St. Lucie Estuary Benthic Community Assessment, 2003

SUBMITTED TO:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Centers for Coastal Ocean Science
Center for Coastal Monitoring and Assessment
Silver Spring, Maryland 20910

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INTRODUCTION

The St. Lucie Estuary was sampled during June, 2003. One aspect of this evaluation was benthic community characterization, which was accomplished via sample collection by National Oceanic and Atmospheric Administration (NOAA) personnel and laboratory and data analysis by Barry A. Vittor & Associates, Inc. (BVA). Location data for the St. Lucie Estuary stations are given in Table 1 and Figure 1.

METHODS

Sample Collection And Handling

A Young-modified Van Veen grab (area = 0.04 m^2) was used to collect three replicate bottom samples at each of the six stations during June, 2003. Macroinfaunal samples were sieved through a 0.5–mm mesh screen and preserved with 10% formalin on ship. Macroinfaunal samples were transported to the BVA laboratory in Mobile, Alabama.

Sediment Analysis

Sediment texture was determined at half-phi intervals using the hydrometer technique for fractions smaller than 44 μm and nested sieves for larger particle fractions. Texture parameters that were computed included percent gravel, sand, and silt /clay. Total organic carbon (TOC) content was measured as ash-free dry weight expressed as a percentage.

Macroinfaunal Sample Analysis

In the laboratory of BVA, benthic samples were inventoried, rinsed gently through a 0.5 mm mesh sieve to remove preservatives and sediment, stained with Rose Bengal, and stored in 70% isopropanol solution until processing. Sample material (sediment, detritus, organisms) was placed in white enamel trays for sorting under Wild M-5A dissecting microscopes. All macroinvertebrates were carefully removed with forceps and placed in labeled glass vials containing 70% isopropanol. Each vial represented a major taxonomic group (e.g. Polychaeta, Mollusca, Arthropoda). All sorted

macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species level unless the specimen was a juvenile, damaged, or otherwise unidentifiable. The number of individuals of each taxon, excluding fragments, was recorded. A voucher collection was prepared, composed of representative individuals of each species not previously encountered in samples from the St. Lucie region.

DATA ANALYSIS

All data generated as a result of laboratory analysis of macroinfauna samples were first coded on data sheets. Enumeration data were entered for each species according to station and replicate. These data were reduced to a data summary report for each station, which included a taxonomic species list and benthic community parameters information. Archive data files of species identification and enumeration were prepared.

The Quality Assurance and Quality Control reports for the St. Lucie samples are given in the Appendix.

Assemblage Structure

Several numerical indices were chosen for analysis and interpretation of the macroinfaunal data. Infaunal abundance is reported as the total number of individuals per station and the total number of individuals per square meter (= density). Taxa richness is reported as the mean number of taxa represented in a given station collection.

Taxa diversity, which is often related to the ecological stability and environmental "quality" of the benthos, was estimated using Shannon's Index (Pielou, 1966), according to the following formula:

$$H' = -\sum_{i=1}^{s} p_i (ln\ p_i)$$

where, S = the number of taxa in the sample,

i = the i'th taxa in the sample, and

p_i = the number of individuals of the i'th taxa divided by the total number of individuals in the sample.

Taxa diversity was calculated using ln; however, diversity may also be calculated using $\log_2$. Both methods of calculating diversity are common in the scientific literature. The taxa diversity calculated in this report using ln, can be converted to $\log_2$ diversity by multiplying the ln taxa diversity by 1.4427.

Taxa diversity within a given community is dependent upon the number of taxa present (taxa richness) and the distribution of all individuals among those taxa (equitability or evenness). In order to quantify and compare the equitability in the fauna to the taxa diversity for a given area, Pielou's Index J' (Pielou, 1966) was calculated as J' = H'/lnS, where $lnS = H'_{max}$, or the maximum possible diversity, when all taxa are represented by the same number of individuals; thus, $J' = H' / H'_{max}$.

HABITAT CHARACTERISTICS

Water quality and sediment data for the six St. Lucie stations are given in Table 1 and Figure 2. Salinities varied from 0.8 ppt at Station 7 to 8.0 at Station 17. Sediments at the six stations were dominated by the silt+clay fraction (Table 1; Figure 2). The total organic carbon (TOC) fraction of the sediment was greater than 6% at all stations (Table 1, Figure 3).

BENTHIC COMMUNITY CHARACTERIZATION

Microsoft ™Excel spreadsheets are being provided separately to NOAA which include: raw data on taxa abundance and density by replicate, a complete taxonomic listing with station abundance and occurrence, a major taxa table with overall taxa

abundance, and an assemblage parameter table including data on mean number of taxa, mean density, taxa diversity and taxa evenness by station.

A total of 1886 organisms, representing 40 taxa, were identified from the six St. Lucie stations (Table 2). Polychaetes were the most numerous organisms present representing 30.9% of the total assemblage, followed in abundance by bivalves (29.1%), gastropods (25.3%), and malacostracans (11.7%). Polychaetes represented 27.5% of the total number of taxa followed by malacostracans (22.5%), and gastropods (22.5%) (Table 2).

The abundance of major taxa by station are given in Table 3 and Figure 3. The number of taxa per station ranged from 10 at Station 15 to 20 at Station 5. The number of organisms per station ranged from 128 at Station 15 to 461 at Station 5. Annelids (polychaetes) dominated the assemblage at Stations 15 and 17, mollusks dominated at Stations 5 and 12, a mixed assemblage of annelids and mollusks dominated at Station 7, and a mixed assemblage of annelids, mollusks, and arthropods dominated at Station 3 (Figure 3).

The dominant taxon collected from the St. Lucie stations was the bivalve, *Mulinia lateralis* representing 27.6% of the total individuals (Table 4). Other dominant taxa included the polychaete, *Streblospio benedicti*, the gastropod, *Pyrgophorus platyrachis*, and the malacostracan, *Grandidierella bonnieroides* representing 19.6%, 11.9%, and 11.2% of the total individuals collected, respectively (Table 4). The polychaete, *Streblospio benedicti* was the most widely distributed taxon being found at 100% of the stations (Table 4). The distribution of dominant taxa representing > 10% of the total assemblage at each station is given in Table 5.

Mean station taxa richness and station density data are given in Table 6 and Figure 4. Taxa richness varied and ranged from 6.0 (± 2.0) at Station 15 to 12.0 (± 1.7) at Station 5 (Table 6; Figure 4). Station mean densities ranged from 1066.7 organisms/m^2 (± 425.2) at Station 15 to 3841.7 organisms/m^2 (± 1040.8) at Station 5 (Table 6, Figure 4). Taxa diversity and evenness are given in Table 6 and Figure 5. Taxa diversity (H') was uniformly low and ranged from 0.91 at Station 5 to 1.60 at Station 7 (Table 6, Figure 5). Taxa evenness (J') ranged from 0.30 at Station 5 to 0.60 at Station 17 (Table 6, Figure 5).

LITERATURE CITED

Pielou, E.C. 1966. The measurement of diversity in different types of biological collections. Journal of Theoretical Biology 13:131-144.

Table 1. Summary of station location, water quality and sediment data for St. Lucie stations, June 2003.

Station	Latitude	Longitude	Depth (m)	Sample Location	Temp (˚C)	Sal (ppt)	DO (% Sat)	% Moisture	% TOC	% Sand	% Silt	% Clay	USACE Description	Median Particle Size (phi)	Sorting Coefficient
3	27.23495	80.30635	2.1	bottom	29.4	6.5	–	75.1	8.70	42.83	34.33	22.84	Clayey Sand	4.437	3.782
5	27.21727	80.28405	2.5	bottom	29.0	6.7	57.2	72.1	7.81	43.69	32.07	24.24	Clayey Sand	4.440	4.059
7	27.17834	80.26434	0.7	bottom	29.7	0.8	76.5	70.6	7.41	38.24	38.99	22.77	Clayey Silt	4.532	3.234
12	27.16336	80.25632	0.6	bottom	29.7	1.7	82.6	72.8	10.27	19.69	40.93	39.38	Silty Clay	6.698	3.121
15	27.20599	80.26519	2.9	bottom	29.3	6.4	62.3	68.7	6.04	46.93	30.12	22.95	Clayey Sand	5.012	3.462
17	27.18989	80.26616	1.6	bottom	28.9	8.0	70.6	77.1	10.20	24.27	51.45	24.28	Clayey Silt	5.178	2.923

Table 2. Summary of overall abundance of major benthic macroinfaunal taxonomic groups for the St. Lucie stations, June 2003.

Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
Annelida				
Oligochaeta	1	2.5	33	1.7
Polychaeta	11	27.5	582	30.9
Mollusca				
Bivalvia	7	17.5	549	29.1
Gastropoda	9	22.5	477	25.3
Arthropoda				
Insecta	1	2.5	17	0.9
Malacostraca	9	22.5	221	11.7
Other Taxa	2	5.0	7	0.4
Total	**40**		**1,886**	

Table 3. Summary of abundance of major benthic macroinfaunal taxonomic groups by station for the St. Lucie stations, June 2003.

Station	Taxa	Total No. Taxa	% Total	Total No. Individuals	% Total
3	Annelida	4	22.2	105	23.4
	Mollusca	8	44.4	133	29.7
	Arthropoda	4	22.2	206	46.0
	Echinodermata	0	0.0	0	0.0
	Other Taxa	2	11.1	4	0.9
	Total	**18**		**448**	
5	Annelida	9	45.0	34	7.4
	Mollusca	8	40.0	420	91.1
	Arthropoda	3	15.0	7	1.5
	Echinodermata	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	Total	**20**		**461**	
7	Annelida	4	22.2	173	55.1
	Mollusca	9	50.0	129	41.1
	Arthropoda	4	22.2	11	3.5
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	5.6	1	0.3
	Total	**18**		**314**	
12	Annelida	1	9.1	4	1.1
	Mollusca	8	72.7	341	96.6
	Arthropoda	2	18.2	8	2.3
	Echinodermata	0	0.0	0	0.0
	Other Taxa	0	0.0	0	0.0
	Total	**11**		**353**	
15	Annelida	5	50.0	123	96.1
	Mollusca	2	20.0	2	1.6
	Arthropoda	2	20.0	2	1.6
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	10.0	1	0.8
	Total	**10**		**128**	
17	Annelida	6	54.5	176	96.7
	Mollusca	1	9.1	1	0.5
	Arthropoda	3	27.3	4	2.2
	Echinodermata	0	0.0	0	0.0
	Other Taxa	1	9.1	1	0.5
	Total	**11**		**182**	

Table 4. Distribution and abundance of benthic macroinfaunal taxa for the St. Lucie stations, June 2003.

Taxon Name	Phylum	Class	No. of Individuals	% Total	Cumulative %	Station Occurrence	% Station Occurrence
Mulinia lateralis	Mol	Biva	521	27.62	27.62	4	67
Streblospio benedicti	Ann	Poly	370	19.62	47.24	6	100
Pyrgophorus platyrachis	Mol	Gast	224	11.88	59.12	2	33
Grandidierella bonnieroides	Art	Mala	212	11.24	70.36	5	83
Hydrobiidae (LPIL)	Mol	Gast	171	9.07	79.43	4	67
Mediomastus (LPIL)	Ann	Poly	105	5.57	84.99	3	50
Leitoscoloplos robustus	Ann	Poly	57	3.02	88.02	5	83
Acteocina canaliculata	Mol	Gast	51	2.70	90.72	5	83
Tubificidae (LPIL)	Ann	Olig	33	1.75	92.47	1	17
Paraprionospio pinnata	Ann	Poly	24	1.27	93.74	4	67
Coelotanypus (LPIL)	Art	Inse	17	0.90	94.64	4	67
Tellina versicolor	Mol	Biva	17	0.90	95.55	4	67
Elimia floridensis	Mol	Gast	12	0.64	96.18	2	33
Pectinaria gouldii	Ann	Poly	11	0.58	96.77	2	33
Rictaxis punctostriatus	Mol	Gast	8	0.42	97.19	2	33
Glycinde solitaria	Ann	Poly	7	0.37	97.56	3	50
Mytilopsis leucophaeata	Mol	Biva	6	0.32	97.88	2	33
Odostomia (LPIL)	Mol	Gast	5	0.27	98.14	1	17
Rhynchocoela (LPIL)	Rhy	-	5	0.27	98.41	4	67
Gastropoda (LPIL)	Mol	Gast	4	0.21	98.62	3	50
Nereis succinea	Ann	Poly	3	0.16	98.78	1	17
Ampelisca abdita	Art	Mala	2	0.11	98.89	2	33
Bivalvia (LPIL)	Mol	Biva	2	0.11	98.99	2	33
Capitella capitata	Ann	Poly	2	0.11	99.10	1	17
Tubulanus (LPIL)	Rhy	Anop	2	0.11	99.20	1	17
Capitellidae (LPIL)	Ann	Poly	1	0.05	99.26	1	17
Cerapus benthophilus	Art	Mala	1	0.05	99.31	1	17
Cyclaspis varians	Art	Mala	1	0.05	99.36	1	17
Edotia triloba	Art	Mala	1	0.05	99.42	1	17
Gitanopsis laguna	Art	Mala	1	0.05	99.47	1	17
Halmyrapseudes sp. A	Art	Mala	1	0.05	99.52	1	17
Hobsonia florida	Ann	Poly	1	0.05	99.58	1	17
Mitrella lunata	Mol	Gast	1	0.05	99.63	1	17
Nereis (LPIL)	Ann	Poly	1	0.05	99.68	1	17
Odostomia impressa	Mol	Gast	1	0.05	99.73	1	17
Polymesoda caroliniana	Mol	Biva	1	0.05	99.79	1	17
Rangia cuneata	Mol	Biva	1	0.05	99.84	1	17
Rhithropanopeus harrisii	Art	Mala	1	0.05	99.89	1	17
Spelaeomysis sp. A	Art	Mala	1	0.05	99.95	1	17
Tellina (LPIL)	Mol	Biva	1	0.05	100.00	1	17

Taxa Key

Ann=Annelida
- Olig=Oligochaeta
- Poly=Polychaeta

Art=Arthropoda
- Inse=Insecta
- Mala=Malacostraca

Mol=Mollusca
- Biva=Bivalvia
- Gast=Gastropoda

Rhy=Rhynchocoela
- Anop=Anopla

Table 5. Percentage abundance of dominant benthic macroinfaunal taxa (> 10% of the total) for the St. Lucie stations, June 2003.

Taxa	3	5	7	12	15	17
Annelida						
Oligochaeta						
Tubificidae (LPIL)						18.1
Polychaeta						
Leitoscoloplos robustus					25.8	
Mediomastus (LPIL)					55.5	16.5
Streblospio benedicti	21.4		53.5			51.6
Arthropoda						
Malacostraca						
Grandidierella bonnieroides	44.0					
Mollusca						
Bivalvia						
Mulinia lateralis	23.0	82.4	11.8			
Gastropoda						
Hydrobiidae (LPIL)			14.0	34.3		
Pyrgophorus platyrachis				57.5		

Table 6. Summary of the benthic macroinfaunal data for the St. Lucie stations, June 2003.

Station	Rep	No. of Taxa	No. of Individuals	Density (no/m2)	Mean No. Taxa	Taxa (SD)	Mean Density	Density (SD)	Total No. Taxa	Total No. Individuals	H' Diversiy	J' Evenness
3	1	13	229	5725	10.3	2.3	3733.3	1735.0	18	448	1.56	0.54
	2	9	117	2925								
	3	9	102	2550								
5	1	11	107	2675	12.0	1.7	3841.7	1040.8	20	461	0.91	0.30
	2	11	167	4175								
	3	14	187	4675								
7	1	13	213	5325	10.7	2.1	2616.7	2406.3	18	314	1.60	0.55
	2	9	29	725								
	3	10	72	1800								
12	1	9	147	3675	7.7	1.5	2941.7	1081.2	11	353	1.05	0.44
	2	8	138	3450								
	3	6	68	1700								
15	1	8	62	1550	6.0	2.0	1066.7	425.2	10	128	1.28	0.56
	2	4	30	750								
	3	6	36	900								
17	1	7	39	975	7.0	1.0	1516.7	1184.4	11	182	1.44	0.60
	2	6	28	700								
	3	8	115	2875								

Figure 1. Station locations for the St. Lucie Estuary benthic assessment, June 2003.

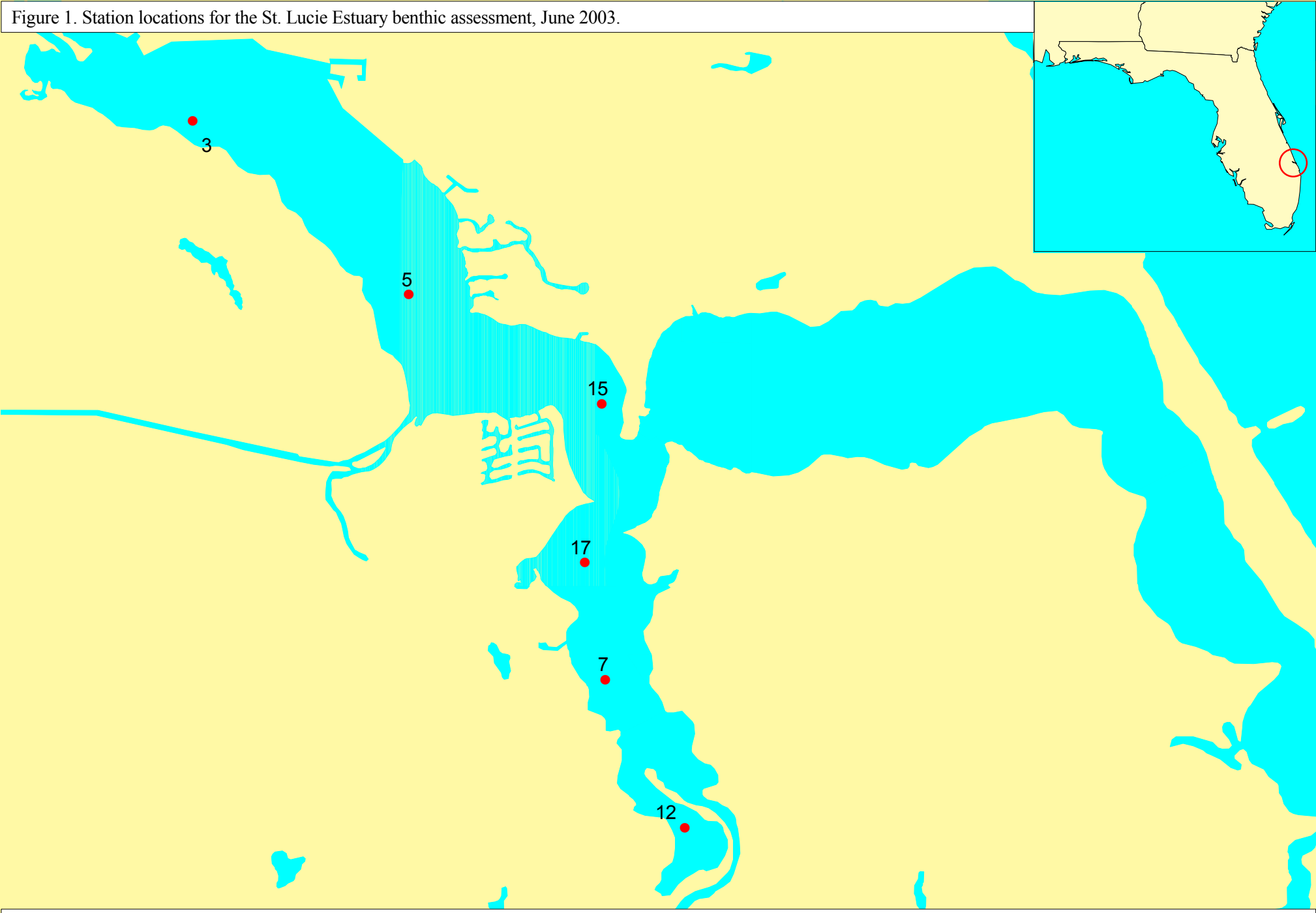
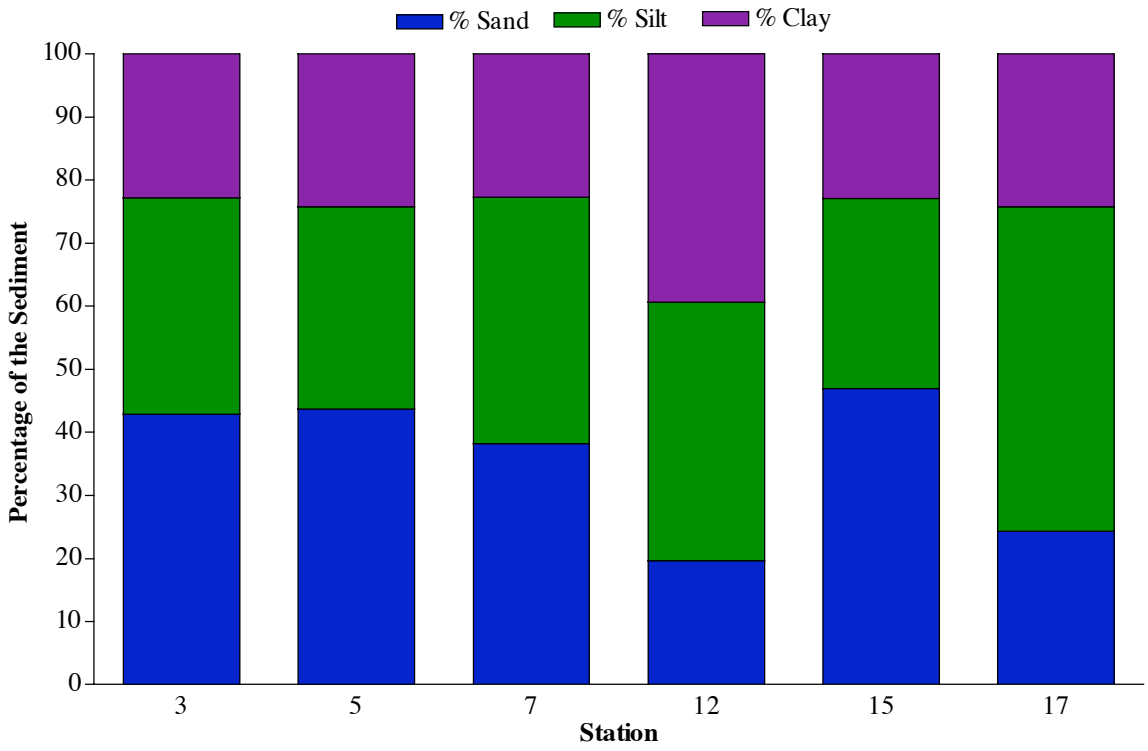


Figure 2. Sediment texture and sediment percent organic carbon (TOC) data for the St. Lucie Estuary stations, June 2003.



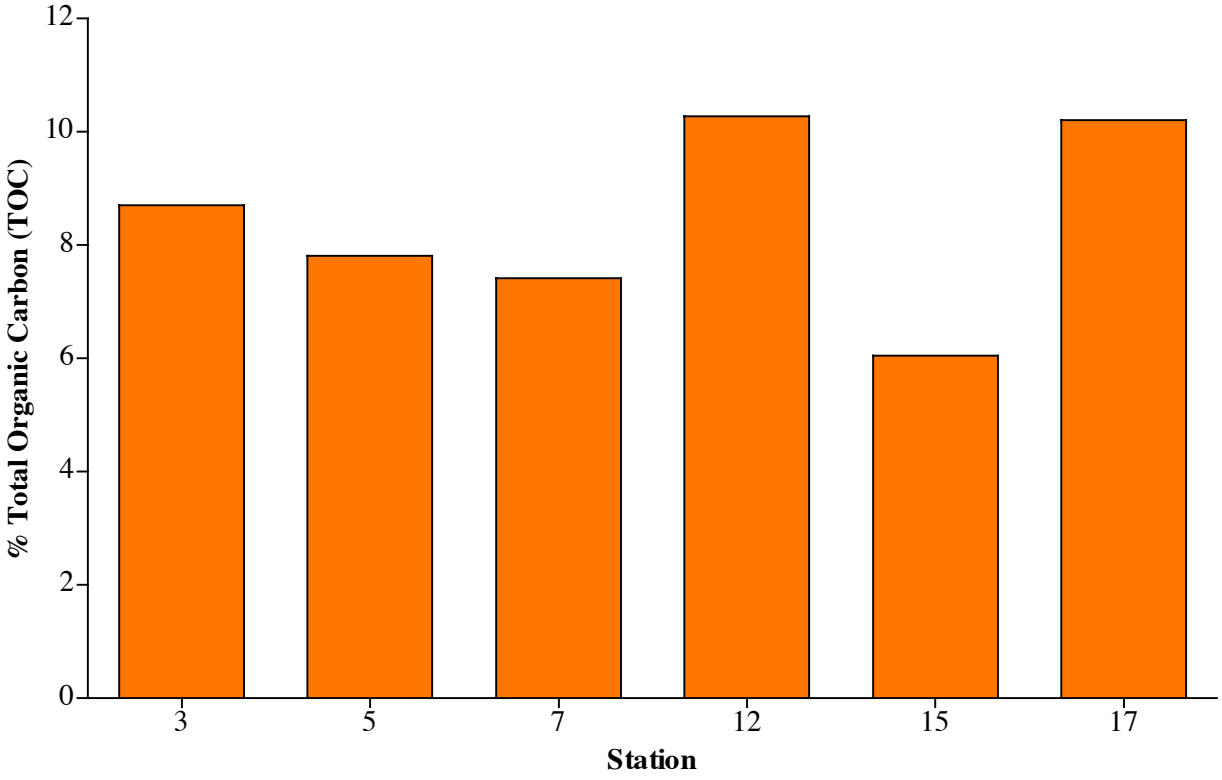


Figure 3. Distribution of major macroinvertebrate taxa for the St. Lucie Estuary stations, June 2003.

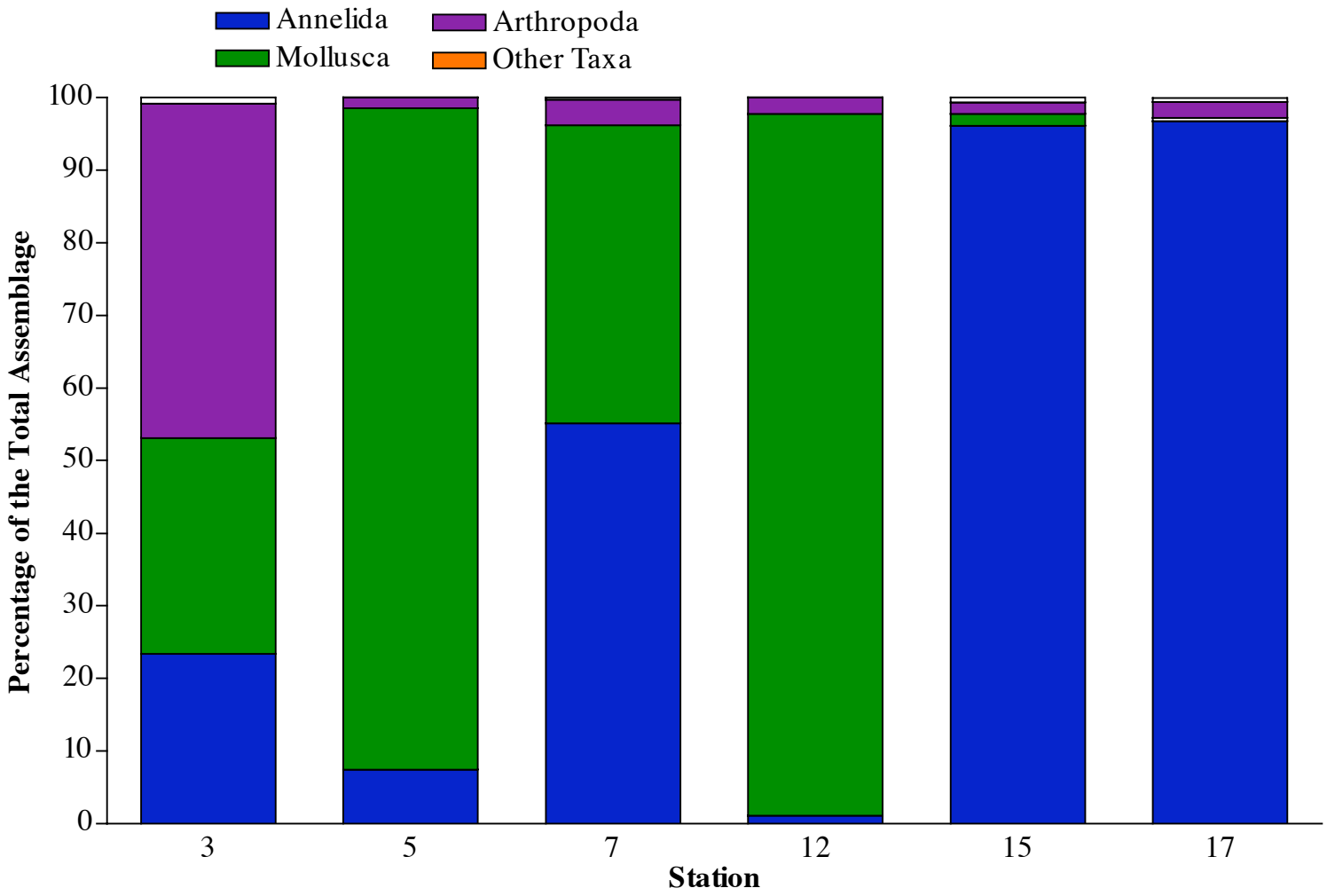
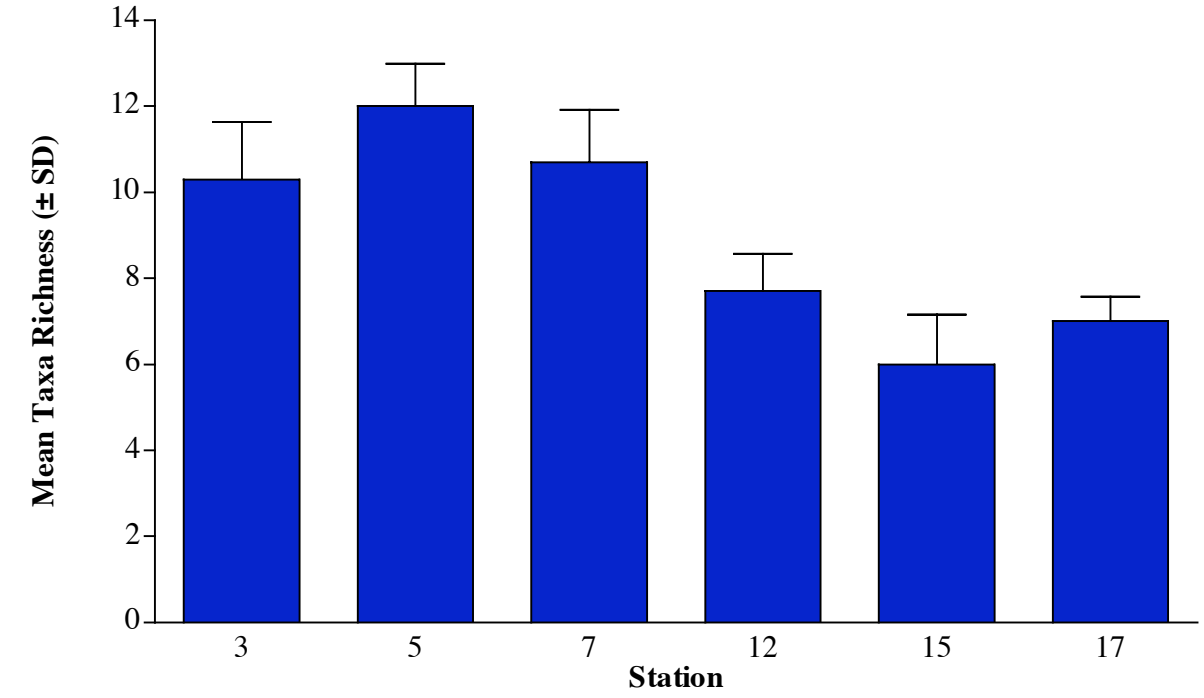


Figure 4. Taxa richness and taxa density data for the St. Lucie Estuary stations, June 2003.



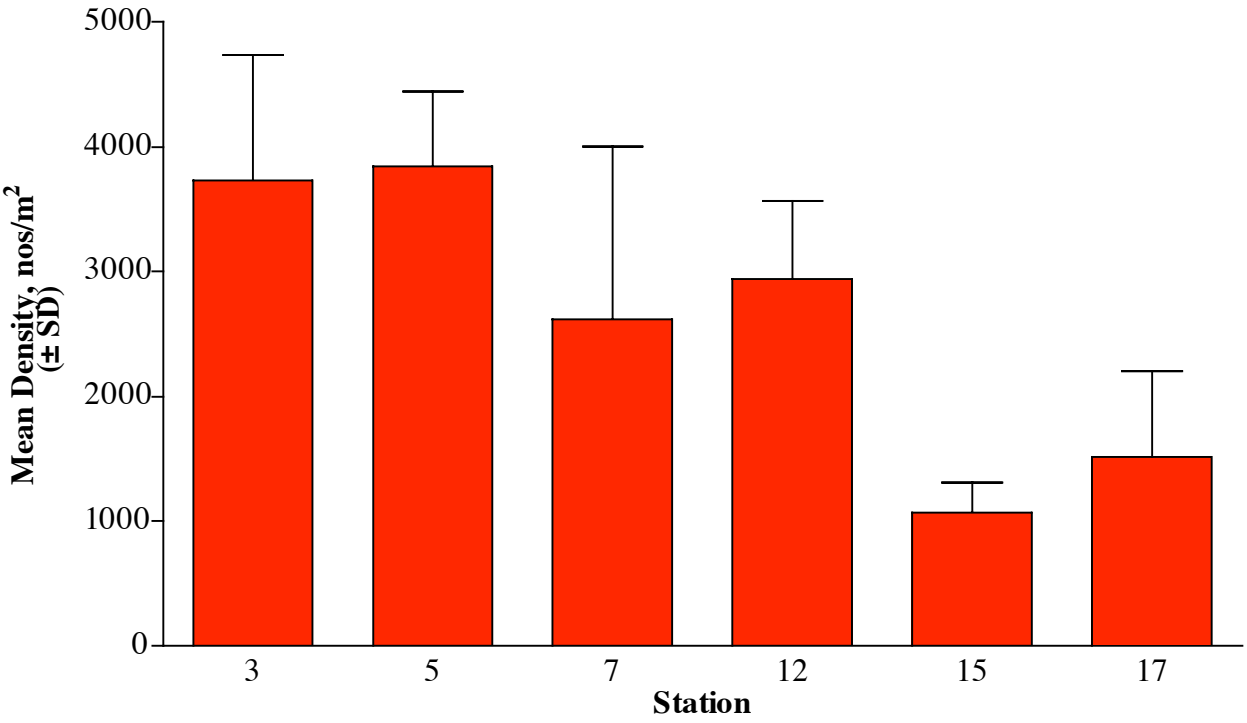
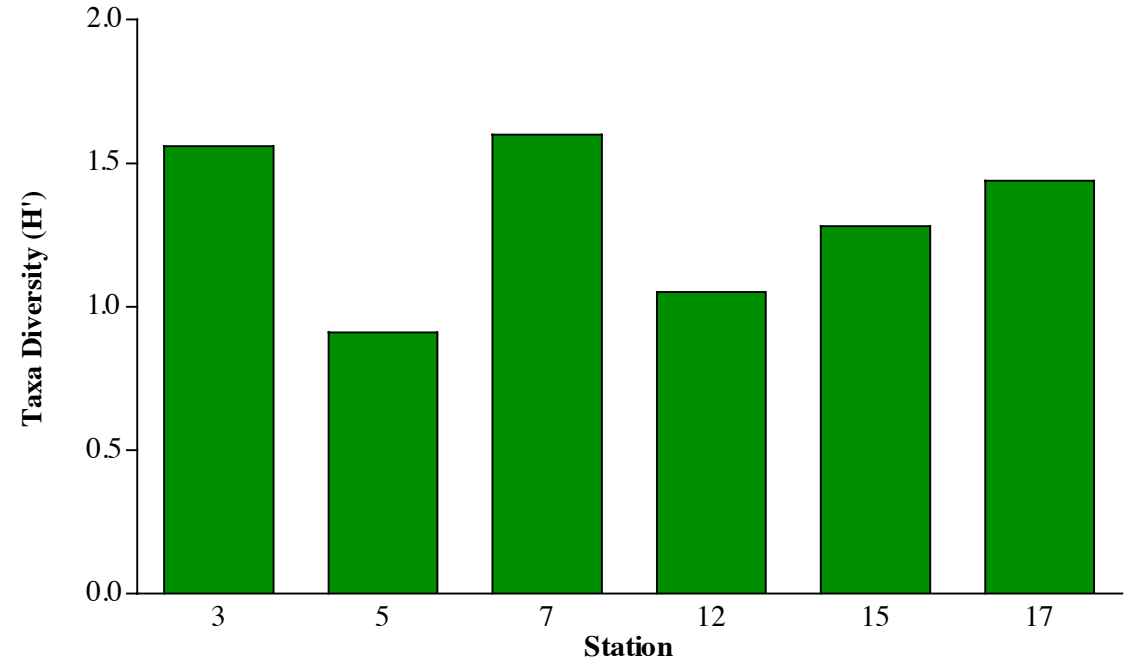
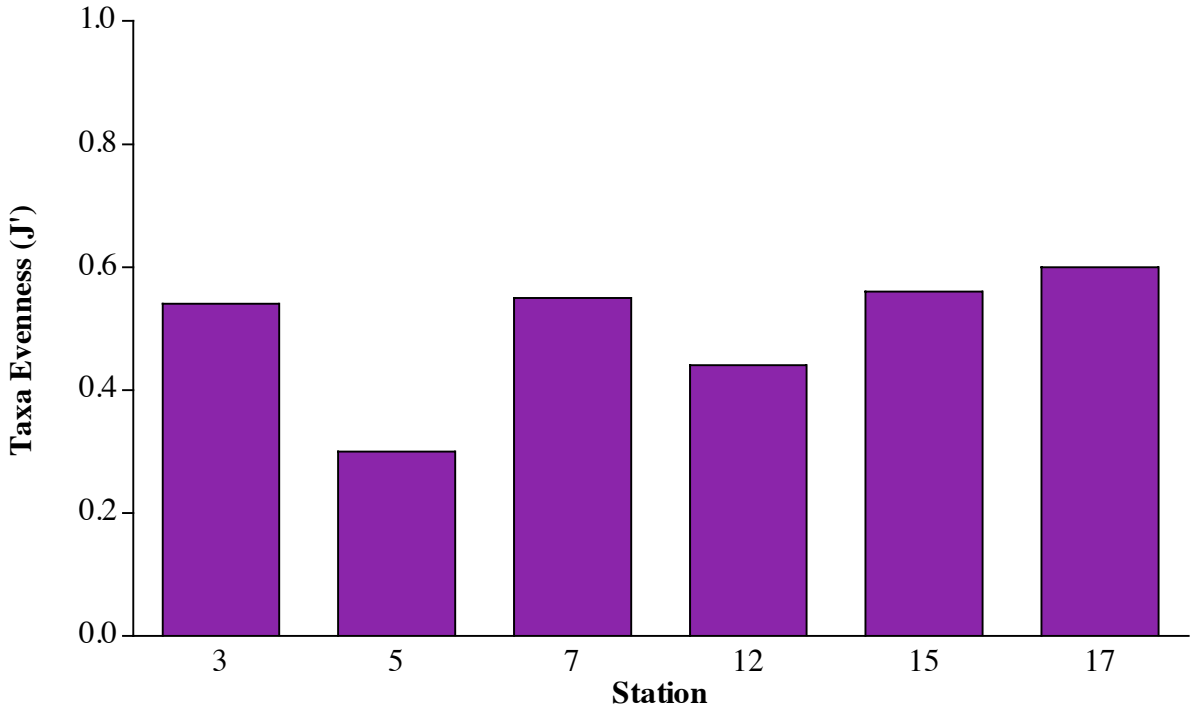


Figure 5. Taxa diversity (H') and taxa evenness (J') data for the St. Lucie Estuary stations, June 2003.





APPENDICES

QUALITY ASSURANCE STATEMENT

Client/Project: NOAA

Work Assignment Title: St. Lucie Estuary

Task Number: Opt 3-2

Description of Data Set or Deliverable: 18 Benthic macroinvertebrate samples collected in June 2003; Young Dredge grabs.

Description of audit and review activities: Judged accuracy rates were well above standard levels for sorting and taxonomy. Laboratory QC reports were completed. Copies of QC results follow (see attachment.) All taxonomic data were entered into computer and printed. This list was checked for accuracy against original taxonomic data sheets.

Description of outstanding issues or deficiencies which may affect data quality: None

_____

Signature of QA Officer or Reviewer Date

_____

Signature of Project Manager Date

QUALITY CONTROL REWORKS

Client/Project: **NOAA - St. Lucie Estuary**
Task Number: **Opt 3-2**

Sorting Results:

Sample #	% Accuracy
SLE-017A1-2	100%
SLE-003-1	100%
SLE-003-2	100%
SLE-015-2	100%

Taxonomy Results:

Sample #	Taxa	% Accuracy
SLE003-1	Crust./Moll.	98%
SLE015-1	Crust./Moll.	100%
SLE003-1	Poly./Misc.	97%
SLE007-1	Poly./Misc.	100%

Description of outstanding issues or deficiencies which may affect data quality: None

Signature of QA Officer or Reviewer Date