ECOLOGICAL ASSESSMENT OF SELECTED DREDGE HOLES IN TAMPA BAY: HYDROGRAPHIC CONDITIONS, SEDIMENT CONTAMINATION AND BENTHIC MACROINVERTEBRATES

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EXECUTIVE SUMMARY

Sixteen dredge holes were surveyed during August and October 2002 and fourteen during April and May 2003 for a suite of hydrographic, sediment contaminant, and biotic variables. Most dredge hole habitats were characterized as polyhaline muds (salinities 18-30 ‰; silt+clay >25.95%). Density stratification was evident during both sampling periods at the McKay Bay and St. Petersburg-Clearwater Airport West dredge holes. Instantaneous measurements of near-bottom dissolved oxygen (DO) concentrations detected anoxia (<0.2 ppm) in the Northeast St. Petersburg Borrow Pit B1 dredge hole and hypoxia (<2 ppm) in the McKay Bay (Fall 2002) and Gandy Channel North (Spring 2003) dredge holes. Subnominal (DO<4 ppm) was observed at four other dredge holes. Continuous monitoring of near-bottom DO took place in four dredge holes. Subnominal DO persisted for >10 hours in the Georgetown, McKay Bay, and Gandy Channel North dredge holes during at least one of these extended sampling events.

Overall sediment contaminant concentrations were highest in the McKay Bay dredge hole and the remaining dredge holes sediment had contaminant levels indicative of moderate levels of degradation ("Threshold Effects Level" = TEL). Cadmium and chromium were the two contaminants most responsible for these values. Organic contaminants (pesticides, PAHs, and PCBs) were generally detected at low concentrations. Exceptions included the pesticide Lindane, which had TEL exceedences at McKay Bay, St. Petersburg-Clearwater Airport East, and Whiskey Stump Key Dredge Hole #1; Total DDT exceeded TEL levels at the MacDill Docks and MacDill Beach, High Molecular Weight PAH concentrations were above there TEL level at the MacDill Docks, and PCBs exceeded the TEL concentration at the St. Petersburg-Clearwater Airport West.

Benthic assemblages were extremely degraded (few species present, low abundances and low Tampa Bay Benthic Index values) at seven dredge holes during Summer/Fall 2002 and five dredge holes during Spring 2003. Cypress Point, McKay Bay, Northshore Beach, and the two St. Petersburg Borrow Pits were degraded during both sampling periods. Highest Benthic Index scores and highest numbers of taxa were observed in the Georgetown, Shore Acres and Gandy Channel North dredge holes.

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INTRODUCTION

The Tampa Bay Estuary Program (TBEP) adopted as one of its Action Plans the goal of identifying beneficial uses for dredge spoil produced as a result of dredging activities in Tampa Bay (Tampa Bay National Estuary Program 1996). One possible use of this material is to fill older dredge holes that may be problematic from an ecological sense. Tampa Bay Watch, Inc. (2000) identified 29 dredge holes in Tampa Bay and upland locations proximal to the bay and reported on the physical characteristics of eleven of them. As part of a contract with USEPA, the TBEP and its partners, the Florida Marine Research Institute (FMRI) of the Florida Fish and Wildlife Conservation Commission (FWCC) and the Environmental Protection Commission of Hillsborough County (EPCHC), undertook an ecological characterization study of a number of these dredge holes. This report summarizes the hydrographic conditions, sediment contaminant status, and benthic community structures of sixteen of these dredge holes.

METHODS

Study Design

Sixteen dredge holes were sampled during the Summer/Fall of 2002 (16 August; 1-2, 7-9, and 22-23 October) and 14 locations were sampled during Spring 2003 (21-22 and 30 April; 12-15 and 27 May) (Figure 1). At each dredge hole, boat transects were run along each longitudinal axis; GPS readings of latitude and longitude were made at the start and finish of each run. Estimates were then made for the center point, and four other points each approximately 1/3 in from the start and end points of each longitudinal axis. This yielded five possible sampling locations (Figure 2).

Hydrographic Measurements

Temperature, salinity, and dissolved oxygen were measured at 1-m intervals from surface (0.1 m below the air-water interface) to bottom (0.2 m above bottom) and again from bottom to surface at each of the five sampling locations as well as a sixth location outside the dredge hole (random direction: N, S, E or W of the hole). All measurements were made using a Hydrolab® Surveyor™.

Hach® kit measurements of H_2S were also made at selected locations to determine whether dataloggers could be deployed for continuous (every 15 minutes) measurements of temperature, salinity and dissolved oxygen. Where near-bottom DO was >2 ppm and H_2S concentrations were <0.5 ppm, dataloggers were deployed at one of the sites within the dredge hole and at the "reference" location outside the hole.

Benthos and Sediment Chemistry

Three of the five possible sampling locations were selected at random for collection of benthic samples and sediment chemistry samples (Summer/Fall 2002 only). Samples were collected with a 0.04 m^2 stainless steel Young grab sampler. Chemically cleaned glass (organics) and plastic jars (metals) were filled with sediment for contaminant analyses and placed on ice.

A core was removed from the benthic sample using a 60 cc syringe and the width of the apparent redox potential discontinuity layer (RPD) was measured with a metric ruler. This sample was then extruded into a plastic vial, stored on ice, and returned to the laboratory for sediment characterization. Benthic samples were rinsed into plastic bags; a solution of magnesium sulfate was added to relax the animals; the sample bag was then placed on ice. At the end of the day the benthic samples were rinsed through a 0.5-mm mesh sieve and fixed in 10% borax-buffered formalin with Rose Bengal stain. Within two weeks benthic samples were transferred to 70% isopropanol and Rose Bengal stain for preservation.

Laboratory Analyses

Sediment Chemistry: analyses of trace metals (Ag, As, Cd, Cr, Cu, Ni, Pb, and Zn) and organic contaminants (organochlorine pesticides [OPs], polychlorinated biphenyls [PCBs], and polycyclic aromatic hydrocarbons [PAHs]) were after NOAA (1993) and USEPA (1993).

Sediment Characterization: The percentage of silt+clay (%SC) was determined using methods outlined in Courtney *et al*. (1995).

Benthic Assemblages: Benthic samples were sorted, identified to the lowest practical taxonomic level, and counted using methods described in Courtney *et al*. (1995).

Data Analyses

Analysis of variance (ANOVA) was used to test for differences between seasons and dredge holes for a suite of abiotic and biotic variables. All variables except index or quotient variables were transformed ($\log_{10}$ n+1 or arcsine). The degree of water column stratification was based on criteria suggested by NOAA (Hyland *et al*. 1996) for differences between surface and bottom water density (as σ-t). Stratification was "low" where the difference was <1 and "high" when the difference is >2. Sediment quality assessment guidelines were after MacDonald Environmental Services (1994).

Two metrics were used to examine the status of the sediments with respect to contaminants. A site specific (for Tampa Bay) composite Predicted Effects Level (PEL) Quotient was calculated

using data from trace metals, total polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) (MacDonald *et al*. 2004). PEL Quotients <0.05 were considered to have a low probability of being toxic to aquatic life and quotients >0.34 were considered to have a high probability of being toxic (MacDonald *et al.* 2004). Anthropometric enrichment of sediments by trace metals was evaluated using the metals : aluminum ratio tool developed by Schropp *et al.* (1990) for Florida coastal waters.

The Tampa Bay Benthic Index (TBBI) has recently been revised (David Wade, Janicki Environmental, Inc. pers. comm. 18 January 2005) and was calculated for this study. The current revision of the TBBI ranks sites on a scale from 0 – 100 based on the number of species vs. expected number of species at a given salinity and the proportional abundance of spionid and capitellid polychaetes. Sites with TBBI values < 73 are rated as "Potential Restoration Areas", values between 73-87 as "Intermediate Areas" and values >87 are rated as "Protection Areas" .

Seasonal comparison of benthic community structure (defined as Bray-Curtis similarity based on 4^{th} root n+0.1 abundances) within dredge holes were made using PRIMER's SIMPER procedure (similarity percentage; Clarke and Warwick 2001).

RESULTS

Habitat Characteristics

Near-bottom salinities were generally in the polyhaline (18-30 ‰) range (Figure 3). The Station x Season interaction in the ANOVA was not significant ($p=0.98$). There was a significant difference between Seasons ($p<0.001$); salinities were generally lower during the Spring 2003 "dry season" sampling than during the Summer/Fall 2002 "wet season" (Figure 3). There were also significant ($p<0.001$) differences between Stations. Lowest mean salinities were observed at the two St. Petersburg-Clearwater Airport dredge holes and the highest were at the MacDill Runway, Northshore Beach, and Shore Acres dredge holes (Figure 3).

Water temperatures also differed by Station x Season ($p<0.001$). Water temperatures were generally higher during Summer/Fall 2002—especially at the St. Petersburg-Clearwater Airport and McKay Bay dredge holes. However, at several dredge holes (*e.g.*, both Whiskey Stump Key dredge holes and Northshore Beach) Spring 2003 temperatures were higher (Figure 4). The length of time taken to sample the dredge holes during Summer/Fall 2002 (August and October) likely contributed to the differences between stations within that season (Figure 4). During Spring 2003 coolest water temperatures were observed at McKay Bay and warmest temperatures at Gandy Channel North (Figure 4).

Density stratification was evident only at the McKay Bay (Summer/Fall 2002) and St. Petersburg/Clearwater Airport-1 (Spring 2003) dredge holes (Figure 5).

Mud-sized sediments (>25.95% SC; *cf*. Grabe and Barron 2004) generally predominated in the dredge holes surveyed (Figure 6). The %SC of the dredge holes differed by Stations ($p<0.001$) although not by Season ($p=0.91$). The Shore Acres and Georgetown dredge holes were the only ones that had %SC values indicative of sand-sized sediments during both survey periods.

Dredge holes habitats were primarily polyhaline muds. Ten dredge holes in Summer/Fall 2002 and 11 in Spring 2003 were so categorized.

Dredge holes ranged in depth from approximately 1.5 m (Gandy Channel North and St. Petersburg-Clearwater Airport #1) to >6-m (St. Petersburg Borrow Pit B1) (Figure 7); station depths were significantly different (p<0.001). Summer/Fall and Spring sample depths were not significantly different (p=0.92).

Ecological Stressors

Near-bottom dissolved oxygen (DO) concentrations were generally >4 ppm; hypoxia was only observed at the McKay Bay hole during the October 2002 survey date (Figure 8). ANOVA showed that there was a significant Station x Season interaction (p<0.001). There was no consistent pattern for differences in DO (Figure 8). At some dredge holes (*e.g.*, Whiskey Stump Key) the Summer/Fall 2002 DO was somewhat higher than that of Spring 2003. However, at the McKay Bay and St. Petersburg-Clearwater Airport-1 dredge holes, Spring 2003 DOs were somewhat higher (Figure 8).

Composite PEL Quotient values differed by dredge hole (p=0.003). All of the sites exceeded the 0.05 criterion for "marginally contaminated" sediments (*cf*. MacDonald *et al*. 2004) with the McKay Bay dredge hole having the highest mean PEL Quotient (Figure 9).

There was evidence of anthropogenic enrichment, based upon the relationship between the various metals and aluminum. Enrichment was most often observed for cadmium and lead and was rarely observed for arsenic and chromium (Figure 10). There are no Florida-specific guidelines for silver.

Effects level guidelines have been developed for four OPs: chlordane, total DDT, dieldrin, and lindane (Tables 1, 3-17); Total DDT was detected at concentrations above the Threshold Effects Level (TEL) (MacDonald Environmental Sciences 1994) at the MacDill Docks and MacDill Beach dredge holes, and lindane exceeded the TEL level at the McKay Bay, St. Petersburg-Clearwater Airport East, and Whiskey Stump Key #1 dredge holes. Other OPs were present in the dredge holes although concentrations were generally below or near the method detection limit (MDL) (Tables 1, 3-17). PCB concentrations were generally near or below the MDL at all sites except the St. Petersburg-Clearwater Airport West dredge hole, where it exceeded the TEL

concentration (Tables 1, 3-17). Total PAH concentrations were <TEL (1,684 ppb) at all sites but High Molecular Weight PAHs were >TEL at the Cypress Point and MacDill Docks, and St. dredge holes (Tables 1, 3-17).

Benthic Assemblages

Species richness, total abundance, and TBBI differed by Station x Season (p<0.001). The most depauperate dredge holes during Summer/Fall 2002 included Cypress Point, McKay Bay, Northshore Beach, St. Petersburg-Clearwater Airport #2, and both Whiskey Stump Key dredge holes (Figures 11 and 12). The Gandy Channel North dredge hole supported a much more abundant and rich assemblage during the Summer/Fall period than it did during Spring. The Whiskey Stump Key dredge holes underwent the greatest increases in both abundance and species richness from Summer/Fall to Spring survey periods.

TBBI scores ranged from 45.2 to 88.7. TBBI scores were higher during Spring 2003 at seven of the dredge holes, notably Big Island Cut, Georgetown and the Whiskey Stump Key dredge holes (Figure 13). Summer/Fall TBBI scores were higher at St. Petersburg-Clearwater Airport #1, McKay Bay, and Gandy Channel North dredge holes (Figure 13).

Characterization of Individual Dredge Holes

CYPRESS POINT: This dredge hole is located along the eastern shoreline of Old Tampa Bay, just north of the Howard Frankland Bridge (Figure 1). The habitat was polyhaline mud. There was no hypoxia detected in the instantaneous measurements (Table 1A) and the values were better than those generally observed in polyhaline mud habitats elsewhere in the bay (Table 2). There was evidence of at least moderate levels of sediment contamination (Table 1B). This level of contamination was consistent with that observed in polyhaline mud habitats throughout Tampa Bay (Table 2).The benthic community was depauperate during the Fall 2002 survey (Table 1C). Defaunation of polyhaline mud habitats throughout Tampa Bay during the summer/early fall months was not necessarily uncommon (Table 2). During the spring survey, the benthic community had rebounded, although species richness and diversity remained “low”.

GEORGETOWN DREDGE HOLE: This dredge hole is located along the eastern shoreline of Old Tampa Bay just north of the Gandy Bridge (Figure 1). The habitats ranged from polyhaline very fine sands (Fall 2002) to polyhaline fine sands (Spring 2003) (Table 3A). There was no evidence of hypoxia, although DO was subnominal for >13 hours (Table 3A). Sediment contaminant concentrations were generally low (Table 3B). These abiotic characteristics are consistent with observations at similar sites in Old Tampa Bay (Table 2).

The Fall 2002 benthic community was somewhat richer in species and more diverse than matched sites in Old Tampa Bay during summer/fall months; overall abundance was similar to the matched sites (Tables 2 and 3C). The Spring assemblage was richer, more diverse and supported a larger standing crop than the Fall assemblage (Table 3C). Fall and Spring assemblages were only 33% similar (Table 18).

MacDILL RUNWAY EXTENSION: There are three dredge holes proximate to the Interbay Peninsula and MacDill Air Force Base (Figure 1). This dredge hole is located off the southwestern portion of the Interbay Peninsula (Figure 1). The habitat was polyhaline mud (Table 4A). DO concentrations were >5 ppm (Table 4A), generally better than other polyhaline mud habitats in the bay (Table 2). There was evidence of moderate levels of sediment contaminants, notably three metals (Table 4B).

The Fall benthic community was more speciose, more diverse, and somewhat more abundant than Tampa Bay polyhaline mud habitats in general (Tables 2 and 4C). The Fall and Spring assemblages were only 24% similar (Table 18). The benthic community at this location was somewhat unusual in that the Spring assemblage was lower in taxa and standing crop than the Fall assemblage (Table 4C).

MacDILL BEACH: This dredge hole was sampled only during the summer of 2002. The percent silt+clay (%SC) was not measured so sediment type and habitat could not be categorized. Near-bottom DO was >4 ppm and sediment contamination was moderate (Table 5A and 5B). The

benthic community was impoverished with respect to species richness and diversity and abundance was also relatively low (Table 5C).

MacDILL DOCKS: The MacDill Docks dredge hole was also only sampled during August 2002. The %SC was not measured so sediment type and habitat could not be categorized. Near-bottom DO was subnominal and six sediment metals and high molecular weight PAHs were present at concentrations >TEL (Table 6A and 6B). The benthic community was neither impoverished nor especially rich (Table 6C).

McKAY BAY DREDGE HOLE: This dredge hole (Figure 1) was also characterized as a polyhaline mud habitat. There was extensive stress from hypoxia during the Fall sampling period and some stress from subnominal DO during the Spring (Table 7A). Other polyhaline mud habitats in McKay Bay were characterized by subnominal DO, if not hypoxia (Table 2). Six metals contributed to a relatively high (for the dredge holes) composite PEL Quotient (Table 7B), although this is consistent with the polyhaline mud habitat of McKay Bay (Tables 2 and 7B).

The benthic community in the McKay Bay dredge hole showed the highest similarity between seasons of any of the dredge holes (Table 18) because it was one of the most impoverished dredge holes during both sampling periods (Table 7C). The benthic community resident in this dredge hole was similar to that of other polyhaline mud sites in McKay Bay (Tables 2 and 7C).

WHISKEY STUMP KEY DREDGE HOLES: Both Whiskey Stump Key dredge holes (Figure 1) were approximately 3 m deep at the sampling locations (Tables 8A and 9A). All near-bottom salinities were within the polyhaline range. Mud-sized sediments predominated at both dredge holes as well (Tables 8A and 9A). There was mild stratification at both dredge hole #2 and its "control" during the Spring 2003 survey (Table 9A).

DO concentrations were all >4 ppm (Tables 8A and 9A). Four metals (Cd, Cr, Cu, and Ni) exceeded their TELs in both dredge holes (Tables 8B and 9B). Organic contaminants were

present only at relatively low concentrations, either <TEL or near the method detection limit, except for the OP lindane, which exceeded the TEL level at hole #1 (Tables 8B and 9B).

Species composition, within seasons was generally similar for the two dredge holes. During the Fall 2002 period both dredge holes were only sparsely populated by benthic macroinvertebrates (Tables 8C and 9C). However, by Spring, both standing crop and numbers of taxa increased dramatically (Tables 8C and 9C). The tube-building amphipod *Ampelisca vadorum* comprised >75% of the community during the Spring survey.

Both dredge holes showed less evidence of density stratification and higher DO levels than comparable habitats in Tampa Bay (Tables 2, 8A and 9A). The composite PEL Quotients in these two dredge holes were slightly higher than those of similar habitats (Tables 2, 8B and 9B). Depauperate benthic assemblages were not unusual in polyhaline mud habitats throughout the bay (Table 2).

NORTHSHORE BEACH DREDGE HOLE: The Northshore Beach dredge hole (Figure 1) also represented a polyhaline mud habitat (Table 10A). Although DO conditions were adequate, concentrations of six metals exceeded TELs (Table 10B). The benthic community was depauperate during both surveys (Table 10C).

This dredge holes showed less evidence of density stratification and higher DO levels than comparable habitats in Tampa Bay (Tables 2 and 10A). The composite PEL Quotients was comparable to those of similar bay habitats (Tables 2 and 10B). Depauperate benthic assemblages were not atypical of polyhaline mud habitats in Tampa Bay (Table 2).

SHORE ACRES DREDGE HOLE: This dredge hole is located offshore of Shore Acres, south of Venetian Isles in Pinellas County (Figure 1). The habitats sampled ranged from polyhaline very-fine sands to muds (Table 11A). DO concentrations were generally acceptable, although diel monitoring during spring 2003 showed five hours of DO levels <4 ppm (Table 11A). The TEL exceedence by cadmium contributed to the PEL Quotient exceeding 0.05 (Table 11B). Species richness was relatively high during both sampling periods and peracarid crustaceans

predominated (Figure 12; Table 11C). Species diversity was low, however, because of high numbers of the tube-building amphipod *A. vadorum* (Table 11C).
The Shore Acres dredge hole showed a comparable degree of density stratification, sediment contaminant levels, and benthic condition and higher DO concentrations to comparable habitats (very-fine sands) in Middle Tampa Bay (Tables 2 and 11A-C).

GANDY CHANNEL NORTH DREDGE HOLE: The sampled habitats in the Gandy Channel North dredge hole differed between the two season because of differences in sediment type (Table 12A). The Fall 2002 sediments were characterized as medium sands whereas in Spring 2003 they were defined as mud (Table 12A). Salinities were in the polyhaline range during both sampling events.

Subnominal DO was observed during the diel datalogger deployments (Table 12A) with considerably more stress during the Spring survey. Sediment contaminant concentrations were generally low (Table 12B). The benthos was numerically dominated by peracarid crustaceans during both sampling periods and the Fall 2002 assemblage was unusually speciose and diverse (Table 12C). Benthic structure was <20% similar between seasons (Table 18).

The Gandy Channel North dredge hole showed a comparable degree of density stratification, similar DO concentrations, and slightly higher sediment contaminant levels to comparable habitats (medium sands) in Old Tampa Bay (Tables 2 and 12A&B). Species richness during the Fall was somewhat higher than summer-fall samples in similar habitats and overall abundance was similar (Table 2 and 12C).

BIG ISLAND CUT DREDGE HOLE: The Big Island Cut Dredge Hole is located in a backwater area adjacent to the western end of the Howard Frankland Bridge (Figure 1). The habitat was polyhaline muds during both sampling events, even though there were marked differences in the %SC values (Table 13A).

Bottom DO concentrations were subnominal during both surveys (Table 13A). TEL exceedences were observed for cadmium, chromium, and nickel (Table 13B). The benthic community was impoverished during the Fall survey (Table 13C).

The Big Island Cut dredge hole showed a lower degree of density stratification, similar DO concentrations, sediment contaminant levels, and benthic community metrics than comparable habitats (polyhaline muds) in Tampa Bay (Tables 2 and 13A-C).

ST. PETERSBURG-CLEARWATER AIRPORT WEST AND EAST DREDGE HOLES: The western dredge hole (Figure 1) habitat was polyhaline mud (Table 14A) whereas the eastern dredge hole was characterized as polyhaline very-fine sand and mud (Table 15A). The western dredge hole exhibited density stratification during both survey periods and it was especially well developed during the Spring survey (Table 14A).

There was a prolonged period of subnominal DO (>13 hours) at the East dredge hole during Spring 2003 (Table 15A). Other DO data were unremarkable. Sediment contaminant levels in both dredge holes were at the high end of the "moderately contaminated' range (Tables 14B and 15B). However, concentrations of the OP Aldrin in two of the three replicates at the East dredge hole ranked 4th (7.9 ppb) and 7th (5.8 ppb) among Aldrin concentrations in Tampa Bay to date (EPCHC, unpublished data).

The benthic communities at the West dredge hole were moderately "rich" in both numbers of organisms and numbers of taxa (Table 14C). The East dredge hole showed greater seasonal changes in structure (Tables 15C and 18) with the Fall 2002 assemblage noticeably "poorer" than the Spring assemblage (Table 15C).

The West dredge hole showed a similar degree of density stratification, DO concentrations, and sediment contaminant levels, to comparable habitats (polyhaline muds) in Tampa Bay (Tables 2 and 14A&B). The Fall benthic community was more speciose and more abundant than polyhaline mud communities in general (Table 2 and 14C). The East dredge hole was less

stratified, had higher DO, a similar PEL Quotient, and similar benthic community metrics to bay-wide polyhaline mud habitats (Tables 2 and 15A-C).

ST. PETERSBURG BORROW PITS B1 AND B2: These borrow pits were located to the west of the nexus between Bayou Grande and Riviera Bay (Figure 1). The habitats were polyhaline very-fine sand and muds (Tables 16A and 17A). Stratification was well developed during Spring 2003 in Borrow Pit B1 but otherwise absent (Tables 16A and 17A).

Both borrow pits exhibited subnominal near-bottom DO (Tables 16A and 17A) with Borrow Pit B1 anoxic during Spring 2003. Five metals exceeded their TELs at Borrow Pit B1 (Table 16B) and only cadmium exceeded the TEL at Borrow Pit B2 (Table 17B).

The benthic assemblages at both borrow pits were noticeably degraded (Tables 16C and 17C). Very few organisms and taxa were found in the samples and the Fall 2002 samples at Borrow Pit B1 were azoic. Because the benthic habitats were so degraded, the similarity between the seasonal surveys was relatively high (>24%; Table 18).

SUMMARY

The predominant habitats in the dredge holes were polyhaline muds; sandy habitats were found in the Georgetown, Shore Acres, Gandy Channel North, St. Petersburg-Clearwater Airport East, and St. Petersburg Borrow Pit B2 dredge holes (Table 19). Water column stratification was not evident in 12 of the dredge holes (Table 19). Stratification was, however, especially strong, in McKay Bay (Fall 2002), St. Petersburg-Clearwater Airport West (Spring 2003), and St. Petersburg Borrow Pit B1 (Spring 2003).

Ecological stress (subnominal DO, elevated sediment contaminants) affected at least eight of the dredge holes (Table 19). Hypoxia or anoxia was observed at McKay Bay, Gandy Channel North, and St. Petersburg Borrow Pit B1.

All dredge holes had composite PEL Quotients >0.05, the threshold for sediments having a low *probability* of being toxic to aquatic life (MacDonald *et al.* 2004). The lowest PEL Quotients (<0.10) were found at Georgetown, Shore Acres and Gandy Channel North (Table 19). Two metals included in the computation of the PEL Quotient, cadmium and chromium, were most often responsible for the PEL Quotients exceeding 0.05. Nickel, which is excluded from the PEL Quotient, was also often detected at concentrations greater than its individual TEL. McKay Bay had the highest PEL Quotient (0.21). Contaminants contributing to this condition included cadmium, chromium, copper, lead and zinc. Organic contaminants (pesticides, PAHs, and PCBs) were generally detected at low concentrations. Exceptions included the pesticide Lindane, which had TEL exceedences at McKay Bay, St. Petersburg-Clearwater Airport East, and Whiskey Stump Key Dredge Hole #1; Total DDT exceeded TEL levels at the MacDill Docks and MacDill Beach, as did the DDT breakdown products DDT and DDE at MacDill Docks and DDD at MacDill Beach. High Molecular Weight PAH concentrations were above there TEL level at the MacDill Docks, and PCBs exceeded the TEL concentration at the St. Petersburg-Clearwater Airport West.

The most speciose and diverse benthic assemblages were found at Georgetown, Shore Acres, and Gandy Channel North (Table 19). At six dredge holes the numbers of taxa ranged between 0 and

two during at least one sampling event (Table 19). Tampa Bay Benthic Index scores <73 were provisionally defined as “potential restoration areas”. At least eleven of the dredge holes had such scores during at least one of the sampling seasons. Both the Georgetown and Shore Acres holes had TBBI scores >87, defined as a “protection areas”, during the Spring sampling period and Gandy Channel North during the Fall sampling period.

Seasonal changes in benthic community structure were profound. Data collected at the Big Bend area (Grabe *et al*. 2003) found that Spring *vs*. Summer/Fall assemblages were >80% similar (*cf*. Table 18). In contrast, the dredge holes which were most similar (41% to 67%) had extremely degraded benthic assemblages. At seven of the 14 dredge holes that were surveyed during both seasons percent similarity was <20% (Table 18). The greatest seasonal changes in benthic community structure were observed at Big Island Cut, Whiskey Stump Key #1 and Cypress Point.

Overall, the least impacted dredge holes appeared to be Georgetown and Shore Acres. Both supported benthic assemblages relatively rich in species and were among the lowest in sediment contaminants. DO was somewhat problematic at the Georgetown site during the Fall 2002 period. Gandy Channel North also supported a speciose benthic community but exhibited more stress from low DO.

Dredge holes that appeared to be the most degraded biologically included McKay Bay, the St. Petersburg Borrow Pits, Northshore Beach, and Cypress Point. Of this group, Northshore Beach and Cypress Point did not appear to be impacted by low DO. McKay Bay was hypoxic during Fall 2002, experienced extended periods of subnominal DO, evidenced strong stratification during the Fall, and had problematic concentrations of trace metals.

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Table 1. Summary Statistics for Cypress Point Dredge Hole (CYPPT).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	**Fall 2002-Control**		**Spring 2003-Dredge Hole**	**Spring 2003-Control**
Depth (m)	3.7	2.4		3.0	2.3
% SC	76.8	ND		74.3	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	28.8	29.1		24.6	24.9
Bottom Temperature	28.5	28.7		24.4	24.8
Surface Salinity	22.5	22.6		22.2	22.2
Bottom Salinity	22.6	22.6		22.2	22.2
Stratification Index	0.1	0.1		0.1	<0.1
Surface D.O.	6.9	6.8		6.6	6.8
Bottom D.O.	6.1	6.3		6.1	6.6
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 1-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.58
Al	49,010
As	3.5
Cd	2.55*
Cr	153*
Cu	30.7*
Ni	33.0*
Pb	47.8*
Zn	120

Table 1-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.26
ABHC	0.06
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	0.57
DDE	0.02
DDT	0.04
TOTAL DDT	0.63
DIELDRIN	0.19
ENDOSULFAN I	0.04
ENDOSULFAN II	0.12
ENSOSULFAN SULFATE	0.10
ENDRIN	0.14
ENDRIN ALDEHYDE	0.23
HEPTACHLOR	0.21
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.18
MIREX	0.25
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	52.8
HIGH MW PAHS	652.7*
TOTAL PAHS	705.6
TOTAL PCBS (CONGENERS)	1.4
COMPOSITE PEL QUOTIENT	0.17*

* >TEL **>PEL

Table 1-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	0		7
SHANNON-WIENER DIVERSITY	0.00		0.71
EVENNESS	0.00		0.29
TOTAL ABUNDANCE (#m^{-2})	0		3,733
FIVE MOST ABUNDANT TAXA (% COMPOSITION)			1-*Ampelisca vadorum* (89%) 2- *Cyclaspis varians* (3%) 3-*Mysella planulata* (2%) 4-*Acteocina canaliculata* and *A. holmesi* (1%)
TBBI	53.2		73.3

Table 2. Summary of abiotic and biotic statistics (25th-75th percentiles) within "reference" areas for Tampa Bay dredge holes (summer/fall period).

	POLYHALINE MUDS (BAYWIDE) (n=104-182)	POLYHALINE MUDS (McKAY BAY) (n=7-25)	POLYHALINE MEDIUM SANDS (OTB) (n=46-62)	VERY FINE SANDS (OTB) (n=12-17)	VERY FINE SANDS (MTB) (n=7-13)
DEPTH (m)	1.3-4.5	0.1-3.5	1.3-3.3	1.2-3.8	1.8-7.3
STRATIFICATION INDEX	1.0-8.1	0.3-3.5	<0.1-0.3	0.1-0.6	0.2-1.1
BOTTOM D.O.	0.2-3.1	1.6-3.5	4.8-6.7	2.8-5.0	3.8-5.1
COMPOSITE PEL QUOTIENT	0.11-0.28	0.11-0.51	0.03-0.07	0.02-0.09	0.05-0.11
SPECIES RICHNESS	0-10	7-14	35-45	12-29	18-40
SHANNON-WIENER DIVERSITY	0.00-1.86	0.77-2.24	2.43-4.09	1.70-2.69	2.80-3.15
TOTAL ABUNDANCE (#m^{-2})	0-950	225-2,800	7,000-15,700	2,894-10,444	2,500-12,638

Table 3. Summary Statistics for Georgetown Dredge Hole (GEORGE).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth (m)	5.7	1.0		4.1	0.5
% SC	13.0	ND		5.0	ND
RPD (mm)	3	ND		8	ND
Surface Temperature	28.8	29.4		25.1	25.8
Bottom Temperature	28.8	29.3		25.1	22.5
Surface Salinity	23.7	23.8		22.2	22.5
Bottom Salinity	23.8	23.8		22.3	22.5
Stratification Index	0.1	<0.1		0.1	0.0
Surface D.O.	5.8	6.7		6.3	6.7
Bottom D.O.	5.2	6.7		5.8	6.7
Daily Minimum D.O.	2.7	4.1		5.3	5.7
D.O. <4 ppm (Hours)	13.25	0.00		0.00	0.00
Hypoxia (Hours)	0.0	0.0		0.00	0.00

Table 3-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.55
Al	7,863
As	3.32
Cd	2.10*
Cr	23.1
Cu	5.53
Ni	9.82
Pb	6.56
Zn	28.8

Table 3-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.03
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	0.15
DDE	0.02
DDT	0.04
TOTAL DDT	0.21
DIELDRIN	0.23
ENDOSULFAN I	0.04
ENDOSULFAN II	0.04
ENSOSULFAN SULFATE	0.08
ENDRIN	0.04
ENDRIN ALDEHYDE	0.09
HEPTACHLOR	0.19
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.06
MIREX	0.05
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	26.1
HIGH MW PAHS	176.5
TOTAL PAHS	202.7
TOTAL PCBS (CONGENERS)	0.9
COMPOSITE PEL QUOTIENT	0.07*

* >TEL **>PEL

Table 3-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	30		47
SHANNON-WIENER DIVERSITY	3.36		4.13
EVENNESS	0.80		0.74
TOTAL ABUNDANCE (#m^{-2})	5,200		10,150
FIVE MOST ABUNDANT TAXA (% COMPOSITION)	1-*Ampelisca* sp. C (12%); 2-*Cyclaspis varians* (11%) 3-*Eudevenopus honduranus* (11%) 4-*Rudilemboides naglei* (8%) 5-*Erycina floridana* (8%)		1- *A. vadorum* (25%) 2- *A. holmesi* (11%) 3- *R. naglei* (8%) 4- *Eobrolgus spinosus* (4%) 5- Tubificidae-gen. undet. (4%)
TBBI	84.4		88.7

Table 4. Summary Statistics for MacDill Runway Extension Dredge Hole (MCDRUN).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth (m)	2.2	ND		2.8	1.6
% SC	72.9	ND		75.9	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	30.4	ND		28.8	28.8
Bottom Temperature	30.0	ND		28.7	28.8
Surface Salinity	27.2	ND		23.9	24.0
Bottom Salinity	27.6	ND		24.0	24.0
Stratification Index	0.41	ND		0.05	0.01
Surface D.O.	7.0	ND		5.8	5.6
Bottom D.O.	6.6	ND		5.6	5.6
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 4-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.54
Al	30,582
As	3.18
Cd	2.75*
Cr	86*
Cu	16
Ni	20.7*
Pb	17.7
Zn	60

Table 4-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.43
ABHC	0.07
BBHC	0.11
DBHC	0.03
CHLORDANE	0.25
DDD	0.05
DDE	0.02
DDT	0.04
TOTAL DDT	0.11
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.02
ENSOSULFAN SULFATE	0.07
ENDRIN	0.02
ENDRIN ALDEHYDE	0.03
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.27
MIREX	0.02
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	16.1
HIGH MW PAHS	68.0
TOTAL PAHS	84.1
TOTAL PCBS (CONGENERS)	1.1
COMPOSITE PEL QUOTIENT	0.11*

* >TEL **>PEL

Table 4-continued.

C. Biotic Variables

	Fall 2002	**Spring 2003**
SPECIES RICHNESS	15	11
SHANNON-WIENER DIVERSITY	3.38	2.85
EVENNESS	0.89	0.90
TOTAL ABUNDANCE (#m^{-2})	1,000	592
FIVE MOST ABUNDANT TAXA (% COMPOSITION)	1-*Pinnixa* sp. (15%) 2-*Macoma tenta* and Enteropneusta-gen. undet. (9%) 4-*Cyclaspis varians* (8%) 5- *Listriella barnardi* (7%)	1- *Cyrtopleura costata* (27%) 2-*Pamphinome* sp. B (14%) 3- Enteropneusta-gen. undet. (7%) 4-*Paraprionospio pinnata* (6%) 5- *Cerapus* sp(p), *Erichthonius brasiliensis*, *Eobrolgus spinosus* (4%) 6- 6 species (3%)
TBBI	79.2	77.3

Table 5. Summary Statistics for MacDill Beach Dredge Hole (MCDS).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	**Fall 2002-Control**		**Spring 2003-Dredge Hole**	**Spring 2003-Control**
Depth (m)	1.6	ND		ND	ND
% SC	ND	ND		ND	ND
RPD (mm)	0	ND		ND	ND
Surface Temperature	28.7	ND		ND	ND
Bottom Temperature	28.6	ND		ND	ND
Surface Salinity	25.3	ND		ND	ND
Bottom Salinity	25.7	ND		ND	ND
Stratification Index	0.4	ND		ND	ND
Surface D.O.	5.3	ND		ND	ND
Bottom D.O.	4.4	ND		ND	ND
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 5-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.60
Al	21,588
As	3.55
Cd	2.77*
Cr	59*
Cu	12.0
Ni	15.1
Pb	16.0
Zn	47

Table 5-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.10
ABHC	0.03
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	1.47*
DDE	0.59
DDT	0.99
TOTAL DDT	3.06*
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.06
ENSOSULFAN SULFATE	0.12
ENDRIN	0.23
ENDRIN ALDEHYDE	0.76
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.01
MIREX	0.05
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	18.4
HIGH MW PAHS	100.6
TOTAL PAHS	119.0
TOTAL PCBS (CONGENERS)	21.5
COMPOSITE PEL QUOTIENT	0.13*

* >TEL **>PEL

Table 5-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	7		ND
SHANNON-WIENER DIVERSITY	1.17		ND
EVENNESS	0.65		ND
TOTAL ABUNDANCE (#m^{-2})	1,308		ND
FIVE MOST ABUNDANT TAXA (% COMPOSITION)	1-*Bittiolum varium* (76%) 2-*Capitella capitata* (5%) 3-*Paramphinome* sp. B (3%) 4-*Astryis lunata* (3%) 5- *Tubificoides wasselli, Nassarius vibex, Cymadusa compta, Dulichiella appendiculata* (2%)		ND
TBBI	72.1		ND

Table 6. Summary Statistics for MacDill Docks Dredge Hole (MCDE).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	2.6	ND		ND	ND
% SC	ND	ND		ND	ND
RPD (mm)	0	ND		ND	ND
Surface Temperature	28.6	ND		ND	ND
Bottom Temperature	28.3	ND		ND	ND
Surface Salinity	25.2	ND		ND	ND
Bottom Salinity	24.9	ND		ND	ND
Stratification Index	<0.1	ND		ND	ND
Surface D.O.	5.7	ND		ND	ND
Bottom D.O.	2.6	ND		ND	ND
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 6-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	1.02*
Al	39,483
As	3.40
Cd	3.06*
Cr	111*
Cu	25.5*
Ni	22.6*
Pb	40.3*
Zn	112

Table 6-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	3.95
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	1.30
DDD	0.88
DDE	11.97*
DDT	1.66*
TOTAL DDT	14.51*
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	2.85
ENSOSULFAN SULFATE	0.04
ENDRIN	0.05
ENDRIN ALDEHYDE	4.11
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.07
MIREX	0.51
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	94.2
HIGH MW PAHS	946.4*
TOTAL PAHS	1040.6
TOTAL PCBS (CONGENERS)	7.1
COMPOSITE PEL QUOTIENT	0.19*

* >TEL **>PEL

Table 6-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	15		ND
SHANNON-WIENER DIVERSITY	2.99		ND
EVENNESS	0.76		ND
TOTAL ABUNDANCE (#m^{-2})	2,475		ND
5 MOST ABUNDANT TAXA (%)	1-Enteropneusta-gen. undet. (29%) 2-*Teinostoma* sp. (28%) 3- *Gyptis crypta* (10%) 4-*Paraprionospio pinnata, Carazziella hobsonae*, *Paramphinome* sp. (3%)		ND
TBBI	80.8		ND

Table 7. Summary Statistics for McKay Bay Dredge Hole (MCKAY).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	4.1	0.9		3.8	0.8
% SC	69.0	ND		76.6	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	28.9	29.5		24.8	25.8
Bottom Temperature	29.0	29.5		24.0	24.8
Surface Salinity	19.7	19.9		21.4	21.5
Bottom Salinity	24.7	20.0		22.6	22.0
Stratification Index	3.8	0.1		1.1	0.6
Surface D.O.	3.4	4.4		6.2	6.5
Bottom D.O.	1.2	4.7		4.2	6.2
Daily Minimum D.O.	0.9	3.6		3.0	5.9
DO < 4 ppm (Hours)	18.75	5.00		7.00	0.00
Hypoxia (Hours)	11.75	0.00		0.00	0.00

Table 7-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.72
Al	34,051
As	3.39
Cd	4.04*
Cr	98.6*
Cu	39.4*
Ni	22.0*
Pb	75.6*
Zn	220*

Table 7-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
Aldrin	1.10
ABHC	0.16
BBHC	0.11
DBHC	0.03
CHLORDANE	0.22
DDD	0.25
DDE	0.80
DDT	0.04
TOTAL DDT	1.10
DIELDRIN	0.05
ENDOSULFAN I	0.06
ENDOSULFAN II	0.05
ENSOSULFAN SULFATE	0.04
ENDRIN	0.02
ENDRIN ALDEHYDE	0.05
HEPTACHLOR	0.12
HEPTACHLOR EPOXIDE	0.07
LINDANE	0.65*
MIREX	0.11
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	43.4
HIGH MW PAHS	375.8
TOTAL PAHS	419.2
TOTAL PCBS (CONGENERS)	2.6
COMPOSITE PEL QUOTIENT	0.21*

* >TEL **>PEL

Table 7-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	<1		<1
SHANNON-WIENER DIVERSITY	0.00		0.00
EVENNESS	0.00		0.00
TOTAL ABUNDANCE (#m^{-2})	8		25
5 MOST ABUNDANT TAXA (% COMPOSITION)	1- *Dosinia discus* (100%)		1-*Streblospio gynobranchiata* (100%)
TBBI	55.6		45.2

Table 8. Summary Statistics for Whiskey Stump Key Dredge Hole 1 (WSK 1).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	2.8	0.7		3.0	0.9
% SC	77.2	ND		65.8	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	28.1	28.2		29.6	31.2
Bottom Temperature	27.4	28.2		29.0	29.2
Surface Salinity	24.2	24.4		21.2	21.4
Bottom Salinity	24.9	24.5		21.9	21.8
Stratification Index	0.7	0.1		0.6	0.8
Surface D.O.	6.7	7.4		4.8	3.9
Bottom D.O.	5.2	7.3		5.9	4.9
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 8-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.58
Al	42,553
As	3.47
Cd	3.90*
Cr	119.0*
Cu	30.2*
Ni	25.9*
Pb	22.4
Zn	102

Table 8-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
Aldrin	2.07
ABHC	0.04
BBHC	0.11
DBHC	0.03
CHLORDANE	0.21
DDD	0.06
DDE	0.02
DDT	0.04
TOTAL DDT	0.12
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.02
ENSOSULFAN SULFATE	0.04
ENDRIN	0.04
ENDRIN ALDEHYDE	0.10
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.36*
MIREX	0.02
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	11.4
HIGH MW PAHS	20.9
TOTAL PAHS	32.3
TOTAL PCBS (CONGENERS)	0.7
COMPOSITE PEL QUOTIENT	0.14*

* >TEL **>PEL

Table 8-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	2		20
SHANNON-WIENER DIVERSITY	0.75		1.05
EVENNESS	0.32		0.37
TOTAL ABUNDANCE (#m^{-2})	50		12,542
5 MOST ABUNDANT TAXA (%)	1-*Stenoninereis martini* (40%) 2-*Polydora cornuta, Cyclaspis varians, Batea catharinensis* (19%)		1-*Ampelisca vadorum* (82%) 2-*Mysella planulata* (10%) 3-*Amygdalum papyrium, Nereis succinea, Astyris lunata* (1%)
TBBI	58.2		83.3

Table 9. Summary Statistics for Whiskey Stump Key Dredge Hole 2 (WSK 2).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	**Fall 2002-Control**		**Spring 2003-Dredge Hole**	**Spring 2003-Control**
Depth	3.1	0.9		3.1	0.9
% SC	57.2	ND		59.5	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	28.5	27.7		30.6	31.3
Bottom Temperature	27.9	28.2		28.8	29.8
Surface Salinity	24.1	24.2		20.8	20.8
Bottom Salinity	24.6	24.4		21.8	21.7
Stratification Index	0.5	<0.1		1.2	1.0
Surface D.O.	6.2	7.1		5.1	5.2
Bottom D.O.	6.1	7.3		4.1	5.6
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 9-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.54
Al	42,784
As	3.26
Cd	3.97*
Cr	115.5*
Cu	34.0*
Ni	25.8*
Pb	20.8
Zn	92

Table 9-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
Aldrin	0.03
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	0.06
DDE	0.02
DDT	0.04
TOTAL DDT	0.12
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.08
ENSOSULFAN SULFATE	0.25
ENDRIN	0.02
ENDRIN ALDEHYDE	0.11
HEPTACHLOR	0.07
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.28
MIREX	0.07
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	23.8
HIGH MW PAHS	74.8
TOTAL PAHS	98.5
TOTAL PCBS (CONGENERS)	17.1
COMPOSITE PEL QUOTIENT	0.17*

* >TEL **>PEL

Table 9-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	2		19
SHANNON-WIENER DIVERSITY	0.79		1.57
EVENNESS	0.62		0.37
TOTAL ABUNDANCE (#m^{-2})	58		8,067
5 MOST ABUNDANT TAXA (%)	1- *Stenoninereis martini* (36%) 2- *Cyclaspis varians and Ampelisca vadorum* (24.6%)		1- *A. vadorum* (76%) 2- *Mysella planulata* (6%) 3- *Amygdalum papyrium* (5%) 4- *Boonea impressa* (2%) 5- *Nereis succinea* (1%)
TBBI	61.8		84.7

Table 10. Summary Statistics for Northshore Beach Dredge Hole (NSHORE).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	4.0	0.7		4.0	0.7
% SC	61.8	ND		53.2	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	26.9	26.7		29.0	29.2
Bottom Temperature	25.8	26.7		28.6	29.2
Surface Salinity	26.0	26.1		24.5	24.5
Bottom Salinity	26.4	26.1		24.5	24.5
Stratification Index	0.5	<0.1		0.1	<0.1
Surface D.O.	5.4	5.5		6.1	6.3
Bottom D.O.	5.2	5.4		5.1	6.3
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 10-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.55
Al	43,298
As	3.31
Cd	3.37*
Cr	114.9*
Cu	53.5*
Ni	30.5*
Pb	42.9*
Zn	135*

Table 10-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
Aldrin	5.45
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.75
DDD	0.28
DDE	0.91
DDT	0.47
TOTAL DDT	1.66
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.03
ENSOSULFAN SULFATE	0.11
ENDRIN	0.28
ENDRIN ALDEHYDE	0.03
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.01
MIREX	0.21
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	30.0
HIGH MW PAHS	242.2
TOTAL PAHS	272.2
TOTAL PCBS (CONGENERS)	1.2
COMPOSITE PEL QUOTIENT	0.17*

* >TEL **>PEL

Table 10-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	1		5
SHANNON-WIENER DIVERSITY	0.00		0.85
EVENNESS	0.00		0.41
TOTAL ABUNDANCE (#m^{-2})	50		1,400
5 MOST ABUNDANT TAXA (% COMPOSITION)	1-*Stenoninereis martini* (100%)		1- *Ampelisca vadorum* (86%) 2- *A. holmesi* (4%) 3- *Astyris lunata* and *Mysella planulata* (2%) 5- *Rudilemboides naglei* and *Erichthonius brasiliensis* (1%)
TBBI	60.3		71.1

Table 11. Summary Statistics for Shore Acres Dredge Hole (SHACRES).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth (m)	3.5	0.9		4.1	0.8
% SC	21.9	ND		25.1	ND
RPD (mm)	13	ND		11	ND
Surface Temperature	28.1	28.6		29.4	29.7
Bottom Temperature	26.5	28.6		27.9	29.4
Surface Salinity	25.2	25.6		24.0	24.4
Bottom Salinity	25.9	25.6		24.4	24.4
Stratification Index	0.9	<0.1		0.7	0.1
Surface D.O.	6.8	9.2		6.1	7.3
Bottom D.O.	5.4	9.3		5.3	7.4
Daily Minimum D.O.	5.1	4.3		3.5	4.2
D.O. <4 ppm (Hours)	0.00	0.00		5.00	0.00
Hypoxia (Hours)	0.00	0.00		0.00	0.00

Table 11-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.53
Al	15,200
As	3.16
Cd	3.02*
Cr	41.5
Cu	12.2
Ni	15.2
Pb	10.43
Zn	30

Table 11-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.05
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.11
DDD	0.10
DDE	0.02
DDT	0.10
TOTAL DDT	0.22
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.02
ENSOSULFAN SULFATE	0.04
ENDRIN	0.08
ENDRIN ALDEHYDE	0.07
HEPTACHLOR	0.17
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.06
MIREX	0.02
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	13.2
HIGH MW PAHS	53.4
TOTAL PAHS	66.5
TOTAL PCBS (CONGENERS)	0.5
COMPOSITE PEL QUOTIENT	0.08*

* >TEL **>PEL

Table 11-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	28		38
SHANNON-WIENER DIVERSITY	2.86		1.94
EVENNESS	0.53		0.37
TOTAL ABUNDANCE (#m^{-2})	3,800		20,636
5 MOST ABUNDANT TAXA (% COMPOSITION)	1- *Metharpinia floridana* (25%) 2-*Cyclaspis varians* (8%) 3-*Ampelisca* sp. C (7%) 4-*Eudevenopus honduranus* (5%) 5-*Oxyurostylis smithi* and *Phascolion cryptum* (5%)		1- *A. vadorum* (67%) 2- *A. holmesi* (5%) 3- *Rudilemboides naglei* (4%) 4- *Eobrolgus spinosus* (3%) 5- *Ampelisca* sp. C (3%)
TBBI	72.9		87.8

Table 12. Summary Statistics for Gandy Channel North Dredge Hole (GANDYCH).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth (m)	1.7	1.0		2.4	0.9
% SC	3.9	ND		34.6	ND
RPD (mm)	8	ND		1	ND
Surface Temperature	30.3	30.3		30.0	30.1
Bottom Temperature	29.7	30.5		30.1	30.1
Surface Salinity	22.7	22.6		21.5	21.6
Bottom Salinity	23.1	22.7		22.0	21.6
Stratification Index	0.4	0.1		0.4	<0.1
Surface D.O.	6.5	7.0		5.6	5.8
Bottom D.O.	5.2	7.5		4.7	5.9
Daily Minimum D.O.	3.7	4.0		1.4	2.4
DO < 4 ppm (HRS)	0.75	0.00		11.50	4.75
Hypoxia (Hours)	0.00	0.00		1.75	0.00

Table 12-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.52
Al	2,337
As	3.14
Cd	2.70*
Cr	10.4
Cu	1.6
Ni	8.9
Pb	3.56
Zn	5.5

Table 12-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.03
ABHC	0.06
BBHC	0.11
DBHC	0.03
CHLORDANE	0.15
DDD	0.02
DDE	0.02
DDT	0.07
TOTAL DDT	0.11
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.36
ENSOSULFAN SULFATE	0.07
ENDRIN	0.12
ENDRIN ALDEHYDE	0.44
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.18
MIREX	0.02
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	11.4
HIGH MW PAHS	17.3
TOTAL PAHS	28.8
TOTAL PCBS (CONGENERS)	0.9
COMPOSITE PEL QUOTIENT	0.06*

* >TEL **>PEL

Table 12-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	50		22
SHANNON-WIENER DIVERSITY	4.07		1.65
EVENNESS	0.72		0.52
TOTAL ABUNDANCE (#m^{-2})	10,075		12,600
FIVE MOST ABUNDANT TAXA (% COMPOSITION)	1- *Rudilemboides naglei (*19%) 2- *Prionospio heterobranchia* (9%) 3- Tubificidae- gen. undet. (9%) 4- *Cyclaspis varians* (8%) 5- *Ampelisca holmesi* (7%)		1- *A. vadorum* (64%) 2- *Eobrolgus spinosus* (9%) 3- *R. naglei* (6%) 4- *Shoemakerella cubensis* (4%) 5- *Astyris lunata* (3%)
TBBI	88.0		80.1

Table 13. Summary Statistics for Big Island Cut Dredge Hole (BIGISL).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth (m)	2.5	0.5		2.6	1.4
% SC	66.4	ND		26.8	ND
RPD (mm)	0	ND		2	ND
Surface Temperature	29.8	30.1		30.5	30.8
Bottom Temperature	28.6	30.0		29.2	30.2
Surface Salinity	21.7	21.8		20.2	19.9
Bottom Salinity	22.0	21.8		20.4	20.3
Stratification Index	0.5	<0.1		0.4	0.4
Surface D.O.	4.8	5.0		5.4	6.3
Bottom D.O.	2.6	5.1		3.1	5.4
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 13-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.58
Al	47,083
As	3.45
Cd	2.60*
Cr	119.2*
Cu	16.9
Ni	27.7*
Pb	22.0
Zn	61

Table 13-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	3.24
ABHC	0.10
BBHC	0.11
DBHC	0.03
CHLORDANE	0.25
DDD	0.02
DDE	0.02
DDT	0.04
TOTAL DDT	0.08
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.18
ENSOSULFAN SULFATE	0.04
ENDRIN	0.02
ENDRIN ALDEHYDE	0.90
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.01
MIREX	0.05
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	17.9
HIGH MW PAHS	63.7
TOTAL PAHS	81.6
TOTAL PCBS (CONGENERS)	0.7
COMPOSITE PEL QUOTIENT	0.12*

* >TEL **>PEL

Table 13-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	1		22
SHANNON-WIENER DIVERSITY	0.00		2.59
EVENNESS	0.00		0.64
TOTAL ABUNDANCE (#m^{-2})	17		3,033
5 MOST ABUNDANT TAXA (% COMPOSITION)	1- *Stenoninereis martini* (100%)		1- *Ampelisca vadorum* (46%) 2- *Tubificoides wasselli* (6%) 3- *Streblospio gynobranchiata* and *Grania monospermatheca* (4%) 5- *Kinbergonuphis simoni* and *Macoma tenta* (4%)
TBBI	58.1		72.8

Table 14. Summary Statistics for St. Petersburg-Clearwater Airport Dredge Hole West (SPCWA 1).

A. Hydrographic and Sediment Variables.

	Fall 2002-Dredge Hole	**Fall 2002-Control**		**Spring 2003-Dredge Hole**	**Spring 2003-Control**
Depth (m)	1.6	0.4		1.2	0.4
% SC	43.9	ND		57.5	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	29.7	30.8		26.1	25.8
Bottom Temperature	29.5	30.8		25.8	25.8
Surface Salinity	19.6	20.1		14.9	19.2
Bottom Salinity	21.1	20.2		19.0	19.2
Stratification Index	1.2	0.1		3.2	<0.1
Surface D.O.	4.7	6.0		5.4	5.9
Bottom D.O.	2.9	6.0		4.9	5.9
Daily Minimum D.O.	ND	ND		4.1	4.2
D.O. <4 ppm (Hours)	ND	ND		0.00	0.00
Hypoxia (Hours)	ND	ND		0.00	0.00

Table 14-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.52
Al	33,525
As	3.12
Cd	2.76*
Cr	92.4*
Cu	12.5
Ni	20.8
Pb	18.6
Zn	56

Table 14-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.22
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	0.02
DDE	0.02
DDT	0.04
TOTAL DDT	0.08
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.02
ENSOSULFAN SULFATE	0.10
ENDRIN	0.02
ENDRIN ALDEHYDE	0.03
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.25
MIREX	0.16
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	27
HIGH MW PAHS	299
TOTAL PAHS	326
TOTAL PCBS (CONGENERS)	26*
COMPOSITE PEL QUOTIENT	0.16*

* >TEL **>PEL

Table 14-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	13		14
SHANNON-WIENER DIVERSITY	2.85		2.22
EVENNESS	0.80		0.77
TOTAL ABUNDANCE (#m^{-2})	1,350		3,300
5 MOST ABUNDANT TAXA (% COMPOSITION)	1- *Ampelisca vadorum* (26%) 2- *Prionospio pinnata* (24%) 3- *Parahesione luteola* (10**%**) 4- *Gyptis crypta* (7%) 5- *Cyclaspis varians* (6%)		1-*Steblospio gynobranchiata* (23%) 2- *Capitella jonesi* (15%) 3- *A. vadorum* (9%) 4-*Melita elongata* (8%) 5-*Polydora cornuta* (5%)
TBBI	77.9		46.6

Table15. Summary Statistics for St. Petersburg-Clearwater Airport Dredge Hole East (SPCWA 2).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	2.6	2.0		2.5	1.4
% SC	56.9	ND		20.8	ND
RPD (mm)	0	ND		5	ND
Surface Temperature	31.1	31.4		25.7	26.1
Bottom Temperature	29.2	29.2		25.3	25.5
Surface Salinity	21.3	21.2		18.3	18.4
Bottom Salinity	21.4	21.4		19.1	19.0
Stratification Index	0.5	0.6		0.7	0.6
Surface D.O.	7.1	6.0		6.3	6.5
Bottom D.O.	4.1	5.2		4.0	6.1
Daily Minimum D.O.	ND	ND		2.6	4.3
D.O. <4 ppm (Hours)	ND	ND		13.25	0.00
Hypoxia (Hours)	ND	ND		0.00	0.00

Table 15-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.52
Al	52,707
As	3.13
Cd	2.55*
Cr	138.4*
Cu	17.0
Ni	28.8*
Pb	27.1
Zn	66

Table 15-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	4.78
ABHC	0.20
BBHC	0.11
DBHC	0.03
CHLORDANE	0.27
DDD	0.02
DDE	0.02
DDT	0.04
TOTAL DDT	0.08
DIELDRIN	0.05
ENDOSULFAN I	0.04
ENDOSULFAN II	0.10
ENSOSULFAN SULFATE	0.04
ENDRIN	0.02
ENDRIN ALDEHYDE	0.03
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.64
MIREX	0.02
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	15
HIGH MW PAHS	64
TOTAL PAHS	79
TOTAL PCBS (CONGENERS)	1
COMPOSITE PEL QUOTIENT	0.12*

* >TEL **>PEL

Table 15-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	5		24
SHANNON-WIENER DIVERSITY	1.02		3.02
EVENNESS	0.47		0.67
TOTAL ABUNDANCE (#m^{-2})	792		3,642
5 MOST ABUINDANT TAXA (% COMPOSITION)	1- *Ampelisca vadorum* (45%) 2- *Gyptis crypta* (39%) 3- *Carazziella hobsonae* (8%) 4- *Nassarius vibex* (2%) 5- 6 taxa (1%)		1- *Prionospio perkinsi* (23%) 2- *A. holmesi* (16%) 3- *Streblospio gynobranchiata* (6%) 4- *Diopatra cuprea* (4%) 5- *Haminoea succinea* (4%)
TBBI	70.1		72.8

Table 16. Summary Statistics for Northeast St. Petersburg Borrow Pit 1 Dredge Hole (STPETEB1).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	6.6	1.8		7.0	1.8
% SC	66.8	ND		77.3	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	30.5	30.6		30.1	30.1
Bottom Temperature	29.5	30.2		27.4	29.9
Surface Salinity	22.2	22.2		21.0	21.1
Bottom Salinity	23.0	22.2		22.7	21.2
Stratification Index	0.8	0.1		2.0	0.1
Surface D.O.	5.4	6.5		5.1	5.2
Bottom D.O.	3.1	5.2		0.1	4.3
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 16-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.56
Al	52,633
As	3.33
Cd	2.50*
Cr	117.0*
Cu	36.8*
Ni	32.5*
Pb	43.2*
Zn	105

Table 16-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.98
ABHC	0.05
BBHC	0.11
DBHC	0.03
CHLORDANE	0.73
DDD	0.18
DDE	0.56
DDT	0.04
TOTAL DDT	0.79
DIELDRIN	0.19
ENDOSULFAN I	0.04
ENDOSULFAN II	0.07
ENSOSULFAN SULFATE	0.16
ENDRIN	0.02
ENDRIN ALDEHYDE	0.29
HEPTACHLOR	0.29
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.01
MIREX	0.22
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	37.0
HIGH MW PAHS	312.3
TOTAL PAHS	349.2
TOTAL PCBS (CONGENERS)	8.7
COMPOSITE PEL QUOTIENT	0.16*

* >TEL **>PEL

Table 16-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	0		1
SHANNON-WIENER DIVERSITY	0.00		0.33
EVENNESS	0.00		0.33
TOTAL ABUNDANCE (#m^{-2})	0		33
5 MOST ABUNDANT TAXA (% COMPOSITION)			1- *Kinbergonuphis simoni*, *Thalassodrilides ineri*, *Ampelisca* spp., and *A. abdita* (25%)
TBBI	53.2		61.9

Table 17. Summary Statistics for Northeast St. Petersburg Borrow Pit 2 Dredge Hole (STPETEB2).

A. Hydrographic and Sediment Variables

	Fall 2002-Dredge Hole	Fall 2002-Control		Spring 2003-Dredge Hole	Spring 2003-Control
Depth	3.3	1.0		3.8	2.4
% SC	15.6	ND		40.0	ND
RPD (mm)	0	ND		0	ND
Surface Temperature	29.6	29.5		30.6	30.4
Bottom Temperature	29.6	29.4		29.9	30.4
Surface Salinity	21.5	21.7		20.4	21.1
Bottom Salinity	22.1	21.9		20.9	21.1
Stratification Index	0.4	0.2		0.5	<0.1
Surface D.O.	4.4	3.7		6.5	6.0
Bottom D.O.	3.3	3.5		3.7	5.8
Daily Minimum D.O.	ND	ND		ND	ND
D.O. <4 ppm (Hours)	ND	ND		ND	ND
Hypoxia (Hours)	ND	ND		ND	ND

Table 17-continued.

B. Sediment Contaminants

	PPM
METALS	
Ag	0.55
Al	14,179
As	3.32
Cd	2.38*
Cr	33.4
Cu	10.5
Ni	14.8
Pb	12.7
Zn	33

Table 17-continued.

	PPB
ORGANOCHLORINE PESTICIDES	
ALDRIN	0.03
ABHC	0.02
BBHC	0.11
DBHC	0.03
CHLORDANE	0.09
DDD	0.15
DDE	0.20
DDT	0.04
TOTAL DDT	0.39
DIELDRIN	0.07
ENDOSULFAN I	0.04
ENDOSULFAN II	0.03
ENSOSULFAN SULFATE	0.17
ENDRIN	0.02
ENDRIN ALDEHYDE	0.22
HEPTACHLOR	0.05
HEPTACHLOR EPOXIDE	0.04
LINDANE	0.02
MIREX	0.17
POLYCYCLIC AROMATIC HYDROCARBONS	
LOW MW PAHS	44
HIGH MW PAHS	598.4
TOTAL PAHS	642.2
TOTAL PCBS (CONGENERS)	9
COMPOSITE PEL QUOTIENT	0.11*

* >TEL **>PEL

Table 17-continued.

C. Biotic Variables

	Fall 2002		**Spring 2003**
SPECIES RICHNESS	2		1
SHANNON-WIENER DIVERSITY	0.86		0.20
EVENNESS	0.67		0.20
TOTAL ABUNDANCE (#m^{-2})	50		67
5 MOST ABUNDANT TAXA (% COMPOSITION)	1- *Stenoninereis martini* (50%) 2- *Ampelisca abdita, A. vadorum, A. holmesi* (17%)		1- *Ampelisca abdita/vadorum* (75%) 2- *Aricidea philbinae* and *Parastarte triquetra* (25%)
TBBI	64.5		59.6

Table 18. Summary of SIMPER analysis (4th root transformed abundance; Bray-Curtis similarity) comparing benthic community structure by season, of Tampa Bay Dredge Holes with that of the Big Bend area of Tampa Bay.

DREDGE HOLE	% SIMILARITY-SUMMER/FALL *vs.* SPRING SEASONS
CYPRESS POINT	10.2
GEORGETOWN	32.8
MacDILL AFB RUNWAY EXTENSION	23.8
MacDILL BEACH	ND
MacDILL DOCKS	ND
McKAY BAY	67.0
WHISKEY STUMP KEY DREDGE HOLE 1	6.3
WHISKEY STUMP KEY DREDGE HOLE 2	9.9
NORTHSHORE BEACH	11.3
SHORE ACRES	20.7
GANDY CHANNEL NORTH	17.1
BIG ISLAND CUT	4.5
ST. PETERSBURG-CLEARWATER AIRPORT WEST	20.2
ST. PETERSBURG-CLEARWATER AIRPORT EAST	10.6
ST. PETERSBURG BORROW PIT B1	41.8
ST. PETERSBURG BORROW PIT B2	24.8
"REFERENCE AREA": BIG BEND AREA (1999-2002) (Grabe *et al.* 2003)	80.7

ND= not determined

Ta**ble 19. Comparison of dredge holes (Summer/Fall 2002-Spring 2003). Subnominal values are represented in bold type.**

DREDGE HOLE	Habitat	Stratification Index	DO (instantaneous minimum)	DO (hours < 4 ppm)	PEL Quotient	Numbers of taxa	TBBI
CYPRESS POINT	PM-PM	0.1-0.1	6.1-6.1		0.17	**0-7**	**53.2 –** 73.3
GEORGETOWN	PFS-PMS	0.1-0.1	**2.7**-5.3	**13.25**-0.00	0.07	30-47	84.4 – 88.7
MacDILL AFB RUNWAY EXTENSION	PM-PM	0.4-<0.1	6.6-5.6		0.11	15-11	79.2 – 77.3
MacDILL BEACH	ND-ND	0.4-ND	4.4-ND		0.13	7-ND	**72.1** - ND
MacDILL DOCKS	ND-ND	<0.1-ND	2.6-ND		0.19	15-ND	80.8 - ND
McKAY BAY	PM-PM	**3.8-1.1**	**1.2**-4.2	**18.75-7.00**	0.21	**<1-<1**	**55.6 – 45.2**
WHISKEY STUMP KEY DREDGE HOLE 1	PM-PM	0.7-0.6	5.2-5.9		0.14	**2**-20	**58.2 – 83.3**
WHISKEY STUMP KEY DREDGE HOLE 2	PM-PM	0.5-**1.2**	6.1-4.1		0.17	**2**-19	**61.8 –** 84.7
NORTHSHORE BEACH	PM-PM	0.5-0.1	5.2-5.1		0.17	**1-5**	**60.3 – 71.1**
SHORE ACRES	PVFS-PVFS	0.9-0.7	5.4-5.3	0.00-**5.00**	0.08	28-38	**72.9** – 87.8
GANDY CHANNEL	PMS-PM	0.4-0.4	**3.7-1.4**	**0.75-11.50**	0.06	50-22	88.0 – 80.1

Table 19-continued.

BIG ISLAND	PM-PM	0.5-0.4	**2.6-3.1**		0.12	**1**-22	**58.1 – 72.8**
ST. PETERSBURG-CLEARWATER AIRPORT WEST	PM-PM	**1.2-3.2**	**2.9**-4.9		0.16	13-14	77.9 – **46.6**
ST. PETERSBURG-CLEARWATER AIRPORT EAST	PM-PVFS	0.5-0.7	4.1-4.0		0.12	**5**-24	**70.1 – 72.8**
NE ST. PETERSBURG BORROW PIT B1	PM-PM	0.8-**2.0**	**3.1-0.1**		0.16	**0-1**	**53.2 – 61.9**
NE ST. PETERSBURG BORROW PIT B2	PFS-PM	0.4-0.5	**3.3-3.7**		0.11	**2-1**	**64.5 – 59.6**

ND= NO DATA

HABITAT KEY: P=POLYHALINE; MS=MEDIUM SAND; FS=FINE SAND; VFS=VERY-FINE SAND; M=MUD

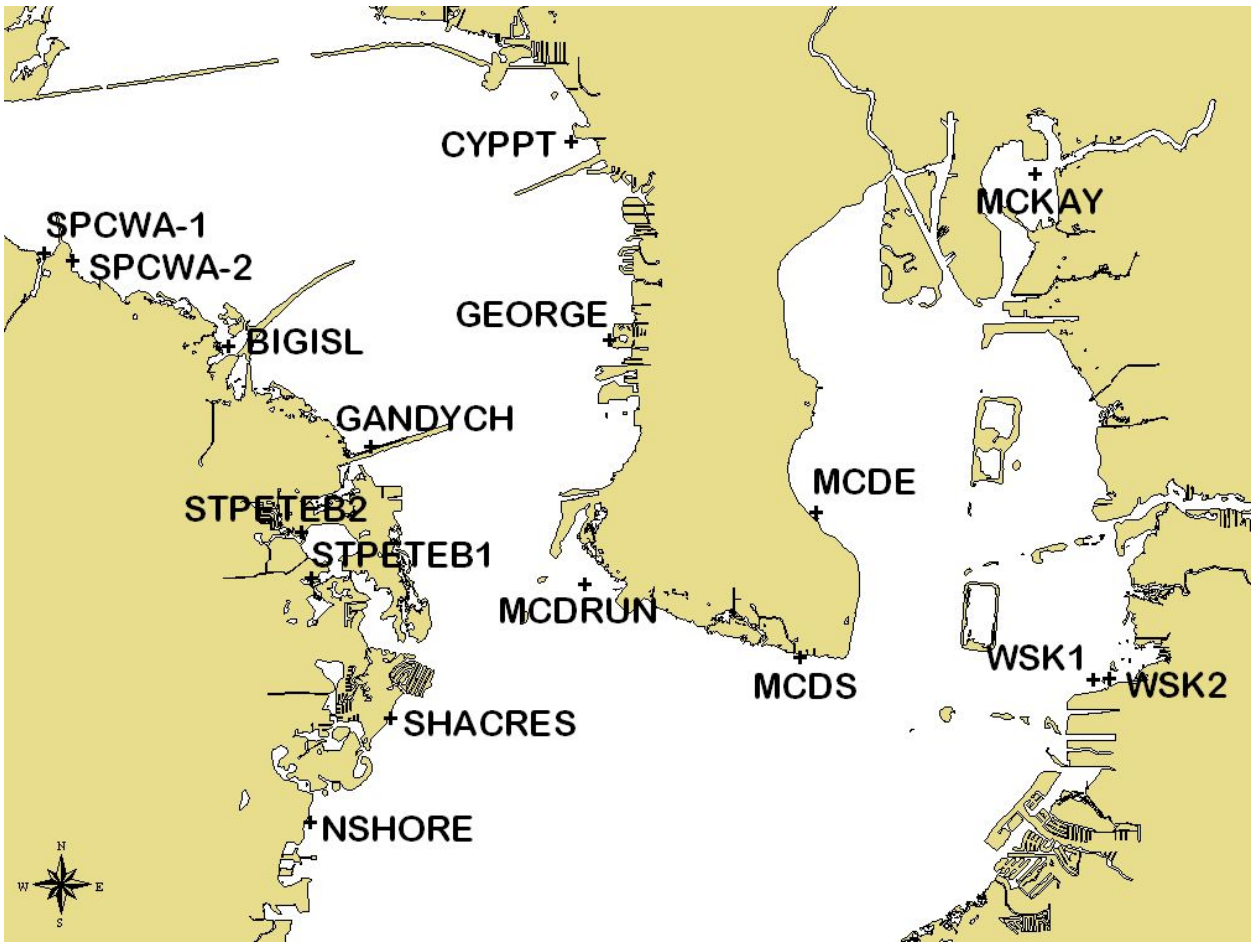

Figure 1. Location (mean latitude and longitude of all samples) of dredge holes sampled in Tampa Bay, Summer/Fall 2002 and Spring 2003. KEY: CYPRESS POINT (CYPPT); GEORGETOWN (GEORGE); MacDILL AFB RUNWAY EXTENSION (MCDRUN); MacDILL BEACH (MCDS); MacDILL DOCKS (MCDE); McKAY BAY (MCKAY); WHISKEY STUMP KEY DREDGE HOLE 1 (WSK1); WHISKEY STUMP KEY DREDGE HOLE 2 (WSK2); NORTHSHORE BEACH (NSHORE); SHORE ACRES (SHACRES); GANDY CHANNEL NORTH (GANDYCH); BIG ISLAND CUT (BIGISL); ST. PETERSBURG-CLEARWATER AIRPORT WEST (SPCWA-1); ST. PETERSBURG-CLEARWATER AIRPORT EAST (SPCWA-2); ST. PETERSBURG BORROW PIT B1 (STPETEB1); ST. PETERSBURG BORROW PIT B2 (STPETEB2).

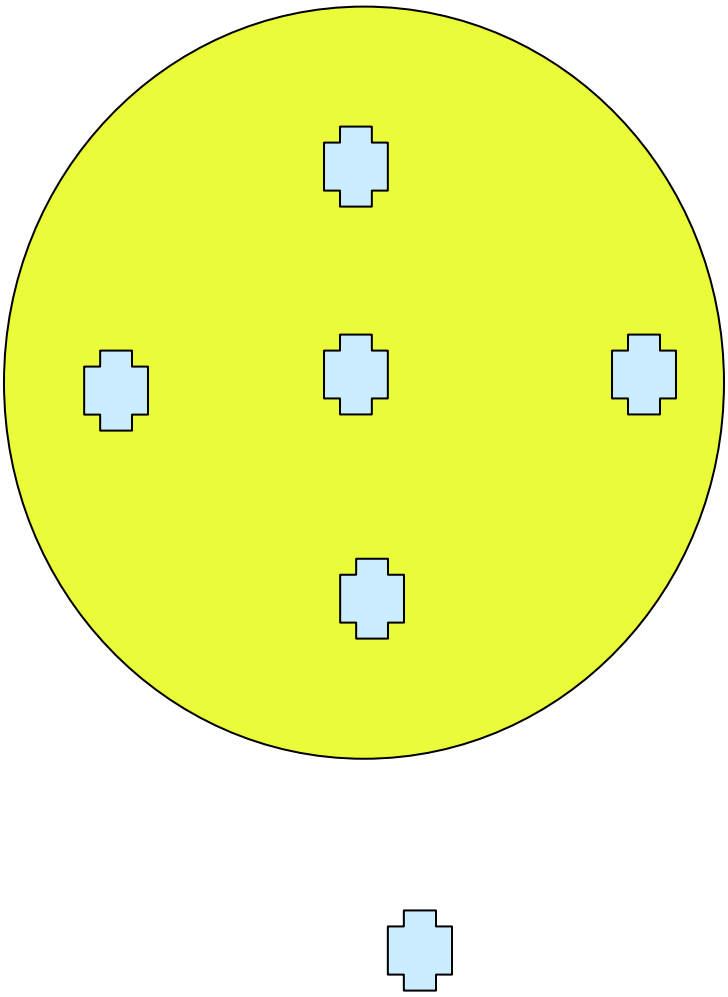

Figure 2. Schematic representation of sampling design for the hydrographic profile and sediment characterization of a hypothetical dredge hole. Hydrographic profiles are taken at the five locations within the dredge hole and at the (randomly) positioned "reference" location outside of the dredge hole. Samples for sediment contaminants and benthic macroinvertebrates were collected from three, randomly selected, locations within the dredge hole.

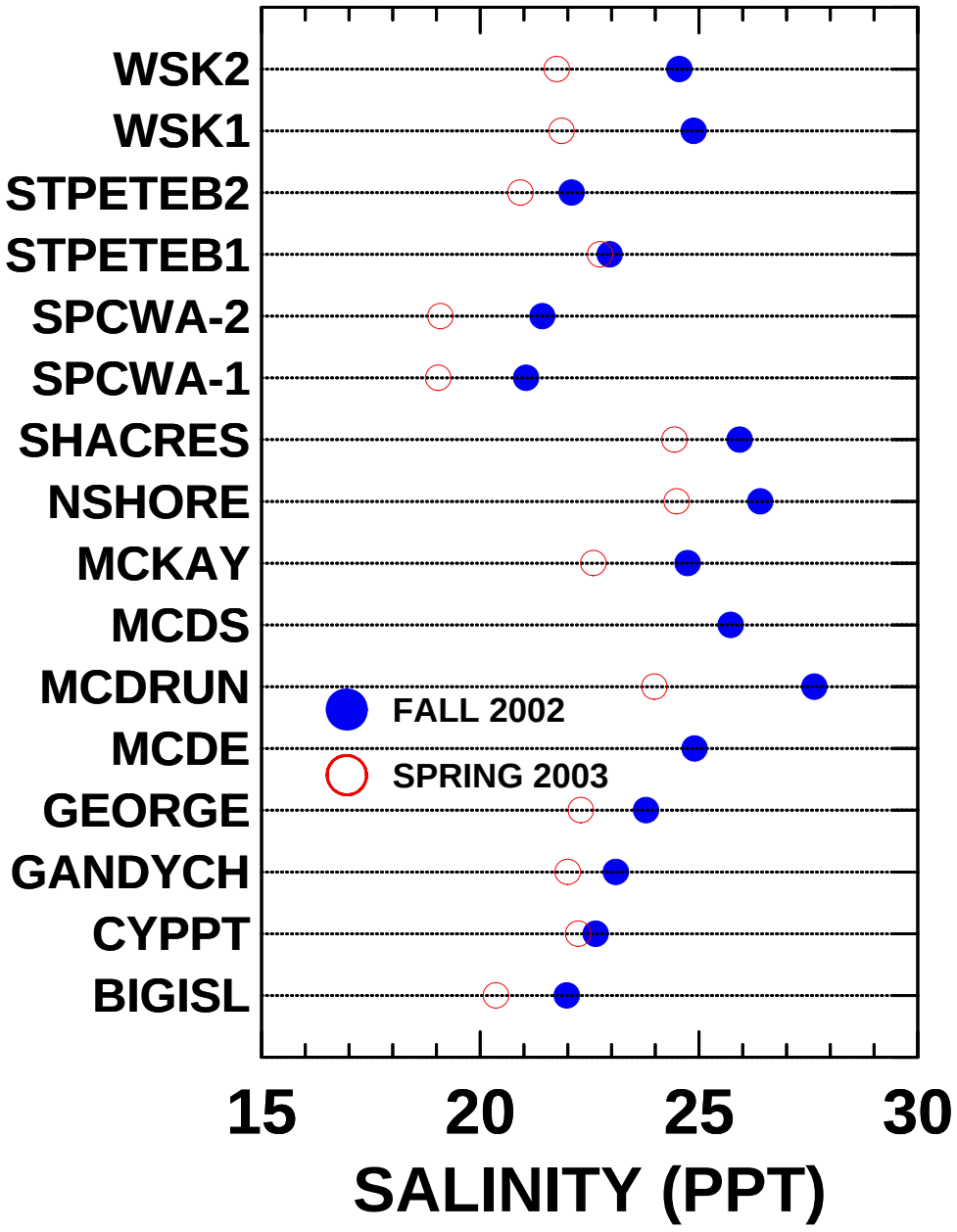

Figure 3. Dot plot of mean near-bottom salinities by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

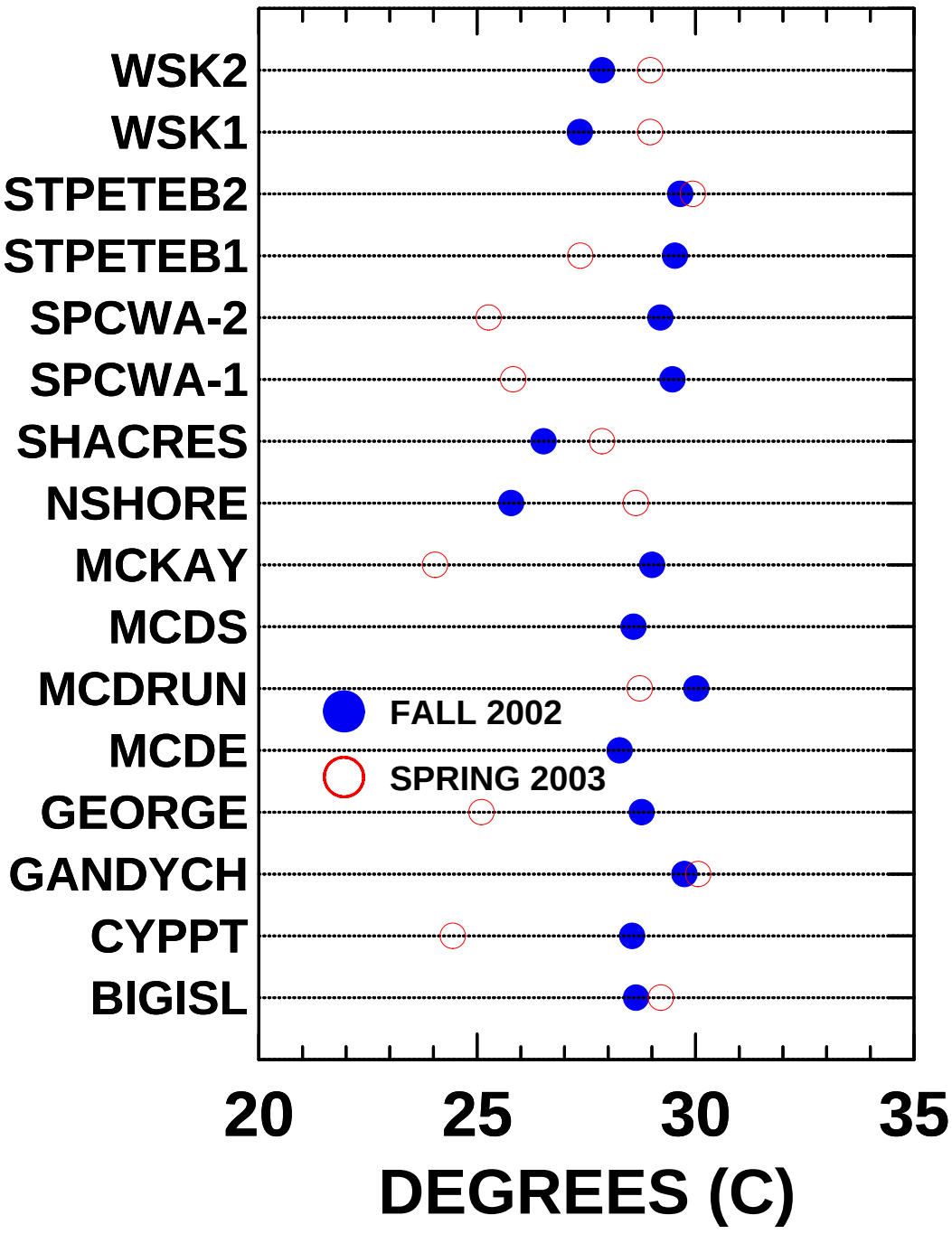

Figure 4. Dot plot of mean near-bottom water temperatures by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

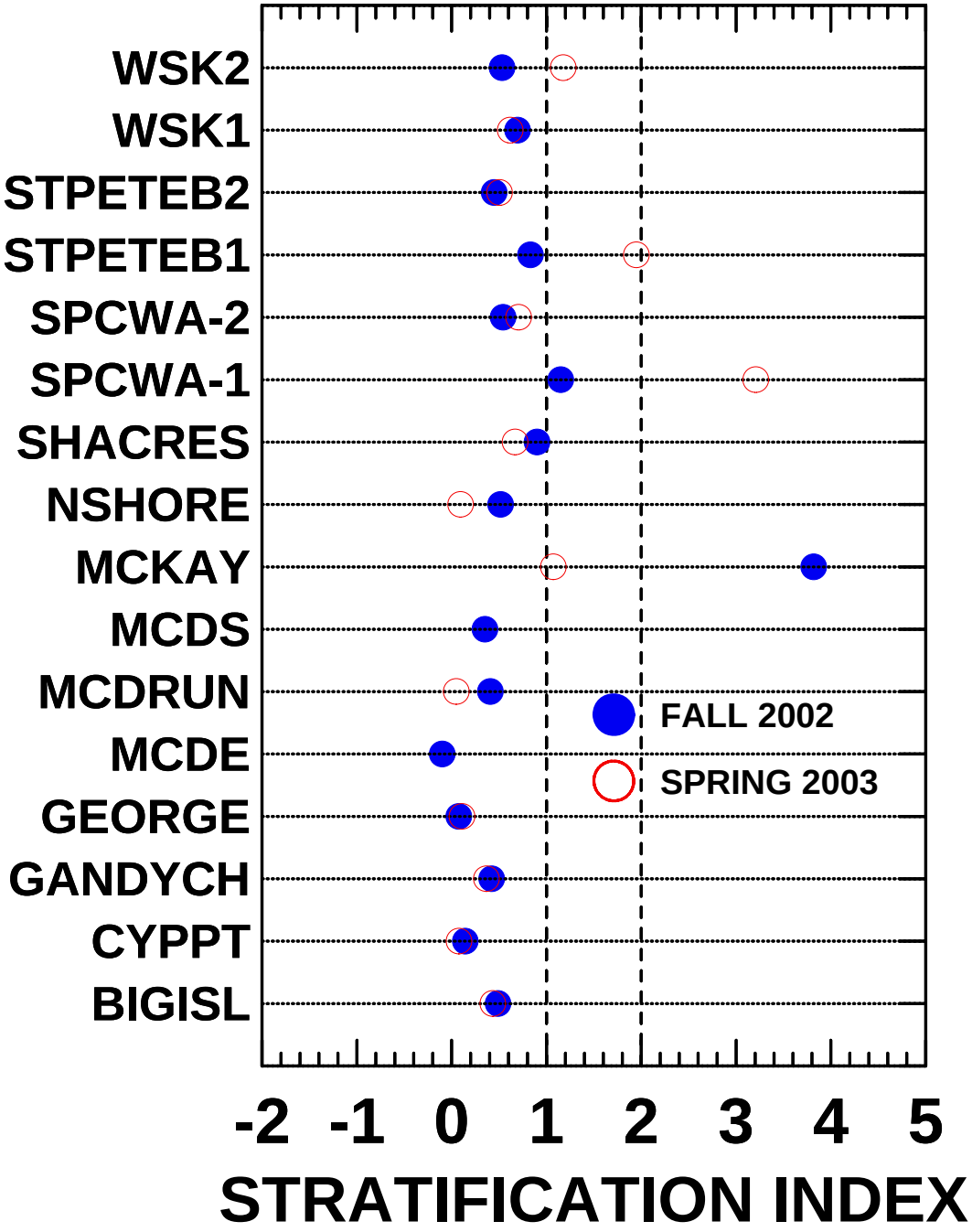

Figure 5. Dot plot of mean stratification index values by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003. 0= no stratification; 1= slight stratification; 2= highly stratified.

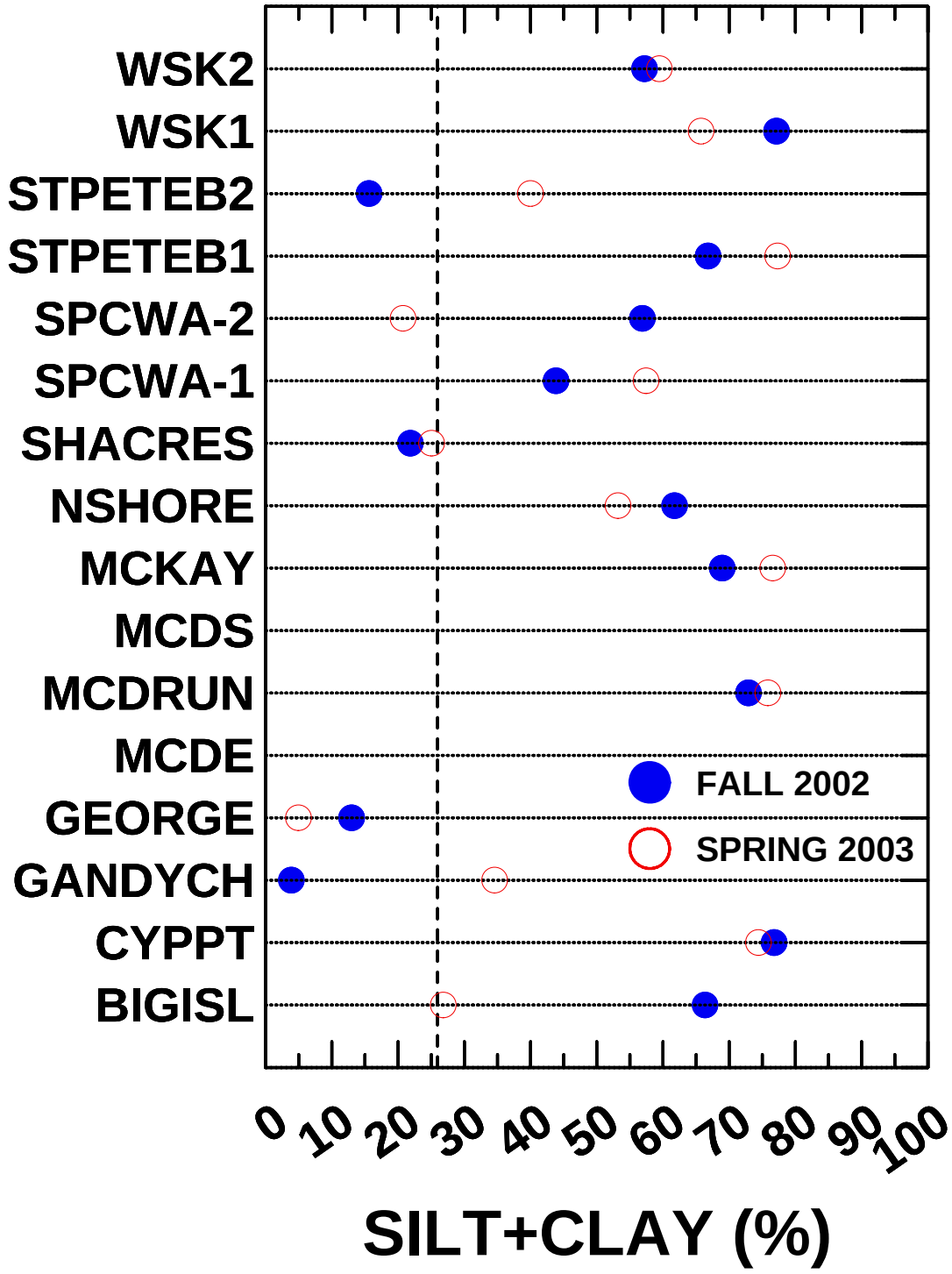

Figure 6. Dot plot of mean % silt+clay content of sediments by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

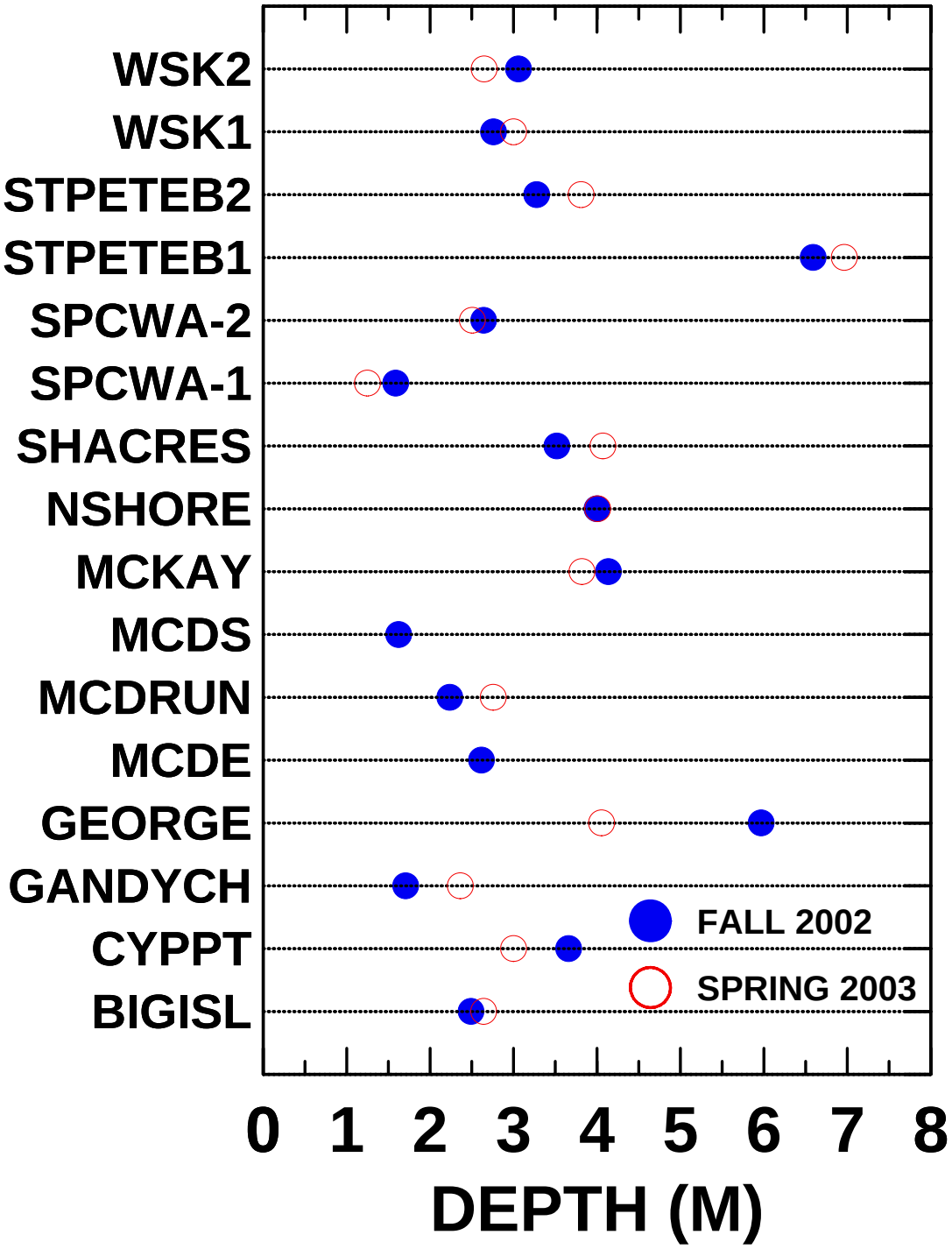

Figure 7. Dot plot of mean sample depths by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

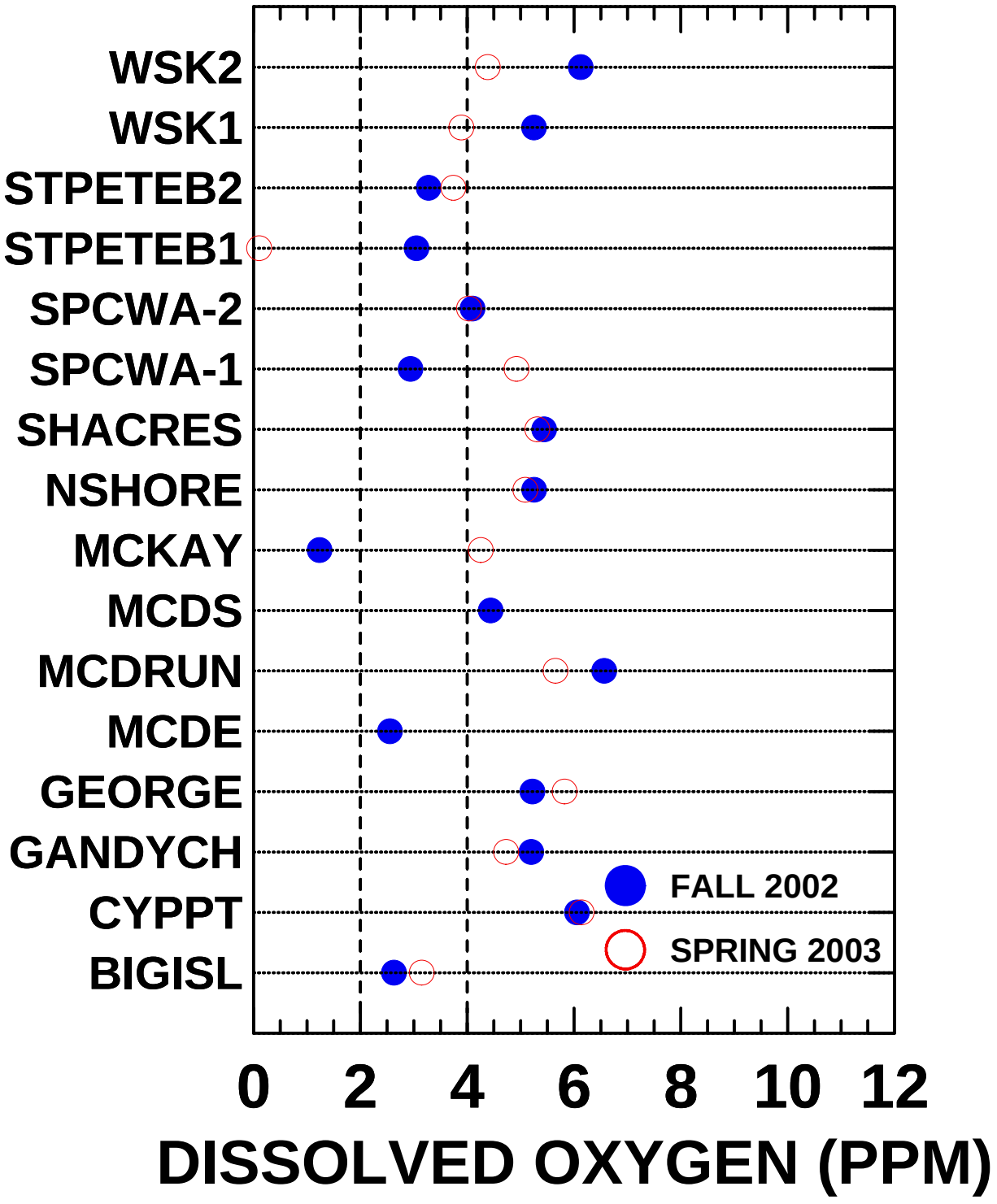

Figure 8. Dot plot of mean near-bottom dissolved oxygen (DO) concentration by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003. DO<2=hypoxia; DO≥2<4= subnominal.

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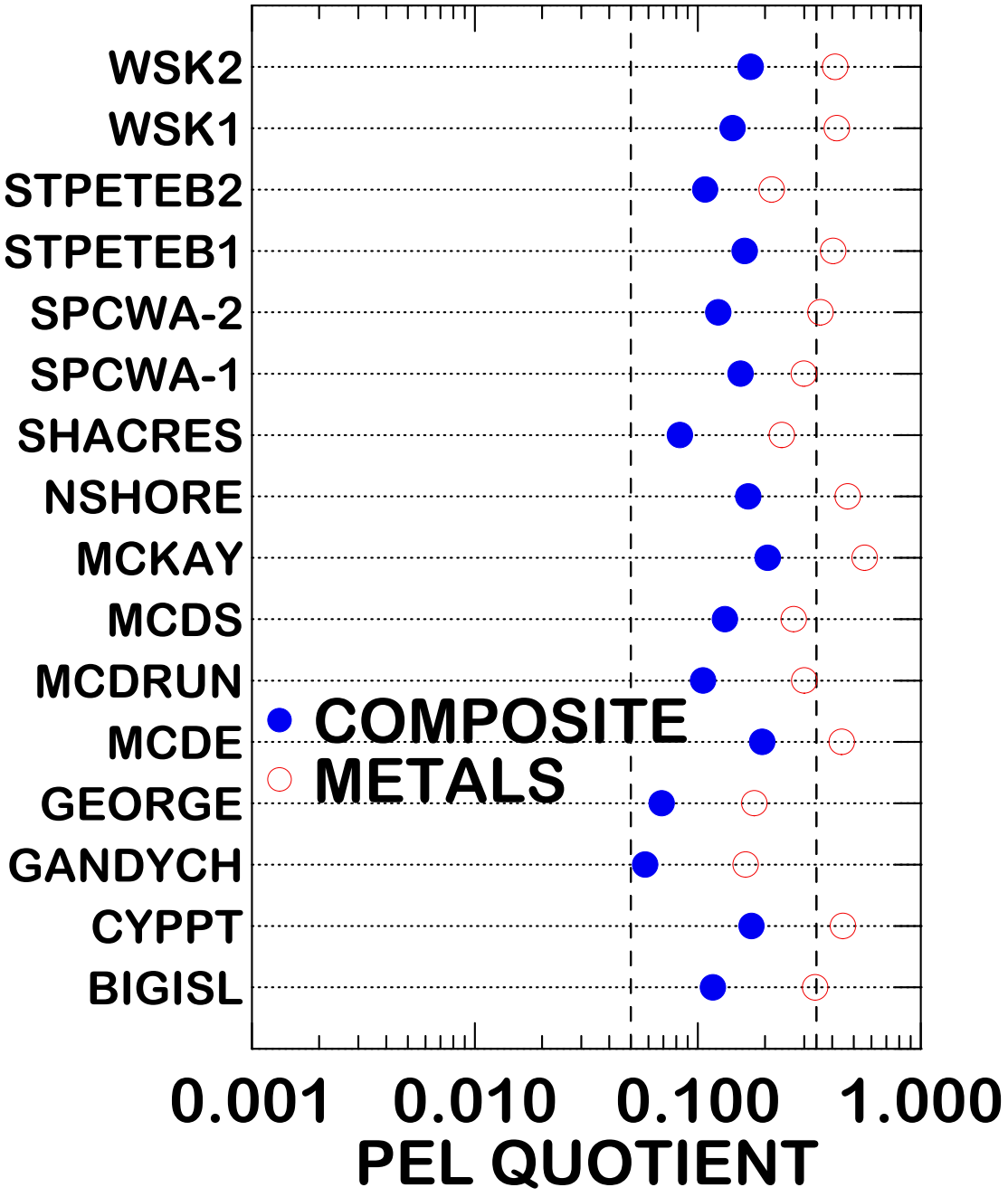

Figure 9. Dot plot of mean PEL Quotient for metals and the composite (metals, PAHs, PCBs) PEL Quotient by dredge hole, Summer/Fall 2002. PEL Quotients <0.05 have a low probability of toxicity; PEL Quotients >0.34 have a high probability.

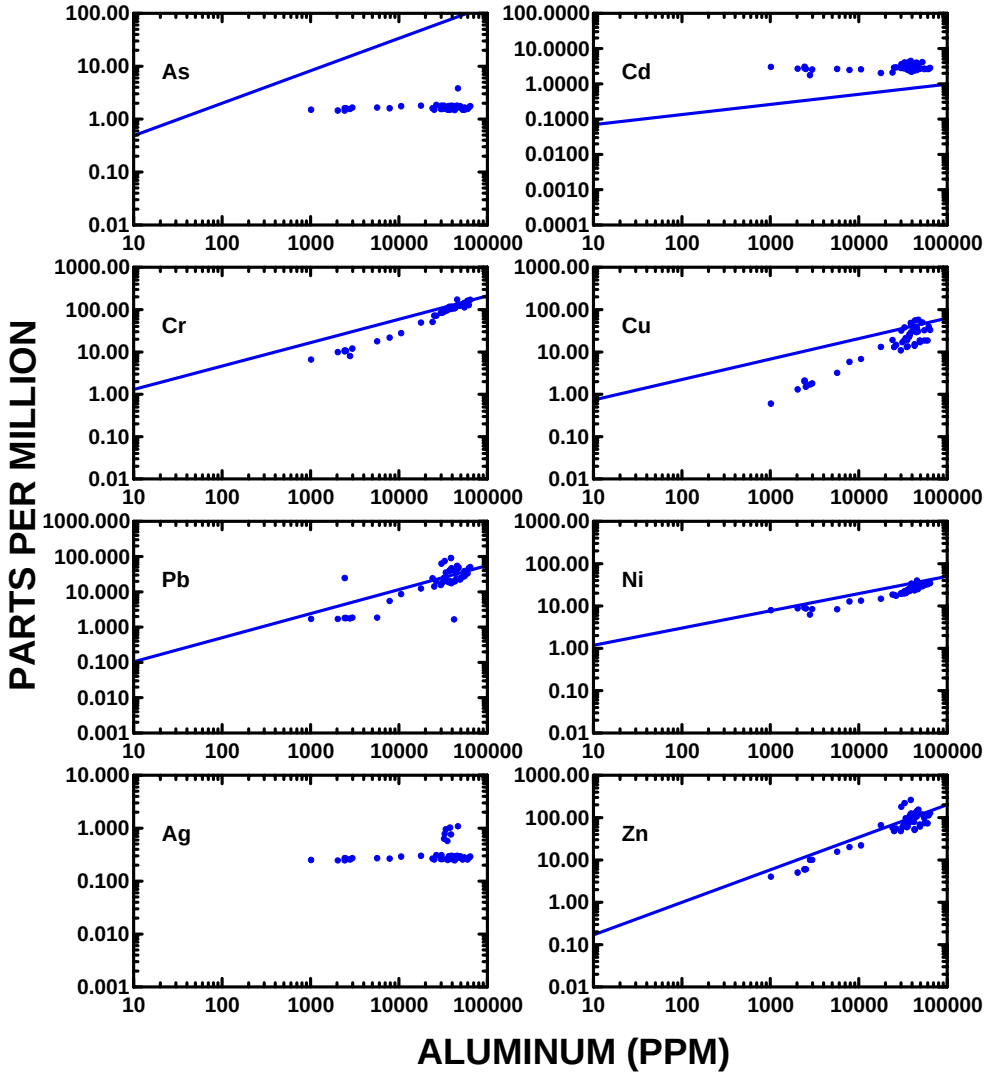

Figure 10. Metal: Aluminum ratio plot of dredge holes in Tampa Bay, Summer/Fall 2002. Values located above the regression line are indicative of anthropogenically enriched sediments. No relationship has been established for Ag:Al for Florida sediments.

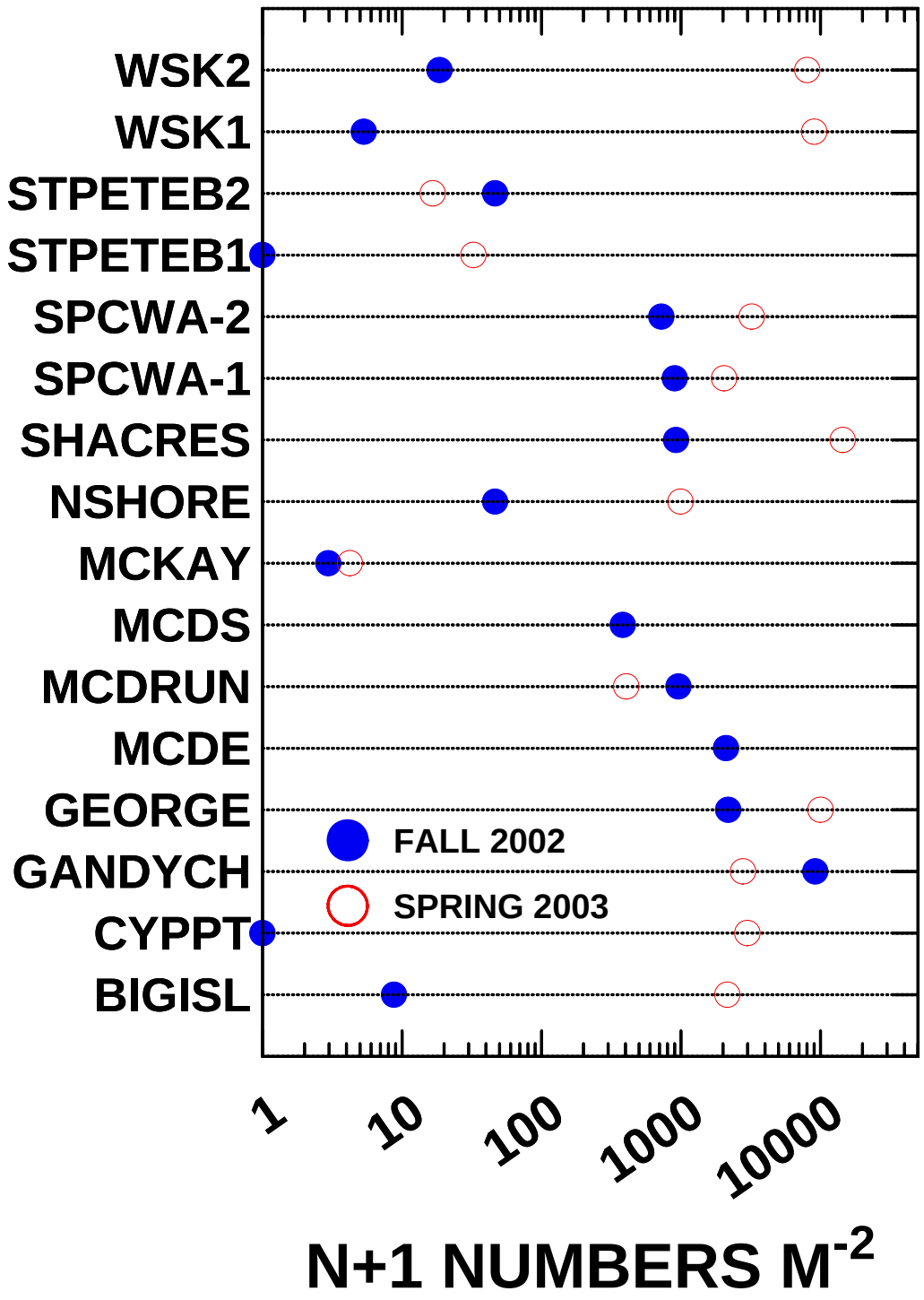

Figure 11. Dot plot of mean numbers of benthic macroinvertebrates by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

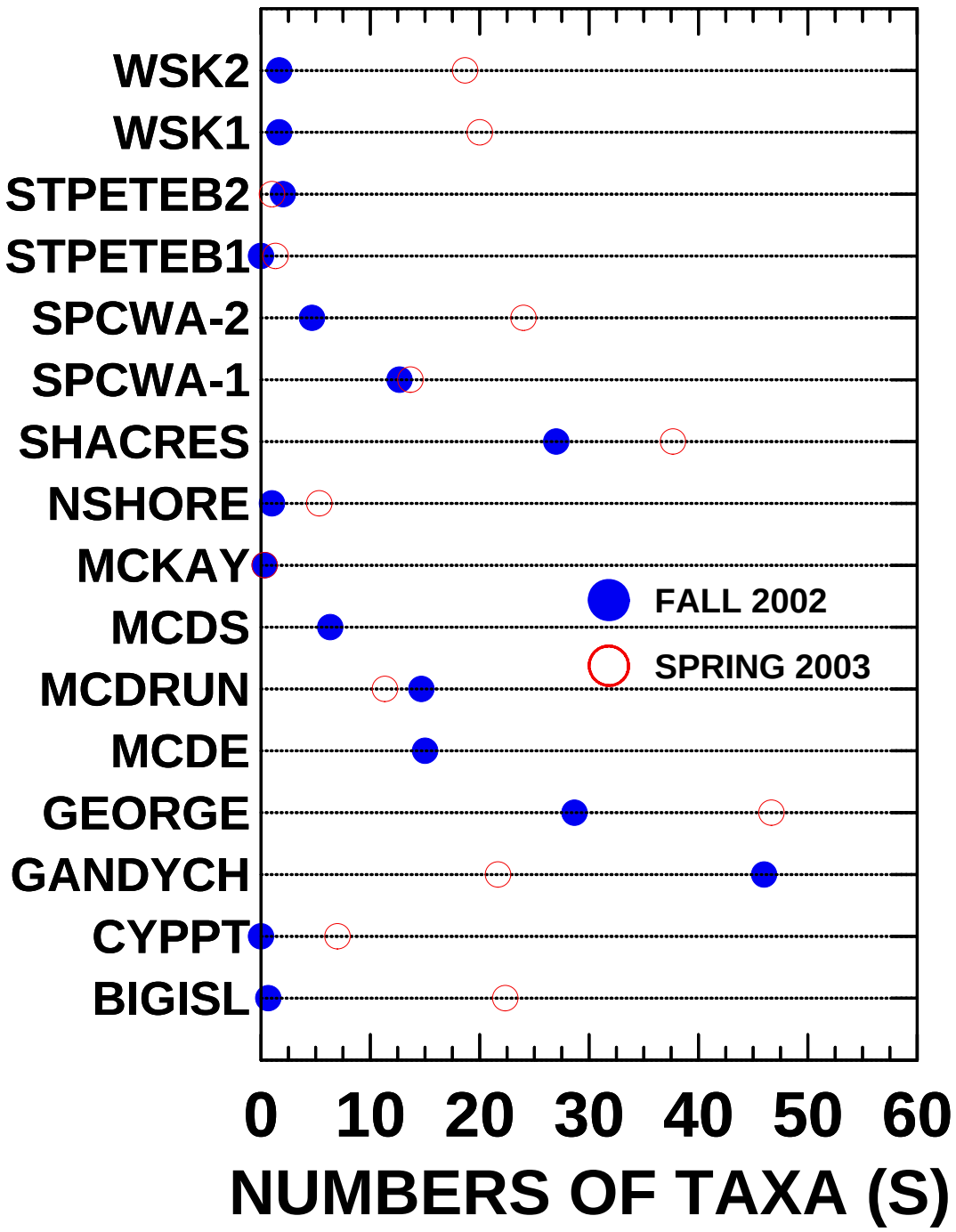

Figure 12. Dot plot of mean numbers of taxa by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.

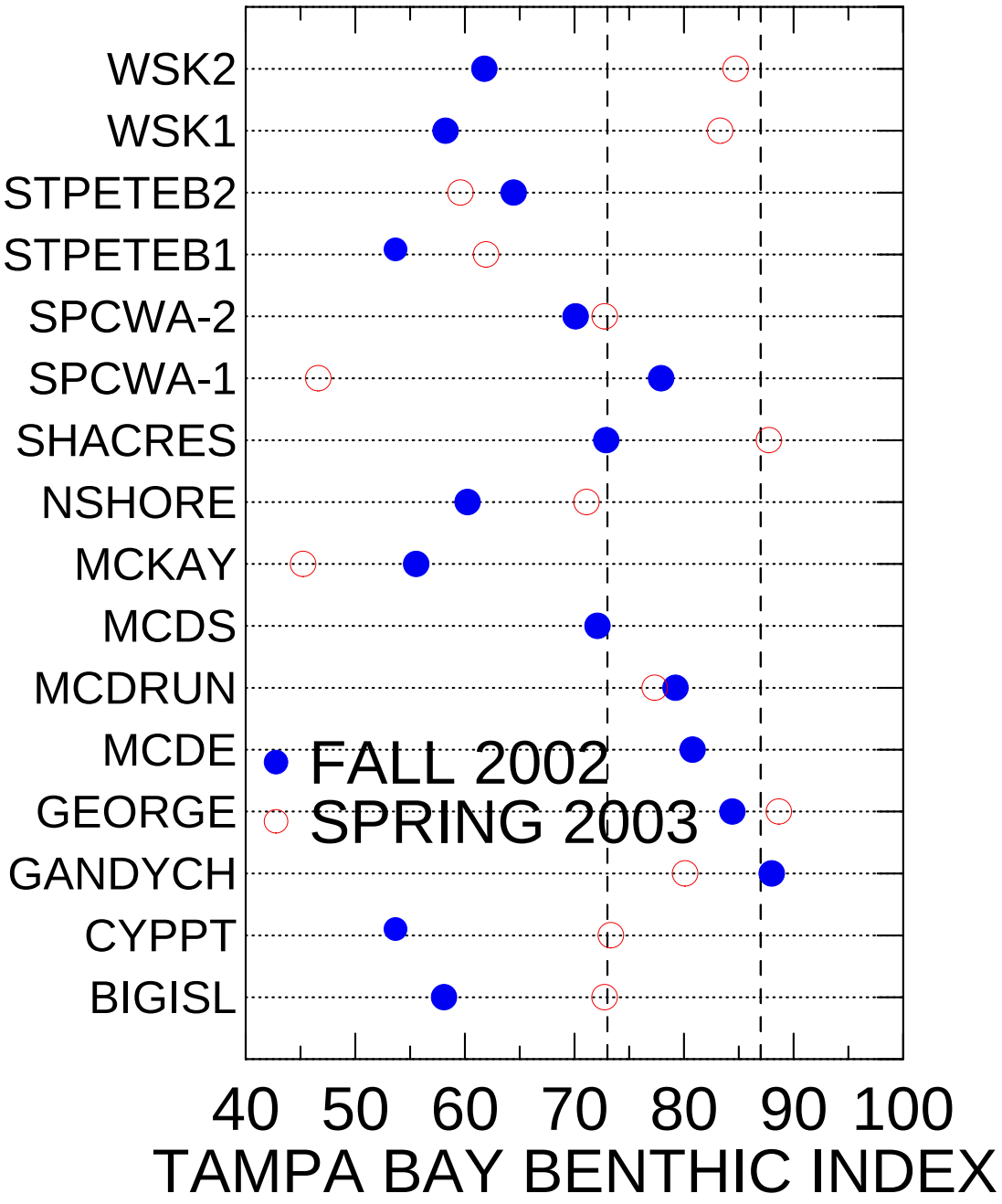

Figure 13. Dot plot of mean Tampa Bay Benthic Index scores by dredge hole and season, Tampa Bay, Florida, Summer/Fall 2002 and Spring 2003.