2001 Regional Monitoring Program

Sediment Results

3.0 Sediment Monitoring

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3.1 Background

Sediments are monitored because they are a fundamental component of the Bay ecosystem, and they play a key role in the fate 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 RMP Objectives (listed in the *Overview*). 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 sites in the region which requires information about background contaminant levels; and the continued dredging throughout the Estuary which requires testing and comparisons to a reference, or background concentration. The RMP provides information that may be used by the Regional Board and others to assess the condition of Estuary sediments.

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 physical sediment characteristics may affect contaminant concentrations. An overview of Estuary hydrology is presented in *Section 2.5.1*. Conductivity, temperature, and depth (CTD) profiles of the water column were collected at all RMP sediment stations. Although not documented in this report, these data are available upon request from the San Francisco Estuary Institute. Several sediment quality parameters that may affect sediment contaminant concentrations (grain-size, organic carbon, pore water ammonia, and pore water sulfides) were also monitored and are listed in the *Data Tables* (see Table 11).

Sediment contaminant monitoring in 2001 included 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). Additionally, sediments were monitored at two stations in the southern end of the Estuary that were part of the Estuary Interface Pilot Study: Standish Dam on Coyote Creek (station BW10) and Alviso Slough near the mouth of the Guadalupe River (station BW15). For more information see *Results of the Estuary Interface Pilot Study, 1996-1999* (Leatherbarrow *et al*. 2002).

The locations of the 22 RMP, two Southern Slough (C-3-0, C-1-3), and two Estuary Interface sampling stations (BW10, BW15) are shown in Figure 1.1 in the *Introduction*. Sediment samples were collected at 4 RMP stations during the wet season (February) as part of a Coastal Intensive Sites Network (CISNet) Study (a collaborative project with UC Davis, Point Reyes Bird Observatory, USGS, and funded by the U.S. EPA) and 26 stations during the dry season (August). A detailed description of methods of collection and analysis

are presented in the *Description of Methods*. A complete list of all parameters measured in the 2001 sediment samples is included in Table 1.2 in the *Introduction*. Station names, codes, location, and sampling dates are shown in the *Introduction* in Table 1.3. Sediment quality parameters, station depths, and all contaminant concentrations are tabulated in *Data Tables* 11-16.

In order to compare sediment results among regions of the Estuary, the RMP stations are separated into six groups of stations (five base program plus the Southern Sloughs). The segments used in 2001 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) are included for comparative purposes. Stations with coarse sediments (>60% sand: one station in the wet season and five in the dry season) generally have considerably lower contaminant concentrations and are identified on Figures 3.1–3.15, and plotted separately in the trends plots (Figures 3.17-3.30).

3.2 Sediment Quality Guidelines

Currently, no Basin Plan objectives or other regulatory criteria for sediment contaminant concentrations exist for the San Francisco Estuary. However, several sets of sediment quality guidelines (Table 3.1) may be used as informal screening tools for sediment contaminant concentrations, even though they have 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). Presently, no effects-range guidelines exist 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 is also used (Gandesbery 1998, Gandesbery *et al.* 1999). Ambient Sediment Concentration (ASC) values are derived from samples collected from the cleanest portions of the Estuary by the RMP (1991-1996) and by the Bay Protection and Toxic Cleanup Program (BPTCP) for their 1995 Reference Site study, and are used to distinguish "ambient" from "contaminated" conditions. Given the fact that virtually no San Francisco Estuary mixed surface layer sediments are free of anthropogenic contaminants this approach was thought to define contemporary ambient contaminant levels. Different ASC values are used for sandy (>60% sand) and muddy (>40% fines) sediments. Both the Long *et al*. (1995) and the ASC guideline values are indicated for comparative purposes on the sediment contaminant concentration bar charts (Figures 3.1–3.15).

Presently the Regional Board is developing Total Maximum Daily Loads (TMDLs) which may result in proposed sediment targets for certain contaminants on the "Impaired Waters" list (the 303(d) list). A sediment target for mercury of 0.4 mg/kg has already been developed and proposed (Abu-Saba and Tang 2000). Potentially, these target limits could be used as a new set of sediment quality guidelines, specific to the different regions of the San Francisco Estuary.

3.3 Sediment Bioassays

Sediment bioassays are performed to determine the potential for biological effects from exposure to sediment contamination. Two types of sediment bioassays were conducted at 13 of the RMP stations in August of 2001 (Figure 3.16). 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) for 48 hours with percent normal development as the endpoint. In addition to exposures with estuarine organisms, sediments from three stations that are heavily influenced by fresh water were tested with a fresh water amphipod (*Hyalella azteca*) and a cladoceran (*Ceriodaphnia dubia*). The control for the *Eohaustorius* (amphipod) solid-phase test consisted of home sediment, which was clean, well-sorted fine-grained sand collected at the same place and time as the test amphipods. The *Mytilus* (mussel) sediment elutriate test negative control was clean seawater from Granite Canyon, California. The control for *Hyalella* consisted of reference sediment obtained from USGS, and the *Ceriodaphnia* control consisted of moderately hard water (U.S. EPA 1993). The *Description of Methods* contains detailed methods of collection and testing, and the *QA Tables* contain the relevant quality assurance information for the sediment bioassays.

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

A sample was considered toxic if:

1. There was a significant difference between the laboratory control and test replicates using a separate variance t-test (alpha = 0.01), and
2. The difference between the mean endpoint value (% survival for amphipods or % normal development for bivalves) in the control and the mean endpoint value in the test sample was greater than the 90^{th} percentile minimum significant difference (MSD).

The reason two measures of a toxic hit must be met before a sample is considered toxic, is that in many cases a small among-replicate variance will result in a significant t-test, even though the magnitude of the difference may be small. One way to ensure that statistical significance is determined based on large differences between means, rather than on small variation among replicates, is to use the MSD. MSD is a statistic that indicates the difference between the two means (the mean of the sample and control replicates) that will be considered statistically significant given the observed level of among-replicate variation and the alpha level chosen for the comparison. The detectable difference inherent to a bioassay protocol can be determined by identifying the magnitude of difference detected by the protocol 90% of the time (Schimmel *et al*. 1991, Thursby and Schlekat 1993, Phillips *et al*. 2001). An additional set of t-tests (alpha = 0.05) is conducted and MSD values are calculated for each comparison. The MSDs are ranked in ascending order, and the 90^{th} percentile value is identified. This value is greater than or equal to 90% of the MSD values

generated. The 90th percentile MSD value is the difference that 90% of the t-tests will be able to detect as statistically significant and is equivalent to setting the level of statistical power at 0.90. The 90th percentile MSD threshold was established from 119 bioassay results for San Francisco Estuary (MPSL unpublished data, Hunt *et al*. 1996). A recalculation in 2003 confirmed the 90th percentile MSD for *Eohaustorius* was 18.8%, but determined that it should be revised to 15.2% for the bivalve larvae test. For the August 2001 sediment bioassays, an amphipod bioassay was toxic if it had below 77.2% survival while the larval bivalve bioassay was toxic it if had below 74.8% normal development, and there was a significant difference between the mean of the control and sample replicates using a separate variance t-test (alpha = 0.01).

3.4 Sediment Data

Sediment contaminant concentrations have been measured at most of the RMP sites since 1991. Samples were collected in 1991 and 1992 by the State's BPTCP Pilot Studies (Flegal *et al*. 1994), and by the RMP since 1993. Combining data from these two programs provides a time-series of 20 sampling events over 11 years. Averages and ranges of concentrations for several trace elements are shown for each major Estuary region (Figures 3.17–3.30). 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. Chromium measurements were discontinued in 2000. Methylmercury in sediments was measured by the RMP for the first time in 2000.

Except for the Rivers, plots for the various Estuary reaches include only muddy sediment samples (>40% fines). At the River stations, one or both stations had coarse sediments in each sampling period. A separate plot is presented for all samples with coarse (>60% sand) sediments, including the Rivers when sandy.

3.5 Results and Discussion

Sediment contaminant concentrations measured in the San Francisco Estuary exhibit considerable variation depending on the location and time of sampling. High contaminant concentrations can reflect 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; Leatherbarrow *et al*. 2002). However, complex sediment transport dynamics within the Estuary confound this simplistic model. For example, sediments with more silt- and clay-sized particles 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). As a consequence the concentrations reported provide information only about the condition of sediments at the times and locations of sampling. RMP sediment monitoring provides reliable measurements of sediment contamination in the most recently deposited sediments and is useful to examine trends in concentrations in time and space.

3.5.1 Spatial Distributions

Concentrations of most contaminants, as in previous years, were higher in the Southern Sloughs and South Bay compared to other reaches of the Estuary (Figures 3.1–3.15). This pattern is emphasized by the gradient in contaminant concentrations across the margin of

the South Bay (SFEI 1999; 2000; 2001). Contaminant concentrations in sediment samples from the Central Bay, Northern Estuary, and River reaches were generally lower than those measured at the Estuary Interface stations, Standish Dam (BW10) and Guadalupe River (BW15).

Average concentrations of cadmium, copper, lead, mercury, methylmercury, nickel, selenium, silver, zinc, DDTs, and chlordanes were highest in sediment samples from the Estuary Interface sites, whereas average PAH concentrations were found to be highest in South Bay sediments and average PCB concentrations in the Southern Sloughs. The Northern Estuary reach had the highest average concentrations of arsenic. Average concentrations of all contaminants except arsenic, nickel, and chlordanes were lowest in the Rivers. Average arsenic and nickel concentrations were lowest in the Southern Sloughs and Central Bay, respectively. Chlordanes were not detected in the Central Bay and Rivers reaches, and dieldrin was not detected in any of the sediment samples. Individual stations high in contaminant concentrations were primarily located at the Estuary Interface sites.

The highest numbers of ERL exceedances were observed at Petaluma River (BD15) in February, and Guadalupe River (BW15) in August (see Table 3.2). ERL guideline exceedances and sediment contaminant concentrations tended to be lowest at the coarse sediment stations (>60% sand): Sacramento River (BG20), San Joaquin River (BG30), Pacheco Creek (BF10), Davis Point (BD41), Red Rock (BC60), and Horseshoe Bay (BC21). Low numbers of ERL exceedances were also observed in August 2001 at the non-coarse stations of Petaluma River (BD15), Oyster Point (BB30), Coyote Creek (BA10), and Sunnyvale (C-3-0).

3.5.2 Sediment Contaminant Patterns

After six consecutive wet or above normal years northern California experienced a dry water year in 2001 (http://cdec.water.ca.gov/cgi-progs/iodir/wsihist). January began with dry hydrologic conditions, but eventually winter precipitation brought large amounts of runoff from mid-February through mid-March. Outflows from the Sacramento-San Joaquin Delta to the Estuary were well below average for most of the year (Harrison 2002). Sacramento and San Joaquin River mean daily flows peaked at about 1,310 and 160 m^3/s, respectively, in early March. Flows then decreased rapidly in mid-March remaining low through late November. Sacramento River flows increased during November and December due to a series of storms that started at the end of October.

Sediment samples in February were collected before peak storm flows. Concentrations of arsenic, lead, methylmercury, nickel, zinc, and chlordanes tended to be higher in the Northern Estuary during the wet season (Figures 3.1-3.15). Elevated sediment contaminant concentrations may be due to the flushing of sediment-associated contaminants into the Estuary by flood flows (SFEI 1999), a pattern most obvious at sites nearest the major tributaries of the Estuary. A large spike in PAHs at Petaluma River (BD15) in February may be indicative of such an event (Figure 3.11).

Contamination trends have been observed in RMP sediment samples at both seasonal (wet and dry) and interannual scales (SFEI 1999). Even so, it is important to recognize that contaminant concentration variation seen in the plots may be influenced by physical sediment characteristics, as well as proximity to sources. In general, sediments with more silt and clay (percent fines (<63 µm)) and higher total organic carbon (TOC) have higher concentrations than sediments with higher sandy content (>63 µm) and low TOC. Therefore, some of the variation represented in the plots could be attributable to spatial and temporal variations in sediment characteristics rather than in changes in concentrations over time.

A depth profile of sediments can reveal historical trends in contaminant concentrations. United States Geological Survey (USGS) sediment coring studies in the Estuary allow us to place the observed contaminant trends at RMP stations 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-industrial) concentrations. Silver, lead, copper, and zinc contamination first appeared in the Bay sediment record after 1910. Concentrations of most contaminants have decreased from the peak levels documented in the 1960s and 1970s (Hornberger *et al.* 1999; Venkatesan *et al.* 1999) probably due to improvements in treatment of wastewater, changes in industrial and shipping technology, product bans, and other regulatory measures.

A complex set of processes that include deposition, resuspension, mixing, transport, and biogeochemistry are reflected in changes in sediment concentrations with time. The interplay of these processes determines the "active sediment layer" and any rates of burial and erosion. The depth of the active layer was determined to be a key factor in the fate of polychlorinated hydrocarbons in sediments (Davis 2002). In the absence of better information, Davis (2002) used a "best estimate" of 15 cm for the Bay-wide average active sediment layer depth. Deep mixing generally accounts for the long residence times of contaminants in the surface sediments of the Bay. Fuller *et al*. (1999) proposed that even in the absence of continued contaminant inputs at the Richardson Bay location, over 75 years would be required to bury 90% of a deposited contaminant below the active mixed sediment layer.

3.5.3 Sediment Toxicity

Toxicity tests, described in Section 3.3, were conducted to determine whether sediments were toxic to sensitive benthic 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.

Estuary sediments were toxic to either amphipods or bivalve embryos in 7 out of 13 samples (54%) of the 2001 RMP samples; 60% of the RMP samples tested between 1993 and 2001 were toxic to these organisms. Patterns of toxicity for the two test organisms vary at the different RMP sites. Stations located in the northern part of the Estuary, Sacramento River (BG20), San Joaquin River (BG30), Grizzly Bay (BF21), and Napa River (BD50) have been consistently toxic to bivalve embryos since 1994. However, there has been a decrease in the incidence of amphipod toxicity at Sacramento River. Central Bay sediments show an increase in the incidence of amphipod toxicity at Yerba Buena Island (BC11), but a decrease in the incidence of bivalve embryo toxicity at Alameda (BB70). The southern part of the Estuary has seen a small increase in the incidence of toxicity at the South Bay (BA21) station to bivalve embryos. No increases or decreases in the incidence of toxicity were seen at other RMP stations. Bioassay results for 2001 indicate sediments from San Bruno Shoal (BB15), Yerba Buena Island (BC11), Horseshoe Bay (BC21), Red Rock (BC60), and Davis Point (BD41) were not toxic to amphipods or bivalve larvae. Seasonal patterns were not examined in 2001 because no sampling occurred in the winter, but prior to 2000 sediments were usually more toxic during the wet sampling period (SFEI 2000; 2001).

Causes of toxicity to the amphipods and bivalve larvae are poorly understood. Analyses using several years of monitoring data suggest that amphipod toxicity is associated with the cumulative effects of mixtures of contaminants (Thompson *et al.* 1999). 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 to survival. Sediment elutriates (water soluble fraction) have been observed as being toxic to bivalve larvae for the Sacramento and San Joaquin Rivers, and Grizzly Bay samples since 1993 (SFEI 2000; 2001). Toxicity identification evaluations (TIEs) conducted on the sediment elutriates from the Sacramento and San Joaquin Rivers and Grizzly Bay in 1997 and 1998 indicated that dissolved trace metals, particularly copper, could be partially responsible for the toxicity, but organic contaminants were also identified as possible toxic components from the Sacramento River site (Phillips *et al*. 2000). These results suggest that sediment toxicity at the different RMP stations may be related to different contaminants and may vary with time.

Studies by RMP investigators 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 (BF21). 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. 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 contaminants accumulated in amphipods were PAHs, which may have been a key causative agent of the observed toxicity. However, mixtures of contaminants are also believed to be important (Anderson *et al*. 2000).

3.5.4 Assessment of Sediment Quality

Estuary sediments are evaluated through comparisons to several sets of sediment quality guidelines described in *Section 3.2 Sediment Quality Guidelines*. Although these guidelines hold no regulatory status, they provide concentration guidelines that are useful in assessing the potential for toxic and benthic effects.

Sediment contamination and toxicity results were used to evaluate the quality of the 2001 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, Gandesbery *et al.* 1999), Effects-Range guidelines (ERL and ERM, Long *et al.* 1995), and the 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). Long *et al*. (1998) found samples with more than four ERM exceedances showed toxicity in 68% of amphipod tests, while 51% of samples were toxic to amphipods when more than nine ERLs were above the guidelines. Based on these results the 2001 RMP sediment samples were considered potentially toxic if either four or more ERMs, nine or more ERLs, or half (22) of the ASC values were exceeded.

ERM values were used to calculate a mean ERM quotient (mERMq) for each sample. The mERMq has been used in previous RMP reports and San Francisco Estuary publications, as an index of cumulative sediment contaminant concentrations (Thompson *et al.* 1999, Hunt *et al*. 2001a,b; Fairey *et al*. 2001, Thompson and Lowe, ms). The primary reason for using the mERMq is that it provides a measure of potential additive contaminant effects. For example, amphipod survival has been found to be significantly and inversely correlated to mERMq (Thompson *et al.* 1999), suggesting that contaminants individually present in relatively low concentrations in sediments may act together to adversely influence amphipod survival. In these past reports and publications, however, the mERMq has been

calculated in several different ways. However, if comparisons to other U.S. estuaries are to be accomplished, a standard method of calculation is necessary. Therefore, the calculation of mERMq was changed this year in order to make the RMP ERM quotients comparable to other studies from around the United States (Hyland *et al.* 1999, Long *et al*. 2002, Hyland *et al.* 2003). In the past, RMP mERMqs were calculated using 13 contaminants, including nickel, but the revised calculations use 24 contaminants (Hyland *et al.* 1999), excluding nickel (Table 3.1). Samples that did not have values for at least 19 of the 24 parameters were not included in the calculations. The resulting values are considerably lower than the values calculated in previous years, and are heavily weighted with PAHs.

Long *et al*. (1998) showed that 49% of sediment samples were toxic to amphipods when mERMq values were above 0.5, and 71% of samples were toxic when mERMq values were greater than 1.0. Mean ERM quotients, calculated with 24 contaminants, were used in a previous study of the San Francisco Estuary in which values greater than 0.15 were associated with increased risks of benthic impact (Thompson and Lowe, ms). These values were used to evaluate the 2001 RMP sediment samples for potential adverse ecological effects. Only one (Guadalupe River (BW15)) of 30 samples in 2001 had a mERMq value above 0.15, suggesting a potential for negative benthic impact (Table 3.2). Guadalupe River and Petaluma River (BD15) had nine contaminants above the ERL guidelines, but these samples were not tested for toxicity. Seven benthic samples were toxic (Sacramento River (BG20), San Joaquin River (BG30), Grizzly Bay (BF21), Alameda (BB70), Redwood Creek (BA41), and South Bay (BA21); however, all had mERMq values below 0.15 and also ERL, ERM, and ASC exceedences below the number considered to be potentially toxic. Horseshoe Bay (BC21) sediments had a high number of ASC exceedences (27), but tested not toxic to both test organisms.

Sediment evaluations are useful tools that incorporate sediment contamination and toxicity into a weight of evidence assessment of the condition of sediments in the Estuary. Each component is analyzed independently and weighted equally, but although they should be related the results do not always agree. The complexity of sediment evaluations demonstrate the need to consider as much data as possible in assessing the condition of Estuary sediments and the importance of performing future studies to reconcile and understand the observed contradictions.

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 Gandesbe *et al*. (1999).
Ambient sediment levels from background sediments in the Estuary allow one to assess whether a site has elevated levels or is "degrac

Background sediment concentrations for selected trace elements in the San Francisco Bay, from Hornberge *et al*. (1999)
Chromium and Nickel ranges were seen throughout the core. All TEs, 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 - 0.07
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	0.7 - 0.11	0.7 - 0.11
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		

* Chromium concentrations were not measured in 2001 sediment samples.

** Method detection limit (MDL) for the February and August cruises is greater than the ERL, ASC-sandy, and ASC-muddy guidelines. Therefore, conclusions regarding these benchmarks could not be drawn.

† values used to calculate mean ERM quotients (Hyland *et al*. 1999).

Table 3.2. Summary of sediment quality for the RMP in 2001.

. = 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?
BD50	Napa River	2/15/01	0.0678	1	5	1	.	.
BD41	Davis Point	2/15/01	0.0237	0*	1	1	.	.
BD22	San Pablo Bay	2/15/01	0.0746	0	6	1	.	.
BD15	Petaluma River	2/15/01	0.1250	14	9	1	.	.
BG20	Sacramento River	8/9/01	0.0214	0*	1	1	no	yes
BG30	San Joaquin River	8/9/01	0.0292	1*	1	1	no	yes
BF40	Honker Bay	8/9/01	0.0768	1	5	1	.	.
BF21	Grizzly Bay	8/9/01	0.0720	2	5	1	no	yes
BF10	Pacheco Creek	8/9/01	0.0282	2*	1	1	.	.
BD50	Napa River	8/10/01	0.0850	0	6	1	yes	no
BD41	Davis Point	8/10/01	0.0856	1*	2	2	no	no
BD31	Pinole Point	8/10/01	0.0735	0	5	1	.	.
BD22	San Pablo Bay	8/10/01	0.0889	1	7	1	.	.
BD15	Petaluma River	8/10/01	0.0785	0	4	1	.	.
BC60	Red Rock	8/13/01	0.0304	2*	2	1	no	no
BC41	Point Isabel	8/13/01	0.1102	3	6	1	.	.
BC32	Richardson Bay	8/13/01	0.0899	3	6	0	.	.
BC21	Horseshoe Bay	8/13/01	0.0722	27*	3	1	no	no
BC11	Yerba Buena Island	8/13/01	0.0935	1	6	1	no	no
BB70	Alameda	8/14/01	0.1184	4	6	1	yes	no
BB30	Oyster Point	8/14/01	0.0653	0	4	1	.	.
BB15	San Bruno Shoal	8/14/01	0.0983	2	5	1	no	no
BA41	Redwood Creek	8/14/01	0.0922	3	6	1	yes	no
BA30	Dumbarton Bridge	8/14/01	0.1021	2	7	1	.	.
BA21	South Bay	8/15/01	0.0980	2	8	1	no	yes
BA10	Coyote Creek	8/15/01	0.0590	0	3	1	no	no
C-3-0	San Jose	8/15/01	0.1034	3	7	1	.	.
C-1-3	Sunnyvale	8/15/01	.	0	2	0	.	.
BW10	Standish Dam	8/21/01	0.1285	4	8	1	.	.
BW15	Guadalupe River	8/21/01	0.1563	7	9	2	.	.

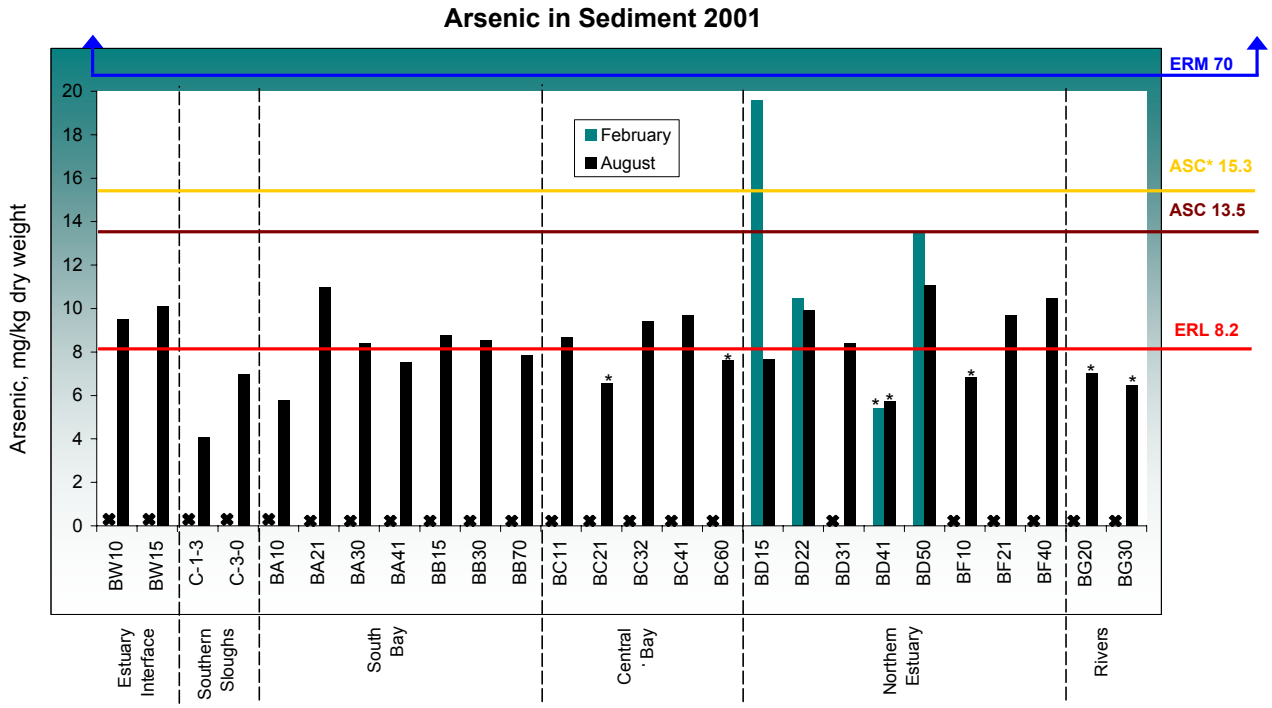

Figure 3.1. Arsenic (As) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Arsenic concentrations ranged from 4.06 to 19.57 ppm. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at Sunnyvale (C-1-3) in August. Average concentrations were highest (12.24 ppm) in the Northern Estuary in February, and lowest (5.51 ppm) in the Southern Sloughs in August.

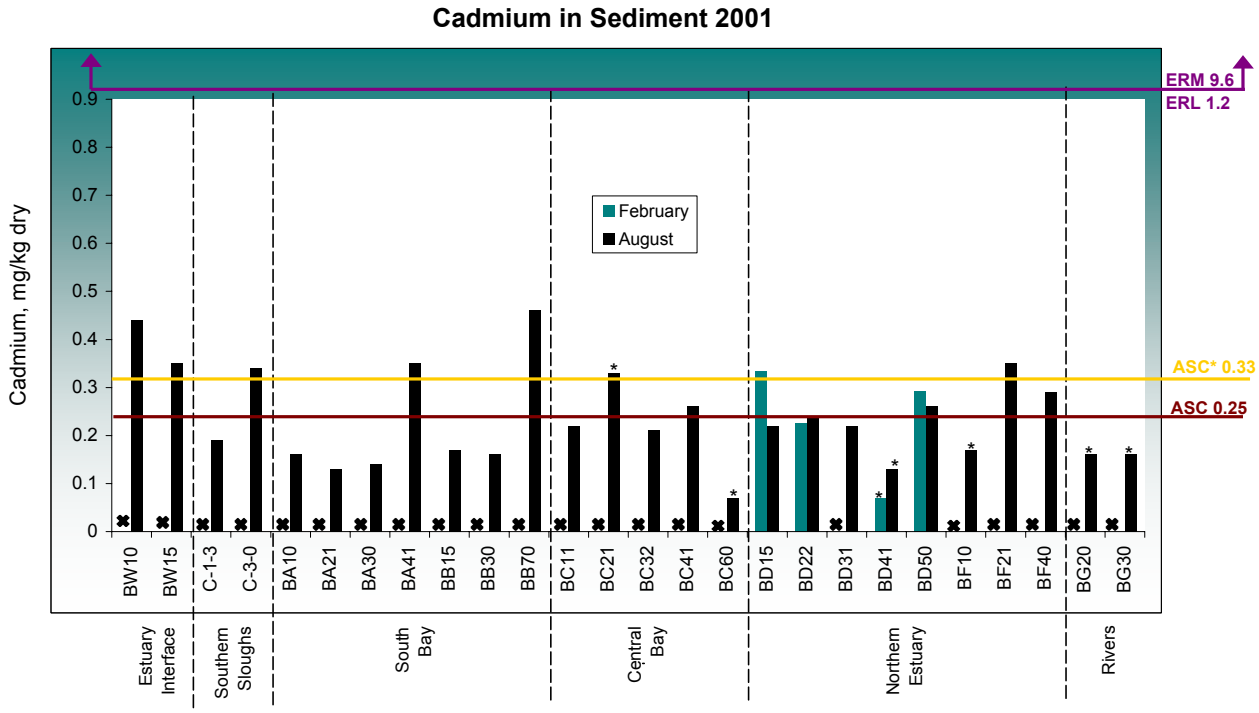

Figure 3.2. Cadmium (Cd) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Cadmium concentrations ranged from 0.07 to 0.46 ppm. The highest concentration was sampled at Alameda (BB70) in August and the lowest at Davis Point (BD41) in February and Red Rock (BC60) in August. Average concentrations were highest (0.40 ppm) in the Estuary Interface and lowest (0.16 ppm) in the Rivers, both in August.

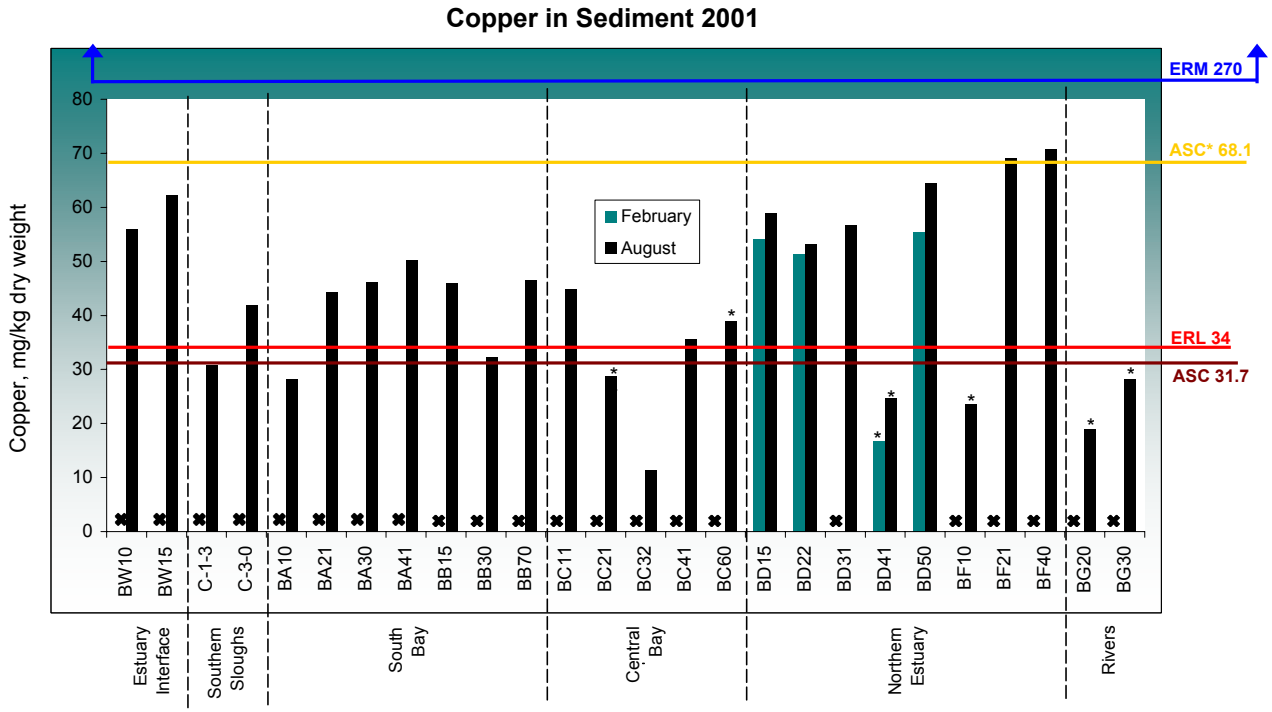

Figure 3.3. Copper (Cu) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Copper concentrations ranged from 11.3 to 70.7 ppm. The highest concentration was sampled at Honker Bay (BF40) and the lowest at Richardson Bay (BC32), both in August. Average concentrations were highest (59.1 ppm) in the Estuary Interface and lowest (23.6 ppm) in the Rivers, both in August.

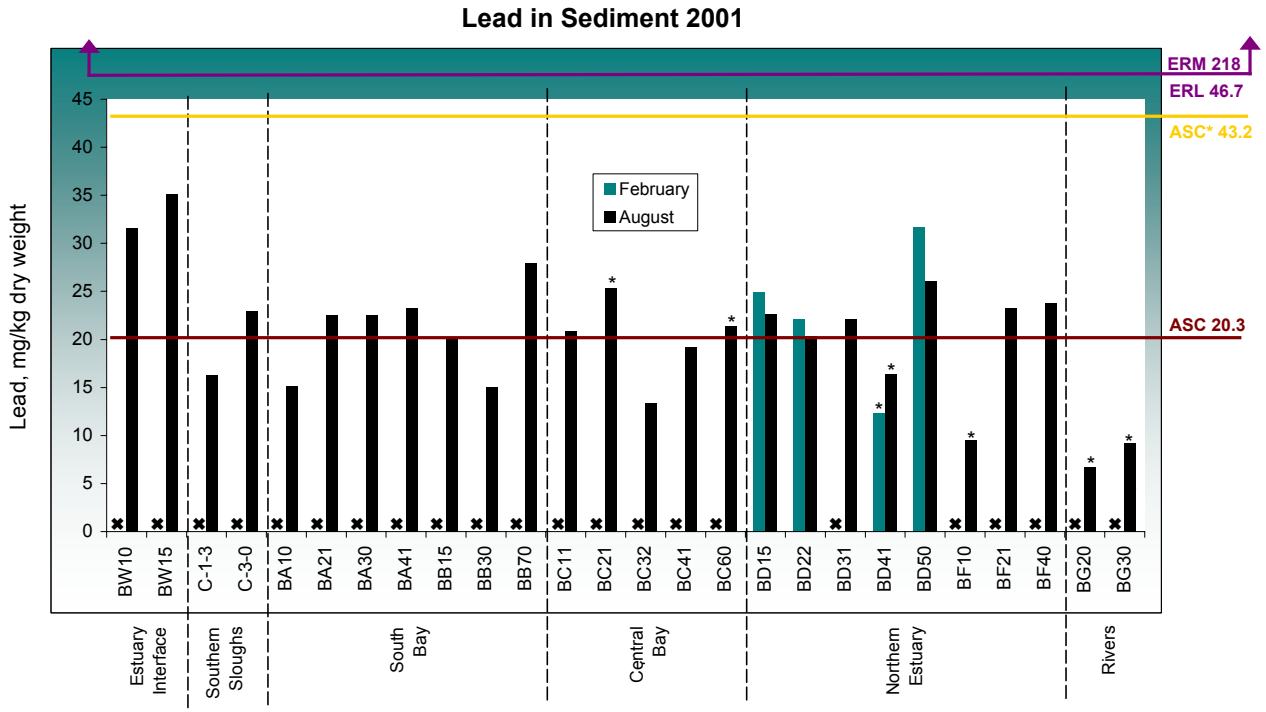

Figure 3.4. Lead (Pb) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Lead concentrations ranged from 6.7 to 35.1 ppm. The highest concentration was sampled at Guadalupe River (BW15) and the lowest at Sacramento River (BG20), both in August. Average concentrations were highest (33.3 ppm) in the Estuary Interface and lowest (7.97 ppm) in the Rivers, both in August.

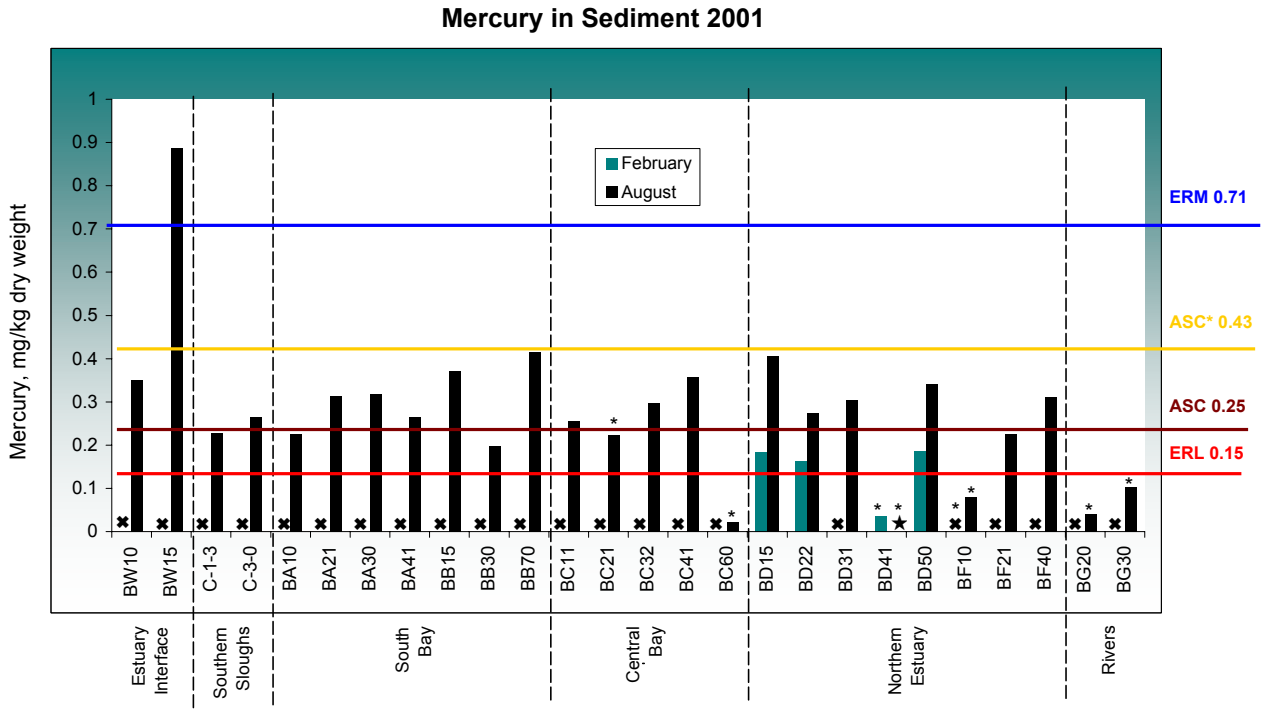

Figure 3.5. Mercury (Hg) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ★ indicates result not available. Mercury concentrations ranged from 0.02 to 0.89 ppm. The highest concentration was sampled at Guadalupe River (BW15) and the lowest at Red Rock (BC60), both in August. Average concentrations were highest (0.62 ppm) in the Estuary Interface and lowest (0.07 ppm) in the Rivers, both in August.

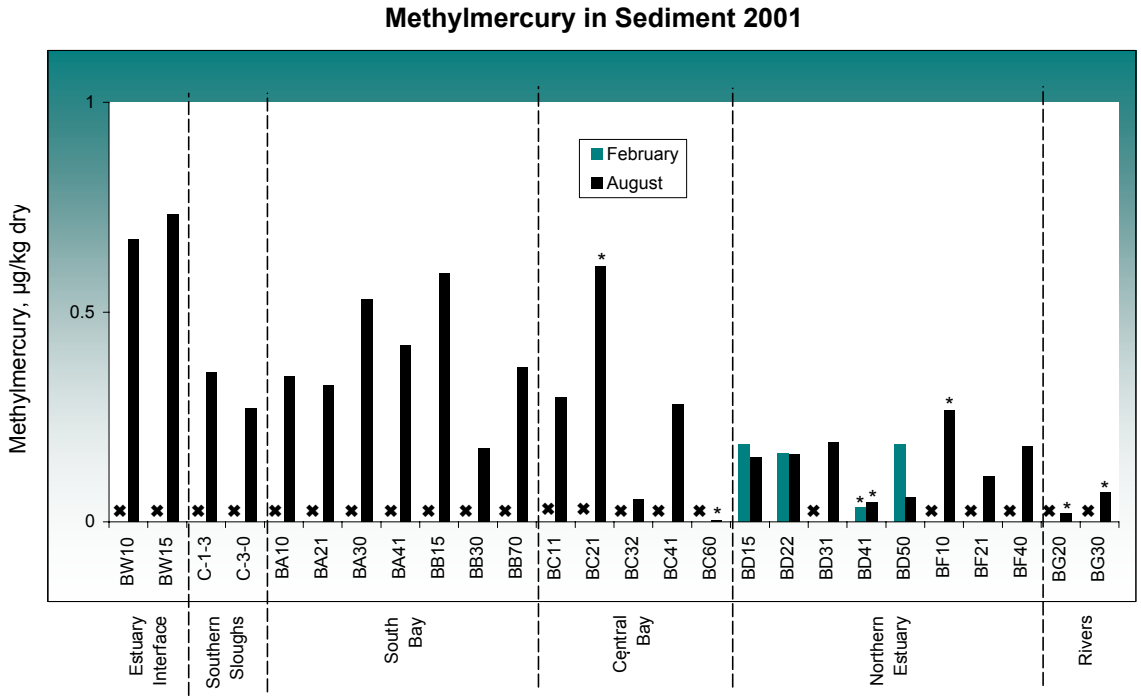

Figure 3.6. Methylmercury (MeHg) concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Methylmercury concentrations ranged from 0.005 to 0.73 ppb. The highest concentration was sampled at Guadalupe River and the lowest at Red Rock (BC60), both in August . Average concentrations were highest (0.70 ppb) in the Estuary Interface and lowest (0.05 ppb) in the Rivers, both in August. There are no ERL, ERM, or ASC values for methylmercury.

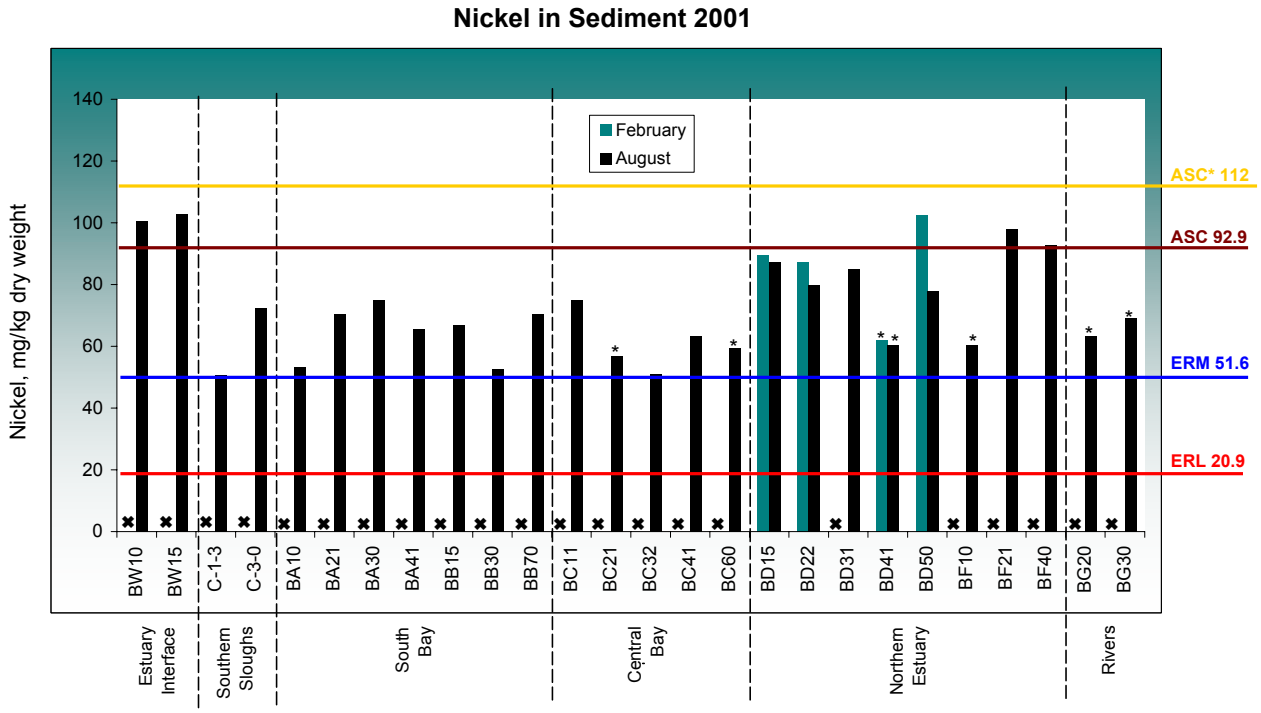

Figure 3.7. Nickel (Ni) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Nickel concentrations ranged from 50.5 to 102.8 ppm. The highest concentration was sampled at Guadalupe River (BW15) and the lowest at Sunnyvale (C-1-3), both in August. Average concentrations were highest (101.5 ppm) in the Estuary Interface and lowest (61.1 ppm) in the Central Bay, both in August.

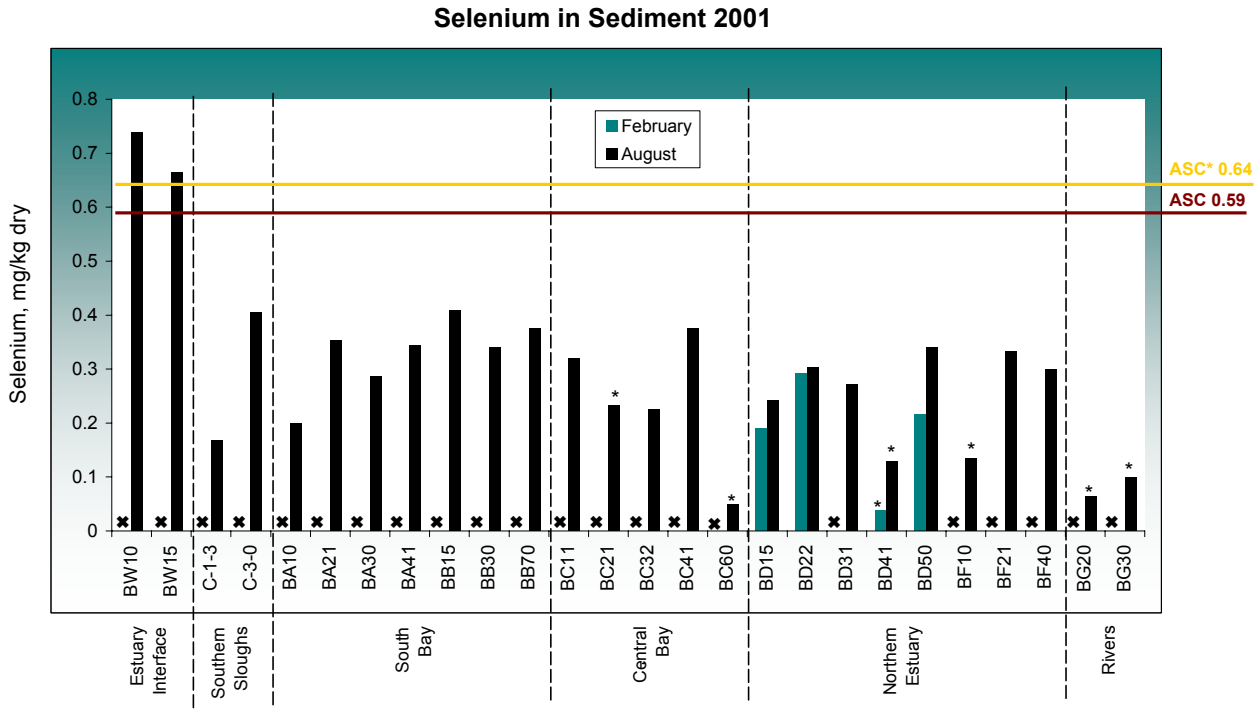

Figure 3.8. Selenium (Se) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Selenium concentrations ranged from 0.04 to 0.74 ppm. The highest concentration was sampled at Standish Dam (BW10) in August and the lowest at Davis Point (BD41) in February. Average concentrations were highest (0.70 ppm) in the Estuary Interface and lowest (0.08 ppm) in the Rivers, both in August. No ERM and ERL values exist for selenium. None of the samples were above the Regional Board suggested guidelines of 1.4 ppm (Wolfenden and Carlin 1992), and 1.5 ppm (Taylor *et al*. 1992).

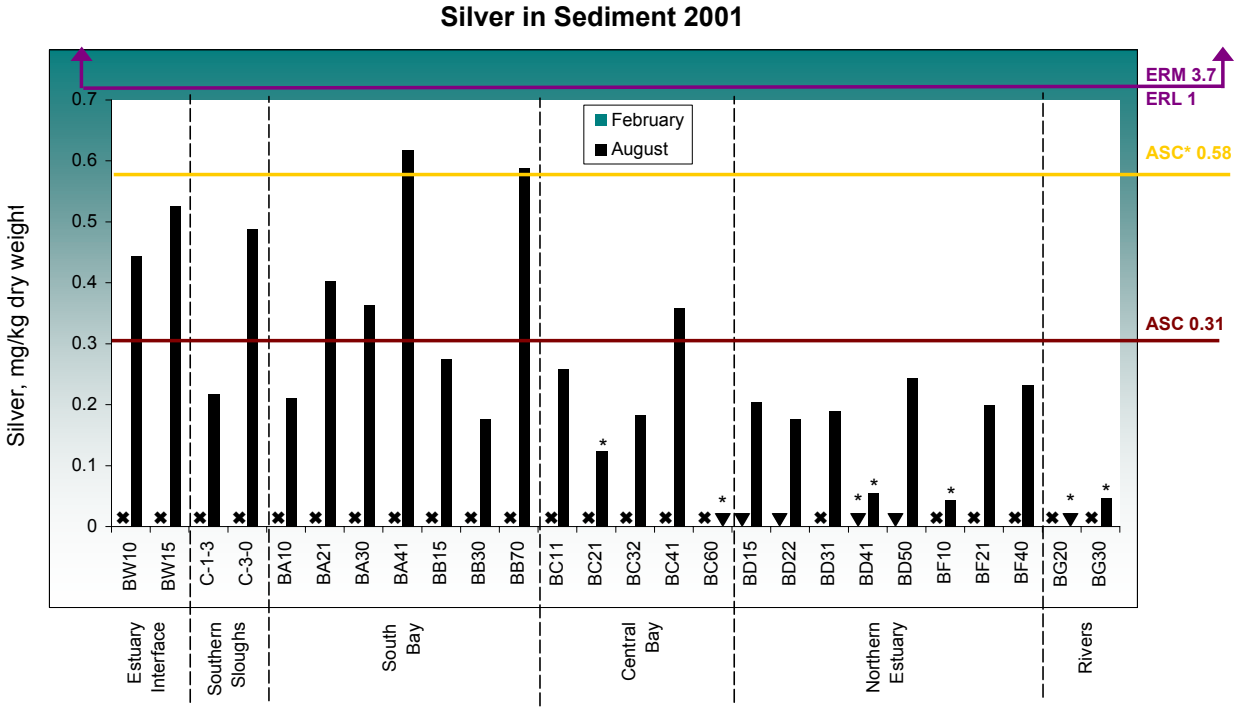

Figure 3.9. Silver (Ag) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ▼ indicates that analyte was not detected. Silver concentrations ranged from not detected (▼) to 0.62 ppm. The highest concentration was sampled at Redwood Creek (BA41) in August. Average concentrations were highest (0.48 ppm) in the Estuary Interface and lowest (0.02) in the Rivers, both in August.

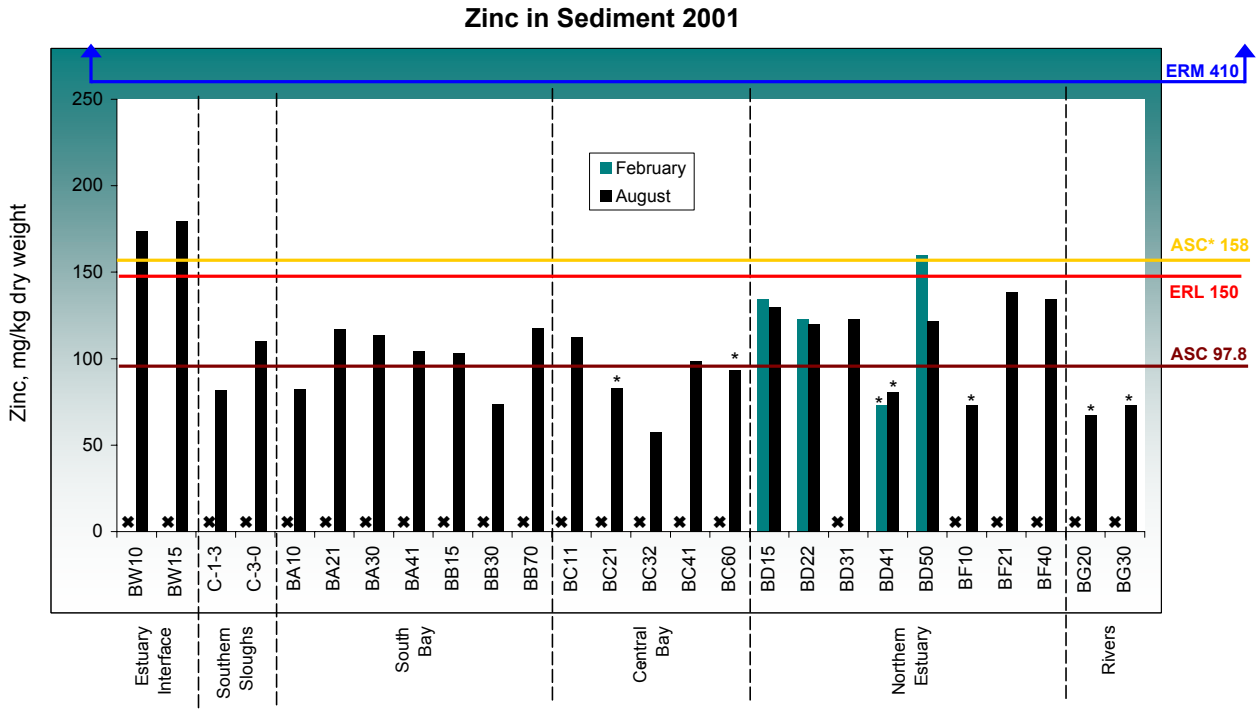

Figure 3.10. Zinc (Zn) concentrations in sediments in parts per million, dry weight (ppm) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. Zinc concentrations ranged from 57.4 to 179.6 ppm. The highest concentration was sampled at Guadalupe River (BW15) and the lowest at Richardson Bay (BC32), both in August. Average concentrations were highest (176.7 ppm) in the Estuary Interface and lowest (70.1 ppm) in the Rivers, both in August.

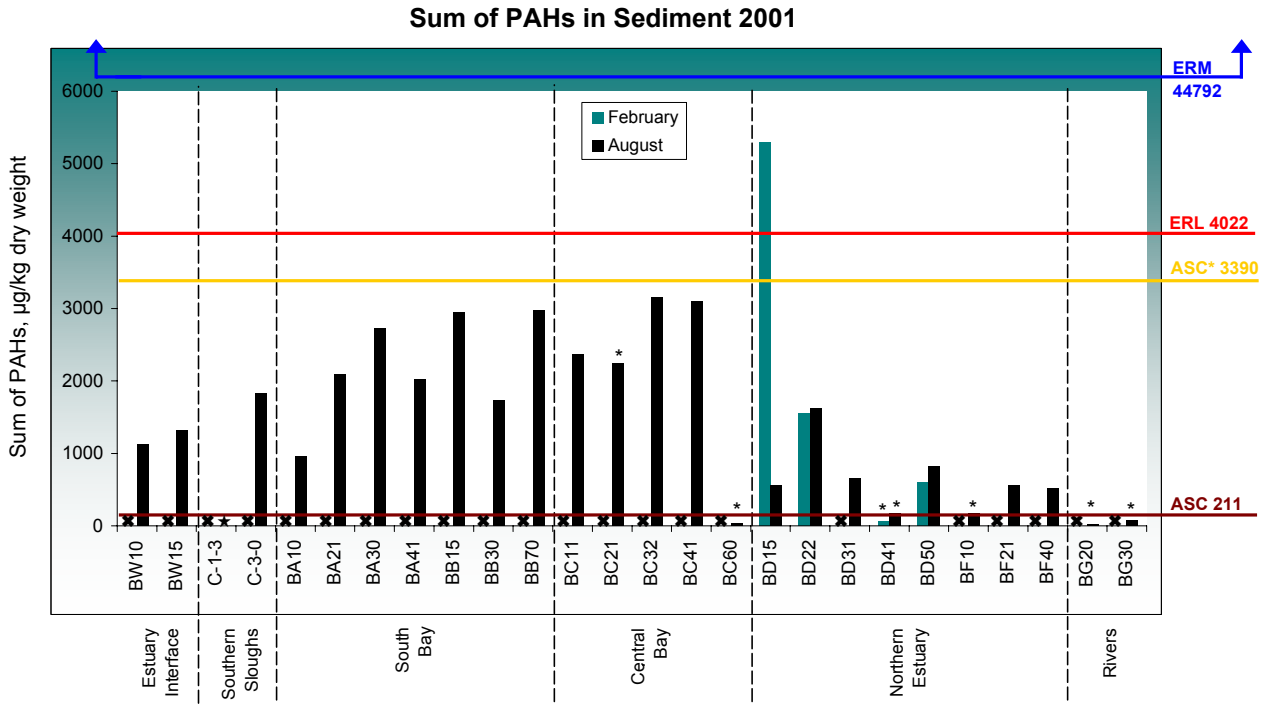

Figure 3.11. Sum of PAH concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ★ indicates analyte was not analyzed. PAH concentrations ranged between 19.78 and 5295.44 µg/kg. The highest concentration was sampled at Petaluma River (BD15) in February and the lowest at Sacramento River (BG20) in August. Average concentrations were highest (2208.87 µg/kg) in the South Bay and lowest (45.9 µg/kg) in the Rivers, both in August.

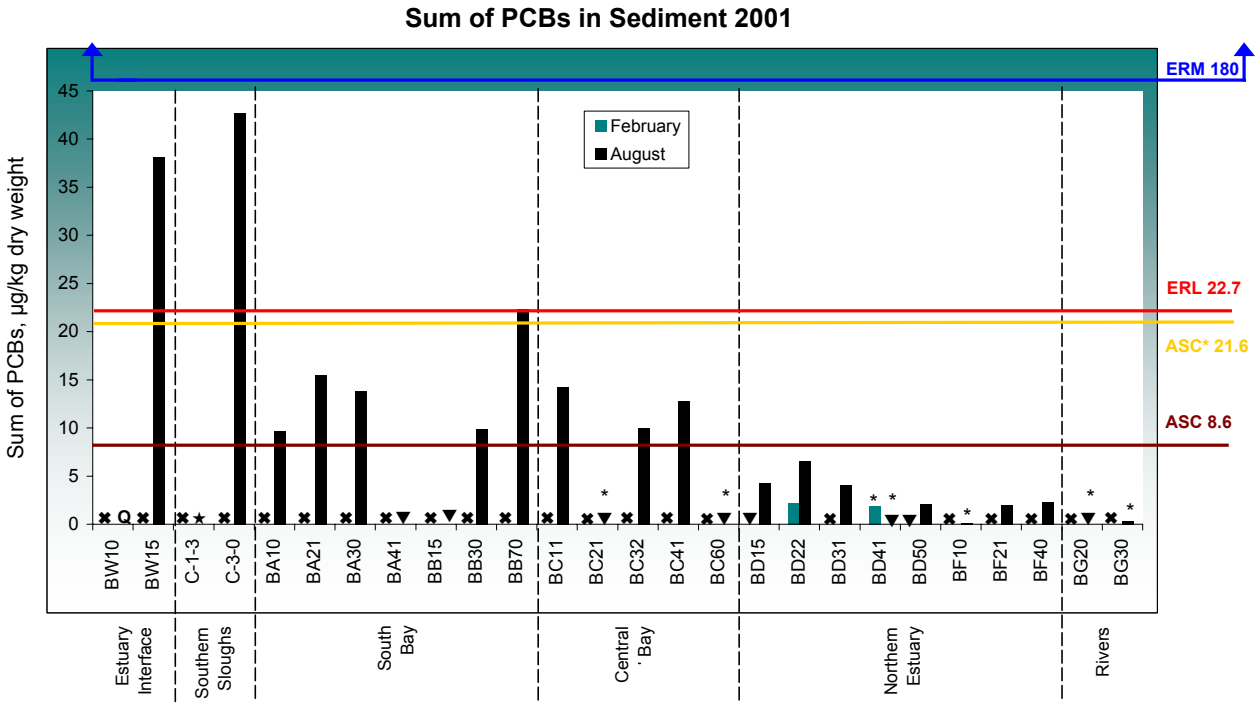

Figure 3.12. Sum of PCB concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and Agust 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ▼ indicates that analyte was not detected. ★ indicates analyte was not analyzed. **Q** indicates outside QA limits. PCB concentrations ranged between not detected (▼) and 42.66 µg/kg. The highest concentration was sampled at San Jose (C-3-0) in August. Average concentrations were highest (42.66 µg/kg) in the Southern Sloughs and lowest (0.18 µg/kg) in the Rivers, both in August.

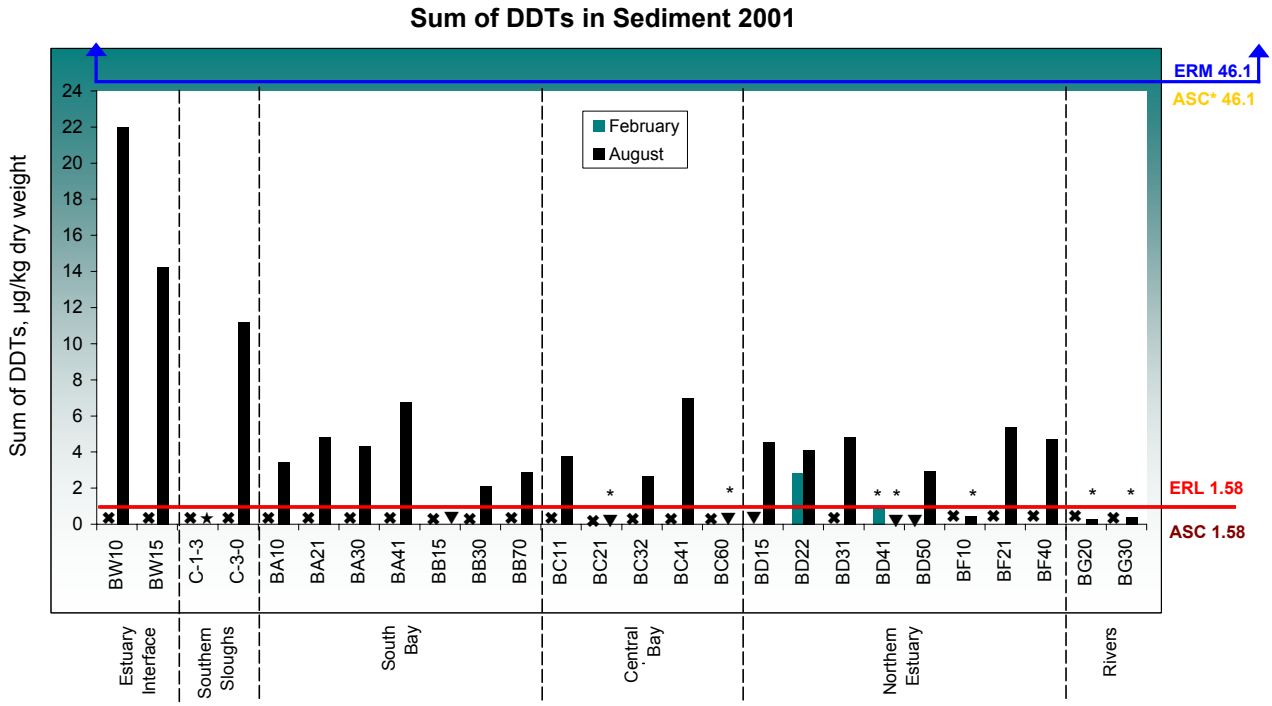

Figure 3.13. Sum of DDT concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ▼ indicates that analyte was not detected. ★ indicates analyte was not analyzed. DDT concentrations ranged between not detected (▼) and 22.01 µg/kg. The highest concentration was sampled at Standish Dam (BW10) in August. Average concentrations were highest (18.14 µg/kg) in the Estuary Interface and lowest (0.34 µg/kg) in the Rivers, both in August.

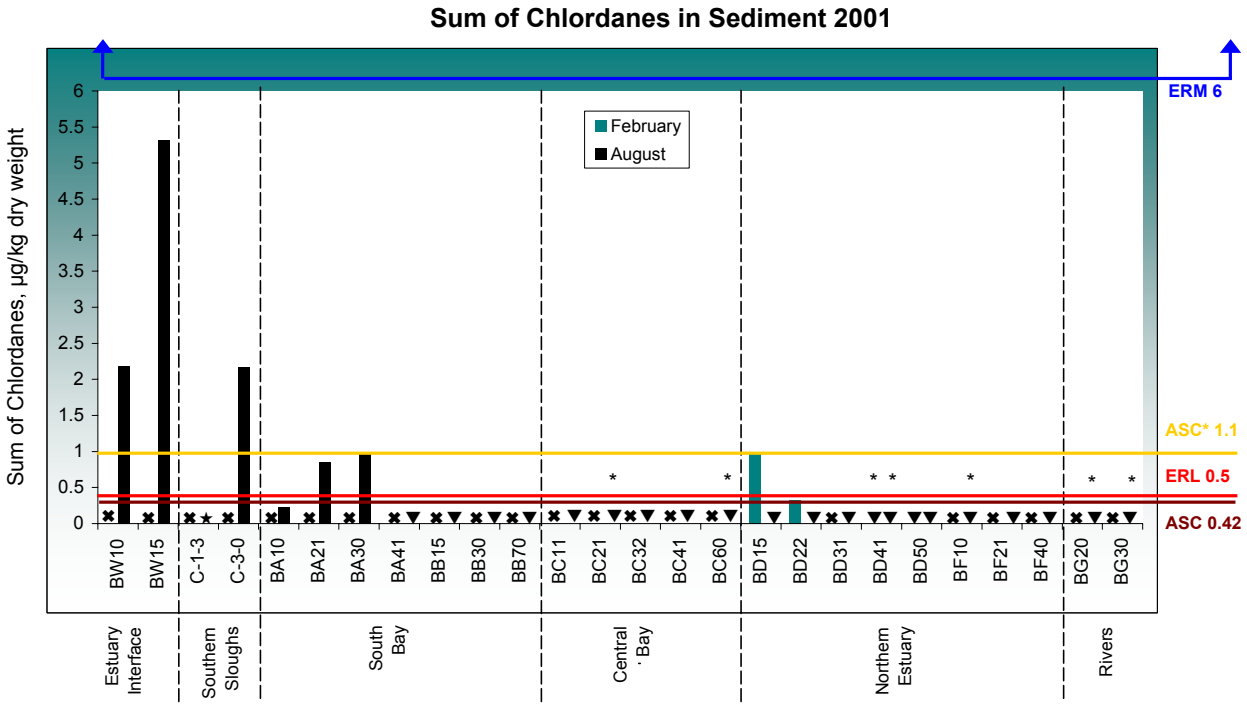

Figure 3.14. Sum of chlordane concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and August 2001. * indicates coarse sediment stations. ✖ indicates station was not sampled. ▼ indicates that analyte was not detected. ★ indicates analyte was not analyzed. Chlordane concentrations ranged between not detected (▼) and 5.32 µg/kg. The highest concentration was sampled at Guadalupe River (BW15) in August. Average concentrations were highest (3.75 µg/kg) in the Estuary Interface and lowest (not detected) in the Central Bay and Rivers, all in August.

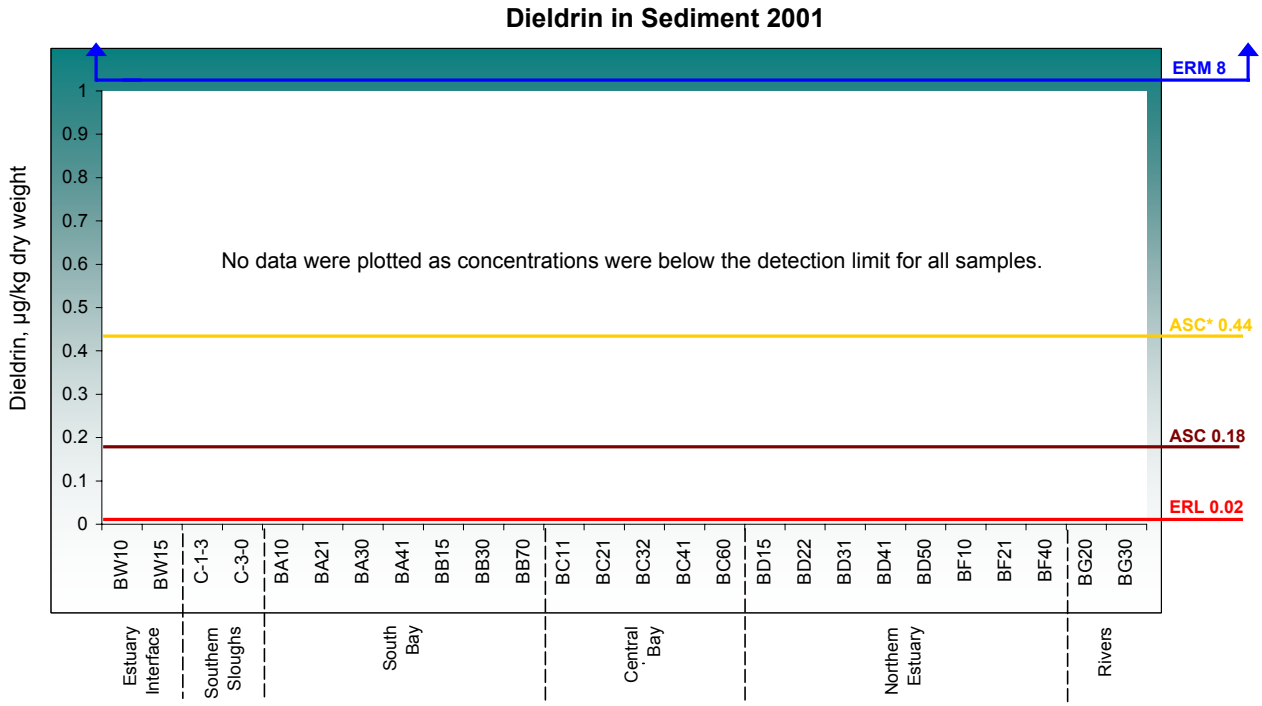

Figure 3.15. Dieldrin concentrations in sediments in parts per billion, dry weight (ppb) at 26 stations sampled in February and August 2001. No data were plotted as concentrations were below the method detection limit (MDL) for all samples. Since the MDL values were greater than the guidelines for both the wet and dry season cruises, conclusions regarding these benchmarks could not be drawn.

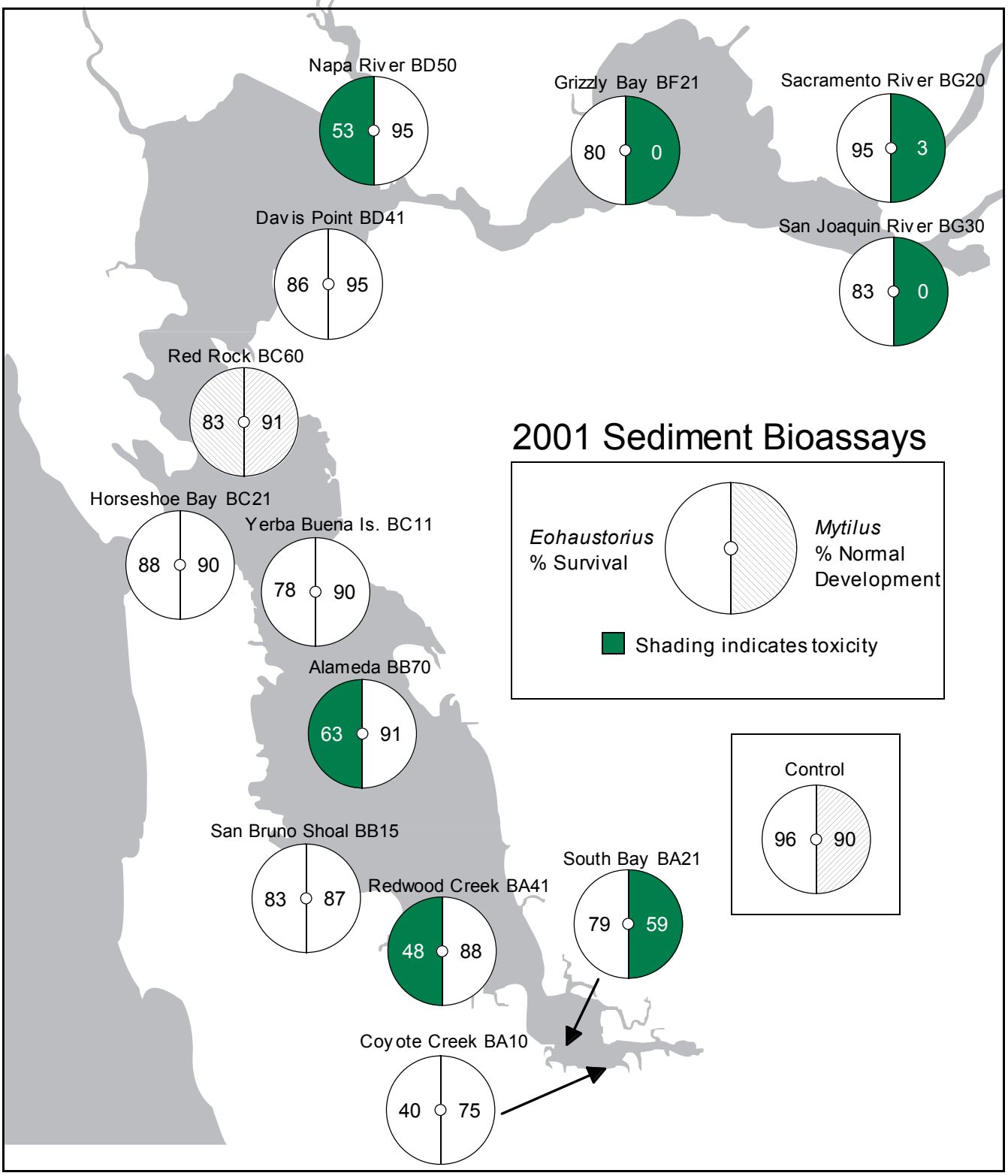

Figure 3.16. Sediment bioassay results for August 2001. Sediments were not toxic (see Section 3.3 Sediment Bioassays) to either amphipods or bivalve larvae at Davis Point (BD41), Red Rock (BC60), Horseshoe Bay (BC21), Yerba Buena Island (BC11), San Bruno Shoal (BB15), and Coyote Creek (BA10). Amphipod toxicity was observed at Napa River (BD50), Alameda (BB70), and Redwood Creek (BA41). Sediments at the River stations (BG20, BG30), Grizzly Bay (BF21), and South Bay (BA21) were not toxic to amphipods. Sediment elutriates were toxic to larval mussels at Sacramento River (BG20), San Joaquin River (BG30), Grizzly Bay (BF21), and South Bay (BA21). They were not toxic to bivalve larvae at the remaining stations. Sediment conditions that could have influenced toxicity are considered in the *Results and Discussion.*

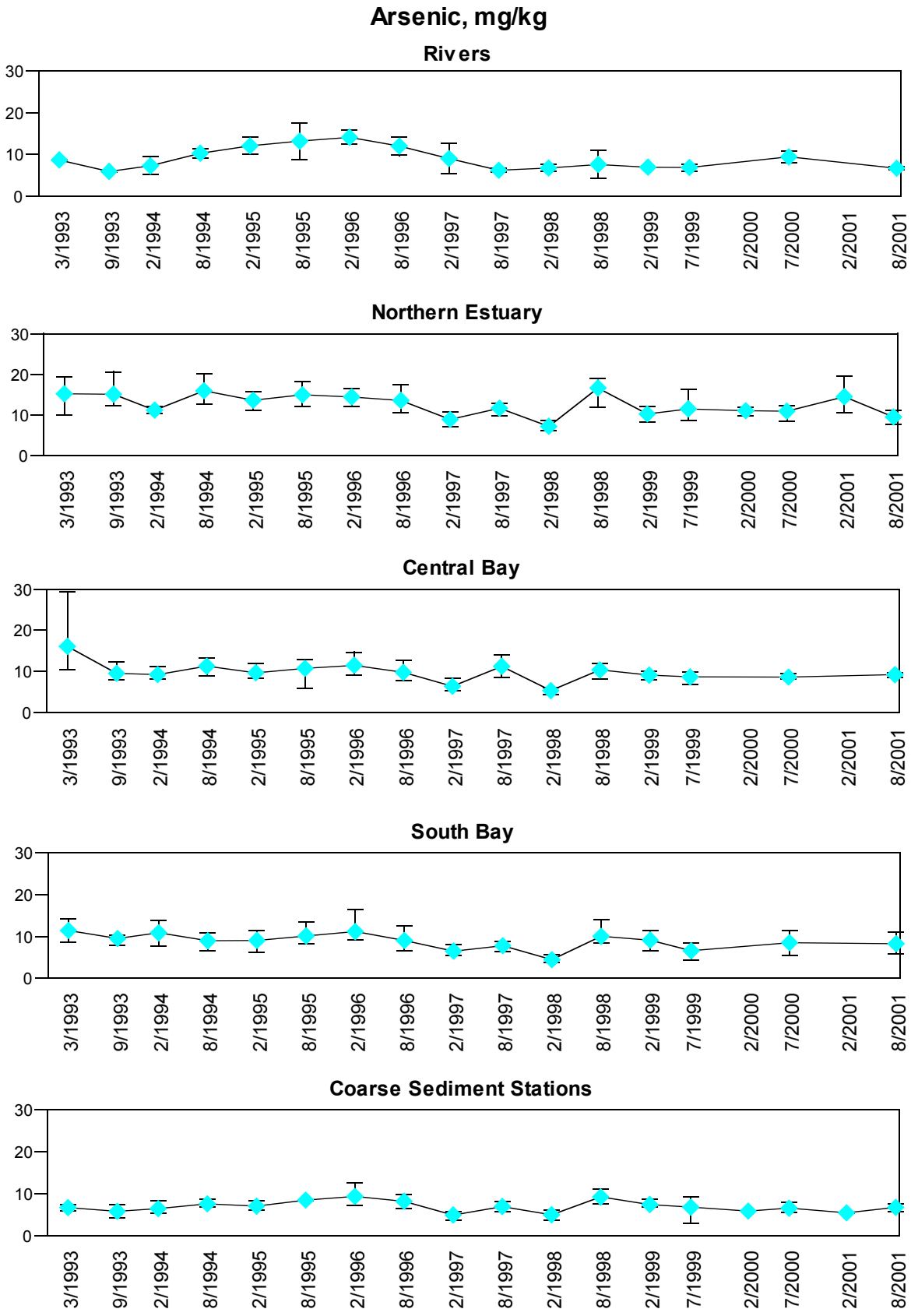

Figure 3.17. Average arsenic concentrations in sediments for each Estuary reach from 1993–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination, arsenic data for February 1999 is incomplete as follows: some stations in the South Bay and Coarse Sediment reaches are not included in averages; the February Rivers arsenic average consists of only one sample. Due to the RMP redesign, arsenic data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

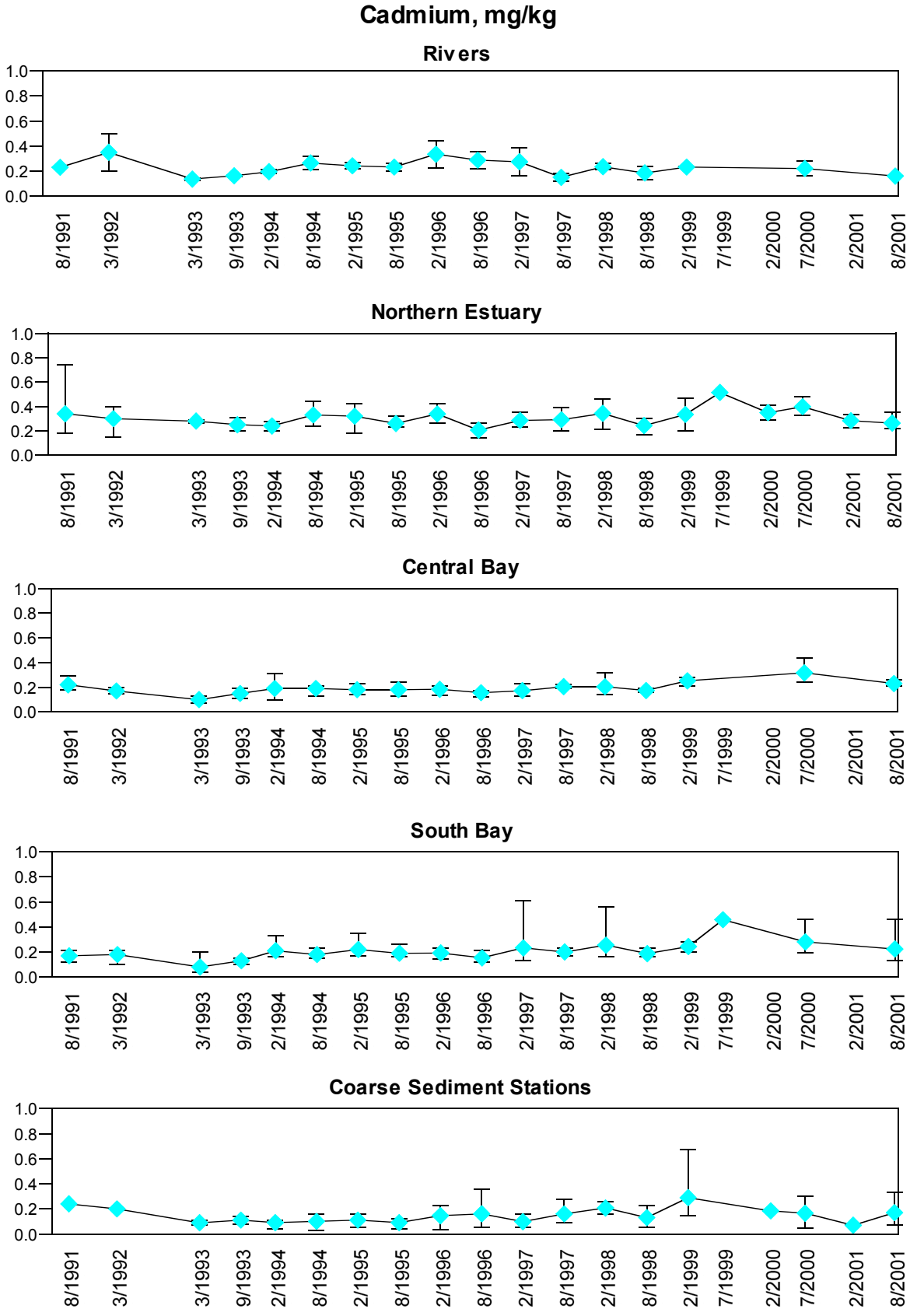

Figure 3.18. Average cadmium concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination there are 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. Due to the RMP redesign, cadmium data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

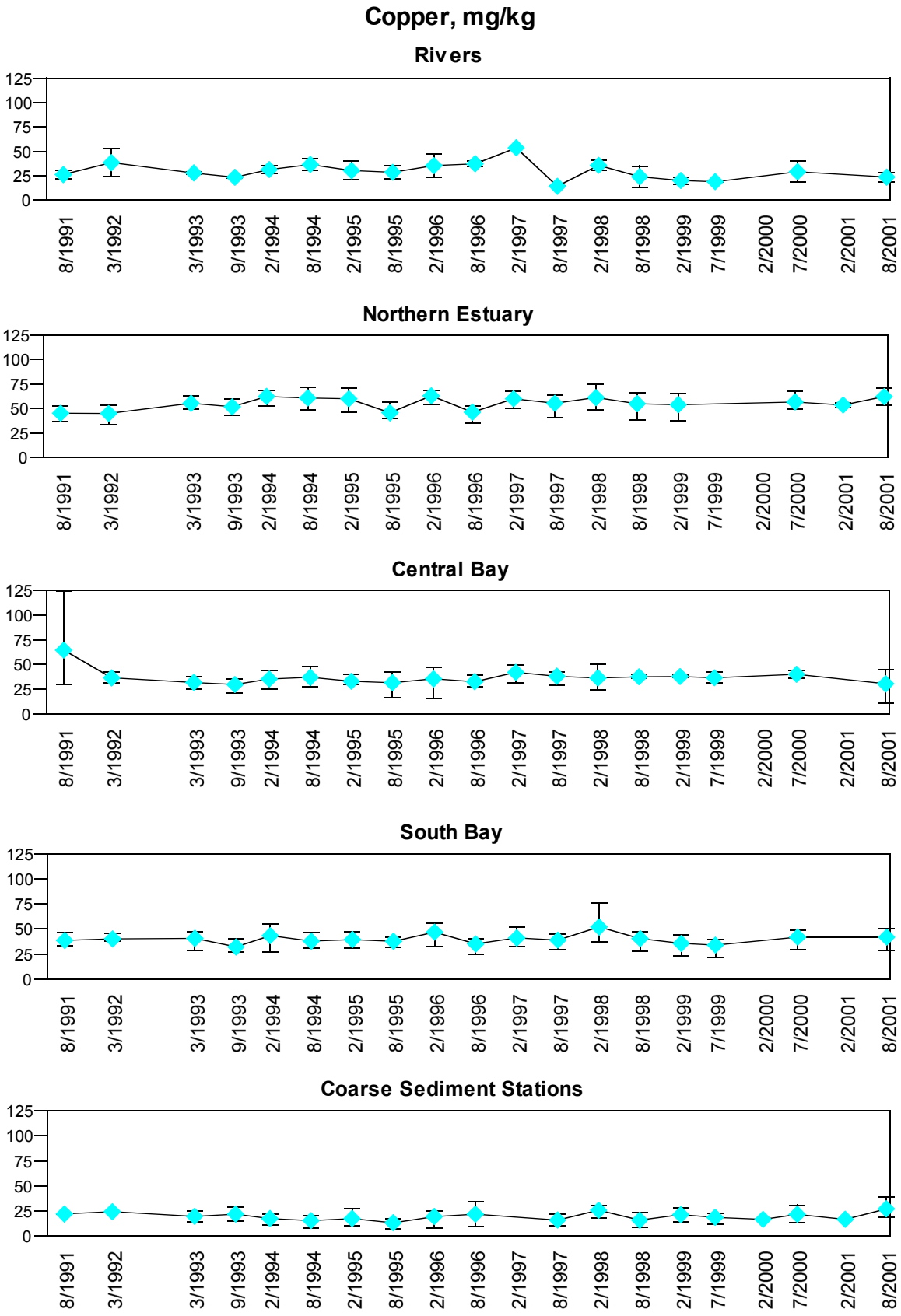

Figure 3.19. Average copper concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to contaminated blanks, copper data for 1997 are incomplete as follows: February Rivers and Northern Estuary data are incomplete; the February Central Bay average consists of only one sample; February and August South Bay data are incomplete; and there are no February data for the Coarse Sediment stations. Due to the RMP redesign, copper data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

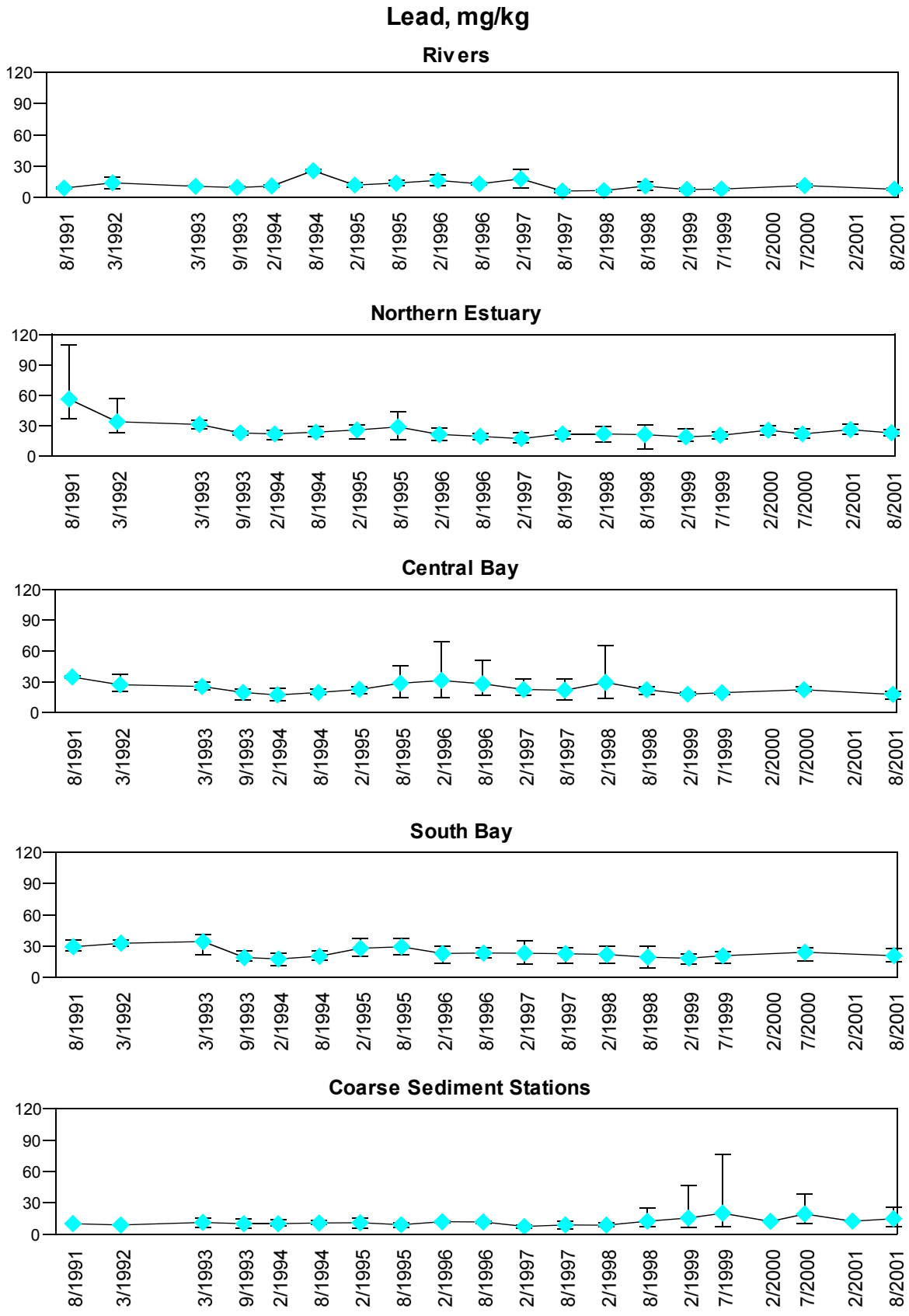

Figure 3.20. Average lead concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to the RMP redesign, lead data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

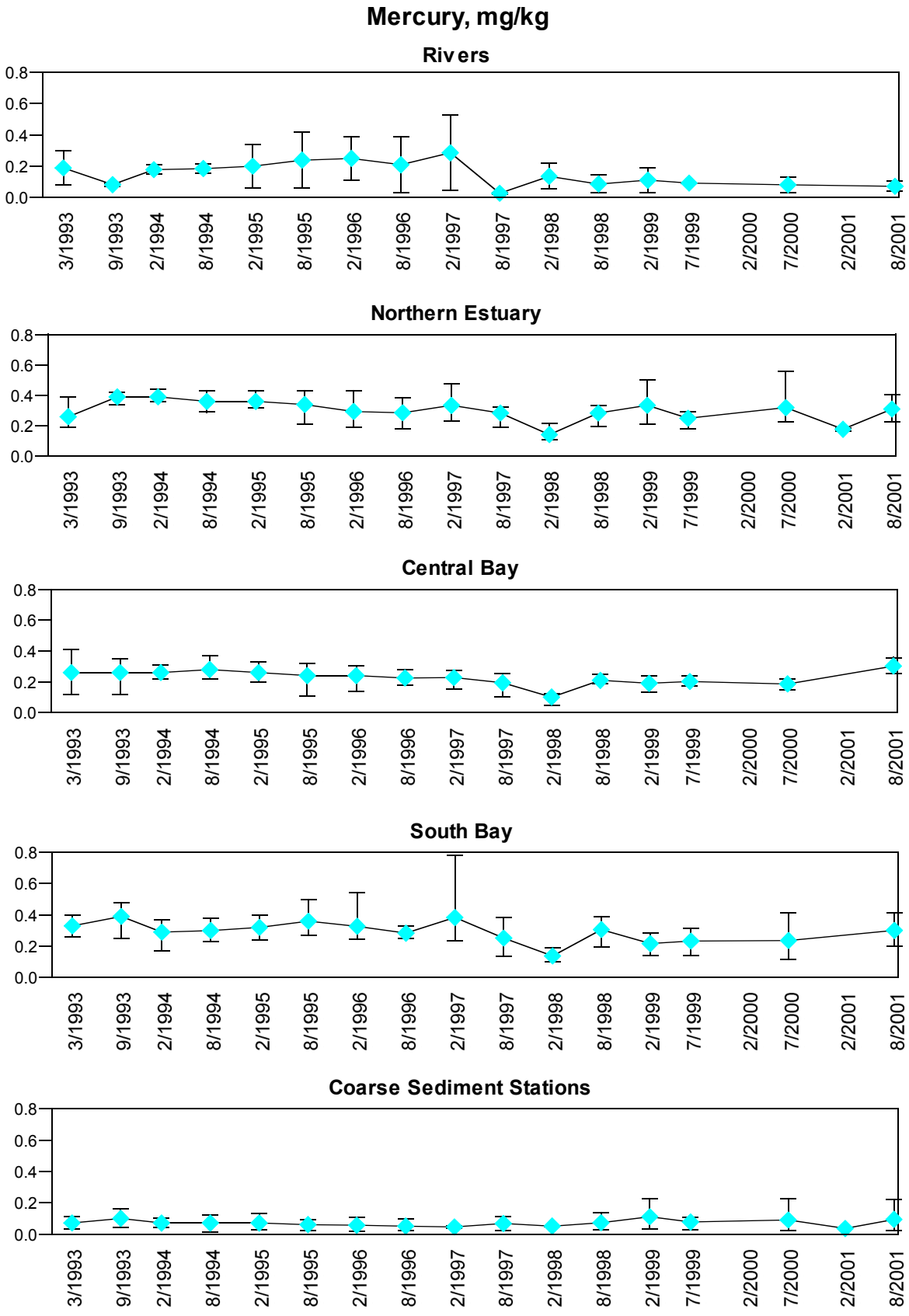

Figure 3.21. Average mercury concentrations in sediments for each Estuary reach from 1993–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to blank contamination, mercury data for 1999 are incomplete as follows: July data are not available for some of the Coarse Sediment stations; the July Rivers mercury average consists of only one sample. February 2000 sediments were not analyzed for mercury. Due to the RMP redesign, lead data for February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

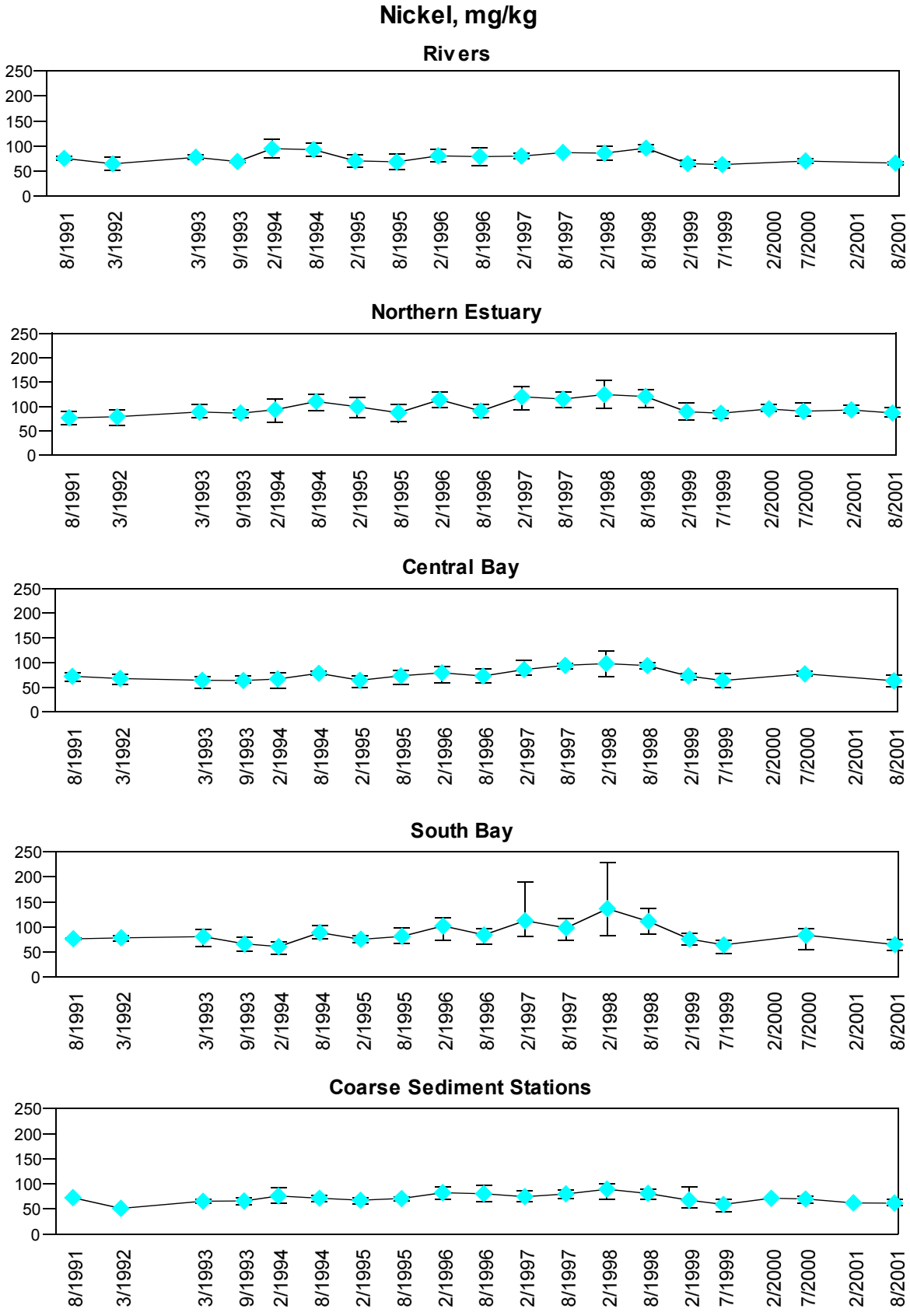

Figure 3.22. Average nickel concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to the RMP redesign, nickel data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

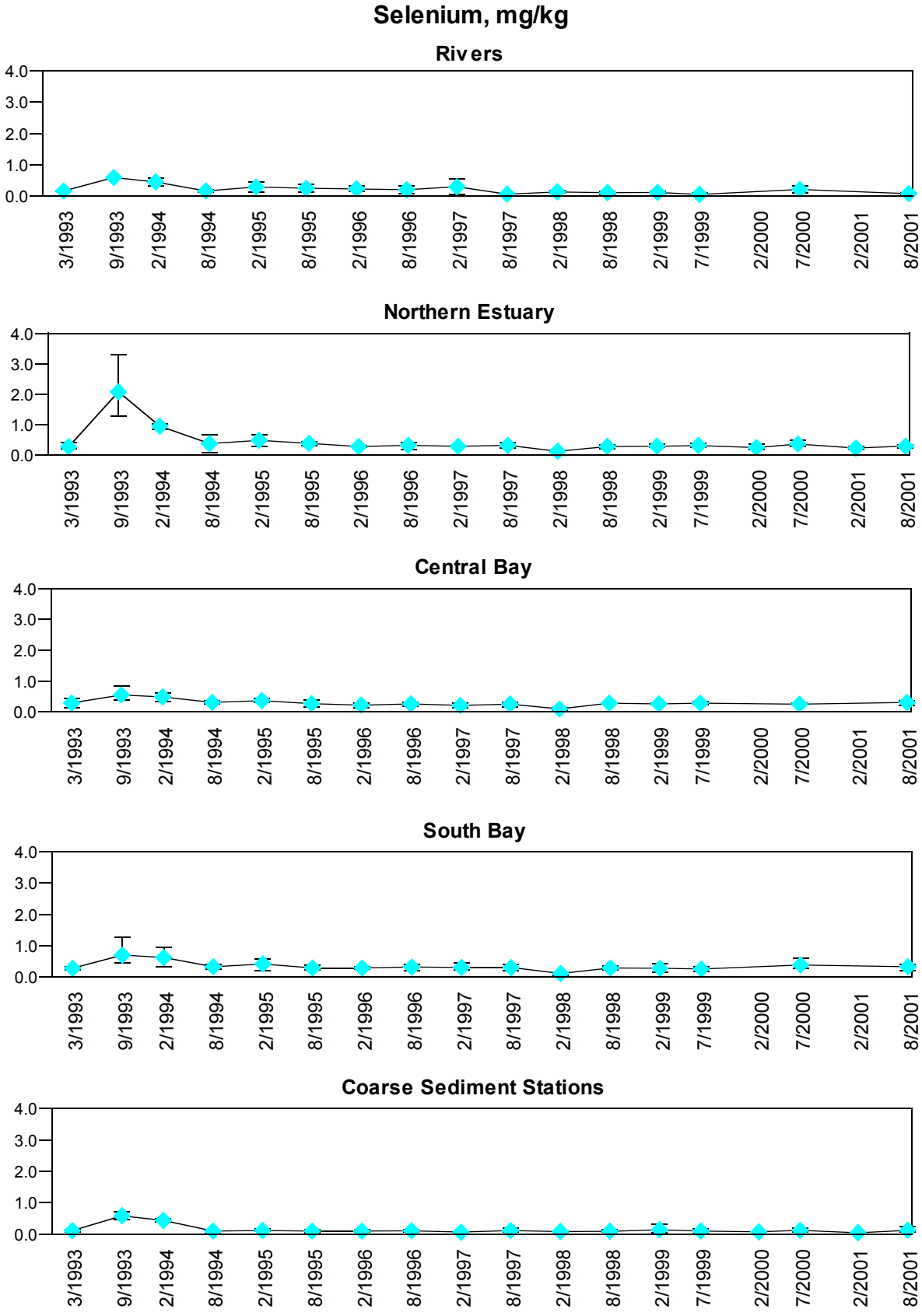

Figure 3.23. Average selenium concentrations in sediments for each Estuary reach from 1993–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to the RMP redesign, selenium data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

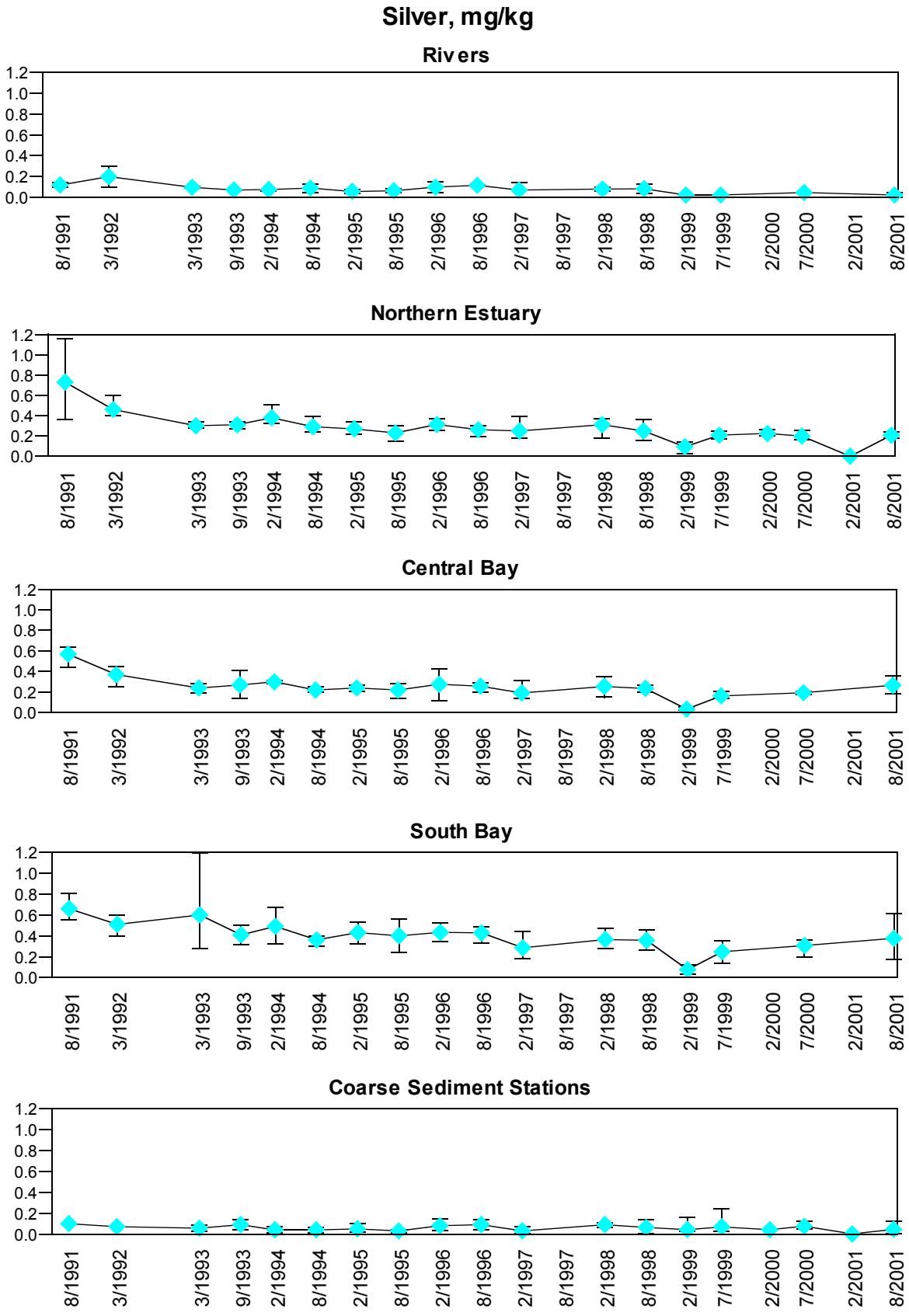

Figure 3.24. Average silver concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. There are no data for silver in August 1997 because the blanks were contaminated. Due to the RMP redesign, silver data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

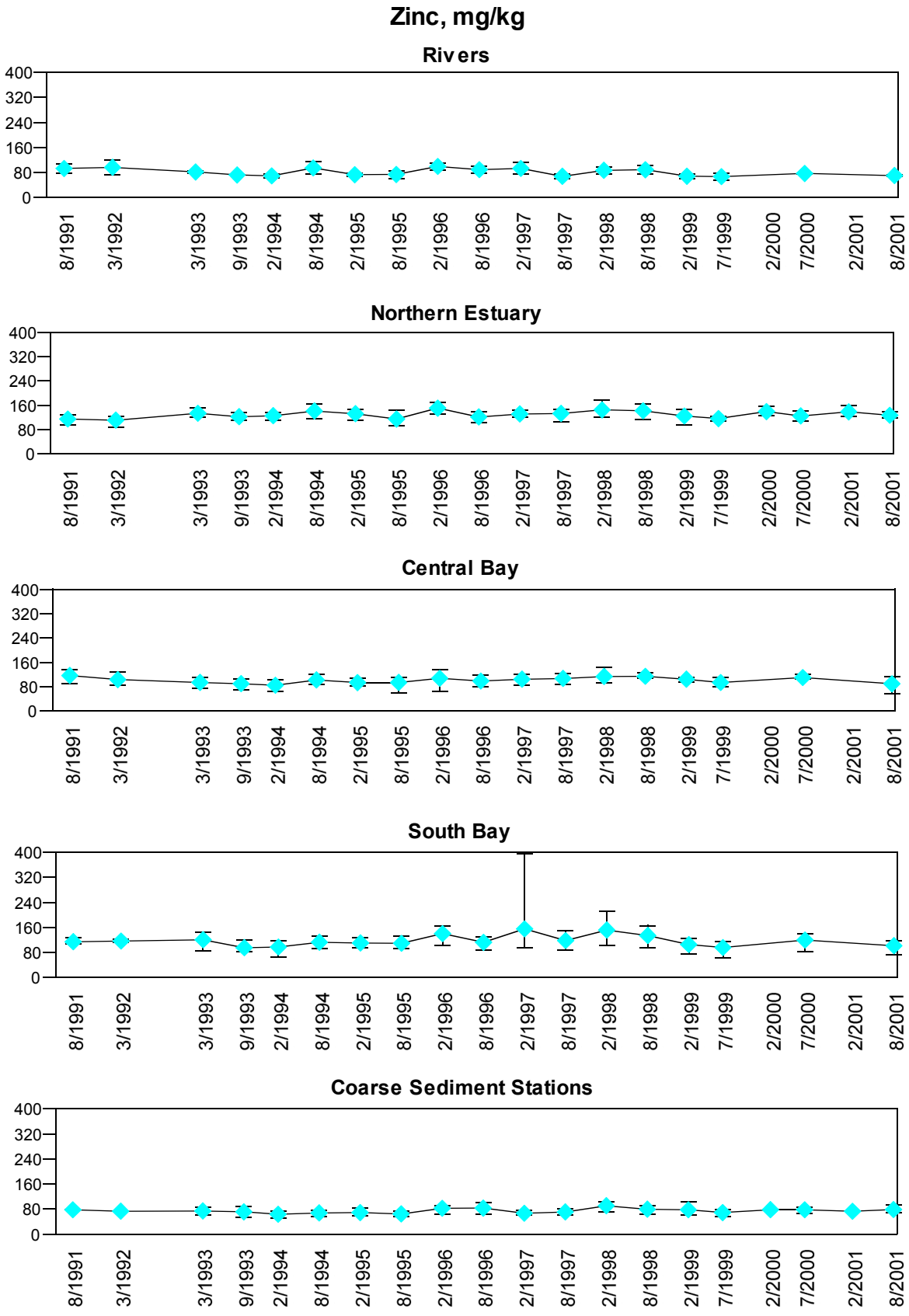

Figure 3.25. Average zinc concentrations in sediments for each Estuary reach from 1991–2001. The vertical bars represent the range of all values within a reach. The sample size varies between reach and between seasons. The South Bay reach does not include Southern Slough stations. Due to the RMP redesign, zinc data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

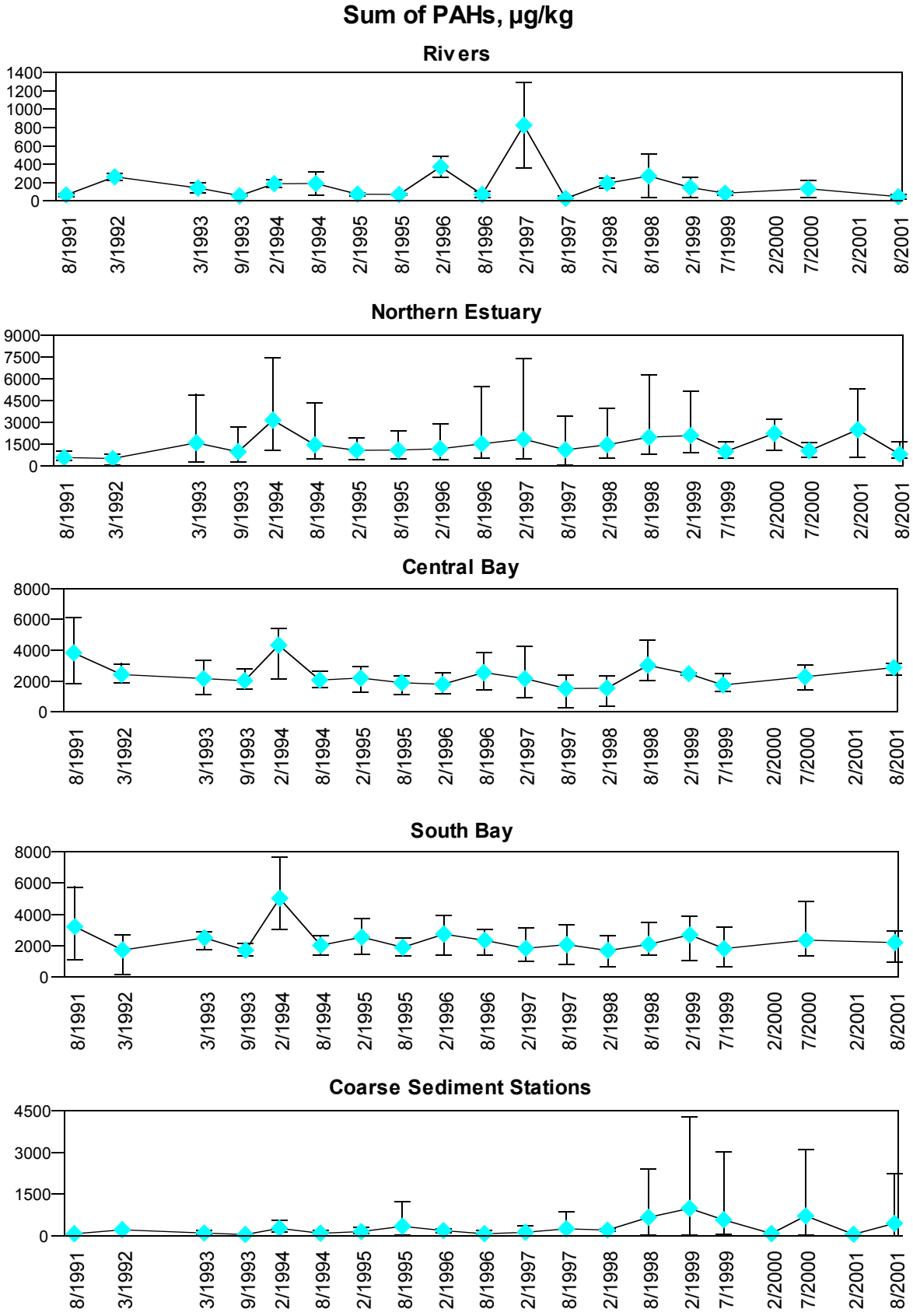

Figure 3.26. Plots of average PAH concentrations in sediments for each Estuary reach from 1991–2001. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. Due to the RMP redesign, PAH data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

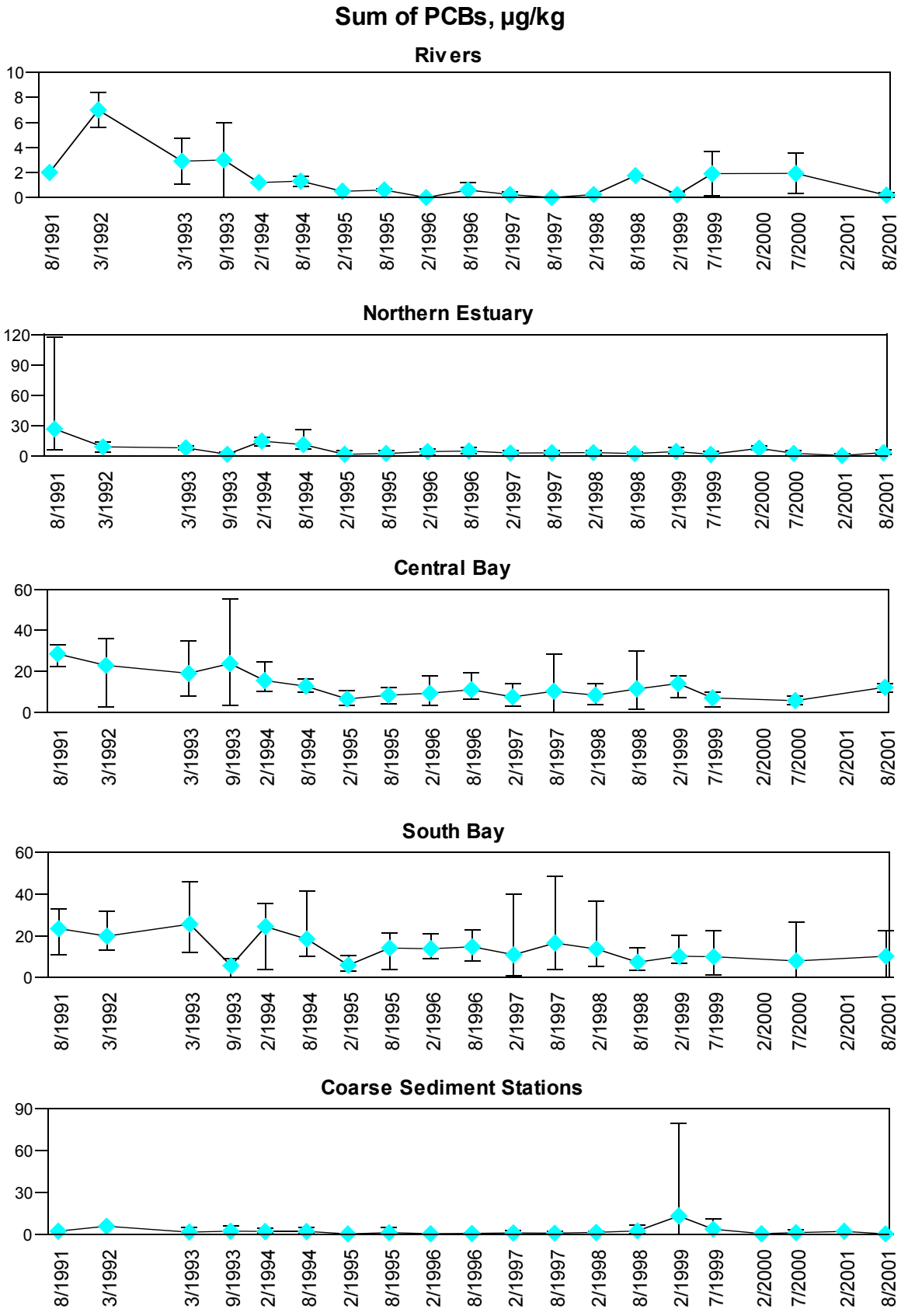

Figure 3.27. Plots of average PCB concentrations in sediments for each Estuary reach from 1991–2001. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. Due to the RMP redesign, PCB data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

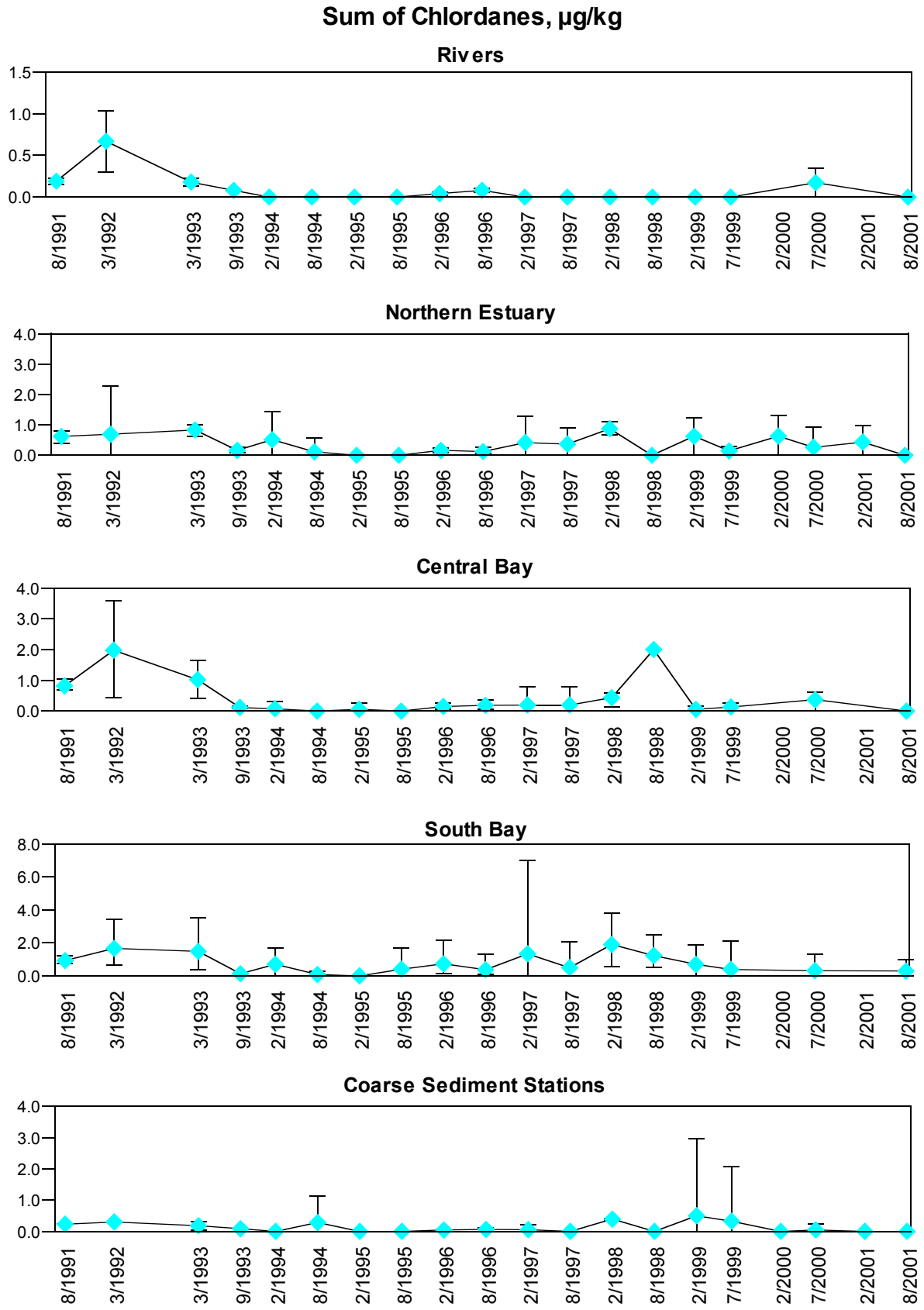

Figure 3.28. Plots of average chlordane concentrations in sediments for each Estuary reach from 1991–2001. Units are in parts per billion, ppb. Note scale changes. Vertical bars represent the range of all values within a reach. Sample size varies between sites and seasons. Chlordanes were not detected for the following reaches and seasons: Rivers: February and August 1998, February and July 1999, and August 2001; Northern Estuary: August 1998 and August 2001; Central Bay: August 2001; Coarse Sediment Stations: August 1998 and August 2001. Due to the RMP redesign, chlordane data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

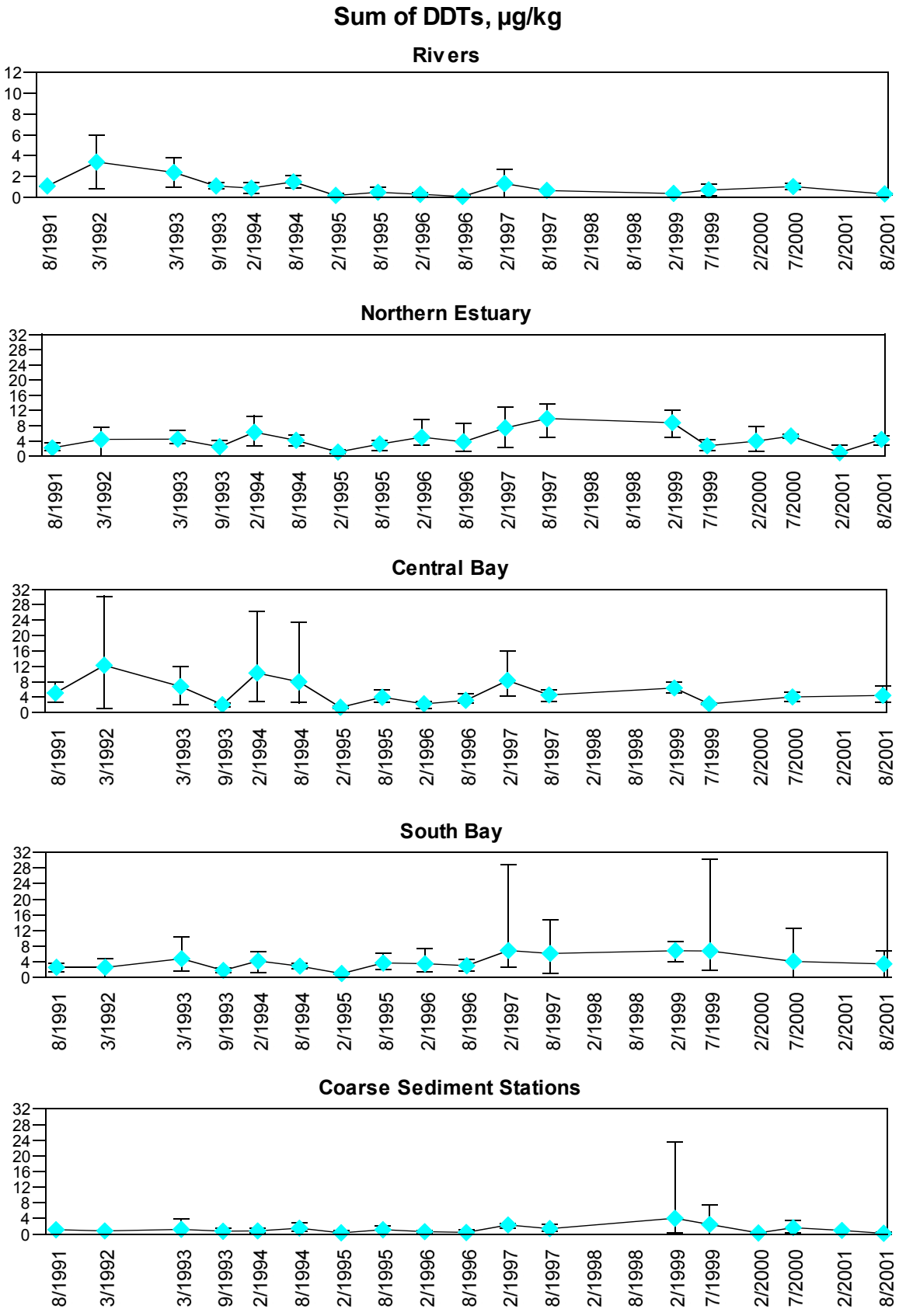

Figure 3.29. Plots of average DDT concentrations in sediments for each Estuary reach from 1991–2001. Units are in parts per billion, ppb. Note scale changes. The vertical bars represent the range of all values within a reach. The sample size varies between sites and between seasons. There were no 1998 DDT data to plot due to matrix interference. Due to the RMP redesign, DDT data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

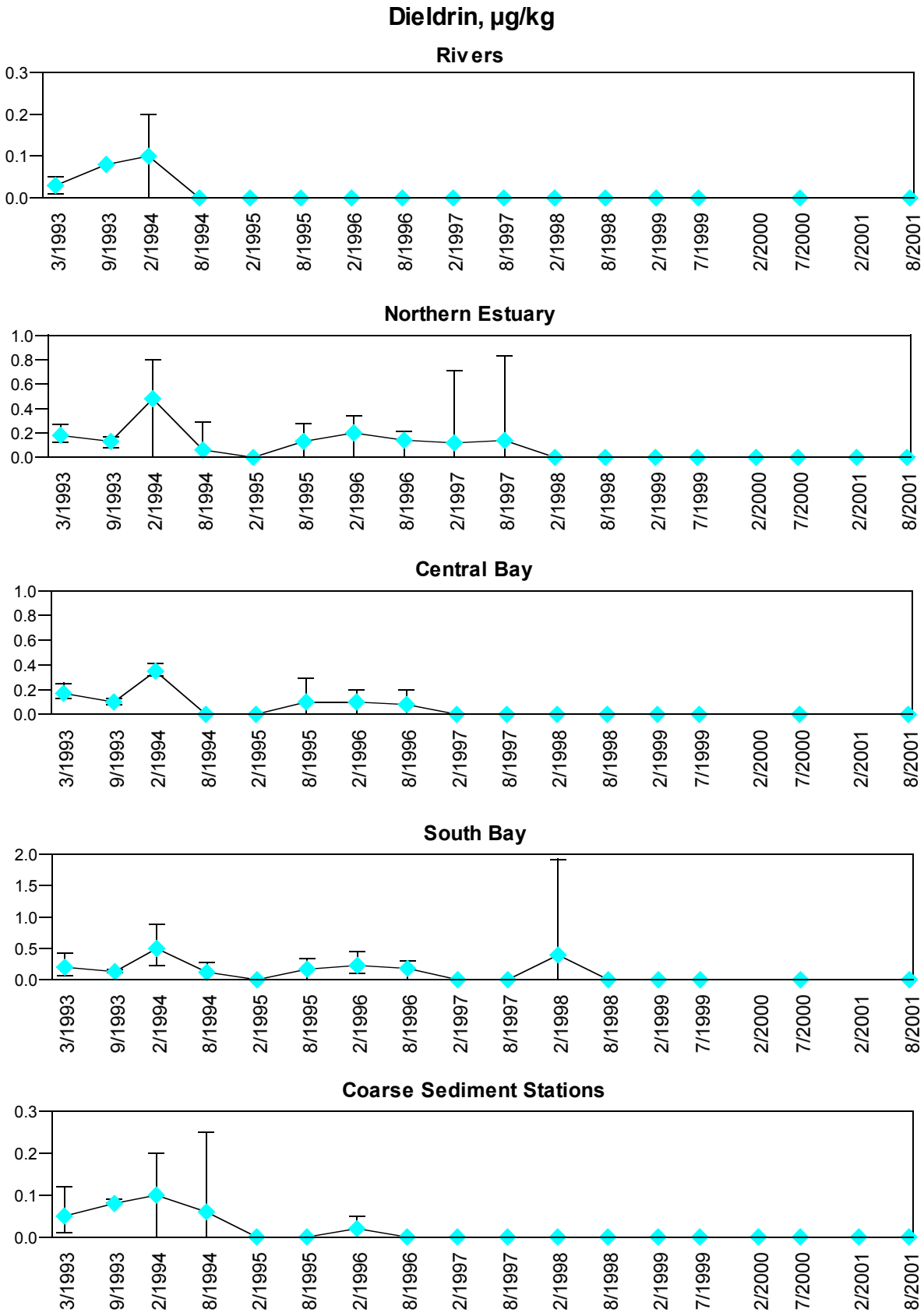

Figure 3.30. Plots of average dieldrin concentrations in sediments for each Estuary reach from 1993–2001. Units are in parts per billion, ppb. Note scale changes. Vertical bars represent the range of all values within a reach. Sample size varies between sites and seasons. Dieldrin was not detected for the following reaches and seasons: Rivers and Central Bay: February and August 1997 and 1998, February and July 1999, July 2000, and August 2001; Coarse Sediment Stations: February and August 1997 and 1998, February and July 1999 and 2000, and August 2001; South Bay: February and August 1997, February and July 1999, July 2000, and August 2001; and Northern Estuary: February and August 1998, February and July 1999 and 2000, and February and August 2001. Due to the RMP redesign, dieldrin data for February 2000 and February 2001 are available for only a few of the Northern Estuary and Coarse Sediment stations.

2001 Regional Monitoring Program

Sediment Data Tables

Table 11. General characteristics of sediment samples, 2001.

* indicates pore water measurement. NA = not analyzed/not available, ND = not detected, NS = not sampled.

Station Code	Station	Date	Cruise	% Fines (<63 µm)	% Clay (<4µm)	% Silt (4µm-63µm)	% Sand (63µm-2mm)	% Gravel+Shell (>2mm)	Water Depth	Ammonia *	Hydrogen Sulfide *	pH *	TOC	Total Sulfide *	Total Nitrogen
				%	%	%	%	%	m	mg/L	mg/L	pH	%	mg/L	%
BF21	Grizzly Bay	2/16/01	2001-02	NA	NA	NA	NA	NA	1	0.8	ND	7.4	NA	ND	NA
BD50	Napa River	2/15/01	2001-02	98	72	26	2	0	1	6	ND	7	1.4	ND	0.15
BD41	Davis Point	2/15/01	2001-02	13	7	7	85	1	6	2	ND	7.8	0.2	ND	0.03
BD22	San Pablo Bay	2/15/01	2001-02	88	56	32	12	0	2	0.8	ND	7.3	1.2	ND	0.13
BD15	Petaluma River	2/15/01	2001-02	93	57	36	7	0	2	1.4	ND	7.2	1.1	ND	0.12
BG20	Sacramento River	8/9/01	2001-08	11	6	5	89	0	7	2.2	ND	7.1	0.2	ND	0.03
BG30	San Joaquin River	8/9/01	2001-08	22	12	10	78	0	8	2.1	ND	7.2	0.5	ND	0.04
BF40	Honker Bay	8/9/01	2001-08	98	63	35	2	0	2	2.7	ND	7	1.5	ND	0.15
BF21	Grizzly Bay	8/9/01	2001-08	98	64	34	2	0	1	2.2	ND	7.1	1.4	ND	0.16
BF10	Pacheco Creek	8/9/01	2001-08	20	12	8	80	0	4	2.7	ND	7.2	0.4	ND	0.05
BD50	Napa River	8/10/01	2001-08	90	60	30	9	1	1	1.3	ND	7.5	1.5	ND	0.15
BD41	Davis Point	8/10/01	2001-08	24	15	9	74	2	7	3	ND	7.3	0.5	ND	0.06
BD31	Pinole Point	8/10/01	2001-08	81	54	28	19	0	5	2.3	ND	6.9	1.2	ND	0.14
BD22	San Pablo Bay	8/10/01	2001-08	78	51	27	22	0	2	1.1	ND	7.2	1.2	ND	0.14
BD15	Petaluma River	8/10/01	2001-08	95	62	33	3	1	2	7	ND	7.6	1.2	ND	0.14
BC60	Red Rock	8/13/01	2001-08	6	3	2	93	2	10	1.2	ND	7.6	0.1	ND	0.02
BC41	Point Isabel	8/13/01	2001-08	74	45	29	26	0	2	1.5	ND	6.9	1.0	ND	0.12
BC32	Richardson Bay	8/13/01	2001-08	65	33	33	35	0	2	1.4	ND	6.9	0.8	ND	0.11
BC21	Horseshoe Bay	8/13/01	2001-08	40	23	17	60	0	6	1.3	ND	7.1	0.8	ND	0.10
BC11	Yerba Buena Island	8/13/01	2001-08	80	48	31	20	0	5	1.0	ND	7.3	1.3	ND	0.16
BB70	Alameda	8/14/01	2001-08	65	43	22	35	0	9	0.7	ND	7.3	0.9	ND	0.12
BB30	Oyster Point	8/14/01	2001-08	62	41	22	36	1	8	0.7	ND	7.4	1.0	ND	0.14
BB15	San Bruno Shoal	8/14/01	2001-08	92	61	31	8	0	10	2.3	ND	6.7	1.3	ND	0.17
BA41	Redwood Creek	8/14/01	2001-08	77	54	24	19	3	2	1.1	ND	7.3	1.2	ND	0.16
BA30	Dumbarton Bridge	8/14/01	2001-08	98	65	33	2	0	1	2.6	ND	7.2	1.3	ND	0.17
BA21	South Bay	8/15/01	2001-08	100	72	28	0	0	3	3	ND	7.4	1.3	ND	0.18
BA10	Coyote Creek	8/15/01	2001-08	56	41	16	36	7	4	2.2	ND	7.4	1.4	ND	0.14
C-3-0	San Jose	8/15/01	2001-08	67	42	25	33	0	2	0.7	ND	7.3	1.5	ND	0.16
C-1-3	Sunnyvale	8/15/01	2001-08	49	29	19	51	0	1	6	NS	7.1	0.6	NS	0.08
BW10	Standish Dam	8/21/01	2001-08	93	63	30	7	0	0	2.1	ND	6.9	2.1	ND	0.24
BW15	Guadalupe River	8/21/01	2001-08	100	80	19	0	0	0	0.3	ND	7.7	1.7	ND	0.24

Table 12. Concentrations of trace elements for sediment samples, 2001.

b = blank contamination <30% of measured concentration, NA = not analyzed/not available, ND = not detected.
Chromium was not analyzed in 2001 sediments.

Station Code	Station	Date	Cruise	% Solids - As, 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
BD50	Napa River	2/15/01	2001-02	42	43	ND	b 37284	13.5	0.29	NA	b 55.4
BD41	Davis Point	2/15/01	2001-02	72	68	ND	b 19746	5.39	0.07	NA	b 16.7
BD22	San Pablo Bay	2/15/01	2001-02	46	47	ND	b 33740	10.49	0.23	NA	b 51.4
BD15	Petaluma River	2/15/01	2001-02	46	49	ND	b 42271	19.57	0.33	NA	b 54.1
BG20	Sacramento River	8/9/01	2001-08	66	69	ND	b 19822	7.02	0.16	NA	19.0
BG30	San Joaquin River	8/9/01	2001-08	67	65	0.05	b 30307	6.46	0.16	NA	28.3
BF40	Honker Bay	8/9/01	2001-08	42	39	0.23	b 53792	10.46	0.29	NA	70.7
BF21	Grizzly Bay	8/9/01	2001-08	41	38	0.20	b 59070	9.69	0.35	NA	69.1
BF10	Pacheco Creek	8/9/01	2001-08	63	69	0.04	b 26318	6.83	0.17	NA	23.4
BD50	Napa River	8/10/01	2001-08	46	44	0.24	b 46947	11.09	0.26	NA	64.4
BD41	Davis Point	8/10/01	2001-08	68	67	0.06	b 26457	5.73	0.13	NA	24.6
BD31	Pinole Point	8/10/01	2001-08	41	39	0.19	b 47827	8.40	0.22	NA	56.7
BD22	San Pablo Bay	8/10/01	2001-08	42	44	0.18	b 47522	9.89	0.24	NA	53.1
BD15	Petaluma River	8/10/01	2001-08	37	32	0.20	b 53292	7.65	0.22	NA	58.9
BC60	Red Rock	8/13/01	2001-08	72	70	ND	b 15047	7.62	0.07	NA	38.8
BC41	Point Isabel	8/13/01	2001-08	46	50	0.36	b 44091	9.68	0.26	NA	35.6
BC32	Richardson Bay	8/13/01	2001-08	49	53	0.18	b 37554	9.43	0.21	NA	11.3
BC21	Horseshoe Bay	8/13/01	2001-08	54	57	0.12	b 28180	6.56	0.33	NA	28.7
BC11	Yerba Buena Island	8/13/01	2001-08	41	40	0.26	b 39580	8.66	0.22	NA	44.8
BB70	Alameda	8/14/01	2001-08	50	53	0.59	b 40456	7.84	0.46	NA	46.5
BB30	Oyster Point	8/14/01	2001-08	43	51	0.18	b 34209	8.55	0.16	NA	32.2
BB15	San Bruno Shoal	8/14/01	2001-08	33	36	0.27	b 46046	8.74	0.17	NA	46.0
BA41	Redwood Creek	8/14/01	2001-08	48	42	0.62	b 43340	7.53	0.35	NA	50.3
BA30	Dumbarton Bridge	8/14/01	2001-08	32	36	0.36	b 45896	8.38	0.14	NA	46.1
BA21	South Bay	8/15/01	2001-08	32	31	0.40	b 55249	10.99	0.13	NA	44.4
BA10	Coyote Creek	8/15/01	2001-08	53	49	0.21	b 29888	5.76	0.16	NA	28.3
C-3-0	San Jose	8/15/01	2001-08	44	47	0.49	b 34036	6.96	0.34	NA	41.9
C-1-3	Sunnyvale	8/15/01	2001-08	54	57	0.22	b 28122	4.06	0.19	NA	30.8
BW10	Standish Dam	8/21/01	2001-08	34	35	0.44	b 47040	9.49	0.44	NA	56.0
BW15	Guadalupe River	8/21/01	2001-08	33	31	0.53	b 60418	10.13	0.35	NA	62.2

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02				**6.6**			**0.7**
Standard Deviation of Blanks	2001-02							
Average Method Detection Limit	2001-02	0.1		0.15	0.15	0.1	0.07	0.07
Number of replicates	2001-02	1		1	1	1	1	2
Standard Deviation of Replicates	2001-02	0.6		0.058	860	2	0.02	11
Precision (RSD%)	2001-02	1		ND	6	20	ND	33
Accuracy (%error)	2001-02	NA		87	78	7	7	6

Average Of Blanks Per Cruise	2001-08				**1.1645**			
Standard Deviation of Blanks	2001-08							
Average Method Detection Limit	2001-08	0.25	NA	0.01	0.2	0.3	0.07	0.07
Number of replicates	2001-08	3	58	2	2	3	2	2
Standard Deviation of Replicates	2001-08	1.2	4.1597E-09	0.01	2000	0.2	0.02	1
Precision (RSD%)	2001-08	3	0	4	5	3	8	2
Accuracy (%error)	2001-08	NA	NA	43	44	10	24	5

Table 12. Concentrations of trace elements for sediment samples, 2001 (continued).

b = blank contamination <30% of measured concentration, e = estimated value, NA = not analyzed/not available, NC = not calculated.

Station Code	Station	Date	Cruise	% Solids - As, Se	% Solids - Ag, Al, Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn	Fe	Hg	MeHg	Mn	Ni	Pb	Se	Zn
				%	%	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BD50	Napa River	2/15/01	2001-02	42	43	b 52122	b 0.18	0.11	b 622	102.4	31.7	0.22	b 159.4
BD41	Davis Point	2/15/01	2001-02	72	68	b 32022	b 0.04	0.03	b 380	62.0	12.3	e 0.04	b 72.7
BD22	San Pablo Bay	2/15/01	2001-02	46	47	b 42689	b 0.16	0.15	b 538	87.2	22.1	e 0.29	b 122.8
BD15	Petaluma River	2/15/01	2001-02	46	49	b 41664	b 0.18	0.02	b 563	89.3	24.9	0.19	b 134.4
BG20	Sacramento River	8/9/01	2001-08	66	69	25387	0.04	0.02	377	b 63.2	6.7	e 0.07	b 67.4
BG30	San Joaquin River	8/9/01	2001-08	67	65	35986	0.10	0.07	413	b 69.0	9.2	e 0.1	b 72.8
BF40	Honker Bay	8/9/01	2001-08	42	39	48541	0.31	0.18	831	b 92.8	23.8	0.30	b 134.3
BF21	Grizzly Bay	8/9/01	2001-08	41	38	49902	0.23	0.11	920	b 97.9	23.3	0.33	b 138.6
BF10	Pacheco Creek	8/9/01	2001-08	63	69	30232	0.08	0.27	401	b 60.2	9.5	0.13	b 72.8
BD50	Napa River	8/10/01	2001-08	46	44	39421	0.34	0.06	529	b 77.8	26	0.34	b 121.7
BD41	Davis Point	8/10/01	2001-08	68	67	35740	NA	0.05	445	b 60.4	16.4	0.13	b 80.7
BD31	Pinole Point	8/10/01	2001-08	41	39	43582	0.30	0.19	751	b 84.8	22.1	0.27	b 122.8
BD22	San Pablo Bay	8/10/01	2001-08	42	44	41461	0.27	0.16	595	b 79.8	20.4	0.30	b 119.7
BD15	Petaluma River	8/10/01	2001-08	37	32	45312	0.41	0.16	993	b 87.0	22.6	0.24	b 129.5
BC60	Red Rock	8/13/01	2001-08	72	70	29627	0.02	0.005	781	59.5	21.4	e 0.05	93.2
BC41	Point Isabel	8/13/01	2001-08	46	50	41245	0.36	0.28	314	63.1	19.2	0.38	98.4
BC32	Richardson Bay	8/13/01	2001-08	49	53	34688	0.30	0.05	288	50.9	13.3	0.23	57.4
BC21	Horseshoe Bay	8/13/01	2001-08	54	57	30387	0.22	0.61	288	b 56.9	25.4	0.23	b 83.0
BC11	Yerba Buena Island	8/13/01	2001-08	41	40	39240	0.25	0.30	479	b 75.0	20.9	0.32	b 112.4
BB70	Alameda	8/14/01	2001-08	50	53	36031	0.42	0.37	35	b 70.3	28.0	0.38	b 117.3
BB30	Oyster Point	8/14/01	2001-08	43	51	28779	0.20	0.18	547	52.7	15.1	0.34	73.7
BB15	San Bruno Shoal	8/14/01	2001-08	33	36	38499	0.37	0.59	393	66.8	20.2	0.41	103.2
BA41	Redwood Creek	8/14/01	2001-08	48	42	35988	0.26	0.42	494	65.5	23.2	0.34	104.3
BA30	Dumbarton Bridge	8/14/01	2001-08	32	36	41096	0.32	0.53	878	74.7	22.5	0.29	113.6
BA21	South Bay	8/15/01	2001-08	32	31	48796	0.31	0.33	1586	70.2	22.5	0.35	116.9
BA10	Coyote Creek	8/15/01	2001-08	53	49	24604	0.23	0.35	727	53.1	15.2	0.20	82.3
C-3-0	San Jose	8/15/01	2001-08	44	47	33218	0.27	0.27	864	72.2	23.0	0.41	109.8
C-1-3	Sunnyvale	8/15/01	2001-08	54	57	27941	0.23	0.36	537	50.5	16.3	0.17	81.8
BW10	Standish Dam	8/21/01	2001-08	34	35	43699	0.35	0.67	905	b 100.3	31.5	0.74	b 173.8
BW15	Guadalupe River	8/21/01	2001-08	33	31	51584	0.89	0.73	1461	b 102.8	35.1	0.66	b 179.6

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02	**7.3**	**0.0002**		**0.056**						**0.5**
Standard Deviation of Blanks	2001-02		**0.00009**								
Average Method Detection Limit	2001-02	1.5	0.00009	0.0026	0.022	0.15	0.7	0.03	0.07		
Number of replicates	2001-02	1	1	0	1	1	1	1	1		
Standard Deviation of Replicates	2001-02	600	0.02	NC	14	1.2	0.1	0.07	1		
Precision (RSD%)	2001-02	3	10	NA	8	3	4	21	3		
Accuracy (%error)	2001-02	18	8	70	13	19	10	4	10		

Average Of Blanks Per Cruise	2001-08					**0.19**			**0.2**		
Standard Deviation of Blanks	2001-08										
Average Method Detection Limit	2001-08	3	0.000003	0.0019	0.07	0.13	0.7	0.02	0.07		
Number of replicates	2001-08	2	4	1	2	2	2	3	2		
Standard Deviation of Replicates	2001-08	1000	0.08	0.0064	40	2.4	0.6	0.02	0.2		
Precision (RSD%)	2001-08	3	28	NA	4	3	2	8	0		
Accuracy (%error)	2001-08	5	10	44	11	17	5	11	6		

Table 13. PAH concentrations in sediment samples, 2001.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, LPAH = low molecular weight PAH's,
NA = not analyzed/not available, NC = not calculated, ND = not detected, p = low precision (<30% of field value). QA numbers in < > exceed target range.

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
BD50	Napa River	2/15/01	2001-02	45	606	147	6	b 21	ND	13	b 5	ND	6	b 4	b 20	ND	15	b 57	ND
BD41	Davis Point	2/15/01	2001-02	74	64	9	ND	b 3	ND	2	ND	ND	ND	ND	B	ND	ND	b 5	ND
BD22	San Pablo Bay	2/15/01	2001-02	50	1551	289	10	b 28	9	13	b 7	ND	16	b 12	b 43	10	15	b 126	ND
BD15	Petaluma River	2/15/01	2001-02	48	5295	428	12	b 75	4	14	b 6	ND	12	b 23	b 53	14	15	b 200	ND
BG20	Sacramento River	8/9/01	2001-08	79	20	3	ND	B,p	ND	ND	ND	ND	ND	ND	ND	ND	ND	b 3	ND
BG30	San Joaquin River	8/9/01	2001-08	70	72	10	ND	b 3	ND	ND	ND	ND	ND	ND	B	ND	2	b 6	ND
BF40	Honker Bay	8/9/01	2001-08	48	515	121	5	b 16	6	11	b 5	ND	4	b 3	b 11	4	12	b 39	6
BF21	Grizzly Bay	8/9/01	2001-08	41	563	138	6	b 16	6	11	b 5	ND	4	b 4	b 11	5	11	b 40	20
BF10	Pacheco Creek	8/9/01	2001-08	72	176	44	ND	b 6	2	3	B	ND	3	b 1	b 5	2	6	b 17	ND
BD50	Napa River	8/10/01	2001-08	46	828	152	6	b 25	8	14	b 7	ND	7	b 5	b 17	6	ND	b 58	ND
BD41	Davis Point	8/10/01	2001-08	68	177	34	2	b 6	2	4	B	ND	1	b 1	b 3	ND	ND	b 14	ND
BD31	Pinole Point	8/10/01	2001-08	44	650	171	6	b 19	6	11	b 6	ND	6	b 6	b 16	6	13	b 59	18
BD22	San Pablo Bay	8/10/01	2001-08	50	1624	384	8	b 27	9	15	b 9	5	10	b 12	b 120	10	20	b 118	21
BD15	Petaluma River	8/10/01	2001-08	42	551	144	7	b 20	6	12	b 6	ND	5	b 5	b 14	5	10	b 47	7
BC60	Red Rock	8/13/01	2001-08	80	36	7	ND	B	ND	p 2	ND	ND	ND	ND	1	ND	ND	b,p 4	ND
BC41	Point Isabel	8/13/01	2001-08	51	3097	323	9	b 41	8	20	11	6	10	b 14	58	10	15	b 123	ND
BC32	Richardson Bay	8/13/01	2001-08	56	3152	410	10	b 43	9	18	13	6	12	b 17	50	11	21	b 176	24
BC21	Horseshoe Bay	8/13/01	2001-08	62	2241	298	8	b 33	11	20	19	6	11	b 9	36	9	11	b 107	18
BC11	Yerba Buena Island	8/13/01	2001-08	42	2373	370	10	b 41	9	22	12	ND	11	b 16	48	12	17	b 145	28
BB70	Alameda	8/14/01	2001-08	55	2971	439	11	b 44	11	17	b 11	4	20	b 16	b 58	17	19	b 198	15
BB30	Oyster Point	8/14/01	2001-08	54	1732	168	6	b 33	6	13	9	ND	5	b 8	19	6	7	b 55	ND
BB15	San Bruno Shoal	8/14/01	2001-08	44	2952	301	10	b 40	8	16	11	ND	11	b 13	48	8	13	b 110	12
BA41	Redwood Creek	8/14/01	2001-08	50	2021	240	8	b 61	8	15	8	ND	6	b 9	28	7	14	b 77	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	2728	335	10	b 47	9	20	11	ND	12	b 16	32	12	13	b 144	10
BA21	South Bay	8/15/01	2001-08	38	2096	233	9	b 46	9	20	8	ND	8	b 9	21	8	13	b 77	5
BA10	Coyote Creek	8/15/01	2001-08	53	963	165	5	b 25	5	12	6	ND	5	b 5	16	5	8	b 64	11
C-3-0	San Jose	8/15/01	2001-08	47	1827	183	6	b 32	8	19	9	ND	5	b 6	25	8	10	b 58	ND
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	1133	187	9	b 33	8	19	11	ND	4	b 6	18	7	8	b 65	ND
BW15	Guadalupe River	8/21/01	2001-08	37	1315	174	8	b 38	9	21	12	ND	6	b 7	12	7	13	b 40	ND

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02		**0.8**			**0.8**					**0.8**				**0.8**	
Standard Deviation of Blanks	2001-02		NA			NA					NA				NA	
Average Method Detection Limit	2001-02	1.6	0.7	1.4	1.4	0.8	2.7	0.9	0.8	0.9	1.3	1.4	0.7	0.9
Number of replicates	2001-02	2	2	2	2	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-02	NC	0.4	NC	0.17	NC	NC	NC	NC	NC	NC	NC	0.1	NC
Precision (RSD%)	2001-02	ND	28	ND	ND	ND	ND	ND	ND	ND	ND	ND	< 4 >	ND
Accuracy (%error)	2001-02	NA	30	NA	NA	NA	NA	NA	NA	19	NA	29	1	NA

Average Of Blanks Per Cruise	2001-08		**1.6**			**0.82**				**0.83**			**1.0**	
Standard Deviation of Blanks	2001-08					NA				NA				
Average Method Detection Limit	2001-08	2.6	1.2	2.2	2.2	1.3	4	1.4	1.3	1.5	2	2.2	1.0	1.4
Number of replicates	2001-08	2	2	2	2	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-08	NC	0.55	NC	0.30	NC	NC	NC	NC	0.10	NC	NC	1.1	NC
Precision (RSD%)	2001-08	NA	24	NA	18	NA	NA	NA	NA	9	NA	NA	< 37 >	NA
Accuracy (%error)	2001-08	NA	< 36 >	NA	NA	NA	NA	NA	NA	26	NA	16	6	NA

Table 13. PAH concentrations in sediment samples, 2001 (continued).

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, HPAH = high molecular weight PAH's,
M = matrix interference, NA = not analyzed/not available, NC = not calculated, ND = not detected, p = low precision (<30% of field value), r = low recovery (< 2x outside target %).
QA numbers in < > exceed target range.

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
BD50	Napa River	2/15/01	2001-02	45	606	459	44	74	ND	142	29	22	35	11	ND	50	31	23
BD41	Davis Point	2/15/01	2001-02	74	64	55	4	4	10	18	3	2	3	1	ND	4	2	2
BD22	San Pablo Bay	2/15/01	2001-02	50	1551	1261	102	126	230	293	98	56	79	33	6	69	86	83
BD15	Petaluma River	2/15/01	2001-02	48	5295	4868	203	238	571	846	613	382	529	116	60	259	570	481
BG20	Sacramento River	8/9/01	2001-08	79	20	17	p 2	3	4	6	ND,r	ND,r	ND,r	ND,r	ND	2	ND,r	ND
BG30	San Joaquin River	8/9/01	2001-08	70	72	62	4	5	8	13	2	1	1	ND	ND	27	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	515	394	34	46	80	93	18	15	19	6	ND	53	19	13
BF21	Grizzly Bay	8/9/01	2001-08	41	563	425	37	48	83	104	19	14	22	8	ND	48	20	23
BF10	Pacheco Creek	8/9/01	2001-08	72	176	131	8	12	29	29	5	5	9	2	ND	21	4	6
BD50	Napa River	8/10/01	2001-08	46	828	676	62	76	M	185	49	37	63	24	5	75	54	47
BD41	Davis Point	8/10/01	2001-08	68	177	143	12	16	M	42	11	7	13	5	ND	17	8	14
BD31	Pinole Point	8/10/01	2001-08	44	650	479	42	49	110	115	24	18	28	9	4	32	28	21
BD22	San Pablo Bay	8/10/01	2001-08	50	1624	1241	118	132	229	284	85	59	84	28	13	67	67	75
BD15	Petaluma River	8/10/01	2001-08	42	551	408	42	50	79	106	21	15	24	6	ND	24	22	20
BC60	Red Rock	8/13/01	2001-08	80	36	28	b,p 3	p 2	M	p 7	p 3	b,p 2	b,p 3	ND	ND	b,p 4	2	p 3
BC41	Point Isabel	8/13/01	2001-08	51	3097	2774	b 184	168	500	324	301	b 167	b 315	84	47	b 159	296	229
BC32	Richardson Bay	8/13/01	2001-08	56	3152	2742	b 146	177	567	361	266	b 155	b 298	78	43	b 139	283	229
BC21	Horseshoe Bay	8/13/01	2001-08	62	2241	1944	b 104	142	501	288	162	b 104	b 164	46	24	b 108	176	125
BC11	Yerba Buena Island	8/13/01	2001-08	42	2373	2003	b 136	155	364	293	200	b 137	b 190	59	26	b 121	178	144
BB70	Alameda	8/14/01	2001-08	55	2971	2532	226	212	421	422	238	154	236	80	19	124	212	188
BB30	Oyster Point	8/14/01	2001-08	54	1732	1564	b 76	85	330	192	154	b 90	b 151	48	25	b 100	159	154
BB15	San Bruno Shoal	8/14/01	2001-08	44	2952	2652	b 143	140	364	336	318	b 176	b 303	84	49	b 186	288	265
BA41	Redwood Creek	8/14/01	2001-08	50	2021	1781	b 101	112	301	227	168	b 116	b 202	65	29	b 92	190	178
BA30	Dumbarton Bridge	8/14/01	2001-08	41	2728	2393	b 130	140	380	331	271	b 174	b 276	88	36	b 145	229	193
BA21	South Bay	8/15/01	2001-08	38	2096	1862	b 78	98	216	229	208	b 133	b 256	61	44	b 126	218	195
BA10	Coyote Creek	8/15/01	2001-08	53	963	798	b 46	53	152	128	56	b 49	b 76	19	13	b 46	90	72
C-3-0	San Jose	8/15/01	2001-08	47	1827	1643	b 81	85	185	185	153	b 142	b 232	66	11	b 104	225	174
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	1133	946	b 41	129	127	144	54	b 63	b 100	29	16	b 62	108	74
BW15	Guadalupe River	8/21/01	2001-08	37	1315	1141	b 54	72	185	134	102	b 59	b 148	46	26	b 122	91	102

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02																
Standard Deviation of Blanks	2001-02																
Average Method Detection Limit	2001-02			0.3	1.1	0.9	1.1	0.7	0.5	0.5	0.9	1.1	0.6	1.1	1.1
Number of replicates	2001-02			2	2	2	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-02			1	0.25	0.5	0.46	NC	NC	NC	NC	NC	0.3	NC	NC
Precision (RSD%)	2001-02			< 98 >	11	14	< 8 >	ND	ND	ND	ND	ND	11	ND	ND
Accuracy (%error)	2001-02			7	33	31	12	< 49 >	< 39 >	6	< 38 >	< 44 >	19	31	1

Average Of Blanks Per Cruise	2001-08			**0.4**					**0.6**	**0.6**			**0.5**		
Standard Deviation of Blanks	2001-08			NA					NA	NA			NA		
Average Method Detection Limit	2001-08			0.5	1.8	1.4	1.7	1.1	0.8	0.8	1.5	1.7	0.9	1.8	1.8
Number of replicates	2001-08			2	2	2	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-08			1	0.51	0.26	1.7	0.59	0.6	0.7	NC	NC	0.7	0.064	0.63
Precision (RSD%)	2001-08			< 86 >	27	7	< 37 >	< 36 >	< 42 >	< 41 >	NA	NA	20	4	31
Accuracy (%error)	2001-08			10	31	< 63 >	22	< 37 >	33	19	27	< 64 >	17	27	30

Table 14. PCB concentrations in sediment samples, 2001.

e = estimated value, NA = not analyzed/not available, NC = not calculated, ND = not detected, Q = outside QA limits. QA numbers in < > exceed target range.

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	µg/kg	µg/kg
BD50	Napa River	2/15/01	2001-02	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/15/01	2001-02	74	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	2/15/01	2001-02	50	2.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	2/15/01	2001-02	48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG20	Sacramento River	8/9/01	2001-08	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	8/9/01	2001-08	70	0.4	ND	ND	ND	ND	ND	ND	ND	e 0.4	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	2.3	ND	ND	ND	ND	ND	ND	e 0.5	0.5	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	8/9/01	2001-08	41	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	8/9/01	2001-08	72	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD50	Napa River	8/10/01	2001-08	46	2.1	ND	ND	ND	ND	ND	ND	ND	E	ND	ND	ND	ND	ND	ND
BD41	Davis Point	8/10/01	2001-08	68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	8/10/01	2001-08	44	4.1	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	8/10/01	2001-08	50	6.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	8/10/01	2001-08	42	4.3	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	e 0.4	ND	ND
BC60	Red Rock	8/13/01	2001-08	80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	8/13/01	2001-08	51	12.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	E	ND	ND	ND
BC32	Richardson Bay	8/13/01	2001-08	56	10.0	ND	ND	ND	ND	ND	ND	ND	ND	e 0.5	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	8/13/01	2001-08	62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	8/13/01	2001-08	42	14.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BB70	Alameda	8/14/01	2001-08	55	22.3	ND	ND	ND	ND	ND	e 0.3	ND	ND	e 0.3	e 0.2	ND	ND	ND	ND
BB30	Oyster Point	8/14/01	2001-08	54	9.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND
BB15	San Bruno Shoal	8/14/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	8/14/01	2001-08	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	13.9	ND	ND	ND	ND	ND	ND	ND	ND	e 0.7	ND	ND	ND	ND	ND
BA21	South Bay	8/15/01	2001-08	38	15.5	ND	ND	ND	ND	e 0.7	ND	ND	ND	ND	ND	ND	ND	ND	1.2
BA10	Coyote Creek	8/15/01	2001-08	53	9.7	ND	ND	ND	ND	ND	ND	ND	ND	e 0.9	e 0.4	ND	ND	ND	ND
C-3-0	San Jose	8/15/01	2001-08	47	42.7	ND	ND	ND	ND	ND	ND	e 4.4	ND	ND	ND	ND	e 4.1	ND	ND
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
BW15	Guadalupe River	8/21/01	2001-08	37	38.2	ND	ND	ND	ND	ND	3.0	e 6.7	ND	ND	ND	ND	2.4	ND	ND

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02																
Standard Deviation of Blanks	2001-02																
Average Method Detection Limit	2001-02		1.5	1.8	0.6	1.0	1.4	2.6	1.1	2.0	1.3	1.3	0.9	1.0	1.1	2.1	
Number of replicates	2001-02		1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Standard Deviation of Replicates	2001-02		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Precision (RSD%)	2001-02		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Accuracy (%error)	2001-02		NA	NA	NA	NA	NA	18	23	28	NA	NA	5	NA	NA	< 66 >	
Average Of Blanks Per Cruise	2001-08																
Standard Deviation of Blanks	2001-08																
Average Method Detection Limit	2001-08		0.3	0.4	0.14	0.19	0.3	0.5	0.21	0.4	0.26	0.27	0.18	0.2	0.22	0.4	
Number of replicates	2001-08		2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Standard Deviation of Replicates	2001-08		NC	NC	NC	0.0	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
Precision (RSD%)	2001-08		NA	NA	NA	NA	NA	14	7	12	NA	NA	< 52 >	NA	NA	< 57 >	
Accuracy (%error)	2001-08		NA	NA	NA	NA	NA	10	15	9	NA	NA	< 34 >	NA	NA	< 52 >	

Table 14. PCB concentrations in sediment samples, 2001 (continued).

e = estimated value, NA = not analyzed/not available, NC = not calculated, ND = not detected, Q = outside QA limits. QA numbers in < > exceed target range.

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
BD50	Napa River	2/15/01	2001-02	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/15/01	2001-02	74	1.9	ND	ND	e 0.3	0.2	ND	0.4	e 0.3	0.1	ND	ND	ND	e 0.4	ND	0.2
BD22	San Pablo Bay	2/15/01	2001-02	50	2.2	ND	ND	e 0.3	e 0.2	ND	0.3	e 0.3	0.1	ND	ND	ND	e 0.4	ND	0.4
BD15	Petaluma River	2/15/01	2001-02	48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG20	Sacramento River	8/9/01	2001-08	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	8/9/01	2001-08	70	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	2.3	ND	ND	ND	ND	ND	0.5	e 0.3	ND	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	8/9/01	2001-08	41	2.0	ND	ND	ND	ND	ND	0.8	e 0.6	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	8/9/01	2001-08	72	0.2	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
BD50	Napa River	8/10/01	2001-08	46	2.1	ND	ND	ND	ND	ND	2.1	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	8/10/01	2001-08	68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	8/10/01	2001-08	44	4.1	ND	ND	0.5	ND	ND	e 0.5	e 0.5	ND	ND	ND	ND	ND	ND	0.6
BD22	San Pablo Bay	8/10/01	2001-08	50	6.5	0.4	ND	ND	ND	ND	e 0.6	e 0.5	ND	ND	e 0.7	ND	e 0.4	ND	0.8
BD15	Petaluma River	8/10/01	2001-08	42	4.3	ND	ND	ND	ND	ND	0.7	e 0.6	ND	ND	ND	ND	e 0.4	ND	0.8
BC60	Red Rock	8/13/01	2001-08	80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	8/13/01	2001-08	51	12.8	ND	ND	e 0.9	e 0.6	ND	1.0	e 1.1	ND	e 0.4	e 3.9	ND	e 1.1	ND	1.5
BC32	Richardson Bay	8/13/01	2001-08	56	10.0	ND	ND	ND	e 0.7	ND	e 0.6	e 0.9	ND	e 0.4	e 3.8	ND	e 0.7	ND	0.8
BC21	Horseshoe Bay	8/13/01	2001-08	62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	8/13/01	2001-08	42	14.2	e 0.8	e 1.1	ND	e 0.9	ND	1.4	e 1.3	ND	e 0.6	e 2.3	0.2	e 1.3	ND	1.6
BB70	Alameda	8/14/01	2001-08	55	22.3	1.2	ND	e 1.4	2.0	e 0.4	2.3	e 1.9	0.5	e 0.7	e 3.4	0.4	e 2.2	ND	3
BB30	Oyster Point	8/14/01	2001-08	54	9.9	ND	ND	ND	0.6	ND	e 0.8	e 1.3	0.3	ND	e 1.6	ND	e 0.8	ND	e 0.6
BB15	San Bruno Shoal	8/14/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	8/14/01	2001-08	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	13.9	e 2.0	ND	ND	e 0.3	ND	e 1.1	e 1.2	ND	ND	e 3.7	ND	e 0.9	ND	1.4
BA21	South Bay	8/15/01	2001-08	38	15.5	e 0.4	ND	ND	0.7	ND	e 1.6	e 1.4	ND	ND	e 1.7	0.3	e 0.9	ND	1.9
BA10	Coyote Creek	8/15/01	2001-08	53	9.7	ND	ND	ND	ND	ND	e 0.8	e 0.7	ND	ND	e 3.5	ND	e 0.6	e 1.0	ND
C-3-0	San Jose	8/15/01	2001-08	47	42.7	1.3	e 2.0	e 1.6	2.7	e 0.8	e 3.7	e 2.7	0.6	e 0.9	e 3.5	0.6	e 3.1	ND	3.9
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
BW15	Guadalupe River	8/21/01	2001-08	37	38.2	ND	ND	e 1.5	e 1.4	ND	e 4.1	e 1.8	0.5	e 0.8	e 2.7	e 0.3	e 2.2	ND	3.1

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02																	
Standard Deviation of Blanks	2001-02																	
Average Method Detection Limit	2001-02		1.2	1.1	2.0	0.85	2.3	0.9	1.5	0.7	2.1	1.3	0.7	1.3	5	1.7
Number of replicates	2001-02		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Standard Deviation of Replicates	2001-02		NC	NC	0.030	0.088	NC	0.2	0.074	0.003	NC	NC	NC	0.027	NC	0.00
Precision (RSD%)	2001-02		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Accuracy (%error)	2001-02		4	NA	3	22	< 41 >	29	< 47>	10	NA	< 47 >	NA	33	NA	20
Average Of Blanks Per Cruise	2001-08																	
Standard Deviation of Blanks	2001-08																	
Average Method Detection Limit	2001-08		0.24	0.23	0.4	0.18	0.5	0.19	0.3	0.14	0.4	0.26	0.15	0.27	1.1	0.4
Number of replicates	2001-08		2.0	2.0	2	2	2	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-08		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Precision (RSD%)	2001-08		6	NA	1	1	7	23	20	0	NA	18	NA	20	NA	1
Accuracy (%error)	2001-08		21	NA	28	8	25	18	20	10	NA	23	NA	14	NA	15

Table 14. PCB concentrations in sediment samples, 2001 (continued).

e = estimated value, NA = not analyzed/not available, NC = not calculated, ND = not detected, Q = outside QA limits. QA numbers in < > exceed target range.

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
				%	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
BD50	Napa River	2/15/01	2001-02	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/15/01	2001-02	74	1.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	2/15/01	2001-02	50	2.2	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND
BD15	Petaluma River	2/15/01	2001-02	48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG20	Sacramento River	8/9/01	2001-08	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	8/9/01	2001-08	70	0.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	2.3	ND	ND	ND	ND	ND	e 0.4	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	8/9/01	2001-08	41	2.0	ND	ND	ND	ND	ND	e 0.5	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	8/9/01	2001-08	72	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD50	Napa River	8/10/01	2001-08	46	2.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	8/10/01	2001-08	68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	8/10/01	2001-08	44	4.1	ND	ND	ND	ND	ND	0.5	ND	e 0.4	ND	ND	ND	ND
BD22	San Pablo Bay	8/10/01	2001-08	50	6.5	ND	e 1.4	e 0.3	ND	ND	e 0.7	0.6	e 0.3	ND	ND	ND	ND
BD15	Petaluma River	8/10/01	2001-08	42	4.3	ND	ND	e 0.4	ND	ND	e 0.6	ND	ND	ND	ND	ND	ND
BC60	Red Rock	8/13/01	2001-08	80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	8/13/01	2001-08	51	12.8	ND	e 0.4	ND	0.8	ND	1.0	ND	ND	ND	ND	ND	ND
BC32	Richardson Bay	8/13/01	2001-08	56	10.0	ND	e 0.3	ND	ND	ND	0.6	ND	e 0.6	ND	ND	ND	ND
BC21	Horseshoe Bay	8/13/01	2001-08	62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	8/13/01	2001-08	42	14.2	ND	e 1.2	0.5	ND	ND	ND	ND	e 0.9	ND	0.2	ND	ND
BB70	Alameda	8/14/01	2001-08	55	22.3	ND	e 0.4	ND	ND	ND	ND	0.5	e 1.1	ND	ND	ND	ND
BB30	Oyster Point	8/14/01	2001-08	54	9.9	ND	e 0.5	ND	ND	ND	0.9	ND	e 0.5	0.3	ND	ND	ND
BB15	San Bruno Shoal	8/14/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	8/14/01	2001-08	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	13.9	ND	e 1.8	ND	ND	ND	ND	ND	e 0.7	ND	ND	ND	ND
BA21	South Bay	8/15/01	2001-08	38	15.5	ND	e 2.8	ND	ND	ND	1.1	ND	e 0.8	ND	ND	ND	ND
BA10	Coyote Creek	8/15/01	2001-08	53	9.7	ND	e 0.6	ND	e 0.3	ND	e 0.8	ND	ND	ND	ND	ND	ND
C-3-0	San Jose	8/15/01	2001-08	47	42.7	ND	e 0.8	ND	ND	e 1.0	2.2	e 0.7	1.6	e 0.5	ND	ND	ND
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
BW15	Guadalupe River	8/21/01	2001-08	37	38.2	ND	e 1.9	ND	ND	0.6	2.1	0.9	e 1.0	e 0.5	ND	ND	0.7

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02															
Standard Deviation of Blanks	2001-02															
Average Method Detection Limit	2001-02		1.3	1.5	1.0	1.1	2.0	0.7	0.6	1.3	0.9	0.6	1.7	0.7		
Number of replicates	2001-02		1	1	1	1	1	1	1	1	1	1	1	1		
Standard Deviation of Replicates	2001-02		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC		
Precision (RSD%)	2001-02		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
Accuracy (%error)	2001-02		32	NA	25	NA	NA	< 56 >	NA	NA	3	NA	NA	NA		
Average Of Blanks Per Cruise	2001-08															
Standard Deviation of Blanks	2001-08															
Average Method Detection Limit	2001-08		0.26	0.3	0.19	0.22	0.4	0.14	0.12	0.27	0.18	0.14	0.4	0.16		
Number of replicates	2001-08		2	2	2	2	2	2	2	2	2	2	2	2		
Standard Deviation of Replicates	2001-08		NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC		
Precision (RSD%)	2001-08		6	NA	2	NA	NA	6	NA	NA	5	NA	NA	NA		
Accuracy (%error)	2001-08		22	NA	28	NA	NA	28	NA	NA	3	NA	NA	NA		

Table 15. Pesticide concentrations in sediment samples, 2001.

B = blank contamination >30% of measured concentration, b = blank contamination <30% of measured concentration, E/e = estimated value,
NA = not analyzed/not available, NC = not calculated, ND = not detected, p = low precision (< 30% of field value). QA numbers in < > exceed target range.

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 (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
BD50	Napa River	2/15/01	2001-02	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/15/01	2001-02	74	0.9	ND	ND	ND	0.505	B	0.415	ND	ND	B	ND	ND	ND	B,p	ND
BD22	San Pablo Bay	2/15/01	2001-02	50	2.9	ND	ND	ND	1.34	b 1.06	e 0.458	0.3	e 0.328	B	ND	ND	ND	B	ND
BD15	Petaluma River	2/15/01	2001-02	48	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND	ND	b 0.972	ND
BG20	Sacramento River	8/9/01	2001-08	79	0.3	ND	ND	ND	ND	0.269	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	8/9/01	2001-08	70	0.4	ND	ND	ND	ND	e 0.407	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	4.7	ND	ND	ND	1.84	2.03	e 0.85	ND	ND	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	8/9/01	2001-08	41	5.4	ND	ND	ND	1.93	2.05	e 1.39	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	8/9/01	2001-08	72	0.5	ND	ND	ND	ND	0.455	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD50	Napa River	8/10/01	2001-08	46	3.0	ND	ND	ND	ND	e 2.95	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	8/10/01	2001-08	68	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD31	Pinole Point	8/10/01	2001-08	44	4.9	ND	ND	ND	1.87	1.79	e 1.2	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	8/10/01	2001-08	50	4.1	ND	ND	ND	1.78	1.68	e 0.641	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	8/10/01	2001-08	42	4.6	ND	ND	ND	2.18	1.67	e 0.72	ND	ND	ND	ND	ND	ND	ND	ND
BC60	Red Rock	8/13/01	2001-08	80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	8/13/01	2001-08	51	7.0	ND	ND	ND	4.06	1.87	e 1.07	ND	ND	ND	ND	ND	ND	ND	ND
BC32	Richardson Bay	8/13/01	2001-08	56	2.7	ND	ND	ND	e 1.32	1.34	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	8/13/01	2001-08	62	ND	ND	ND	ND	ND	ND,e	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	8/13/01	2001-08	42	3.8	ND	ND	ND	2.12	1.64	ND	ND	ND	ND	ND	ND	ND	ND	ND
BB70	Alameda	8/14/01	2001-08	55	2.9	ND	E	ND	1.68	e 0.881	e 0.315	ND	ND	ND	ND	ND	ND	ND	ND
BB30	Oyster Point	8/14/01	2001-08	54	2.1	ND	ND	ND	0.815	0.844	e 0.473	ND	ND	ND	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	8/14/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	8/14/01	2001-08	50	6.8	ND	ND	ND	ND	2.68	e 4.08	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	4.3	ND	ND	ND	e 0.983	1.51	e 1.85	1.0	ND	ND	0.985	ND	ND	ND	ND
BA21	South Bay	8/15/01	2001-08	38	4.8	ND	ND	E	2.11	e 2.7	ND	0.8	ND	ND	e 0.841	ND	ND	ND	ND
BA10	Coyote Creek	8/15/01	2001-08	53	3.4	ND	ND	ND	e 1.01	1.48	e 0.927	0.2	ND	e 0.227	ND	ND	ND	ND	ND
C-3-0	San Jose	8/15/01	2001-08	47	11.2	ND	ND	E	4.11	e 7.08	ND	2.2	e 0.842	0.457	0.869	ND	ND	ND	ND
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	22.0	ND	ND	ND	6.83	10.8	4.38	2.2	ND	ND	ND	e 2.18	ND	ND	ND
BW15	Guadalupe River	8/21/01	2001-08	37	14.3	ND	ND	ND	7.61	6.16	e 0.502	5.3	e 0.784	0.618	e 1.02	e 0.298	ND	2.6	ND

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02						**0.17**				**0.1**					**0.2**	
Standard Deviation of Blanks	2001-02						NA				NA					NA	
Average Method Detection Limit	2001-02		0.9	1.7	0.7	3	1.4	2.0		2.2	0.9	0.7	0.7	0.9	0.5	0.5
Number of replicates	2001-02		1	1	1	1	1	1		0	1	1	1	1	1	1
Standard Deviation of Replicates	2001-02		0	0	0	0.001	0.0042	0.040		NA	0	0	0	0.01	0	0.2
Precision (RSD%)	2001-02		NA	NA	NA	NA	1	NA		NA	NA	NA	NA	NA	NA	< 82 >
Accuracy (%error)	2001-02		NA	< 36 >	NA	27	28	31		33	NA	NA	26	NA	NA	< 73 >
Average Of Blanks Per Cruise	2001-08															
Standard Deviation of Blanks	2001-08															
Average Method Detection Limit	2001-08		0.18	0.3	0.16	0.6	0.28	0.4		0.5	0.17	0.15	0.14	0.18	0.1	0.1
Number of replicates	2001-08		2	2	2	2	2	2		2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-08		NC	NC	NC	0.02	0.028	0.03		NC	NC	NC	NC	NC	NC	NC
Precision (RSD%)	2001-08		NA	< 36 >	NA	15	3	13		1	NA	NA	6	NA	NA	28
Accuracy (%error)	2001-08		NA	< 120 >	NA	20	15	10		20	NA	NA	10	NA	NA	< 70>

Table 15. Pesticide concentrations in sediment samples, 2001 (continued).

B = blank contamination >30% of measured concentration, e = estimated value, NA = not analyzed/not available,
NC = not calculated, ND = not detected. QA numbers in < > exceed target range

Station Code	Station	Date	Cruise	% Solids	Sum of HCHs (SFEI)	alpha-HCH	beta-HCH	delta-HCH	gamma-HCH	Aldrin	Dieldrin	Endrin	Hexachlorobenzene	Mirex
				%	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
BD50	Napa River	2/15/01	2001-02	45	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	2/15/01	2001-02	74	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	2/15/01	2001-02	50	ND	ND	ND	ND	B,e	ND	ND	e 0.349	ND	ND
BD15	Petaluma River	2/15/01	2001-02	48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG20	Sacramento River	8/9/01	2001-08	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BG30	San Joaquin River	8/9/01	2001-08	70	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF40	Honker Bay	8/9/01	2001-08	48	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF21	Grizzly Bay	8/9/01	2001-08	41	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BF10	Pacheco Creek	8/9/01	2001-08	72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD50	Napa River	8/10/01	2001-08	46	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD41	Davis Point	8/10/01	2001-08	68	ND	ND	ND	ND	ND	1.43	ND	ND	ND	ND
BD31	Pinole Point	8/10/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD22	San Pablo Bay	8/10/01	2001-08	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BD15	Petaluma River	8/10/01	2001-08	42	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC60	Red Rock	8/13/01	2001-08	80	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC41	Point Isabel	8/13/01	2001-08	51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC32	Richardson Bay	8/13/01	2001-08	56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC21	Horseshoe Bay	8/13/01	2001-08	62	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BC11	Yerba Buena Island	8/13/01	2001-08	42	ND	ND	ND	ND	ND	ND	ND	0.842	ND	ND
BB70	Alameda	8/14/01	2001-08	55	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BB30	Oyster Point	8/14/01	2001-08	54	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BB15	San Bruno Shoal	8/14/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA41	Redwood Creek	8/14/01	2001-08	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA30	Dumbarton Bridge	8/14/01	2001-08	41	ND	ND	ND	ND	ND	2.22	ND	1.27	ND	ND
BA21	South Bay	8/15/01	2001-08	38	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BA10	Coyote Creek	8/15/01	2001-08	53	ND	ND	ND	ND	ND	ND	ND	ND	e 0.224	ND
C-3-0	San Jose	8/15/01	2001-08	47	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
C-1-3	Sunnyvale	8/15/01	2001-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BW10	Standish Dam	8/21/01	2001-08	44	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BW15	Guadalupe River	8/21/01	2001-08	37	0.487	0.487	ND	ND	ND	ND	ND	ND	ND	ND

Quality Assurance Tables

Average Of Blanks Per Cruise	2001-02					**0.19**						
Standard Deviation of Blanks	2001-02					NA						
Average Method Detection Limit	2001-02	0.8	1.1	1.6	1.1	0.6	4	4	0.9	1.4
Number of replicates	2001-02	1	1	1	1	1	0	1	1	1
Standard Deviation of Replicates	2001-02	0	0	0	0	0	NA	0	0	0
Precision (RSD%)	2001-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
Accuracy (%error)	2001-02	NA	NA	NA	NA	NA	1	NA	18	NA
Average Of Blanks Per Cruise	2001-08									
Standard Deviation of Blanks	2001-08									
Average Method Detection Limit	2001-08	0.16	0.23	0.3	0.21	0.12	0.7	0.7	0.17	0.3
Number of replicates	2001-08	2	2	2	2	2	2	2	2	2
Standard Deviation of Replicates	2001-08	NC	NC	NC	NC	NC	NC	NC	NC	NC
Precision (RSD%)	2001-08	NA	NA	NA	NA	NA	8	NA	5	NA
Accuracy (%error)	2001-08	NA	NA	NA	NA	NA	< 39 >	NA	12	NA

Table 16. Sediment bioassay results, 2001.

* = Sample mean was significantly different than control mean based on separate variance t-test (1-tailed, alpha = 0.01). Sample mean was less than 80% of control mean. NA = not available. 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	Mean % Survival	SD - % Survival	Mean % Survival	SD - % Survival
				Mytilus galloprovincialis		*Eohaustorius estuarius*		*Hyalella azteca*		*Ceriodaphnia dubia*	
BG20	Sacramento River	8/9/01	2001-08	3 *	2 *	95	6	95	8	100	0
BG30	San Joaquin River	8/9/01	2001-08	0 *	0 *	83	3	93	9	96	9
BF21	Grizzly Bay	8/9/01	2001-08	0 *	0 *	80	17	98	7	100	0
BD50	Napa River	8/10/01	2001-08	95	10	53 *	13 *	NA	NA	NA	NA
BD41	Davis Point	8/10/01	2001-08	95	6	86	13	NA	NA	NA	NA
BC60	Red Rock	8/13/01	2001-08	91	7	83	3	NA	NA	NA	NA
BC21	Horseshoe Bay	8/13/01	2001-08	90	5	88	12	NA	NA	NA	NA
BC11	Yerba Buena Island	8/13/01	2001-08	90	4	78	4	NA	NA	NA	NA
BB70	Alameda	8/14/01	2001-08	91	9	63 *	10 *	NA	NA	NA	NA
BB15	San Bruno Shoal	8/14/01	2001-08	87	6	83	8	NA	NA	NA	NA
BA41	Redwood Creek	8/14/01	2001-08	88	5	48 *	24 *	NA	NA	NA	NA
BA21	South Bay	8/15/01	2001-08	59 *	13 *	79	9	NA	NA	NA	NA
BA10	Coyote Creek	8/15/01	2001-08	75	8	40	35	NA	NA	NA	NA
-	Control	-	2001-08	90	7	96	4	93	9	96	9

Table 16. Sediment bioassay results, 2001 (continued).
NA = not available. For physical/chemical measurements of test solutions and QA information, refer to *QA Tables.*

Station Code	Station	Date	Cruise	Bivalve SWI Mean % Normal Development	SD - Bivalve SWI Mean % Normal Development	Daphnid SWI Mean % Survival	SD - Daphnid SWI Mean % Survival
				Mytilus galloprovincialis		*Ceriodaphnia dubia*	
BG20	Sacramento River	8/9/01	2001-08	NA	NA	96	9
BG30	San Joaquin River	8/9/01	2001-08	NA	NA	100	0
BF21	Grizzly Bay	8/9/01	2001-08	83	5	NA	NA
BD50	Napa River	8/10/01	2001-08	89	5	NA	NA
BD41	Davis Point	8/10/01	2001-08	90	9	NA	NA
BC60	Red Rock	8/13/01	2001-08	93	10	NA	NA
BC21	Horseshoe Bay	8/13/01	2001-08	87	14	NA	NA
BC11	Yerba Buena Island	8/13/01	2001-08	85	4	NA	NA
BB70	Alameda	8/14/01	2001-08	90	5	NA	NA
BB15	San Bruno Shoal	8/14/01	2001-08	85	9	NA	NA
BA41	Redwood Creek	8/14/01	2001-08	76	34	NA	NA
BA21	South Bay	8/15/01	2001-08	86	8	NA	NA
BA10	Coyote Creek	8/15/01	2001-08	85	7	NA	NA
-	Control	-	2001-08	84	7	100	0