jose	2/2/99	19	6.7	5.66	0.73	0.28	1.9	ND	0.23	0.30	ND	ND	ND	ND	2.1	0.12
BW10	Standish Dam	2/11/99	19	4.9	4.30	0.77	0.33	1.8	ND	ND	ND	ND	ND	ND	ND	1.4	ND
BW15	Guadalupe River	2/11/99	19	8.0	7.41	1.0	0.56	3.0	ND	0.17	0.18	ND	ND	ND	ND	2.5	ND
BG20	Sacramento River	4/21/99	20	2.0	1.01	ND	ND	0.49	ND	ND	ND	ND	ND	ND	ND	0.52	ND
BG30	San Joaquin River	4/21/99	20	1.8	0.72	ND	ND	0.46	ND	ND	ND	ND	ND	ND	ND	0.26	ND
BF20	Grizzly Bay	4/21/99	20	4.4	2.49	ND	0.14	1.5	ND	ND	0.13	ND	ND	ND	ND	0.72	ND
BD50	Napa River	4/20/99	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD40	Davis Point	4/19/99	20	2.4	1.64	ND	ND	0.56	ND	ND	0.17	ND	ND	ND	ND	0.91	ND
BD30	Pinole Point	4/19/99	20	5.3	3.03	ND	0.13	0.95	ND	0.15	0.20	ND	ND	ND	ND	1.6	ND
BD20	San Pablo Bay	4/19/99	20	6.7	4.24	ND	0.19	1.6	ND	0.27	0.38	ND	ND	ND	ND	1.8	ND
BD15	Petaluma River	4/19/99	20	5.4	3.34	ND	0.17	1.3	ND	0.28	0.39	ND	ND	ND	ND	1.2	ND
BC60	Red Rock	4/14/99	20	2.5	1.33	ND	ND	0.34	ND	ND	ND	ND	ND	ND	ND	0.99	ND
BC20	Golden Gate	4/15/99	20	1.4	0.48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.48	ND
BC10	Yerba Buena Island	4/14/99	20	4.9	1.81	ND	ND	0.61	ND	ND	ND	ND	ND	ND	ND	1.2	ND
BB70	Alameda	4/14/99	20	2.8	1.45	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	1.0	ND
BA40	Redwood Creek	4/12/99	20	5.0	1.76	ND	ND	0.63	ND	ND	0.14	ND	ND	ND	ND	0.99	ND
BA30	Dumbarton Bridge	4/12/99	20	5.2	2.87	0.19	0.17	0.86	ND	0.24	0.31	ND	ND	ND	ND	1.1	ND
BA10	Coyote Creek	4/13/99	20	5.2	3.06	0.13	0.17	0.91	ND	0.26	0.39	ND	ND	ND	ND	1.2	ND
C-3-0	San Jose	4/13/99	20	16.9	7.09	0.35	0.38	2.9	ND	0.34	0.42	ND	ND	ND	ND	2.7	ND
BW10	Standish Dam	4/22/99	20	10.5	4.74	M	M	M	M	M	M	M	ND	0.14	ND	4.6	ND
BW15	Guadalupe River	4/22/99	20	19.4	10.3	0.90	0.53	3.5	ND	0.66	1.0	0.31	ND	ND	0.27	2.5	0.59
BG20	Sacramento River	7/21/99	21	3.6	1.86	ND	ND	0.86	ND	ND	ND	ND	ND	ND	ND	1.0	ND
BG30	San Joaquin River	7/21/99	21	3.3	2.46	ND	0.16	1.1	ND	ND	ND	ND	ND	ND	ND	1.2	ND
BF20	Grizzly Bay	7/20/99	21	6.1	4.66	0.15	0.19	1.8	ND	0.19	0.23	ND	ND	ND	ND	2.1	ND
BD50	Napa River	7/20/99	21	0.63	0.63	ND	0.21	ND	ND	0.19	0.23	ND	ND	ND	ND	ND	ND
BD40	Davis Point	7/19/99	21	8.2	3.82	ND	0.12	1.5	ND	ND	ND	ND	ND	ND	ND	2.2	ND
BD30	Pinole Point	7/19/99	21	6.9	3.30	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	2.0	ND
BD20	San Pablo Bay	7/19/99	21	5.7	3.33	ND	0.11	1.3	ND	0.15	0.17	ND	ND	ND	ND	1.6	ND
BD15	Petaluma River	7/19/99	21	6.8	4.74	0.15	0.16	1.9	ND	0.23	0.3	ND	ND	ND	ND	2.0	ND
BC60	Red Rock	7/15/99	21	8.9	3.48	ND	ND	0.73	ND	ND	0.15	ND	ND	ND	ND	2.6	ND
BC20	Golden Gate	7/15/99	21	4.7	1.27	ND	ND	0.27	ND	ND	ND	ND	ND	ND	ND	1.0	ND
BC10	Yerba Buena Island	7/16/99	21	8.5	3.45	ND	ND	0.85	ND	ND	ND	ND	ND	ND	ND	2.6	ND
BB70	Alameda	7/16/99	21	7.9	3.78	ND	0.13	1.0	ND	ND	0.15	ND	ND	ND	ND	2.5	ND
BA40	Redwood Creek	7/13/99	21	4.0	2.90	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	1.9	ND
BA30	Dumbarton Bridge	7/14/99	21	10.2	4.81	0.14	0.14	1.9	ND	0.20	0.23	ND	ND	ND	ND	2.2	ND
BA10	Coyote Creek	7/13/99	21	14.0	7.27	0.23	0.23	2.8	ND	0.33	0.42	ND	ND	ND	ND	3.1	0.16
C-3-0	San Jose	7/14/99	21	25.3	8.60	0.27	ND	3.7	ND	0.33	0.40	ND	ND	ND	ND	3.9	ND
BW10	Standish Dam	7/22/99	21	11.3	5.93	0.21	0.29	2.6	ND	0.32	0.31	ND	ND	ND	ND	2.2	ND
BW15	Guadalupe River	7/22/99	21	12.8	9.51	0.34	0.41	3.8	ND	0.55	0.62	0.19	ND	ND	ND	3.3	0.30

Table 5. Total (dissolved + particulate) PAH concentrations in water, 1999. B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, NA = not available, ND = not detected.

Station Code	Station	Date	Cruise	SUM PAHS	SUM LPAHS	Biphenyl	Naphthalene	1-Methylnaphthalene	2-Methylnaphthalene	2,6-Dimethylnaphthalene	2,3,5-Trimethylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Dibenzothiophene	Fluorene	Phenanthrene	1-Methylphenanthrene
					ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
BG20	Sacramento River	2/10/99	19	4.5	0.64	ND	ND	0.22	ND	ND	ND	ND	ND	ND	ND	0.23	NA	0.2
BG30	San Joaquin River	2/10/99	19	9.2	0.16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16	NA	ND
BF20	Grizzly Bay	2/9/99	19	17	0.81	ND	ND	ND	0.32	ND	ND	ND	ND	ND	ND	0.18	NA	0.3
BD50	Napa River	2/9/99	19	96	16	1.4	ND	1.7	3.3	1.0	0.88	0.85	ND	0.93	0.62	2.4	NA	3.3
BD40	Davis Point	2/8/99	19	20	0.68	ND	ND	ND	0.13	ND	ND	0.11	ND	ND	ND	0.27	NA	0.2
BD30	Pinole Point	2/8/99	19	13	0.65	ND	ND	ND	0.20	ND	ND	ND	ND	ND	ND	0.26	NA	0.2
BD20	San Pablo Bay	2/8/99	19	27	1.6	0.14	ND	ND	0.40	ND	ND	ND	ND	0.18	ND	0.43	NA	0.4
BD15	Petaluma River	2/8/99	19	7.8	0.77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.52	NA	0.3
BC60	Red Rock	2/3/99	19	14	0.93	ND	ND	ND	0.36	ND	ND	0.21	ND	ND	ND	0.36	NA	ND
BC20	Golden Gate	2/3/99	19	12	0.37	ND	ND	ND	0.16	ND	ND	ND	ND	ND	ND	0.21	NA	ND
BC10	Yerba Buena Island	2/4/99	19	17	0.80	ND	ND	ND	0.23	ND	ND	0.13	ND	ND	ND	0.24	NA	0.2
BB70	Alameda	2/4/99	19	47	8.3	ND	ND	ND	0.17	ND	ND	ND	ND	0.18	0.25	0.21	NA	7.5
BA40	Redwood Creek	2/1/99	19	140	4.2	0.27	ND	ND	ND	0.19	0.13	0.23	0.34	1.1	0.48	0.66	NA	0.8
BA30	Dumbarton Bridge	2/2/99	19	48	2.1	0.30	ND	ND	0.39	ND	ND	0.14	0.11	0.30	0.20	0.29	NA	0.4
BA10	Coyote Creek	2/1/99	19	199	7.4	0.53	ND	ND	0.22	0.36	0.30	0.43	0.61	2.4	0.81	1.7	NA	M
C-3-0	San Jose	2/2/99	19	107	3.9	0.35	ND	ND	ND	ND	ND	ND	0.20	0.92	0.39	1.0	NA	1.0
BW10	Standish Dam	2/11/99	19	69	6.0	0.41	ND	0.56	0.89	0.22	0.27	0.17	ND	0.33	0.29	0.76	NA	2.1
BW15	Guadalupe River	2/11/99	19	142	4.6	0.20	ND	0.14	0.25	ND	ND	0.27	0.12	1.0	0.54	0.72	NA	1.4
BG20	Sacramento River	4/21/99	20	5.4	1.9	ND	0.19	0.31	0.14	ND	ND	ND	ND	ND	ND	ND	1.0	0.3
BG30	San Joaquin River	4/21/99	20	5.6	1.7	0.15	0.17	0.13	0.24	ND	ND	ND	ND	ND	ND	ND	0.7	0.2
BF20	Grizzly Bay	4/21/99	20	24	4.9	0.20	0.28	0.33	0.48	ND	ND	ND	ND	0.22	0.20	0.30	1.7	1.2
BD50	Napa River	4/20/99	20	45	7.7	0.40	ND	0.21	0.41	0.20	0.1	0.50	0.20	0.82	0.40	0.80	2.8	0.8
BD40	Davis Point	4/19/99	20	108	14	1.0	ND	0.48	0.79	0.40	0.3	0.60	0.50	1.6	0.70	1.6	6.3	M
BD30	Pinole Point	4/19/99	20	38	6.8	0.30	ND	0.19	0.32	0.20	ND	0.33	0.10	0.39	0.20	1.0	3.0	0.7
BD20	San Pablo Bay	4/19/99	20	145	19	1.6	ND	0.48	0.91	0.60	0.3	0.70	0.70	2.3	0.80	2.1	7.8	1.0
BD15	Petaluma River	4/19/99	20	56	2.4	0.70	0.2	0.48	0.90	0.20	M	M	M	M	M	M	M	M
BC60	Red Rock	4/14/99	20	12	2.6	ND	ND	0.14	0.15	ND	ND	ND	ND	ND	ND	0.41	1.6	0.3
BC20	Golden Gate	4/15/99	20	3.6	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.25	1.0	0.2
BC10	Yerba Buena Island	4/14/99	20	20	4.8	0.20	0.29	ND	0.44	ND	ND	0.24	ND	ND	ND	0.60	2.5	0.5
BB70	Alameda	4/14/99	20	70	9.5	0.60	0.20	0.48	0.69	0.30	0.20	0.40	0.30	1.0	0.30	0.92	4.1	M
BA40	Redwood Creek	4/12/99	20	45	6.5	0.30	0.46	0.39	0.53	0.20	ND	0.43	0.20	0.31	ND	0.67	3.0	M
BA30	Dumbarton Bridge	4/12/99	20	69	8.0	0.40	0.37	0.50	0.81	0.20	ND	0.44	0.30	0.62	0.20	0.80	3.4	M
BA10	Coyote Creek	4/13/99	20	98	7.8	0.50	ND	0.27	0.65	0.30	0.20	0.30	0.50	1.0	0.33	1.3	2.5	M
C-3-0	San Jose	4/13/99	20	132	22	1.0	1.5	1.7	2.6	0.76	0.50	0.88	0.71	1.2	0.90	1.6	6.8	1.9
BW10	Standish Dam	4/22/99	20	20	8.7	0.37	0.69	0.58	0.76	0.10	0.16	0.19	ND	0.22	0.81	0.64	4.2	Q
BW15	Guadalupe River	4/22/99	20	272	35	2.8	0.70	1.8	2.9	1.6	1.1	1.9	1.1	4.0	1.3	3.5	11.4	1.0
BG20	Sacramento River	7/21/99	21	15	1.8	B	ND	0.17	B	ND	ND	ND	ND	ND	ND	0.40	b 1.2	B
BG30	San Joaquin River	7/21/99	21	15	2.3	B	0.61	B	B	ND	ND	ND	ND	ND	ND	0.36	b 1.3	B
BF20	Grizzly Bay	7/20/99	21	38	3.7	ND	ND	ND	ND	ND	ND	ND	ND	0.29	0.15	0.61	b 2.6	B
BD50	Napa River	7/20/99	21	25	1.9	B	ND	ND	B	ND	ND	ND	ND	0.24	0.15	0.27	b 1.2	B
BD40	Davis Point	7/19/99	21	20	4.7	B	0.27	B	B	0.58	0.13	0.65	ND	ND	0.21	0.87	b 2	B
BD30	Pinole Point	7/19/99	21	15	3.3	B	0.28	B	B	0.18	ND	0.39	ND	ND	0.19	0.66	b 1.6	B
BD20	San Pablo Bay	7/19/99	21	33	3.5	B	0.18	B	B	0.13	ND	0.20	ND	0.13	0.30	0.60	b 2	B
BD15	Petaluma River	7/19/99	21	91	8.8	B	ND	B	B	0.35	0.18	0.44	0.27	0.72	0.51	1.0	b 4.2	b 1.1
BC60	Red Rock	7/15/99	21	50	9.3	B	0.19	B	B	0.52	0.14	0.92	0.16	0.53	0.50	1.5	b 4	b 0.89
BC20	Golden Gate	7/15/99	21	5.0	1.5	B	0.37	0.4	B	ND	ND	0.32	ND	ND	ND	0.43	B	ND
BC10	Yerba Buena Island	7/16/99	21	34	6.8	B	0.24	0.4	B	0.47	ND	0.88	0.11	0.35	0.37	1.1	b 2.8	B
BB70	Alameda	7/16/99	21	48	7.4	B	ND	0.2	B	0.27	ND	0.93	0.18	0.52	0.44	1.2	b 3.7	B
BA40	Redwood Creek	7/13/99	21	25	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	b 1.9	B
BA30	Dumbarton Bridge	7/14/99	21	51	7.4	B	0.15	0.40	0.57	ND	ND	0.56	0.16	0.31	0.48	1.2	b 3.6	B
BA10	Coyote Creek	7/13/99	21	161	19	B	0.35	0.43	B	0.46	0.23	1.3	0.60	1.6	1.2	2.4	b 8.6	b 1.7
C-3-0	San Jose	7/14/99	21	278	39	b 2.5	2.2	B	B	1.6	0.51	3.3	1.2	3.2	2.4	5.2	b 14	b 3.3
BW10	Standish Dam	7/22/99	21	62	8.2	0.3	ND	0.34	0.53	0.16	ND	0.45	ND	0.48	0.56	1.32	b 4.1	B
BW15	Guadalupe River	7/22/99	21	119	11.8	B	0.23	B	B	0.22	0.14	0.35	0.35	1.23	0.79	1.33	b 5.8	b 1.4

Data Table 5 continued on next page

Table 5. Total (dissolved + particulate) PAH concentrations in water, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, NA = not available, ND = not detected.

Station Code	Station	Date	Cruise	SUM PAHS	SUM HPAHS	Benz(a)anthracene	Chrysene	Pyrene	Benzo(a)pyrene	Benzo(e)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Perylene	Benzo(ghi)perylene	Fluoranthene	Indeno(1,2,3-cd)pyrene
					ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
BG20	Sacramento River	2/10/99	19	4.5	3.8	0.6	0.3	0.8	ND	0.3	0.4	0.1	ND	ND	0.1	1.1	0.2
BG30	San Joaquin River	2/10/99	19	9.2	9.1	1.5	1.0	1.7	ND	0.7	0.9	0.6	ND	ND	0.2	2.2	0.2
BF20	Grizzly Bay	2/9/99	19	17	16	2.8	1.2	3.2	1.3	1.2	1.6	0.7	0.2	ND	0.1	2.9	0.6
BD50	Napa River	2/9/99	19	96	80	17	7.8	16	0.7	6.4	8.4	2.6	0.8	ND	4.7	13	3.3
BD40	Davis Point	2/8/99	19	20	19	3.5	1.4	4.2	ND	1.7	2.4	0.9	0.3	ND	ND	3.9	1.2
BD30	Pinole Point	2/8/99	19	13	12	2.0	0.9	2.6	ND	1.1	1.4	0.6	0.2	ND	ND	2.8	0.6
BD20	San Pablo Bay	2/8/99	19	27	25	4.3	1.8	5.6	ND	2.4	3.4	1.1	0.3	ND	ND	4.8	1.6
BD15	Petaluma River	2/8/99	19	7.8	7.0	0.9	0.5	1.7	ND	0.5	0.5	0.2	0.2	ND	0.2	2.1	0.2
BC60	Red Rock	2/3/99	19	14	13	2.1	1.0	2.6	ND	1.1	1.7	0.6	0.2	ND	ND	3.4	0.6
BC20	Golden Gate	2/3/99	19	12	12	1.6	0.9	2.3	ND	1.2	1.7	0.5	0.2	ND	0.2	2.5	0.6
BC10	Yerba Buena Island	2/4/99	19	17	16	2.6	1.1	3.4	ND	1.4	1.8	0.7	0.2	ND	0.2	3.9	0.9
BB70	Alameda	2/4/99	19	47	38	5.6	2.0	18	ND	1.8	2.7	0.8	0.2	ND	0.3	6.0	1.3
BA40	Redwood Creek	2/1/99	19	140	136	22	7.8	25	0.5	13.2	17.3	6.0	1.5	ND	13	17	12
BA30	Dumbarton Bridge	2/2/99	19	48	46	7.5	3.1	9.2	0.1	5.3	7.0	2.0	0.6	ND	0.9	6.9	3.1
BA10	Coyote Creek	2/1/99	19	199	192	29	17	1.3	10	21	29	8.8	2.1	0.2	19	36	17
C-3-0	San Jose	2/2/99	19	107	103	17	6.8	18	1.1	9.7	14	4.1	1.2	ND	10	14	7.4
BW10	Standish Dam	2/11/99	19	69	63	15	5.5	11	1.7	5.1	7.3	2.0	0.7	ND	4.2	8.3	2.8
BW15	Guadalupe River	2/11/99	19	142	138	24	14	29	4.9	10	14	5.0	1.1	ND	8.1	22	6.0
BG20	Sacramento River	4/21/99	20	5.4	3.5	ND	0.3	1.1	ND	0.3	0.5	0.1	ND	ND	ND	1.2	ND
BG30	San Joaquin River	4/21/99	20	5.6	3.9	ND	0.4	1.2	ND	0.4	0.6	0.2	ND	ND	ND	1.0	0.2
BF20	Grizzly Bay	4/21/99	20	24	19	0.4	1.8	5.3	ND	1.9	2.9	0.8	0.2	ND	ND	3.9	1.3
BD50	Napa River	4/20/99	20	45	38	0.9	2.9	9.8	ND	3.6	5.8	1.9	0.4	ND	1.6	8.2	2.5
BD40	Davis Point	4/19/99	20	108	94	1.8	6.2	21	6.9	8.7	14	4.1	1.0	ND	7.4	16	7.0
BD30	Pinole Point	4/19/99	20	38	31	0.5	2.2	7.2	ND	3.3	4.8	1.4	0.4	ND	1.9	6.6	2.6
BD20	San Pablo Bay	4/19/99	20	145	126	2.2	8.6	30	9.4	11	18	5.1	1.2	ND	9.3	22	8.7
BD15	Petaluma River	4/19/99	20	56	53	M	5.6	M	6.8	9.0	13	4.0	0.9	ND	6.9	M	6.6
BC60	Red Rock	4/14/99	20	12	9.3	0.2	0.7	1.8	ND	1.1	1.6	0.5	0.1	ND	ND	2.6	0.7
BC20	Golden Gate	4/15/99	20	3.6	2.2	ND	0.2	0.3	ND	0.3	0.4	0.1	ND	ND	ND	0.9	ND
BC10	Yerba Buena Island	4/14/99	20	20	15	0.2	1.1	3.4	ND	1.8	2.7	0.9	0.2	ND	ND	3.4	1.6
BB70	Alameda	4/14/99	20	70	61	0.8	4.0	13	ND	6.3	10	3.1	0.8	ND	6.1	9.8	6.2
BA40	Redwood Creek	4/12/99	20	45	38	0.6	2.6	9.0	ND	4.9	7.2	2.2	0.6	ND	0.2	5.8	5.1
BA30	Dumbarton Bridge	4/12/99	20	69	61	1.1	4.1	13	ND	7.3	11	3.3	0.9	ND	5.1	8.1	7.4
BA10	Coyote Creek	4/13/99	20	98	90	1.7	5.8	20	0.5	10	15	4.5	1.2	ND	9.3	12	9.3
C-3-0	San Jose	4/13/99	20	132	110	2.4	7.2	24	2.2	11	17	5.3	1.4	ND	11	18	10
BW10	Standish Dam	4/22/99	20	20	11	M	M	M	M	M	M	M	0.3	0.1	1.5	7.7	1.3
BW15	Guadalupe River	4/22/99	20	272	237	11	17	59	19	18	33	9.1	1.4	10	9.1	42	10
BG20	Sacramento River	7/21/99	21	15	13	0.8	1.0	b 3.2	ND	1.4	1.9	0.6	0.2	ND	ND	3.0	1.0
BG30	San Joaquin River	7/21/99	21	15	12	0.8	1.2	b 3.3	ND	1.3	1.8	0.6	0.2	ND	ND	3.1	0.3
BF20	Grizzly Bay	7/20/99	21	38	34	2.3	2.3	b 7.5	ND	3.9	5.3	1.7	0.6	ND	ND	7.0	3.4
BD50	Napa River	7/20/99	21	25	23	1.6	1.9	b 4.3	ND	3.0	4.3	1.3	ND	ND	ND	3.8	2.7
BD40	Davis Point	7/19/99	21	20	16	0.8	0.9	b 3.7	ND	1.6	2.2	0.7	0.2	ND	ND	4.1	1.5
BD30	Pinole Point	7/19/99	21	15	12	0.6	0.7	b 2.9	ND	1.4	1.3	0.6	0.2	ND	ND	3.7	0.6
BD20	San Pablo Bay	7/19/99	21	33	30	1.5	1.7	b 6	ND	3.9	5.3	1.6	0.5	ND	ND	5.4	3.7
BD15	Petaluma River	7/19/99	21	91	82	5.1	4.9	b 16	ND	9.9	13	4.7	1.6	ND	4.1	13	9.5
BC60	Red Rock	7/15/99	21	50	41	2.7	2.7	b 7.9	ND	4.6	6.7	2.2	0.1	ND	0.2	8.6	4.8
BC20	Golden Gate	7/15/99	21	5.0	3.5	0.2	0.3	B	ND	0.4	0.6	0.2	ND	ND	ND	1.5	0.3
BC10	Yerba Buena Island	7/16/99	21	34	27	1.7	1.8	b 5.3	ND	2.9	4.2	1.4	0.4	ND	ND	6.3	3.1
BB70	Alameda	7/16/99	21	48	41	2.7	2.8	b 7.7	ND	4.5	6.9	2.4	0.8	ND	0.2	8.0	5.1
BA40	Redwood Creek	7/13/99	21	25	23	1.2	1.3	b 4.4	ND	2.8	4.1	1.3	ND	ND	ND	4.6	3.2
BA30	Dumbarton Bridge	7/14/99	21	51	44	2.5	2.5	b 8.7	ND	5.6	7.8	2.6	0.2	ND	ND	7.4	6.6
BA10	Coyote Creek	7/13/99	21	161	142	8.0	8.1	b 24	2.7	15	21	7.9	0.5	ND	18	19	17
C-3-0	San Jose	7/14/99	21	278	239	14	14	b 40	18	23	33	13	3.9	ND	23	33	23
BW10	Standish Dam	7/22/99	21	62	54	2.8	3.2	b 9.6	0.1	6.0	8.5	2.8	1.0	ND	5.7	7.8	6.5
BW15	Guadalupe River	7/22/99	21	119	107	5.9	6.5	b 19	0.7	12	16	6.1	2.0	ND	12	15	12

Table 6. Dissolved PCB concentrations in water, 1999. B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits. * PCB 008 coeluted with PCB 005.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 008*	PCB 018	PCB 028	PCB 031	PCB 044	PCB 049	PCB 052	PCB 060	PCB 066	PCB 070	PCB 074	PCB 087	PCB 095
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	64	Q	Q	3.3	3.3	5.1	3.6	7.1	1.6	2.3	5.0	2.8	1.3	Q
BG30	San Joaquin River	2/10/99	19	89	12	9.5	5.5	4.1	4.9	4.1	6.0	1.6	2.9	4.7	1.6	1.4	Q
BF20	Grizzly Bay	2/9/99	19	72	Q	Q	3.0	2.7	4.8	3.6	5.6	1.5	2.3	3.7	1.8	1.3	Q
BD50	Napa River	2/9/99	19	147	Q	Q	5.8	7.4	9.5	7.7	11	5.6	8.7	13	7.2	2.3	Q
BD40	Davis Point	2/8/99	19	91	Q	Q	3.7	4.6	5.1	5.4	6.6	1.7	3.5	4.5	3.0	1.6	Q
BD30	Pinole Point	2/8/99	19	95	10	Q	5.2	3.5	4.3	5.3	6.8	1.8	3.1	4.5	1.4	1.4	Q
BD20	San Pablo Bay	2/8/99	19	120	Q	12	6.4	5.1	4.7	5.4	7.9	1.9	3.8	4.9	2.5	2.0	Q
BD15	Petaluma River	2/8/99	19	133	17	12	9.9	8.1	6.8	6.6	9.2	4.3	4.5	8.7	4.5	2.3	Q
BC60	Red Rock	2/3/99	19	107	14	Q	4.5	3.4	4.2	5.8	7.1	1.4	3.2	4.4	1.4	1.9	Q
BC20	Golden Gate	2/3/99	19	114	Q	7.7	3.6	5.7	4.7	4.5	6.5	2.0	3.7	7.2	1.8	2.8	Q
BC10	Yerba Buena Island	2/4/99	19	123	18	10	4.7	4.6	4.4	6.1	7.6	1.6	3.2	4.4	1.1	1.9	Q
BB70	Alameda	2/4/99	19	152	9	11	7.6	5.7	4.7	6.8	9.9	2.4	4.7	7.6	2.1	3.5	Q
BA40	Redwood Creek	2/1/99	19	220	43	13	8.9	9.3	6.4	7.4	10	3.1	5.7	5.7	3	3.5	Q
BA30	Dumbarton Bridge	2/2/99	19	202	23	14	9.4	8.0	7.5	9.0	13	3.0	6.1	8.0	3.3	3.6	Q
BA10	Coyote Creek	2/1/99	19	259	41	14	12	13	9.9	8.3	12	3.6	7.7	7.3	2.6	3.7	Q
C-3-0	San Jose	2/2/99	19	343	41	26	20	19	14	14	22	6.8	12	13	6.3	6.2	Q
BW10	Standish Dam	2/11/99	19	194	32	16	12	13	9.5	4.9	9.3	3.3	7.3	5.9	3.2	2.3	Q
BW15	Guadalupe River	2/11/99	19	571	37	21	19	17	17	8.9	30	6.9	11	16	8.3	10	Q
BG20	Sacramento River	4/21/99	20	41	NA	4.3	2.3	5.0	2.5	2.6	3.8	ND	ND	3.5	ND	ND	ND
BG30	San Joaquin River	4/21/99	20	52	NA	4.1	3.4	5.1	2.5	2.9	3.6	ND	2.3	2.2	ND	1.1	2.2
BF20	Grizzly Bay	4/21/99	20	75	NA	5.1	3.5	7.7	2.0	5.4	4.6	ND	2.3	2.8	1.6	1.5	2.0
BD50	Napa River	4/20/99	20	110	NA	5.1	3.7	5.4	4.1	3.7	5.9	M	4.6	6.2	1.3	1.7	10
BD40	Davis Point	4/19/99	20	99	NA	8.3	5.2	9.2	2.5	3.0	4.8	ND	2.7	3.0	ND	1.5	2.4
BD30	Pinole Point	4/19/99	20	94	NA	5.3	4.6	7.7	3.1	4.1	5.0	ND	3.2	2.6	ND	2.0	3.5
BD20	San Pablo Bay	4/19/99	20	121	NA	3.8	5.3	9.4	2.9	4.0	7.0	ND	3.8	4.3	1.9	2.2	4.2
BD15	Petaluma River	4/19/99	20	120	NA	2.4	7.2	7.9	2.6	4.3	5.4	1.8	2.5	4.6	ND	1.3	4.2
BC60	Red Rock	4/14/99	20	50	NA	1.7	1.9	2.6	1.7	2.6	3.8	ND	1.9	1.8	ND	ND	1.9
BC20	Golden Gate	4/15/99	20	34	NA	3.8	2.8	3.8	2.7	2.0	2.9	ND	ND	1.4	ND	ND	2.0
BC10	Yerba Buena Island	4/14/99	20	70	NA	3.0	4.0	5.2	2.4	2.4	4.0	ND	2.9	2.8	1.0	1.2	1.4
BB70	Alameda	4/14/99	20	84	NA	6.3	5.6	6.6	2.3	3.3	5.2	ND	3.3	3.1	ND	1.8	1.3
BA40	Redwood Creek	4/12/99	20	97	NA	4.5	4.5	6.6	3.3	6.5	6.7	1.5	3.6	4.7	1.7	2.5	3.2
BA30	Dumbarton Bridge	4/12/99	20	147	NA	1.5	5.3	9.3	4.1	5.7	8.8	1.8	4.0	5.6	1.2	3.4	6.0
BA10	Coyote Creek	4/13/99	20	251	NA	2.7	13	17	12	10	27	4.5	9.4	17	1.4	7.4	12
C-3-0	San Jose	4/13/99	20	398	NA	47	22	36	20	17	39	2.9	9.3	16	2.9	6.8	24
BW10	Standish Dam	4/22/99	20	274	NA	15	26	32	9.8	13	18	4.0	10	14	3.8	4.2	6.0
BW15	Guadalupe River	4/22/99	20	427	NA	14	17	21	16	12	32	M	M	M	M	7.9	M
BG20	Sacramento River	7/21/99	21	52	7.9	2.3	3.7	3.9	2.4	3.1	3.9	ND	1.9	1.9	ND	ND	4.5
BG30	San Joaquin River	7/21/99	21	50	ND	3.2	2.3	2.5	2.8	4.2	4.8	ND	2.0	2.0	ND	ND	5.5
BF20	Grizzly Bay	7/20/99	21	57	1.4	1.5	2.7	3	1.7	2.8	3.8	1.4	1.6	2.0	ND	ND	6.1
BD50	Napa River	7/20/99	21	75	Q	4.2	2.7	3.5	ND	3.8	4.6	4.0	2.6	2.7	4.7	2.2	Q
BD40	Davis Point	7/19/99	21	72	2.7	4.5	6.1	4.9	2.4	3.8	4.6	1.4	1.5	2.5	ND	ND	7.9
BD30	Pinole Point	7/19/99	21	53	1.8	2.8	3.2	3.2	2.0	3.7	4.6	ND	1.8	2.0	ND	ND	6.5
BD20	San Pablo Bay	7/19/99	21	66	2.8	3.1	3.5	3.7	2.0	3.3	3.7	1.4	1.3	2.2	ND	ND	7.0
BD15	Petaluma River	7/19/99	21	94	ND	1.4	3.4	3.2	2.7	4.7	5.5	1.9	1.9	3.1	ND	ND	10
BC60	Red Rock	7/15/99	21	89	17	5.4	5.3	4.4	2.7	4.1	5.5	ND	2.4	3.6	ND	ND	8.0
BC20	Golden Gate	7/15/99	21	20	ND	2.0	3.6	2.9	ND	2.6	2.8	ND	ND	1.9	ND	ND	2.4
BC10	Yerba Buena Island	7/16/99	21	72	2.0	4.4	5.2	4.4	2.9	4.1	6.1	ND	1.7	3.0	ND	ND	7.7
BB70	Alameda	7/16/99	21	96	1.7	4.8	4.9	Q	3.2	5.6	7.8	1.9	2.2	3.8	ND	ND	10
BA40	Redwood Creek	7/13/99	21	110	ND	2.3	3.4	5.2	3.9	6.4	9	2	3.3	3.7	ND	1.6	13
BA30	Dumbarton Bridge	7/14/99	21	147	ND	4.0	5.6	7.1	6.1	8.9	12	2.7	5.0	5.5	1.6	2.1	16
BA10	Coyote Creek	7/13/99	21	269	2.6	12	11	17	12	15	21	4.7	7.1	10	2.7	4.1	27
C-3-0	San Jose	7/14/99	21	801	7.9	78	56	56	43	47	77	12	25	31	10	9.6	66
BW10	Standish Dam	7/22/99	21	395	2.2	22	20	20	19	20	36	7.5	8.8	16	3.8	7.2	40
BW15	Guadalupe River	7/22/99	21	458	2.7	21	17	18	19	21	36	7.8	9.5	16	4.4	8.5	47

Data Table 6 continued on next page

Table 6. Dissolved PCB concentrations in water, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 097	PCB 099	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 132	PCB 138	PCB 141	PCB 149	PCB 151	PCB 153
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	64	ND	1.6	4.2	3.3	9.4	2.6	ND	1.3	Q	ND	1.7	1.1	2.4
BG30	San Joaquin River	2/10/99	19	89	1.1	1.9	5.1	2.1	6.8	2.7	ND	1.4	2.0	1.0	2.4	0.95	3.2
BF20	Grizzly Bay	2/9/99	19	72	ND	2.9	4.8	3.0	11	2.4	ND	1.2	9.4	ND	2.4	1.1	2.8
BD50	Napa River	2/9/99	19	147	2.4	3.3	8.8	2.9	21	3.8	ND	3.1	Q	2.1	6.0	3.7	4.6
BD40	Davis Point	2/8/99	19	91	1.5	3.5	7.8	3.2	9.9	5.5	ND	1.9	3.2	ND	4.4	1.5	5.1
BD30	Pinole Point	2/8/99	19	95	1.5	3.4	7.0	2.6	9.9	3.4	ND	1.7	3.0	ND	4.8	1.8	5.1
BD20	San Pablo Bay	2/8/99	19	120	1.9	3.9	9.6	1.6	11	4.9	1.2	2.7	5.5	1.3	6.1	1.9	6.3
BD15	Petaluma River	2/8/99	19	133	2.0	2.6	6.7	2.2	9.5	4.1	ND	1.3	ND	ND	3.8	3.1	2.8
BC60	Red Rock	2/3/99	19	107	2.3	4.2	9.2	1.5	5.7	4.4	ND	2.8	4.5	1.5	5.9	2.4	6.2
BC20	Golden Gate	2/3/99	19	114	3.9	4.4	11	2.8	6.7	6.2	ND	2.4	5.6	1.5	6.6	2.0	7.4
BC10	Yerba Buena Island	2/4/99	19	123	2.2	4.1	9.2	1.7	7.5	5.0	ND	2.5	4.7	ND	5.9	2.4	6.1
BB70	Alameda	2/4/99	19	152	3.0	5.3	13	2.2	9.8	8.1	1.2	3.1	5.9	1.5	7.9	2.9	7.4
BA40	Redwood Creek	2/1/99	19	220	3.4	5.2	13	2.8	13	7.9	1.6	4.2	7.7	1.7	10	4.1	12
BA30	Dumbarton Bridge	2/2/99	19	202	3.0	5.0	13	1.9	14	7.4	1.5	4.4	6.6	1.5	9.2	4.3	10
BA10	Coyote Creek	2/1/99	19	259	3.6	5.0	15	2.4	18	10	1.9	5.7	9.8	2.5	13	4.9	14
C-3-0	San Jose	2/2/99	19	343	4.9	6.9	20	3.2	25	11	2.2	6.9	11	2.5	13	6.6	13
BW10	Standish Dam	2/11/99	19	194	1.1	2.0	8.9	1.4	22	3.3	ND	5.0	Q	2.4	8.6	4.2	6.2
BW15	Guadalupe River	2/11/99	19	571	5.8	6.1	33	2.5	44	10	4.0	24	34	13	43	18	38
BG20	Sacramento River	4/21/99	20	41	ND	1.6	2.9	ND	3.0	2.4	ND	ND	ND	ND	2.2	2.6	2.2
BG30	San Joaquin River	4/21/99	20	52	ND	ND	3.6	ND	5.5	3.7	ND	1.7	1.7	ND	2.5	1.1	3.2
BF20	Grizzly Bay	4/21/99	20	75	ND	2.1	4.4	1.3	4.9	3.1	ND	2.3	3.9	ND	4.3	1.3	5.9
BD50	Napa River	4/20/99	20	110	1.6	3.8	6.6	1.7	6.7	3.7	ND	3.1	5.9	1.2	7.6	2.1	8.7
BD40	Davis Point	4/19/99	20	99	2.0	2.7	5.5	1.5	6.8	4.3	ND	2.8	6.1	1.2	5.8	1.9	8.8
BD30	Pinole Point	4/19/99	20	94	1.7	2.9	7.2	1.2	5.9	3.6	ND	3.0	5.1	1.2	6.0	1.8	8.1
BD20	San Pablo Bay	4/19/99	20	121	2.6	3.8	7.7	ND	9.7	5.7	ND	2.8	8.1	1.3	7.7	2.5	9.9
BD15	Petaluma River	4/19/99	20	120	2.4	3.6	9.1	1.9	6.7	4.6	ND	2.4	7.8	ND	7.8	2.6	14
BC60	Red Rock	4/14/99	20	50	1.3	2.0	5.0	ND	4.8	3.1	ND	1.4	3.0	ND	3.9	1.4	4.6
BC20	Golden Gate	4/15/99	20	34	ND	1.2	3.5	ND	1.7	1.4	ND	ND	1.4	ND	1.7	ND	2.0
BC10	Yerba Buena Island	4/14/99	20	70	1.4	2.1	5.1	1.1	5.6	3.3	ND	2.3	3.2	ND	3.1	1.6	5.0
BB70	Alameda	4/14/99	20	84	2.0	2.7	7.5	ND	5.8	3.9	ND	1.7	4.3	ND	5.0	1.9	6.9
BA40	Redwood Creek	4/12/99	20	97	1.2	2.5	7.7	1.1	6.1	4.1	ND	1.7	4.5	ND	4.3	2.0	6.7
BA30	Dumbarton Bridge	4/12/99	20	147	3.0	4.6	11	1.9	7.9	6.2	1.2	4.1	10	1.3	9.0	3.5	14
BA10	Coyote Creek	4/13/99	20	251	5.8	7.2	21	1.7	15	8.1	ND	4.4	10	1.2	11	4.6	15
C-3-0	San Jose	4/13/99	20	398	5.9	8.9	21	2.5	13	13	1.1	5.5	14	2.6	18	5.3	19
BW10	Standish Dam	4/22/99	20	274	3.8	3.7	19	1.9	10	6.4	ND	3.8	11	2.5	14	5.0	17
BW15	Guadalupe River	4/22/99	20	427	8.9	11	27	5.8	25	19	2.9	7.1	29	6.2	35	13	37
BG20	Sacramento River	7/21/99	21	52	ND	ND	3.5	ND	2.8	1.5	ND	1.3	1.9	ND	3.1	ND	2.8
BG30	San Joaquin River	7/21/99	21	50	ND	1.7	3.9	ND	2.3	1.6	ND	ND	2.5	ND	3.4	ND	3.5
BF20	Grizzly Bay	7/20/99	21	57	1.5	2.2	4.5	ND	3.8	1.9	ND	ND	3.3	ND	4.2	1.5	4.7
BD50	Napa River	7/20/99	21	75	2.0	1.5	5.3	1.9	Q	2.8	ND	2.4	2.5	ND	4.7	1.9	4.8
BD40	Davis Point	7/19/99	21	72	1.8	2.5	6.0	ND	3.9	1.9	ND	ND	2.5	ND	4.2	1.6	4.3
BD30	Pinole Point	7/19/99	21	53	ND	2.3	4.5	ND	3.3	1.7	ND	ND	2.1	ND	3.6	ND	3.8
BD20	San Pablo Bay	7/19/99	21	66	1.7	2.6	5.3	ND	4.0	1.9	ND	ND	2.9	ND	4.7	1.8	5.0
BD15	Petaluma River	7/19/99	21	94	2.7	4.3	8.5	ND	6.5	3.3	ND	2.1	5.2	ND	7.5	2.9	8.3
BC60	Red Rock	7/15/99	21	89	1.9	2.8	6.1	ND	4.0	2.5	ND	ND	2.6	ND	4.5	1.8	4.7
BC20	Golden Gate	7/15/99	21	20	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC10	Yerba Buena Island	7/16/99	21	72	1.8	2.8	5.8	ND	3.7	2.2	ND	ND	2.7	ND	4.1	1.8	4.6
BB70	Alameda	7/16/99	21	96	1.9	5.7	8.5	ND	4.8	3.7	ND	1.4	4.0	ND	5.9	2.2	7.3
BA40	Redwood Creek	7/13/99	21	110	2.6	4.8	10	ND	6.2	3.8	ND	2.0	4.9	ND	7.0	2.7	8.1
BA30	Dumbarton Bridge	7/14/99	21	147	3.4	5.6	12	ND	8.1	4.6	ND	2.3	6.0	ND	8.9	3.3	9.7
BA10	Coyote Creek	7/13/99	21	269	5.9	9.1	21	1.7	13	8.1	ND	3.8	9.8	ND	14	5.3	15
C-3-0	San Jose	7/14/99	21	801	14	20	51	ND	28	19	ND	8.0	23	4.5	33	12	33
BW10	Standish Dam	7/22/99	21	395	8.0	9.3	24	4.1	22	10	2.0	6.5	13	3.6	21	8.6	17
BW15	Guadalupe River	7/22/99	21	458	9.3	13	31	3.1	27	13	2.7	8.7	18	4.1	28	12	26

Data Table 6 continued on next page

Table 6. Dissolved PCB concentrations in water, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 156	PCB 158	PCB 170	PCB 174	PCB 177	PCB 180	PCB 183	PCB 187	PCB 194	PCB 195	PCB 201	PCB 203	Hexachlorobenzene
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	64	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	B	ND	13
BG30	San Joaquin River	2/10/99	19	89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	B	ND	41
BF20	Grizzly Bay	2/9/99	19	72	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	B	ND	18
BD50	Napa River	2/9/99	19	147	ND	ND	ND	2.4	ND	2.3	1.2	1.3	ND	ND	ND	ND	17
BD40	Davis Point	2/8/99	19	91	ND	ND	ND	1.3	ND	1.3	ND	1.4	ND	ND	B	ND	14
BD30	Pinole Point	2/8/99	19	95	ND	ND	ND	0.94	ND	1.1	ND	1.3	ND	ND	B	ND	13
BD20	San Pablo Bay	2/8/99	19	120	ND	ND	ND	1.5	ND	1.9	ND	2.5	ND	ND	B	ND	15
BD15	Petaluma River	2/8/99	19	133	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	18
BC60	Red Rock	2/3/99	19	107	ND	ND	ND	ND	ND	1.8	ND	2.1	ND	ND	B	1.3	11
BC20	Golden Gate	2/3/99	19	114	ND	ND	ND	ND	ND	1.6	ND	1.9	ND	ND	ND	ND	31
BC10	Yerba Buena Island	2/4/99	19	123	ND	ND	ND	1.1	ND	1.6	ND	1.8	ND	ND	B	ND	12
BB70	Alameda	2/4/99	19	152	ND	ND	ND	1.3	ND	1.9	ND	2.4	ND	ND	B	ND	13
BA40	Redwood Creek	2/1/99	19	220	ND	ND	1.7	1.8	1.7	3.8	1.5	4.0	ND	ND	B	ND	41
BA30	Dumbarton Bridge	2/2/99	19	202	ND	ND	1.3	1.7	1.4	3.0	1.3	3.7	ND	ND	B	ND	47
BA10	Coyote Creek	2/1/99	19	259	ND	ND	2.1	2.3	2.0	4.6	1.7	5.2	ND	ND	B	ND	50
C-3-0	San Jose	2/2/99	19	343	ND	ND	1.9	2.6	1.8	4.0	1.8	4.6	ND	ND	B	ND	53
BW10	Standish Dam	2/11/99	19	194	ND	ND	1.2	2.6	1.0	2.8	ND	2.5	ND	ND	B	ND	11
BW15	Guadalupe River	2/11/99	19	571	ND	1.6	12	16	7.9	24	7.2	17	3.5	1.8	b 8.1	2.8	18
BG20	Sacramento River	4/21/99	20	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
BG30	San Joaquin River	4/21/99	20	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12
BF20	Grizzly Bay	4/21/99	20	75	ND	ND	ND	ND	ND	1.5	ND	1.6	ND	ND	ND	ND	8.6
BD50	Napa River	4/20/99	20	110	ND	ND	ND	1.2	ND	2.5	ND	2.3	ND	ND	ND	ND	35
BD40	Davis Point	4/19/99	20	99	ND	ND	1.2	1.4	ND	2.5	ND	1.9	ND	ND	ND	ND	19
BD30	Pinole Point	4/19/99	20	94	ND	ND	ND	1.1	ND	1.8	ND	1.8	ND	ND	ND	ND	30
BD20	San Pablo Bay	4/19/99	20	121	ND	ND	1.4	1.8	1.3	3.1	ND	2.7	ND	ND	ND	ND	18
BD15	Petaluma River	4/19/99	20	120	1.4	ND	1.8	1.6	1.5	3.2	ND	3.0	ND	ND	ND	ND	12
BC60	Red Rock	4/14/99	20	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23
BC20	Golden Gate	4/15/99	20	34	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13
BC10	Yerba Buena Island	4/14/99	20	70	1.6	1.2	0.83	ND	ND	1.0	ND	1.1	ND	ND	ND	ND	8.5
BB70	Alameda	4/14/99	20	84	ND	ND	ND	ND	ND	1.6	ND	1.6	ND	ND	ND	ND	24
BA40	Redwood Creek	4/12/99	20	97	1.3	ND	1.4	0.96	ND	1.2	ND	1.4	ND	ND	ND	ND	14
BA30	Dumbarton Bridge	4/12/99	20	147	ND	1.2	1.5	1.5	1.5	3.0	ND	3.7	ND	ND	ND	ND	20
BA10	Coyote Creek	4/13/99	20	251	ND	1.4	1.7	1.7	1.5	3.4	0.99	2.2	ND	ND	ND	ND	52
C-3-0	San Jose	4/13/99	20	398	ND	1.7	2.9	3.0	2.2	6.0	2.1	5.9	1.3	ND	ND	ND	50
BW10	Standish Dam	4/22/99	20	274	ND	2.3	2.4	3.0	1.6	5.2	1.5	4.1	ND	ND	ND	ND	110
BW15	Guadalupe River	4/22/99	20	427	2.5	4.1	8.9	8.6	6.1	18	5.2	15	4.5	1.7	2.7	2.6	12
BG20	Sacramento River	7/21/99	21	52	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	CE	ND	12
BG30	San Joaquin River	7/21/99	21	50	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	CE	ND	13
BF20	Grizzly Bay	7/20/99	21	57	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	CE	ND	8.8
BD50	Napa River	7/20/99	21	75	6.0	ND	1.6	ND	ND	1.1	ND	1.4	ND	ND	CE	ND	4.5
BD40	Davis Point	7/19/99	21	72	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	CE	ND	8.5
BD30	Pinole Point	7/19/99	21	53	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	CE	ND	7.6
BD20	San Pablo Bay	7/19/99	21	66	ND	ND	ND	ND	ND	ND	ND	1.8	ND	ND	CE	ND	5.8
BD15	Petaluma River	7/19/99	21	94	ND	ND	ND	ND	ND	1.9	ND	3.0	ND	ND	CE	ND	9.0
BC60	Red Rock	7/15/99	21	89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	CE	ND	8.2
BC20	Golden Gate	7/15/99	21	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	CE	ND	6.8
BC10	Yerba Buena Island	7/16/99	21	72	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	CE	ND	7.5
BB70	Alameda	7/16/99	21	96	ND	ND	ND	ND	ND	1.7	ND	2.5	ND	ND	CE	ND	12
BA40	Redwood Creek	7/13/99	21	110	2.0	ND	ND	ND	ND	ND	ND	2.7	ND	ND	CE	ND	5.9
BA30	Dumbarton Bridge	7/14/99	21	147	1.4	ND	ND	ND	ND	1.8	ND	3.1	ND	ND	CE	ND	9.2
BA10	Coyote Creek	7/13/99	21	269	1.7	ND	2.0	1.8	2.0	3.5	ND	5.0	ND	ND	CE	ND	6.6
C-3-0	San Jose	7/14/99	21	801	ND	ND	4.5	4.9	3.7	8.9	3.5	11	ND	ND	CE	ND	22
BW10	Standish Dam	7/22/99	21	395	1.6	ND	2.8	3.5	2.3	5.4	2.0	5.5	ND	ND	CE	ND	14
BW15	Guadalupe River	7/22/99	21	458	2.0	1.9	3.9	4.6	3.4	7.7	2.7	8.3	ND	ND	CE	ND	8.5

Table 7. Total (dissolved + particulate) PCB concentrations in water, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.

CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits. * PCB 008 coeluted with PCB 005.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 008*	PCB 018	PCB 028	PCB 031	PCB 044	PCB 049	PCB 052	PCB 060	PCB 066	PCB 070	PCB 074	PCB 087	PCB 095
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	82	Q	Q	5.2	B	5.1	3.6	7.1	1.6	2.3	6.6	2.8	1.3	B
BG30	San Joaquin River	2/10/99	19	118	12	10	7.3	B	4.9	5.4	B	1.6	2.9	6.8	1.6	1.4	B
BF20	Grizzly Bay	2/9/99	19	194	Q	Q	6.1	B	7.2	6.5	B	3.1	5.7	9.0	3.8	3.2	Q
BD50	Napa River	2/9/99	19	719	Q	Q	20	b 22	24	18	b 21	10	20	35	M	12	Q
BD40	Davis Point	2/8/99	19	263	Q	Q	7.6	B	8.0	10	B	4.5	7.5	12	4.7	4.1	Q
BD30	Pinole Point	2/8/99	19	217	10	Q	10	B	6.1	8.1	B	4.0	6.8	10	1.4	3.2	Q
BD20	San Pablo Bay	2/8/99	19	398	Q	Q	13	B	10	12	B	6.1	12	16	7.3	6.4	Q
BD15	Petaluma River	2/8/99	19	174	17	14	M	M	6.8	15	9.2	7.4	4.5	13	6.0	2.3	B
BC60	Red Rock	2/3/99	19	235	14	Q	8.1	B	6.1	9.1	B	3.6	7.3	10	1.4	3.8	Q
BC20	Golden Gate	2/3/99	19	281	Q	12	7.5	B	7.2	7.8	B	4.8	9.2	14	3.7	5.1	Q
BC10	Yerba Buena Island	2/4/99	19	307	18	Q	9.1	b 12	7.1	10	B	5.0	8.9	12	3.0	4.6	Q
BB70	Alameda	2/4/99	19	409	9.0	13	13	B	8.8	12	b 16	6.5	12	16	5.0	7.5	Q
BA40	Redwood Creek	2/1/99	19	1722	47	16	36	b 29	23	27	b 39	21	42	47	15	26	Q
BA30	Dumbarton Bridge	2/2/99	19	811	27	20	21	b 20	16	19	b 23	13	23	29	9.3	12	Q
BA10	Coyote Creek	2/1/99	19	3317	52	M	82	b 62	M	55	b 83	M	M	M	M	51	M
C-3-0	San Jose	2/2/99	19	1800	45	40	53	b 44	41	39	b 56	29	49	62	19	27	Q
BW10	Standish Dam	2/11/99	19	1098	32	23	27	b 27	30	16	b 22	8.2	22	23	11	11	Q
BW15	Guadalupe River	2/11/99	19	5000	41	32	41	b 37	51	31	b 80	M	46	51	M	49	Q
BG20	Sacramento River	4/21/99	20	54	NA	4.3	4.1	B	2.5	2.6	B	ND	ND	B	ND	ND	2
BG30	San Joaquin River	4/21/99	20	96	NA	4.1	5.3	B	4.4	4.4	B	ND	B	B	ND	1.1	5
BF20	Grizzly Bay	4/21/99	20	304	NA	6.7	8.2	B	5.7	10	b 11	2.2	B	b 11	3.7	4.7	10
BD50	Napa River	4/20/99	20	481	NA	7.4	11	b 14	M	11	b 15	M	M	M	7.9	7.4	M
BD40	Davis Point	4/19/99	20	1498	NA	13	30	b 29	20	14	b 33	14	b 69	b 45	13	27	67
BD30	Pinole Point	4/19/99	20	533	NA	7.4	13	B	9.4	11	b 15	4.5	b 13	b 15	4.3	8.2	20
BD20	San Pablo Bay	4/19/99	20	1458	NA	3.8	23	b 20	16	18	b 38	M	b 65	M	M	21	78
BD15	Petaluma River	4/19/99	20	1281	NA	2.4	23	b 21	21	18	b 32	17	b 32	b 27	10	19	53
BC60	Red Rock	4/14/99	20	197	NA	1.7	5.4	B	4.1	5.0	B	1.5	B	B	1.7	1.9	9.1
BC20	Golden Gate	4/15/99	20	56	NA	3.8	4.3	B	2.7	2.0	2.9	ND	ND	B	ND	ND	4.4
BC10	Yerba Buena Island	4/14/99	20	386	NA	5.4	10	B	8.5	8.9	b 13	3.5	b 9.8	b 13	4.8	6.5	16
BB70	Alameda	4/14/99	20	941	NA	8.8	19	b 20	12	13	b 21	7.0	b 29	b 26	8.7	15	31
BA40	Redwood Creek	4/12/99	20	511	NA	8.5	12	B	9.1	11	b 17	5.9	b 12	b 16	4.9	8.3	21
BA30	Dumbarton Bridge	4/12/99	20	830	NA	5.7	17	b 21	14	15	b 24	8.0	b 21	b 25	8.6	12	20
BA10	Coyote Creek	4/13/99	20	1489	NA	10	33	b 36	31	28	b 55	19	b 42	b 48	13	26	63
C-3-0	San Jose	4/13/99	20	2588	NA	70	61	b 80	63	48	b 100	25	b 67	b 69	25	44	124
BW10	Standish Dam	4/22/99	20	1360	NA	24	38	b 50	29	71	b 45	M	M	M	M	18	M
BW15	Guadalupe River	4/22/99	20	7169	NA	M	117	b 140	M	M	M	M	M	M	M	118	M
BG20	Sacramento River	7/21/99	21	115	11	2.3	b 7.3	B	2.4	B	5.8	ND	3.8	4.6	ND	ND	7.9
BG30	San Joaquin River	7/21/99	21	151	ND	3.2	B	B	2.8	B	7.5	ND	4.6	5.1	ND	ND	8.9
BF20	Grizzly Bay	7/20/99	21	269	1.4	2.6	b 8.3	B	4.7	B	10	4.1	5.8	9.3	1.4	3.1	16
BD50	Napa River	7/20/99	21	217	Q	4.2	b 7.4	B	2.2	B	8.1	5.4	5.0	9.3	4.7	4.1	Q
BD40	Davis Point	7/19/99	21	148	4.0	4.5	B	B	3.7	B	7.2	2.6	3.5	5.4	ND	ND	12
BD30	Pinole Point	7/19/99	21	130	1.8	2.8	B	B	2.0	B	6.6	1.2	3.9	4.4	ND	1.2	10
BD20	San Pablo Bay	7/19/99	21	230	5.2	3.1	B	B	4.1	B	7.4	2.9	4.0	7.6	ND	1.9	13
BD15	Petaluma River	7/19/99	21	716	2.2	4.2	b 16	b 9.8	8.1	b 13	13	5.4	17	22	3.2	5.7	22
BC60	Red Rock	7/15/99	21	287	M	M	M	M	M	M	M	ND	M	M	M	4.8	M
BC20	Golden Gate	7/15/99	21	38	ND	2.0	B	B	ND	2.6	2.8	ND	ND	1.9	ND	ND	4.6
BC10	Yerba Buena Island	7/16/99	21	258	3.8	4.4	b 11	b 8.4	5.5	B	10	ND	4.8	12	M	2.0	14
BB70	Alameda	7/16/99	21	411	4.1	4.8	b 11	Q	6.3	b 10	14	4.3	7.6	14	1.7	3.7	20
BA40	Redwood Creek	7/13/99	21	277	ND	4.3	B	b 9.2	5.9	B	13	4.2	7.9	8.1	ND	3.5	21
BA30	Dumbarton Bridge	7/14/99	21	513	ND	5.9	b 14	b 14	11	b 16	20	8.3	15	16	5.4	6.3	31
BA10	Coyote Creek	7/13/99	21	1925	42	M	b 41	b 39	31	b 37	46	M	49	49	33	24	67
C-3-0	San Jose	7/14/99	21	6457	40	M	b 196	b 170	M	b 116	197	M	M	M	M	92	M
BW10	Standish Dam	7/22/99	21	1632	M	M	b 40	b 35	37	b 35	58	15	36	48	11	24	118
BW15	Guadalupe River	7/22/99	21	2086	M	21	b 40	b 35	36	b 37	58	7.8	45	52	M	30	120

Data Table 7 continued on next page

Table 7. Total (dissolved + particulate) PCB concentrations in water, 1999 (continued).
B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.
CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 097	PCB 099	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 132	PCB 138	PCB 141	PCB 149	PCB 151	PCB 153
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	82	ND	1.6	B	3.3	12	4.5	ND	2.8	Q	ND	5.2	1.1	6.4
BG30	San Joaquin River	2/10/99	19	118	2.7	3.6	b 8.5	2.1	10	5.7	ND	2.8	4.9	1.0	6.1	1.0	7.8
BF20	Grizzly Bay	2/9/99	19	194	3.3	6.6	13	5.5	18	10	1.8	3.7	19	2.4	12	3.7	15
BD50	Napa River	2/9/99	19	719	12	18	33	14	55	38	7.1	15	Q	12	50	15	66
BD40	Davis Point	2/8/99	19	263	4.9	9.4	19	8.4	20	17	2.3	5.9	17	3.2	18	5.3	24
BD30	Pinole Point	2/8/99	19	217	4.0	7.5	15	7.7	17	11	3.7	5.1	13	3.7	14	4.9	18
BD20	San Pablo Bay	2/8/99	19	398	9.0	15	29	7.5	27	23	4.7	8.3	27	6.3	28	8.8	36
BD15	Petaluma River	2/8/99	19	174	3.9	4.5	11	4.2	13	8.2	ND	4.2	5.1	M	7.9	3.1	8.0
BC60	Red Rock	2/3/99	19	235	5.0	9.3	18	5.2	13	13	1.8	5.5	16	3.7	17	5.7	20
BC20	Golden Gate	2/3/99	19	281	8.9	10	23	9.0	16	16	2.3	6.4	23	4.9	19	5.7	23
BC10	Yerba Buena Island	2/4/99	19	307	5.7	11	23	5.1	17	17	2.6	6.3	20	4.0	20	7.1	24
BB70	Alameda	2/4/99	19	409	8.3	14	30	8.3	24	23	4.9	8.0	24	5.7	26	8.8	32
BA40	Redwood Creek	2/1/99	19	1722	26	49	b 86	35	89	108	26	29	128	19	120	36	182
BA30	Dumbarton Bridge	2/2/99	19	811	18	23	b 49	13	44	45	10	15	51	10	52	17	71
BA10	Coyote Creek	2/1/99	19	3317	64	115	M	75	218	240	55	66	320	41	273	84	414
C-3-0	San Jose	2/2/99	19	1800	29	46	b 90	31	99	99	21	35	121	23	113	39	163
BW10	Standish Dam	2/11/99	19	1098	11	13	b 38	11	58	31	8.3	25	Q	24	94	34	99
BW15	Guadalupe River	2/11/99	19	5000	42	43	b 183	31	194	120	41	144	394	133	453	148	508
BG20	Sacramento River	4/21/99	20	54	ND	1.6	B	ND	5.7	4.9	ND	ND	4.1	ND	4.9	3.9	6.6
BG30	San Joaquin River	4/21/99	20	96	1.2	1.2	B	1.8	9.4	7.5	ND	3.3	7.8	ND	7.3	3.2	11
BF20	Grizzly Bay	4/21/99	20	304	4.1	8.0	b 14	5.6	18	17	3.2	5.9	24	3.0	21	7.4	32
BD50	Napa River	4/20/99	20	481	9.3	15	M	10	31	30	6.0	8.1	47	5.9	40	13	58
BD40	Davis Point	4/19/99	20	1498	27	39	b 72	27	90	83	18	23	126	8.5	85	30	149
BD30	Pinole Point	4/19/99	20	533	10	15	b 25	9.0	29	29	5.5	12	42	6.2	37	13	55
BD20	San Pablo Bay	4/19/99	20	1458	25	38	b 68	25	84	88	17	20	138	11	104	36	150
BD15	Petaluma River	4/19/99	20	1281	22	38	b 61	20	70	70	14	13	108	9.2	92	34	144
BC60	Red Rock	4/14/99	20	197	4.4	7.0	b 14	3.4	13	12	1.8	4.2	17	1.7	16	5.2	24
BC20	Golden Gate	4/15/99	20	56	ND	3.0	B	ND	4.2	4.0	ND	ND	5.2	ND	5.1	ND	7.8
BC10	Yerba Buena Island	4/14/99	20	386	7.8	10	b 21	6.0	21	21	3.7	7.7	28	4.0	24	9.2	38
BB70	Alameda	4/14/99	20	941	17	25	b 45	13	44	52	9.0	15	78	7.5	63	20	99
BA40	Redwood Creek	4/12/99	20	511	8.4	12	b 29	7.8	24	28	4.9	8.7	40	4.5	33	12	55
BA30	Dumbarton Bridge	4/12/99	20	830	15	23	b 43	11	37	47	8.6	16	70	8.3	56	19	91
BA10	Coyote Creek	4/13/99	20	1489	27	39	b 76	21	70	79	14	22	120	11	94	34	145
C-3-0	San Jose	4/13/99	20	2588	42	62	b 118	33	113	133	23	41	194	20	168	54	239
BW10	Standish Dam	4/22/99	20	1360	18	19	M	16	63	46	12	20	108	25	109	42	127
BW15	Guadalupe River	4/22/99	20	7169	109	M	M	126	475	419	100	137	819	126	735	253	947
BG20	Sacramento River	7/21/99	21	115	1.5	2.1	7.5	1.7	6.7	5.9	ND	2.8	8.0	ND	7.9	1.7	10
BG30	San Joaquin River	7/21/99	21	151	1.8	4.6	8.3	2.0	4.8	8.8	2.3	2.6	12	2.8	9.0	2.6	18
BF20	Grizzly Bay	7/20/99	21	269	5.3	8.4	17	3.9	17	16	3.3	4.6	21	3.7	18	6.4	26
BD50	Napa River	7/20/99	21	217	5.3	7.0	13	4.9	Q	12	2.6	5.9	17	1.9	17	6.0	23
BD40	Davis Point	7/19/99	21	148	3.8	5.8	11	1.2	8.4	7.4	1.3	1.9	11	ND	11	3.8	14
BD30	Pinole Point	7/19/99	21	130	2.0	5.5	10	ND	7.4	6.8	1.2	1.7	10	ND	11	2.2	15
BD20	San Pablo Bay	7/19/99	21	230	5.0	8.3	14	3.4	13	12	2.6	3.5	18	2.1	18	5.8	25
BD15	Petaluma River	7/19/99	21	716	13	22	32	10	39	41	9.4	12	57	6.8	51	17	77
BC60	Red Rock	7/15/99	21	287	8.3	13	M	6.1	21	22	4.9	7.2	30	4.6	27	10	39
BC20	Golden Gate	7/15/99	21	38	ND	1.4	4.9	ND	1.7	1.7	ND	ND	2.9	ND	3.3	ND	4
BC10	Yerba Buena Island	7/16/99	21	258	5.5	8.5	13	2.7	13	12	2.8	3.7	18	2.7	17	6.4	24
BB70	Alameda	7/16/99	21	411	7.4	15	23	4.8	20	22	4.9	7.2	30	4.4	27	10	41
BA40	Redwood Creek	7/13/99	21	277	5.2	10	20	2.4	14	14	4.1	4.8	19	3.4	18	6.6	29
BA30	Dumbarton Bridge	7/14/99	21	513	10	17	33	6.1	25	26	5.3	9.0	36	3.3	33	12	49
BA10	Coyote Creek	7/13/99	21	1925	32	46	80	34	97	108	24	33	150	20	124	42	195
C-3-0	San Jose	7/14/99	21	6457	113	200	M	100	398	399	82	318	613	90	513	162	853
BW10	Standish Dam	7/22/99	21	1632	26	29	67	22	87	66	17	29	110	26	110	40	127
BW15	Guadalupe River	7/22/99	21	2086	33	37	86	26	111	97	24	34	158	31	148	54	196

Data Table 7 continued on next page

Table 7. Total (dissolved + particulate) PCB concentrations in water, 1999 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.
CE = coeluted, M = matrix interference, NA = not available, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM PCBs (SFEI)	PCB 156	PCB 158	PCB 170	PCB 174	PCB 177	PCB 180	PCB 183	PCB 187	PCB 194	PCB 195	PCB 201	PCB 203	Hexachlorobenzene
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	82	ND	ND	1.6	2.6	ND	3.3	ND	1.9	ND	ND	B	ND	B
BG30	San Joaquin River	2/10/99	19	118	ND	ND	1.8	1.5	ND	3.4	ND	2.3	ND	ND	B	ND	B
BF20	Grizzly Bay	2/9/99	19	194	1.7	ND	4.2	4.1	2.7	8.3	2.2	6.1	2.8	ND	B	2.3	b 36
BD50	Napa River	2/9/99	19	719	6.7	2.0	23	19	12	49	14	31	14	4.5	b 17	11	b 38
BD40	Davis Point	2/8/99	19	263	2.2	ND	5.7	5.8	4.0	13	3.3	11	3.6	ND	B	2.4	b 27
BD30	Pinole Point	2/8/99	19	217	ND	ND	3.7	3.9	2.6	8.4	2.0	7.3	1.8	ND	B	2.8	B
BD20	San Pablo Bay	2/8/99	19	398	3.4	1.7	9.4	8.4	6.5	20	5.4	19	5.9	2.0	B	4.9	b 27
BD15	Petaluma River	2/8/99	19	174	ND	ND	ND	ND	ND	2.8	ND	3.3	ND	ND	B	ND	b 29
BC60	Red Rock	2/3/99	19	235	1.5	ND	4.3	3.4	2.9	10	2.4	8.9	2.2	ND	B	3.8	B
BC20	Golden Gate	2/3/99	19	281	1.6	ND	4.6	3.9	3.2	12	2.9	10	3.0	ND	B	2.2	B
BC10	Yerba Buena Island	2/4/99	19	307	2.2	ND	6.0	5.8	4.1	13	3.3	11	3.7	1.6	B	3.3	B
BB70	Alameda	2/4/99	19	409	2.7	ND	7.9	7.3	5.6	18	4.6	15	5.3	2.0	B	4.0	B
BA40	Redwood Creek	2/1/99	19	1722	16	10	54	33	37	102	28	84	32	10	B	17	b 52
BA30	Dumbarton Bridge	2/2/99	19	811	6.9	3.2	18	14	14	37	11	35	11	3.1	B	6.3	B
BA10	Coyote Creek	2/1/99	19	3317	33	18	132	77	79	225	60	205	69	23	B	47	b 73
C-3-0	San Jose	2/2/99	19	1800	13	11	50	36	32	91	26	75	28	9.4	B	17	B
BW10	Standish Dam	2/11/99	19	1098	6.1	12	50	50	27	103	27	63	28	11	B	23	b 24
BW15	Guadalupe River	2/11/99	19	5000	31	29	292	236	138	544	117	287	124	55	b 168	88	b 35
BG20	Sacramento River	4/21/99	20	54	ND	ND	1.6	ND	ND	2.4	ND	1.8	ND	ND	1.2	ND	15
BG30	San Joaquin River	4/21/99	20	96	ND	ND	2.2	1.7	1.4	4.3	1.7	3.5	1.4	ND	1.5	ND	28
BF20	Grizzly Bay	4/21/99	20	304	2.7	1.9	8.2	5.3	4.5	17	4.2	13	4.8	1.8	2.7	2.6	22
BD50	Napa River	4/20/99	20	481	5.4	4.3	16	11	8.9	33	8.5	25	10	3.2	5.3	5.7	50
BD40	Davis Point	4/19/99	20	1498	14	13	42	24	25	82	23	62	27	7.6	13	15	46
BD30	Pinole Point	4/19/99	20	533	4.7	4.7	14	11	8.6	29	8.2	24	9.2	2.9	4.9	4.8	41
BD20	San Pablo Bay	4/19/99	20	1458	14	17	44	31	26	87	23	67	27	8.7	13	14	73
BD15	Petaluma River	4/19/99	20	1281	13	13	36	25	25	67	20	63	22	7.1	10	11	31
BC60	Red Rock	4/14/99	20	197	1.5	1.5	5.7	3.7	3.8	10	2.9	8.0	2.7	ND	2.0	1.8	27
BC20	Golden Gate	4/15/99	20	56	ND	ND	1.6	ND	ND	2.5	ND	2.1	ND	ND	ND	ND	16
BC10	Yerba Buena Island	4/14/99	20	386	4.4	4.2	10	6.6	6.9	19	5.4	15	5.1	1.8	2.7	3.0	14
BB70	Alameda	4/14/99	20	941	8.5	8.0	30	20	18	58	17	43	18	6.3	7.9	9.2	31
BA40	Redwood Creek	4/12/99	20	511	4.8	4.6	14	9.2	11	24	7.5	23	7.8	2.5	4.5	4.0	18
BA30	Dumbarton Bridge	4/12/99	20	830	6.3	8.8	23	15	18	42	12	40	13	4.3	5.8	7.0	27
BA10	Coyote Creek	4/13/99	20	1489	12	12	40	27	30	72	22	64	24	7.6	9.4	12	55
C-3-0	San Jose	4/13/99	20	2588	19	22	71	52	44	126	38	106	42	14	17	22	64
BW10	Standish Dam	4/22/99	20	1360	10	18	63	52	30	115	31	73	37	15	14	23	121
BW15	Guadalupe River	4/22/99	20	7169	70	86	329	239	166	668	145	435	185	75	49	103	40
BG20	Sacramento River	7/21/99	21	115	1.5	ND	2.4	1.6	B	4.4	ND	3.5	1.4	ND	CE	ND	20
BG30	San Joaquin River	7/21/99	21	151	Q	M	3.0	2.1	B	3.2	9.4	10	1.5	2.0	CE	8.5	19
BF20	Grizzly Bay	7/20/99	21	269	4.3	1.9	6.7	4.3	B	12	3.1	11	5.1	1.5	CE	2.3	17
BD50	Napa River	7/20/99	21	217	9.0	1.4	7.0	3.6	B	12	2.9	11	3.3	ND	CE	1.6	8.1
BD40	Davis Point	7/19/99	21	148	1.6	1.2	3.1	2.1	B	6.1	1.5	6.6	1.8	ND	CE	ND	12
BD30	Pinole Point	7/19/99	21	130	2.0	ND	3.2	2.2	B	6.0	1.5	5.4	2.2	ND	CE	1.7	9.2
BD20	San Pablo Bay	7/19/99	21	230	4.3	1.5	6.6	4.0	B	11	3.2	12	4.4	1.5	CE	2.7	11
BD15	Petaluma River	7/19/99	21	716	13	7.4	23	12	b 15	41	11	37	16	4.8	CE	7.4	22
BC60	Red Rock	7/15/99	21	287	7.0	3.3	12	8.1	B	22	5.6	16	10	3.5	CE	4.1	8.2
BC20	Golden Gate	7/15/99	21	38	ND	ND	ND	ND	ND	2.0	ND	1.9	ND	ND	CE	ND	6.8
BC10	Yerba Buena Island	7/16/99	21	258	4.0	2.0	7.0	5.0	B	13	3.1	11	4.4	ND	CE	2.0	10
BB70	Alameda	7/16/99	21	411	6.8	3.4	12	8.0	B	24	5.6	20	8.4	2.9	CE	3.7	15
BA40	Redwood Creek	7/13/99	21	277	7.1	3.2	5.9	4.3	B	9.4	3.3	13	1.7	ND	CE	3.2	10
BA30	Dumbarton Bridge	7/14/99	21	513	7.2	3.9	10	6.9	B	21	5.3	22	6.6	1.3	CE	3.2	11
BA10	Coyote Creek	7/13/99	21	1925	32	20	62	39	b 41	104	25	90	37	14	CE	20	16
C-3-0	San Jose	7/14/99	21	6457	100	57	245	155	b 124	479	98	301	120	52	CE	76	37
BW10	Standish Dam	7/22/99	21	1632	22	13	57	43	b 27	101	23	64	32	15	CE	23	21
BW15	Guadalupe River	7/22/99	21	2086	30	15	78	54	b 42	138	32	93	44	17	CE	28	15

Table 8. Dissolved pesticide concentrations in water, 1999. B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	Chlorpyrifos	Diazinon	SUM DDTs (SFEI)	o,p^-DDD	o,p^-DDE	o,p^-DDT	p,p^-DDD	p,p^-DDE	p,p^-DDT
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	350	10,000	120	5.0	10	Q	19	83	2.6
BG30	San Joaquin River	2/10/99	19	420	17,000	122	5.8	6.3	Q	21	85	4.3
BF20	Grizzly Bay	2/9/99	19	170	15,000	112	6.1	5.4	Q	23	77	ND
BD50	Napa River	2/9/99	19	420	4,400	258	18	5.9	Q	68	150	16
BD40	Davis Point	2/8/99	19	270	11,000	113	8.5	5.8	Q	34	61	3.8
BD30	Pinole Point	2/8/99	19	290	9,800	111	12	5.3	Q	36	54	3.2
BD20	San Pablo Bay	2/8/99	19	37	9,000	118	11	6.8	Q	38	59	3.3
BD15	Petaluma River	2/8/99	19	710	6,500	97	11	6.1	Q	22	52	5.4
BC60	Red Rock	2/3/99	19	71	4,400	96	20	2.9	Q	37	35	1.2
BC20	Golden Gate	2/3/99	19	29	ND	90	15	4.0	ND	26	26	19
BC10	Yerba Buena Island	2/4/99	19	45	5,200	95	19	2.8	Q	35	35	3.6
BB70	Alameda	2/4/99	19	100	4,200	69	8.8	2.5	Q	23	31	4.0
BA40	Redwood Creek	2/1/99	19	160	3,500	373	23	6.3	1.0	300	33	10
BA30	Dumbarton Bridge	2/2/99	19	140	1,000	405	66	5.3	3.4	270	51	9.1
BA10	Coyote Creek	2/1/99	19	360	5,100	863	25	4.5	3.6	740	78	12
C-3-0	San Jose	2/2/99	19	760	15,000	271	58	3.2	3.5	110	73	23
BW10	Standish Dam	2/11/99	19	560	9,700	279	31	19	Q	65	150	14
BW15	Guadalupe River	2/11/99	19	940	13,000	152	Q	11	Q	37	94	9.8
BG20	Sacramento River	4/21/99	20	b 280	2,200	144	b 21	1.8	ND	28	87	5.9
BG30	San Joaquin River	4/21/99	20	b 440	3,000	142	b 20	5	Q	32	85	ND
BF20	Grizzly Bay	4/21/99	20	b 320	2,700	166	b 29	4.2	Q	53	77	2.8
BD50	Napa River	4/20/99	20	b 200	3,800	190	b 41	4.5	Q	67	70	7.0
BD40	Davis Point	4/19/99	20	b 110	2,500	90	b 10	3.8	Q	28	47	1.5
BD30	Pinole Point	4/19/99	20	b 160	3,200	149	b 27	4.3	Q	63	51	3.2
BD20	San Pablo Bay	4/19/99	20	b 220	4,100	138	b 26	4.0	Q	51	55	2.4
BD15	Petaluma River	4/19/99	20	b 130	ND	170	b 31	4.2	Q	65	66	4.0
BC60	Red Rock	4/14/99	20	b 53	1,900	18	Q	1.9	Q	NA	12	4.0
BC20	Golden Gate	4/15/99	20	B	680	13	Q	2.3	Q	NA	6.6	3.7
BC10	Yerba Buena Island	4/14/99	20	b 65	1,500	37	b 8.5	0.96	Q	17	9.7	1.2
BB70	Alameda	4/14/99	20	b 40	2,000	17	Q	2.1	Q	NA	12	2.8
BA40	Redwood Creek	4/12/99	20	b 87	ND	22	Q	1.2	Q	4.3	16	ND
BA30	Dumbarton Bridge	4/12/99	20	b 220	5,600	116	b 31	1.4	Q	42	40	1.5
BA10	Coyote Creek	4/13/99	20	b 150	7,500	114	b 29	2.0	Q	40	36	6.8
C-3-0	San Jose	4/13/99	20	b 11000	24,000	260	b 47	1.3	Q	99	100	13
BW10	Standish Dam	4/22/99	20	b 13000	7,100	228	M	5.7	2.0	M	220	M
BW15	Guadalupe River	4/22/99	20	b 8100	4,900	492	b 73	5.9	5.6	190	180	37
BG20	Sacramento River	7/21/99	21	390	6,500	193	42	2.8	3.3	62	52	31
BG30	San Joaquin River	7/21/99	21	ND	5,600	135	18	ND	ND	54	54	8.6
BF20	Grizzly Bay	7/20/99	21	8.5	4,900	133	18	1.9	ND	64	44	4.9
BD50	Napa River	7/20/99	21	8.8	6,300	42	2.2	2.5	M	4.2	32	1.4
BD40	Davis Point	7/19/99	21	6.4	5,500	119	15	2.2	ND	58	41	2.6
BD30	Pinole Point	7/19/99	21	7.1	5,100	113	15	1.8	ND	56	38	2.6
BD20	San Pablo Bay	7/19/99	21	8.0	5,300	111	15	2.1	ND	53	39	1.5
BD15	Petaluma River	7/19/99	21	ND	5,000	159	21	3.4	ND	75	56	3.1
BC60	Red Rock	7/15/99	21	3.1	2,200	67	9.8	ND	ND	27	28	2.2
BC20	Golden Gate	7/15/99	21	12	880	17	1.5	ND	ND	5.3	8.2	1.6
BC10	Yerba Buena Island	7/16/99	21	3.8	2,900	64	8.7	1.4	ND	29	23	1.6
BB70	Alameda	7/16/99	21	6.8	3,900	57	5.3	ND	ND	28	21	2.8
BA40	Redwood Creek	7/13/99	21	ND	5,300	56	9.3	ND	ND	24	20	3.0
BA30	Dumbarton Bridge	7/14/99	21	ND	5,200	124	14	1.6	ND	61	45	2.2
BA10	Coyote Creek	7/13/99	21	ND	6,200	194	23	3.0	ND	93	72	3.3
C-3-0	San Jose	7/14/99	21	ND	11,000	443	37	4.3	ND	190	200	12
BW10	Standish Dam	7/22/99	21	ND	12,000	683	120	7.2	ND	320	230	5.9
BW15	Guadalupe River	7/22/99	21	ND	6,100	509	58	6.0	ND	270	170	4.9

Data Table 8 continued on next page

Table 8. Dissolved pesticide concentrations in water, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM Chlordanes (SFEI)	alpha-Chlordane	gamma-Chlordane	cis-Nonachlor	trans-Nonachlor	Heptachlor	Heptachlor Epoxide	Oxychlordane
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	65	12	9.0	B	29	ND	13	2.4
BG30	San Joaquin River	2/10/99	19	67	16	10	B	24	ND	13	3.5
BF20	Grizzly Bay	2/9/99	19	48	8.5	8.1	B	19	1.2	9.3	2.3
BD50	Napa River	2/9/99	19	321	110	44	B	63	ND	93	11
BD40	Davis Point	2/8/99	19	72	17	16	B	23	ND	14	2.4
BD30	Pinole Point	2/8/99	19	66	19	13	B	19	ND	12	2.8
BD20	San Pablo Bay	2/8/99	19	56	14	12	B	17	ND	10	3.4
BD15	Petaluma River	2/8/99	19	141	31	21	B	29	ND	55	5.3
BC60	Red Rock	2/3/99	19	40	13	9.7	B	8.9	ND	7.0	1.4
BC20	Golden Gate	2/3/99	19	46	6.4	8.0	B	9.0	5.6	5.8	11
BC10	Yerba Buena Island	2/4/99	19	41	13	9.9	B	9.9	ND	6.3	2.2
BB70	Alameda	2/4/99	19	39	9.3	8.3	B	10	1.8	7.6	2.0
BA40	Redwood Creek	2/1/99	19	67	12	8.1	B	17	ND	26	3.8
BA30	Dumbarton Bridge	2/2/99	19	151	36	27	B	29	ND	52	7.2
BA10	Coyote Creek	2/1/99	19	129	16	10	B	23	25	50	4.8
C-3-0	San Jose	2/2/99	19	253	38	18	B	33	18	130	16
BW10	Standish Dam	2/11/99	19	141	31	39	B	46	ND	19	6.3
BW15	Guadalupe River	2/11/99	19	233	29	55	B	84	ND	60	5.2
BG20	Sacramento River	4/21/99	20	49	18	11	3.8	8.4	ND	5.8	1.6
BG30	San Joaquin River	4/21/99	20	41	10	7.1	3.3	9.0	ND	10	2.0
BF20	Grizzly Bay	4/21/99	20	44	17	7.1	3.7	9.2	ND	7.2	M
BD50	Napa River	4/20/99	20	111	20	47	5.9	12	3.9	20	1.8
BD40	Davis Point	4/19/99	20	38	7.1	6.7	1.8	13	ND	9.4	ND
BD30	Pinole Point	4/19/99	20	60	15	8.7	1.6	14	ND	19	1.4
BD20	San Pablo Bay	4/19/99	20	51	12	6.8	1.6	16	ND	13	1.1
BD15	Petaluma River	4/19/99	20	71	22	13	6.8	9.9	1.7	16	1.5
BC60	Red Rock	4/14/99	20	39	6.1	M	3.1	16	ND	12	1.7
BC20	Golden Gate	4/15/99	20	60	4.5	21	2.0	14	3.2	9.6	5.4
BC10	Yerba Buena Island	4/14/99	20	29	7.2	3.9	6.5	4.4	ND	7.1	ND
BB70	Alameda	4/14/99	20	57	9.5	Q	ND	10	14	23	ND
BA40	Redwood Creek	4/12/99	20	49	11	9.2	9.1	6.5	ND	12	0.84
BA30	Dumbarton Bridge	4/12/99	20	115	30	23	13	13	ND	34	1.6
BA10	Coyote Creek	4/13/99	20	130	18	20	8.9	15	5.7	56	6.5
C-3-0	San Jose	4/13/99	20	340	77	67	17	42	21	110	5.9
BW10	Standish Dam	4/22/99	20	521	180	200	M	99	ND	42	ND
BW15	Guadalupe River	4/22/99	20	363	120	100	28	70	ND	41	3.9
BG20	Sacramento River	7/21/99	21	65	14	12	20	10	7.6	1.5	ND
BG30	San Joaquin River	7/21/99	21	33	10	5.7	5.2	9.0	ND	3.3	ND
BF20	Grizzly Bay	7/20/99	21	29	9.0	4.9	5.0	7.1	ND	3.2	ND
BD50	Napa River	7/20/99	21	45	6.1	6.8	ND	20	4.3	6.0	2.1
BD40	Davis Point	7/19/99	21	36	11	5.9	4.5	7.3	4.1	3.1	ND
BD30	Pinole Point	7/19/99	21	36	9.7	5.4	4.5	6.8	6.5	3.3	ND
BD20	San Pablo Bay	7/19/99	21	32	8.6	4.8	4.4	7.0	4.4	3.0	ND
BD15	Petaluma River	7/19/99	21	44	13	6.1	6.8	10	2.7	5.1	ND
BC60	Red Rock	7/15/99	21	44	3.8	4.4	ND	8.4	21	2.9	3.1
BC20	Golden Gate	7/15/99	21	42	1.5	1.6	ND	ND	33	ND	6.2
BC10	Yerba Buena Island	7/16/99	21	29	5.0	3.9	ND	4.7	13	2.8	ND
BB70	Alameda	7/16/99	21	34	6.7	4.8	2.7	5.3	11	3.6	ND
BA40	Redwood Creek	7/13/99	21	49	15	9.4	6.4	8.3	3.0	7.3	ND
BA30	Dumbarton Bridge	7/14/99	21	66	19	14	9.0	15	1.7	6.9	ND
BA10	Coyote Creek	7/13/99	21	114	35	25	15	26	2.5	10	ND
C-3-0	San Jose	7/14/99	21	230	66	51	16	54	15	22	5.8
BW10	Standish Dam	7/22/99	21	344	130	73	28	80	2.7	30	ND
BW15	Guadalupe River	7/22/99	21	262	88	58	22	59	3.9	31	ND

Data Table 8 continued on next page

Table 8. Dissolved pesticide concentrations in water, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	Sum HCHs (SFEI)	alpha-HCH	beta-HCH	delta-HCH	gamma-HCH	Dieldrin	Endrin	Mirex
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	103	13	11	2.8	76	74	19	54
BG30	San Joaquin River	2/10/99	19	152	19	11	1.8	120	95	9.6	ND
BF20	Grizzly Bay	2/9/99	19	147	16	16	4.8	110	70	ND	1.1
BD50	Napa River	2/9/99	19	225	36	32	6.7	150	230	ND	1.3
BD40	Davis Point	2/8/99	19	181	31	15	5.0	130	85	5.5	ND
BD30	Pinole Point	2/8/99	19	201	39	17	4.9	140	72	4.7	ND
BD20	San Pablo Bay	2/8/99	19	198	34	18	5.5	140	74	7.5	ND
BD15	Petaluma River	2/8/99	19	192	27	82	15	68	64	ND	ND
BC60	Red Rock	2/3/99	19	408	160	85	2.8	160	38	3.9	ND
BC20	Golden Gate	2/3/99	19	346	140	68	7.6	130	23	9.8	ND
BC10	Yerba Buena Island	2/4/99	19	363	120	69	4.3	170	48	5.6	ND
BB70	Alameda	2/4/99	19	324	87	64	3.0	170	43	8.4	ND
BA40	Redwood Creek	2/1/99	19	249	35	70	3.8	140	42	ND	ND
BA30	Dumbarton Bridge	2/2/99	19	624	83	80	81	380	65	ND	ND
BA10	Coyote Creek	2/1/99	19	597	51	84	32	430	58	24	ND
C-3-0	San Jose	2/2/99	19	1237	65	220	22	930	81	64	ND
BW10	Standish Dam	2/11/99	19	183	8.8	58	5.9	110	76	26	ND
BW15	Guadalupe River	2/11/99	19	105	7.0	49	3.0	46	130	22	ND
BG20	Sacramento River	4/21/99	20	138	34	4.7	2.4	97	57	ND	ND
BG30	San Joaquin River	4/21/99	20	160	22	11	7.1	120	ND	ND	ND
BF20	Grizzly Bay	4/21/99	20	164	36	5.0	3.4	120	67	1.5	ND
BD50	Napa River	4/20/99	20	242	78	40	14	110	68	ND	ND
BD40	Davis Point	4/19/99	20	155	44	46	1.9	63	30	ND	ND
BD30	Pinole Point	4/19/99	20	300	97	81	2.2	120	61	ND	ND
BD20	San Pablo Bay	4/19/99	20	292	91	73	8.0	120	27	1.6	ND
BD15	Petaluma River	4/19/99	20	278	110	63	4.7	100	57	1.7	ND
BC60	Red Rock	4/14/99	20	289	82	130	8.4	69	26	2.6	ND
BC20	Golden Gate	4/15/99	20	395	170	160	5.9	59	13	3.9	ND
BC10	Yerba Buena Island	4/14/99	20	209	75	76	5.1	53	24	ND	ND
BB70	Alameda	4/14/99	20	221	47	110	8.2	56	22	ND	ND
BA40	Redwood Creek	4/12/99	20	373	82	68	2.6	220	32	ND	ND
BA30	Dumbarton Bridge	4/12/99	20	610	140	120	ND	350	72	4.5	ND
BA10	Coyote Creek	4/13/99	20	553	130	29	14	380	17	11	ND
C-3-0	San Jose	4/13/99	20	1849	220	100	29	1500	170	ND	ND
BW10	Standish Dam	4/22/99	20	357	82	43	12	220	210	130	ND
BW15	Guadalupe River	4/22/99	20	110	27	30	10	43	150	24	ND
BG20	Sacramento River	7/21/99	21	164	31	36	6.5	90	49	3.7	ND
BG30	San Joaquin River	7/21/99	21	103	25	2.2	ND	76	64	ND	ND
BF20	Grizzly Bay	7/20/99	21	147	43	15	2.0	87	47	ND	ND
BD50	Napa River	7/20/99	21	53	ND	44	4.8	4.6	35	18	ND
BD40	Davis Point	7/19/99	21	265	120	64	1.7	79	37	ND	ND
BD30	Pinole Point	7/19/99	21	287	130	70	6.0	81	36	ND	ND
BD20	San Pablo Bay	7/19/99	21	262	110	71	2.5	78	33	1.7	ND
BD15	Petaluma River	7/19/99	21	203	83	36	1.8	82	40	24	ND
BC60	Red Rock	7/15/99	21	486	230	170	2.5	83	21	ND	ND
BC20	Golden Gate	7/15/99	21	324	190	93	2.0	39	6.8	5.5	ND
BC10	Yerba Buena Island	7/16/99	21	321	160	99	1.6	60	21	1.6	ND
BB70	Alameda	7/16/99	21	377	160	120	3.3	94	30	2.4	ND
BA40	Redwood Creek	7/13/99	21	234	72	77	2.4	83	41	ND	ND
BA30	Dumbarton Bridge	7/14/99	21	313	67	66	ND	180	47	9.9	ND
BA10	Coyote Creek	7/13/99	21	421	93	66	1.9	260	68	8.6	ND
C-3-0	San Jose	7/14/99	21	1861	76	70	15	1700	94	ND	ND
BW10	Standish Dam	7/22/99	21	196	30	32	3.7	130	180	22	ND
BW15	Guadalupe River	7/22/99	21	81	11	16	2.5	51	120	24	ND

Table 9. Total (dissolved + particulate) pesticide concentrations in water, 1999.
B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration,
M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	Chlorpyrifos	Diazinon	SUM DDTs (SFEI)	o,p^-DDD	o,p^-DDE	o,p^-DDT	p,p^-DDD	p,p^-DDE	p,p^-DDT
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	b 368	10,000	613	18	B	Q	139	203	253
BG30	San Joaquin River	2/10/99	19	b 442	17,000	315	22	b 13	Q	66	195	19
BF20	Grizzly Bay	2/9/99	19	b 223	15,000	470	33	B	Q	153	247	37
BD50	Napa River	2/9/99	19	b 530	4,499	2064	148	b 32	Q	508	1030	346
BD40	Davis Point	2/8/99	19	b 318	11,000	466	33	b 13	Q	144	221	56
BD30	Pinole Point	2/8/99	19	b 314	9,800	217	23	B	Q	57	127	10
BD20	San Pablo Bay	2/8/99	19	b 92	9,000	537	42	b 19	Q	188	239	49
BD15	Petaluma River	2/8/99	19	b 756	6,500	197	11	B	Q	52	97	37
BC60	Red Rock	2/3/99	19	b 85	4,400	203	33	B	Q	81	75	14
BC20	Golden Gate	2/3/99	19	B	ND	163	15	b 13	Q	53	63	19
BC10	Yerba Buena Island	2/4/99	19	B	5,200	221	34	b 8.4	Q	84	82	13
BB70	Alameda	2/4/99	19	B	4,200	174	13	b 15	Q	56	82	8.5
BA40	Redwood Creek	2/1/99	19	b 219	3,500	1043	81	b 16	20	510	343	73
BA30	Dumbarton Bridge	2/2/99	19	b 183	1,110	755	85	b 15	16	390	201	47
BA10	Coyote Creek	2/1/99	19	M	5,370	3285	195	M	60	1370	1478	182
C-3-0	San Jose	2/2/99	19	b 1000	15,270	1332	124	b 16	36	410	603	143
BW10	Standish Dam	2/11/99	19	b 890	10,090	2696	191	b 46	Q	525	1750	184
BW15	Guadalupe River	2/11/99	19	b 1310	13,650	2369	160	b 18	Q	607	1294	290
BG20	Sacramento River	4/21/99	20	b 290	2,200	362	b 30	5.8	7.1	45	237	37
BG30	San Joaquin River	4/21/99	20	b 455	3,000	306	b 27	8.4	Q	46	205	20
BF20	Grizzly Bay	4/21/99	20	b 395	2,700	655	b 53	15	Q	128	397	62
BD50	Napa River	4/20/99	20	b 239	3,800	770	b 76	6.0	Q	197	390	101
BD40	Davis Point	4/19/99	20	b 250	2,700	1804	b 130	48	Q	368	1047	212
BD30	Pinole Point	4/19/99	20	b 202	3,200	666	b 59	19	Q	158	331	98
BD20	San Pablo Bay	4/19/99	20	b 320	4,100	1675	b 136	51	Q	371	945	172
BD15	Petaluma River	4/19/99	20	b 212	ND	1332	b 113	34	Q	285	786	114
BC60	Red Rock	4/14/99	20	b 66	1,900	88	Q	5.3	Q	17	51	15
BC20	Golden Gate	4/15/99	20	B	680	33	Q	6.1	Q	3.4	18	5.8
BC10	Yerba Buena Island	4/14/99	20	b 80	1,500	182	b 25	5.1	Q	50	76	26
BB70	Alameda	4/14/99	20	b 74	2,000	347	Q	19	Q	79	212	37
BA40	Redwood Creek	4/12/99	20	b 113	ND	132	Q	4.9	Q	32	85	10
BA30	Dumbarton Bridge	4/12/99	20	b 262	5,697	405	b 53	4.6	Q	103	180	65
BA10	Coyote Creek	4/13/99	20	b 224	7,700	669	b 73	14	Q	160	366	56
C-3-0	San Jose	4/13/99	20	b 11270	24,570	1645	b 157	16	Q	409	880	183
BW10	Standish Dam	4/22/99	20	b 13250	7,450	1361	M	8.9	32	M	1320	M
BW15	Guadalupe River	4/22/99	20	b 8840	5,800	5595	b 743	M	65	M	4080	707
BG20	Sacramento River	7/21/99	21	390	6,710	333	44	6.3	Q	102	147	34
BG30	San Joaquin River	7/21/99	21	ND	5,800	276	29	1.4	Q	89	130	27
BF20	Grizzly Bay	7/20/99	21	9	5,240	341	20	7.0	Q	133	174	7.8
BD50	Napa River	7/20/99	21	9	6,560	195	8.1	5.5	M	61	117	2.9
BD40	Davis Point	7/19/99	21	6	5,690	197	18	4.2	Q	85	88	2.6
BD30	Pinole Point	7/19/99	21	7	5,240	183	19	3.3	ND	79	79	2.6
BD20	San Pablo Bay	7/19/99	21	8	5,910	256	19	4.5	Q	108	121	3.1
BD15	Petaluma River	7/19/99	21	ND	5,460	683	37	7.5	Q	235	396	7.7
BC60	Red Rock	7/15/99	21	3	2,580	256	19	ND	Q	106	127	3.8
BC20	Golden Gate	7/15/99	21	12	880	38	1.5	1.9	Q	7.9	23	3.8
BC10	Yerba Buena Island	7/16/99	21	4	3,040	150	13	3.5	Q	58	74	1.6
BB70	Alameda	7/16/99	21	7	4,070	171	14	2.3	Q	80	72	2.8
BA40	Redwood Creek	7/13/99	21	ND	5,397	98	9.3	ND	Q	43	43	3.0
BA30	Dumbarton Bridge	7/14/99	21	ND	5,440	250	24	4.1	Q	95	118	9.1
BA10	Coyote Creek	7/13/99	21	ND	7,130	948	57	M	Q	283	582	26
C-3-0	San Jose	7/14/99	21	ND	13,500	1210	167	M	Q	680	320	43
BW10	Standish Dam	7/22/99	21	ND	13,600	1788	193	15	Q	580	990	11
BW15	Guadalupe River	7/22/99	21	ND	6,780	1413	111	6.0	Q	560	710	26

Data Table 9 continued on next page

Table 9. Total (dissolved + particulate) pesticide concentrations in water, 1999 (continued).
B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	SUM Chlordanes (SFEI)	alpha-Chlordane	gamma-Chlordane	cis-Nonachlor	trans-Nonachlor	Heptachlor	Heptachlor Epoxide	Oxychlordane
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	87	b 24	9.0	B	36	ND	13	5.3
BG30	San Joaquin River	2/10/99	19	89	b 23	14	B	32	ND	13	7.3
BF20	Grizzly Bay	2/9/99	19	77	b 27	8.1	B	27	1.2	9.3	5.8
BD50	Napa River	2/9/99	19	702	b 270	135	B	154	B	128	15
BD40	Davis Point	2/8/99	19	137	b 41	38	B	42	ND	14	2.4
BD30	Pinole Point	2/8/99	19	95	b 31	24	B	25	ND	12	2.8
BD20	San Pablo Bay	2/8/99	19	115	b 37	31	B	30	B	10	6.7
BD15	Petaluma River	2/8/99	19	233	b 75	39	B	44	B	65	10
BC60	Red Rock	2/3/99	19	48	13	13	B	11	ND	10	1.4
BC20	Golden Gate	2/3/99	19	36	B	8.0	B	11	B	5.8	11
BC10	Yerba Buena Island	2/4/99	19	49	13	15	B	13	ND	6.3	2.2
BB70	Alameda	2/4/99	19	43	B	18	B	13	1.8	7.6	2.0
BA40	Redwood Creek	2/1/99	19	176	b 47	47	B	38	ND	31	13
BA30	Dumbarton Bridge	2/2/99	19	237	b 64	69	B	42	B	55	7.2
BA10	Coyote Creek	2/1/99	19	782	b 216	270	B	123	M	58	115
C-3-0	San Jose	2/2/99	19	568	b 124	138	B	80	18	140	68
BW10	Standish Dam	2/11/99	19	573	b 171	179	B	186	B	25	12
BW15	Guadalupe River	2/11/99	19	1054	b 299	315	B	344	ND	79	17
BG20	Sacramento River	4/21/99	20	58	18	17	3.8	10	ND	7.0	1.6
BG30	San Joaquin River	4/21/99	20	50	10	13	3.3	11	ND	11	2.0
BF20	Grizzly Bay	4/21/99	20	64	21	17	Q	15	ND	11	M
BD50	Napa River	4/20/99	20	148	27	65	Q	26	3.9	23	3.2
BD40	Davis Point	4/19/99	20	141	40	44	Q	44	ND	13	ND
BD30	Pinole Point	4/19/99	20	97	22	24	Q	27	ND	22	1.4
BD20	San Pablo Bay	4/19/99	20	141	42	39	Q	42	ND	16	2.7
BD15	Petaluma River	4/19/99	20	142	48	42	Q	31	M	19	1.5
BC60	Red Rock	4/14/99	20	42	7.5	M	3.1	16	ND	14	1.7
BC20	Golden Gate	4/15/99	20	63	4.5	23	2.0	14	3.2	11	5.4
BC10	Yerba Buena Island	4/14/99	20	46	13	13	Q	10	ND	10	ND
BB70	Alameda	4/14/99	20	96	22	15	Q	20	14	26	ND
BA40	Redwood Creek	4/12/99	20	74	19	21	Q	17	Q	17	0.8
BA30	Dumbarton Bridge	4/12/99	20	173	46	44	Q	36	5.8	40	1.6
BA10	Coyote Creek	4/13/99	20	232	52	59	Q	49	M	63	9.0
C-3-0	San Jose	4/13/99	20	656	172	197	Q	133	21	127	5.9
BW10	Standish Dam	4/22/99	20	985	320	390	M	219	ND	50	5.7
BW15	Guadalupe River	4/22/99	20	2187	770	840	Q	480	M	75	22
BG20	Sacramento River	7/21/99	21	62	14	15	20	12	Q	1.5	ND
BG30	San Joaquin River	7/21/99	21	39	10	7.8	8.5	9.0	ND	3.3	ND
BF20	Grizzly Bay	7/20/99	21	40	11	7.6	8.6	10	ND	3.2	ND
BD50	Napa River	7/20/99	21	56	6.1	11	2.5	24	4.3	6.0	2.1
BD40	Davis Point	7/19/99	21	42	11	8.6	5.7	9.2	4.1	3.1	ND
BD30	Pinole Point	7/19/99	21	34	10	8.3	4.5	8.3	Q	3.3	ND
BD20	San Pablo Bay	7/19/99	21	44	10	7.7	7.9	11	4.4	3.0	ND
BD15	Petaluma River	7/19/99	21	75	20	13	16	18	2.7	5.1	ND
BC60	Red Rock	7/15/99	21	61	6.8	8.3	3.0	14	21	2.9	5.4
BC20	Golden Gate	7/15/99	21	58	7.2	8.2	ND	3.2	33	ND	6.2
BC10	Yerba Buena Island	7/16/99	21	38	5.0	7.0	2.9	6.8	13	2.8	ND
BB70	Alameda	7/16/99	21	44	8.6	8.9	5.0	6.6	11	3.6	ND
BA40	Redwood Creek	7/13/99	21	53	15	13	6.4	11	Q	7.3	ND
BA30	Dumbarton Bridge	7/14/99	21	93	23	22	14	24	1.7	8.2	ND
BA10	Coyote Creek	7/13/99	21	231	62	55	39	60	2.5	12	ND
C-3-0	San Jose	7/14/99	21	635	166	161	87	174	15	24	8.0
BW10	Standish Dam	7/22/99	21	532	167	125	54	148	2.7	32	3.5
BW15	Guadalupe River	7/22/99	21	412	118	99	45	109	3.9	33	3.9

Data Table 9 continued on next page

Table 9. Total (dissolved + particulate) pesticide concentrations in water, 1999 (continued).
B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration,
M = matrix interference, ND = not detected, Q = outside QA limits.

Station Code	Station	Date	Cruise	Sum HCHs (SFEI)	alpha-HCH	beta-HCH	delta-HCH	gamma-HCH	Dieldrin	Endrin	Mirex
				pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l	pg/l
BG20	Sacramento River	2/10/99	19	148	32	21	16	79	89	19	54
BG30	San Joaquin River	2/10/99	19	176	25	19	13	120	113	10	ND
BF20	Grizzly Bay	2/9/99	19	191	29	32	17	114	90	ND	1.1
BD50	Napa River	2/9/99	19	261	50	43	11	157	289	31	1.3
BD40	Davis Point	2/8/99	19	209	45	25	9.2	130	110	5.5	ND
BD30	Pinole Point	2/8/99	19	235	54	31	4.9	146	87	4.7	ND
BD20	San Pablo Bay	2/8/99	19	226	43	31	5.5	146	98	13	ND
BD15	Petaluma River	2/8/99	19	220	34	94	19	72	78	ND	ND
BC60	Red Rock	2/3/99	19	423	164	91	2.8	164	43	3.9	ND
BC20	Golden Gate	2/3/99	19	380	147	80	15	138	23	10	ND
BC10	Yerba Buena Island	2/4/99	19	388	124	82	6.9	175	55	14	ND
BB70	Alameda	2/4/99	19	334	87	71	3.0	173	51	8.4	ND
BA40	Redwood Creek	2/1/99	19	265	45	77	3.8	140	86	81	3.1
BA30	Dumbarton Bridge	2/2/99	19	645	93	86	81	385	86	45	ND
BA10	Coyote Creek	2/1/99	19	M	M	M	M	M	157	24	9.4
C-3-0	San Jose	2/2/99	19	1275	80	225	26	944	125	136	3.0
BW10	Standish Dam	2/11/99	19	200	15	61	10	114	124	26	1.9
BW15	Guadalupe River	2/11/99	19	124	10	52	9.4	53	193	22	ND
BG20	Sacramento River	4/21/99	20	144	35	6.8	3.8	98	61	ND	ND
BG30	San Joaquin River	4/21/99	20	166	22	13	8.9	121	3.7	ND	ND
BF20	Grizzly Bay	4/21/99	20	170	36	7.8	5.7	120	77	1.5	2.2
BD50	Napa River	4/20/99	20	251	78	45	16	111	80	ND	3.1
BD40	Davis Point	4/19/99	20	169	54	49	1.9	65	62	ND	4.3
BD30	Pinole Point	4/19/99	20	309	99	83	5.1	122	72	ND	2.5
BD20	San Pablo Bay	4/19/99	20	301	95	78	8.0	120	55	1.6	4.7
BD15	Petaluma River	4/19/99	20	M	M	M	M	M	79	1.7	5.8
BC60	Red Rock	4/14/99	20	298	85	133	8.4	72	29	4.0	ND
BC20	Golden Gate	4/15/99	20	406	170	164	10	62	13	3.9	ND
BC10	Yerba Buena Island	4/14/99	20	220	81	80	6.5	53	28	ND	ND
BB70	Alameda	4/14/99	20	247	51	126	8.2	62	26	ND	3.3
BA40	Redwood Creek	4/12/99	20	404	89	85	4.7	225	34	ND	ND
BA30	Dumbarton Bridge	4/12/99	20	657	147	152	2.3	356	75	4.5	1.7
BA10	Coyote Creek	4/13/99	20	657	157	115	M	385	26	14	3.9
C-3-0	San Jose	4/13/99	20	1905	231	125	29	1520	217	6.4	5.6
BW10	Standish Dam	4/22/99	20	366	82	47	16	222	242	130	5.5
BW15	Guadalupe River	4/22/99	20	M	M	M	M	M	320	24	16
BG20	Sacramento River	7/21/99	21	171	31	44	6.5	90	53	3.7	ND
BG30	San Joaquin River	7/21/99	21	111	33	2.2	ND	76	67	4.3	4.2
BF20	Grizzly Bay	7/20/99	21	154	43	22	2.0	87	52	1.5	ND
BD50	Napa River	7/20/99	21	60	ND	48	6.1	5.8	39	19	ND
BD40	Davis Point	7/19/99	21	267	120	66	1.7	79	39	ND	ND
BD30	Pinole Point	7/19/99	21	290	131	70	7.8	81	38	ND	ND
BD20	San Pablo Bay	7/19/99	21	265	110	72	4.1	78	37	3.3	ND
BD15	Petaluma River	7/19/99	21	215	85	44	1.8	84	50	30	1.7
BC60	Red Rock	7/15/99	21	494	231	172	4.9	86	27	ND	ND
BC20	Golden Gate	7/15/99	21	333	190	96	5.0	43	6.8	5.5	ND
BC10	Yerba Buena Island	7/16/99	21	323	160	99	3.5	60	24	1.6	ND
BB70	Alameda	7/16/99	21	386	160	127	5.2	94	34	2.4	ND
BA40	Redwood Creek	7/13/99	21	243	72	80	4.2	87	41	ND	ND
BA30	Dumbarton Bridge	7/14/99	21	318	68	68	ND	182	53	12	ND
BA10	Coyote Creek	7/13/99	21	429	93	72	1.9	262	87	8.6	3.3
C-3-0	San Jose	7/14/99	21	1897	80	80	15	1722	155	14	13
BW10	Standish Dam	7/22/99	21	208	33	41	3.7	131	200	26	3.7
BW15	Guadalupe River	7/22/99	21	87	13	21	2.5	51	137	26	4.5

Table 10. Aquatic bioassay results, 1999. * = significantly less than in the control.

Station Code	Station	Date	Cruise	Mean % Survival	Mean % Survival (Control)
				Mysidopsis bahia	
BG30	San Joaquin River	2/10/99	19	77.5	85
BF20	Grizzly Bay	2/9/99	19	82.5	85
BD30	Pinole Point	2/8/99	19	100	90
BA30	Dumbarton Bridge	2/2/99	19	97.5	100
C-3-0	San Jose	2/2/99	19	95	100
C-1-3	Sunnyvale	2/2/99	19	92.5	100
BG30	San Joaquin River	7/21/99	21	95	90
BF20	Grizzly Bay	7/20/99	21	95	90
BD30	Pinole Point	7/19/99	21	92.5	93
BA30	Dumbarton Bridge	7/14/99	21	92.5	95
C-3-0	San Jose	7/14/99	21	90	93
C-1-3	Sunnyvale	7/14/99	21	0 *	93

Table 11. General characteristics of sediment samples, 1999.

NA = not analyzed/not available, ND = not detected, NS = not sampled.

e = Due to a shipboard malfunction of the meter, value is an estimation from lab measurements.

* = Hydrogen Sulfide concentrations could not be calculated due to a malfunction in the field pH meter.

Station Code	Station	Date	Cruise	% Clay (<4um)	% Silt (4um-63um)	% Sand (63um-2mm)	% Gravel+Shell (>2mm)	Depth	Ammonia	Hydrogen Sulfide	pH	TOC	Total Sulfide	Total Nitrogen
				%	%	%	%	m	mg/L	mg/L	pH	%	mg/L	%
BG20	Sacramento River	2/11/99	19	5	4	92	0	8	ND	NA *	e 7.7	NA	0.1	NA
BG30	San Joaquin River	2/11/99	19	15	18	67	0	5	e 0.1	NA *	e 7.6	NA	0.2	NA
BF40	Honker Bay	2/11/99	19	48	44	8	0	3	NA	NA *	NA	1.5	0.1	0.15
BF21	Grizzly Bay	2/11/99	19	61	38	1	0	3	ND	NA *	e 7.6	1.5	0.1	0.14
BF10	Pacheco Creek	2/11/99	19	12	7	81	0	4	NA	NA *	NA	NA	0.1	NA
BD50	Napa River	2/12/99	19	60	27	7	7	4	ND	NA *	e 7.6	1.6	1.1	0.16
BD41	Davis Point	2/12/99	19	6	4	88	2	7	ND	NA *	e 7.8	0.2	0.4	0.03
BD31	Pinole Point	2/12/99	19	34	23	42	0	7	NA	NA *	NA	1.1	0.3	0.11
BD22	San Pablo Bay	2/12/99	19	49	31	19	1	3	NA	NA *	NA	NA	0.1	NA
BD15	Petaluma River	2/12/99	19	65	25	8	1	4	NA	NA *	NA	NA	0.3	NA
BC60	Red Rock	2/16/99	19	20	9	69	1	11	ND	NA *	e 7.8	1.1	0.2	0.07
BC41	Point Isabel	2/16/99	19	53	31	15	1	2	NA	NA *	NA	1.0	0.1	0.09
BC32	Richardson Bay	2/16/99	19	45	39	17	0	1	NA	NA *	NA	1.1	0.2	0.09
BC21	Horseshoe Bay	2/16/99	19	13	11	77	0	12	ND	NA *	e 7.8	0.7	0.1	ND
BC11	Yerba Buena Island	2/16/99	19	51	18	23	8	6	ND	NA *	e 7.7	1.2	0.1	0.12
BB70	Alameda	2/17/99	19	42	30	28	0	10	ND	NA *	e 7.9	1.1	0.2	0.08
BB30	Oyster Point	2/17/99	19	36	21	38	5	9	NA	NA *	NA	1.3	0.2	0.10
BB15	San Bruno Shoal	2/17/99	19	33	17	50	0	12	ND	NA *	e 7.8	1.2	0.2	0.13
BA41	Redwood Creek	2/17/99	19	48	23	9	21	3	ND	NA *	e 7.9	1.4	0.1	0.13
BA30	Dumbarton Bridge	2/17/99	19	56	30	12	2	7	NA	NA *	NA	1.5	0.1	0.09
BA21	South Bay	2/17/99	19	61	35	2	2	6	ND	NA *	e 7.8	1.8	0.2	0.15
BA10	Coyote Creek	2/17/99	19	24	12	49	15	5	ND	NA *	e 7.8	1.2	0.1	0.10
C-3-0	San Jose	2/18/99	19	20	10	68	2	3	ND	NA *	e 7.8	0.9	0.2	0.06
C-1-3	Sunnyvale	2/18/99	19	16	9	73	2	3	NA	NA *	NA	0.7	0.3	ND
BW10	Standish Dam	2/22/99	19	66	26	8	1	0	NA	NA *	NA	1.8	0.1	0.18
BW15	Guadalupe River	2/9/99	19	81	19	0	0	0	NA	NA *	NA	2.1	0.2	0.24
BG20	Sacramento River	7/22/99	21	4	4	92	0	9	3.0	ND	7.7	NA	ND	NA
BG30	San Joaquin River	7/22/99	21	10	9	81	0	8	3.0	ND	7.6	0.3	ND	ND
BF40	Honker Bay	7/22/99	21	48	41	11	0	2	1.6	ND	7.3	1.3	ND	0.12
BF21	Grizzly Bay	7/22/99	21	62	35	3	0	2	1.6	ND	7.1	1.2	ND	0.11
BF10	Pacheco Creek	7/22/99	21	17	10	73	0	5	1.2	ND	7.5	0.4	ND	0.06
BD50	Napa River	7/23/99	21	63	22	9	6	2	2.2	0.004	7.6	1.6	ND	0.22
BD41	Davis Point	7/23/99	21	6	4	90	1	7	NS	ND	7.7	0.2	ND	ND
BD31	Pinole Point	7/23/99	21	59	31	9	0	7	6.0	ND	7.1	1.2	ND	0.12
BD22	San Pablo Bay	7/23/99	21	52	32	16	0	4	0.5	ND	7.4	1.1	ND	0.12
BD15	Petaluma River	7/23/99	21	59	40	2	0	3	2.0	ND	7.6	1.0	ND	0.12
BC60	Red Rock	7/23/99	21	6	3	91	0	10	2.1	ND	7.8	0.2	ND	ND
BC41	Point Isabel	7/26/99	21	57	30	13	0	2	0.7	ND	7.5	1.0	ND	0.13
BC32	Richardson Bay	7/26/99	21	49	36	16	0	3	0.7	ND	7.3	1.0	ND	0.09
BC21	Horseshoe Bay	7/26/99	21	17	14	69	0	10	2.5	ND	7.3	0.6	ND	ND
BC11	Yerba Buena Island	7/26/99	21	46	18	28	8	6	0.9	ND	7.4	1.1	ND	0.11
BB70	Alameda	7/26/99	21	46	23	31	0	11	0.6	0.010	7.6	0.9	ND	0.10
BB30	Oyster Point	7/27/99	21	29	16	48	7	9	1.2	ND	7.6	NA	ND	NA
BB15	San Bruno Shoal	7/27/99	21	62	31	4	3	11	2.5	0.018	7.1	1.2	ND	0.12
BA41	Redwood Creek	7/27/99	21	48	21	16	14	5	0.7	ND	7.5	NA	ND	NA
BA30	Dumbarton Bridge	7/27/99	21	62	34	4	0	5	4.0	ND	7.1	NA	ND	NA
BA21	South Bay	7/27/99	21	65	34	2	0	5	7.0	0.017	7.2	1.2	ND	0.12
BA10	Coyote Creek	7/28/99	21	30	14	40	15	4	2.7	ND	7.7	1.0	ND	0.11
C-3-0	San Jose	7/28/99	21	42	18	40	0	2	3.0	ND	7.8	1.2	ND	0.11
C-1-3	Sunnyvale	7/28/99	21	11	8	81	0	2	2.7	NA	NA	0.4	NA	ND
BW10	Standish Dam	7/29/99	21	69	26	5	0	0	0.7	ND	7.4	1.6	ND	0.16
BW15	Guadalupe River	7/29/99	21	82	18	0	0	0	1.4	ND	7.7	1.7	ND	0.20

Table 12. Concentrations of trace elements for sediment samples, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, ND = not detected.

Station Code	Station	Date	Cruise	% Solids - As, Hg, Se	% Solids - Ag, Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn	Ag	Al	As	Cd	Cr	Cu
				%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BG20	Sacramento River	2/11/99	19	70	67	ND	b 21994	B	b 0.23	69	b 17
BG30	San Joaquin River	2/11/99	19	68	69	ND	b 27790	b 7.0	b 0.23	74	b 24
BF40	Honker Bay	2/11/99	19	50	43	0.14	b 51328	b 8.8	b 0.35	105	b 57
BF21	Grizzly Bay	2/11/99	19	40	38	0.11	b 63524	b 11.0	b 0.47	125	b 66
BF10	Pacheco Creek	2/11/99	19	69	63	ND	b 22350	B	b 0.35	67	b 21
BD50	Napa River	2/12/99	19	45	39	0.11	b 50208	b 10.0	b 0.36	107	b 64
BD41	Davis Point	2/12/99	19	71	68	ND	b 20234	B	b 0.14	67	b 14
BD31	Pinole Point	2/12/99	19	54	50	ND	b 22336	b 8.4	b 0.20	69	b 38
BD22	San Pablo Bay	2/12/99	19	51	47	0.10	b 47021	b 11.4	b 0.36	92	b 50
BD15	Petaluma River	2/12/99	19	28	34	0.08	b 50098	b 12.1	b 0.26	103	b 50
BC60	Red Rock	2/16/99	19	63	60	ND	b 29351	b 7.1	b 0.19	78	b 25
BC41	Point Isabel	2/16/99	19	47	45	0.06	b 42962	b 10.0	b 0.21	98	b 39
BC32	Richardson Bay	2/16/99	19	47	43	ND	b 39593	b 9.4	b 0.26	93	b 37
BC21	Horseshoe Bay	2/16/99	19	66	65	ND	b 23413	b 8.6	b 0.26	65	b 19
BC11	Yerba Buena Island	2/16/99	19	48	42	ND	b 40107	b 8.0	b 0.28	85	b 37
BB70	Alameda	2/17/99	19	48	47	0.04	b 36334	b 9.1	b 0.25	95	b 36
BB30	Oyster Point	2/17/99	19	57	49	0.10	b 34354	B	b 0.20	83	b 31
BB15	San Bruno Shoal	2/17/99	19	37	35	0.06	b 35423	b 10.0	b 0.25	98	b 44
BA41	Redwood Creek	2/17/99	19	53	45	0.12	b 44555	b 6.5	b 0.28	98	b 41
BA30	Dumbarton Bridge	2/17/99	19	51	50	0.07	b 29112	b 8.5	b 0.26	72	b 32
BA21	South Bay	2/17/99	19	38	37	0.09	b 44693	b 11.4	b 0.27	102	b 41
BA10	Coyote Creek	2/17/99	19	62	59	0.05	b 26950	B	b 0.20	71	b 23
C-3-0	San Jose	2/18/99	19	65	59	0.16	b 26952	b 6.8	b 0.67	88	b 28
C-1-3	Sunnyvale	2/18/99	19	57	63	0.04	b 19671	B	b 0.24	58	b 23
BW10	Standish Dam	2/22/99	19	48	45	0.36	b 44251	b 9.4	b 0.99	114	b 51
BW15	Guadalupe River	2/9/99	19	44	39	0.38	b 56680	b 9.8	b 0.53	132	b 56
BG20	Sacramento River	7/22/99	21	69	66	ND	b 17651	7.7	B	b 65	b 18
BG30	San Joaquin River	7/22/99	21	70	69	ND	b 22521	6.1	B	b 72	b 19
BF40	Honker Bay	7/22/99	21	46	45	0.21	b 33591	8.7	B	b 90	b 55
BF21	Grizzly Bay	7/22/99	21	38	39	0.24	b 28186	10.4	B	b 80	b 55
BF10	Pacheco Creek	7/22/99	21	64	62	0.07	b 14738	9.2	B	b 55	b 22
BD50	Napa River	7/23/99	21	38	36	0.19	b 42416	11.3	B	98	b 57
BD41	Davis Point	7/23/99	21	71	69	ND	b 17839	6.5	B	68	b 16
BD31	Pinole Point	7/23/99	21	38	38	0.18	b 41110	9.9	B	92	b 53
BD22	San Pablo Bay	7/23/99	21	47	45	0.17	b 30995	12.4	b 0.51	83	b 45
BD15	Petaluma River	7/23/99	21	36	33	0.25	b 33188	16.4	B	86	b 49
BC60	Red Rock	7/23/99	21	73	71	ND	b 14671	8.9	B	b 53	b 12
BC41	Point Isabel	7/26/99	21	42	43	0.14	b 34955	9.9	B	b 91	b 42
BC32	Richardson Bay	7/26/99	21	44	43	0.15	b 20220	9.3	B	66	b 36
BC21	Horseshoe Bay	7/26/99	21	63	63	0.08	b 15314	5.9	B	55	b 21
BC11	Yerba Buena Island	7/26/99	21	53	47	0.20	b 17074	6.9	B	54	b 31
BB70	Alameda	7/26/99	21	51	49	0.35	b 28205	8.5	b 0.46	85	b 39
BB30	Oyster Point	7/27/99	21	60	58	0.17	b 22292	6.9	B	67	b 24
BB15	San Bruno Shoal	7/27/99	21	35	35	0.25	b 24295	7.3	B	81	b 40
BA41	Redwood Creek	7/27/99	21	49	44	0.26	b 21552	4.4	B	67	b 36
BA30	Dumbarton Bridge	7/27/99	21	40	39	0.29	b 13963	7.0	B	56	b 39
BA21	South Bay	7/27/99	21	43	40	0.27	b 16149	7.6	B	61	b 38
BA10	Coyote Creek	7/28/99	21	64	53	0.14	b 11080	4.3	B	38	b 22
C-3-0	San Jose	7/28/99	21	55	54	0.87	b 27786	8.4	b 0.89	b 94	b 45
C-1-3	Sunnyvale	7/28/99	21	69	68	0.24	b 17136	2.9	B	57	b 22
BW10	Standish Dam	7/29/99	21	34	36	0.41	b 31271	7.3	B	95	b 50
BW15	Guadalupe River	7/29/99	21	29	31	0.51	b 30834	9.1	B	b 93	b 47

Data Table 12 continued on next page

Table 12. Concentrations of trace elements for sediment samples, 1999 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, ND = not detected.

Station Code	Station	Date	Cruise	% Solids - As, Hg, Se	% Solids - Ag, Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn	Fe	Hg	Mn	Ni	Pb	Se	Zn
				%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BG20	Sacramento River	2/11/99	19	70	67	b 25544	b 0.03	b 464	71	6.0	0.07	b 74.7
BG30	San Joaquin River	2/11/99	19	68	69	b 28544	b 0.19	b 413	59	9.4	0.17	b 61.5
BF40	Honker Bay	2/11/99	19	50	43	b 41863	b 0.24	b 912	93	15.0	0.27	b 126.0
BF21	Grizzly Bay	2/11/99	19	40	38	b 50399	b 0.34	b 1134	107	21.3	0.38	b 148.2
BF10	Pacheco Creek	2/11/99	19	69	63	b 29529	b 0.06	b 533	72	7.4	0.09	b 76.9
BD50	Napa River	2/12/99	19	45	39	b 45294	b 0.39	b 688	94	27.1	0.28	b 145.0
BD41	Davis Point	2/12/99	19	71	68	b 25516	b 0.06	b 375	61	7.9	0.03	b 64.7
BD31	Pinole Point	2/12/99	19	54	50	b 32822	b 0.21	b 614	72	14.4	0.26	b 96.7
BD22	San Pablo Bay	2/12/99	19	51	47	b 37045	b 0.33	b 489	76	18.9	0.29	b 116.5
BD15	Petaluma River	2/12/99	19	28	34	b 40478	b 0.50	b 826	94	18.0	0.31	b 118.3
BC60	Red Rock	2/16/99	19	63	60	b 34305	b 0.07	b 503	77	11.6	b 0.14	b 85.8
BC41	Point Isabel	2/16/99	19	47	45	b 37213	b 0.24	b 408	78	20.1	b 0.28	b 111.8
BC32	Richardson Bay	2/16/99	19	47	43	b 36295	b 0.20	b 456	75	17.0	b 0.26	b 105.3
BC21	Horseshoe Bay	2/16/99	19	66	65	b 25488	b 0.10	b 293	51	46.4	b 0.12	b 75.2
BC11	Yerba Buena Island	2/16/99	19	48	42	b 31221	b 0.14	b 423	65	16.9	b 0.25	b 96.6
BB70	Alameda	2/17/99	19	48	47	b 35805	b 0.20	b 462	75	18.1	b 0.29	b 105.3
BB30	Oyster Point	2/17/99	19	57	49	b 31273	b 0.14	b 415	73	14.8	b 0.21	b 91.6
BB15	San Bruno Shoal	2/17/99	19	37	35	b 39678	b 0.29	b 818	85	22.2	b 0.32	b 124.8
BA41	Redwood Creek	2/17/99	19	53	45	b 37807	b 0.20	b 543	82	21.2	b 0.24	b 122.4
BA30	Dumbarton Bridge	2/17/99	19	51	50	b 28894	b 0.28	b 484	64	19.0	b 0.42	b 94.5
BA21	South Bay	2/17/99	19	38	37	b 39134	b 0.27	b 783	88	21.5	b 0.35	b 124.1
BA10	Coyote Creek	2/17/99	19	62	59	b 23266	b 0.14	b 610	64	12.6	b 0.15	b 75.1
C-3-0	San Jose	2/18/99	19	65	59	b 29357	b 0.23	b 687	93	19.5	b 0.16	b 102.1
C-1-3	Sunnyvale	2/18/99	19	57	63	b 23440	b 0.16	b 404	54	14.8	b 0.30	b 78.3
BW10	Standish Dam	2/22/99	19	48	45	b 41499	b 0.31	b 787	107	49.4	b 0.59	b 171.6
BW15	Guadalupe River	2/9/99	19	44	39	b 46799	b 0.42	b 1023	111	34.6	b 0.63	b 191.0
BG20	Sacramento River	7/22/99	21	69	66	b 24262	B	b 423	69	9.0	ND	b 77.2
BG30	San Joaquin River	7/22/99	21	70	69	b 24884	b 0.09	b 303	57	7.1	0.10	b 56.2
BF40	Honker Bay	7/22/99	21	46	45	b 38097	b 0.25	b 718	87	17.4	0.27	b 118.3
BF21	Grizzly Bay	7/22/99	21	38	39	b 38518	b 0.29	b 775	91	19.9	0.32	b 116.1
BF10	Pacheco Creek	7/22/99	21	64	62	b 26381	b 0.09	b 455	68	10.9	0.11	b 78.4
BD50	Napa River	7/23/99	21	38	36	b 40160	b 0.25	b 924	90	24.1	0.38	b 125.1
BD41	Davis Point	7/23/99	21	71	69	b 26385	b 0.04	b 395	64	10.7	ND	b 67.5
BD31	Pinole Point	7/23/99	21	38	38	b 38430	b 0.25	b 774	88	20.0	0.31	b 118.8
BD22	San Pablo Bay	7/23/99	21	47	45	b 34020	b 0.27	b 594	76	20.8	0.31	b 109.1
BD15	Petaluma River	7/23/99	21	36	33	b 36765	b 0.18	b 729	85	21.5	0.33	b 113.5
BC60	Red Rock	7/23/99	21	73	71	b 25724	b 0.03	b 465	57	12.7	0.08	b 56.2
BC41	Point Isabel	7/26/99	21	42	43	b 36293	b 0.24	b 425	78	20.3	0.35	b 111.2
BC32	Richardson Bay	7/26/99	21	44	43	b 29793	b 0.17	b 305	64	18.0	0.27	b 89.7
BC21	Horseshoe Bay	7/26/99	21	63	63	b 23758	b 0.10	b 253	52	76.8	0.16	b 75.9
BC11	Yerba Buena Island	7/26/99	21	53	47	b 23112	b 0.19	b 274	49	19.9	0.24	b 80.4
BB70	Alameda	7/26/99	21	51	49	b 30897	b 0.31	b 355	69	24.3	0.31	b 105.9
BB30	Oyster Point	7/27/99	21	60	58	b 22755	b 0.15	b 341	55	13.4	0.17	b 74.2
BB15	San Bruno Shoal	7/27/99	21	35	35	b 34666	b 0.26	b 804	73	22.7	0.33	b 114.1
BA41	Redwood Creek	7/27/99	21	49	44	b 28358	b 0.26	b 593	66	21.4	0.22	b 102.1
BA30	Dumbarton Bridge	7/27/99	21	40	39	b 28072	b 0.31	b 874	68	24.3	0.32	b 106.4
BA21	South Bay	7/27/99	21	43	40	b 29738	b 0.19	b 667	71	24.5	0.28	b 105.8
BA10	Coyote Creek	7/28/99	21	64	53	b 17997	b 0.14	b 1056	47	15.3	0.18	b 62.2
C-3-0	San Jose	7/28/99	21	55	54	b 31226	b 0.45	b 564	89	39.8	0.36	b 140.8
C-1-3	Sunnyvale	7/28/99	21	69	68	b 21254	b 0.11	b 390	44	12.7	0.17	b 67.7
BW10	Standish Dam	7/29/99	21	34	36	b 38212	b 0.36	b 916	102	30.4	0.67	b 164.0
BW15	Guadalupe River	7/29/99	21	29	31	b 37676	b 0.70	b 1267	94	30.5	0.64	b 149.0

Table 13. PAH concentrations in sediment samples, 1999. B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, LPAH = low molecular weight PAH's, ND = not detected. p = low precision (<30% of field value), r = low recovery (< 2x outside target %). For method detection limits, refer to *QA Tables*.

Station Code	Station	Date	Cruise	% Solids	Sum of PAHs (SFEI)	Sum of LPAHs (SFEI)	Biphenyl	Naphthalene	1-Methylnaphthalene	2-Methylnaphthalene	2,6-Dimethylnaphthalene	2,3,5-Trimethylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Dibenzothiophene	Fluorene	Phenanthrene	1-Methylphenanthrene
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	37	3	ND	B	ND	ND	ND	ND	ND	ND	ND	ND	ND	b 3	ND
BG30	San Joaquin River	2/11/99	19	72	257	21	ND	b 4	ND	2	1	ND	1	1	2	ND	2	b 7	2
BF40	Honker Bay	2/11/99	19	53	964	109	4	b 13	3	9	4	6	3	3	10	3	8	b 35	7
BF21	Grizzly Bay	2/11/99	19	47	1067	129	6	b 16	4	11	6	8	3	4	11	4	9	b 39	8
BF10	Pacheco Creek	2/11/99	19	67	357	77	3	b 5	ND	3	2	ND	16	2	7	3	11	b 22	3
BD50	Napa River	2/12/99	19	43	3278	277	9	b 39	11	27	12	18	7	14	37	7	21	b 76	ND
BD41	Davis Point	2/12/99	19	73	118	16	ND	b 3	ND	2	1	ND	ND	ND	1	ND	2	b 6	1
BD31	Pinole Point	2/12/99	19	53	1117	129	6	b 17	4	11	6	6	6	4	11	4	8	b 39	8
BD22	San Pablo Bay	2/12/99	19	51	5116	412	10	b 53	6	17	9	14	10	22	54	12	18	b 165	23
BD15	Petaluma River	2/12/99	19	44	901	118	5	b 17	4	11	6	5	4	4	9	4	7	b 36	6
BC60	Red Rock	2/16/99	19	64	329	58	3	b 8	2	6	3	4	2	2	5	2	4	b 15	3
BC41	Point Isabel	2/16/99	19	48	2553	331	7	b 28	6	17	10	15	10	25	42	8	16	b 127	21
BC32	Richardson Bay	2/16/99	19	51	2479	316	8	b 32	7	18	11	14	8	17	44	8	16	b 115	19
BC21	Horseshoe Bay	2/16/99	19	66	4269	783	9	b 47	10	20	17	52	22	41	104	22	38	b 298	103
BC11	Yerba Buena Island	2/16/99	19	46	2379	329	10	b 36	7	18	12	11	19	14	42	9	19	b 121	12
BB70	Alameda	2/17/99	19	50	3880	522	9	b 40	8	19	12	15	16	32	92	14	26	b 205	34
BB30	Oyster Point	2/17/99	19	56	2261	298	7	b 26	5	14	10	11	13	15	47	8	16	b 110	17
BB15	San Bruno Shoal	2/17/99	19	44	2780	400	10	b 57	8	23	14	15	11	20	55	10	21	b 134	24
BA41	Redwood Creek	2/17/99	19	44	2937	338	8	b 41	7	18	11	10	8	23	37	8	15	b 122	29
BA30	Dumbarton Bridge	2/17/99	19	52	3608	387	8	b 45	6	17	10	14	11	28	47	9	18	b 148	24
BA21	South Bay	2/17/99	19	46	2350	259	8	b 35	7	18	11	11	6	16	24	7	14	b 83	18
BA10	Coyote Creek	2/17/99	19	64	1052	125	4	b 16	3	10	6	6	3	7	11	4	7	b 41	8
C-3-0	San Jose	2/18/99	19	61	1291	188	5	b 22	5	17	10	17	5	7	18	7	15	b 50	11
C-1-3	Sunnyvale	2/18/99	19	64	1300	224	5	b 13	4	13	8	8	4	4	15	6	12	b 70	64
BW10	Standish Dam	2/22/99	19	52	1324	180	6	b 25	6	23	14	13	4	5	10	5	13	b 47	9
BW15	Guadalupe River	2/9/99	19	51	2320	261	9	b 35	8	23	15	12	7	9	22	8	15	b 82	16
BG20	Sacramento River	7/22/99	21	72	61	26	2	B	3	5	2	ND	2	ND	ND	ND	3	b 5	3
BG30	San Joaquin River	7/22/99	21	71	106	10	ND	B	ND	2	2	ND	ND	ND	ND	ND	ND	b 6	ND
BF40	Honker Bay	7/22/99	21	49	510	87	4	b 13	5	9	5	ND	4	2	6	3	7	b 28	ND
BF21	Grizzly Bay	7/22/99	21	43	781	122	6	b 19	7	13	8	ND	4	3	8	4	8	b 37	5
BF10	Pacheco Creek	7/22/99	21	65	323	55	ND	b 7	2	4	2	ND	2	1	4	2	4	b 21	6
BD50	Napa River	7/23/99	21	39	1038	153	8	b 23	7	14	8	ND	6	4	11	5	9	b 51	7
BD41	Davis Point	7/23/99	21	71	83	11	ND	B	ND	3	1	ND	1	ND	1	ND	ND	b 4	ND
BD31	Pinole Point	7/23/99	21	42	1130	165	7	b 20	7	13	6	ND	6	6	18	5	10	b 59	8
BD22	San Pablo Bay	7/23/99	21	45	1656	179	7	b 25	7	13	6	ND	5	7	21	5	8	b 69	6
BD15	Petaluma River	7/23/99	21	44	731	114	6	b 19	7	13	6	ND	4	3	7	3	7	b 34	4
BC60	Red Rock	7/23/99	21	79	51	7	ND	B	ND	2	1	ND	ND	ND	ND	ND	ND	b 3	ND
BC41	Point Isabel	7/26/99	21	44	1412	187	7	b 30	8	b 14	6	ND	6	9	19	4	8	66	9
BC32	Richardson Bay	7/26/99	21	47	2490	255	9	b 33	9	b 16	8	ND	8	12	36	6	13	95	10
BC21	Horseshoe Bay	7/26/99	21	65	3013	555	9	b 38	13	b 19	11	8	14	30	78	17	33	246	39
BC11	Yerba Buena Island	7/26/99	21	55	1351	315	9	b 36	19	b 29	10	ND	25	6	26	7	28	112	9
BB70	Alameda	7/26/99	21	52	3192	466	13	b 55	14	b 23	12	5	17	23	52	12	22	199	20
BB30	Oyster Point	7/27/99	21	56	1579	237	6	b 26	6	b 11	6	ND	8	12	34	7	11	96	14
BB15	San Bruno Shoal	7/27/99	21	42	1409	201	8	b 34	9	b 16	7	ND	7	9	17	5	10	68	11
BA41	Redwood Creek	7/27/99	21	51	1601	172	7	b 30	7	b 13	6	ND	5	8	15	4	8	62	6
BA30	Dumbarton Bridge	7/27/99	21	43	2131	245	9	b 38	9	b 17	7	ND	10	10	24	6	12	93	10
BA21	South Bay	7/27/99	21	45	2123	228	10	b 37	10	b 18	9	ND	7	9	19	6	11	80	13
BA10	Coyote Creek	7/28/99	21	56	669	99	5	b 18	4	b 9	4	ND	3	4	8	3	5	32	5
C-3-0	San Jose	7/28/99	21	54	1012	173	6	b 35	9	b 22	9	4	6	4	p 12	5	9	44	8
C-1-3	Sunnyvale	7/28/99	21	70	447	77	3	b 11	4	b 9	4	ND	2	1	6	3	5	26	3
BW10	Standish Dam	7/29/99	21	41	1006	158	7	b 23	8	17	9	ND	10	4	9	4	11	b 50	5
BW15	Guadalupe River	7/29/99	21	38	1173	175	9	b 29	9	19	10	ND	p 7	6	10	5	10	b 54	7

Data Table 13 continued on next page

Table 13. PAH concentrations in sediment samples, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, HPAH = high molecular weight PAHs, ND = not detected. p = low precision (<30% of field value), r = low recovery (< 2x outside target %). For method detection limits, refer to QA Tables.

Station Code	Station	Date	Cruise	% Solids	Sum of PAHs (SFEI)	Sum of HPAHs (SFEI)	Benz(a)anthracene	Chrysene	Fluoranthene	Pyrene	Benzo(a)pyrene	Benzo(e)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Perylene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	37	34	b 1	2	5	7	2	b 2	b 3	1	ND	9	2	1
BG30	San Joaquin River	2/11/99	19	72	257	235	b 5	7	19	24	8	b 6	b 10	4	ND	138	8	7
BF40	Honker Bay	2/11/99	19	53	964	855	b 37	46	110	139	71	b 53	b 91	31	6	142	70	60
BF21	Grizzly Bay	2/11/99	19	47	1067	938	b 42	53	126	157	75	b 56	b 98	34	8	156	71	64
BF10	Pacheco Creek	2/11/99	19	67	357	280	b 12	17	56	55	15	b 13	b 27	11	3	38	18	14
BD50	Napa River	2/12/99	19	43	3278	3001	b 233	261	444	593	231	b 162	b 320	107	23	291	160	176
BD41	Davis Point	2/12/99	19	73	118	102	b 5	6	14	16	8	b 6	b 11	5	ND	18	7	7
BD31	Pinole Point	2/12/99	19	53	1117	988	b 44	51	176	213	86	b 57	b 106	28	7	88	69	63
BD22	San Pablo Bay	2/12/99	19	51	5116	4704	b 221	303	579	914	545	b 310	b 599	176	35	199	428	395
BD15	Petaluma River	2/12/99	19	44	901	782	b 37	52	98	136	81	b 54	b 93	29	7	66	68	60
BC60	Red Rock	2/16/99	19	64	329	270	b 13	17	44	58	22	17	36	12	1	25	13	12
BC41	Point Isabel	2/16/99	19	48	2553	2222	b 132	130	363	448	254	145	313	95	13	99	112	118
BC32	Richardson Bay	2/16/99	19	51	2479	2163	b 120	129	357	462	241	138	296	83	12	96	114	115
BC21	Horseshoe Bay	2/16/99	19	66	4269	3486	b 228	233	690	872	336	b 176	b 358	98	27	98	182	188
BC11	Yerba Buena Island	2/16/99	19	46	2379	2049	b 117	122	282	344	235	b 137	b 272	92	17	113	159	159
BB70	Alameda	2/17/99	19	50	3880	3357	b 222	203	599	723	364	196	453	132	19	123	157	166
BB30	Oyster Point	2/17/99	19	56	2261	1964	b 123	124	315	405	216	126	266	83	12	85	103	106
BB15	San Bruno Shoal	2/17/99	19	44	2780	2380	b 139	154	377	497	255	161	335	91	15	104	124	128
BA41	Redwood Creek	2/17/99	19	44	2937	2600	b 141	140	474	648	259	149	304	89	19	102	137	138
BA30	Dumbarton Bridge	2/17/99	19	52	3608	3221	b 165	178	539	756	334	201	430	133	18	119	170	178
BA21	South Bay	2/17/99	19	46	2350	2091	b 99	117	321	452	217	145	313	89	12	95	113	118
BA10	Coyote Creek	2/17/99	19	64	1052	928	b 42	50	148	196	93	64	135	39	5	43	56	57
C-3-0	San Jose	2/18/99	19	61	1291	1103	b 50	57	168	228	107	79	163	46	8	63	67	69
C-1-3	Sunnyvale	2/18/99	19	64	1300	1076	b 59	81	185	185	97	69	181	54	9	45	54	58
BW10	Standish Dam	2/22/99	19	52	1324	1144	b 47	71	122	142	97	85	188	46	15	73	137	122
BW15	Guadalupe River	2/9/99	19	51	2320	2059	b 88	135	258	305	196	b 154	b 308	79	24	115	208	189
BG20	Sacramento River	7/22/99	21	72	61	36	1	2	6	8	2	2	2	ND	ND	8	2	2
BG30	San Joaquin River	7/22/99	21	71	106	97	3	3	11	12	6	4	5	1	ND	41	7	5
BF40	Honker Bay	7/22/99	21	49	510	423	17	27	66	79	33	27	36	11	4	56	40	26
BF21	Grizzly Bay	7/22/99	21	43	781	658	26	38	94	117	55	44	60	14	8	96	65	43
BF10	Pacheco Creek	7/22/99	21	65	323	268	13	17	54	52	21	18	23	6	2	28	20	14
BD50	Napa River	7/23/99	21	39	1038	885	37	52	107	130	85	66	87	22	14	r 90	116	79
BD41	Davis Point	7/23/99	21	71	83	72	3	3	9	12	6	5	7	2	ND	11	8	5
BD31	Pinole Point	7/23/99	21	42	1130	965	56	61	128	165	101	65	96	33	15	71	102	73
BD22	San Pablo Bay	7/23/99	21	45	1656	1477	70	91	161	245	176	115	159	46	22	88	178	127
BD15	Petaluma River	7/23/99	21	44	731	617	26	34	79	105	61	43	67	17	5	53	73	52
BC60	Red Rock	7/23/99	21	79	51	44	2	2	7	8	4	3	4	1	ND	6	4	3
BC41	Point Isabel	7/26/99	21	44	1412	1225	82	82	171	213	131	77	142	43	24	53	116	90
BC32	Richardson Bay	7/26/99	21	47	2490	2235	125	184	263	320	259	146	278	100	48	96	240	177
BC21	Horseshoe Bay	7/26/99	21	65	3013	2458	237	216	389	524	251	122	255	68	28	85	152	132
BC11	Yerba Buena Island	7/26/99	21	55	1351	1036	64	64	166	181	102	59	121	37	14	45	104	80
BB70	Alameda	7/26/99	21	52	3192	2726	171	165	364	456	318	161	336	95	48	114	277	222
BB30	Oyster Point	7/27/99	21	56	1579	1343	88	85	224	303	134	71	140	42	15	49	109	82
BB15	San Bruno Shoal	7/27/99	21	42	1409	1208	63	68	175	231	124	73	142	40	19	54	125	94
BA41	Redwood Creek	7/27/99	21	51	1601	1430	75	84	159	220	160	101	192	53	27	66	166	126
BA30	Dumbarton Bridge	7/27/99	21	43	2131	1886	99	110	243	316	214	125	237	72	30	83	202	155
BA21	South Bay	7/27/99	21	45	2123	1895	92	113	212	287	208	132	242	69	36	89	244	170
BA10	Coyote Creek	7/28/99	21	56	669	569	28	34	88	114	55	35	68	17	7	25	58	41
C-3-0	San Jose	7/28/99	21	54	1012	839	p,r 41	p 49	146	190	p 77	52	r 110	p 35	8	35	54	44
C-1-3	Sunnyvale	7/28/99	21	70	447	369	21	27	69	71	30	21	45	16	4	15	29	22
BW10	Standish Dam	7/29/99	21	41	1006	848	44	59	b 109	130	83	65	132	38	9	49	74	56
BW15	Guadalupe River	7/29/99	21	38	1173	998	46	63	b 130	r 167	95	73	135	36	14	60	102	77

Table 14. PCB concentrations in sediment samples, 1999. B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value, ND = not detected, p = low precision (<30% of field value), R = low recovery (> 2x outside target %), r = low recovery (< 2x outside target %). For method detection limits, refer to QA Tables.

Station Code	Station	Date	Cruise	% Solids	Sum of PCBs (SFEI)	PCB 008	PCB 018	PCB 028	PCB 031	PCB 033	PCB 044	PCB 049	PCB 052	PCB 056	PCB 060	PCB 066	PCB 070	PCB 074	PCB 087
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	2/11/99	19	72	0.4	ND	e 0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	2/11/99	19	53	2.4	0.5	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	2/11/99	19	47	3.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	2/11/99	19	67	3.5	ND	ND	ND	e 0.2	ND	ND	ND	1.4	ND	ND	ND	e 0.3	ND	ND
BD50	Napa River	2/12/99	19	43	8.4	ND	ND	ND	ND	ND	ND	ND	ND	0.6	0.5	ND	ND	ND	ND
BD41	Davis Point	2/12/99	19	73	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 0.1	ND	ND
BD31	Pinole Point	2/12/99	19	53	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 1.0	ND	ND
BD22	San Pablo Bay	2/12/99	19	51	4.4	ND	ND	ND	ND	ND	ND	ND	b 1.4	ND	ND	ND	e 0.2	ND	ND
BD15	Petaluma River	2/12/99	19	44	3.3	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC60	Red Rock	2/16/99	19	64	3.2	ND	ND	e 1.1	ND	ND	ND	ND	0.9	ND	ND	0.1	ND	ND	ND
BC41	Point Isabel	2/16/99	19	48	7.2	ND	e 1.0	ND	ND	0.4	ND	ND	e 2.0	ND	ND	ND	ND	ND	ND
BC32	Richardson Bay	2/16/99	19	51	18.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND
BC21	Horseshoe Bay	2/16/99	19	66	12.6	ND	ND	3.0	e 3.5	ND	0.9	1.1	ND	ND	ND	0.6	ND	ND	ND
BC11	Yerba Buena Island	2/16/99	19	46	17.3	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	0.8	ND	ND	ND
BB70	Alameda	2/17/99	19	50	8.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BB30	Oyster Point	2/17/99	19	56	10.4	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	e 0.7	ND	0.5
BB15	San Bruno Shoal	2/17/99	19	44	7.6	r 0.1	r 0.2	r 0.1	r 0.1	r 0.1	ND	ND	ND	ND	ND	ND	0.5	ND	ND
BA41	Redwood Creek	2/17/99	19	44	10.2	ND	ND	ND	ND	ND	ND	e 0.3	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	2/17/99	19	52	20.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	0.7	ND	0.7
BA21	South Bay	2/17/99	19	46	7.0	ND	ND	ND	ND	ND	0.5	ND	ND	ND	ND	ND	0.5	ND	ND
BA10	Coyote Creek	2/17/99	19	64	6.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 0.4	ND	ND
C-3-0	San Jose	2/18/99	19	61	79.6	1.4	ND	2.2	2.1	1.0	2.4	2.1	3.7	1.0	0.6	2.6	3.7	1.5	1.8
C-1-3	Sunnyvale	2/18/99	19	64	4.0	ND	2.8	ND	ND	ND	0.2	0.2	ND	ND	0.2	ND	ND	ND	ND
BW10	Standish Dam	2/22/99	19	52	26.7	r 0.1	r 0.2	r 0.1	r 0.1	ND	r 0.8	r 0.1	r 0.2	ND	ND	r 1.0	r 0.1	r 0.1	0.3
BW15	Guadalupe River	2/9/99	19	51	22.0	ND	e 0.6	1.7	ND	ND	0.5	ND	ND	0.3	0.6	1.0	e 0.9	5.6	0.8
BG20	Sacramento River	7/22/99	21	72	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	7/22/99	21	71	3.7	2.0	ND	ND	ND	e 0.2	ND	ND	e 1.0	ND	ND	e 0.4	ND	ND	ND
BF40	Honker Bay	7/22/99	21	49	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 0.2	ND	ND	ND
BF21	Grizzly Bay	7/22/99	21	43	4.7	ND	ND	ND	e 1.6	ND	ND	ND	ND	ND	ND	e 0.2	e 0.2	e 0.2	ND
BF10	Pacheco Creek	7/22/99	21	65	2.5	ND	ND	ND	ND	ND	e 0.7	ND	e 0.4	ND	ND	e 0.1	ND	ND	ND
BD50	Napa River	7/23/99	21	39	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	7/23/99	21	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	7/23/99	21	42	2.2	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	7/23/99	21	45	1.1	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	7/23/99	21	44	1.2	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC60	Red Rock	7/23/99	21	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	7/26/99	21	44	3.0	e 0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 0.1	ND	ND	ND
BC32	Richardson Bay	7/26/99	21	47	8.6	2.6	ND	ND	ND	ND	0.4	0.2	1.8	ND	ND	e 0.4	e 0.1	ND	ND
BC21	Horseshoe Bay	7/26/99	21	65	11.0	e 2.0	e 0.9	ND	1.2	ND	ND	e 0.2	1.4	ND	0.1	e 0.2	0.1	ND	ND
BC11	Yerba Buena Island	7/26/99	21	55	10.1	e 1.1	ND	ND	ND	ND	e 0.4	e 0.4	ND	ND	e 0.1	e 0.4	ND	ND	ND
BB70	Alameda	7/26/99	21	52	22.5	e 1.9	ND	ND	ND	ND	0.3	e 0.5	ND	ND	0.3	e 0.6	0.4	ND	0.2
BB30	Oyster Point	7/27/99	21	56	8.3	ND	ND	ND	ND	ND	ND	e 1.7	1.0	ND	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	7/27/99	21	42	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	7/27/99	21	51	4.1	ND	0.5	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	7/27/99	21	43	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND
BA21	South Bay	7/27/99	21	45	7.9	e 1.8	ND	ND	ND	ND	0.6	ND	1.4	ND	ND	ND	ND	ND	ND
BA10	Coyote Creek	7/28/99	21	56	19.3	e 2.4	ND	ND	1.2	e 2.3	ND	1.9	ND	ND	ND	0.3	ND	ND	ND
C-3-0	San Jose	7/28/99	21	54	62.8	4.0	ND	ND	2.3	ND	1.4	2.0	e 6.9	0.7	ND	2.2	2.4	0.7	0.8
C-1-3	Sunnyvale	7/28/99	21	70	7.3	ND	ND	ND	ND	e 1.2	ND	e 0.6	ND	ND	ND	ND	ND	0.1	ND
BW10	Standish Dam	7/29/99	21	41	30.0	ND	ND	1.3	ND	ND	ND	2.6	ND	ND	ND	0.7	1.1	ND	0.6
BW15	Guadalupe River	7/29/99	21	38	30.5	ND	e 1.4	ND	ND	ND	ND	4.9	ND	ND	ND	ND	ND	ND	ND

Data Table 14 continued on next page

Table 14. PCB concentrations in sediment samples, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value, ND = not detected, p = low precision (<30% of field value), R = low recovery (> 2x outside target %), r = low recovery (< 2x outside target %). For method detection limits, refer to QA Tables.

Station Code	Station	Date	Cruise	% Solids	Sum of PCBs (SFEI)	PCB 095	PCB 097	PCB 099	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 132	PCB 138	PCB 141	PCB 149	PCB 151	PCB 153
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	R,ND
BG30	San Joaquin River	2/11/99	19	72	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	R,ND
BF40	Honker Bay	2/11/99	19	53	2.4	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	0.3	ND	R,ND
BF21	Grizzly Bay	2/11/99	19	47	3.8	ND	ND	ND	ND	ND	1.0	0.9	ND	ND	0.6	ND	ND	ND	R
BF10	Pacheco Creek	2/11/99	19	67	3.5	ND	ND	ND	ND	0.2	ND	ND	ND	ND	0.4	e 0.3	ND	ND	R,ND
BD50	Napa River	2/12/99	19	43	8.4	ND	ND	ND	ND	0.7	0.8	ND	ND	ND	2.6	ND	ND	e 0.8	R,ND
BD41	Davis Point	2/12/99	19	73	0.7	ND	ND	ND	ND	ND	0.2	ND	0.1	ND	ND	ND	ND	ND	R,ND
BD31	Pinole Point	2/12/99	19	53	6.2	ND	ND	0.7	b 0.7	ND	ND	0.6	ND	0.3	0.8	e 0.3	ND	ND	R,ND
BD22	San Pablo Bay	2/12/99	19	51	4.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	e 0.2	ND	ND	R,ND
BD15	Petaluma River	2/12/99	19	44	3.3	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.9	ND	R,ND
BC60	Red Rock	2/16/99	19	64	3.2	0.2	ND	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	R,ND
BC41	Point Isabel	2/16/99	19	48	7.2	ND	ND	0.4	0.7	ND	0.5	ND	ND	ND	1.1	ND	ND	ND	R,ND
BC32	Richardson Bay	2/16/99	19	51	18.0	1.6	ND	0.4	b 2.1	ND	ND	1.8	ND	ND	4.0	1.5	3.7	ND	R
BC21	Horseshoe Bay	2/16/99	19	66	12.6	0.2	ND	ND	ND	ND	1.2	0.7	ND	ND	ND	ND	0.4	ND	R,ND
BC11	Yerba Buena Island	2/16/99	19	46	17.3	1.3	0.3	ND	b 1.2	0.3	3.5	1.3	0.5	0.5	ND	ND	1.3	e 0.9	R,ND
BB70	Alameda	2/17/99	19	50	8.9	ND	0.3	0.5	0.7	ND	0.8	1.8	e 0.3	ND	1.3	ND	0.6	ND	R,ND
BB30	Oyster Point	2/17/99	19	56	10.4	ND	0.3	0.4	1.3	0.4	ND	1.2	0.4	0.3	1.7	ND	0.6	ND	R,ND
BB15	San Bruno Shoal	2/17/99	19	44	7.6	ND	e 0.4	ND	ND	ND	ND	1.1	0.5	ND	1.6	ND	1.1	ND	R,ND
BA41	Redwood Creek	2/17/99	19	44	10.2	ND	ND	0.5	0.9	ND	ND	0.9	ND	ND	2.5	e 0.2	1.2	ND	R,ND
BA30	Dumbarton Bridge	2/17/99	19	52	20.0	1.8	e 0.6	ND	1.9	ND	ND	2.3	e 0.5	ND	3.1	e 0.3	1.6	ND	R,ND
BA21	South Bay	2/17/99	19	46	7.0	ND	ND	0.7	ND	ND	ND	0.8	ND	0.6	1.5	e 0.2	0.8	ND	R,ND
BA10	Coyote Creek	2/17/99	19	64	6.8	ND	ND	0.5	0.5	0.4	1.2	0.5	e 0.2	ND	0.6	0.1	0.5	ND	R,ND
C-3-0	San Jose	2/18/99	19	61	79.6	3.5	1.3	1.7	4.6	1.6	5.4	4.4	ND	1.8	6.1	e 1.5	5.3	e 1.4	R,ND
C-1-3	Sunnyvale	2/18/99	19	64	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	R,ND
BW10	Standish Dam	2/22/99	19	52	26.7	1.1	0.5	ND	1.7	0.5	r 0.1	2.2	0.6	0.6	6.2	ND	2.4	ND	R
BW15	Guadalupe River	2/9/99	19	51	22.0	ND	e 0.7	3.0	2.5	ND	ND	ND	B	0.8	0.1	e 0.3	ND	ND	R,ND
BG20	Sacramento River	7/22/99	21	72	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	7/22/99	21	71	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	7/22/99	21	49	1.2	e 0.4	ND	ND	0.1	ND	ND	ND	ND	ND	0.1	ND	ND	ND	0.2
BF21	Grizzly Bay	7/22/99	21	43	4.7	e 1.3	ND	ND	0.2	ND	0.2	0.2	ND	ND	0.2	ND	ND	ND	0.3
BF10	Pacheco Creek	7/22/99	21	65	2.5	e 0.5	ND	ND	ND	ND	ND	e 0.3	0.1	ND	0.1	ND	ND	ND	ND
BD50	Napa River	7/23/99	21	39	0.6	ND	ND	ND	ND	ND	0.1	ND	ND	ND	0.3	ND	ND	ND	0.2
BD41	Davis Point	7/23/99	21	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	7/23/99	21	42	2.2	ND	ND	ND	e 0.2	ND	ND	e 0.3	ND	ND	0.3	ND	e 0.4	ND	ND
BD22	San Pablo Bay	7/23/99	21	45	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	7/23/99	21	44	1.2	ND	ND	ND	ND	ND	ND	0.2	ND	ND	0.3	ND	ND	ND	0.3
BC60	Red Rock	7/23/99	21	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	7/26/99	21	44	3.0	e 1.0	ND	ND	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	0.3
BC32	Richardson Bay	7/26/99	21	47	8.6	e 1.1	ND	ND	ND	ND	0.2	e 0.2	ND	ND	0.2	ND	e 0.3	ND	0.3
BC21	Horseshoe Bay	7/26/99	21	65	11.0	e 2.0	ND	ND	0.3	ND	0.4	0.3	ND	ND	0.5	ND	0.3	ND	0.3
BC11	Yerba Buena Island	7/26/99	21	55	10.1	e 0.6	ND	e 0.3	0.7	e 0.3	e 0.6	e 0.7	0.1	e 0.2	1.0	ND	e 0.8	ND	0.9
BB70	Alameda	7/26/99	21	52	22.5	e 0.8	0.5	0.8	1.4	e 0.6	e 1.3	1.4	0.3	e 0.6	e 2.1	0.3	1.5	ND	2.2
BB30	Oyster Point	7/27/99	21	56	8.3	e 0.1	ND	ND	0.4	ND	0.6	e 0.5	ND	ND	e 0.8	ND	e 0.7	ND	0.9
BB15	San Bruno Shoal	7/27/99	21	42	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	0.5
BA41	Redwood Creek	7/27/99	21	51	4.1	ND	ND	ND	0.3	ND	e 0.4	e 0.4	ND	ND	e 0.5	ND	e 0.4	ND	0.6
BA30	Dumbarton Bridge	7/27/99	21	43	6.2	1.9	ND	ND	0.3	ND	0.5	e 0.5	0.2	ND	e 0.7	ND	e 0.4	ND	0.6
BA21	South Bay	7/27/99	21	45	7.9	1.8	ND	ND	0.3	ND	0.4	0.3	ND	ND	0.6	ND	ND	ND	ND
BA10	Coyote Creek	7/28/99	21	56	19.3	0.8	ND	ND	1.1	e 0.4	e 1.7	e 1.0	ND	e 0.6	2.0	ND	e 1.1	ND	1.3
C-3-0	San Jose	7/28/99	21	54	62.8	2.7	1.0	e 1.9	3.4	e 0.7	e 3.4	e 2.3	ND	e 1.2	e 4.2	e 0.9	e 3.3	e 1.1	4.0
C-1-3	Sunnyvale	7/28/99	21	70	7.3	ND	ND	0.4	0.4	ND	e 0.8	e 0.3	ND	e 0.2	0.6	ND	e 0.6	ND	0.8
BW10	Standish Dam	7/29/99	21	41	30.0	1.3	ND	e 0.5	1.6	ND	e 3.7	e 1.3	ND	0.6	3.1	0.5	e 2.2	ND	2.9
BW15	Guadalupe River	7/29/99	21	38	30.5	p 1.0	ND	ND	1.8	ND	e 3.9	e 1.6	ND	p 0.9	2.5	ND	e 2.5	e 0.6	3.1

Data Table 14 continued on next page

Table 14. PCB concentrations in sediment samples, 1999 (continued). B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value, ND = not detected, p = low precision (<30% of field value), R = low recovery (> 2x outside target %), r = low recovery (< 2x outside target %). For method detection limits, refer to QA Tables.

Station Code	Station	Date	Cruise	% Solids	Sum of PCBs (SFEI)	PCB 156	PCB 158	PCB 170	PCB 174	PCB 177	PCB 180	PCB 183	PCB 187	PCB 194	PCB 195	PCB 201	PCB 203	Hexachlorobenzene
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	2/11/99	19	72	0.4	ND	ND	e 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	2/11/99	19	53	2.4	ND	ND	ND	ND	ND	0.4	ND	0.4	ND	ND	ND	ND	e 0.4
BF21	Grizzly Bay	2/11/99	19	47	3.8	ND	0.6	ND	ND	ND	ND	ND	0.6	0.2	ND	ND	ND	0.8
BF10	Pacheco Creek	2/11/99	19	67	3.5	0.6	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	0.1	0.1
BD50	Napa River	2/12/99	19	43	8.4	ND	1.1	ND	e 0.2	ND	e 0.5	e 0.2	0.4	ND	ND	ND	ND	ND
BD41	Davis Point	2/12/99	19	73	0.7	0.2	ND	ND	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND
BD31	Pinole Point	2/12/99	19	53	6.2	ND	0.9	ND	ND	ND	ND	e 0.2	0.4	0.4	ND	ND	ND	e 0.4
BD22	San Pablo Bay	2/12/99	19	51	4.4	ND	ND	ND	e 0.1	ND	ND	e 0.2	1.1	e 0.4	ND	ND	ND	ND
BD15	Petaluma River	2/12/99	19	44	3.3	ND	ND	ND	ND	ND	ND	ND	0.6	ND	ND	ND	e 0.3	ND
BC60	Red Rock	2/16/99	19	64	3.2	ND	ND	ND	e 0.2	ND	0.1	ND	0.2	ND	ND	ND	ND	0.1
BC41	Point Isabel	2/16/99	19	48	7.2	ND	ND	ND	ND	ND	0.5	e 0.2	0.3	ND	ND	ND	ND	ND
BC32	Richardson Bay	2/16/99	19	51	18.0	ND	ND	1.5	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	2/16/99	19	66	12.6	e 0.7	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	2/16/99	19	46	17.3	1.6	ND	e 0.6	ND	ND	1.7	0.3	1.0	ND	ND	ND	ND	0.3
BB70	Alameda	2/17/99	19	50	8.9	ND	ND	0.3	ND	0.2	0.7	e 0.2	0.7	0.3	ND	ND	0.2	0.2
BB30	Oyster Point	2/17/99	19	56	10.4	e 0.2	ND	e 0.3	0.2	ND	0.6	e 0.2	0.6	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	2/17/99	19	44	7.6	ND	0.3	ND	ND	ND	0.6	ND	1.0	ND	r 0.1	ND	ND	e 0.2
BA41	Redwood Creek	2/17/99	19	44	10.2	ND	ND	0.4	e 0.3	0.6	0.8	0.2	0.9	0.5	ND	ND	ND	ND
BA30	Dumbarton Bridge	2/17/99	19	52	20.0	ND	0.4	0.6	ND	e 0.5	1.3	0.3	1.7	0.5	ND	0.2	e 0.5	0.2
BA21	South Bay	2/17/99	19	46	7.0	ND	ND	ND	ND	ND	ND	ND	0.8	0.6	ND	ND	ND	ND
BA10	Coyote Creek	2/17/99	19	64	6.8	ND	0.2	0.3	0.2	e 0.2	0.5	ND	0.3	0.3	ND	ND	ND	ND
C-3-0	San Jose	2/18/99	19	61	79.6	e 0.5	0.8	1.9	1.5	1.3	4.5	0.9	2.5	1.2	ND	ND	ND	ND
C-1-3	Sunnyvale	2/18/99	19	64	4.0	ND	ND	ND	ND	ND	ND	0.2	0.3	ND	ND	ND	ND	ND
BW10	Standish Dam	2/22/99	19	52	26.7	ND	ND	e 0.9	0.7	e 0.7	2.1	0.4	1.6	e 0.8	ND	e 0.2	e 0.5	0.6
BW15	Guadalupe River	2/9/99	19	51	22.0	ND	1.4	0.4	ND	ND	ND	ND	0.3	0.6	ND	ND	ND	0.3
BG20	Sacramento River	7/22/99	21	72	0.1	ND	ND	ND	ND	ND	ND	ND	e 0.1	ND	ND	ND	ND	ND
BG30	San Joaquin River	7/22/99	21	71	3.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	7/22/99	21	49	1.2	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	e 0.1
BF21	Grizzly Bay	7/22/99	21	43	4.7	ND	ND	ND	ND	ND	ND	ND	e 0.2	ND	ND	ND	ND	e 0.1
BF10	Pacheco Creek	7/22/99	21	65	2.5	ND	ND	ND	e 0.1	ND	ND	e 0.1	e 0.2	ND	ND	ND	ND	0.1
BD50	Napa River	7/23/99	21	39	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	7/23/99	21	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	7/23/99	21	42	2.2	ND	ND	ND	ND	ND	0.1	0.1	e 0.3	0.1	ND	ND	ND	1.0
BD22	San Pablo Bay	7/23/99	21	45	1.1	ND	ND	ND	ND	ND	e 0.1	ND	0.3	ND	ND	ND	ND	ND
BD15	Petaluma River	7/23/99	21	44	1.2	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	1.2
BC60	Red Rock	7/23/99	21	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	7/26/99	21	44	3.0	ND	ND	ND	ND	ND	0.1	ND	e 0.2	ND	ND	ND	ND	ND
BC32	Richardson Bay	7/26/99	21	47	8.6	ND	ND	e 0.1	ND	ND	0.2	ND	e 0.4	e 0.1	ND	ND	ND	ND
BC21	Horseshoe Bay	7/26/99	21	65	11.0	ND	ND	ND	ND	ND	ND	ND	e 0.8	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	7/26/99	21	55	10.1	ND	ND	ND	ND	0.2	0.6	0.2	0.6	0.2	ND	ND	0.1	ND
BB70	Alameda	7/26/99	21	52	22.5	ND	e 0.2	ND	0.4	0.4	1.2	0.3	e 1.1	e 0.3	ND	ND	0.2	e 0.2
BB30	Oyster Point	7/27/99	21	56	8.3	ND	ND	ND	ND	ND	0.7	ND	e 0.7	0.2	ND	ND	ND	0.2
BB15	San Bruno Shoal	7/27/99	21	42	1.4	ND	ND	ND	ND	ND	0.2	ND	e 0.3	ND	ND	ND	ND	ND
BA41	Redwood Creek	7/27/99	21	51	4.1	ND	ND	0.1	ND	ND	0.2	0.1	e 0.4	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	7/27/99	21	43	6.2	ND	ND	0.1	ND	ND	0.3	ND	0.5	e 0.2	ND	ND	ND	ND
BA21	South Bay	7/27/99	21	45	7.9	ND	ND	ND	ND	ND	0.2	ND	0.4	ND	ND	ND	e 0.1	ND
BA10	Coyote Creek	7/28/99	21	56	19.3	ND	ND	ND	ND	ND	0.6	ND	e 0.7	0.2	ND	ND	ND	ND
C-3-0	San Jose	7/28/99	21	54	62.8	ND	e 0.4	ND	1.2	1.1	3.2	0.7	1.7	0.8	0.2	ND	ND	0.7
C-1-3	Sunnyvale	7/28/99	21	70	7.3	ND	ND	e 0.2	0.2	ND	0.4	ND	e 0.3	0.1	ND	ND	ND	e 0.2
BW10	Standish Dam	7/29/99	21	41	30.0	ND	ND	e 1.0	0.7	0.6	1.7	0.4	e 1.2	0.5	e 0.3	ND	ND	e 0.6
BW15	Guadalupe River	7/29/99	21	38	30.5	ND	ND	e 1.2	0.7	ND	1.9	ND	e 1.6	0.6	ND	ND	0.2	e 0.3

Table 15. Pesticide concentrations in sediment samples, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value,
ND = not detected, p = low precision (< 30% of field value), r = low recovery (< 2x outside target %). For method detection limits, refer to *QA Tables.*

Station Code	Station	Date	Cruise	% Solids	Sum of DDTs (SFEI)	o,p'-DDD	o,p'-DDE	o,p'-DDT	p,p'-DDD	p,p'-DDE	p,p'-DDT	Sum of Chlordanes	alpha-Chlordane	gamma-Chlordane	cis-Nonachlor	trans-Nonachlor	Heptachlor	Heptachlor Epoxide	Oxychlordane
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	0.4	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	2/11/99	19	72	0.4	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	2/11/99	19	53	8.7	ND	ND	ND	e 2.3	3.8	2.6	0.9	0.9	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	2/11/99	19	47	11.3	ND	ND	ND	3.0	e 3.7	4.6	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	2/11/99	19	67	1.4	ND	ND	0.2	ND	1.2	ND	0.7	ND	0.3	ND	0.2	e 0.2	ND	ND
BD50	Napa River	2/12/99	19	43	12.1	ND	ND	ND	e 4.0	e 4.1	4.0	1.2	ND	0.3	0.9	ND	ND	ND	ND
BD41	Davis Point	2/12/99	19	73	0.7	ND	ND	ND	e 0.3	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	2/12/99	19	53	7.5	ND	ND	0.4	e 1.8	2.4	2.9	1.1	ND	ND	0.5	ND	ND	0.5	ND
BD22	San Pablo Bay	2/12/99	19	51	8.2	ND	ND	ND	e 2.3	1.7	4.2	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	2/12/99	19	44	5.0	ND	ND	ND	2.2	2.9	ND	0.6	0.6	ND	ND	ND	ND	ND	ND
BC60	Red Rock	2/16/99	19	64	3.8	ND	ND	0.1	0.9	1.6	1.2	0.2	ND	ND	0.2	ND	ND	ND	ND
BC41	Point Isabel	2/16/99	19	48	7.9	0.8	ND	ND	e 2.4	e 2.0	2.7	0.2	ND	ND	ND	e 0.2	ND	ND	ND
BC32	Richardson Bay	2/16/99	19	51	6.2	ND	ND	ND	e 2.8	e 2.1	1.3	ND	ND	ND	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	2/16/99	19	66	1.0	ND	ND	ND	ND	e 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	2/16/99	19	46	5.1	ND	ND	ND	ND	e 2.4	2.7	ND	ND	ND	ND	ND	ND	ND	ND
BB70	Alameda	2/17/99	19	50	9.1	ND	ND	ND	3.5	e 1.9	3.7	ND	ND	ND	ND	ND	ND	ND	ND
BB30	Oyster Point	2/17/99	19	56	6.1	ND	ND	0.5	e 1.2	1.4	2.9	1.3	ND	ND	1.3	ND	ND	ND	ND
BB15	San Bruno Shoal	2/17/99	19	44	6.1	ND	ND	ND	2.1	2.4	r 1.6	0.1	ND	ND	ND	ND	r 0.1	ND	ND
BA41	Redwood Creek	2/17/99	19	44	9.2	ND	ND	ND	2.0	2.0	5.2	0.3	ND	ND	ND	e 0.3	ND	ND	ND
BA30	Dumbarton Bridge	2/17/99	19	52	8.6	ND	ND	ND	3.5	2.6	2.6	0.4	ND	ND	ND	0.4	ND	ND	ND
BA21	South Bay	2/17/99	19	46	5.0	ND	ND	ND	2.1	2.9	ND	1.9	ND	0.9	ND	0.7	0.3	ND	ND
BA10	Coyote Creek	2/17/99	19	64	3.9	ND	ND	ND	e 1.1	2.0	0.9	1.0	ND	e 0.6	ND	0.4	ND	ND	ND
C-3-0	San Jose	2/18/99	19	61	23.6	ND	0.6	0.6	9.1	11.9	1.4	3.0	2.5	e 0.3	ND	ND	ND	0.2	ND
C-1-3	Sunnyvale	2/18/99	19	64	0.8	ND	e 0.2	ND	ND	ND	0.7	0.1	ND	ND	ND	ND	ND	e 0.1	ND
BW10	Standish Dam	2/22/99	19	52	19.9	ND	ND	0.4	6.2	r 10.9	r 2.4	7.2	ND	2.6	r 2.6	2.0	ND	ND	ND
BW15	Guadalupe River	2/9/99	19	51	15.7	ND	ND	0.4	ND	9.0	6.4	8.4	0.6	2.3	2.9	2.0	0.4	0.2	ND
BG20	Sacramento River	7/22/99	21	72	1.3	ND	ND	ND	ND	0.3	e 1.0	ND	ND	ND	ND	B	ND	ND	ND
BG30	San Joaquin River	7/22/99	21	71	0.2	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	B	ND	ND	ND
BF40	Honker Bay	7/22/99	21	49	3.1	ND	ND	ND	e 0.6	0.9	e 1.6	ND	ND	ND	ND	B	ND	ND	ND
BF21	Grizzly Bay	7/22/99	21	43	4.3	ND	ND	0.1	ND	1.4	e 2.9	0.3	ND	ND	ND	b 0.3	ND	ND	ND
BF10	Pacheco Creek	7/22/99	21	65	2.4	ND	ND	0.1	0.5	e 0.5	e 1.3	ND	ND	ND	ND	B	ND	ND	ND
BD50	Napa River	7/23/99	21	39	3.1	ND	ND	0.1	ND	0.7	2.3	0.3	ND	ND	ND	0.3	ND	ND	ND
BD41	Davis Point	7/23/99	21	71	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	B	ND	ND	ND
BD31	Pinole Point	7/23/99	21	42	1.8	ND	ND	ND	ND	ND	e 1.8	0.3	ND	ND	ND	b 0.3	ND	ND	ND
BD22	San Pablo Bay	7/23/99	21	45	1.6	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND	B	ND	ND	ND
BD15	Petaluma River	7/23/99	21	44	2.4	ND	ND	ND	ND	ND	e 2.4	ND	ND	ND	ND	B	ND	ND	ND
BC60	Red Rock	7/23/99	21	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	7/26/99	21	44	2.4	ND	ND	ND	ND	e 0.5	e 1.8	0.3	ND	ND	ND	0.3	ND	ND	ND
BC32	Richardson Bay	7/26/99	21	47	2.4	ND	ND	ND	ND	0.7	1.7	ND	ND	ND	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	7/26/99	21	65	7.5	ND	ND	ND	ND	0.6	e 7.0	0.2	ND	ND	ND	0.2	ND	ND	ND
BC11	Yerba Buena Island	7/26/99	21	55	2.1	ND	ND	ND	ND	e 0.6	1.4	0.2	ND	ND	ND	0.2	ND	ND	ND
BB70	Alameda	7/26/99	21	52	30.2	ND	ND	0.2	ND	1.0	e 29.0	0.3	ND	ND	ND	e 0.3	ND	ND	ND
BB30	Oyster Point	7/27/99	21	56	3.0	ND	ND	ND	0.8	e 0.7	e 1.5	ND	ND	ND	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	7/27/99	21	42	1.8	ND	ND	ND	ND	ND	e 1.8	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	7/27/99	21	51	2.3	ND	ND	ND	ND	0.5	e 1.8	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	7/27/99	21	43	2.9	ND	ND	0.1	ND	e 0.8	2.0	ND	ND	ND	ND	ND	ND	ND	ND
BA21	South Bay	7/27/99	21	45	3.0	ND	ND	ND	ND	e 0.8	2.2	0.3	ND	ND	ND	e 0.3	ND	ND	ND
BA10	Coyote Creek	7/28/99	21	56	4.4	ND	ND	ND	e 1.3	1.6	e 1.5	2.1	0.5	0.6	0.5	0.6	ND	ND	ND
C-3-0	San Jose	7/28/99	21	54	13.5	ND	ND	ND	e 3.7	7.6	2.1	3.6	e 0.6	0.7	0.9	0.2	e 0.8	e 0.4	ND
C-1-3	Sunnyvale	7/28/99	21	70	5.7	0.5	ND	ND	1.5	2.6	e 1.0	2.1	e 0.5	0.6	0.2	0.5	0.3	ND	ND
BW10	Standish Dam	7/29/99	21	41	17.1	1.6	ND	ND	5.2	7.2	e 3.2	6.4	e 1.2	1.5	0.8	1.4	1.1	0.4	ND
BW15	Guadalupe River	7/29/99	21	38	15.2	ND	ND	ND	5.8	4.9	e 4.5	2.6	0.8	0.9	ND	0.9	ND	ND	ND

Data Table 15 continued on next page

Table 15. Pesticide concentrations in sediment samples, 1999 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, e = estimated value, ND = not detected, p = low precision (< 30% of field value), r = low recovery (< 2x outside target %). For method detection limits, refer to *QA Tables*.

Station Code	Station	Date	Cruise	% Solids	Aldrin	Dieldrin	Endrin	alpha-HCH	beta-HCH	delta-HCH	gamma-HCH	Mirex
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	2/11/99	19	77	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	2/11/99	19	72	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	2/11/99	19	53	ND	ND	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	2/11/99	19	47	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	2/11/99	19	67	ND	ND	ND	ND	ND	ND	ND	0.3
BD50	Napa River	2/12/99	19	43	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/12/99	19	73	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	2/12/99	19	53	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	2/12/99	19	51	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	2/12/99	19	44	ND	ND	ND	0.3	ND	ND	ND	0.7
BC60	Red Rock	2/16/99	19	64	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	2/16/99	19	48	ND	ND	ND	ND	e 0.5	ND	ND	0.5
BC32	Richardson Bay	2/16/99	19	51	ND	ND	ND	ND	1.1	ND	ND	0.8
BC21	Horseshoe Bay	2/16/99	19	66	e 0.1	ND	ND	ND	ND	ND	ND	e 0.4
BC11	Yerba Buena Island	2/16/99	19	46	ND	ND	ND	ND	ND	ND	ND	0.4
BB70	Alameda	2/17/99	19	50	ND	ND	ND	ND	ND	ND	ND	e 0.6
BB30	Oyster Point	2/17/99	19	56	ND	ND	ND	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	2/17/99	19	44	ND	ND	r 0.3	r 0.1	r 0.1	r 0.1	r 0.1	ND
BA41	Redwood Creek	2/17/99	19	44	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	2/17/99	19	52	ND	ND	ND	ND	ND	ND	ND	e 1.1
BA21	South Bay	2/17/99	19	46	ND	ND	ND	ND	1.6	ND	ND	ND
BA10	Coyote Creek	2/17/99	19	64	ND	ND	ND	ND	ND	ND	ND	ND
C-3-0	San Jose	2/18/99	19	61	ND	ND	ND	ND	0.3	ND	ND	e 0.2
C-1-3	Sunnyvale	2/18/99	19	64	ND	ND	ND	ND	ND	ND	ND	ND
BW10	Standish Dam	2/22/99	19	52	ND	0.5	ND	ND	r 0.1	ND	r 0.1	0.4
BW15	Guadalupe River	2/9/99	19	51	ND	1.1	ND	ND	ND	ND	ND	ND
BG20	Sacramento River	7/22/99	21	72	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	7/22/99	21	71	ND	ND	ND	0.2	ND	ND	ND	ND
BF40	Honker Bay	7/22/99	21	49	ND	ND	ND	ND	ND	ND	ND	0.2
BF21	Grizzly Bay	7/22/99	21	43	e 0.1	ND	ND	ND	ND	ND	ND	e 0.4
BF10	Pacheco Creek	7/22/99	21	65	ND	ND	ND	ND	ND	ND	ND	0.2
BD50	Napa River	7/23/99	21	39	ND	ND	ND	ND	ND	ND	ND	0.3
BD41	Davis Point	7/23/99	21	71	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	7/23/99	21	42	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	7/23/99	21	45	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	7/23/99	21	44	ND	ND	ND	ND	ND	ND	ND	ND
BC60	Red Rock	7/23/99	21	79	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	7/26/99	21	44	ND	ND	ND	e 0.1	ND	ND	ND	ND
BC32	Richardson Bay	7/26/99	21	47	ND	ND	ND	0.2	ND	ND	ND	ND
BC21	Horseshoe Bay	7/26/99	21	65	ND	ND	ND	e 0.2	ND	ND	ND	ND
BC11	Yerba Buena Island	7/26/99	21	55	ND	ND	ND	e 0.1	ND	ND	ND	ND
BB70	Alameda	7/26/99	21	52	ND	ND	ND	e 0.2	ND	ND	ND	ND
BB30	Oyster Point	7/27/99	21	56	ND	ND	ND	0.1	ND	ND	ND	ND
BB15	San Bruno Shoal	7/27/99	21	42	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	7/27/99	21	51	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	7/27/99	21	43	ND	ND	ND	ND	ND	ND	ND	ND
BA21	South Bay	7/27/99	21	45	ND	ND	ND	e 0.2	ND	ND	ND	ND
BA10	Coyote Creek	7/28/99	21	56	e 0.5	ND	ND	e 0.3	ND	ND	ND	e 0.8
C-3-0	San Jose	7/28/99	21	54	ND	ND	ND	e 0.3	ND	ND	ND	ND
C-1-3	Sunnyvale	7/28/99	21	70	ND	ND	ND	0.1	ND	ND	ND	ND
BW10	Standish Dam	7/29/99	21	41	ND	ND	ND	0.3	ND	ND	ND	e 0.9
BW15	Guadalupe River	7/29/99	21	38	ND	ND	ND	p 0.5	ND	ND	ND	ND

Table 16. Sediment bioassay results, 1999.

* = Sample mean was significantly different than control mean based on separate variance t-test (1-tailed, alpha = 0.01).
For physical/chemical measurements of test solutions and QA information, refer to *QA Tables*.

Station Code	Station	Date	Cruise	Mean % Normal Development	SD - % Normal Development	Mean % Survival	SD - % Survival	Bivalve SWI Mean % Survival	SD - Bivalve SWI Mean % Survival
				Mytilus galloprovincialis		*Eohaustorius estuarius*		*Mytilus galloprovincialis*	
BG20	Sacramento River	2/11/99	19	0 *	0 *	96	4	0 *	0 *
BG30	San Joaquin River	2/11/99	19	0 *	0 *	88	6	0 *	0 *
BF21	Grizzly Bay	2/11/99	19	0 *	0 *	29 *	15 *	18 *	4 *
BD50	Napa River	2/12/99	19	0 *	0 *	63 *	15 *	20 *	13 *
BD41	Davis Point	2/12/99	19	89	8	96	4	67	8
BC60	Red Rock	2/16/99	19	90	5	79	25	92	7
BC21	Horseshoe Bay	2/16/99	19	92	10	91	4	84	8
BC11	Yerba Buena Island	2/16/99	19	93	5	41 *	8 *	84	5
BB70	Alameda	2/17/99	19	86	4	65 *	9 *	80	7
BB15	San Bruno Shoal	2/17/99	19	91	2	67 *	7 *	73	11
BA41	Redwood Creek	2/17/99	19	93	7	35 *	32 *	73	4
BA21	South Bay	2/17/99	19	89	8	65 *	19 *	55 *	7 *
BA10	Coyote Creek	2/17/99	19	90	6	78 *	16 *	80	2
C-3-0	San Jose	2/18/99	19	0 *	0 *	89	4	44 *	17 *
-	Control	-	19	88	8	100	0	85	6
BG20	Sacramento River	7/22/99	21	0 *	0 *	96	4	11 *	16 *
BG30	San Joaquin River	7/22/99	21	0 *	0 *	87	10	0 *	0 *
BF21	Grizzly Bay	7/22/99	21	0 *	0 *	63 *	14 *	80	8
BD50	Napa River	7/23/99	21	89	8	8 *	6 *	82	8
BD41	Davis Point	7/23/99	21	87	11	95	4	84	10
BC60	Red Rock	7/23/99	21	87	13	91	10	79	5
BC21	Horseshoe Bay	7/26/99	21	88	17	68	38	80	6
BC11	Yerba Buena Island	7/26/99	21	92	7	52 *	19 *	82	5
BB70	Alameda	7/26/99	21	84	6	47	44	79	6
BB15	San Bruno Shoal	7/27/99	21	83	4	58	33	88	5
BA41	Redwood Creek	7/27/99	21	80	12	54 *	16 *	86	9
BA21	South Bay	7/27/99	21	87	5	71	17	84	5
BA10	Coyote Creek	7/28/99	21	83	6	76	19	92	6
C-3-0	San Jose	7/28/99	21	88	11	74	14	80	8
-	Control	-	21	89	7	91	8	90	5

Table 17. Ancillary bivalve tissue data, 1999.

NA = not analyzed. Bivalves were not deployed at Grizzly Bay in 1999.

CFLU - *Corbicula fluminea* , CGIG - *Crassostrea gigas* , MCAL - *Mytilus californianus*

T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.

There are no T-0 values from Bodega Head and Tomales Bay for Cruise 19; samples were accidentally destroyed.

Station Code	Station	Date	Cruise	Species	% Lipids	% Moisture	% Solids - Organics	% Solids - Trace Elements	Dry Weight
					%	%	%	%	g
BG20	Sacramento River	5/6/99	19	CFLU	8.4	90.8	9.7	7.4	2.0
BG30	San Joaquin River	5/6/99	19	CFLU	8.4	92.2	8.6	8.6	2.2
BF20	Grizzly Bay	-	19	-	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	12.7	89.3	7.0	8.9	5.4
BD40	Davis Point	4/27/99	19	CGIG	10.4	84.1	9.9	10.5	9.9
BD30	Pinole Point	4/30/99	19	MCAL	4.5	90.4	7.5	9.3	4.2
BD20	San Pablo Bay	4/30/99	19	CGIG	10.6	87.8	12.6	12.8	5.8
BD15	Petaluma River	4/30/99	19	CGIG	1.6	76.0	8.0	21.1	13.0
BC61	Red Rock	4/30/99	19	MCAL	4.9	90.0	9.6	9.2	4.2
BC21	Horseshoe Bay	4/30/99	19	MCAL	6.9	86.4	13.7	9.9	5.5
BC10	Yerba Buena Island	4/28/99	19	MCAL	6.9	66.9	14.3	10.7	16.3
BB71	Alameda	4/28/99	19	MCAL	6.8	64.1	14.2	10.8	16.1
BA40	Redwood Creek	4/28/99	19	MCAL	8.0	79.2	20.9	15.4	7.2
BA30	Dumbarton Bridge	4/28/99	19	MCAL	7.4	83.7	15.9	12.3	6.2
BA10	Coyote Creek	4/28/99	19	CGIG	13.0	82.4	16.7	16.0	10.9
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	6.1	92.7	10.2	7.4	2.4
BG30	San Joaquin River	9/21/99	21	CFLU	7.0	94.3	7.2	2.8	2.2
BF20	Grizzly Bay	-	21	-	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	9.0	92.0	8.6	8.5	4.2
BD40	Davis Point	9/16/99	21	CGIG	12.4	91.3	11.1	9.8	4.8
BD30	Pinole Point	9/15/99	21	MCAL	5.4	91.4	8.7	7.4	3.5
BD20	San Pablo Bay	9/15/99	21	CGIG	10.5	90.0	11.6	9.8	4.7
BD15	Petaluma River	9/15/99	21	CGIG	7.9	93.6	8.3	7.5	2.7
BC61	Red Rock	9/15/99	21	MCAL	4.9	89.2	11.2	9.3	4.1
BC21	Horseshoe Bay	9/15/99	21	MCAL	5.0	82.8	18.2	9.1	4.4
BC10	Yerba Buena Island	9/14/99	21	MCAL	5.6	88.8	12.0	8.4	4.3
BB71	Alameda	9/14/99	21	MCAL	6.0	90.5	10.1	7.7	2.9
BA40	Redwood Creek	9/14/99	21	MCAL	4.5	92.5	8.4	6.4	3.4
BA30	Dumbarton Bridge	9/14/99	21	MCAL	4.3	92.5	9.4	6.0	3.3
BA10	Coyote Creek	9/14/99	21	CGIG	1.9	94.5	19.4	5.8	2.9
T-0	Tomales Bay	6/4/99	21	CGIG	7.0	82.4	19.7	15.2	7.0
T-0	Bodega Head	6/4/99	21	MCAL	4.7	89.5	12.4	7.6	4.6

Table 18. Bivalve condition index and survival, 1999.

NA = not analyzed, NA* = resident bivalves used. Bivalves were not deployed at Grizzly Bay in 1999.
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.

Station Code	Station	Date	Cruise	Species	CI Mean	CI Standard Error	% Survival per Species
BG20	Sacramento River	5/6/99	19	CFLU			NA*
BG30	San Joaquin River	5/6/99	19	CFLU			NA*
BF20	Grizzly Bay	-	19	NA			NA
BD50	Napa River	4/27/99	19	CGIG			99
BD40	Davis Point	4/27/99	19	CGIG			100
BD30	Pinole Point	4/30/99	19	MCAL			96
BD20	San Pablo Bay	4/30/99	19	CGIG			100
BD15	Petaluma River	4/30/99	19	CGIG			100
BC61	Red Rock	4/30/99	19	MCAL			99
BC21	Horseshoe Bay	4/30/99	19	MCAL			84
BC10	Yerba Buena Island	4/28/99	19	MCAL			94
BB71	Alameda	4/28/99	19	MCAL			99
BA40	Redwood Creek	4/28/99	19	MCAL	CI could not be		99
BA30	Dumbarton Bridge	4/28/99	19	MCAL	calculated due to		99
BA10	Coyote Creek	4/28/99	19	CGIG	missing T-0 values.		97
T-0	Tomales Bay	12/28/98	19	CGIG	There are no T-0 values for cruise 19 because the specimen from		
T-0	Bodega Head	12/17/98	19	MCAL	Bodega Head and Tomales Bay were accidentally destroyed.		
BG20	Sacramento River	9/21/99	21	CFLU	0.0493	0.0038	NA*
BG30	San Joaquin River	9/21/99	21	CFLU	0.0639	0.0043	NA*
BF20	Grizzly Bay	-	21	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	0.0676	0.0043	54
BD40	Davis Point	9/16/99	21	CGIG	0.0814	0.0038	36
BD30	Pinole Point	9/15/99	21	MCAL	0.0664	0.0026	76
BD20	San Pablo Bay	9/15/99	21	CGIG	0.0986	0.0042	57
BD15	Petaluma River	9/15/99	21	CGIG	0.0593	0.0028	53
BC61	Red Rock	9/15/99	21	MCAL	0.0824	0.0017	88
BC21	Horseshoe Bay	9/15/99	21	MCAL	0.1499	0.0038	39
BC10	Yerba Buena Island	9/14/99	21	MCAL	NA	NA	0
BB71	Alameda	9/14/99	21	MCAL	0.0869	0.0018	96
BA40	Redwood Creek	9/14/99	21	MCAL	0.0633	0.0014	95
BA30	Dumbarton Bridge	9/14/99	21	MCAL	0.0585	0.0014	99
BA10	Coyote Creek	9/14/99	21	CGIG	0.0482	0.0036	71
T-0	Tomales Bay	6/4/99	21	CGIG	0.1617	0.004	NA
T-0	Bodega Head	6/4/99	21	MCAL	0.0747	0.0019	NA

CFLU - *Corbicula fluminea* , CGIG - *Crassostrea gigas* , MCAL - *Mytilus californianus*

Table 19. Trace element concentration in bivalve tissue, 1999. Units expressed as dry weight.

NA = not analyzed, ND = not detected, NS = not sampled, b = blank contamination <30% of measured concentration, e = estimated value.
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	% Solids	Ag	Al	As	Cd	Cr	Cu	Hg
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BG20	Sacramento River	5/6/99	19	CFLU	7.4	0.003	e,b 2104.9	b 11.80	2.01	10.36	71.9	b 0.20
BG30	San Joaquin River	5/6/99	19	CFLU	8.6	0.59	e,b 5218.1	9.29	2.90	16.54	105.8	b 0.20
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	8.9	2.54	e,b 1077.4	7.11	10.18	2.88	186.0	b 0.38
BD40	Davis Point	4/27/99	19	CGIG	10.5	3.27	e,b 779.2	5.99	9.62	2.37	216.8	b 0.32
BD30	Pinole Point	4/30/99	19	MCAL	9.3	ND	e,b 1731.5	7.54	7.22	5.75	13.9	b 0.17
BD20	San Pablo Bay	4/30/99	19	CGIG	12.8	3.08	e,b 535.0	7.27	8.66	1.37	189.3	b 0.26
BD15	Petaluma River	4/30/99	19	CGIG	21.1	2.24	e,b 1938.0	3.69	11.70	5.30	176.4	b 0.52
BC61	Red Rock	4/30/99	19	MCAL	9.2	ND	e,b 756.8	9.35	5.53	14.98	9.6	b 0.22
BC21	Horseshoe Bay	4/30/99	19	MCAL	9.9	0.04	e,b 735.3	11.70	4.84	2.81	9.2	b 0.26
BC10	Yerba Buena Island	4/28/99	19	MCAL	10.7	0.03	e,b 965.6	8.42	3.66	2.86	7.3	b 0.19
BB71	Alameda	4/28/99	19	MCAL	10.8	0.11	e,b 898.0	7.66	5.60	2.93	11.0	b 0.19
BA40	Redwood Creek	4/28/99	19	MCAL	15.4	0.16	e,b 557.4	7.12	3.36	2.23	12.4	b 0.16
BA30	Dumbarton Bridge	4/28/99	19	MCAL	12.3	0.08	e,b 498.3	7.79	2.84	1.80	6.6	b 0.21
BA10	Coyote Creek	4/28/99	19	CGIG	16.0	3.96	e,b 640.8	6.19	4.38	1.89	191.8	b 0.18
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	7.4	0.177	b 5894.0	17.43	3.61	29.57	177.8	b 0.32
BG30	San Joaquin River	9/21/99	21	CFLU	2.8	0.52	b 2901.0	24.1	4.83	21.26	284.5	b 0.52
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	8.5	7.411	b 1091.0	6.45	17.73	2.7	560.0	b 0.38
BD40	Davis Point	9/16/99	21	CGIG	9.8	7.584	b 587.0	6.07	13.36	2.46	410.6	b 0.24
BD30	Pinole Point	9/15/99	21	MCAL	7.4	0.125	b 931.0	9.05	5.53	3.41	9.0	b 0.36
BD20	San Pablo Bay	9/15/99	21	CGIG	9.8	10.535	b 740.0	7.34	15.02	2.02	473.5	b 0.27
BD15	Petaluma River	9/15/99	21	CGIG	7.5	3.016	b 383.0	8.49	6.54	0.94	182.8	b 0.38
BC61	Red Rock	9/15/99	21	MCAL	9.3	0.108	b 1125.0	11.42	6.83	5.44	10.9	b 0.34
BC21	Horseshoe Bay	9/15/99	21	MCAL	9.1	0.109	b 575.0	14.11	6.59	3.06	7.8	0.20
BC10	Yerba Buena Island	9/14/99	21	MCAL	8.4	0.137	b 868.0	10.91	6.09	3.2	9.0	b 0.32
BB71	Alameda	9/14/99	21	MCAL	7.7	0.144	b 638.0	12.28	6.23	2.8	7.3	b 0.29
BA40	Redwood Creek	9/14/99	21	MCAL	6.4	0.202	b 1048.0	8.45	8.21	4.59	8.3	b 0.49
BA30	Dumbarton Bridge	9/14/99	21	MCAL	6.0	0.171	b 654.0	8.47	7.57	3.25	6.6	b 0.58
BA10	Coyote Creek	9/14/99	21	CGIG	5.8	17.654	b 639.0	8.53	17.41	2.02	535.4	b 0.52
T-0	Tomales Bay	6/4/99	21	CGIG	15.2	0.702	b 41.3	7.41	5.47	0.27	59.9	b 0.20
T-0	Bodega Head	6/4/99	21	MCAL	7.6	0.069	b 62.8	16.62	6.25	1.14	6.2	b 0.19

CFLU - *Corbicula fluminea*, CGIG - *Crassostrea gigas*, MCAL - *Mytilus californianus*

Data Table 19 continued on next page

Table 19. Trace element concentration in bivalve tissue, 1999 (continued). Units expressed as dry weight.
NA = not analyzed, ND = not detected, NS = not sampled, b = blank contamination <30% of measured concentration, e = estimated value.
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	% Solids	Ni	Pb	Se	Zn	DBT	MBT	TBT	TTBT
						mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	5/6/99	19	CFLU	7.4	8.87	2.46	4.05	165.2	NA	NA	NA	NA
BG30	San Joaquin River	5/6/99	19	CFLU	8.6	16.37	10.50	4.42	229.6	16.21	17.47	28.54	ND
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	8.9	e 3.26	0.61	3.04	1005.7	9.52	ND	14.31	ND
BD40	Davis Point	4/27/99	19	CGIG	10.5	2.84	0.63	4.02	1145.4	4.40	ND	5.10	ND
BD30	Pinole Point	4/30/99	19	MCAL	9.3	6.81	2.00	3.42	237.0	11.52	ND	55.11	ND
BD20	San Pablo Bay	4/30/99	19	CGIG	12.8	2.13	0.49	4.80	941.7	ND	ND	3.57	ND
BD15	Petaluma River	4/30/99	19	CGIG	21.1	7.87	1.45	1.49	898.0	4.61	0.26	21.86	ND
BC61	Red Rock	4/30/99	19	MCAL	9.2	4.92	1.53	4.42	177.7	4.41	ND	2.76	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	9.9	4.39	1.66	5.45	168.2	ND	ND	ND	ND
BC10	Yerba Buena Island	4/28/99	19	MCAL	10.7	4.21	1.46	b 4.37	153.3	4.98	0.89	58.80	ND
BB71	Alameda	4/28/99	19	MCAL	10.8	4.75	1.93	4.82	213.0	ND	ND	7.27	ND
BA40	Redwood Creek	4/28/99	19	MCAL	15.4	e 3.73	1.39	2.75	169.7	1.17	ND	1.70	ND
BA30	Dumbarton Bridge	4/28/99	19	MCAL	12.3	3.15	0.86	3.70	117.6	1.89	ND	14.42	ND
BA10	Coyote Creek	4/28/99	19	CGIG	16.0	e 1.96	0.53	4.40	871.7	1.88	ND	2.38	ND
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	7.4	18.24	2.783	5.095	b 170.0	5.35	28.83	14.2	ND
BG30	San Joaquin River	9/21/99	21	CFLU	2.8	12.3	1.451	7.367	b 207.0	15.8	44.47	24.43	ND
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	8.5	3.34	1.231	4.261	b 1396.0	4.35	4.26	80.39	ND
BD40	Davis Point	9/16/99	21	CGIG	9.8	2.66	0.422	3.153	b 981.0	3.19	3.05	73.59	ND
BD30	Pinole Point	9/15/99	21	MCAL	7.4	4.87	2.509	3.981	b 249.0	4.03	ND	46.92	ND
BD20	San Pablo Bay	9/15/99	21	CGIG	9.8	2.68	0.902	2.97	b 1045.0	2.1	ND	38.44	ND
BD15	Petaluma River	9/15/99	21	CGIG	7.5	1.43	0.325	5.764	b 392.0	ND	ND	6.36	ND
BC61	Red Rock	9/15/99	21	MCAL	9.3	6	2.244	5.18	b 261.0	4.77	3.85	55.46	ND
BC21	Horseshoe Bay	9/15/99	21	MCAL	9.1	3.76	1.364	5.372	b 170.0	4.7	ND	56.27	ND
BC10	Yerba Buena Island	9/14/99	21	MCAL	8.4	4.03	2.983	3.377	b 258.0	5.07	5.48	116.9	ND
BB71	Alameda	9/14/99	21	MCAL	7.7	3.6	1.966	4.479	b 244.0	5.75	3.59	86.69	ND
BA40	Redwood Creek	9/14/99	21	MCAL	6.4	6.36	3.048	4.509	b 314.0	3.07	ND	8.55	ND
BA30	Dumbarton Bridge	9/14/99	21	MCAL	6.0	5.47	2.075	3.035	b 287.0	ND	ND	7.32	ND
BA10	Coyote Creek	9/14/99	21	CGIG	5.8	3.27	0.98	4.801	b 1590.0	ND	ND	1.51	ND
T-0	Tomales Bay	6/4/99	21	CGIG	15.2	0.23	0.235	2.06	b 379.0	ND	ND	ND	ND
T-0	Bodega Head	6/4/99	21	MCAL	7.6	2.29	1.197	2.757	b 203.0	ND	ND	2.79	ND

CFLU - *Corbicula fluminea*, CGIG - *Crassostrea gigas*, MCAL - *Mytilus californianus*

Table 20. PAH concentration in bivalve tissue, 1999. LPAH = low molecular weight PAHs, NA = not analyzed, ND = not detected.
Units expressed as dry weight. T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	Total LPAH	Biphenyl	Naphthalene	1-Methylnaphthalene	2-Methylnaphthalene	2,6-Dimethylnaphthalene	2,3,5-Trimethylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Dibenzothiophene	Fluorene	Phenanthrene	1-Methylphenanthrene
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG30	San Joaquin River	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	40.45	ND	5.4	ND	ND	ND	ND	ND	ND	6.77	ND	ND	28.3	ND
BD40	Davis Point	4/27/99	19	CGIG	18.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18.9	ND
BD30	Pinole Point	4/30/99	19	MCAL	41.14	ND	12.9	ND	8.84	ND	ND	ND	ND	ND	ND	ND	19.4	ND
BD20	San Pablo Bay	4/30/99	19	CGIG	51.42	ND	7.4	ND	ND	ND	ND	6.7	ND	5.9	ND	7.6	23.8	ND
BD15	Petaluma River	4/30/99	19	CGIG	12.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	12.1	ND
BC61	Red Rock	4/30/99	19	MCAL	40.01	ND	12.7	ND	8.81	ND	ND	ND	ND	ND	ND	ND	18.5	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	59.44	ND	17.7	ND	11.2	ND	ND	ND	ND	ND	ND	7.6	22.9	ND
BC10	Yerba Buena Island	4/28/99	19	MCAL	13	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	ND
BB71	Alameda	4/28/99	19	MCAL	6.86	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.86	ND
BA40	Redwood Creek	4/28/99	19	MCAL	26	ND	10.3	ND	5.1	ND	ND	ND	ND	ND	ND	ND	10.6	ND
BA30	Dumbarton Bridge	4/28/99	19	MCAL	34.37	ND	13.2	ND	6.67	ND	ND	ND	ND	ND	ND	ND	14.5	ND
BA10	Coyote Creek	4/28/99	19	CGIG	23.25	ND	6.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	16.4	ND
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	115.57	7.2	17.1	ND	7.61	5.6	ND	ND	6.4	9.62	ND	14.6	32.7	14.82
BG30	San Joaquin River	9/21/99	21	CFLU	158.91	12.9	32.9	6.32	10.2	8.7	11.9	ND	ND	11.77	ND	12.4	34.41	17.34
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	109.9	ND	24.6	ND	6.43	ND	6.8	12.9	5.5	14.53	ND	7.5	25.93	5.7
BD40	Davis Point	9/16/99	21	CGIG	72.73	ND	16.5	ND	5.96	ND	ND	5.2	ND	7.33	ND	11.2	20.95	5.54
BD30	Pinole Point	9/15/99	21	MCAL	37.78	ND	10	ND	5.17	ND	ND	ND	ND	6.65	ND	ND	15.93	ND
BD20	San Pablo Bay	9/15/99	21	CGIG	45.75	ND	13.7	ND	ND	ND	ND	6.1	ND	6.57	ND	5.2	14.21	ND
BD15	Petaluma River	9/15/99	21	CGIG	66.41	5.7	25.9	ND	7.55	5.4	ND	ND	ND	6.1	ND	ND	15.77	ND
BC61	Red Rock	9/15/99	21	MCAL	33.54	ND	13.2	ND	ND	ND	ND	ND	ND	ND	ND	6.3	14.08	ND
BC21	Horseshoe Bay	9/15/99	21	MCAL	55.68	ND	11.3	ND	6.23	ND	ND	ND	ND	8.13	ND	5	24.98	ND
BC10	Yerba Buena Island	9/14/99	21	MCAL	167.76	5.1	15.8	ND	ND	10.5	8.6	10.9	5.1	26.59	ND	16.3	68.89	ND
BB71	Alameda	9/14/99	21	MCAL	61.92	ND	15.1	ND	6.4	ND	ND	ND	ND	10.08	ND	5.9	24.48	ND
BA40	Redwood Creek	9/14/99	21	MCAL	40.04	ND	12.9	ND	6.04	ND	ND	ND	ND	5.69	ND	ND	15.39	ND
BA30	Dumbarton Bridge	9/14/99	21	MCAL	43.84	ND	14.8	ND	6.23	ND	ND	ND	ND	5.45	ND	ND	17.36	ND
BA10	Coyote Creek	9/14/99	21	CGIG	87.67	ND	19.8	ND	6.97	ND	5.9	8.8	ND	10.39	ND	10.8	25.07	ND
T-0	Tomales Bay	6/4/99	21	CGIG	12.49	ND	6.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	ND
T-0	Bodega Head	6/4/99	21	MCAL	28.56	ND	13.5	ND	6.96	ND	ND	ND	ND	ND	ND	ND	8.09	ND

Data Table 20 continued on next page

Table 20. PAH concentration in bivalve tissue, 1999 (continued). HPAH = high molecular weight PAHs, NA = not analyzed, ND = not detected.
Units expressed as dry weight. T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	Total HPAH	Benz(a)anthracene	Chrysene	Fluoranthene	Pyrene	Benzo(a)pyrene	Benzo(e)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Perylene	Benzo(ghi)perylene	Indeno(1,2,3-cd)pyrene
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG30	San Joaquin River	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	368.3	29	33.3	72	86.1	22.4	32.7	35.4	10.9	ND	15.7	18.8	12
BD40	Davis Point	4/27/99	19	CGIG	232.41	17.9	19.5	50.4	57.1	11.8	21.6	22.8	6.74	ND	10	8.93	5.64
BD30	Pinole Point	4/30/99	19	MCAL	70.81	5.26	ND	12.4	15.2	6.5	5.91	7.1	ND	ND	5.4	7.54	5.54
BD20	San Pablo Bay	4/30/99	19	CGIG	197.69	9.05	9.06	66.7	80.6	ND	11.9	11.1	ND	ND	ND	9.28	ND
BD15	Petaluma River	4/30/99	19	CGIG	205.5	14.7	16.8	33.2	41.9	15.9	20.6	22.2	8.06	ND	9.5	12.9	9.73
BC61	Red Rock	4/30/99	19	MCAL	61.09	ND	5.99	13.2	16	6.02	5.47	7.62	ND	ND	ND	6.79	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	73.27	5.18	15	13.1	14.3	5.3	ND	5.41	ND	ND	ND	9.85	5.13
BC10	Yerba Buena Island	4/28/99	19	MCAL	19.32	ND	ND	9.53	9.79	ND	ND	ND	ND	ND	ND	ND	ND
BB71	Alameda	4/28/99	19	MCAL	14.28	ND	ND	6.25	8.03	ND	ND	ND	ND	ND	ND	ND	ND
BA40	Redwood Creek	4/28/99	19	MCAL	62.27	ND	10.3	10.9	14.3	6.33	5.81	7.48	ND	ND	ND	7.15	ND
BA30	Dumbarton Bridge	4/28/99	19	MCAL	88.59	5.34	ND	14.5	20.6	8.79	8.08	10.3	ND	ND	ND	12.6	8.38
BA10	Coyote Creek	4/28/99	19	CGIG	336.35	21.2	25.8	51.2	66.4	19.7	53.1	48.1	12.1	ND	8.7	19.7	10.4
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	237.7	17.24	61.6	47.49	49.59	10.43	15.9	17.54	7.1	ND	10.8	ND	ND
BG30	San Joaquin River	9/21/99	21	CFLU	290.17	15.76	54.54	39.6	58	16.16	18.69	22.58	7.59	5.06	16.5	19.51	16.23
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	489.12	33.48	31.08	108.51	105.36	24.4	47.64	61.35	18.12	ND	27.2	18.17	13.86
BD40	Davis Point	9/16/99	21	CGIG	409.06	25.61	33.85	87.52	76.47	18.36	45.09	59.07	15.53	ND	23.5	14.67	9.42
BD30	Pinole Point	9/15/99	21	MCAL	53.14	6.19	5.46	14.55	13.67	ND	ND	7.71	ND	ND	ND	5.56	ND
BD20	San Pablo Bay	9/15/99	21	CGIG	428.36	24.13	30.06	80.93	77.23	25.08	52.61	67.58	19.07	ND	24.1	16.14	11.42
BD15	Petaluma River	9/15/99	21	CGIG	336.06	12.58	15.76	50.35	72.34	23.68	40.78	49.54	12.83	ND	16.6	23.89	17.68
BC61	Red Rock	9/15/99	21	MCAL	70.38	6.56	13.07	12.67	ND	7.67	5.22	10.01	ND	ND	ND	8.6	6.58
BC21	Horseshoe Bay	9/15/99	21	MCAL	56.91	5.55	5.61	14.07	14.17	ND	ND	6.87	ND	ND	ND	5.64	5
BC10	Yerba Buena Island	9/14/99	21	MCAL	122.36	14.26	25.65	23.36	25.53	6.17	5.68	9.36	ND	ND	ND	6.84	5.51
BB71	Alameda	9/14/99	21	MCAL	93.71	6.39	5.62	18.94	21.53	7.37	5.54	10.49	ND	ND	ND	9.96	7.87
BA40	Redwood Creek	9/14/99	21	MCAL	103.75	7.25	7.3	15.39	20.4	10.26	7.53	12.23	ND	ND	ND	13.35	10.04
BA30	Dumbarton Bridge	9/14/99	21	MCAL	65.18	ND	5.13	11.76	14.55	6.09	5.01	8.1	ND	ND	ND	7.74	6.8
BA10	Coyote Creek	9/14/99	21	CGIG	891.37	45.47	63.48	142.24	147.68	56.38	120.21	158.37	40.81	6.16	52.7	32.95	24.88
T-0	Tomales Bay	6/4/99	21	CGIG	12.41	ND	ND	6.82	5.59	ND	ND	ND	ND	ND	ND	ND	ND
T-0	Bodega Head	6/4/99	21	MCAL	9.04	ND	9.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 21. PCB concentration in bivalve tissue, 1999.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.
NA = not analyzed, ND = not detected. Units expressed as dry weight.
CFLU - *Corbicula fluminea*, CGIG - *Crassostrea gigas*, MCAL - *Mytilus californianus*.
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	SUM of PCBs (SFEI)	PCB 008	PCB 017/18	PCB 018	PCB 020/33	PCB 028	PCB 028/31	PCB 031	PCB 033	PCB 044	PCB 049	PCB 052	PCB 056/60	PCB 060	PCB 066	PCB 070	PCB 074
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	5/6/99	19	CFLU	174.11	4.87	5.52	*r*	4.87	*s*	b 11.4	*s*	*t*	5.52	3.55	4.08	1.72	*u*	2.07	2.65	1.66
BG30	San Joaquin River	5/6/99	19	CFLU	253.86	5.55	5.27	*r*	6.59	*s*	b 11.5	*s*	*t*	6.56	4.27	4.93	4.39	*u*	3.89	4.71	3.36
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	75.17	1.65	1.58	*r*	1.89	*s*	b 4.22	*s*	*t*	1.4	1.92	2.67	ND	*u*	ND	1.66	ND
BD40	Davis Point	4/27/99	19	CGIG	61.7	1.06	1.14	*r*	1.21	*s*	B	*s*	*t*	1.03	1.62	2.18	ND	*u*	ND	1.33	ND
BD30	Pinole Point	4/30/99	19	MCAL	87.89	2.21	1.78	*r*	2.68	*s*	B	*s*	*t*	1.58	1.6	1.88	1.45	*u*	1.51	1.57	1.24
BD20	San Pablo Bay	4/30/99	19	CGIG	119.24	1.6	1.34	*r*	1.31	*s*	b 4.02	*s*	*t*	2.27	3.44	4.35	1.04	*u*	1.23	2.3	1.07
BD15	Petaluma River	4/30/99	19	CGIG	31.57	ND	ND	*r*	ND	*s*	B	*s*	*t*	ND	ND	1.34	ND	*u*	ND	ND	ND
BC61	Red Rock	4/30/99	19	MCAL	51.72	2.34	2.03	*r*	2.62	*s*	B	*s*	*t*	1.3	1.34	1.82	ND	*u*	ND	ND	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	54.5	1.17	ND	*r*	1.14	*s*	b 2.97	*s*	*t*	ND	1.14	1.57	ND	*u*	ND	ND	ND
BC10	Yerba Buena Island	4/28/99	19	MCAL	21.78	ND	ND	*r*	ND	*s*	B	*s*	*t*	ND	ND	ND	ND	*u*	ND	ND	ND
BB71	Alameda	4/28/99	19	MCAL	36.08	ND	ND	*r*	ND	*s*	B	*s*	*t*	ND	1.35	1.6	ND	*u*	1.01	1.4	ND
BA40	Redwood Creek	4/28/99	19	MCAL	123.43	1.58	1.58	*r*	1.91	*s*	B	*s*	*t*	1.87	2.7	3.81	ND	*u*	2.26	2.48	1.13
BA30	Dumbarton Bridge	4/28/99	19	MCAL	130.5	2.06	1.62	*r*	1.93	*s*	B	*s*	*t*	1.62	2.78	3.29	ND	*u*	1.54	2.38	1.02
BA10	Coyote Creek	4/28/99	19	CGIG	260.82	2.06	1.93	*r*	1.97	*s*	B	*s*	*t*	4.72	7.11	9.67	2.71	*u*	4.74	7.17	3.11
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	200.54	1.12	ND	*r*	2.42	*s*	ND	*s*	*t*	9.59	ND	ND	ND	*u*	ND	ND	ND
BG30	San Joaquin River	9/21/99	21	CFLU	187.6	1.74	2.53	*r*	3.09	*s*	4.37	*s*	*t*	6.24	4.41	4.1	ND	*u*	2.38	2.71	2.33
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	110.27	ND	ND	*r*	ND	*s*	2.18	*s*	*t*	1.57	2.53	3.02	ND	*u*	1.17	1.96	ND
BD40	Davis Point	9/16/99	21	CGIG	149.56	ND	ND	*r*	ND	*s*	3.03	*s*	*t*	2.26	3.41	4.26	ND	*u*	1.79	2.92	1.52
BD30	Pinole Point	9/15/99	21	MCAL	77.57	ND	ND	*r*	ND	*s*	ND	*s*	*t*	1.52	2.04	2.16	ND	*u*	1.67	2.24	1.15
BD20	San Pablo Bay	9/15/99	21	CGIG	147.2	ND	ND	*r*	1.07	*s*	2.37	*s*	*t*	1.88	3.74	3.71	ND	*u*	1.63	2.35	1.16
BD15	Petaluma River	9/15/99	21	CGIG	92.79	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	1.7	1.51	ND	*u*	ND	1.33	ND
BC61	Red Rock	9/15/99	21	MCAL	53.3	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	1.55	1.38	ND	*u*	ND	ND	ND
BC21	Horseshoe Bay	9/15/99	21	MCAL	62.46	ND	ND	*r*	ND	*s*	ND	*s*	*t*	1.09	1.41	2.13	ND	*u*	1.23	1.25	ND
BC10	Yerba Buena Island	9/14/99	21	MCAL	102.97	ND	ND	*r*	ND	*s*	ND	*s*	*t*	1.48	2.8	2.88	ND	*u*	1.2	2.57	1.04
BB71	Alameda	9/14/99	21	MCAL	113.3	ND	ND	*r*	ND	*s*	ND	*s*	*t*	1.07	2.05	2.61	ND	*u*	1.57	1.63	ND
BA40	Redwood Creek	9/14/99	21	MCAL	111.91	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	1.49	1.89	ND	*u*	1.61	1.47	ND
BA30	Dumbarton Bridge	9/14/99	21	MCAL	89.73	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	1.31	1.49	ND	*u*	1.05	1.6	ND
BA10	Coyote Creek	9/14/99	21	CGIG	137.74	ND	ND	*r*	ND	*s*	ND	*s*	*t*	1.59	3.05	2.95	ND	*u*	1.45	2.51	1.35
T-0	Tomales Bay	6/4/99	21	CGIG	1.09	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	ND	ND	ND	*u*	ND	ND	ND
T-0	Bodega Head	6/4/99	21	CGIG	1.09	ND	ND	*r*	ND	*s*	ND	*s*	*t*	ND	ND	ND	ND	*u*	ND	ND	ND

Footnotes:
r = PCB 017 and 018 coeluted. See PCB 017/18.
s = PCB 028 and 031 coeluted. See PCB 028/31.
t = PCB 020 and 033 coeluted. See PCB 020/33.
u = PCB 056 and 060 coeluted. See PCB 056/060.
v = PCB 090 and 101 coeluted. See PCB 090/101.
w = PCB 132 and 153 coeluted. See PCB 132/153.
x = PCB 138 and 158 coeluted. See PCB 138/158.
y = PCB 170 and 190 coeluted. See PCB 170/190.
z = PCB 196 and 203 coeluted. See PCB 196/203.

Data Table 21 continued on next page

Table 21. PCB concentration in bivalve tissue, 1999 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.

NA = not analyzed, ND = not detected. Units expressed as dry weight.

CFLU - *Corbicula fluminea*, CGIG - *Crassostrea gigas*, MCAL - *Mytilus californianus*.

T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.

T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	SUM of PCBs (SFEI)	PCB 087	PCB 090/101	PCB 095	PCB 097	PCB 099	PCB 101	PCB 105	PCB 110	PCB 118	PCB 128	PCB 132	PCB 132/153	PCB 138	PCB 138/158	PCB 141	PCB 149
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	5/6/99	19	CFLU	174.11	2.03	5.41	5.23	4.26	3.39	*v*	2.31	6.34	6.73	2	*w*	35.7	*x*	11.6	ND	9.82
BG30	San Joaquin River	5/6/99	19	CFLU	253.86	4.42	6.75	6.43	5.37	4.93	*v*	5.43	7.75	8.79	5.18	*w*	29.7	*x*	12.3	4.27	10.8
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	75.17	1.24	5.27	3.97	1.56	3.49	*v*	ND	5.72	2.63	ND	*w*	11.5	*x*	4.59	ND	8.99
BD40	Davis Point	4/27/99	19	CGIG	61.7	1.04	4.91	3.43	1.24	3.4	*v*	ND	4.66	2.52	ND	*w*	10.4	*x*	4.4	ND	7.87
BD30	Pinole Point	4/30/99	19	MCAL	87.89	1.54	3.23	2.25	1.83	2.31	*v*	1.86	3.47	2.75	2.16	*w*	7.35	*x*	7.59	1.5	5.21
BD20	San Pablo Bay	4/30/99	19	CGIG	119.24	2.36	8.93	5.99	2.41	5.73	*v*	1.16	8.36	3.56	ND	*w*	16.9	*x*	6.86	1.23	14.4
BD15	Petaluma River	4/30/99	19	CGIG	31.57	ND	2.57	2.14	ND	2.17	*v*	ND	3.24	1.58	ND	*w*	6.23	*x*	2.91	ND	5.07
BC61	Red Rock	4/30/99	19	MCAL	51.72	ND	3.24	1.88	1.21	2.12	*v*	ND	3.05	1.95	ND	*w*	8.46	*x*	4.8	ND	5.17
BC21	Horseshoe Bay	4/30/99	19	MCAL	54.5	1.05	4.21	2.31	1.32	2.34	*v*	ND	3.5	2.47	ND	*w*	9.53	*x*	5.17	ND	5.98
BC10	Yerba Buena Island	4/28/99	19	MCAL	21.78	ND	2.37	1.39	ND	1.3	*v*	ND	2.03	1.45	ND	*w*	4.83	*x*	2.73	ND	3.32
BB71	Alameda	4/28/99	19	MCAL	36.08	ND	3.17	2.08	ND	2.04	*v*	ND	3.08	2.21	ND	*w*	6.43	*x*	3.94	ND	4.56
BA40	Redwood Creek	4/28/99	19	MCAL	123.43	2.3	9.82	5.74	2.44	6.27	*v*	1.42	7.95	5.5	1.26	*w*	20	*x*	10.6	ND	13.6
BA30	Dumbarton Bridge	4/28/99	19	MCAL	130.5	2.06	9.69	5	2.33	6.33	*v*	1.54	8.38	6.02	1.36	*w*	22.2	*x*	12.8	ND	14.2
BA10	Coyote Creek	4/28/99	19	CGIG	260.82	5.71	22.7	13.3	5.81	12.2	*v*	2.46	18	9.67	2.2	*w*	39.5	*x*	15.7	2.48	29.3
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	200.54	2.11	ND	10.67	6.01	5.71	*v*	ND	8.45	11.71	2.34	*w*	71	*x*	18.12	ND	19.27
BG30	San Joaquin River	9/21/99	21	CFLU	187.6	1.79	5.5	7.49	5.24	4.38	*v*	ND	6.44	7.61	2.28	*w*	51	*x*	14.18	ND	14.15
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	110.27	2.3	7.66	5.93	2.61	5.63	*v*	1.63	7.58	4.08	1.33	*w*	19.02	*x*	7.96	ND	14.73
BD40	Davis Point	9/16/99	21	CGIG	149.56	2.6	9.39	6.84	4.31	7.68	*v*	ND	10.34	6.65	ND	*w*	27.51	*x*	10.83	ND	19.02
BD30	Pinole Point	9/15/99	21	MCAL	77.57	1.78	4.78	3.03	1.84	3.52	*v*	1.29	5.27	3.74	1.38	*w*	13.21	*x*	7.45	ND	8
BD20	San Pablo Bay	9/15/99	21	CGIG	147.2	2.57	11.7	7.84	3.12	8.7	*v*	1.54	9.88	5.18	1.46	*w*	24.51	*x*	10.11	1.8	19.16
BD15	Petaluma River	9/15/99	21	CGIG	92.79	ND	5.39	3.63	2.26	5	*v*	ND	5.44	3.51	1.32	*w*	20.49	*x*	6.88	ND	13.63
BC61	Red Rock	9/15/99	21	MCAL	53.3	ND	3.63	2.09	1.07	2.78	*v*	ND	3.24	2.42	ND	*w*	11.41	*x*	5.87	ND	6.98
BC21	Horseshoe Bay	9/15/99	21	MCAL	62.46	1.56	4.87	3.14	1.33	3.48	*v*	1.18	4.1	3.1	ND	*w*	10.94	*x*	5.75	ND	7.3
BC10	Yerba Buena Island	9/14/99	21	MCAL	102.97	2.06	8.16	4.83	2.45	5.56	*v*	1.52	6.54	4.68	1.48	*w*	17.6	*x*	9.58	ND	11.3
BB71	Alameda	9/14/99	21	MCAL	113.3	2.15	7.73	4.18	2.08	5.64	*v*	1.49	6.59	5.24	1.77	*w*	22.04	*x*	12.24	ND	13.87
BA40	Redwood Creek	9/14/99	21	MCAL	111.91	2.05	7.32	3.17	2.01	5.45	*v*	1.66	5.72	5.87	2.06	*w*	23.52	*x*	13.5	ND	12.35
BA30	Dumbarton Bridge	9/14/99	21	MCAL	89.73	1.49	5.33	2.61	1.68	4.69	*v*	1.41	5.19	4.6	1.64	*w*	18.5	*x*	11.3	ND	9.97
BA10	Coyote Creek	9/14/99	21	CGIG	137.74	2.16	8.77	7.01	2.97	7.54	*v*	1.62	9.08	5.21	1.52	*w*	26.9	*x*	9.75	ND	19.47
T-0	Tomales Bay	6/4/99	21	CGIG	1.09	ND	ND	ND	ND	ND	*v*	ND	ND	ND	ND	*w*	1.09	*x*	ND	ND	ND
T-0	Bodega Head	6/4/99	21	CGIG	1.09	ND	ND	ND	ND	ND	*v*	ND	ND	ND	ND	*w*	1.09	*x*	ND	ND	ND

Footnotes:

r = PCB 017 and 018 coeluted. See PCB 017/18.
s = PCB 028 and 031 coeluted. See PCB 028/31.
t = PCB 020 and 033 coeluted. See PCB 020/33.
u = PCB 056 and 060 coeluted. See PCB 056/060.
v = PCB 090 and 101 coeluted. See PCB 090/101.
w = PCB 132 and 153 coeluted. See PCB 132/153.
x = PCB 138 and 158 coeluted. See PCB 138/158.
y = PCB 170 and 190 coeluted. See PCB 170/190.
z = PCB 196 and 203 coeluted. See PCB 196/203.

Data Table 21 continued on next page

Table 21. PCB concentration in bivalve tissue, 1999 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration.
NA = not analyzed, ND = not detected. Units expressed as dry weight.
CFLU - *Corbicula fluminea* , CGIG - *Crassostrea gigas* , MCAL - *Mytilus californianus* .
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	SUM of PCBs (SFEI)	PCB 151	PCB 153	PCB 156	PCB 158	PCB 170	PCB 170/190	PCB 174	PCB 177	PCB 180	PCB 183	PCB 187	PCB 194	PCB 195	PCB 196/203	PCB 201	PCB 203
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BG20	Sacramento River	5/6/99	19	CFLU	174.11	2.6	*w*	ND	*x*	*y*	3.31	1.71	2.95	7.16	2.45	5.84	1.4	1.36	2.6	ND	*z*
BG30	San Joaquin River	5/6/99	19	CFLU	253.86	5.37	*w*	5.46	*x*	*y*	7.25	5.55	6.56	10.3	5.71	8.82	7.25	7	7.34	4.11	*z*
BF20	Grizzly Bay	-	19	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	4/27/99	19	CGIG	75.17	2.39	*w*	ND	*x*	*y*	ND	ND	1.35	2.15	ND	3.33	ND	ND	ND	ND	*z*
BD40	Davis Point	4/27/99	19	CGIG	61.7	1.96	*w*	ND	*x*	*y*	ND	ND	1.21	2	ND	3.09	ND	ND	ND	ND	*z*
BD30	Pinole Point	4/30/99	19	MCAL	87.89	3.22	*w*	1.84	*x*	*y*	2.34	1.6	2.31	2.41	2.14	3.05	2.68	2.14	2.08	1.53	*z*
BD20	San Pablo Bay	4/30/99	19	CGIG	119.24	3.58	*w*	ND	*x*	*y*	ND	1.23	2.17	3.35	1.6	5.45	ND	ND	ND	ND	*z*
BD15	Petaluma River	4/30/99	19	CGIG	31.57	1.18	*w*	ND	*x*	*y*	ND	ND	ND	1.18	ND	1.96	ND	ND	ND	ND	*z*
BC61	Red Rock	4/30/99	19	MCAL	51.72	2.03	*w*	ND	*x*	*y*	ND	ND	1.4	1.43	1.09	2.44	ND	ND	ND	ND	*z*
BC21	Horseshoe Bay	4/30/99	19	MCAL	54.5	2.06	*w*	ND	*x*	*y*	ND	ND	1.19	1.42	1.25	2.71	ND	ND	ND	ND	*z*
BC10	Yerba Buena Island	4/28/99	19	MCAL	21.78	1.02	*w*	ND	*x*	*y*	ND	ND	ND	ND	ND	1.34	ND	ND	ND	ND	*z*
BB71	Alameda	4/28/99	19	MCAL	36.08	1.38	*w*	ND	*x*	*y*	ND	ND	ND	ND	ND	1.83	ND	ND	ND	ND	*z*
BA40	Redwood Creek	4/28/99	19	MCAL	123.43	3.82	*w*	ND	*x*	*y*	ND	ND	2.17	2.51	2.24	6.47	ND	ND	ND	ND	*z*
BA30	Dumbarton Bridge	4/28/99	19	MCAL	130.5	4	*w*	ND	*x*	*y*	1.01	ND	2.36	3.1	2.6	7.28	ND	ND	ND	ND	*z*
BA10	Coyote Creek	4/28/99	19	CGIG	260.82	8.71	*w*	ND	*x*	*y*	1.08	1.23	4.37	6.18	2.43	12.6	ND	ND	ND	ND	*z*
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BG20	Sacramento River	9/21/99	21	CFLU	200.54	4.47	*w*	ND	*x*	*y*	ND	ND	6.74	ND	3.81	12.06	ND	ND	4.98	ND	*z*
BG30	San Joaquin River	9/21/99	21	CFLU	187.6	3.83	*w*	ND	*x*	*y*	3.6	2.68	5.14	ND	3.61	9.41	ND	ND	5.4	ND	*z*
BF20	Grizzly Bay	-	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BD50	Napa River	9/16/99	21	CGIG	110.27	4.06	*w*	ND	*x*	*y*	ND	ND	2.51	2.69	1.81	6.31	ND	ND	ND	ND	*z*
BD40	Davis Point	9/16/99	21	CGIG	149.56	5.64	*w*	ND	*x*	*y*	ND	ND	5.65	4.09	ND	9.82	ND	ND	ND	ND	*z*
BD30	Pinole Point	9/15/99	21	MCAL	77.57	2.5	*w*	ND	*x*	*y*	ND	ND	1.92	1.81	1.75	3.52	ND	ND	ND	ND	*z*
BD20	San Pablo Bay	9/15/99	21	CGIG	147.2	5.51	*w*	ND	*x*	*y*	ND	ND	3.2	3.65	1.93	7.43	ND	ND	ND	ND	*z*
BD15	Petaluma River	9/15/99	21	CGIG	92.79	3.47	*w*	ND	*x*	*y*	ND	ND	3.61	2.67	2.78	8.17	ND	ND	ND	ND	*z*
BC61	Red Rock	9/15/99	21	MCAL	53.3	1.87	*w*	ND	*x*	*y*	ND	ND	1.72	1.6	1.55	4.14	ND	ND	ND	ND	*z*
BC21	Horseshoe Bay	9/15/99	21	MCAL	62.46	1.98	*w*	ND	*x*	*y*	ND	ND	1.02	1.53	1.32	2.75	ND	ND	ND	ND	*z*
BC10	Yerba Buena Island	9/14/99	21	MCAL	102.97	3.89	*w*	ND	*x*	*y*	ND	ND	2.3	2.34	2.25	4.46	ND	ND	ND	ND	*z*
BB71	Alameda	9/14/99	21	MCAL	113.3	3.98	*w*	ND	*x*	*y*	ND	ND	2.78	3.49	2.84	6.26	ND	ND	ND	ND	*z*
BA40	Redwood Creek	9/14/99	21	MCAL	111.91	3.59	*w*	ND	*x*	*y*	1.06	ND	3.36	3.07	2.6	7.09	ND	ND	ND	ND	*z*
BA30	Dumbarton Bridge	9/14/99	21	MCAL	89.73	3.12	*w*	ND	*x*	*y*	ND	ND	2.44	2.43	2.11	5.77	ND	ND	ND	ND	*z*
BA10	Coyote Creek	9/14/99	21	CGIG	137.74	4.5	*w*	ND	*x*	*y*	ND	ND	3.59	4.02	2.27	8.46	ND	ND	ND	ND	*z*
T-0	Tomales Bay	6/4/99	21	CGIG	1.09	ND	*w*	ND	*x*	*y*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*z*
T-0	Bodega Head	6/4/99	21	CGIG	1.09	ND	*w*	ND	*x*	*y*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	*z*

Footnotes:
r = PCB 017 and 018 coeluted. See PCB 017/18.
s = PCB 028 and 031 coeluted. See PCB 028/31.
t = PCB 020 and 033 coeluted. See PCB 020/33.
u = PCB 056 and 060 coeluted. See PCB 056/060.
v = PCB 090 and 101 coeluted. See PCB 090/101.
w = PCB 132 and 153 coeluted. See PCB 132/153.
x = PCB 138 and 158 coeluted. See PCB 138/158.
y = PCB 170 and 190 coeluted. See PCB 170/190.
z = PCB 196 and 203 coeluted. See PCB 196/203.

Table 22. Pesticide concentration in bivalve tissue, 1999. Units expressed as dry weight.
NA = not analyzed, ND = not detected, NS = not sampled. CFLU - *Corbicula fluminea*, CGIG - *Crassostrea gigas*, MCAL - *Mytilus californianus*.
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	Sum of DDTs (SFEI)	o,p^-DDD	o,p^-DDE	o,p^-DDT	p,p^-DDD	p,p^-DDE	p,p^-DDT	Sum of Chlordanes (SFEI)	alpha-Chlordane	gamma-Chlordane	cis-Nonachlor	trans-Nonachlor	Heptachlor	Heptachlor Epoxide	Oxychlordane
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BA10	Coyote Creek	4/28/99	19	CGIG	120.6	9.0	1.3	5.5	24.7	70.1	9.8	56.3	17.7	15.7	2.3	17.8	ND	1.7	1.1
BA30	Dumbarton Bridge	4/28/99	19	MCAL	47.6	3.9	1.0	2.3	10.0	28.2	2.3	24.9	8.2	6.2	1.8	6.4	0.5	1.2	0.6
BA40	Redwood Creek	4/28/99	19	MCAL	43.5	3.7	0.4	1.0	10.3	25.5	2.7	22.0	6.8	5.5	1.2	6.3	0.3	1.3	0.7
BB71	Alameda	4/28/99	19	MCAL	34.1	3.2	ND	0.7	7.7	20.1	2.4	13.1	4.3	3.5	0.8	3.3	ND	0.6	0.6
BC10	Yerba Buena Island	4/28/99	19	MCAL	31.3	2.8	0.8	0.6	7.1	17.0	3.1	11.4	3.7	3.0	0.7	2.8	0.6	0.7	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	26.8	2.2	0.5	0.9	6.2	15.1	1.9	9.2	2.8	2.5	0.6	2.5	ND	0.6	0.3
BC60	Red Rock	4/30/99	19	MCAL	27.0	2.3	1.0	1.4	5.9	14.1	2.3	10.0	3.3	2.5	ND	3.2	0.6	0.4	ND
BD15	Petaluma River	4/30/99	19	CGIG	91.4	7.7	1.7	6.7	20.2	46.8	8.5	18.0	5.6	4.5	ND	6.2	1.2	ND	0.5
BD20	San Pablo Bay	4/30/99	19	CGIG	100.2	7.8	1.3	3.0	22.8	59.9	5.4	20.3	5.8	4.5	2.0	6.6	ND	0.6	0.9
BD30	Pinole Point	4/30/99	19	MCAL	60.7	5.2	3.5	2.3	14.3	33.1	2.4	19.8	6.4	5.9	1.3	5.4	ND	0.8	ND
BD40	Davis Point	4/27/99	19	CGIG	102.6	7.4	0.6	5.6	22.4	58.9	7.6	19.8	4.7	5.0	3.3	6.9	ND	ND	ND
BD50	Napa River	4/27/99	19	CGIG	101.4	7.9	2.3	3.6	20.8	59.8	7.0	21.9	6.6	5.1	2.5	6.8	1.0	ND	ND
BF20	Grizzly Bay	-	19	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BG20	Sacramento River	5/6/99	19	CFLU	166.3	6.7	2.2	5.4	15.7	120.9	15.4	20.5	6.4	5.1	ND	9.0	ND	ND	ND
BG30	San Joaquin River	5/6/99	19	CFLU	139.0	5.9	2.6	2.9	14.9	103.6	9.1	14.3	4.6	3.8	2.0	4.0	ND	ND	ND
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BA10	Coyote Creek	9/14/99	21	CGIG	31.6	3.5	0.8	0.3	5.6	21.0	0.5	6.8	2.1	1.8	0.3	2.4	ND	0.1	ND
BA30	Dumbarton Bridge	9/14/99	21	MCAL	33.1	Q	1.5	ND	7.7	23.5	0.4	13.7	4.3	4.1	0.4	4.6	ND	0.3	ND
BA40	Redwood Creek	9/14/99	21	MCAL	38.0	Q	1.2	Q	8.4	27.6	0.8	15.5	4.4	4.5	0.4	5.5	ND	ND	0.8
BB71	Alameda	9/14/99	21	MCAL	42.3	6.7	1.6	0.4	9.5	22.8	1.4	8.4	2.7	2.7	0.3	2.7	ND	ND	ND
BC10	Yerba Buena Island	9/14/99	21	MCAL	57.0	7.7	1.4	1.6	14.5	29.0	2.7	12.8	3.3	4.2	0.3	4.2	ND	0.4	0.5
BC21	Horseshoe Bay	9/15/99	21	MCAL	38.0	4.7	1.2	0.7	10.3	20.1	1.0	8.3	2.2	2.5	0.3	2.6	ND	0.4	0.3
BC60	Red Rock	9/15/99	21	MCAL	34.2	3.6	1.3	0.7	9.4	18.4	1.0	7.6	2.2	2.6	ND	2.9	ND	ND	ND
BD15	Petaluma River	9/15/99	21	CGIG	140.5	16.8	4.9	2.9	30.7	83.1	2.2	13.5	3.6	3.6	1.1	4.8	ND	0.3	ND
BD20	San Pablo Bay	9/15/99	21	CGIG	161.9	14.2	5.7	3.5	45.6	89.0	4.0	18.3	5.4	5.0	1.1	6.5	ND	0.3	ND
BD30	Pinole Point	9/15/99	21	MCAL	57.3	8.4	1.6	ND	14.3	31.1	1.8	9.5	3.1	2.9	ND	3.6	ND	ND	ND
BD40	Davis Point	9/16/99	21	CGIG	226.5	17.6	4.2	5.2	63.4	130.5	5.7	23.1	5.6	7.2	1.3	8.4	ND	0.5	ND
BD50	Napa River	9/16/99	21	CGIG	139.4	12.5	4.0	4.0	38.7	77.0	3.4	16.6	4.6	4.9	1.0	5.7	ND	0.4	ND
BF20	Grizzly Bay	-	21	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
BG20	Sacramento River	9/21/99	21	CFLU	162.0	10.3	4.4	3.8	20.8	107.1	15.5	16.3	3.8	3.9	1.5	7.2	ND	ND	ND
BG30	San Joaquin River	9/21/99	21	CFLU	96.1	7.5	4.5	2.4	15.5	60.7	5.5	13.3	3.3	2.5	0.9	5.7	ND	1.0	ND
T-0	Tomales Bay	6/4/99	21	CGIG	11.3	1.4	0.4	0.3	1.6	6.3	1.3	2.3	0.7	0.4	ND	0.7	ND	0.5	ND
T-0	Bodega Head	6/4/99	21	MCAL	15.9	2.9	0.7	0.5	1.8	9.2	0.7	4.1	1.2	1.2	ND	1.0	ND	0.7	ND

Data Table 22 continued on next page

Table 22. Pesticide concentration in bivalve tissue, 1999 (continued). Units expressed as dry weight.
NA = not analyzed, ND = not detected, NS = not sampled. CFLU - *Corbicula fluminea* , CGIG - *Crassostrea gigas* , MCAL - *Mytilus californianus* .
T-0 = time of bivalve deployment into the Estuary from the source indicated under station name heading.
T-0 samples for *C.gigas* and *M. californianus* for Cruise 19 were accidentally destroyed. Bivalves were not deployed at Grizzly Bay in 1999.

Station Code	Station	Date	Cruise	Species	Aldrin	Dieldrin	Endrin	alpha-HCH	beta-HCH	delta-HCH	gamma-HCH	Mirex
					µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BA10	Coyote Creek	4/28/99	19	CGIG	ND	11.6	2.9	0.3	1.3	ND	1.9	ND
BA30	Dumbarton Bridge	4/28/99	19	MCAL	ND	12.5	ND	0.2	1.8	ND	1.0	ND
BA40	Redwood Creek	4/28/99	19	MCAL	ND	9.5	1.6	0.3	1.2	ND	0.8	ND
BB71	Alameda	4/28/99	19	MCAL	ND	10.3	1.1	0.4	2.4	ND	0.5	ND
BC10	Yerba Buena Island	4/28/99	19	MCAL	ND	8.8	1.0	0.5	0.9	ND	0.3	ND
BC21	Horseshoe Bay	4/30/99	19	MCAL	ND	6.6	0.8	0.6	1.1	ND	0.4	ND
BC60	Red Rock	4/30/99	19	MCAL	ND	8.9	ND	ND	2.4	ND	ND	ND
BD15	Petaluma River	4/30/99	19	CGIG	ND	4.1	ND	ND	2.0	ND	0.4	ND
BD20	San Pablo Bay	4/30/99	19	CGIG	ND	6.2	1.5	0.6	2.1	ND	0.3	ND
BD30	Pinole Point	4/30/99	19	MCAL	ND	18.7	2.5	0.7	1.8	ND	0.6	ND
BD40	Davis Point	4/27/99	19	CGIG	ND	6.5	3.1	ND	1.4	ND	0.4	ND
BD50	Napa River	4/27/99	19	CGIG	ND	6.6	2.9	ND	0.5	ND	ND	ND
BF20	Grizzly Bay	-	19	NA	NS	NS	NS	NS	NS	NS	NS	NS
BG20	Sacramento River	5/6/99	19	CFLU	ND	5.9	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	5/6/99	19	CFLU	ND	5.0	ND	ND	ND	ND	ND	ND
T-0	Tomales Bay	12/28/98	19	CGIG	NA	NA	NA	NA	NA	NA	NA	NA
T-0	Bodega Head	12/17/98	19	MCAL	NA	NA	NA	NA	NA	NA	NA	NA
BA10	Coyote Creek	9/14/99	21	CGIG	ND	0.8	ND	0.1	ND	ND	0.2	ND
BA30	Dumbarton Bridge	9/14/99	21	MCAL	ND	7.5	ND	0.3	ND	ND	0.5	ND
BA40	Redwood Creek	9/14/99	21	MCAL	ND	6.7	ND	ND	ND	ND	0.6	ND
BB71	Alameda	9/14/99	21	MCAL	ND	6.6	ND	0.3	0.9	0.2	0.5	ND
BC10	Yerba Buena Island	9/14/99	21	MCAL	ND	8.1	0.9	0.7	ND	ND	1.4	ND
BC21	Horseshoe Bay	9/15/99	21	MCAL	ND	6.2	1.1	0.6	1.8	ND	0.9	ND
BC60	Red Rock	9/15/99	21	MCAL	ND	5.6	ND	0.6	1.0	ND	0.2	ND
BD15	Petaluma River	9/15/99	21	CGIG	ND	2.4	ND	0.4	ND	ND	ND	ND
BD20	San Pablo Bay	9/15/99	21	CGIG	ND	4.9	ND	0.5	ND	ND	0.3	ND
BD30	Pinole Point	9/15/99	21	MCAL	ND	6.4	ND	0.3	0.4	ND	ND	ND
BD40	Davis Point	9/16/99	21	CGIG	3.5	6.2	ND	0.5	ND	ND	0.5	ND
BD50	Napa River	9/16/99	21	CGIG	2.3	4.0	ND	0.3	ND	ND	0.3	ND
BF20	Grizzly Bay	-	21	NA	NS	NS	NS	NS	NS	NS	NS	NS
BG20	Sacramento River	9/21/99	21	CFLU	ND	4.2	ND	ND	3.4	ND	0.7	ND
BG30	San Joaquin River	9/21/99	21	CFLU	ND	3.4	ND	ND	4.1	ND	ND	ND
T-0	Tomales Bay	6/4/99	21	CGIG	2.4	0.7	ND	1.2	0.6	ND	0.4	ND
T-0	Bodega Head	6/4/99	21	MCAL	ND	4.9	1.5	1.3	1.2	ND	0.7	ND

Glossary

A

Ag: The chemical symbol for silver, a trace metal measured by the RMP.

Al: The chemical symbol for aluminum, a trace metal measured by the RMP.

aliquot: A subsample taken from a field sample (e.g., of sediment).

ambient: Refers to the overall conditions surrounding a place or thing. In the case of the RMP, ambient monitoring is used to determine existing pollutant levels in the San Francisco Estuary. ambient sediment concentrations--sandy (ASC*) are the upper threshold values for distinguishing between sediment concentrations representing "ambient" versus contaminated conditions. ASC values are different for sandy (< 40% fines) and muddy (> 40% fines) sediments. ambient sediment concentrations--muddy (ASC) are the upper threshold values for distinguishing between sediment concentrations representing "ambient" versus contaminated conditions. ASC values are different for sandy (< 40% fines) and muddy (> 40% fines) sediments.

ammonia: A colorless gas which is less dense than air and has a penetrating odor. It is the fourth largest industrial chemical produced, with over 80% used in the manufacturing of agricultural fertilizers.

amphipods: An order of small shrimp-like crustaceans, such as sand fleas. Many live on the bottom of the Estuary (i.e., are benthic) and feed on algae and detritus.

analyte: A targeted compound that is analyzed in a test.

anthropogenic: Effects or processes that are derived from human activities, as opposed to natural effects or processes that occur in the environment without human influences.

arenaceous: Resembling, derived from, or containing sand.

arthropod: Any member of a large phylum of invertebrate animals with jointed legs and a segmented body, such as insects, crustaceans, arachnids, myriapods, and trilobites.

As: The chemical symbol for arsenic, a trace element measured by the RMP.

assemblage: A group of persons, animals, plants, or things gathered together.

(automated) Winkler titration: The process of determining the amount of a certain substance contained in a known volume of a solution by measuring volumetrically how much of a standard solution is required to produce a given reaction.

axial transect: A line which follows the deep channel along the length or "axis" of the Estuary. Most RMP stations are on this axial transect, also known as the "spine".

B

Base Program: Standard RMP monitoring conducted primarily for the purposes of characterization and trends, i.e. water, sediment, and tissue cruise sampling and analyses at the stations normally sampled, excluding special and pilot studies.

Basin Plan: The SFBRWQCB's plan for the Estuary basin. This includes the land and waters within the boundaries of the immediate San Francisco Bay watershed, Suisun Marsh, and the western part of the Sacramento-San Joaquin Delta.

benthos, benthic: Bottom dwelling; non-planktonic; attached to or resting on the substrate.

bioaccumulation: The buildup of contaminants in an organism's tissues (usually fatty tissue) through ingestion, or contact with the skin or respiratory tissue. Contaminants that bioaccumulate may also biomagnify in the food web, resulting in higher tissue concentrations in predators relative to ambient environmental concentrations.

bioassay: A laboratory test using live organisms to measure biological effects of a substance, factor, or condition. The effect measured may be growth, reproduction, or survival.

bioavailability: The extent to which a compound is available for intake by organisms. Bioavailable compounds have the potential to cause biological effects, such as increased mortality.

biogeochemical cycle: The cycle in which nitrogen, carbon, and other inorganic elements of the soil, atmosphere, etc. of a region are converted into the organic substances of animals and plants of the region and released back into the environment.

biological condition index: A measure of the biological condition of RMP transplanted bivalves expressed as the ratio of tissue dry weight to shell cavity volume.

biomagnification: The net effect of bioconcentration (accumulation of pollutants via dermal or respiratory tissue exposure), bioaccumulation (accumulation via ingestion), and depuration (excretion or loss of pollutants via metabolic processes).

biomass: Total weight of all organisms in a particular habitat or area.

biomonitoring: Monitoring conducted to determine existing environmental conditions, pollutant levels, rates, or species in the environment.

biota: The animals, plants, and microbes that live in a particular location or region.

bivalves: Any mollusk, such as an oyster or clam, that has a shell with two hinged "valves" or shell halves.

blooms (algal): A population burst that remains within a defined part of the water column.

brackish: Somewhat salty water that is less salty than seawater.

C

calcareous: Being made of calcium carbonate.

Cd: The chemical symbol for cadmium, a trace metal measured by the RMP.

chironomids: Small, two-winged flies in the adult stage, closely related to mosquitoes and Chaoborus (Phantom Midge or Glassworm). Most lay eggs singularly or in strings while skimming over the water surface. The eggs hatch into larvae and form mud tubes from bottom material and muscous. A few species have free swimming larva.

chlordanes: A contact insecticide used in agriculture until 1978 to control soil pests, particularly termites. It belongs to a group of closely related organochlorines, which includes aldrin, dieldrin, endosulfan, and heptachlor.
chlorinated hydrocarbons: A group of organic compounds which includes PCBs, DDTs, chlordanes, and dieldrin.
chlorophyll a: A key substance in the process of photosynthesis. It is found with photosynthesizing organisms and is used in the RMP as a measure of the abundance of photosynthetic organisms in the water column (phytoplankton).
community: The organisms inhabiting a common environment and interacting with one another.
congener: A compound of the same kind. conventional pollutant: As specified under the federal Clean Water Act, conventional pollutants are total suspended solids, fecal coliform bacteria, biochemical oxygen demand, pH, oil, and grease. In addition, there are a large number of nonconventional and toxic pollutants that are of concern.
copepod: A type of herbivorous microscopic crustacean. They are important in the food chain because they are eaten by many fish or by other organisms that are eventually eaten by fish.
Cr: The chemical symbol for chromium, a trace metal measured by the RMP.
criterion: A standard rule or test on which a judgment or decision can be based.
crustacean: Any of a class of arthropods, including shrimps, crabs, barnacles, and lobsters, that usually live in the water and breathe through gills; they have a hard outer shell and jointed appendages.
Cu: The chemical symbol for copper, a trace metal measured by the RMP.

D

DDD (dichlorodiphenyldichlorethane): DDD was a commonly used pesticide in the past, but is now banned in the United States.
DDE (dichlorodiphenyldichloroethylene): DDE is found in the environment as a result of the breakdown of the insecticide DDT. DDE has been listed as a pollutant of concern to the U.S. EPA's Great Waters Program due to its persistence in the environment, potential to bioaccumulate, and toxicity to humans and the environment. See also DDTs.
DDT (dichlorodiphenyltrichloroethane): The combination of DDT and its degradation products, DDD and DDE. A chlorinated hydrocarbon that was a highly effective, but extremely persistent organic pesticide. DDT was extensively used in the past for the control of insects (crop protection and disease control). In 1972 its use was banned in the United States, except in the case of a public health emergency.
Delta Outflow Index (DOI): Freshwater flows from the Delta into San Francisco Bay. The DOI is calculated as total Delta inflow plus precipitation, minus in-Delta uses and exports.
depuration: The loss of contaminants from an animal's gut or tissue.
"detectable difference" criterion: A significance test which is based on the minimum significant difference (MSD) values.
dinoflagellate: Any of numerous minute, chiefly marine protozoans or algae of the order Dinoflagellata, having two flagella and a cellose-covering. They are a main constituent of plankton.
dischargers: Public and private organizations that discharge treated wastewater, cooling water, or urban runoff, or are involved in dredging activities.
dissolved compounds: Compounds that are present (dissolved) in the water and, therefore, are available for fish and other aquatic animals.
dry-season sampling period: RMP sampling carried out between July and September.

E

Effects Range-Low (ERL): Part of the Effects Range sediment quality guidelines, established by the National Oceanic and Atmospheric Administration. The guidelines were developed to identify concentrations of contaminants associated with biological effects in laboratory, field, or modeling studies. The ERL value is the concentration equivalent to the lower 10th percentile of the compiled study data. Sediment concentrations below the ERL are interpreted as being "rarely" associated with adverse effects. See also ERM.
Effects Range-Median (ERM): Part of the Effects Range sediment quality guidelines established by the National Oceanic and Atmospheric Administration. The guidelines were developed to identify concentrations of contaminants associated with biological effects in laboratory, field, or modeling studies. The ERM is the concentration equivalent to the 50th percentile of the compiled study data. Sediment concentrations above the ERM are "frequently" associated with adverse effects. See also ERL.
effluent: An outflow from a sewer or sewage system.
ELISA analysis: Enzyme-linked immunosorbent assay that tries to determine the nature, proportions, and function of the examined parts.
El Niño: El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific and have important consequences for weather around the globe.
elutriate: To purify, separate, or remove by washing, decanting, and settling.
embayment: Forming into a bay or a formation resembling a bay.
equilibrium predictions: A theoretical model or experimental determination of reactions, that describes the ratio of concentrations of the product to the reactant. It expresses chemical activity in terms of related concentration.
estuary: A body of water at the lower end of a river which is connected to the ocean and semi-enclosed by land. In an estuary, sea water is measurably diluted by freshwater from the land.

F

Fe: The chemical symbol for iron, a trace metal measured by the RMP.

fluorometer: An instrument to detect and measure the emission of fluorescence.

food web: The rather linear food chains (from plants through herbivores and carnivores) tend to be woven into a complex food web, where energy is transferred to all different levels.

foraminifera: Protozoan group (usually) secreting a calcareous shell; both planktonic and benthic representatives exist.

G

genus: A classification of plants or animals with common distinguishable characteristics. It is the main subdivision of a family and is made up of a small group of closely related species or of a single species.

grab: Benthic sampling device with two or more curved metal plates designed to converge when the sampler hits the bottom and grab a specific volume of sediment.

gravimetric method: Measurements by weight or of the pull of gravity.

guidelines: Comparisons to guidelines were made to provide a context for evaluating the condition of the Estuary in terms of contamination, and not for any regulatory purpose. Guidelines were selected based on guidance from the San Francisco Bay Regional Water Quality Control Board.

H

HCH (hexachlorocyclohexane): A manufactured chemical that exists in eight forms, or isomers.

Hg: The chemical symbol for mercury, a trace metal measured by the RMP.

hydrocarbons: Organic compounds containing carbon and hydrogen.

L

ligand: An ion, a molecule, or a molecular group that binds to another chemical entity to form a larger complex.

linear regressions: A common practice in science to try to explain natural phenomena by models. The true regression of Y on X consisting of the means of populations of Y values, where a population is determined by X values. The regression line needs to be straight to develop a computation procedure.

LC50: The concentration of a contaminant that is lethal to half the organisms in a bioassay.

loadings: The total amount of material entering a system from all sources.

M

marshes: A wetland where the dominant vegetation is non-woody plants, such as grasses and sedges, as opposed to a swamp where the dominant vegetation is woody plants, such as trees.

matrix: Any non-living, intercellular substance, in which living cells are embedded, as in bone, cartilage, etc.

mean Effects Range-Median quotient: Reflects the increasing contaminant concentrations in sediment from many contaminants and appears to provide a useful way to express the degree of overall sediment contamination. It was shown to have a highly significant correlation with amphipod survival.

method detection limit (MDL): The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. It is determined by analysis of a sample in a given matrix containing the analyte.

microfauna: Animals whose shortest dimension is less than 0.1 mm.

minimum significant difference (MSD): The lowest distinguishable difference that is statistically meaningful.

morphology: The study of form and structure, at any level or organization.

mysid: Small, shrimp-like, chiefly marine crustaceans of the order Mysidacea.

N

National Pollutant Discharge Elimination System (NPDES): A provision of the Clean Water Act that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the U.S. EPA, a state, or other delegated agency.

neap tide: Tides with the smallest height difference between high tide and low tide, usually occurring during the moon's quarters. Compare with spring tide.

nematode: Any of a phylum of worms, often parasites of animals and plants, with long, cylindrical, unsegmented bodies and a heavy cuticle (e.g., hookworm, pinworm).

Ni: The chemical symbol for nickel, a trace metal measured by the RMP.

Niskin bottle: An oceanographic water sampling device.

O

oligochaete: Any of a class of segmented worms, such as the earthworm, lacking a definite head and having relatively few body bristles. They are mostly found in moist soil and freshwater.

oligotrophic: Water bodies or habitats with low concentrations of nutrients.

optical backscatter sensor: An instrument that measures total suspended solids (TSS), organic and inorganic particles of all sizes, in a certain volume of water.

organochlorine: A group of organic chemicals to which varying amounts of chlorine have been added. Organochlorine or chlorinated hydrocarbons (insecticides) are part of a broader class of halogenated hydrocarbons.

oxygen electrode: A terminal that conducts an electric current into or away from various conducting substances and collects and controls the flow of oxygen electrons.

P

"p" value: A confidence coefficent or a statistical value used in the multiple comparison procedure for comparing several treatments with a control.

PAHs (Polycyclic or Polynuclear Aromatic Hydrocarbons): A class of complex organic compounds, some of which are persistent and carcinogenic. PAHs are formed from the combustion of organic material and are ubiquitous in the environment.

particulate: A small, solid piece of matter that is easily lifted into the air, such as dust or ash. Smaller, fine particulates are more hazardous than larger, coarse ones because they are more easily inhaled deep into the lungs.

Pb: The chemical symbol for lead, a trace metal measured by the RMP.

PCBs (Polychlorinated Biphenyls): A group of manufactured chemicals including 209 different, but closely related, compounds made up of carbon, hydrogen, and chlorine. If released to the environment, they persist for long periods of time and can biomagnify in the food web. They are an organic toxicant suspected of causing cancer, endocrine disruption, and other adverse impacts on organisms.

pH: The acidity of water. A water quality parameter analyzed by the RMP.

peristaltic: Rhythmic, wavelike motion of the walls of the alimentary canal and certain other hollow organs. Alternating contraction and dilation of transverse and longitudinal muscles move the contents of the tube through the system.

pesticide: A general term to describe chemical substances used to destroy or control pest organisms, including herbicides, insecticides, algicides, and fungicides.

phaeophytin: A gray accessory plant pigment in green leaves. Accessory pigments help the plant to make more efficient use of sunlight because, unlike chlorophyll, they can trap energy from the wavelengths of light.

phytoplankton: Microscopic photosynthesizing organisms that drift with the currents.

pilot study: A study which employs methods that are under evaluation for potential incorporation into the RMP.

pollutant: A substance that adversely alters the physical, chemical, or biological properties of the environment.

pollution-index species: Species that are sensitive to a certain pollutant and that are monitored in terms of abundance and death in unpolluted and polluted areas. Measured in deaths per unit of pollution.

polychaete: ("with much hair") Any of a class of primarily marine, annelid worms that have a pair of fleshy, leg-like appendages covered with bristles on most segments.
principal components analyses
(PCA): A method that gives ecologists their first ordination technique in which ordination scores are derived from the data matrix alone. It involves the simultaneous production of species and sample ordination scores in one integrated analysis. PCAs are used for the indication and indirect measurement of environmental complexes.

protozoan: Any of a large group of single-celled, usually microscopic eukaryotic organisms, such as amoebas.

pseudopod: A temporary cytoplasmic protrusion from an ameobid cell which functions in locomotion or in feeding by phagocytosis.

R

red tide: A dense outburst of phytoplankton (usually dinoflagellates) often coloring the water reddish brown.

resuspension: The condition of a substance whose particles are dispersed through a fluid but not dissolved in it.

runoff: An overflow of fluid not absorbed by soil, such as rainfall.

S

salinity: The number of grams of dissolved salts in 1,000 grams of sea water. In the RMP it is expressed as (parts per thousand).

screening value (SV): tissue screening values (SVs) for use in State fish/shellfish consumption advisory programs for the general adult population* from table 5-2 of EPA document #823-R-95-007 (Methods for Sampling and Analyzing Contaminants in Fish and Shellfish Tissue)

Se: The chemical symbol for selenium, a trace element measured by the RMP.

sediment pore water: The parts of water that are in channels or passages in the suspended material on the bottom of a fluid through which it may be absorbed or discharged.

sediment quality guidelines (SQG): The National Oceanic and Atmospheric Administration (NOAA) provided these guidelines, which are based on data compiled from numerous studies in the United States that linked sediment contamination and biological effects information. They were developed to identify concentrations of contaminants associated with biological effects in laboratory, field, or modeling studies.

sediment quality triad: A sediment assessment technique that incorporates information about sediment chemistry, toxicity, and benthos. The RMP is monitoring all three components and uses this information to evaluate the condition of the estuarine sediment.

sediment water interface (SWI): An exposure system that mimics situations that may occur in nature when negatively buoyant bivalve embryos contact sediment before hatching. Comparison of test results with other manipulating tests allows for the evaluation of possible effects related to the elutriate preparation process.

semidiurnal tide cycle: The two high and two low tides per lunar day (24.84 hours). In the San Francisco Bay-Delta, the cycle is known as a mixed semidiurnal cycle, since the two

high and the two low tides are of unequal height.
shoals (broad and lateral): Shallows or sandbars in a body of water.
special study: A study initiated by the RMP in order to help improve interpretation or collection of RMP data.
speciation: The process of formation of a new species.
species: A fundamental biological classification, comprising a subdivision of a genus and consisting of a number of plants or animals all of which have a high degree of similarity, can generally interbreed only among themselves, and show persistent differences from members of allied species.
spectrophotometric method: A method used for comparing the color intensities of different spectra.
spring tide: Tides with the greatest range between highs and lows, usually occurring during the full or new moons. Compare with neap tide.
sulfides: A compound of sulfur with another element or a radical.
suspended-solids concentration (SSC): Organic or inorganic particles that are suspended in and carried by water. The term includes sand, mud, and clay particles, as well as solids in wastewater.

T

taxon: A group of organisms that has been formally named (e.g., species, genus, family, order, etc.).
tolerance limits: It is the maximum amount of a contaminant residue legally permitted by U.S. EPA, for example in drinking water.
total maximum daily load (TMDL): The TMDL process provides a flexible assessment and planning framework for identifying load reductions or other actions needed to attain water quality standards (i.e., water quality goals to protect aquatic life, drinking water, and other water uses). The Clean Water Act §303(d) established the TMDL process to guide application of state standards to individual water bodies and watersheds.
total organic carbon (TOC): This is the sum of organic carbon and is a monitoring parameter analyzed in environmental water programs. It is a physical sediment factor which can influence the concentration of other compounds. Represented variations in concentration can be attributable to spatial and temporal variations in sediment type.
toxic: Poisonous, carcinogenic, mutagenic, teratogenic, or otherwise directly harmful to life.
toxic equivalent: The combined potency of complex mixtures of compounds as an equivalent in toxicity.
toxic hot spots: Locations in enclosed bays, estuaries, or the ocean where pollutants have accumulated in the water or sediment to levels which (1) may pose a hazard to aquatic life, wildlife, fisheries, or human health, (2) may impact beneficial uses, or (3) exceed State Water Resources Control Board or Regional Water Quality Control Board-adopted water quality or sediment quality objectives.
toxicity: A measure of characteristics which are poisonous, carcinogenic, or otherwise harmful to life.
toxicity identification evaluation (TIE): A process used to determine the compound(s) responsible for toxicity in ambient waters, effluents, and sediments.
trace contaminants: Substances that pollute another substance, air, or water, and are found in low concentrations.
trace element: One of a group of naturally occurring elements found in low ("trace") concentrations in the water, sediment, and tissue measured by the RMP.
trace organic: An organic compound found in low ("trace") concentrations in the water, sediment, and tissue measured by the RMP.
transport: To carry from one place to another, especially over long distances.
trophic level: Representing one step in the food web with number of individuals, energy, or biomass.
trophic transfer: The energy transfer from one trophic level to another.
Total Suspended Solids (TSS): Organic and inorganic particles of all sizes suspended in a measured volume of water.
t-test: Statistical method for testing differences between two samples.

U

upstream: In the direction against the current of a stream.
upwelling: Vertical or upward movement of water. This usually occurs near the coasts and is driven by onshore winds that bring nutrients from the depths of the ocean to the surface layer.

W

water column: The water in a lake, estuary, or ocean which extends from the bottom sediments to the water surface. The water column contains dissolved and particulate matter and is the habitat for fish, plankton, and marine mammals.
water quality criteria: Specific levels of water quality which, if exceeded, are expected to render a body of water unsuitable for its designated beneficial use.
water quality guidelines: Specific levels of water quality which, if reached, may adversely affect human health or aquatic life. These are non-enforceable guidelines issued by a governmental agency or other institution.
wet-season sampling period: RMP sampling carried out between January and April.

Z

Zn: The chemical symbol for zinc, a trace metal measured by the RMP.