# The Benthic Macrofaunal Community and Sediment Quality Conditions in Clam Bayou, Pinellas County, Florida

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# Introduction

The Tampa Bay Estuary Program (TBEP) started the annual bay-wide Tampa Bay Benthic Monitoring Program in 1993 to evaluate and monitor the health of the sediment environment of Tampa Bay. Monitoring in Boca Ciega Bay was added to the program in 1995. The program is a cooperative effort between the Environmental Protection Commission of Hillsborough County (EPCHC), the Manatee County Department of Environmental Management (MCDEM), and the Pinellas County Watershed Management Department (PCWMD). Each agency assists in the annual field sampling within their respective jurisdictions in Tampa Bay. Sample processing and data analysis is conducted by the EPCHC.

The benthic monitoring program's objectives and sampling design were reevaluated in 2003 (Janicki Environmental, 2003). As a result of this assessment, the reporting period was increased from one year to four years and the number of samples collected annually was cut in half (from 124 to 64 samples per year). This reduced sampling allowed for the redirecting of efforts towards collecting samples from areas of concern ("Special Studies") and typically two such sites are picked each year. Clam Bayou was chosen as one of the Special Study site in 2008 because of recent concerns about increased siltation in the bayou and because it is a current restoration site for the Southwest Florida Water Management District/ Surface Water Improvement Program (SWFWMD/SWIM). This data report details the results from the 2008 Clam Bayou special study and compares these results with previous data collected by the Florida Department of Environmental Protection in 2001 and with selected past sites from the Tampa Bay Benthic Monitoring Program that have similar physical parameters.

# Materials and Methods

## *Site Selection*

Ten sites were selected for sampling in Clam Bayou by PCWMD staff. Six of the sites roughly corresponded to the six locations sampled by FDEP in 2001. The remaining four sites were selected from randomly generated coordinates. In order to compare the 2008 Clam Bayou benthic community with expected baseline conditions in Tampa Bay, samples were chosen from past benthic monitoring sites which most closely matched the Clam Bayou sites based on their sediment and salinity characteristics. This was determined by calculating the $25^{th}$ and $75^{th}$ percentile values for the percent silt + clay and bottom salinity at the Clam Bayou sites and searching the EPCHC benthic monitoring database for past sites which fell within those ranges for both parameters. A total of nine sites sampled between 1995-2007 were found in the database; eight from Boca Ciega Bay and one from Lower Tampa Bay.

## *Field Collection*

The field collection of sediment samples and water quality data was conducted by PCWMD staff. Samples were collected at 10 sites (Figure 1) on three dates: 14 August 2008 (sites #4, 5, and 10), 26 August 2008 (sites# 1,2,7,8, and 12), and 26 September 2008 (sites #3 and 6). The disjunction in the field collections was due in part to weather delays and low tides inhibiting boat access to several sites.

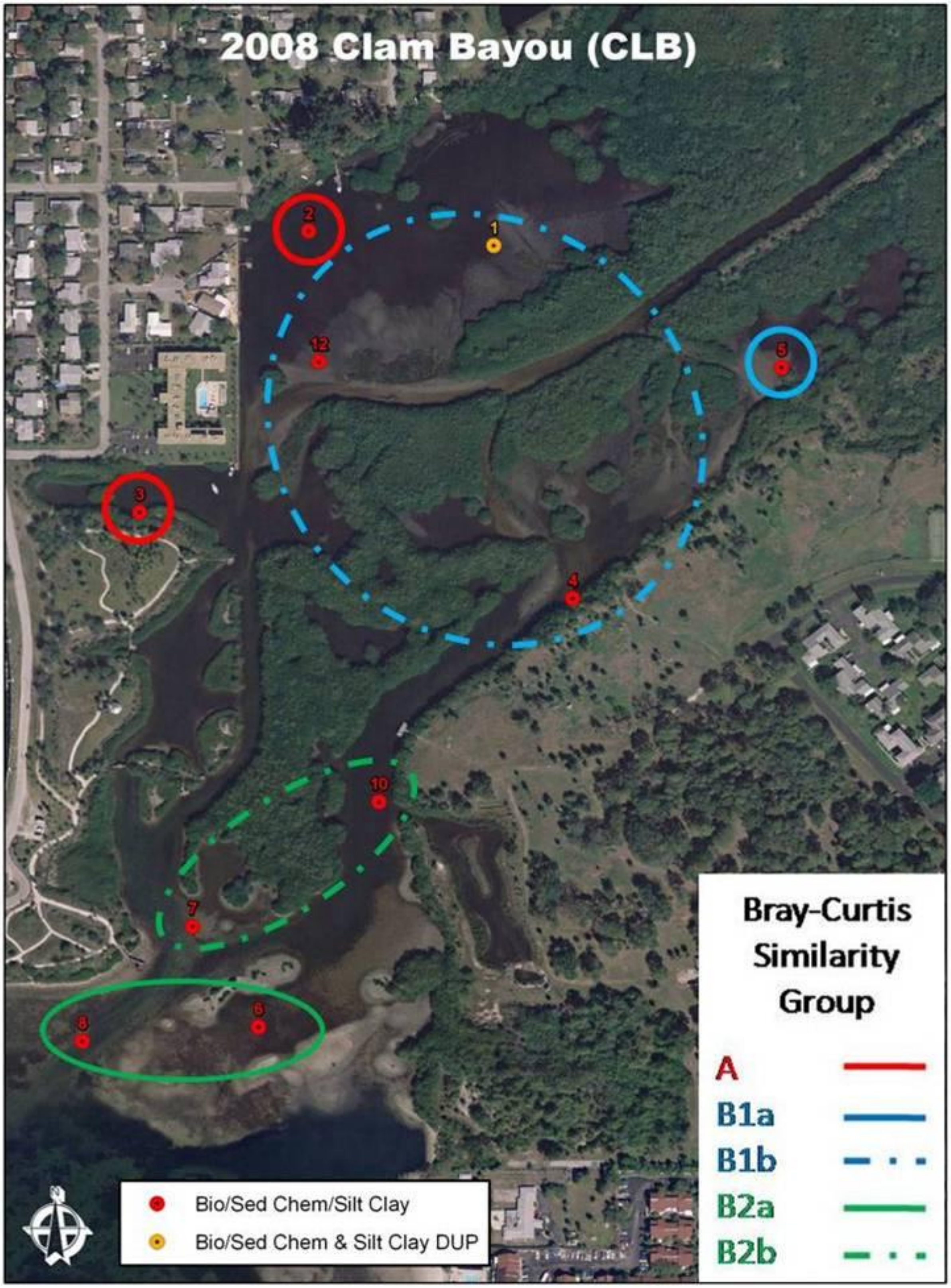



**Figure 1 TBEP 2008 Clam Bayou sampling locations and Bray-Curtis Similarity grouping.**

Field and laboratory methods were adopted from the EMAP-E Louisianan Province operations manual (Macauley, 1993) and modified for the Tampa Bay monitoring program (Versar, 1993; Courtney *et al.* 1995). A hydrographic profile was taken at each site using a Hydrolab® multi-probe sonde. Measurements were taken from the surface (0.1 meters) to the bottom at 1 meter intervals for temperature, salinity, pH, and dissolved oxygen.

Sediment samples for benthic macrofaunal community analysis were taken at each site using a Young-Modified Van Veen grab sampler (or Young grab). The grab sample was taken to a sediment depth of 15 cm and covered an area of 0.04 $m^2$. A 60 cc corer was used to take a subsample for Silt+Clay analysis. Samples were sieved through a 0.5 mm mesh sieve and the remaining fraction was rinsed into plastic sample jars. Samples were fixed in 10% buffered formalin for a minimum of 72 hours and then transferred into 70% isopropyl alcohol for preservation and storage. Rose Bengal was added to the formalin and isopropyl alcohol solutions to stain the organisms.

**Sediment Chemistry:** A second sediment grab sample was taken at each site for sediment contaminant analysis. The grab sampler and all sampling utensils were field cleaned with Liqui-Nox® detergent (Alconox, Inc. White Plains, NY), rinsed with ambient seawater and decontaminated with 99% pesticide grade isopropyl alcohol (2-Propanol, FisherChemicals, Fisher Scientific Fair Lawn, NJ) prior to sampling and all equipment and samples were handled wearing latex gloves. The top 2 cm layer of sediment was removed from each grab using a stainless steel or Teflon coated spoon and placed in a stainless steel beaker. The removed layers of sediment were composited in the stainless steel beaker and homogenized by stirring. The homogenized sample was then split, with one fraction being placed in a HDPE sample bottle for metals analysis and the second fraction being placed in a glass sample jar with a Teflon® lined lid for analysis of organic compounds (pesticides, PCBs, PAHs).

## *Laboratory Procedures*

### Field data

Hydrographic and other field data were entered into a Microsoft® Access database maintained by the Environmental Protection Commission of Hillsborough County.

### Sediment Chemistry

All sediment chemistry samples were analyzed by the EPCHC. The sediment metal samples were processed using a total digestion method with hydrofluoric acid using a CEM MARS Xpress microwave digester. Analysis was performed on a Perkin Elmer Optima 2000 Optical Emission Spectrometer according to EPA Method 200.7. The organic samples were extracted using EPA Method 3545A (Accelerated Solvent Extraction), followed by the cleanup methods, EPA 3630C (Silica gel) and EPA 3660B (copper). Analysis was completed using EPA Method 8081 (organochlorine pesticides) and EPA Method 8082 (PCB congeners) on a gas chromatograph equipped with dual Electron Capture Detectors (ECDs). Polycyclic aromatic hydrocarbons (PAHs) were analyzed using EPA Method 8270c on a mass spectrometer.

## Benthic Community Analysis

Benthic sorting and identification work was conducted by EPCHC staff. Benthic sediment samples were rough sorted under a dissecting microscope into general taxonomic categories (Annelids, Molluscs, Crustaceans, and Miscellaneous Taxa). Resorting was done on 10% of the samples completed by each technician for QA/QC. The sorted animals were identified to the lowest practical taxonomic level (species level when possible) and counted. Taxonomic identifications were conducted using available identification keys and primary scientific literature. All identification and count data were recorded on laboratory bench sheets and entered into a Microsoft Access® database maintained by the EPCHC.

# *Data Analysis*

## Data Categorization

Potential toxicity levels for sediment contaminants followed the sediment quality guidelines established for Florida coastal waters and utilized the Threshold Effects Levels (TELs) and Probable Effects Levels (PELs) established for individual contaminants (MacDonald 1994; MacDonald *et al*. 1996). The metal:aluminum ratio was used to determine if individual sediment metals were elevated relative to background levels (Schropp *et al*. 1990). The Tampa Bay Benthic Index (TBBI) was calculated for each site following the methods established in Janicki Environmental (2005) and Malloy *et al.* (2007). The TBBI threshold scores for "Degraded" ( < 73), "Intermediate" (between 73 to 87) and "Healthy" (> 87 ) benthic habitats were established by Janicki Environmental (2005) and Malloy *et al*. (2007) .

## Univariate Statistical Analysis

Parametric and non-parametric statistical analysis was done with SigmaStat ® 3.5 (SYSTAT Software, Inc. 2006a). Data were transformed for normality where needed for the parametric tests. Analysis of Variance (ANOVA) with a Holm-Sidak method pair-wise post hoc test was used to test for differences between sampling events. Where the assumptions of the ANOVA could not be met by the data transformation, a non-parametric Kruskal Wallace test was used along with a Dunn's Pairwise Multiple Comparison test.

## Multivariate Statistical Analysis and Benthic Community Indices

PRIMER v6 software (PRIMER-E, Ltd. 2006; Clarke and Gorley 2006) was used for all multivariate statistical analysis and for calculating univariate biological metrics (species richness, abundance, Shannon diversity index and Simpson diversity index). Species richness (*S*) was defined as the total number of taxa. Abundance (*N*) was expressed as the number of individuals per $m^2$ (calculated as the raw count x 25) except for colonial organisms which were counted as present/absent. The Shannon diversity index (*H'*) calculations employed the natural logarithm opposed to log base 2 (Clarke and Warwick 2001). The zero-adjusted Bray-Curtis similarity (Clarke *et al.* 2006) was calculated on square root transformed abundance data and the resulting similarity matrix was used for running Cluster Analysis, Non-metric Multi-Dimensional Scaling (MDS), Similarity Percentage (SIMPER), and Analysis of Similarity (ANOSIM). The BIO-ENV procedure (Clarke and Ainsworth 1993) was used to find correlations between the environmental parameters and benthic community structure. All environmental parameters were normalized and log transformed prior to analysis.

## Comparison with 2001 FDEP Samples

Only the six 2008 sites which corresponded to the 2001 FDEP sites were used in the analysis. In order to compare the 2008 Clam Bayou benthic community results with the results from the 2001 FDEP survey, the 2008 species identifications were modified to more closely match the 2001 species list. Modifications to the dataset included eliminating taxonomic groups which were not identified by the FDEP (e.g. Bryozoa), updating taxonomic names in the 2001 dataset to match the current taxonomic nomenclature, and contracting some of the 2008 identifications to a higher taxonomic level (e.g. Nemertea) to match the 2001 species list.

The FDEP raw count data was converted to densities (#/$m^2$) to standardize it with the 2008 data. The FDEP samples were collected with a smaller grab sampler (petite ponar) and each sample was a composite of three combined grabs. The total surface area sampled was calculated as the area of the petite ponar grab ($0.023m^2 \times 3 = 0.069m^2$) and the raw counts were converted to densities by multiply by 14.5.

The modified dataset was then used to recalculate the benthic community indices and for further comparative analysis.

## Spatial and Graphical Analysis

Graphs were generated using SigmaPlot® 10.0 software (Systat Software, Inc. 2006b). Maps were generated by the Environmental Protection Commission of Hillsborough County using ArcGIS 9.2 (ESRI 2006).

# Results

## *Benthic Macrofaunal Community Analysis*

Cluster analysis arranged the ten sites into five distinct groups (Figures 1 and 2). The red branches of the dendrogram display the results from a similarity profile (SIMPROF) test and indicate statistically significant groupings of sites (Clarke and Gorley 2006). The first group, designated as group "A", consisted of sites 08CLB02 and 08CLB03. The remaining eight sites formed group "B" which was further divided into groups "B1" and "B2". The "B1" group split into two additional subgroups: Group "B1a" consisting of site 08CLB05; and Group "B1b" consisting of sites 08CLB04, 08CLB01, and 08CLB12. Group "B2" also split into two subgroups designated as "B2a" and "B2b". Group "B2a" consisted of sites 08CLB06 and 08CLB08 while Group "B2b" consisted of sites 08CLB07 and 08CLB10. Further details on this analysis will be presented below. The organization of the following data tables and figures in this report are based on these site groupings.

A total of 108 taxa were identified in the 2008 Clam Bayou samples (excluding unidentified damaged/juvenile Gastropoda, Bivalvia and Tellininae) (Appendix A). The polychaete *Mediomastus* sp. also is not included in this total since it may represent incomplete specimens of *M. californiensis* which was also present. Polychaetes were the most speciose taxonomic group with 41 taxa identified (38% of the total). Bivalves and Gastropods were the next most speciose groups with 19 and 15 taxa respectively. Species richness (*S*) ranged from 2 taxa at site 08CLB02 to 44 taxa at site 08CLB06 (Table 1; Figure 3) with a median of 27 taxa/site. The Group "A" sites had the lowest species richness while the highest numbers of taxa were present within the B2 group (Table 1; Figure 3).

The overall abundance (raw count) was 1,745 individual organisms. Oligochaetes (Tubificinae) were the dominate taxon, accounting for 13.41% of the abundance followed by the polychaete *Laeonereis culveri* and an unidentified gastropod (Rissooidea) with each accounting for 9.8% of the abundance. Sample densities (*N*) ranged from 225/$m^2$ at site 08CLB03 to 9,625/$m^2$ at site 08CLB04 (Table 1) with a median value of 3,763/$m^2$. The lowest abundances were at the Group "A" sites and the highest abundances were within the B1 group sites (Table 1; Figure 4).

Two indices were calculated to evaluate the species diversity at the Clam Bayou sites: the Shannon (or Shannon – Wiener) diversity index (*H'*), and the Simpson index (expressed as 1-λ'). Both indices are based on the proportional abundance of each species present in the sample (Clarke and Warwick 2001). The species diversity indices generally followed the same trend that was observed with species richness, with lowest values at the two Group "A" sites and highest values at the Group "B2a" sites (Table 1, Figure 5 & Figure 6). The Tampa Bay Benthic Index (TBBI) scores were generally near or below the "Degraded" threshold value of 73 and none were above the "Healthy" threshold value of 87 (Table 1). The lowest TBBI scores were at the B2a sites, despite relatively high species richness and diversity values at these two locations (Table 1).

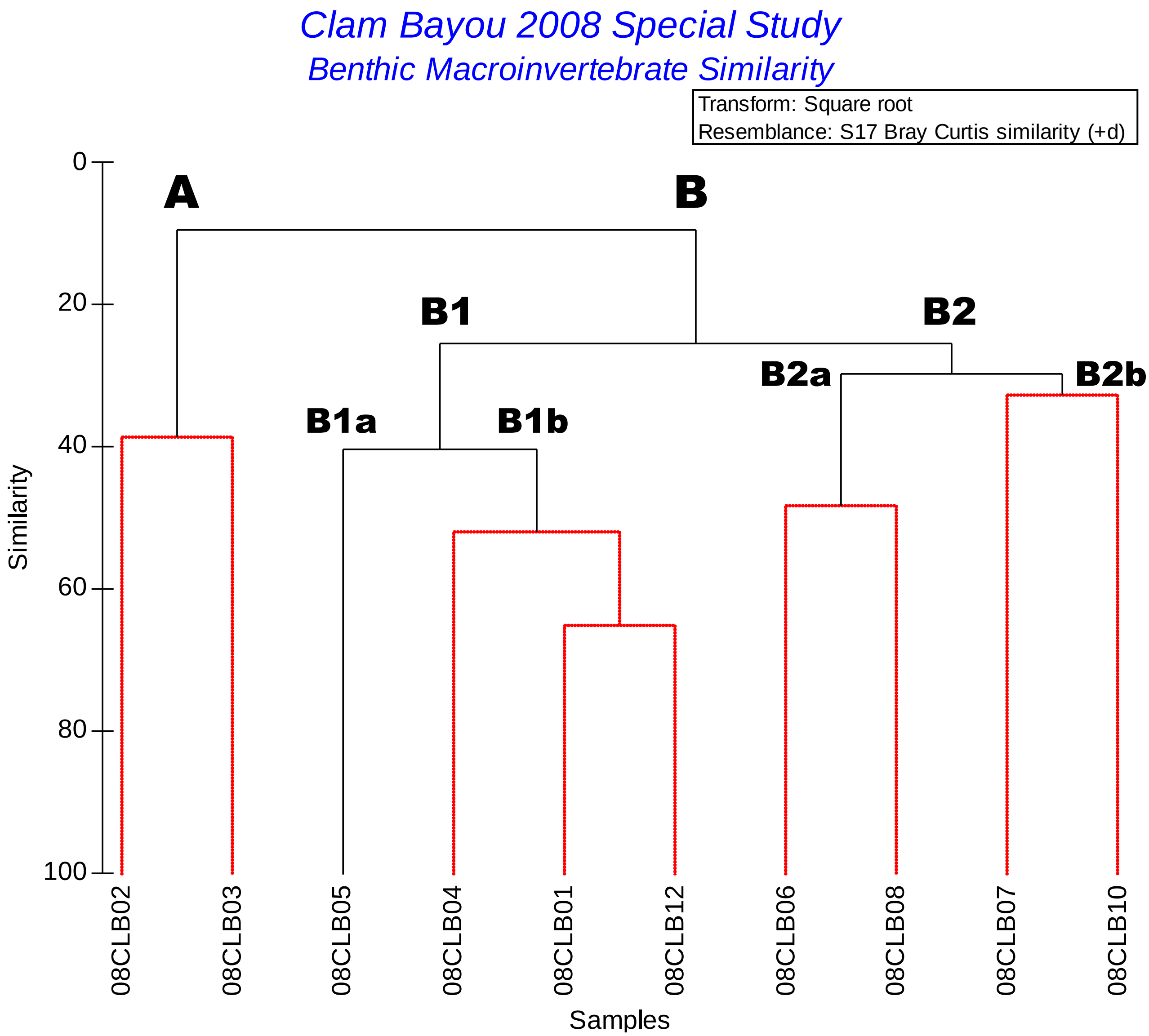



**Figure 2 Bray-Curtis Similarity dendrogram of 2008 TBEP Clam Bayou sampling sites.**

**Table 1  Clam Bayou 2008 benthic community summary metrics.**

| Bray-Curtis Similarity Grouping | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | B1 | | | | B2 | | | |
| | | | B1a | B1b | | | B2a | | B2b | |
| Site | 08CLB02 | 08CLB03 | 08CLB05 | 08CLB04 | 08CLB01 | 08CLB12 | 08CLB06 | 08CLB08 | 08CLB07 | 08CLB10 |
| **Species Richness (*S*) [number of taxa]** | 2 | 5 | 14 | 30 | 24 | 31 | 44 | 32 | 42 | 22 |
| **Abundance (*N*) [Density = #/m$^2$]** | 650 | 225 | 9425 | 9625 | 3750 | 4900 | 5601 | 3776 | 3750 | 1925 |
| **Shannon-Wiener Diversity $H'(\log_e)$** | 0.16 | 1.30 | 1.92 | 2.38 | 2.82 | 2.97 | 3.17 | 3.01 | 2.89 | 2.70 |
| **Simpson Index (1-λ')** | 0.07 | 0.64 | 0.76 | 0.84 | 0.93 | 0.93 | 0.94 | 0.93 | 0.90 | 0.91 |
| **Tampa Bay Benthic Index** | 64.69 | 72.38 | 76.38 | 72.24 | 76.61 | 71.70 | 62.75 | 38.56 | 84.86 | 81.51 |

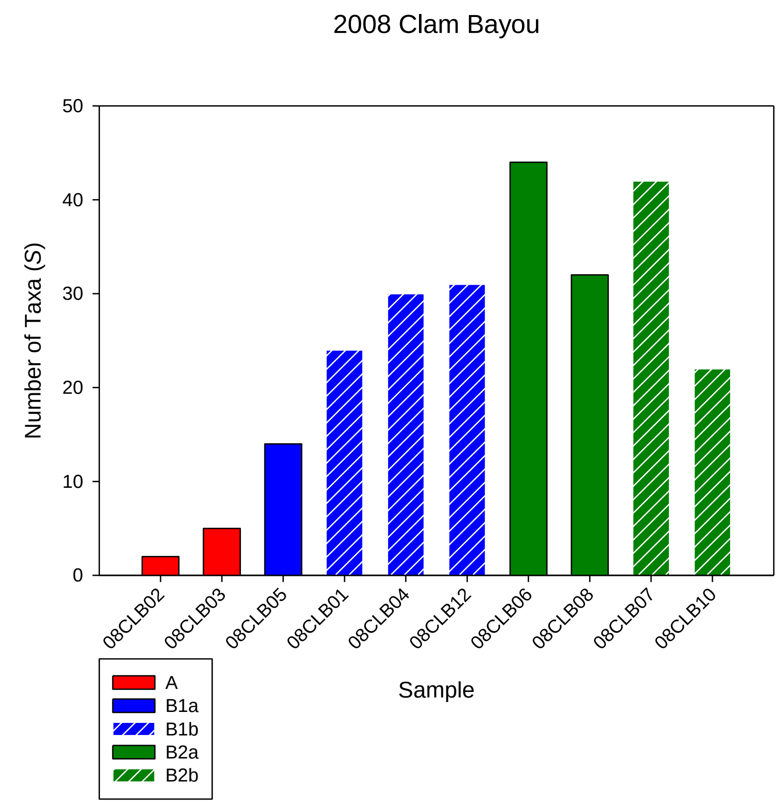



**Figure 3 Clam Bayou 2008 benthic species richness.**

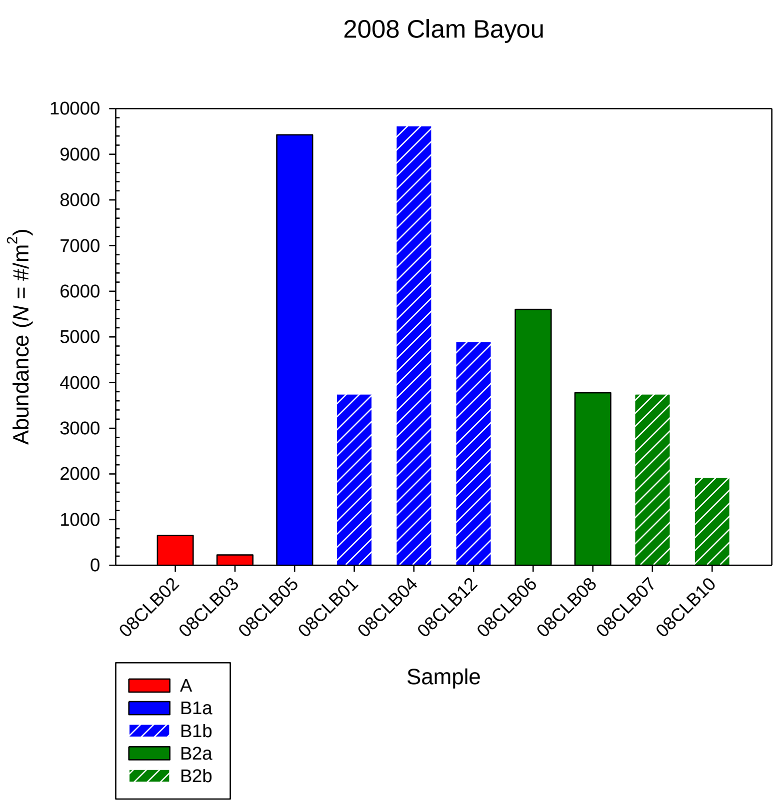



**Figure 4 Clam Bayou 2008 benthic abundance.**

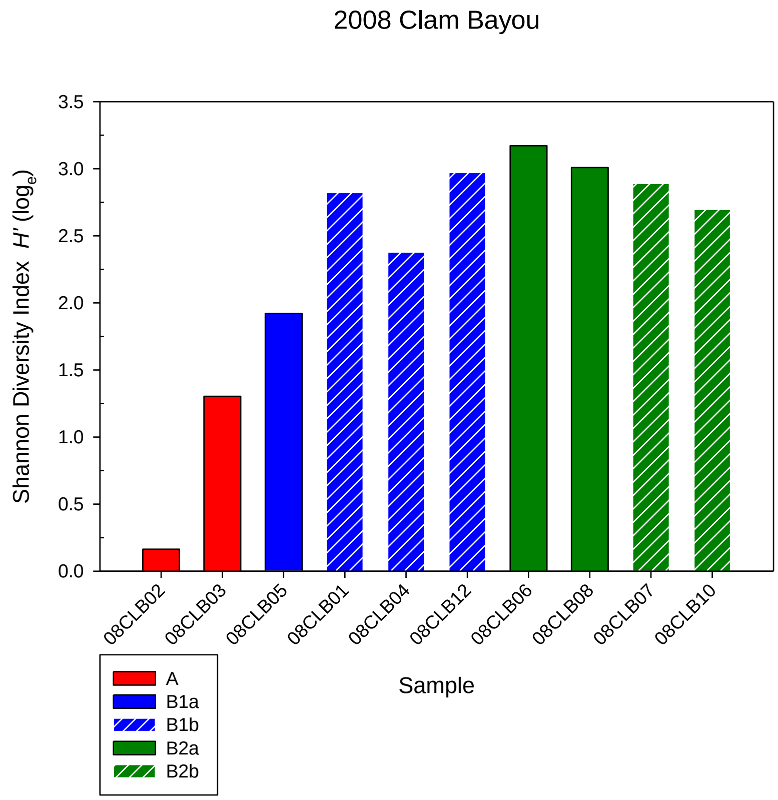



**Figure 5 Clam Bayou 2008 Shannon diversity index.**

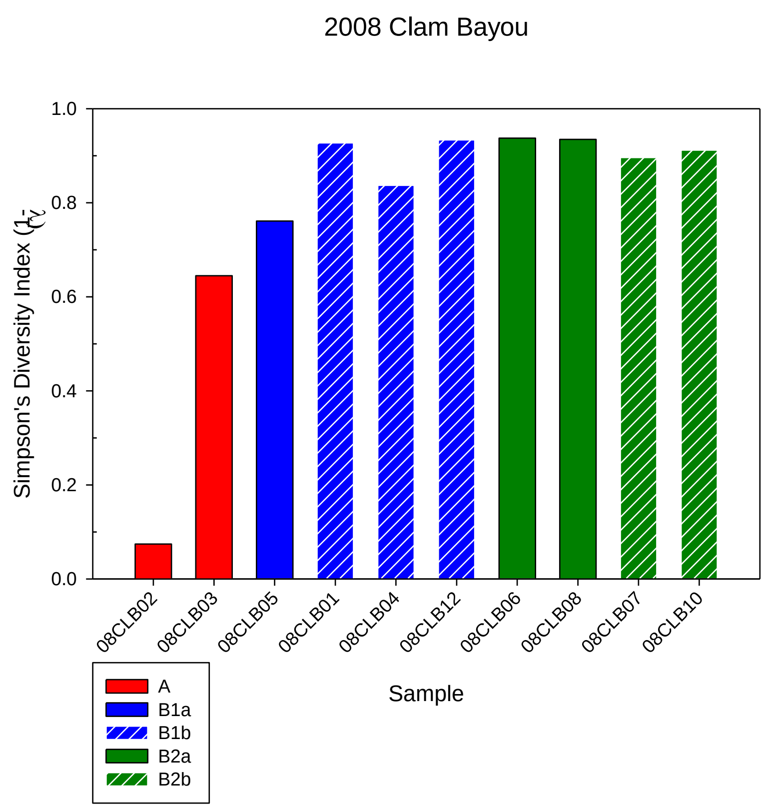



**Figure 6 Clam Bayou 2008 Simpson's diversity index.**

The dominate taxa based on relative abundance at each site are presented in Table 2. Unidentified tubificinae oligochaetes were dominate at both Group “A” sites, however the low species richness and abundances at those sites did inflate the relative abundance values at those sites. The single site in Group “B1a” was dominated by unidentified Rissooidea gastropods, which comprised nearly 45% of the relative abundance at that site (Table 2). The three sites that comprise Group “B1b” had an average Bray-Curtis similarity of 56% and all were characterized by relatively high abundances of the polychaete *Laeonereis culveri*, although it was not the most abundant species. The similarity among these sites was also due to the presence of the gastropod *Acteocina canaliculata*. Site 08CLB04 was the least diverse of these sites, although it had relatively high species richness and the highest abundance (Table 1). This site was dominated by unidentified tubificinae oligochaetes and *L. culveri* which together accounted for over 52% of the relative abundance at that site (Table 2). Site 08CLB01 was unique in that it was dominated by aquatic insect larvae (Dolichopodidae). The two Group “B2a” sites had an average Bray-Curtis similarity of 48% and were characterized by the polychaete *Prionospio heterobranchia*. Site 08CLB06 was dominated by *Laeonereis culveri* and the isopod crustacean *Erichsonella attenuate*, which each comprised 12.5% of the relative abundance. Site 08CLB08 was dominated by polychaetes and oligochaetes, with the polychaetes *Capitella capitata* and *Prionospio heterobranchia* accounting for over 25% of the relative abundance combined (Table 2). The two Group “B2b” sites were largely represented by bivalve mollusks along with polychaetes and oligochaetes. Site 08CLB07 was dominated by the polychaete *Monticellina dorsobranchialis*, which made up 24% of the relative abundance. Unidentified juvenile or damaged bivalve mollusks dominated site 08CLB10 along with the oligochaete *Tubificoides wasselli* and the bivalves *Mysella planulata* and *Macoma cerina* (Table 2).

## ***Physical Parameters***

The water quality measurements and silt/clay results are presented in Table 3. The site depths ranged from 0.42 to 1.26 meters with a median value of 0.9 meters. The Group “A” and B2b sites tended to be deeper relative to the other Clam Bayou sites (Table 3; Figure 7). Bottom water temperatures ranged from 25.9 to 31.7°C (Table 3). The lower temperature measurements were at the sites sampled on 26 September 2008. Bottom salinities ranged between 33.18 to 35.61 psu with a median of 34.4 psu. The salinities were highest at the B2a sites near the mouth of Clam Bayou (Table 3; Figure 8). The bottom dissolved oxygen ranged from 1.61 to 6.14 mg/l with a median value of 3.53 mg/l. Most of the sites had dissolved oxygen values which were above the 2 mg/l threshold for hypoxia, but fell below the 4 mg/l threshold for normoxic conditions (Figure 9). Only site 08CLB05 had a dissolved oxygen level in the hypoxic range (Table 3; Figure 9). The highest dissolved oxygen levels were at the two B2a sites (Table 3; Figure 9). Bottom pH levels were below the normal value for seawater (~ 8) at most of the Clam Bayou sites and ranged between 7.6 and 8.24 with a median value of 7.91. The lowest pH occurred at site 08CLB05 while pHs were highest at the B2a sites (Table 3; Figure 10). The percent silt+clay values ranged from 2.2 to 51.3% with a median value of 8.7%. The highest silt+clay values were at the Group “A” sites (Table 3; Figure 11). The percent silt+clay values were also relatively high at site 08CLB10 while the remaining sites all had values well below 25% (Table 3; Figure 11).

**Table 2  Clam Bayou 2008 relative abundance of benthic taxa.**

| A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | B1 | | | | B2 | | | |
| | | B1a | B1b | | | B2a | | B2b | |
| 08CLB02 | 08CLB03 | 08CLB05 | 08CLB04 | 08CLB01 | 08CLB12 | 08CLB06 | 08CLB08 | 08CLB07 | 08CLB10 |
| Tubificinae (96.15%) | Tubificinae (55.56%) | Rissooidea (44.83%) | Tubificinae (32.31%) | Dolichopodidae (13.33%) | *Xenanthura brevitelson* (13.27%) | *Laeonereis culveri* (12.50%) | *Capitella capitata* spp. complex (13.24%) | *Monticellina dorsobranchialis* (24.00%) | Bivalvia (16.88%) |
| | | Tubificinae (11.67%) | *Laeonereis culveri* (19.74%) | *Laeonereis culveri* (10.67%) | *Acteocina canaliculata* (9.69%) | *Erichsonella attenuate* (12.50%) | *Prionospio heterobranchia* (11.92%) | *Eurytellina* sp. A of EPC (13.33%) | *Tubificoides wasselli* (14.29%) |
| | | | | *Acteocina canaliculata* (9.33%) | *Laeonereis culveri* (9.18%) | *Heteromastus filiformis* (10.71%) | Tubificinae (8.61%) | Tellininae (12.67%) | *Mysella planulata* (10.39%) |
| | | | | *Eurytellina* sp. A of EPC (9.33%) | *Parastarte triquetra* (9.18%) | *Prionospio heterobranchia* (7.59%) | *Mediomastus* sp. (7.28%) | | *Macoma cerina* (9.09%) |
| | | | | Actiniaria (8.00%) | *Heteromastus filiformis* (7.14%) | *Erycina floridana* (4.91%) | *Tubificoides wasselli* (6.62%) | | |
| | | | | | *Leitoscoloplos foliosus* (6.12%) | *Magelona pettiboneae* (4.46%) | *Monticellina dorsobranchialis* (5.96%) | | |

**Table 3 Clam Bayou 2008 bottom physical and sediment parameters.**

| Bray-Curtis Similarity Grouping | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | B1 | | | | B2 | | | |
| | | | B1a | B1b | | | B2a | | B2b | |
| **Site** | 08CLB02 | 08CLB03 | 08CLB05 | 08CLB04 | 08CLB01 | 08CLB12 | 08CLB06 | 08CLB08 | 08CLB07 | 08CLB10 |
| **Depth (meters)** | 1.08 | 1.26 | 0.49 | 0.82 | 0.55 | 0.42 | 0.80 | 0.98 | 1.20 | 1.14 |
| **Bottom Temp. (°C)** | 30.53 | 25.89 | 28.35 | 28.37 | 30.91 | 31.73 | 26.95 | 27.11 | 31.06 | 28.48 |
| **Bottom Salinity (psu)** | 34.34 | 35.28 | 33.87 | 34.46 | 33.71 | 33.18 | 35.61 | 35.53 | 33.85 | 34.74 |
| **Bottom Dissolved Oxygen (mg/l)** | 3.33 | 4.06 | 1.61 | 2.19 | 3.25 | 3.90 | 6.14 | 5.34 | 3.72 | 2.42 |
| **Bottom pH** | 7.91 | 8.03 | 7.60 | 7.68 | 7.90 | 7.94 | 8.24 | 8.20 | 7.81 | 7.73 |
| **% SILT+CLAY** | 44.2 | 51.3 | 7.1 | 3.2 | 8.4 | 9.0 | 15.8 | 2.2 | 6.2 | 37.2 |

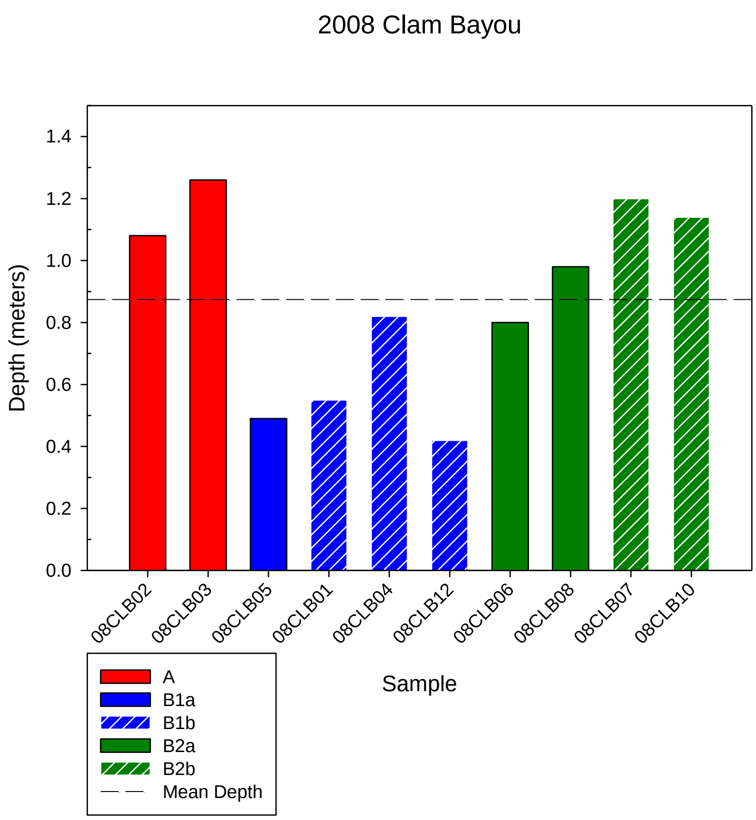



**Figure 7  Clam Bayou 2008 sample depth.**

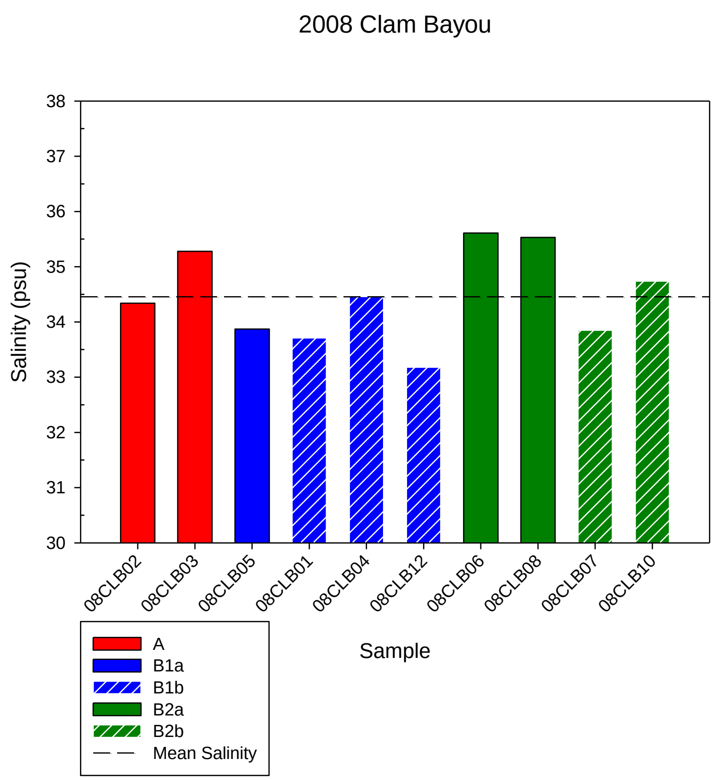



**Figure 8  Clam Bayou 2008 bottom salinities.**

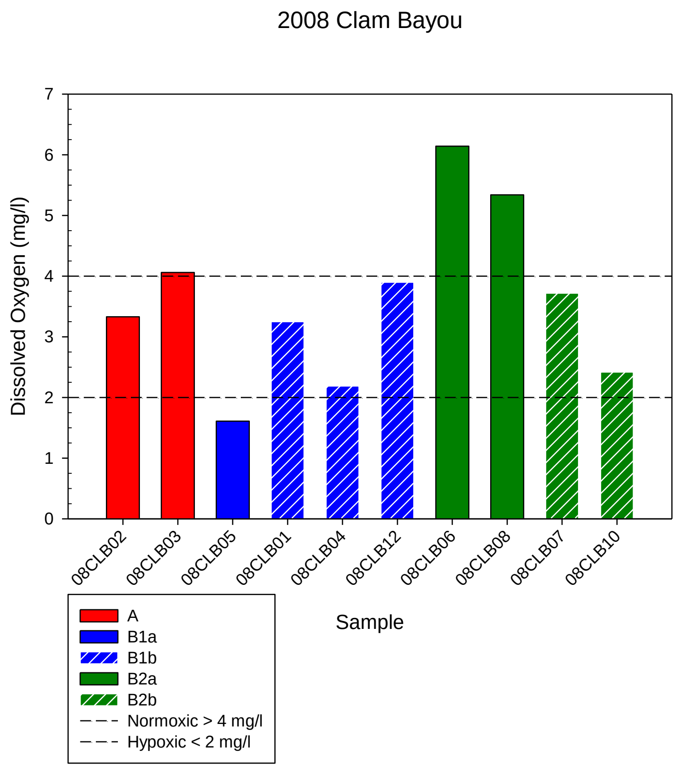



**Figure 9  Clam Bayou 2008 bottom dissolved oxygen.**

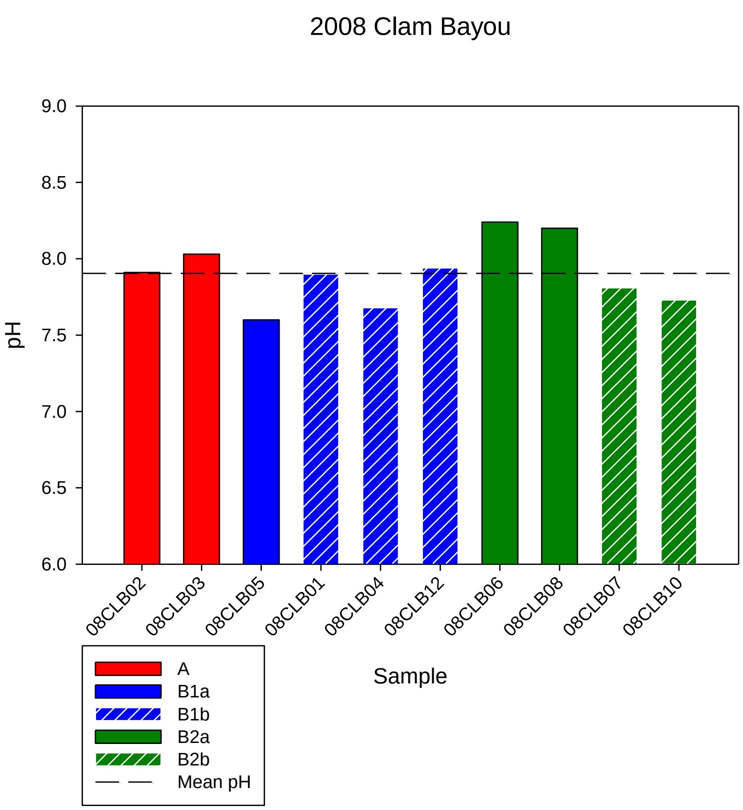



**Figure 10  Clam Bayou 2008 bottom pH.**

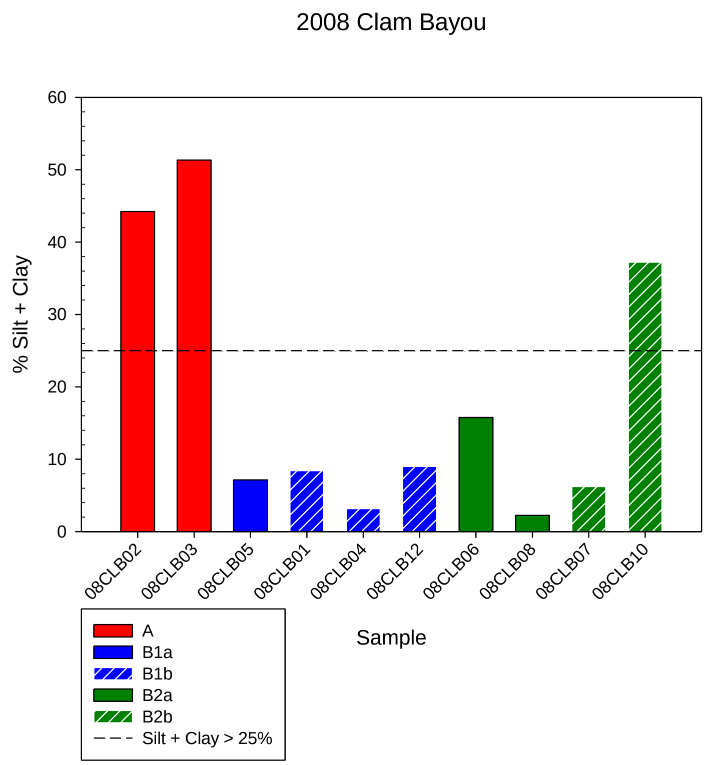



**Figure 11  Clam Bayou 2008 sediment percent silt + clay.**

## *Sediment Contaminants*

The results from the metals analysis are presented in Table 4. All of the metal:aluminum regressions shown in Figure 12 suggest that the metals concentrations in Clam Bayou were not elevated above natural levels. Generally, metals values were highest at the two Group "A" sites and at site 08CLB10. Most metals were below their established TEL concentrations with a few exceptions and silver was below the method detection limit (<MDL) at all sites. Arsenic was above its TEL at sites 08CLB05 and 08CLB08, but was <MDL at both of the Group "A" and Group "B2b" sites. Cadmium was above its TEL at all ten sites, however the Cd:Al regression (Figure 12) did not indicate that these levels were anthropogenically enriched. Copper and lead were above their TEL concentrations at both Group "A" sites and at 08CLB10. Lead also exceeded its TEL at two of the Group B1b sites: 08CLB01 and 08CLB12. Zinc was above its TEL at 08CLB03 and 08CLB10.

Polychlorinated Biphenyls (PCBs) concentrations are shown in Table 5 and Figure 13. The Total PCB concentrations were above the established TEL at four sites including 08CLB05, 08CLB06, and both of the Group B2b sites (08CLB07 and 08CLB10).

Chlorinated pesticide concentrations are shown in Table 6. Only seven of the measured pesticides have established sediment quality guidelines and eight of the ten sites showed elevated levels for several of these pesticides. The two sites that did not have high pesticide levels (08CLB04 and 08CLB01) both were in the B1b similarity group (Table 6). Lindane levels were high at half of the sites and exceeded the PEL at sites 08CLB05 and 08CLB06 (Table 6; Figure 14). Dieldrin concentrations were above its TEL at five sites, but did not have any PEL exceedences (Table 6; Figure 15). Total Chlordane exceeded its PEL at five sites (Table 6; Figure 16). DDT or one of its breakdown compounds (p,p'-DDT, DDE, DDD) were elevated at eight of the ten sites with highest concentrations at 08CLB03 and 08CLB12 (Table 6; Figures 17-20).

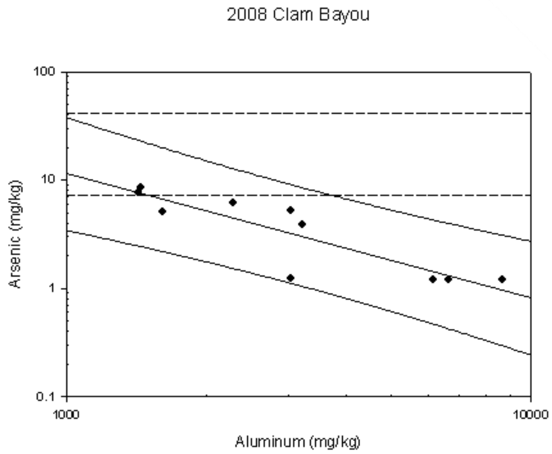
Polycyclic aromatic hydrocarbons (PAHs) exhibited high concentrations at all sites (Table 7). Low molecular weight PAH (LMW PAH) levels were generally lower than the high molecular weight PAH (HMW PAH) levels (Table 6). The total LMW PAHs exceeded its PEL at three sites and had highest concentrations at sites 08CLB10 and 08CLB03 (Table 6; Figure 21). The LMW PAH phenanthrene was particularly high and was above its PEL at six sites (Table 6). The six constituent HMW PAHs all exceeded their PEL concentrations at eight or nine of the ten sites (Table 6) and the total HMW PAH levels were above its PEL at seven sites and exceeded its TEL at the remaining three sites (Table 6; Figure 22). Total PAHs (sum of the LMW and HMW PAHs) exceeded the TEL at five sites and the PEL at four sites (Table 6; Figure 23). Sites 08CLB03 and 08CLB10 had the highest PAH levels overall, and concentrations at both of these sites were twice the PEL concentration for total PAHs (Table 6; Figure 23). Site 08CLB08 was the only site which did not exceed the SQG for total PAHs. The LMW PAHs at this site were generally low with only anthracene being above the TEL concentration, while all of the HMW PAHs exceeded their TELs, none were above their PEL concentrations at this site (Table 6).

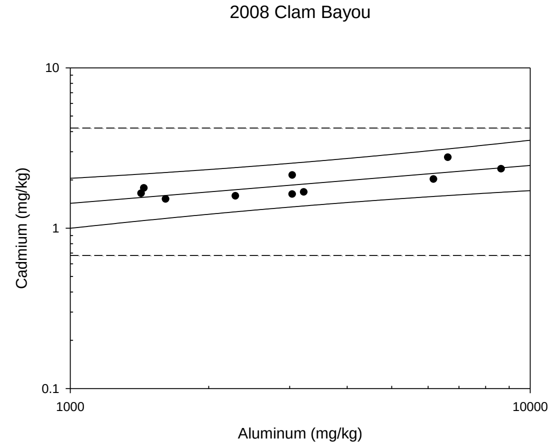
**Table 4 Clam Bayou 2008 sediment metals concentrations (mg/kg).**

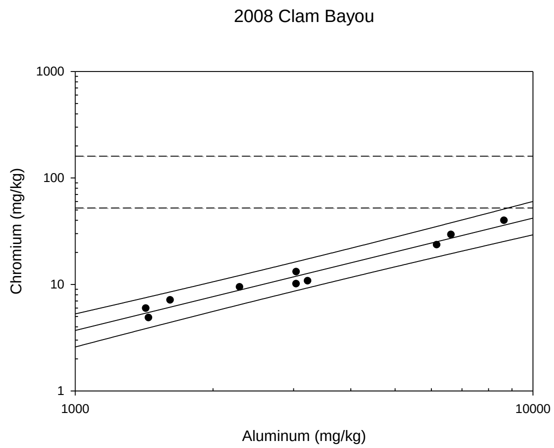
MDL = Method Detection Limit; TEL = Threshold Effects Level; PEL = Potential Effects Level.

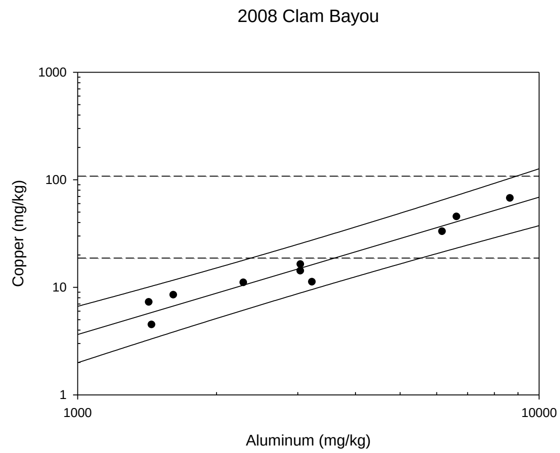
Yellow highlighting indicates >TEL concentration. Red highlighting indicates >PEL concentration.

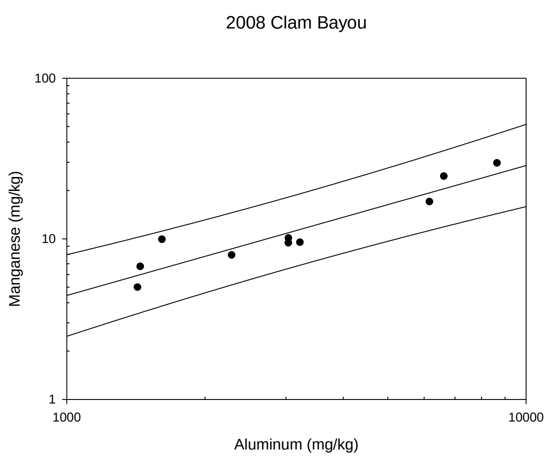
| Bray-Curtis Similarity Grouping | | | | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B1 | | | | B2 | | | |
| | | | | | | B1a | B1b | | | B2a | | B2b | |
| | MDL | TEL | PEL | 08CLB02 | 08CLB03 | 08CLB05 | 08CLB04 | 08CLB01 | 08CLB12 | 08CLB06 | 08CLB08 | 08CLB07 | 08CLB10 |
| Silver (Ag) | 0.100 | 0.733 | 1.77 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** |
| Aluminum (Al) | 15 | NA | NA | 6174.61 | 8665.62 | 1428.96 | 1615.29 | 2291.03 | 3045.85 | 3226.80 | 1448.83 | 3043.92 | 6636.23 |
| Arsenic (As) | 2.367 | 7.24 | 41.6 | **<MDL** | **<MDL** | 7.63 | 5.11 | 6.18 | 5.21 | 3.84 | 8.49 | **<MDL** | **<MDL** |
| Cadmium (Cd) | 0.110 | 0.676 | 4.21 | 2.01 | 2.33 | 1.64 | 1.51 | 1.58 | 2.13 | 1.67 | 1.77 | 1.62 | 2.75 |
| Chromium (Cr) | 1.000 | 52.3 | 160 | 23.38 | 39.58 | 5.92 | 7.08 | 9.39 | 13.06 | 10.72 | 4.84 | 10.05 | 29.15 |
| Copper (Cu) | 0.360 | 18.7 | 108 | 32.87 | 67.05 | 7.23 | 8.43 | 11.00 | 16.23 | 11.14 | 4.46 | 14.08 | 45.06 |
| Nickel (Ni) | 0.720 | 15.9 | 42.8 | 6.59 | 10.10 | 4.74 | 4.24 | 5.35 | 5.74 | 4.89 | 4.47 | 4.86 | 8.88 |
| Lead (Pb) | 1.800 | 30.2 | 112 | 66.39 | 88.49 | 22.95 | 20.84 | 31.97 | 43.27 | 17.98 | 15.41 | 20.86 | 76.12 |
| Tin (Sn) | 1.100 | NA | NA | 4.12 | 4.22 | 6.65 | 6.02 | 8.17 | 6.97 | 6.31 | 7.76 | 5.83 | 4.49 |
| Zinc (Zn) | 1.800 | 124 | 271 | 103.73 | 209.06 | 57.38 | 36.42 | 38.75 | 80.03 | 49.69 | 31.59 | 54.72 | 214.79 |
| Manganese (Mn) | 0.050 | NA | NA | 16.91 | 29.49 | 4.96 | 9.86 | 7.88 | 10.04 | 9.44 | 6.68 | 9.38 | 24.38 |
| Antimony (Sb) | 5.100 | NA | NA | 16.98 | 19.45 | 11.29 | 12.95 | 11.89 | 15.29 | 14.60 | 15.36 | 13.45 | 18.05 |
| Selenium (Se) | 3.500 | NA | NA | 8.97 | 7.66 | 6.48 | 4.72 | 4.71 | 6.07 | 6.41 | 5.26 | 5.74 | 8.69 |
| Iron (Fe) | 2.000 | NA | NA | 3973.00 | 7198.73 | 855.91 | 1142.05 | 1402.91 | 2112.06 | 1896.53 | 692.62 | 1804.81 | 5588.65 |

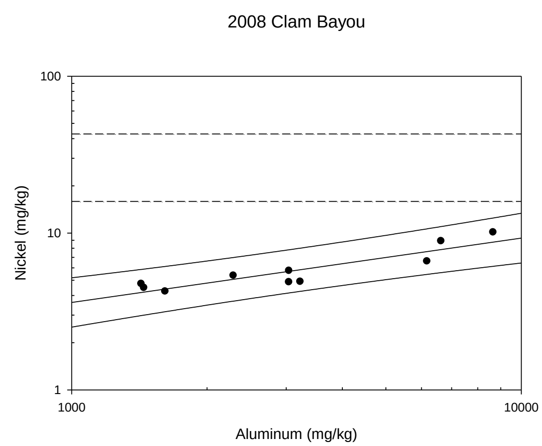

2008 Clam Bayou
100
10
1
0.1
Arsenic (mg/kg)
1000
10000
Aluminum (mg/kg)


2008 Clam Bayou
10
1
0.1
Cadmium (mg/kg)
1000
10000
Aluminum (mg/kg)


2008 Clam Bayou
1000
100
10
1
Chromium (mg/kg)
1000
10000
Aluminum (mg/kg)


2008 Clam Bayou
1000
100
10
1
Copper (mg/kg)
1000
10000
Aluminum (mg/kg)


2008 Clam Bayou
100
10
1
Manganese (mg/kg)
1000
10000
Aluminum (mg/kg)


2008 Clam Bayou
100
10
1
Nickel (mg/kg)
1000
10000
Aluminum (mg/kg)

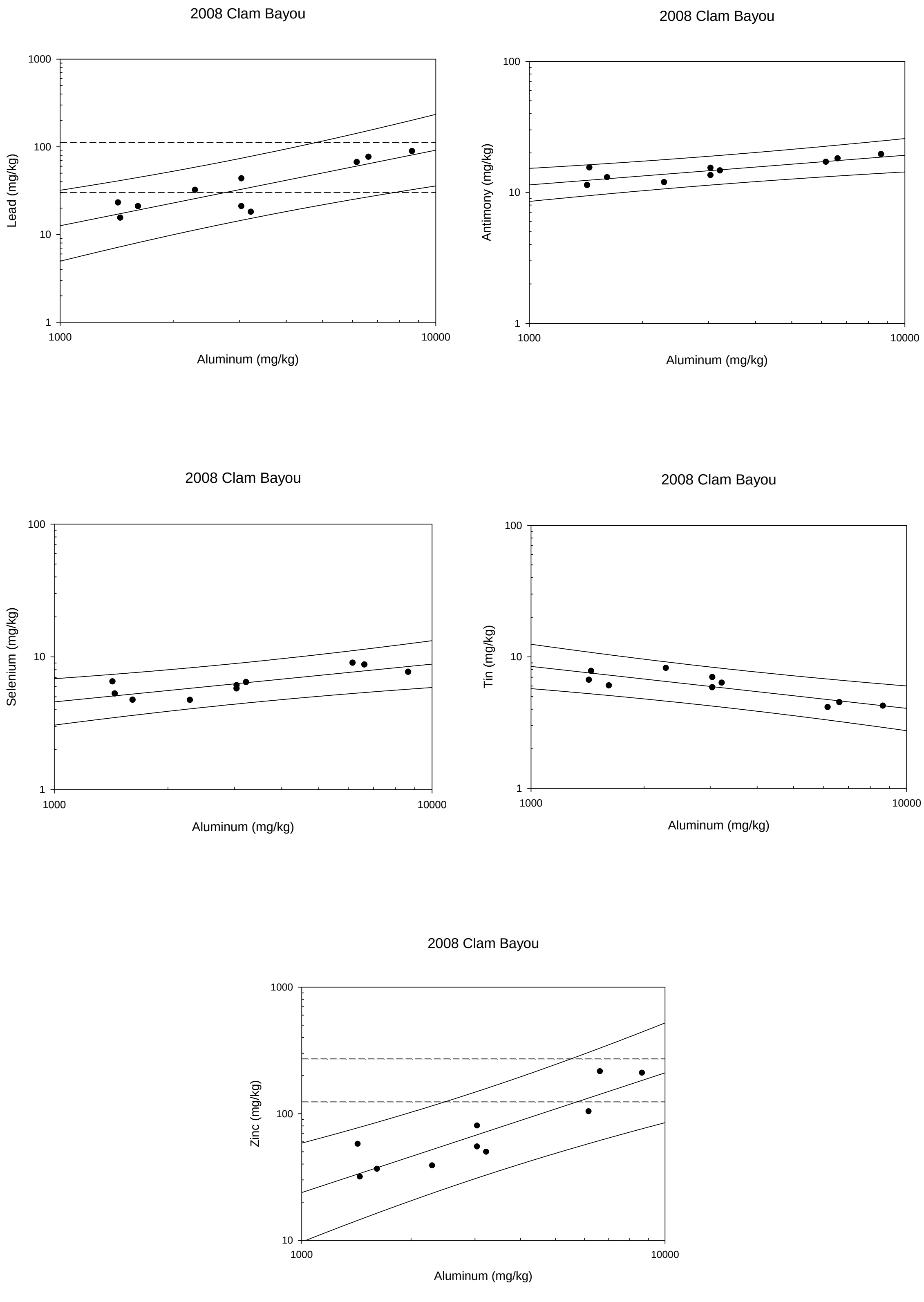



**Figure 12 Clam Bayou 2008 metals:aluminum regressions.**

**Table 5 Clam Bayou 2008 sediment PCB congener and total PCB concentrations (μg/kg).**

MDL = Method Detection Limit; TEL = Threshold Effects Level; PEL = Potential Effects Level.

Yellow highlighting indicates >TEL concentration. Red highlighting indicates >PEL concentration.

| Bray-Curtis Similarity Grouping | | | | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B1 | | | | B2 | | | |
| | | | | | | B1a | B1b | | | B2a | | B2b | |
| Congener | **MDL** | **TEL** | **PEL** | 08CLB02 | 08CLB03 | 08CLB05 | 08CLB04 | 08CLB01 | 08CLB12 | 08CLB06 | 08CLB08 | 08CLB07 | 08CLB10 |
| PCB_8 | 0.511 | **NA** | **NA** | 1.08 | 0.78 | 1.43 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** |
| PCB_18 | 0.453 | **NA** | **NA** | 1.54 | 1.64 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** |
| PCB_28 | 0.412 | **NA** | **NA** | 0.55 | 0.38 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** |
| PCB_44 | 0.354 | **NA** | **NA** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | 1.62 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** |
| PCB_52 | 0.340 | **NA** | **NA** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | 12.66 | **<MDL** | **<MDL** | 4.33 |
| PCB_66 | 0.272 | **NA** | **NA** | 4.87 | 4.13 | **<MDL** | 0.93 | **<MDL** | **<MDL** | 1.57 | **<MDL** | 0.30 | 2.79 |
| PCB_101 | 0.319 | **NA** | **NA** | **<MDL** | 0.32 | 7.65 | **<MDL** | **<MDL** | 4.01 | 0.70 | 0.53 | 9.04 | 1.60 |
| PCB_105 | 0.258 | **NA** | **NA** | 5.47 | 3.53 | 0.36 | 0.55 | **<MDL** | 1.96 | 3.62 | **<MDL** | 7.65 | 15.78 |
| PCB_118 | 0.283 | **NA** | **NA** | 1.27 | 1.02 | 1.20 | 0.06 | 0.07 | 1.59 | 1.87 | **<MDL** | 10.15 | 0.70 |
| PCB_153 | 0.349 | **NA** | **NA** | 2.10 | 1.57 | **<MDL** | 0.08 | **<MDL** | 1.55 | **<MDL** | 0.64 | 5.35 | 9.54 |
| PCB_170 | 0.354 | **NA** | **NA** | 1.21 | 1.12 | 2.69 | **<MDL** | **<MDL** | 1.48 | 9.34 | 0.64 | 7.34 | 23.78 |
| PCB_180 | 0.403 | **NA** | **NA** | 0.88 | **<MDL** | 2.00 | **<MDL** | **<MDL** | 1.90 | 5.12 | 0.60 | 3.09 | 11.85 |
| PCB_195 | 1.341 | **NA** | **NA** | **<MDL** | **<MDL** | 2.27 | **<MDL** | **<MDL** | **<MDL** | 4.47 | **<MDL** | **<MDL** | 2.06 |
| PCB_206 | 0.153 | **NA** | **NA** | **<MDL** | **<MDL** | 8.04 | **<MDL** | **<MDL** | 4.19 | 2.91 | **<MDL** | 1.86 | 4.48 |
| Total PCB | **NA** | 21.6 | 189 | 19.96 | 15.78 | 26.73 | 3.93 | 3.53 | 18.52 | 43.30 | 4.60 | 46.49 | 77.78 |

**Table 6 Clam Bayou 2008 sediment chlorinated pesticide concentrations (μg/kg).**

MDL = Method Detection Limit; TEL = Threshold Effects Level; PEL = Potential Effects Level.

Yellow highlighting indicates >TEL concentration. Red highlighting indicates >PEL concentration.

| Bray-Curtis Similarity Grouping | | | | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B1 | | | | B2 | | | |
| | | | | | | B1a | B1b | | | B2a | | B2b | |
| **Pesticide** | **MDL** | **TEL** | **PEL** | **08CLB02** | **08CLB03** | **08CLB05** | **08CLB04** | **08CLB01** | **08CLB12** | **08CLB06** | **08CLB08** | **08CLB07** | **08CLB10** |
| Alpha BHC | 0.061 | **NA** | **NA** | **<MDL** | **<MDL** | 0.67 | **<MDL** | **<MDL** | 0.11 | 1.02 | **<MDL** | **<MDL** | 0.20 |
| Beta BHC | 0.213 | **NA** | **NA** | **<MDL** | **<MDL** | 18.05 | **<MDL** | **<MDL** | **<MDL** | 1.02 | **<MDL** | 13.78 | **<MDL** |
| Delta BHC | 0.147 | **NA** | **NA** | 0.55 | **<MDL** | **<MDL** | 0.21 | 0.06 | **<MDL** | 1.43 | 0.24 | **<MDL** | 0.65 |
| Lindane (Gamma BHC) | 0.107 | 0.32 | 0.99 | 0.83 | 0.22 | 1.11 | **<MDL** | **<MDL** | 0.45 | 1.52 | 0.21 | 0.23 | 0.50 |
| Aldrin | 0.083 | **NA** | **NA** | 3.09 | 3.26 | 0.54 | 0.94 | **<MDL** | 0.38 | 1.35 | 0.14 | 0.30 | 0.32 |
| Dieldrin | 0.113 | 0.715 | 4.3 | 2.88 | 2.18 | 1.80 | 0.45 | **<MDL** | 0.23 | 2.02 | 0.21 | 1.80 | 0.61 |
| Endrin | 0.214 | **NA** | **NA** | 0.59 | **<MDL** | 5.86 | **<MDL** | **<MDL** | 5.40 | 10.61 | 3.74 | 2.74 | 6.94 |
| Endosulfan 1 | 0.459 | **NA** | **NA** | **<MDL** | **<MDL** | 0.96 | **<MDL** | **<MDL** | 0.58 | 0.55 | **<MDL** | **<MDL** | **<MDL** |
| Endosulfan 2 | 0.132 | **NA** | **NA** | 0.39 | **<MDL** | 3.03 | **<MDL** | **<MDL** | 1.90 | 1.59 | 0.22 | 0.38 | 1.05 |
| Heptachlor | 0.664 | **NA** | **NA** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | 1.18 |
| Heptachlor epoxide | 0.139 | **NA** | **NA** | 0.64 | 0.13 | **<MDL** | **<MDL** | **<MDL** | 0.21 | 0.93 | **<MDL** | 0.18 | 0.79 |
| p,p'- DDD | 0.368 | 1.2 | 7.8 | **<MDL** | **<MDL** | 2.29 | **<MDL** | **<MDL** | 3.08 | 4.93 | 0.73 | 5.62 | 7.80 |
| p,p'- DDE | 0.222 | 2.1 | 37.4 | 2.10 | 31.36 | 15.92 | 1.58 | **<MDL** | 44.72 | 0.26 | 3.62 | 0.54 | 2.84 |
| p,p'- DDT | 0.163 | 1.2 | 4.8 | 10.24 | 28.29 | 0.68 | 1.18 | **<MDL** | 6.89 | 36.30 | 1.73 | 9.90 | **<MDL** |
| Total DDT | **NA** | 3.89 | 51.7 | 12.52 | 59.83 | 18.89 | 2.94 | 0.38 | 54.69 | 41.49 | 6.08 | 16.06 | 10.72 |
| Endrin aldehyde | 0.137 | **NA** | **NA** | 2.24 | 1.64 | **<MDL** | **<MDL** | **<MDL** | **<MDL** | **<MDL** | 0.81 | 2.16 | **<MDL** |
| Endosulfate | 0.052 | **NA** | **NA** | 0.94 | 0.30 | 0.69 | **<MDL** | 0.08 | 0.91 | 0.98 | 0.20 | 1.22 | 0.63 |
| Methoxychlor | 0.800 | **NA** | **NA** | **<MDL** | **<MDL** | 3.03 | **<MDL** | **<MDL** | 1.86 | 9.52 | **<MDL** | **<MDL** | 2.14 |
| Endrin ketone | 0.071 | **NA** | **NA** | **<MDL** | **<MDL** | 1.59 | **<MDL** | **<MDL** | **<MDL** | 3.47 | 0.88 | **<MDL** | 0.43 |
| Mirex | 0.486 | **NA** | **NA** | 1.32 | 1.01 | 0.57 | **<MDL** | **<MDL** | 0.71 | 2.91 | **<MDL** | 3.69 | 2.13 |
| Alpha Chlordane | 0.111 | **NA** | **NA** | 0.66 | 10.46 | 6.15 | 0.20 | **<MDL** | 3.69 | 15.49 | 0.70 | 16.03 | 0.92 |
| Gamma Chlordane | 0.196 | **NA** | **NA** | **<MDL** | 13.96 | 4.91 | **<MDL** | **<MDL** | 6.32 | 4.85 | **<MDL** | 11.64 | 0.48 |
| Total Chlordane | **NA** | 2.3 | 4.8 | 0.69 | 24.42 | 11.06 | 0.30 | 0.08 | 10.01 | 20.34 | 0.80 | 27.67 | 1.40 |

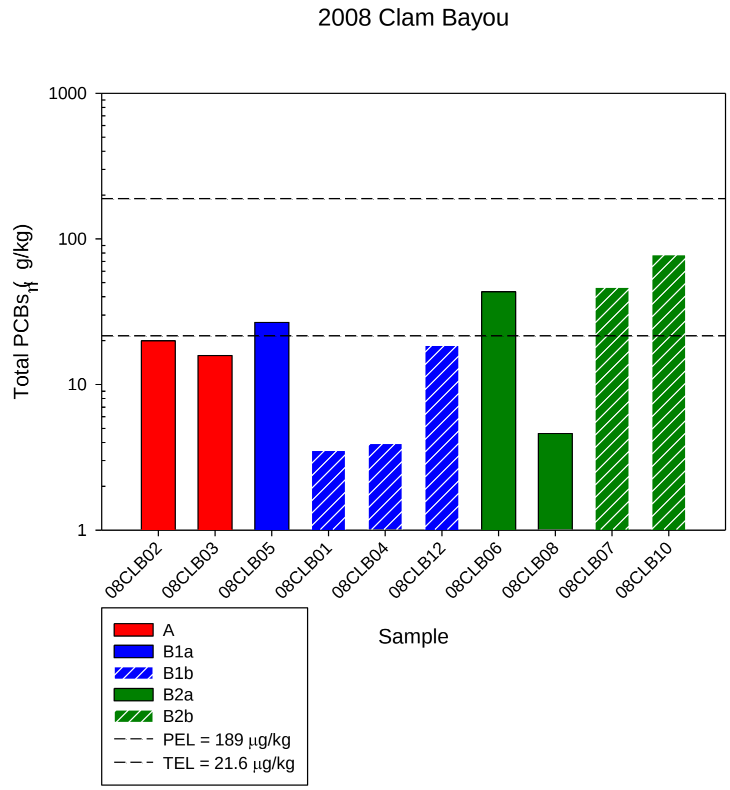



**Figure 13 Clam Bayou 2008 sediment total PCBs concentrations (µg/kg).**

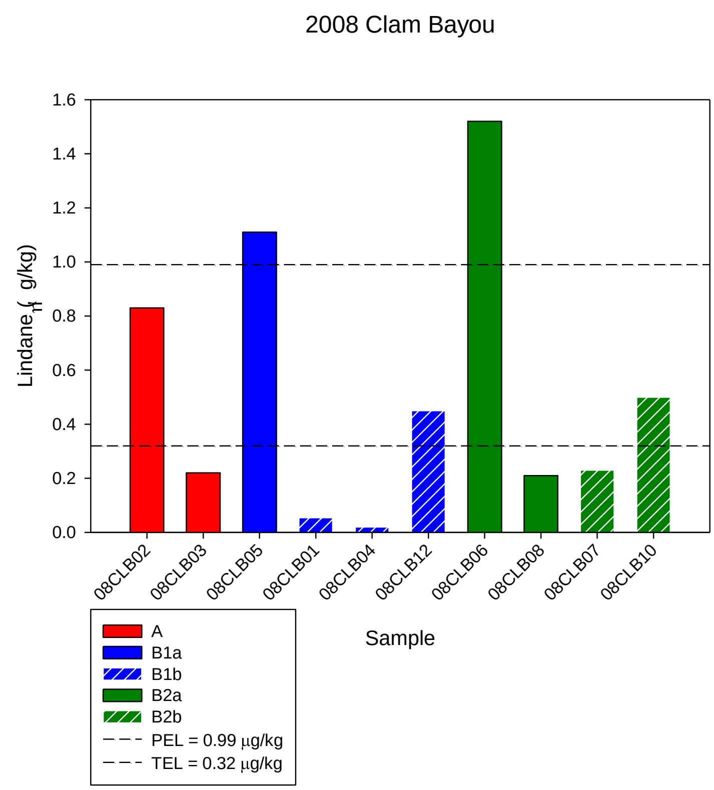



**Figure 14 Clam Bayou 2008 sediment lindane concentrations (µg/kg).**

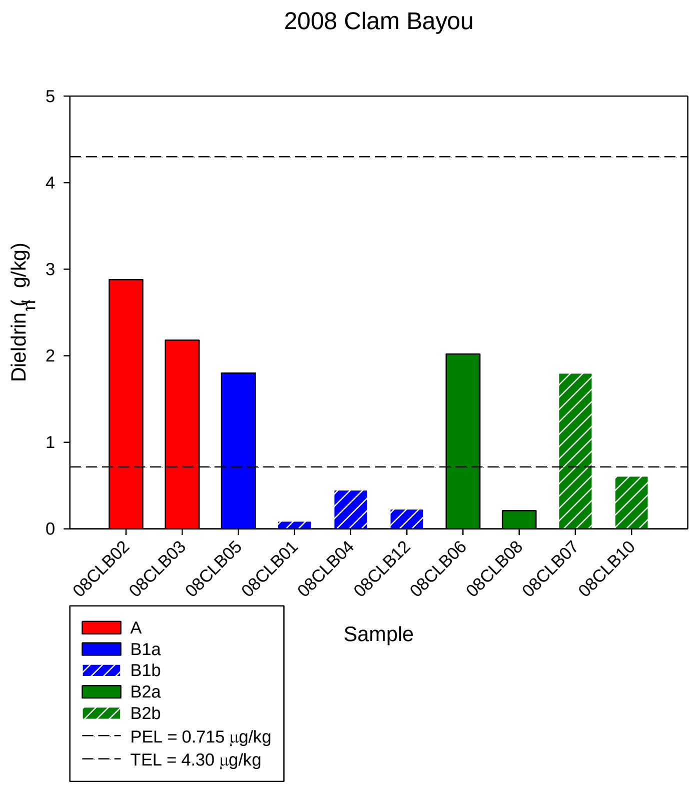



**Figure 15  Clam Bayou 2008 sediment dieldrin concentrations (µg/kg).**

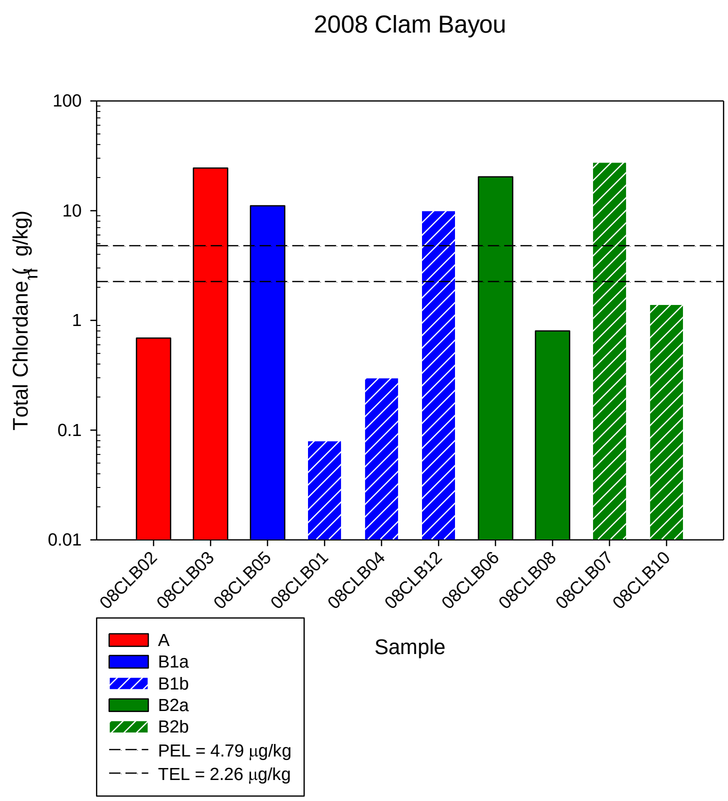



**Figure 16  Clam Bayou 2008 sediment total chlordane concentrations (µg/kg).**

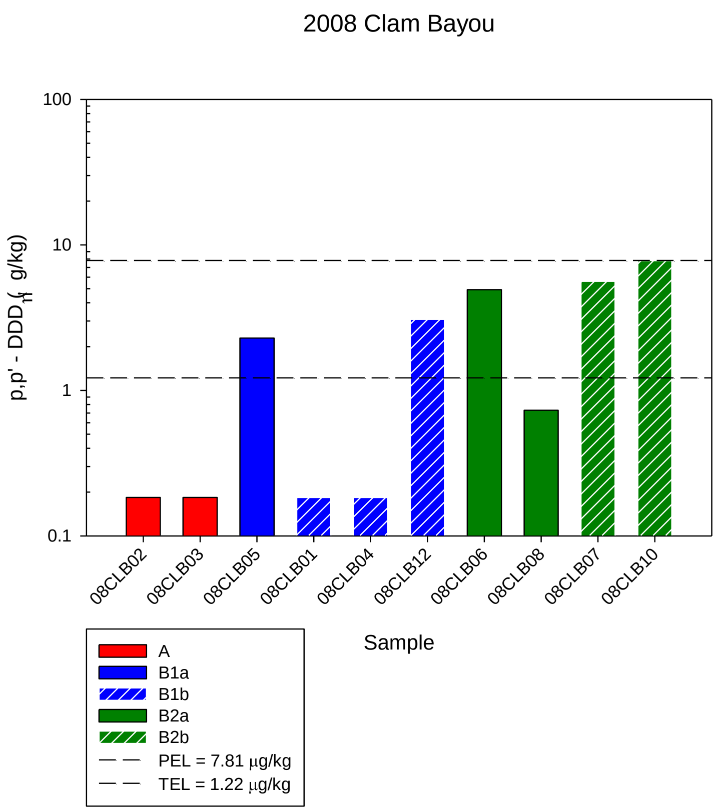



**Figure 17 Clam Bayou 2008 sediment p,p'-DDD concentrations (µg/kg).**

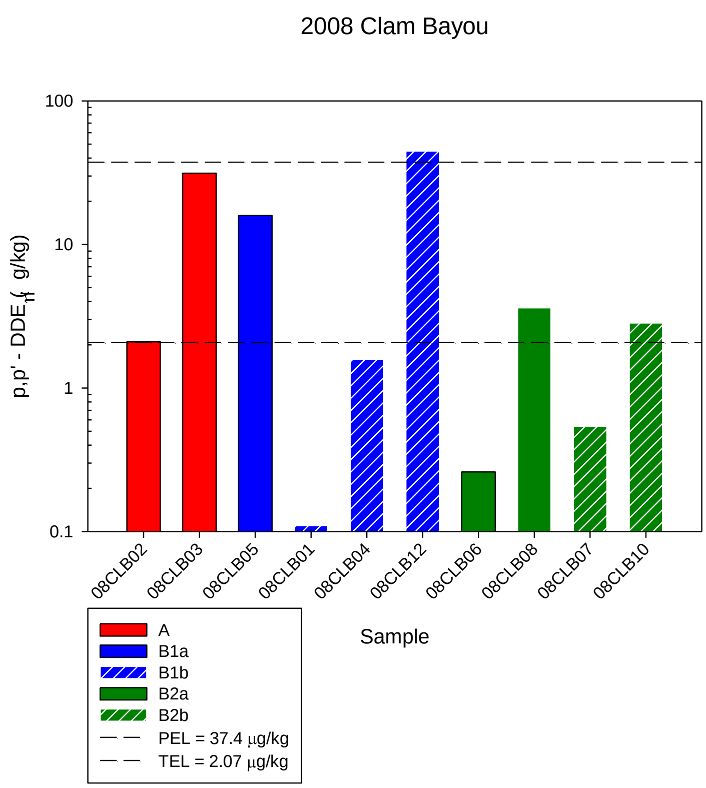



**Figure 18 Clam Bayou 2008 sediment p,p'-DDE concentrations (µg/kg).**

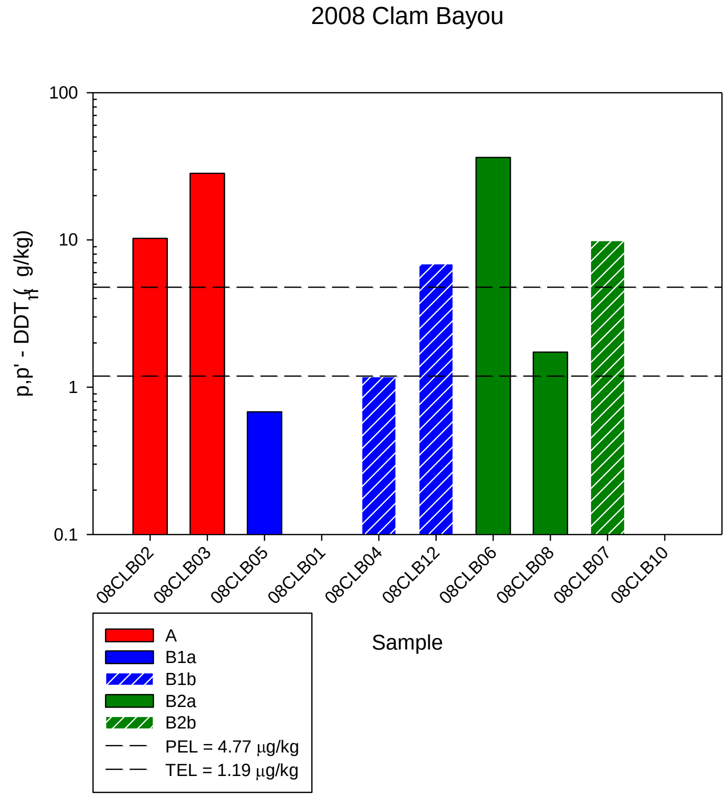



**Figure 19  Clam Bayou 2008 sediment p,p'-DDT concentrations (µg/kg).**

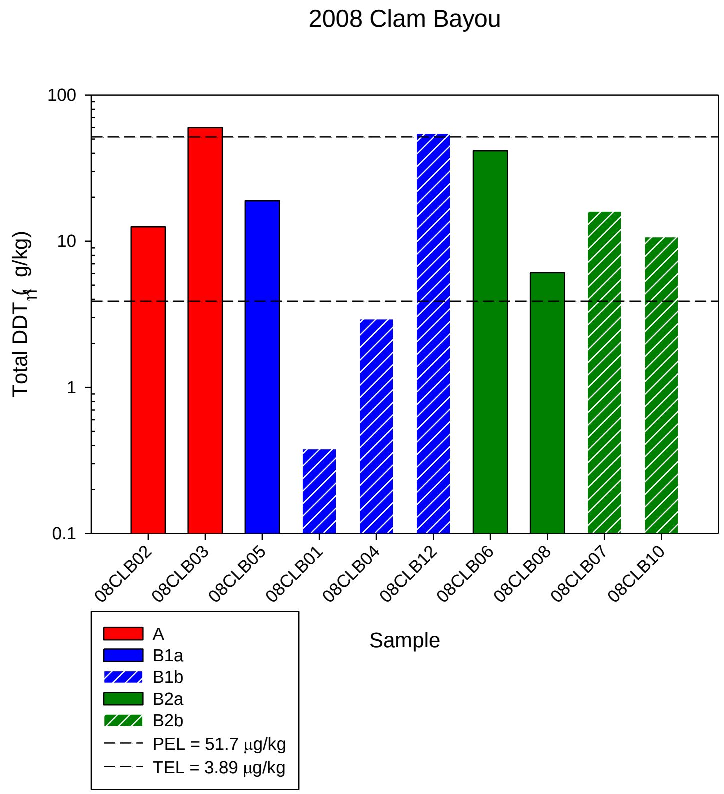



**Figure 20  Clam Bayou 2008 sediment total DDT concentrations (µg/kg).**

**Table 7  Clam Bayou 2008 sediment polycyclic aromatic hydrocarbon (PAH) concentrations (μg/kg).**

MDL = Method Detection Limit; TEL = Threshold Effects Level; PEL = Potential Effects Level.

Yellow highlighting indicates >TEL concentration. Red highlighting indicates >PEL concentration. Blue highlighting indicates MDL>TEL.

| Bray-Curtis Similarity Grouping | | | | A | | B | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | B1 | | | | B2 | | | |
| | | | | | | B1a | B1b | | | B2a | | B2b | |
| **PAH** | **MDL** | **TEL** | **PEL** | **08CLB02** | **08CLB03** | **08CLB05** | **08CLB04** | **08CLB01** | **08CLB12** | **08CLB06** | **08CLB08** | **08CLB07** | **08CLB10** |
| | | | | **Low Molecular Weight PAHs** | | | | | | | | | |
| Acenaphthene | 11.9 | 6.7 | 88.9 | <MDL | <MDL | <MDL | <MDL | <MDL | 51.98 | <MDL | <MDL | <MDL | 99.23 |
| Acenaphthylene | 12.15 | 5.9 | 128 | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL | <MDL |
| Anthracene | 23.07 | 46.9 | 245 | 138.65 | 216.33 | 70.31 | 100.81 | 43.48 | 178.22 | <MDL | 70.51 | 52.17 | 258.00 |
| Fluorene | 10.85 | 21.2 | 144 | 50.42 | <MDL | <MDL | 28.23 | <MDL | 44.55 | <MDL | <MDL | <MDL | 79.38 |
| Naphthalene | 11.45 | 34.6 | 391 | 44.12 | 81.12 | <MDL | <MDL | 13.59 | 21.63 | <MDL | <MDL | <MDL | 78.74 |
| Phenanthrene | 19.33 | 86.7 | 544 | 1171.33 | 2040.73 | 631.51 | 866.02 | 371.36 | 1469.01 | 186.21 | 69.22 | 500.87 | 2340.54 |
| Total LMW PAHs | NA | 312 | 1440 | 1416.55 | 2355.64 | 725.01 | 1012.82 | 445.89 | 1771.47 | 230.23 | 162.92 | 576.23 | 2861.97 |
| | | | | **High Molecular Weight PAHs** | | | | | | | | | |
| Benzo(a)anthracene | 23.81 | 74.8 | 693 | 2691.11 | 3948.08 | 914.04 | 1254.03 | 703.79 | 2472.77 | 520.83 | 173.08 | 984.76 | 4624.12 |
| Benzo(a)pyrene | 22.57 | 88.8 | 763 | 4140.65 | 6557.60 | 1320.28 | 1693.55 | 1005.41 | 3415.84 | 923.61 | 250.00 | 1480.40 | 7204.10 |
| Chrysene | 21.15 | 108 | 846 | 4002.00 | 7071.39 | 1460.90 | 1915.32 | 1135.84 | 3215.35 | 840.28 | 256.41 | 1480.40 | 6946.10 |
| Dibenzo(a,h)anthracene | 14.98 | 6.2 | 135 | 1020.98 | 1527.85 | 367.18 | 463.71 | 304.34 | 920.79 | 270.83 | 83.33 | 410.86 | 2024.29 |
| Fluoranthene | 28.41 | 113 | 1490 | 5388.52 | 10735.53 | 2609.31 | 3669.35 | 1676.59 | 5175.74 | 1076.39 | 365.38 | 2295.59 | 11272.53 |
| Pyrene | 23.27 | 153 | 1400 | 5873.80 | 10586.80 | 2156.20 | 2971.77 | 1508.11 | 5183.17 | 1118.06 | 326.92 | 2256.47 | 12225.13 |
| Total HMW PAHs | NA | 655 | 6680 | 23117.06 | 40427.25 | 8827.91 | 11967.73 | 6334.08 | 20383.66 | 4750.00 | 1455.12 | 8908.48 | 44296.27 |
| | | | | | | | | | | | | | |
| Total PAHs | **NA** | 1680 | 16800 | 24533.61 | 42782.89 | 9552.92 | 12980.55 | 6779.97 | 22155.13 | 4980.23 | 1618.04 | 9484.71 | 47158.24 |
| | | | | | | | | | | | | | |
| | | | | **Other PAHs** | | | | | | | | | |
| Benzo(b)fluoranthene | 16.74 | **NA** | **NA** | 5319.19 | 7815.04 | 1578.09 | 2213.71 | 1339.64 | 3274.75 | 1354.17 | 320.51 | 1897.78 | 9744.38 |
| Benzo(k)fluoranthene | 17.07 | **NA** | **NA** | 3327.65 | 4813.41 | 1226.53 | 1302.42 | 872.26 | 2910.89 | 763.89 | 256.41 | 1147.80 | 6013.34 |
| Indeno(1,2,3-c,d)pyrene | 17.05 | **NA** | **NA** | 2842.37 | 4583.56 | 1007.79 | 1177.42 | 828.78 | 2205.45 | 784.72 | 237.18 | 1154.32 | 5457.65 |
| Benzo(g,h,i)perylene | 17.84 | **NA** | **NA** | 2905.39 | 4624.12 | 937.48 | 1173.39 | 850.52 | 2079.21 | 756.94 | 250.00 | 1108.67 | 5398.11 |
| Retene | 20.17 | **NA** | **NA** | 214.28 | <MDL | <MDL | <MDL | <MDL | 103.96 | <MDL | <MDL | <MDL | 337.38 |
| Coronene | 20.27 | **NA** | **NA** | 1707.94 | 2555.44 | 546.86 | 637.10 | 472.81 | 987.62 | 340.28 | 121.79 | 547.81 | 2460.90 |

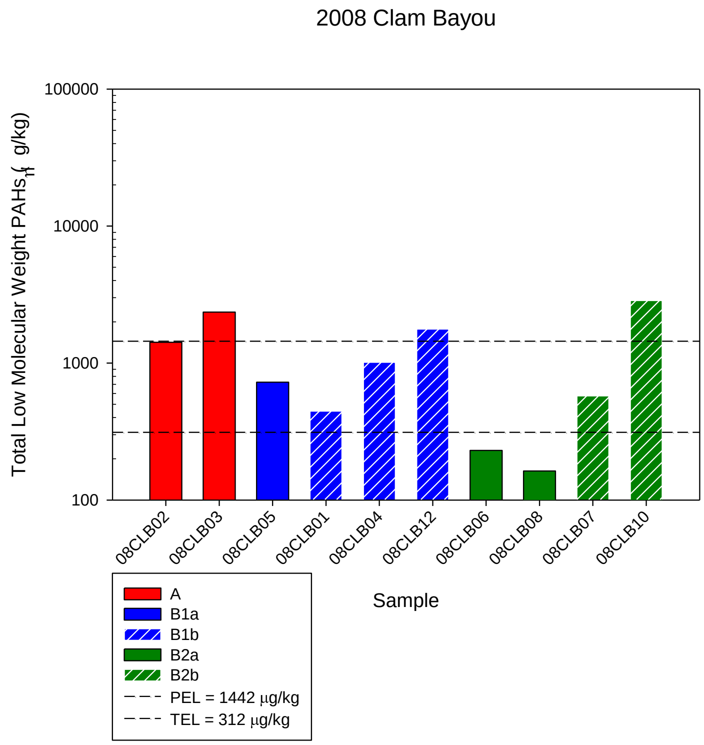



**Figure 21  Clam Bayou 2008 sediment low molecular weight PAH concentrations (µg/kg).**

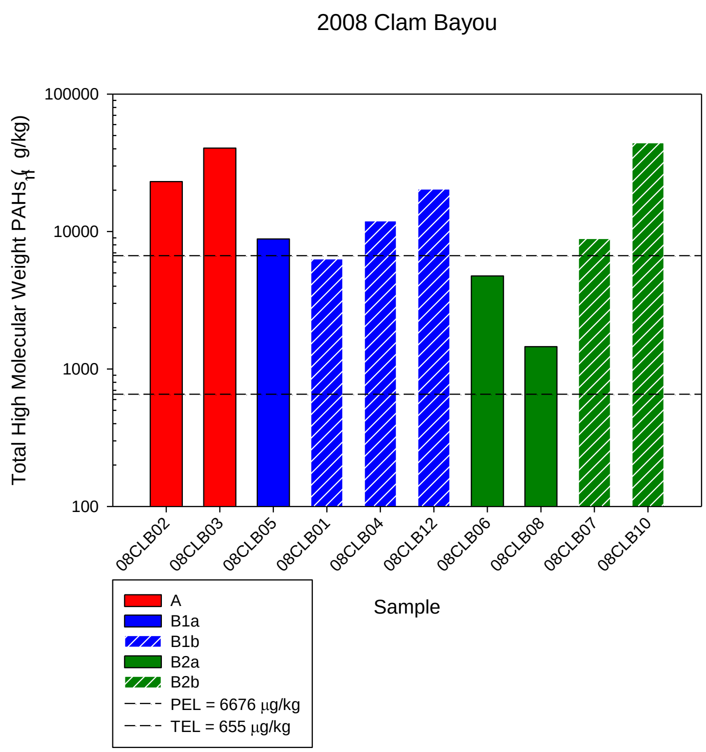



**Figure 22  Clam Bayou 2008 sediment high molecular weight PAH concentrations (µg/kg).**

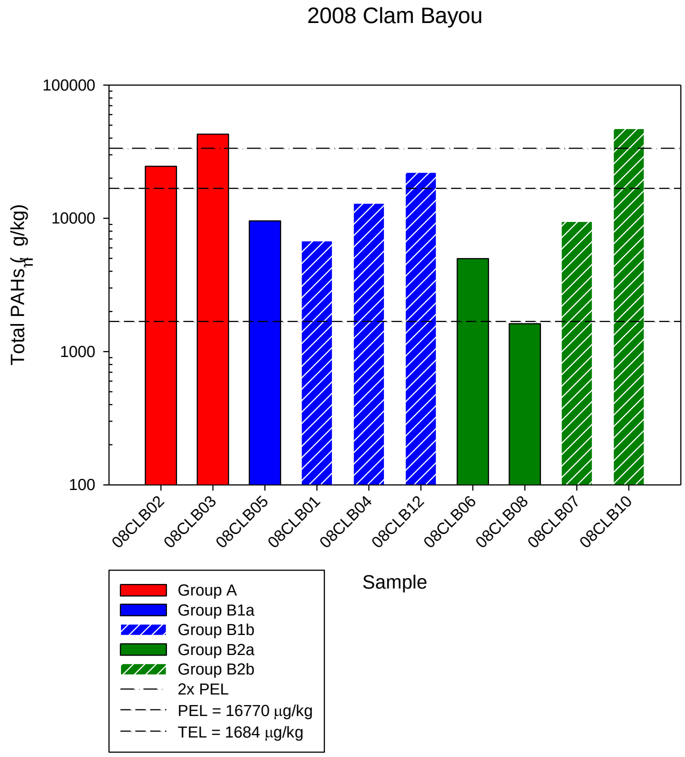



**Figure 23 Clam Bayou 2008 sediment total PAH concentrations (µg/kg).**

## *Comparison on Biological and Physical Variables.*

A BIO-ENV analysis was run on the water quality + silt/clay dataset to look for correlations between these various physical parameters and structure of the benthic community seen in the similarity analysis. Results found the highest correlation ($\rho = 0.499$) was due to a combination of depth and the percent silt+clay. The percent silt+clay had the strongest single variable correlation ($\rho = 0.460$) of the measured parameters followed by depth ($\rho = 0.198$).

## *Comparison with TBEP Baseline and 2001 FDEP data.*

The similarity analysis of the benthic community composition between the 2008 TBEP and 2001 FDEP Clam Bayou sites is shown in Figure 24. The resulting dendrogram shows three primary clusters of sites with a similar topology as seen in Figure 2. Two of the 2001 FDEP sites (01FDEP05 and 01FDEP06) grouped with the two “Group A” sites from 2008. SIMPER analysis indicated that the similarity among these sites was due to tubificinae oligochaetes and all four sites were characterized by relatively low species richness and abundances. The remaining four 2001 FDEP sites grouped with the four 2008

"Group B1" sites from Figure 2. Within this grouping, site 01FDEP07 fell out from the rest of the sites (Figure 24) due possibly to the dominance of mollusks at this site. The SIMPER analysis showed that the similarity within this grouping was largely due to the presence of *Laeonereis culveri*. The remaining four 2008 sites followed the same clustering pattern as Group B2 and its subgroups B2a and B2b as seen in Figure 2.

The similarity analysis between the 2008 TBEP and the selected TBEP reference sites is shown in Figure 25. One reference site grouped with the two Group A sites from Clam Bayou. SIMPER analysis showed that these three sites were grouped based on the presence of tubifid oligochaetes. One of the reference sites (06LTB02) fell out as an outlier to the remaining sites. This site was dominated by the bivalve *Anadara transversa* and polychaete *Prionospio multibranchiata*. The remaining sites formed two groups with the 2008 Clam Bayou samples separating out from the TBEP reference sites (Figure 25), with a single Clam Bayou site (08CLB07) grouping with the TBEP reference sites. The SIMPER analysis indicated that similarity among the Clam Bayou group was due to *Laeonereis culveri*, and the topology within this cluster was basically the same as Figure 2. The grouping of the TBEP reference sites plus 08CLB07 was due to the polychaetes *Monticellina cf. dorsobranchialis* and *Carazziella hobsonae*.

The 2008 Clam Bayou sites had more taxa present than the 2001 FDEP samples (Figure 26), but the mean number of taxa was not significantly higher (t-test; $p = 0.194$). The mean number of taxa at the 2008 Clam Bayou sites was lower relative to the TBEP reference sites (Figure 27), however the mean values were not found to be significantly different (t-test; $p=0.115$). It should be noted that the statistical power ($1-ß$) for both t-tests were low (0.337 and 0.228 respectively), suggesting the observed differences in species richness may actually be significant but cannot be determined due to small sample size or high variability in the data.

The macrofaunal abundance at the Clam Bayou sites was apparently higher in 2008 than in 2001 (Figure 28). The mean values were not found to be significantly different (t-test; $p=0.539$), however the statistical power of the t-test was low ($1-ß = 0.05$). The 2008 Clam Bayou macrofaunal abundance was lower than at the TBEP reference sites (Figure 29), however the mean values were not significantly different (MW; 0.391).

The Shannon diversity index values were higher in 2008 relative to the 2001 FDEP samples (Figure 30). The mean values were not found to be significantly different (t-test; $p=0.051$), however the statistical power of the t-test was low ($1-ß = 0.421$). There was no significant difference in the Shannon diversity index between the 2008 Clam Bayou sites and the TBEP reference sites (MW; $p = 0.653$) although the Clam Bayou sites were relatively lower (Figure 31). Pielou's evenness index (*J'*) was significantly higher at the 2008 Clam Bayou sites than at the 2001 FDEP sites (t-test; $p=0.003$; $1-ß = 0.942$). There was no significant difference in *J'* between the 2008 Clam Bayou and TBEP reference sites (MW; $p=0.438$).

The mean Tampa Bay Benthic Index score for the 2008 Clam Bayou sites was lower than at the 2001 FDEP sites (Figure 32) and at the TBEP reference sites (Figure 33). There was no significant difference found in the mean TBBI scores between the 2008 Clam Bayou sites and either the 2001 FDEP sites (t-test; $p = 0.062$) or the TBEP reference sites (t-test; $p=0.302$). In both cases however, the statistical power of the t-tests were low.

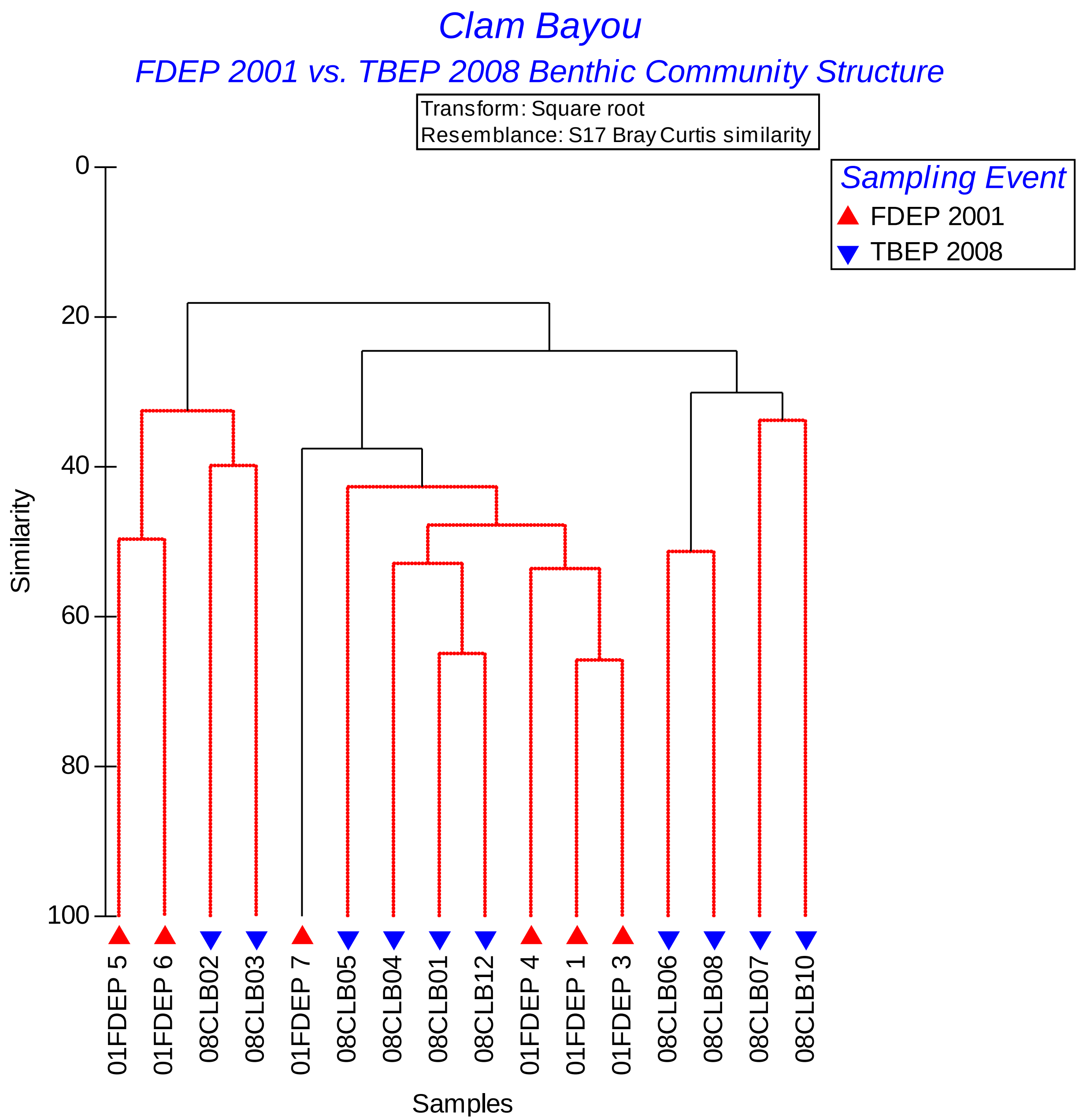



**Figure 24 Clam Bayou 2008 and 2001 FDEP Bray-Curtis similarity analysis.**

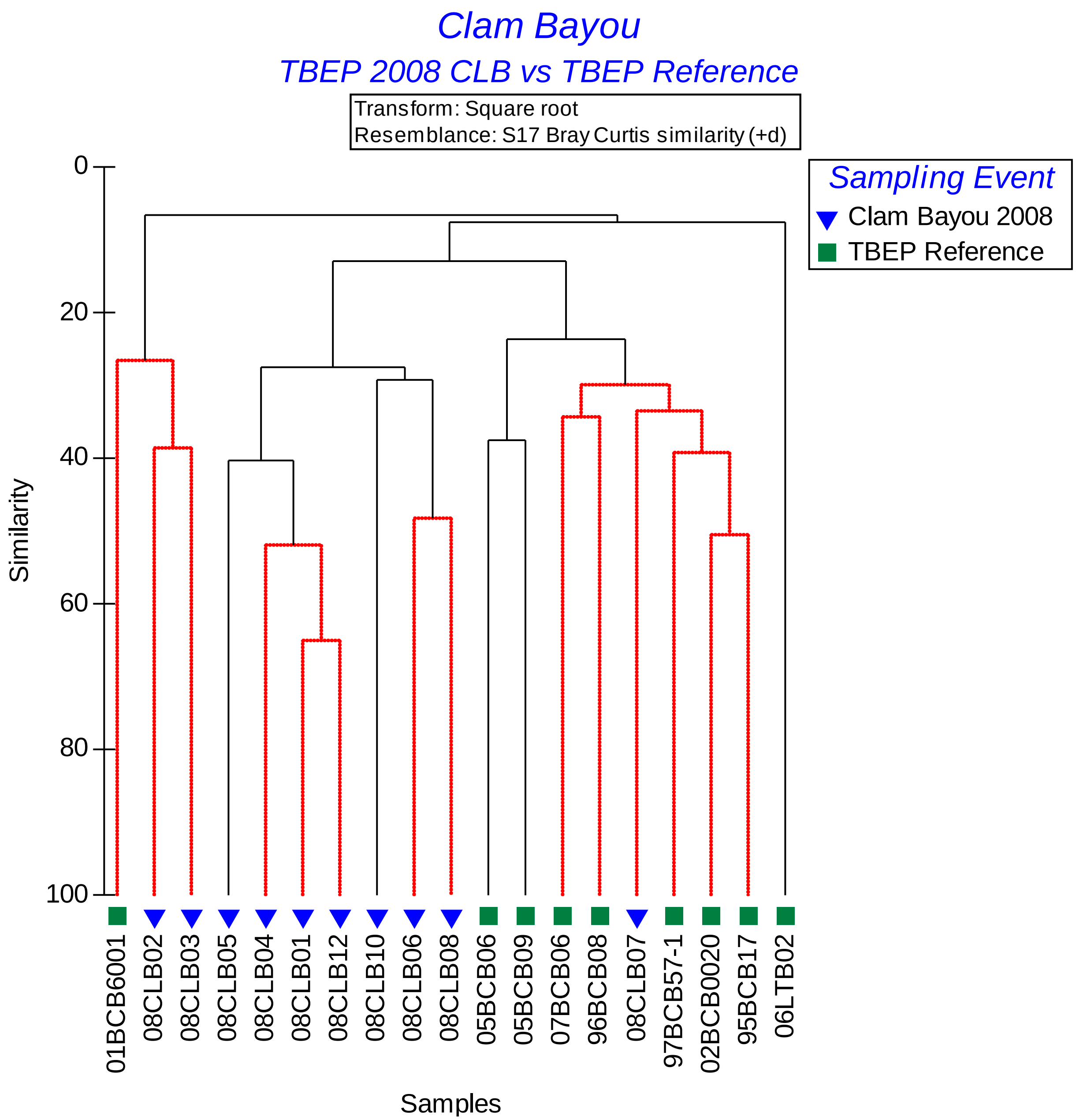



**Figure 25 Clam Bayou 2008 and TBEP reference Bray-Curtis similarity analysis.**

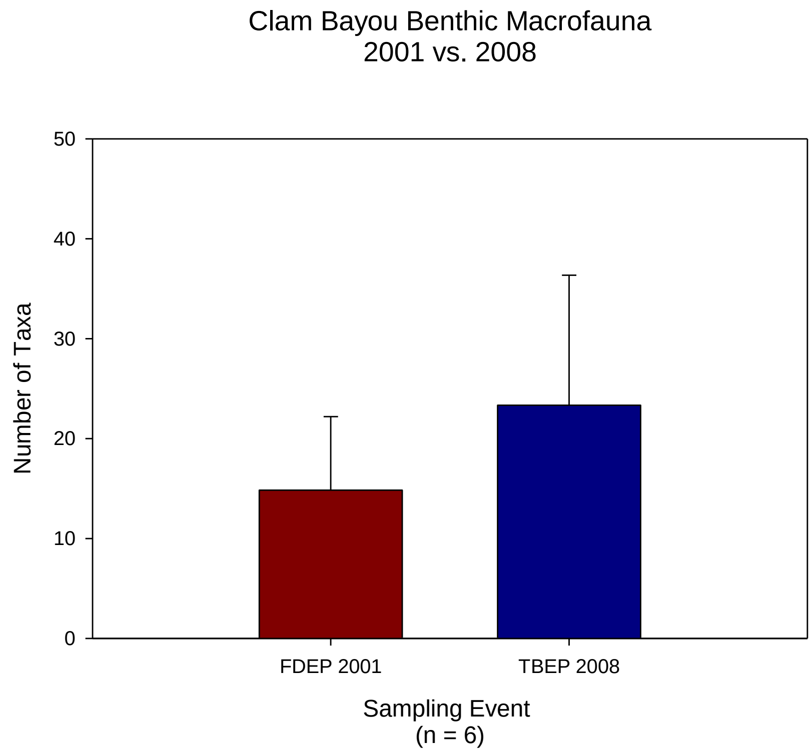



**Figure 26  Clam Bayou 2001 vs. 2008 species richness.**

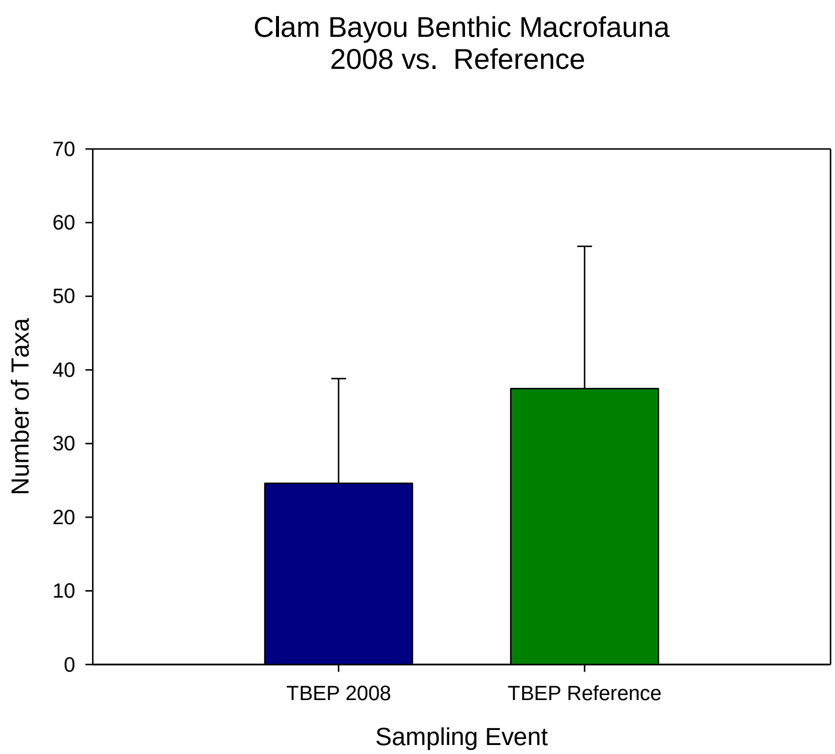



**Figure 27  Clam Bayou 2008 vs. TBEP reference sites species richness.**

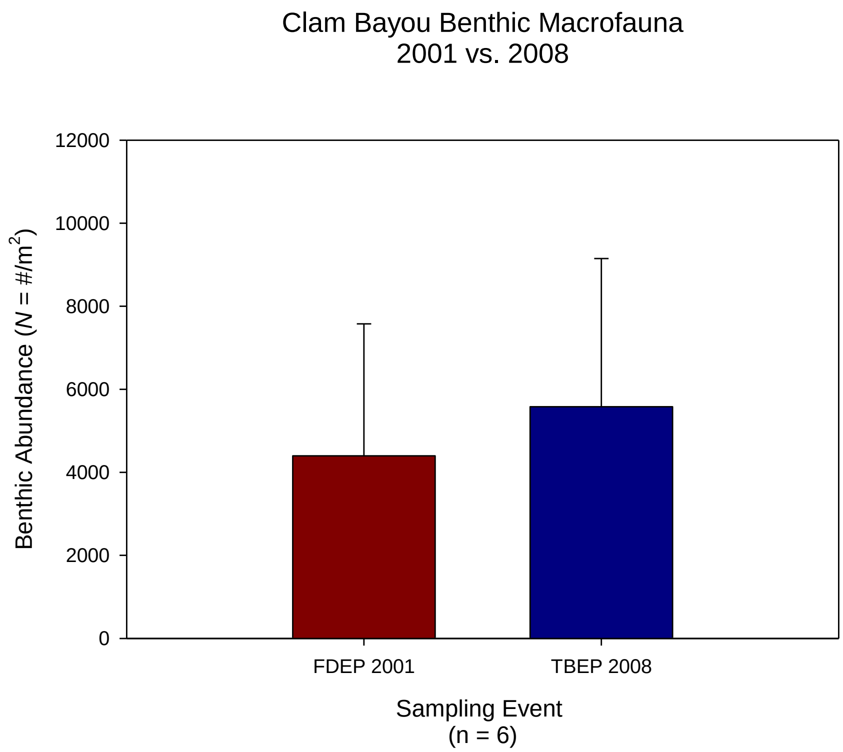



**Figure 28 Clam Bayou 2001 vs. 2008 benthic abundance.**

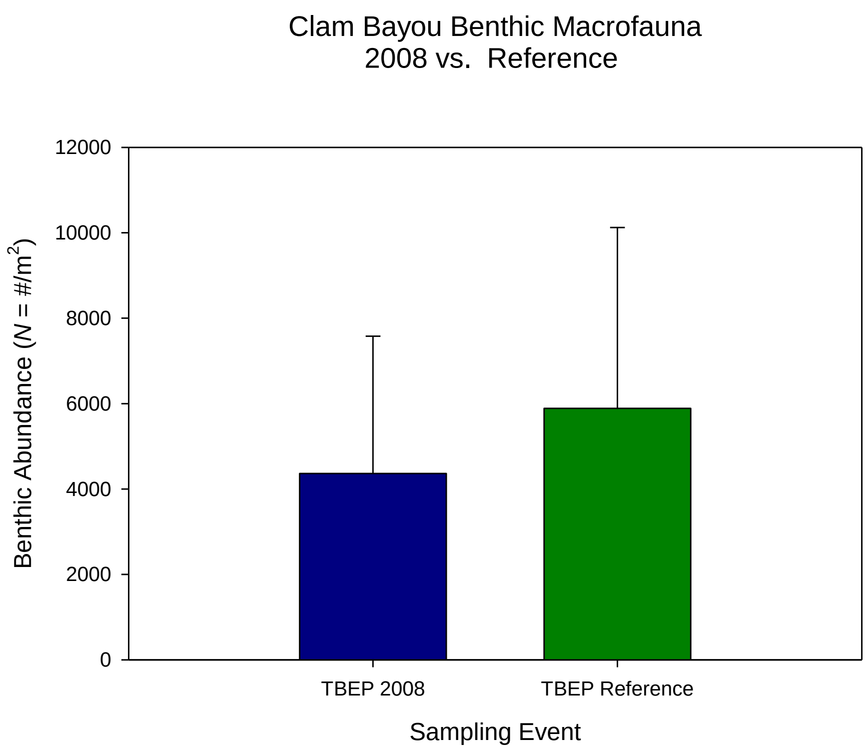



**Figure 29 Clam Bayou 2008 vs. TBEP reference sites benthic abundance.**

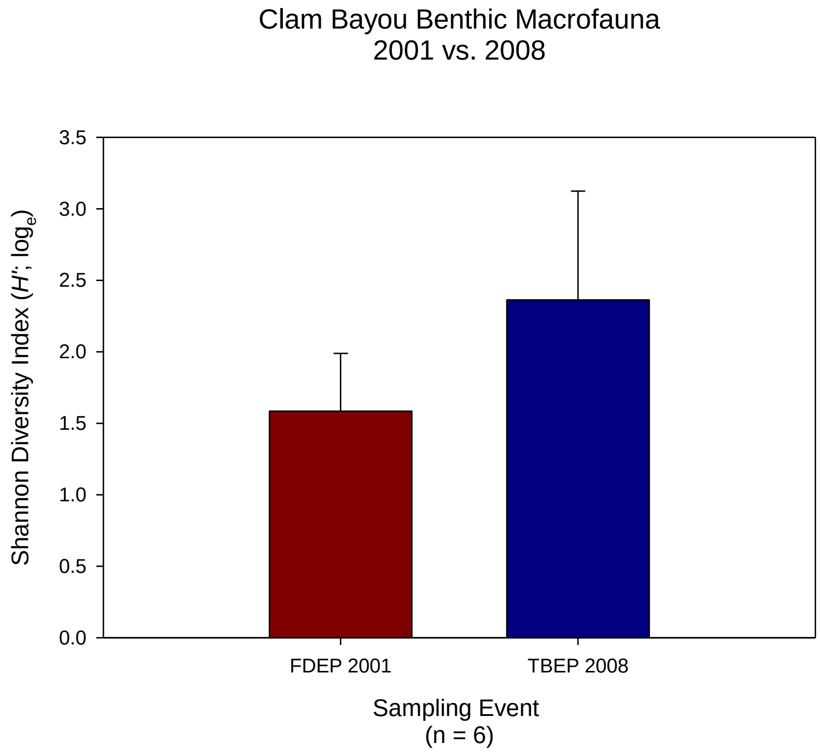



**Figure 30  Clam Bayou 2001 vs. 2008 Shannon diversity index.**

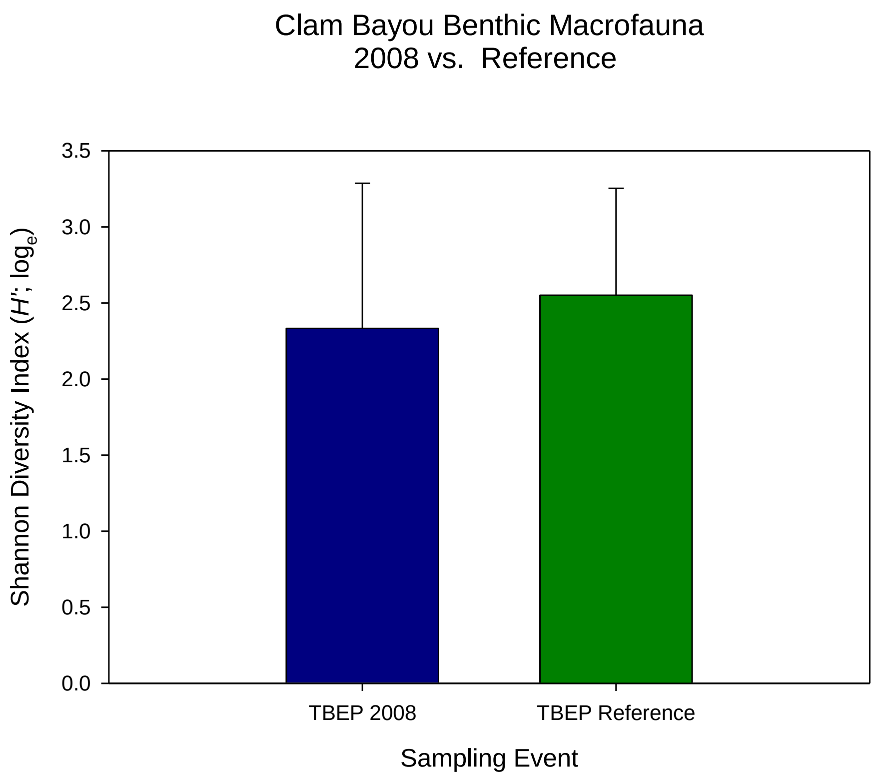



**Figure 31  Clam Bayou 2008 vs. TBEP reference sites Shannon diversity index.**

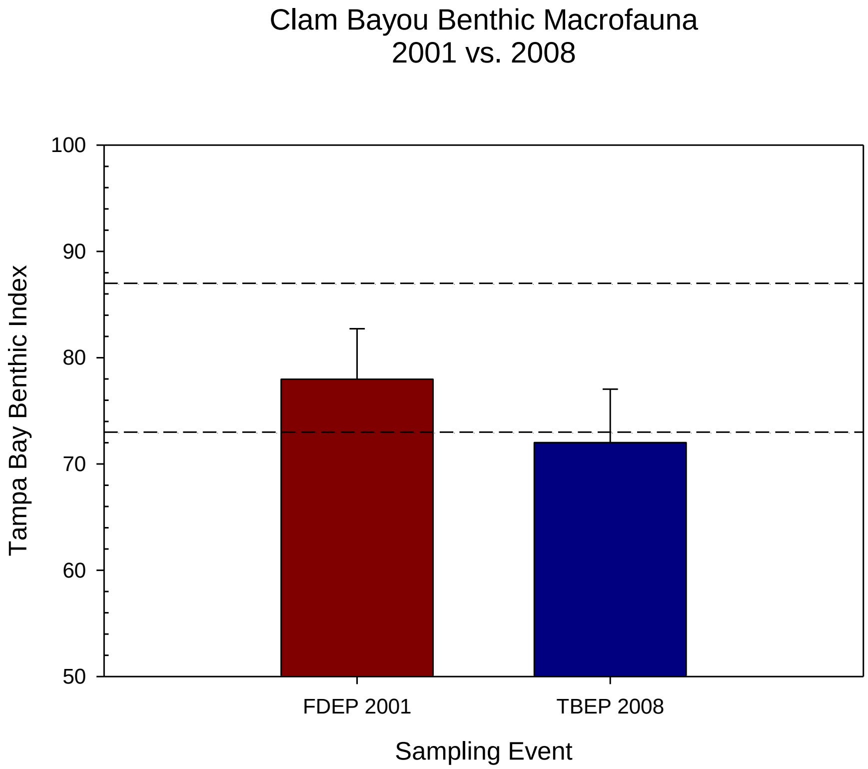



**Figure 32  Clam Bayou 2001 vs. 2008 Tampa Bay Benthic Index.**

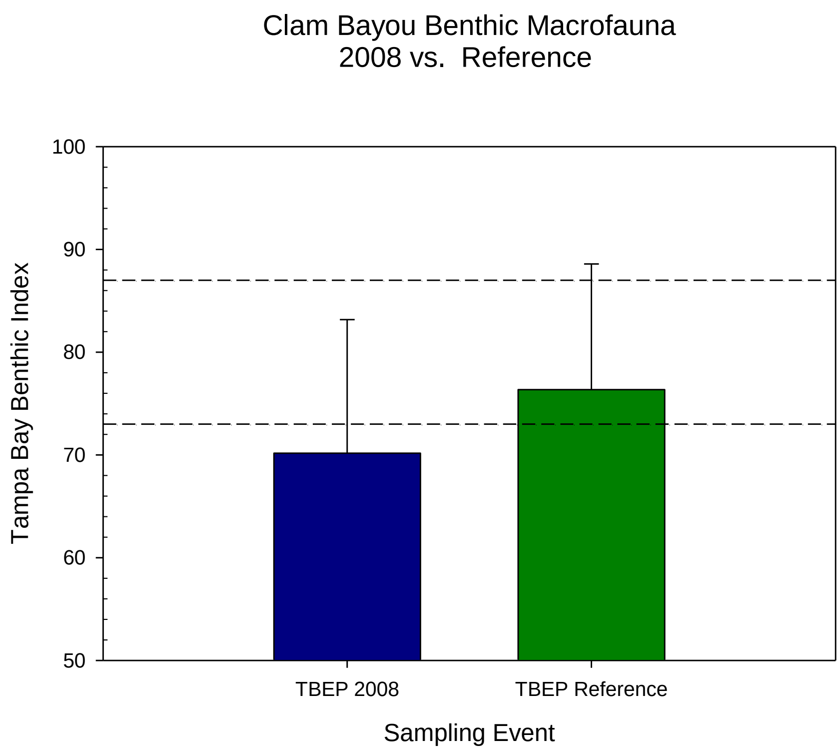



**Figure 33  Clam Bayou 2008 vs. TBEP reference sites Tampa Bay Benthic Index.**

Sediment metals results for four of the metal contaminants (Cd, Cu, Pb, Zn) which were above their respective TEL threshold concentrations at several of the 2008 Clam Bayou sites are shown in Figures 34-37. Concentrations were generally higher in the 2008 samples than in either the 2001 FDEP or TBEP reference samples. For Cd and Cu the 2008 levels were significantly higher than the 2001 FDEP samples but were not significantly different from the TBEP reference sites (KW; $p<0.001$). The 2008 samples were significantly higher in Pb and Zn than both the 2001 FDEP samples and the TBEP reference sites. There were no significant differences found between the 2001 FDEP and TBEP reference sites.

Organic sediment contaminants (PCBs, pesticides, PAHs) at the 2008 Clam Bayou sites were compared with the TBEP reference sites but the 2001 FDEP sampling event did not test for these contaminants. The mean concentration of PCBs in the 2008 Clam Bayou samples was greater than the TEL concentration (Figure 38) and significantly higher than at the TBEP reference sites (MW; $p<0.001$). The pesticide lindane (Figure 39) was significantly higher in Clam Bayou by an order of magnitude (MW; $p=0.003$), with a mean concentration exceeding the TEL. Dieldrin (Figure 40) was also significantly higher in Clam Bayou (MW; $p>0.001$), where the mean value exceeded its TEL concentration and was an order of magnitude higher than at the reference sites (Figure 40). Total chlordane levels in Clam Bayou were two orders of magnitude greater than at the TBEP reference sites (MW; $p=0.002$) and the mean value exceeded the PEL threshold concentration (Figure 41). The three measured DDT break-down products and total DDT all were significantly higher in the Clam Bayou sediments compared to the reference sites (MW; $P<0.001$). Levels of p,p'-DDD (Figure 42) were an order of magnitude higher in Clam Bayou and the mean concentration was above its TEL. The mean concentration of p,p'-DDE in Clam Bayou was above its TEL and was two orders of magnitude higher than at the reference sites (Figure 43). The mean concentration of p,p'-DDT in Clam Bayou exceeded its PEL threshold and was also two orders of magnitude greater than at the reference sites (Figure 44). Total DDT concentrations were also two orders of magnitude higher in Clam Bayou relative to the reference sites, and the mean concentration in Clam Bayou was above the TEL (Figure 45).

Polycyclic aromatic hydrocarbons (PAHs) levels were greatly elevated in Clam Bayou and both the low molecular weight and high molecular weight PAH's were generally two orders of magnitude higher than at the reference sites (Figures 46-48). The low molecular weight PAHs (figure 46) had a mean value in Clam Bayou above its TEL and was significantly higher than at the reference sites (MW; $p<0.001$). Mean concentrations for both the high molecular weight (Figure 47) and for total PAHs (Figure 48) were above their PELs and were significantly higher than at the TBEP reference sites (MW; $p<0.001$).

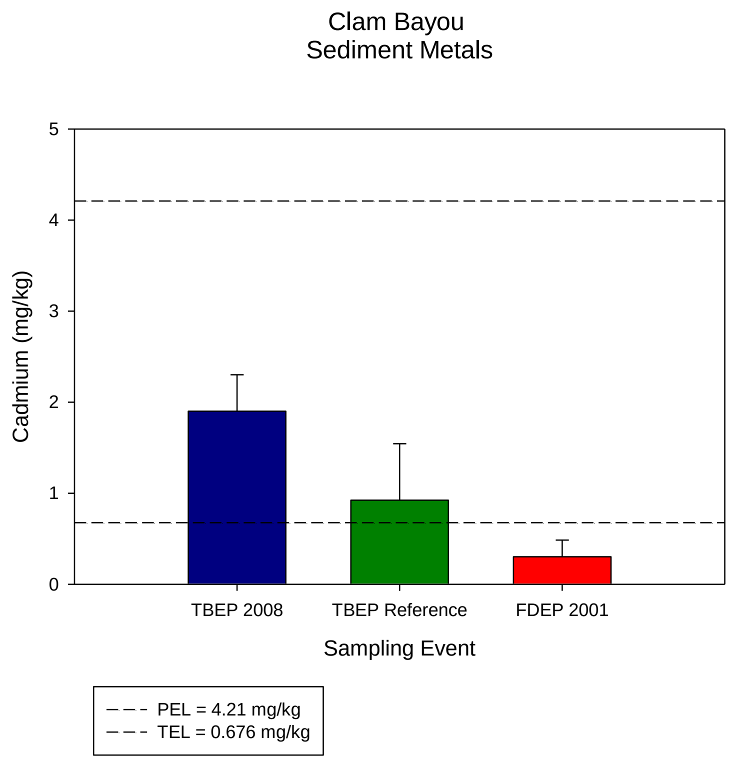



**Figure 34 Sediment cadmium concentrations (mg/kg) by sampling event.**

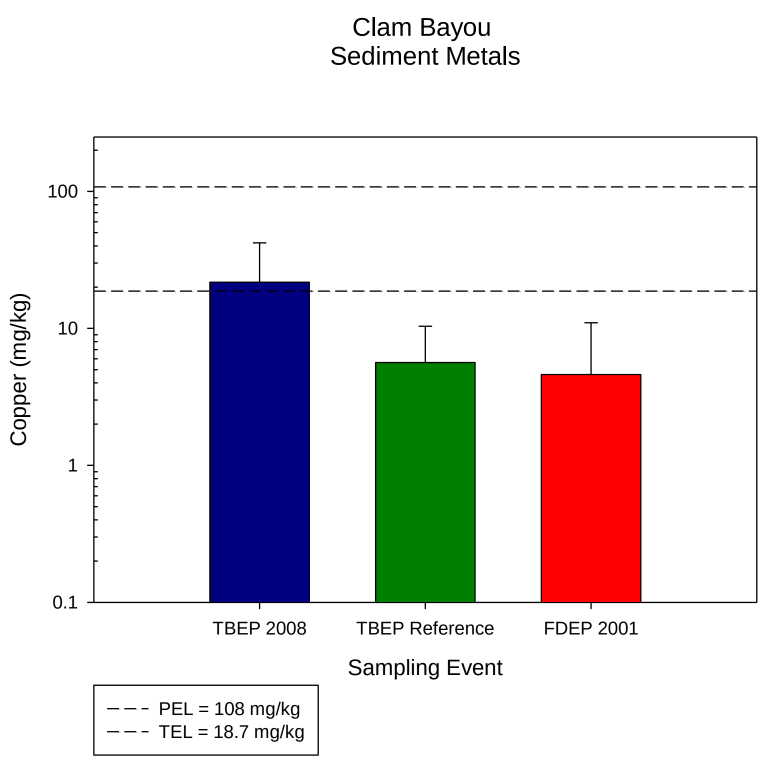



**Figure 35 Sediment copper concentrations (mg/kg) by sampling event.**

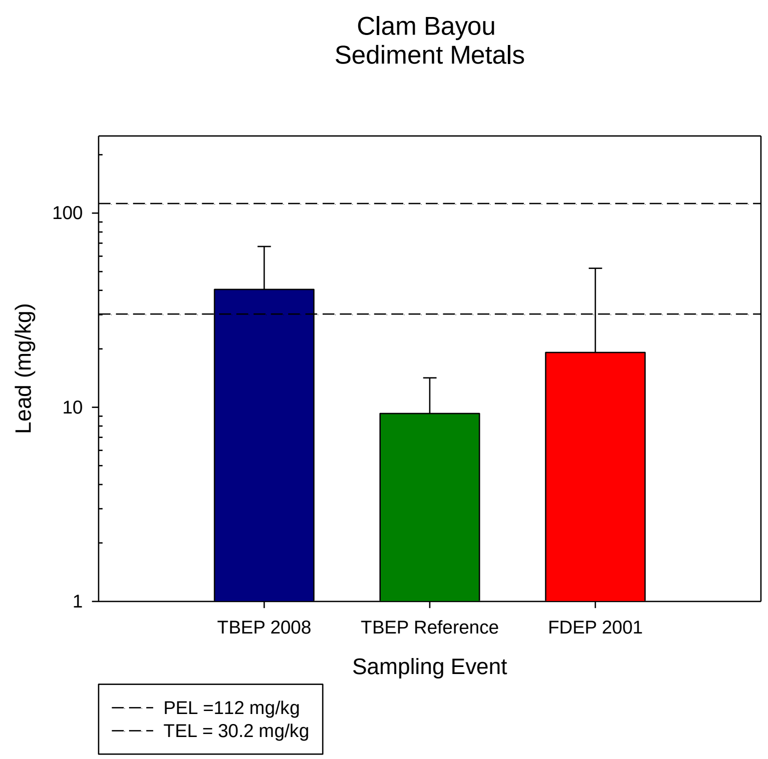



**Figure 36  Sediment lead concentrations (mg/kg) by sampling event.**

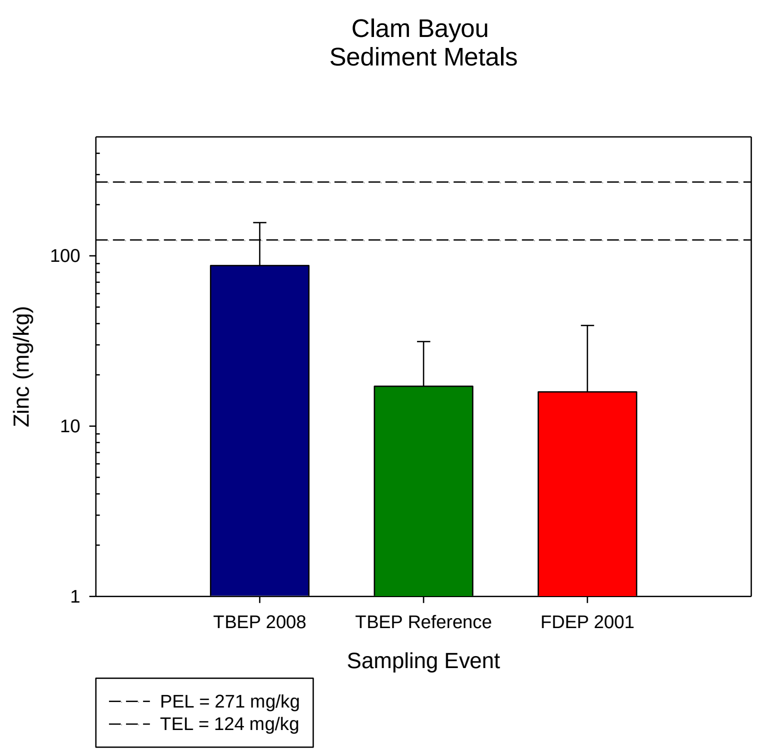



**Figure 37  Sediment zinc concentrations (mg/kg) by sampling event.**

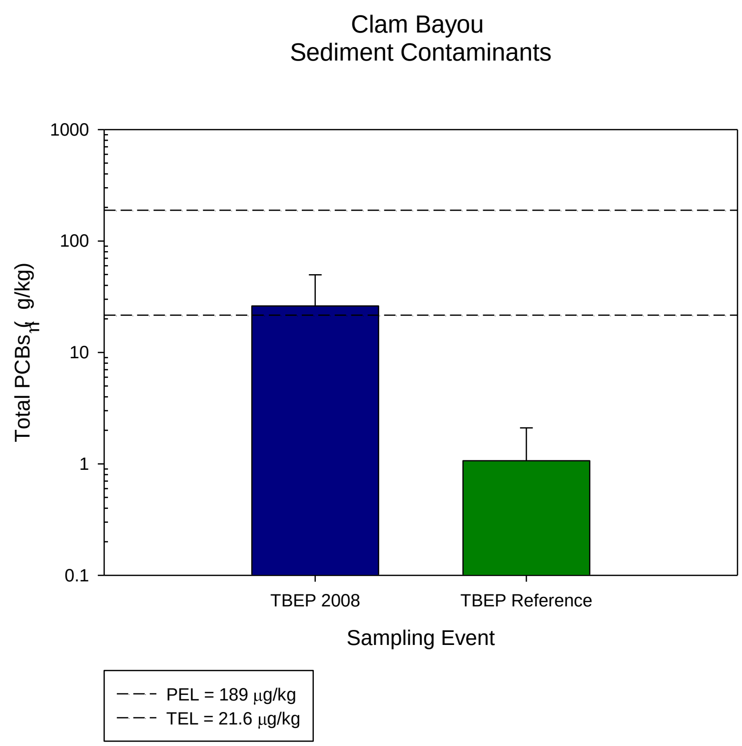



**Figure 38 Clam Bayou 2008 vs. TBEP reference sites sediment PCB concentrations (µg/kg).**

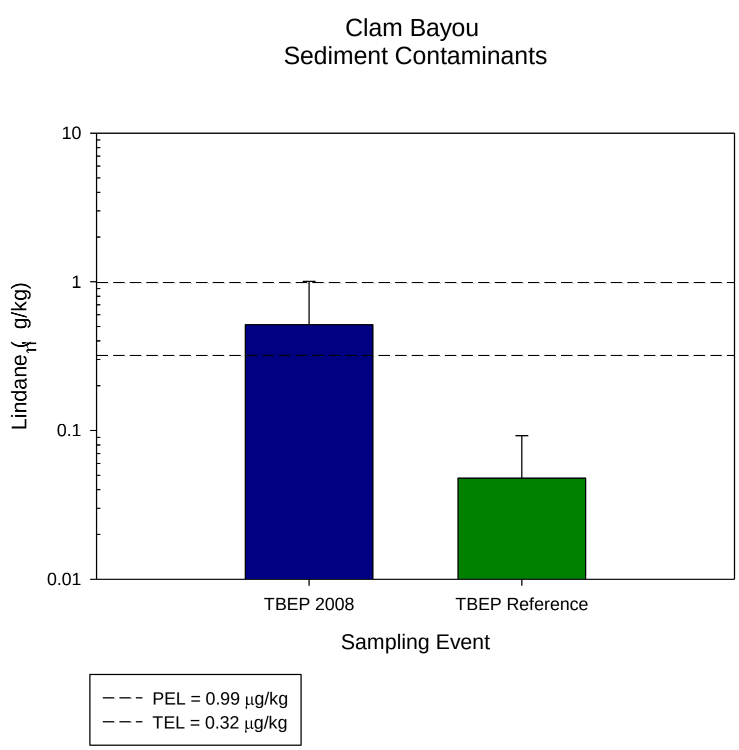



**Figure 39 Clam Bayou 2008 vs. TBEP reference sites sediment lindane concentrations (µg/kg).**

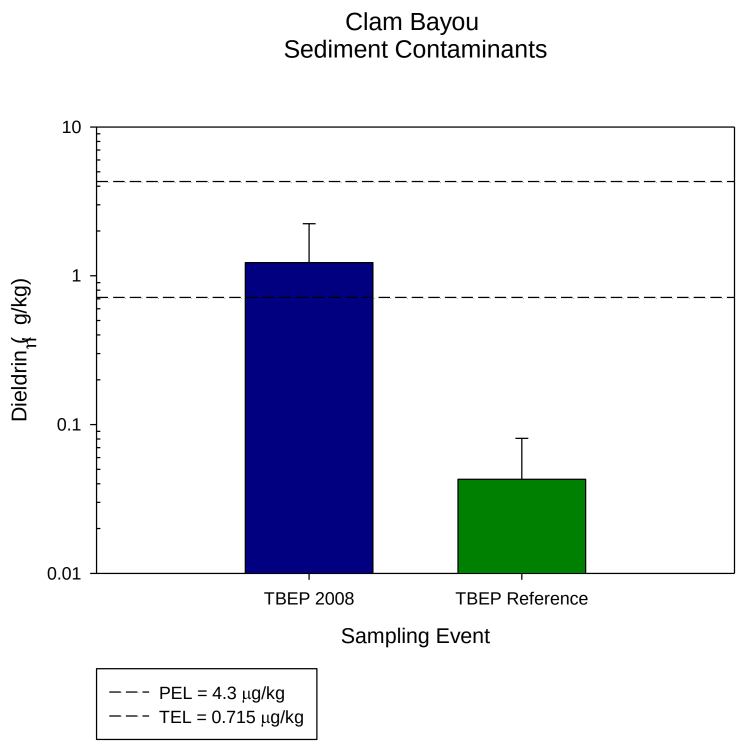



**Figure 40 Clam Bayou 2008 vs. TBEP reference sites sediment dieldrin concentrations (µg/kg).**

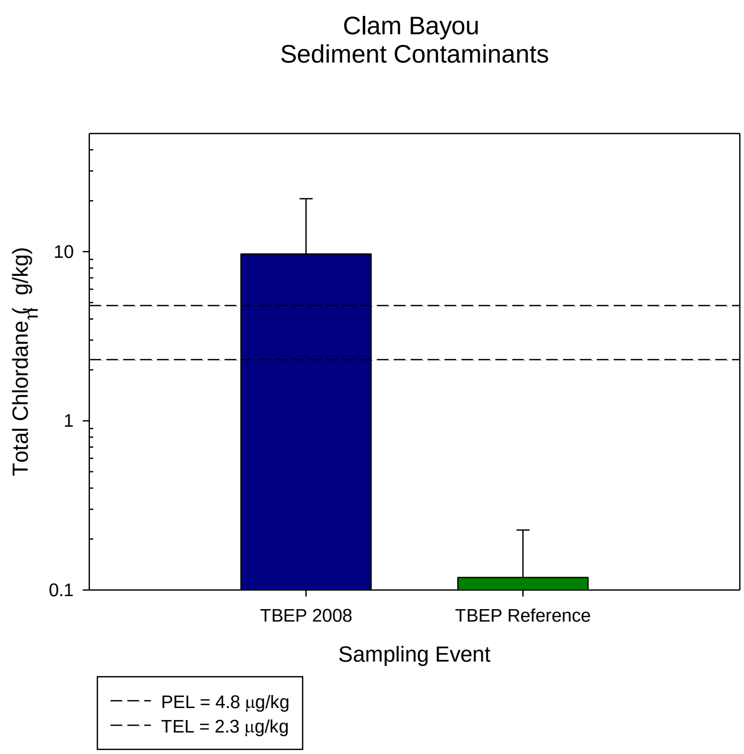



**Figure 41 Clam Bayou 2008 vs. TBEP reference sites sediment total chlordane concentrations (µg/kg).**

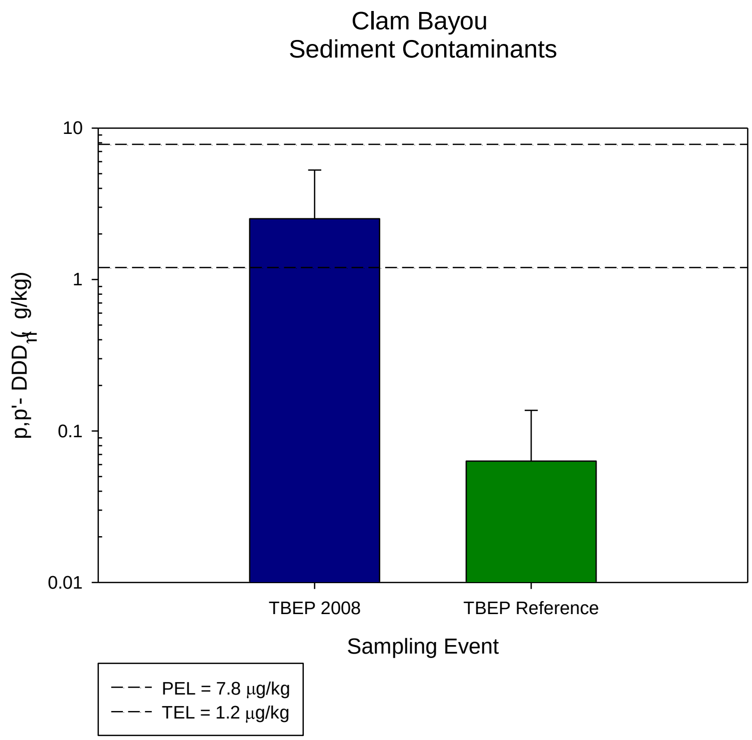



**Figure 42 Clam Bayou 2008 vs. TBEP reference sites sediment p,p'-DDD concentrations (µg/kg).**

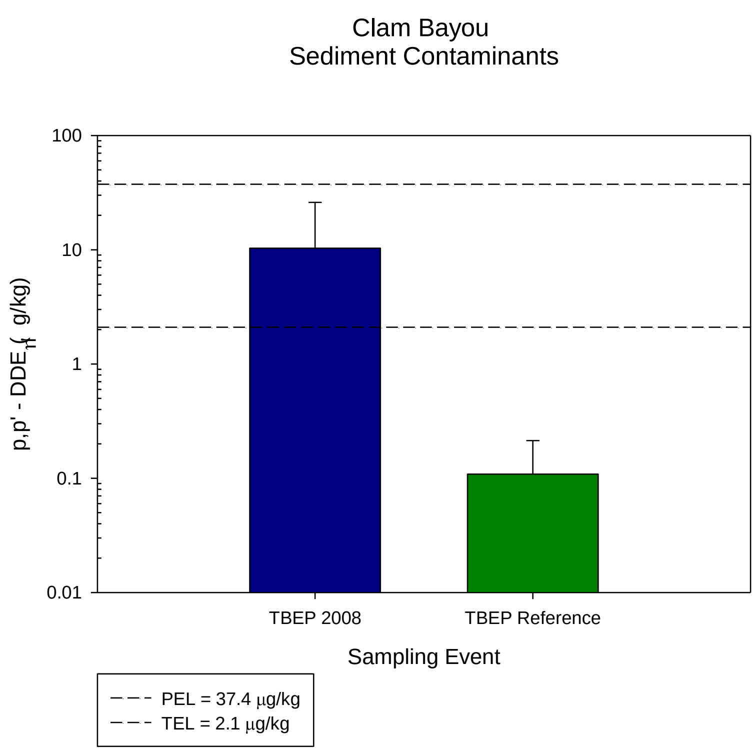



**Figure 43 Clam Bayou 2008 vs. TBEP reference sites sediment p,p'-DDE concentrations (µg/kg).**

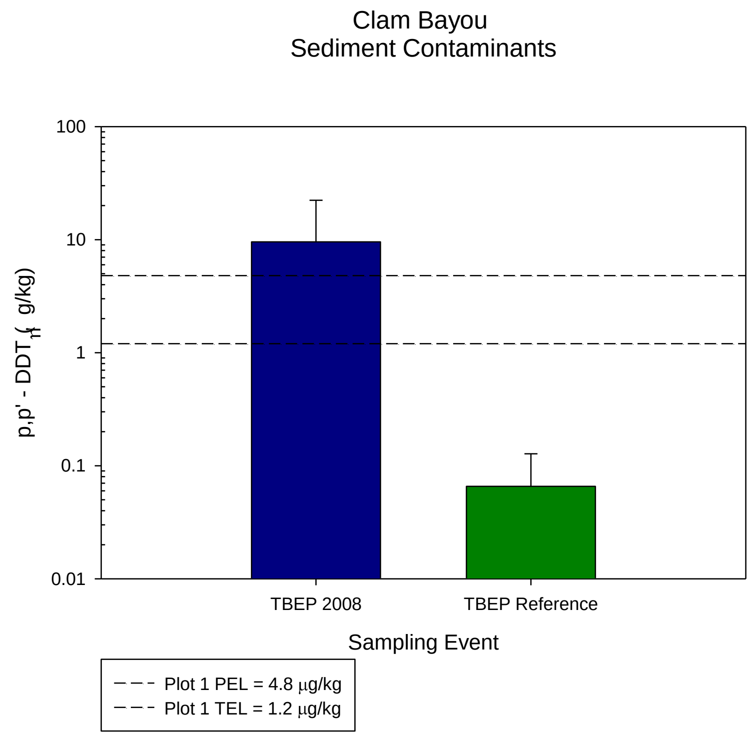



**Figure 44  Clam Bayou 2008 vs. TBEP reference sites sediment p,p'-DDT concentrations (µg/kg).**

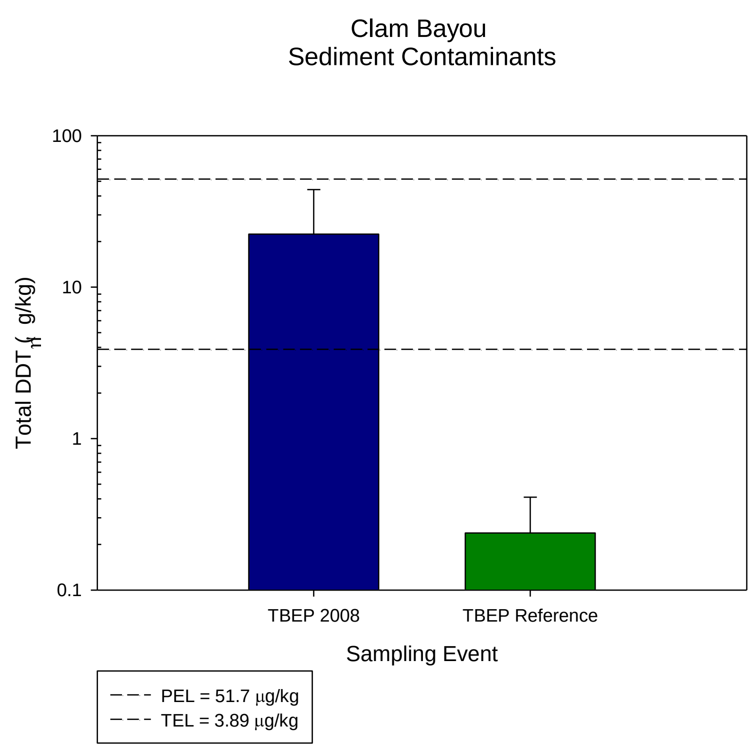



**Figure 45  Clam Bayou 2008 vs. TBEP reference sites sediment total DDT concentrations (µg/kg).**

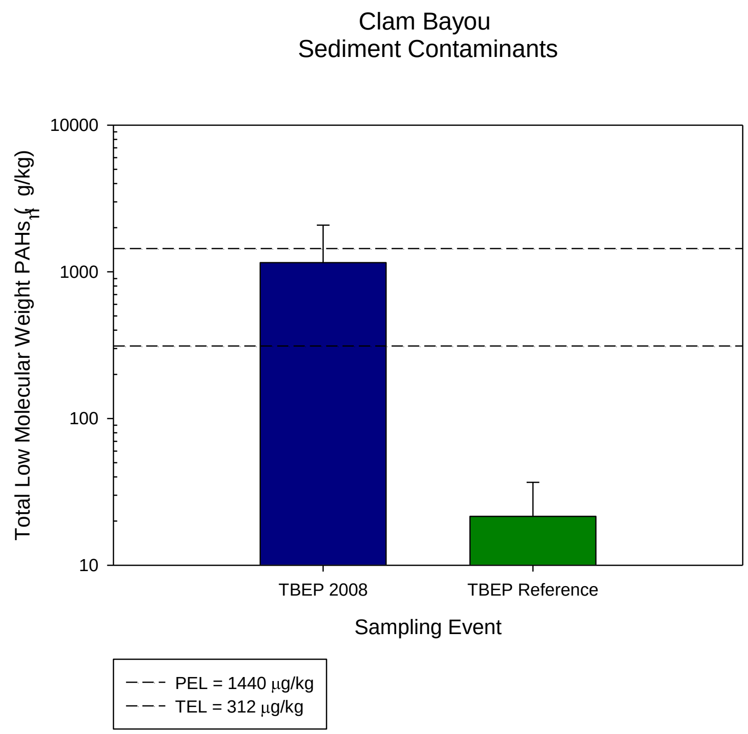



**Figure 46 Clam Bayou 2008 vs. TBEP reference sites sediment low molecular weight PAH concentrations (µg/kg).**

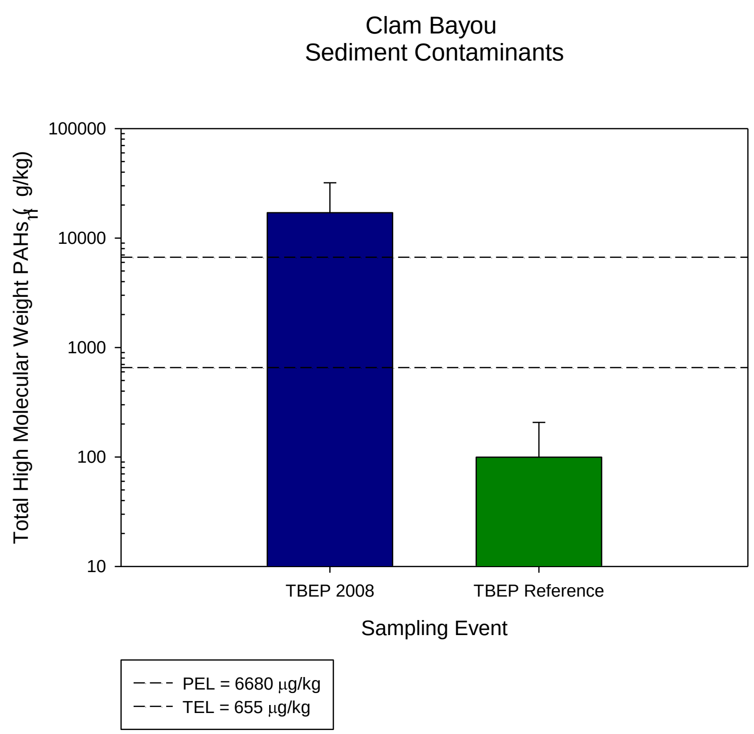



**Figure 47 Clam Bayou 2008 vs. TBEP reference sites sediment high molecular weight PAH concentrations (µg/kg).**

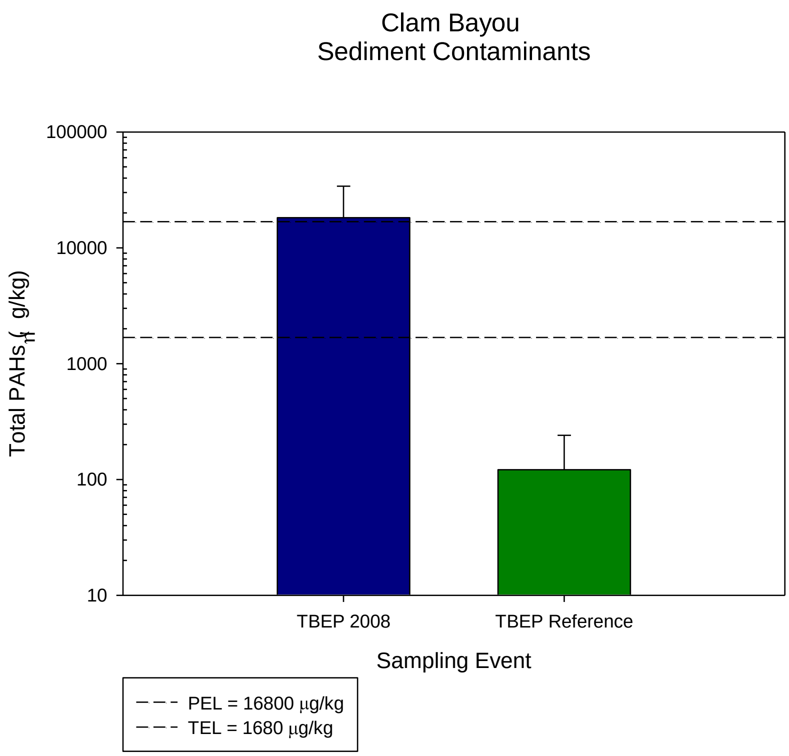



**Figure 48 Clam Bayou 2008 vs. TBEP reference sites sediment total PAH concentrations (µg/kg).**

# Discussion and Conclusions

Two sites in particular, 08CLB02 and 08CLB 03, were unique in that they had low numbers of taxa and abundances relative to the other 2008 sites and were dominated by oligochaetes. These two sites were characterized by sediments with high silt+clay content and were associated with dredged channels. Sediment composition was the primary factor influencing the benthic community composition in Clam Bayou. The remaining site similarity groupings generally matched their geographic location within the bayou (Figure 1). The 2008 Clam Bayou benthic community overall was dominated by polychaetes and molluscs, while crustaceans comprised a relatively minor proportion of the species richness and abundance. This finding matches the results seen in the 2001 FDEP samples. Both the 2008 and 2001 datasets had many of the same taxa in common, which is reflected in the similarity analysis between the two sampling events (Figure 24). The selected reference sites were also dominated by several polychaete species, but had more taxa and higher overall diversity. The reference sites also had a different overall species composition as seen in the similarity analysis results with the 2008 Clam Bayou sites (Figure 25) and represented a healthier benthic community relative to Clam Bayou.

Most of the benthic community indices were higher for the 2008 Clam Bayou sites relative to the 2001 FDEP data suggesting an improving benthic community over time. The Tampa Bay Benthic Index, conversely, showed the opposite trend and the mean TBBI score for the 2008 sites was below the threshold value for "Degraded" benthic habitats. These observed trends may be in part explained by the higher salinities observed in 2008, which ranged between 33.2 -35.6 psu and reflected the drought conditions experienced over the summer of 2008. In contrast, the average salinity at the 2001 FDEP sites was 22 psu. Species richness and diversity are positively correlated with salinity. The TBBI calculation takes this into account and is based in part on the observed number of taxa vs. the expected number of taxa given the sample salinity. Therefore, even though the observed number of taxa was higher in 2008, it was still relatively low compared to the expected number of taxa that should be found at the observed salinities. All of the 2008 Clam Bayou benthic community indices were lower compared to the TBEP reference sites and this comparison may be a better reflection of the current conditions in Clam Bayou.

The sediment metals tended to be higher at the 2008 Clam Bayou sites relative to both the 2001 FDEP sites and the TBEP reference sites and suggest an accumulation of metals over time. Most of the sites however did not show evidence of anthropogenic enrichment for metals based on their metal:aluminum ratios. A few of the metals had concentrations in excess of their TELs, most notably cadmium and lead. Copper and zinc levels were also relatively high at a few of the sites that had higher percent silt + clay.

The 2001 FDEP study did not include organic sediment contaminants, but the 2008 Clam Bayou sites had higher concentrations of PCBs, pesticides and PAHs relative to the TBEP reference sites. The levels of several pesticides including DDT products and chlordane were particularly high. Since these substances are currently either banned or restricted the high concentrations observed in Clam Bayou represents historical deposition, possibly from agricultural runoff which occurred before the current urbanization of the surrounding watershed.

The concentration of PAHs in Clam Bayou sediments were particularly high and levels were twice the PEL concentration for total PAHs at some sites and one to two orders of magnitude higher than at the TBEP reference sites. The probable source of these contaminants is from stormwater runoff from the surrounding roads and urban development (Ngabe *et al*. 2000; Van Dolah *et al*. 2005). Stormwater runoff is channeled into Clam Bayou through the Clam Bayou Drain, which is located at the upper northeast end of the bayou (Figure 1; Pinellas County Water Atlas) and through surface runoff along the shoreline.

Clam Bayou has shown signs of continued influx of contaminants since 2001, which is probably due to runoff from the surrounding roads and urban areas. The accumulation of sediment contaminants further impacts the benthic community, particularly in areas of high silt+clay deposition. Possible methods to reduce the influx of containments from nonpoint sources that enters Clam Bayou is to increase the vegetative buffer zones around the shoreline and through the retention and treatment of storm water before it reaches the Clam Bayou.

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# Appendix A: Clam Bayou 2008 Benthic Macrofaunal Data

| Taxon | 08CLB01 | 08CLB02 | 08CLB03 | 08CLB04 | 08CLB05 | 08CLB06 | 08CLB07 | 08CLB08 | 08CLB10 | 08CLB12 |
|---|---|---|---|---|---|---|---|---|---|---|
| CAMPANULARIIDAE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| ACTINIARIA | 300 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 25 |
| Eustylochus meridianalis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| ARCHINEMERTEA sp. A of EPC | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 25 | 0 | 0 |
| Amphiporus bioculatus | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 |
| Eteone heteropoda | 25 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phyllodoce arenae | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Microphthalmus sp. | 0 | 0 | 0 | 25 | 25 | 0 | 0 | 0 | 0 | 0 |
| Parahesione luteola | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 |
| Ophiodromus obscurus | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 25 | 0 |
| Podarkeopsis levifuscina | 0 | 0 | 0 | 25 | 0 | 75 | 50 | 50 | 50 | 0 |
| Synelmis ewingi | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 25 | 0 | 0 |
| Exogone dispar | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Neanthes acuminata | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 |
| Laeonereis culveri | 400 | 0 | 0 | 1900 | 600 | 700 | 0 | 125 | 100 | 450 |
| Stenoninereis martini | 0 | 0 | 25 | 150 | 925 | 0 | 0 | 0 | 0 | 0 |
| Glycera americana | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Glycinde solitaria | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 25 | 0 |
| Kinbergonuphis simoni | 0 | 0 | 0 | 0 | 0 | 125 | 25 | 50 | 0 | 0 |
| Lumbrineris tenuis | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 25 |
| Drilonereis magna | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Ophryotrocha sp. A of EPC | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Dorvillea cf. rudolphi | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 150 | 0 |
| Scoloplos rubra | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Leitoscoloplos foliosus | 175 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 300 |
| Leitoscoloplos robustus | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 100 | 0 | 0 |
| Aricidea cerrutii | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Aricidea philbinae | 0 | 0 | 0 | 0 | 0 | 125 | 0 | 150 | 0 | 0 |
| Dipolydora socialis | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Polydora cornuta | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 |
| Prionospio heterobranchia | 0 | 0 | 0 | 0 | 0 | 425 | 0 | 450 | 0 | 0 |
| Paraprionospio pinnata | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |

| Taxon | 08CLB01 | 08CLB02 | 08CLB03 | 08CLB04 | 08CLB05 | 08CLB06 | 08CLB07 | 08CLB08 | 08CLB10 | 08CLB12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Scolelepis texana | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 |
| Carazziella hobsonae | 0 | 0 | 0 | 0 | 0 | 0 | 200 | 0 | 0 | 0 |
| Magelona pettiboneae | 0 | 0 | 0 | 0 | 0 | 250 | 0 | 200 | 0 | 25 |
| Spiochaetopterus costarum | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Monticellina dorsobranchialis | 25 | 0 | 0 | 25 | 50 | 175 | 900 | 225 | 25 | 50 |
| Capitella capitata complex | 150 | 0 | 0 | 175 | 250 | 200 | 50 | 500 | 50 | 75 |
| Capitella jonesi | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 100 | 0 | 0 |
| Heteromastus filiformis | 50 | 0 | 0 | 675 | 0 | 600 | 25 | 75 | 0 | 350 |
| Notomastus n. sp? of EPC | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Mediomastus sp. | 0 | 0 | 0 | 25 | 0 | 25 | 0 | 275 | 0 | 25 |
| Mediomastus californiensis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 |
| Axiothella mucosa | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| Pectinaria gouldii | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Melinna maculata | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| Fabricinuda trilobata | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 100 |
| TUBIFICINAE | 50 | 625 | 125 | 3100 | 1100 | 100 | 100 | 325 | 125 | 200 |
| Tubificoides brownae | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 50 | 0 | 0 |
| Tubificoides wasselli | 25 | 0 | 0 | 0 | 0 | 225 | 100 | 250 | 275 | 125 |
| GASTROPODA | 0 | 0 | 0 | 50 | 550 | 0 | 0 | 0 | 50 | 25 |
| RISSOOIDEA | 0 | 0 | 0 | 50 | 4225 | 0 | 0 | 0 | 0 | 0 |
| Sayella hemphillii | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Teinostoma biscaynense | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Caecum pulchellum | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| CERITHIIDAE | 0 | 0 | 0 | 0 | 225 | 0 | 0 | 0 | 0 | 0 |
| Bittiolum varium | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Crepidula ustulatulina | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Melongena corona corona | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nassarius vibex | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 25 | 0 |
| Jaspidella blanesi | 0 | 0 | 0 | 0 | 0 | 0 | 250 | 0 | 0 | 0 |
| Olivella pusilla | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 0 | 0 |
| Prunum apicinum | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 |
| Turbonilla (Strioturbonilla) sp. | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |

| Taxon | 08CLB01 | 08CLB02 | 08CLB03 | 08CLB04 | 08CLB05 | 08CLB06 | 08CLB07 | 08CLB08 | 08CLB10 | 08CLB12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Acteocina canaliculata | 350 | 0 | 0 | 350 | 300 | 0 | 0 | 50 | 0 | 475 |
| Haminoea succinea | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| BIVALVIA | 100 | 0 | 25 | 175 | 0 | 0 | 0 | 25 | 325 | 75 |
| Solemya occidentalis | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 |
| Amygdalum papyrium | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 25 | 0 |
| Mysella planulata | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 200 | 0 |
| Erycina floridana | 0 | 0 | 0 | 0 | 0 | 275 | 25 | 0 | 0 | 0 |
| Macoma sp. | 0 | 0 | 0 | 150 | 0 | 0 | 0 | 0 | 0 | 0 |
| Macoma tenta | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Macoma cerina | 100 | 0 | 0 | 0 | 0 | 150 | 25 | 0 | 175 | 50 |
| Macoma nr. cerina | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TELLININAE | 200 | 0 | 0 | 175 | 0 | 0 | 475 | 150 | 0 | 250 |
| Angulus cf. versicolor | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Angulus texanus | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 50 | 0 | 0 |
| Angulus nr. tampaensis | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 125 | 0 | 100 |
| Eurytellina sp. A of EPC | 350 | 0 | 0 | 475 | 0 | 175 | 500 | 50 | 0 | 0 |
| Angulus sp. | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Tagelus sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 |
| Tagelus plebeius | 0 | 0 | 0 | 175 | 0 | 0 | 0 | 0 | 0 | 25 |
| Tagelus divisus | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 0 |
| Mercenaria campechiensis | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Anomalocardia cuneimeris | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| Parastarte triquetra | 275 | 0 | 0 | 225 | 450 | 100 | 25 | 0 | 50 | 450 |
| Balanus cf. amphitrite | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 |
| Balanus improvisus | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Almyracuma bacescui | 150 | 0 | 0 | 875 | 0 | 0 | 0 | 0 | 0 | 100 |
| Cyclaspis cf. varians | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Leptochelia sp. | 100 | 0 | 0 | 150 | 425 | 50 | 0 | 0 | 0 | 225 |
| Cyathura polita | 200 | 0 | 0 | 100 | 275 | 0 | 0 | 0 | 0 | 250 |
| Amakusanthura magnifica | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Xenanthura brevitelson | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 650 |

| Taxon | 08CLB01 | 08CLB02 | 08CLB03 | 08CLB04 | 08CLB05 | 08CLB06 | 08CLB07 | 08CLB08 | 08CLB10 | 08CLB12 |
|---|---|---|---|---|---|---|---|---|---|---|
| Erichsonella attenuata | 0 | 0 | 0 | 0 | 0 | 700 | 0 | 0 | 0 | 0 |
| Edotia triloba | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Ampelisca abdita | 0 | 0 | 0 | 0 | 0 | 150 | 0 | 0 | 50 | 0 |
| Ampelisca holmesi | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 150 | 0 | 0 |
| Monocorophium acherusicum | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Americorophium ellisi | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 200 |
| Grandidierella bonnieroides | 50 | 0 | 0 | 200 | 0 | 50 | 0 | 0 | 0 | 50 |
| Gammarus mucronatus | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| Farfantepenaeus duorarum | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 |
| DOLICHOPODIDAE | 500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phascolion cryptum | 25 | 0 | 0 | 0 | 0 | 100 | 50 | 0 | 25 | 50 |
| Phascolion cf. caupo | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |
| Phoronis sp. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 |
| Bowerbankia cf. gracilis | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Amphiodia atra | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| Ophiophragmus filograneus | 0 | 0 | 0 | 0 | 0 | 25 | 25 | 0 | 25 | 0 |
| Amphioplus thrombodes | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 |

Data presented as density (#/$m^2$) = raw count x 25, except for colonial taxa which are presented as present = 1.