

**San Diego County Municipal Copermittees
2003-2005
Ambient Bay and Lagoon Monitoring
Review and Recommendations**

Final Report

Prepared For:

County of San Diego
9325 Hazard Way, MS 0326
San Diego, CA 92123

January 2007



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1.0 INTRODUCTION and EXECUTIVE SUMMARY

1.1 Overview and Summary

The Ambient Bay and Lagoon Monitoring (ABLM) program began collecting sediment samples as part of the San Diego County Copermittees' Urban Runoff Monitoring program in 2003. After three years of data collection, this report examines the program to determine if any linkage was observed between sediment conditions in monitored bays and lagoons and freshwater conditions at upstream mass loading stations (MLS), as stated in the Report of Waste Discharge (ROWD), County of San Diego Copermittees. The three years of data are compared to the corresponding three years of wet weather mass loading station (MLS) data from upstream runoff sources. This analysis is also used to assess the future direction of the ABLM program, as stated in the ROWD.



As described in the "San Diego County Municipal Copermittees 2001-2002 Urban Runoff Monitoring Final Report, January 2003" and the "County of San Diego, Department of Environmental Health, Land and Water Quality Division memo, March 12, 2002" (Appendix C), the ABLM program was designed to use the weight-of-evidence Triad approach in twelve lagoons and bays along the southern coast of California to:

- Fulfill NPDES requirements under Order 2001-01;
- Implement a regional study of coastal embayment sediments;
- Identify coastal lagoons or bays in the region whose sediments are negatively affected by urban runoff through the incorporation of upstream MLS data;
- Use a combination of ABLM and MLS data to develop an assessment of bay and lagoon patterns across the County.

To achieve these goals, sediments were sampled in two phases during the summer over three years. A stratified random approach was implemented to target sediments potentially deposited during the previous rainy season. The sampling rationale for freshwater upstream MLS sampling, storm water toxicity testing, and benthic community health assessments are described in Weston's Urban Runoff Monitoring reports (MEC Analytical, Inc., 2000-2003; Weston Solutions, Inc., 2004-2006).

The ABLM program used the weight-of-evidence Triad approach to examine sediment contaminant conditions, benthic community health, and toxicity using the amphipod *Eohaustorius estuaricus*. These results were then compared to the Triad results used to examine freshwater conditions at upstream MLS stations, along with benthic community health and toxicity test data. The results presented in this report were based on three years of data collection.

In addition to the Triad approach, a multivariate analysis was completed to determine if benthic infaunal communities are closely related between years within lagoons, if communities are

similar between lagoons, if there is a detectable difference between open, closed, and intermittently open lagoons, and what physical or chemical characteristics may be driving these relationships.

Results of the ABLM program indicate that San Diego County lagoons are relatively healthy. Sediment metals chemistry and mean ERM-Q values were low, the majority of lagoons had mean ERM-Q values below 0.2 in all three years. In addition, the levels of pesticides and organics were not detectable in the sediments during any sampling year. Toxicity test results also indicate low toxicity of sediment across the region, with particularly low toxicity in 2004 and 2005. During these two years, 9 of 12 and 7 of 12 of the lagoons had survivorship of greater than 82%. Benthic infaunal health was measured by two indices for estuarine conditions and these indices indicate mixed results for the San Diego County lagoons. These index scores may be negatively affected by freshwater conditions and TOC. Samples collected in marine environments with low TOC received higher scores, while those collected in highly freshwater influenced areas received lower scores. Species diversity was higher in locations with higher salinity and lower TOC, perhaps due to increased flushing. It should be noted that the method for benthic infauna health estimation may be biased by the freshwater influence in some lagoons, and may account for some of the lack of consistency between the three metrics of the Triad method.

Conditions in the lagoons have not changed appreciably over the three year study period. The pattern between sediment conditions observed in the lagoon monitoring and upstream MLS stormwater monitoring for the three year study period is unclear. Overall, Triad results from each watershed display patterns between chemistry, toxicity, and biological health that do not correspond to any general (county-wide) pattern. It is possible that factors affecting lagoon and receiving water health are independent between watersheds.

These results will be used to assess the future direction of the ABLM program, as stated in the ROWD.

1.2 Background and Rationale

The sampling rationale for sediments in twelve lagoons of San Diego County included a stratified random approach and is based on the physical characteristics and the tidal influences of lagoons, and the chemical binding properties of sediments and is described in detail below. The physical characteristics and depositional patterns within lagoons vary spatially because of the influence of stream and tidal channels, marshes and grasses, and connectivity with the ocean. Some of the lagoons are completely closed to the ocean, some are regularly flushed, and some are intermittently open to the ocean. Sediments that accumulate in the lagoons as a result of urban runoff are dispersed according to the different energy conditions that are encountered at stream outfalls and in the lagoon. Fine-grained sediments accumulate in lower energy conditions between active stream and tidal channels whereas, coarse sediments accumulate in stream and tidal channels as point bars.

The chemical binding of fine-grained sediments was also important to the sampling design because fine-grained sediments tend to have large surface areas with unsatisfied surface charges that promote adsorption of ionic complexes of metals and pesticides. In addition, fine-grained organic materials associated with sediment also tend to adsorb and complex with metals, PCBs, PAHs, and pesticides. In contrast, coarse-grained sediments have small surface areas with little ionic charges and therefore do not readily adsorb metals, pesticides, and other organic chemicals. Fine-grained sediment in overabundance overwhelms the endemic flora and fauna of lagoons and estuaries. Based on these chemical binding properties and affects on fauna and flora of lagoons, the baseline premise for the ABLM monitoring program assumes that fine-grained materials pose the greatest threat to the biological communities within the lagoons because of their ability to complex and adsorb potential pollutants. The ABLM program therefore focuses on sampling and testing finer-grained size materials (County of San Diego, Appendix C).

2.0 METHODS

2.1 Sampling

Twelve coastal embayments were monitored in two phases each year. Phase I sampling was conducted using a stratified random approach that selected nine sample sites within each lagoon, based on three strata from areas near stream outfalls, near the center of the lagoon, and near the ocean mouth. Each stratum contained three stations for sediment sampling: two on opposite sides of the lagoon and one near the center. Sediment samples from the top 5 cm at each of the nine sites were collected and analyzed for total organic carbon (TOC) and grain size distribution to identify stations most likely impacted by stream sediment output. The three samples of the nine with highest TOC and smallest grain size were sampled during Phase II each year. These three samples were composited into one sample and analyzed for chemistry and toxicity, while infaunal data were analyzed for individual samples. Therefore, for each lagoon, there were a total of three samples per year of infauna and grain size data, and one sample each year for chemistry and toxicity. Chemical sampling analytes included metals, PCBs, PAHs, and pesticides. Toxicity testing was performed using the estuarine amphipod *E. estuarius*. Table 2-1 provides a listing of lagoons sampled and the corresponding freshwater tributaries, and Appendix A contains maps of all phase II site locations.



Mass loading station data collection was conducted three times during each wet season prior to ABLM sediment sampling. Bioassessment monitoring was conducted each May prior to ABLM sediment sampling. Methods for MLS and Bioassessment monitoring are presented in the yearly Urban Stormwater Runoff report (Weston 2005).

Table 2-1. Coastal embayments monitored in the Ambient Bay and Lagoon Monitoring Program

Name of Coastal Embayment	Site Designation	Watershed Management Area	Major Freshwater Tributary
Santa Margarita River Estuary	SME	Santa Margarita River	Santa Margarita River
Oceanside Harbor	OH	Santa Margarita River	None
San Luis Rey River Estuary	SLR	San Luis Rey River	San Luis Rey River
Buena Vista Lagoon	BVL	Carlsbad	Buena Vista Creek
Agua Hedionda Lagoon	AHL	Carlsbad	Agua Hedionda Creek
Batiquitos Lagoon	BL	Carlsbad	San Marcos Creek
San Elijo Lagoon	SEL	Carlsbad	Escondido Creek
San Dieguito Lagoon	SDL	San Dieguito	San Dieguito River
Los Peñasquitos Lagoon	LPL	Peñasquitos	Los Peñasquitos Creek
Mission Bay (includes Rose and Tecolote Creek inflows)	MB	Mission Bay	Tecolote Creek and Rose Creek
Sweetwater River Estuary	SRE	San Diego Bay	Sweetwater River
Tijuana River Estuary	TRE	Tijuana River	Tijuana River

2.2 Data

A database was assembled of all ABLM phase II data collected from three years of sediment monitoring in 12 of the bays, lagoons, and estuaries from the Santa Margarita River Estuary south to the Tijuana River Estuary. The database includes all sediment chemistry, toxicity, and benthic infauna index scores for the three years of sampling, as well as chemistry, total suspended solids, and toxicity data from associated upstream wet weather mass loading station (MLS) sites. Bioassessment index scores from spring sampling events at MLS stations upstream of the lagoons were also included. All sediment data are included in Appendix B, and the complete MLS dataset can be found in the 2005 Stormwater Report (Weston, 2005).

Two measures of sediment biological health were calculated for this analysis, the Benthic Response Index (BRI) and the Relative Benthic Index (RBI). The BRI was used as the measure of benthic health for the first two years of the ABLM program. This index is most applicable to marine environments, and is not entirely relevant to lagoons that are intermittently open or closed to the ocean because it is based on the presence or absence of select species. However, the index does provide some insight into the benthic health of the lagoons, and is therefore included in this analysis. The RBI was included in this report because it is less dependent on marine benthic species. It is less influenced by freshwater environments, and so inclusion of both the BRI and RBI gives a measure of how the benthic communities are doing overall in both freshwater and marine influenced lagoons.

The BRI is the abundance-weighted average pollution tolerance score of organisms occurring in a sample (Smith *et al.*, 2001; Smith *et al.*, 2003; Ranasinghe *et al.*, 2004). The coefficients used to calculate the BRI score are the same as those created from the Southern California Bight 1998 Regional Monitoring Program (Bight '98) for bays and harbors. For this analysis, the three samples in each lagoon were combined by year and the BRI calculated from the combined data.

The RBI is the weighted sum of three measures of abundance; 1) total number of species, number of crustacean species, number of crustacean individuals, and number of mollusc species; 2) abundance of three positive and 3) two negative indicator organisms (Hunt *et al.*, 2001). As with the BRI, all three samples from each lagoon for each year were combined and a collective RBI score calculated for each year. The RBI is relative to the highest score overall all lagoons in the three years combined.

Freshwater biological assessment was measured using the Index of Biotic Integrity (IBI). The IBI is used to identify community measures outside of a reference range (Weisberg *et al.*, 1997; Van Dolah *et al.*, 1999; and Thompson and Lowe, 2004). This method has been used previously in reporting results of the Stormwater Monitoring Program and is described in detail in the annual reports (MEC, 2003; MEC, 2004; Weston, 2005).

The sediment metals chemistry metric for each sample was estimated by using the mean ERM-Q. The mean ERM-Q is calculated by dividing each sediment metal result by its Effects Range-Median (ER-M) value to obtain an ER-M quotient (ERM-Q). An ER-M is a contaminant-specific value above which biological effects are more frequently, though not always observed. The ERM-Q is then averaged for all quotients as described in Long *et al.* (1995) to calculate the

mean ERM-Q. This method has been used and evaluated by many researchers (Hyland *et al.*, 1999; Car *et al.*, 1996; Chapman, 1996; and Long *et al.*, 1995) and has also been utilized for reporting of previous ABLM monitoring years (MEC, 2004; Weston, 2005).

Freshwater metals chemistry was assessed using a Water Quality Objective ratio (WQO-ratio) calculated using methods similar to the calculation of the mean ERM-Q for sediment. Total metal results for arsenic, cadmium, chromium, copper, lead, nickel, and zinc were used in this analysis. Because of the affinity of metals for suspended sediment, total metals were used in this assessment instead of dissolved metals. As suspended solids settle in the lagoons, a greater association with total metals and downstream sediment would be expected. Each total metal result was divided by its hardness-based water quality objective (a standard hardness of 100 was used as a conservative approach) and a count of ratios greater than one was used as a final water chemistry score. This value was used in scoring water chemistry in the Triad approach.

Toxicity scores were calculated from one sediment toxicity and the average of four freshwater toxicity tests. Sediment toxicity was estimated using *Eohaustorius estuarinus* species for percent survival adjusted for control sample survival (MEC, 2003). An average of four toxicity test results was used to compute the freshwater toxicity score based on the no observed effect concentration (NOEC). Two species were used in the average, *Ceriodaphnia dubia* and *Hyalella azteca*. *Ceriodaphnia dubia* was tested for acute, chronic, and reproductive endpoints, and *H. azteca* was tested for acute toxicity.

2.3 Triad Relationships

The Triad method was used to assess the relationships between chemistry, biology, and toxicity for the lagoon sediments and associated freshwater streams. This method is an integrated approach that depends on “weight of evidence” (Chapman, 1996) and integrates chemistry, biological observation, and toxicity endpoints, allowing the user to classify results based on a decision framework.

To quantify the results of the Triad approach, and allow for comparisons between years and lagoons, a score was calculated for each of the three “legs” (or metrics) of the Triad as “Good”, “Fair”, or “Poor”. This allowed for comparisons between years and lagoons. Each score was classified based on the ranges presented in Table 2-2. The chemistry ranges were based on comparison with literature values (Long *et al.*, 1995) or the number of exceedances of water quality objectives. Toxicity ranges were also based on published ranges (Bay *et al.*, 2005) and biological index ranges were categorized based on the published classifications of community health (Smith *et al.*, 2003; Hunt *et al.*, 2001). Each range was assigned a number from 1-3, and the three segments were labeled “Good”, “Fair”, or “Poor” accordingly.

The Mass Loading Station (MLS) Triad analysis was also completed using water chemistry, bioassessment, and average toxicity in the same manner as that for lagoon sediment. The Triad comparison of lagoons to MLS was done only for the nine lagoons with associated upstream stations.

Table 2-2. Range values for Triad metric scores

Score	Biology			Toxicity		Chemistry	
	BRI	RBI	IBI	%Survival	Mean NOEC	ERM-Q	# Over WQO
Good (1)	<31	>0.61	>26	>83	>83	<0.09	0
Fair (2)	31-53	0.31-0.60	13-26	50-83	50-83	0.1-0.19	1-2
Poor (3)	>53	<0.30	<13	<50	<50	>0.2	3-5

2.4 Multivariate Analysis

A multivariate analysis of all benthic infauna data was completed to make use of the wealth of benthic data available from this program. The purpose of this analysis was to determine if benthic infaunal communities are closely related between years within lagoons, if communities are similar between lagoons, if there is a detectable difference between open, closed, and intermittently open lagoons, and what physical or chemical characteristics may be driving these relationships. Cluster analysis and canonical discriminant analysis were the methods used to explore these relationships, and methods for both are presented below.

2.4.1 Cluster Analysis

The benthic infauna data were analyzed using agglomerative hierarchical cluster analysis and the Bray-Curtis dissimilarity index (Clifford, 1975) to determine which lagoons support similar communities and also to see whether the communities within each lagoon were consistent through the three years of monitoring. Agglomerative hierarchical cluster analysis is a method for grouping samples into unknown groups. Each sample begins as its own cluster, and samples most alike (or closest in multivariate space) are grouped together. These groups build until all samples are included. The groups are not decided before hand, and the number and characteristics of the groups are derived from the data (Afifi and Clark, 1990). For this analysis, the three benthic infauna samples in each lagoon and year were combined to represent each lagoon as a whole. The species count data were square-root transformed and standardized to the mean for each species prior to calculation of a Bray-Curtis dissimilarity index. Species and lagoon/year dendograms were created that show the degree of dissimilarity among the entities in each. The dendograms were combined with a two-way table of standardized abundance to demonstrate the relationships among lagoons for the benthic community.

2.4.2 Canonical Analysis

Canonical discriminant analysis was used to determine which of the sediment and physical measures were most important in determining the benthic cluster groups. Discriminant analysis is a method where groups are pre-determined, in this case the cluster membership groups, and is used to identify which variables contribute to making the classification (Afifi and Clark, 1990). This method varies from a cluster analysis in that membership in a group is pre-determined. Canonical discriminant analysis was performed as a two step process. First, a stepwise discriminant analysis was performed to determine which of the measures had a strong relationship with the cluster groups. The measures that were retained in the analysis were then used in the canonical discriminant analysis.

3.0 RESULTS and DISCUSSION

3.1 Triad Analysis

Triad Analysis results are presented in Figure 3-1, which is a summary figure created to address the main goals of the ABLM program. The lagoons sampled are ordered from north to south, Santa Margarita River Estuary to Tijuana River Estuary. Data from all three years and all three legs of the triad are presented for both ABLM and MLS stations, where applicable. The estuaries and lagoons are presented in the yellowish left hand columns and their associated MLS in the green right hand columns. The three squares for each of the Triad legs (Biology, Toxicology, and Chemistry) are further divided horizontally into three sections to represent the three years of the program. The Biology square in each lagoon is divided into two columns (the BRI and RBI) to allow presentation of both index results. Based on the scoring system presented in Section 2.3, each metric for each year was scored on a scale of one to three, with a one as the optimal score (solid green) and three as the lowest score (orange dots).

Comparison of the BRI and RBI shows that the two indices provided some differences in benthic community health scores. Overall, the RBI resulted in 13 higher scores and 19 that were the same as the BRI. Only two lagoons received a lower score when using the RBI. The higher RBI scores are likely due to the method of calculating the index which is relative for within the 12 lagoons and three years, whereas the BRI calculates a value that is compared to levels of impairment from previous marine studies (Figure 3-1). In this case, the RBI may be more applicable because of the freshwater influence in some lagoons.

The Triad analysis (Figure 3-1) also shows that most of the lagoons have different results when comparing legs of the Triad. Seven of the twelve lagoons have biology results that differ in score from the chemistry and toxicology legs. Most often, the toxicology and chemistry legs receive a score of “Good”, while the benthic results may be lower. In fact, nine of the twelve lagoons have toxicology scores of “Good” for at least one of three years and seven of the twelve have high scores for chemistry for at least one year.

Where MLS data are available, a comparison of MLS stations with ABLM stations is made for similar patterns between Triad legs over the three years. Of the nine possible lagoon/MLS combinations, three of them have a similar pattern between the three legs of the Triad.

Figure 3-1 can also be used to assess region-wide patterns for individual years. During 2003, 7 of the 12 lagoons had similar RBI scores for biology, 9 of the 12 had similar scores for toxicity, and 8 of the 12 for chemistry. Conditions across the region improved during 2005, with 6 of 12 lagoons receiving a Good score for chemistry and 5 of the 9 MLS as well. Region-wide factors such as rainfall may have contributed to these results, 2005 was a year with above average rainfall in San Diego County.

Overall, Triad scoring patterns for the three years are similar for four ABLM/MLS datasets and opposite for two data sets, with three inconclusive patterns. This result indicates that, while there is no definitive link between the ABLM and MLS datasets for several of the watersheds, a weak link is detected.

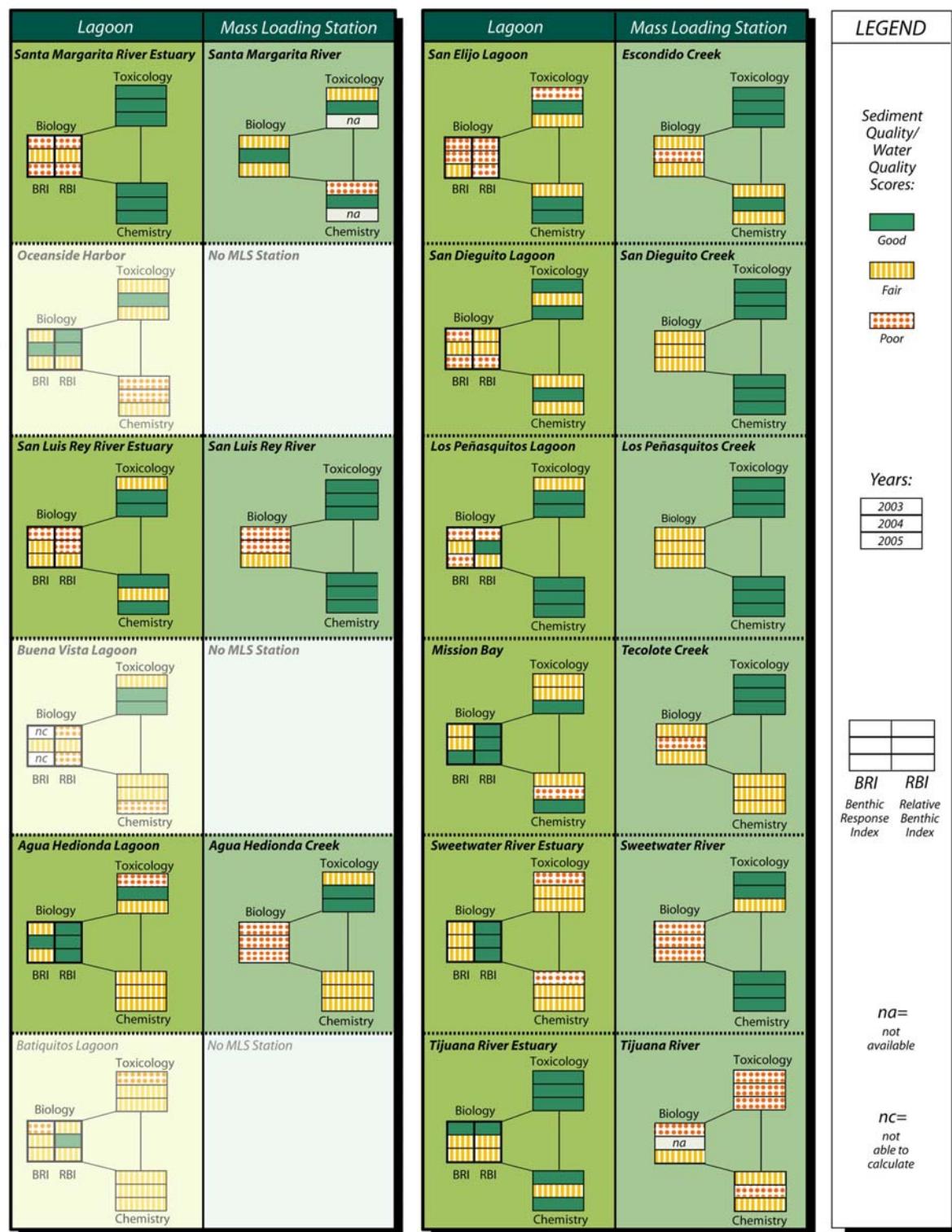


Figure 3-1. Triad summary of 2003, 2004, 2005 Monitoring, Ambient Bay and Lagoon results presented opposite Mass Loading Station results

3.2 Multivariate Analysis

The results of this multivariate analysis, presented in more detail below, indicate that benthic infauna groups by freshwater, marine, and intermittently open lagoons (Figure 3-2 and Figure 3-3). Further, the marine cluster (A, green in Table 3-1, Figure 3-2 and Figure 3-3) is driven by lower TOC, higher salinity, and higher species diversity, while the freshwater cluster (D, pink in Table 3-1, Figure 3-2, and Figure 3-3) is driven by higher TOC and lower salinity. This group is also characterized by lower species diversity overall. Membership in Cluster A also corresponds to higher RBI scores (Figure 3-1).

3.2.1 Cluster Analysis

The cluster analysis of the benthic infauna data identified four major lagoon/year cluster groups (Table 3-1 and Figure 3-2). Cluster group A (green) is composed of bay and lagoon stations that are definitely marine influenced. These samples are dominated by the species in cluster groups 5, 6, and 7. On the other end of the dendrogram, cluster group D (pink) contains samples from the more freshwater lagoon, as well as two other lagoons. The salinity measurements for these two lagoons indicate a freshwater environment at the time of sampling during these years. The few species and relative absence of infauna in these samples appears to be the similarity of these stations.

Table 3-1. Benthic infauna cluster groups.

Cluster Group						
A	B	C	D			
2003 AHL	2004 AHL	2004 LPL	2003 BVL			
2005 AHL	2003 BL	2005 SDL	2004 BVL			
2003 MB	2004 BL	2004 SEL	2005 BVL			
2004 MB	2005 BL	2004 SLR	2003 SDL			
2005 MB	2003 LPL	2003 SLR	2003 SEL			
2003 OH	2005 LPL	2004 SLR	2005 SEL			
2004 OH	2005 SLR	2003 SMR				
2005 OH	2004 SMR					
2003 SRE	2005 SMR					
2004 SRE	2003 TJR					
2005 SRE	2004 TJR					
	2005 TJR					

The remaining two lagoon/year cluster groups, B and C, (blue and orange) are comprised of the lagoons that are more intermittently exposed to marine influence. The two groups are somewhat similar in species composition with species cluster 2 dominant in both cluster groups, however species clusters 3 and 7 are also strong contributors to lagoon/year cluster group B. On the whole, the lagoons/years in cluster group B are more diverse than those in cluster group C.

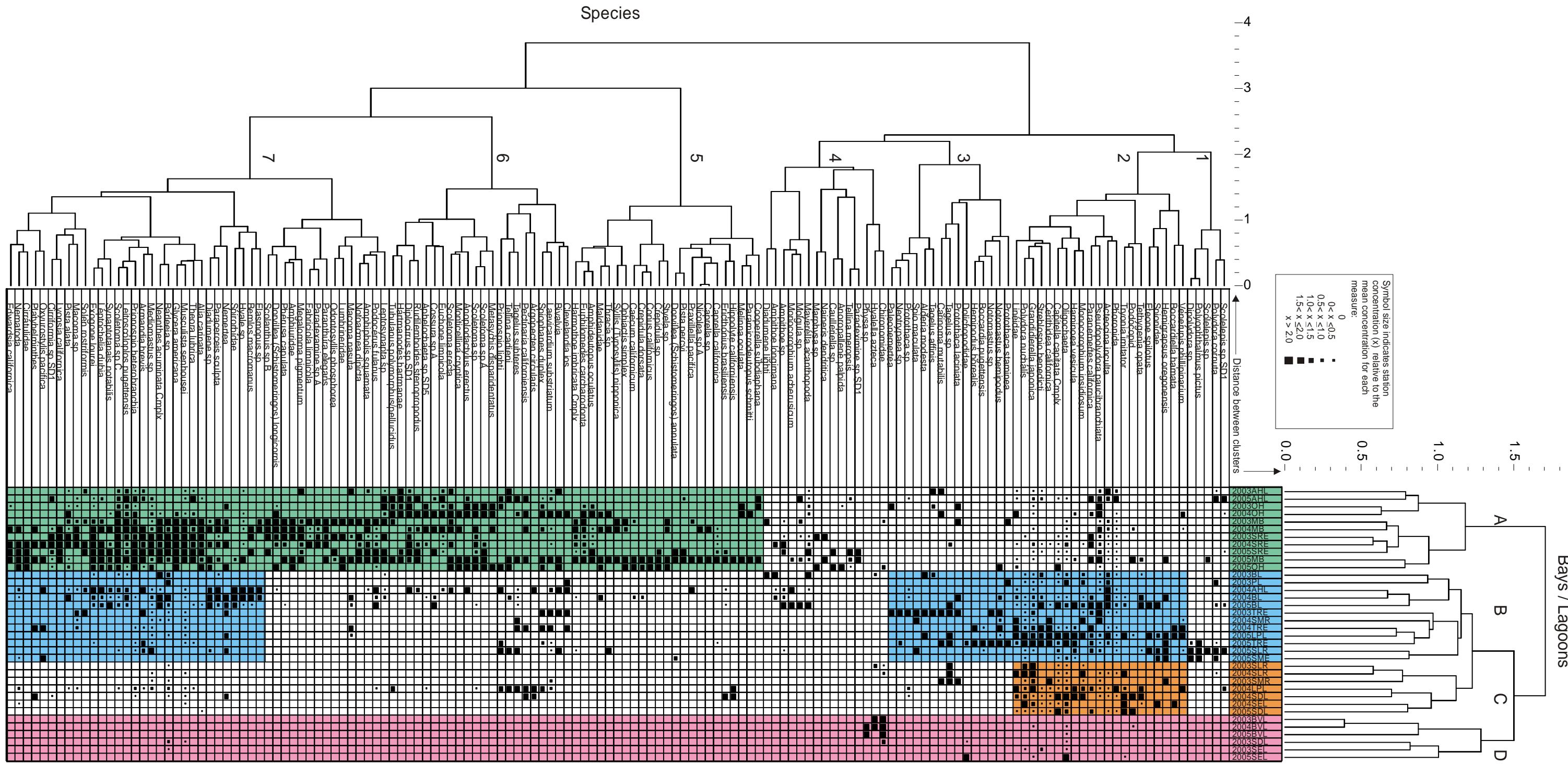


Figure 3-2. Benthic infauna cluster analysis results

3.2.2 Canonical Analysis

Further clarification of the chemical and physical factors distinguishing lagoon/year cluster groups comes from the results of the canonical discriminant analysis. The first step in this assessment was a stepwise analysis to determine which measures best discriminated the cluster groups. Five measures were identified in this step at a significance level of 0.15: salinity, zinc, pH, TOC, and turbidity. The second step was the canonical discriminant analysis which defines the relationships of these five measures in discriminating the cluster groups. Two significant canonical variables were identified that cumulatively explained 98% of the variance. The first canonical variable represents a salinity/TOC component where the salinity gradient is inversely related to that of TOC. In other words, as salinity increases, TOC decreases. The second canonical variable is dominated by zinc concentrations. Figure 3-3 shows the relationship of these two canonical variables and the discrimination of the four cluster groups. Cluster group D (pink) is completely separate from the other three groups while cluster groups A and C each overlap with cluster group B, but do not overlap each other.

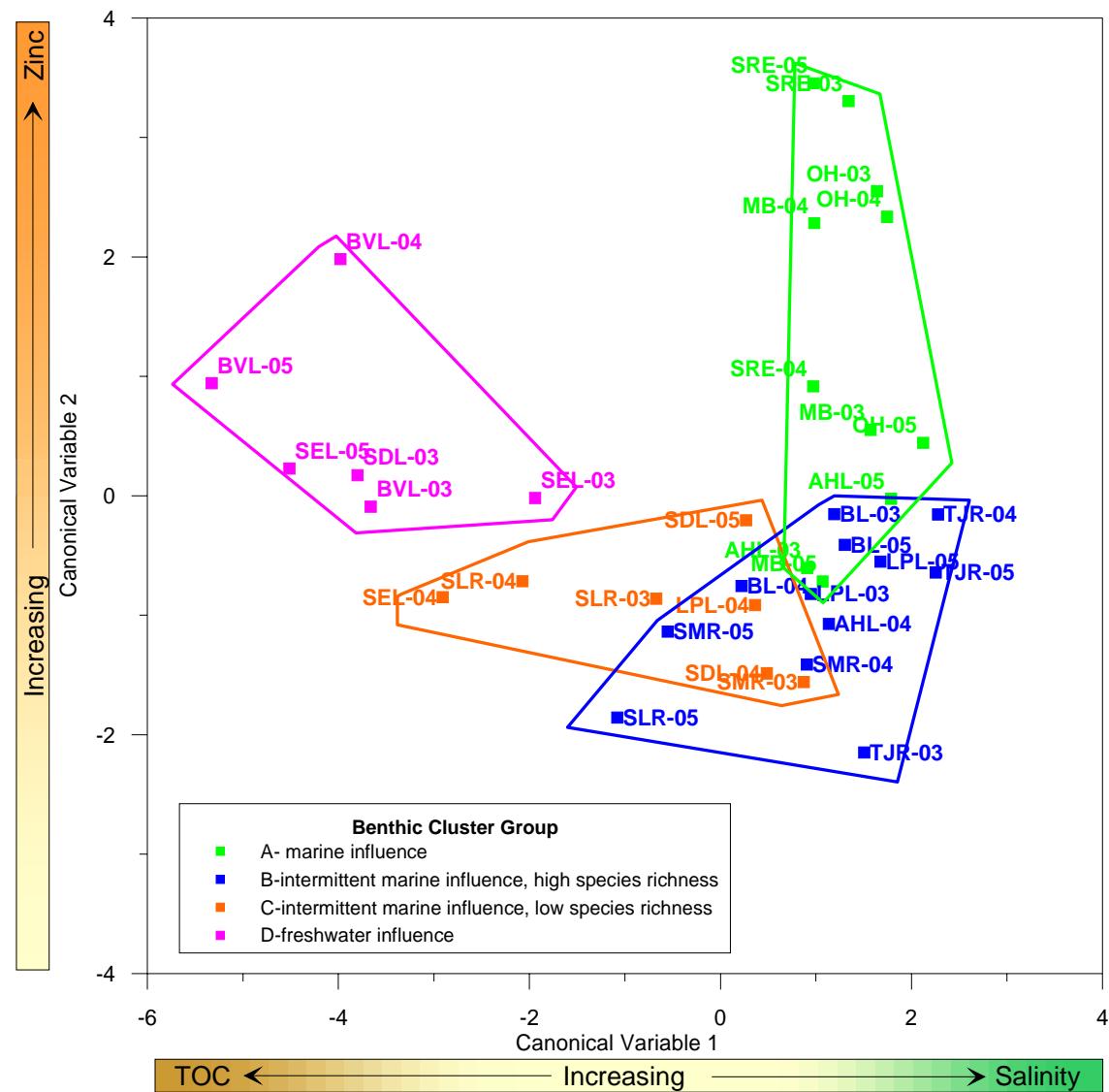


Figure 3-3. Canonical Discriminant Analysis results overlaid with benthic cluster group

3.3 Data Tables

Tables 3-2 through 3-10 provide numerical results of all data used in this analysis. The index results for BRI, RBI, and IBI, as well as the mean ERM-Q and WQO-ratio count are presented in Tables 3-2 to 3-4. The sediment metals chemistry results from the ABLM composite sampling for each year are included in Tables 3-5 to 3-7. A complete data table for all sediment results is provided in Appendix B. Benthic infauna data are included in Appendix B.3. Mass loading station total metals chemistry data for each lagoon for years 2002-2003, 2003-2004, and 2004-2005 are presented in Tables 3-8 to 3-10. A complete set of mass loading station data for all years can be found in the 2005 Urban Stormwater Monitoring report (Weston, 2005).

Table 3-2. 2003 Indices

Index	Media	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.23	0.66	0.29	0.17	0.63	0.43	0.09	0.34	0.11	0.97	0.77	0.69
BRI	Sediment	59	33	58	NA	50	64	71	62	59	43	44	11
IBI	Water	16	NA	6	NA	12	NA	13	13	12	13	5	5
Mean ERM-Q	Sediment	0.04	0.24	0.09	0.16	0.15	0.13	0.10	0.11	0.10	0.18	0.23	0.05
WQO-ratio Count	Water	3	NA	0	NA	1	NA	1	0	0	2	0	2
Sediment Toxicity	Sediment	93.6	57.5	71.3	67.0	47.9	30.9	42.6	91.5	59.6	78.7	28.7	85.1
Average Water Toxicity	Water	78.1	NA	100.0	NA	66.7	NA	100.0	88.5	100.0	87.5	87.5	29.7

Table 3-3. 2004 Indices

Index	Media	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.51	0.83	0.26	0.31	0.86	0.74	0.20	0.37	0.71	0.94	0.91	0.54
BRI	Sediment	33	31	50	48	29	51	59	48	33	41	38	46
IBI	Water	29	NA	2	NA	2	NA	11	15	15	3	7	NA
Mean ERM-Q	Sediment	0.04	0.21	0.11	0.18	0.11	0.11	0.07	0.10	0.10	0.26	0.12	0.12
WQO-ratio Count	Water	0	NA	0	NA	1	NA	0	0	0	1	0	4
Sediment Toxicity	Sediment	98.0	86.9	93.0	99.0	85.9	66.7	88.9	66.7	97.5	81.8	79.8	98.0
Average Water Toxicity	Water	100.0	NA	95.8	NA	95.8	NA	100.0	100.0	100.0	95.8	100.0	24.5

Table 3-4. 2005 Indices

Index	Media	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.06	0.60	0.37	0.14	0.80	0.57	0.03	0.00	0.46	1.00	0.89	0.49
BRI	Sediment	64	37	35	NA	32	38	48	69	62	21	35	43
IBI	Water	15	NA	13	NA	10	NA	15	13	18	20	1	17
Mean ERM-Q	Sediment	0.05	0.12	0.05	0.24	0.14	0.10	0.08	0.12	0.10	0.09	0.19	0.09
WQO-ratio Count	Water	NA	NA	0	NA	2	NA	1	0	0	2	0	2
Sediment Toxicity	Sediment	95.9	76.0	92.8	90.7	63.9	70.1	69.1	95.9	93.8	87.6	72.2	96.9
Average Water Toxicity	Water	NA	NA	100.0	NA	89.6	NA	100.0	93.8	100.0	100.0	78.1	47.9

Table 3-5. 2003 Phase II Sediment chemistry results

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	73.7	53	63.8	31.2	45.3	35.1	38.8	46.7	40.1	37.3	41.4	68.7
Metals													
Antimony	mg/kg	<0.814	<1.13	<0.940	<1.92	<1.32	<1.71	1.93	<1.28	<1.50	<1.61	<1.45	<0.873
Arsenic	mg/kg	1.15	7.09	2.11	7.26	9.65	8.88	5.84	3.69	7.61	11.7	7.76	2.52
Cadmium	mg/kg	<0.136	<0.189	<0.157	<0.321	<0.221	<0.285	0.298	<0.214	<0.249	0.312	0.443	<0.146
Chromium	mg/kg	14.7	42	27.1	40.8	42.2	33.2	23.3	38.7	22.7	34.3	42.2	13.5
Copper	mg/kg	9.53	164	19.2	48.3	46	36.1	31.5	29.8	19.5	36.4	91.2	9.92
Lead	mg/kg	3.01	18.4	4.94	31.6	16.5	17.6	15.5	8.05	15.6	47.3	40	7.84
Nickel	mg/kg	5.7	16.7	18.3	15.7	16.5	12.7	10.5	13.9	8.63	13.3	16.5	5.89
Selenium	mg/kg	<0.814	<1.13	<0.940	<1.92	<1.32	<1.71	1.61	<1.28	<1.50	<1.61	<1.45	<0.873
Zinc	mg/kg	33.9	181	41	105	78.5	96.2	63.7	77.9	70.3	134	206	40.8

Table 3-6. 2004 Phase II Sediment chemistry Results

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	64.9	49.9	55.9	21.9	41.7	31.8	34.5	43.5	35.7	31.7	49	41.5
Metals													
Antimony	mg/kg	<0.924	<1.20	<1.07	<2.74	<1.44	<1.89	<1.74	<1.38	<1.68	<1.89	<1.22	<1.45
Arsenic	mg/kg	1.67	8.15	2.25	7.38	8.28	9.19	3.52	3.21	9.39	12.7	4.67	5.36
Cadmium	mg/kg	<0.154	<0.200	<0.179	0.646	<0.240	<0.314	0.33	1.33	<0.280	<0.315	<0.204	0.374
Chromium	mg/kg	13.2	42.2	37.4	35.9	33.2	30.4	15.3	26.1	21.8	43.2	24.5	28.4
Copper	mg/kg	6.45	116	17.6	43.5	23.1	18.6	17.8	16.5	14.4	148	33.1	18
Lead	mg/kg	5.13	19.6	4.1	32.5	13.7	15.7	12.7	8.19	17.7	50.4	22.9	11.1
Nickel	mg/kg	4.92	15	21.5	14.1	10.6	10.6	5.89	7.65	8.1	12.9	8.57	19.9
Selenium	mg/kg	<0.924	1.63	<1.07	<2.74	<1.44	<1.89	<1.74	<1.38	1.98	1.96	<1.22	<1.45
Zinc	mg/kg	37.2	177	39.8	180	70.2	76.2	51.5	63.8	75.6	191	129	98.4

Table 3-7. 2005 Phase II Sediment chemistry Results

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	57.6	56.5	57.6	19.1	38	37.6	49.1	39.5	38.3	52.8	43.1	66.3
Metals													
Antimony	mg/kg	<1.04	<1.06	<1.04	<3.14	<1.58	<1.60	<1.22	<1.52	<1.57	<1.14	<1.39	<0.905
Arsenic	mg/kg	1.54	5.02	1.63	10.1	10.5	7.95	4.79	5.58	7.84	6.06	8.77	3.5
Cadmium	mg/kg	<0.174	<0.177	<0.174	0.554	<0.263	<0.266	0.219	<0.253	0.279	0.418	0.394	0.27
Chromium	mg/kg	17.8	33.5	15.2	67.8	46.9	26.4	19.6	42.3	22.9	27.4	41.4	20.6
Copper	mg/kg	7.45	42.3	10.2	66.1	33	20.2	19.5	19.8	15.5	15.3	49.4	13.4
Lead	mg/kg	4	11.2	4.4	46.6	20.1	17.6	15.4	12.4	19.5	15.5	38.2	19.3
Nickel	mg/kg	5.96	11.6	6	18.4	13.4	7.85	6.26	12.5	7.58	7.23	12.1	7.53
Selenium	mg/kg	<1.04	<1.06	<1.04	<3.14	<1.58	<1.60	<1.22	<1.52	<1.57	<1.14	<1.39	<0.905
Zinc	mg/kg	46.4	103	33.6	186	102	83.4	65	101	79.3	73.2	202	80.6

Data from 2003, 2004, and 2005 ABLM monitoring, complete results in Appendix B

Table 3-8. 2003 Mass Loading Station Chemistry Results

Analyte	Units	Santa Margarita		San Luis Rey River			Agua Hedionda Creek			Escondido Creek			San Dieguito Creek			Los Peñasquitos Creek			Tecolote Creek			San Diego River			Chollas Creek			Sweetwater River			Tijuana River		
		2/12/03	2/25/03	11/8/02	2/11/03	2/25/03	11/8/02	2/11/03	2/25/03	11/8/02	2/11/03	2/25/03	2/11/03	2/25/03	3/15/03	11/8/02	12/16/02	2/11/03	11/8/02	12/16/02	2/11/03	11/8/02	12/16/02	2/11/03	11/8/02	2/11/03	2/25/03	12/16/02	2/11/03	2/25/03	11/8/02	2/11/03	2/25/03
Total Suspended Solids	mg/L	405	3090	14	8	152	508	380	674	54	150	221	10	23	34	35	58	38	158	346	301	43	212	66	63	193	295	74	14	51	160	97	1070
Total Hardness	mg/L	341	242	779	832	463	418	370	205	530	365	388	1030	726	767	428	602	602	344	245	298	545	331	483	69.1	78	44	344	758	549	279	334	395

Table 3-9. 2004 Mass Loading Station Chemistry Results

Analyte	Units	Santa Margarita		San Luis Rey River			Agua Hedionda Creek			Escondido Creek			San Dieguito Creek			Los Peñasquitos Creek			Tecolote Creek			San Diego River			Chollas Creek			Sweetwater River			Tijuana River		
		2/24/04	11/12/03	2/2/04	2/18/04	11/12/03	1/19/03	2/18/04	11/12/03	2/3/04	3/2/04	2/3/04	2/18/04	3/2/04	11/12/03	2/3/04	2/18/04	11/12/03	2/3/04	2/18/04	11/12/03	2/3/04	3/2/04	2/3/04	2/18/04	3/2/04	11/12/03	2/3/04	2/18/04	11/12/03	2/3/04	2/18/04	
Total Suspended Solids	mg/L	69	<20	<20	<20	842	<20	403	75	<20	55	<20	44	101	27	<20	<20	102	<20	<20	34	<20	21	24	290	56	<20	<20	<20	590	120	128	
Total Hardness	mg/L	225	891	749	867	680	576	403	610	284	547	935	999	564	692	805	880	1470	1300	591	759	476	206	87	88	74	817	728	816	328	308	417	

Table 3-10. 2005 Mass Loading Station Chemistry Results

Analyte	Units	Santa Margarita		San Luis Rey River			Agua Hedionda Creek			Escondido Creek			San Dieguito Creek			Los Peñasquitos Creek			Tecolote Creek			San Diego River			Chollas Creek			Sweetwater River			Tijuana River		
		6/27/05	10/27/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/27/04	2/11/05	2/18/05	10/27/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/17/04	2/11/05	2/18/05	10/27/04	2/11/05	2/18/05	
Total Suspended Solids	mg/L	NA	165	30	78	962	246	859	60	72	264	28	24	28	<20	<20	108	2180	229	245	477	50	61	753	135	275	20	26	102	7440	890	2900	
Total Hardness	mg/L	NA	353	650	581	422	387	225	700	663	514	967	767	487	1000	707	379	126	330	152	201	364	251	244	40	46	1210	991	556	702	376	350	

Data from 2003, 2004, and 2005 Urban Monitoring Stormwater Reports (MEC/Weston 2003, 2004, and Weston 2005)

Bold shaded values are above the criteria continuous concentrations (CCC) water quality guidelines based on hardness levels for the specific sample

4.0 CONCLUSIONS

Overall, the lagoon sediment health across San Diego County is fair. Sediment metals mean ERM-Q values are low, as well as sediment toxicity. However, benthic infauna scores are generally only in the mid-range and do not score well. The method for benthic infauna health estimation may be biased by the freshwater influence in some lagoons, and may account for some of the lack of consistency between the three metrics of the Triad method.

The three years of data provide a baseline of information that can be used to characterize the health of estuaries and provide a benchmark for comparison of future sampling results. Based on these results, we now have a better understanding of the health of San Diego County estuaries and lagoons, as represented by sampling in portions of each bay/lagoon/estuary determined to have the highest potential for contamination.

Sediment metals chemistry contamination levels across the region are low. During 2003 and 2004, 10 of 12 lagoons had mean ERM-Q values of less than 0.20; in 2005 11 of 12 were below this value. In addition, the levels of pesticides and organics were not detectable in the sediments during any sampling year.

Toxicology results were also good across the region, especially during 2004 and 2005. During these two years, 9 of 12 and 7 of 12 of the lagoons had survivorship of greater than 82%.

Biology, as measured by the RBI, was marginally healthy during 2004 with 6 of 12 lagoons receiving a score of >0.61. However, during 2003 and 2005, only 5 of 12 and 3 of 12 sites, respectively, scored above 0.61. BRI scores were generally indicated poorer conditions than RBI scores, with 2 of 11, 3 of 12, and 1 of 11 lagoon scores equal to or below 31 for the 2003, 2004, and 2005, respectively (for the BRI a low score indicates better conditions). Biology scores may be negatively affected by freshwater and increased TOC. Samples collected in marine environments with low TOC received higher RBI scores. Species diversity was also higher in these samples, perhaps due to increased flushing and low TOC.

The results of the Triad method indicate that the three legs do not tend to support each other in this study. In other words, low levels of sediment toxicity and metals chemistry do not necessarily indicate high benthic infauna species diversity and abundance.

The use of both the RBI and BRI allows for a more useful measure of benthic health across the region. The BRI is biased in freshwater-influenced areas because it is calculated on the presence of species with known disturbance coefficients. If these species are absent, the score cannot be calculated. The RBI, on the other hand, is based on measures that are present in both marine and freshwater environments. Currently new measures for assessing benthic health in enclosed bay and estuarine environments are being evaluated as part of the Southern California Bight '03 analysis and the Sediment Quality Objectives development by the State Water Resources Control Board; these new measures will likely provide a better measure of benthic health than is available for use in this report.

The pattern between sediment conditions observed in the lagoon monitoring and upstream MLS stormwater monitoring for the three year study period is weak. Several lagoons and upstream MLS data exhibit tentative patterns common to both datasets, but several of the watersheds exhibit no upstream/downstream pattern. Overall, Triad results from each watershed display patterns between chemistry, toxicity, and biological health that do not correspond to any general (county-wide) pattern. It is possible that factors affecting lagoon and receiving water health are independent between watersheds and future studies should be designed accordingly.

5.0 RECOMMENDATIONS

Based on the relative health of most of the sediments in the lagoons of San Diego County, and the results of this analysis, it is recommended that the co-permittees take part in the Bight program. This will allow for periodic (5 year) monitoring of sediments within the lagoons and allow assessment of the status of the lagoons in San Diego County in relation to those throughout southern California. The Bight program is consistent with the intent of the Ambient Bay and Lagoon monitoring requirement in the MS4 Permit as it provides an ambient assessment of conditions every five years.

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APPENDIX A

Three-Year Site Locations

Santa Margarita River Estuary



2003



2004



2005

Oceanside Harbor



2003



2004

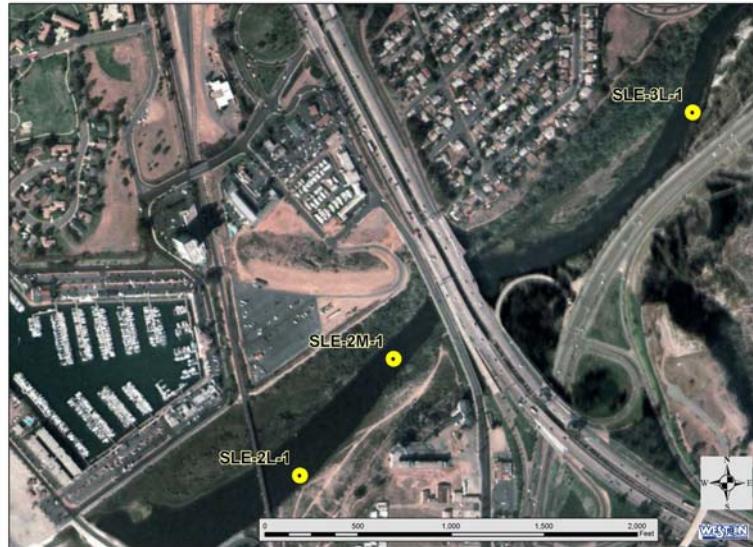


2005

San Luis Rey River Estuary



2003

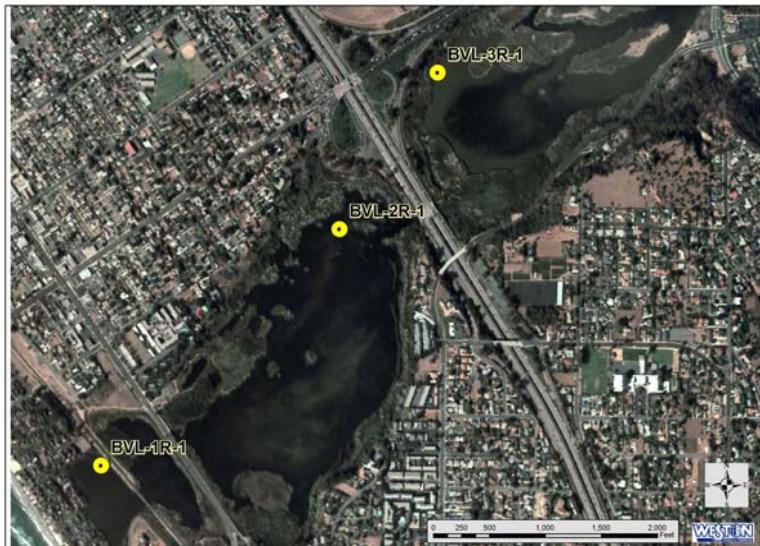


2004



2005

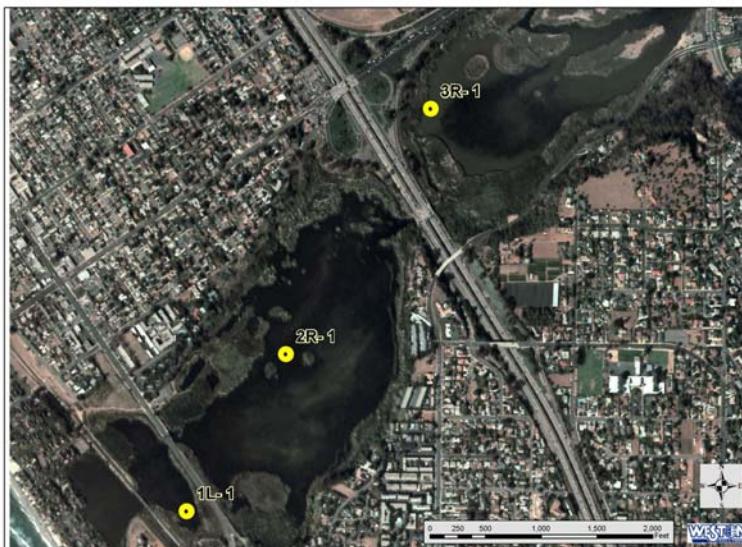
Buena Vista Lagoon



2003



2004



2005

Agua Hedionda Lagoon



2003



2004



2005

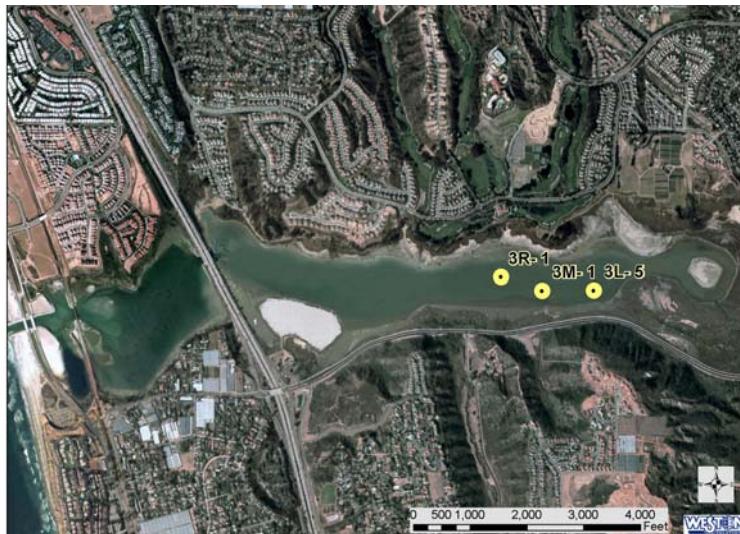
Batiquitos Lagoon



2003



2004



2005

San Elijo Lagoon



2003



2004



2005

San Dieguito Lagoon



2003



2004



2005

Los Peñasquitos Lagoon



2003



2004



2005

Mission Bay



2003



2004



2005

Sweetwater River Estuary



2003



2004



2005

Tijuana River Estuary



2003



2004



2005

APPENDIX B

Ambient Bay and Lagoon Monitoring Data

- B.1 Indices**
- B.2 Sediment Chemistry**
- B.3 Benthic Infauna**

B.1 Indices

Appendix B.1-1. Indices used in Ambient Bay and Lagoon analyses for 2003.

Index	Media	Site Designation											
		SMR	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.23	0.66	0.29	0.17	0.63	0.43	0.09	0.34	0.11	0.97	0.77	0.69
BRI	Sediment	59	33	58	NA	50	64	71	62	59	43	44	11
IBI	Water	16	NA	6	NA	12	NA	13	13	12	13	5	5
Mean ERM-Q	Sediment	0.04	0.24	0.09	0.16	0.15	0.13	0.10	0.11	0.10	0.18	0.23	0.05
WQO-ratio Count	Water	3	NA	0	NA	1	NA	1	0	0	2	0	2
Sediment Toxicity	Sediment	93.6	57.4	71.3	67.0	47.9	30.9	42.6	91.5	59.6	78.7	28.7	85.1
Average Water Toxicity	Water	78.1	NA	100.0	NA	66.7	NA	100.0	88.5	100.0	87.5	87.5	29.7

Appendix B.1-2. Indices used in Ambient Bay and Lagoon analyses for 2004.

Index	Media	Site Designation											
		SMR	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.51	0.83	0.26	0.31	0.86	0.74	0.20	0.37	0.71	0.94	0.91	0.54
BRI	Sediment	33	31	50	48	29	51	59	48	33	41	38	46
IBI	Water	29	NA	2	NA	2	NA	11	15	15	3	7	NA
Mean ERM-Q	Sediment	0.04	0.21	0.11	0.18	0.11	0.11	0.07	0.10	0.10	0.26	0.12	0.12
WQO-ratio Count	Water	0		0		1		0	0	0	1	0	4
Sediment Toxicity	Sediment	98.0	86.9	92.9	99.0	85.9	66.7	88.9	66.7	97.5	81.8	79.8	98.0
Average Water Toxicity	Water	100.0	NA	95.8	NA	95.8	NA	100.0	100.0	100.0	95.8	100.0	24.5

Appendix B.1-3. Indices used in Ambient Bay and Lagoon analyses for 2005.

Index	Media	Site Designation											
		SMR	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
RBI	Sediment	0.06	0.60	0.37	0.14	0.80	0.57	0.03	0.00	0.46	1.00	0.89	0.49
BRI	Sediment	64	37	35	NA	32	38	48	69	62	21	35	43
IBI	Water	15	NA	13	NA	10	NA	15	13	18	20	1	17
Mean ERM-Q	Sediment	0.05	0.12	0.05	0.24	0.14	0.10	0.08	0.12	0.10	0.09	0.19	0.09
WQO-ratio Count	Water	NA	NA	0	NA	2	NA	1	0	0	2	0	2
Sediment Toxicity	Sediment	95.9	76.0	92.8	90.7	63.9	70.1	69.1	95.9	93.8	87.6	72.2	96.9
Average Water Toxicity	Water	NA	NA	100.0	NA	89.6	NA	100.0	93.8	100.0	100.0	78.1	47.9

B.2 Sediment Chemistry

Appendix B.2-1. Sediment Chemistry Results for 2003.

ANALYTE	Units	Site Description											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	73.7	53	63.8	31.2	45.3	35.1	38.8	46.7	40.1	37.3	41.4	68.7
Metals													
Antimony	mg/kg	<0.814	<1.13	<0.940	<1.92	<1.32	<1.71	1.93	<1.28	<1.50	<1.61	<1.45	<0.873
Arsenic	mg/kg	1.15	7.09	2.11	7.26	9.65	8.88	5.84	3.69	7.61	11.7	7.76	2.52
Cadmium	mg/kg	<0.136	<0.189	<0.157	<0.321	<0.221	<0.285	0.298	<0.214	<0.249	0.312	0.443	<0.146
Chromium	mg/kg	14.7	42	27.1	40.8	42.2	33.2	23.3	38.7	22.7	34.3	42.2	13.5
Copper	mg/kg	9.53	164	19.2	48.3	46	36.1	31.5	29.8	19.5	36.4	91.2	9.92
Lead	mg/kg	3.01	18.4	4.94	31.6	16.5	17.6	15.5	8.05	15.6	47.3	40	7.84
Nickel	mg/kg	5.7	16.7	18.3	15.7	16.5	12.7	10.5	13.9	8.63	13.3	16.5	5.89
Selenium	mg/kg	<0.814	<1.13	<0.940	<1.92	<1.32	<1.71	1.61	<1.28	<1.50	<1.61	<1.45	<0.873
Zinc	mg/kg	33.9	181	41	105	78.5	96.2	63.7	77.9	70.3	134	206	40.8
Aroclors													
Aroclor 1016	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1221	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1232	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1242	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1248	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1254	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Aroclor 1260	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
PAHs													
Acenaphthene	ug/kg	<4.88	<6.79	<5.64	<11.5	<7.95	<10.3	<9.28	<7.71	<8.98	<9.65	<8.70	<5.24
Acenaphthylene	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Anthracene	ug/kg	<8.55	<11.9	<9.87	<20.2	<13.9	<17.9	<16.2	<13.5	<15.7	<16.9	<15.2	<9.17
Benzo (a) anthracene	ug/kg	<9.05	18.2	22.3	<21.4	<14.7	<19.0	<17.2	<14.3	<16.6	<17.9	16.3	<9.71
Benzo (a) pyrene	ug/kg	<10.0	17.6	37.7	<23.7	<16.3	<21.0	<19.0	<15.8	<18.4	<19.8	<17.8	<10.7
Benzo (b) fluoranthene	ug/kg	<12.1	<16.8	46.2	<28.5	<19.6	<25.3	<22.9	<19.0	<22.2	<23.8	<21.5	<12.9
Benzo (g,h,i) perylene	ug/kg	<13.2	<18.3	24	<31.2	<21.5	<27.7	<25.1	<20.8	<24.2	<26.1	<23.5	<14.1
Benzo (k) fluoranthene	ug/kg	<9.28	<12.9	<10.7	<21.9	<15.1	<19.5	<17.6	<14.6	<17.1	<18.3	<16.5	<9.96
Chrysene	ug/kg	<5.37	19.7	24.5	<12.7	<8.74	<11.3	<10.2	<8.48	<9.88	<10.6	14.7	6.77
Dibenz (a,h) anthracene	ug/kg	<12.5	<17.3	<14.4	<29.4	<20.3	<26.2	<23.7	<19.7	<22.9	<24.6	<22.2	<13.4
Fluoranthene	ug/kg	<7.82	<10.9	58.6	<18.5	<12.7	<16.4	<14.8	<12.3	<14.4	<15.4	<13.9	<8.38
Fluorene	ug/kg	<6.35	<8.83	<7.34	<15.0	<10.3	<13.3	<12.1	<10.0	<11.7	<12.5	<11.3	<6.81
Indeno (1,2,3-cd) pyrene	ug/kg	<13.6	<18.9	21.6	<32.1	<22.1	<28.5	<25.8	<21.4	<24.9	<26.8	<24.2	<14.6
Naphthalene	ug/kg	<2.59	<3.60	7.6	<6.12	<4.22	<5.44	<4.92	<4.09	<4.76	<5.12	<4.61	<2.78
Phenanthrene	ug/kg	<5.69	<7.91	25.8	<13.4	<9.25	<11.9	<10.8	<8.97	<10.4	<11.2	<10.1	<6.10
Pyrene	ug/kg	<8.25	30.8	77.5	<19.5	<13.4	<17.3	<15.7	<13.0	<15.2	<16.3	<14.7	<8.85

Appendix B.2-2. Sediment Chemistry Results for 2004.

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	64.9	49.9	55.9	21.9	41.7	31.8	34.5	43.5	35.7	31.7	49	41.5
Metals													
Antimony	mg/kg	<0.924	<1.20	<1.07	<2.74	<1.44	<1.89	<1.74	<1.38	<1.68	<1.89	<1.22	<1.45
Arsenic	mg/kg	1.67	8.15	2.25	7.38	8.28	9.19	3.52	3.21	9.39	12.7	4.67	5.36
Cadmium	mg/kg	<0.154	<0.200	<0.179	0.646	<0.240	<0.314	0.33	1.33	<0.280	<0.315	<0.204	0.374
Chromium	mg/kg	13.2	42.2	37.4	35.9	33.2	30.4	15.3	26.1	21.8	43.2	24.5	28.4
Copper	mg/kg	6.45	116	17.6	43.5	23.1	18.6	17.8	16.5	14.4	148	33.1	18
Lead	mg/kg	5.13	19.6	4.1	32.5	13.7	15.7	12.7	8.19	17.7	50.4	22.9	11.1
Nickel	mg/kg	4.92	15	21.5	14.1	10.6	10.6	5.89	7.65	8.1	12.9	8.57	19.9
Selenium	mg/kg	<0.924	1.63	<1.07	<2.74	<1.44	<1.89	<1.74	<1.38	1.98	1.96	<1.22	<1.45
Zinc	mg/kg	37.2	177	39.8	180	70.2	76.2	51.5	63.8	75.6	191	129	98.4
Aroclors													
Aroclor 1016	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1221	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1232	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1242	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1248	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1254	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Aroclor 1260	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
PAHs													
Acenaphthene	ug/kg	<5.55	<7.21	<6.44	<16.4	<8.63	<11.3	<10.4	<8.28	<10.1	<11.4	<7.35	<8.67
Acenaphthylene	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Anthracene	ug/kg	<9.71	<12.6	<11.3	<28.8	<15.1	<19.8	<18.3	<14.5	<17.6	<19.9	<12.9	<15.2
Benzo (a) anthracene	ug/kg	<10.3	<13.4	<11.9	<30.5	<16.0	<21.0	<19.3	<15.6	<18.7	<21.0	<13.6	<16.1
Benzo (a) pyrene	ug/kg	<11.4	<14.8	<13.2	<33.7	<17.7	<23.2	<21.4	<17	<20.7	<23.3	<15.1	<17.8
Benzo (b) fluoranthene	ug/kg	<13.7	<17.8	<15.9	<40.6	<21.3	<28.0	<25.8	<20.4	<24.9	<28.0	<18.1	<21.4
Benzo (g,h,i) perylene	ug/kg	<15.0	<19.5	<17.4	<44.4	<23.3	<30.6	<28.2	<22.3	<27.2	<30.7	<19.8	<23.4
Benzo (k) fluoranthene	ug/kg	<10.5	<13.7	<12.2	<31.2	<16.4	<21.5	<19.8	<15.7	<19.2	<21.6	<14.0	<16.5
Chrysene	ug/kg	<6.10	<7.94	<7.08	<18.1	<9.50	<12.5	<11.5	<9.1	<11.1	<12.5	<8.08	<9.54
Dibenz (a,h) anthracene	ug/kg	<14.1	<18.4	<16.4	<41.9	<22.0	<28.9	<26.6	<21.1	<25.7	<29.0	<18.7	<22.1
Fluoranthene	ug/kg	<8.88	<11.5	<10.3	<26.3	<13.8	<18.1	<16.7	<13.2	<16.1	<18.2	<11.8	<13.9
Fluorene	ug/kg	<7.21	<9.38	<8.37	<21.4	<11.2	<14.7	<13.6	<10.8	<13.1	<14.8	<9.55	<11.3
Indeno (1,2,3-cd) pyrene	ug/kg	<15.4	<20.0	<17.9	<45.7	<24.0	<31.4	<29	<23	<28.0	<31.5	<20.4	<24.1
Naphthalene	ug/kg	<2.94	<3.83	<3.42	<8.72	<4.58	<6.01	<5.54	<4.39	<5.35	<6.03	<3.90	<4.6
Phenanthrene	ug/kg	<6.46	<8.40	<7.50	<19.1	<10.0	<13.2	<12.1	<9.63	<11.7	<13.2	<8.55	<10.1
Pyrene	ug/kg	<9.37	<12.2	<10.9	<27.8	<14.6	<19.1	<17.6	<14	<17.0	<19.2	<12.4	<14.7

Appendix B.2-3. Sediment Chemistry Results for 2005.

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
% Solids	%	57.6	56.5	57.6	19.1	38	37.6	49.1	39.5	38.3	52.8	43.1	66.3
Metals													
Antimony	mg/kg	<1.04	<1.06	<1.04	<3.14	<1.58	<1.60	<1.22	<1.52	<1.57	<1.14	<1.39	<0.905
Arsenic	mg/kg	1.54	5.02	1.63	10.1	10.5	7.95	4.79	5.58	7.84	6.06	8.77	3.5
Cadmium	mg/kg	<0.174	<0.177	<0.174	0.554	<0.263	<0.266	0.219	<0.253	0.279	0.418	0.394	0.27
Chromium	mg/kg	17.8	33.5	15.2	67.8	46.9	26.4	19.6	42.3	22.9	27.4	41.4	20.6
Copper	mg/kg	7.45	42.3	10.2	66.1	33	20.2	19.5	19.8	15.5	15.3	49.4	13.4
Lead	mg/kg	4	11.2	4.4	46.6	20.1	17.6	15.4	12.4	19.5	15.5	38.2	19.3
Nickel	mg/kg	5.96	11.6	6	18.4	13.4	7.85	6.26	12.5	7.58	7.23	12.1	7.53
Selenium	mg/kg	<1.04	<1.06	<1.04	<3.14	<1.58	<1.60	<1.22	<1.52	<1.57	<1.14	<1.39	<0.905
Zinc	mg/kg	46.4	103	33.6	186	102	83.4	65	101	79.3	73.2	202	80.6
Aroclors													
Aroclor 1016	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1221	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1232	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1242	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1248	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1254	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
Aroclor 1260	ug/kg	<4.06	<4.14	<4.06	<12.3	<6.16	<6.22	<4.77	<5.92	<6.11	<4.43	<5.43	<3.53
PAHs													
Acenaphthene	ug/kg	<6.25	<6.37	<6.25	<18.8	<9.47	<9.57	<7.33	<9.11	<9.40	<6.82	<8.35	<5.43
Acenaphthylene	ug/kg	<8.12	<8.28	<8.12	<24.5	<12.3	<12.4	<9.53	<11.8	<12.2	<8.86	<10.9	<7.06
Anthracene	ug/kg	<10.9	<11.2	<10.9	<33.0	<16.6	<16.8	<12.8	<15.9	<16.4	<11.9	<14.6	<9.50
Benzo (a) anthracene	ug/kg	<11.6	<11.8	<11.6	<34.9	<17.6	<17.7	<13.6	<16.9	<17.4	<12.6	<15.5	<10.1
Benzo (a) pyrene	ug/kg	<12.8	<13.1	<12.8	<38.6	<19.4	<19.6	<15.0	<18.7	<19.3	<14.0	<17.1	<11.1
Benzo (b) fluoranthene	ug/kg	<15.4	<15.7	<15.4	<46.5	<23.4	<23.6	<18.1	<22.5	<23.2	<16.8	29.7	<13.4
Benzo (g,h,i) perylene	ug/kg	<16.9	<17.2	<16.9	<50.9	<25.6	<25.9	<19.8	<24.6	<25.4	<18.4	<22.6	<14.7
Benzo (k) fluoranthene	ug/kg	<11.9	<12.1	<11.9	<35.8	<18.0	<18.2	<13.9	<17.3	<17.9	<13.0	27.7	<10.3
Chrysene	ug/kg	<6.88	<7.01	<6.88	<20.7	<10.4	<10.5	<8.07	<10.0	<10.3	<7.50	<9.19	<5.97
Dibenz (a,h) anthracene	ug/kg	<15.9	<16.2	<15.9	<48.1	<24.2	<24.4	<18.7	<23.2	<24.0	<17.4	<21.3	<13.8
Fluoranthene	ug/kg	<10.0	<10.2	<10.0	<30.2	<15.2	<15.3	<11.7	<14.6	<15.0	<10.9	27	<8.69
Fluorene	ug/kg	<8.12	<8.28	<8.12	<24.5	<12.3	<12.4	<9.53	<11.8	<12.2	<8.86	<10.9	<7.06
Indeno (1,2,3-cd) pyrene	ug/kg	<17.4	<17.7	<17.4	<52.4	<26.3	<26.6	<20.4	<25.3	<26.1	<18.9	<23.2	<15.1
Naphthalene	ug/kg	<3.32	<3.38	<3.32	<10.0	<5.03	<5.08	<3.89	<4.84	<4.99	<3.62	<4.43	<2.88
Phenanthrene	ug/kg	<7.27	<7.42	<7.27	<21.9	<11.0	<11.1	<8.53	<10.6	<10.9	<7.94	<9.72	<6.32
Pyrene	ug/kg	<10.6	<10.8	<10.6	<31.8	<16.0	<16.2	<12.4	<15.4	<15.9	<11.5	26.5	<9.17

Appendix B.2-3. Sediment Chemistry Results for 2005.

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
Pesticides													
2,4'-DDD	ug/kg	na	<1.07	<1.05	<3.17	<1.59	<1.61	<1.23	<1.53	<1.58	<1.15	<1.40	<0.91
2,4'-DDE	ug/kg	na	<0.97	<0.95	<2.88	<1.45	<1.46	<1.12	<1.39	<1.44	<1.04	<1.28	<0.83
2,4'-DDT	ug/kg	na	<0.88	<0.87	<2.62	<1.32	<1.33	<1.02	<1.27	<1.31	<0.95	<1.16	<0.75
4,4'-DDD	ug/kg	na	<1.07	<1.05	<3.17	<1.59	<1.61	3.13	<1.53	<1.58	<1.15	<1.40	<0.91
4,4'-DDE	ug/kg	na	3.54	6.91	<2.88	5.67	<1.46	<1.12	<1.39	<1.44	<1.04	4.49	1.94
4,4'-DDT	ug/kg	na	<0.88	<0.87	<2.62	<1.32	<1.33	<1.02	<1.27	<1.31	<0.95	<1.16	<0.75
Aldrin	ug/kg	na	<0.88	<0.86	<2.59	<1.30	<1.32	<1.01	<1.25	<1.29	<0.94	<1.15	<0.75
Chlordane (Total)	ug/kg	na	<4.16	<4.08	<12.3	<6.18	<6.25	<4.79	<5.95	<6.14	<4.45	<5.45	<3.54
Dieldrin	ug/kg	na	<1.15	<1.13	<3.40	<1.71	<1.73	<1.32	<1.65	<1.70	<1.23	<1.51	<0.98
Endosulfan I	ug/kg	na	<1.42	<1.39	<4.19	<2.11	<2.13	<1.63	<2.03	<2.09	<1.52	<1.86	<1.21
Endosulfan II	ug/kg	na	<1.42	<1.39	<4.19	<2.11	<2.13	<1.63	<2.03	<2.09	<1.52	<1.86	<1.21
Endosulfan sulfate	ug/kg	na	<1.24	<1.22	<3.66	<1.84	<1.86	<1.43	<1.77	<1.83	<1.33	<1.62	<1.06
Endrin	ug/kg	na	<1.32	<1.29	<3.90	<1.96	<1.98	<1.52	<1.89	<1.95	<1.41	<1.73	<1.12
Endrin aldehyde	ug/kg	na	<1.42	<1.39	<4.19	<2.11	<2.13	<1.63	<2.03	<2.09	<1.52	<1.86	<1.21
Endrin ketone	ug/kg	na	<1.77	<1.74	<5.24	<2.63	<2.66	<2.04	<2.53	<2.61	<1.89	<2.32	<1.51
Heptachlor	ug/kg	na	<1.50	<1.48	<4.45	<2.24	<2.26	<1.73	<2.15	<2.22	<1.61	<1.97	<1.28
Heptachlor epoxide	ug/kg	na	<1.50	<1.48	<4.45	<2.24	<2.26	<1.73	<2.15	<2.22	<1.61	<1.97	<1.28
Methoxychlor	ug/kg	na	<1.32	<1.29	<3.90	<1.96	<1.98	<1.52	<1.89	<1.95	<1.41	<1.73	<1.12
Toxaphene	ug/kg	na	<7.81	<7.66	<23.1	<11.6	<11.7	<8.98	<11.2	<11.5	<8.35	<10.2	<6.65
alpha-BHC	ug/kg	na	<1.77	<1.74	<5.24	<2.63	<2.66	<2.04	<2.53	<2.61	<1.89	<2.32	<1.51
alpha-Chlordane	ug/kg	na	<4.16	<4.08	<12.3	<6.18	<6.25	<4.79	<5.95	<6.14	<4.45	<5.45	<3.54
beta-BHC	ug/kg	na	<1.31	<1.28	<3.87	<1.95	<1.97	<1.51	<1.87	<1.93	<1.40	<1.72	<1.12
delta-BHC	ug/kg	na	<1.31	<1.28	<3.87	<1.95	<1.97	<1.51	<1.87	<1.93	<1.40	<1.72	<1.12
gamma-BHC (Lindane)	ug/kg	na	<1.31	<1.28	<3.87	<1.95	<1.97	<1.51	<1.87	<1.93	<1.40	<1.72	<1.12
gamma-Chlordane	ug/kg	na	<4.16	<4.08	<12.3	<6.18	<6.25	<4.79	<5.95	<6.14	<4.45	<5.45	<3.54
Azinphos methyl	ug/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
Bolstar	ug/kg	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47	<1.47
Chlorpyrifos	ug/kg	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640
Coumaphos	ug/kg	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43	<1.43
Demeton-o	ug/kg	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50	<2.50
Demeton-s	ug/kg	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57	<8.57
Diazinon	ug/kg	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670	<0.670
Dichlorvos	ug/kg	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58	<1.58
Dimethoate	ug/kg	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66
Disulfoton	ug/kg	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840	<0.840
EPN	ug/kg	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66
Ethoprop	ug/kg	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770	<0.770

Appendix B.2-3. Sediment Chemistry Results for 2005.

ANALYTE	Units	Site Designation											
		SME	OH	SLR	BVL	AHL	BL	SEL	SDL	LPL	MB	SRE	TRE
Ethyl parathion	ug/kg	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66
Fensulfothion	ug/kg	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730	<0.730
Fenthion	ug/kg	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640	<0.640
Malathion	ug/kg	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830	<0.830
Morphos	ug/kg	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270	<0.270
Methyl parathion	ug/kg	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08	<1.08
Mevinphos	ug/kg	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42	<1.42
Monocrotophos	ug/kg	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66	<1.66
Naled	ug/kg	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59	<1.59
Phorate	ug/kg	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500	<0.500
Ronnel	ug/kg	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64	<1.64
Sulfotep	ug/kg	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15	<4.15
Tetrachlorvinphos	ug/kg	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26	<2.26
Tokuthion (Prothiofos)	ug/kg	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860	<0.860
Trichlorinate	ug/kg	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810	<0.810

B.3 Benthic Infauna

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
Crustaceans																		
<i>Amphideutopus oculatus</i>				3	2	1												
<i>Ampithoe longimana</i>																52		123
<i>Ampithoe sp</i>																		
<i>Anoplodactylus erectus</i>									4									
<i>Anoropallene palpida</i>						1												
<i>Aoroides sp</i>																		
<i>Bemlos macromanus</i>																		
<i>Caprella californica</i>																		
<i>Elasmopus bampo</i>																		
<i>Elasmopus sp</i>																		
<i>Eohaustorius sp</i>		2																
<i>Ericthonius sp</i>																		1
<i>Euphilomedes carcharodonta</i>						1												
<i>Excirolana sp</i>		1																
Gammaridea																		
<i>Grandidierella japonica</i>	140	197			5	2				623	288			2	1	2	10	24
<i>Hartmanodes hartmanae</i>					1									2		2		
<i>Hemigrapsus oregonensis</i>			1															
<i>Heterophoxus sp A</i>																		
<i>Hyale frequens</i>																2		5
<i>Hyale sp</i>														1				
<i>Hyalella azteca</i>							18				2							1
<i>Leptocheilia dubia</i>																		
<i>Listriella eriopisa</i>			1															
<i>Lophopanopeus leucomanus</i>																		
<i>Mayerella acanthopoda</i>				1	5	3								3			112	1
<i>Monocorophium insidiosum</i>	1	1								1						5		6
Mysida															1	1		
<i>Mysidopsis sp</i>					1													
<i>Neotrypaea sp</i>																		
<i>Paracerceis sculpta</i>																3		5
<i>Paradexamine sp A</i>																		
<i>Paranthuria elegans</i>																		
<i>Pinnixa sp</i>					1													
<i>Podocerus fulanus</i>																		
<i>Postasterope barnesi</i>																		
<i>Processa sp</i>																		
<i>Pyromaia tuberculata</i>																		
<i>Rhepoxynius daboiius</i>							1											
<i>Tethygenia opata</i>																1		1
<i>Zeuxo sp</i>																		
Echinoderms																		
<i>Amphiadia occidentalis</i>					2													
<i>Amphiadia urtica</i>					3													
<i>Amphipholis squamata</i>														1		1		
<i>Amphiuridae</i>																		

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Dendraster sp</i>																		
<i>Leptosynapta sp</i>				4	2	2							1			1		
<i>Ophiactis simplex</i>																		
<i>Pentamera sp</i>																		
Minor Phyla																		
Actiniaria																		
<i>Amaroucium sp</i>																		
Aplousobranchia																		
Athenaria																		
<i>Barentsia sp (colonial)</i>													1					
<i>Botryllus sp</i>																		
<i>Bowerbankia sp (colonial)</i>													1					
<i>Carinoma mutabilis</i>			1													1		
Chironomidae								24	5			2						
<i>Clevelandia ios</i>																		
Coenagrionidae																		
<i>Diadumene lighti</i>																8		20
<i>Diadumene sp</i>																		
Diadumenidae																		
Didemnidae																		
Dolichopodidae																		
<i>Edwardsia californica</i>				1														
Edwardsiidae				1														
<i>Ilypnus gilberti</i>					1													
Lineidae															1			
<i>Molgula sp</i>																		
Nemertea						1												
Paleonemertea					1													
<i>Paranemertes californica</i>																		
Phorida														23	22	21	8	9
<i>Quietula y-cauda</i>													1	1			1	
Rhabdocoela																		
<i>Scolanthus sp B</i>																		
<i>Styela sp</i>																		
Stylochidae																		
<i>Syngnathus auliscus</i>																		
<i>Thalamoporella californica (colonial)</i>																		
<i>Trichocorixa sp</i>								1	8									
<i>Tubulanus nothus</i>					1													
<i>Tubulanus polymorphus/pellucidus</i>							1											
<i>Tubulanus sp</i>																		
<i>Zaolutes actius</i>													1	2				
<i>Zygeupolia rubens</i>																		
Molluscs																		
<i>Acteocina inculta</i>													189	25	69	68	19	50
<i>Alderia modesta</i>																1		
<i>Alia carinata</i>																		

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Barleeia</i> sp		12	5							1	7					127	23	45
Bivalvia																1		
<i>Caecum californicum</i>																		
<i>Cerithidea californica</i>			23															
<i>Cooperella subdiaphana</i>						1												
<i>Crassostrea gigas</i>																		
Gastropoda																	1	
<i>Laevicardium substriatum</i>	1	3											1		2			
<i>Leptopecten latiauratus</i>																		
<i>Lyonsia californica</i>																		
<i>Macoma nasuta</i>													3					
<i>Macoma</i> sp				1		1												
<i>Musculista senhousei</i>														1				
<i>Notoacmea dipicta</i>																		
<i>Orobittella</i> sp																		
<i>Petricola tellimyalis</i>					1													
<i>Philine auriformis</i>				2														
<i>Philine</i> sp						2												
<i>Protothaca laciniata</i>		1			7	2												
<i>Protothaca</i> sp																		
<i>Protothaca staminea</i>																		
<i>Rictaxis punctocaelatus</i>				1														
<i>Saxidomus</i> sp						3												
<i>Siliqua lucida</i>				1	1													
<i>Simonactra falcata</i>													2					
<i>Solen rostriformis</i>															1			
<i>Sphenia fragilis</i>																		
<i>Tagelus affinis</i>					1									4	6	2		1
<i>Tagelus</i> sp	1	2									2							
<i>Tellina cadieni</i>													2					
<i>Theora lubrica</i>															1			
Thraciidae																		
Polychaetes																		
<i>Aphelochaeta</i> sp															1			
<i>Aphelochaeta</i> sp SD5						7	6											
<i>Apoprionospio pygmaea</i>																		
<i>Armandia brevis</i>													1		2			
<i>Brania brevipharyngea</i>																		
<i>Capitella capitata Cmplx</i>	53	38									4	33				20		23
Capitellidae																		
<i>Cirriformia</i> sp SD1																		
<i>Diplocirrus</i> sp SD1				3	2								1					
<i>Dorvillea (Schistomerings) longicornis</i>					1													
Eteone aestuarium																		
<i>Euchone limnicola</i>				2	7	2							8		4			
<i>Exogone lourei</i>					2	2										1		
<i>Fabriciola limnicola</i>																		

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Glycera americana</i>																		
<i>Glycera nana</i>																		
<i>Harmothoe hirsuta</i>				1														
<i>Harmothoe imbricata</i> Cmplx																		
<i>Hydroides pacificus</i>																		
<i>Leitoscoloplos pugettensis</i>				8	13	18							12	9	9		9	
Lumbrineridae																		
<i>Malmgreniella</i> sp A				1														
<i>Marpysa</i> sp																		
<i>Mediomastus</i> sp		1	1															
<i>Megalomma pigmentum</i>													2					
<i>Melinna oculata</i>			1															
<i>Metasychis disperidentatus</i>				5		4												
<i>Microspio pigmentata</i>			1															
<i>Naineris dendritica</i>																		
<i>Naineris</i> sp																		
<i>Neanthes acuminata</i> Cmplx															16	2	35	
<i>Nephtys caecoides</i>				3														
<i>Notomastus hemipodus</i>																		
<i>Notomastus magnus</i>				2														
<i>Notomastus</i> sp																		
<i>Odontosyllis phosphorea</i>																		
Oligochaeta	1	1								3	3				3		10	
<i>Pherusa capulata</i>																		
<i>Pista alata</i>				1	2								2					
<i>Polydora cornuta</i>															2			
<i>Polydora nuchalis</i>	11	31								72	109				1		4	
<i>Praxillella pacifica</i>																		
<i>Prionospio heterobranchia</i>			1										2		1			
<i>Prionospio lighti</i>			1															
<i>Prionospio</i> sp										1								
<i>Pseudopolydora paucibranchiata</i>	1		92	176									3	9	26	1		
<i>Scolelepis squamata</i>																		
<i>Scoletoma erecta</i>				1											1			
<i>Scoletoma</i> sp			18	8	6													
<i>Scoletoma</i> sp A			11		1													
<i>Scoletoma</i> sp C			10	9	10								4	1	10	3		
<i>Spio maculata</i>																		
<i>Spiophanes duplex</i>			3	1														
<i>Streblospio benedicti</i>															2	17	3	33
<i>Syllis (Typosyllis) nipponica</i>																		
<i>Syllis (Typosyllis) pigmentata</i>																		
<i>Syllis (Typosyllis)</i> sp																		
<i>Tenonia priops</i>				2														

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3	
Crustaceans																			
<i>Amphideutopus oculatus</i>													2						
<i>Ampithoe longimana</i>																			
<i>Ampithoe sp</i>												1			2				
<i>Anoplodactylus erectus</i>																			
<i>Anoropallene palpida</i>																			
<i>Aoroides sp</i>												5							
<i>Bemlos macromanus</i>														12	13				
<i>Caprella californica</i>														1	1				
<i>Elasmopus bampo</i>											10								
<i>Elasmopus sp</i>												1							
<i>Eohaustorius sp</i>																			
<i>Ericthonius sp</i>																			
<i>Euphilomedes carcharodonta</i>												1	3	1					
<i>Excirolana sp</i>																			
<i>Gammaridea</i>	1																		
<i>Grandidierella japonica</i>							8	1	1							137	5	156	
<i>Hartmanodes hartmanae</i>																			
<i>Hemigrapsus oregonensis</i>																			
<i>Heterophoxus sp A</i>													2						
<i>Hyale frequens</i>																			
<i>Hyale sp</i>													1						
<i>Hyalella azteca</i>																			
<i>Leptochelia dubia</i>												1	1						
<i>Listriella eriopisa</i>																			
<i>Lophopanopeus leucomanus</i>														1					
<i>Mayerella acanthopoda</i>															2				
<i>Monocorophium insidiosum</i>							3	3	14							1	1		
<i>Mysida</i>													1						
<i>Mysidopsis sp</i>																17	2	4	
<i>Neotrypaea sp</i>																			
<i>Paracerceis sculpta</i>										2	281	286		5	1				
<i>Paradexamine sp A</i>										44	1	1			2				
<i>Paranthuria elegans</i>										27	27			3	2				
<i>Pinnixa sp</i>																			
<i>Podocerus fulanus</i>										100	31				3				
<i>Postasterope barnesi</i>													3						
<i>Processa sp</i>															1				
<i>Pyromaia tuberculata</i>														2					
<i>Rhepoxynius daboius</i>																			
<i>Tethygenia opata</i>																			
<i>Zeuxo sp</i>												63							
Echinoderms																			
<i>Amphiodia occidentalis</i>																			
<i>Amphiodia urtica</i>																			
<i>Amphipholis squamata</i>											3	33	1						
<i>Amphiuridae</i>											1		1						

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Dendraster sp</i>																1		
<i>Leptosynapta sp</i>												32		2	6			
<i>Ophiactis simplex</i>											2	19						
<i>Pentamera sp</i>												1						
Minor Phyla																		
Actiniaria										2								
<i>Amaroucium sp</i>											1	1						
Aplousobranchia													1	1				
Athenaria										2								
<i>Barentsia sp (colonial)</i>							1											
<i>Botryllus sp</i>											1							
<i>Bowerbankia sp (colonial)</i>																		
<i>Carinoma mutabilis</i>																2	3	
Chironomidae						7					1	2						
<i>Clevelandia ios</i>							1									2		
Coenagrionidae			1															
<i>Diadumene lighti</i>										20								
<i>Diadumene sp</i>											1							
Diadumenidae											5							
Didemnidae															1			
Dolichopodidae					1													
<i>Edwardsia californica</i>											2							
Edwardsiidae																		
<i>Ilypnus gilberti</i>															1			
Lineidae																		
<i>Molgula sp</i>											24		3					
Nemertea											1					1		
Paleonemertea																12		
<i>Paranemertes californica</i>												2				1		
Phoronida											5		1		3			
<i>Quietula y-cauda</i>																		
Rhabdocoela											1							
<i>Scolanthus sp B</i>										5		1						
<i>Styela sp</i>											1	1						
Stylochidae															1	1		
<i>Syngnathus auliscus</i>											1							
<i>Thalamoporella californica (colonial)</i>											1							
<i>Trichocorixa sp</i>																		
<i>Tubulanus nothus</i>																		
<i>Tubulanus polymorphus/pellucidus</i>												1						
<i>Tubulanus sp</i>													1					
<i>Zaolutes actius</i>																		
<i>Zygeupolia rubens</i>																3		
Molluscs																		
<i>Acteocina inculta</i>							86	14	29	1	2	60	7			4	1	2
<i>Alderia modesta</i>																9	3	
<i>Alia carinata</i>											10	12		3	15			

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Barleeia</i> sp	39	10		96	45		203	41	41	70	150	722		243	512		2	
Bivalvia																	2	
<i>Caecum californicum</i>													1					
<i>Cerithidea californica</i>																		
<i>Cooperella subdiaphana</i>																		
<i>Crassostrea gigas</i>											2							
Gastropoda																		
<i>Laevicardium substriatum</i>																7	6	137
<i>Leptopecten latiauratus</i>							1											
<i>Lyonsia californica</i>													3					
<i>Macoma nasuta</i>										31				1				
<i>Macoma</i> sp											6	10	61	18	6		4	
<i>Musculista senhousei</i>						1				104	95	40	66	94		3	1	
<i>Notoacmea dipicta</i>											8		7	1				
<i>Orobittella</i> sp											1							
<i>Petricola tellimyalis</i>																		
<i>Philine auriformis</i>																		
<i>Philine</i> sp																		
<i>Protothaca laciniata</i>											1				1			
<i>Protothaca</i> sp															10	31	281	
<i>Protothaca staminea</i>							3					1						
<i>Rictaxis punctocaelatus</i>																		
<i>Saxidomus</i> sp																		
<i>Siliqua lucida</i>																		
<i>Simonactra falcata</i>																		
<i>Solen rostriformis</i>												1			3			
<i>Sphenia fragilis</i>												2						
<i>Tagelus affinis</i>															19			
<i>Tagelus</i> sp															5	5		
<i>Tellina cadieni</i>																		
<i>Theora lubrica</i>										6	4	18						
Thraciidae							1											
Polychaetes																		
<i>Aphelochaeta</i> sp																		
<i>Aphelochaeta</i> sp SD5																		
<i>Apopionospio pygmaea</i>														1				
<i>Armandia brevis</i>													9	14	13	1		
<i>Brania brevipharyngea</i>													5					
<i>Capitella capitata Cmplx</i>							1	2	35					2				
Capitellidae																1		
<i>Cirriformia</i> sp SD1														31	60			
<i>Diplocirrus</i> sp SD1												3						
<i>Dorvillea (Schistomerings) longicornis</i>										10	18	5						
<i>Eteone aestuarium</i>										1	1			1				
<i>Euchone limnicola</i>													1	1				
<i>Exogone lourei</i>										24	19	60	14	29				
<i>Fabriciola limnicola</i>												35		1				

Appendix B.3-1. Benthic Infauna Counts for 2003.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Glycera americana</i>										2		4						
<i>Glycera nana</i>																1	1	2
<i>Harmothoe hirsuta</i>																		
<i>Harmothoe imbricata Cmplx</i>											2	3		1	2			
<i>Hydroides pacificus</i>							1											
<i>Leitoscoloplos pugettensis</i>											9	187	18	25	7			
<i>Lumbrineridae</i>										21			2					
<i>Malmgreniella sp A</i>																		
<i>Marpysa sp</i>														1	9			
<i>Mediomastus sp</i>											4	99	41	20		2	3	
<i>Megalomma pigmentum</i>											1	2						
<i>Melinna oculata</i>																		
<i>Metasychis disparidentatus</i>																		
<i>Microspio pigmentata</i>																		
<i>Naineris dendritica</i>													1		18			
<i>Naineris sp</i>															6			
<i>Neanthes acuminata Cmplx</i>											6	51	1	10	22			
<i>Nephtys caecoides</i>															1			
<i>Notomastus hemipodus</i>																17	4	
<i>Notomastus magnus</i>																		
<i>Notomastus sp</i>																2	1	
<i>Odontosyllis phosphorea</i>											34	1	6		3			
<i>Oligochaeta</i>	4	2		5	2	3	4	2	28		2	4			9			
<i>Pherusa capulata</i>											4	10			28			
<i>Pista alata</i>											9		34	8	6			
<i>Polydora cornuta</i>								1	14									
<i>Polydora nuchalis</i>	8	4						1							1		3	
<i>Praxillella pacifica</i>											1							
<i>Prionospio heterobranchia</i>											13		10	1				
<i>Prionospio lighti</i>																		
<i>Prionospio sp</i>																		
<i>Pseudopolydora paucibranchiata</i>							2		1		1	1	6	3	16	5	368	7
<i>Scolelepis squamata</i>															4			
<i>Scoletoma erecta</i>												1						
<i>Scoletoma sp</i>												5						
<i>Scoletoma sp A</i>																		
<i>Scoletoma sp C</i>											47	48	71	8	6			
<i>Spio maculata</i>																12		
<i>Spiophanes duplex</i>																10		
<i>Streblospio benedicti</i>	29						1		3									
<i>Syllis (Typosyllis) nipponica</i>											8							
<i>Syllis (Typosyllis) pigmentata</i>											3	1			2			
<i>Syllis (Typosyllis) sp</i>															1			
<i>Tenonia priops</i>																		

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
Crustaceans																		
<i>Alpheus californiensis</i>					1	1												
<i>Amphideutopus oculatus</i>					11	2												
<i>Ampithoe longimana</i>													1				7	
<i>Ampithoe sp</i>													10	1			10	
<i>Anoplodactylus erectus</i>				1	1								1	4				
<i>Bemlos macromanus</i>													24			10		
<i>Caprella californica</i>																		
<i>Caprella sp</i>																		
<i>Cumella sp</i>																		
<i>Cyclopoida</i>													1					
<i>Daphnia sp</i>							2						3		1			
<i>Elasmopus sp</i>					1													
<i>Elthusa sp</i>																		
<i>Eochelidium sp A</i>																		
<i>Erithonius brasiliensis</i>													2					
<i>Erithonius sp</i>																		
<i>Euphilomedes carcharodonta</i>				3		1												
<i>Grandidierella japonica</i>	44	16	19				14	1			4	154	442	6		4	223	
<i>Hartmanodes hartmae</i>					1	4												
<i>Hemigrapsus oregonensis</i>																	1	
<i>Hippolyte californiensis</i>																		
<i>Hippolytidae</i>									1									
<i>Hyale sp</i>						1							27		67	5		
<i>Hyalella azteca</i>								24	3	1								
<i>Idoteidae</i>																		
<i>Janiralata sp</i>																1		
<i>Jassa slatteryi</i>																		
<i>Leptochelia dubia</i>													4		1			
<i>Liljeborgia sp</i>							1											
<i>Listriella melanica</i>					2													
<i>Lophopanopeus sp</i>																		
<i>Mayerella acanthopoda</i>					7	2							1					
<i>Mayerella sp</i>																		
<i>Megalopa/Zoea</i>	1																	
<i>Monocorophium acherusicum</i>													2					
<i>Monocorophium insidiosum</i>	14	12	8								7	50			1	3		
<i>Monocorophium sp</i>																		
<i>Neotrypaea californiensis</i>							1											
<i>Orchomene pacifica</i>																		
<i>Oxyurostylis pacifica</i>														1				
<i>Palaemon ritteri</i>																		
<i>Paracerceis sculpta</i>													169		153	8	11	
<i>Paracerceis sp</i>						1												
<i>Paradexamine sp A</i>																		
<i>Paramicrodeutopus schmitti</i>							5											

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Paranthura elegans</i>																		
<i>Photis californica</i>																		
<i>Pinnixa sp</i>																		
<i>Podocerus fulanus</i>													49			7		1
Podocopid									1									
<i>Postasterope barnesi</i>																		
<i>Rudilemboides sp</i>																	1	
<i>Rudilemboides stenopropodus</i>					6	8							1	1				
<i>Synaptotanais notabilis</i>					1								5			2		
<i>Tethygenia opata</i>																1	11	
<i>Traskorchestia sp</i>								1										
Echinoderms																		
<i>Amphiodia digitata</i>																		
<i>Amphiodia urtica</i>						1												
<i>Amphipholis squamata</i>													1					
Amphiuridae																		
<i>Leptosynapta sp</i>					1	1								1		2		
<i>Ophiactis simplex</i>																		
Minor Phyla																		
<i>Acanthogobius flavimanus</i>																		
Acoela																		
<i>Aplousobranchia</i>																		
<i>Barentsia sp (colonial)</i>																		
<i>Bowerbankia sp (colonial)</i>																		
<i>Carinoma mutabilis</i>						1												
<i>Celleporina sp (colonial)</i>					1													
Chironomidae								46	43	34	3							
<i>Clevelandia ios</i>					2	1								1				
Culicidae											1							
<i>Diadumene sp</i>														2		2	4	1
<i>Dynamena furcata</i>																		
<i>Edwardsia californica</i>																		
Gobiidae													1					
<i>Hygrotus sp</i>									1									
<i>Ilypnus gilberti</i>						2												
Lineidae	2	15	8	4	4	4				40				1		4		
Nematoda													38			11	1	
Nemertea															1		1	
<i>Pachycerianthus fimbriatus</i>																		
<i>Paranemertes californica</i>					1											1		
<i>Phascolosoma agassizi</i>																		
Phoronida							3				1	1		11	20	14	5	1
Platyhelminthes																		
<i>Quietula y-cauda</i>																		
Rhabdocoela																		
<i>Scolanthus sp B</i>																		

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Styela</i> sp																		
<i>Syngnathus</i> sp																		
<i>Thalamoporella californica</i> (colonial)																		1
<i>Tubulanus cingulatus</i>						1												
<i>Tubulanus nothus</i>						1												
<i>Tubulanus polymorphus/pellucidus</i>					1	10												
<i>Watersipora cucullata</i> (colonial)					1													
<i>Zaolutes actius</i>																		
Molluscs																		
<i>Acteocina carinata</i>				2														
<i>Acteocina eximia</i>																		
<i>Acteocina inculta</i>										1	26	378		8	435	32		
<i>Alia carinata</i>																		
<i>Argopecten circularis</i>												8						
<i>Asthenothaerus diegensis</i>												1						
<i>Balcis</i> sp					1													
<i>Barleeria</i> sp	2		5												1332	60	67	
Bivalvia					2	6							1					
<i>Bulla gouldiana</i>					1		1							1				
<i>Caecum californicum</i>															1			
<i>Cerithidea californica</i>	26	50	45															
<i>Chione californiensis</i>																2		
<i>Crepidula dorsata</i>																1		
<i>Cryptomya californica</i>																		
<i>Erato vitellina</i>												7						
<i>Haminoea vesicula</i>					1	6												
<i>Laevicardium substriatum</i>					7	22	2						11					
<i>Lyonsia californica</i>																		
<i>Macoma nasuta</i>																	2	
<i>Macoma</i> sp		2											1					
<i>Mactrotoma californica</i>																		
<i>Musculista senhousei</i>	1			4							1	3		7	1			
<i>Mya arenaria</i>																		
<i>Mytilus galloprovincialis</i>																		
<i>Nassarius tegula</i>															1			
<i>Notoacmea dipicta</i>																		
<i>Petricola tellimyalis</i>																		
<i>Philine auriformis</i>					1													
<i>Physa</i> sp										1								
<i>Protobrachia laciniata</i>																	1	
<i>Protobrachia</i> sp													1		1			
<i>Rictaxis punctocaelatus</i>				3														
<i>Rochefortia coani</i>				2	1	1												
<i>Solen rostriformis</i>														1				
<i>Solen sicarius</i>																		
<i>Tagelus</i> sp										6								

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Tagelus subteres</i>	11	13	10	3	5								3				1	
<i>Tellina cadieni</i>																1		
<i>Tellina sp</i>																		
<i>Theora lubrica</i>				2														
<i>Thracia sp</i>					1													
<i>Tresus nuttalli</i>																		
<i>Tryonia imitator</i>													49	71			11	
<i>Turbonilla sp</i>					1													
<i>Venerupis philippinarium</i>	1			4														
<i>Vitrinella oldroydi</i>							3											
Polychaetes																		
<i>Amaeana occidentalis</i>				1	14	1												
<i>Aphelochaeta sp</i>	1																	
<i>Aphelochaeta sp SD5</i>				16		8										1		
<i>Apopriionospio pygmaea</i>																		
<i>Armandia brevis</i>													10	1	1			
<i>Boccardia pugettensis</i>																		
<i>Boccardiella hamata</i>																		
<i>Branchiosyllis sp</i>																		
<i>Brania californiensis</i>																		
<i>Brania heterocoma</i>																		
<i>Brania medioidentata</i>																		
<i>Capitella capitata Cmplx</i>													18	1			5	
<i>Chaetozone corona</i>					2													
<i>Cheilonereis cyclurus</i>																		
<i>Cirratulidae</i>																		
<i>Cirriformia sp</i>																		
<i>Cirriformia sp SD1</i>																		
<i>Cossura sp A</i>				11	2	4										1		
<i>Diplocirrus sp SD1</i>				14	11	2							2	2				
<i>Dorvillea (Dorvillea) sp</i>																1		
<i>Dorvillea (Schistomeringsos) longicornis</i>				7									1					
<i>Drilonereis sp</i>																		
<i>Euchone limnicola</i>				12	29	19							5	1	1			
<i>Euclymeninae sp A</i>					2	2												
<i>Eulalia quadrioculata</i>																		
<i>Eumida longicornuta</i>															1			
<i>Exogone lourei</i>													90		54			
<i>Fabriciola limnicola</i>																		
<i>Glycera americana</i>				1														
<i>Halosydra sp</i>													1					
<i>Harmothoe imbricata Cmplx</i>																1		
<i>Hemipodus borealis</i>																		
<i>Hydroides pacificus</i>																		
<i>Leitoscoloplos pugettensis</i>				14	5	25							24	14	5	53		
<i>Maldanidae</i>					1											1		

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3	
<i>Mediomastus sp</i>	2	2	4	9	3	11				3			3			17			
<i>Megalomma pigmentum</i>																			
<i>Melinna oculata</i>						1													
<i>Metasynchis disparidentatus</i>					6	22	2												
<i>Microspio pigmentata</i>							1												
<i>Monticellina cryptica</i>							1												
<i>Monticellina siblina</i>								1											
<i>Naineris uncinata</i>																			
<i>Neanthes acuminata Cmplx</i>	1					2							2			43	3	11	
<i>Nephrys caecoides</i>						2		2											
<i>Nicolea sp A</i>																			
<i>Notomastus hemipodus</i>				2												5			
Oligochaeta									3		1					3	2		
<i>Pectinaria californiensis</i>							1												
<i>Pherusa capulata</i>																			
<i>Phyllodoce hartmanae</i>																			
<i>Pista alata</i>				55	2	2								2		1	75		
<i>Platynereis bicanaliculata</i>																			
<i>Podarkeopsis glabrus</i>						1													
<i>Polydora cornuta</i>										1									
<i>Polydora nuchalis</i>	3									1	269	125					12		
<i>Praxillella pacifica</i>														2					
<i>Prionospio heterobranchia</i>				10		2											3		
<i>Prionospio lighti</i>														1	1				
<i>Pseudopolydora paucibranchiata</i>	88	6	6	147		45				1				1					
Sabellidae																			
<i>Scolelepis sp SD1</i>							1												
<i>Scoletoma erecta</i>						2								1					
<i>Scoletoma sp</i>					12	24	5												
<i>Scoletoma sp A</i>					1	8	1												
<i>Scoletoma sp B</i>					2	1													
<i>Scoletoma sp C</i>					118	44	31							24	8	2	2		
<i>Scoloplos acmeceps</i>																			
<i>Spio maculata</i>	1																		
<i>Spiochaetopterus costarum</i>																			
Spionidae																			
<i>Spiophanes duplex</i>					9	27	5												
Spirorbidae														31			4		
<i>Sternaspis fossor</i>							1												
<i>Streblospio benedicti</i>															3	36			
<i>Syllis (Typosyllis) nipponica</i>																			

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
Crustaceans																		
<i>Alpheus californiensis</i>																		
<i>Amphideutopus oculatus</i>										2			2					
<i>Ampithoe longimana</i>															10			
<i>Ampithoe sp</i>														1	31			
<i>Anoplodactylus erectus</i>																		
<i>Bemlos macromanus</i>													17					
<i>Caprella californica</i>											2	6	5	1				
<i>Caprella sp</i>												1						
<i>Cumella sp</i>															1			
Cyclopoida																		
<i>Daphnia sp</i>																		
<i>Elasmopus sp</i>											1	12						
<i>Elthusa sp</i>																		
<i>Eochelidium sp A</i>													1					
<i>Erithonius brasiliensis</i>							14											
<i>Erithonius sp</i>														2				
<i>Euphilomedes carcharodonta</i>											2	1	2					
<i>Grandidierella japonica</i>	296	38	10	20	1	396	193	474	3				2	152	83	19	167	
<i>Hartmanodes hartmae</i>																		
<i>Hemigrapsus oregonensis</i>																		
<i>Hippolyte californiensis</i>						1	1		1									
Hippolytidae																		
<i>Hyale sp</i>												1	1	1				
<i>Hyalella azteca</i>																		
Idoteidae												1						
<i>Janiralata sp</i>																		
<i>Jassa slatteryi</i>															1			
<i>Leptochelia dubia</i>											4	11	4					
<i>Liljeborgia sp</i>																		
<i>Listriella melanica</i>																		
<i>Lophopanopeus sp</i>										1								
<i>Mayerella acanthopoda</i>													8	1				
<i>Mayerella sp</i>										1								
Megalopa/Zoea																		
<i>Monocorophium acherusicum</i>																		
<i>Monocorophium insidiosum</i>				54	27	13	1	14	4						1			
<i>Monocorophium sp</i>													1					
<i>Neotrypaea californiensis</i>																		
<i>Orchomene pacifica</i>										2								
<i>Oxyurostylis pacifica</i>												1				7		
<i>Palaemon ritteri</i>															1			
<i>Paracerceris sculpta</i>											5	160	49	3				
<i>Paracerceris sp</i>																		
<i>Paradexamine sp A</i>											1			17				
<i>Paramicrodeutopus schmitti</i>																		

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Paranthura elegans</i>										1		16		5	6			
<i>Photis californica</i>												1						
<i>Pinnixa sp</i>											1							
<i>Podocerus fulanus</i>								1				5			7			
<i>Podocopid</i>				21	31							2						
<i>Postasterope barnesi</i>												1						
<i>Rudilemboides sp</i>																		
<i>Rudilemboides stenopropodus</i>										1		1	1	1				
<i>Synaptotanais notabilis</i>											19			3	1			
<i>Tethygenia opata</i>	1		177	12	9	1	5	6										
<i>Traskorchestia sp</i>																		
Echinoderms																		
<i>Amphiodia digitata</i>							1											
<i>Amphiodia urtica</i>																		
<i>Amphipholis squamata</i>											3	11		4				
<i>Amphiuridae</i>											2	8						
<i>Leptosynapta sp</i>																		
<i>Ophiactis simplex</i>												3						
Minor Phyla																		
<i>Acanthogobius flavimanus</i>			1															
<i>Acoela</i>											1							
<i>Aplousobranchia</i>												1						
<i>Barentsia sp (colonial)</i>								1										
<i>Bowerbankia sp (colonial)</i>																	1	
<i>Carinoma mutabilis</i>																		
<i>Celleporina sp (colonial)</i>																		
<i>Chironomidae</i>																		
<i>Clevelandia ios</i>																	3	
<i>Culicidae</i>																		
<i>Diadumene sp</i>												10		2				
<i>Dynamena furcata</i>																	1	
<i>Edwardsia californica</i>											6	23	5	3				
<i>Gobiidae</i>												1						
<i>Hygrotus sp</i>																		
<i>Ilypnus gilberti</i>																		
<i>Lineidae</i>						7	31	2	5				1			5	4	44
<i>Nematoda</i>	5							23	25		43	256	2	190	146			
<i>Nemertea</i>					1						2		3		3			
<i>Pachycerianthus fimbriatus</i>												4	3					
<i>Paranemertes californica</i>									1					2		1	1	2
<i>Phascolosoma agassizi</i>										2								
<i>Phoronida</i>						2	660	46	15			5	1			1		
<i>Platyhelminthes</i>					1							1		2			1	
<i>Quietula y-cauda</i>									1									
<i>Rhabdocoela</i>					3									6				
<i>Scolanthus sp B</i>																		

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Styela</i> sp												1						
<i>Syngnathus</i> sp															1			
<i>Thalamoporella californica</i> (colonial)																		
<i>Tubulanus cingulatus</i>																		
<i>Tubulanus nothus</i>																		
<i>Tubulanus polymorphus/pellucidus</i>							1											
<i>Watersipora cucullata</i> (colonial)																		
<i>Zaolutes actius</i>							1											
Molluscs																		
<i>Acteocina carinata</i>																		
<i>Acteocina eximia</i>									1									
<i>Acteocina inculta</i>				4	10		2			1	89		6	9		13	4	2
<i>Alia carinata</i>											1	8			6			
<i>Argopecten circularis</i>					1	4	5	2										
<i>Asthenothaerus diegensis</i>																		
<i>Balcis</i> sp																		
<i>Barleeria</i> sp					1		4	127	33	1	21	199		299	487			
Bivalvia																		
<i>Bulla gouldiana</i>																		
<i>Caecum californicum</i>																		
<i>Cerithidea californica</i>	1	2		3					1						3		32	
<i>Chione californiensis</i>																		
<i>Crepidula dorsata</i>																		
<i>Cryptomya californica</i>																	2	
<i>Erato vitellina</i>																		
<i>Haminoea vesicula</i>				8	35	4	1	9	5							1	4	
<i>Laevicardium substriatum</i>							4	2	1	1				1		12		18
<i>Lyonsia californica</i>												1	6					
<i>Macoma nasuta</i>																1	1	
<i>Macoma</i> sp									1			10	52	3	36	1		4
<i>Mactrotoma californica</i>								1										
<i>Musculista senhousei</i>	2				5	2	2			2	44	82	57	45	50	2		
<i>Mya arenaria</i>																2		
<i>Mytilus galloprovincialis</i>								1										
<i>Nassarius tegula</i>									1						1			
<i>Notoacmea dipicta</i>														1				
<i>Petricola tellimyalis</i>									1									
<i>Philine auriformis</i>																		
<i>Physa</i> sp																		
<i>Protobrachia laciniata</i>																		
<i>Protobrachia</i> sp							3		6									
<i>Rictaxis punctocaelatus</i>																		
<i>Rochefortia coani</i>																		
<i>Solen rostriformis</i>														14				
<i>Solen sicarius</i>																2		
<i>Tagelus</i> sp															1			

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Tagelus subteres</i>							4	26	8							19	2	6
<i>Tellina cadieni</i>								2	1									
<i>Tellina sp</i>										2								
<i>Theora lubrica</i>								1		3			1		4			
<i>Thracia sp</i>												1						
<i>Tresus nuttalli</i>	1						1	1								1		
<i>Tryonia imitator</i>	92			178	374	54		19										
<i>Turbonilla sp</i>																		
<i>Venerupis philippinarium</i>							2		19	1						15	1	13
<i>Vitrinella oldroydi</i>																		
Polychaetes																		
<i>Amaeana occidentalis</i>																		
<i>Aphelochaeta sp</i>																		
<i>Aphelochaeta sp SD5</i>							1			199	2	2		4				
<i>Apopriionospio pygmaea</i>								1										
<i>Armandia brevis</i>								1			9	40	1	7		2		
<i>Boccardia pugettensis</i>																1		
<i>Boccardiella hamata</i>	2															7		
<i>Branchiosyllis sp</i>											8							
<i>Brania californiensis</i>											1		1					
<i>Brania heterocoma</i>											1							
<i>Brania medioidentata</i>														2				
<i>Capitella capitata Cmplx</i>	4			346	635	5	1	48	12					2	6	1	1	
<i>Chaetozone corona</i>																		
<i>Cheiloneris cyclurus</i>														1				
<i>Cirratulidae</i>															7			
<i>Cirriformia sp</i>														2				
<i>Cirriformia sp SD1</i>					2					1					56			
<i>Cossura sp A</i>										20	1							
<i>Diplocirrus sp SD1</i>										2			8					
<i>Dorvillea (Dorvillea) sp</i>																		
<i>Dorvillea (Schistomerings) longicornis</i>										10	3	31	2	1				
<i>Drilonereis sp</i>											1							
<i>Euchone limnicola</i>										140			1	1				
<i>Euclymeninae sp A</i>																		
<i>Eulalia quadrioculata</i>														1				
<i>Eumida longicornuta</i>																		
<i>Exogone lourei</i>										34	25	159	31	169	4			
<i>Fabriciola limnicola</i>											1	1	7	58				
<i>Glycera americana</i>										4		1	1	1				
<i>Halosydra sp</i>																		
<i>Harmothoe imbricata Cmplx</i>										5		7		3				
<i>Hemipodus borealis</i>															1	2		
<i>Hydroides pacificus</i>										1								
<i>Leitoscoloplos pugettensis</i>										38	72	84	14	9				
<i>Maldanidae</i>										1								

Appendix B.3-2. Benthic Infauna Counts for 2004.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3	
<i>Mediomastus sp</i>							17	2		19	2	7	124	239	13	2	1	6	
<i>Megalomma pigmentum</i>										1	13	1							
<i>Melinna oculata</i>																			
<i>Metasychis disparidentatus</i>										8									
<i>Microspio pigmentata</i>																			
<i>Monticellina cryptica</i>										6									
<i>Monticellina siblina</i>																			
<i>Naineris uncinata</i>														2	50				
<i>Neanthes acuminata Cmplx</i>											11	30		20	1				
<i>Nephthys caecoides</i>																			
<i>Nicolea sp A</i>										1									
<i>Notomastus hemipodus</i>																10	1		
<i>Oligochaeta</i>	19	1	10	18	11	77	5	5	4		5	4	2	8	15	2	8		
<i>Pectinaria californiensis</i>						2	3	1		4							1		
<i>Pherusa capulata</i>												28	3	1					
<i>Phyllodoce hartmanae</i>																1			
<i>Pista alata</i>										1	1		38	9					
<i>Platynereis bicanaliculata</i>						1													
<i>Podarkeopsis glabrus</i>																			
<i>Polydora cornuta</i>																			
<i>Polydora nuchalis</i>	829			65	50	7		55	16							22	44	2	
<i>Praxillella pacifica</i>																			
<i>Prionospio heterobranchia</i>					1		5		1	31	3	28	38	7	2	1			
<i>Prionospio lighti</i>							1												
<i>Pseudopolydora paucibranchiata</i>						1	1		4	69	2	12	11	6	8				
<i>Sabellidae</i>												1							
<i>Scolelepis sp SD1</i>								9	3	1									
<i>Scoletoma erecta</i>												1	3	1					
<i>Scoletoma sp</i>										1	2		8	7					
<i>Scoletoma sp A</i>														1					
<i>Scoletoma sp B</i>																			
<i>Scoletoma sp C</i>								1		5	73	52	83	25					
<i>Scoloplos acmeceps</i>												1							
<i>Spio maculata</i>																			
<i>Spiochaetopterus costarum</i>							2									1			
<i>Spionidae</i>	8																		
<i>Spiophanes duplex</i>								6		4						6	1	3	
<i>Spirorbidae</i>																			
<i>Sternaspis fossor</i>																			
<i>Streblospio benedicti</i>	18				7	2	1	10	7			21		1		13	260	53	43
<i>Syllis (Typosyllis) nipponica</i>																			

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
Crustaceans																		
<i>Acuminodeutopus heteruropus</i>																		
<i>Alpheus californiensis</i>																	1	
<i>Americhelidium rectipalmum</i>																		
<i>Ammothea hilgendorfi</i>				3														
<i>Amothella spinifera</i>				3														
<i>Amphideutopus oculatus</i>																		
<i>Ampithoe lacertosa</i>																		
<i>Ampithoe sp</i>										1					11	38	363	
<i>Ampithoe valida</i>																		
<i>Anoplodactylus erectus</i>				9										1				
<i>Anoropallene palpida</i>				88														
<i>Aoroides columbiae</i>																		
<i>Aoroides inermis</i>																		
<i>Apolochus barnardi</i>																		
<i>Bemlos macromanus</i>																	1	
<i>Cancer anthonyi</i>				1														
<i>Caprella californica</i>																		
<i>Caprella sp</i>																		
<i>Caprellidae</i>																		
<i>Cyclopoida</i>																		
<i>Erithonius brasiliensis</i>																	1	
<i>Euphilomedes carcharodonta</i>																		
<i>Gammaropsis thompsoni</i>				1														
<i>Gnathia steveni</i>				1														
<i>Grandidierella japonica</i>										1			180	12	9	29	208	5
<i>Harpacticoida</i>																		
<i>Hartmanodes hartmanae</i>													5					
<i>Hemigrapsus oregonensis</i>				1						5								
<i>Heterophoxus cf ellisi</i>																		
<i>Heteroserolis carinata</i>																		
<i>Hippolyte californiensis</i>																		
<i>Hyale sp</i>																	1	
<i>Lagunogammarus sp</i>																		
<i>Leptochelia dubia</i>				3									1				2	
<i>Leucothoe spinicarpa</i>																		
<i>Maera simile</i>																		
<i>Mayerella acanthopoda</i>													2	3		14	177	66
<i>Megabalanus californicus</i>					13													
<i>Monocorophium acherusicum</i>															9		14	
<i>Monocorophium insidiosum</i>															16	3		
<i>Nebalia kensleyi</i>					40													
<i>Neotrypaea gigas</i>													1					
<i>Neotrypaea sp</i>																		
<i>Oxyurostylis pacifica</i>	1															1	8	8
<i>Paracercis sculpta</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Paradeximine sp SD1</i>																		
<i>Paramicrodeutopus schmitti</i>																		
<i>Paranthura elegans</i>																		
<i>Parhyalella sp</i>							63	1										
<i>Photis sp</i>				6														
<i>Photis sp SD 9</i>					2													
<i>Podocerus fulanus</i>				1											3	1	33	
<i>Podocopid</i>																		
<i>Pollicipes sp</i>				2														
<i>Postasterope barnesi</i>				1		1												
<i>Pyromaia tuberculata</i>																		
<i>Rudilemboides stenopropodus</i>												9						
<i>Rutiderma judayi</i>																		
<i>Rutiderma rotundum</i>				3														
<i>Schmittius politus</i>																		
<i>Synaptotanais notabilis</i>				8											1	1	71	
<i>Tanystylum californicum</i>					6													
<i>Tanystylum cf intermedium</i>					8													
<i>Tethygenia opata</i>									3						34	1	1	
Echinoderms																		
<i>Amphiodia digitata</i>					1													
<i>Amphiodia sp</i>				1	1													
<i>Amphipholis squamata</i>																		
<i>Amphiuridae</i>				1														
<i>Leptosynapta sp</i>												2	3	1				
<i>Ophiactis simplex</i>				9														
Minor Phyla																		
<i>Amathia sp (colonial)</i>					1													
<i>Apionsoma sp</i>					1	1												
<i>Aplousobranchia</i>					1													
<i>Asciidiacea</i>																		
<i>Barentsia sp (colonial)</i>																		
<i>Bowerbankia sp (colonial)</i>		1	1															
<i>Carinoma mutabilis</i>																		
<i>Chironomidae</i>				8			3		19									
<i>Ciona intestinalis</i>																		
<i>Diadumene sp</i>				2						1						7		
<i>Diptera</i>																		
<i>Disporella sp</i>															1	12		
<i>Dolichopodidae</i>																		
<i>Ectoprocta (colonial)</i>																		
<i>Edwardsia californica</i>																		
<i>Ephydriidae</i>																		
<i>Glottidia albida</i>																		
<i>Gobiidae</i>													1					
<i>Hydromedusa</i>														1				

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
Hydrozoa (colonial)				1														
<i>Imogine exiguum</i>										1								
Lineidae				2	1								1				1	
<i>Micrura</i> sp										7	7							
<i>Molgula</i> sp												108	1			94	384	
Muscidae																		
Nematoda		1	1179															
Nemertea				1	1						1						1	
<i>Paranemertes californica</i>										1			4	1				2
<i>Paraplanocera oligoglена</i>																		
<i>Phascolion</i> sp				3														
<i>Phascolosoma agassizi</i>																		
Phoronida						2				37	7	7	666	1713	343	1	53	20
Platyhelminthes																		
<i>Psychoda</i> sp																		
<i>Quietula y-cauda</i>																	1	
<i>Scolanthus</i> sp B																		
<i>Styela</i> sp				14														
<i>Tetraстемма</i> sp																		
<i>Thalamoporella californica</i> (colonial)																		
Tintinnidae (Protozoa)																		
<i>Tubulanus polymorphus/pellucidus</i>													2					
<i>Zaolotus actius</i>													1					
Molluscs																		
<i>Acteocina inculta</i>												62	11	24	222	72	133	
<i>Aglaja diomedea</i>											1							
<i>Alderia modesta</i>																		
<i>Alia carinata</i>			13								1						1	
<i>Alvania</i> sp																		
<i>Argopecten ventricosus</i>																		
<i>Barleeia</i> sp															5	22	159	
Bivalvia				1						1								
<i>Bulla gouldiana</i>										1	1						1	
<i>Caecum californicum</i>				16														
Cardiidae																		
Cephalaspidea	1																	
<i>Cerithidea californica</i>														1				
<i>Cerithiopsis cosmia</i>			2															
<i>Chione californiensis</i>			1															
<i>Chione</i> sp																		
<i>Conus californicus</i>			7		1													
<i>Cooperella subdiaphana</i>												2						
<i>Corambe</i> sp			1															
<i>Crepidula dorsata</i>			3															
<i>Crepidula</i> sp			11		1													
<i>Crucibulum spinosum</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Cryptomya californica</i>						7												
<i>Epitonium sawinae</i>					2													
<i>Erato vitellina</i>													1					
<i>Fartulum occidentales</i>																		
<i>Haminea vesicula</i>	1										6	1	3			4	15	4
<i>Hiatella arctica</i>						8												
<i>Iselica ovoidea</i>																		
<i>Kurtziella plumbea</i>						1												
<i>Lacuna sp</i>																		
<i>Laevicardium substriatum</i>										3			5	1				
<i>Lithophaga plumula</i>						1												
<i>Lyonsia californica</i>																		
<i>Macoma nasuta</i>																	1	
<i>Macoma sp</i>													1		2			
<i>Mactrotoma californica</i>													2					1
<i>Melanochlamys diomedea</i>																		
<i>Modiolus sp</i>						1												
<i>Mopaliidae</i>						3												
<i>Musculista senhousei</i>													7					
<i>Mytilidae</i>					81													
<i>Mytilus galloprovincialis</i>																		
<i>Nassarina penicillata</i>						1												
<i>Nassarius tegula</i>													1				3	
<i>Notoacmea dipicta</i>																		
<i>Nudibranchia</i>																		
<i>Nutricola sp</i>						1												
<i>Olivella biplicata</i>						1												
<i>Philine auriformis</i>														1				
<i>Physa sp</i>								11										
<i>Platyodon cancellatus</i>																		
<i>Protothaca sp</i>													1	1				
<i>Protothaca staminea</i>																		
<i>Rochefortia tumida</i>						1												
<i>Saxidomus sp</i>																		
<i>Solen rostriformis</i>																		
<i>Tagelus sp</i>																7		
<i>Tagelus subteres</i>											2	39	19	13	5		1	
<i>Tellina cadieni</i>						6					8	1	1	1				
<i>Tellina meropsis</i>						1							1		1			
<i>Tellina sp</i>														1				
<i>Theora lubrica</i>													11		4			1
<i>Thracia sp</i>									1									
<i>Tresus nuttalli</i>						1									1			
<i>Tricolia sp</i>						1												
<i>Tricolia substriata</i>						2												
<i>Triphora pedroana</i>						1												

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Tryonia imitator</i>																13	10	
<i>Turbonilla sp</i>				2														
Veneridae																		
<i>Venerupis philippinarium</i>												1						
Polychaetes																		
<i>Ampharete labrops</i>			3											1				
<i>Aphroditidae sp</i>				1														
<i>Armandia brevis</i>			2							3	2	2	5		1			
<i>Autolytus sp</i>				1														
<i>Axiothella sp</i>																		
<i>Boccardia probosoidea</i>			55															
<i>Boccardia pugettensis</i>										2		2						
<i>Boccardiella hamata</i>																		
<i>Branchiosyllis sp</i>																		
<i>Brania californiensis</i>																		
<i>Capitella capitata Cmplx</i>	24	28	1778		1					1		137	1	2	3	126	541	2
Capitellidae																		
<i>Caullerella sp</i>			8															
<i>Chaetopterus variopedatus</i>																		
<i>Chaetozone corona</i>			1															
<i>Chone minuta</i>				2														
<i>Chone mollis</i>																		
Cirratulidae			1		1													
<i>Cirratulus spectabilis</i>				14														
<i>Cirriformia sp</i>	1																	
<i>Cirriformia sp SD1</i>			1											7				
<i>Cossura sp A</i>													1			1	7	
<i>Crucigera websteri</i>																		
<i>Diopatra ornata</i>			2															
<i>Diopatra sp</i>													1	2	1			
<i>Diplocirrus sp SD1</i>														3				
<i>Dipolydora sp</i>	6											29						
<i>Dorvillea (Schistomerings) annulata</i>	1																	
<i>Dorvillea (Schistomerings) longicornis</i>			6															
<i>Eteone lighti</i>													1	3				
<i>Eteone sp 11</i>																		
<i>Eteone spilotus</i>												1			2	1		
<i>Euchone limnicola</i>													97	55	44			
<i>Euclymeninae sp A</i>																		
<i>Eumida longicornuta</i>										2								
<i>Exogone lourei</i>			67										1	1			25	
<i>Fabricinuda limnicola</i>																		
<i>Glycera americana</i>			3															
<i>Halosydnha johnsoni</i>			1															
<i>Harmothoe imbricata Cmplx</i>										1								
<i>Hemipodus borealis</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Leitoscoloplos puggettensis</i>				2	11								35	56	136	1		23
Lumbrineridae					4													
<i>Lumbrineris limicola</i>						1												
<i>Lumbrineris sp</i>															1			
Maldanidae					1													
<i>Malmgreniella sp A</i>																		
<i>Marpysa sp</i>					1													
<i>Mediomastus sp</i>				44	10					72	12	5	2	23	1			3
<i>Megalomma pigmentum</i>																		
<i>Melinna oculata</i>																		
<i>Metasychis disparidentatus</i>						4												
<i>Monticellina cryptica</i>					4	1										1		
<i>Monticellina sp SD4</i>																		
<i>Naineris dendritica</i>																		
<i>Neanthes acuminata Cmplx</i>																1	3	26
<i>Nephtys caecoides</i>																		
<i>Nephtys cornuta</i>					1	1	1											
<i>Nereis procera</i>																		
<i>Nicolea sp A</i>																		
<i>Notomastus hemipodus</i>					10													
<i>Notomastus magnus</i>					1													
<i>Notomastus sp</i>																		
<i>Odontosyllis phosphorea</i>																		
Oligochaeta	2	15							3					1		7	17	3
<i>Ophiodromus puggettensis</i>						1												
<i>Owenia fusiformis</i>																		
<i>Paleanotus bellis</i>					1													
<i>Paradoneis sp</i>																		
<i>Parandalia ocularis</i>					1													
<i>Parapriionospio pinnata</i>							1											
<i>Pectinaria californiensis</i>														2				
<i>Pherusa capulata</i>																	1	
<i>Pherusa neopapillata</i>					1													
<i>Phragmatopoma californica</i>						3												
<i>Pista alata</i>					7													
<i>Pista percyi</i>													2					
<i>Platynereis bicanaliculata</i>										1								
<i>Polydora cornuta</i>		15								21	30	181	41	1	3	3	4	
<i>Polydora limicola</i>					2													
<i>Polydora nuchalis</i>		8								1		3				3	8	
<i>Polyopthalmus pictus</i>			1						11									
<i>Praxillella pacifica</i>																		
<i>Prionospio heterobranchia</i>					14					2	1		7	2	3			
<i>Prionospio lighti</i>					11	2				2	1		1					
<i>Prionospio sp</i>																		
<i>Protocirrineris sp</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SME1	SME2	SME3	OH1	OH2	OH3	BVL1	BVL2	BVL3	SLR1	SLR2	SLR3	AHL1	AHL2	AHL3	BL1	BL2	BL3
<i>Pseudopolydora paucibranchiata</i>				2						19	4	5	45	14	26	2	79	122
<i>Pseudopotamilla socialis</i>					2													
<i>Sabellaria nanella</i>						30												
<i>Scolelepis sp</i>												19						
<i>Scolelepis sp SD1</i>										29	17	168	7	70	10	6	2	
<i>Scoletoma erecta</i>				1	2													
<i>Scoletoma sp</i>				19	7	4												1
<i>Scoletoma sp A</i>				2	4													
<i>Scoletoma sp C</i>				17	26	10				1			14	17	10		1	16
<i>Scoloplos acmeceps</i>																		
<i>Scyphoproctus oculatus</i>																		
<i>Serpulidae</i>				1														
<i>Spio maculata</i>										1								
<i>Spionidae</i>		7										6						112
<i>Spiophanes duplex</i>				6										1				
<i>Spirorbidae</i>																	2	
<i>Streblospio benedicti</i>													17	6	7	64	287	60
<i>Syllidae</i>																		
<i>Syllis (Syllis) gracilis</i>				2														
<i>Syllis (Typosyllis) nipponica</i>																		
<i>Thelepus crispus</i>																		
<i>Trypanosyllis zebra</i>				2														

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
Crustaceans																		
<i>Acuminodeutopus heteruropus</i>										1								
<i>Alpheus californiensis</i>																		
<i>Americhelidium rectipalmum</i>										4	1							
<i>Ammothea hilgendorfi</i>																		
<i>Amothella spinifera</i>																		
<i>Amphideutopus oculatus</i>										1	127		10					
<i>Ampithoe lacertosa</i>										9								
<i>Ampithoe sp</i>													1	26				
<i>Ampithoe valida</i>										2								
<i>Anoplodactylus erectus</i>											6							
<i>Anoropallene palpida</i>																		
<i>Aoroides columbiae</i>										35								
<i>Aoroides inermis</i>										1								
<i>Apolochus barnardi</i>										3								
<i>Bemlos macromanus</i>												5	4	8				
<i>Cancer anthonyi</i>																		
<i>Caprella californica</i>										1	616	5	3	1	7		1	
<i>Caprella sp</i>											11							
<i>Caprellidae</i>												1						
<i>Cyclopoida</i>										1								
<i>Erithonius brasiliensis</i>											170				6			
<i>Euphilomedes carcharodonta</i>										33	10	12	1					
<i>Gammaropsis thompsoni</i>																		
<i>Gnathia steveni</i>																		
<i>Grandidierella japonica</i>	1	1					2	38	55	308		1			8	3693		
<i>Harpacticoida</i>											16							
<i>Hartmanodes hartmanae</i>											6		1					
<i>Hemigrapsus oregonensis</i>									2	1		1			3			
<i>Heterophoxus cf ellisi</i>											56							
<i>Heteroserolis carinata</i>											36							
<i>Hippolyte californiensis</i>											7							
<i>Hyale sp</i>											38							
<i>Lagunogammarus sp</i>	3	1	1															
<i>Leptochelia dubia</i>												3	5	5	7	16		
<i>Leucothoe spinicarpa</i>											3							
<i>Maera simile</i>												2						
<i>Mayerella acanthopoda</i>											1	2	6	12	7	6		
<i>Megabalanus californicus</i>																		
<i>Monocorophium acherusicum</i>												1						
<i>Monocorophium insidiosum</i>								128	148	46								
<i>Nebalia kensleyi</i>																		
<i>Neotrypaea gigas</i>																		
<i>Neotrypaea sp</i>																1		
<i>Oxyurostylis pacifica</i>											1	4	1					
<i>Paracercis sculpta</i>											50							

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Paradeximine sp SD1</i>										2	5		1	27				
<i>Paramicrodeutopus schmitti</i>										8								
<i>Paranthura elegans</i>										7								
<i>Parhyalella sp</i>																		
<i>Photis sp</i>																		
<i>Photis sp SD 9</i>																		
<i>Podocerus fulanus</i>										6	77		16	1	42			
<i>Podocopid</i>				6		5	1			13		1						
<i>Pollicipes sp</i>																		
<i>Postasterope barnesi</i>										2								
<i>Pyromia tuberculata</i>											1							
<i>Rudilemboides stenopropodus</i>											23	7	7					
<i>Rutiderma judayi</i>										5								
<i>Rutiderma rotundum</i>																		
<i>Schmittius politus</i>												1						
<i>Synaptotanais notabilis</i>											7	8		30				
<i>Tanystylum californicum</i>																		
<i>Tanystylum cf intermedium</i>																		
<i>Tethygenia opata</i>											10							
Echinoderms																		
<i>Amphiodia digitata</i>											2							
<i>Amphiodia sp</i>											1							
<i>Amphipholis squamata</i>											18	6	1	6				
<i>Amphiuridae</i>											1	2	1					
<i>Leptosynapta sp</i>											20	5	3	3	2			
<i>Ophiactis simplex</i>											54							
Minor Phyla																		
<i>Amathia sp (colonial)</i>																		
<i>Apionsoma sp</i>																		
<i>Aplousobranchia</i>																		
<i>Asciidiacea</i>											3							
<i>Barentsia sp (colonial)</i>								1										
<i>Bowerbankia sp (colonial)</i>																		
<i>Carinoma mutabilis</i>															2			
<i>Chironomidae</i>																		
<i>Ciona intestinalis</i>											5	1						
<i>Diadumene sp</i>											4	1						
<i>Diptera</i>	2																	
<i>Disporella sp</i>																		
<i>Dolichopodidae</i>	69	15													1	2		
<i>Ectoprocta (colonial)</i>														1				
<i>Edwardsia californica</i>											6	3	25	59	1			
<i>Ephydriidae</i>			3												6			
<i>Glottidia albida</i>												2						
<i>Gobiidae</i>											1		2					
<i>Hydromedusa</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
Hydrozoa (colonial)																		
<i>Imogine exiguum</i>													3					4
Lineidae						1		11	6		2						1	3
<i>Micrura sp</i>																		
<i>Molgula sp</i>											23	1						
Muscidae																		6
Nematoda											144					141		
Nemertea									1									
<i>Paranemertes californica</i>							1		1				2				1	
<i>Paraplanocera oligoglена</i>													2					
<i>Phascolion sp</i>																		
<i>Phascolosoma agassizi</i>												1						
Phoronida				5	2	18	7	41	4		9	4	3	3			2	
Platyhelminthes												6						
<i>Psychoda sp</i>			1															
<i>Quietula y-cauda</i>															2			
<i>Scolanthus sp B</i>																		
<i>Styela sp</i>											1	2						
<i>Tetraстемма sp</i>											1							
<i>Thalamoporella californica (colonial)</i>												1						
Tintinnidae (Protozoa)			1															
<i>Tubulanus polymorphus/pellucidus</i>												3						
<i>Zaolotus actius</i>																		
Molluscs																		
<i>Acteocina inculta</i>				3		10	2	1068	26		5	17	31	1	12	67		
<i>Aglaja diomedea</i>																		
<i>Alderia modesta</i>							1		2									
<i>Alia carinata</i>			1								4			3	48			
<i>Alvania sp</i>										1								
<i>Argopecten ventricosus</i>												13						
<i>Barleeia sp</i>							3		11	211	1			168	1124			
Bivalvia												1						
<i>Bulla gouldiana</i>												3						
<i>Caecum californicum</i>											26							
Cardiidae																	11	
Cephalaspidea																		
<i>Cerithidea californica</i>						2		20	70							62		
<i>Cerithiopsis cosmia</i>																		
<i>Chione californiensis</i>							1				1							
<i>Chione sp</i>															7			
<i>Conus californicus</i>												29						
<i>Cooperella subdiaphana</i>												9						
<i>Corambe sp</i>																		
<i>Crepidula dorsata</i>												52						
<i>Crepidula sp</i>											1	4			1			
<i>Crucibulum spinosum</i>												36						

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Cryptomya californica</i>																		
<i>Epitonium sawinae</i>																		
<i>Erato vitellina</i>										1								
<i>Fartulum occidentales</i>										2								
<i>Haminea vesicula</i>							77	31	70	1		6				5		8
<i>Hiatella arctica</i>																		
<i>Iselica ovoidea</i>											4							
<i>Kurtziella plumbea</i>																		
<i>Lacuna sp</i>											2							
<i>Laevicardium substriatum</i>											27							1
<i>Lithophaga plumula</i>																		
<i>Lyonsia californica</i>										1	1			1				
<i>Macoma nasuta</i>							1				5							
<i>Macoma sp</i>																		
<i>Mactrotoma californica</i>											1							
<i>Melanochlamys diomedea</i>											1							
<i>Modiolus sp</i>											1							
<i>Mopaliidae</i>										2								
<i>Musculista senhousei</i>										1	118	119	115	43	36	117	1	
<i>Mytilidae</i>																		
<i>Mytilus galloprovincialis</i>				1						1	1							
<i>Nassarina penicillata</i>																		
<i>Nassarius tegula</i>																		
<i>Notoacmea dipicta</i>											5				2			
<i>Nudibranchia</i>							2					1						
<i>Nutricola sp</i>																		
<i>Olivella biplicata</i>																		
<i>Philine auriformis</i>																		
<i>Physa sp</i>																		
<i>Platyodon cancellatus</i>											1							
<i>Protothaca sp</i>																		
<i>Protothaca staminea</i>																7		
<i>Rochefortia tumida</i>																		
<i>Saxidomus sp</i>											2							
<i>Solen rostriformis</i>													1	3				
<i>Tagelus sp</i>								2									2	
<i>Tagelus subteres</i>											45							
<i>Tellina cadieni</i>										1	10							
<i>Tellina meropsis</i>										1	1	1	11	16	66			
<i>Tellina sp</i>																		
<i>Theora lubrica</i>										3	1	13	12		16	1		
<i>Thracia sp</i>										1	9							
<i>Tresus nuttalli</i>							1											
<i>Tricolia sp</i>																		
<i>Tricolia substriata</i>																		
<i>Triphora pedroana</i>																		

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Tryonia imitator</i>		2		87		114	43	52	9									
<i>Turbonilla sp</i>										1	4							
Veneridae												8						
<i>Venerupis philippinarium</i>								16	1									
Polychaetes																		
<i>Ampharete labrops</i>																		
<i>Aphroditidae sp</i>													1					
<i>Armandia brevis</i>										6	4	4	6	3	23	1	9	
<i>Autolytus sp</i>																		
<i>Axiothella sp</i>										7	2							
<i>Boccardia probosoidea</i>																		
<i>Boccardia pugettensis</i>															1		448	
<i>Boccardiella hamata</i>							1	3										
<i>Branchiosyllis sp</i>																1		
<i>Brania californiensis</i>										1					4			
<i>Capitella capitata Cmplx</i>				605	64	1327	114	471	131	1		1			3	78	64	
<i>Capitellidae</i>															5			
<i>Caullerella sp</i>													2					
<i>Chaetopterus variopedatus</i>												1						
<i>Chaetozone corona</i>																		
<i>Chone minuta</i>										1								
<i>Chone mollis</i>											1							
<i>Cirratulidae</i>										3					1			
<i>Cirratulus spectabilis</i>																		
<i>Cirriformia sp</i>													2					
<i>Cirriformia sp SD1</i>										1					5			
<i>Cossura sp A</i>													7					
<i>Crucigera websteri</i>											1							
<i>Diopatra ornata</i>																		
<i>Diopatra sp</i>																		
<i>Diplocirrus sp SD1</i>											1	2	14					
<i>Dipolydora sp</i>																1		
<i>Dorvillea (Schistomerings) annulata</i>											11	7	2	4				
<i>Dorvillea (Schistomerings) longicornis</i>																		
<i>Eteone lighti</i>																		
<i>Eteone sp 11</i>									1									
<i>Eteone spilotus</i>							1	7	1						1	1	2	
<i>Euchone limnicola</i>																		
<i>Euclymeninae sp A</i>										1	4							
<i>Eumida longicornuta</i>											2							
<i>Exogone lourei</i>										303	12	103	75	74	117		3	
<i>Fabricinuda limnicola</i>													6	15	19			
<i>Glycera americana</i>										1	8		1	3	1			
<i>Halosydnha johnsoni</i>															1			
<i>Harmothoe imbricata Cmplx</i>										74	1	4			1			
<i>Hemipodus borealis</i>															7		4	

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Leitoscoloplos pugettensis</i>										19	47	26	3	8	30			
<i>Lumbrineridae</i>										2		1						
<i>Lumbrineris limicola</i>																		
<i>Lumbrineris sp</i>																		
<i>Maldanidae</i>										6	11	1						
<i>Malmgreniella sp A</i>											1							
<i>Marpysa sp</i>																		
<i>Mediomastus sp</i>										3	1	2	20	1	87	42	214	2
<i>Megalomma pigmentum</i>											1	1	1	1				
<i>Melinna oculata</i>												10						
<i>Metasychis disparidentatus</i>																		
<i>Monticellina cryptica</i>												5						
<i>Monticellina sp SD4</i>																		
<i>Naineris dendritica</i>											10							
<i>Neanthes acuminata Cmplx</i>											20	2	5	4	11	54		
<i>Nephthys caecoides</i>											1							
<i>Nephthys cornuta</i>																		
<i>Nereis procera</i>											1	1						
<i>Nicolea sp A</i>											9							
<i>Notomastus hemipodus</i>										1						90		
<i>Notomastus magnus</i>																		10
<i>Notomastus sp</i>																		
<i>Odontosyllis phosphorea</i>												1		2	2	8		
<i>Oligochaeta</i>	14	43	5	14		9	7	240	16	1	1		1	1	4	91		7
<i>Ophiodromus pugettensis</i>										1								
<i>Owenia fusiformis</i>												1						
<i>Paleanotus bellis</i>																		
<i>Paradoneis sp</i>												1						
<i>Parandalia oocularis</i>																		
<i>Parapriionospio pinnata</i>																		
<i>Pectinaria californiensis</i>											1							
<i>Pherusa capulata</i>											40	2	1					
<i>Pherusa neopapillata</i>																		
<i>Phragmatopoma californica</i>																		
<i>Pista alata</i>												2						
<i>Pista percyi</i>											20	42	32	11		2		
<i>Platynereis bicanaliculata</i>											2	1						
<i>Polydora cornuta</i>																		2
<i>Polydora limicola</i>																1		2
<i>Polydora nuchalis</i>					4	1	331	42	54							1149	4	483
<i>Polyopthalmus pictus</i>																		1
<i>Praxillella pacifica</i>											29	2	1					
<i>Prionospio heterobranchia</i>											5	20	9	11	4	7	2	1
<i>Prionospio lighti</i>																		1
<i>Prionospio sp</i>												1						
<i>Protocirrineris sp</i>											20							

Appendix B.3-3. Benthic Infauna Counts for 2005.

Species	SEL1	SEL2	SEL3	SDL1	SDL2	SDL3	LPL1	LPL2	LPL3	MB1	MB2	MB3	SRE1	SRE2	SRE3	TRE1	TRE2	TRE3
<i>Pseudopolydora paucibranchiata</i>							2	27	17	157			1	20	7	25	10	
<i>Pseudopotamilla socialis</i>																		
<i>Sabellaria nanella</i>																		
<i>Scolelepis sp</i>											1							
<i>Scolelepis sp SD1</i>													1			1		
<i>Scoletoma erecta</i>											1	2	4					
<i>Scoletoma sp</i>											4	9	6	4				
<i>Scoletoma sp A</i>												2		2				
<i>Scoletoma sp C</i>											31	34	58	55	12	21		
<i>Scoloplos acmeceps</i>												2						
<i>Scyphoproctus oculatus</i>											125							
<i>Serpulidae</i>																		
<i>Spio maculata</i>																		
<i>Spionidae</i>								1	3									
<i>Spiophanes duplex</i>													38					2
<i>Spirorbidae</i>											1							
<i>Streblospio benedicti</i>				1		4		9	66							1	557	
<i>Syllidae</i>											2							
<i>Syllis (Syllis) gracilis</i>																		
<i>Syllis (Typosyllis) nipponica</i>											42		1					
<i>Thelepus crispus</i>																1		
<i>Trypanosyllis zebra</i>																		

APPENDIX C

**Memo to the
Regional Water Quality Control Board**



County of San Diego

GARY W. ERBECK
DIRECTOR

DEPARTMENT OF ENVIRONMENTAL HEALTH
LAND AND WATER QUALITY DIVISION

RICHARD HAAS
ASSISTANT DIRECTOR

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March 14, 2002

David W. Gibson
California Regional Water Quality Control Board
San Diego Region
9174 Sky Park Court, Suite 100
San Diego, CA 92129-4340

Dear Mr. Gibson:

2002/2003 Ambient Bay and Lagoon Monitoring for Order No. 2001-01

The San Diego Stormwater Copermittees would like to confirm the proposed scope of work for Ambient Bay and Lagoon Monitoring for the 2002/2003 monitoring year. This will allow the Copermittees to develop proper budget allocations for the overall monitoring program for the upcoming fiscal year. The proposed scope of work was originally presented to you, Phil Hammer and Bob Morris on February 7, 2002 at your offices.

The following outlines the final recommended approach for Ambient Bay, Lagoon, and Coastal Receiving Water Monitoring as discussed in our February 7 meeting and at the Copermittee Monitoring Workgroup Meeting on February 12. Sediment chemistry, toxicity, and ecological community data (benthos) evaluations in the lagoons and bays are recommended as baseline studies for the first year of the program. Data from mass loading and urban stream bioassessment stations will be utilized to evaluate sensitive upstream areas. The bay and lagoon data will be complimentary to data collected as part of the Bight 2003 ocean survey planned by the Southern California Coastal Water Research Project (SCWRP). Data from these evaluations will provide an indication of how marine life in the bays and lagoons is affected by pollution, and allow prioritization of lagoon outfall areas for additional investigation in subsequent years.

Outline of the First Year Study (Monitoring Year 2002/2003)

The physical characteristics and depositional patterns within lagoons vary spatially, both longitudinally and laterally. There are wide variations in sediment characteristics within lagoons because of the influence of stream and tidal channels, marshes and grasses, and connectivity with the ocean. Sediments that accumulate in the lagoons as a result of urban runoff are dispersed according to the different energy conditions that are encountered at stream outfalls and in the lagoon. Fine-grained sediments accumulate in lower energy conditions between active stream and tidal channels; whereas, coarser sediments accumulate in stream and tidal channels as point bars. Fine-grained sediments tend to have large surface areas with unsatisfied surface charges that promote adsorption of ionic complexes of metals and pesticides. In addition, fined-grained organic materials associated with the sediments also tend to adsorb and complex with metals, PCBs, PAHs, and pesticides. Additionally, fine-grain sediment in overabundance overwhelms the endemic flora and fauna of lagoons and estuaries. Based on these facts, the baseline program that we are suggesting for monitoring year 2002/2003 assumes that finer-grained materials pose the greatest

threat to the biological communities within the lagoons because of their ability to complex and adsorb potential pollutants. The proposed program therefore focuses on testing finer-grained size materials using the same "triad" approach that is being utilized for the stormwater runoff program. The proposed program has the following components:

- Field surveys of nine stations within each lagoon, including three strata from areas near stream outfalls, near the center of the lagoon, and near the ocean mouth. Each strata will have three stations for sediment sampling: two on opposite sides and one near the center. Sediments in the top 5 cm will be sampled using a box corer and submitted for testing. Visual observations of algal standing stock will be recorded as an indicator of potential eutrophication. Dissolved oxygen, salinity, and distinguishing odors within the sediment, such as the presence of hydrogen sulfide, will also be recorded in the field.
- Laboratory testing of all samples for total organic carbon and grain size to identify the stations most likely impacted by stream sediment output.
- Toxicity and chemical testing of composite sediment samples from each lagoon. The composite sample will be composed of three stations from each lagoon that have a combination of the highest fraction of fine-grained sediments and organic carbon.
- Toxicity testing will be performed using the estuarine amphipod *E. estuaris*.
- The chemical sampling will include the following analyses:
 - **Metals:**
 - Antimony
 - Arsenic
 - Cadmium
 - Chromium
 - Copper
 - Lead
 - Nickel
 - Selenium
 - Zinc
 - **Organics:**
 - PAHs
 - PCBs
 - Diazinon
 - Chlorpyrifos
- Benthic assemblage analysis of three samples from each lagoon. The benthic testing samples will represent the same three stations that are utilized to form the composite sample for the toxicity and chemical testing.
- Toxicity, chemical and benthic assemblage analyses of one random sample of the nine stations that will be consistent with the random sampling procedures utilized in the Bight 2003 program.

The proposed 2002/2003 program includes sampling and analysis from the following lagoons, bays, and outfalls as identified in Table 2 of the permit:

- Oceanside Harbor
- Santa Margarita Estuary
- San Luis Rey River Estuary
- Batiquitos Lagoon
- San Elijo Lagoon
- Agua Hedionda Lagoon
- Buena Vista Lagoon
- San Dieguito Estuary
- Los Peñasquitos Lagoon
- Sweetwater River outfall at San Diego Bay
- Tijuana River Estuary
- Rose and Tecolote Creek Outfalls at Mission Bay

Data Analysis and Reporting

Data from upstream testing including urban stream bioassessment, toxicity, and chemical water quality testing from Mass Loading Stations will be combined with data from the proposed bay and lagoon monitoring program and used to identify if coastal lagoons or bays in the region are negatively impacted by urban runoff.

A matrix will be developed so that the combination of data is used to develop a ranking of the bays, and lagoons across the County. The monitoring program in subsequent years will focus on areas where the baseline data indicates the strongest potential for toxicity and/or bioaccumulation of pollutants in marine organisms. Investigation in subsequent years may focus on answering questions related to determining the extent of contamination and the bioaccumulation potential of the pollutants.

The Copermittees are in the process of finalizing budgeting plans for the 2002/2003 monitoring year and we would appreciate any feedback that you might have concerning the scope of the proposed Ambient Bay and Lagoon Monitoring Program outlined above. If you have any questions or concerns about the proposed program, please contact me at your earliest convenience.

Respectfully,

JON VAN RHYN
Supervising Environmental Health Specialist

cc: Phil Hammer, RQWCB-SD

APPENDIX D

Lagoon Rank Order Analysis

APPENDIX D

Rank Order Analysis

The results of the rank order analysis for biology, toxicology, and chemistry are presented in Table D-1, below. Values within the table highlighted in red are the same or within one rank of each other. Only Mission Bay had comparable ranks between the two indices in all three years; and Mission Bay was the only location with comparable ranks in both 2003 and 2005. Toxicity ranks for the three years are somewhat more comparable, with two to three comparable ranks per year. Chemistry ranks are the most comparable between lagoons and MLS stations, with five similar rankings during 2003, two during 2004, and one during 2005.

Table D-1. Rank results for Biology, Toxicology, and Chemistry 2003-2005

Biology						
	2003		2004		2005	
Station	BRI	IBI	BRI	IBI	BRI	IBI
SME	7	1	2	1	**	**
SLR	5	7	7	7.5	3	5.5
AHL	4	5.5	1	7.5	2	7
SEL	9	3	8	4	6	4
SDL	8	3	6	2.5	8	5.5
LPL	6	5.5	3	2.5	7	2
MB	2	3	5	6	1	1
SRE	3	8.5	4	5	4	8
TRE	1	8.5	*	*	5	3
Toxicology						
	2003		2004		2005	
Station	Lagoon	Stream	Lagoon	Stream	Lagoon	Stream
SME	1	7	1	3	**	**
SLR	5	2	3	7	3	2.5
AHL	7	8	5	7	8	6
SEL	8	2	4	3	7	2.5
SDL	2	4	8	3	2	5
LPL	6	2	2	3	5	2.5
MB	4	5.5	6	7	4	2.5
SRE	9	5.5	7	3	6	7
TRE	3	9	*	*	1	8
Chemistry						
	2003		2004		2005	
Station	Lagoon	Stream	Lagoon	Stream	Lagoon	Stream
SME	1	9	1	6	**	**
SLR	3	2	5	1	1	4
AHL	7	6	6	8	7	6
SEL	5	5	2	5	2	5
SDL	6	1	3	3	6	3
LPL	4	4	4	2	5	1
MB	8	8	8	7	4	7
SRE	9	3	7	4	8	2
TRE	2	7	*	*	3	8

* No bioassessment data collected in 2004

** No chemistry or toxicity data collected in 2005

During previous ABLM reporting years, the ranks for all metrics were summed together to calculate a total rank score per year. When comparing rank scores across years, this approach may lead to spurious results because each rank is relative only to other scores during each year. Therefore, to best compare BRI /RBI scores across years, a rank for all years was calculated using scores presented in Table D-2. The scores for each year of both BRI and RBI were summed, and the overall total ranked. Using this method, the standardized Triad scores enable ranking without the bias of relative index scores per year (Table D-2). Results of the ranking are presented in Table D-3.

Table D-2. Range values for Triad metric scores

Score	Biology			Toxicity		Chemistry	
	BRI	RBI	IBI	%Survival	Mean NOEC	ERM-Q	# Over WQO
Good (1)	<31	>0.61	>26	>83	>83	<0.09	0
Fair (2)	31-53	0.31-0.60	13-26	50-83	50-83	0.1-0.19	1-2
Poor (3)	>53	<0.30	<13	<50	<50	>0.2	3-5

Table D-3. BRI and RBI summed scores and ranks for 2003, 2004, and 2005
(lower scores indicate better health)

Station	Sum Lagoon Benthic Score	Lagoon Benthic Rank
SME	16	11
OH	9	3.5
SLR	15	9.5
BVL	14	7.5
AHL	8	1.5
BL	12	6
SEL	17	12
SDL	15	9.5
LPL	14	7.5
MB	8	1.5
SRE	9	3.5
TRE	10	5