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TECHNICAL REPORT:
A SYNOPTIC SURVEY OF THE BENTHIC MACROINVERTEBRATES OF TERRA CEIA BAY AND THE MANATEE RIVER OCTOBER 1993-1995

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SECTION 1

INTRODUCTION

A benthic monitoring program has been included in the draft Comprehensive Conservation and Management Plan [CCMP] for Tampa Bay, "Charting the Course" (Tampa Bay National Estuary Program [TBNEP] 1996) as a key instrument for assessing the status, or "health" of Tampa Bay's biotic resources as well as a measurement tool to assess the effects of management decisions *vis a vis* toxic contaminants, stormwater runoff, and freshwater inflow (TBNEP 1996).

The benthic monitoring program envisioned for Tampa Bay (VERSAR 1992; Coastal Environmental, Inc. 1994) recommended annual sampling in each of the seven designated segments of Tampa Bay: Old Tampa Bay, Hillsborough Bay, Middle Tampa Bay, Lower Tampa Bay, Terra Ceia Bay, Manatee River, and Boca Ciega Bay. This report summarizes the results of the first three years (1993-1995) of monitoring in the Manatee river and Terra Ceia Bay segments of Tampa Bay. In the future, these results will be integrated with those of the other bay segments as part of a more comprehensive report.

SECTION 2

METHODS

2.1 STUDY DESIGN

The study design employed was a stratified (by bay segment), random, probability based sampling design (Larsen *et al.* 1994; Coastal Environmental, Inc. 1994). A hexagonal grid was randomly superimposed over the Terra Ceia Bay and Manatee River segments of the Tampa Bay estuarine system. The grid size was 1.9 km^2, or 470 acres ("7x7x7").Within each hexagon, the sampling location is randomly determined, with a known probability of inclusion.

The value of such an approach is that it is possible to determine the extents to which the sample population represents the "true"population (*i.e.*,any given segment of Tampa Bay); it is also possible to estimate the area of each segment, and of the bay as a whole, which is "subnominal" or "healthy".

2.2 FIELD METHODS

All sampling occurred during October of 1993, 1994, and 1995 and was conducted by MCEMD staff. The methodology for the sample selection process is described in Courtney *et al.* (1993). The locations (Figure 2-1) of the stations sampled are described in Appendix 2-A.

Benthic infauna, hydrographic profiles, diel hydrographic data, and sediments were collected using the standard EMAP techniques adopted by USEPA for the Louisianian Province. This section only summarizes the standard protocols; detailed descriptions are found in Courtney *et al.* (1993).

At each station the coordinates, time, date, and conditions were recorded. The water column profile was then measured with a Hydrolab Surveyor 3 (temperature, dissolved oxygen, pH, and salinity/conductivity). A Hydrolab Recorder was deployed to measure temperature, dissolved oxygen, salinity/conductivity, and pH every 15 minutes over at least a 12-hour (through early morning) cycle. These overnight physicochemical data are not included in this report.

Sediment samples were collected with a 0.04 m^2 stainless steel, Young-modified Van-Veen grab sampler. Two benthic grabs were cored and the depth of the redox potential discontinuity layer [RPD] measured; a sample was retained for sediment grain size analysis (% silt+clay only); the remainder of each grab was then emptied into a plastic bag, a seawater-epsom salt solution was added to relax the animals (Steedman 1976), and the samples were stored on ice. At the end of the day, samples were sieved (500 μm mesh) and the organisms preserved in a 10% solution of borax-buffered formalin, with Rose Bengal added to stain the organisms.

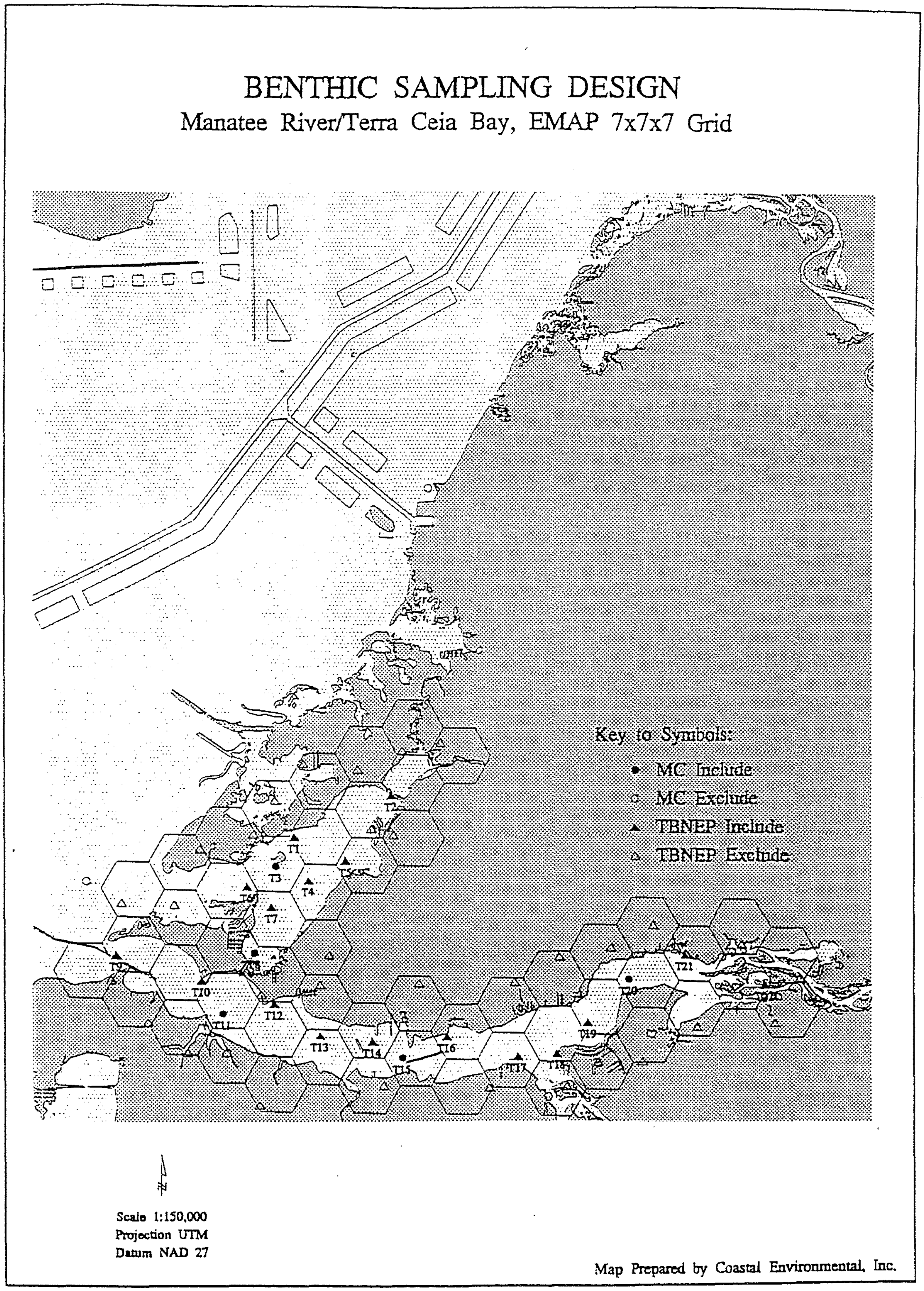

Figure 2-1. Location of benthic sampling stations in the Manatee River and Terra Ceia Bay segments of Tampa Bay, October 1993-1995.

Tampa Bay, October 1993-1995.

2.3 LABORATORY METHODS

2.3.1 PHYSICAL ANALYSIS OF SEDIMENT SAMPLES

Particle size is used to describe the physical characteristics of sediments. Because particle size influences both chemical and biological variables, it can be used to normalize chemical concentrations according to sediment characteristics and to account for some of the variability found in biological assemblages. For these samples, only the percent silt+clay($<63\mu m$) was determined. Manatee County's Environmental Management Department performed the silt+clay analyses. Sediment samples were homogenized by stirring with a stainless steel spatula. For sandy sediments, an aliquot of approximately 50 g wet weight was removed for analysis. For muddy sediments, approximately 20 g wet weight was removed for analysis.

Five ml of sodium hexametaphosphate (6.2 g/L) and 50 ml of distilled water was added to the sediment and the slurry stirred by a magnetic stirrer. This served to break up sediment aggregates, particularly clays, using the sodium hexametaphosphate as a dispersant. After stirring, the sample was sieved through a 63 μm mesh stainless steel sieve.

The filtrate ($<63\ \mu m$) was transferred to a graduated cylinder, and distilled water was added to bring the volume to the next highest 50 ml mark. The sample was shaken to suspend sediment particles evenly. Immediately after shaking, 40 ml was removed with a volumetric pipette and placed in a tared evaporating dish. The pipette was rinsed with distilled water, which was also added to the sample dish.

The two fractions ($>63\ \mu m$ and $<63\ \mu m$) were then dried to a constant weight at 60°C. As a check of the stability of the dry weight measurements, samples were heated for an additional 24 hour period and a randomly selected subsample was re-weighed. The percent silt+clay [%SC] was calculated as:

$$\%SC = [(silt + clay)_g/(sand + silt+clay)_g] \times 100$$

2.3.2 MACROBENTHIC COMMUNITY ASSESSMENT

The fauna of interest are invertebrate macrofauna, defined as those organisms retained on a 500 μm mesh sieve. All fauna retained were identified and enumerated, except organisms generally treated as meiofauna (e.g., ostracods, copepods, and nematodes), plankton (*e.g.*, cladocerans and copepods), fish, aerial insects, and eggs or egg cases. Samples collected during 1993 were sorted by EPCHC staff and the animals were identified by Mote Marine Laboratory and Gulf Coast Research Laboratory scientists. All 1994-1995 benthic analyses were conducted by EPCHC staff.

Animals were either sorted directly from the samples, or, in 1994-1995, initially separated from the sediments using sugar (Gonor & Kemp 1978) to increase the density of the water, thereby causing many of the animals to float. These animals were then decanted off. The floatation process was repeated several times for each sample to ensure maximum recovery. The sediments were then searched for any remaining organisms (usually mollusks) under a stereomicroscope. All organisms were identified to the species level whenever possible, or to the lowest practicable taxon.

2.4 QUALITY ASSURANCE AND QUALITY CONTROL

All field and laboratory QA/QC protocols are described in detail in Courtney *et al.* (1995a and 1995b). Laboratory QA/QC results for 1994 and 1995 are reported in Appendix 2-B. QA/QC results for 1993 were summarized in Grabe *et al.* (1996).

2.5 DATA ANALYSES

"Dominance" for this report integrates two measures: percent composition [%C] (the percentage a particular taxon comprises of the total abundance) and frequency of occurrence [%O] (the percentage of samples a taxon occurs in). "Dominance" [D] of taxa was calculated as the geometric mean of (% C x % O) (Windell 1971). A third measure which could be incorporated into this metric, biomass, was not determined.

Species richness (S) of the benthos was defined as the number of species or number of distinct taxa (Pielou 1975). Species diversity was defined as the Shannon-Wiener index (H') (Pielou 1975). Evenness (J) is a measure of how species are distributed and is constrained between 0 and 1.0. Higher J values indicate a more even distribution of species abundances (*i.e.*, species abundances will generally be similar) and lower values indicate more of a "clumped" abundance distribution (*i.e.*, some species will be much more abundant than others). Species richness, diversity, and evenness can be integrated as a Diversity Monitoring Model [DIMO] (Qinghong 1995). This model presents the three parameters in a graphical format, permitting a visual assessment of the relationships between S, H', and J over space (or time).

Three metrics were used to describe the biological communities in these two bay segments. The first, a modification of the EMAP Louisianian Province Benthic Index, was applied to these data (Coastal Environmental, Inc. 1995). The development of the original EMAP index for the Louisianian Province is described in detail in Engle *et al.* (1994) and its subsequent modification is described in Coastal Environmental, Inc. (1995). This index has subsequently been modified to exclude normalization of species diversity (H') by salinity, and includes a different suite of biotic variables (abundance of tubificid oligochaetes and capitellid polychaetes, proportion of gastropods and amphipods) than Engle *et al.* (1994) incorporated (proportion of tubificids and bivalves). Direct application of the original EMAP index to Tampa Bay was considered to be inadvisable for several reasons. First, the estuaries sampled in Louisianian Province for EMAP tended to have higher %SC than the sampling locations in Tampa Bay. Second, species richness was markedly higher in Tampa Bay than in the other Louisianian Province estuaries. This is in part due to differences in sediment type and, in part, due to the fact that Tampa Bay lies near the juncture of two faunal provinces, the Louisianian and the West Indian. A consequence of this is that H' is generally much higher in Tampa Bay than in the Louisianian Province estuaries. The USEPA will likely be developing an Index for the West Indian Province over the next several years. Such an index will likely be a more valid indicator for Tampa Bay.

A second approach was to apply a modified "biological integrity" standard as per Florida Administrative Code [FAC]. Chapter 62-302 FAC adopts Shannon-Wiener diversity, H', as the metric for "biological integrity" for Class II (shellfish harvesting) and III (recreation and propagation of fish and wildlife) waters. To meet the designated use class for that waterbody, H' cannot be less than 75% of that of a suitable reference location (based upon the mean of three replicate samples). To adapt this "standard" to this study design, the "reference" condition was defined as the mean of the three highest values for H' since a more rigorously defined "reference" location could not be defined with this study design.

The third approach was the application of an index developed by the late Dr. Douglas Farrell (Farrell unpubl.). This Florida Marine Index (*cf.* Grabe *et al.* 1996), assigns scores to individual species of polychaetes, molluscs, crustaceans, and echinoderms. These scores range from one to five and are based upon responses to different dissolved oxygen regimes. Lower scores indicate more tolerance to low dissolved oxygen and higher scores less tolerance. For each species, the density is multiplied by its score and this product is divided by the density. The composite score of all taxa is the index. As designed, this index is an indicator of organic enrichment. Although specifically developed for the Gulf coast of Florida, a number of common species have not been assigned scores. This is one shortcoming of the index; as more data become available, from this ongoing program, on the distribution of benthic species as a function of dissolved oxygen (and other physicochemical variables), the index will become more robust.

Regression and correlation analyses (of transformed variables) (Sokal & Rohlf 1981), were used to examine associations of total benthic abundance, S, H', J, the modified EMAP Benthic Index, and the Florida Marine Index *vs.* salinity, dissolved oxygen, and the percentage of silt + clay (Neter *et al.* 1985). Analysis of variance (Sokal & Rohlf 1981) and a *post hoc* Bonferroni comparison, were used to determine whether there were differences between years for mean physicochemical variables. Statistical analyses were carried out with SYSTAT (Wilkinson 1990) software.

SECTION 3

RESULTS & DISCUSSION

3.1. STUDY AREA

3.1.1 TERRA CEIA BAY

Near-bottom water temperatures in Terra Ceia Bay had similar means for each of the three years ($p=0.14$). Mean salinities did differ between years in this segment ($p<.001$); mean salinity in 1995 (mean=21.1 ppt) was significantly lower than 1993 (mean=28.7 ppt) and 1994 (mean=27.4 ppt). The temperature-salinity plot (Figure 3-1) showed no overlap between the three years between 95% confidence limits around the mean temperature and salinity. Therefore, water masses would be considered to be different during each year during the survey periods.

Dissolved oxygen concentrations were not significantly different between years ($p=.32$) and this daytime mean (Table 3-1A) was above the State standard for Class III waters (5 mg/l). Neither anoxia (dissolved oxygen <0.2mg/l) nor hypoxia (dissolved oxygen <2.0mg/l) were detected in Terra Ceia Bay. The mean percentage of fine-grained sediments, measured as the percentage of silt + clay, was not significantly different between years either ($p=.30$).

3.1.2 MANATEE RIVER

Near-bottom water temperatures differed between years in the Manatee River segment ($p=.001$); 1995 temperatures (mean=29.2°C) were significantly higher than 1993 (27.0°C) and 1994 (26.0°C). Mean salinity also differed between years ($p=.03$), with the 1993 mean (25.7 ppt) greater than 1995 (18.0 ppt); the 1994 mean salinity (21.4 pp) was not significantly different from 1993 and 1995. These differences are borne out in the temperature-salinity plot (Figure 3-2).

Dissolved oxygen had similar means between years ($p=.32$) in the Manatee River. although anoxia was never observed, hypoxia occurred in 6.2% of the samples. The mean percentage of silt + clay also did not differ between years ($p=.75$).

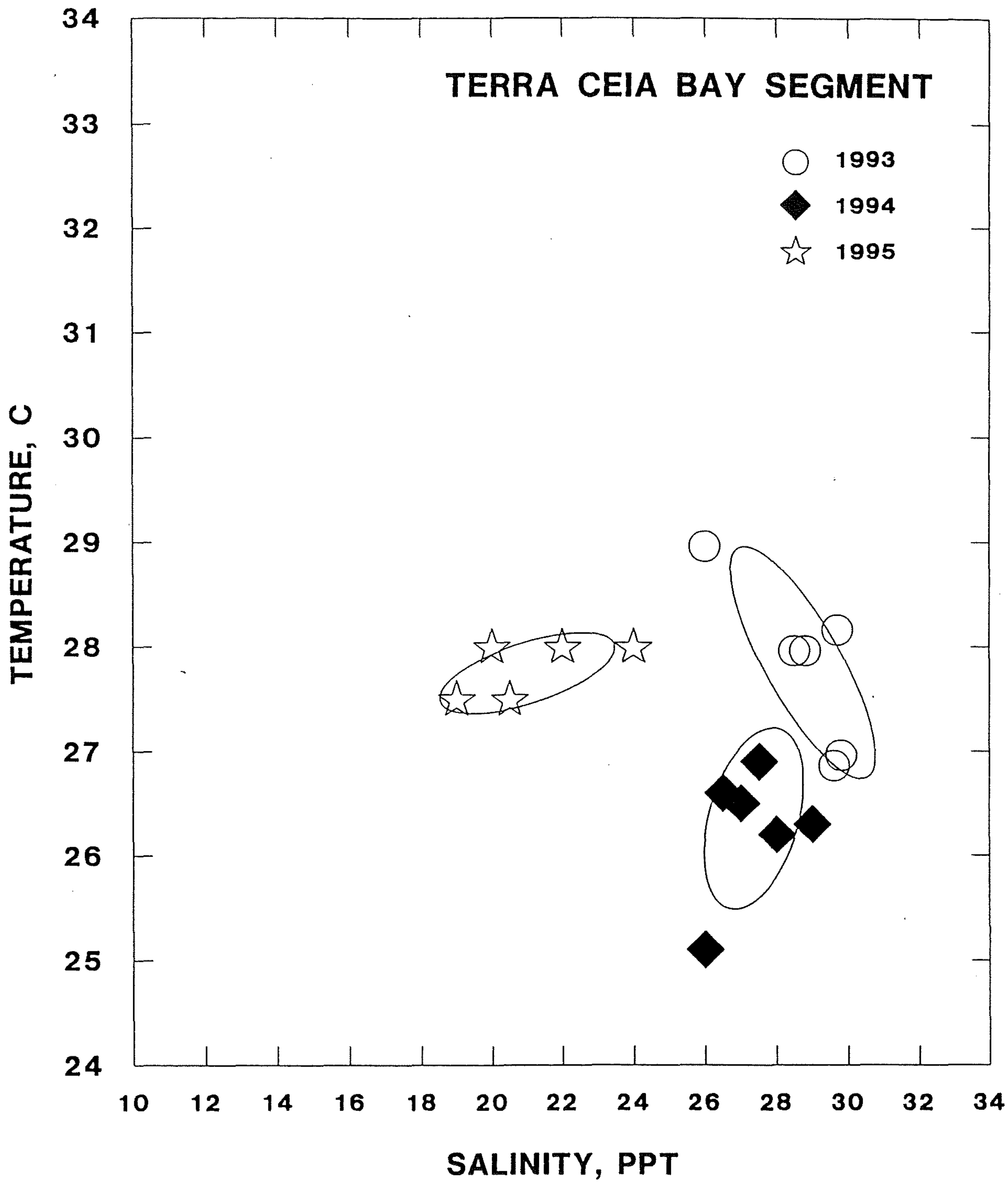

Figure 3-1. Temperature-salinity plot of near-bottom waters from Terra Ceia Bay, October 1993, 1994, and 1995. Ellipses represent bivariate 95% confidence limits for the mean temperature and salinity for each year.

Table 3-1. Summary of physical and hydrographic characteristics of Terra Ceia Bay and the Manatee River, October 1993-1995. Near-bottom samples only.

A. Terra Ceia Bay

Variable (n=20-21)	Mean	(range)
Temperature (°C)	27.1	(23.0-29.0)
Salinity (ppt)	25.6	(19.0-29.8)
Dissolved oxygen (mg/l)	5.2	(3.2-7.2)
% Silt + clay	4.6	(1.7-10.9)

B. Manatee River

Variable (n=29-33)	Mean	(range)
Temperature (°C)	27.4	(24.6-33.0)
Salinity (ppt)	21.6	(11.0-32.0)
Dissolved oxygen (mg/l)	4.2	(0.5-6.5)
% Silt + clay	6.2	(1.2-13.5)

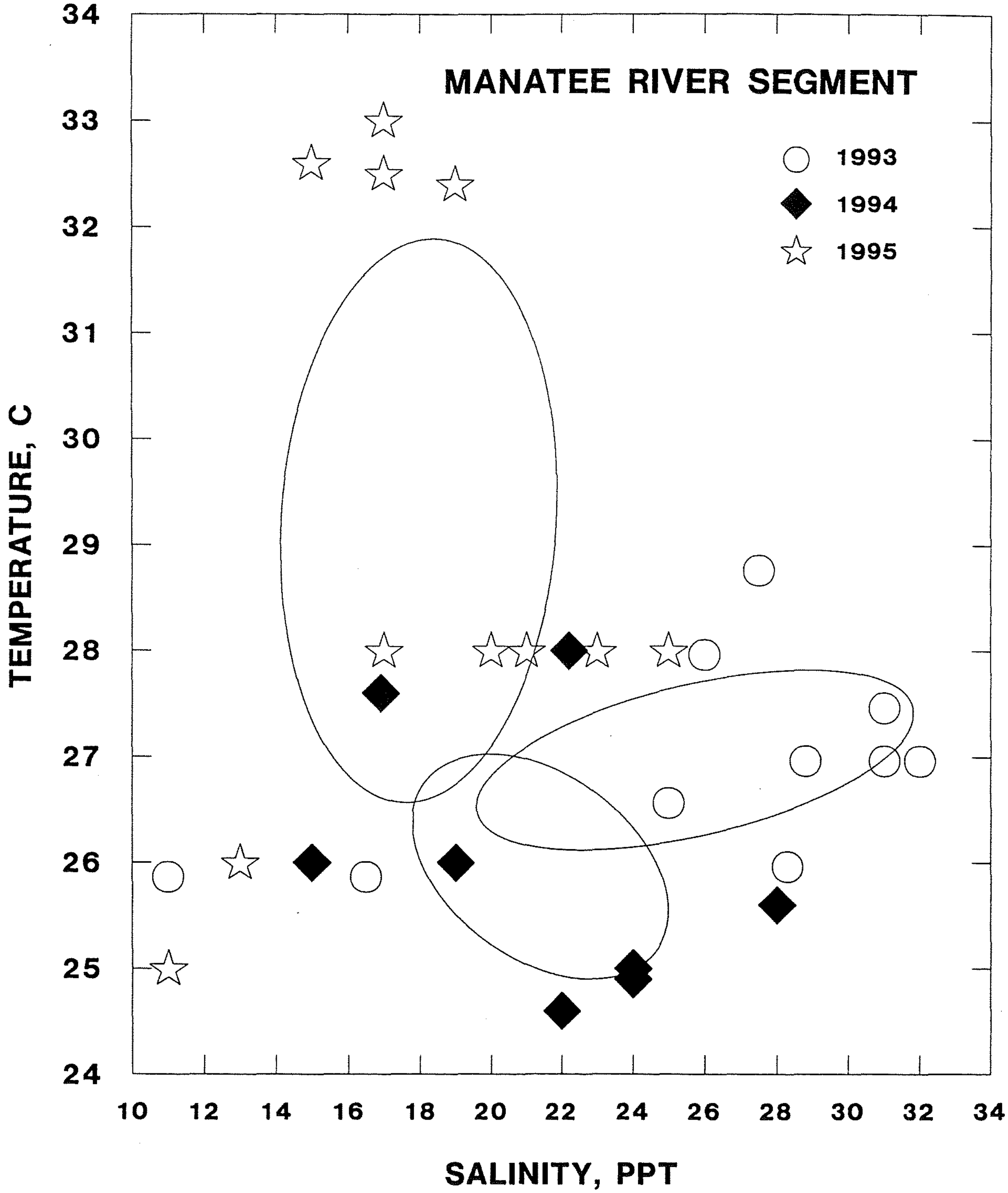

Figure 3-2. Temperature-salinity plot of near-bottom waters from the Manatee River, October 1993, 1994, and 1995. Ellipses represent bivariate 95% confidence limits for the mean temperature and salinity for each year.

3.2 BENTHIC MACROINVERTEBRATES

3.2.1 TAXONOMIC COMPOSITION AND ABUNDANCE

3.2.1.1 Terra Ceia Bay

The total mean abundance was for the period 1993-1995was >5300indiviuals/m^2. Polychaetes comprised 43% of the infaunal density, and oligochaetes worms made up 14%, gastropods 13%, bivalves 10%, and amphipods 9%. In 1993, mean abundance was >5200 ind./m^2 (Figure 3-3A). The polychaetes accounted for 33% of the mean density, followed by amphipods (19%), gastropods (16%), bivalves (10%), and oligochaete worms (4%). For 1994, mean density was again >5200 ind./m^2, of which polychaetes comprised 57%, bivalves 13%, oligochaetes 12%, gastropods 8%, and amphipods 3%. Mean density during 1995, declined to only >4400 ind./m^2. Polychaetes again predominated (36%), followed by oligochaetes (28%), gastropods (17%), amphipods (7%), and bivalves (4%).

Dominant taxa (Table 3-2A) for the three year period included *Monticellina dorsobranchialis* (Polychaeta), oligochaetes, *Paraprionospio pinnata* (Polychaeta), *Ampelisca holmesi* (Amphipoda), and *Mediomastus* spp.. Dominants in 1993 and 1994 included *A. holmesi, Mediomastus* spp., tubificid oligochaetes, *M. dorsobranchialis,* and *P. pinnata*. Oligochaetes were dominant in 1995 followed by *M. dorsobranchialis, P. pinnata, Scololepis texana* (Polychaeta), and *Acteocina canaliculata* (Gastropoda).

3.2.1.2 Manatee River

The overall mean abundance for 1993-1995 was >9800 ind./m^2. Polychaetes (33%) predominated, followed by amphipod crustaceans (25%), bivalves (20%), and gastropods (6%). In 1993, mean abundance was nearly 13,000 ind./m^2 (Figure 3-3B). Amphipods composed 31% of the fauna, followed by bivalves (26%), polychaetes (24%), and gastropods (5%). Mean abundance in 1994 was about half that of 1993. Polychaetes accounted for more than half (56%) of the community, followed by amphipods (13%), bivalves (11%), and gastropods (7%). Overall abundance increased again in 1995 (Figure 3-3B). Polychaetes again predominated (31%), followed by amphipods (26%), bivalves (19%), and gastropods (6%). Mean density and the relative contributions of the major taxonomic groups showed more inter-year variation in the Manatee River segment than in Terra Ceia Bay.

The dominant taxon was the tube-building amphipod *Ampelisca abdita* (Table 3-2B). Other dominants included *M. dorsobranchialis, Mulinia lateralis* (Bivalvia), *Grandidierella bonnieroides* (Amphipoda), and *Amygdalum papyrium* (Bivalvia). Variations were seen in the dominant taxa between sampling years. *Ampelisca abdita* was also the dominant in 1993; subdominants included *M. lateralis, A. papyrium, Cyclaspis* cf. *varians* (Cumacea), and *A. holmesi* (Table 3-3). In 1994 polychaetes were predominant. Dominant taxa for 1995 included *G. bonnieroides, C.* cf. *varians, M. dorsobranchialis, A. papyrium,* and *M. lateralis.*

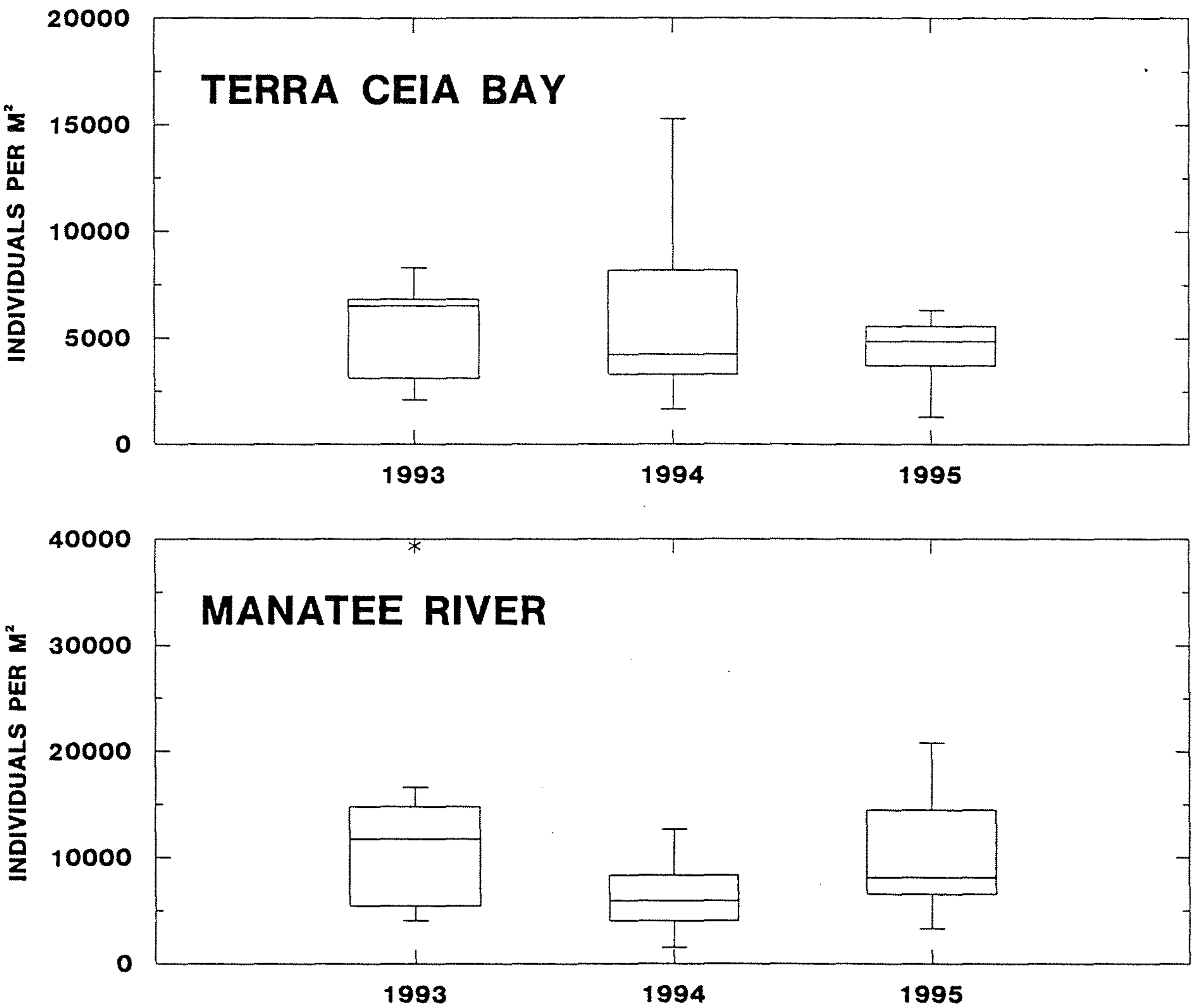

Figure 3-3. Box plot of total benthic macroinvertebrate abundance, by year. Terra Ceia Bay (top) and the Manatee River (bottom), October 1993-1995. Middle horizontal line represents the median density; hinges represent quartiles.

Table 3-2. "Dominant" benthic macroinvertebrates in Terra Ceia Bay and the Manatee River, Florida, October 1993-1995. Dominance = (% composition x % occurrence)$^{0.5}$.

A. Terra Ceia Bay

Taxa	1993-1995	1993	1994	1995
Monticellina dorsobranchialis (P)	33.0	15.1	44.9	24.5
Oligochaeta (O)	27.7	19.1	32.0	52.6
Paraprionospio pinnata (P)	20.9	15.0	24.1	22.0
Ampelisca holmesi (A)	*14.4*	*29.1*	*NR*	*10.1*
Mediomastus spp. (P)	13.4	20.0	10.0	9.7
Prionospio pygmaea (P)	11.8	13.3	14.1	NR
Acteocina canaliculata (G)	9.8	NR	NR	17.1
Haminoea succinea (G)	9.6	NR	NR	15.4
Mulinia lateralis (B)	8.6	NR	16.6	NR
Carazziella hobsonae (P)	8.5	11.2	9.1	NR
Prionospio perkinsi (P)	NR	NR	8.1	NR
Bivalvia (B)	NR	NR	NR	9.6
Pinnixa sp(p). (D)	NR	13.1	NR	NR
Scolelepis texana (P)	NR	NR	NR	17.3

B. Manatee River

Taxa	1993-1995	1993	1994	1995
Ampelisca abdita (A)	24.4	36.9	8.0	14.4
Monticellina dorsobranchialis (P)	22.0	NR	37.0	23.0
Mulinia lateralis (B)	21.4	28.1	NR	19.0
Grandidierella bonnieroides (A)	20.6	12.4	12.3	30.7
Amygdalum papyrium (B)	20.2	23.9	NR	20.4
Cyclaspis cf. varians (C)	17.8	19.2	NR	23.8
Mediomastus spp. (P)	16.2	13.1	19.1	17.9
Paraprionospio pinnata (P)	16.0	11.7	21.8	16.5
Ampelisca holmesi (A)	13.8	18.8	9.5	NR
Aricidea taylori (P)	11.6	NR	17.1	NR
Mediomastus ambiseta (P)	NR	NR	14.8	12.6
Fabriciola trilobata (P)	7.4	11.5	NR	NR
Prionospio perkinsi (P)	7.3	NR	8.0	NR
Tellina spp. (B)	7.0	NR	10.8	NR
Thenaria (Cn)	7.0	10.7	NR	NR

A= amphipod crustacean; B= bivalve; C= cumacean crustacean; Cn= Cnidarian; G= gastropod; O= oligochaete worm; P= polychaete worm

NR= not ranked among the 10 dominant species in that year

3.2.2. NUMBERS OF SPECIES

3.2.2.1 Terra Ceia Bay

More than 300 taxa were identified from 21 sampling locations in Terra Ceia Bay during the 1993-1995 sampling period (Appendix 3). This included more than 100 species of polychaetes, 79 species of molluscs (43 gastropods, 35 bivalves, and 1 scaphopod), and 80 species of crustaceans (including 34 species of amphipods). For 1993, when two field replicates were analyzed at each station, >220taxa were identified, including nearly 80 species of polychaetes, 32 species of gastropods, 26 bivalves, and 55 crustaceans. In 1994, at least 135 taxa were identified, of which there were approximately 50 species of polychaetes, 20 gastropods, 22 bivalves, and 33 crustaceans. More than 100 taxa were identified in 1995; these included approximately 45 species of polychaetes, 12 gastropods, 11 bivalves, and 30 crustaceans. During 1994 and 1995 only single samples were analyzed at each station; this may explain some of the differences in numbers of species between 1993 and 1994-1995 (Figure 3-4A) (Pielou 1975).

For Terra Ceia Bay, species richness was not significantly associated with any of the three physicochemical variables measured (Figure 3-5): salinity ($r=0.37; p=0.11$), dissolved oxygen ($r=0.30; p=0.20$), or the percentage of silt + clay in the sediments ($r=0.05; p=0.84$).

3.2.2.2 Manatee River

At least 311 taxa were identified from the 33 sampling locations for the Manatee River (Appendix 3). This included at least 129 species of polychaete worms, 75 species of molluscs (36 bivalves and 37 gastropods), and 73 species of crustacea (including 32 amphipods). For the 1993 sampling period approximately 230 taxa were identified, including almost 100 polychaetes, 53 molluscs (24 gastropods and 28 bivalves), and 61 crustaceans (including 28 amphipods). In 1994, approximately 146 taxa were identified, including nearly 60 polychaetes, 45 molluscs (19 gastropods and 26 bivalves), and 25 crustaceans. In 1995, more than 120 taxa were indentified, including almost 50 polychaetes, 38 molluscs (17 gastropods, 20 bivalves, and 1 scaphopod), 26 crustaceans.

As noted above for Terra Ceia Bay, two replicate grabs were processed at each of the stations in 1993, versus only a single sample at each site in 1994 and 1995. This accounts, at least in part, for the greater number of taxa reported for this 1993 year relative to the other years (Figure 3-4B) (*cf.* Pielou 1975).

Numbers of taxa was positively associated with salinity ($r=0.67; p=0.00$) (Figure 3-6). Since mean salinity was highest in 1993 (Section 3.1.2), this too may be a factor in explaining the larger number of species identified in 1993, not just the increased number of samples. Associations beween numbers of taxa and dissolved oxygen ($r=0.32; p=0.08$) and percent silt + clay ($r=-0.25; p=0.15$) were not statistically significant (Figure 3-6).

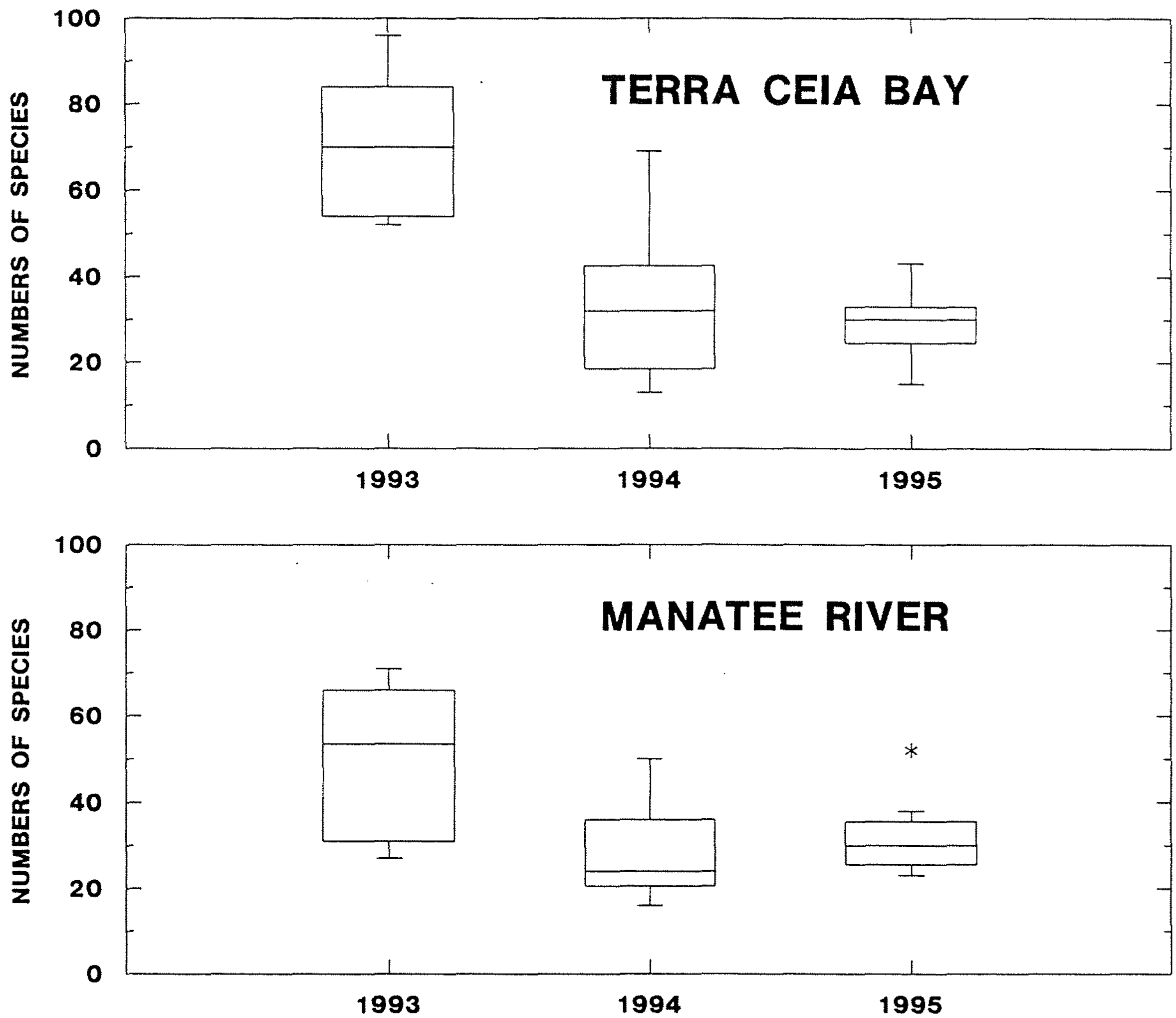

Figure 3-4. Box plot of numbers of species, by year. Terra Ceia Bay (top) and the Manatee River (bottom), October 1993-1995. Middle horizontal line represents the median density; hinges represent quartiles.

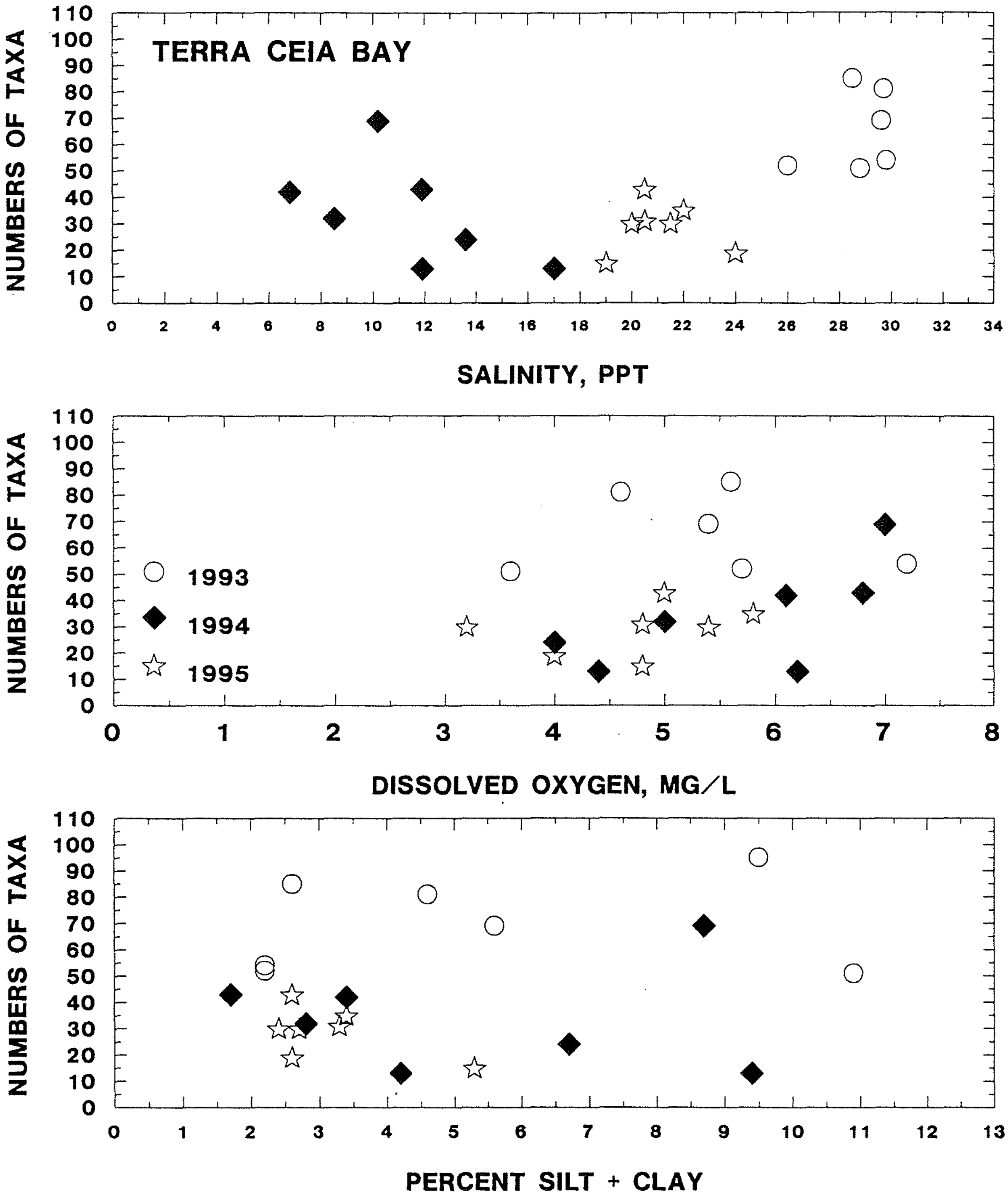

Figure 3-5. Association between numbers of taxa and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Terra Ceia Bay, October 1993-1995.

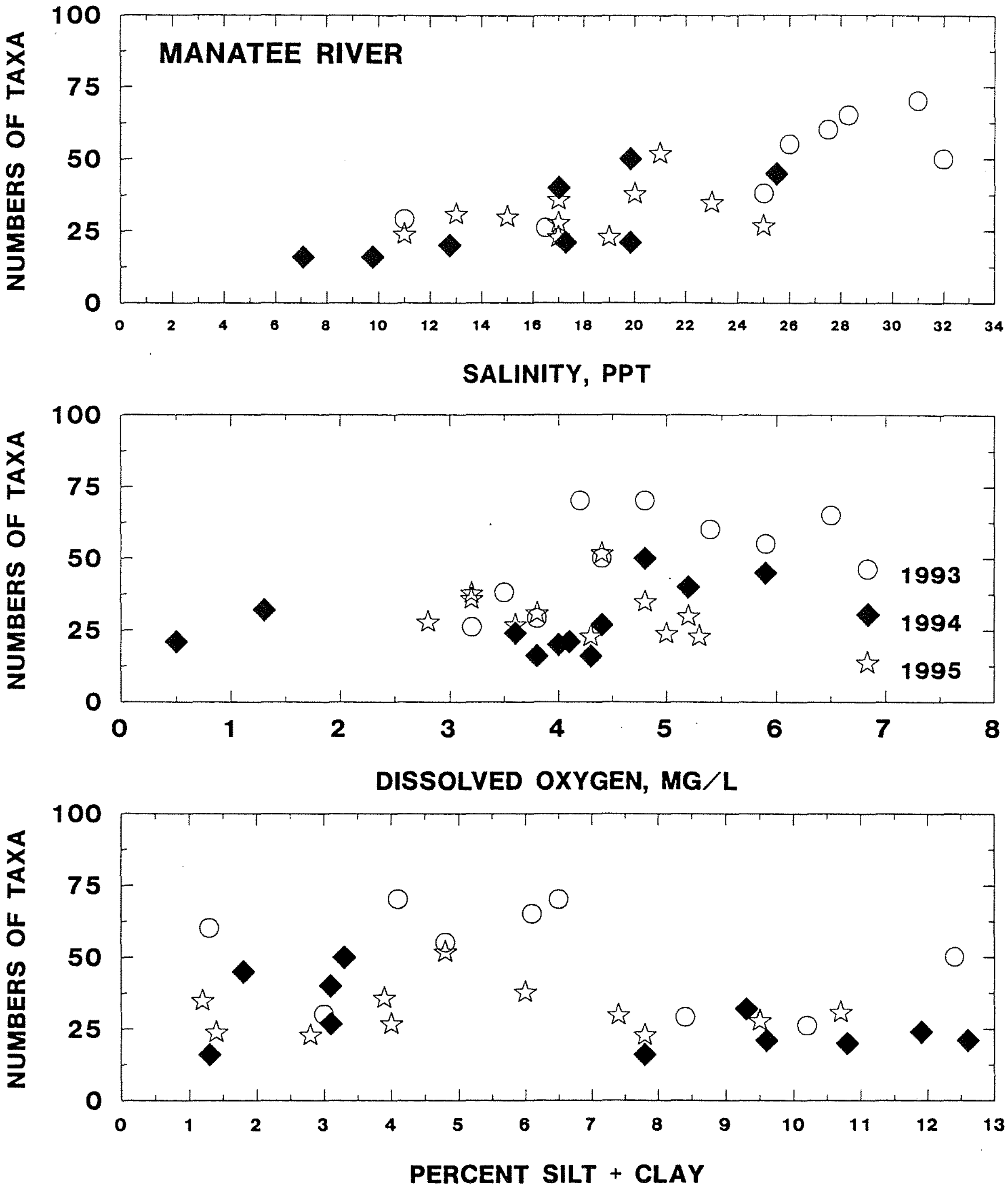

Figure 3-6. Association between numbers of taxa and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Manatee River, October 1993-1995.

3.2.3. SPECIES DIVERSITY

3.2.3.1 Terra Ceia Bay

The composite Shannon-Wiener diversity (H') for the three year study period was 4.14. There was a trend of decreasing H' over the study period (Figure 3-7A). Differences between 1993 and 1994-1995 likely reflect the larger numbers of samples processed in 1993, since H' is known to be sample size dependent (Pielou 1975). For Terra Ceia Bay, there is a general, but non-significant ($r=0.41; p=0.08$), trend of increasing diversity with increasing salinity (Figure 3-8). Likewise, neither dissolved oxygen ($r=0.21; p=0.37$) nor the percentage of silt + clay ($r=-0.09; p=0.69$) were significantly associated with H' (Figure 3-8).

3.2.3.2 Manatee River

The Manatee River had an overall H' of 3.87 for 1993-1995. There was little variation from year to year (Figure 3-7B), despite a larger number of samples being processed in 1993. H' was associated (Figure 3-9) with salinity ($r=0.63; p=0.00$) and the percentage of silt + clay ($r=-0.34; p=0.05$), but not with dissolved oxygen ($r=0.28; p=0.12$) (Figure 3-9).

3.2.4. EVENNESS

3.2.4.1 Terra Ceia Bay

The overall evenness (J) in Terra Ceia Bay was 0.72 for the study period. Evenness generally declined from 1993 to 1995 (Figure 3-10A). J was not associated with salinity ($r=0.31; p=0.18$), dissolved oxygen ($r=0.06; p=0.82$), or silt + clay ($r=-0.29; p=0.20$) (Figure 3-11).

3.2.4.2 Manatee River

For the Manatee River the overall evenness value for 1993-1995 was 0.68. Evenness showed an increasing trend over the three sampling years (Figure 3-10B). As with Terra Ceia Bay, neither salinity ($r=0.35; p=0.06$), nor dissolved oxygen ($r=0.26; p=0.14$), nor percent silt + clay ($r=-0.25; p=0.16$) were associated with J (Figure 3-12).

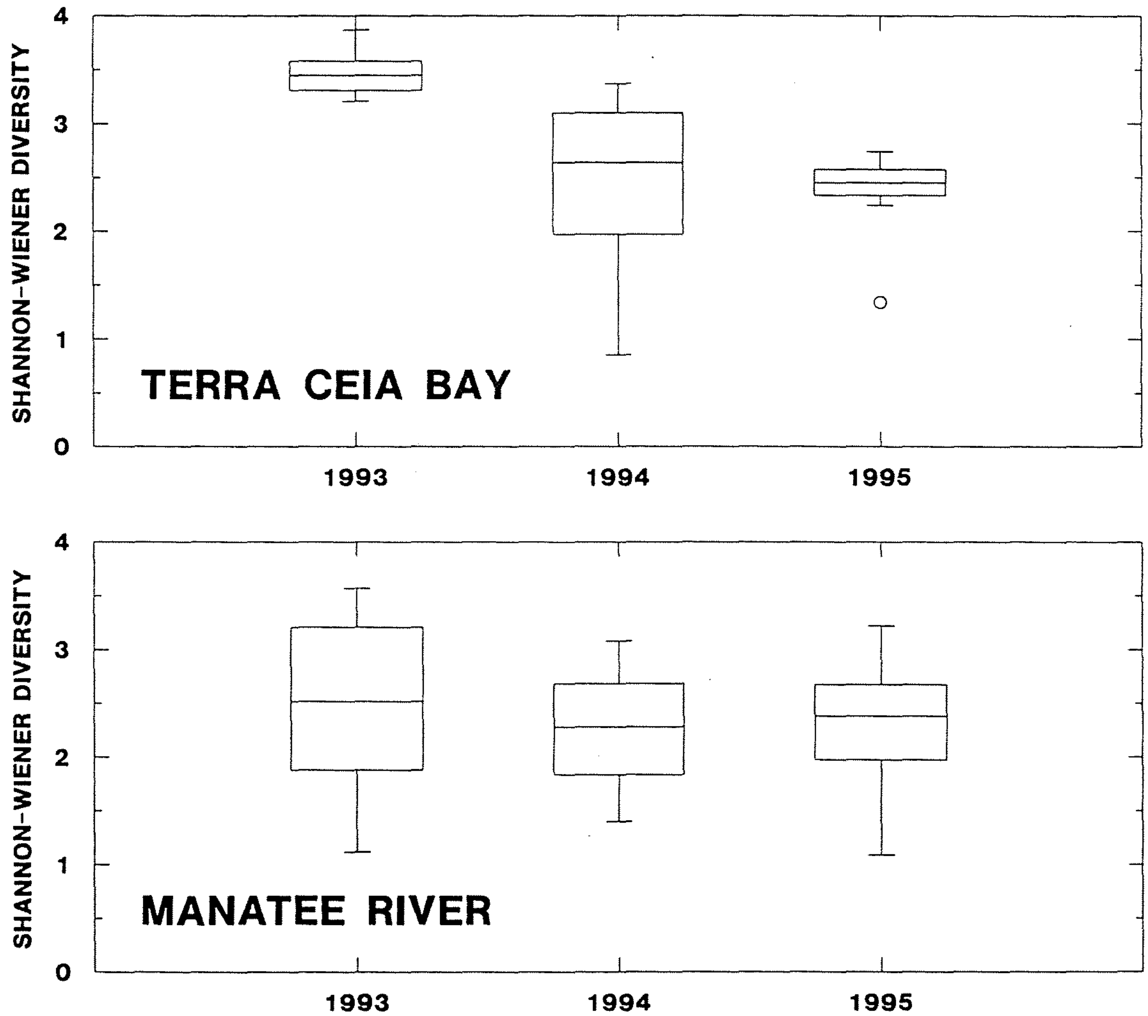

Figure 3-7. Box plot of Shannon-Wiener diversity, by year. Terra Ceia Bay (top) and the Manatee River (bottom), October 1993-1995. Middle horizontal line represents the median density; hinges represent quartiles.

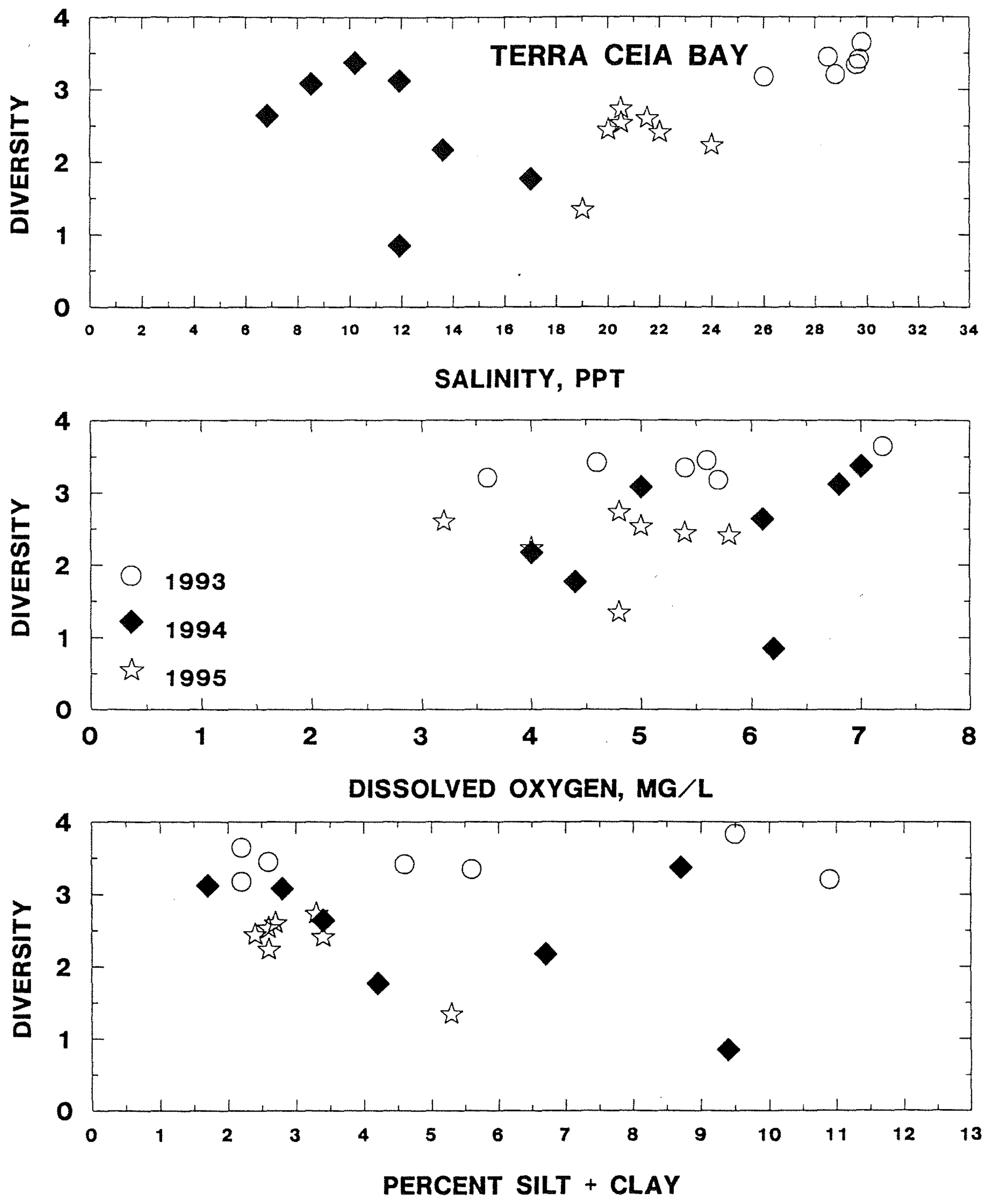

Figure 3-8. Association between Shannon-Wiener diversity and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Terra Ceia Bay, October 1993-1995.

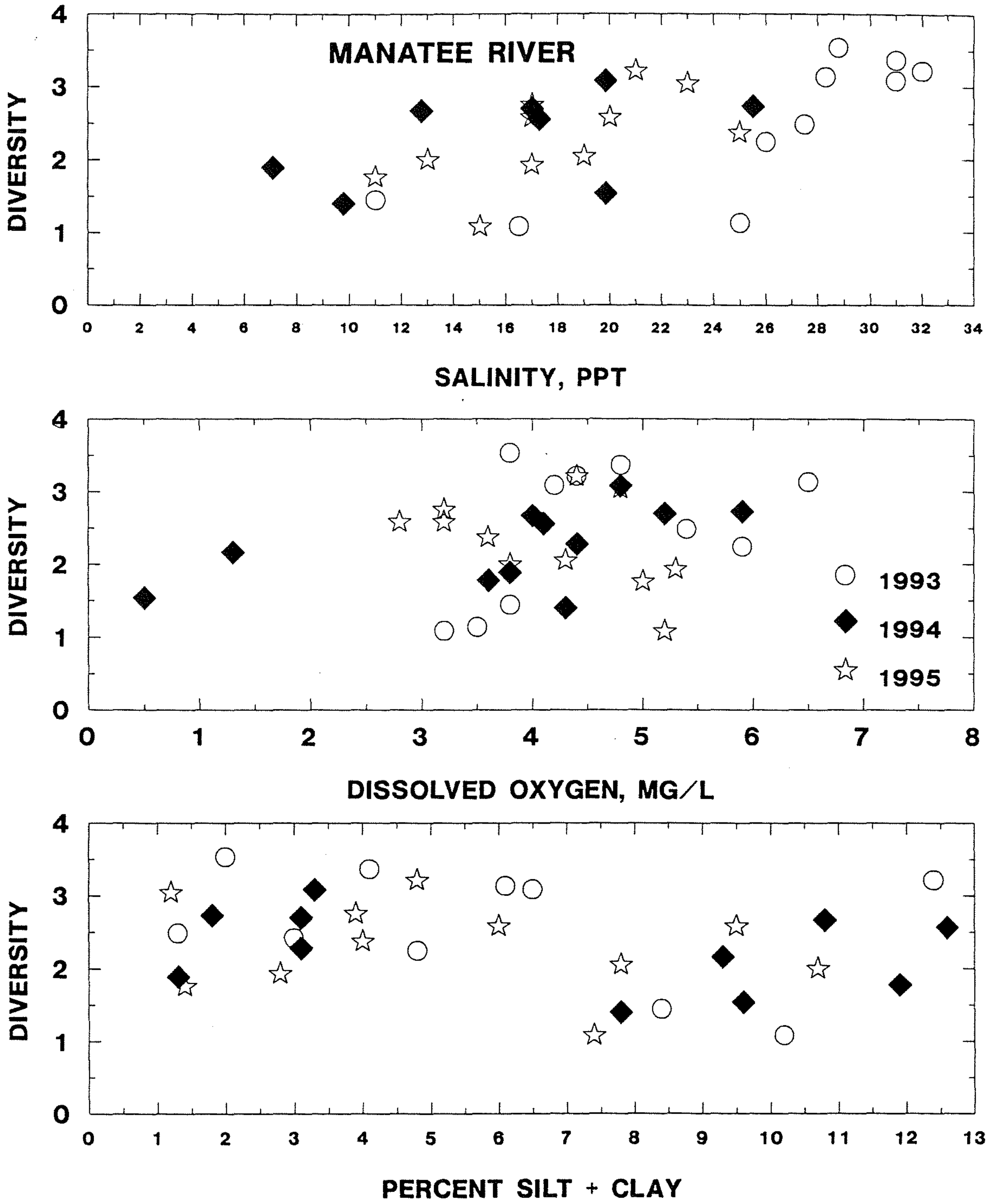

Figure 3-9. Association between Shannon-Wiener diversity and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Manatee River, October 1993-1995.

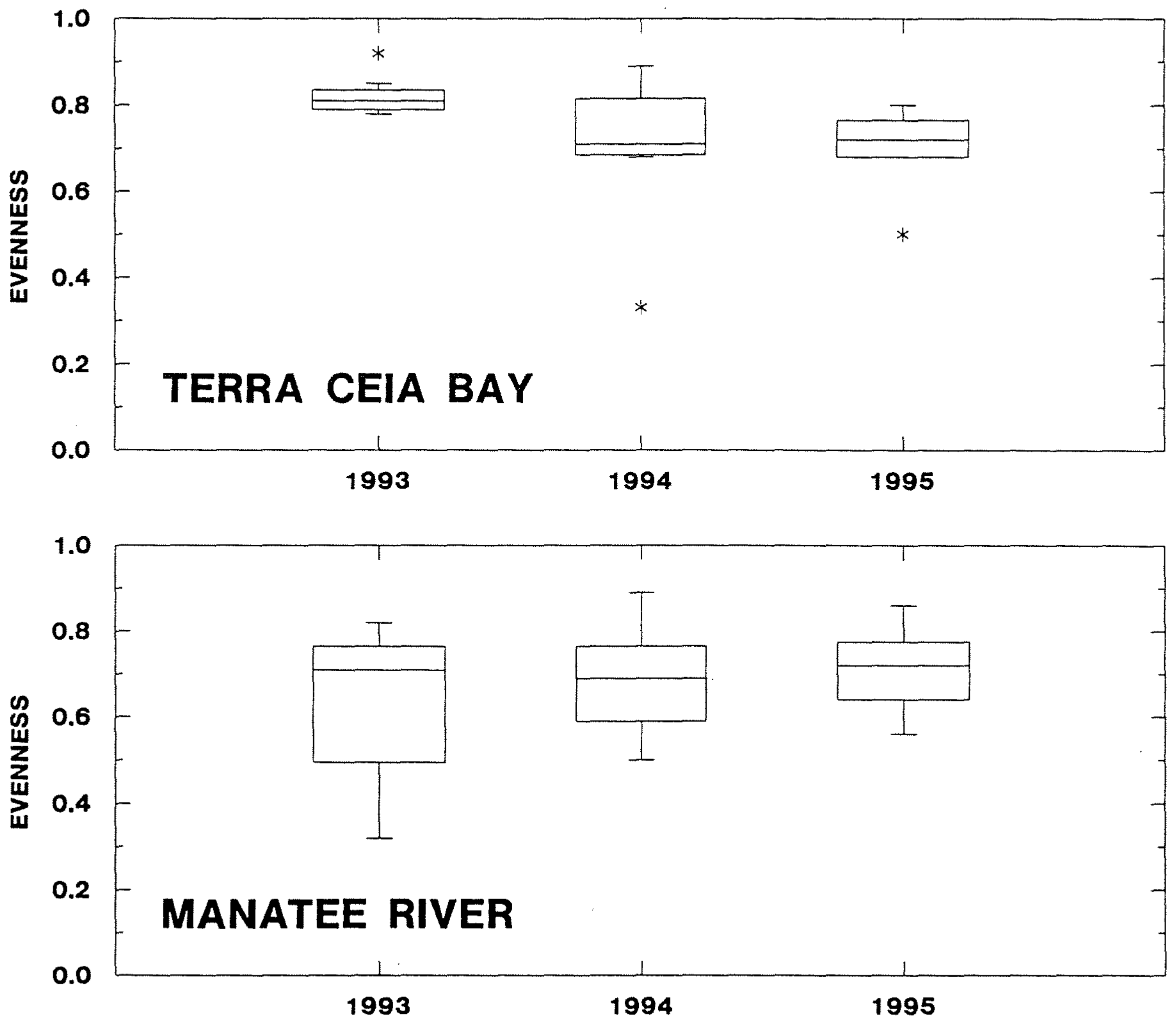

Figure 3-10. Box plot of evenness, by year. Terra Ceia Bay (top) and the Manatee River (bottom), October 1993-1995.Middle horizontal line represents the median density; hinges represent quartiles.

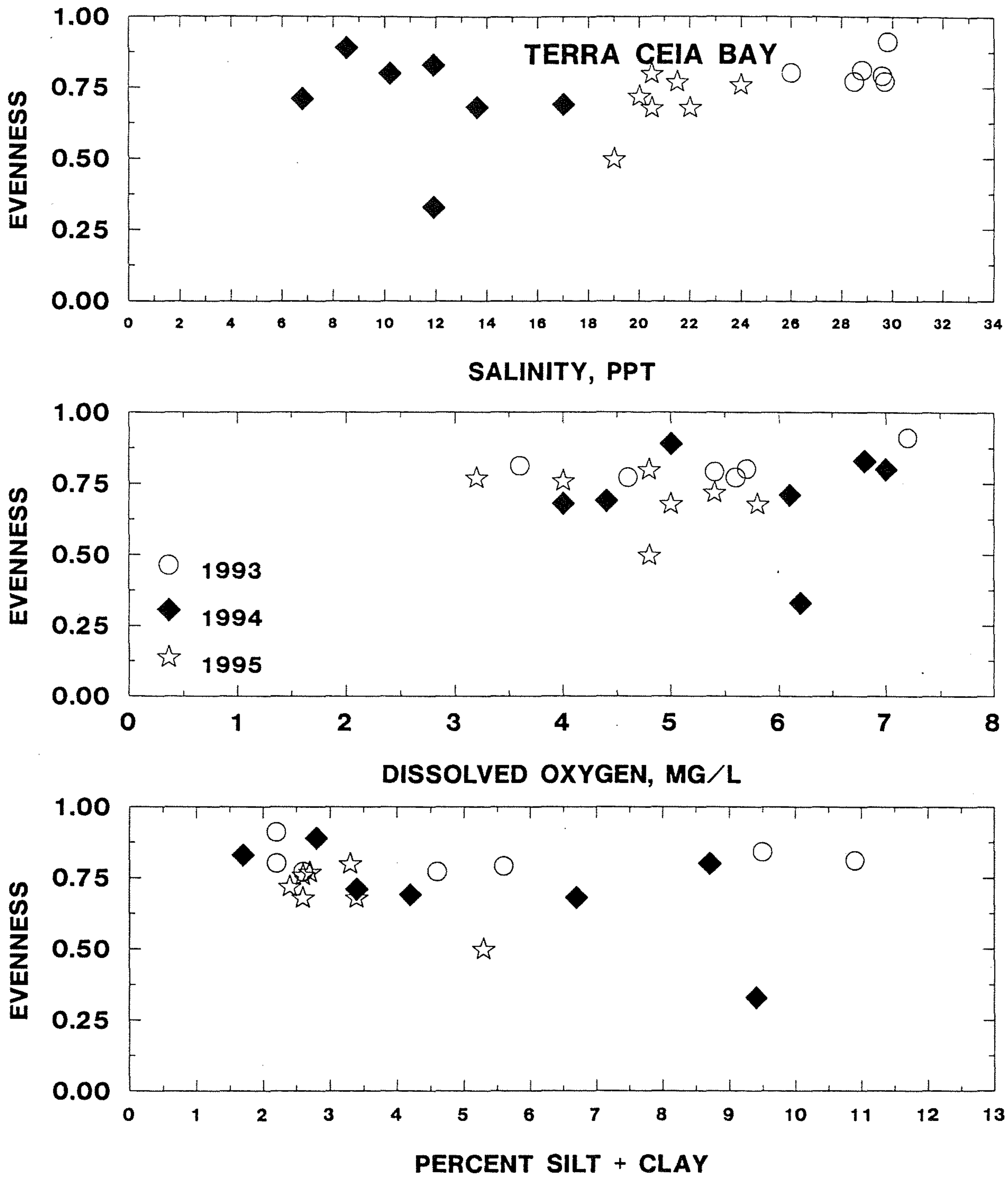

Figure 3-11. Association between evenness and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Terra Ceia Bay, October 1993-1995.

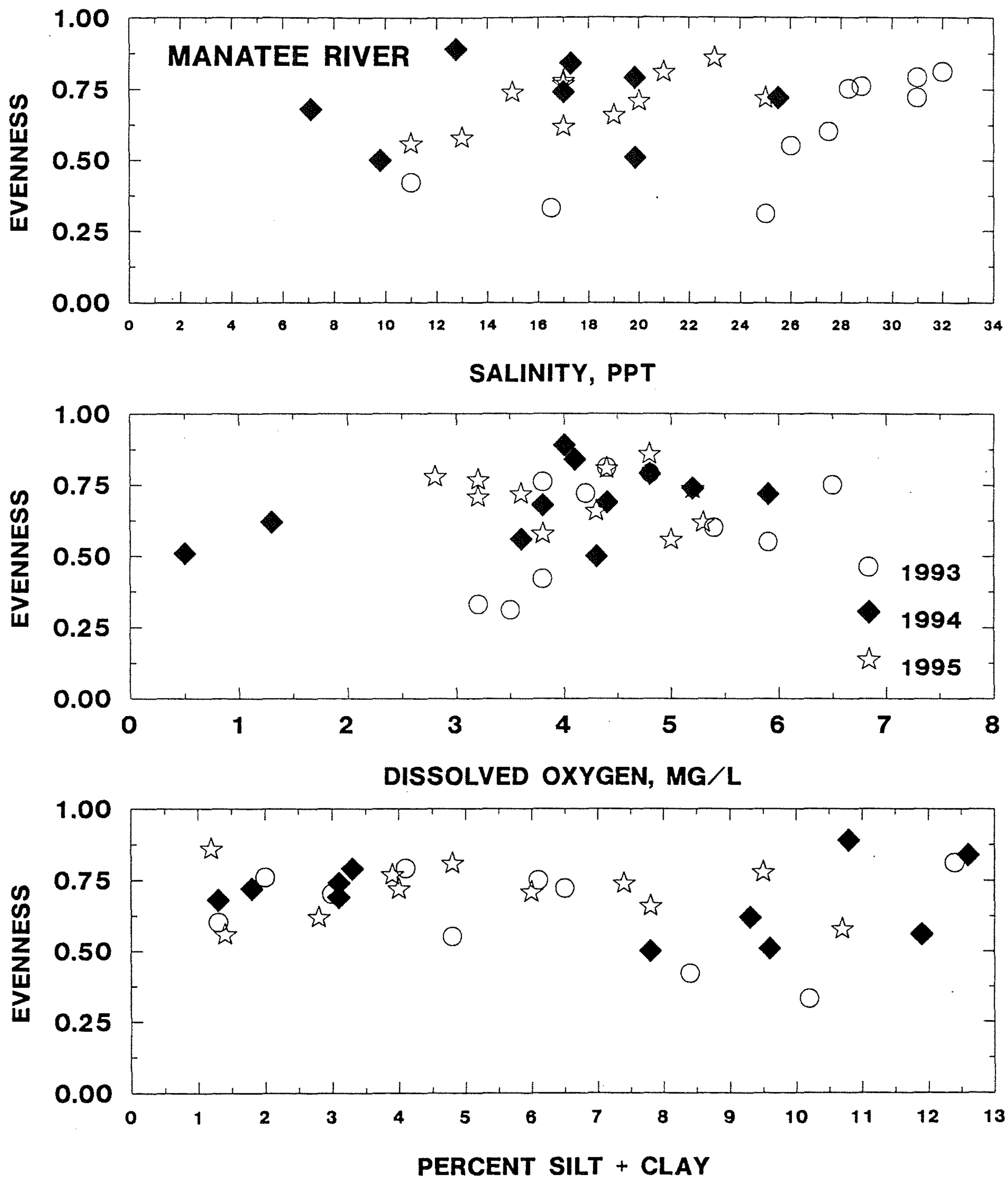

Figure 3-12. Association between evenness and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Manatee River, October 1993-1995.

3.2.5. DIVERSITY MODEL ["DIMO"]

3.2.5.1 Terra Ceia Bay

The DIMO plot for Terra Ceia Bay (Figure 3-13) showed that diversity and numbers of taxa were somewhat higher in 1993, when replicate samples were collected at each station, than in 1995 (cf. Sections 3.2.2.1 and 3.2.3.1);the 95% confidence intervals on the bivariate mean for 1994 showed overlap between the confidence intervals for 1993 and 1995. Evenness, represented by the angle from the origin, was generally similar between years, although there was somewhat of a decline over time (see Section 3.2.4.1).Since the number of species tends to increase as the number of samples increases (Pielou 1975), the observation that diversity and numbers of species were greater in 1993 was not unexpected.

3.2.5.2 Manatee River

The Manatee River also showed that 1993, when sampling effort was greater, had higher numbers of species (see Section 3.2.2.2),but diversity (Section 3.2.3.2)was similar to 1994 and 1995 (Figure 3-14). Thus, evenness was slightly lower in 1993 (Section 3.2.4.2).The 1994 and 1995 distributions showed considerable overlap.

3.2.6. BENTHIC INDEX

3.2.6.1 Terra Ceia Bay

The Benthic Index ranged from <1 to 22.9 in Terra Ceia Bay (mean=13.6) (Figure 3-15). Benthic Index scores were not associated with the physicochemical variables (Figure 3-16) salinity ($r=0.37$;$p=0.11$),dissolved oxygen (0.20; $p=0.39$), or percent silt + clay ($r=-0.22$;$p=0.33$).

3.2.6.2 Manatee River

In the Manatee River, the Benthic Index ranged from 7.7 to 21.5 (mean=13.6) (Figure 3-17). Unlike the Terra Ceia Bay segment, both salinity ($r=0.61$;$p<.001$)and dissolved oxygen ($r=0.43$;$p=.01$)(Figure 3-18) were significantly associated with Benthic Index scores. The percentage of silt + clay, however, was not ($r=-0.19$; $p=0.28$).

3.2.6.3 Assessment

Ideally, the Benthic Index scores should be independent of salinity and the percentage of silt + clay in the sediments (Engle *et al.* 1994). Rather, it should be responsive to sediment *contamination* (not measured in this study) and hypoxia/anoxia. The association between the Benthic Index and salinity in the Manatee River may ultimately require the Benthic Index to be standardized by salinity in this segment, as in the original EMAP Benthic Index (Engle *et al.* 1994).

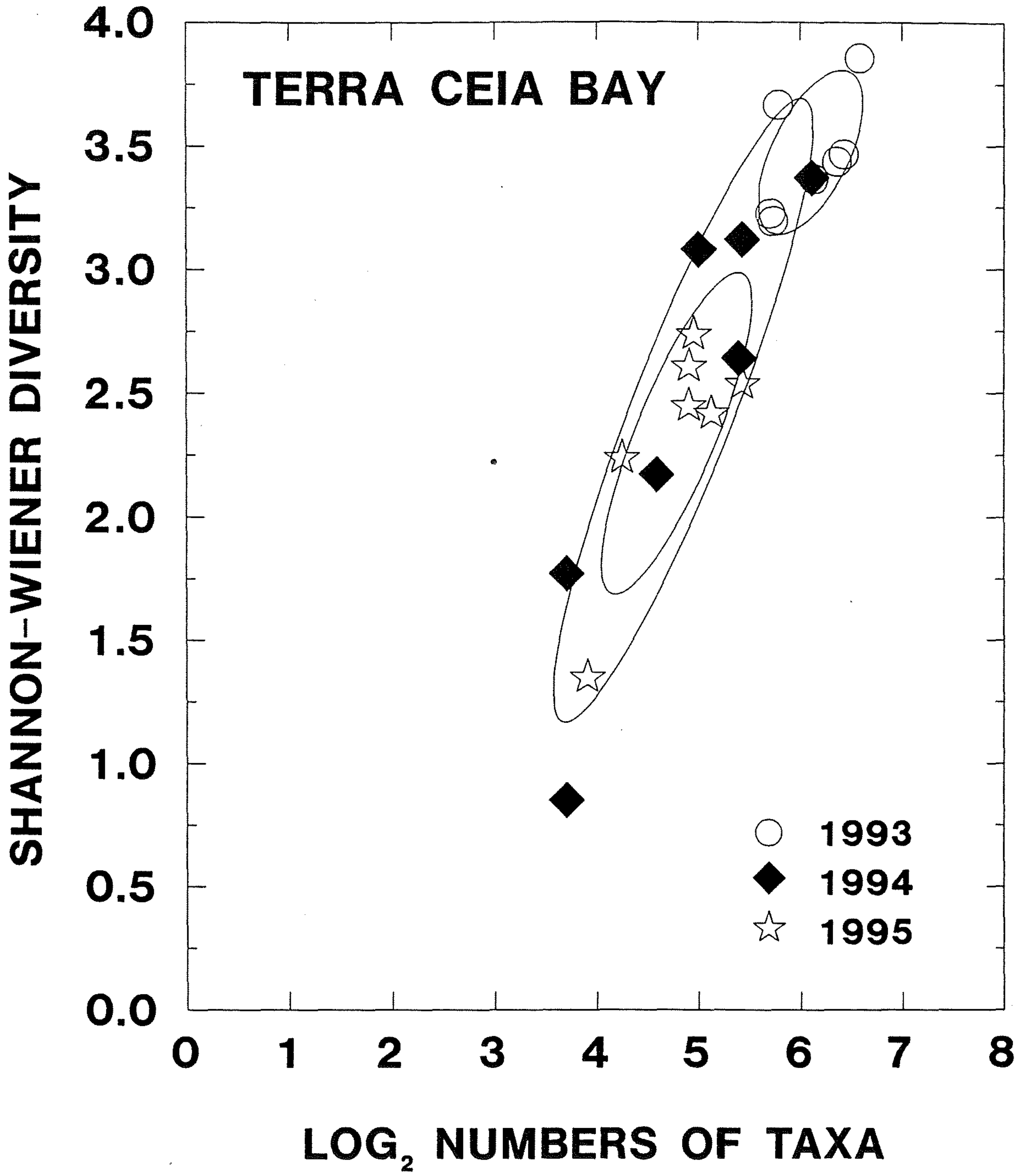

Figure 3-13. "DIMO" plot of diversity *vs.* numbers of taxa, by station and year. Terra Ceia Bay, October 1993-1995. Ellipses represent 95% confidence intervals around the mean diversity and numbers of species.

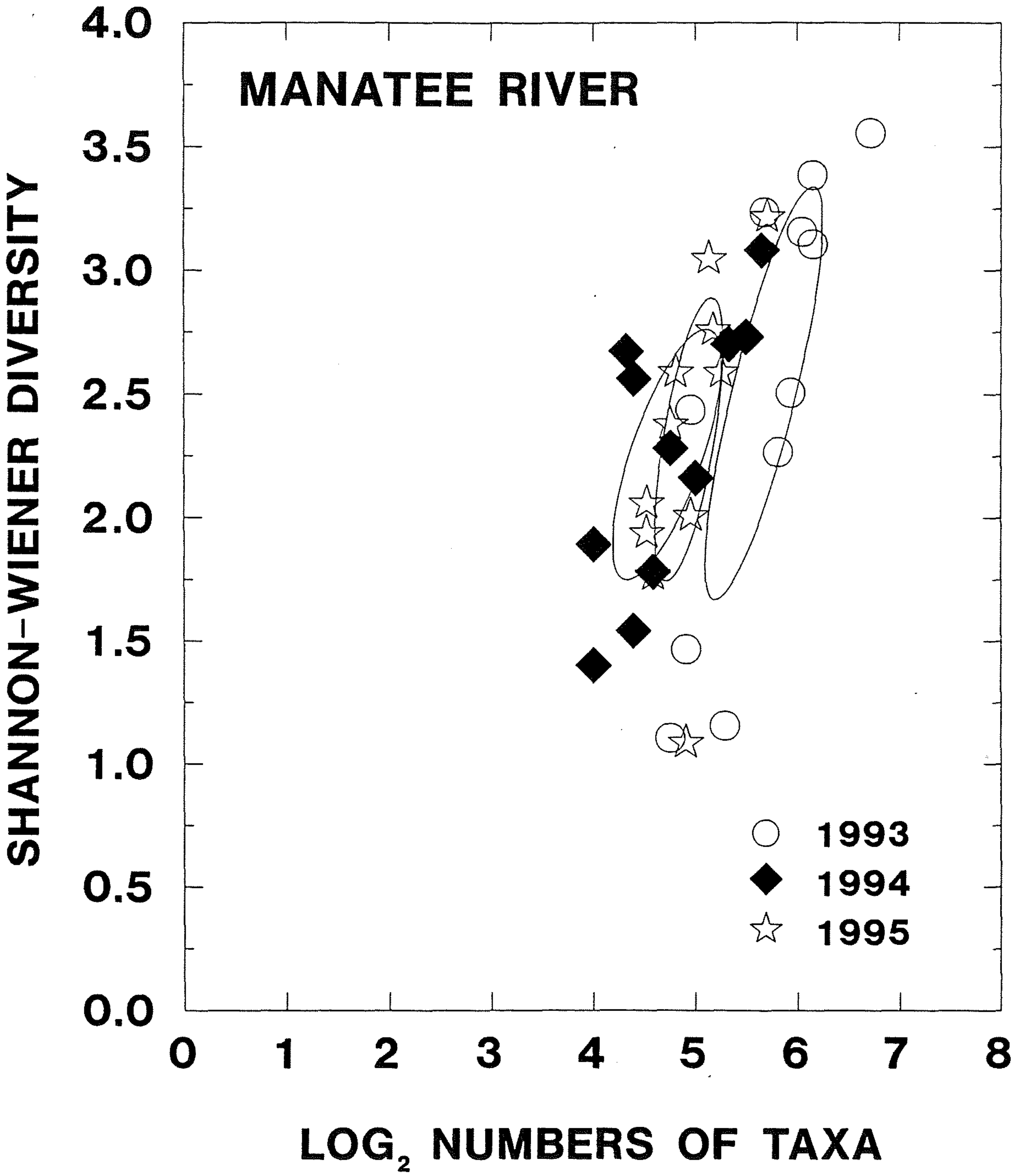

Figure 3-14. "DIMO" plot of diversity *vs.* numbers of taxa, by station and year. Manatee River, October 1993-1995. Ellipses represent 95% confidence intervals around the mean diversity and numbers of species.

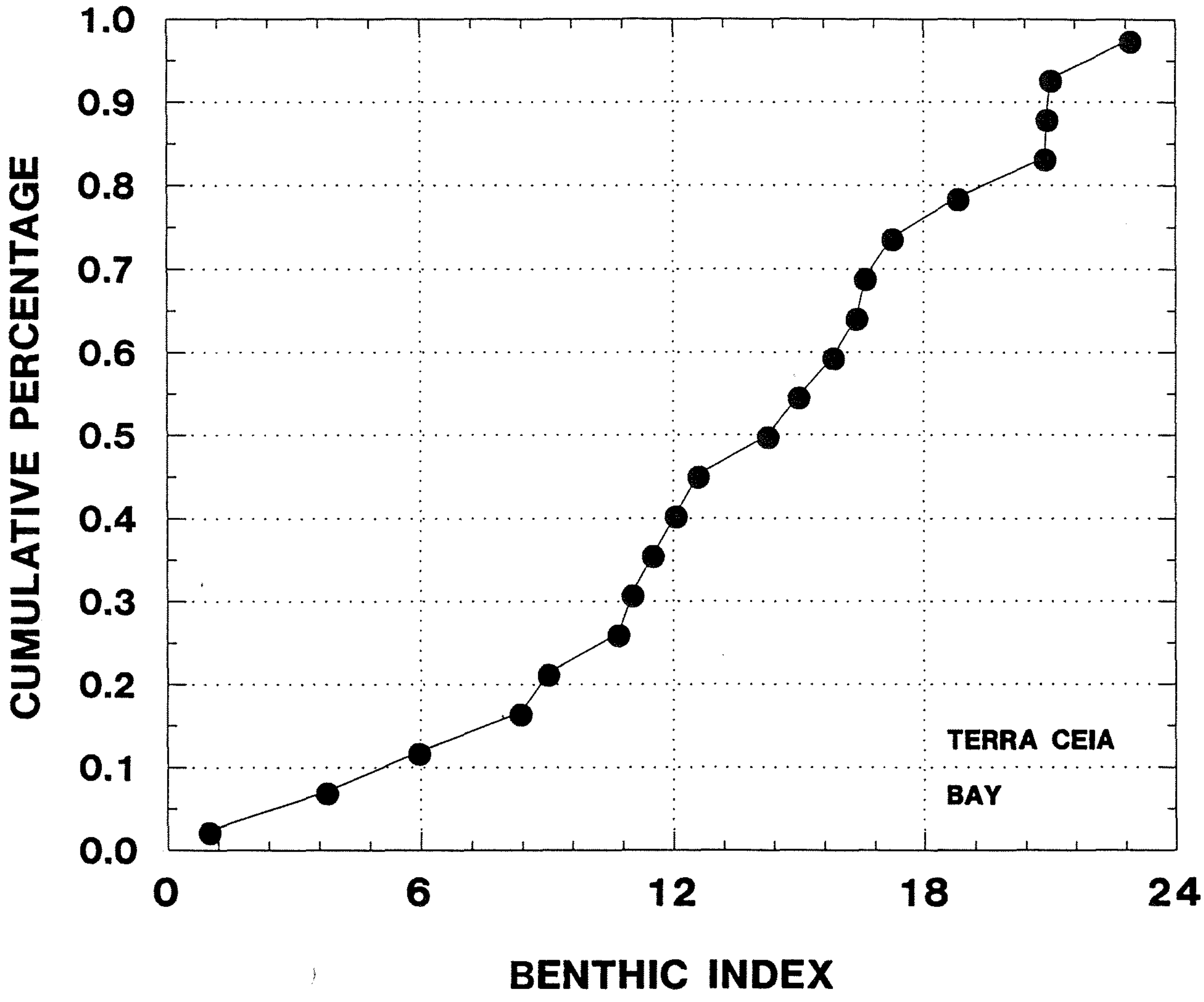

Figure 3-15. Quantile plot of the modified EMAP Benthic Index. Terra Ceia Bay, October 1993-1995.

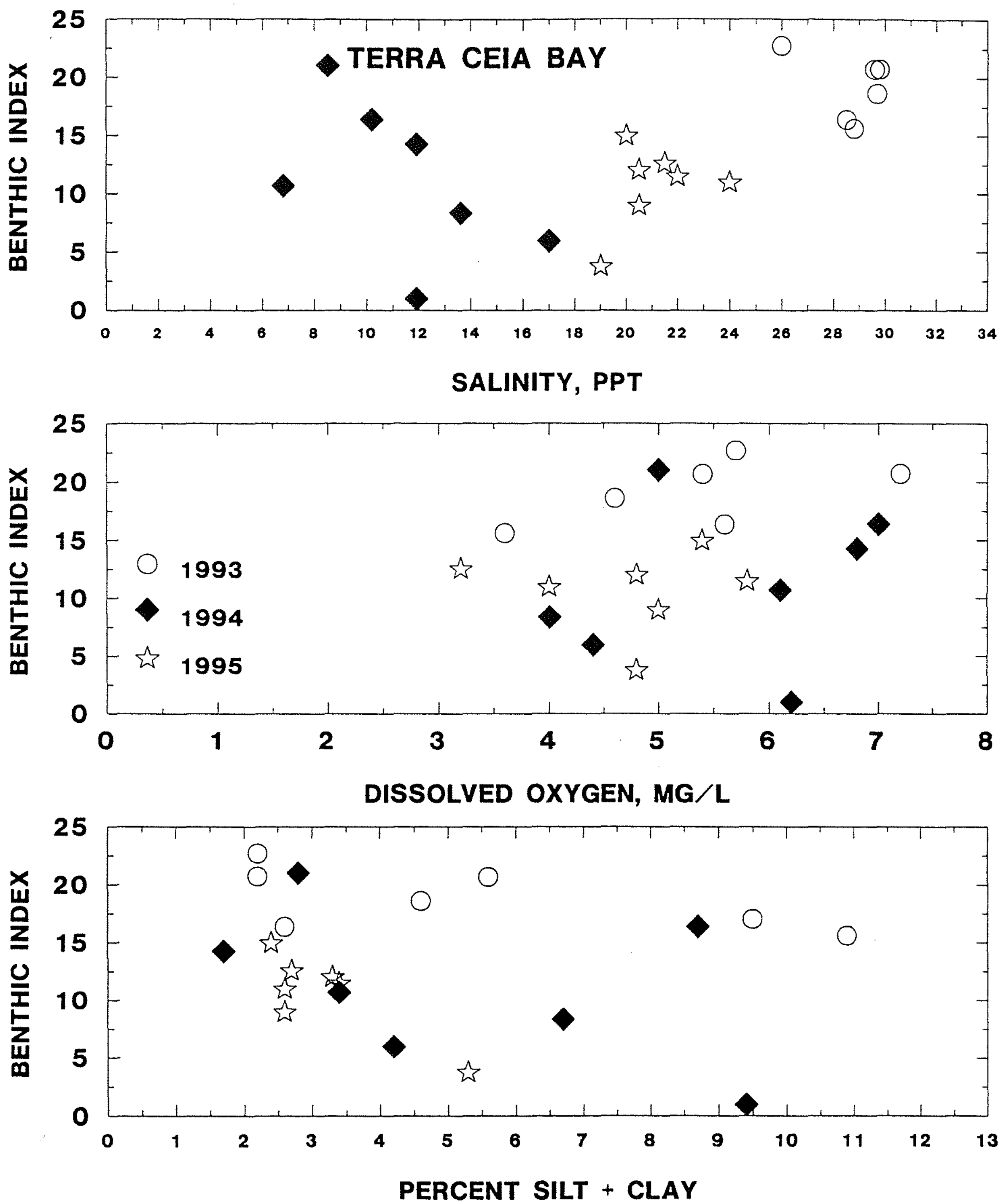

Figure 3-16. Association between the Benthic Index scores and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Terra Ceia Bay, October 1993-1995.

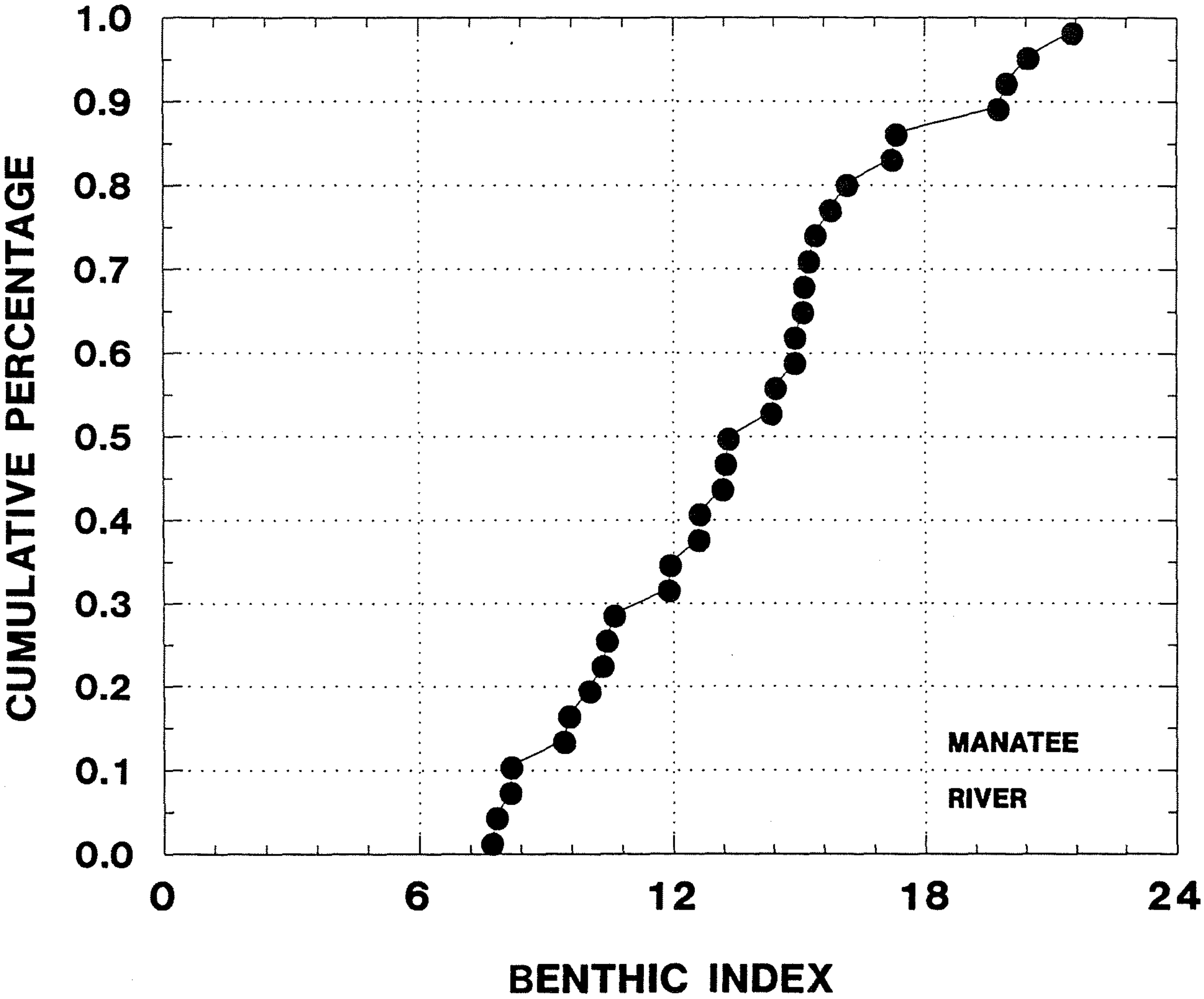

Figure 3-17. Quantile plot of the modified EMAP Benthic Index. Manatee River, October 1993-1995.

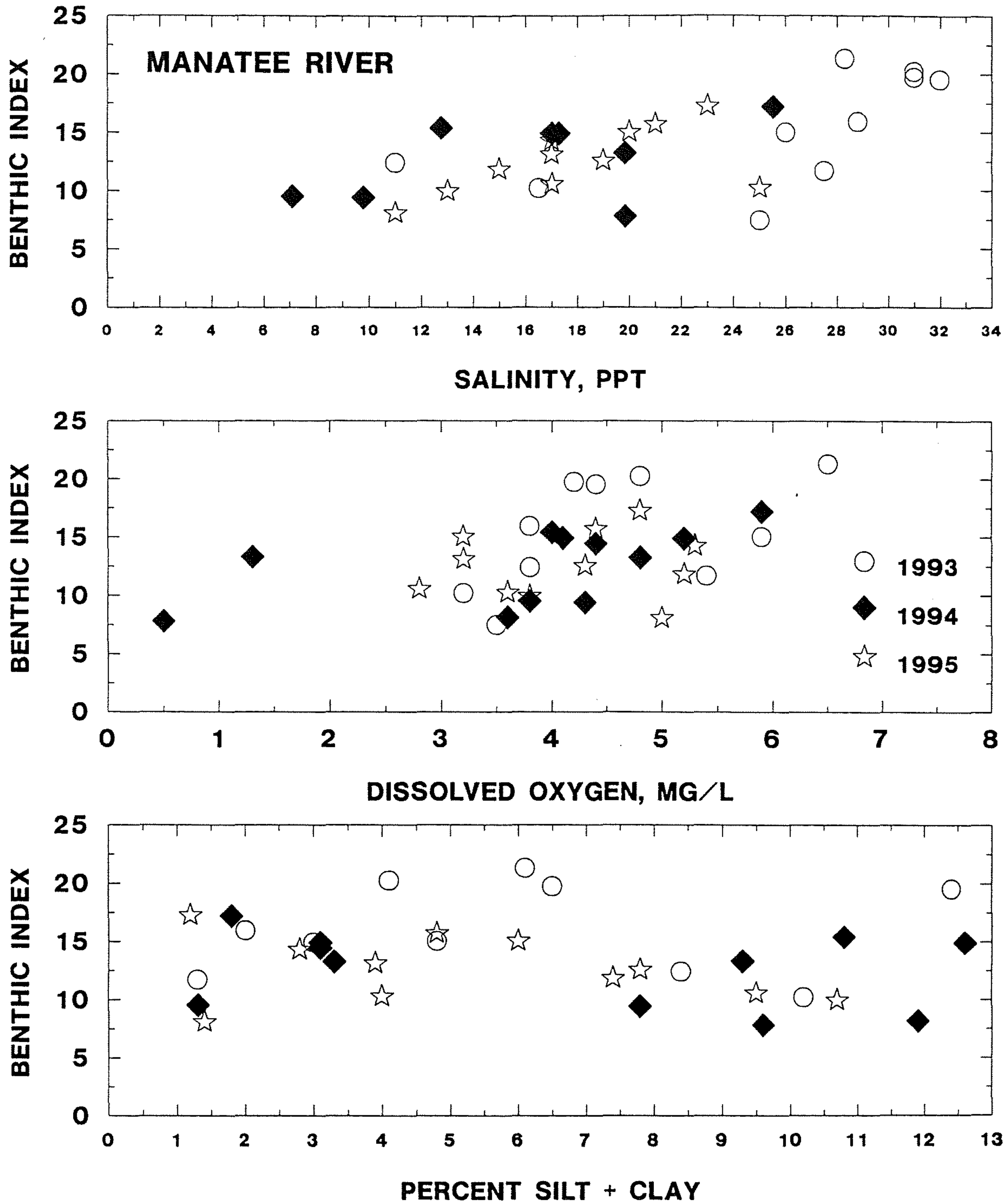

Figure 3-18. Association between the Benthic Index scores and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Manatee River, October 1993-1995.

The ultimate goal is for the Benthic Index to be the basis for assessing and tracking trends in the status of Tampa Bay's benthic habitats, as envisioned for the original EMAP index (Engle *et al.* 1994). In order to accomplish this goal contaminated sites must be identified and Index scores from these sites compared with scores from uncontaminated sites. Contaminatied sites will be identified based upon sediment chemistry data and subnominal dissolved oxygen concentrations. At the present time, sediment chemistry data are only being secured for the Old Tampa Bay, Hillsborough Bay, Middle Tampa Bay, and Lower Tampa Bay segments of this system. Upon completion of the initial four-year cycle, which will establish "baseline" conditions for the system, Index scores in contaminated *vs.* uncontaminated habitats will be compared. Based upon these comparisons, cutoff Index scores for "healthy" and "subnominal" habitat should be defined.

3.2.7. "BIOLOGICAL INTEGRITY"

Shannon-Wiener diversity (H') is used as a measure of "biological integrity" in Florida Administrative Code (FAC 62-302). A "reference" location is established and sites with H' values <75% of the reference condition are considered to not meet the use standards for that water body. Although no true "reference" site(s) are identified in this study, the mean of the three highest H' values was calculated and considered to represent the "reference" condition. Application of this modified criterion showed that 50% of Terra Ceia Bay (Figure 3-19) and 60% of the Manatee River (Figure 3-20) had H' values <75% of the "reference" condition.

3.2.8. FLORIDA MARINE INDEX

3.2.8.1 Terra Ceia Bay

Farrell's Florida Marine Index [FMI] was designed to be sensitive to organic enrichment, as manifested by tolerance and sensitivity to concentrations of dissolved oxygen. In Terra Ceia Bay (Figure 3-21) 50% of the segment supported a "tolerant" fauna (*i.e.*, can withstand dissolved oxygen concentrations of 1.0-1.5mg/l; Farrell unpubl.). FMI scores were not significantly associated with salinity ($r=0.39; p=0.10$), dissolved oxygen ($r=0.44; p=0.06$), or percent silt + clay ($r=<0.01; p=0.99$) (Figure 3-22).

3.2.8.2 Manatee River

FMI scores for the Manatee River showed that 70% of this segment supported a "tolerant" fauna (Figure 3-23). The FMI was not associated with salinity ($r=0.29; p=0.13$), but was positively associated with dissolved oxygen ($r=.46; p=0.01$) and negatively associated with the percentage of silt + clay ($r=-.49; p=<0.01$) (Figure 3-24).

3.2.8.3. Assessment

FMI scores behaved somewhat differently in the two segments in their association with physicochemical variables. Dissolved oxygen, which is expected to be associated with FMI scores, was related in the Manatee River, but not in the Terra Ceia Bay segment. Salinity, which follows a gradient in the Manatee River, was not a factor in either bay segment. The silt + clay content was associated with the FMI only in the Manatee River.

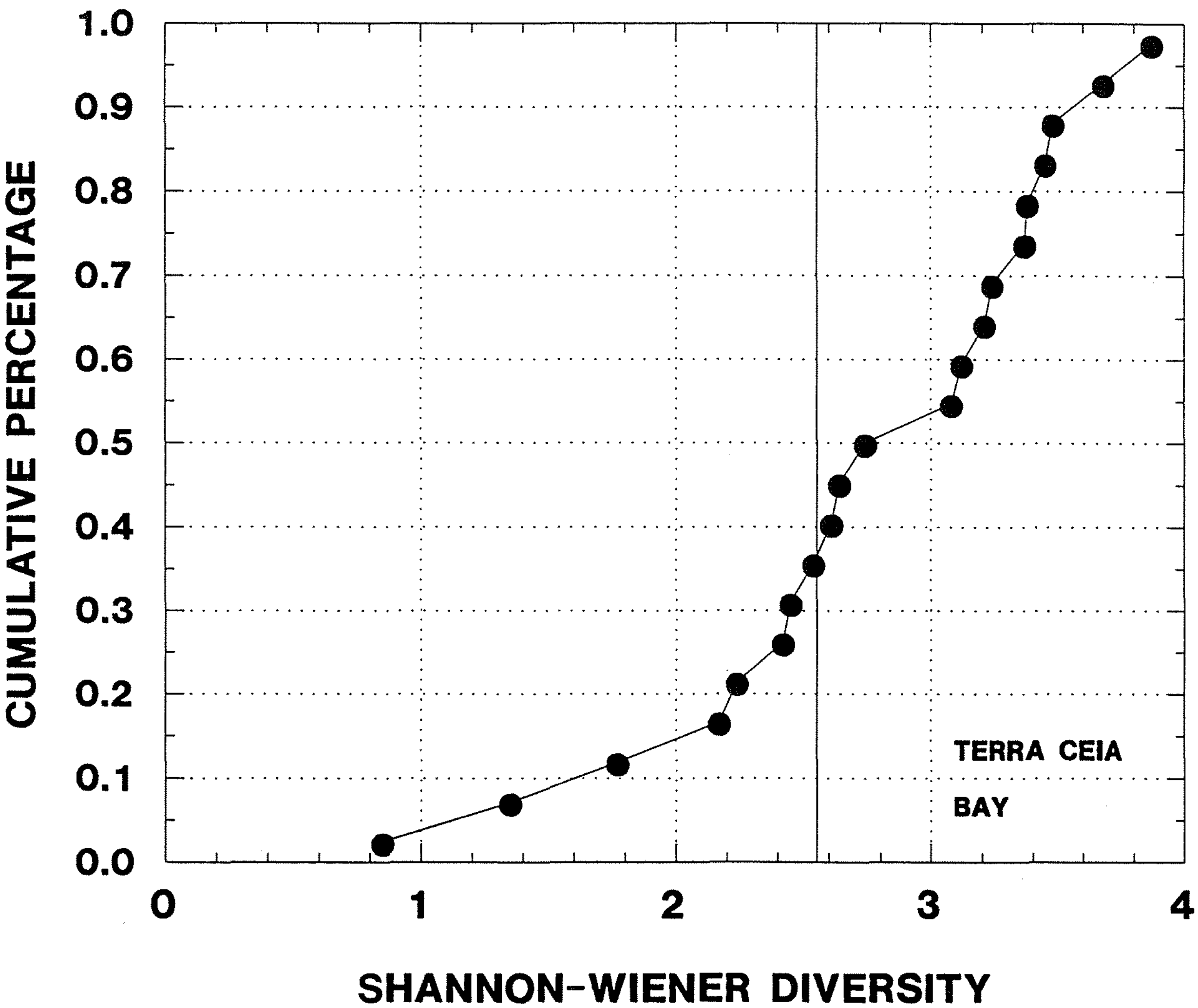

Figure 3-19. Quantile plot of Shannon-Wiener diversity. Terra Ceia Bay, October 1993-1995. The solid vertical line represents the threshold for compliance with FAC 62-302 for "biological integrity".

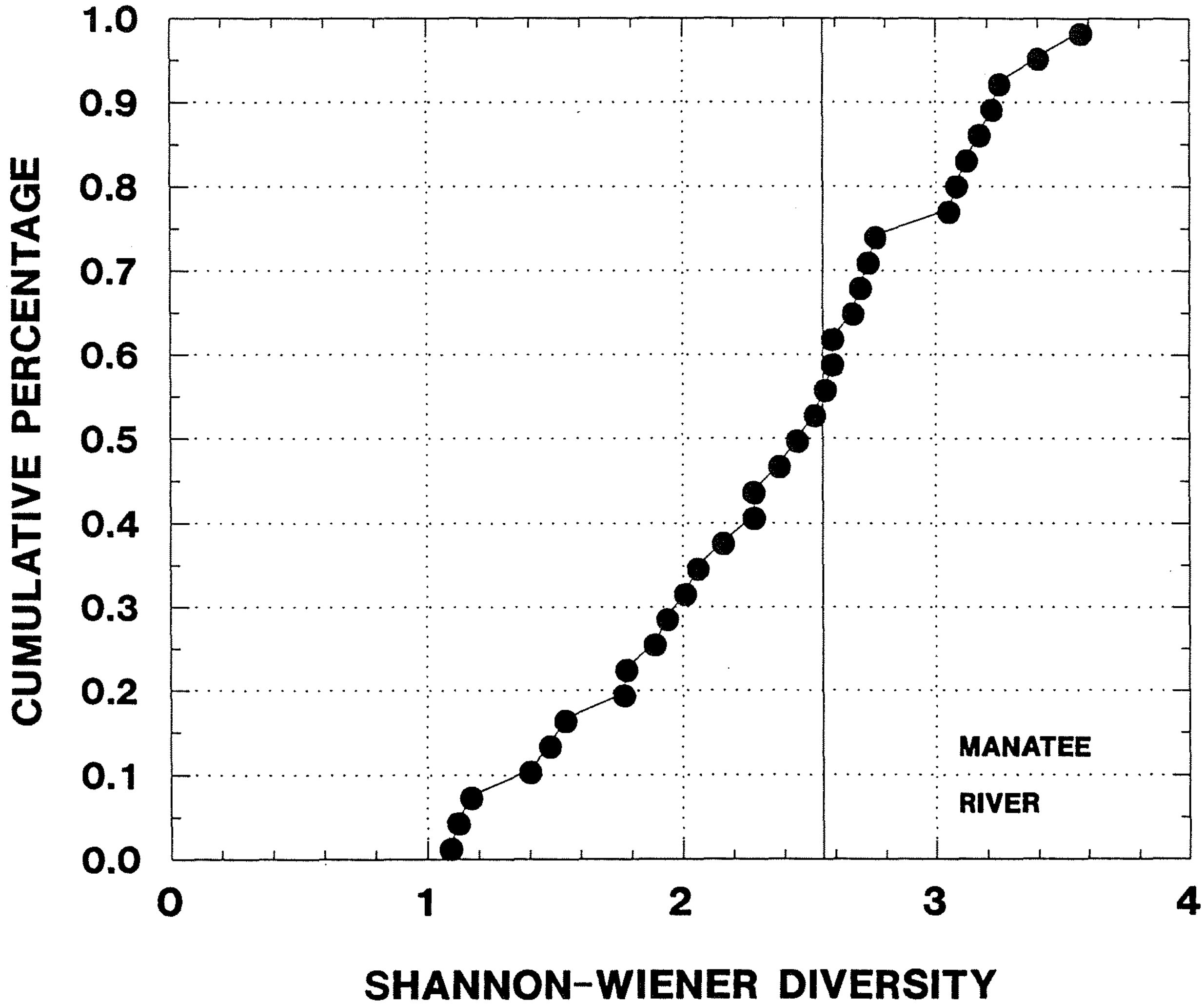

Figure 3-20. Quantile plot of Shannon-Wiener diversity. Manatee River, October 1993-1995. The solid vertical line represents the threshold for compliance with FAC 62-302 for "biological integrity".

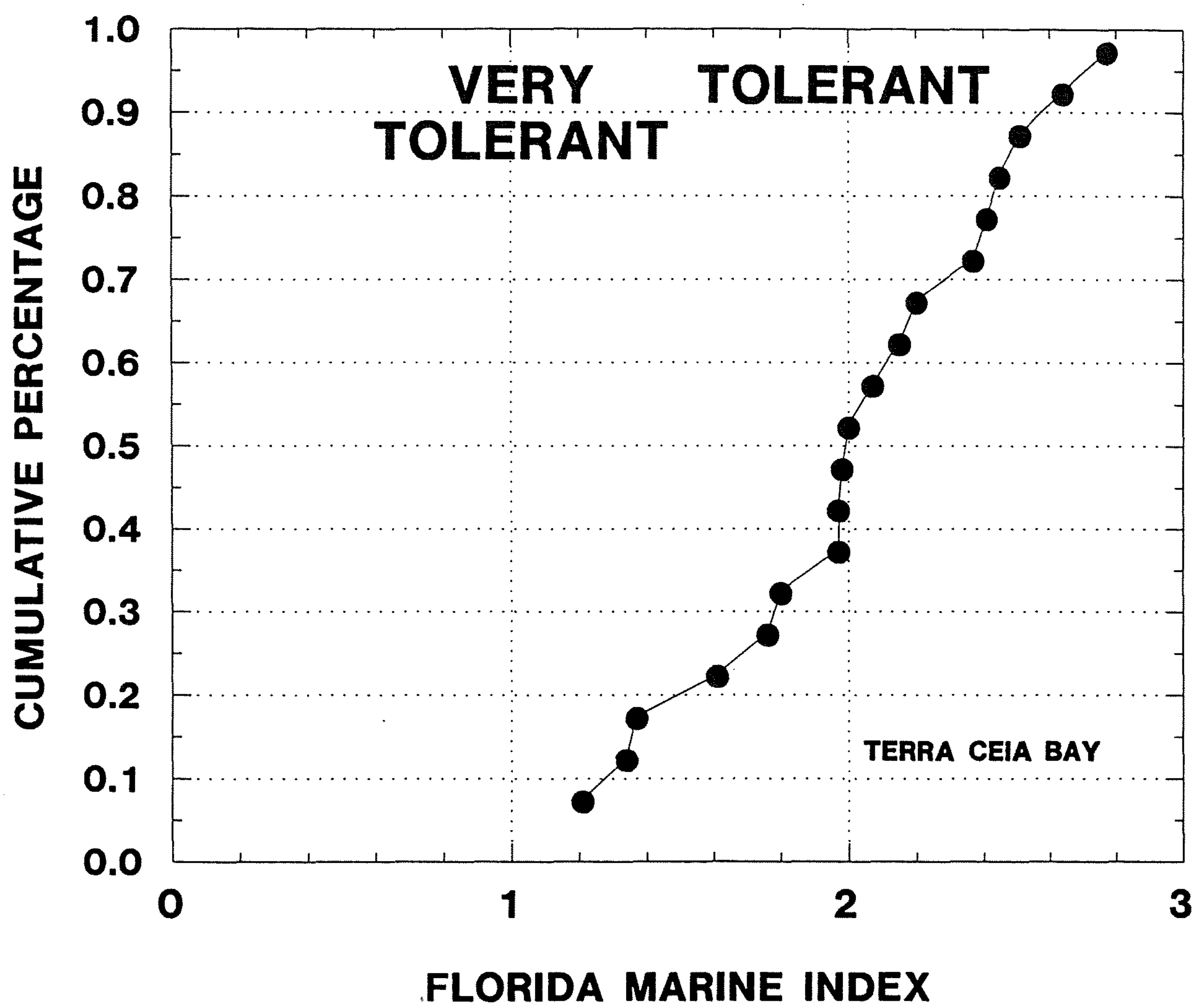

Figure 3-21. Quantile plot of the Florida Marine Index. Terra Ceia Bay, October 1993-1995. Break-points are indicated for communities "very tolerant" to low concentrations of dissolved oxygen (even down to 0.2 mg/l) and "tolerant" to dissolved oxygen concentrations between 1.0-1.5mg/l.

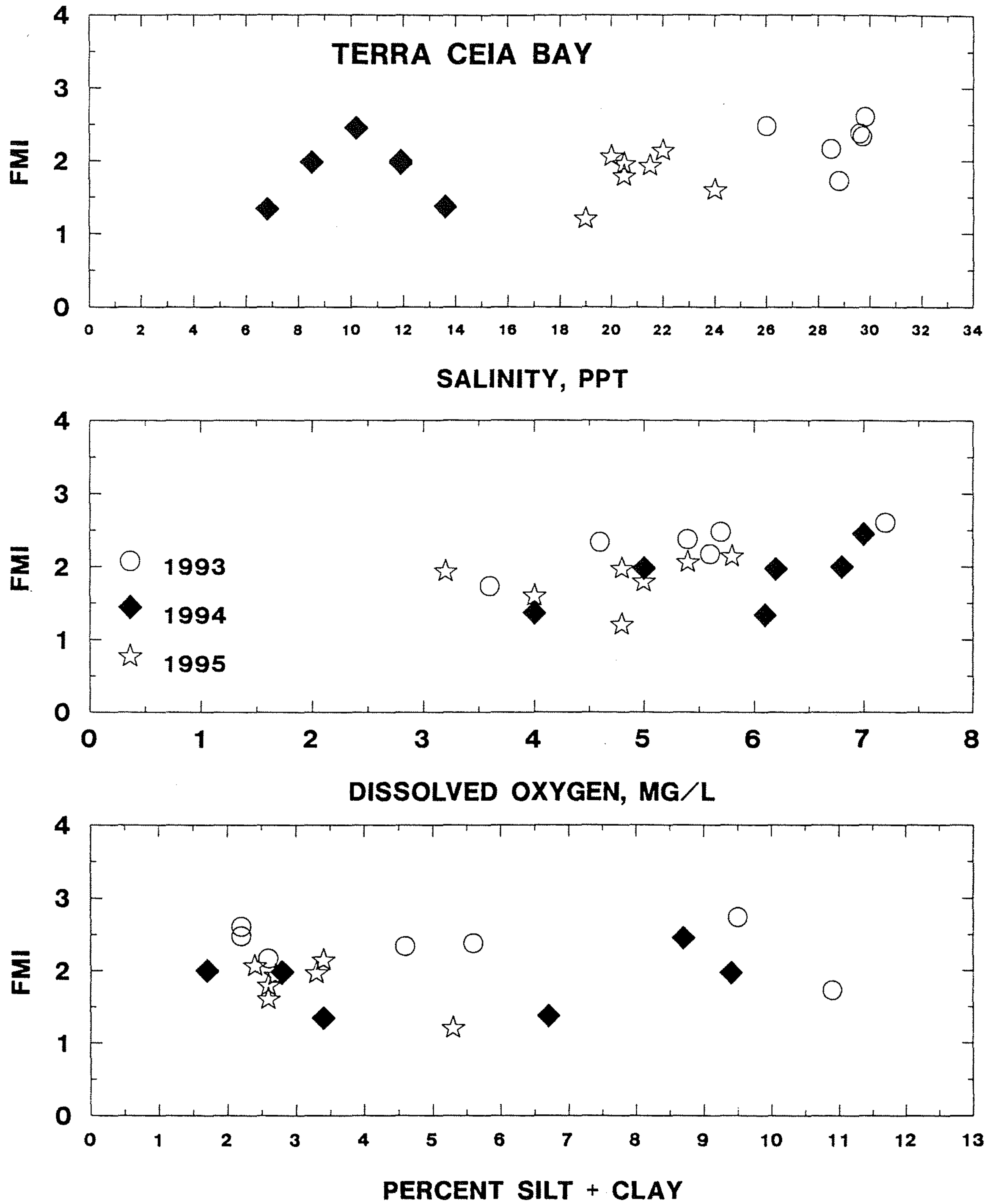

Figure 3-22. Association between the Florida Marine Index and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Terra Ceia Bay, October 1993-1995.

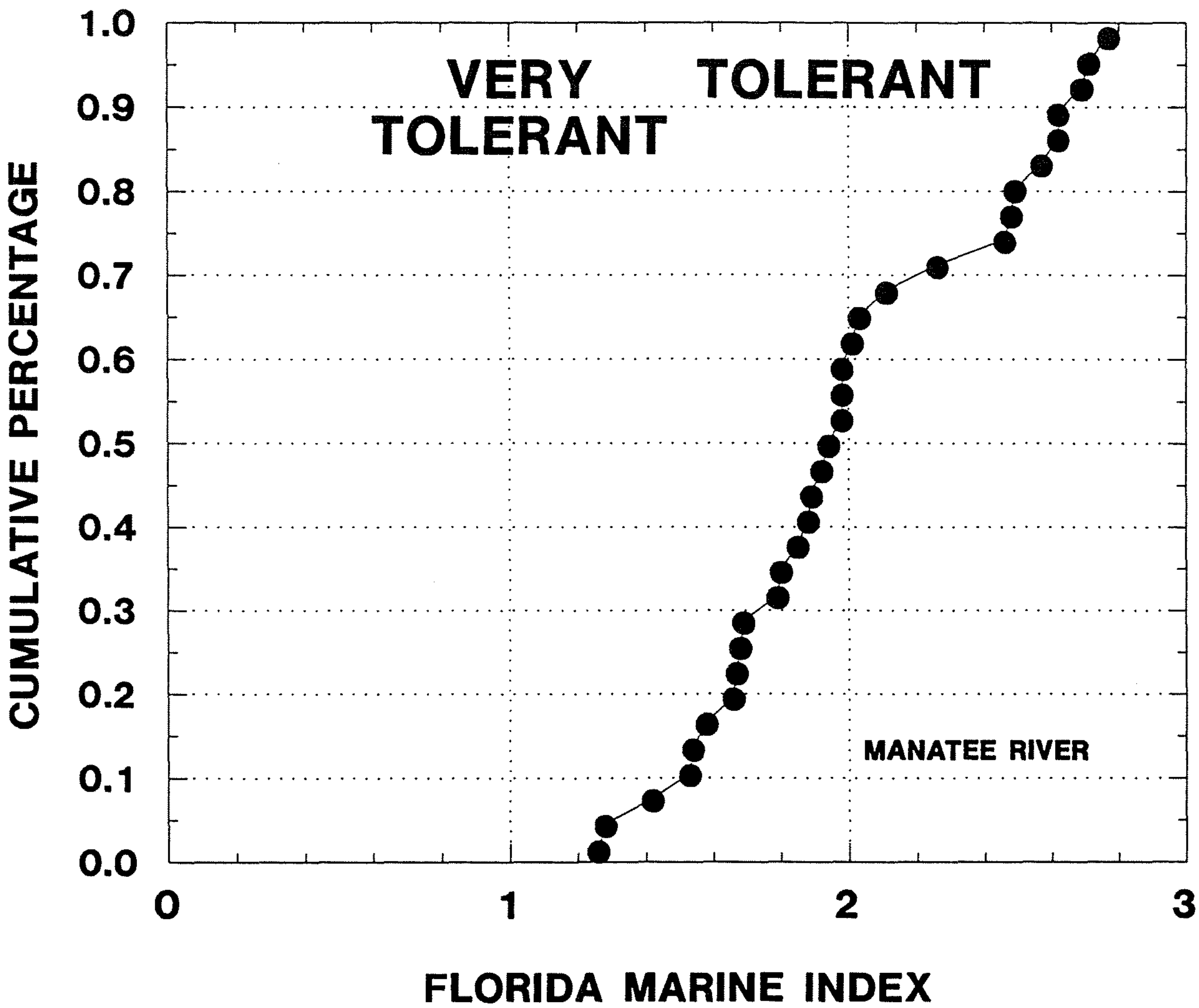

Figure 3-23. Quantile plot of the Florida Marine Index. Manatee River, October 1993-1995.Break-points are indicated for communities "verytolerant" to low concentrations of dissolved oxygen (even down to 0.2 mg/l) and "tolerant"to dissolved oxygen concentrations between 1.0-1.5mg/l.

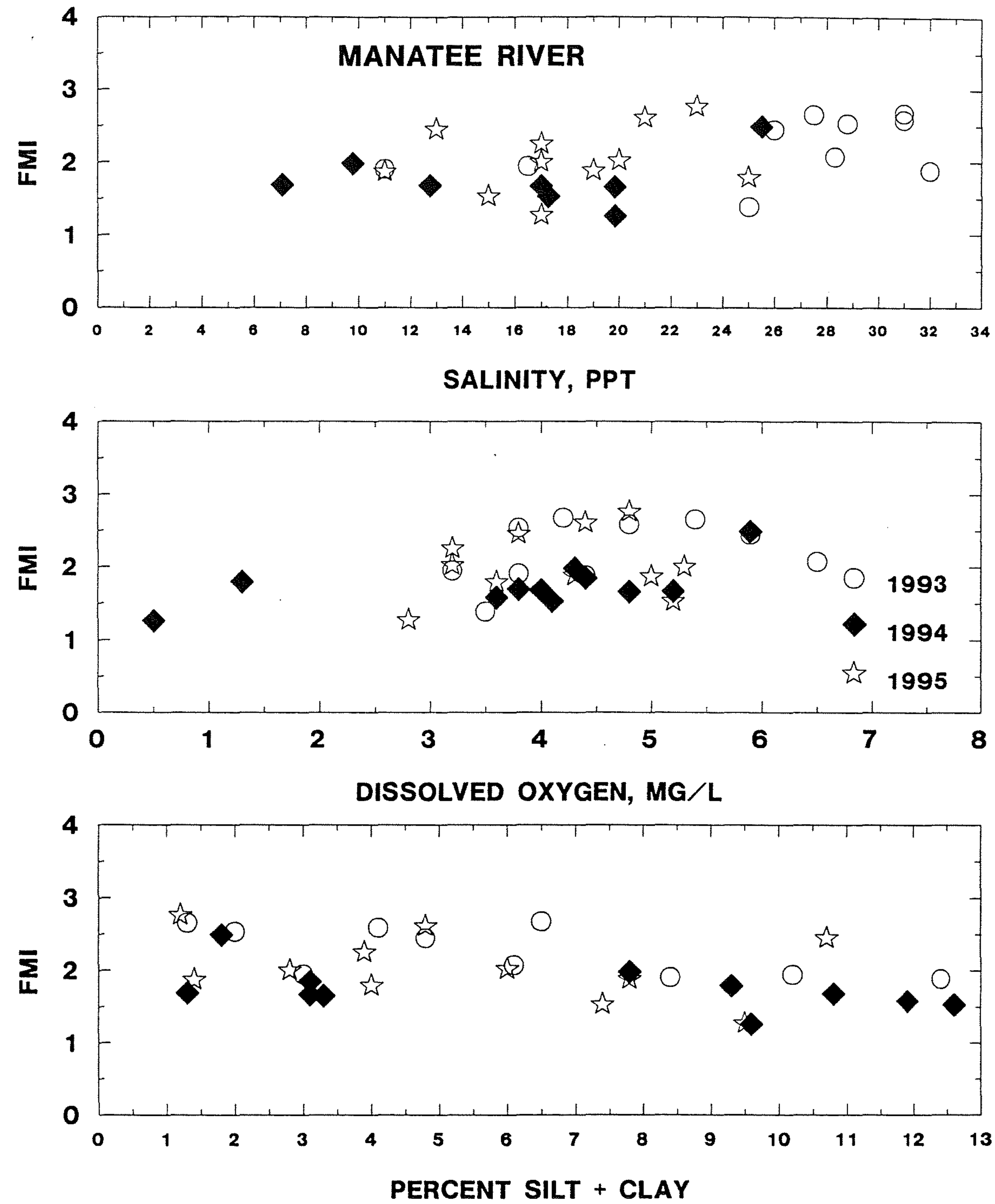

Figure 3-24. Association between the Florida Marine Index and salinity (top), dissolved oxygen (middle), and the percentage of silt + clay in the sediments (bottom). Manatee River, October 1993-1995.

The FMI requires further modifications. Many taxa common to Tampa Bay do not yet have scores assigned to them. The FMI should also be applied in other estuarine systems along Florida's Gulf coast not only to develop scores for other species, but also to verify that the FMI is, indeed, a valid metric for assessing environmental quality.

SECTION 4

SUMMARY

1. Water-mass characteristics, identified by temperature-salinity data, showed that there were differences between the three years for both Terra Ceia Bay and the Manatee River.

2. Dissolved oxygen concentrations in near-bottom waters were not significantly different between years in either segment. **Hypoxia was not observed in Terra Ceia Bay in conjunction with the *daytime* sampling; hypoxia was evident in 6% of the Manatee River samples.**

3. Density of macroinvertebrates varied little between years in Terra Ceia Bay and averaged approximately 5,300 individuals/m^2. In the Manatee River, mean density showed greater variability between years and averaged just under 10,000 individuals/m^2.

Polychaetes, especially *Monticellina dorsobranchialis*, were dominant in Terra Ceia Bay. Oligochaete worms comprised a large fraction (28%) of the Terra Ceia Bay fauna in 1995. In the Manatee River, amphipods (*e.g.*, the tube-building *Ampelisca abdita*), were subdominants after polychaetes (*e.g.*, *M. dorsobranchialis*). There was more year to year variability among dominants in the Manatee River than in Terra Ceia Bay.

4. More than 300 taxa were identified from each of the two segments during the three years of study, including more than 100 species of polychaete worms in each segment. Differences between years in numbers of taxa collected were affected by the larger number of samples processed in 1993 than in 1994 and 1995, and the positive association between numbers of taxa and salinity in the Manatee River. Neither dissolved oxygen nor the percentage of fine-grained sediments were associated with the numbers of taxa.

5. Species diversity generally declined over time in Terra Ceia Bay, but this may be explained, in part, by the larger number of samples processed in 1993. Manatee River diversity showed less variability between years. Physicochemical factors (salinity, dissolved oxygen, and the percentage of silt + clay in the sediments) generally had little association with diversity; in the Manatee River the association with salinity (positive) and silt + clay (negative) were significant.

Diversity is also employed in Florida Administrative Code as a measure of "biological integrity" (FAC 62-302). Although no true "reference" site(s) are identified in this study, it may be that 50% of Terra Ceia Bay and 60% of the Manatee River had diversity values <75% of the "reference" condition.

6. Evenness, a measure of how organisms are numerically distributed in a sample, generally declined over time in Terra Ceia Bay and increased in the Manatee River, but the differences were slight. Evenness was not associated with any of the physicochemical variables.

7. The Benthic Index ranged from < 1 to 22.9 in Terra Ceia Bay and from 7.7 to 21.5 in the Manatee River. Benthic Index scores were not associated with salinity, dissolved oxygen, or percent silt + clay in Terra Ceia Bay. In the Manatee River, both salinity and dissolved oxygen were positively associated with Benthic Index scores. Ideally, Benthic Index scores should be independent of salinity and the percentage of silt + clay in the sediments and should be responsive to sediment contamination (not measured in this study) and hypoxia/anoxia. The association between the Benthic Index and salinity in the Manatee River may ultimately require a salinity standardization.

8. Farrell's Florida Marine Index was designed to be sensitive to organic enrichment, as manifested by tolerance and sensitivity to concentrations of dissolved oxygen. **In Terra Ceia Bay, 50% of the segment supported a "tolerant" fauna (*i.e.*, can withstand dissolved oxygen concentrations of 1.0-1.5mg/l).** FMI scores were not associated with salinity, dissolved oxygen, or percent silt + clay. **70% of the Manatee River supported a "tolerant" fauna.** The FMI was not associated with salinity, but was positively associated with dissolved oxygen and negatively associated with the percentage of silt + clay.

SECTION 5

RECOMMENDATIONS

1. At a minimum, the current sampling regimen should remain intact for these segments of Tampa Bay as per the recommendations and monitoring objectives of the bay-wide management plan (TBNEP 1996). The study design adopted for this monitoring program considers that a four-year effort is needed to describe baseline conditions--after which trends would then be evaluated.

Continuation of the current design will strengthen the capability to detect temporal trends during the initial years of the investigation and will increase the power to detect trends both within and between bay segments (Larsen *et al.* 1995). Sample locations should also be randomized each year.

2. Ideally, efforts should be made to increase the number of samples in this bay segment to correspond more closely to the total number of "hexagons" available. For example, in the Manatee River segment, approximately 29 of the 34 hexagons designated would fall into this category. In the Terra Ceia Bay segment, 15 of 21 hexagons could be sampled.

3. Analysis of sediment contaminants (trace metals and organics) is underway for the four major segments of Tampa Bay. The CCMP (TBNEP 1996) and the Science Advisory Group to the TBNEP (MacDonald 1995) address the importance of identification and tracking of contaminated sediments. Very little information is available about sediment contamination in these segments (Long *et al.* 1994). Results from single sites in the Manatee River and Terra Ceia Bay showed that sediments were non-toxic.

This information is critical to the identification of contaminated sediments and determining Benthic Index cutoff scores to necessary designate "healthy" and "subnominal" benthic habitat. At present, such designations will rely wholly on data collected outside of the Terra Ceia Bay and Manatee River segments of Tampa Bay.

4. Sediment grain size analysis could be more comprehensive in order to facilitate understanding of physical factors affecting the distribution of the benthos and to aid in the interpretation of sediment contaminant data. The percentage of silt+clay has been shown to be associated with the distributions of specific organisms and with chemical contaminants in the sediments. Other sedimentary factors (*e.g.*,sorting coefficients) can also explain some of the patterns observed.

SECTION 6

LITERATURE CITED

COASTAL ENVIRONMENTAL, INC. 1995. Statistical analysis of the Tampa Bay National Estuary Program 1993 benthic survey. Prep. for Tampa Bay National Estuary Program. St. Petersburg. Coastal Environmental, Inc. St. Petersburg.

COASTAL ENVIRONMENTAL, INC. 1994. *Monitoring program to assess environmental changes in Tampa Bay, Florida.* TBNEP Tech. Rep. 02-93.

COURTNEY, C.M., S.A. GRABE, D.J. KARLEN, R. BROWN, & D. HEIMBUCH. 1995a. 1995 Field *operations manual for a synoptic survey of benthic macroinvertebrates of the Tampa Bay estuaries.*

COURTNEY, C.M., S.A. GRABE, D.J. KARLEN, R. BROWN, & D. HEIMBUCH. 1995b. 1995 Laboratory *operations manual for a synoptic survey of benthic macroinvertebrates of the Tampa Bay estuaries.*

COURTNEY, C.M., R. BROWN, & D. HEIMBUCH. 1993. *Environmental monitoring and assessment program estuaries--West Indian Province: Volume I. Introduction, methods and materials, and quality assurance. Field and laboratory operations manual for a synoptic survey of benthic macroinvertebrates of the Tampa Bay estuaries.*

ENGLE, V.D., J.K. SUMMERS & G.R. GASTON. 1994. A benthic index of environmental condition of Gulf of Mexico estuaries. *Estuaries* 17:372-384.

FARRELL, D. no date. The Florida Marine Index. FDEP, Tampa. unpubl.

GONOR, J.J. & P.F. KEMP. 1978. Procedures for quantitative ecological assessments in intertidal environments. EPA-600/3-78-087. Corvallis Environ. Res. Lab. ORD. USEPA. Corvallis, OR. 112p.

GRABE, S.A., C.M. COURTNEY, Z. LIN, D. ALBERDI, H.T. WILSON, JR., & G. BLANCHARD. 1996. *Environmental monitoring and assessment program-estuaries. West Indian Province 1993 sampling. Volume III. Technical report: A synoptic survey of the benthic macroinvertebrates and demersal fishes of the Tampa Bay estuarine system.* Tampa Bay National Estuary Program Tech. Publ. #12-95. St. Petersburg.

LARSEN, D.P., K.W. THORNTON, N.S. URQUART, & S.G. PAULSEN. 1994. The role of sample surveys for monitoring the condition of the nation's lakes. *Environ. Monit. Assess.* 32:101-134.

LARSEN, D.P., N.S. URQUART, & D.L. KUGLER. 1995. Regional scale trend monitoring of indicators of trophic condition of lakes. *Water Res. Bull.* 31:117-140.

LONG, E.R., D.A. WOLFE, R.S. CARR, K.J. SCOTT, G.B. THURSBY, H.L. WINDOM, R. LEE, F. CALDER, G.M. SLOANE, & T. SEAL. 1994. *Magnitude and extent of sediment toxicity in Tampa Bay, Florida.* NOAA Tech. Mem. NOS ORCA 78. NOS. NMFS. Silver Spring, MD. 84 p.

MacDONALD, D.D. 1995. *Science Advisory Group workshop on sediment assessment in Tampa Bay: Summary report.* Prep. for: Tampa Bay National Estuary Program. MacDonald Environmental Sciences Ltd., Ladysmith, B.C., Canada. 44p.

NETER, J., W. WASSERMAN, & M.H. KUTNER. 1985. *Applied linear statistical models. Regression, analysis of variance, and experimental designs.* 2nd Ed. Homewood, ILL. 1127 p.

PIELOU, E.C. 1975. *Ecological diversity.* Wiley-Interscience. N.Y. 165 p.

QINGHONG, L. 1995. A model for species diversity monitoring at community level and its applications. *Environ. Monit. Assess.* 34:271-287.

SOKAL, R.R. & F.J. ROHLF. 1981. *Biometry.* 2nd Ed. W.H. Freeman. San Francisco.

STEEDMAN, H.F. 1976. Narcotizing agents and methods. Pp. 87-96. In: H.F. Steedman (Ed.). Zoopankton fixation and preservation. Monogr. Oceanog. Method. 4. UNESCO Press. Paris. 350 p.

TAMPA BAY NATIONAL ESTUARY PROGRAM [TBNEP]. 1996. *Charting the course for Tampa Bay: Draft comprehensive conservation and management plan.* 265 p.

VERSAR. 1992. Design of a basinwide monitoring program for the Tampa Bay estuary. Prep. for TBNEP. TBNEP Tech. Pub. #09-92.

WILKINSON, L. 1990. SYSTAT: The system for statistics. SYSTAT, Inc. Evanston, Ill.

WINDELL, J.T. 1971. Food analysis and rate of digestion. Pages 215-226. In: W.E. Ricker (Ed.) *Methods for assessment of fish production in fresh waters.* IBP Handbook No. 3. 2nd Ed. Blackwell Scientific Publ. Oxford. xiv + 348 pp.

SECTION 7

APPENDICES

APPENDIX 2-A

COORDINATES OF BENTHIC STATIONS
IN TERRA CEIA BAY AND THE MANATEE RIVER
OCTOBER 1993-1995

Sampling Grid	Manatee County Station ID	TBNEP Station ID	Longitude Degrees	Longitude Minutes	Longitude Seconds	Latitude Degrees	Latitude Minutes	Latitude Seconds
Manatee/Terra Ceia	.	T1	82	35	45.600	27	33	25.2000
Manatee/Terra Ceia	.	T2	82	34	12.000	27	34	4.8000
Manatee/Terra Ceia	TC-2	T3	82	36	3.600	27	33	0.0000
Manatee/Terra Ceia	.	T4	82	35	31.200	27	32	49.2000
Manatee/Terra Ceia	.	T5	82	34	55.200	27	33	7.2000
Manatee/Terra Ceia	.	T6	82	36	32.400	27	32	42.0000
Manatee/Terra Ceia	.	T7	82	36	7.200	27	32	24.0000
Manatee/Terra Ceia	TC-3	T8	82	36	25.200	27	31	44.4000
Manatee/Terra Ceia	.	T9	82	38	42.000	27	31	40.8000
Manatee/Terra Ceia	.	T10	82	37	15.600	27	31	19.2000
Manatee/Terra Ceia	LM-1	T11	82	36	54.000	27	30	50.4000
Manatee/Terra Ceia	.	T12	82	36	3.600	27	31	1.2000
Manatee/Terra Ceia	.	T13	82	35	20.400	27	30	32.4000
Manatee/Terra Ceia	.	T14	82	34	26.400	27	30	28.8000
Manatee/Terra Ceia	LM-2	T15	82	33	57.600	27	30	14.4000
Manatee/Terra Ceia	.	T16	82	33	10.800	27	30	32.4000
Manatee/Terra Ceia	.	T17	82	32	2.400	27	30	14.4000
Manatee/Terra Ceia	.	T18	82	31	22.800	27	30	18.0000
Manatee/Terra Ceia	.	T19	82	30	50.400	27	30	46.8000
Manatee/Terra Ceia	LM-4	T20	82	30	10.800	27	31	26.4000
Manatee/Terra Ceia	.	T21	82	29	16.800	27	31	48.0000
Manatee/Terra Ceia	.	T22	82	27	54.000	27	31	19.2000

APPENDIX 2-B

SUMMARY OF LABORATORY QUALITY ASSURANCE CHECKS FOR BENTHIC MACROINVERTEBRATE SORTING, COUNTS, AND IDENTIFICATIONS

A. SORTING

	Error range	Mean error
Percent error (N=8)	0.0 - 33.1%	9.0 %

B. IDENTIFICATIONS

COMMENTS ON HILLSBOROUGH COUNTY E.C.P. VOUCHER COLLECTION OF CRUSTACEANS FROM TAMPA BAY N.E.P. BENTHIC MONITORING PROGRAM -- re-examined by David K. Camp, March 1996.

VIAL NO.	SAMPLE NO.	ORIGINAL ID	MY ID	COMMENTS
D-1	95-BCB-07	Unid. Porcellanidae	Polyonyx gibbesii	
D-2	95-BCB-11-1	Libinia dubia	Same	
D-3	95-BCB-07-1	Pinnixa chaetopterana	Same	
D-4	95-BCB-05	Dyspanopeus texana	Dyspanopeus texanus	Note corrected spelling. ID of adult OK. The 3 juveniles could be something else, however.
D-5	95-BCB-02	Polyonyx gibbesii	Same	
D-6	95-BCB-07-01	Panopeus herbstii? Change	Panopeus sp. immature ♀	Williams (1983) restricted P. herbstii to the Atlantic Seaboard, exclusive of the Gulf of Mexico. This small specimen, with a length-to-width ratio of 74%, may be P. simpsoni or possibly P. lacustris.
D-7	95-BCB-05	Pitho ?lherminieri	Same	
D-8	95-BCB-05-1	Dyspanopeus texana	D. texanus	Note spelling.
D-9	95-BCB-19	Pagurus sp.	Pagurus maclaughlinae	
D-10	95-BCB-21	Pagurus sp. ?maclaughlinae	Pagurus maclaughlinae	
D-11	95-BCB-02-01	Pinnixa sp.	Pinnixa cf. chaetopterana	Subadult.
D-12	95-BCB-13-1	Pagurus ?maclaughlinae	Pagurus maclaughlinae	

D-13	95-BCB-04	Pinnixa	Pinnixa sp. juv.	
D-14	95-BCB-10-1	Pagurus sp.	Same	The legs on one juvenile are banded like those of P. maclaughlinae. The other juvenile lacks claws and legs, however.
D-15	95-BCB-09-1	Pinnixa	Pinnixa sp. juv.	
D-16	95-BCB-15	?Goneplacidae	Same?	Extremely small juvenile; could be something else.
D-17	95-BCB-10	Automate ?sp. A	Alpheus sp. juvs.	Not an Automate because the major claw does have a molar-like tooth on the dactylus. Not A. heterochaelis, A. angulatus, or A. normanni. Pereopods 2 and 4 have epipods. A rostrum is present. The adrostral furrows are not abruptly delimited. Dactyls of pereopods 3 and 4 are not subspatulate. Merus of the major chela has a distal spine. Identity unknown.
D-18	95-BCB-15	Ambidexter symmetricus	Processa hemphilli	Not Ambidexter because the right pereopod 1 is not chelate.
D-19	95-BCB-07-1	Upogebia sp.	Callianassidae; Callichirinae sp. juv.	Pereopod 1 is chelate, not subchelate. This extremely small juvenile is a Callianassid, not an Upogebiid.
D-20	95-BCB-05	Periclimenes americanus	Same	
D-21	95-BCB-11	Thalassinid - Upogebia	Callianassidae: Callichirinae sp. juv.	P-1 is chelate.
MD-1	Manatee County T-1-94-1	Upogebia affinis PL?	Upogebia sp. PL	Too small to ID with certainty. This is Upogebia.

A-28	95-BCB-05-1	Lembos unifasciatus	Lembos cf. unifasciatus	No GCRL 1993 voucher. If these are L. unifasciatus, they don't correspond well with either subspecies from Florida. Male gnathopod (Gn) 1 looks like that of L. u. reductus (the subspecies Myers reported as being from the central west coast of Florida). However, the spinous process on the peduncle of uropod 1 in these specimens is long, like those of L. u. unifasciatus, which is the subspecies Myers reported as being from "tropical Florida." Gnathopod 1 in the Tampa Bay females do not look like the female Gn-1 shown in Myers, 1977 (Fig. 131). These specimens have a tooth on the posterodistal end of the propodus; there is no such tooth in Myers's figure. I do not know what other species this could be if it is not L. unifasciatus, however.
A-29	95-BCB-10-1	Lembos unifasciatus	Same?	The 3 larger specimens may be L. unifasciatus, but the identity of the 2 smaller specimens is anybody's guess.
MA-1	94-TCB-40-1	Ampelisca sp. C	Same	Corresponds with GCRL 1993 voucher.
MA-2	94-TCB-37-1	Carinobatea ?cuspidata (on data sheet)- or - Eusiroides ?yucatenensis (on vial tag)	Batea cf. catherinensis	Similar to GCRL 1993 voucher. Not cuspidata because there are no spines on the dorsum.
MA-3	95-TCB-22-1	Ampelisca holmesi	Same	

MD-2	94-MR-32-1	Pinnixa sp.	Pinnixa sp. damaged	The 3rd leg is missing, making ID impossible. This is the same species as the one in vial MD-3.
MD-3	94-MR-23-1	Pinnixa	Pinnixa sp. damaged	The 3rd leg is missing.
MD-4	94-TCB-37-1	Periclimenes longicaudatus	Same	
MD-5	94-MR-23-1	Pagurid	Same	
MD-6	94-MR-26-1	Pinnoth.	Pinnotheridae spp. damaged juvs.	
614 MD-7	94-TCB-37-1	Alphaeus armillatus, 2 specimens	6179 140102 A. normanni - 1 spec. A. angulatus - 1 spec. 4011100	A. normanni has subtriangular eye hoods; major claw not notched ventrally. A. angulatus lacks movable spine on P-5 ischium, so this is not A. armillatus, which has a spine.
619 MD-8	94-TCB-37-1	Processa bermudensis	Ambidexter symmetricus	Both P-1 are chelate.
MD-9	94-TCB-37-1	Xanthidae	Same, sp. juv.	
MD-10	94-TCB-37-1	Panopeus herbstii	Hexapanopeus angustifrons - 1 ♂. ?Hexapanopeus sp. juv. - 1	The gonopod of the larger male corresponds to that of H. angustifrons as depicted by Williams (1984: fig. 331n). The gonopod of the extremely small male is not developed well enough to help reveal the identity with certainty.
√ MD-11	94-TCB-37-1	?Paguristes hummi?	Paguridae sp. juv. (damaged)	Maxillipeds 3 are widely separated by the sternum. The claws and most legs are missing, however.
I-1	94-MR-23-1	Asellote		Vial not received at FMRI; missing.

MA-4	94-TCB-37-1	Stenothoe ? gallensis	Stenothoe sp. B	Probably not S. gallensis, a northern species that was not even found by Bynum & Fox in N. Carolina (does it occur in the Gulf?). This is also not Stenothoe sp. A of the GCRL 1993 voucher set, which has only one marginal spine on the telson, not three.
MA-5	94-MR-27-1	Ampelisca holmesi	Same	One specimen has urosomite 1 shaped differently from other the A. holmesi. Seen laterally, the dorsal margin is very concave (and not from being pinched).
MA-6	94-TCB-37-1	Carinobatea ?cuspidata (on data sheet) - or - Eusiroides ?yucatenensis (on vial tag)	Batea cuspidata	Corresponds well with GCRL 1993 voucher. Barnard & Karaman (1991) synonymized Carinobatea under Batea.
MA-7	94-MR-23-1	Argissa hamatipes	Same	Corresponds with GCRL 1993 voucher.
C-1	95-BCB-12-1	Unid. Cumacea	Same	I cannot identify this incomplete female. If it lacked an independent telson, it would key out to Nannastacidae using Jones (1976: British Cumaceans). If it had a telson, it cannot be keyed out to family using Jones. It does not correspond with any of the GCRL 1993 voucher specimens.
C-2	95-BCB-12-1	Oxyurostylis lecroyae	Same	Corresponds to O. sp. B in GCRL 1993 voucher set, which Sara LeCroy told me (pers. comm.) was O. lecroyae. These specimens correspond well to the description of O. lecroyae.
MC-1	94-MR-27-1	Oxyurostylis lecroyae	Same	See above.

MC-2	94-TCB-43-1	Cyclaspis sp. C	Cannot ID	I do not have LeCroy's key that distinguishes Cyclaspis sp. C. However, the uropods on this very brittle specimen do not seem to correspond to the one remaining uropod on the GCRL 1993 voucher specimen of Cyclaspis sp. C in regard to the spination of the mesial margins of the peduncle and endopod. The 1993 voucher is much more spinose than the TCB specimen appears to be.
O-1 thru MO-2		Various ostracods	Cannot ID	Ostracods are specifically excluded from identification by the 1994 EMAP protocol, because they are considered meiofauna instead of macrofauna (although some are large). I have never assembled ostracod literature and am unable to identify them.

76.5

94 Crust 13/17

95 Dec 15/21. 77.1

22/27

37/48

APPENDIX 3

BENTHIC SAMPLE SUMMARY SHEETS

APPENDIX 3-A

TERRA CEIA BAY 1993-1995

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATETAXA

TERRA CEIA BAY 1993-1995
Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Actiniaria	1.19	----	1/ 21
Athenaria	1.79	5.98	2/ 21
Thenaria	2.98	11.11	2/ 21
Turbellaria	2.38	7.52	2/ 21
Nemertea	16.07	32.87	6/ 21
Nemertea sp. Q	1.19	----	1/ 21
Nemertea sp. N	7.14	16.09	4/ 21
Nemertea sp. F	23.21	43.17	8/ 21
Nemertea sp. K	5.95	17.51	3/ 21
Nemertea sp. B	22.62	28.94	10/ 21
Malmgreniella maccraryae	3.57	8.96	4/ 21
Malmgreniella taylori	0.60	----	1/ 21
Polynoidae Genus D	3.57	8.05	4/ 21
Sthenelais sp. A	11.31	28.75	4/ 21
Paramphinome sp. B	1.19	----	1/ 21
Anaitides groenlandica	1.19	----	1/ 21
Genetyllis castanea	3.57	8.96	3/ 21
Paranaitis gardineri (=polynoides)	2.38	7.52	2/ 21
Eumida sp. A	1.19	----	1/ 21
Phyllodoce arenae	10.71	23.48	5/ 21
Gyptis crypta	4.76	----	1/ 21
Parahesione luteola	7.14	22.56	3/ 21
Podarke obscura	0.60	----	1/ 21
Podarkeopsis levifuscina	33.33	33.39	15/ 21
Sigambra tentaculata	2.38	6.40	3/ 21
Cabira incerta	0.60	----	1/ 21
Synelmis sp. B	0.60	----	1/ 21
Syllidae	1.79	----	1/ 21
Procerae sp. A	1.19	----	1/ 21
Pionosyllis sp. D	1.19	----	1/ 21
Syllis cornuta	26.19	114.42	2/ 21
Syllis (Typosyllis) prolifera	0.60	----	1/ 21
Exogone dispar	7.14	19.59	3/ 21
Sphaerosyllis aciculata	0.60	----	1/ 21
Sphaerosyllis taylori	0.60	----	1/ 21
Sphaerosyllis labrinthophila	5.95	----	1/ 21
Brania clavata	3.57	----	1/ 21
Brania wellfleetensis	23.81	61.48	6/ 21
Syllides floriidanus	1.19	----	1/ 21
Streptosyllis pettiboneae	1.19	3.76	2/ 21
Nereidae	1.19	----	1/ 21
Neanthes succinea	1.79	5.98	2/ 21
Nereis sp. (anterior frag.)	1.19	----	1/ 21
Nereis lamellosa	3.57	11.95	2/ 21

Nephtys cf. hombergii	0.60	----	1/ 21
Aglaophamus verrilli	1.19	3.76	2/ 21
Glyceridae	1.19	3.76	2/ 21
Glycera americana	5.95	12.88	5/ 21
Glycinde solitaria	11.31	15.76	9/ 21
Mooreonuphis cf. nebulosa	0.60	----	1/ 21
Kinbergonuphis simoni	4.17	14.43	2/ 21
Lumbrinereis latreilli	5.95	19.21	2/ 21
Lumbrineris sp. D	1.79	5.98	2/ 21
Arabella mutans	1.19	----	1/ 21
Schistomeringos cf. rudolphi	23.81	66.25	7/ 21
?Pettiboneia sp.	1.19	----	1/ 21
Leitoscoloplos robustus	1.79	5.98	2/ 21
Scoloplos rubra	1.19	----	1/ 21
Leitoscoloplos fragilis	1.19	----	1/ 21
Aricidea cf. suecica	2.38	7.52	2/ 21
Aricidea lopezi	8.33	19.90	4/ 21
Aricidea philbinae	28.57	46.29	9/ 21
Aricidea taylori	23.21	26.89	11/ 21
Paraonis fulgens	1.19	----	1/ 21
Paraonella sp.	1.19	----	1/ 21
Cirrophorus ?lyra	19.05	81.74	2/ 21
Cirrophorus ?furcatus	1.19	----	1/ 21
Laonice cirrata	3.57	8.96	3/ 21
Polydora socialis	4.76	16.99	2/ 21
Polydora cornuta (=ligni)	2.38	----	1/ 21
Prionospio	24.40	54.98	6/ 21
Prionospio heterobranchia	54.17	138.26	9/ 21
Prionospio steenstrupi	8.93	24.09	4/ 21
Prionospio pygmaea	130.36	175.47	12/ 21
Prionospio cristata	3.57	9.80	3/ 21
Prionospio perkinsi	47.02	55.47	14/ 21
Paraprionospio pinnata	325.60	458.32	15/ 21
Streblospio benedicti	1.19	----	1/ 21
Scolelepis	0.60	----	1/ 21
Scolelepis texana	82.74	230.10	6/ 21
Carazziella hobsonae	89.88	159.18	9/ 21
Prionospio multibranchiata	3.57	----	1/ 21
Magelonidae	0.60	----	1/ 21
Magelona pettiboneae	26.19	39.90	9/ 21
Spiochaetopterus costarum	5.95	12.88	5/ 21
Cirratulidae	0.60	----	1/ 21
Caulleriella	1.19	----	1/ 21
Caulleriella cf. alata	4.76	----	1/ 21
Caulleriella sp. D	11.90	39.23	3/ 21
Tharyx	7.14	----	1/ 21
?Aphelochaeta sp.	2.38	----	1/ 21
Monticellina dorsobranchialis	761.90	2545.33	16/ 21
Chaetozone	3.57	----	1/ 21
Cirriformia	0.60	----	1/ 21
Cirriformia sp. B	0.60	----	1/ 21
Cirriformia sp. A	0.60	----	1/ 21

Armandia maculata	7.74	22.53	4/ 21
Capitellidae	0.60	----	1/ 21
Capitella sp. A	16.67	44.95	5/ 21
Capitella capitata	5.95	17.95	3/ 21
Notomastus	0.60	----	1/ 21
Notomastus latericeus	1.79	4.48	3/ 21
Mediomastus	166.67	223.69	12/ 21
Mediomastus ambiseta	45.83	88.15	9/ 21
Mediomastus californiensis	33.33	72.60	6/ 21
Scyphoproctus	5.36	----	1/ 21
Maldanidae	3.57	9.80	3/ 21
Branchioasychis americanus	0.60	----	1/ 21
Asychis elongatus	1.19	----	1/ 21
Axiothella mucosa	2.38	----	1/ 21
Owenia sp. A	2.98	7.81	3/ 21
Myriochele oculata	0.60	----	1/ 21
Sabellaria sp. A	42.86	185.26	2/ 21
Sabellaria sp. C	2.38	----	1/ 21
Pectinaria gouldii	2.98	7.81	3/ 21
Ampharetidae	2.38	8.50	2/ 21
Isolda pulchella	4.76	9.25	5/ 21
Pista cf. quadrilobata	0.60	----	1/ 21
Streblosoma hartmanae	1.79	----	1/ 21
Chone cf. americana	0.60	----	1/ 21
Megalomma pigmentum	0.60	----	1/ 21
Fabriciola trilobata	8.33	21.41	3/ 21
Serpulidae	2.98	----	1/ 21
Spirorbis spirillum	1.19	----	1/ 21
Pomatoceros americanus	5.36	----	1/ 21
Boguea enigmatica	1.19	----	1/ 21
Spirorbidae	2.98	----	1/ 21
Oligochaeta	659.52	918.10	13/ 21
Enchytraeidae	1.79	5.98	2/ 21
Tubificidae	74.40	205.68	6/ 21
Gastropoda	13.10	48.81	5/ 21
Schwartziella catesbyana	11.31	----	1/ 21
Vitrinellidae sp. A	4.76	19.15	2/ 21
Cyclostremiscus ?pentagonus	1.19	----	1/ 21
Caecum	0.60	----	1/ 21
Caecum pulchellum	39.29	118.21	5/ 21
Caecum nitidum	20.24	89.92	2/ 21
Modulus modulus	0.60	----	1/ 21
Bittiolum varium	29.17	101.81	3/ 21
Cerithium muscarum	11.90	----	1/ 21
Epitonium angulatum	0.60	----	1/ 21
Melanella	1.19	3.76	2/ 21
Microeulima hemphilli	12.50	29.84	6/ 21
Crepidula	3.57	11.28	3/ 21
Crepidula fornicata	3.57	----	1/ 21
Crepidula plana	3.57	----	1/ 21
Crepidula maculosa	32.74	108.72	2/ 21
Natica pusilla	3.57	8.96	3/ 21

Phyllonatus pomum	3.57	----	1/ 21
Astris lunulata	116.67	422.67	3/ 21
Parvanachis obesa	1.19	----	1/ 21
Nassarius vibex	13.10	22.87	7/ 21
Olivella	35.71	87.35	6/ 21
Olivella pusilla	7.14	----	1/ 21
Jaspidella blanesi	20.24	41.55	5/ 21
Granulina hadria	1.19	----	1/ 21
Dentimargo aureocinctus	7.14	----	1/ 21
Gibberula lavalleenana	17.86	----	1/ 21
Prunum apicinum	19.05	27.56	9/ 21
Eulimastoma weberi	7.14	22.56	2/ 21
Odostomia producta	2.38	----	1/ 21
Turbonilla	5.95	19.21	2/ 21
Turbonilla interrupta	1.19	----	1/ 21
Turbonilla conradi	44.64	121.81	7/ 21
Turbonilla incisa	1.19	----	1/ 21
Pyramidella crenulata	1.79	----	1/ 21
Turbonilla sp. I	8.93	----	1/ 21
Rictaxis punctostriatus	8.93	23.43	3/ 21
Acteocina canaliculata	97.62	191.65	11/ 21
Cylichnella bidentata	5.36	12.85	4/ 21
Bulla striata	0.60	----	1/ 21
Haminoea succinea	79.17	126.57	13/ 21
Haminoea antillarum	2.38	----	1/ 21
Bivalvia	50.00	91.34	11/ 21
Nucula crenulata	26.79	68.04	7/ 21
Nuculana acuta	0.60	----	1/ 21
Anadara transversa	1.79	5.98	2/ 21
Musculus lateralis	5.95	22.23	2/ 21
Brachidontes exustus	4.76	10.06	4/ 21
Anomia simplex	1.19	----	1/ 21
Lucinidae sp.	3.57	----	1/ 21
Parvilucina multilineata	8.33	17.82	6/ 21
Lucina nassula	8.93	35.61	2/ 21
Crassostrea virginica	51.19	228.92	2/ 21
Diplodonta semiaspera	4.76	12.79	3/ 21
Mysella planulata	39.29	41.32	12/ 21
Mysella sp. A	10.12	26.70	4/ 21
Carditamera floridana	5.36	----	1/ 21
Laevicardium mortoni	13.10	22.87	7/ 21
Mulinia lateralis	137.50	516.24	6/ 21
Tellinidae	4.17	----	1/ 21
Macoma tenta	20.83	37.15	8/ 21
Macoma constricta	4.76	15.04	2/ 21
Tellina spp.	45.24	65.13	9/ 21
Tellina iris	3.57	----	1/ 21
Tellina lineata	1.19	----	1/ 21
Tellina versicolor	7.74	25.15	2/ 21
Tagelus divisus	15.48	37.27	5/ 21
Abra aequalis	9.52	18.92	6/ 21
Cumingia tellinoides vanhyningi	1.19	----	1/ 21

Cyclinella tenuis	1.19	----	1/ 21
Transennella conradina	0.60	----	1/ 21
Dosinia discus	2.38	5.03	4/ 21
Mercenaria	0.60	----	1/ 21
Chione cancellata	1.79	4.48	3/ 21
Corbula contracta	3.57	7.01	5/ 21
Lyonsia hyalina floridana	7.14	15.60	5/ 21
Asthenothaerus hemphilli	0.60	----	1/ 21
Dentalium texasianum	0.60	----	1/ 21
Pycnogonida	1.19	----	1/ 21
Balanus venustus	16.07	70.84	2/ 21
Americamysis bigelowi	2.38	----	1/ 21
Mysidopsis furca	1.19	----	1/ 21
Bowmaniella floridana	2.38	6.40	3/ 21
Americamysis stucki	2.98	11.11	2/ 21
Oxyurostylis	1.19	3.76	2/ 21
Oxyurostylis smithi (=B)	42.26	115.01	5/ 21
Oxyurostylis lecroyae (=A)	8.33	22.48	4/ 21
Cyclaspis	1.19	----	1/ 21
Cyclaspis cf. varians	9.52	33.28	3/ 21
Leptochelia	1.79	----	1/ 21
Amakusanthura magnifica	54.76	100.74	11/ 21
Paracerceis caudata	43.45	140.40	2/ 21
Erichsonella attenuata	1.79	----	1/ 21
Edotea triloba	6.55	12.88	6/ 21
Ampelisca	18.45	73.49	3/ 21
Ampelisca abdita	5.95	10.17	6/ 21
Ampelisca agassizi	1.79	----	1/ 21
Ampelisca holmesi	211.31	389.65	11/ 21
Ampelisca sp. C	27.98	89.43	8/ 21
Ampelisca sp. E	1.19	----	1/ 21
Amphilochus sp. B	2.98	----	1/ 21
Gitanopsis laguna	0.60	----	1/ 21
Ampithoe longimana	22.62	83.63	2/ 21
Cymadusa compta	26.79	119.91	2/ 21
Globosolembos smithi	1.79	----	1/ 21
Paramicrodeutopus cf. myersi	2.98	11.11	2/ 21
Rudilemboides naglei	10.12	25.50	4/ 21
Bemlos rectangulatus	2.38	7.52	2/ 21
Batea catharinensis	1.19	----	1/ 21
Batea inspidata	0.60	----	1/ 21
Batea cuspidata	2.38	----	1/ 21
Cerapus	1.19	----	1/ 21
Cerapus tubularis	1.19	----	1/ 21
Cerapus sp. C	10.12	32.26	3/ 21
Corophium acherusicum	1.19	----	1/ 21
Corophium cf. baconi	1.19	----	1/ 21
Erichthonius brasiliensis	17.26	59.62	6/ 21
Grandidierella bonnieroides	11.90	----	1/ 21
Pontogenia bartschi	2.38	----	1/ 21
Dulichiella appendiculata	4.76	----	1/ 21
Acanthohaustorius uncinus	4.76	10.06	4/ 21

Listriella barnardi	27.38	71.98	8/ 21
Shoemakerella sp.	2.38	7.52	2/ 21
Monoculodes nyei	5.95	19.61	3/ 21
Eudevenopus honduranus	16.67	43.00	5/ 21
Stenothoe ?gallensis	16.67	----	1/ 21
Caprellidae-unid.	3.57	----	1/ 21
Deutella incerta	17.26	64.04	2/ 21
Penaeus duorarum	0.60	----	1/ 21
Trachypenaeus constrictus	1.79	4.48	3/ 21
Leptochela serratorbita	3.57	11.95	2/ 21
Periclimenes americanus	3.57	----	1/ 21
Periclimenes longicaudatus	11.31	35.77	2/ 21
Alpheus normanni	1.19	----	1/ 21
Alpheus angulatus	1.19	----	1/ 21
Hippolyte	20.24	----	1/ 21
Hippolyte zostericola	7.14	27.55	2/ 21
Latreutes parvulus	25.00	----	1/ 21
Tozeuma carolinense	0.60	----	1/ 21
Processa hemphilli	0.60	----	1/ 21
Ambidexter symmetricus	5.36	12.85	4/ 21
Pagurus	7.74	17.89	5/ 21
Pagurus gymnodactylus	0.60	----	1/ 21
Pagurus maclaughlinae	11.31	----	1/ 21
Paguristes hummi	4.17	13.31	2/ 21
Paguristes ?limonensis	4.76	----	1/ 21
Upogebia	2.38	7.52	2/ 21
Brachyura	0.60	----	1/ 21
Pitho laevigata	1.19	----	1/ 21
Heterocrypta granulata	0.60	----	1/ 21
Xanthidae	1.19	----	1/ 21
Panopeus sp.	13.10	49.76	2/ 21
Dyspanopeus texanus	0.60	----	1/ 21
Pinnotheridae	0.60	----	1/ 21
Pinnixa	50.60	134.77	10/ 21
Pinnixa cf. pearsei	13.10	46.68	3/ 21
Pinnixa sp. A	1.79	5.98	2/ 21
Sipuncula	0.60	----	1/ 21
Phascolion	1.19	----	1/ 21
Phascolion strombi	20.83	46.83	9/ 21
Phoronida	0.60	----	1/ 21
Phoronis ?architecta	7.14	27.55	2/ 21
Phoronida sp. B	1.19	----	1/ 21
Glottidia pyramidata	7.14	14.56	5/ 21
Ophiuroidea	11.31	15.26	9/ 21
Amphiodia pulchella	0.60	----	1/ 21
Ophiophragmus	2.38	----	1/ 21
Ophiphragmus brachyactus	0.60	----	1/ 21
Amphioplus thrombodes	5.95	17.06	4/ 21
Micropholis	4.76	11.51	5/ 21
Micropholis atra	4.76	14.51	3/ 21
Micropholis gracillima	2.38	6.40	3/ 21
Micropholis sp. A	1.19	----	1/ 21

Echinoidea	2.38	7.52	2/ 21
Mellita tenuis	2.98	7.81	3/ 21
Holothuroidea	1.19	3.76	2/ 21
Enteropneusta	12.50	44.02	3/ 21
Branchiostoma floridae	14.29	23.15	8/ 21

APPENDIX 3-B

TERRA CEIA BAY 1993-1995

RANKED ABUNDANCE & PERCENT COMPOSITION OF MACROINVERTEBRATE TAXA COMPRISING $\geq$1% OF TOTAL ABUNDANCE

TERRA CEIA BAY 1993-1995

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Monticellina dorsobranchialis	761.90	14.31
Oligochaeta	659.52	12.39
Paraprionospio pinnata	325.60	6.12
Ampelisca holmesi	211.31	3.97
Mediomastus	166.67	3.13
Mulinia lateralis	137.50	2.58
Prionospio pygmaea	130.36	2.45
Astris lunulata	116.67	2.19
Acteocina canaliculata	97.62	1.83
Carazziella hobsonae	89.88	1.69
Scolelepis texana	82.74	1.55
Haminoea succinea	79.17	1.49
Tubificidae	74.40	1.40
Amakusanthura magnifica	54.76	1.03
Prionospio heterobranchia	54.17	1.02

APPENDIX 3-C

TERRA CEIA BAY 1993

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATETAXA

TERRA CEIA BAY 1993
Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Athenaria	5.36	9.83	2/ 7
Thenaria	1.79	----	1/ 7
Turbellaria	7.14	12.20	2/ 7
Nemertea	48.21	42.35	6/ 7
Nemertea sp. F	44.64	59.89	5/ 7
Nemertea sp. B	32.14	25.88	5/ 7
Malmgreniella maccraryae	10.71	13.36	4/ 7
Malmgreniella taylori	1.79	----	1/ 7
Polynoidae Genus D	10.71	11.25	4/ 7
Sthenelais sp. A	26.79	44.15	3/ 7
Paramphinome sp. B	3.57	----	1/ 7
Phyllodoce arenae	32.14	32.16	5/ 7
Parahesione luteola	3.57	----	1/ 7
Podarke obscura	1.79	----	1/ 7
Podarkeopsis levifuscina	28.57	24.70	6/ 7
Sigambra tentaculata	3.57	6.10	2/ 7
Cabira incerta	1.79	----	1/ 7
Synelmis sp. B	1.79	----	1/ 7
Syllidae	5.36	----	1/ 7
Syllis cornuta	75.00	----	1/ 7
Syllis (Typosyllis) prolifera	1.79	----	1/ 7
Exogone dispar	7.14	----	1/ 7
Sphaerosyllis aciculata	1.79	----	1/ 7
Sphaerosyllis taylori	1.79	----	1/ 7
Sphaerosyllis labrinthophila	17.86	----	1/ 7
Brania wellfleetensis	10.71	19.67	2/ 7
Streptosyllis pettiboneae	3.57	6.10	2/ 7
Neanthes succinea	1.79	----	1/ 7
Nephtys cf. hombergii	1.79	----	1/ 7
Aglaophamus verrilli	3.57	6.10	2/ 7
Glyceridae	3.57	6.10	2/ 7
Glycera americana	7.14	9.83	3/ 7
Glycinde solitaria	19.64	14.17	6/ 7
Mooreonuphis cf. nebulosa	1.79	----	1/ 7
Kinbergonuphis simoni	12.50	23.94	2/ 7
Lumbrineris sp. D	5.36	9.83	2/ 7
Schistomeringos cf. rudolphi	7.14	9.83	3/ 7
Leitoscoloplos robustus	1.79	----	1/ 7
Aricidea philbinae	7.14	----	1/ 7
Aricidea taylori	37.50	26.02	6/ 7
Prionospio	44.64	68.03	4/ 7
Prionospio heterobranchia	58.93	93.74	5/ 7
Prionospio steenstrupi	23.21	38.48	3/ 7
Prionospio pygmaea	130.36	129.47	5/ 7
Prionospio cristata	10.71	15.19	3/ 7

Prionospio perkinsi	69.64	59.89	6/ 7
Paraprionospio pinnata	166.07	270.00	5/ 7
Scolelepis	1.79	----	1/ 7
Scolelepis texana	12.50	----	1/ 7
Carazziella hobsonae	116.07	193.75	4/ 7
Magelonidae	1.79	----	1/ 7
Magelona pettiboneae	7.14	12.20	2/ 7
Spiochaetopterus costarum	10.71	18.30	3/ 7
Cirratulidae	1.79	----	1/ 7
Caulleriella sp. D	35.71	64.32	3/ 7
Tharyx	21.43	----	1/ 7
Monticellina dorsobranchialis	139.29	166.06	6/ 7
Cirriformia	1.79	----	1/ 7
Cirriformia sp. B	1.79	----	1/ 7
Cirriformia sp. A	1.79	----	1/ 7
Armandia maculata	19.64	36.70	3/ 7
Capitellidae	1.79	----	1/ 7
Capitella capitata	7.14	14.17	2/ 7
Notomastus	1.79	----	1/ 7
Notomastus latericeus	5.36	6.68	3/ 7
Mediomastus	292.86	313.90	5/ 7
Mediomastus ambiseta	30.36	54.89	2/ 7
Mediomastus californiensis	3.57	----	1/ 7
Scyphoproctus	16.07	----	1/ 7
Maldanidae	10.71	15.19	3/ 7
Branchioasychis americanus	1.79	----	1/ 7
Owenia sp. A	5.36	9.83	2/ 7
Myriochele oculata	1.79	----	1/ 7
Sabellaria sp. A	7.14	----	1/ 7
Pectinaria gouldii	1.79	----	1/ 7
Ampharetidae	7.14	14.17	2/ 7
Isolda pulchella	10.71	11.25	4/ 7
Pista cf. quadrilobata	1.79	----	1/ 7
Streblosoma hartmanae	5.36	----	1/ 7
Chone cf. americana	1.79	----	1/ 7
Megalomma pigmentum	1.79	----	1/ 7
Fabriciola trilobata	25.00	32.27	3/ 7
Serpulidae	8.93	----	1/ 7
Pomatoceros americanus	16.07	----	1/ 7
Boguea enigmatica	3.57	----	1/ 7
Spirorbidae	8.93	----	1/ 7
Enchytraeidae	5.36	9.83	2/ 7
Tubificidae	223.21	319.78	6/ 7
Gastropoda	7.14	6.68	4/ 7
Schwartziella catesbyana	33.93	----	1/ 7
Vitrinellidae sp. A	14.29	32.62	2/ 7
Caecum	1.79	----	1/ 7
Caecum pulchellum	75.00	----	1/ 7
Caecum nitidum	60.71	155.19	2/ 7
Modulus modulus	1.79	----	1/ 7
Bittiolum varium	1.79	----	1/ 7
Epitonium angulatum	1.79	----	1/ 7

Melanella	3.57	6.10	2/ 7
Microeulima hemphilli	16.07	22.49	4/ 7
Crepidula	10.71	18.30	3/ 7
Crepidula fornicata	10.71	----	1/ 7
Crepidula maculosa	33.93	----	1/ 7
Astris lunulata	25.00	----	1/ 7
Nassarius vibex	7.14	9.83	3/ 7
Olivella	107.14	128.46	6/ 7
Granulina hadria	3.57	----	1/ 7
Dentimargo aureocinctus	21.43	----	1/ 7
Gibberula lavalleenana	53.57	----	1/ 7
Prunum apicinum	10.71	15.19	3/ 7
Turbonilla	17.86	31.34	2/ 7
Turbonilla interrupta	3.57	----	1/ 7
Turbonilla conradi	130.36	191.06	6/ 7
Pyramidella crenulata	5.36	----	1/ 7
Turbonilla sp. I	26.79	----	1/ 7
Rictaxis punctostriatus	12.50	----	1/ 7
Acteocina canaliculata	82.14	143.95	3/ 7
Cylichnella bidentata	5.36	9.83	2/ 7
Bulla striata	1.79	----	1/ 7
Haminoea succinea	44.64	62.02	7/ 7
Haminoea antillarum	7.14	----	1/ 7
Bivalvia	57.14	52.47	5/ 7
Nucula crenulata	51.79	110.03	4/ 7
Nuculana acuta	1.79	----	1/ 7
Anadara transversa	5.36	9.83	2/ 7
Brachidontes exustus	3.57	----	1/ 7
Parvilucina multilineata	7.14	9.83	3/ 7
Lucina nassula	23.21	----	1/ 7
Crassostrea virginica			
Mysella planulata	42.86	39.43	5/ 7
Mysella sp. A	30.36	40.73	4/ 7
Carditamera floridana	16.07	----	1/ 7
Laevicardium mortoni	21.43	32.85	3/ 7
Mulinia lateralis	5.36	9.83	2/ 7
Tellinidae	12.50	----	1/ 7
Macoma tenta	44.64	53.45	5/ 7
Tellina spp.	78.57	77.30	5/ 7
Tellina versicolor	8.93	----	1/ 7
Tagelus divisus	42.86	56.76	4/ 7
Abra aequalis	25.00	26.02	5/ 7
Cumingia tellinoides vanhyningi	3.57	----	1/ 7
Transennella conradina	1.79	----	1/ 7
Dosinia discus	7.14	6.68	4/ 7
Mercenaria	1.79	----	1/ 7
Chione cancellata	5.36	6.68	3/ 7
Corbula contracta	7.14	6.68	4/ 7
Lyonsia hyalina floridana	14.29	23.31	3/ 7
Asthenothaerus hemphilli	1.79	----	1/ 7
Dentalium texasianum	1.79	----	1/ 7
Balanus venustus	1.79	----	1/ 7

Bowmaniella floridana	3.57	6.10	2/	7
Americamysis stucki	8.93	18.70	2/	7
Oxyurostylis	3.57	6.10	2/	7
Oxyurostylis smithi (=B)	98.21	188.53	3/	7
Oxyurostylis lecroyae (=A)	25.00	34.61	4/	7
Cyclaspis cf. varians	28.57	55.30	3/	7
Leptochelia	5.36	----	1/	7
Amakusanthura magnifica	92.86	158.42	4/	7
Paracerceis caudata	51.79	----	1/	7
Erichsonella attenuata	5.36	----	1/	7
Edotea triloba	5.36	6.68	3/	7
Ampelisca	48.21	----	1/	7
Ampelisca abdita	3.57	6.10	2/	7
Ampelisca agassizi	5.36	----	1/	7
Ampelisca holmesi	519.64	558.12	6/	7
Ampelisca sp. C	73.21	151.11	5/	7
Amphilochus sp. B	8.93	----	1/	7
Gitanopsis laguna	1.79	----	1/	7
Ampithoe longimana	53.57	----	1/	7
Cymadusa compta	1.79	----	1/	7
Globosolembos smithi	5.36	----	1/	7
Paramicrodeutopus cf. myersi	8.93	18.70	2/	7
Rudilemboides naglei	26.79	39.81	3/	7
Bemlos rectangulatus	3.57	----	1/	7
Batea inspidata	1.79	----	1/	7
Cerapus	3.57	----	1/	7
Cerapus sp. C	30.36	52.47	3/	7
Corophium cf. baconi	3.57	----	1/	7
Erichthonius brasiliensis	5.36	6.68	3/	7
Pontogenia bartschi	7.14	----	1/	7
Acanthohaustorius uncinus	3.57	----	1/	7
Listriella barnardi	75.00	114.56	6/	7
Monoculodes nyei	17.86	32.16	3/	7
Eudevenopus honduranus	21.43	37.30	3/	7
Deutella incerta	41.07	----	1/	7
Penaeus duorarum	1.79	----	1/	7
Trachypenaeus constrictus	5.36	6.68	3/	7
Periclimenes americanus	10.71	----	1/	7
Periclimenes longicaudatus	16.07	----	1/	7
Hippolyte zostericola	17.86	----	1/	7
Tozeuma carolinense	1.79	----	1/	7
Processa hemphilli	1.79	----	1/	7
Ambidexter symmetricus	5.36	9.83	2/	7
Pagurus	16.07	27.68	3/	7
Pagurus gymnodactylus	1.79	----	1/	7
Pagurus maclaughlinae	33.93	----	1/	7
Paguristes hummi	5.36	----	1/	7
Brachyura	1.79	----	1/	7
Heterocrypta granulata	1.79	----	1/	7
Dyspanopeus texanus	1.79	----	1/	7
Pinnotheridae	1.79	----	1/	7
Pinnixa	126.79	222.26	5/	7

Pinnixa cf. pearsei	39.29	77.87	3/ 7
Pinnixa sp. A	5.36	9.83	2/ 7
Sipuncula	1.79	----	1/ 7
Phascolion	3.57	----	1/ 7
Phascolion strombi	33.93	78.96	3/ 7
Phoronida	1.79	----	1/ 7
Glottidia pyramidata	17.86	20.23	4/ 7
Ophiuroidea	19.64	18.90	5/ 7
Amphiodia pulchella	1.79	----	1/ 7
Ophiophragmus	7.14	----	1/ 7
Ophiphragmus brachyactus	1.79	----	1/ 7
Amphioplus thrombodes	3.57	6.10	2/ 7
Micropholis	14.29	16.81	5/ 7
Micropholis atra	14.29	23.31	3/ 7
Micropholis gracillima	7.14	9.83	3/ 7
Micropholis sp. A	3.57	----	1/ 7
Echinoidea	3.57	----	1/ 7
Mellita tenuis	1.79	----	1/ 7
Holothuroidea	3.57	6.10	2/ 7
Enteropneusta	37.50	73.24	3/ 7
Branchiostoma floridae	21.43	22.49	5/ 7

APPENDIX 3-D

TERRA CEIA BAY 1993

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

TERRA CEIA BAY 1993

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Ampelisca holmesi	519.64	9.90
Mediomastus	292.86	5.58
Tubificidae	223.21	4.25
Paraprionospio pinnata	166.07	3.17
Monticellina dorsobranchialis	139.29	2.65
Prionospio pygmaea	130.36	2.48
Turbonilla conradi	130.36	2.48
Pinnixa	126.79	2.42
Carazziella hobsonae	116.07	2.21
Olivella	107.14	2.04
Oxyurostylis smithi (=B)	98.21	1.87
Amakusanthura magnifica	92.86	1.77
Acteocina canaliculata	82.14	1.57
Tellina spp.	78.57	1.50
Caecum pulchellum	75.00	1.43
Syllis cornuta	75.00	1.43
Listriella barnardi	75.00	1.43
Ampelisca sp. C	73.21	1.40
Prionospio perkinsi	69.64	1.33
Caecum nitidum	60.71	1.16
Prionospio heterobranchia	58.93	1.12
Bivalvia	57.14	1.09
Ampithoe longimana	53.57	1.02
Gibberula lavalleenana	53.57	1.02
Paracerceis caudata	51.79	0.99
Nucula crenulata	51.79	0.99

APPENDIX 3-E

TERRA CEIA BAY 1994

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATETAXA

TERRA CEIA BAY 1994

Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Nemertea sp. Q	3.57	----	1/ 7
Nemertea sp. N	14.29	24.40	2/ 7
Nemertea sp. F	17.86	37.40	2/ 7
Nemertea sp. K	10.71	----	1/ 7
Nemertea sp. B	17.86	23.78	3/ 7
Sthenelais sp. A	7.14	----	1/ 7
Genetyllis castanea	3.57	----	1/ 7
Paranaitis gardineri (=polynoides)	7.14	12.20	2/ 7
Eumida sp. A	3.57	----	1/ 7
Gyptis crypta	14.29	----	1/ 7
Podarkeopsis levifuscina	28.57	33.63	4/ 7
Procerae sp. A	3.57	----	1/ 7
Pionosyllis sp. D	3.57	----	1/ 7
Syllis cornuta	3.57	----	1/ 7
Brania wellfleetensis	53.57	101.48	3/ 7
Syllides floriidanus	3.57	----	1/ 7
Glycinde solitaria	3.57	----	1/ 7
Lumbrinereis latreilli	17.86	31.34	2/ 7
Arabella mutans	3.57	----	1/ 7
Schistomeringos cf. rudolphi	53.57	112.20	2/ 7
Leitoscoloplos robustus	3.57	----	1/ 7
Aricidea cf. suecica	3.57	----	1/ 7
Aricidea lopezi	25.00	28.87	4/ 7
Aricidea philbinae	35.71	64.32	3/ 7
Aricidea taylori	3.57	----	1/ 7
Paraonis fulgens	3.57	----	1/ 7
Paraonella sp.	3.57	----	1/ 7
Cirrophorus ?lyra	3.57	----	1/ 7
Laonice cirrata	3.57	----	1/ 7
Polydora socialis	10.71	----	1/ 7
Prionospio	28.57	65.24	2/ 7
Prionospio heterobranchia	85.71	----	1/ 7
Prionospio steenstrupi	3.57	----	1/ 7
Prionospio pygmaea	217.86	253.60	4/ 7
Prionospio perkinsi	57.14	65.69	5/ 7
Paraprionospio pinnata	510.71	700.72	5/ 7
Scolelepis texana	3.57	----	1/ 7
Carazziella hobsonae	121.43	194.95	3/ 7
Prionospio multibranchiata	10.71	----	1/ 7
Magelona pettiboneae	28.57	41.90	3/ 7
Spiochaetopterus costarum	7.14	12.20	2/ 7
Caulleriella cf. alata	14.29	----	1/ 7
?Aphelochaeta sp.	7.14	----	1/ 7
Monticellina dorsobranchialis	1775.00	4389.76	5/ 7

Chaetozone	10.71	----	1/ 7
Capitella sp. A	17.86	23.78	3/ 7
Mediomastus	110.71	158.68	4/ 7
Mediomastus ambiseta	53.57	121.13	2/ 7
Mediomastus californiensis	89.29	107.87	4/ 7
Owenia sp. A	3.57	----	1/ 7
Sabellaria sp. A	121.43	----	1/ 7
Sabellaria sp. C	7.14	----	1/ 7
Pectinaria gouldii	3.57	----	1/ 7
Isolda pulchella	3.57	----	1/ 7
Spirorbis spirillum	3.57	----	1/ 7
Oligochaeta	753.57	847.11	6/ 7
Caecum pulchellum	39.29	64.32	3/ 7
Bittiolum varium	21.43	----	1/ 7
Cerithium muscarum	35.71	----	1/ 7
Microeulima hemphilli	21.43	46.61	2/ 7
Crepidula plana	10.71	----	1/ 7
Crepidula maculosa	64.29	----	1/ 7
Natica pusilla	7.14	12.20	2/ 7
Phyllonatus pomum	10.71	----	1/ 7
Astris lunulata	50.00	----	1/ 7
Parvanachis obesa	3.57	----	1/ 7
Nassarius vibex	32.14	31.34	4/ 7
Olivella pusilla	21.43	----	1/ 7
Jaspidella blanesi	32.14	49.40	3/ 7
Prunum apicinum	32.14	34.50	4/ 7
Eulimastoma weberi	21.43	36.60	2/ 7
Turbonilla incisa	3.57	----	1/ 7
Rictaxis punctostriatus	14.29	24.40	2/ 7
Acteocina canaliculata	28.57	39.34	3/ 7
Cylichnella bidentata	10.71	19.67	2/ 7
Haminoea succinea	46.43	----	1/ 7
Bivalvia	21.43	46.61	2/ 7
Nucula crenulata	28.57	41.90	3/ 7
Musculus lateralis	14.29	----	1/ 7
Brachidontes exustus	3.57	----	1/ 7
Anomia simplex	3.57	----	1/ 7
Lucinidae sp.	10.71	----	1/ 7
Parvilucina multilineata	14.29	28.35	2/ 7
Crassostrea virginica	150.00	----	1/ 7
Diplodonta semiaspera	14.29	19.67	3/ 7
Mysella planulata	25.00	38.19	3/ 7
Laevicardium mortoni	10.71	13.36	3/ 7
Mulinia lateralis	403.57	874.22	3/ 7
Macoma tenta	14.29	24.40	2/ 7
Macoma constricta	14.29	24.40	2/ 7
Tellina spp.	57.14	65.69	4/ 7
Tellina iris	10.71	----	1/ 7
Tellina lineata	3.57	----	1/ 7
Tellina versicolor	14.29	----	1/ 7
Tagelus divisus	3.57	----	1/ 7
Abra aequalis	3.57	----	1/ 7

Cyclinella tenuis	3.57	----	1/ 7
Lyonsia hyalina floridana	7.14	12.20	2/ 7
Balanus venustus	46.43	----	1/ 7
Mysidopsis furca	3.57	----	1/ 7
Oxyurostylis smithi (=B)	28.57	50.89	2/ 7
Amakusanthura magnifica	50.00	70.71	4/ 7
Paracerceis caudata	78.57	----	1/ 7
Edotea triloba	3.57	----	1/ 7
Ampelisca	7.14	12.20	2/ 7
Ampelisca abdita	7.14	12.20	2/ 7
Ampelisca holmesi	35.71	----	1/ 7
Ampelisca sp. C	3.57	----	1/ 7
Ampithoe longimana	14.29	----	1/ 7
Rudilemboides naglei	3.57	----	1/ 7
Batea cuspidata	7.14	----	1/ 7
Cerapus tubularis	3.57	----	1/ 7
Erichthonius brasiliensis	3.57	----	1/ 7
Acanthohaustorius uncinus	3.57	----	1/ 7
Listriella barnardi	3.57	----	1/ 7
Shoemakerella sp.	3.57	----	1/ 7
Eudevenopus honduranus	28.57	65.24	2/ 7
Stenothoe ?gallensis	50.00	----	1/ 7
Deutella incerta	10.71	----	1/ 7
Periclimenes longicaudatus	17.86	----	1/ 7
Alpheus normanni	3.57	----	1/ 7
Alpheus angulatus	3.57	----	1/ 7
Ambidexter symmetricus	3.57	----	1/ 7
Pagurus	3.57	----	1/ 7
Paguristes hummi	7.14	----	1/ 7
Paguristes ?limonensis	14.29	----	1/ 7
Upogebia	3.57	----	1/ 7
Pitho laevigata	3.57	----	1/ 7
Xanthidae	3.57	----	1/ 7
Panopeus sp.	7.14	----	1/ 7
Pinnixa	7.14	12.20	2/ 7
Phascolion strombi	17.86	23.78	3/ 7
Glottidia pyramidata	3.57	----	1/ 7
Ophiuroidea	7.14	12.20	2/ 7
Amphioplus thrombodes	10.71	----	1/ 7
Echinoidea	3.57	----	1/ 7
Branchiostoma floridae	14.29	28.35	2/ 7

APPENDIX 3-F

TERRA CEIA BAY 1994

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

TERRA CEIA BAY 1994

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Monticellina dorsobranchialis	1775.00	28.21
Oligochaeta	753.57	11.98
Paraprionospio pinnata	510.71	8.12
Mulinia lateralis	403.57	6.41
Prionospio pygmaea	217.86	3.46
Crassostrea virginica	150.00	2.38
Sabellaria sp. A	121.43	1.93
Carazziella hobsonae	121.43	1.93
Mediomastus	110.71	1.76
Mediomastus californiensis	89.29	1.42
Prionospio heterobranchia	85.71	1.36
Paracerceis caudata	78.57	1.25
Crepidula maculosa	64.29	1.02

APPENDIX 3-G

TERRA CEIA BAY 1995

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATETAXA

TERRA CEIA BAY 1995
Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Actiniaria	3.57	----	1/ 7
Thenaria	7.14	----	1/ 7
Nemertea sp. N	7.14	12.20	2/ 7
Nemertea sp. F	7.14	----	1/ 7
Nemertea sp. K	7.14	12.20	2/ 7
Nemertea sp. B	17.86	37.40	2/ 7
Anaitides groenlandica	3.57	----	1/ 7
Genetyllis castanea	7.14	12.20	2/ 7
Parahesione luteola	17.86	37.40	2/ 7
Podarkeopsis levifuscina	42.86	42.61	5/ 7
Sigambra tentaculata	3.57	----	1/ 7
Exogone dispar	14.29	28.35	2/ 7
Brania clavata	10.71	----	1/ 7
Brania wellfleetensis	7.14	----	1/ 7
Nereidae	3.57	----	1/ 7
Neanthes succinea	3.57	----	1/ 7
Nereis sp. (anterior frag.)	3.57	----	1/ 7
Nereis lamellosa	10.71	19.67	2/ 7
Glycera americana	10.71	19.67	2/ 7
Glycinde solitaria	10.71	19.67	2/ 7
Schistomeringos cf. rudolphi	10.71	19.67	2/ 7
?Pettiboneia sp.	3.57	----	1/ 7
Scoloplos rubra	3.57	----	1/ 7
Leitoscoloplos fragilis	3.57	----	1/ 7
Aricidea cf. suecica	3.57	----	1/ 7
Aricidea philbinae	42.86	42.61	5/ 7
Aricidea taylori	28.57	30.37	4/ 7
Cirrophorus ?lyra	53.57	----	1/ 7
Cirrophorus ?furcatus	3.57	----	1/ 7
Laonice cirrata	7.14	12.20	2/ 7
Polydora socialis	3.57	----	1/ 7
Polydora cornuta (=ligni)	7.14	----	1/ 7
Prionospio heterobranchia	17.86	27.82	3/ 7
Prionospio pygmaea	42.86	60.75	3/ 7
Prionospio perkinsi	14.29	19.67	3/ 7
Paraprionospio pinnata	300.00	256.58	5/ 7
Streblospio benedicti	3.57	----	1/ 7
Scolelepis texana	232.14	369.04	4/ 7
Carazziella hobsonae	32.14	55.37	2/ 7
Magelona pettiboneae	42.86	51.47	4/ 7
Caulleriella	3.57	----	1/ 7
Monticellina dorsobranchialis	371.43	685.93	5/ 7
Armandia maculata	3.57	----	1/ 7
Capitella sp. A	32.14	74.60	2/ 7
Capitella capitata	10.71	----	1/ 7

Mediomastus	96.43	122.84	3/ 7
Mediomastus ambiseta	53.57	88.30	5/ 7
Mediomastus californiensis	7.14	----	1/ 7
Asychis elongatus	3.57	----	1/ 7
Axiothella mucosa	7.14	----	1/ 7
Pectinaria gouldii	3.57	----	1/ 7
Oligochaeta	1225.00	1096.02	7/ 7
Gastropoda	32.14	----	1/ 7
Cyclostremiscus ?pentagonus	3.57	----	1/ 7
Caecum pulchellum	3.57	----	1/ 7
Bittiolum varium	64.29	----	1/ 7
Natica pusilla	3.57	----	1/ 7
Astris lunulata	275.00	----	1/ 7
Jaspidella blanesi	28.57	50.89	2/ 7
Prunum apicinum	14.29	28.35	2/ 7
Odostomia producta	7.14	----	1/ 7
Turbonilla conradi	3.57	----	1/ 7
Acteocina canaliculata	182.14	293.23	5/ 7
Haminoea succinea	146.43	162.93	5/ 7
Bivalvia	71.43	146.08	4/ 7
Musculus lateralis	3.57	----	1/ 7
Brachidontes exustus	7.14	12.20	2/ 7
Parvilucina multilineata	3.57	----	1/ 7
Lucina nassula	3.57	----	1/ 7
Crassostrea virginica	3.57	----	1/ 7
Mysella planulata	50.00	47.87	4/ 7
Laevicardium mortoni	7.14	----	1/ 7
Mulinia lateralis	3.57	----	1/ 7
Macoma tenta	3.57	----	1/ 7
Corbula contracta	3.57	----	1/ 7
Pycnogonida	3.57	----	1/ 7
Americamysis bigelowi	7.14	----	1/ 7
Bowmaniella floridana	3.57	----	1/ 7
Cumacea-unid.			
Cyclaspis	3.57	----	1/ 7
Amakusanthura magnifica	21.43	26.73	3/ 7
Edotea triloba	10.71	19.67	2/ 7
Ampelisca abdita	7.14	12.20	2/ 7
Ampelisca holmesi	78.57	134.96	4/ 7
Ampelisca sp. C	7.14	12.20	2/ 7
Ampelisca sp. E	3.57	----	1/ 7
Cymadusa compta	78.57	----	1/ 7
Bemlos rectangulatus	3.57	----	1/ 7
Batea catharinensis	3.57	----	1/ 7
Corophium acherusicum	3.57	----	1/ 7
Erichthonius brasiliensis	42.86	102.79	2/ 7
Grandidierella bonnieroides	35.71	----	1/ 7
Dulichiella appendiculata	14.29	----	1/ 7
Acanthohaustorius uncinus	7.14	12.20	2/ 7
Listriella barnardi	3.57	----	1/ 7
Shoemakerella sp.	3.57	----	1/ 7
Caprellidae-unid.	10.71	----	1/ 7

Leptochela serratorbita	10.71	19.67	2/ 7
Hippolyte	60.71	----	1/ 7
Hippolyte zostericola	3.57	----	1/ 7
Latreutes parvulus	75.00	----	1/ 7
Ambidexter symmetricus	7.14	----	1/ 7
Pagurus	3.57	----	1/ 7
Upogebia	3.57	----	1/ 7
Panopeus sp.	32.14	----	1/ 7
Pinnixa	17.86	27.82	3/ 7
Phascolion strombi	10.71	13.36	3/ 7
Phoronis ?architecta	21.43	46.61	2/ 7
Phoronida sp. B	3.57	----	1/ 7
Ophiuroidea	7.14	12.20	2/ 7
Amphioplus thrombodes	3.57	----	1/ 7
Mellita tenuis	7.14	12.20	2/ 7
Branchiostoma floridae	7.14	----	1/ 7

APPENDIX 3-H

TERRA CEIA BAY 1995

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

TERRA CEIA BAY 1995

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Oligochaeta	1225.00	27.66
Monticellina dorsobranchialis	371.43	8.39
Paraprionospio pinnata	300.00	6.77
Astris lunulata	275.00	6.21
Scolelepis texana	232.14	5.24
Acteocina canaliculata	182.14	4.11
Haminoea succinea	146.43	3.31
Mediomastus	96.43	2.18
Ampelisca holmesi	78.57	1.77
Cymadusa compta	78.57	1.77
Latreutes parvulus	75.00	1.69
Bivalvia	71.43	1.61
Bittiolum varium	64.29	1.45
Hippolyte	60.71	1.37
Mediomastus ambiseta	53.57	1.21
Cirrophorus ?lyra	53.57	1.21
Mysella planulata	50.00	1.13
Magelona pettiboneae	42.86	0.97
Prionospio pygmaea	42.86	0.97
Podarkeopsis levifuscina	42.86	0.97
Erichthonius brasiliensis	42.86	0.97
Aricidea philbinae	42.86	0.97

APPENDIX 3-I

MANATEE RIVER 1993-1995

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATETAXA

MANATEE RIVER 1993-1995
Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Hydrozoa	0.38	----	1/ 33
Athenaria	12.12	47.75	4/ 33
Thenaria	227.27	821.81	7/ 33
Turbellaria	4.92	20.24	3/ 33
Nemertea	14.77	39.21	9/ 33
Nemertea sp. Q	3.03	----	1/ 33
Nemertea sp. N	6.06	18.78	4/ 33
Nemertea sp. F	44.70	57.79	19/ 33
Nemertea sp. I	6.82	15.65	6/ 33
Nemertea sp. K	7.58	15.92	7/ 33
Nemertea sp. B	25.00	33.95	16/ 33
Nemertea sp. J	5.30	23.18	2/ 33
Malmgreniella maccraryae	25.76	56.85	10/ 33
Malmgreniella taylori	6.82	17.70	6/ 33
Sthenelais sp. A	10.98	32.44	5/ 33
Bhawania heteroseta	10.98	37.21	4/ 33
Paramphinome sp. B	0.76	----	1/ 33
Genetyllis castanea	10.61	18.52	10/ 33
Paranaitis gardineri (=polynoides)	0.38	----	1/ 33
Eumida cf. sanguinea	0.76	----	1/ 33
Phyllodoce arenae	13.26	26.87	10/ 33
Gyptis crypta	2.27	----	1/ 33
Parahesione luteola	1.52	----	1/ 33
Podarke obscura	6.06	24.63	4/ 33
Podarkeopsis levifuscina	41.29	94.71	15/ 33
Cabira incerta	0.76	----	1/ 33
Synelmis sp. B	1.52	----	1/ 33
Syllis cornuta	12.12	35.97	4/ 33
Syllis (Typosyllis) sp. A	1.52	----	1/ 33
Syllis (Typosyllis) cf. lutea	1.52	----	1/ 33
Exogone dispar	1.14	----	1/ 33
Exogone lourei	10.61	----	1/ 33
Exogone arenosa	9.09	----	1/ 33
Sphaerosyllis taylori	0.38	----	1/ 33
Brania clavata	96.21	543.79	2/ 33
Brania wellfleetensis	7.95	23.76	4/ 33
Brania sp. A	8.33	----	1/ 33
Streptosyllis pettiboneae	30.30	111.24	4/ 33
Parapionosyllis longicirrata	155.68	885.39	2/ 33
?Parapionosyllis sp. A	0.76	----	1/ 33
Ceratonereis irritabilis	0.76	----	1/ 33
Ceratonereis (?composetia) sp. A	0.76	----	1/ 33

Neanthes succinea	15.91	50.22	7/ 33
Nereis falsa	22.73	113.43	3/ 33
Nereis lamellosa	3.79	17.81	2/ 33
?Ceratocephale sp. A	0.76	----	1/ 33
Laeonereis culveri	15.91	89.17	2/ 33
Nephtys cf. hombergii	0.76	3.03	2/ 33
Nephtys bucera	3.79	17.81	2/ 33
Nephtys picta	0.38	----	1/ 33
Nephtys cryptomma	1.52	6.06	2/ 33
Aglaophamus verrilli	2.65	7.50	4/ 33
Glyceridae	0.38	----	1/ 33
Glycera americana	3.03	7.01	6/ 33
Goniadidae	0.38	----	1/ 33
Glycinde solitaria	38.64	47.94	26/ 33
Goniadides carolinae	2.65	----	1/ 33
Diopatra cuprea	2.27	11.03	2/ 33
Kinbergonuphis simoni	0.38	----	1/ 33
Lumbrinereis latreilli	1.52	----	1/ 33
Lumbrineris verrilli	2.27	7.94	3/ 33
Lumbrineris coccinea	0.38	----	1/ 33
Lumbrineris sp. E	0.76	----	1/ 33
Lumbrineris sp. D	1.89	7.73	2/ 33
Drilonereis longa	1.89	5.52	4/ 33
Arabella mutans	0.38	----	1/ 33
Schistomeringos cf. rudolphi	1.14	3.65	3/ 33
Leitoscoloplos robustus	17.05	69.16	3/ 33
Scoloplos rubra	6.82	11.73	9/ 33
Scoloplos sp. D	0.38	----	1/ 33
Leitoscoloplos	0.38	----	1/ 33
Paraonidae	0.76	----	1/ 33
Aricidea philbinae	4.55	18.17	3/ 33
Aricidea taylori	256.06	565.27	17/ 33
Cirrophorus	1.14	4.80	2/ 33
Cirrophorus ?lyra	3.79	----	1/ 33
Aricidea cerrutii	0.76	----	1/ 33
Spionidae	0.76	----	1/ 33
Laonice cirrata	3.03	12.12	2/ 33
Polydora	0.38	----	1/ 33
Polydora socialis	2.65	8.12	4/ 33
Polydora cornuta (=ligni)	1.52	----	1/ 33
Prionospio	0.76	----	1/ 33
Prionospio heterobranchia	8.33	43.60	2/ 33
Prionospio steenstrupi	7.58	29.14	3/ 33
Prionospio pygmaea	22.73	55.42	8/ 33
Prionospio perkinsi	143.18	336.56	12/ 33
Spio pettiboneae	11.36	45.22	3/ 33
Paraprionospio pinnata	331.82	383.40	25/ 33
Streblospio benedicti	76.52	285.04	8/ 33
Scolelepis texana	1.52	5.19	3/ 33
Carazziella hobsonae	76.14	282.68	6/ 33
Magelona pettiboneae	4.55	16.18	4/ 33
Poecilochaetus	0.38	----	1/ 33

Poecilochaetus johnsoni	39.02	----	1/ 33
Spiochaetopterus costarum	2.27	6.60	4/ 33
Cirratulidae	2.65	----	1/ 33
Caulleriella	2.27	9.61	2/ 33
Caulleriella cf. alata	5.30	----	1/ 33
Caulleriella sp. E	45.45	----	1/ 33
Monticellina dorsobranchialis	717.42	1346.99	22/ 33
Chaetozone	1.52	----	1/ 33
Chaetozone sp. A	0.38	----	1/ 33
Cirriformia	0.76	----	1/ 33
Cirriformia sp. D	12.50	----	1/ 33
Cirriformia sp. B	0.76	3.03	2/ 33
Macrochaeta cf. clavicornis	5.30	----	1/ 33
Piromis roberti	0.76	3.03	2/ 33
Armandia maculata	29.55	148.36	3/ 33
Travisia hobsonae	83.33	370.69	2/ 33
Capitella capitata	3.03	9.90	3/ 33
Heteromastus filiformis	3.79	14.14	3/ 33
Notomastus	0.76	----	1/ 33
Notomastus latericeus	0.76	3.03	2/ 33
Mediomastus	329.55	520.29	26/ 33
Mediomastus ambiseta	130.68	286.29	18/ 33
Mediomastus californiensis	24.62	84.81	6/ 33
Maldanidae	1.89	5.52	4/ 33
Branchioasychis americanus	0.38	----	1/ 33
Asychis sp.	0.76	----	1/ 33
Asychis elongatus	0.76	----	1/ 33
Clymenella torquata	2.27	----	1/ 33
Rhodine sp. A	0.76	----	1/ 33
Pectinaria gouldii	6.82	13.65	9/ 33
Ampharetidae	0.38	----	1/ 33
Amphicteis gunneri	4.92	15.92	4/ 33
Hobsonia florida	50.00	153.73	6/ 33
Melinna maculata	6.44	15.35	6/ 33
Isolda pulchella	1.52	6.82	2/ 33
Pista quadrilobata	0.38	----	1/ 33
Polycirrus	4.55	17.90	4/ 33
Polycirrus sp. E	1.14	----	1/ 33
Polycirrus sp. C	11.74	65.25	2/ 33
Loimia viridis	0.76	----	1/ 33
Chone cf. americana	3.03	13.27	3/ 33
Megalomma pigmentum	4.17	12.37	5/ 33
Fabriciola trilobata	148.86	411.71	12/ 33
Demonax	0.38	----	1/ 33
Boguea enigmatica	0.76	----	1/ 33
Archiannelida sp. B	1.14	----	1/ 33
Archiannelida sp. A	2.27	----	1/ 33
Oligochaeta	56.82	119.12	11/ 33
Enchytraeidae	0.38	----	1/ 33
Tubificidae	10.98	50.46	4/ 33
Gastropoda	6.82	20.51	6/ 33
Sayella fusca	120.45	647.67	5/ 33

Teinostoma sp.	0.76	----	1/ 33
Teinostoma ?nesacum	0.76	----	1/ 33
Vitrinellidae sp. A	1.14	----	1/ 33
Cochliolepis striata	0.38	----	1/ 33
Caecum imbricatum	0.76	----	1/ 33
Caecum cf. johnsoni	135.98	539.29	4/ 33
Epitonium rupicolum	3.79	14.14	3/ 33
Microeulima hemphilli	4.92	15.92	3/ 33
Crepidula	1.52	5.19	3/ 33
Crepidula plana	6.06	----	1/ 33
Natica pusilla	3.03	7.67	5/ 33
Eupleura sulcidentata	0.38	----	1/ 33
Astris lunulata	15.15	38.75	6/ 33
Parvanachis obesa	9.85	23.95	7/ 33
Melongena corona	0.76	----	1/ 33
Nassarius vibex	10.98	21.82	8/ 33
Olivella	1.14	----	1/ 33
Olivella pusilla	18.18	71.34	3/ 33
Jaspidella blanesi	14.39	47.61	4/ 33
Prunum apicinum	4.92	12.48	5/ 33
Turridae	0.38	----	1/ 33
Pyrgocythara plicosa	0.38	----	1/ 33
Odostomia	14.02	65.83	3/ 33
Eulimastoma weberi	37.88	80.07	11/ 33
Turbonilla conradi	6.82	15.96	6/ 33
Turbonilla cf. dalli	0.76	----	1/ 33
Turbonilla nr. mighelsi	0.76	----	1/ 33
Turbonilla sp. A= dalli	0.76	----	1/ 33
Boonea impressa	0.76	----	1/ 33
Odostomia gibbosa	0.76	----	1/ 33
Rictaxis punctostriatus	30.30	38.78	17/ 33
Acteocina canaliculata	90.53	127.09	19/ 33
Tornatina inconspicua	6.44	26.17	2/ 33
Haminoea succinea	6.06	28.32	4/ 33
Aplysiidae sp. A	0.76	----	1/ 33
Acanthochitona pygmaea	0.38	----	1/ 33
Bivalvia	62.12	95.48	19/ 33
Nucula crenulata	18.94	37.65	10/ 33
Nuculana acuta	1.14	4.80	2/ 33
Anadara transversa	3.41	10.49	4/ 33
Brachidontes exustus	4.92	22.08	3/ 33
Amygdalum papyrium	700.00	2205.10	19/ 33
Anomia simplex	0.38	----	1/ 33
Parvilucina multilineata	2.27	6.60	4/ 33
Lucina nassula	2.27	9.61	2/ 33
Crassostrea virginica			
Diplodonta semiaspera	6.82	19.54	7/ 33
Neaeromya sp.	7.58	----	1/ 33
Neaeromya floridana	22.73	----	1/ 33
Mysella planulata	114.39	216.71	20/ 33
Mysella sp. A	122.73	330.68	10/ 33
Pteromeris perplanna	1.52	----	1/ 33

Laevicardium mortoni	2.27	7.94	3/ 33
Mulinia lateralis	643.94	1922.68	23/ 33
Macoma tenta	12.50	48.81	5/ 33
Macoma constricta	0.76	----	1/ 33
Tellina spp.	114.02	271.55	14/ 33
Tellina versicolor	60.98	99.06	16/ 33
Tagelus plebeius	3.79	8.55	6/ 33
Tagelus divisus	4.55	11.62	5/ 33
Abra aequalis	4.55	14.93	4/ 33
Mylilopsis leucophaeta	40.91	165.22	4/ 33
Cyclinella tenuis	0.76	----	1/ 33
Agriopoma texasiana	0.38	----	1/ 33
Chione cancellata	7.58	28.29	3/ 33
Anomalocardia auberiana	0.38	----	1/ 33
Sphenia antillensis	4.17	21.80	2/ 33
Corbula contracta	1.14	4.80	2/ 33
Corbula barrattiana	0.76	----	1/ 33
Corbula swiftiana	0.76	----	1/ 33
Lyonsia hyalina floridana	3.41	7.83	6/ 33
Asthenothaerus hemphilli	5.30	24.21	3/ 33
Dentalium (Antalis) antillarum	0.76	----	1/ 33
Balanus venustus	0.76	----	1/ 33
Mysidopsis furca	0.76	----	1/ 33
Americamysis	0.38	----	1/ 33
Americamysis alleni	1.14	----	1/ 33
Leucon americanus	0.76	----	1/ 33
Oxyurostylis	3.41	17.48	2/ 33
Oxyurostylis smithi (=B)	36.36	123.72	11/ 33
Oxyurostylis lecroyae (=A)	3.41	8.43	5/ 33
Cyclaspis	27.27	----	1/ 33
Cyclaspis cf. varians	446.97	846.03	23/ 33
Cyclaspis sp. C	0.76	----	1/ 33
Halmyrapseudes bahamensis	2.27	----	1/ 33
Kalliapseudes sp. A	7.95	25.16	4/ 33
Cyathura polita	71.97	199.90	6/ 33
Xenanthura brevitelson	87.12	190.64	10/ 33
Amakusanthura magnifica	60.61	81.38	17/ 33
Serolis mgrayi	0.38	----	1/ 33
Edotea triloba	66.67	290.75	11/ 33
Munna sp. n.	0.76	----	1/ 33
Uromunna hayesi	0.38	----	1/ 33
Ampelisca	3.79	17.81	2/ 33
Ampelisca abdita	1070.45	3718.39	18/ 33
Ampelisca vadorum	23.48	83.78	4/ 33
Ampelisca holmesi	256.06	474.40	24/ 33
Ampelisca sp. C	3.41	9.52	4/ 33
Ampelisca sp. A	2.27	----	1/ 33
Amphilochus neopolitanus	0.76	----	1/ 33
Gitanopsis	0.76	----	1/ 33
Gitanopsis laguna	9.09	----	1/ 33
Globosolembos smithi	1.14	----	1/ 33

Bemlos brunneamaculatus mackinneyi	0.38	----	1/ 33
Paramicrodeutopus cf. myersi	18.18	87.84	3/ 33
Rudilemboides naglei	25.38	97.80	5/ 33
Bemlos	1.52	6.06	2/ 33
Bemlos unicornis	12.50	----	1/ 33
Argissa hamatipes	1.14	4.80	2/ 33
Batea catharinensis	0.76	----	1/ 33
Cerapus	0.76	----	1/ 33
Cerapus tubularis	13.64	----	1/ 33
Cerapus sp. C	6.44	26.35	5/ 33
Corophium acherusicum	1.52	----	1/ 33
Corophium louisianum	99.24	370.94	3/ 33
Erichthonius brasiliensis	6.82	25.21	4/ 33
Grandidierella bonnieroides	858.71	2207.76	16/ 33
Elasmopus laevis	4.17	----	1/ 33
Melita	0.76	3.03	2/ 33
Listriella barnardi	11.36	29.21	9/ 33
Lysianassidae sp. B	0.38	----	1/ 33
Monoculodes nyei	0.76	----	1/ 33
Metharpinia floridana	21.21	72.65	3/ 33
Eudevenopus honduranus	25.00	75.45	9/ 33
Paracaprella	0.38	----	1/ 33
Penaeidae	0.38	----	1/ 33
Alpheus armillatus	2.27	----	1/ 33
Ambidexter symmetricus	1.89	6.34	3/ 33
Pagurus	3.03	15.32	2/ 33
Pagurus gymnodactylus	0.38	----	1/ 33
Petrolisthes armatus	2.27	----	1/ 33
Upogebia	5.68	16.85	6/ 33
Paguroidea	0.76	----	1/ 33
Brachyura	3.79	19.64	2/ 33
Heterocrypta granulata	0.38	----	1/ 33
Hexapanopeus angustifrons	19.32	106.58	2/ 33
Panopeus bermudensis	7.58	41.33	2/ 33
Rhithropanopeus harrisii	2.27	11.03	2/ 33
Dyspanopeus texanus	3.41	12.21	3/ 33
Pinnotheridae	0.38	----	1/ 33
Pinnixa	31.06	50.59	16/ 33
Pinnixa chaetopterana	0.76	----	1/ 33
Pinnixa cf. pearsei	8.71	39.59	3/ 33
Pinnixa sp. B	1.52	----	1/ 33
Pinnixa sp. A	2.27	6.60	4/ 33
Sipuncula	0.38	----	1/ 33
Phascolion strombi	20.83	53.83	6/ 33
Aspidosiphonidae	10.61	----	1/ 33
Phoronis	3.03	13.27	3/ 33
Phoronis ?architecta	0.76	----	1/ 33
Phoronis sp. C	0.76	----	1/ 33
Glottidia pyramidata	0.38	----	1/ 33
Ophiuroidea	30.68	79.43	11/ 33

Hemipholis elongata	15.91	75.47	2/ 33
Amphioplus	0.38	----	1/ 33
Amphioplus abdita	12.88	39.59	5/ 33
Amphioplus thrombodes	1.14	4.80	2/ 33
Micropholis	0.38	----	1/ 33
Micropholis atra	10.61	28.15	7/ 33
Micropholis gracillima	17.05	60.42	5/ 33
Micropholis subtilis	1.52	----	1/ 33
Mellita tenuis	2.27	7.94	3/ 33
Holothuroidea sp. B	0.76	----	1/ 33
Enteropneusta	0.38	----	1/ 33
Ascidiacea	1.14	----	1/ 33
Branchiostoma floridae	59.09	205.64	5/ 33

APPENDIX 3-J

MANATEE RIVER 1993-1995

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq 1\%$ OF TOTAL ABUNDANCE

MANATEE RIVER 1993-1995

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Ampelisca abdita	1070.45	10.88
Grandidierella bonnieroides	858.71	8.72
Monticellina dorsobranchialis	717.42	7.29
Amygdalum papyrium	700.00	7.11
Mulinia lateralis	643.94	6.54
Cyclaspis cf. varians	446.97	4.54
Paraprionospio pinnata	331.82	3.37
Mediomastus	329.55	3.35
Ampelisca holmesi	256.06	2.60
Aricidea taylori	256.06	2.60
Thenaria	227.27	2.31
Parapionosyllis longicirrata	155.68	1.58
Fabriciola trilobata	148.86	1.51
Prionospio perkinsi	143.18	1.45
Caecum cf. johnsoni	135.98	1.38
Mediomastus ambiseta	130.68	1.33
Mysella sp. A	122.73	1.25
Sayella fusca	120.45	1.22
Mysella planulata	114.39	1.16
Tellina spp.	114.02	1.16
Corophium louisianum	99.24	1.01
Brania clavata	96.21	0.98

APPENDIX 3-K

MANATEE RIVER 1993

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATE TAXA

MANATEE RIVER 1993
Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Hydrozoa	1.14	----	1/ 11
Athenaria	36.36	79.54	4/ 11
Thenaria	411.36	1262.31	4/ 11
Turbellaria	14.77	33.92	3/ 11
Nemertea	44.32	58.99	9/ 11
Nemertea sp. F	52.27	67.27	8/ 11
Nemertea sp. B	27.27	31.53	7/ 11
Malmgreniella maccraryae	27.27	71.33	3/ 11
Malmgreniella taylori	6.82	15.17	3/ 11
Sthenelais sp. A	28.41	51.26	4/ 11
Bhawania heteroseta	5.68	12.95	2/ 11
Paramphinome sp. B	2.27	----	1/ 11
Genetyllis castanea	13.64	19.73	5/ 11
Paranaitis gardineri (=polynoides)	1.14	----	1/ 11
Eumida cf. sanguinea	2.27	----	1/ 11
Phyllodoce arenae	37.50	35.79	9/ 11
Podarke obscura	18.18	41.22	4/ 11
Podarkeopsis levifuscina	32.95	63.31	5/ 11
Cabira incerta	2.27	----	1/ 11
Synelmis sp. B	4.55	----	1/ 11
Syllis cornuta	18.18	46.22	2/ 11
Syllis (Typosyllis) cf. lutea	4.55	----	1/ 11
Exogone dispar	3.41	----	1/ 11
Exogone arenosa	27.27	----	1/ 11
Sphaerosyllis taylori	1.14	----	1/ 11
Brania wellfleetensis	7.95	19.58	2/ 11
Brania sp. A	25.00	----	1/ 11
Streptosyllis pettiboneae	27.27	69.33	2/ 11
Parapionosyllis longicirrata	462.50	----	1/ 11
Ceratonereis irritabilis	2.27	----	1/ 11
Neanthes succinea	45.45	81.06	6/ 11
Nereis falsa	59.09	----	1/ 11
Laeonereis culveri	47.73	154.19	2/ 11
Nephtys cf. hombergii	2.27	5.06	2/ 11
Nephtys picta	1.14	----	1/ 11
Aglaophamus verrilli	1.14	----	1/ 11
Glyceridae	1.14	----	1/ 11
Glycera americana	6.82	8.59	5/ 11
Goniadidae	1.14	----	1/ 11
Glycinde solitaria	34.09	33.58	10/ 11
Goniadides carolinae	7.95	----	1/ 11
Diopatra cuprea	6.82	18.84	2/ 11
Kinbergonuphis simoni	1.14	----	1/ 11
Lumbrineris verrilli	4.55	11.56	2/ 11

Lumbrineris coccinea	1.14	----	1/ 11
Lumbrineris sp. D	3.41	----	1/ 11
Drilonereis longa	3.41	5.84	3/ 11
Arabella mutans	1.14	----	1/ 11
Schistomeringos cf. rudolphi	3.41	5.84	3/ 11
Leitoscoloplos robustus	32.95	105.22	2/ 11
Scoloplos rubra	9.09	13.80	4/ 11
Scoloplos sp. D	1.14	----	1/ 11
Leitoscoloplos	1.14	----	1/ 11
Paraonidae	2.27	----	1/ 11
Aricidea taylori	172.73	300.09	7/ 11
Cirrophorus	3.41	8.08	2/ 11
Aricidea cerrutii	2.27	----	1/ 11
Polydora	1.14	----	1/ 11
Polydora socialis	5.68	11.68	3/ 11
Prionospio	2.27	----	1/ 11
Prionospio heterobranchia	25.00	75.00	2/ 11
Prionospio steenstrupi	13.64	41.25	2/ 11
Prionospio pygmaea	13.64	26.49	4/ 11
Prionospio perkinsi	50.00	96.50	5/ 11
Spio pettiboneae	34.09	75.43	3/ 11
Paraprionospio pinnata	245.45	355.24	8/ 11
Scolelepis texana	2.27	5.06	2/ 11
Carazziella hobsonae	26.14	67.19	3/ 11
Magelona pettiboneae	9.09	26.27	2/ 11
Poecilochaetus	1.14	----	1/ 11
Poecilochaetus johnsoni	117.05	----	1/ 11
Spiochaetopterus costarum	4.55	8.43	3/ 11
Cirratulidae	7.95	----	1/ 11
Caulleriella sp. E	136.36	----	1/ 11
Monticellina dorsobranchialis	120.45	165.01	7/ 11
Chaetozone sp. A	1.14	----	1/ 11
Cirriformia sp. D	37.50	----	1/ 11
Cirriformia sp. B	2.27	5.06	2/ 11
Macrochaeta cf. clavicornis	15.91	----	1/ 11
Piromis roberti	2.27	5.06	2/ 11
Armandia maculata	86.36	255.04	2/ 11
Travisia hobsonae	184.09	----	1/ 11
Capitella capitata	6.82	15.17	2/ 11
Heteromastus filiformis	2.27	----	1/ 11
Notomastus latericeus	2.27	5.06	2/ 11
Mediomastus	304.55	652.05	8/ 11
Mediomastus ambiseta	1.14	----	1/ 11
Mediomastus californiensis	1.14	----	1/ 11
Maldanidae	3.41	5.84	3/ 11
Branchioasychis americanus	1.14	----	1/ 11
Pectinaria gouldii	4.55	6.31	4/ 11
Ampharetidae	1.14	----	1/ 11
Amphicteis gunneri	1.14	----	1/ 11
Melinna maculata	7.95	16.08	3/ 11
Isolda pulchella	4.55	11.56	2/ 11
Pista quadrilobata	1.14	----	1/ 11

Polycirrus	2.27	5.06	2/ 11
Polycirrus sp. E	3.41	----	1/ 11
Polycirrus sp. C	35.23	112.75	2/ 11
Chone cf. americana	9.09	22.42	3/ 11
Megalomma pigmentum	10.23	19.22	4/ 11
Fabriciola trilobata	378.41	658.81	5/ 11
Demonax	1.14	----	1/ 11
Boguea enigmatica	2.27	----	1/ 11
Archiannelida sp. B	3.41	----	1/ 11
Enchytraeidae	1.14	----	1/ 11
Tubificidae	32.95	85.75	4/ 11
Gastropoda	20.45	32.25	6/ 11
Vitrinellidae sp. A	3.41	----	1/ 11
Cochliolepis striata	1.14	----	1/ 11
Caecum cf. johnsoni	167.05	533.63	2/ 11
Microeulima hemphilli	5.68	----	1/ 11
Crepidula	4.55	8.43	3/ 11
Crepidula plana	18.18	----	1/ 11
Natica pusilla	4.55	8.43	3/ 11
Eupleura sulcidentata	1.14	----	1/ 11
Astris lunulata	43.18	58.73	5/ 11
Parvanachis obesa	25.00	36.66	5/ 11
Melongena corona	2.27	----	1/ 11
Nassarius vibex	17.05	23.23	5/ 11
Olivella	3.41	----	1/ 11
Prunum apicinum	3.41	----	1/ 11
Turridae	1.14	----	1/ 11
Pyrgocythara plicosa	1.14	----	1/ 11
Odostomia	42.05	112.12	3/ 11
Turbonilla conradi	11.36	21.25	3/ 11
Boonea impressa	2.27	----	1/ 11
Rictaxis punctostriatus	40.91	41.87	8/ 11
Acteocina canaliculata	148.86	154.86	9/ 11
Tornatina inconspicua	7.95	----	1/ 11
Haminoea succinea	18.18	48.21	4/ 11
Acanthochitona pygmaea	1.14	----	1/ 11
Bivalvia	131.82	126.17	10/ 11
Nucula crenulata	31.82	54.01	5/ 11
Nuculana acuta	1.14	----	1/ 11
Anadara transversa	5.68	15.17	2/ 11
Brachidontes exustus	3.41	8.08	2/ 11
Amygdalum papyrium	1361.36	3693.41	6/ 11
Anomia simplex	1.14	----	1/ 11
Parvilucina multilineata	4.55	8.43	3/ 11
Diplodonta semiaspera	4.55	6.31	4/ 11
Mysella planulata	163.64	293.60	9/ 11
Mysella sp. A	40.91	66.40	4/ 11
Laevicardium mortoni	4.55	11.56	2/ 11
Mulinia lateralis	1411.36	3237.82	8/ 11
Macoma tenta	32.95	82.59	3/ 11
Tellina spp.	12.50	25.00	3/ 11
Tellina versicolor	42.05	57.90	6/ 11

Tagelus plebeius	2.27	5.06	2/ 11
Tagelus divisus	2.27	----	1/ 11
Abra aequalis	4.55	11.56	2/ 11
Agriopoma texasiana	1.14	----	1/ 11
Chione cancellata	13.64	----	1/ 11
Anomalocardia auberiana	1.14	----	1/ 11
Sphenia antillensis	12.50	37.50	2/ 11
Corbula contracta	3.41	8.08	2/ 11
Corbula swiftiana	2.27	----	1/ 11
Lyonsia hyalina floridana	3.41	5.84	3/ 11
Asthenothaerus hemphilli	13.64	41.25	2/ 11
Americamysis	1.14	----	1/ 11
Americamysis alleni	3.41	----	1/ 11
Oxyurostylis	1.14	----	1/ 11
Oxyurostylis smithi (=B)	88.64	208.00	6/ 11
Oxyurostylis lecroyae (=A)	3.41	8.08	2/ 11
Cyclaspis cf. varians	584.09	872.44	9/ 11
Kalliapseudes sp. A	17.05	36.77	3/ 11
Cyathura polita	84.09	187.92	3/ 11
Xenanthura brevitelson	45.45	78.32	4/ 11
Amakusanthura magnifica	61.36	91.42	6/ 11
Serolis mgrayi	1.14	----	1/ 11
Edotea triloba	9.09	18.62	4/ 11
Uromunna hayesi	1.14	----	1/ 11
Ampelisca	9.09	----	1/ 11
Ampelisca abdita	2765.91	6243.05	7/ 11
Ampelisca vadorum	70.45	137.19	4/ 11
Ampelisca holmesi	504.55	706.43	10/ 11
Ampelisca sp. C	5.68	12.95	2/ 11
Ampelisca sp. A	6.82	----	1/ 11
Gitanopsis	2.27	----	1/ 11
Gitanopsis laguna	27.27	----	1/ 11
Globosolembos smithi	3.41	----	1/ 11
Bemlos brunneamaculatus mackinneyi	1.14	----	1/ 11
Paramicrodeutopus cf. myersi	54.55	150.03	3/ 11
Rudilemboides naglei	76.14	162.35	5/ 11
Bemlos	2.27	----	1/ 11
Bemlos unicornis	37.50	----	1/ 11
Argissa hamatipes	1.14	----	1/ 11
Cerapus	2.27	----	1/ 11
Cerapus sp. C	19.32	44.15	5/ 11
Corophium acherusicum	4.55	----	1/ 11
Erichthonius brasiliensis	20.45	41.56	4/ 11
Grandidierella bonnieroides	273.86	559.64	8/ 11
Elasmopus laevis	12.50	----	1/ 11
Melita	2.27	5.06	2/ 11
Listriella barnardi	15.91	44.75	3/ 11
Lysianassidae sp. B	1.14	----	1/ 11
Monoculodes nyei	2.27	----	1/ 11
Metharpinia floridana	15.91	----	1/ 11
Eudevenopus honduranus	6.82	15.17	3/ 11

Paracaprella	1.14	----	1/ 11
Penaeidae	1.14	----	1/ 11
Alpheus armillatus	6.82	----	1/ 11
Ambidexter symmetricus	3.41	8.08	2/ 11
Pagurus	9.09	26.27	2/ 11
Pagurus gymnodactylus	1.14	----	1/ 11
Petrolisthes armatus	6.82	----	1/ 11
Upogebia	14.77	26.70	5/ 11
Brachyura	11.36	33.75	2/ 11
Heterocrypta granulata	1.14	----	1/ 11
Hexapanopeus angustifrons	57.95	184.07	2/ 11
Panopeus bermudensis	22.73	71.33	2/ 11
Rhithropanopeus harrisii	6.82	18.84	2/ 11
Dyspanopeus texanus	5.68	----	1/ 11
Pinnotheridae	1.14	----	1/ 11
Pinnixa	34.09	38.36	7/ 11
Pinnixa chaetopterana	2.27	----	1/ 11
Pinnixa cf. pearsei	26.14	67.19	3/ 11
Pinnixa sp. B	4.55	----	1/ 11
Pinnixa sp. A	6.82	10.25	4/ 11
Sipuncula	1.14	----	1/ 11
Phascolion strombi	26.14	68.57	2/ 11
Phoronis	9.09	22.42	3/ 11
Glottidia pyramidata	1.14	----	1/ 11
Ophiuroidea	55.68	130.91	4/ 11
Hemipholis elongata	9.09	----	1/ 11
Amphioplus	1.14	----	1/ 11
Amphioplus thrombodes	1.14	----	1/ 11
Micropholis	1.14	----	1/ 11
Micropholis atra	18.18	37.65	4/ 11
Micropholis gracillima	1.14	----	1/ 11
Mellita tenuis	4.55	11.56	2/ 11
Enteropneusta	1.14	----	1/ 11
Ascidiacea	3.41	----	1/ 11
Branchiostoma floridae	70.45	229.56	2/ 11

APPENDIX 3-L

MANATEE RIVER 1993

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

MANATEE RIVER 1993

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Ampelisca abdita	2765.91	21.34
Mulinia lateralis	1411.36	10.89
Amygdalum papyrium	1361.36	10.50
Cyclaspis cf. varians	584.09	4.51
Ampelisca holmesi	504.55	3.89
Parapionosyllis longicirrata	462.50	3.57
Thenaria	411.36	3.17
Fabriciola trilobata	378.41	2.92
Mediomastus	304.55	2.35
Grandidierella bonnieroides	273.86	2.11
Paraprionospio pinnata	245.45	1.89
Travisia hobsonae	184.09	1.42
Aricidea taylori	172.73	1.33
Caecum cf. johnsoni	167.05	1.29
Mysella planulata	163.64	1.26
Acteocina canaliculata	148.86	1.15
Caulleriella sp. E	136.36	1.05
Bivalvia	131.82	1.02

APPENDIX 3-M
MANATEE RIVER 1994
MEAN ABUNDANCE & OCCURRENCE
OF MACROINVERTEBRATE TAXA

MANATEE RIVER 1994

Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Thenaria	65.91	202.57	2/ 11
Nemertea sp. N	6.82	----	1/ 11
Nemertea sp. F	15.91	37.54	3/ 11
Nemertea sp. I	6.82	16.17	2/ 11
Nemertea sp. K	9.09	16.85	3/ 11
Nemertea sp. B	31.82	40.45	5/ 11
Nemertea sp. J	11.36	----	1/ 11
Malmgreniella maccraryae	22.73	51.79	4/ 11
Malmgreniella taylori	11.36	25.89	2/ 11
Sthenelais sp. A	4.55	----	1/ 11
Bhawania heteroseta	15.91	----	1/ 11
Phyllodoce arenae	2.27	----	1/ 11
Gyptis crypta	6.82	----	1/ 11
Podarkeopsis levifuscina	25.00	31.62	5/ 11
Syllis cornuta	11.36	----	1/ 11
Syllis (Typosyllis) sp. A	4.55	----	1/ 11
Exogone lourei	31.82	----	1/ 11
Brania clavata	284.09	----	1/ 11
Brania wellfleetensis	15.91	35.83	2/ 11
Streptosyllis pettiboneae	9.09	----	1/ 11
Neanthes succinea	2.27	----	1/ 11
Nereis falsa	9.09	23.11	2/ 11
Nephtys bucera	11.36	30.34	2/ 11
Nephtys cryptomma	2.27	----	1/ 11
Aglaophamus verrilli	4.55	10.11	2/ 11
Glycinde solitaria	43.18	75.08	6/ 11
Lumbrinereis latreilli	4.55	----	1/ 11
Lumbrineris sp. D	2.27	----	1/ 11
Drilonereis longa	2.27	----	1/ 11
Leitoscoloplos robustus	18.18	----	1/ 11
Scoloplos rubra	11.36	13.06	5/ 11
Aricidea philbinae	9.09	----	1/ 11
Aricidea taylori	334.09	706.60	6/ 11
Spionidae	2.27	----	1/ 11
Laonice cirrata	4.55	----	1/ 11
Polydora socialis	2.27	----	1/ 11
Prionospio steenstrupi	9.09	----	1/ 11
Prionospio pygmaea	27.27	64.67	2/ 11
Prionospio perkinsi	125.00	281.51	4/ 11
Paraprionospio pinnata	406.82	425.60	8/ 11
Streblospio benedicti	20.45	45.85	3/ 11
Carazziella hobsonae	138.64	----	1/ 11
Magelona pettiboneae	2.27	----	1/ 11
Spiochaetopterus costarum	2.27	----	1/ 11
Caulleriella	4.55	----	1/ 11

Neaeromya floridana	68.18	----	1/ 11
Mysella planulata	61.36	93.12	5/ 11
Mysella sp. A	143.18	307.02	3/ 11
Pteromeris perplanna	4.55	----	1/ 11
Mulinia lateralis	63.64	76.94	6/ 11
Macoma tenta	2.27	----	1/ 11
Tellina spp.	159.09	354.66	5/ 11
Tellina versicolor	9.09	23.11	2/ 11
Tagelus divisus	2.27	----	1/ 11
Abra aequalis	2.27	----	1/ 11
Mylilopsis leucophaeta	20.45	53.41	2/ 11
Cyclinella tenuis	2.27	----	1/ 11
Chione cancellata	9.09	20.23	2/ 11
Corbula barrattiana	2.27	----	1/ 11
Lyonsia hyalina floridana	2.27	----	1/ 11
Asthenothaerus hemphilli	2.27	----	1/ 11
Balanus venustus	2.27	----	1/ 11
Mysidopsis furca	2.27	----	1/ 11
Leucon americanus	2.27	----	1/ 11
Oxyurostylis smithi (=B)	4.55	10.11	2/ 11
Oxyurostylis lecroyae (=A)	2.27	----	1/ 11
Cyclaspis cf. varians	43.18	57.11	5/ 11
Cyclaspis sp. C	2.27	----	1/ 11
Cyathura polita	63.64	202.91	2/ 11
Xenanthura brevitelson	47.73	109.80	2/ 11
Amakusanthura magnifica	59.09	83.12	5/ 11
Edotea triloba	15.91	25.67	4/ 11
Munna sp. n.	2.27	----	1/ 11
Ampelisca abdita	109.09	219.17	4/ 11
Ampelisca holmesi	88.64	132.93	7/ 11
Ampelisca sp. C	4.55	10.11	2/ 11
Amphilochus neopolitanus	2.27	----	1/ 11
Bemlos	2.27	----	1/ 11
Argissa hamatipes	2.27	----	1/ 11
Grandidierella bonnieroides	513.64	1687.02	2/ 11
Listriella barnardi	13.64	23.35	4/ 11
Metharpinia floridana	31.82	----	1/ 11
Eudevenopus honduranus	31.82	97.53	2/ 11
Paguroidea	2.27	----	1/ 11
Pinnixa	36.36	61.61	6/ 11
Phascolion strombi	20.45	41.56	3/ 11
Aspidosiphonidae	31.82	----	1/ 11
Phoronis ?architecta	2.27	----	1/ 11
Phoronis sp. C	2.27	----	1/ 11
Ophiuroidea	18.18	31.80	3/ 11
Hemipholis elongata	38.64	----	1/ 11
Amphioplus abdita	29.55	64.05	3/ 11
Micropholis atra	11.36	30.34	2/ 11
Micropholis gracillima	9.09	20.23	2/ 11
Branchiostoma floridae	95.45	277.67	2/ 11

Caulleriella cf. alata	15.91	----	1/ 11
Monticellina dorsobranchialis	1168.18	1820.68	8/ 11
Chaetozone	4.55	----	1/ 11
Armandia maculata	2.27	----	1/ 11
Travisia hobsonae	65.91	----	1/ 11
Capitella capitata	2.27	----	1/ 11
Heteromastus filiformis	6.82	----	1/ 11
Mediomastus	277.27	301.96	9/ 11
Mediomastus ambiseta	165.91	221.44	9/ 11
Mediomastus californiensis	56.82	140.58	2/ 11
Maldanidae	2.27	----	1/ 11
Asychis sp.	2.27	----	1/ 11
Asychis elongatus	2.27	----	1/ 11
Clymenella torquata	6.82	----	1/ 11
Rhodine sp. A	2.27	----	1/ 11
Pectinaria gouldii	2.27	----	1/ 11
Amphicteis gunneri	13.64	25.89	3/ 11
Hobsonia florida	13.64	37.69	2/ 11
Polycirrus	9.09	----	1/ 11
Loimia viridis	2.27	----	1/ 11
Megalomma pigmentum	2.27	----	1/ 11
Fabriciola trilobata	54.55	140.90	4/ 11
Oligochaeta	50.00	134.16	3/ 11
Sayella fusca	2.27	----	1/ 11
Teinostoma ?nesacum	2.27	----	1/ 11
Caecum imbricatum	2.27	----	1/ 11
Caecum cf. johnsoni	236.36	----	1/ 11
Epitonium rupicolum	2.27	----	1/ 11
Microeulima hemphilli	4.55	----	1/ 11
Astris lunulata	2.27	----	1/ 11
Parvanachis obesa	2.27	----	1/ 11
Nassarius vibex	15.91	28.00	3/ 11
Olivella pusilla	20.45	53.41	2/ 11
Jaspidella blanesi	20.45	48.50	2/ 11
Prunum apicinum	2.27	----	1/ 11
Eulimastoma weberi	52.27	71.98	6/ 11
Turbonilla conradi	4.55	10.11	2/ 11
Turbonilla sp. A= dalli	2.27	----	1/ 11
Odostomia gibbosa	2.27	----	1/ 11
Rictaxis punctostriatus	9.09	23.11	2/ 11
Acteocina canaliculata	47.73	109.80	3/ 11
Tornatina inconspicua	11.36	----	1/ 11
Bivalvia	36.36	66.49	4/ 11
Nucula crenulata	6.82	16.17	2/ 11
Nuculana acuta	2.27	----	1/ 11
Anadara transversa	4.55	10.11	2/ 11
Amygdalum papyrium	59.09	84.61	6/ 11
Parvilucina multilineata	2.27	----	1/ 11
Lucina nassula	4.55	----	1/ 11
Crassostrea virginica			
Diplodonta semiaspera	11.36	30.34	2/ 11
Neaeromya sp.	22.73	----	1/ 11

APPENDIX 3-N

MANATEE RIVER 1994

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

MANATEE RIVER 1994

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Monticellina dorsobranchialis	1168.18	18.79
Grandidierella bonnieroides	513.64	8.26
Paraprionospio pinnata	406.82	6.54
Aricidea taylori	334.09	5.37
Brania clavata	284.09	4.57
Mediomastus	277.27	4.46
Caecum cf. johnsoni	236.36	3.80
Mediomastus ambiseta	165.91	2.67
Tellina spp.	159.09	2.56
Mysella sp. A	143.18	2.30
Carazziella hobsonae	138.64	2.23
Prionospio perkinsi	125.00	2.01
Ampelisca abdita	109.09	1.76
Branchiostoma floridae	95.45	1.54
Ampelisca holmesi	88.64	1.43
Neaeromya floridana	68.18	1.10
Travisia hobsonae	65.91	1.06
Thenaria	65.91	1.06
Cyathura polita	63.64	1.02
Mulinia lateralis	63.64	1.02
Mysella planulata	61.36	0.99
Amygdalum papyrium	59.09	0.95
Amakusanthura magnifica	59.09	0.95

APPENDIX 3-O

MANATEE RIVER 1995

MEAN ABUNDANCE & OCCURRENCE

OF MACROINVERTEBRATE TAXA

MANATEE RIVER 1995

Mean Abundance and Occurrence of Macroinvertebrate Taxa

Taxa	Mean (Divisor = N)	Std.Dev.	M / N
Thenaria	204.55	----	1/ 11
Nemertea sp. Q	9.09	----	1/ 11
Nemertea sp. N	11.36	23.35	3/ 11
Nemertea sp. F	65.91	57.31	8/ 11
Nemertea sp. I	13.64	20.50	4/ 11
Nemertea sp. K	13.64	20.50	4/ 11
Nemertea sp. B	15.91	30.15	4/ 11
Nemertea sp. J	4.55	----	1/ 11
Malmgreniella maccraryae	27.27	50.56	3/ 11
Malmgreniella taylori	2.27	----	1/ 11
Bhawania heteroseta	11.36	----	1/ 11
Genetyllis castanea	18.18	22.61	5/ 11
Parahesione luteola	4.55	----	1/ 11
Podarkeopsis levifuscina	65.91	150.53	5/ 11
Syllis cornuta	6.82	----	1/ 11
Brania clavata	4.55	----	1/ 11
Streptosyllis pettiboneae	54.55	----	1/ 11
Parapionosyllis longicirrata	4.55	----	1/ 11
?Parapionosyllis sp. A	2.27	----	1/ 11
Ceratonereis (?composetia) sp. A	2.27	----	1/ 11
Nereis lamellosa	11.36	30.34	2/ 11
?Ceratocephale sp. A	2.27	----	1/ 11
Nephtys cryptomma	2.27	----	1/ 11
Aglaophamus verrilli	2.27	----	1/ 11
Glycera americana	2.27	----	1/ 11
Glycinde solitaria	38.64	23.35	10/ 11
Lumbrineris verrilli	2.27	----	1/ 11
Lumbrineris sp. E	2.27	----	1/ 11
Aricidea philbinae	4.55	10.11	2/ 11
Aricidea taylori	261.36	647.14	4/ 11
Cirrophorus ?lyra	11.36	----	1/ 11
Laonice cirrata	4.55	----	1/ 11
Polydora cornuta (=ligni)	4.55	----	1/ 11
Prionospio pygmaea	27.27	69.33	2/ 11
Prionospio perkinsi	254.55	500.35	3/ 11
Paraprionospio pinnata	343.18	385.37	9/ 11
Streblospio benedicti	209.09	478.18	5/ 11
Scolelepis texana	2.27	----	1/ 11
Carazziella hobsonae	63.64	180.40	2/ 11
Magelona pettiboneae	2.27	----	1/ 11
Caulleriella	2.27	----	1/ 11
Monticellina dorsobranchialis	863.64	1350.90	7/ 11
Cirriformia	2.27	----	1/ 11
Heteromastus filiformis	2.27	----	1/ 11
Notomastus	2.27	----	1/ 11

Mediomastus	406.82	582.78	9/ 11
Mediomastus ambiseta	225.00	428.51	8/ 11
Mediomastus californiensis	15.91	37.54	3/ 11
Pectinaria gouldii	13.64	20.50	4/ 11
Hobsonia florida	136.36	248.59	4/ 11
Melinna maculata	11.36	20.50	3/ 11
Polycirrus	2.27	----	1/ 11
Fabriciola trilobata	13.64	25.89	3/ 11
Archiannelida sp. A	6.82	----	1/ 11
Oligochaeta	120.45	139.11	8/ 11
Sayella fusca	359.09	1117.27	4/ 11
Teinostoma sp.	2.27	----	1/ 11
Caecum cf. johnsoni	4.55	----	1/ 11
Epitonium rupicolum	9.09	23.11	2/ 11
Microeulima hemphilli	4.55	----	1/ 11
Natica pusilla	4.55	10.11	2/ 11
Parvanachis obesa	2.27	----	1/ 11
Olivella pusilla	34.09	----	1/ 11
Jaspidella blanesi	22.73	67.50	2/ 11
Prunum apicinum	9.09	16.85	3/ 11
Eulimastoma weberi	61.36	113.67	5/ 11
Turbonilla conradi	4.55	----	1/ 11
Turbonilla cf. dalli	2.27	----	1/ 11
Turbonilla nr. mighelsi	2.27	----	1/ 11
Rictaxis punctostriatus	40.91	42.24	7/ 11
Acteocina canaliculata	75.00	98.11	7/ 11
Aplysiidae sp. A	2.27	----	1/ 11
Bivalvia	18.18	25.23	5/ 11
Nucula crenulata	18.18	31.80	3/ 11
Brachidontes exustus	11.36	----	1/ 11
Amygdalum papyrium	679.55	988.93	7/ 11
Lucina nassula	2.27	----	1/ 11
Diplodonta semiaspera	4.55	----	1/ 11
Mysella planulata	118.18	222.79	6/ 11
Mysella sp. A	184.09	489.17	3/ 11
Laevicardium mortoni	2.27	----	1/ 11
Mulinia lateralis	456.82	532.22	9/ 11
Macoma tenta	2.27	----	1/ 11
Macoma constricta	2.27	----	1/ 11
Tellina spp.	170.45	304.10	6/ 11
Tellina versicolor	131.82	136.52	8/ 11
Tagelus plebeius	9.09	12.61	4/ 11
Tagelus divisus	9.09	16.85	3/ 11
Abra aequalis	6.82	----	1/ 11
Mylilopsis leucophaeta	102.27	279.39	2/ 11
Lyonsia hyalina floridana	4.55	10.11	2/ 11
Dentalium (Antalis) antillarum	2.27	----	1/ 11
Oxyurostylis	9.09	----	1/ 11
Oxyurostylis smithi (=B)	15.91	32.16	3/ 11
Oxyurostylis lecroyae (=A)	4.55	10.11	2/ 11
Cyclaspis	81.82	----	1/ 11
Cyclaspis cf. varians	713.64	1117.05	9/ 11

Halmyrapseudes bahamensis	6.82	----	1/ 11
Kalliapseudes sp. A	6.82	----	1/ 11
Cyathura polita	68.18	----	1/ 11
Xenanthura brevitelson	168.18	295.40	4/ 11
Amakusanthura magnifica	61.36	76.94	6/ 11
Edotea triloba	175.00	500.12	3/ 11
Ampelisca	2.27	----	1/ 11
Ampelisca abdita	336.36	670.39	7/ 11
Ampelisca holmesi	175.00	312.25	7/ 11
Batea catharinensis	2.27	----	1/ 11
Cerapus tubularis	40.91	----	1/ 11
Corophium louisianum	297.73	612.62	3/ 11
Grandidierella bonnieroides	1788.64	3313.58	6/ 11
Listriella barnardi	4.55	10.11	2/ 11
Metharpinia floridana	15.91	----	1/ 11
Eudevenopus honduranus	36.36	89.00	4/ 11
Ambidexter symmetricus	2.27	----	1/ 11
Upogebia	2.27	----	1/ 11
Dyspanopeus texanus	4.55	10.11	2/ 11
Pinnixa	22.73	52.98	3/ 11
Phascolion strombi	15.91	----	1/ 11
Ophiuroidea	18.18	31.80	4/ 11
Amphioplus abdita	9.09	20.23	2/ 11
Amphioplus thrombodes	2.27	----	1/ 11
Micropholis atra	2.27	----	1/ 11
Micropholis gracillima	40.91	101.41	2/ 11
Micropholis subtilis	4.55	----	1/ 11
Mellita tenuis	2.27	----	1/ 11
Holothuroidea sp. B	2.27	----	1/ 11
Branchiostoma floridae	11.36	----	1/ 11

APPENDIX 3-P

MANATEE RIVER 1995

RANKED ABUNDANCE & PERCENT COMPOSITION

OF MACROINVERTEBRATE TAXA

COMPRISING $\geq$1% OF TOTAL ABUNDANCE

MANATEE RIVER 1995

Ranked Abundance and Percent Occurrence of Macroinvertebrates

Taxa	Observed	Percentage
Grandidierella bonnieroides	1788.64	17.28
Monticellina dorsobranchialis	863.64	8.34
Cyclaspis cf. varians	713.64	6.90
Amygdalum papyrium	679.55	6.57
Mulinia lateralis	456.82	4.41
Mediomastus	406.82	3.93
Sayella fusca	359.09	3.47
Paraprionospio pinnata	343.18	3.32
Ampelisca abdita	336.36	3.25
Corophium louisianum	297.73	2.88
Aricidea taylori	261.36	2.53
Prionospio perkinsi	254.55	2.46
Mediomastus ambiseta	225.00	2.17
Streblospio benedicti	209.09	2.02
Thenaria	204.55	1.98
Mysella sp. A	184.09	1.78
Edotea triloba	175.00	1.69
Ampelisca holmesi	175.00	1.69
Tellina spp.	170.45	1.65
Xenanthura brevitelson	168.18	1.62
Hobsonia florida	136.36	1.32
Tellina versicolor	131.82	1.27
Oligochaeta	120.45	1.16
Mysella planulata	118.18	1.14
Mylilopsis leucophaeta	102.27	0.99