Technical Memorandum
Terra Ceia Bay Benthic Monitoring
1998

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INTRODUCTION

Benthic samples have been collected from Terra Ceia Bay since 1993 as part of the Bay-wide Benthic Monitoring Program for Tampa Bay (Tampa Bay National Estuary Program 1996). Objectives of this sampling program are to discern the "health" of the benthic habitat of the various segments of Tampa Bay—as well as Tampa Bay as a whole. This is to be accomplished by developing and implementing a Benthic Index for Tampa Bay, assessing sediment quality using two sediment quality assessment guidelines (SQAGs), and evaluating the dissolved oxygen status of near-bottom waters. These measures are then to be summarized as cumulative distribution functions (CDFs) to estimate the areal extents of "healthy", "marginal", and "degraded" (or "subnominal") benthic habitats in Tampa Bay.

This technical memorandum summarizes the status of the benthic assemblages of Terra Ceia Bay for 1998. Data from 1993 through 1997 are summarized in Grabe *et al.* (1996), Karlen & Grabe (1996), and Grabe (1998).

METHODS

Field Collection and Laboratory Procedures: A total of 8 stations (Figure 1) were sampled during September 1998 (Figure 1). Sampling coordinates were randomly selected from computer generated coordinates for the 1993 event and resampled every year. Benthic samples were collected using a Young grab sampler following the field protocols outlined in Courtney *et. al.* (1993). Laboratory procedures followed the protocols set forth in Courtney *et. al.* (1995).

Data Analysis: Numerical dominants were determined by calculating a "dominance" index: $[\text{(\% total abundance)} * \text{(\% occurrence)}]^{0.5}$. Descriptive statistics, the Tampa Bay Benthic Index (TBBI) (Coastal Environmental, 1995), multiple regression analysis, and graphs for hydrographic and biological data were generated using SYSTAT 10.0. (SSPS Inc., 2000). TBBI "cutoff" points were TBBI<13.5 for "degraded" habitat and >=20.38 for "healthy"; these demarcations are preliminary and are based upon data collected through 1996 (EPCHC, unpublished data.)

RESULTS

Hydrographic: Table 1 and Figure 2 summarize selected physical and hydrographic variables for the stations sampled during 1998. Two salinity strata were represented in Terra Ceia Bay during 1998: high mesohaline (18-30 ppt) and polyhaline (>30 ppt) (Figure 3). Salinities were generally higher during 1998 than during any of the prior years (Figure 3). Near-bottom dissolved oxygen concentrations were >5 ppm (Figure 2).

Benthic Community: Table 2 summarizes selected benthic community measures for the 1998 Terra Ceia Bay samples. At least 167 taxa were identified from these 8 samples (Appendix I). Based upon the current, *preliminary* criteria, "marginal" benthic habitat predominated in Terra Ceia Bay during 1998 (Figure 4). Dominant taxa during the 1998 survey included the amphipod *Ampelisca holmesi*, several bivalve mollusks, and tubificid oligochaetes (Table 3).

Comparison of 1993-1998 data did not reveal any clear long-term trends (Figure 5). When biotic variables were partitioned by salinity strata (Figure 6) there were no apparent trends over time. The TBBI did appear to be associated with both dissolved oxygen and sample depth, but not with salinity or the silt+clay content of the sediments (Figure 7).

DISCUSSION

During 1998, salinities in Terra Ceia Bay were markedly higher than in prior years. The benthic assemblages observed in Terra Ceia Bay during 1998 were generally of "marginal" quality, as defined by the current, *preliminary*, TBBI criteria. Long-term trends in the biotic variables were not apparent, although more rigorous analysis is warranted. The TBBI did appear to increase with increasing dissolved oxygen concentration and decreasing sample depth. Neither salinity nor the silt+clay content of the sediments, variables which are major factors in structuring estuarine benthic communities, appeared to be key variables in Terra Ceia Bay.

CONCLUSIONS

The benthic assemblages within Terra Ceia Bay during 1998 were generally of "marginal" quality. The salinity within Terra Ceia Bay was generally higher than prior years. Dissolved oxygen and sample depths were factors which may be more important in controlling benthic community structure in Terra Ceia Bay than salinity and sediment characteristics. Long-term trends should be evaluated more rigorously incorporating data on sediment contaminants, species composition and abundance, and the measured physico-chemical variables.

ACKNOWLEDGEMENTS

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Table 1. Summary of Terra Ceia Bay Hydrographic Variables: September 1998 (1993-1998)

A. Surface

	Temperature (° C)	Salinity (ppt)	Dissolved Oxygen (ppm)	pH (units)
Minimum	28.0 (25.8)	28.0 (5.1)	5.85 (4.40)	7.70 (7.59)
Maximum	30.0 (30.1)	33.0 (33.0)	6.85 (9.00)	8.20 (8.75)
Median	29.2 (28.0)	31.0 (17.4)	6.35 (6.20)	7.90 (8.10)
Mean	29.1 (28.1)	30.6 (18.4)	6.33 (6.16)	7.92 (8.10)

B. Bottom

	Depth (m)	Temperature (° C)	Salinity (ppt)	Dissolved Oxygen (ppm)	pH (units)
Minimum	1.0 (0.6)	28.0 (25.1)	28.0 (10.5)	6.00 (3.30)	7.70 (7.58)
Maximum	3.7 (4.0)	30.0 (30.0)	33.0 (33.0)	6.95 (8.70)	8.20 (8.33)
Median	2.0 (1.8)	29.0 (28.0)	31.0 (18.0)	6.42 (5.75)	7.88 (8.10)
Mean	2.2 (2.0)	28.8 (27.8)	30.8 (19.8)	6.48 (5.82)	7.91 (8.02)

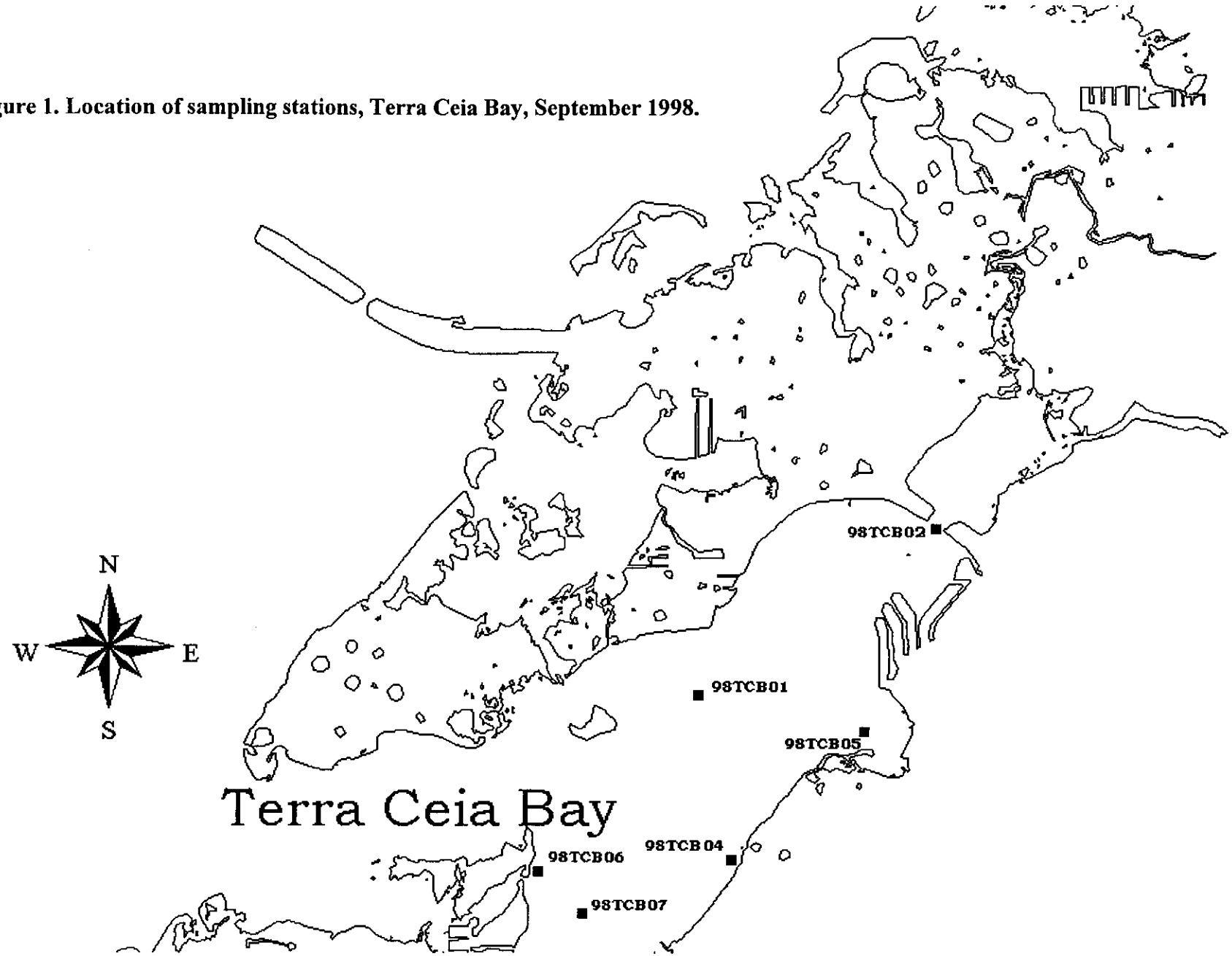
Table 2. Summary of Terra Ceia Bay Benthic Community Variables: September 1998 (1993-1998)

	Abundance (#/m^2)	Species Richness (S)	Diversity (H')	TBBI
Minimum	425 (425)	14 (11)	2.59 (1.22)	13.03 (3.16)
Maximum	13375 (15275)	96 (96)	3.54 (5.13)	18.76 (30.26)
Median	2838 (4550)	33 (35)	2.91 (3.84)	16.39 (21.350
Mean	4225 (5624)	39 (39)	2.94 (3.76)	16.35 (20.28)

Table 3. Terra Ceia Bay Dominant Benthic Taxa: September 1998

Rank	Taxa	Abundance (#/m^2)	% Abundance	% Frequency	Dominance Score
1	*Ampelisca holmesi (Amphipoda)*	2150	6.36	100.0	25.2
2	*Mysella planulata (Bivalvia)*	1200	3.55	87.5	17.6
3	*Tubificidae (Olligochaeta)*	1250	3.70	75.0	16.6
4	*Crassostrea virginica (Bivalvia)*	3425	10.13	12.5	11.2
5	*Parastarte triquetra (Bivalvia)*	1675	4.96	25.0	11.1
6	*Parapionospio pinnata (Polychaeta)*	650	1.92	62.5	11.0
7	*Mulinia lateralis (Bivalvia)*	550	1.63	62.5	10.1
8	*Asthenothaerus hemphilli (Bivalvia)*	450	1.33	75.0	10.0
9	*Fabricinuda trilobata (Polychaeta)*	650	1.92	50.0	9.8
10	*Tagelus divisus (Bivalvia)*	425	1.26	62.5	8.9

Figure 1. Location of sampling stations, Terra Ceia Bay, September 1998.



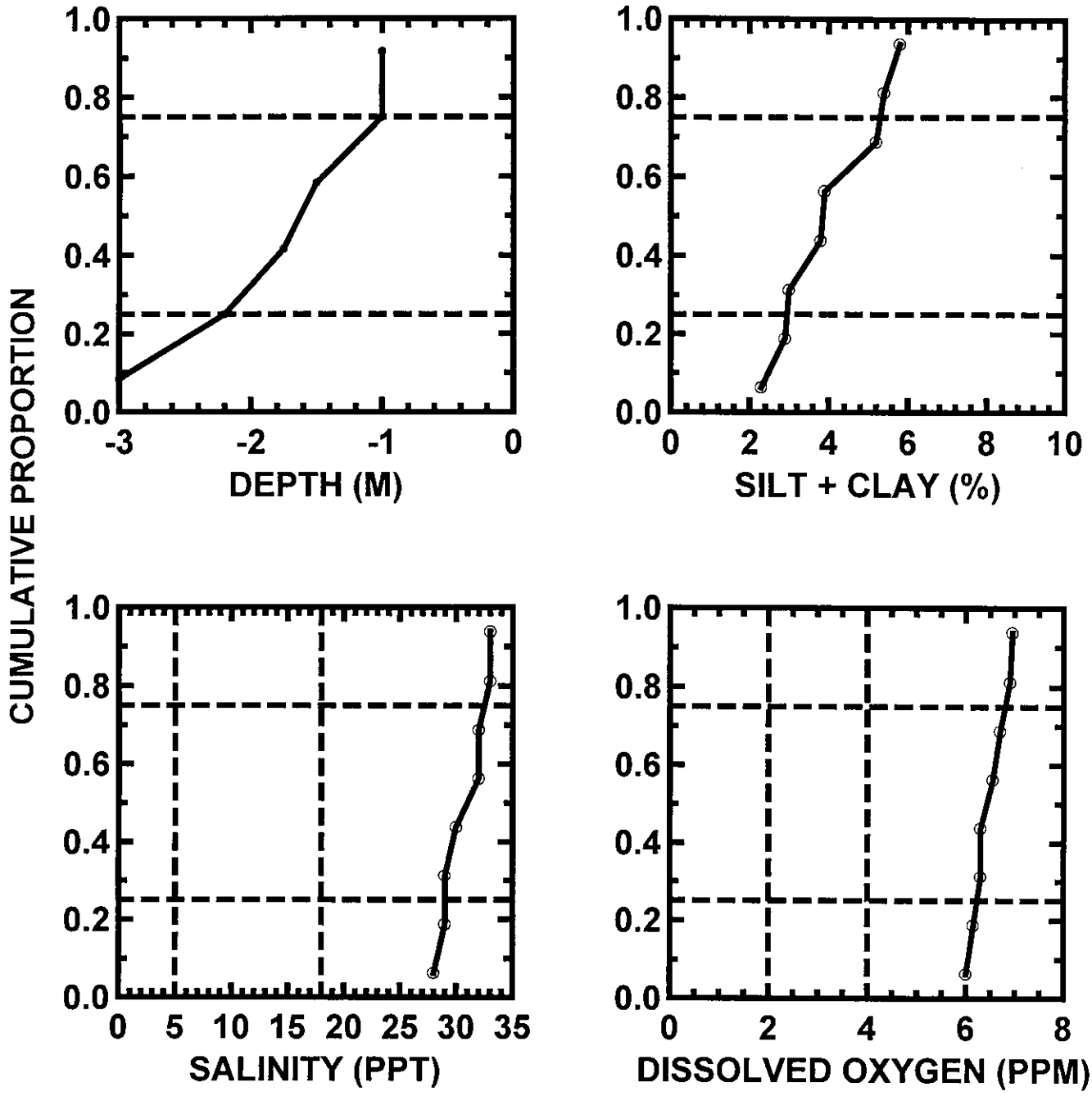


Figure 2. Cumulative distribution of sample depth, % silt+clay, near-bottom salinity, and dissolved oxygen: Terra Ceia Bay, 1998.

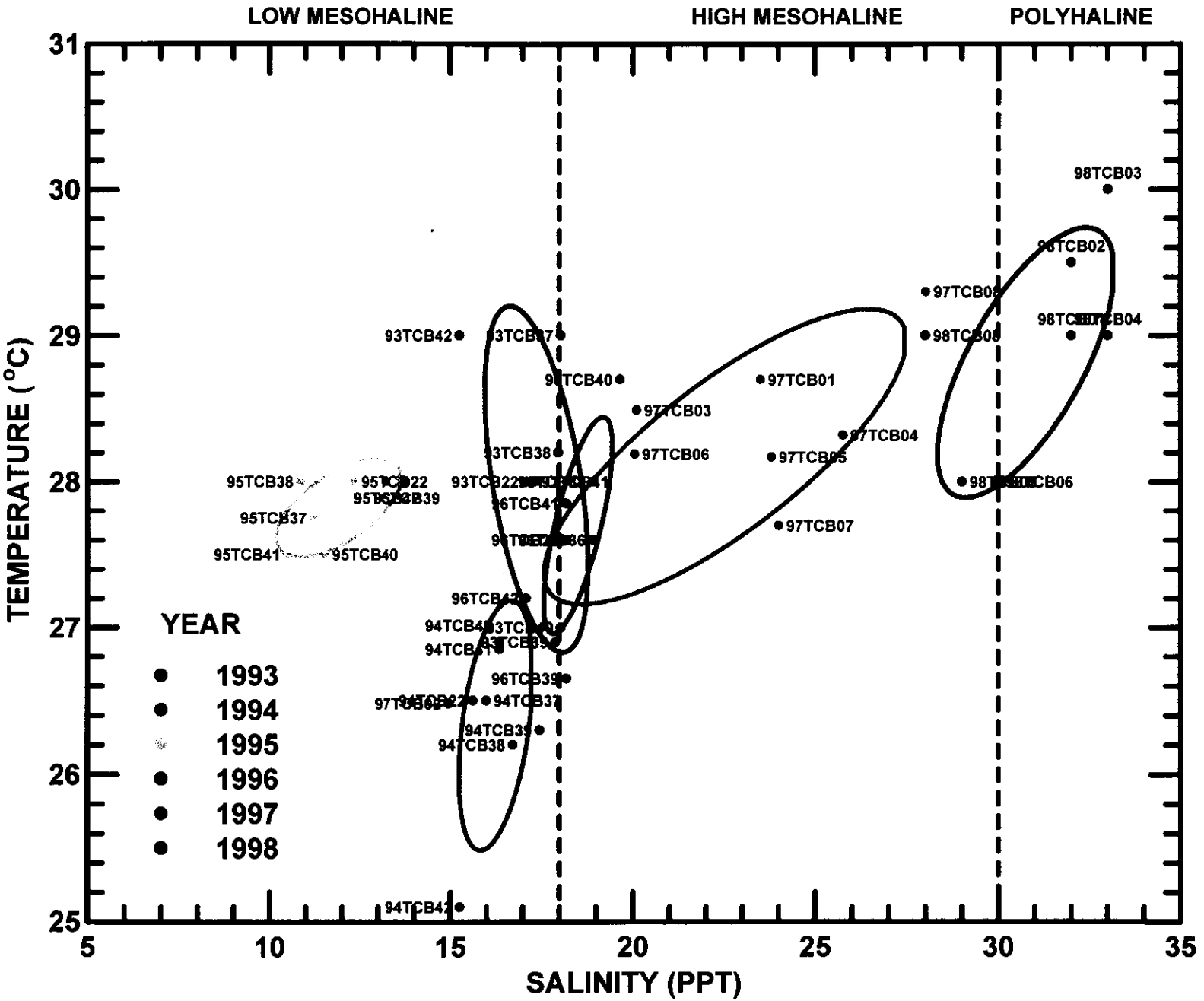


Figure 3. Temperature-salinity plot of stations sampled for benthos, Terra Ceia Bay, 1993-1998.

Axes of ellipses are the standard deviations of the means.

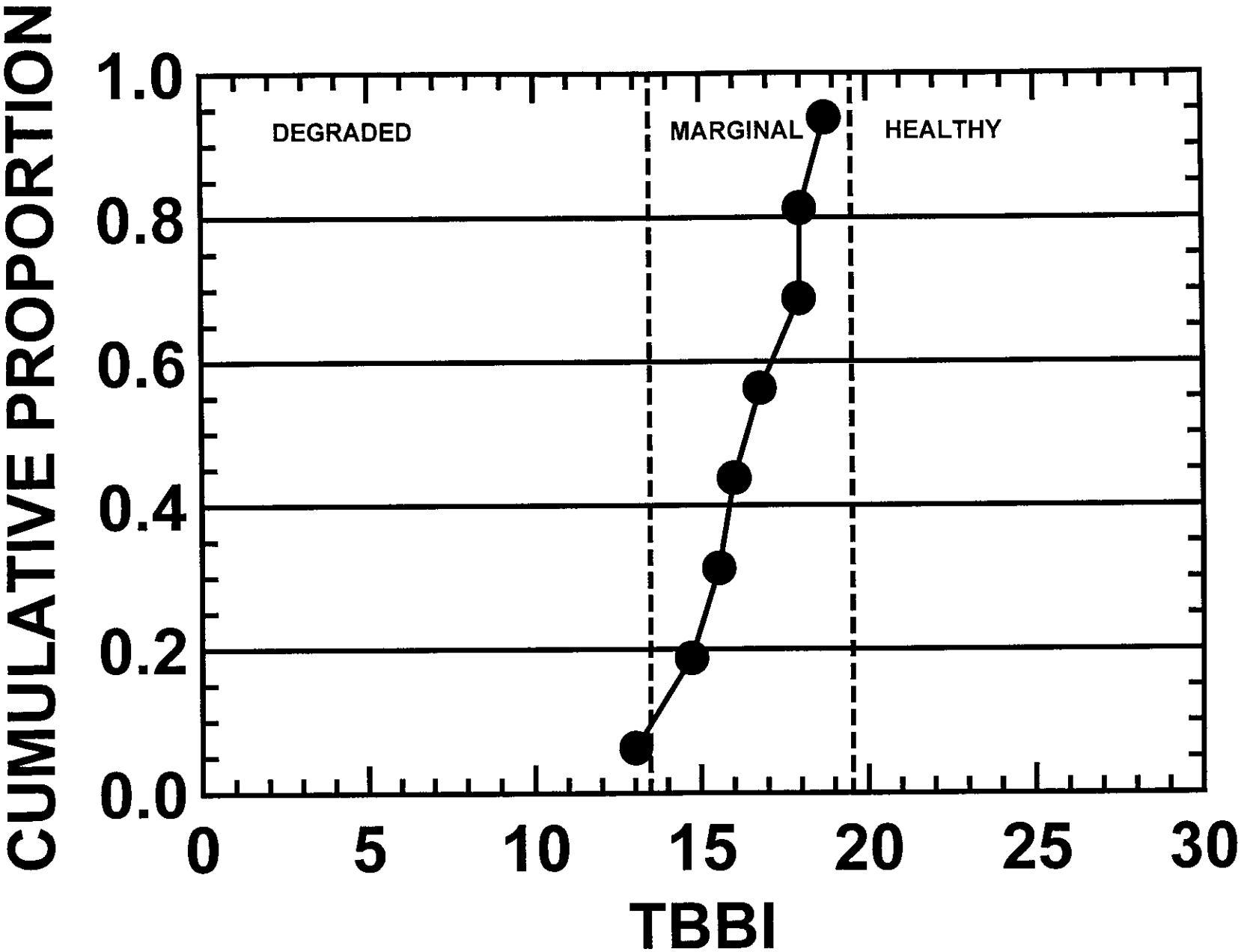


Figure 4. Cumulative distribution plot: TBBI, Terra Ceia Bay 1998.

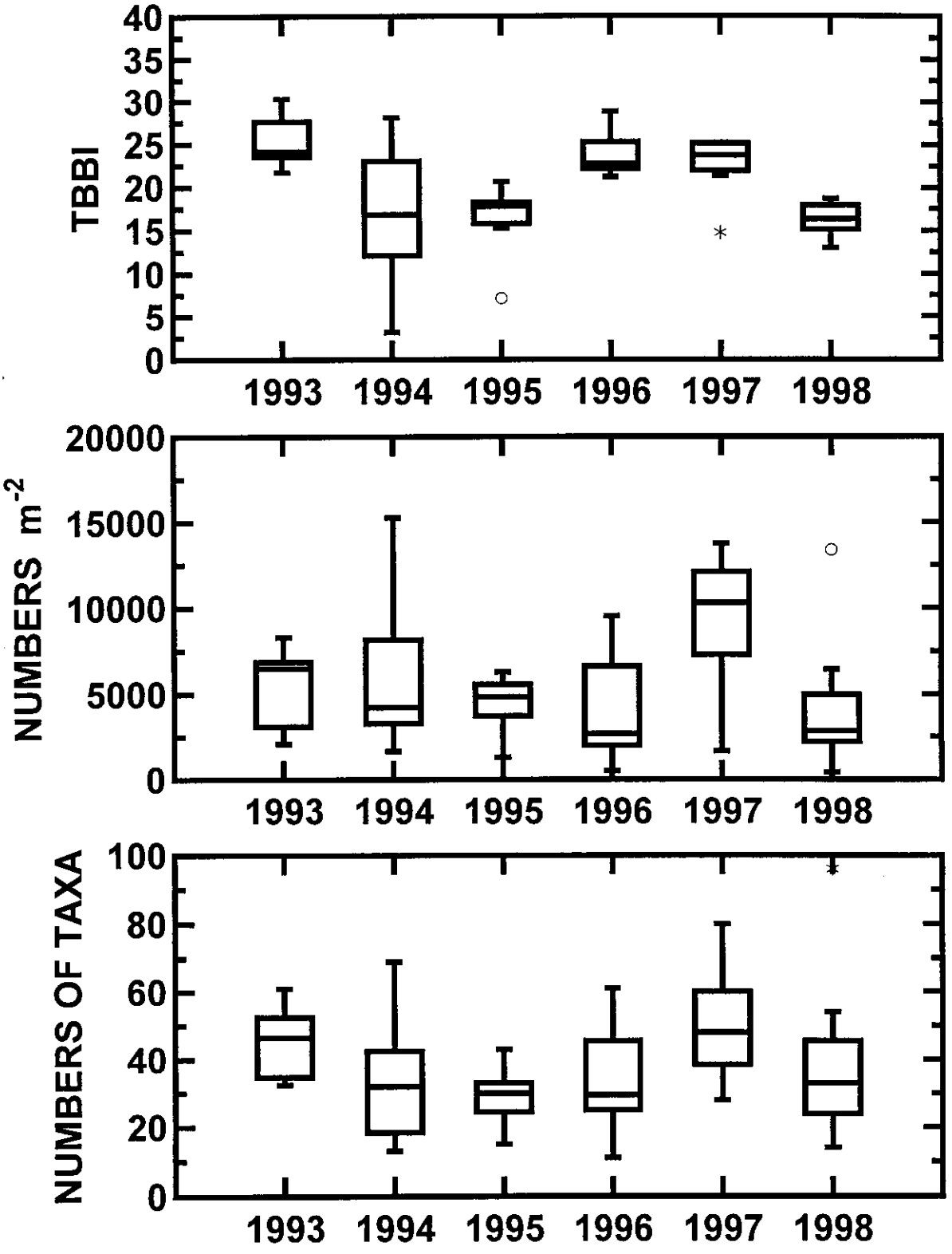


Figure 5. Box plots depicting median and quartile distribution of numbers taxa, total abundance, and the TBBI. Terra Ceia Bay benthos, 1993-1998.

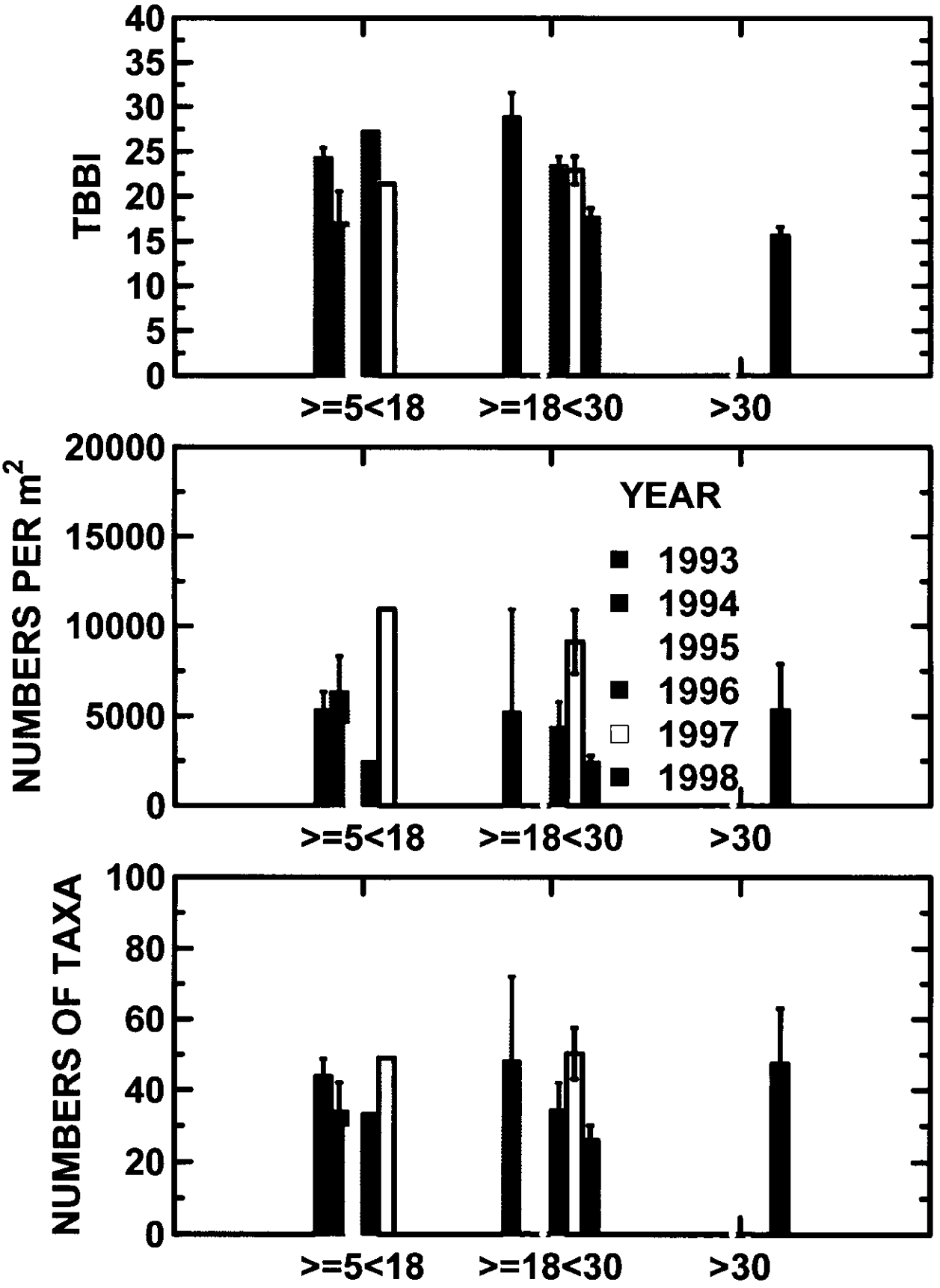


Figure 6. Mean (standard error) numbers of taxa, total abundance, and TBBI, by salinity strata and year. Terra Ceia Bay benthos, 1993-1998.

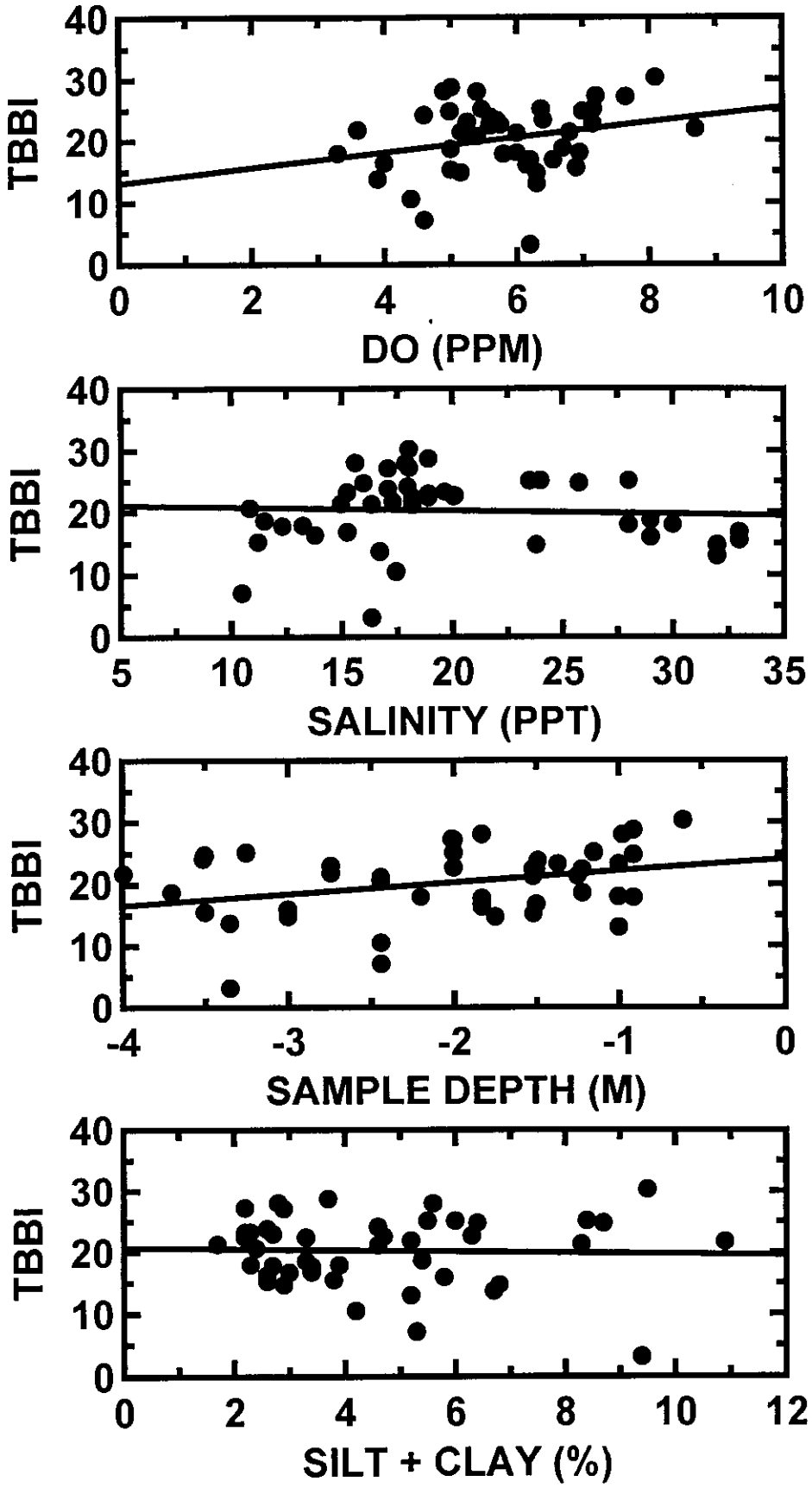


Figure 7. Scatterplots of the association between dissolved oxygen, salinity, sample depth, % silt+clay and the TBBI. Terra Ceia Bay benthos, 1993-1998.

APPENDIX I
ABUNDANCE (#/m^2) OF BENTHIC MACROINVERTEBRATES: TERRA CEIA BAY 1998

NAME	98TCB01	98TCB02	98TCB03	98TCB04	98TCB05	98TCB06	98TCB07	98TCB08
HYDROZOA	0	0	0	0	0	0	0	0
Thenaria	0	0	300	0	0	0	0	0
Turbellaria	0	0	50	0	0	0	75	0
Turbellaria A	0	0	0	0	0	0	25	0
Nemertea sp.	0	25	0	0	0	0	0	0
Nemertea F	0	0	0	0	0	50	0	0
Nemertea A	0	0	0	0	0	0	25	0
Nemertea J	0	50	0	0	0	0	25	0
Harmothoe sp.	0	0	25	0	0	0	0	0
Malmgreniella maccraryae	0	0	25	0	0	0	0	0
Malmgreniella taylori	0	0	0	25	0	0	0	0
Eteone heteropoda	0	0	0	0	0	0	0	25
Phyllodoce arenae	0	0	125	25	0	0	0	0
Ophiodromus obscura	0	0	75	0	0	0	0	0
Podarkeopsis levifuscina	0	0	75	25	0	0	0	0
Sigambra bassi	0	0	25	0	0	0	0	0
Synelmis ewingi	0	0	50	0	0	0	0	0
SYLLIDAE	0	0	25	0	0	0	0	0
Pionosyllis sp.	0	0	50	0	0	0	0	0
Syllis B	0	0	200	0	0	0	0	0
Syllis (Typosyllis) tortugaensis	0	0	125	0	0	0	0	0
Exogone dispar	0	0	625	0	0	0	0	0
Grubeosyllis clavata	0	0	25	0	0	0	0	0
Brania wellfleetensis	0	0	0	50	0	0	0	0
Laeonereis culveri	0	125	0	0	0	0	0	0
Glycera americana	25	50	0	50	0	0	0	0
Glycinde solitaria	0	0	0	0	0	0	50	25
Goniadides carolinae	0	0	50	0	0	0	0	0
ONUPHIDAE	0	100	0	0	0	0	0	0
Diopatra cuprea	0	150	0	0	0	0	0	0
Kinbergonuphis simoni	0	100	0	0	0	0	0	25
Lumbrineris verrilli	0	0	100	0	0	0	0	0
Scoloplos rubra	0	50	0	0	0	0	0	25
Aricidea philbinae	0	175	0	0	0	0	0	0
Aricidea taylori	150	25	100	0	0	0	0	0
Aricidea allisdari	75	0	0	0	0	0	0	0
Cirrophorus sp.	0	0	300	0	0	0	0	0
Dipolydora socialis	0	0	350	0	75	0	0	0
Polydora cornuta	0	25	125	0	0	0	0	0
Prionospio heterobranchia	25	25	25	0	0	0	0	25
Apoprionospio pygmaea	0	0	25	0	0	0	0	0
Prionospio perkinsi	175	0	150	0	0	0	0	0
Spio pettiboneae	0	0	75	0	0	0	0	0
Paraprionospio pinnata	175	75	0	125	175	0	100	0
Streblospio spp.	0	1150	0	0	0	0	0	0
Carazziella hobsonae	0	0	0	0	50	0	0	0
Magelona pettiboneae	0	50	0	0	0	0	0	25
Spiochaetopterus costarum	0	75	0	0	0	0	0	0
Spiochaetopterus oculatus	0	0	50	0	0	0	0	0
CIRRATULIDAE	0	0	125	0	0	0	0	0
Caulleriella cf0alata	0	0	25	0	0	0	0	0
Monticellina dorsobranchialis	450	150	125	50	100	0	275	0
Chaetozone sp.	0	0	100	0	0	0	0	0
Dodecaceria sp.	0	0	25	0	0	0	0	0
Capitella capitata	0	175	0	0	0	0	0	0
Heteromastus filiformis	0	50	0	0	0	0	0	0
Notomastus americanus	25	0	0	0	0	0	0	0
Mediomastus sp.	100	25	200	0	25	25	0	0
Mediomastus ambiseta	0	0	0	125	0	0	0	0
Mediomastus californiensis	0	50	0	0	0	0	0	0
MALDANIDAE	0	25	25	0	0	0	0	0
Sabaco americanus	0	0	0	25	0	0	0	0
Sabellaria A	0	0	25	0	0	0	0	0
Augeneriella hummelincki	0	25	0	0	0	0	0	0
Pectinaria gouldii	0	25	25	0	0	0	0	0
Hobsonia florida	0	25	0	0	0	0	0	0

APPENDIX I (CONTINUED)
ABUNDANCE (#/m^2) OF BENTHIC MACROINVERTEBRATES: TERRA CEIA BAY 1998

Melinna cristata	0	0	25	0	0	0	0	0
Isolda pulchella	0	0	50	0	0	25	0	0
Chone cf0americana	25	0	400	0	0	0	0	50
Megalomma pigmentum	0	50	50	0	0	0	25	0
Pseudopotamilla cf0reniformis	0	50	0	0	0	0	0	0
Fabricinuda trilobata	0	25	575	25	0	0	0	25
Oriopsis sp.	0	0	25	0	0	0	0	0
Hydroides sp.	0	0	50	0	0	0	0	0
Hydroides dianthus	0	0	50	0	0	0	0	0
ENCHYTRAEIDAE	0	0	150	0	0	0	0	0
TUBIFICIDAE	0	425	475	175	25	0	125	25
Tubificoides brownae	50	225	0	0	0	0	0	0
Tubificoides wasselli	375	75	0	0	0	0	0	0
Tectidrilus squalidus	0	0	425	0	0	0	0	0
GASTROPODA	50	100	150	25	0	0	50	50
Schwartziella catesbyana	0	0	25	0	0	0	0	0
Teinostoma biscaynense	0	0	0	0	0	0	75	0
Caecum strigosum	25	0	0	0	0	0	0	0
Bittiolum varium	0	0	350	0	0	0	25	0
Cerithium atratum	0	0	50	0	0	0	0	0
Cerithium eburneum	0	0	75	0	0	0	0	0
Melanella jamaicensis	0	0	0	0	0	0	25	0
Microeulima hemphilli	0	0	25	0	0	0	0	0
Crepidula sp.	0	0	25	0	0	0	0	0
Crepidula plana	0	0	250	0	0	0	0	0
Crepidula aculeata	0	0	75	0	0	0	0	0
Tectonatica pusilla	0	0	0	25	0	0	0	0
Astrys lunulata	0	25	100	0	0	0	25	0
Nassarius vibex	50	50	0	0	0	0	0	0
Olivella sp.	0	0	25	0	0	0	0	0
Jaspidella blanesi	50	0	50	50	0	0	0	0
Olivella pusilla	0	0	0	0	0	0	0	25
Granulina hadria	0	50	0	0	0	0	0	0
Prunum apicinum	0	50	0	25	0	0	0	25
Kurtziella atrostyla	0	0	25	0	0	0	0	0
Turbonilla sp.	0	0	0	0	50	0	0	0
Turbonilla conradi	0	25	0	50	125	0	100	0
Turbonilla cf0dalli	25	0	25	0	0	0	0	0
Turbonilla textilis	0	0	0	0	100	0	0	0
Eulimastoma sp.	0	50	0	0	0	0	50	0
Boonea impressa	0	0	75	0	0	0	0	0
Rictaxis punctostriatus	0	100	0	50	0	0	0	0
Acteocina canaliculata	50	25	0	0	0	25	0	250
Haminoea succinea	0	50	0	0	0	0	0	125
Nucula crenulata	0	0	0	175	0	25	50	0
Anadara transversa	0	0	0	0	0	0	0	25
MYTILIDAE	0	0	50	0	0	0	0	0
Brachidontes exustus	0	0	100	0	0	0	0	0
Lioberus castaneus	0	0	25	0	0	0	0	0
Parvilucina multilineata	0	0	0	25	0	0	0	0
Crassostrea virginica	0	0	3425	0	0	0	0	0
Diplodonta semiaspera	50	0	50	25	0	0	0	0
Orobitella floridana	0	50	0	0	0	0	150	0
Mysella planulata	50	75	25	250	50	0	75	675
Erycina floridana	50	50	0	75	0	0	0	0
Laevicardium mortoni	0	25	25	50	25	0	0	100
Mulinia lateralis	0	0	0	50	200	25	250	25
Ensis minor	0	25	0	0	0	0	0	0
Macoma tenta	25	25	0	25	0	0	25	0
Tellina sp.	25	0	100	200	0	0	75	0
Tellina versicolor	0	0	0	75	0	0	75	0
Tagelus divisus	250	0	25	25	25	0	100	0
Abra aequalis	25	0	0	0	0	25	0	0
Parastarte triquetra	0	1650	0	0	0	0	0	25
Sphenia antillensis	0	0	250	0	0	0	0	0
Lyonsia floridana	0	25	25	25	0	0	0	0
Asthenothaerus hemphilli	75	25	125	0	175	0	50	0
Oxyurostylis spp.	25	0	0	150	0	0	0	25

APPENDIX I (CONTINUED)
ABUNDANCE (#/m^2) OF BENTHIC MACROINVERTEBRATES: TERRA CEIA BAY 1998

Oxyurostylis smithi	0	0	0	0	125	0	125	25
Cyclaspis cf0varians	25	0	0	50	125	0	0	25
Kalliapseudes sp0A	125	0	0	50	25	0	50	0
Leptochelia sp.	0	0	75	0	0	0	0	0
Amakusanthura magnifica	0	0	150	0	0	25	0	25
Paracerceis caudata	0	0	50	0	0	0	0	0
Serolis mgrayi	0	0	25	0	0	0	0	0
Edotia triloba	0	0	50	0	0	0	0	0
Ampelisca abdita	0	0	0	0	0	0	0	25
Ampelisca vadorum	0	0	0	25	0	0	0	0
Ampelisca holmesi	25	175	75	1050	50	25	275	475
Ampelisca sp0C	0	0	25	0	0	50	0	0
Ampelisca abdita/vadorum	0	0	25	0	0	0	0	0
AMPHILOCIDAE	0	0	25	0	0	0	0	0
Rudilemboides naglei	75	0	50	0	0	0	0	0
Colomastix sp.	0	0	25	0	0	0	0	0
Cerapus spp.	0	25	0	0	0	0	0	0
Cerapus sp0C (="tubularis")	25	0	25	25	0	0	125	0
Monocorophium acherusicum	0	0	225	0	0	0	0	0
Laticorophium cf0baconi	0	0	25	0	0	0	0	0
Erichthonius brasiliensis	0	25	150	0	0	0	0	25
Grandidierella bonnieroides	0	0	50	0	0	0	0	0
Listriella barnardi	0	25	0	25	0	0	0	25
Eudevenopus honduranus	0	0	50	0	0	25	0	0
CARIDEA	0	0	25	0	0	0	0	0
ALPHEIDAE	0	0	25	0	0	0	0	0
Ambidexter symmetricus	0	0	0	0	0	0	0	25
Pagurus sp.	0	0	50	0	0	0	0	0
Pagurus stimpsoni	0	0	50	0	0	0	0	0
Pagurus maclaughlinae	0	0	25	0	0	0	0	0
PORCELLANIDAE	0	0	100	0	0	0	0	0
Pelia mutica	0	0	25	0	0	0	0	0
Panopeus sp.	0	0	100	0	0	0	0	0
Rhithropanopeus harrisii	0	0	25	0	0	0	0	0
Pilumnus caribaeus	0	0	25	0	0	0	0	0
Pinnixa spp.	0	0	0	50	125	0	0	0
Phoronis ?architecta	0	0	0	0	0	25	0	175
Phoronis A	0	25	0	0	0	0	0	0
BRYOZOA	0	0	0	0	0	0	0	0
Glottidia pyramidata	25	25	0	0	0	0	0	75
OPHIUROIDEA	25	25	25	0	125	0	50	50
Amphipholis squamata	0	0	0	100	0	0	0	0
Amphioplus thrombodes	25	0	25	0	0	0	0	0
Amphioplus sepultus	25	0	0	0	0	0	0	0
Amphipholis atra	50	0	0	25	0	0	175	0
Mellita tenuis	0	0	0	0	0	50	0	0
HOLOTHUROIDEA	0	0	25	0	0	0	0	0
Holothuroidea sp0E	0	0	0	0	0	0	25	0
Branchiostoma floridae	25	0	100	0	25	25	0	50